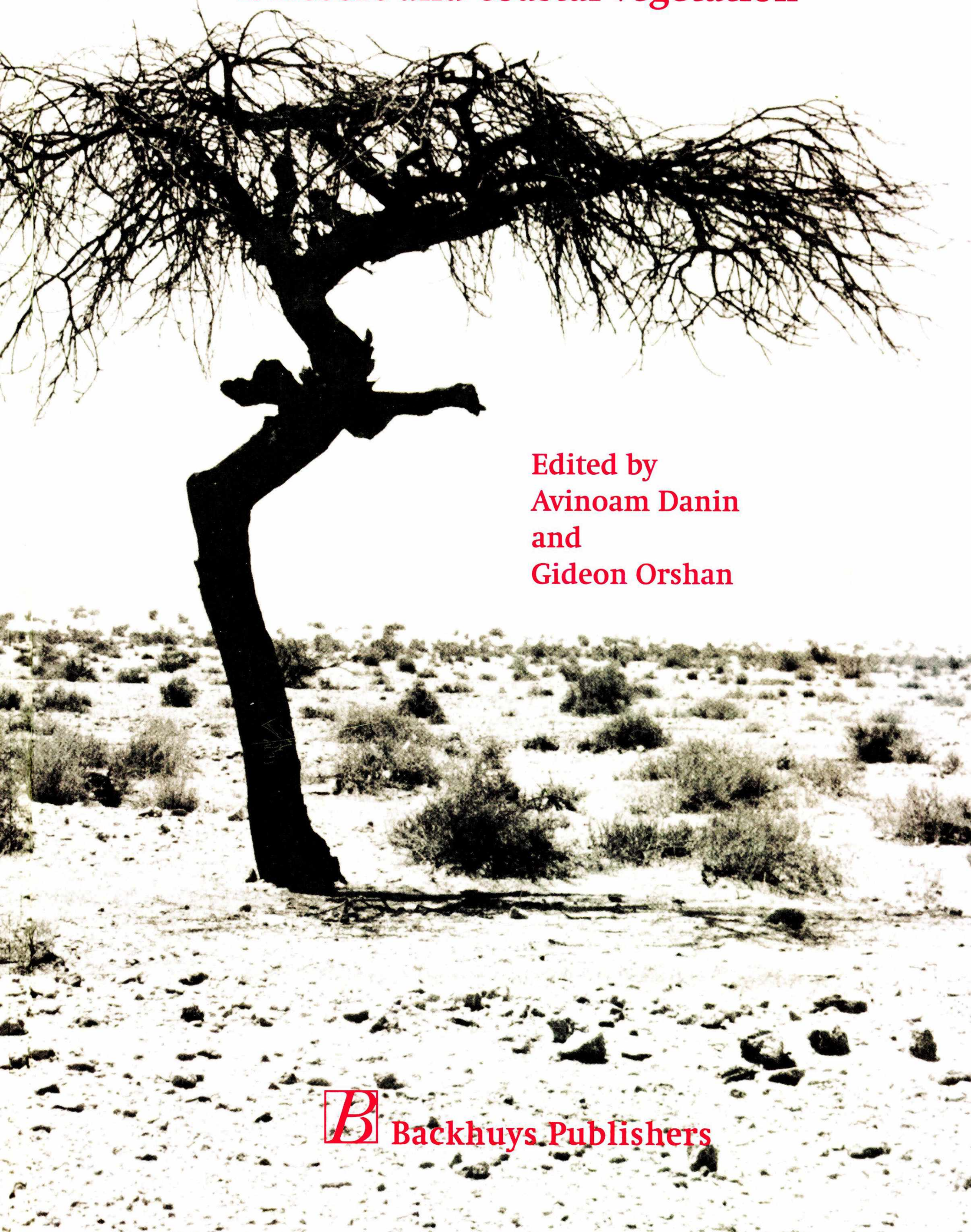
VEGETATION OF ISRAEL

I. Desert and coastal vegetation



Edited by
Avinoam Danin
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Backhuys Publishers

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Introduction

The principal aim of the present volume is to revise the phytosociological work carried out so far in Israel, determine the plant communities and give them legitimate names according to the "Code of phytosociological nomenclature" (Barkman et al., 1986). We hope this volume to be the first in a series of books dedicated to the divers vegetation of Israel which is situated in a meeting zone of several phytochoria and has a long history of human interaction with the vegetation.

We thank Prof. M.J.A. Werger for his continuous support during all the long history of the initiation and preparation of this book; Mr. P. Grosmann for drawing most illustrations and Mrs. Tamar Soffer for preparing a few basic maps. We thank Mr. B. Danin for making the computer programs which enabled the preparation of the principal core of the book; Prof. U. Motro for his help in methodological and statistical issues; Ms. Naava Aisland for assistance along the long way of processing the material.

1. HISTORY OF BOTANICAL INVESTIGATIONS IN ISRAEL

The history of the botanical investigations associated with the present volume is discussed here in its three components – vegetation mapping, phytosociological investigations, and plant geographical studies. The history of taxonomic research is beyond the scope of the present book.

1.1 Vegetation mapping of Israel (Danin)

Vegetation description has its roots in the ancient Hebrew Scriptures. The first modern investigators visited the area in the previous century and started the process of accumulating information about its vegetation. The present researchers in this field are assisted by measures of remote sensing such as aerial photographs and satellite images.

1.1.1 Vegetation in the Hebrew Scriptures

Early observations on the vegetation of Israel have their echo in the Hebrew Scriptures. Abraham, the first Patriarch, came with his wife Sarai and nephew Lot to the promised land and **"when they arrived in the land of Canaan, Abraham passed through the land as far as the site of Shechem, at <u>the oak of Moreh</u>."** (Genesis 12: 5-6). Hareuveni & Frenkley (1974) interpret it as a description of the landscape that was inhabited by the Cnaanites who cultivated the lowlands. The mountains were afforested with oaks and Abraham and his family with their herds went to the pasture land. Later Abraham established at the vicinity of Hebron **"at the oak of Mamre"**. The same status of vegetation is found at present, 3700-3800 years after the events described above (cf. Fig. 11 and Sect. 4.1), where remnants of the *Quercus calliprinos* woodlands are found in Samaria and Judea, surrounded by cultivated land.

The first "vegetation survey" of the land of Israel is described in Numbers 13: 1-2, when the Lord commands Moses **"send men to scout the land of Canaan, which I am giving the Israelite people"**. The scouts were instructed to go to **"the Negev and up into the hill country"**. They report **"we came to the land... and it flows with milk and honey"**. According to Hareuveni & Frenkley (1974), the "milk" refers to goat and sheep milk, reflecting large pasture land on the uncultivated areas whereas the "honey" depicts the wealth of fallow fields supporting rich bee-pollinated herbaceous plants (cf. categories 2-7 in Fig. 11 and Sect. 4.2-4.7).

Another use of vegetation and its distribution is that of Samson and Delilah. He said to her **"If they bind me with seven wet withes that were never dried out, then I shall become weak and be like anyone else"** (Judges 16:7). The "wet withes" are believed to be made from the bark of *Thymelaea hirsuta* (Hareuveni, 1984: pp. 54-56). This plant does not grow in the Sorek Valley between Zorah and Eshtaol (district 11 in Fig.1) where Delilah lived, and the demand was for fresh wet ropes that their humidity is the original plant's sap. In Judges 16: 8, we read **"the lords of the Philistines brought <u>up</u> to her seven green withes which had not been dried"**. *Thymelaea hirsuta* grows on sandy soils of the Philistean Plain (district 5 in Fig. 1) and the Philistines had to bring them **"<u>up</u>"** due to the altitudinal differences.

Among his other excellent qualities King Solomon was a botanist who **"would speak of trees from the cedar that is in the Lebanon** (*Cedrus libani*) **to the hyssop** (*Majorana syriaca*) **that grows in the wall"** (Kings 5:13).

A demonstration of the continuity of uses of plant indicators and plant names since Biblical time is associated with Elijah. **"He got up and fled for his life, and came to Beer Sheva** (Fig. 1: district 13)... **But he himself went a day's journey into the wilderness, and came and sat down under a solitary broom tree"** (1 Kings 19:34). In Hebrew, the language in which these Scriptures were written, the broom tree is ROTEM. The name of the plant remained the same for thousands of years. Its Latin name is *Retama raetam* which provided the name for the class Retametea raetam to which about half of this book is dedicated. The Latin name follows the Arabic name RATAM, the roots of which are in the Biblical Hebrew – ROTEM.

Many other aspects of plant life in the Bible are discussed among others by Hareuveni (1980, 1984, 1991), Zohary (1982a), Hepper (1992), and Feliks (1997).

1.1.2 Early vegetation surveys

At the end of the 19th century explorers visiting Palestine presented written reports on the vegetation cover of the country. Schumacher (1888) displays an accurate map of woodland areas of the Golan comparable to that of the present (Danin, 1968). Hart (1891) reports the flora along the route of his expedition in 1833-4 to Sinai and Palestine. Lists of plants observed in the main stations of the expedition are presented with only fragmentary ecological and vegetational overview. The information in this work is rather important for taxonomic research but can hardly provide a comprehensive view on the vegetation of the area. A similar role in the study of the flora of the area but not of the vegetation is that of A. Aaronsohn who made geological-botanical expeditions in Palestine from 1904 to 1908 (Oppenheimer, 1931; Oppenheimer & Evenari, 1941). His valueable herbarium and notes helped much the floristic investigations of the area but could not help much the surveys of vegetation.

The vegetation map of Smith (1936) does not agree with the higher level of knowledge of the vegetation at that time in the history of investigation. He presented only three mapping units: 1. Cultivated Lands (which agree with our Fig. 11 category 18), 2. Sandy Deserts (which agree with our Fig. 11 category 13), 3. Limestone Hill-lands covered in Spring with more or less pastures. This last category includes, undivided, all the area with 16 categories (Fig. 11).

1.1.3 Vegetation surveys by resident researchers

The first modern account on the vegetation of the area is Eig's (1927) fundamental sketch. Basing on thorough personal knowledge of environmental condition and vegetation he produced a map that in many aspects does not differ much from that of the present at the same scale. Eig presented the main formations of the vegetation of Palestine. He accurately displayed the extension of various sandy and loess soils and related to their specific vegetation in that (Eig, 1927: map 1) and in his later accounts (Eig, 1933, 1939). Various types of hydrophilic vegetation are displayed in map 2 and the steppe, desert areas, and tropical enclaves are well portrayed in map 3. The relationships of plant communities and environmental factors in natural stands and in human-managed habitats are well represented in Eig's (1927) comprehensive account. This work prepared a broad baseline from which later vegetation maps of the area started. The first detailed map displaying vegetation of a small area at the association level with relation to topography and edaphic conditions is that of Orshansky (Orshan) et al., (1937). Orshan and his collaborators (Zohary & Orshansky, G. , 1947, 1949; Orshan & Zohary, 1955; Orshan, 1962; Orshan & Zohary, 1963) continued to produce vegetation maps at the association level. Vegetation maps at the formation level were published by M. Zohary (1944, 1945, 1947, 1949-1950, 1955, 1982b), by D. Zohary (1953), and by Danin (1986c, 1988 = Fig. 11 in the present book) and Danin (1995a, 1996b). The latter two maps were prepared in parts as a generalization of much more detailed maps and in other parts as a synthesis of dozens of years of field observations.

The use of aerial photographs interpretation in the study of vegetation was practiced in M.Sc. and Ph.D. theses by Bourvine (1963) in the southern Dead Sea area; Danin, Orshan & Zohary (1964; 1975) in the Negev and the Judean Desert; Lipkin (1972) and Rudich & Danin (1978) in the extreme desert areas of the southern Negev and the Arava Valley; Sapir (1977) in the Judean foothills, Rabinovitch-Vin (1979) in the Galilee, Sabah (1991) in the Samarian Desert, and Danin & Nokrian (1991) in the southern coastal plain. Here associations delimited and sampled by relevés were mapped. In many cases complexes of associations were assembled together into mapping units.

To conclude, there are scattered areas, accumulating to less than 40% of Israel, where vegetation is mapped at the association level. Generalized maps at the formation level (Zohary, 1955; Zohary, 1981; Danin, 1986c, 1988, 1996b) cover the entire country.

1.2 Phytosociological investigations of Israel (Orshan & Danin)

Systematic phytosociological determination of the plant communities of Israel according to the Braun-Blanquet method was started by A. Eig and his collaborators at the beginning of the thirties. Eig's (1927): "On the vegetation of Palestine" is a systematic description of the main plant formations of Israel including vegetation types such as Maquis, Garrigue, Batha which are first defined and described as related to their habitats and environmental factors. He combined the study of plant taxonomy – a field in which he made important contributions – with the study of plant communities. He surveyed the country and with his collaborators M. Zohary and N. Feinbrun started to collect vegetation records of every plant community he could put his hand on. This work was interrupted by his untimely death of cancer in 1938. The articles concerning the present study area are listed among the references. M. Zohary collected the vegetation records made by Eig and his collaborators and used them as raw material for a detailed phytosociological description of the vegetation of Israel. He then published in Eig's name the sample records for each plant association examined (Eig, 1946). The plant communities were listed for each phytogeographical region and classified to the rank of alliance.

The work started by Eig was continued by Zohary and his colleagues and students. In 1947 he published the "Vegetation map of western Palestine" which was elaborated and extended to parts of Transjordan in his books (Zohary 1955, 1962). The legend of these maps is unique in that each of its units represents:

1. The supposed climax plant community which dominated the area before the destructive effect of man took place, 2. The plant communities dominating the area at present, and 3. The segetal plant communities. Any change in one of these components would change the legend unit.

In 1952 Zohary published his "Environment and vegetation classes" in which he extended Eig's hierarchical classification of the plant communities of the light soils belt and laid the foundation of a hierarchical classification of the plant communities of the entire area of Israel. It was subsequently elaborated and published three times (Zohary, 1955, 1962, 1982b).

One should pay attention to the fact that although the approach used in determining this hierarchical classification follows the Braun-Blanquet method, it deviates from the latter in certain important aspects. Zohary did not produce in the first place full association tables summing up a sufficient number of record and classifying the species as characteristic of associations, alliances, orders and classes. Instead he used dominance and parameters of the environment as first approximation of factors determining the plant communities of different ranks. The idea was to create intuitively a hierarchical system and later confirm or change it on the basis of more detailed and systematic study.

At about the same period Zohary, his collaborators, and students embarked on a phytosociological determination and description of the plant communities of selected relatively small areas of special interest like the Huleh Plain, the Dead Sea region, the Zygophylletum dumosi in the Negev, and selected components of the vegetation of the Arava Valley. These investigation (Zohary & Orshansky [Orshan], 1947,1949; Zohary & Orshan 1954, 1956) included detailed but incomplete association or alliance tables, and certain parameters of environmental factors as well as phytosociological vegetation maps.

A modification of the Braun-Blanquet method was published by Danin, Orshan, and Zohary (1964) who studied desert vegetation in the Negev. The persisting and ephemeral species were listed in two separate lists and the cover of each growth form group determined as well as the relative cover for each species in its group (Chap. 5).

Because of difficulties to find good characteristic species these authors started to characterize the associations by "marker species" i.e., species of high presence and/or high cover. Later studies are incorporated in the text of the present volume.

1.3 Phytogeographical research of Israel (Danin)

As with the basis for the phytosociological research, Eig (1931-1932) laid the foundation for the phytogeographic subdivision of the Middle East. He produced a detailed analysis of the ca 2500 species of the flora of Israel based on their world geographic distribution. Details of his work are further discussed in chapter 3. The map presented by Eig was revised and published with somewhat different boundaries by Zohary (1955, 1962, 1966, 1978, 1981) who did not add more basic data to his phytogeographical analysis. He added his subjective perception of the phytogeographical subdivision of the Middle East. In personal long conversations with him he stated that one tree is much more important as to where a plant geographical boundary should pass than thousands of small shrubs. The phytogeographical analysis of the Flora Palaestina area (Zohary, 1966, 1972; Feinbrun, 1978, 1986) and the application of a chorotype to each species was done as part of the Ph.D. thesis of Gruenberg-Feritg (1966).

Phytogeographical analyses of the flora of associations studied in the Negev and the Judean Desert (Danin 1970), were based on the chorotypes of Gruenberg-Feritg (1966), and came into contradiction with the phytogeographical territories of Zohary (1955, 1966) maps. The percentage of Saharo-Arabian species in the list of species of associations of the Negev Highlands, dominated by Irano-Turanian species, was higher than the percentage of Irano-Turanian species. Analysis of association tables of semi-steppe bathas, regarded by Eig and by Zohary as Irano-Turanian, displayed prevalence of the Mediterranean and the bi-regional Mediterranean – Irano-Turanian chorotypes. Additional criticism of Zohary's map results from phytogeographical studies of Africa (White & Leonard 1991). The incompatibility of the phytochoria in the maps of the latter with those of the former demand further investigations.

A quantitative analysis of the flora of the entire country using a large data base and analyzing the flora of squares of 5 x 5 km^2 is that of Danin & Plitmann (1987). Their map (see Fig. 9, Chap. 3) resembles more the phytogeographical map of Eig (1937) than that of Zohary (1966). A somewhat different method was used by Danin (1995b) who analyzed the lists of species of each of the 31 geographical districts presented in Feinbrun-Dothan & Danin (1991).

Whereas chorotypes provided by Gruenberg-Feritg (1966) or by Zohary (1966, 1972) and Fein-brun (1978, 1986) were the basis for the phytogeographical maps discussed above, Kadmon & Danin (1997) used only the plant names of the same data base used by Danin & Plitmann (1987). The high similarity in the boundaries of the maps of Kadmon & Danin (1997) and that of Danin & Plitmann (1987) indicates that the phytogeographical boundaries are real entities and not a methodological interpretation or artifact of the data.

2. ENVIRONMENT (DANIN)

The high diversity of the vegetation in Israel derives from the combination of small-sized geomorphological bodies, built up from a rich assemblage of rock and soil types, situated at a transition zone between the mesic Mediterranean zone and the extreme desert, and with elevations from snow-covered subalpine mountains to the lowest place on earth surface.

2.1 Topography

The topography of Israel can be best described as north-south topographic elements which are influenced by the geomorphologic features of the area. The Mediterranean coastal plain is narrow in northern Israel and wide in the south. It is subdivided into several geographical districts (Fig. 1) which generally agree with geomorphology. Low hills with gentle topography constitute the foothill territory, known in Hebrew as Shefela. The mountainous area reaches the altitude of ca. 1,000 m at Judea and the Negev Highlands, and 1,200 m at the Galilee.

Steep escarpments dissected by canyons, typify the area east of the water divide, leading to the Jordan – Dead Sea – Arava rift valley. This valley is at elevation of 400 m below mean sea level in its deepest part of the Dead Sea and ascends to 200 m above sea level northwards and southwards. Several west-east valleys cut across the country, e.g., the Esderaelon Plain (Fig. 1: No. 9) and the Dimona-Beer-Sheva valley. There are faults at the margins of the former, whereas the latter is an ancient erosion channel.

East of the Jordan River, Mt. Hermon, situated at the borders junction of Israel, Lebanon, and Syria reaches the elevation of 2,800 m and delineated southwards sharply by basalt-covered plateau of the Golan; the latter descends gently from an elevation of 1,200 m towards the Yarmouch River and towards the Kinneret (the Sea of Galilee) at elevation of 200 m below sea level.

2.2 Climate

2.2.1 Rainfall

The Mediterranean climate of Israel is characterized by a rainless and warm summer, and a mild rainy winter. Meteorologists divide the country according to Köppen's method: 1. Mediterranean or temperate zone, 2. A semi-arid, and 3. An arid zone (Rosenan & Gilead, 1985; Jaffe, 1988, 1995). Climographs typical to each of these zones are presented in Fig. 2, showing a similar rhythm of the main climatic parameters throughout the country but with variability in monthly and annual quantities of rainfall.

Rainfall quantities vary in two main directions; it decreases gradually from north to south and sharply from the water-divide eastwards in Israel (Fig. 3). The orographic effect on rainfall in the Golan and the Hermon is prominent. The isohyets rise there densely, along a gradient 45 km long, from 500 mm near the Kinneret to 1,300 mm at Mt. Hermon. The north-to-south gradient, seen also in the height of monthly bars in Fig. 2, is influenced mainly by the intensity and frequency of rain-contributing systems, whereas the west to east gradients are influenced by the topography. The ascent of air bodies towards the mountains of Judea and Galilee result in cooling of the air and increasing of rainfall with elevation. Air bodies descending towards the rift valley get warmer and drier. Thus, the Samarian and Judean Deserts occur at the rain shadow of the Judean and Samarian mountains.

The driest and warmest parts of southern Israel and Sinai may rarely get sporadic local strong showers in the summer. These occur in unpredictable time and location at the extreme desert part of the study area where mean annual rainfall is less than 100 mm. In the area of Elat most rains are convective (Sharon, 1972). The indicator tree for these summer showers is *Tamarix aphylla* which grows in wadis (Danin, 1981a). It is a typical plant of Sudanian to tropical origin (Zohary, 1972) which grows in Africa beside seasonal rivers in deciduous bushlands (Hunt, 1966). It blooms in summer. Like other species of *Tamarix* it loses the vitality of the minute wind-dispersed seed shortly after their dispersal (Waisel, 1960a). Germination and establishment take place only when the seeds arrive to a freshly watered site with considerable quantity of water for a long time and without competition of other plants. Such habitats fitting germination and establishment are mainly in wadis which had an event of flood during the summer. Germination under semi-simulated conditions was observed in agricultural areas in the desert where it developed as a weed in places

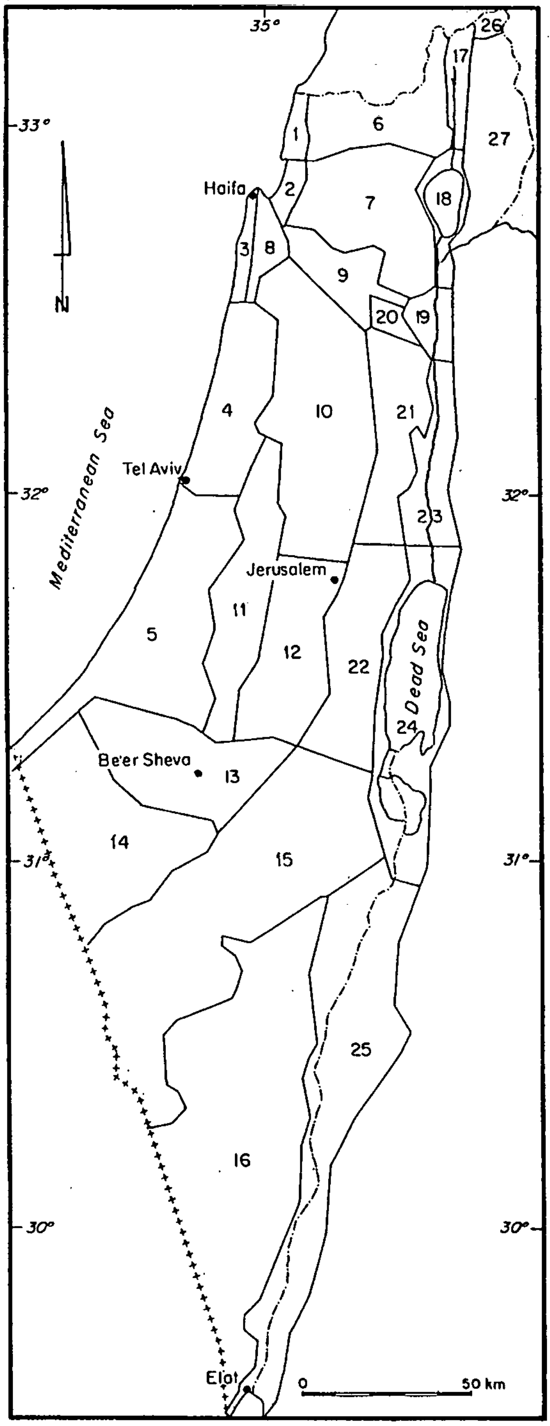

Figure 1. The geographical districts of Israel:

1 Coastal Galilee, 2 Acco Plain, 3 Coast of Carmel, 4 Sharon Plain, 5 Philistean Plain, 6 Upper Galilee, 7 Lower Galilee, 8 Mt. Carmel, 9 Esdraelon Plain, 10 Samaria, 11 Shefela, 12 Judean Mountains, 13 Northern Negev, 14 Western Negev, 15 Negev Highlands, 16 Southern Negev, 17 Hula Plain, 18 Kinnroth Valley, 19 Beit Shean Valley, 20 Mt. Gilboa, 21 Samarian Desert, 22 Judean Desert, 23 Lower Jordan Valley, 24 Dead Sea Valley, 25 Arava Valley, 26 Mt. Hermon, 27 Golan.

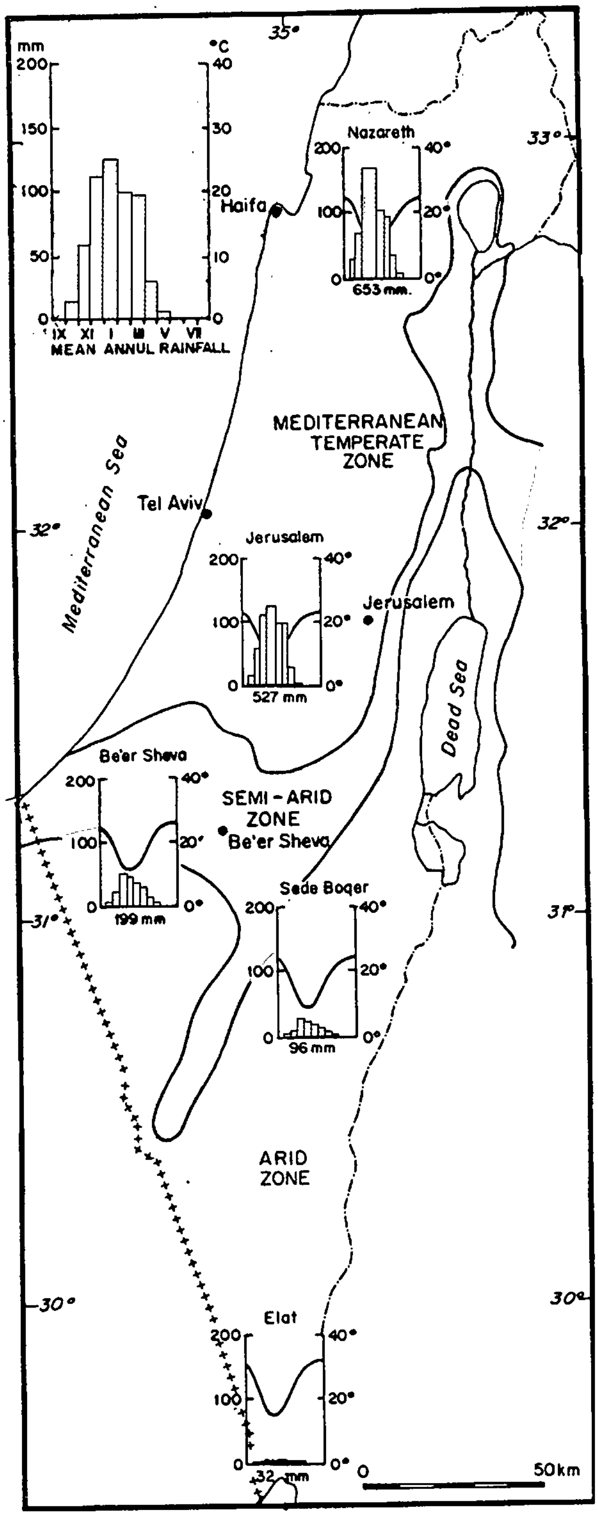

Figure 2. Climatic zones of Israel with typical climographs (After The New Atlas of Israel 1995: pp. 27-28).

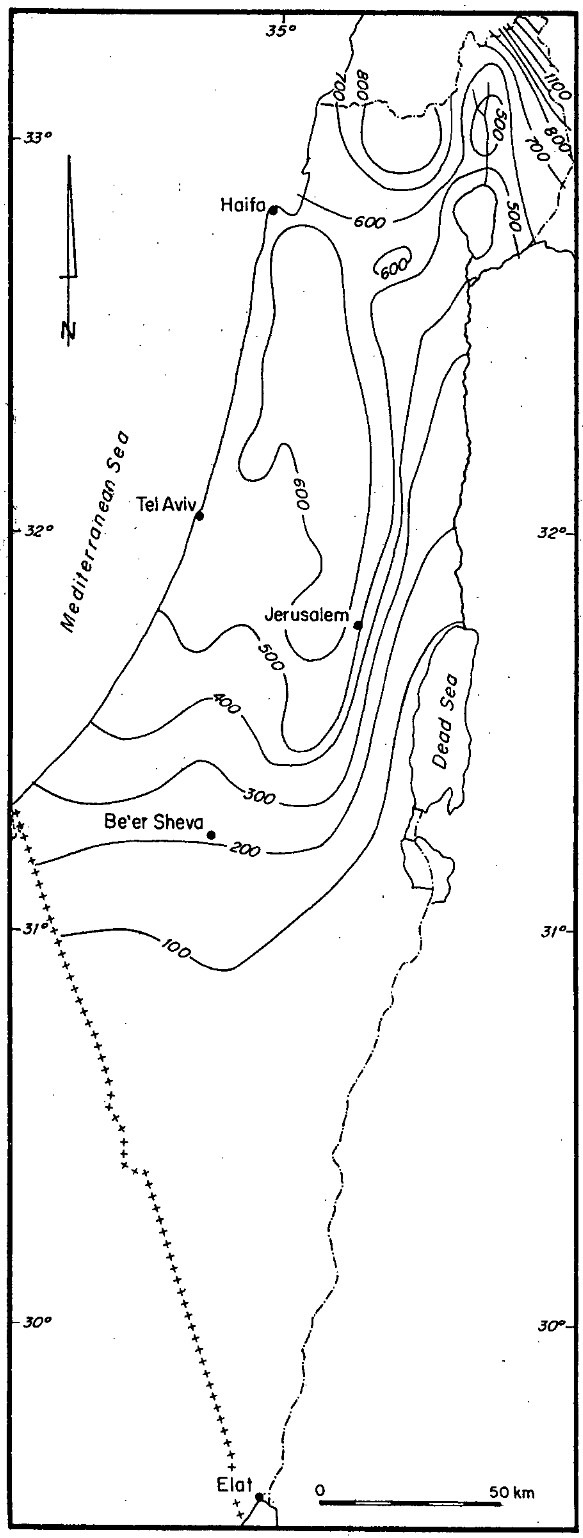

Figure 3. Mean annual rainfall for the years 1961-1990 (After The New Atlas of Israel 1995: p. 28).

where trickle pipes irrigation took place (Danin, 1981a). Local summer rains which were recorded in Israel and Sinai between 1925 and 1975 are presented in Table 1. The distribution map of spontaneously growing *Tamarix aphylla* (Fig. 4) may serve as a climate map indicating at least one event of strong summer shower which led to floods in the particular watershed in the recent history.

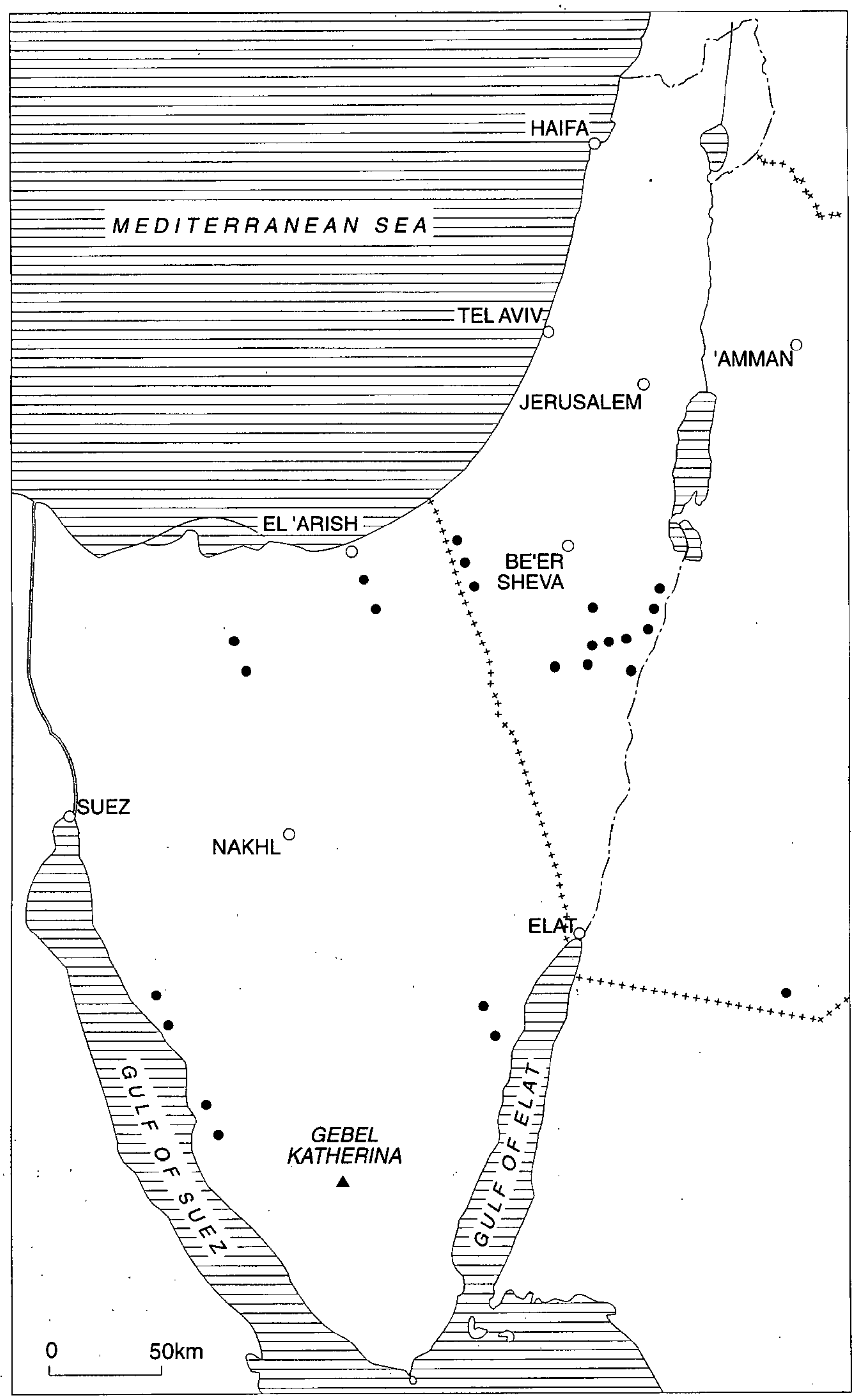

Figure 4. The distribution map of spontaneously growing *Tamarix aphylla*.

Snow may fall in winters of cold and wet years on the highest summits of mountains in Israel and stay there for a few days.

Dew and fog are important sources of moisture for the existence of poikilohydric organisms such as cyanobacteria, lichens, and mosses (Danin & Garty, 1983; Danin, 1986b; Budel & Lange, 1991; Green et al., 1994).

Table 1. Local summer rains which caused floods in the Negev and Sinai (From Danin, 1981a)

Date	Locality	Event	Reference*
12.05.1950	Elat-'Aqaba	floods	Schick (1971)
30.05.1957	75 km N of Elat	heavy rains and hail	112/W:40
01.05.1965	Negev (without locality)	floods	190/W:41
15.05.1967	Mizpe Ramon	20 mm in 20 min.	242/W:41
22.05.1969	southern Arava	11.6 mm in 3 hrs.	268/W:50
12.06.1957	'En Yahav	floods	113/W:48
14.06.1975	20 km S of 'En Yahav	26 mm per day	residents of Zofar
23.07.1963	HaMeshar (100 km N of Elat)	heavy rain	194/W:81
08.1967	S. Sinai	heavy rain	Ganor et al., (1973)
04.09.1956	En Gedi	15.7 mm in 30 min.	103/W:72
30.09.1975	Judean Desert	heavy floods, killed six people	350/W:90
27-30.10.1961	Elat	floods	169/W:80
10.1937	Thamad	150 mm	Ashbel (1951)
17.10.1967	Elat	22.1 mm per day	247/W:100
18.11.1925	Thamad	142 or 146 mm	Ashbel (1951)
04.11.1958	Mizpe Ramon	15.6 mm in 20 min.	12/R
21.11.1963	'En Gedi	42 mm in 120 min	196/W:110
24.11.1968	Elat	9.2 mm in 6 min	261/W:110

Most references are from Series B of the Israel Meteorological Service abbreviated as follows: 112/W:40 stands for Monthly Report Series B No. 112/W:40, Bet Dagan, 1957.

2.2.2 Temperature

The distribution of the mean annual temperature in Israel is presented in Fig. 5. Most of the country has a mean temperature of 19°-21°C, the mountain ranges have 17°-19°, whereas the highest peaks have less than 17°. The rift valley is much warmer than the rest of the country having mean annual temperature of 23°-25°C. The southern part of the Dead Sea Valley has even more than 25°C. The maps of the mean temperature of the coldest (Fig. 6) and of the warmest month (Fig. 7) display even more details of the thermal regime in specific parts of the country.

2.3 Rock types

The most common rock types in Israel are the sedimentary marine calcareous rocks of the Cenoman, Turon, and Eocene (Fig. 8). The impact of rocks on distribution of vegetation will be discussed in details at the vegetation class or association hierarchial level (Chapter 6). Considerable parts of the eastern Galilee and most of the Golan are covered with basalt. Young (Tertiary and Quaternary) continental sediments cover the large valleys and the coastal plain. Sands derived from desert weathering in Africa were transported by the Nile into the Mediterranean and were sedimented along the coasts of Israel building in the past dunes and sand sheets. Under semi-arid climates which prevailed in the Pleistocene calcareous sandstone, locally known as Kurkar, developed from the sand dunes. Under mesic temperate climate the sand was transformed into sandy-loamy soils known as Hamra (Danin & Yaalon, 1982). The fine-grained sediments of the valleys and foothills plains of the temperate parts of the Israel are formed of clays eroded from the mountainous areas and from *in-situ* leaching of wind-borne fine-grained particles. The continental sediments of the semi-arid or arid parts of the country are composed of conglomerates in parts of the rift valley. Conglomerates are the main features of large valleys and plains such as the Arad-Dimona-Beer-Sheva plains of the northern Negev and Nahal Paran in the southern Negev. Pleistocene sands cover the western Negev whereas Tertiary sands cover considerable parts of the Arava valley and valleys near Dimona. Loess sediments cover considerable parts of the northern Negev and valleys of the Negev Highlands. A rather unique feature of the rift valley from south of the Dead Sea up to the Sea of Galilee are the Lisan formation sediments. These are lake sediments of soft calcareous and clay varves which have been sedimented in the lake which preceded the Dead Sea between 100,000 and 20,000 years ago (Begin et al., 1974).

Prominent in the landscape however prevailing only in small areas are the magmatic and metamorphic crystalline rocks which are exposed mainly in the southern Negev at the vicinity of Elat. Small outcrops are found also in Makhtesh Ramon in the Negev Highlands.

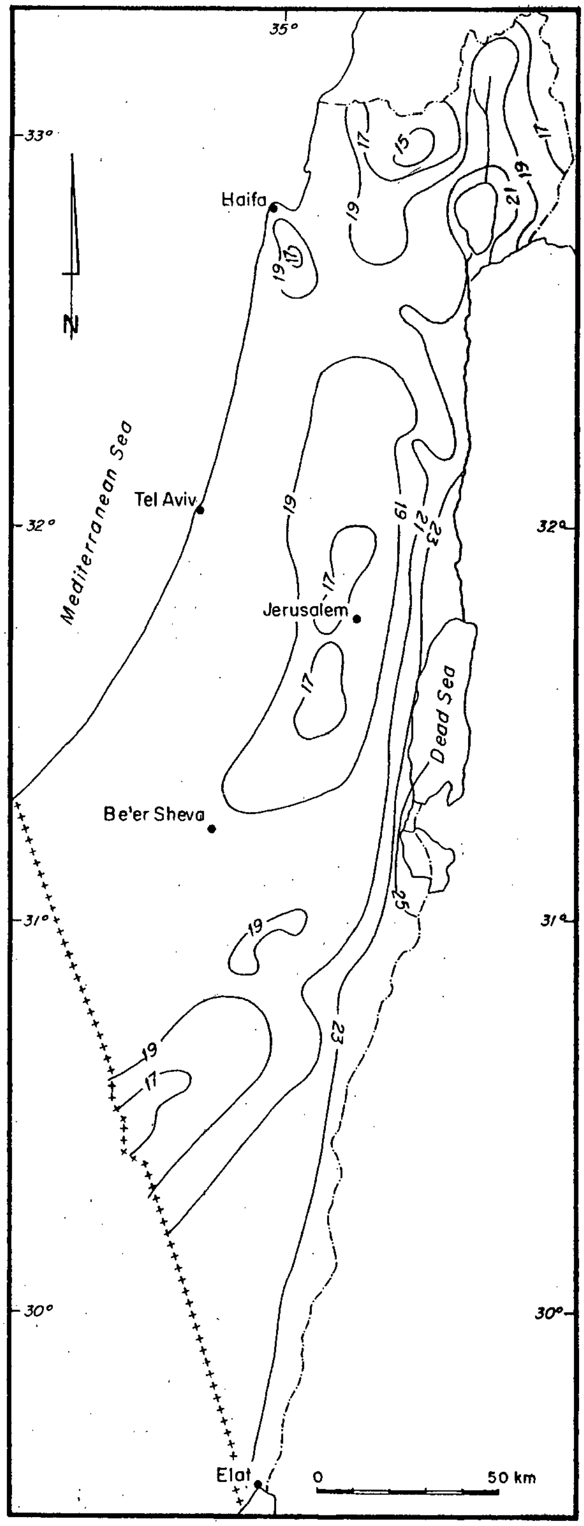

Figure 5. Mean annual temperature (After The New Atlas of Israel 1995: p. 27, 9).

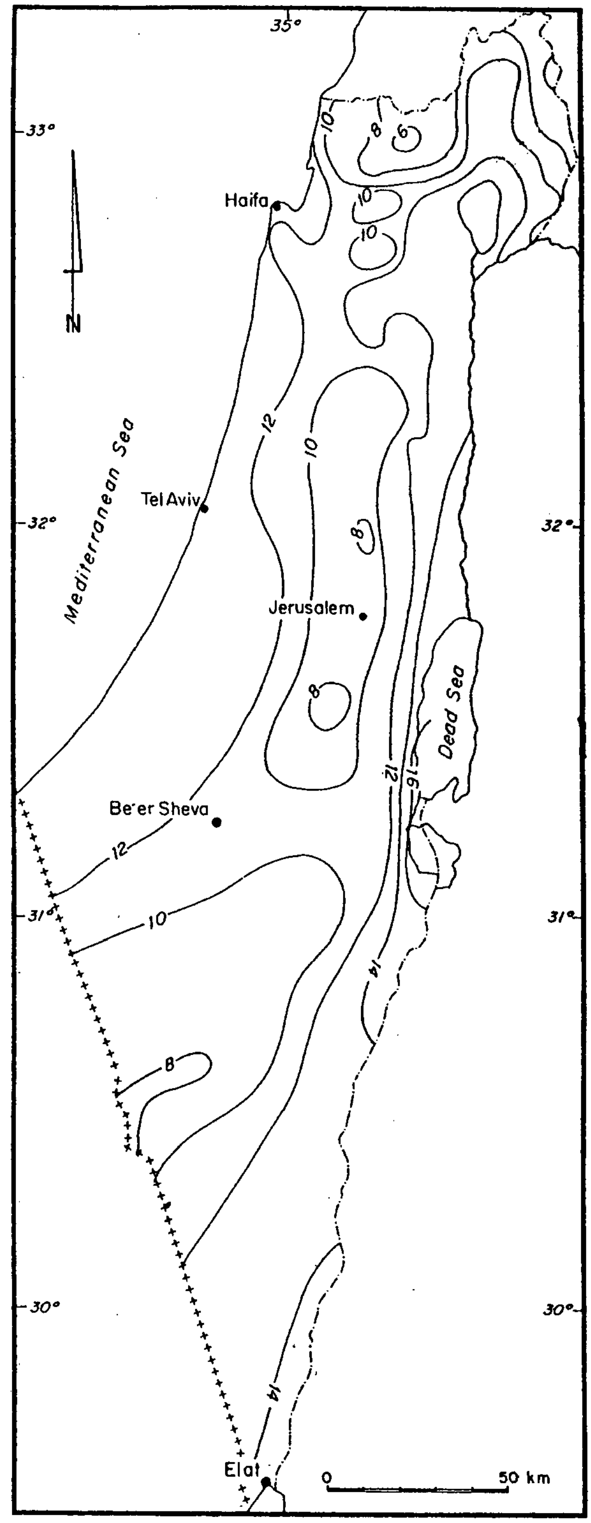

Figure 6. Mean temperature of January (After The New Atlas of Israel 1995: p. 27, 11).

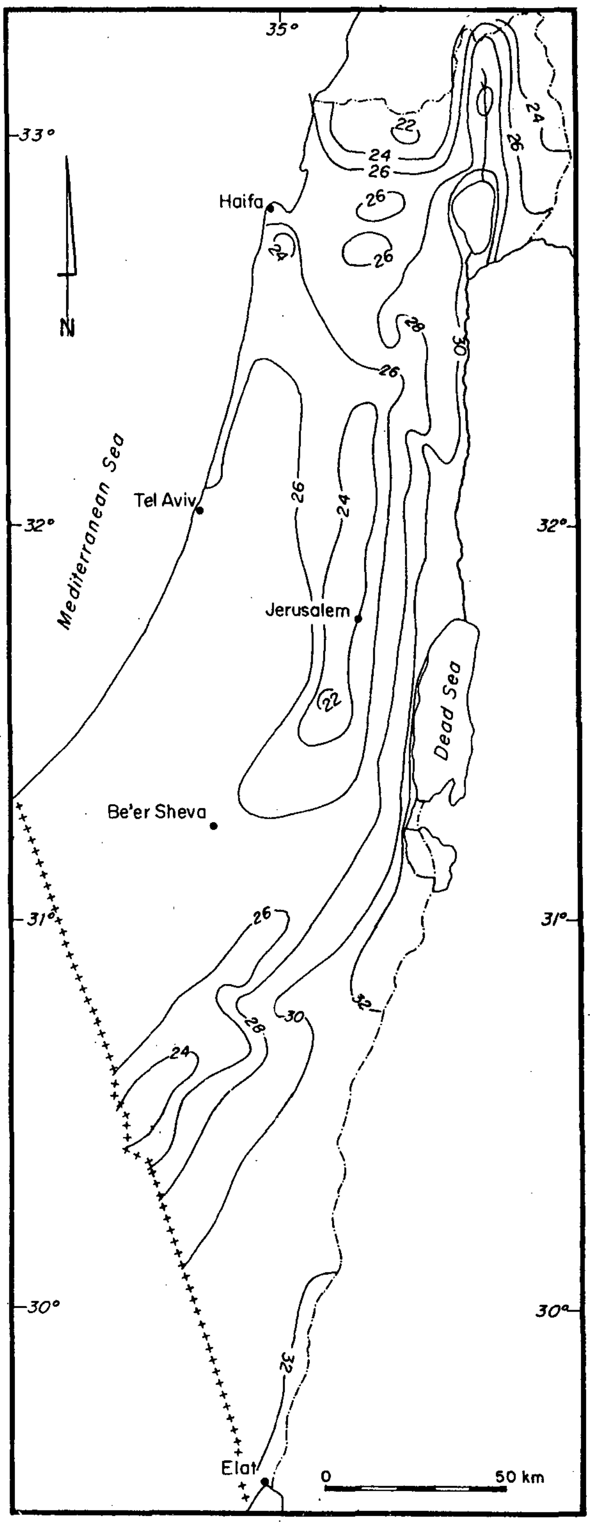

Figure 7. Mean temperature of August (After The New Atlas of Israel 1995: p. 27, 10).

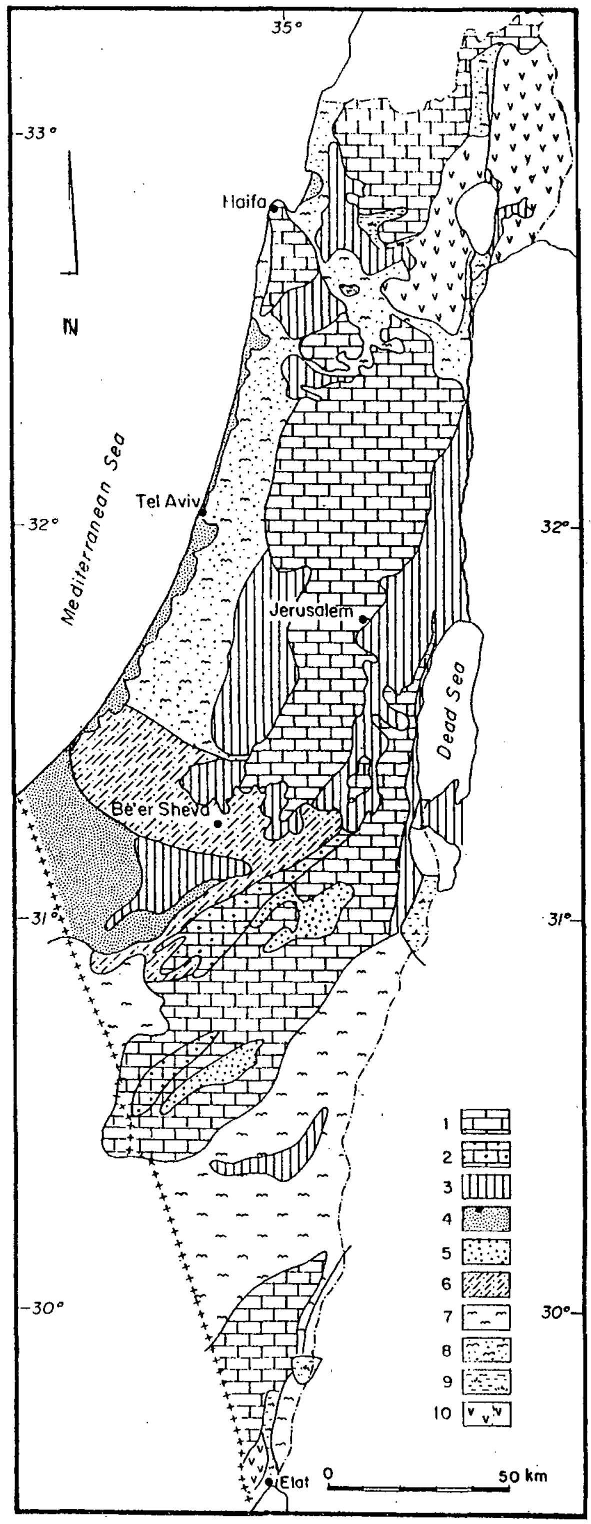

Figure 8. A schematized geological map of Israel (after Bartov 1994).
1. Limestone and dolomite. 2. Limestone with large outcrops of smooth-faced rocks. 3. Chalk and soft sedimentary rocks. 4. Sand. 5. Old sandstone with or without sand cover. 6. Loess. 7. Coarse alluvium, mostly in gravel plains. 8. Fine alluvium, mostly deep clay soils. 9. Salt marshes. 10. Basalt in the north part of the country, magmatic and metamorphic crystaline rocks in the south.

2.4 Soils

Terra Rossa soils occur in the mountainous areas on hard rocks, and Rendzinas on the soft ones (Dan & Raz, 1970; Dan et al., 1975). The influence of various kinds of Terra Rossa on the distribution of maquis associations will be specifically discussed in the chapter on this kind of vegetation in the forthcoming volumes. Basaltic Brown Mediterranean soils, lithosols, and grumosols develop on basalt rocks of much of the Golan plateau and the NE Galilee. Whereas most Terra Rossa soils in Israel are poor in available phospohrus, the soils developed on basalt rocks are rich in it (Rabinovitch, 1981). The form of nitrogen compounds, either nitrates or ammonia compounds determines the nature of plants and plant communities on Rendzinas. These soils develop above marly chalk in the Mediterranean part of the country, are poorly aerated and much of their nitrogen is in the form of ammonia ions. The well aerated Terra Rossa soils have most of their nitrogen in the form of nitrates (Rabinovitch, 1981).

The Tertiary and Pleistocene rocks and derived soils fill up the small and large valleys and are typified by calcareous sandstones and sandy soils (Kurkar and Hamra) close to the coast and young sand dunes less than 2000 years old (Danin & Yaalon, 1982). The process of plant succession and the syngenetic changes in soil properties are discussed in detail in Section 6.6.1. Deep clay soils (grumusols) develop on alluvium far from the Mediterranean coast and on basalt plateau of the Golan and the Galilee. The high intensity of swelling of the montmorilonitic clay component of these soils through imbibition, and their contraction through desiccation dictate two kinds of stress on plant life. In winter the rhizosphere becomes waterlogged and thus oxygen-poor; in summer the contraction of the soil causes deep fissures which tear roots and deeply desiccate the soil. These two kinds of stress influence much the nature of plants growing there.

The steppe and desert areas of Israel develop on rather divers kinds of rocks such as limestone, chalk, marl, chert, or gravel of alluvial origin. Fine-grained substratum with high water holding capacity becomes salty under desert conditions (Yaalon, 1963). They hold much of their water close to the soil surface, thus losing much of it through direct evaporation. The minute quantities of salts (8 ppm) carried from the Mediterranean sea by clouds and later deposited by rain remain and accumulate in the soil (Yaalon, 1963).

Loess is an important aeolian sediment, composed mainly of silt and clay, which influences much the soils of the transition zone of the Mediterranean territory and the steppelands. Large flat lands south of that transition zone occur in the northern Negev. At the boundary of the loessial soils with the sands of the western Negev (Dan et al., 1975) and in alluvial terraces of large wadis dissecting the sand sheets, there are mixtures of loess and sand at varying quantities which have a fundamental impact on plant life. The impact of loess on the nature of soils is prominent also in the Brown Lithosols which develop on the layers of limestone and dolomite of the Negev Highlands. Although undivided by pedologists, some 20 kinds of this soil have been recognized during vegetation mapping (Danin, 1970; Danin et al., 1975). Small areas of wet saline soils occur in the small areas of the coastal salinas at the Akko area, at the Jordan and Dead Sea Valleys, and at the southern Arava. Non-saline hydromorphic soils occur at Bika'at Bet Zaida (Bteikha) and the Hula Valley at the northern Rift Valley.

3. FLORA OF ISRAEL AND THE SURROUNDING COUNTRIES (DANIN)

There are 2682 plant species in Israel (Feinbrun-Dothan & Danin, 1991; Danin, 1992). This number includes about 200 species that occur at the Mt. Hermon area and are absent from other districts of Israel. The high species-to-area ratio of Israel, is related mainly to the following factors:

1. Its position in a meeting zone between four plant geographical regions, each with its typical flora.
2. The wealth of habitats derives from the climatic transition between the relatively humid area in the northern part of the country and the desert in the south. Topography influences the warm climate of the Jordan to Arava rift valleys and the relatively cold climate of Mt. Hermon. In a similar way other highlands and lowlands have local influence on the climate which increases the habitat diversity of Israel and hence plant species diversity. Although the geomorphologic structures are relatively small, the number of rock types is high. As a result, many soil types developed in a small area (Dan & Raz, 1970) and increase the diversity of habitats available for plants.
3. A long history of human activity of cultivation and grazing by domestic animals led to conclusive stress on the existing flora and enabled the penetration of many alien species. Many of the latter occupy synanthropic habitats (i.e., growing in habitats created by human activity (Zohary, 1973; Danin, 1991a).

According to Eig (1931-32), Zohary (1962, 1966, 1972), Feinbrun-Dothan (1978, 1986), and Danin & Plitmann (1987), the flora of Israel is divided into the following seven groups:

1. Mediterranean (M) species, which are distributed around the Mediterranean sea.
2. Irano-Turanian (IT) species, which inhabit Asian steppes of the Syrian desert, Iran, Anatolia in Turkey, and the Gobi desert.
3. Saharo-Arabian (SA) species, which grow in the Sahara, Sinai, and Arabian deserts.
4. Sudano-Zambesian (S) species, typical to the subtropical savannas of Africa.
5. Euro-Siberian species, also known in countries with a moister and cooler climate than that of Israel; growing mainly in wet habitats and along the Mediterranean coasts.
6. Bi-regional, tri-regional, and multi-regional species that grow in more than one of the regions mentioned above. The most common of these are M-IT species.
7. Alien species from remote countries which grow without human assistance. The principle countries of origin of these plants are the Americas, Australia, and South Africa.

Four plant geographical territories have been delineated in Israel (Eig, 1938; Zohary, 1962): 1. Mediterranean, 2. Irano-Turanian, 3. Saharo-Sindian, and 4. Sudano-Decanian enclaves. Zohary (1966) renamed some of the phytogeographical regions; he regarded parts of Eig's Saharo-Sindian as Saharo-Arabian and Eig's Sudano-Decanian as Sudanian. Eig's Sudano-Decanian enclaves in the Dead Sea area became a "territory of Sudanian penetration".

In a recent quantitative analysis of the plant geographical territories of Israel and Sinai (Danin & Plitmann, 1987), based on the chorotypes presented in Flora Palaestina (Zohary, 1966, 1972; Feinbrun-Dothan, 1978, 1986) a new plant geographical map of the area was composed (Fig. 9). In that map the Mediterranean territory (see M in Fig. 9), is rather similar in extent to that of Eig (1931-32). All other territories are regarded as "complex territories" where the second most frequent chorotype is in parentheses. For example, in the M(M-IT) territory the most frequent chorotype is the Mediterranean (M) and the second one is the bi-regional M-IT. Thus the complex territories are the following: M(M-IT), SA(M), SA(IT), SA(S), IT(SA), and S(SA). On a large scale map one can see two main domains in Israel – the Mediterranean – including the M and the M(M-IT) territories, and the Saharo-Arabian – including the SA(M), SA(IT), and SA(S) territories. The area that the IT(SA) and the S(SA) territories occupy in Sinai is more prominent than in Israel. The basic elements of the phytogeographical map (Fig. 9) were produced in a map showing floristic gradients that was based on plant names and not on their chorotypes (Kadmon & Danin, 1997).

A phytogeographical analysis of the flora of each of the geographical districts of Israel and Jordan is presented in Fig. 10. The data used for this map are predominantly from Feinbrun-Dothan & Danin (1991). The flora of each of the 31 districts was analyzed and the bars presented in the diagrams of Fig. 10 are those of the following chorotypes in order, from left to right: M, M-IT, IT, SA, Thrm (= thermophilous, including Sudanian, Tropical and Subtropical), and Oth (= other chorotypes).

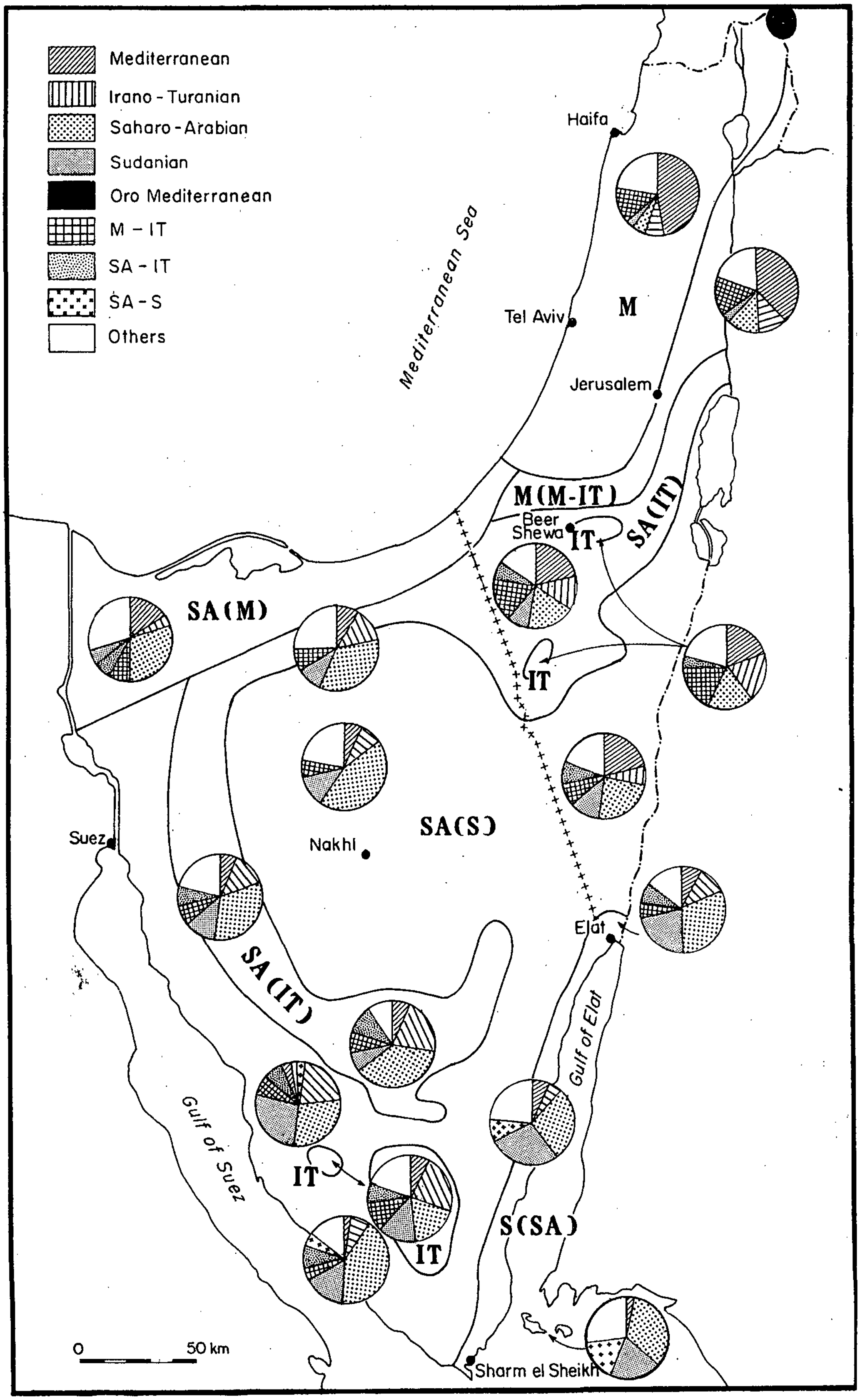

Figure 9. A phytogeographical map of Israel and Sinai (after Danin & Plitmann 1987).

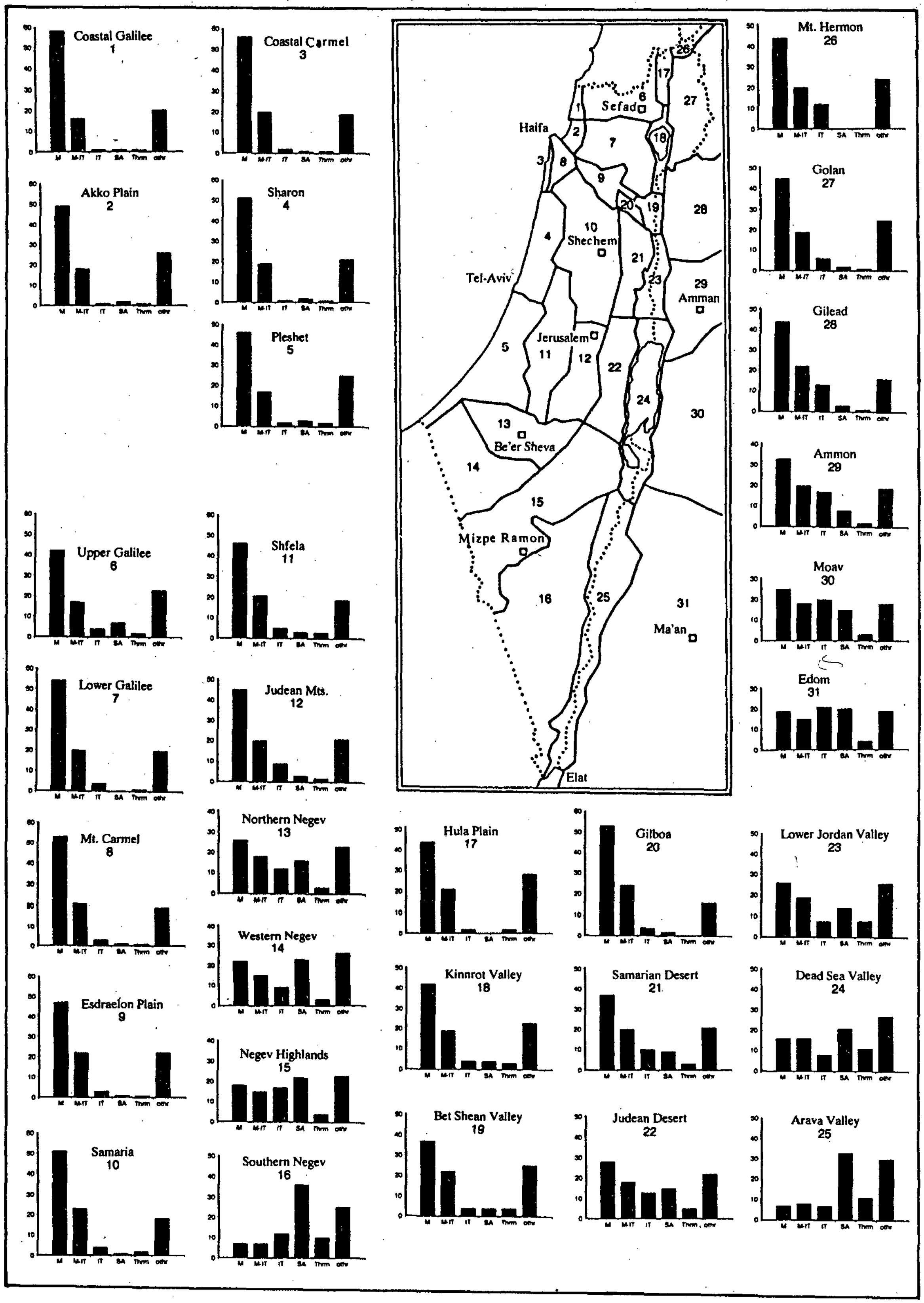

Figure 10. A phytogeographical map of Israel and Jordan (from Danin 1995b).

Bar graphs of districts 1 through 5 display the distribution of chorotypes in the districts of the coastal plain. There is a gradual decrease in the percentage of Mediterranean (M) and M-IT species from north (1) to south (5) and an increase of the desert (SA and IT) and thermophilous species.

Bar graphs of districts 6 through 12 and 17 through 20 are of the Mediterranean territory of Israel and display a rather similar phytogeographical spectrum, with M and M-IT chorotypes being the most frequent ones. In most of these eleven districts the percentages of the IT, SA, and thermophilous species are negligible.

Most of the desert districts display a rather mixed spectrum except for the extreme desert ones (16 and 25) where the SA chorotype has the highest percentage. This mixed spectrum indicates that the environmental conditions are neither too dry nor excessively moist, thus enabling the coexistence of species from various chorotypes. The high percentage of M and M-IT species in districts 13, 14, 21, 22, 23, and 24 may be explained by the geographical proximity of these districts to the boundary of the Mediterranean region. The high percentage of the latter species in the Negev Highlands was attributed by Danin & Plitmann (1987) to the presence of many relicts (Danin, 1972) of moister climates in crevices of smooth-faced outcrops of limestone and in wadis. The districts east of the Jordan river display patterns that are similar to those of the area west of the Jordan, with exception of the highest peak in the study area, Mt. Hermon, having a high percentage of Irano-Turanian species (Danin, 1995b).

Whereas the north to south gradients in the floristic composition in areas with small differences in mean annual rainfall is moderate, the gradients in west to east transects are much more abrupt. The floristic differences between the districts of the main mountain range and the area east of it display, floristically, the rain shadow effect. This is evident when districts 6 or 7 are compared with 18, district 10 with 21, 12 with 22, and 15 with 16. In all these cases the more drought resistant species that belong to the IT and SA chorotypes and the thermophilous species display a higher percentage at the rain shadow whereas the M and M-IT chorotypes have a lower percentage.

4. THE MAIN VEGETATION TYPES OF ISRAEL (DANIN)

The vegetation is divided into that of the relatively humid part characterized by woodlands of Mediterranean species and that of the more arid part with steppes and deserts dominated by Irano-Turanian and Saharo-Arabian species. The units of the vegetation map (Fig. 11) are also the headings of sections in this chapter.

4.1 Woodlands and forests

Woodlands inhabit the mountains of Judea, Carmel, and Galilee, but in considerable areas are replaced by cultivated plants. A few thousand years ago, man in Israel, as in the neighboring Mediterranean countries, started to clear the natural vegetation and created agricultural land. Annual grasses, such as wild wheat, barley, and oats, have been domesticated from the spontaneous flora of the area and were cultivated over gradually increasing areas. Trees such as olives (*Olea europaea*) and almonds (*Amygdalus communis*) have been domesticated as well and were planted on hill slopes. The timber derived from the cleared woodlands was used for the construction of houses, for agricultural tools, and as fuel. During the few last millennia shepherds burned considerable woodland areas in order to improve the pasture quality through replacement of sclerophyllous trees by more palatable herbaceous plants.

Woodlands of the sclerophyllous evergreen *Quercus calliprinos* and the deciduous *Pistacia palaestina* dominated in historic times hard limestone with Terra Rossa soil, which covered the mountains of the northern and central part of the country. Their mesic aspect is still common at present in the Upper Galilee and Mt. Carmel and their xeric aspect in the Judean Mts., (Zohary, 1960). In the upper Galilee, where the climate is the most humid in Israel, the mesophytic companions of *Q. calliprinos* are: *Rhamnus alaternus, R. punctatus, Eriolobus trilobatus, Acer obtusifolium, Crataegus azarolus, C. monogyna, Arbutus andrachne, Laurus nobilis,* the vines *Clematis flammula,* and *Hedera helix*, and many geophytes and herbaceous species. Mesophytic components rarely occur in the woodlands of the Judean mountains. In the woodlands of the driest sites *Rhamnus lycioides* subsp. *graecus* is the only arboreal companion of *Q. calliprinos.* Typical vines in these maquis are *Rubia tenuifolia, Lonicera etrusca, Asparagus aphyllus,* and *Ephedra foeminea.*

Marly-chalk is a common rock type which has a high moisture holding capacity and when weathered, is covered with Light Rendzina soil. Since the aeration of the rhizosphere of trees growing on these soft rocks is poor only specially adapted plants develop there. Much of the nitrogen in these Rendzinas is ammonium nitrogen whereas in the Terra Rossa it is nitrate nitrogen. The vegetation of Light Rendzinas of marly-chalk is poor in annuals when compared with that of Terra Rossa. In sites with high clay content of the rock and low aeration, *Arbutus andrachne* is the dominant, occasionally accompanied by *Pinus halepnsis*. At lower clay content the latter is the dominant.

Following abandonment of cultivated areas, they are invaded by Mediterranean semi-shrubs locally known since Biblical times as "batha" (= phrygana). At present, after thousands of years of deforestation, agricultural and urban developments, large parts of these areas are in fact mosaics of seral semi-shrubs communities dominated by *Sarcopoterium spinosum, Coridothymus capitatus, Cistus creticus* and *C. salviifolius*. Formations of taller shrubs such as *Calicotome villosa* and *Salvia fruticosa* replace the *Sarcopoterium* dominated bathas.

4.2 *Quercus calliprinos* woodlands on basalt

These differ from woodlands on Terra Rossa by the rich herbaceous layers and the absence of seral semi-shrub communities. Remnants of such woodlands occur in the northern Golan and in the northeastern Galilee. In the Golan, the companions are *Q. boissieri, Crataegus monogyna, C. aronia,* and *Prunus ursina*. The rich herbaceous layer includes some 20 species of *Trifolium*. Most tree trunks and thick stems are covered by mosses and lichens supported by the frequent mist and low clouds. The richness of this layer may be an outcome of the relatively high amounts of available phosphorous in the soil (Rabinovitz, 1981).

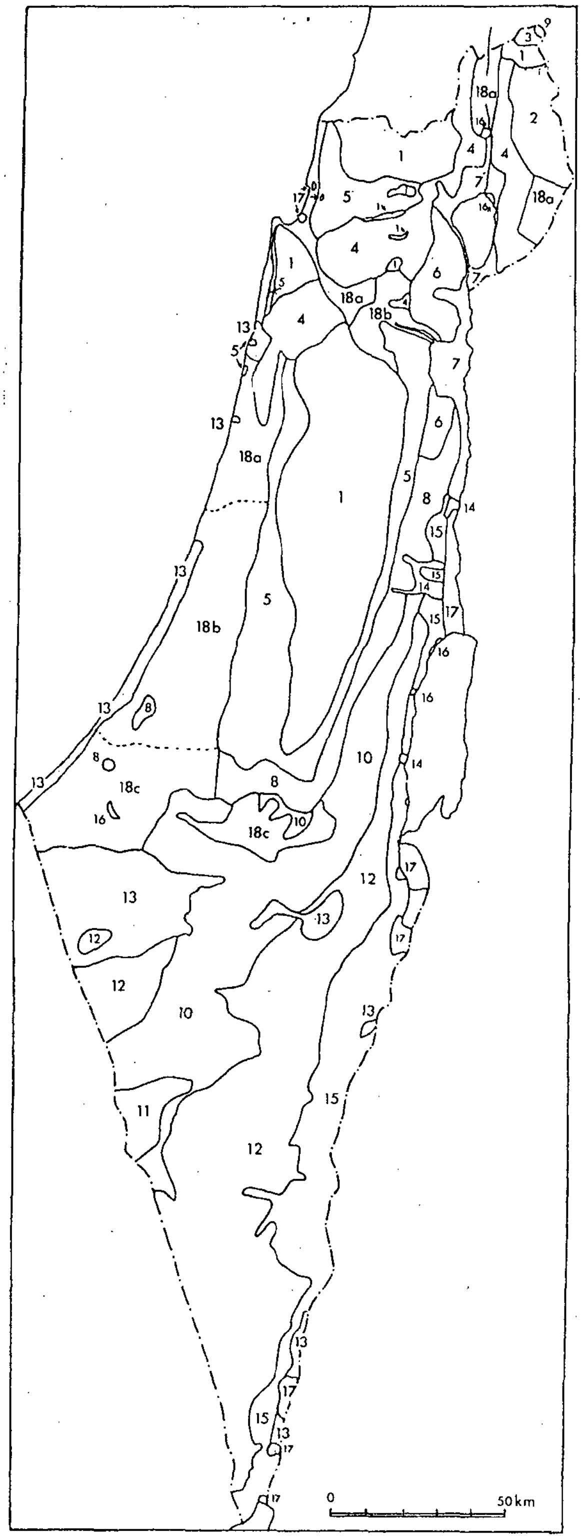

Figure 11. Vegetation map of Israel: 1. Maquis and forests. 2. *Quercus calliprinos* woodlands on basalt. 3. Montane forest of Mt. Hermon. 4. Open forests of *Quercus ithaburensis*. 5. Open forests of *Ceratonia siliqua* and *Pistacia lentiscus*. 6. *Ziziphus lotus* with herbaceous vegetation. 7. Mediterranean savannoid vegetation. 8. Semi-steppe batha. 9. Tragacanth vegetation. 10. Shrub-steppes. 11. Shrub-steppes with trees. 12. Desert vegetation. 13. Sand vegetation. 14. Oases with Sudanian trees. 15. Desert savannoid vegetation. 16. Swamps and reed thickets. 17. Salt marshes. 18. Synanthropic vegetation.

4.3 Montane woodland of Mt. Hermon

The montane woodland stretches from elevation of 1,300 to 1,700 m and its dominants are deciduous trees such as *Quercus boissieri, Q. libani, Acer microphyllum*, as well as several species of *Crataegus, Amygdalus,* and *Prunus*. Their companions are mainly perennial grasses such as *Hordeum bulbosum, Bromus tomentellus, Secale montanum,* and *Elymus panormitanus.*

4.4 Park forests of *Quercus ithaburensis*

The Tabor oak is often accompanied in the opened forests by *Styrax officinalis*, sometimes by *Pistacia atlantica*, and always by plenty of herbaceous plants. The few semi-shrubs found in this community when developing on chalky ground are mainly of *Majorana syriaca*. This type of vegetation, once dominating the Sharon Plain, is now restricted in the Sharon to single sporadic Tabor oak trees and one reserve between Haifa and Tel Aviv. There are extensive park forests of the Tabor oak in the Lower Galilee and in the Golan, below 500 m (Fig. 12).

4.5 Park forests of *Ceratonia siliqua* and *Pistacia lentiscus*

This type of vegetation occupies Terra Rossa or Brown Rendzina soils at the lower elevations of the main mountain ranges, below 300 m a.s.l. on both sides of the central mountain range, and light soils of the Sharon Plain. Shifting sand covered the carob-pistachio landscape to varying extent and near Caesarea carobs accompanied by *Artemisia monosperma* shrubland commonly occurred before urbanization (Fig. 13). Generally, the community is more drought and heat resistant than the communities dominated by *Quercus calliprinos.* One of the important companions in rocky situations at Mt. Carmel and the Galilee is the wild olive – *Olea europaea* var. *sylvestris* – that resembles the cultivated olive but has much smaller fruits. The main companion of the carob at the southern Judean foothills is *Rhamnus lycioides* subsp. *graecus*. The latter totally replaces all the other arboreal components in dry habitats.

4.6 Mediterranean Savannoid vegetation

Ziziphus spina-christi is the dominant tree in savannoid vegetation, where it is accompanied by grasslands of large-seeded Mediterranean grasses such as *Triticum dicoccoides, Hordeum spontaneaum,* and *Avena sterilis*. True savannas of *Z. spina-christi* occur in Africa where its companions are Sudanian perennial grasses. The savannoid vegetation develop on warm stony-rocky slopes of the Galilee, Golan, Gilead, and Samaria descending to the rift valley at elevation of sea level and below it. Stands of *Z. spina-christi* also typify the transversal valleys on grumusols where the companions are *Scolymus maculatus* (Fig. 14), *Carthamus tenuis* and several species of *Daucus, Torilis,* and *Ammi.* At the southern coastal plain, on sandy soils the companions are *Hyparrhenia hirta* and *Coridothymus capitatus.*

Acacia albida, a relatively rare Sudanian tree in Israel, forms patches of savannoid vegetation in a few places in the Bet-Shean, Esdraelon, HaElla Valleys, and the southern coastal plain. Its thick coated fruits, that do not open when ripe, are rare in Israel. It is suggested that the tree arrived in Israel a few million years ago from Africa and established itself in a few isolated places where it propagates mostly vegetatively from root-borne shoots at present (Halevy, 1971).

4.7 *Ziziphus lotus* with herbaceous vegetation

Grasslands of *Triticum dicoccoides, Hordeum spontaneaum,* and *Avena sterilis* cover the relatively dry and warm area of basalt hills in the southeastern Galilee, and the slopes around the Sea of Galilee down to the Samarian desert. In drier and warmer sites *Stipa capensis* becomes the dominant species. However, together with the herbaceous species the spiny shrub, *Ziziphus lotus*, forms green patches all over the area. This vegetation type is presented as a mosaic with the Mediterranean savannoid on steep topography at the vicinity of the rift valley north of Jericho and up to north of the Sea of Galilee. Nests of harvesting ants (*Messor* spp.) become prominent from afar due to successful development of otherwise ruderal plants such as *Silybum marianum, Chrysanthemum coronarium,* and *Beta vulgaris* (Fig. 15) on the nutrient-rich trashing zone of the nest (Danin & Yom-Tov, 1990; Danin, 1989a, 1989b).

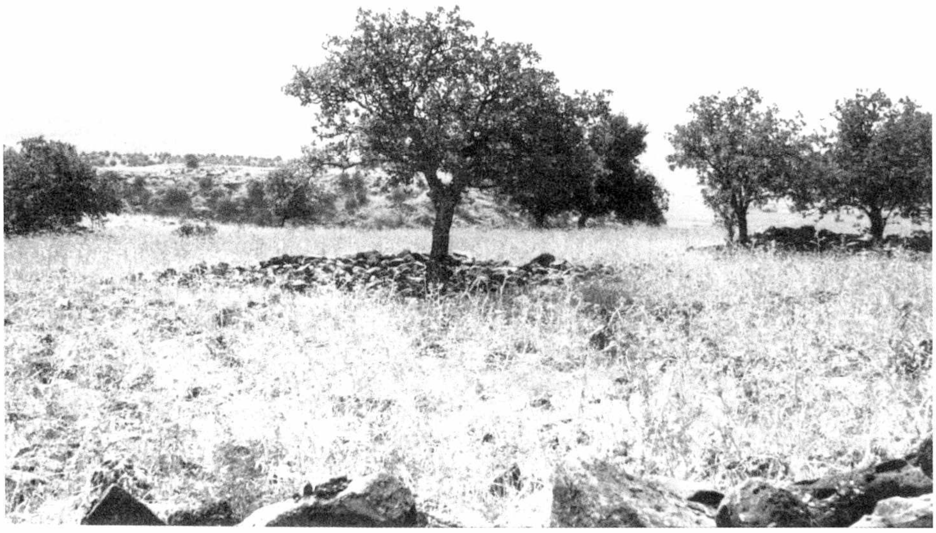

Figure 12. Park forest of the Tabor oak in the Golan, below 500 m. Note the annual companions and the piles of stones gathered during the Middle Bronze age and function as establishment sites for the oaks.

Figure 13. Park forests of carob (*Ceratonia siliqua*) near Caesarea, covered with sand which became populated with Artemisietum monospermae.

Figure 14. Savannoid vegetation above the Sea of Galilee, dominated by *Ziziphus spina-christi* with *Scolymus maculatus* as the main companion.

4.8 Semi-steppe batha

The communities dominated by semi-shrubs at the boundary of the Mediterranean zone, where mean annual rainfall is 300-400 mm, are regarded as semi-steppe bathas (Zohary, 1962). There are several communities dominated by Mediterranean plants such as *Sarcopoterium spinosum* that dominates bathas in more mesic parts of the country (Sect. 4.1). Others, such as *Artemisia sieberi* and *Noaea mucronata,* which otherwise dominate steppe areas in the Negev, Sinai, Jordan, and eastwards to Afghanistan, may inhabit drier habitats (Fig. 16). Many plants, such as *Sarcopoterium spinosum,* that play an important role in the seral communities in fallow fields at the center of the Mediterranean territory of Israel grow here in their primary habitats. Trees are limited in this area to relatively moist habitats such as crevices of smooth rocks (e.g. *Pistacia atlantica, Amygdalus korschinskii,* and *Crataegus aronia*) and to dry water courses (e.g. *Ziziphus spina-christi*).

4.9 Tragacanth vegetation of Mt. Hermon

The most prominent formation of vegetation developed on the windward slopes of the peaks of Mt. Hermon above 1,900 m is dominated by spiny cushions plants. This formation is also known as tragacanth vegetation, a name derived from a large group in the genus *Astragalus* – section *Tragacantha* (also known as the independent genus *Astracantha* Podlech). Many species of this group and of the genus *Acantholimon* are components of this type of vegetation all over the Middle East. Because of the short growth season and the harsh environment only very few small-sized annual plants accompany the cushion plants.

Several species of tragacanth *Astragalus* occur in areas remote from Mt. Hermon and the Lebanon mountains. *A. bethlehemiticus* is a typical companion of steppes and rock vegetation in the shrub-steppes of the Negev Highlands and SW Jordan; *A. echinus* is a representative of this group at the high elevations of S. Sinai.

4.10 Shrub-steppes

Semi-shrubs dominate in a diffused pattern most of the area of the Negev Highlands and the Judean Desert where mean annual rainfall is 80-250 mm, thus forming shrub-steppes. The most common dominants of these steppes are

Figure 15. A nest of harvesing ants (*Messor semirufus*) with successful development of otherwise ruderal plants of *Chrysanthemum coronarium*, and *Beta vulgaris* on the nutrient-rich trashing zone of the nest.

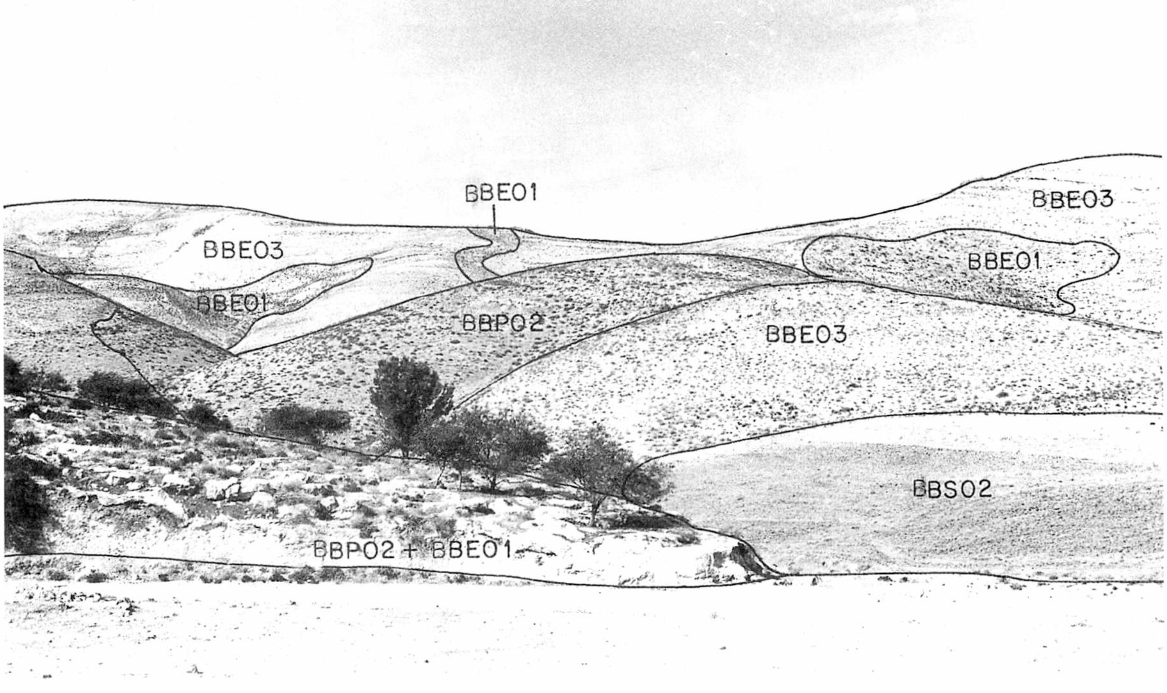

Figure 16. Slopes covered by semi-steppe bathas 5 km east of Jerusalem. Codes for associations in the synopsis (Sect. 6.1). BBP02 – on hard limestone, BBE associations on soft chalk, and BBS02 on alluvial soil.

Artemisia sieberi, *Noaea mucronata*, and *Gymnocarpos decander*. Showy geophytes, such as species of *Tulipa*, *Iris*, *Ixiolirion*, *Ranunculus*, and *Anemone*, may bloom in high quantities in the steppes in moist years. The phytomass produced by annuals in the plant communities developing on stony or rocky soils is always rather small when compared with that of fine-grained and deep soils. Rain water penetrates in the latter types only the upper shallow soil layers, therefore losing much of it through direct evaporation. The minute quantities of salts (8 ppm) carried from the Mediterranean sea and contained in the rain remain in the soil and accumulate there (Yaalon, 1963). The soil may be too dry or too saline for the growth of annuals in regular or dry years. In moist years there is a wealthy development of annuals, although in patches with high salinity there are mono-specific patches of salt-resistant annuals. Nearly monospecific communities of semi-shrubs exist, each of them best adapted to the specific local saline conditions (Danin, 1978b). The most common dominants under these conditions are *Reaumuria hirtella*, *Reaumuria negevensis*, *Salsola vermiculata*, *Bassia* (*Chenolea*) *arabica*, and *Atriplex glauca* on chalk- and marl-derived soils; *Anabasis syriaca* and *Haloxylon scoparium* are the shrubby dominants on loess derived soils.

Outcrops of smooth-faced hard limestone support plants that may differ much from those on the other soil types. These rocks do not absorb much water and their crevices receive high amounts of water through local runoff (Danin, 1972, Yair & Danin, 1980). They support rather rich vegetation typically characterized by *Chiliadenus iphionoides* (Fig. 17), *Globularia arabica, Stachys aegyptiaca, Origanum dayi,* and *Capparis aegyptia.* Isolated populations of dozens of Mediterranean relicts and many rare desert plants are found in this habitat in the Negev and the Judean Desert. The semi-shrub *Sarcopoterium spinosum*, and the geophytes *Narcissus tazetta* (Fig. 18), and *Sternbergia clusiana* are representative examples of this phenomenon in the Negev (Danin, 1983).

Shrubs of *Retama raetam, Lycium shawii,* and the semi-shrub *Achillea fragrantissima* are the dominants in wadis of the terrain of hard limestones. *Atriplex halimus* prevails in this habitat where the catchment area is built up from chalk, clay or marl. At lower elevation *Acacia raddiana, A. pachyceras, Tamarix nilotica,* and *T. aphylla* occur as well.

Many small springs can be detected from afar by the date palm (*Phoenix dactylifera*) which is confined to sites with high water-table of fresh water. It is accompanied by *Nitraria retusa, Juncus arabicus, Phragmites australis,* and *Cressa cretica.* Canyons occur in many wadis and may have long lasting water pools supplied by floods and support rich flora of green algae such as *Chara* spp. hydrophytes such as *Zannichellia palustris* and *Potamogeton* spp.

4.11 Shrub-steppes with trees

Most of the area of this category is dominated by the semi-shrubs *Artemisia sieberi, Noaea mucronata*, and *Gymnocarpos decander*. However, almost 1,400 adult trees, most of which are of *Pistacia atlantica*, and some are of *Amygdalus ramonensis* or *Rhamnus disperma* (Danin & Orshan, 1970; Danin, 1983), occur throughout the area. These trees are found close to outcrops of smooth-faced rocks (Fig. 19). The high yields of runoff water from these rocks to their crevices enable the successful germination and the establishment of trees even out of wadis. The trees may be several hundred years old. Wadis with such outcrops in their catchment area support large trees. Rare relicts, such as the vines of the Mediterranean maquis *Prasium majus* and *Ephedra foeminea*, and endemic plants, such as *Origanum ramonense* and *Ferula negevensis* also occur in these habitats.

4.12 Desert vegetation

Vegetation in the arid part of the country, where mean annual rainfal < 80 mm, is either restricted to dry watercourses (= wadis; 'mode contracte' *sensu* Monod, 1954) or covers slopes and depressions ('mode diffus' *sensu* Monod, 1954). In an area where the climatic conditions enable the development of diffused vegetation on most soil types, relatively dry soils such as silty or clayey soils locally support contracted vegetation. On the other hand plants demanding high quantities of moisture occur in special habitats out of wadis, in zones of contracted vegetation. In most areas of this vegetation type shrubs and trees are confined to wadis. However, on the boundary with steppes typical semi-shrubs *Anabasis articulata* and *Zygophyllum dumosum* grow in a diffused pattern. Chalk and marl outcrops are populated by the halophyte communities of *Suaeda asphaltica*, *Salsola tetrandra*, and *Haloxylon negevensis*. The nearly monospecific communities of semi-shrub halophytes (Fig. 20) are accompanied by diverse assemblage of herbaceous plants that grow on soil leached only in rainy years.

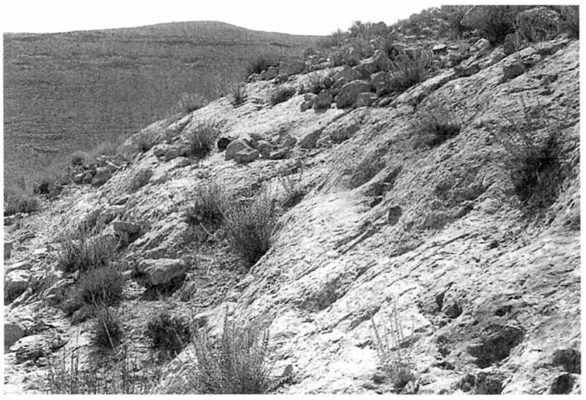

Figure 17. Smooth-faced limestone outcrop covered with epilithic lichens and supporting *Chiliadenus iphionoides* in the crevices (from Danin 1983).

Figure 19. A steppe-forest at Nahal Elot catchment area. *Pistacia atlantica*, and *Amygdalus ramonensis* trees with a few *Rhamnus disperma* shrubs growing near large rocks. A shrub-steppe of *Artemisia sieberi*, *Noaea mucronata*, and *Gymnocarpos decander* cover the rest of the area.

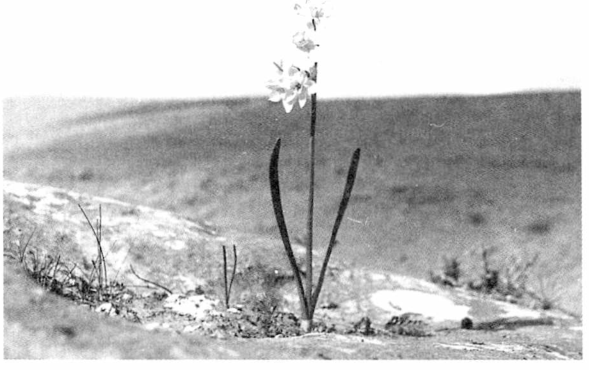

Figure 18. *Narcissus tazetta* growing as a Mediterranean relict in a crevice of smooth-faced limestone, covered by epilithic lichens.

Figure 20. A chalk slope at the Judean Desert dominated by *Suaeda asphaltica*. This nearly monospecifric layer of semishrubs is accompanied by a rich assemblage of ephemerals. The white lines are grazing paths created by their continuous passaege.

The nature of plant communities and the sequence of their occurrence along the wadis are in close affinity to rock and soil types, which greatly affect the moisture, salinity, and nutrient regime of the wadi systems (Lipkin, 1971). There are different plant communities in wadis on flint pebbles, flint rocks, limestone outcrops, magmatic rocks, or marl. An example of the diversity of plant communities in such an area near Hazeva is discussed by Rudich & Danin (1978). Generally, annuals grow at the upper section of the wadi and only in winter and spring of rainy years. Annual associations dominated by *Aaronsohnia factorovskyi, Stipa capensis,* or *Anastatica hierochuntica* are typically growing in wadis of old and well-leached regs. Sandy ground of the gravel plain support annual associations of *Savignya parviflora, Polycarpon succulentum,* and *Eremobium aegyptium*. More salty ground, often chalky-marl, support associations dominated by *Salsola inermis, Salsola volkensii*, and *Mesembryanthemum forsskalii*. The lower sections of the wadis, which get higher quantities of water, support small and short living semi-shrubs such as *Pulicaria incisa* which may locally turn to an annual. The common small perennial plants of other associations are: *Helianthemum kahiricum, H. lippi, H. sancti-antoni, Salvia lanigera, S. deserti, Asteriscus graveolens, Anvillea garcini, Erodium crassifolium,* and *E. arborescens*. Further down in the wadis, larger semi-shrubs such as *Anabasis articulata* dominate. Further down the wadi system the dominants are shrubs such as *Retama raetam* and *Lycium shawii*. In the lowest section of the wadi system trees, mostly acacias or tamarisks, may be found.

4.13 Sand vegetation

Sand dunes or sand sheets occur in Israel at the Mediterranean coastal plain, in the Western Negev, a few valleys of the Northern Negev, and in the Arava Valley. These areas differ from each other in their climatic regime, and sand texture. Hence, their vegetation types and processes of their development differ accordingly.

Sand carried by the Nile River from Africa to the Mediterranean is transported by sea currents and deposited on the coast. When dried, it is transported inland by the common westerly winds. Devoid of fine-grained particles, the plantless sands become populated by the perennial grass *Ammophila arenaria* which forms phytogenic mounds, also known as nebkas (Danin, 1996). Airborne fine-grained material is incorporated into the sand near the plants, thus leading to amelioration of its moisture regime.

Under such conditions a succession of plant communities take place. *Artemisia monosperma* is the dominant on stable sand rich in nebkas in the first few years. In the course of time new *Artemisia* plants establish themselves among the mounds and the area becomes flat. Dust accumulation becomes efficient once the vegetation covers more than 30 percent of an area. The moisture regime of the soil becomes even better as additional quantities of dust and humus accumulate at upper soil layers.

The response of vegetation is an increase in species diversity and phytomass production. At a certain stage the woodland plants succeed in growing at the shade of the *Retama raetam* shrubs and, in the course of time, replace them. When much of the area is covered by shrubs of *Pistacia lentiscus* and *Calicotome villosa*, trees of *Ceratonia siliqua* establish themselves in their shade on a humus-rich soil. In the southern coastal plain the succession does not go much beyond the *Artemisia monosperma* with *Retama raetam* stage.

Mobile sands in the Western Negev are dominated by *Stipagrostis scoparia* constituting nebkas (Fig. 21). The sand has a finer texture than that of the coastal sands and, therefore, has a relatively good moisture regime. Airborne silt and clay become incorporated into the upper soil layers that soon become populated by filamentous cyanobacteria (Danin et al., 1989). Being drought resistant, these blue-green algae flourish in the fine-grained upper layers of the sand and bind the soil grains, thus decreasing their mobility. Stable sand supports communities of *Artemisia monosperma* and desert plants such as *Noaea mucronata* and *Panicum turgidum*. The north to south gradient in the Haluza sands (Fig. 22: No. 2) displays an increasing proportion of mobile sands that are organized as longitudinal dunes, whereas large parts of the northern sandy area is immobile sand sheets covered by the microbiotic crust. In Sinai, west of the border (Fig. 22: No. 3), overgrazing, cutting of lignified plants, and destruction of the microbiotic crust by continuous trampling has led to reworking of the sand and to the light colour of this area.

The sand of three valleys in the eastern Negev, some 20 km west of the Dead Sea Valley, is derived from Neogene sandstone and dominated by *Anabasis articulata*. Wadis in these sandy soils support larger shrubs of *Calligonum comosum* and *Retama raetam* (Fig. 23). The sands of the Arava Valley are derived from weathering of Nubian Sandstones in Edom. The relatively high water table there enables the successful development of *Haloxylon persicum* in sites where sand is sufficiently deep. The common semi-shrubs growing in the sandy areas are *Haloxylon salicornicum* and *Salsola cyclophylla*. In wadis crossing the sandy areas there are large *Haloxylon persicum* plants as well as occasional *Tamarix aphylla* trees covered by sand mounds that may reach a height of 5 m or even more.

4.14 Oases with Sudanian trees

The three main oases marked in the vegetation map (Fig. 11) are from south to north: En Gedi, Jericho, and Auja. The main features of the environment in these oases are high temperatures typical of the rift valley and the high quantities of fresh water derived from perennial springs. Most springs in the desert part of Israel, may be recognized from afar by the presence of date palms (*Phoenix dactylifera*) that are regarded as part of the typical flora of this habitat (Danin, 1983: Fig. 50). Other tree species typical of the Sudanian savannas are found in these oases, such as: *Acacia raddiana*, *Acacia tortilis*, *Calotropis procera*, *Moringa peregrina*, *Balanites aegyptiaca*, *Cordia sinensis*, *Maerua crassifolia*, *Dalbergia sisoo*, and *Ziziphus spina-christi*.

Figure 21. Nebkas formed by sand accumulation and growth of *Stipagrostis scoparia* at the crest of a longitudinal dune, the western Negev.

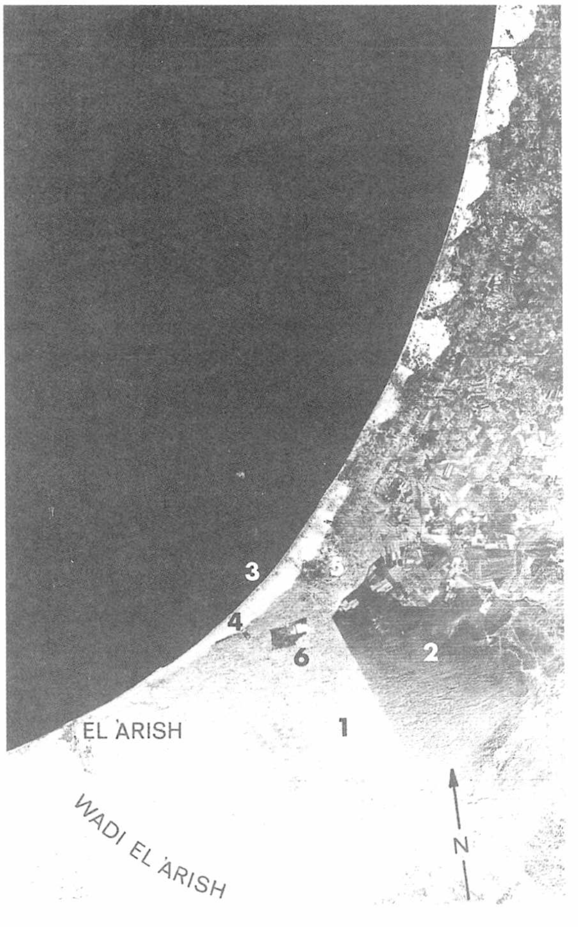

Figure 22. LANDSAT imagery of El 'Arish - Nizzana area as it appeared in 1973: 1. Sand, microbiotic crust and higher vegetation destroyed. 2. Sand, vegetation and microbiotic crust intact. 3. Date palm plantations along the coast. 4. Shifting sands. 5. Sandy soils covered by orchards south of Gaza. 6. An area which was protected for a few years from trampling and cutting of vegetation. (From Danin 1983).

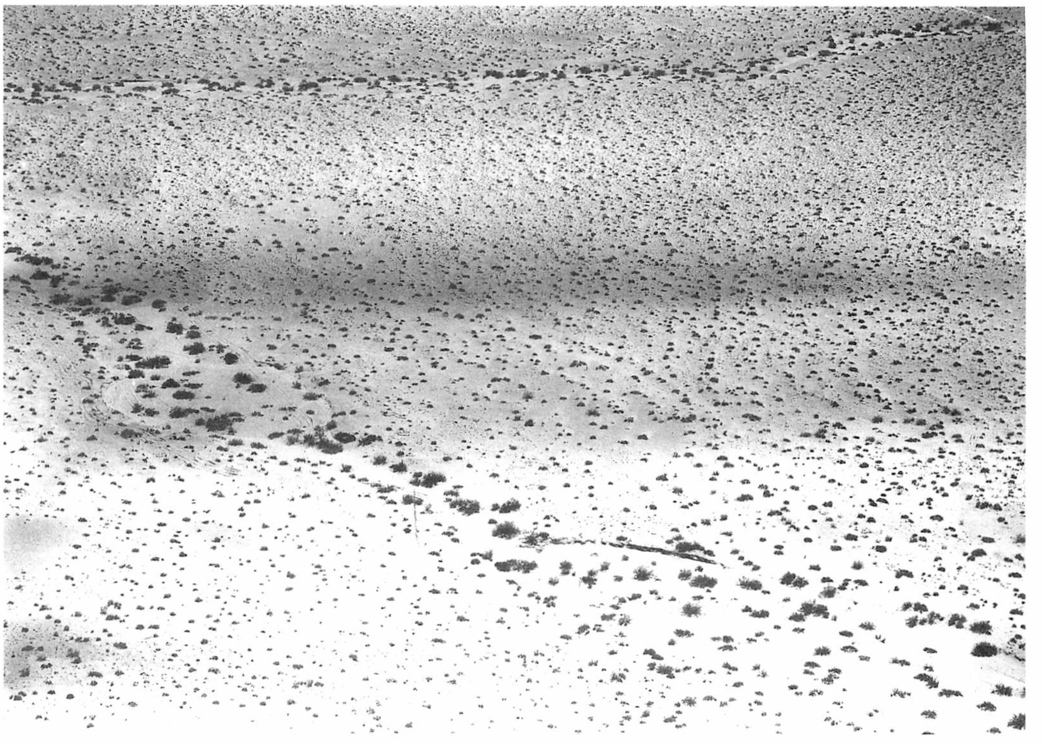

Figure 23. An aerial view of a sand sheet covering Neogene sandstone dominated by *Anabasis articulata* and its companions. Large shrubs of *Calligonim comosum* and *Retama raetam* inhabit the wadis.

Figure 24. Desert savannoid vegetation with an *Acacia raddiana* tree and desert shrubs of *Anabasis articulata* in a wide wadi at the Arava Valley.

4.15 Desert savannoid vegetation

Savannoid vegetation where *Acacia* trees are accompanied by desert semi-shrubs is the main feature of large parts of the Arava and the Dead Sea Valleys (Fig. 24). This vegetation type develops at lower sections of the wadi system that hold sufficient amount of water to support savanna trees. The upper soil layers support the typical desert vegetation with *Anabasis articulata*, *Haloxylon salicornicum*, *Zygophyllum dumosum*, *Retama raetam*, and *Lycium shawii* as the principle contributors. *Acacia pachyceras* is confined to the areas that are at a relatively high elevation, such as the upper tributaries of Nahal Paran. *Acacia raddi-ana*, which is less resistant to low temperatures, is the dominant at lower elevations, and *Acacia tortilis*, which has the highest demands for high temperatures, grows in the southern Arava or below sea level in the northern Arava and Dead Sea Valley (Halevy & Orshan, 1972). The density and size of trees depends much on the water regime of the specific wadi and that of the deeper soil layers. Tree density is relatively high in the vicinity of Hazeva, En Yahav, and Yotvata where the water table is high.

4.16 Swamps and reed thickets

The large swamp areas with diverse vegetation that existed in the country at the beginning of the century have been drained and only small nature reserves, such as that at the Hula Valley, remained. However, fresh water springs still flow and a small number of species that produce high quantities of phytomass are rather prominent throughout the country. The most common indicators for the flowing water are *Phragmites australis*, *Arundo donax*, *Arundo plinii*, and *Typha domingensis*. The large springs at the northwestern shores of the Dead Sea support thickets of *Tamarix nilotica* and a few hydrophytes (Fig. 25). Large areas of swamps in the Hula Valley supported until the 1950s *Cyperus papyrus*, which had reached here its northernmost station.

4.17 Salt marshes

Salt marshes occur in places where springs of brackish or salty water occur or in sites where the water table is close to the surface and the evaporating water leaves salt in the upper soil layers (Orshan & Zohary, 1955). In arid regions, a salt crust may be formed at the soil surface and plants may grow only in small wadis where leaching takes place. The typical plants of these salt marshes are *Suaeda monoica*, *Suaeda fruticosa*, *Suaeda vermiculata*, *Nitraria retusa*, *Seidlitzia rosmarinus*, and a few species of *Tamarix*.

Small salt marshes occur along the Mediterranean coast mainly near Akko, where the geological structure enables the penetration of salty water inland and its mixing with fresh underground water (Danin, 1981b). The vegetation in this rainy area is more diverse than in the desert areas and contains also many annual species in microhabitats that are better leached than in the desert.

4.18 Synanthropic vegetation

There are records of human activity in the Middle East starting hundreds of thousands of years ago. Humans had gathered fruits and plants as many animals do today. These activities did not interfere and did not change the vegetation and the natural conditions. The lists of plants found in the excavations of archaeological and prehistoric sites do not differ much from those of the present day flora of Israel. There is no clear evidence supporting the idea (as brought by Zohary, 1983) that the present flora of Israel is composed of plants which escaped the intensive human activities of the last millennia. This is not to say that human activity has had no impact on the vegetation – such an impact was discussed above in terms of the sandy areas of the western Negev. Dozens of species that belong to the flora of remote countries succeed in growing in human-made habitats at present. The degree of affinity to human-made habitats (synanthropy, cf. Danin, 1991a) in the flora of several habitats in Israel can be summarized as follows:

1. Overgrazing in areas such as the Judean Desert, Negev Highlands, and the Galilee do not open niches for the true synanthropic plants that develop in urban areas at present. The flora of this area has experienced the stress of grazing by herbivores, such as ibex and gazelle in evolutionary times. Thus it seems that grazing is not a factor that may enable the penetration of invader colonizing species from remote countries.

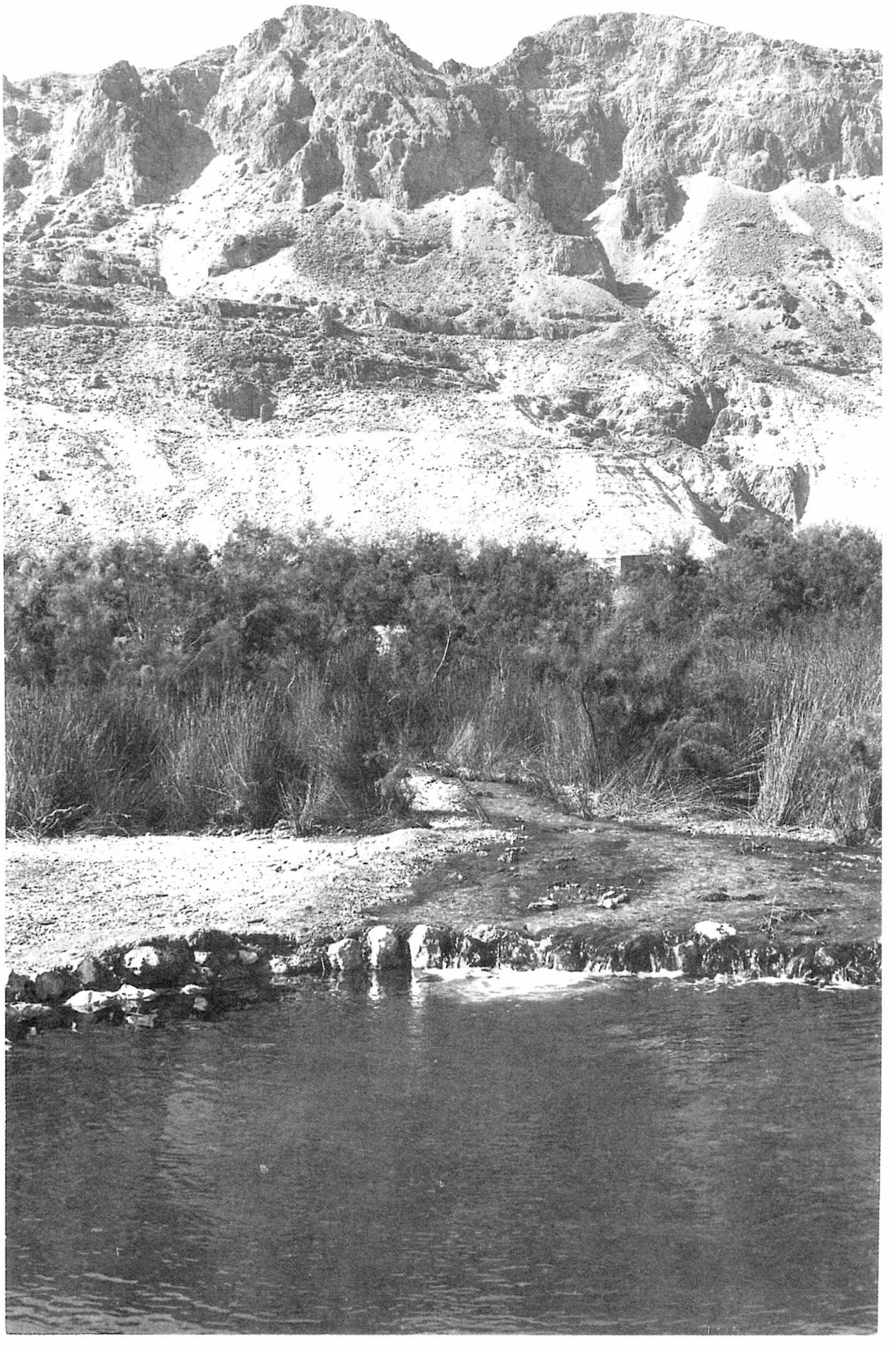

Figure 25. Thickets of *Tamarix nilotica* and *Juncus arabicus* by the spring water of 'Einot Zukim ('Ein Feshkha) at the foot of the Dead Sea fault escarpment.

2. Fire is also one of the natural evolutionary factors leading to the development of plants that belong to the natural flora of an area. Here the number of synanthropic invader species is relatively small.
3. Roadsides at present, in the way they are constructed and managed, function as an important habitat for invaders. The spraying of roadsides with herbicides that control the development of winter annuals, that are typical to Israel's mesic part, leave an opened niche for the establishment of plants that germinate in late winter when the herbicides have already become inactive. Several adventive species from the genera *Sorghum*, *Panicum*, *Conyza*, *Amaranthus*, and *Xanthium* belong to this group (Danin, 1991b).

An analysis done for the 912 species included in the present study revealed the following distribution of types:

A	obligate natural	71.8%
B	mostly natural, also synanthropic	19.6%
C	approximately ½ synanthropic ½ natural	5.0%
D	mostly synanthropic, also natural	2.7%
E	obligate synanthropic	0.8%

This means that the relevés recorded in the present study were done in natural areas which are not under serious human impact. A few species that are known in most of Israel as ruderal synanthropic plants occur here in primary habitats such as near nests of harvesting ants or by sites of excrete accumulation of animals such as gazelles. *Chenopodium murale* and *Malva parviflora* are examples for that. Another species which belongs to the group D is *Heterotheca subaxillaris*. It is an established alien which invades natural vegetation on sandy soils at the coastal plain.

The vegetation which preceded the cultivation included in most parts of mapping unit 18 trees which differed in various parts of the country. This unit is therefore further divided into three subunits according to the remnants of trees found in the intensively cultivated areas: in 18a which is the least arid part of the country it is trees of *Quercus ithaburensis*, in 18b the tree is *Ziziphus spina-christi*, and in 18c it is *Acacia raddiana* and *Ziziphus spina-christi* (Danin, 1988).

5. METHODS (DANIN AND SOLOMESHCH)

Previous studies of vegetation in desert areas of Israel and the surrounding countries revealed the difficulty of using characteristic species as they are used in the classic Braun-Blanquet school (Zohary & Orshan, 1954; Danin et al., 1964, 1975). Whittaker (1962) related to the method developed in the studies of the "Jerusalem School". The methods of recording are summed up by Danin et al., (1975) as follows. Relevés are recorded in sites where a certain species dominates (physiognomy-based decision), and under certain kind of edaphic conditions. The sites where the vegetation is recorded are undisturbed ones as much as possible. The location of the recording site is given in the present volume in the New Israel Grid system, used in all the present publications of the Survey of Israel. An analysis of the affinity of the flora of the entire study area to human-disturbed habitats is further discussed above in section 4.18.

Total cover of the persistent and of the ephemeral species are recorded separately. The "relative cover" of each species is recorded in its growth form group. In most associations only a limited number of species score a certain percentage of cover, most others get less than 1% which is later represented in the association table as a plus sign (+). Association tables are prepared from relevés with similar dominant species which are derived from the same geographical region. Such relevés generally share a similar geomorphological positions, e.g., stabilized ancient dune, silty-sandy alluvial terrace of a dry water course, stony slope, etc. However, the geomorphological position is not playing a role in choosing the table in which a relevé is included. The group of species with presence above 60% and/or average percentage of cover above 5% are regarded as the "markers". These are the most indicative species in the association because they are best developed in the habitat of the association under review and are thus together indicating the environmental conditions. They are used as the diagnostical species of the association and marked in the tables by bold face figures. The phytosociological affinities of the species, by which they are grouped in the tables, are derived from previous studies of the vegetation of Israel, as reviewed in the introduction, and from data accumulated in the present study. The phytosociological categories, or sociotypes, and their ecological relationships are as follows:

A = Species of shrub-steppes developed in areas with 70-250 mm mean annual rainfall on hard sedimentary rocks.
B = Species of semi-steppe shrublands developed in areas with 250-350 mm mean annual rainfall.
C = Thermophilous plants of the warm savannah-like vegetation and of oases in the warm rift valley.
D = Species of nutrient-rich ruderal and disturbed human-induced habitats.
E = Species of shrubby vegetation of sandy habitats of the Mediterranean coastal area and include stable sand sheets, weathered sandstone, and red sandy-loam soil.
F = Species of the mobile and stable sand dunes of the northern Negev.
G = Species of tragacanth shrub vegetation of Mt. Hermon (oro-Mediterranean).
H = Species of herbaceous plant communities of the Mediterranean region, mostly on fertile soils rich in phosphorus.
L = Species confind to banks of rivers and vicinity of springs inundated for considerable part of the year by fresh water.
M = Species growing on chalk and marl in the Mediterranean region.
N = Species of desert vegetation in areas with less than 70 mm mean annual rainfall on hard sedimentary rocks.
O = Hydrophytes floating or anchored fresh-water species.
P = Hydrohalophytes, plants of wet and salty habitats.
Q = Species of the Mediterranean maquis and forest communities.
R = Species of sandy soils of the entire country.
S = Xerohalophytes of steppe and desert areas, developing on salty soils derived from chalky, clayey, and marly substrates.
T = Species of bathas on red Mediterranean soils (Terra Rossa), mostly seral associations in areas where the maquis or forest was destroyed.
V = Species of hard rock outcrops.
W = Common desert species.
Y = Species of the Mediterranean strand vegetation.

In addition to the title at the head of each group of species in the few single table, the code letter of a group to which a species belongs, the sociotype, is indicated for each species of the markers and in the composite tables. The species marked with an asterisk (*) are persistent, i.e., belong to the growth forms chamaephyte or phanerophyte (Raunkiaer, 1934; Danin & Orshan, 1990). A few geophytes such as species of *Asparagus* that have active parts the year round are included in the persistents as well. The other species are ephemerals – therophytes, geophytes, and hemicryptophytes (Raunkiaer, 1934; Danin & Orshan, 1990). The full list of species, author names, growth form, sociotype, and affinity to human-made habitats is presented in appendix 9.1.

Apart from tables 2, 3, 7 and 31 all tables are composed of 2-3 associations in order to save space. The tables are arranged alphabetically to ease the access to plant names. The phytosociological affinity of each species is marked with a letter as discussed above. The markers for each association can be recognized by the bold face figures of the presence (P) and the average cover (C1 and C2). Synoptic table for each alliance or group of alliances, placed at the end of the appropriate section, display the percentage of presence for each species in all associations. These synoptical tables are a result of rearrangement of the tables in a way that displays the diagnostical species of the various syntaxa. The markers are highlighted by the bold-face figures in these tables as well.

Synoptic tables were rearranged according to the Braun-Blanquet approach (Westhoff & van der Maarel, 1978). Species with different ecological range were used as diagnostic for different levels of syntaxonomical hierarchy. Diagnostical species of alliances, orders and classes were established as a result of synoptic tables treatment. Some associations were moved from one alliance to another and some syntaxa were removed as they are insufficiently investigated. It also allowed to change hierarchical ranks of some syntaxa and to make revision of previous classification. We did not separate characteristic and differential species and used groups of diagnostical species due to the absence of true characteristic species. Groups of diagnostical species in this sense were used to characterize alliances, orders and classes. Only for associations marker species were used. Some of the diagnostical species have multiple syntaxonomical sense. They were used as diagnostical for one class and also for some alliance from another class or for alliance and some association from this alliance. Difficulties in using characteristic species in the sense of the Braun-Blanquet school of phytosociology become obvious when a lot of data are available for syntaxonomical analysis. The process of using diagnostical instead of characteristic species is taking place in contemporary European syntaxonomical literature in connection with continual nature of vegetation. Mirkin (1989) related to this issue as to the "Crisis of conception of characteristic species".

Each species has two values of average relative cover: C1 is calculated for the number of relevés in which the plant is present, whereas C2 is calculated as the total number of percentage of presence of the species in relevés in the association table. Coverage of less than 1% is marked in the tables as +; 1-9% = 0, 10-19% = 1, 20-29% = 2, and so on relevés of the association. The average total cover of the persistent species and of ephemerals per relevé, the total number of persistent and ephemeral species, and the average number of species per relevé listed in each association table.

For associations described here as new syntaxa, the holotype relevé is listed in the first column of the association table, and marked by an asterisk (*) at the table header. Species names are basically after Feinbrun-Dothan & Danin (1991). However, in cases of changes that have been made since 1991, the correct names are used. A special case is that of the Chenopodiaceae which include several dominants in a few hierarchical levels. In the last volume of Flora Iranica, Hedge (in Rechinger, 1997) reduced the genus *Hammada* Iljin into synonymy of *Haloxylon* Bunge, and Freitag (in Rechinger, 1997) returned *Salsola damascena* Botsch. back to *Salsola vermiculata* L. The full list of species with their synonyms is presented in Danin (1998). Synonyms for the most common species in the studied area, the names of which have been changed since the first phytosociological work started in the Near East, is presented in appendix 9.2.

The distribution of the associations is displayed in small maps such as Fig. 27 and 28. These maps do not show the exact boundary of the associations but indicate the area where the association is known to exist.

6. SYNOPSIS OF VEGETATION AND ENUMERATION OF THE ASSOCIATIONS (DANIN AND SOLOMESHCH)

6.1 The synopsis of the vegetation of Israel

The following synopsis is based in parts on the previous phytosociological work done in Israel by Eig (1927, 1938, 1939, 1946), by Zohary (1952, 1955, 1960, 1962, 1973) and by Danin, Orshan, & Zohary (1964, 1975). It is expanded to its present form after additional phytosociological studies which were carried out after the completion of the latter studies. Each syntaxon is listed here in its final name, following the "Recommendations" (Barkman, Moravec & Rauschert, 1986) whereas typification and lists of diagnostical species are presented in the appropriate section of the text. This synopsis is temporary in the sense that further changes will take place following the progress of manuscripts preparation of the other volumes of the series.

The letters symbol for the code of each syntaxon represents its level of organization. A single letter (B, A etc.) represents the class level; two letters (BB, AR etc.) represent orders; three letters (BBC, ARS etc.) come for the alliance, and three letters with a two digit number (BBC01, ARS01) is a code for an association. In the present volume we deal with the syntaxa from the classes Ballotetea undulatae, Artemisietea sieberi, Anabasietea articulatae, Chiliadenetea iphionoidis, Retametea raetam, and Ammophiletea arenariae (B, A, M, V, R, and L accordingly). The rest of the syntaxa will be dealt with in the future.

B **Ballotetea undulatae** Danin et Solomeshch class nov.

BB **Ballotetalia undulatae** Zohary 1962 ex Danin et Solomeshch ord. nov.

BBC **Retamo – Calicotomion villosae** Danin et Solomeshch all. nov.

BBC01 Calicotomo villosi – Sarcopoterietum spinosi Danin et Solomeshch ass. nov.

BBP **Balloto – Sarcopoterion spinosi** Danin, Orshan et Zohary 1975 ex Danin et Solomeshch all. nov.
Syn.: Sarcopoterietum spinosi semistepposum Zohary et Feinbrun, 1951 (as assoc.); Sarcopoterion spinosi semistepposum Danin, Orshan et Zohary 1975.

BBP01 Astragalo bethlehemitici – Sarcopoterietum spinosi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.

BBP02 Phlomido brachyodontis – Sarcopoterietum spinosi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.

BBP03 Phlomido brachyodontis – Sarcopoterietum spinosi artemisietosum sieberi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch sub-ass. nov.

BBE **Echinopion polyceratis** Danin, Orshan et Zohary 1975 ex Danin et Solomeshch all. nov.

BBE01 Ononidetum natricis Eig 1946.

BBE02 Alkanno strigosae – Echinopetum polyceratis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.

BBE03 Ononido natricis – Artemisietum sieberi (Eig 1946) Danin et Solomeshch ass. nov.
Syn. Artemisietum Herbae-albae Deserti-Judaici Ononidetosum Natricis Eig 1946.

BBE04 Sarcopoterio – Artemisietum sieberi Danin et Solomeshch ass. nov.

BBE05 Balloto undulatae – Salsoletum vermiculatae Danin et Solomeshch ass. nov.

BBS **Sarcopoterio – Salvion syriacae** Danin, Orshan et Zohary 1975 ex Danin et Solomeshch all. nov.

BBS01 Sarcopoterio – Salvietum syriacae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.

A **Artemisietea sieberi** Zohary 1952 ex Danin et Solomeshch class nov.

AA **Artemisietalia sieberi** Danin et Solomeshch ord. nov.

AAA **Artemision sieberi Eig 1946 em. Danin et Solomeshch 1998 nom. mut.**
Syn.: Artemision herbae-albae palaestinum Eig 1946.

AAA01 Asphodelo ramosi – Deverretum tortuosi Danin et Solomeshch ass. nov.

AAA02 Noaeetum mucronatae Eig 1946.

AAA03 Helianthemo vesicarii – Artemisietum sieberi Danin et Solomeshch ass. nov.

AAA04 Thymelaeo hirsutae – Artemisietum sieberi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.

AAA05 Reaumurio negevensis – Artemisietum sieberi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.

AAA06 Moricandio nitentis – Artemisietum sieberi Danin et Solomeshch ass. nov.
AAA07 Asphodelo ramosi – Artemisietum sieberi Eig 1946 nom. mut., nom. inv.
Syn.: association of Artemisia Herba-alba – Asphodelus microcarpus Eig 1946; Artemisia herba-alba – Gymnocarpos decander assoc. Danin, Orshan et Zohary 1975.
AAH Haloxylion scopariae Eig 1946 em. Danin et Solomeshch 1998 nom. mut.
Syn.: Haloxylion articulati Eig 1946.
AAH01 Peganetum harmalae Danin et Solomeshch ass. nov.
AAH02 Plantago coronopi – Anabasietum syriacae Eig 1946 nom. mut., nom. inv.
AAH03 Ferulo biverticillatae – Anabasietum syriacae Danin et Solomeshch ass. nov.
AAH04 Helianthemo ledifolii – Anabasietum syriacae Danin et Solomeshch ass. nov.
AAH05 Erucario microcarpae – Haloxyletum scopariae Danin et Solomeshch ass. nov.
AAH06 Haloxyletum scopariae Zohary et Feinbrun 1951 nom. mut..
AAH07 Achilletum santolinae Eig 1946.
AR Reaumurietalia hirtellae Danin et Solomeshch ord. nov.
ARS Salsolion vermiculatae Eig 1946 nom. mut.
Syn. Salsolion villosae Eig 1946
ARS01 Salsoletum vermiculatae Eig 1946.
ARS02 Crithopsio delileanae – Salsoletum vermiculatae Danin et Solomeshch ass. nov.
ARS03 Stipo capensis – Salsoletum vermiculatae Eig 1946 nom. mut., nom. inv.
Syn.: Association of Salsola villosa-Stipa tortilis Eig 1946.
ARS04 Noaeo – Salsoletum vermiculatae Danin et Solomeshch ass. nov.
ARS05 Saturejo thymbrifoliae – Salsoletum vermiculatae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.
ARS06 Reaumurietum hirtellae Eig 1946 nom. mut.
Syn. Reaumurietum palaestinae Eig 1946 nom. mut.
ARS07 Atriplicetum glaucae Eig 1946 nom. mut.
Syn. Atriplicetum palaestinae Eig 1946.
ARR Eremopyro distans – Reaumurion negevensis Danin et Solomeshch all. nov.
ARR01 Anthemido melampodinae – Atriplicetum glaucae Danin et Solomeshch ass. nov.
ARR02 Reaumurietum negevensis Danin, Orshan et Zohary ex Danin et Solomeshch ass. nov.
ARR03 Asterisco hierochuntici – Halothamnetum acutifolii Danin et Solomeshch ass. nov.
ARR04 Pterantho dichotomi – Halothamnetum acutifolii Danin et Solomeshch ass. nov.
ARR05 Helianthemo ledifolii – Salsoletum orientalis Danin et Solomeshch ass. nov.
ARR06 Ferulo daninii – Salsoletum orientalis Danin et Solomeshch ass. nov.
ARR07 Erodio crassifolii – Reaumurietum hirtellae Danin et Solomeshch ass. nov.
ARR08 Halothamno acutifolii – Agathophoretum alopecuroidis Danin et Solomeshch ass. nov.
ARR09 Cymbolaeno griffithii – Reaumurietum hirtellae Danin et Solomeshch ass. nov.
M Anabasietea articulatae Zohary 1952 ex Danin et Solomeshch class nov.
MM Anabasietalia articulatae Zohary 1955 ex Danin et Solomeshch ord. nov.
MMA Agathophoro – Anabasion articulatae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch all. nov.
Syn.: Halogeto – Anabasion articulatae Danin, Orshan et Zohary 1975.
MMA01 Agathophoro alopecuroidis – Anabasietum articulatae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.
MMA02 Anabasietum setiferae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.
MMH Haloxylo scopariae – Anabasion articulatae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch all. nov.
MMH01 Haloxylo scopariae – Anabasietum articulatae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.
MMH02 Haloxylo scopariae – Zygophylletum dumosi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.

MMS **Salsolion tetrandrae** Danin, Orshan et Zohary 1975 ex Danin et Solomeshch all. nov.
MMS01 Bassietum arabicae (= Chenoleetum arabicae) Eig 1946 nom. mut.
MMS02 Agathophoretum alopecuroidis Danin et Solomeshch ass. nov.
MMS03 Haloxyletum negevensis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.
MMS04 Suaedetum asphalticae Eig 1946.
MMS05 Salsolo tetrandrae – Suaedetum palaestinae Danin et Solomeshch ass. nov.
MMS06 Salsoletum tetrandrae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.
MMS07 Stipo capensis – Salsoletum tetrandrae Danin et Solomeshch ass. nov.
MMZ **Zygophyllion dumosi** Eig 1946 ex Danin et Solomeshch all. nov.
MMZ01 Reaumurio hirtellae – Zygophylletum dumosi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.
MMZ02 Gymnocarpo decandri – Zygophylletum dumosi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.
MMZ03 Reaumurio negevensis – Zygophylletum dumosi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.
MMZ04 Salsolo tetrandrae – Zygophylletum dumosi Danin et Solomeshch ass. nov.
MMZ05 Schimpero arabicae – Zygophylletum dumosi Danin et Solomeshch ass. nov.
MMZ06 Helianthemo kahirici – Gymnocarpetum decandri Eig 1946.
MMZ07 Diplotaxio acris – Zygophylletum dumosi Danin et Solomeshch ass. nov.
MMZ08 Trichodesmetum boissierii Danin et Solomeshch ass. nov.
V **Chiliadenetea iphionoidis** Zohary 1955 ex Danin et Solomeshch class nov.
VM **Podonosmo – Chiliadenetalia iphionoidis** Danin et Solomeshch ord. nov.
VMB **Balloto – Chiliadenion iphionoidis** Danin, Orshan et Zohary ex Danin et Solomeshch ass. nov.
VMB01 Majorano syriacae – Chiliadenetum iphionoidis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.
VMB02 Hyparrhenio hirtae – Chiliadenetum iphionoidis Danin et Solomeshch ass. nov.
VMB03 Podonosmo orientalis – Chiliadenetum iphionoidis Danin et Solomeshch ass. nov.
VMB04 Periplocetum aphyllae Danin et Solomeshch ass. nov.
VD **Artemisio sieberi – Chiliadenetalia iphionoidis** Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.
VDN **Origano dayi – Chiliadenion iphionoidis** Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.
VDN01 Origanetum dayi Eig 1946.
VDN02 Pistacio atlanticae – Chiliadenetum iphionoidis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.
VDN03 Helianthemo kahirici – Chiliadenetum iphionoidis Danin et Solomeshch ass. nov.
VDJ **Retamo – Phlomion brachyodontis Eig 1946.**
VDJ01 Rhus tripartiti – Retametum raetam Eig 1946 nom. mut.
VDJ02 Podonosmo orientalis – Kickxietum judaicae Danin et Solomeshch ass. nov.
VDJ03 Tricholaeno tenerrifae – Gymnocarpetum decandri Danin et Solomeshch ass. nov.
D **Retametea raetam** Eig 1939.
Syn.: Retametales arenariae Eig 1939; Retametea retami Zohary 1962.
DM **Retametalia raetam Eig 1939 nom. mut.**
Syn.: Retametalia arenaria Sinaico-Palaestine Eig 1939.
Ammophilo – Artemisienalia monospermae Danin et Solomeshch subord. nov.
DMA **Artemision monospermae Eig 1939.**
Syn. Artemision monospermae (palaestinum) Eig 1939.
DMA01 Cypero macrorrhizi – Ammophiletum arenariae Eig 1939 nom. mut., nom. inv.
Syn.: Ammophila arundinacea – Cyperus conglomeratus assoc. Eig 1939.
DMA02 Cutando memphiticae – Ammophiletum arenariae Danin et Solomeshch ass. nov.
DMA03 Scrophulario hypericifoliae – Ammophiletum arenariae Danin et Solomeshch ass. nov.

DMA04 Centropodio forsskali – Ammophiletum arenariae Danin et Solomeshch ass. nov.
DMB **Senecioni joppensis – Artemision monospermae** Danin et Solomeshch all. nov.
DMB01 Polygono palaestini – Artemisietum monospermae Danin et Solomeshch ass. nov.
DMB02 Centropodio forsskali – Artemisietum monospermae Danin et Solomeshch ass. nov.
DMB03 Stipagrostio lanatae – Artemisietum monospermae Danin et Solomeshch ass. nov.
DMB04 Seneceioni joppensis – Ononidetum natricis subsp. stenophyllae Danin et Solomeshch ass. nov.
DMB05 Echinopo philistaei – Artemisietum monospermae Danin et Solomeshch ass. nov.
DMB06 Launaeo fragilis – Artemisietum monospermae Danin et Solomeshch ass. nov.
DMB07 Echio angustifoliae – Artemisietum monospermae Danin et Solomeshch ass. nov.
DMB08 Convolvulo lanati – Artemisietum monospermae Danin et Solomeshch ass. nov.
DMS **Scrophularion hypericifoliae** Danin et Solomeshch all. nov.
DMS01 Moltkiopsio ciliatae – Scrophularietum hypericifoliae Eig 1939 nom. mut.
DMS02 Echiochilo fruticosae – Artemisietum monospermae Danin et Solomeshch ass. nov.
Geranio robertiani – Artemisienalia monospermae Danin et Solomeshch subord. nov.
DMR **Phagnalo rupestri – Retamion raetam** Danin et Solomeshch all. nov.
DMR01 Senecioni joppensis – Retametum raetam Danin et Solomeshch ass. nov.
DMR02 Centropodo forsskali – Retametum raetam Danin et Solomeshch ass. nov.
DMR03 Corynephoro divaricati – Retametum raetam Danin et Solomeshch ass. nov.
DMR04 Dittricho viscosi – Retametum raetam Danin et Solomeshch ass. nov.
DMR05 Prasio maji – Retametum raetam Danin et Solomeshch ass. nov.
DMR06 Bilacunario boissieri – Retametum raetam Danin et Solomeshch ass. nov.
DMR07 Solano sinaici – Retametum raetam Danin et Solomeshch ass. nov.
DMH **Trifolio palaestini – Helianthemion stipulati** Danin et Solomeshch all. nov.
DMH01 Ephedro aphyllae – Helianthemetum stipulati Danin et Solomeshch ass. nov.
DMH02 Retamo raetam – Echiochiletum fruticosi Danin et Solomeshch ass. nov.
DMH03 Plantago sarcophyllae – Helianthemetum stipulati Danin et Solomeshch ass. nov.
DMH04 Trifolio palaestini – Helianthemetum stipulati Danin et Solomeshch ass. nov.
DMH05 Pistacio lentisci – Helianthemetum stipulati Danin et Solomeshch ass. nov.
DMH06 Pistacio lentisci – Calicotometum villosae Danin et Solomeshch ass. nov.
DS **Erodio laciniati – Stipagrostietalia plumosae** Danin et Solomeshch ord. nov.
Stipagrostio scopariae – Artemisienalia monospermae Danin et Solomeshch subord. nov.
DSA **Stipagrostio scopariae – Artemision monospermae** (Orshan et Zohary 1963) Danin et Solomeshch all. nov.
Syn.: Artemisia monosperma – Aristida scoparia association Orshan et Zohary 1963.
DSA01 Heliotropio digyni – Stipagrostietum scopariae Danin et Solomeshch ass. nov.
DSA02 Stipagrostio scopariae – Artemisietum monospermae Danin et Solomeshch ass. nov.
DSA03 Echinopo philistaei – Moltkiopsietum ciliatae Danin et Solomeshch ass. nov.
DSA04 Stipagrostio plumosae – Artemisietum monospermae Danin et Solomeshch ass. nov.
DSA05 Stipagrostio plumosae – Convolvuletum lanati Danin et Solomeshch ass. nov.
DSA06 Convolvulo lanati – Moltkiopsietum ciliatae Danin et Solomeshch ass. nov.
DSH **Stipagrostio plumosae – Helianthemion sessilifloris** Danin et Solomeshch ord. nov.
DSH01 Retamo raetam – Haloxyletum scoparia Danin et Solomeshch ass. nov.
DSH02 Atractylido cardui – Cornulacetum monacanthae Danin et Solomeshch ass. nov.
DSH03 Stipagrostio plumosae – Helianthemetum sessiliflori Danin et Solomeshch ass. nov.
DSH04 Stipagrostio plumosae – Helianthemetum stipulati Danin et Solomeshch ass. nov.
DSH05 Erucario pinnatae – Echiochiletum fruticosi Danin et Solomeshch ass. nov.
DSH06 Iflogo spicatae – Anabasietum articulatae Danin et Solomeshch ass. nov.
DSH07 Ferulo sinaicae – Salsoletum tetrandrae Danin et Solomeshch ass. nov.
DSN **Atractylido proliferae – Noaeion mucronatae Danin et Solomeshch all. nov.**
DSN01 Helianthemio stipulati – Artemisietum sieberi Danin et Solomeshch ass. nov.

DSN02 Iflogo spicatae – Noaetum mucronatae Danin et Solomeshch ass. nov.
DSN03 Vulpio brevis – Thymelaetum hirsutae Danin et Solomeshch ass. nov.
DSN04 Vulpio brevis – Retametum raetam Danin et Solomeshch ass. nov.
Stipagrostio plumosae – Anabasienalia articulatae Danin et Solomeshch subord. nov.
DSS Stipagrostio plumosae – Anabasion articulatae (Danin, Orshan et Zohary 1964) ex Danin et Solomeshch all. nov.
Syn.: Anabasidetum articulatae arenarium Danin, Orshan et Zohary 1964.
DSS01 Irido petranae – Artemisietum sieberi Danin, Orshan et Zohary 1964 ex Danin et Solomeshch ass. nov.
Syn. Anabasidetum articulatae arenarium artemisietosum Danin, Orshan et Zohary 1964.
DSS02 Artemisio sieberi – Anabasietum articulatae Danin, Orshan et Zohary 1964 ex Danin et Solomeshch ass. nov.
Syn.: Artemisietum herbae-albae arenarium Danin, Orshan et Zohary 1964.
DSS03 Convolvulo spicati – Thymelaetum hirsutae Danin, Orshan et Zohary 1964 ex Danin et Solomeshch ass. nov.
Syn. Anabasidetum articulatae arenarium thymelaeetosum Danin, Orshan et Zohary 1964.
DSS04 Erucario pinnatae – Haloxyletum salicornicae Danin, Orshan et Zohary 1964 ex Danin et Solomeshch ass. nov.
Syn. Anabasidetum articulatae arenarium hammadetosum Danin, Orshan et Zohary 1964.
DSS05 Stipagrostio obtusae – Anabasietum articulatae Danin, Orshan et Zohary 1964 ex Danin et Solomeshch ass. nov.
Syn. Anabasidetum articulatae arenarium retametosum Danin, Orshan et Zohary, 1964.
DSS06 Retamo raetam – Calligonetum comosi Danin et Solomeshch ass. nov.
DSS07 Stipagrostio plumosae – Calligonetum comosi Danin, Orshan et Zohary 1964 ex Danin et Solomeshch ass. nov.
Syn. Anabasidetum articulatae arenarium calligonetosum Danin, Orshan et Zohary 1964.
DSS08 Anastatico hierochunticae – Anabasietum articulatae Danin, Orshan et Zohary 1964 ex Danin et Solomeshch ass. nov.
Syn. Anabasidetum articulatae arenarium anastaticetosum Danin, Orshan et Zohary 1964.
L Ammophiletea arenariae Br. -Bl. et R. Tx. ex Westhoff, Dijk et Passchier, 1946.
LA Ammophiletalia arenariae Br.-Bl. (1931) 1943.
LAL Lotion cretici Eig 1939.
LAL01 Lotio cretici – Ammophiletum arenariae Danin et Solomeshch ass. nov.
LAL02 Elymo farcti – Cackiletum maritimi Danin et Solomeshch ass. nov.
LAL03 Otanthetum maritimis Danin et Solomeshch ass. nov.
LAL04 Helianthemo stipulati – Lotetum cretici Eig 1939.
Syn.: Helianthemum ellipticum – Lotus creticus association Eig 1939.
LAL05 Sporobolo pungentis – Lotetum cretici Eig 1939
Syn.: Sporobolus arenarius – Lotus creticus association Eig 1939.
LAL06 Salsolo kali – Ipomoetum imperati Eig 1939 nom. inv., nom. mut.
Syn.: Ipomaea littoralis – Salsola kali association Eig 1939.
LAL07 Atractylido cardui – Crucianelletum maritimae Eig 1939 nom. mut.
Syn.: Atractylis flava – Crucianella maritima association Eig 1939.

6.2 B Ballotetea undulatae Danin et Solomeshch class nov.

Diagnostical species: *Aegilops peregrina, Ballota undulata, Carlina libanotica, Crithopsis delileana, Eryngium glomeratum, Kickxia aegyptiaca, Onobrychis crista-galli, Phagnalon rupestre, Salvia dominica, Sarcopoterium spinosum, Teucrium capitatum.*

Nomenclatural type: Ballotetalia undulatae Zohary 1962 ex Danin et Solomeshch.

Synoptic table – Table 8.

This class (Sect. 4.8) occupies the large transition zone between the typical Mediterranean woodlands, with the potential vegetation of associations of Quercetea calliprini in the moist side and the shrub-steppes of the Negev and the Judean Desert (Artemisietea sieberi – Sect. 6.3) in the dry side. Mean annual rainfall in the area of this class is 300-400 mm. Distributed over a wide range of elevations, from 850 m at the southern Judean Mts., to 300 m below sea level at the Jordan Valley north of Jericho, the class is under a wide range of temperature regimes. The alliance Retamo – Calicotomion villosae (BBC) is found mainly in the Samarian Desert. In this area there are a few additional associations that were insufficiently recorded (Sabah, 1991) and are excluded from the present volume.

The climate of the Judean Desert and of the transition zone between the Judean Mts. and the Shefela and the Northern Negev is drier than that of the Samarian Desert. The semisteppe bathas of the former area consist of associations of Balloto – Sarcopoterion spinosi (BBP) on hard limestone, of associations of Echinopion polyceratis (BBE) on chalk and marl outcrops, and of associations of Sarcopoterio – Salvion syriacae (BBS) on fine-grained and non-rocky clayey soils. The associations that inhabit smooth-faced limestone and dolomite outcrops in this climatic zone are discussed under the alliance Balloto – Chiliadenion iphionoidis (VMB) of the class Chiliadenetea iphionoidis.

6.2.1 BB Ballotetalia undulatae Zohary 1962 ex Danin et Solomeshch ord. nov.

Diagnostical species of the order = diagnostical species of the class.
Nomenclatural type: Balloto – Sarcopoterion spinosi Danin et Solomeshch.

6.2.1.1 BBC Retamo – Calicotomion villosae Danin et Solomeshch all. nov.
Diagnostical species: *Allium orientale, Calicotome villosa, Echinops adenocaulos* (dif.), *Thymelaea passerina, Trifolium prophetarum*
Nomenclatural type: Calicotomo – Sarcopoterietum spinosi Danin et Solomeshch.

The associations of this alliance differ from the other associations of the class by their physiognomy, determined by the dominance of shrubs, 1-3 m tall, of *Calicotome villosa*, and/or of *Retama raetam*. Associations of most of the class are dominated by semishrubs, up to 50 cm tall. Only one association of this alliance was recorded properly. The phytogeographical spectrum of the representative of this alliance (Fig. 26) shows the prevalence of Mediterranean and M-IT species with a rather small contribution of the IT and SA chorotypes.

6.2.1.1.1 BBC01 Calicotomo villosi – Sarcopoterietum spinosi Danin et Solomeshch ass. nov.
Diagnostical species: the markers in table 2. **Distribution:** Fig. 27.

Ecological notes: The area where this association was recorded is in a nature reserve and it is rather protected from the extensive grazing and cutting of lignified plants. It is confined to hard Cretaceous limestone and dolomite. The markers which contribute much to the physiognomy of the vegetation cover are also known as important components of the seral communities of the Mediterranean districts of Israel (Zohary, 1962, Danin, 1988). They follow abandoned cultivated ground which itself replaced the former woodlands. However, *Sarcopoterium spinosum* and *Calicotome villosa* develop in this part of the Samarian desert without the typical destruction of the arboreal vegetation in the eu-Mediterranean area. Although several components of the Quercetalia calliprini, e.g. the arboreal *Pyrus syriaca*, and *Rhamnus lycioides* and the typical maquis vines *Prasium majus* and *Asparagus aphyllus* occur here, it is only in minute quantities. Such an area could be regarded as a primary habitat for *S. spinosum* and *C. villosa.* The largest phytosociological group in this association is the "Species herbaceous plant communities" indicating its position in the most moist part of the semi-steppe bathas. Species of Artemisietea sieberi, Ballotetea undulatae, and "Common desert" ones indicate that its position is in the margins of the Mediterranean territory.

Association dynamics and conservation: Most of the area of this association is under constant process of recovery from a long period of overgrazing and cutting of lignified plants.

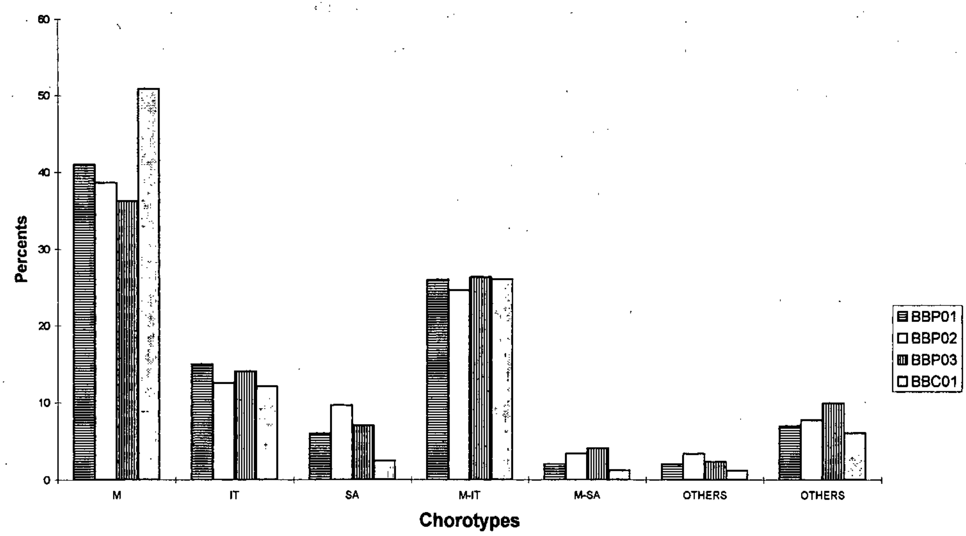

Figure 26. Phytogeographical analysis of associations BBC01, BBP01-- BBP03.

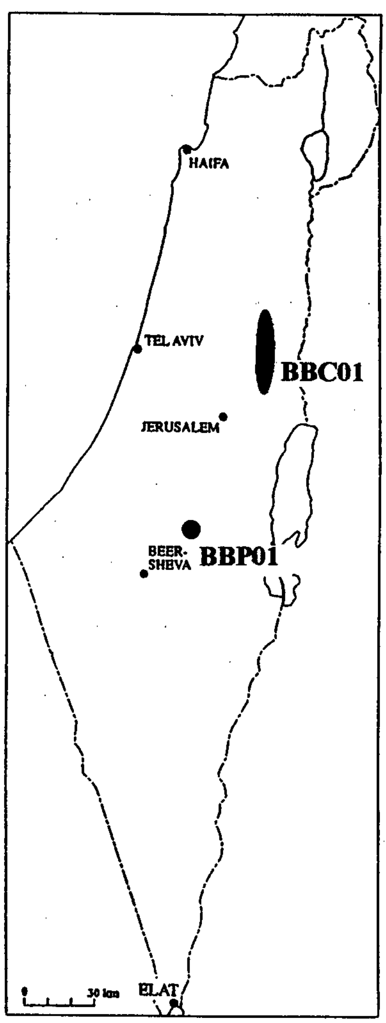

Figure 27. Distribution map of associations BBC01 and BBP01.

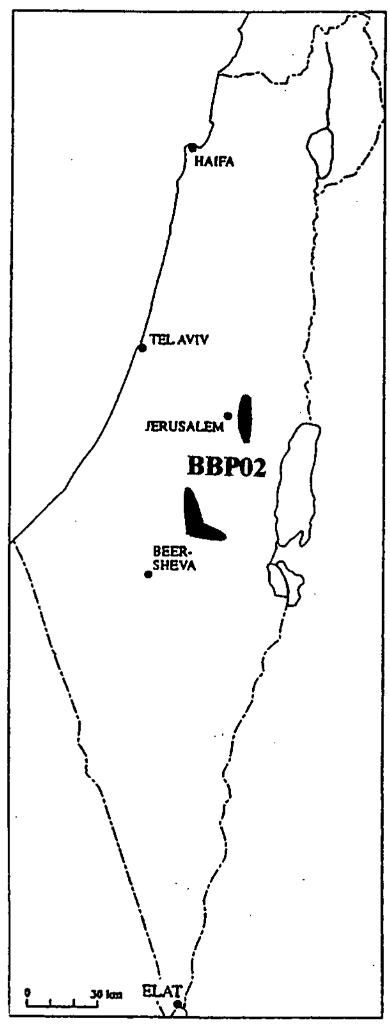

Figure 28. Distribution map of associations BBP02.

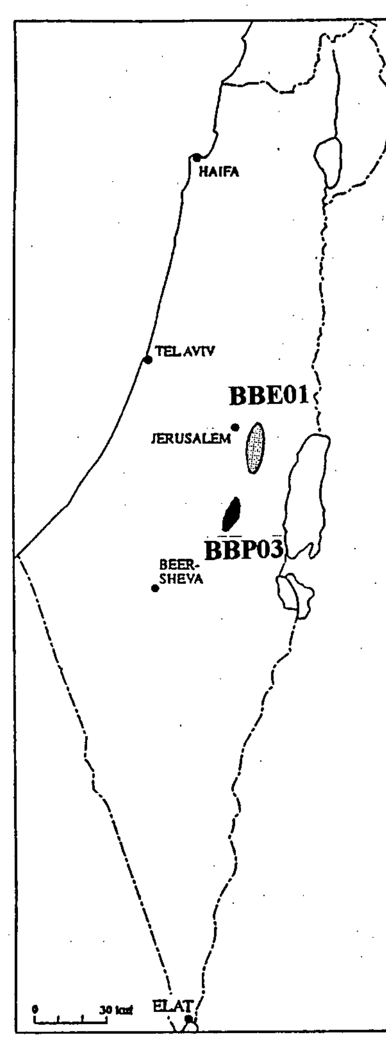

Figure 29. Distribution map of associations BBP03 and BBE01.

Table 2. Association table of Calicotomo villosi – Sarcopoterietum spinosi.

	*1234567	C1	C2	%P
Markers:				
* T-Sarcopoterium spinosum	4655664	52	52	100
* Q-Calicotome villosa	4343235	34	34	100
H-Avena sterilis	1+20545	25	25	100
H-Allium daninianum	+++++++	0	0	100
H-Bromus fasciculatus	47381+.	38	33	86
T-Trifolium prophetarum	020+.++	5	4	86
* B-Ballota undulata	1++0.+0	3	3	86
W-Carrichtera annua	+++.+++	0	0	86
H-Hippocrepis unisiliquosa	++.++++	0	0	86
H-Linum strictum	.++++++	0	0	86
* V-Phagnalon rupestre	++++++.	0	0	86
* H-Teucrium capitatum	++++++.	0	0	86
H-Hordeum spontaneum	+02.35.	21	15	71
W-Brachypodium distachyon	3.2+++.	*10*	*7*	*71*
H-Bromus lanceolatus	.++10.1	5	4	71
* B-Euphorbia hierosolymitana	.0+1.0+	5	4	71
H-Lagoecia cuminoides	+.++.+1	2	1	71
W-Poa eigii	.+++.0+	1	1	71
H-Briza maxima	.+++++.	0	0	71
* H-Echinops adenocaulos	++++..+	0	0	71
* Q-Ephedra foeminea	.++.+++	0	0	71
H-Helianthemum salicifolium	.++.+++	0	0	71
W-Lolium rigidum	.+++.++	0	0	71
* V-Micromeria nervosa	.+++++.	0	0	71
W-Pterocephalus brevis	.++.+++	0	0	71
H-Rhagadiolus stellatus	++++..+	0	0	71
H-Scorzonera papposa	+++++..	0	0	71
H-Trifolium stellatum	++..+++	0	0	71
A Species of steppes				
* Noaea mucronata	.+++..+	0	0	57
Tulipa systola	+++...+	0	0	57
Loliolum subulatum	.++....	0	0	29
Alyssum damascenum	...+...	0	0	14
* Helianthemum vesicarium	+......	0	0	14
B Species of semisteppe bathas				
Convolvulus dorycnium	...++++	0	0	57
* Eryngium glomeratum	.+++..+	0	0	57
* Kickxia aegyptiaca	++.+.+.	0	0	57
* Ononis natrix	.+.+++.	0	0	57
Allium orientale	.+..++.	0	0	43
* Anchusa strigosa	+....++	0	0	43
Carlina libanotica	+.+..+.	0	0	43
* Scutellaria tomentosa	...++.+	0	0	43
* Alkanna strigosa	+..+...	0	0	29
* Phlomis brachyodon	.+....+	0	0	29
Astoma seselifolium	...+...	0	0	14
Chardinia orientalis	......+	0	0	14
* Gypsophila arabica	...+...	0	0	14
* Salvia dominica	.+.....	0	0	14
Serratula pusilla	....+..	0	0	14
D Species of ruderal habitats				
Notobasis syriaca	..+.+++	0	0	57
Hirschfeldia incana	....++.	0	0	29
H Species of herbaceous plant communities				
Aegilops peregrina	1.+.++.	3	1	57
. Bromus alopecuros	.++.+.+	0	0	57
Coronilla scorpioides	..++++.	0	0	57
Crucianella macrostachya	.+++..+	0	0	57

Table 2. continued.

	1234567	C1	C2	%P
Daucus durieua	++.++..	0	0	57
Erodium gruinum	+++...+	0	0	57
Galium judaicum	+++.+..	0	0	57
Linum pubescens	+..+++.	0	0	57
Plantago afra	.+++.+.	0	0	57
Ranunculus asiaticus	.+..+++	0	0	57
Thymelaea passerina	.++.+.+	0	0	57
Torilis tenella	..+++.+	0	0	57
Trifolium campestre	.++..++	0	0	57
Trifolium scabrum	...++++	0	0	57
Urospermum picroides	+.+++..	0	0	57
Onobrychis caput-galli	+....+1	3	1	43
Catananche lutea	.+.+0..	2	1	43
Asphodelus ramosus	.+...++	0	0	43
Biscutella didyma	.+..+.+	0	0	43
Crupina crupinastrum	.++...+	0	0	43
Helianthemum aegyptiacum	.+++...	0	0	43
Medicago coronata	.+...++	0	0	43
Nigella unguicularis	.++..+.	0	0	43
Ononis ornithopodioides	.++...+	0	0	43
Scandix iberica	++...+.	0	0	43
Sedum caespitosum	.++..+.	0	0	43
* Sideritis perfoliata	+.++...	0	0	43
Trifolium dasyurum	+...++.	0	0	43
Vicia sativa	.+...++	0	0	43
Adonis microcarpa	.++....	0	0	29
Althaea hirsuta	....++.	0	0	29
Anthemis pseudocotula	.++....	0	0	29
Avena barbata	.+...+.	0	0	29
Bellevalia flexuosa	.+..+..	0	0	29
Bupleurum nodiflorum	+..+...	0	0	29
Callipeltis cucullaria	.+...+.	0	0	29
Centaurea iberica	..+..+.	0	0	29
Chaetosciadium trichospermum	.++....	0	0	29
Convolvulus pentapetaloides	++.....	0	0	29
Erodium malacoides	...+.+.	0	0	29
Geropogon hybridus	+...+..	0	0	29
Gundelia tournefortii	+..+...	0	0	29
Lactuca tuberosa	.+..+..	0	0	29
Pimpinella cretica	+..+...	0	0	29
Plantago cretica	..+...+	0	0	29
Rostraria smyrnacea	.+.+...	0	0	29
Salvia horminum	.++....	0	0	29
Scandix pecten-veneris	.++....	0	0	29
Valerianella vesicaria	.+.+...	0	0	29
Velezia rigida	.....++	0	0	29
Vulpia ciliata	.++....	0	0	29
Plantago lagopus	.....0.	5	1	14
Psilurus incurvus	.0.....	5	1	14
Ainsworthia trachycarpa	....+..	0	0	14
Bromus tectorum	.....+.	0	0	14
Campanula stellaris	.+.....	0	0	14
Carthamus tenuis	+......	0	0	14
Carduus acicularis	....+..	0	0	14
Cichorium endivia	....+..	0	0	14
* Dactylis glomerata	.+.....	0	0	14
Eryngium creticum	+......	0	0	14
Gynandriris sisyrinchium	.+.....	0	0	14
Hedypnois cretica	......+	0	0	14
Hymenocarpos circinnatus	..+....	0	0	14
Lotus peregrinus	......+	0	0	14
Medicago rotata	...+...	0	0	14

Table 2. continued.

	1234567	C1	C2	%P
Nigella ciliaris	....+..	0	0	14
Piptatherum thomasii	+......	0	0	14
Salvia samuelssonii	...+...	0	0	14
Scorpiurus muricatus	...+...	0	0	14
* Scrophularia peyronii	...+...	0	0	14
Thesium humile	+......	0	0	14
Trifolium tomentosum	...+...	0	0	14
Q Species of maquis				
* Osyris alba	..+.100	5	3	57
Cynoglossum creticum	++++...	0	0	57
* Prasium majus	0+0....	3	1	43
* Majorana syriaca	.+...++	0	0	43
Allium neapolitanum	+.....+	0	0	29
* Asparagus aphyllus	+.....+	0	0	29
Cruciata articulata	....+.+	0	0	29
* Rhamnus lycioides	...++..	0	0	29
* Ajuga chamaepitys	...+...	0	0	14
* Astragalus spinosus	+......	0	0	14
* Pyrus syriaca	+......	0	0	14
T. Species of Mediterranean bathas				
Arrhenatherum palaestinum	++..++.	0	0	57
* Piptatherum blancheanum	.+++..+	0	0	57
Linum corymbulosum	...+++.	0	0	43
Aegilops searsii	++.....	0	0	29
Aethionema heterocarpum	...+...	0	0	14
Clypeola aspera	...+...	0	0	14
Orlaya daucoides	+......	0	0	14
Ziziphora capitata	.+.....	0	0	14
V Species of hard rock outcrops				
* Chiliadenus iphionoides	..++.++	0	0	57
Asterolinon linum-stellatum	.+++...	0	0	43
* Podonosma orientalis	...+++.	0	0	43
* Stipa pellita	.++...+	0	0	43
Valantia hispida	..+++..	0	0	43
* Asparagus horridus	++.....	0	0	29
Centaurea eryngioides	...+..+	0	0	29
Minuartia decipiens	...+.+.	0	0	29
* Paronychia capitata	...+.+.	0	0	29
Campanula erinus	.....+.	0	0	14
* Caralluma europaea	...+...	0	0	14
Erophila minima	.....+.	0	0	14
* Stachys palaestina	.....+.	0	0	14
Telmissa microcarpa	.....+.	0	0	14
W Common desert species				
Anagallis arvensis	..+..++	0	0	43
Anchusa aegyptiaca	.+..+.+	0	0	43
Crithopsis delileana	..++.+.	0	0	43
Picris longirostris	++.+...	0	0	43
Stipa capensis	+++....	0	0	43
Onobrychis crista-galli	++....+	0	0	43
Trigonella stellata	.....0.	5	1	14
Atractylis cancellata	...+...	0	0	14

Aspects of the association: Persistents – 40 spp.; ephemerals – 130 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94450	30	50	56	11.04.94	I 2332 6509
2	94451	20	70	87	11.04.94	I 2335 6507
3	94452	30	70	69	11.04.94	I 2335 6507
4	94453	30	70	73	11.04.94	I 2335 6507
5	94454	30	60	58	11.04.94	I 2328 6517
6	94455	20	50	70	11.04.94	I 2328 6517
7	94456	20	60	62	11.04.94	I 2328 6517
Average:		25.7	61.4	67.9		

6.2.1.2 BBP Balloto – Sarcopoterion spinosi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch all. nov.

Syn.: Sarcopoterion spinosi semistepposum Danin, Orshan et Zohary 1975.

Diagnostical species: *Anthemis hebronica, Carthamus tenuis, Phlomis brachyodon, Thymelaea hirsuta, Trisetaria macrochaeta.*

Nomenclatural type: Phlomido brachyodontis – Sarcopoterietum spinosi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch.

The associations of this alliance presented here develop on hard Cretaceous limestone and dolomite and on nari (caliche) crusts of softer rocks. They were recorded along the ecotone from the southern Judean Mts. near Har Amasa at elevation of 800 m above sea level to the vicinity of Khorvat Kohal at elevation of 600 m. The small increase in aridity along this ecotone may be displayed by the decrease in the percentage of the M chorotype and increase in M-IT, M-SA, and IT species (Fig. 26). As several other associations in the Ballotetea undulatae, this alliance shows prevalence of Mediterranean and M-IT species with a rather small contribution of the IT and SA chorotypes.

6.2.1.2.1 BBP01 Astragalo bethlehemitici – Sarcopoterietum spinosi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov., nom. inv.

Syn.: Sarcopoterium spinosum – Astragalus bethlehemiticus association Danin, Orshan et Zohary 1975.

Diagnostical species: the markers in table 3.

Distribution: Fig. 27.

Ecological notes: This association had developed in a rather special environment; being close to the border between Israel and Jordan from 1948 to 1967 its area was protected from human activity. With hardly any excessive pressure of domestic animals and cutting, a rich flora has developed. Being at a high elevation but under semi-arid moisture regime many cold and drought resistant species succeed to survive. Each of the phytosociological categories is rich in species. The semisteppe bathas position is displayed by many species of the sociotype B, A, H, and W. The proximity to the Mediterranean vegetation is displayed by the few representative shrubs of the maquis found here: *Amygdalus korschinskii, Rhamnus lycioides,* and *Crataegus aronia,* and the vine *Ephedra foeminea.*

Association dynamics and conservation: Most of the area of this association suffered from "efficient" afforestation which led to its nearly complete destruction. Only a small area is still preserved as a nature reserve at the top of Har Amasa.

Table 3. Association table of Astragalo bethlehemitici – Sarcopoterietum spinosi

	*123456789	C1	C2	%P
Markers:				
* T-Sarcopoterium spinosum	586768776	67	67	100
H-Poa bulbosa	213220+5+	18	18	100
B-Trisetaria macrochaeta	02222130+	16	16	100
* A-Helianthemum vesicarium	+++0+++0+	1	1	100

Table 3. continued.

	123456789	C1	C2	%P
* V-Phagnalon rupestre	++++++++0	1	1	100
H-Rhagadiolus stellatus	++++++++0	1	1	100
* B-Astragalus bethlehemiticus	+++++++++	0	0	100
B-Carlina libanotica	+++++++++	0	0	100
H-Gundelia tournefortii	+++++++++	0	0	100
H-Scorzonera papposa	+++++++++	0	0	100
H-Sedum caespitosum	+++++++++	0	0	100
H-Trifolium tomentosum	+++++++++	0	0	100
H-Anthemis pseudocotula	13001.301	14	12	89
H-Asphodelus ramosus	102+03+.0	9	8	89
* B-Echinops polyceras	+0.0101+2	7	6	89
* B-Phlomis brachyodon	3+.1+++0+	6	5	89
* B-Ballota undulata	+0+01++.+	3	2	89
H-Trifolium purpureum	++++.++2+	3	2	89
W-Euphorbia chamaepeplus	+++.+++1+	1	1	89
W-Filago desertorum	+++0.++++	1	1	89
* B-Kickxia aegyptiaca	+++++.++0	1	1	89
W-Adonis dentata	++++++++.	0	0	89
H-Pallenis spinosa	++.++++++	0	0	89
W-Astragalus asterias	+++.+++++	0	0	89
H-Avena sterilis	+++.+++++	0	0	89
H-Biscutella didyma	+++.+++++	0	0	89
W-Carrichtera annua	.++++++++	0	0	89
V-Centaurea eryngioides	++++++.++	0	0	89
H-Hippocrepis unisiliquosa	++.++++++	0	0	89
H-Medicago coronata	+.+++++++	0	0	89
* A-Noaea mucronata	+++++.+++	0	0	89
H-Torilis tenella	+++.+++++	0	0	89
H-Trigonella monspeliaca	++++++++.	0	0	89
H-Vicia sativa	+++.+++++	0	0	89
H-*Anthemis hebronica*	+21.++.01	7	6	78
W-Anagallis arvensis	++.++0++.	1	1	78
* H-Alcea acaulis	.+.++++++	0	0	78
* V-Chiliadenus iphionoides	++++..+++	0	0	78
H-Clypeola jonthlaspi	+++++.+.+	0	0	78
H-Crepis sancta	+++.++++.	0	0	78
* H-Dianthus strictus	.++.+++++	0	0	78
H-Filago pyramidata	++..+++++	0	0	78
W-Gagea reticulata	+++.++++.	0	0	78
H-Ornithogalum neurostegium	++..+++++	0	0	78
* V-Paronychia sinaica	+++.++.++	0	0	78
* V-Stipa pellita	+.++++.++	0	0	78
* B-Teucrium capitatum	.+.++++++	0	0	78
H-Valerianella vesicaria	.++.+++++	0	0	78
W-Stipa capensis	+1+.++..3	7	4	67
* B-Euphorbia hierosolymitana	1.+.1+0.+	4	3	67
H-Plantago cretica	1.+.+++0.	3	2	67
* V-Convolvulus oleifolius	.++.++1.+	2	1	67
H-Dactylis glomerata	+.+++0+..	1	1	67
H-Anemone coronaria	+..+.++++	0	0	67
H-Astragalus hamosus	+..++.+++	0	0	67
H-Calendula arvensis	++..+++.+	0	0	67
H-Coronilla scorpioides	+.+.++++.	0	0	67
* B-Eryngium glomeratum	++..++++.	0	0	67
H-Filago contracta	+.+++.++.	0	0	67
H-Gynandriris sisyrinchium	++.++.+.+	0	0	67
H-Hedypnois cretica	++.+..+++	0	0	67
H-Helianthemum salicifolium	.+++.+++.	0	0	67
H-Hordeum bulbosum	+.+++..++	0	0	67
H-Malcolmia crenulata	.++.++++.	0	0	67
W-Onobrychis crista-galli	+..++.+++	0	0	67
H-Ranunculus asiaticus	++.+..+++	0	0	67

Table 3. continued.

	123456789	C1	C2	%P
W-Silene decipiens	+++.+.++.	0	0	67
H-Trifolium campestre	.++.+.+++	0	0	67
A Species of steppes				
Carex pachystylis	2+.3+.+..	11	6	56
Silene tridentata	++.++...+	0	0	56
Tulipa systola	+++..++..	0	0	56
Astragalus callichrous	++..+...+	0	0	44
* Astragalus sanctus	+...+++..	0	0	44
* Artemisia sieberi	....+0.+.	1	0	33
Buglossoides tenuiflora	.+....++.	0	0	33
Avena wiestii	...+...+.	0	0	22
Loliolum subulatum	....+...+	0	0	22
Malabaila secacul	....+...+	0	0	22
Astragalus caprinus	...+.....	0	0	11
Astragalus palaestinus	..+......	0	0	11
Buglossoides arvensis	+........	0	0	11
Ixiolirion tataricum	.......+.	0	0	11
Valerianella dufresnia	.......+.	0	0	11
B Species of semisteppe bathas				
* Thymelaea hirsuta	..++.0+.+	1	0	56
* Alkanna strigosa	.+++....+	0	0	44
Astragalus epiglottis	....++.++	0	0	44
* Erysimum crassipes	+.+.+.+..	0	0	44
* Salvia dominica	+++..+...	0	0	44
Serratula pusilla	...+.+++.	0	0	44
* Ajuga iva	+....++..	0	0	33
* Anchusa strigosa	.++.....+	0	0	33
* Gypsophila arabica	...++.+..	0	0	33
Anthemis hyalina	...+...+.	0	0	22
Convolvulus dorycnium	+....+...	0	0	22
Factorovskya aschersoniana	+.....+..	0	0	22
* Achillea aleppica	....+....	0	0	11
Allium orientale	.......+.	0	0	11
Astoma seselifolium	..+......	0	0	11
* Astragalus cretaceus	....+....	0	0	11
Chardinia orientalis	......+..	0	0	11
Eremostachys laciniata	.....+...	0	0	11
* Scrophularia xanthoglossa	......+..	0	0	11
* Verbascum fruticulosum	..+......	0	0	11
D Species of ruderal habitats				
Sonchus oleraceus	+.+..++.+	0	0	56
Notobasis syriaca	..+...+++	0	0	44
Hirschfeldia incana	..+..+...	0	0	22
Heliotropium europaeum	..+......	0	0	11
* Marrubium alysson	.+.......	0	0	11
H Species of herbaceous plant communities				
Allium daninianum	++..+++..	0	0	56
Catapodium rigidum	.++.+.++.	0	0	56
Centaurea iberica	+..+..+++	0	0	56
Crucianella macrostachya	.+..+++.+	0	0	56
Plantago afra	+++.++...	0	0	56
Salvia samuelssonii	..++.+++.	0	0	56
Trifolium dasyurum	..+.1+.+.	3	1	44
Alyssum strigosum	+++.+....	0	0	44
Bromus fasciculatus	+...+.++.	0	0	44
Catananche lutea	....++.++	0	0	44
Centaurea hyalolepis	....++.++	0	0	44
Erodium gruinum	++..+.+..	0	0	44

Table 3. continued.

	123456789	C1	C2	%P
Erodium malacoides	+...++.+.	0	0	44
Galium judaicum	+...++..+	0	0	44
Geranium tuberosum	..+..+++.	0	0	44
Helianthemum lasiocarpum	....++++.	0	0	44
Hordeum spontaneum	....++++.	0	0	44
Hymenocarpos circinnatus	++..++...	0	0	44
Linum strictum	.....++++	0	0	44
Matthiola longipetala	....++.++	0	0	44
Ononis mollis	....+++.+	0	0	44
Papaver hybridum	...+++.+.	0	0	44
Salvia horminum	..+..+.++	0	0	44
Scorpiurus muricatus	.....++++	0	0	44
Trifolium stellatum	+...++.+.	0	0	44
* Piptatherum holciforme	.+..+...0	2	1	33
Aegilops peregrina	...++...+	0	0	33
Bupleurum lancifolium	..+.++...	0	0	33
Callipeltis cucullaria	.+..+.+..	0	0	33
Centaurea ascalonica	..+..++..	0	0	33
Erucaria hispanica	.+...+.+.	0	0	33
Eryngium creticum	.....+++.	0	0	33
Helianthemum aegyptiacum	.+.+...+.	0	0	33
Lagoecia cuminoides	....+.++.	0	0	33
Mericarpaea ciliata	...+.+..+	0	0	33
Nonea philistaea	...+.+.+.	0	0	33
Onobrychis squarrosa	.+...+..+	0	0	33
* Paronychia argentea	++..+....	0	0	33
Picris altissima	+...++...	0	0	33
Theligonum cynocrambe	.+...+..+	0	0	33
Urospermum picroides	...+.+.+.	0	0	33
Vicia peregrina	......+++	0	0	33
Avena barbata	....+...+	0	0	22
Brachypodium distachyon	.....+.+.	0	0	22
Bromus lanceolatus	..+....+.	0	0	22
Carthamus tenuis	.....++..	0	0	22
Chaetosciadium trichospermum	..+....+.	0	0	22
Echinaria capitata	.++......	0	0	22
Erodium cicutarium	...++....	0	0	22
Lathyrus hierosolymitanus	+......+.	0	0	22
Lotus peregrinus	.....+..+	0	0	22
Medicago tuberculata	....+.+..	0	0	22
Nigella ciliaris	.....+.+.	0	0	22
Nigella unguicularis	..+..+...	0	0	22
Trifolium clypeatum	+.+......	0	0	22
Trifolium echinatum	+.....+..	0	0	22
Trifolium eriosphaerum	.++......	0	0	22
Velezia rigida	+.....+..	0	0	22
Acanthus syriacus	........+	0	0	11
Adonis microcarpa	......+..	0	0	11
Antirrhinum orontium	.....+...	0	0	11
Bellevalia flexuosa	..+......	0	0	11
Bromus alopecuros	.+.......	0	0	11
Campanula stellaris	..+......	0	0	11
Cynosurus callitrichus	+........	0	0	11
Daucus durieua	........+	0	0	11
Fumaria bracteosa	...+.....	0	0	11
Parentucellia latifolia	.......+.	0	0	11
Lomelosia prolifera	.....+...	0	0	11
Geranium molle	..+......	0	0	11
Geropogon hybridus	.......+.	0	0	11
Gladiolus atroviolaceus	..+......	0	0	11
* Hyparrhenia hirta	........+	0	0	11
Lactuca tuberosa	....+....	0	0	11

Table 3. continued.

	123456789	C1	C2	%P
Linaria micrantha	......+..	0	0	11
Linum pubescens	.+.......	0	0	11
Medicago polymorpha	........+	0	0	11
Medicago rotata	..+......	0	0	11
Ononis ornithopodioides	.......+.	0	0	11
Ornithogalum narbonense	..+......	0	0	11
Phalaris brachystachys	.+.......	0	0	11
Pisum sativum	..+......	0	0	11
Ranunculus millefolius	.......+.	0	0	11
Rostraria smyrnacea	..+......	0	0	11
Sherardia arvensis	....+....	0	0	11
* Sideritis perfoliata	.+.......	0	0	11
Silene crassipes	..+......	0	0	11
Silene dichotoma	+........	0	0	11
Thrincia tuberosa	......+..	0	0	11
Tragopogon coelesyriacus	........+	0	0	11
Urginea maritima	......+..	0	0	11
Vicia palaestina	..+......	0	0	11
L Species of river banks and springs				
Parapholis incurva	........+	0	0	11
M Species of bathas on chalk and marl				
* Fumana thymifolia	......+..	0	0	11
Ophrys umbelicta	...+.....	0	0	11
Q Species of maquis				
* Majorana syriaca	+.+...+++	0	0	56
* Asparagus aphyllus	..++...++	0	0	44
* Amygdalus korschinskii	.+3.+....	10	3	33
* Ephedra foeminea	..++.+...	0	0	33
* Rhamnus lycioides	......+++	0	0	33
* Ajuga chamaepytis	.+..+....	0	0	22
Cruciata articulata	..+....+.	0	0	22
* Crataegus aronia	..+......	0	0	11
Lamium amplexicaule	..+......	0	0	11
R Species of sandy soils				
Picris amalecitana	.+.+++..1	2	1	56
* Plantago albicans	.....3...	30	3	11
Nigella arvensis	......+..	0	0	11
T Species of bathas on Terra Rossa				
Lathyrus ciliolatus	++....+..	0	0	33
Aethionema heterocarpum	.++......	0	0	22
* Andropogon distachyos	.....+..+	0	0	22
Thlaspi perfoliatum	..+...+..	0	0	22
Aegilops geniculata	........+	0	0	11
Arabis verna	..+......	0	0	11
Clypeola aspera	..+......	0	0	11
V Species of hard rock outcrops				
Telmissa microcarpa	+++....+.	0	0	44
Arenaria leptoclados	..+++....	0	0	33
* Ephedra aphylla	....+.+.+	0	0	33
* Micromeria nervosa	..+...++.	0	0	33
Umbilicus intermedius	..+..++..	0	0	33
Valantia hispida	.++...+..	0	0	33
Asterolinon linum-stellatum	......0+.	3	1	22
* Asparagus horridus	+....+...	0	0	22
Campanula erinus	.....++..	0	0	22
* Stipa parviflora	....+...+	0	0	22

Table 3. continued.

	123456789	C1	C2	%P
Erophila minima	..+......	0	0	11
Erophila praecox	..+......	0	0	11
* Micromeria myrtifolia	..+......	0	0	11
Minuartia decipiens	......+..	0	0	11
W Common desert species				
Herniaria hirsuta	+++++....	0	0	56
Reichardia tingitana	+...+++.+	0	0	56
Papaver humile	..+.+..++	0	0	44
Roemeria hybrida	...+++..+	0	0	44
Anchusa aegyptiaca	+....++..	0	0	33
Crepis aspera	+.....++.	0	0	33
Crithopsis delileana	....+++..	0	0	33
Erodium ciconium	+.....++.	0	0	33
Lolium rigidum	....+..++	0	0	33
Scorzonera judaica	....++..+	0	0	33
Trigonella stellata	.++.....+	0	0	33
Erucaria rostrata	......2.+	10	2	22
Atractylis cancellata	.....+..+	0	0	22
Erucaria microcarpa	.....++..	0	0	22
Lathyrus pseudocicera	....++...	0	0	22
Ononis sicula	......+.+	0	0	22
Phalaris minor	.+..+....	0	0	22
Plantago coronopus	...+...+.	0	0	22
Erodium neuradifolium	.....+...	0	0	11
Helianthemum ledifolium	+........	0	0	11
Minuartia picta	...+.....	0	0	11
Parietaria alsinifolia	......+..	0	0	11
Picris longirostris	..+......	0	0	11
Pterocephalus brevis	.....+...	0	0	11
Tordylium aegyptiacum	.......+.	0	0	11
Trigonella arabica	+........	0	0	11

Aspects of the association: Persistents – 51 spp.; ephemerals – 211 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00194	6	24	100	10.04.67	I 2105 5845
2	00195	8	32	96	10.04.67	I 2105 5844
3	00196	35	15	112	10.04.67	I 2105 5839
4	00198	12	28	72	10.04.67	I 2102 5845
5	00201	12	28	119	12.04.67	I 2107 5842
6	00202	10	40	120	12.04.67	I 2108 5841
7	00203	12	28	125	12.04.67	I 2110 5843
8	00207	24	36	116	13.04.67	I 2093 5845
9	00209	30	30	106	13.04.67	I 2093 5845
Average:		16.6	29.0	107.3		

6.2.1.2.2 BBP02 Phlomido brachyodontis – Sarcopoterietum spinosi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov., nom. inv.

Syn.: Sarcopoterium spinosum – Phlomis brachyodon association Danin, Orshan et Zohary 1975.

Diagnostical species: the markers in table 4.

Distribution: Fig. 28.

Ecological notes: Most relevés of this association were recorded near kibbutz Lahav at elevation of 300-400 m and the substratum of Eocene chalk covered with a nari crust. This crust increases runoff yields to the soil pockets among the rocks. The list of species is not as rich in plants of the eu-Mediterranean vegetation; many markers and companions belonging to the B, A, H, and W sociotype indicate the transitional position of the semisteppe bathas. In the Judean Desert east of Jerusalem, there is no *Thymelaea hirsuta* in this association. This Judean Desert aspect of BBP02 may be worth the status of an independent syntaxon, the rank of which should be found when further investigation is done.

Association dynamics and conservation: Most of the area of this association is lost as a result of intensive afforestation.

Table 4. Association tables of BBP02 – Phlomido brachyodontis – Sarcopoterietum spinosi and BBP03 – Phlomido brachyodontis – Sarcopoterietum spinosi artemisietosum sieberi

	Species	BBP02				BBP03			
		*123456789	C1	C2	%P	*12345678	C1	C2	%P
H	Adonis aestivalis				+.......	0	0	13	
W	Adonis dentata	....++..+	0	0	33	.++..++.	0	0	50
H	Adonis microcarpa					.++.....	0	0	25
T	Aegilops geniculata	....++...	0	0	22				
H	Aegilops peregrina	+..+..+++	0	0	56	+.......	0	0	13
H	Ainsworthia trachycarpa	.....+++.	0	0	33				
* Q	Ajuga chamaepitys	...+..+..	0	0	22	.+......	0	0	13
* B	Ajuga iva	.++.+....	0	0	33	.....++.	0	0	25
* H	Alcea acaulis	....+++++	0	0	56				
* B	Alkanna strigosa					..++.0..	1	0	38
W	Allium stamineum	..+.+.++.	0	0	44	.++.....	0	0	25
H	Alyssum strigosum					.+......	0	0	13
W	Anagallis arvensis	..+.0++.+	1	1	56	..+..++.	0	0	38
* B	Anchusa strigosa	....2100+	8	4	56	..+3....	15	4	25
* T	Andropogon distachyos	..+....+.	0	0	22				
H	Anemone coronaria					+....+..	0	0	25
H	Anthemis hebronica					.+......	0	0	13
B	Anthemis hyalina					..+.....	0	0	13
H	Anthemis pseudocotula	++..00220	**8**	**6**	**78**	1.0..0+.	5	2	50
H	Artedia squamata	....+....	0	0	11				
* A	Artemisia sieberi					2+734347	**38**	**38**	**100**
* Q	Asparagus aphyllus					..+.....	0	0	13
* V	Asparagus horridus	+.....+..	0	0	22	.+......	0	0	13
H	Asphodelus ramosus	++.+31.+3	**10**	**8**	**78**	+.+.9.+.	23	11	50
H	Asteriscus aquaticus	++.+.....	0	0	33				
V	Asterolinon linum-stellatum					++......	0	0	25
B	Astoma seselifolium	......+..	0	0	11	.++.....	0	0	25
A	Astragalus aleppicus	......+..	0	0	11				
W	Astragalus asterias	+++.+..+.	0	0	56	+.+.....	0	0	25
* B	Astragalus bethlehemiticus					..+.....	0	0	13
A	Astragalus callichrous	.......++	0	0	22	+.+..++.	0	0	50
A	Astragalus caprinus	.+.......	0	0	11	.....+..	0	0	13
* B	Astragalus cretaceus	+.+......	0	0	22				
B	Astragalus epiglottis	..+....+.	0	0	22				
H	Astragalus hamosus	.....+.+++	0	0	44				
A	Astragalus hispidulus	....+....	0	0	11				
* A	Astragalus sanctus	+........	0	0	11	+.+..+..	0	0	38
B	Astragalus scorpioides					.+......	0	0	13
W	Astragalus tribuloides					.+...+..	0	0	25
W	Atractylis cancellata	+........	0	0	11				
A	Atractylis prolifera	....+++.+	0	0	44				
* A	Atractylis serratuloides	1+++...++	**2**	**1**	**67**	+.......	0	0	13
H	Avena barbata					+++.....	0	0	38
H	Avena sterilis	+.....+++	0	0	44	++......	0	0	25
A	Avena wiestii	.....++++	0	0	44				
* B	Ballota undulata	....++..+	0	0	33	.+.+.0..	1	0	38
H	Bellevalia longipes					..+.....	0	0	13
H	Biscutella didyma	..+.....+	0	0	22	++......	0	0	25
H	Brachypodium distachyon	....+....	0	0	11	.++.....	0	0	25
H	Bromus alopecuros	......+..	0	0	11	.+......	0	0	13
H	Bromus fasciculatus	.......+.	0	0	11	.++.....	0	0	25

Table 4. continued.

		Species	BBP02 123456789	C1	C2	%P	BBP03 12345678	C1	C2	%P
	H	Bromus japonicus					.+......	0	0	13
	H	Bromus lanceolatus	......+++	0	0	33	.++.....	0	0	25
	H	Bromus madritensis					.+......	0	0	13
	H	Bromus scoparius	......+..	0	0	11				
	A	Buglossoides tenuiflora					++......	0	0	25
	H	Bupleurum lancifolium	.....+..+	0	0	22	..+.....	0	0	13
	H	Calendula arvensis	......+..	0	0	11	+....++.	0	0	38
	V	Campanula erinus	.....+.+.	0	0	22				
	H	Carduus acicularis					.+...+..	0	0	25
	A	Carex pachystylis	....+..+.	0	0	22	.+1.+...	3	1	38
	T	Carlina curetum					...++...	0	0	25
	B	Carlina libanotica	.....++++	0	0	44	++...+..	0	0	38
	W	Carrichtera annua	..+......	0	0	11	++...+..	0	0	38
	H	Carthamus tenuis	++1++++++	**1**	**1**	**100**	+.++....	0	0	38
	H	Catananche lutea	.....+++.	0	0	33	.+......	0	0	13
	H	Catapodium rigidum	..++..+++	0	0	56	.+...+..	0	0	25
*	A	Centaurea aegyptiaca					.....+.+	0	0	25
	H	Centaurea ascalonica	......+.+	0	0	22	.++.+...	0	0	38
	V	Centaurea eryngioides					.+......	0	0	13
	H	Centaurea hyalolepis	......+++	0	0	33	..+.....	0	0	13
	H	Centaurea iberica	.+.......	0	0	11	.+......	0	0	13
	H	Chaetosciadium trichospermum	.....++.+	0	0	33	.+...+..	0	0	25
*	V	Chiliadenus iphionoides	....++.++	0	0	44	.+......	0	0	13
	D	Chrysanthemum coronarium	......++.	0	0	22				
	H	Cichorium endivia	+++++++++	**0**	**0**	**100**				
	H	Clypeola jonthlaspi					.+......	0	0	13
	H	Convolvulus althaeoides	++...++..	0	0	44				
	B	Convolvulus dorycnium	........+	0	0	11				
*	V	Convolvulus oleifolius					+++.....	0	0	38
	D	Convolvulus stachydifolius					..+.....	0	0	13
*	M	Coridothymus capitatus	++22.+..+	**7**	**4**	**67**	4....++.	13	5	38
	H	Coronilla scorpioides	.....++++	0	0	44	+.+...+.	0	0	38
	W	Crepis aspera					..+.....	0	0	13
	H	Crepis sancta					+.+...+.	0	0	38
	W	Crithopsis delileana	....+..++	0	0	33				
	H	Crucianella macrostachya	......+..	0	0	11	.+......	0	0	13
	A	Crucianella membranacea	.....++..	0	0	22				
	Q	Cruciata articulata					.+......	0	0	13
	H	Cynosurus callitrichus					.+......	0	0	13
	H	Dactylis glomerata	.....++++	0	0	44	++1+.+..	**2**	**1**	**63**
	H	Daucus durieua	..+++..++	0	0	56				
*	A	Deverra tortuosa	0..+....2	8	3	33	....+...	0	0	13
*	H	Dianthus strictus	.....+.+.	0	0	22	....+...	0	0	13
	H	Diplotaxis erucoides					+.+.....	0	0	25
*	B	Echinops polyceras	.+0.21.++	**7**	**4**	**67**	..1+++..	3	1	50
*	H	Echium angustifolium	.+1+.++++	**1**	**1**	**78**	....+...	0	0	13
	W	Echium judaeum	+...+....	0	0	22				
*	V	Ephedra aphylla	......+..	0	0	11	..+.....	0	0	13
*	Q	Ephedra foeminea	........+	0	0	11				
	B	Eremostachys laciniata	+........	0	0	11	..+.....	0	0	13
	W	Erodium ciconium	....++..+	0	0	33	.+......	0	0	13
	W	Erodium crassifolium	++.......	0	0	22				
	H	Erodium gruinum	......+++	0	0	33	+.+.....	0	0	25
	V	Erophila minima					.+......	0	0	13
	H	Erucaria hispanica	....+....	0	0	11				
	W	Erucaria microcarpa	.....+...	0	0	11				
	W	Erucaria rostrata	........+	0	0	11	..+.....	0	0	13
	H	Eryngium creticum	+.....+++	0	0	44	.++.....	0	0	25
*	B	Eryngium glomeratum					.+.++...	0	0	38
	W	Euphorbia chamaepeplus	....+.++.	0	0	33				
*	V	Euphorbia hierosolymitana	.....+...	0	0	11	+.+.....	0	0	25
	B	Factorovskya aschersoniana	.......+.	0	0	11	.+......	0	0	13

Table 4. continued.

		Species	BBP02				BBP03			
			123456789	C1	C2	%P	12345678	C1	C2	%P
	H	Filago contracta	.....++++	0	0	44	1+...0..	5	2	38
	W	Filago desertorum	......+..	0	0	11	+++..++.	0	0	63
	H	Filago pyramidata	....++...	0	0	22	.++.....	0	0	25
*	M	Fumana thymifolia	..+......	0	0	11				
	H	Fumaria bracteosa					+.......	0	0	13
	W	Gagea reticulata					+.+..++.	0	0	50
	H	Galium judaicum	.......+.	0	0	11				
	H	Geranium rotundifolium					.+......	0	0	13
	H	Geranium tuberosum					.++..+..	0	0	38
	H	Geropogon hybridus	......+..	0	0	11				
	H	Gundelia tournefortii	++.+.++++	**0**	**0**	**78**	..+.....	0	0	13
	H	Gynandriris sisyrinchium	.....++++	0	0	44	++...+..	0	0	38
*	B	Gypsophila arabica	.+.......	0	0	11				
*	H	Haplophyllum buxbaumii	......+..	0	0	11				
	H	Hedypnois cretica	.++.+++++	**0**	**0**	**78**				
	H	Helianthemum aegyptiacum					.+......	0	0	13
*	A	Helianthemum kahiricum					......+.	0	0	13
	H	Helianthemum lasiocarpum	....++...	0	0	22	..+.....	0	0	13
	H	Helianthemum salicifolium	..+.+++++	**0**	**0**	**67**	.1......	10	1	13
*	A	Helianthemum vesicarium	0++0.++++	**1**	**1**	**89**	000..++0	**3**	**3**	**75**
*	B	Heliotropium rotundifolium	++.......	0	0	22				
	W	Herniaria hirsuta	.......+.	0	0	11	+.......	0	0	13
	H	Hippocrepis unisiliquosa	+++++++++	**0**	**0**	**100**	.++.....	0	0	25
	D	Hirschfeldia incana					.+......	0	0	13
	H	Hordeum bulbosum	......+.+	0	0	22	.++.....	0	0	25
	H	Hymenocarpos circinnatus	+..+++++.	**0**	**0**	**67**	.+....+.	0	0	25
	H	Hyparrhenia hirta	.++.0..0.	3	1	44				
	H	Hypericum triquetrifolium	......++.	0	0	22				
	H	Iris palaestina					......+.	0	0	13
	A	Ixiolirion tataricum					..+.....	0	0	13
*	B	Kickxia aegyptiaca	+.+++++++	**0**	**0**	**89**	....+.++	0	0	38
	H	Lagoecia cuminoides	......+.+	0	0	22	.++.....	0	0	25
	H	Lathyrus hierosolymitanus	.......+.	0	0	11	+.......	0	0	13
	W	Lathyrus pseudocicera					..+.....	0	0	13
	A	Leontice leontopetalum					..+.....	0	0	13
	S	Limonium lobatum	....+....	0	0	11				
	H	Linaria micrantha					+.......	0	0	13
	T	Linum corymbulosum	.....++++	0	0	44				
	T	Linum mucronatum	......+..	0	0	11				
	H	Linum strictum	+.....+++	0	0	44				
	A	Loliolum subulatum					.++.....	0	0	25
	W	Lolium rigidum	......++.	0	0	22	..+.....	0	0	13
	W	Lomelosia porphyroneura	.....+.+.	0	0	22				
	H	Lomelosia prolifera	...++.+.+	0	0	44				
*	Q	Majorana syriaca	.....+++1	3	1	44	.+......	0	0	13
	A	Malabaila secacul	..+.....+	0	0	22				
	H	Malcolmia crenulata					+.......	0	0	13
	W	Matthiola livida	......+..	0	0	11				
	H	Matthiola longipetala	....+....	0	0	11	..+.....	0	0	13
	H	Medicago coronata					.+......	0	0	13
	H	Medicago orbicularis	......+..	0	0	11				
	H	Medicago polymorpha	....+...+	0	0	22				
	W	Medicago radiata	......+..	0	0	11				
	H	Medicago rotata	....+....	0	0	11	.+......	0	0	13
	H	Medicago truncatula	.....++.+	0	0	33				
*	V	Micromeria nervosa	.......++	0	0	22				
	V	Minuartia decipiens					.+......	0	0	13
	W	Minuartia picta	.....+++.	0	0	33	+.....+.	0	0	25
	W	Neotorularia torulosa					..+.....	0	0	13
	R	Nigella arvensis	....+....	0	0	11				
	H	Nigella ciliaris	.......+.	0	0	11	+.+.....	0	0	25

Table 4. continued.

		Species	BBP02				BBP03			
			123456789	C1	C2	%P	12345678	C1	C2	%P
	H	Nigella unguicularis					.+......	0	0	13
*	A	Noaea mucronata	++++++..+	**0**	**0**	**78**	+++..+++	**0**	**0**	**75**
	H	Nonea philistaea					+.......	0	0	13
	D	Notobasis syriaca	...+..+++	0	0	44				
	W	Onobrychis crista-galli	....+++++	0	0	56	++...++.	0	0	50
	H	Onobrychis squarrosa	++++.....	0	0	44	..+.....	0	0	13
	H	Ononis mollis	......+++	0	0	33	.+......	0	0	13
	H	Ononis ornithopodioides	......+..	0	0	11				
	W	Ononis sicula	....+..+.	0	0	22	++......	0	0	25
	A	Onopordum alexandrinum					.....+..	0	0	13
*	V	Origanum dayi					....+...	0	0	13
	H	Ornithogalum narbonense					.+......	0	0	13
	H	Ornithogalum neurostegium	.....++..	0	0	22	+++.....	0	0	38
*	Q	Osyris alba					.1......	10	1	13
	H	Pallenis spinosa	+.+.++.+.	0	0	56	.++.....	0	0	25
	W	Papaver humile	.......+.	0	0	11	..+.....	0	0	13
	H	Papaver hybridum	.....++.+	0	0	33	+.+..+..	0	0	38
	H	Parentucellia latifolia					.+......	0	0	13
*	H	Paronychia argentea	++++.+.++	**0**	**0**	**78**	.....+..	0	0	13
*	V	Paronychia sinaica	....+++++	0	0	56	.+......	0	0	13
*	V	Phagnalon rupestre	..+++++++	**0**	**0**	**78**	+++.....	0	0	38
	W	Phalaris minor	........+	0	0	11				
	H	Phalaris paradoxa	......++.	0	0	22				
*	B	Phlomis brachyodon	11+0+1221	**11**	**11**	**100**	+.++1.++	**2**	**1**	**75**
	W	Picris longirostris	.....++++	0	0	44	++......	0	0	25
	H	Pisum sativum					.+......	0	0	13
	H	Plantago afra	.......+.	0	0	11	.+......	0	0	13
*	R	Plantago albicans	++++.++++	**0**	**0**	**89**	1.+.....	5	1	25
	W	Plantago coronopus	.+...+...	0	0	22	.1......	10	1	13
	H	Plantago cretica	.++++++.+	**0**	**0**	**78**	15+..5..	29	14	50
	H	Poa bulbosa	...+.++++	0	0	56	3+3.11+.	**14**	**11**	**75**
	H	Psilurus incurvus	......+++	0	0	33				
	W	Pterocephalus brevis	....+++++	0	0	56				
	H	Ranunculus asiaticus					.++.+++.	**0**	**0**	**63**
	W	Reichardia tingitana					..+.....	0	0	13
	H	Reseda luteola					..+.....	0	0	13
*	R	Retama raetam					.+......	0	0	13
	H	Rhagadiolus stellatus	.....+.++	0	0	33	.++..+..	0	0	38
*	Q	Rhamnus lycioides					.+......	0	0	13
	W	Roemeria hybrida					+++.....	0	0	38
	H	Rostraria smyrnacea	.....+.++.	0	0	33	.+......	0	0	13
*	B	Salvia dominica	....1+...	5	1	22	.+.+.1++	**2**	**1**	**63**
	H	Salvia horminum	.....+...	0	0	11	+....++.	0	0	38
*	A	Salvia lanigera	++.+...++	0	0	56	.....0+0	2	1	38
	H	Salvia samuelssonii	....+++++	0	0	56	..+.....	0	0	13
*	T	Sarcopoterium spinosum	674635665	**55**	**55**	**100**	38034340	**33**	**33**	**100**
	W	Schismus arabicus	+........	0	0	11				
	H	Scorpiurus muricatus	....+++++	0	0	56	.....+..	0	0	13
	W	Scorzonera judaica					+....++.	0	0	38
	H	Scorzonera papposa	.+...++++	0	0	56	+++.....	0	0	38
*	B	Scrophularia xanthoglossa	.+.......	0	0	11				
	H	Sedum caespitosum	....+++++	0	0	56	.+......	0	0	13
	V	Sedum hispanicum	..+......	0	0	11				
	B	Serratula pusilla					.+......	0	0	13
	H	Silene colorata	.......+.	0	0	11	+.......	0	0	13
	W	Silene decipiens					.+...+..	0	0	25
	A	Silene tridentata	........+	0	0	11				
	D	Sinapis alba					..+.....	0	0	13
	D	Sonchus oleraceus					.+......	0	0	13
	H	Stellaria media					.....+..	0	0	13
	W	Stipa capensis	99895646.	**72**	**64**	**89**				
*	V	Stipa parviflora	..++...++	0	0	44				

Table 4. continued.

		Species	BBP02 123456789	BBP02 C1	BBP02 C2	BBP02 %P	BBP03 12345678	BBP03 C1	BBP03 C2	BBP03 %P
*	V	Stipa pellita	......+..	0	0	11	+.......	0	0	13
	V	Telmissa microcarpa					.+......	0	0	13
*	B	Teucrium capitatum	++0++++++	**1**	**1**	**100**	+....++0	1	0	50
	H	Theligonum cynocrambe					.+......	0	0	13
	T	Thlaspi perfoliatum					.+......	0	0	13
	H	Thrincia tuberosa	......+..	0	0	11				
*	B	Thymelaea hirsuta	+01+++11+	**4**	**4**	**100**	+.+.+000	**3**	**2**	**75**
	W	Tordylium aegyptiacum	........+	0	0	11				
	H	Torilis tenella	....+++++	0	0	56	.+......	0	0	13
	H	Trifolium campestre	....+.++.	0	0	33	.++.....	0	0	25
	H	Trifolium dasyurum	......+++	0	0	33	++......	0	0	25
	H	Trifolium echinatum	.......+.	0	0	11	.+......	0	0	13
	H	Trifolium purpureum	...+.++++	0	0	56	.++.....	0	0	25
	H	Trifolium stellatum	....+....	0	0	11	.++.....	0	0	25
	H	Trifolium tomentosum	....++2++	4	2	56	+++..++.	0	0	63
	W	Trigonella arabica	....+++++	0	0	56				
	H	Trigonella monspeliaca	......++.	0	0	22				
	W	Trigonella stellata	..+....+.	0	0	22				
	B	Trisetaria macrochaeta	.....211.	13	4	33	123..3..	24	12	50
	A	Tulipa systola					.....++.	0	0	25
	V	Umbilicus intermedius					.+......	0	0	13
	H	Urospermum picroides	.+.......	0	0	11	.++.....	0	0	25
	V	Valantia hispida	.......+.	0	0	11	.+......	0	0	13
	H	Valerianella coronata					.+......	0	0	13
	H	Valerianella vesicaria	......+.+	0	0	22	+++.....	0	0	38
	H	Velezia rigida					.+......	0	0	13
*	B	Verbascum fruticulosum	....+....	0	0	11	.+++.+..	0	0	50
	H	Vicia peregrina					+.+.....	0	0	25
	H	Vicia sativa	......+..	0	0	11				
	H	Vulpia ciliata	......++.	0	0	22				
	H	Vulpia myuros					.+......	0	0	13

Aspects of the association: Persistents – 38 spp.; ephemerals – 150 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00087	50	45	41	28.04.65	I 1870 5897
2	00088	50	45	37	28.04.65	I 1865 5897
3	00089	45	35	39	28.04.65	I 1879 5888
4	00090	40	50	34	28.04.65	I 1868 5888
5	00256	28	42	66	26.04.67	I 1862 5881
6	00267	64	16	80	28.04.67	I 1858 5860
7	00271	36	24	106	29.04.67	I 1893 5859
8	00272	48	32	102	29.04.67	I 1893 5859
9	00275	28	42	93	29.04.67	I 1888 5847
Average:		44.3	36.7	67.0		

6.2.1.2.3 BBP03 Phlomido brachyodontis – Sarcopoterietum spinosi artemisietosum sieberi Danin, Orshan et Zohary ex Danin et Solomeshch sub-ass. nov., nom. inv.

Syn.: Sarcopoterium spinosum – Phlomis brachyodon artemisietosum association Danin, Orshan et Zohary 1975.

Diagnostical species: the markers in table 4. **Distribution:** Fig. 29.

Ecological notes: The prominent feature of this subassociation is the presence of *Artemisia sieberi* which is the dominant of many steppe associations. The climatic and edaphic conditions prevailing in the specific area where this association was recorded are transitional between the semi-steppe bathas and the shrub-steppe vegetation. The large number of species with sociotype H and B contribute to the prevalence of the Mediterranean chorotype in this association.

Association dynamics and conservation: Most of the area of this subassociation is under constant overgrazing pressure.

Aspects of the association: Persistents – 43 spp.; ephemerals – 154 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00197	12	28	65	10.04.67	I 2103 5849
2	00204	20	20	116	12.04.67	I 2110 5845
3	00208	9	21	86	13.04.67	I 2093 5844
4	00566	1	25	13	07.01.67	I 2128 5828
5	00568	4	16	17	07.01.67	I 2122 5832
6	00614	52	23	51	06.04.67	I 2008 5745
7	00624	6	19	33	06.04.67	I 2043 5788
8	00627	0	20	11	06.04.67	I 2045 5792
Average:		13.0	21.5	49.0		

6.2.1.3 BBE Echinopion polyceratis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch all. nov.

Diagnostical species: *Alkanna strigosa, Echinops polyceras, Ononis natrix.*

Nomenclatural type: Alkanno strigosae – Echinopetum polyceratis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch.

Associations of this alliance inhabit outcrops of chalk and marl rocks or places where shallow soils cover such rocks in the area of the semi-steppe bathas. The proximity of such rocks to the soil surface has some impacts that need to be studied. They always support different vegetation than that of the hard rocks (Fig. 16). In three of the five associations the dominant species belongs to Artemisietea sieberi, the steppe vegetation.

The phytogeographical spectrum displays its position in Ballotetea undulatae by the prevalence of the M and M-IT chorotypes and the low percentage of Irano-Turanian and Saharo-Arabian species (Figs. 30 and 31). The drier habitat of one association as compared with others is evidenced by the lower percentage of the chorotypes M and M-IT and higher percentages of IT, SA, and M-SA. The associations BBE03 and BBE04, dominated by *Artemisia sieberi* – the leading species of the shrub-steppes, have the phytogeographical spectrum of the semisteppe-bathas where the highest frequency is that of the Mediterranean species. The chorotype spectrum of BBE05 shows a more mesophytic position than BBE02, BBE03, and BBE04 by the higher percentages of M and M-IT and low IT and M-SA chorotypes. This association has the northernmost position of the semi-steppe bathas studied here.

6.2.1.3.1 BBE01 Ononidetum natricis Eig 1946.

Diagnostical species: the markers in table 5. **Distribution:** Fig. 29.

Ecological notes: The typical habitats of this association are weathered Senonian chalk and the accompanying flint rocks. There is a high contribution of species of herbaceous plant communities (H) in the markers and in the companion lists. It is situated in a position of transition from the eu-Mediterranean vegetation to that of the semi-steppe bathas. The high number of *Trifolium* species is outstanding in relation to the semi-steppe and steppe associations. On the other hand there are many common desert species which occur here and are not found in the Mediterranean bathas.

Association dynamics and conservation: Most of the area of this association is under constant pressure of overgrazing. The expanding urbanization increase the grazing and cutting pressure on such an association. It was sampled almost 30 years ago and it is hard to investigate its present situation.

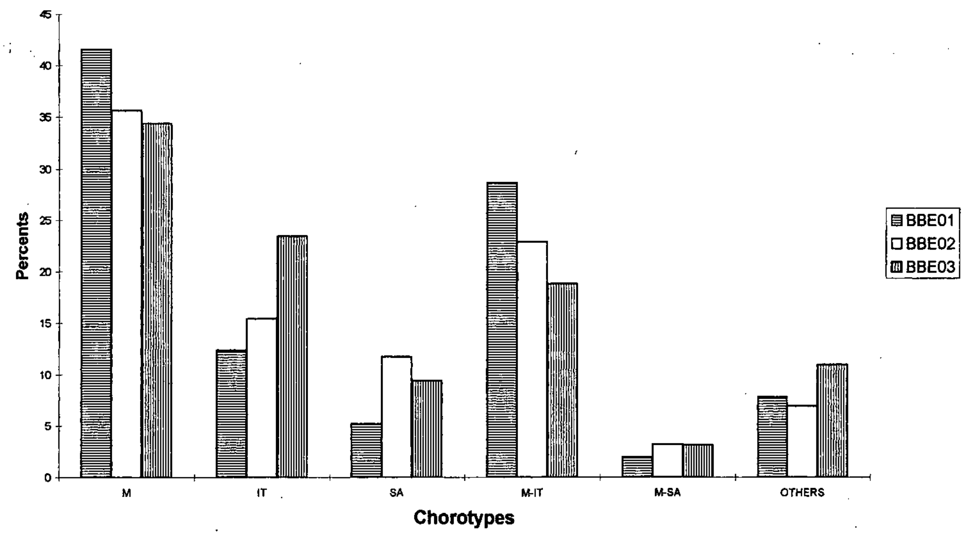

Figure 30. Phytogeographical analysis of associations BBE01-- BBE03.

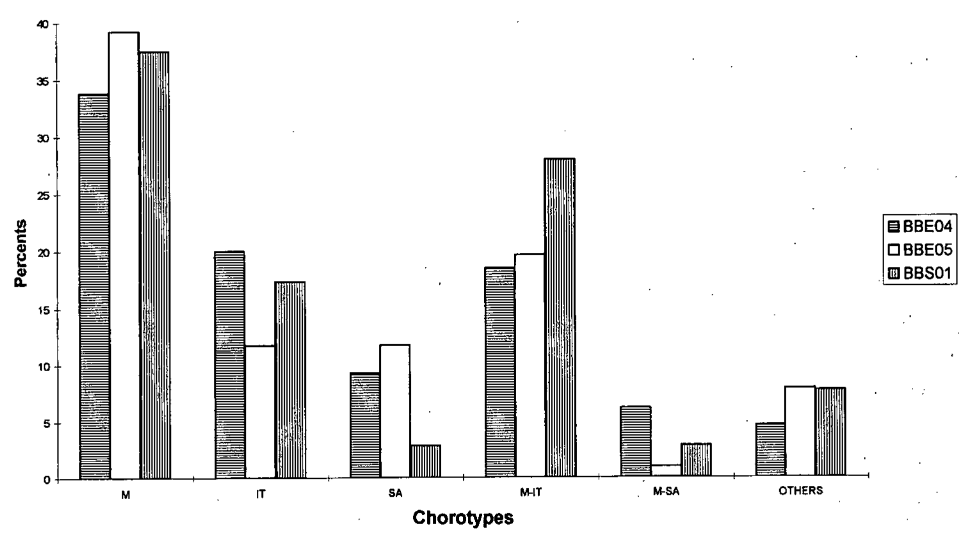

Figure 31. Phytogeographical analysis of associations BBE04, BBE05, and BBS01.

Table 5. Association tables of BBE01 – Ononidetum natricis, BBE02 – Alkanno strigosae – Echinopetum polyceratis, and BBE03 – Ononido natricis – Artemisietum sieberi

		Species	BBE01 *1234567	C1	C2	%P	BBE02 *1234567	C1	C2	%P	BBE03 1234567	C1	C2	%P
	A	Achillea santolina					.....+.	0	0	14				
	W	Adonis dentata					...++.+	0	0	43				
	H	Adonis microcarpa	+..++.+	0	0	57	.+.....	0	0	14				
	T	Aegilops geniculata	+......	0	0	14								
	W	Aegilops kotschyi					...+..+	0	0	29				
	H	Aegilops peregrina					++.+...	0	0	43	1443472	**36**	**36**	**100**
	H	Ainsworthia trachycarpa	..+....	0	0	14	.++....	0	0	29				
*	Q	Ajuga chamaepitys	.+++.++	**0**	**0**	**71**								
*	B	Ajuga iva					..++++.	0	0	57	...++.+	0	0	43
*	H	Alcea acaulis	.....+.	0	0	14	.++...+	0	0	43				

Table 5. continued.

		Species	BBE01 1234567	BBE01 C1	BBE01 C2	BBE01 %P	BBE02 1234567	BBE02 C1	BBE02 C2	BBE02 %P	BBE03 1234567	BBE03 C1	BBE03 C2	BBE03 %P
*	B	Alkanna strigosa	++..0..	2	1	43	++1+410	**9**	**9**	**100**				
	W	Allium stamineum	....+..	0	0	14	...+++.	0	0	43	++..+.+	0	0	57
	D	Ammi majus					....++.	0	0	29				
	W	Anagallis arvensis	+.+++++	**0**	**0**	**86**	1+.++.+	**2**	**1**	**71**				
	W	Anchusa aegyptiaca	.....+.	0	0	14	...+...	0	0	14				
*	B	Anchusa strigosa	.+0++.+	**1**	**1**	**71**	+++.2+.	**4**	**3**	**71**				
	H	Anchusa undulata	+......	0	0	14								
	H	Anthemis hebronica	..+..++	0	0	43								
	H	Anthemis pseudocotula	0+++++.	**1**	**1**	**86**	+21423+	**17**	**17**	**100**	.++++++	**0**	**0**	**86**
	H	Antirrhinum orontium					.+.....	0	0	14				
	V	Arenaria leptoclados	.....++	0	0	29								
	T	Arrhenatherum palaestinum	....+.+	0	0	29								
*	A	Artemisia sieberi	+......	0	0	14					7487989	**76**	**76**	**100**
*	V	Asparagus horridus					.+.....	0	0	14				
	H	Asphodelus ramosus	..2....	20	3	14	41+41++	**15**	**15**	**100**	.++..+.	0	0	43
	V	Asterolinon linum-stellatum	...++..	0	0	29								
	B	Astoma seselifolium	...++.+	0	0	43								
	A	Astragalus aleppicus					..+..+.	0	0	29				
	W	Astragalus asterias	++++...	0	0	57	++++++.	0	0	86				
	A	Astragalus callichrous					.++..+.	0	0	43	.+++++.	**0**	**0**	**71**
	A	Astragalus caprinus					..++.++	0	0	57				
*	B	Astragalus cretaceus					...+...	0	0	14				
	H	Astragalus hamosus	..+.+..	0	0	29	.+++.+.	0	0	57				
	A	Astragalus hispidulus					.+...+.	0	0	29				
*	A	Astragalus sanctus	+2.....	10	3	29	+.+....	0	0	29	+++.+..	0	0	57
*	A	Astragalus spinosus									1.00+10	**6**	**5**	**86**
	W	Atractylis cancellata	..+....	0	0	14								
	A	Atractylis prolifera					...+...	0	0	14				
*	A	Atractylis serratuloides					..+...+	0	0	29				
*	S	Atriplex leucoclada									.+.....	0	0	14
	H	Avena sterilis	..+....	0	0	14	..+.+..	0	0	29	...+...	0	0	14
	A	Avena wiestii	.+++...	0	0	43	..++.+.	0	0	43				
*	B	Ballota undulata	.+..1+0	4	2	57	+1.....	5	1	29				
	A	Bellevalia desertorum					+......	0	0	14	+++.+++	**0**	**0**	**86**
	H	Bellevalia flexuosa					..+....	0	0	14				
	H	Biscutella didyma	+.+.+++	**0**	**0**	**71**								
	H	Brachypodium distachyon	....+..	0	0	14					...+...	0	0	14
	H	Bromus fasciculatus	..+..+.	0	0	29	.+.....	0	0	14	+..+...	0	0	29
	H	Bromus lanceolatus	.4++...	13	6	43	++.....	0	0	29				
	H	Bromus madritensis	.....+.	0	0	14								
	H	Bromus tectorum	.1.++++	**2**	**1**	**71**								
	H	Bupleurum lancifolium	..+++..	0	0	43	+..+...	0	0	29				
	H	Calendula arvensis	.....+.	0	0	14	...+++.	0	0	43				
	B	Calendula pachysperma									.+.....	0	0	14
	B	Calendula palaestina									.+.....	0	0	14
	H	Callipeltis cucullaria					.+.....	0	0	14				
	V	Campanula erinus					.+...+.	0	0	29				
	V	Campanula hierosolymitana	.....+.	0	0	14								
	H	Campanula stellaris					+......	0	0	14				
	A	Carex pachystylis	.....+.	0	0	14	.+..+10	4	2	57	.....+.	0	0	14
	T	Carlina curetum					.+...+.	0	0	29				
	B	Carlina libanotica	+..+.3.	10	4	43	..+.+..	0	0	29	......+	0	0	14
	W	Carrichtera annua	+......	0	0	14	+++++..	**0**	**0**	**71**				
	W	Carthamus nitidus									..++...	0	0	29
	H	Carthamus tenuis	..2.++.	7	3	43	++.+++.	**0**	**0**	**71**				
	H	Catapodium rigidum	30++++.	**6**	**5**	**86**	.+...+.	0	0	29				
*	A	Centaurea aegyptiaca					......+	0	0	14				
	H	Centaurea ascalonica					....+..	0	0	14				
	H	Centaurea hyalolepis					..++++.	0	0	57	.++.+.+	0	0	57
	H	Centaurea iberica	+...+..	0	0	29	+......	0	0	14				
	A	Ceratocephala falcata	...++..	0	0	29								

Table 5. continued.

		Species	BBE01 1234567	C1	C2	%P	BBE02 1234567	C1	C2	%P	BBE03 1234567	C1	C2	%P
	H	Chaetosciadium trichospermum	....2.+	10	3	29	.+.+...	0	0	29				
*	V	Chiliadenus iphionoides					.+.....	0	0	14				
	D	Chrysanthemum coronarium					.....+.	0	0	14				
	T	Cicer judaicum	..++.+.	0	0	43								
	H	Cichorium endivia	.....+.	0	0	14	.+++++.	**0**	**0**	**71**				
	H	Convolvulus althaeoides					..+.++.	0	0	43				
	B	Convolvulus dorycnium	..+....	0	0	14	.+.....	0	0	14				
*	M	Coridothymus capitatus					+..+...	0	0	29				
	H	Coronilla scorpioides	.....+.	0	0	14	++.....	0	0	29				
	V	Crassula alata					.+.....	0	0	14				
	H	Crepis sancta	.....+.	0	0	14								
	W	Crithopsis delileana	+++..++	**0**	**0**	**71**	.+.+.+1	4	2	57	+446508	**40**	**40**	**100**
	A	Crucianella membranacea					.+.+...	0	0	29				
	Q	Cynoglossum creticum	+......	0	0	14								
	H	Cynosurus callitrichus	+..++..	0	0	43								
	H	Dactylis glomerata					..+..+.	0	0	29				
	H	Daucus durieua	+.+....	0	0	29	.+...+.	0	0	29				
*	A	Deverra tortuosa					.++.++0	**1**	**1**	**71**				
*	H	Dianthus strictus					.++..+.	0	0	43				
	H	Echinaria capitata	+...+..	0	0	29								
*	B	Echinops polyceras	+122.1.	**12**	**9**	**71**	5477268	**56**	**56**	**100**	+1+....	3	1	43
*	H	Echium angustifolium	++1..+.	3	1	57	.+0+++.	**1**	**1**	**71**				
	R	Eminium spiculatum	......+	0	0	14								
*	V	Ephedra aphylla					+....+.	0	0	29				
*	Q	Ephedra foeminea									++.....	0	0	29
	B	Eremostachys laciniata					....+..	0	0	14				
	W	Erodium ciconium					+++.+++	**0**	**0**	**86**				
	W	Erodium crassifolium					...+...	0	0	14				
	H	Erodium gruinum	+.+....	0	0	29	.....+.	0	0	14				
	H	Erucaria hispanica	..+.+.+	0	0	43	...++1.	3	1	43				
	W	Erucaria microcarpa					...+..7	35	10	29				
	W	Erucaria rostrata	.+.....	0	0	14	+++...+	0	0	57	++.+++.	**0**	**0**	**71**
	H	Eryngium creticum	..+..+.	0	0	29	..+.+++	0	0	57				
*	B	Eryngium glomeratum	.1.....	10	1	14					..+....	0	0	14
*	B	Erysimum crassipes					.+.....	0	0	14				
	W	Euphorbia chamaepeplus	.+.+...	0	0	29	...+...	0	0	14				
*	V	Euphorbia hierosolymitana					.+.....	0	0	14				
	B	Factorovskya aschersoniana	.....+.	0	0	14								
*	A	Fagonia mollis									+....+.	0	0	29
	H	Ferula communis					.+.....	0	0	14				
	H	Filago contracta	2.+0.+1	**7**	**5**	**71**	.+.++++	**0**	**0**	**71**	..+..+.	0	0	29
	W	Filago desertorum	+......	0	0	14	++.++++	**0**	**0**	**86**				
	H	Filago pyramidata	..+..+.	0	0	29	.+.....	0	0	14				
*	M	Fumana thymifolia					...+...	0	0	14				
	H	Fumaria bracteosa	....+..	0	0	14	......+	0	0	14				
	H	Gagea chlorantha									+......	0	0	14
	H	Galium judaicum	..+..+.	0	0	29								
	H	Geropogon hybridus					.....+.	0	0	14				
	A	Glaucium grandiflorum	...++..	0	0	29								
	H	Gundelia tournefortii					+.1.+++	**2**	**1**	**71**				
	H	Gynandriris sisyrinchium	++.....	0	0	29	.+..+..	0	0	29	.....+.	0	0	14
*	B	Gypsophila arabica	+......	0	0	14	+.+.+++	**0**	**0**	**71**	++.....	0	0	29
*	H	Haplophyllum buxbaumii					....++.	0	0	29				
	H	Hedypnois cretica	+++0+.+	**1**	**1**	**86**	++++...	0	0	57	.+...+.	0	0	29
	H	Helianthemum lasiocarpum					.+.....	0	0	14				
	W	Helianthemum ledifolium	..+....	0	0	14	....+.+	0	0	29				
	H	Helianthemum salicifolium	+.+1...	3	1	43	.0+++++	**1**	**1**	**86**	.....+.	0	0	14
*	A	Helianthemum vesicarium	+..+...	0	0	29	+.++..+	0	0	57	+++...+	0	0	57
*	B	Heliotropium rotundifolium	+++....	0	0	43	++..+..	0	0	43				
*	S	Herniaria hemistemon	...+...	0	0	14								
	W	Herniaria hirsuta	..++.++	0	0	57	.+.+...	0	0	29				
	H	Hippocrepis unisiliquosa	..+....	0	0	14	++.+++.	**0**	**0**	**71**	.+..++.	0	0	43

Table 5. continued.

		Species	BBE01				BBE02				BBE03			
			1234567	**C1**	**C2**	**%P**	**1234567**	**C1**	**C2**	**%P**	**1234567**	**C1**	**C2**	**%P**
	D	Hirschfeldia incana	..+..2+	7	3	43	...+...	0	0	14				
	H	Hordeum bulbosum					.+...+.	0	0	29				
	H	Hordeum spontaneum	.+.....	0	0	14					...++..	0	0	29
	H	Hymenocarpos circinnatus	+.++...	0	0	43	.++++..	0	0	57	.+++++.	**0**	**0**	**71**
*	H	Hyparrhenia hirta					.1..+..	5	1	29				
	A	Hypecoum aegyptiacum	....+..	0	0	14								
	H	Hypericum triquetrifolium	++.....	0	0	29								
	A	Ixiolirion tataricum					......+	0	0	14				
*	B	Kickxia aegyptiaca	++.....	0	0	29	++.1+2.	**7**	**5**	**71**	+++000+	**2**	**2**	**100**
	H	Lagoecia cuminoides	.+.+++.	0	0	57	.....+.	0	0	14	.....+.	0	0	14
	W	Lathyrus pseudocicera	...++..	0	0	29	+......	0	0	14				
	R	Launaea fragilis	......+	0	0	14								
	H	Lens orientalis					+......	0	0	14				
	A	Leontice leontopetalum					.....+.	0	0	14				
	S	Limonium lobatum					.+.....	0	0	14				
	H	Linum strictum					+......	0	0	14				
	A	Loliolum subulatum	.+.....	0	0	14					++..+++	**0**	**0**	**71**
	W	Lolium rigidum	+......	0	0	14	.....+.	0	0	14				
	W	Lomelosia porphyroneura									.....+.	0	0	14
	H	Lomelosia prolifera					++++++.	**0**	**0**	**86**				
*	M	Majorana syriaca					.1..++.	3	1	43				
	A	Malabaila secacul					....++.	0	0	29	.....+.	0	0	14
	D	Malva parviflora					...+...	0	0	14				
	W	Matthiola livida	...+...	0	0	14								
	H	Matthiola longipetala	+.+.+..	0	0	43								
	H	Medicago coronata	..+...+	0	0	29								
	W	Medicago laciniata					.+.....	0	0	14				
	H	Medicago orbicularis	...+...	0	0	14								
	H	Medicago polymorpha	...++.+	0	0	43	+..+.+.	0	0	43				
	W	Medicago radiata					.....+.	0	0	14				
	H	Medicago truncatula					...+.+.	0	0	29				
	H	Medicago tuberculata					+......	0	0	14				
*	V	Micromeria nervosa	...0...	5	1	14								
	W	Minuartia picta	.....+.	0	0	14	.....+.	0	0	14				
	H	Muscari commutatum					+......	0	0	14				
	W	Neotorularia torulosa					...+...	0	0	14				
	H	Nigella unguicularis					+......	0	0	14				
*	A	Noaea mucronata	++.+1.0	**3**	**2**	**71**	.+.+.++	0	0	57	14110+0	**11**	**11**	**100**
	D	Notobasis syriaca	+..++.+	0	0	57					.....+.	0	0	14
	W	Onobrychis crista-galli	..++...	0	0	29	++..+++	**0**	**0**	**71**	+++++..	**0**	**0**	**71**
	H	Onobrychis squarrosa	+...+..	0	0	29								
	H	Ononis mollis	..+....	0	0	14	....++.	0	0	29				
*	B	Ononis natrix	4566788	**64**	**64**	**100**					+++1+..	**2**	**1**	**71**
	W	Ononis sicula	..0....	5	1	14	++.....	0	0	29	+..++.+	0	0	57
	A	Onopordum alexandrinum									.+.....	0	0	14
	B	Onopordum palaestinum	...+..+	0	0	29					..++++.	0	0	57
	A	Onosma echinata					.....+.	0	0	14				
	H	Ornithogalum neurostegium	......+	0	0	14	.+..+..	0	0	29				
	H	Pallenis spinosa	.+.....	0	0	14	.++.+++	**0**	**0**	**71**	...+.+.	0	0	29
	W	Papaver humile					.+...+.	0	0	29				
	H	Papaver hybridum					.+.....	0	0	14				
	L	Parapholis incurva	+......	0	0	14					++.....	0	0	29
	H	Parentucellia latifolia	......+	0	0	14								
*	H	Paronychia argentea	++.+++.	**0**	**0**	**71**	.+.+.+.	0	0	43	.++.+++	**0**	**0**	**71**
*	V	Paronychia sinaica	.+++...	0	0	43	.+.+++.	0	0	57				
*	V	Phagnalon rupestre	+.+....	0	0	29	++++...	0	0	57				
	W	Phalaris minor					..+..+.	0	0	29				
*	B	Phlomis brachyodon	.....0.	5	1	14	.+1.10.	6	4	57				
	W	Picris longirostris	..+...+	0	0	29	+..+...	0	0	29	...+...	0	0	14
	H	Pimpinella cretica	..+..++	0	0	43								
	H	Plantago afra	+.+..++	0	0	57	.+.....	0	0	14				
*	R	Plantago albicans					.+++1+.	**2**	**1**	**71**				
	W	Plantago coronopus					.+.++++	**0**	**0**	**71**				

Table 5. continued.

		Species	BBE01 1234567	C1	C2	%P	BBE02 1234567	C1	C2	%P	BBE03 1234567	C1	C2	%P
	H	Plantago cretica	..+..+.	0	0	29	+..+...	0	0	29				
	H	Plantago lagopus	.....+.	0	0	14								
	A	Plantago phaeostoma					.+.....	0	0	14				
	H	Poa bulbosa	...7638	60	34	57	.+..+++	0	0	57				
	W	Poa eigii									81..+2.	29	16	57
*	V	Podonosma orientalis	..+....	0	0	14								
	H	Psilurus incurvus	.+.++++	**0**	**0**	**71**								
	W	Pterocephalus brevis	..+....	0	0	14	...+...	0	0	14	.+.+...	0	0	29
	H	Pterocephalus plumosus					.+.....	0	0	14				
	H	Ranunculus asiaticus	...++..	0	0	29	..+...+	0	0	29	.....+.	0	0	14
*	S	Reaumuria hirtella									+......	0	0	14
	W	Reichardia tingitana	..+....	0	0	14	+..+...	0	0	29				
	H	Reseda alba	...+...	0	0	14								
	H	Reseda luteola	.+.....	0	0	14								
	H	Rhagadiolus stellatus	+++++..	**0**	**0**	**71**	++++...	0	0	57				
	W	Roemeria hybrida	...+..+	0	0	29								
	H	Rostraria smyrnacea	2++.+.+	**4**	**3**	**71**	++.+.+.	0	0	57	+...+..	0	0	29
*	B	Salvia dominica	0.++..+	1	1	57	2++..+.	5	3	57	...+...	0	0	14
	H	Salvia horminum					1..+...	5	1	29				
*	A	Salvia lanigera					.++++.+	**0**	**0**	**71**	....+..	0	0	14
	H	Salvia samuelssonii					.++.++.	0	0	57				
*	T	Sarcopoterium spinosum	5......	50	7	14	12.....	15	4	29	0..++..	2	1	43
*	W	Scariola orientalis					..+....	0	0	14				
	W	Scilla hanburyi					......+	0	0	14				
	H	Scorpiurus muricatus	...+...	0	0	14	++...++	0	0	57	....+..	0	0	14
	W	Scorzonera judaica									.....+.	0	0	14
	H	Scorzonera papposa	.+.....	0	0	14	..+.+++	0	0	57				
*	N	Scrophularia deserti									+...+..	0	0	29
*	B	Scrophularia xanthoglossa	++.1+.+	**2**	**1**	**71**	+.....+	0	0	29				
	H	Sedum caespitosum					.+.....	0	0	14				
	B	Serratula pusilla	.....+.	0	0	14								
	H	Silene colorata	..+....	0	0	14								
	A	Silene tridentata					.+.+...	0	0	29				
	D	Sonchus oleraceus					.+.....	0	0	14				
*	V	Stipa barbata					..+....	0	0	14				
	W	Stipa capensis	..6..1.	35	10	29	356153.	**38**	**33**	**86**				
*	V	Stipa parviflora					..+....	0	0	14				
*	V	Stipa pellita					+......	0	0	14				
*	B	Teucrium capitatum					+++++++	**0**	**0**	**100**	+.+..+.	0	0	43
	H	Theligonum cynocrambe	.....+.	0	0	14								
	H	Thesium humile									.+.....	0	0	14
*	B	Thymelaea hirsuta					1+.0+.+	**3**	**2**	**71**				
	W	Tordylium aegyptiacum					..+..+.	0	0	29				
	H	Torilis nodosa	...++..	0	0	29								
	H	Torilis tenella	..+0+..	2	1	43	.+...+.	0	0	29				
	H	Trifolium campestre	...+..+	0	0	29								
	H	Trifolium dasyurum					.....+.	0	0	14				
	H	Trifolium eriosphaerum	..++.+.	0	0	43								
	H	Trifolium pilulare	..+....	0	0	14								
	H	Trifolium purpureum					..+.++.	0	0	43				
	H	Trifolium scabrum	..+....	0	0	14								
	H	Trifolium stellatum	....+..	0	0	14	.+.....	0	0	14				
	H	Trifolium tomentosum	+.+...+	0	0	43	+..+++.	0	0	57				
	W	Trigonella arabica					.++++++	**0**	**0**	**86**				
	T	Trigonella hierosolymitana	++++...	0	0	57								
	H	Trigonella monspeliaca	+.++...	0	0	43	++.+...	0	0	43				
	W	Trigonella stellata	..+....	0	0	14								
	B	Trisetaria macrochaeta					..1++1.	5	3	57				
	A	Tulipa systola					......+	0	0	14				
	A	Urginea undulata					......+	0	0	14				
	H	Urospermum picroides					.+.....	0	0	14				
	V	Valantia hispida					.+.....	0	0	14				

Table 5. continued.

	Species	BBE01 1234567	C1	C2	%P	BBE02 1234567	C1	C2	%P	BBE03 1234567	C1	C2	%P
H	Valerianella vesicaria	..+.+.+	0	0	43	+..+...	0	0	29				
* B	Verbascum fruticulosum	...++.+	0	0	43					..+....	0	0	14
H	Verbascum orientale					.+.....	0	0	14				
W	Vicia narbonensis					.....+.	0	0	14				
H	Vicia peregrina					+......	0	0	14				
H	Vicia sativa	+......	0	0	14	.+...+.	0	0	29				
H	Vulpia ciliata	...++.+	0	0	43								

Aspects of the association: Persistents – 28 spp.; ephemerals – 146 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00728	30	30	52	05.04.69	I 2233 6320
2	00729	20	30	37	05.04.69	I 1838 6313
3	00730	50	20	68	05.04.69	I 2239 6240
4	00731	50	20	57	05.04.69	I 2240 6240
5	00732	60	30	48	05.04.69	I 2237 6239
6	00733	50	20	47	05.04.69	I 2232 6225
7	00734	60	30	42	05.04.69	I 2230 6225
Average:		45.7	25.7	50.14		

6.2.1.3.2 BBE02 Alkanno strigosae – Echinopetum polyceratis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov., nom. inv.

Syn.: Echinops polyceras – Alkanna strigosa association Danin, Orshan et Zohary 1975.

Diagnostical species: the markers in table 5. **Distribution:** Fig. 32.

Ecological notes: This association fringes the Ballotetea belt towards the Artemisietea belt where chalk is covered with a nari crust. The grazing and cutting pressures in the area of this association probably leads to the poverty in lignified species and the relative richness in hemicryptophytes and unpalatable perennials such as many toxicant Boraginaceae and spiny plants of other families.

Association dynamics and conservation: Most of the area of this association is under constant pressure of overgrazing and cutting of lignified plants.

Aspects of the association: Persistents – 42 spp.; ephemerals – 146 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00205	25	25	59	12.04.67	I 2111 5846
2	00257	30	30	99	26.04.67	I 1862 5880
3	00266	63	7	57	28.04.67	I 1880 5822
4	00270	28	12	71	28.04.67	I 2053 5842
5	00276	56	14	62	29.04.67	I 1889 5867
6	00356	81	9	86	06.05.67	I 1878 5825
7	00449	34	6	43	20.03.67	I 2050 5742
Average:		45.3	14.7	68.1		

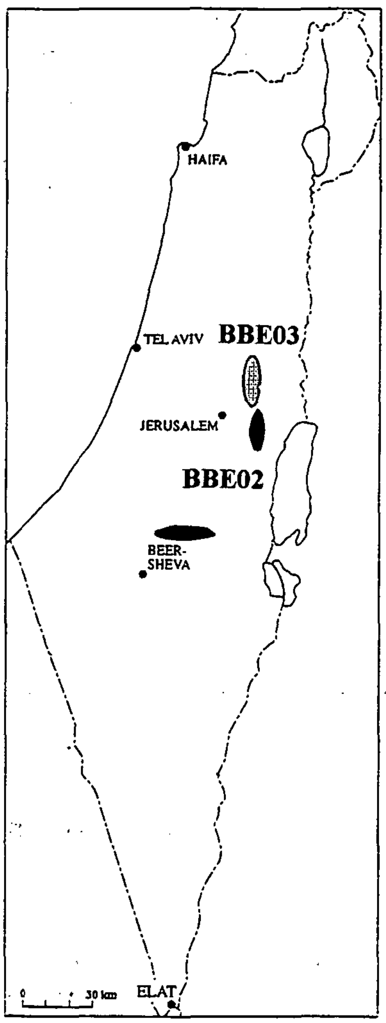

Figure 32. Distribution map of associations BBE02 and BBE03.

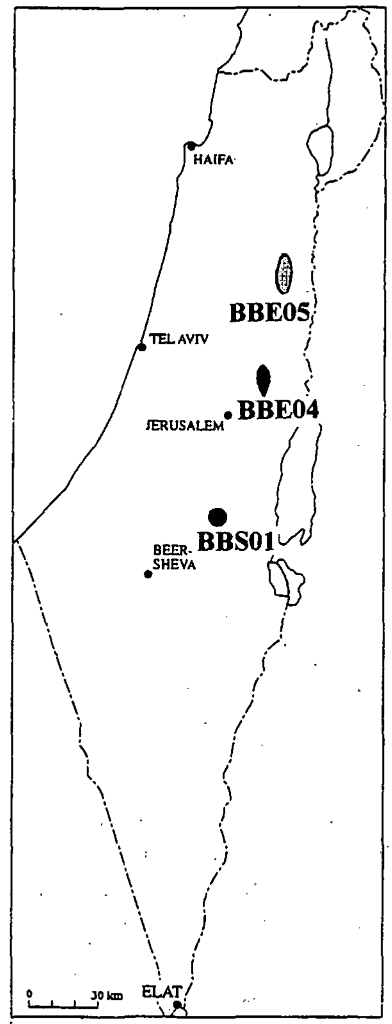

Figure 33. Distribution map of associations BBE04, BBE05 and BBS01.

6.2.1.3.3 BBE03 Ononido natricis – Artemisietum sieberi (Eig 1946) Danin et Solomeshch ass. nov.

Syn. Artemisietum Herbae-albae Deserti-Judaici Ononidetosum Natricis Eig 1946.

Diagnostical species: the markers in table 5. **Distribution:** Fig. 32.

Syntaxonomy and nomenclature: Eig (1946) included Artemisietum Herbae-albae Deserti-Judaici Ononidetosum Natricis in the Artemision Herbae-albae. This was partly the perception of Zohary who in fact compiled Eig's (1946) article. Later, (cf. Danin et al., 1975) Zohary adopted the view of Danin (1970) who found that the phytogeographical position of this association is in the Mediterranean Ballotetea and not in the Irano-Turanian Artemisietea. Eig's (1946) two other subassociations of Artemisietum Herbae-albae could not be detected again, probably due to changes in management of the vegetation in the area and are therefore not fully discussed here.

Ecological notes: The relevés of this association were recorded on a south-facing slope covered with shallow soil above a soft chalk outcrop north of Wadi Qilt near Alon road. This position is at the margin of the semi-steppe bathas, but contrary to BBE02 there are no hard rock (such as the nari crust) outcrops. Therefore the moisture regime is drier as indicated by the higher percentage of IT and lower M and M-IT chorotypes in BBE03. There is high activity of the landsnail *Sphincterochila fimbriata* (Prof. J. Heller, pers. comm.) which graze on the microbiotic crust in the area of this association. This activity is prominent after the first rains of winter, mainly in this association.

Association dynamics and conservation: Most of the area of this association suffers from overgrazing. An area protected from grazing for the purpose of teaching near the town Maale Adumim was burnt in the early 1990s. Even 4 years after the fire there were no signs of recovery of the dominant plants.

Aspects of the association: Persistents – 22 spp.; ephemerals – 44 spp.

No.	Relveé	%E	%P	Species	Date	Grid
1	94457	20	20	28	11.04.94	I 2303 6405
2	94458	20	20	32	11.04.94	I 2303 6406
3	94459	20	20	24	11.04.94	I 2303 6407
4	94460	30	20	25	11.04.94	I 2304 6405
5	94461	20	20	29	11.04.94	I 2304 6406
6	94462	30	20	31	11.04.94	I 2304 6407
7	94463	30	15	16	11.04.94	I 2305 6405
Average:		24.3	19.3	26.4		

6.2.1.3.4 BBE04 Sarcopoterio – Artemisietum sieberi Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 6. **Distribution:** Fig. 33.

Ecological notes: This association was recorded not far from the area of BBE03 and on the same substratum. However, the present association was recorded outside the great depression of Wadi Qilt, at the semi-steppe bathas area and dominated by *Sarcopoterium spinosum* which is the typical plant of the semi-steppes. This association has two peculiar companions which are not found in comparable associations *Reaumuria hirtella* (a typical xerohalophyte of the AR order) and the typical Mediterranean root-parasite *Osyris alba* which seldomly occurs in the Ballotetea.

Association dynamics and conservation: Most of the area of this association is under high overgrazing pressure.

Table 6. Association tables of BBE04 – Sarcopoterio – Artemisietum sieberi and BBE05 – Balloto undulatae – Salsoletum vermiculatae

		Species	BBE04 *1234567	BBE04 C1	BBE04 C2	BBE04 %P	BBE05 *1234567	BBE05 C1	BBE05 C2	BBE05 %P
	W	Adonis dentata	.+.+...	0	0	29	......+	0	0	14
	H	Aegilops peregrina	.++.+1.	4	2	57				
*	B	Ajuga iva	......+	0	0	14				
*	B	Alkanna strigosa	++.+..+	0	0	57				
	A	Alyssum damascenum					..+....	0	0	14
	W	Anagallis arvensis	++..+..	0	0	43	+....++	0	0	43
	W	Anchusa aegyptiaca	...+...	0	0	14	++++1++	**1**	**1**	**100**
*	B	Anchusa strigosa	..+....	0	0	14				
	H	Anemone coronaria					.+....+	0	0	29
	H	Anthemis pseudocotula	++21..1	**8**	**6**	**71**	++..+.+	0	0	57
	V	Arenaria leptoclados					+......	0	0	14
*	A	Artemisia sieberi	1121222	**16**	**16**	**100**				
	H	Asphodelus ramosus	.0++...	2	1	43				
	W	Asphodelus tenuifolius					...+...	0	0	14
*	A	Astragalus sanctus	++++0++	**0**	**0**	**100**				
*	A	Astragalus spinosus	++.+...	0	0	43				
	W	Atractylis cancellata					.....+.	0	0	14
	A	Avena wiestii					...+...	0	0	14
*	B	Ballota undulata	...0...	5	1	14	0131+23	**16**	**16**	**100**
	A	Bellevalia desertorum	55++3..	**26**	**19**	**71**	.....+.	0	0	14
	H	Bellevalia flexuosa					.+.....	0	0	14
	H	Biscutella didyma	.+.+..+	0	0	43	++++.+.	**0**	**0**	**71**

Table 6. continued.

		Species	BBE04				BBE05			
			1234567	C1	C2	%P	1234567	C1	C2	%P
	H	Brachypodium distachyon					......+	0	0	14
	H	Bromus fasciculatus					+++..+.	0	0	57
	H	Bromus tectorum					...+...	0	0	14
	A	Buglossoides tenuiflora	++.....	0	0	29				
	H	Calendula arvensis					++..++.	0	0	57
	B	Calendula palaestina					.....+.	0	0	14
*	Q	Calicotome villosa	..+....	0	0	14				
	B	Carlina libanotica	+..+...	0	0	29	+++222	**9**	**9**	**100**
	W	Carrichtera annua	11+13++	**9**	**9**	**100**	.++.+++	**0**	**0**	**71**
	W	Carthamus nitidus					....+..	0	0	14
	H	Carthamus tenuis	...+...	0	0	14	....1+0	6	3	43
	H	Centaurea hyalolepis	.+.++..	0	0	43	....+..	0	0	14
	H	Chaetosciadium trichospermum	...+...	0	0	14	++1++0+	**2**	**2**	**100**
	B	Convolvulus dorycnium					..+.+++	0	0	57
	H	Coronilla scorpioides					+......	0	0	14
	W	Crepis aspera					...+...	0	0	14
	H	Crepis sancta	...1...	10	1	14	+++...+	0	0	57
	W	Crithopsis delileana	.26111+	**20**	**17**	**86**				
	H	Crucianella macrostachya					..++.+.	0	0	43
	H	Cuscuta planiflora	......+	0	0	14				
	H	Delphinium peregrinum	.+.....	0	0	14	......+	0	0	14
*	H	Dianthus strictus					+.+++..	0	0	57
*	H	Echinops adenocaulos					.++.+..	0	0	43
	W	Echium judaeum					.+..+..	0	0	29
*	V	Ephedra aphylla					....++.	0	0	29
	W	Erodium ciconium					+.+++..	0	0	57
	B	Eruca sativa					.2344242	**30**	**30**	**100**
	W	Erucaria microcarpa	..+1...	8	2	29				
	W	Erucaria rostrata	0++.130	**8**	**7**	**86**	.+...0+	2	1	43
*	B	Eryngium glomeratum	...+...	0	0	14				
*	A	Fagonia mollis	+++++..	**0**	**0**	**71**				
	H	Filago contracta	...+...	0	0	14	++++..+	**0**	**0**	**71**
	H	Filago palaestina					+......	0	0	14
*	M	Fumana thymifolia	+++...+	0	0	57				
	H	Gagea chlorantha	+++.+++	**0**	**0**	**86**	++...++	0	0	57
	H	Galium judaicum					++.++.+	**0**	**0**	**71**
	H	Gynandriris sisyrinchium	++++.++	**0**	**0**	**86**	.++++.+	**0**	**0**	**71**
*	B	Gypsophila arabica	++.+++.	**0**	**0**	**71**	......+	0	0	14
*	R	Haplophyllun tuberculatum					......+	0	0	14
	H	Hedypnois cretica	.+.....	0	0	14				
	H	Helianthemum aegyptiacum					.....+.	0	0	14
	H	Helianthemum salicifolium					.++.+++	**0**	**0**	**71**
*	A	Helianthemum vesicarium	000+001	**5**	**5**	**100**				
*	B	Heliotropium rotundifolium	..+....	0	0	14				
	H	Hippocrepis unisiliquosa	...+...	0	0	14	.+...++	0	0	43
	H	Hordeum spontaneum					.++.+++	**0**	**0**	**71**
	B	Hyacinthella nervosa					+++++++	**0**	**0**	**100**
	H	Hymenocarpos circinnatus					+.++++.	**0**	**0**	**71**
*	H	Hyparrhenia hirta					......+	0	0	14
*	B	Kickxia aegyptiaca	..++.+.	0	0	43				
	H	Lagoecia cuminoides					+..+.++	0	0	57
	W	Lathyrus pseudocicera	...+...	0	0	14	+......	0	0	14
	S	Limonium lobatum					++..+..	0	0	43
	H	Linum strictum	++.....	0	0	29	.+..++.	0	0	43
	H	Lomelosia prolifera					.++.+..	0	0	43
	A	Malabaila secacul	...+...	0	0	14				
	W	Matthiola aspera					0++....	2	1	43
	H	Matthiola longipetala	..+..+.	0	0	29				
	H	Medicago coronata					.++....	0	0	29
	H	Medicago truncatula					+.++..+	0	0	57
	W	Neotorularia torulosa	....+..	0	0	14				
*	A	Noaea mucronata	000.+03	**8**	**7**	**86**				
	D	Notobasis syriaca					....+..	0	0	14

Table 6. continued.

		Species	BBE04				BBE05			
			1234567	C1	C2	%P	1234567	C1	C2	%P
	W	Onobrychis crista-galli	.....+.	0	0	14	+++++++	**0**	**0**	**100**
*	B	Ononis natrix	.....+.	0	0	14				
	W	Ononis sicula	...++1.	3	1	43				
	B	Onopordum palaestinum	.++...+	0	0	43				
	A	Onosma echinata	...+...	0	0	14	......+	0	0	14
*	Q	Osyris alba	......+	0	0	14				
*	H	Paronychia argentea	..+....	0	0	14	.+.....	0	0	14
*	V	Paronychia capitata	++++.+.	**0**	**0**	**71**	......+	0	0	14
*	V	Phagnalon rupestre	+.++..+	0	0	57	.++++++	**0**	**0**	**86**
*	B	Phlomis brachyodon					1.....+	8	2	29
	W	Picris longirostris					......+	0	0	14
	H	Plantago afra					......+	0	0	14
	B	Plantago bellardii					......+	0	0	14
	W	Plantago coronopus					++.....	0	0	29
	W	Plantago ovata					...+..+	0	0	29
	W	Poa eigii	2114128	**29**	**29**	**100**	7544344	**45**	**45**	**100**
	H	Pterocephalus plumosus					....++.	0	0	29
	H	Ranunculus asiaticus	..+...+	0	0	29	+0+++++	**1**	**1**	**100**
*	S	Reaumuria hirtella	....++.	0	0	29	......+	0	0	14
*	R	Retama raetam	.+.....	0	0	14	.....+0	3	1	29
	H	Rhagadiolus stellatus					++0+1..	**4**	**3**	**71**
	W	Roemeria hybrida					+......	0	0	14
	H	Rostraria smyrnacea					..+....	0	0	14
	W	Rumex cyprius					+..+.++	0	0	57
*	S	Salsola vermiculata					8848554	**60**	**60**	**100**
*	B	Salvia dominica	.+.+...	0	0	29	.00.2..	10	4	43
	H	Salvia horminum					....++.	0	0	29
*	A	Salvia lanigera	+.++...	0	0	43				
*	T	Sarcopoterium spinosum	8878774	**70**	**70**	**100**	+			
	T	Scilla autumnalis					.....++	0	0	29
	W	Scilla hanburyi					...++++	0	0	57
	H	Scorzonera papposa					.....++	0	0	29
	H	Sedum caespitosum					...++..	0	0	29
	W	Senecio glaucus	.+.....	0	0	14	+000002	**6**	**6**	**100**
	H	Silene colorata					++++..+	**0**	**0**	**71**
	W	Silene decipiens	...+...	0	0	14				
	W	Stipa capensis	.+.+...	0	0	29	+...+..	0	0	29
	V	Telmissa microcarpa					......+	0	0	14
*	B	Teucrium capitatum	+0++...	1	0	57	..21+10	**10**	**7**	**71**
	W	Tordylium aegyptiacum					....+..	0	0	14
	H	Torilis tenella					+..+...	0	0	29
	H	Trifolium dasyurum					+......	0	0	14
	T	Trifolium prophetarum					++++.+.	**0**	**0**	**71**
	W	Trigonella arabica					+.....+	0	0	29
	H	Trigonella monspeliaca					.+.....	0	0	14
	V	Valantia hispida					......+	0	0	14
	H	Vicia sativa					+...+.+	0	0	43

Aspects of the association: Persistents – 27 spp.; ephemerals – 38 spp.

No.	Revelé	%E	%P	Species	Date	Grid
1	97036	5	20	25	13.03.97	I 2293 6423
2	97037	7	20	35	13.03.97	I 2293 6422
3	97038	5	15	29	13.03.97	I 2293 6421
4	97039	20	15	39	13.03.97	I 2294 6423
5	97040	5	20	19	13.03.97	I 2293 6424
6	97041	5	20	20	13.03.97	I 2294 6424
7	97042	5	20	21	13.03.97	I 2292 6424
Average:		7.4	18.6	26.9		

6.2.1.3.5 BBE05 Balloto undulatae – Salsoletum vermiculatae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 6. **Distribution:** Fig. 33.

Ecological notes: The association was recorded near Sartaba which is the northernmost site of relevés in the Samarian Desert. The substratum is chalk covered by occasional patches of nari crust. These conditions enable the co-existence of plants from the ARS alliance and the BBE alliance. Its affinity to the associations dominating on chalk in the shrub-steppes (AR order) is reflected by the dominance of *Salsola vermiculata* but with very few additional companions of this sociotype. The most common companions are those of the Ballotetea and of the B, H, and W sociotypes.

Association dynamics and conservation: Most of the area of this association is under heavy pressure of overgrazing and cutting of lignified plants.

Aspects of the association: Persistents – 16 spp.; ephemerals – 86 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	97050	30	15	43	13.03.97	I 2449 6667
2	97051	30	10	42	13.03.97	I 2450 6667
3	97052	40	10	38	13.03.97	I 2451 6667
4	97053	30	15	37	13.03.97	I 2452 6667
5	97054	30	10	43	13.03.97	I 2453 6667
6	97055	35	10	42	13.03.97	I 2453 6668
7	97056	30	10	54	13.03.97	I 2453 6669
Average:		32.1	11.4	42.7		

6.2.1.4 BBS Sarcopoterio – Salvion syriacae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch all. nov.

Diagnostical species: *Bellevalia longipes, Bongardia chrysogonum, Diplotaxis erucoides, Galium tricornutum, Mericarpaea ciliata, Ononis spinosa.*

Nomenclatural type: Sarcopoterio – Salvietum syriacae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch.

Associations of this alliance are hard to detect because in most of the area of Israel, as in the rest of the Near East, non-rocky soil rich in clay in the area with 250-350 mm mean annual rainfall, is cultivated almost every year. Since cultivation for the last few thousands of years have strongly influenced the composition of the vegetation it is hard to find places where the vegetation approaches natural conditions. The deep soils were not disturbed at the vicinity of the former border between Israel and Jordan near Lasifar and Har Amasa during the period 1948-1967. There is high variability in soil texture leading to high phytosociological diversity. The rare associations of this alliance were not sufficiently studied and recorded. After 1967 the anthropogenic pressure highly increased. Large areas became cultivated and this habitat is almost lost. The segetal vegetation in these areas as in most of the country is not studied yet.

6.2.1.4.1 BBS01 Sarcopoterio – Salvietum syriacae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov, nom. inv.

Syn.: Salvia syraica – Sarcopoterium spinosum association Danin, Orshan et Zohary 1975.

Diagnostical species: the markers in table 7. **Distribution:** Fig. 33.

Ecological notes: The typical habitat of this association is uncultivated Dark-Brown Grumusolic Soils. Among the companions there are many species which were not recorded elsewhere. These are mainly known as weeds in cultivated Mediterranean fields (Zohary, 1966, 1972; Feinbrun-Dothan & Danin, 1991). The long list of such plants includes: *Astoma seselifolius, Phlomis pungens, Salvia syriaca, Ferula biverticillata, Bongardia chrysogonum, Leontice leontopetalum, Galium tricornutum, Gladiolus italicus, Malvella sherardiana, Ononis hirta, Teucrium parviflorum,* and *Ranunculus arvensis.* The common weed of the Artemisietea sieberi – *Achillea santolina* – is found in BBS01 although not cultivated. In the area of AAH07, where *Achillea santolina* dominates in cultivated ground it is an obligatory weed which dies when soil disturbance ceases.

Astoma seselifolius was regarded as endemic to cultivated ground (Zohary, 1955, 1962); however, there are sites where it is the dominant herbaceous plant in patches, a few meters square, of non-stony silty soil in the same area.

Phytogeographical analysis: The analysis of the list of species, presented in Fig. 31. displays the proximity of the association to the Mediterranean territory with highest frequency of the M and M-IT chorotypes and the lower values of the xerophytic chorotypes IT and M-SA. This much resembles the spectrum of the BBE01 which occurs close to Jerusalem rather than that of other associations of the alliance. This reflects the climatic gradient with increasing amounts of rainfall from south to north.

Association dynamics and conservation: Most of the area of this association became afforested areas or intensively cultivated ground.

Table 7. Association table of BBS01 – Sarcopoterio – Salvietum syriacae

	*1234567	C1	C2	%P
Markers:				
* T-Sarcopoterium spinosum	6986557	67	67	100
H-Rhagadiolus stellatus	+12++++	5	5	100
H-Diplotaxis erucoides	+++1++0	2	2	100
H-Gundelia tournefortii	+++++++	0	0	100
H-Ononis spinosa	1+.455+	26	22	86
H-Bromus tectorum	+111.++	5	4	86
H-Trifolium eriosphaerum	+.++1++	2	1	86
H-Eryngium creticum	+++++.+	0	0	86
H-Hymenocarpos circinnatus	+.+++++	0	0	86
H-Trifolium dasyurum	+.+++++	0	0	86
H-Bromus fasciculatus	0..2644	34	24	71
W-Onobrychis crista-galli	+..++3+	6	4	71
W-Anagallis arvensis	++++.+.	0	0	71
D-Bongardia chrysogonum	.++++.+	0	0	71
H-Crepis sancta	++..+++	0	0	71
H-Filago pyramidata	+++++..	0	0	71
H-Trifolium campestre	+.++++.	0	0	71
H-Trifolium stellatum	..+++++	0	0	71
H-Valerianella vesicaria	+.++++.	0	0	71
A Species of steppes				
Avena wiestii	.+.++.+	0	0	57
Ferula biverticillata	2.+....	10	3	29
Achillea santolina	.+.....	0	0	14
Astragalus aleppicus	+......	0	0	14
Astragalus callichrous	+......	0	0	14
Astragalus hispidulus	+......	0	0	14
* Astragalus spinosus	....+..	0	0	14
* Atractylis serratuloides	..+....	0	0	14
Ceratocephala falcata	+......	0	0	14
* Helianthemum vesicarium	..+....	0	0	14
Holosteum umbellatum	+......	0	0	14
Leontice leontopetalum	+......	0	0	14
Loliolum subulatum	..+....	0	0	14
Vicia monantha	....+..	0	0	14
B Species of semisteppe bathas				
* Echinops polyceras	++..+.1	3	1	57
Astoma seselifolium	+++...+	0	0	57
Carlina libanotica	..++..2	7	3	43
* Teucrium capitatum	1++....	3	1	43
Astragalus epiglottis	+.+....	0	0	29
Anthemis hyalina	2......	20	3	14
* Thymelaea hirsuta	1......	10	1	14
Chardinia orientalis	..+....	0	0	14
Eremostachys laciniata	+......	0	0	14

Table 7. continued.

	1234567	C1	C2	%P
Serratula pusilla	.....+.	0	0	14
Trisetaria macrochaeta	+......	0	0	14
D Species of ruderal habitats				
Notobasis syriaca	+..+.++	0	0	57
Salvia syriaca	.+.51...	20	9	43
Galium tricornutum	.++....	0	0	29
Convolvulus arvensis	..+....	0	0	14
Convolvulus stachydifolius	.+.....	0	0	14
Gladiolus italicus	.+.....	0	0	14
Heliotropium europaeum	..+....	0	0	14
H Species of herbaceous plant communities				
Phlomis brachyodon x pungens	...4+11	15	9	57
Avena sterilis	...++1+	3	1	57
Adonis microcarpa	++.+.+.	0	0	57
Anthemis pseudocotula	...++++	0	0	57
Bellevalia longipes	.+.+++.	0	0	57
Biscutella didyma	...++++	0	0	57
Carthamus tenuis	+++...+	0	0	57
Coronilla scorpioides	.++++..	0	0	57
Gagea chlorantha	...++++	0	0	57
Mericarpaea ciliata	++++...	0	0	57
Trifolium tomentosum	+.+.++.	0	0	57
Helianthemum salicifolium	..+0..0	3	1	43
Bromus lanceolatus	+0...+.	2	1	43
Bupleurum nodiflorum	+++....	0	0	43
Clypeola jonthlaspi	...++.+	0	0	43
Filago contracta	+.+..+.	0	0	43
Gynandriris sisyrinchium	.+...++	0	0	43
Hippocrepis unisiliquosa	+.+.+..	0	0	43
Hordeum spontaneum	....+++	0	0	43
Linaria micrantha	+++....	0	0	43
Medicago tuberculata	+++....	0	0	43
Pisum fulvum	...+.++	0	0	43
Scolymus maculatus	.+++...	0	0	43
Scorpiurus muricatus	.++..+.	0	0	43
Phlomis pungens	5+.....	25	7	29
Anemone coronaria	.....++	0	0	29
Anthemis hebronica	+.+....	0	0	29
Pallenis spinosa	..+...+	0	0	29
Avena barbata	.++....	0	0	29
Calendula arvensis	+...+..	0	0	29
Cardaria draba	+.....+	0	0	29
Centaurea iberica	+.+....	0	0	29
Crupina crupinastrum	...+..+	0	0	29
Echinaria capitata	..++...	0	0	29
Geranium tuberosum	.+....+	0	0	29
Gladiolus atroviolaceus	.++....	0	0	29
Lathyrus blepharicarpos	...++..	0	0	29
* Malvella sherardiana	.++....	0	0	29
Nonea philistaea	+..+...	0	0	29
Ononis hirta	.++....	0	0	29
Ornithogalum narbonense	.++....	0	0	29
Phalaris aquatica	.++....	0	0	29
Pisum sativum	+.+....	0	0	29
Poa bulbosa	...+..+	0	0	29
Scorzonera papposa	+.+....	0	0	29
Silene dichotoma	+.+....	0	0	29
Teucrium parviflorum	.++....	0	0	29
Trigonella monspeliaca	+.+....	0	0	29
Vicia peregrina	..+..+.	0	0	29

Table 7. continued.

	1234567	C1	C2	%P
Acanthus syriacus	.....+.	0	0	14
Aegilops peregrina	...+...	0	0	14
Asperula arvensis	.+.....	0	0	14
Asphodelus ramosus	+......	0	0	14
Bellevalia warburgii	..+....	0	0	14
Catapodium rigidum	+......	0	0	14
Centaurea ascalonica	......+	0	0	14
Chaetosciadium trichospermum	..+....	0	0	14
Cichorium endivia	.....+.	0	0	14
Crucianella macrostachya	......+	0	0	14
* Cynodon dactylon	..+....	0	0	14
Dactylis glomerata	+......	0	0	14
* Echinops adenocaulos	..+....	0	0	14
Erodium cicutarium	+......	0	0	14
Hypecoum dimidiatum	+......	0	0	14
Lens orientalis	....+..	0	0	14
Mandragora autumnalis	+......	0	0	14
Matthiola longipetala	+......	0	0	14
Medicago coronata	..+....	0	0	14
Medicago rotata	..+....	0	0	14
Medicago truncatula	.....+.	0	0	14
Muscari neglectum	+......	0	0	14
Onobrychis squarrosa	..+....	0	0	14
Ornithogalum neurostegium	+......	0	0	14
Papaver hybridum	+......	0	0	14
Parentucellia latifolia	...+...	0	0	14
Plantago afra	....+..	0	0	14
Plantago cretica	+......	0	0	14
* Polygonum equisetiforme	..+....	0	0	14
Ranunculus arvensis	..+....	0	0	14
Ranunculus asiaticus	+......	0	0	14
Senecio vernalis	.+.....	0	0	14
Silene colorata	+......	0	0	14
Silene crassipes	+......	0	0	14
Silene longipetala	.+.....	0	0	14
Thymelaea passerina	..+....	0	0	14
Torilis tenella	..+....	0	0	14
Trifolium purpureum	..+....	0	0	14
M Species of bathas on chalk and marl				
* Astragalus deinacanthus	..+....	0	0	14
Hedysarum spinosissimum	..+....	0	0	14
R Species of sandy soils				
* Plantago albicans	+......	0	0	14
T Species of bathas on Terra Rossa				
Heptaptera anisoptera	...++.+	0	0	43
* Linum mucronatum	.+1....	5	1	29
Ornithogalum montanum	.....+.	0	0	14
V Species of hard rock outcrops				
* Stipa pellita	..+..+.	0	0	29
* Salvia multicaulis	.6.....	60	9	14
Arenaria leptoclados	..+....	0	0	14
Asterolinon linum-stellatum	....+..	0	0	14
W Common desert species				
Erodium ciconium	+..+.++	0	0	57
Crithopsis delileana	+...3.4	23	10	43
Astragalus asterias	+++....	0	0	43
Erodium moschatum	...+..+	0	0	29

Table 7. continued.

	1234567	C1	C2	%P
Erucaria rostrata	.....++	0	0	29
Linaria haelava	.++....	0	0	29
Lolium rigidum	.++....	0	0	29
Minuartia picta	+.+....	0	0	29
Papaver humile	+.+....	0	0	29
Adonis dentata	+......	0	0	14
Astragalus tribuloides	...+...	0	0	14
Crepis aspera	......+	0	0	14
Erodium touchyanum	+......	0	0	14
Euphorbia chamaepeplus	..+....	0	0	14
Filago desertorum	.+.....	0	0	14
Gagea reticulata	+......	0	0	14
Herniaria hirsuta	+......	0	0	14
Lathyrus pseudocicera	+......	0	0	14
Reichardia tingitana	..+....	0	0	14
Roemeria hybrida	+......	0	0	14
* Scariola orientalis	.+.....	0	0	14
Tordylium aegyptiacum	+......	0	0	14
Vicia narbonensis	+......	0	0	14

Aspects of the association: Persistents – 17 spp.; ephemerals – 154 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00193	27	3	83	10.04.67	I 2104 5849
2	00213	20	10	51	13.04.67	I 2093 5843
3	00214	36	4	80	13.04.67	I 2093 5842
4	97085	30	1	46	01.04.97	I 2091 5827
5	97086	40	2	39	01.04.97	I 2092 5827
6	97087	50	1	42	01.04.97	I 2093 5827
7	97088	60	2	45	01.04.97	I 2093 5826
Average:		37.6	3.3	55.1		

Table 8. Synoptic table of the Ballotetea undulatae; 1- BBC01, 2 – BBP01, 3 – BBP02, 4 – BBP03, 5 – BBE01, 6 – BBE02, 7 – BBE03, 8 – BBE04, 9 – BBE05, 10 – BBS01

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P
	d.s. Ballotetea undulatae										
B	Carlina libanotica	57	**100**	44	38	43	29	14	29	**100**	43
H	Onobrychis crista-galli	43	**67**	56	50	29	**71**	**71**	14	**100**	**71**
T	Sarcopoterium spinosum	**100**	**100**	**100**	**100**	14	29	43	**100**		**100**
B	Teucrium capitatum	**86**	**78**	**100**	50		**100**	43	57	**71**	43
W	Crithopsis delileana	43	33	33		**71**	57	**100**	**86**		43
H	Aegilops peregrina	57	33	56	13		43	**100**	57		14
B	Ballota undulata	**86**	**89**	33	38	57	29		14	**100**	
B	Salvia dominica	14	44	22	63	57	57	14	29	43	
V	Phagnalon rupestre	**86**	**100**	**78**	38	29	57		57	**86**	
B	Kickxia aegyptiaca	**71**	**89**	**89**	38	29	**71**	**100**	43		
B	Eryngium glomeratum	**71**	**67**		38	14		14	14		
	d.s. Retamo-Calicotomion villosae										
Q	Calicotome villosa	**100**							14		
B	Trifolium prophetarum	**86**								**71**	
H	Echinops adenocaulos	**71**								43	14

Table 8. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P
H	Thymelaea passerina	57									14
B	Allium orientale	43	11								
	d.s. Balloto - Sarcopoterion spinosi										
B	Trisetaria macrochaeta		100	33	50		57				14
B	Phlomis brachyodon	29	89	100	75	14	57			29	57
H	Anthemis hebronica	14	78		13	43					29
B	Thymelaea hirsuta		56	100	75		71				14
H	Carthamus tenuis	14	22	100	38	43	71		14	43	57
B	Plantago bellardii									14	
B	Heliotropium rotundifolium			22		43	43		14		
H	Medicago truncatula			33			29			57	14
B	Blepharis attenuata										
	d.s. Echinopion polyceratis										
B	Alkanna strigosa	29	44		38	43	100		57		
B	Echinops polyceras		89	67	50	71	100	43			57
B	Ononis natrix	71				100		71	14		
	d.s. Sarcopoterio - Salvion syriacae										
H	Diplotaxis erucoides				25						100
H	Ononis spinosa										86
D	Bongardia chrysogonum										71
H	Bellevalia longipes				13						57
H	Mericarpaea ciliata										57
D	Salvia syriaca										43
D	Galium tricornutum										29
	Marker species of associations										
H	Brachypodium distachyon	71	22	11	25	14		14		14	
B	Euphorbia hierosolymitana	71		11	25		14				
H	Briza maxima	71									
H	Trifolium scabrum	71				14					
Q	Ephedra foeminea	71	33	11				29			
H	Galium judaicum	71	44	11		29				71	
W	Lolium rigidum	71	33	22	13	14	14				29
V	Micromeria nervosa	71	33	22		14					
H	Trifolium stellatum	71	44	11	25	14	14				71
A	Tulipa systola	71	56		25		14				
H	Onobrychis caput-galli	57									
H	Linum pubescens	57	11								
H	Bromus alopecuros	57	11	11	13						
H	Urospermum picroides	57	33	11	25		14				
Q	Osyris alba	57			13				14		
Q	Cynoglossum creticum	57				14					
T	Arrhenatherum palaestinum	57				29					
T	Piptatherum blancheanum	57									
W	Picris longirostris	57	11		13	29		14		14	
H	Crucianella macrostachya	57	56	11	13					43	14
B	Convolvulus dorycnium	57	22	11		14	14			57	
W	Plantago ovata									29	
W	Echium judaeum			22						29	
S	Limonium lobatum			11			14			43	
W	Matthiola aspera									43	
W	Atractylis cancellata	14	22	11		14				14	
W	Erucaria microcarpa		22	11			29			29	
W	Crepis aspera		33							14	14
A	Astragalus callichrous		44	22	50		43	71			14
H	Cichorium endivia	14		100		14	71				14
W	Pterocephalus brevis	71	11	56		14	14	29			

Table 8. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P
H	Hedypnois cretica	14	**67**	**78**		**86**	57	29	14		
W	Reichardia tingitana		56		13	14	29				14
H	Salvia horminum	29	44	11	38		29			29	
R	Haplophyllum tuberculatum									14	
W	Adonis dentata		**89**	33	50		43		29	14	14
W	Asphodelus tenuifolius									14	
H	Centaurea hyalolepis		44	33	13		57	57	43	14	
H	Daucus durieua	57		56		29	29				
H	Pimpinella cretica	29				43					
H	Campanula stellaris	14	11				14				
H	Filago palaestina	14								14	
H	Artedia squamata			11							
W	Carthamus nitidus							29		14	
W	Medicago laciniata						14				
H	Ononis mollis		44	33	13	14	29				
B	Astragalus bethlehemiticus		**100**		13						
H	Poa bulbosa	**71**	**100**	56	**75**	57	57				29
A	Helianthemum vesicarium	14	**100**	**89**	**75**	29	57	57	**100**		14
H	Gundelia tournefortii	29	**100**	**78**	13		**71**				**100**
V	Sedum caespitosum	43	**100**	56	13		14			29	
H	Trifolium tomentosum	14	**100**	56	**63**	43	57				57
H	Trifolium purpureum		**89**	56	25		43				14
W	Euphorbia chamaepeplus		**89**	33		29	14				14
W	Filago desertorum		**89**	11	**63**	14	**86**				14
H	Pallenis spinisa		**89**	56	25	14	**71**	29			29
W	Astragalus asterias		**89**	56	25	57	**86**				43
V	Centaurea eryngioides	29	**89**		13						
H	Medicago coronata	43	**89**		13	29				29	14
H	Trigonella monspeliaca		**89**	22		43	43			14	29
H	Vicia sativa	43	**89**	11		14	29			43	
H	Alcea acaulis		**78**	56		14	43				
H	Clypeola jonthlaspi		**78**		13						43
V	Chiliadenus iphionoides	71	**78**	44	13		14				
H	Crepis sancta		**78**		38	14			14	57	**71**
H	Dianthus strictus		**78**	22	13		43			57	
H	Filago pyramidata		**78**	22	25	29	14				**71**
W	Gagea reticulata		**78**		50						14
H	Ornithogalum neurostegium		**78**	22	38	14	29				14
V	Paronychia sinaica		**78**	56	13	43	57				
V	Stipa pellita	43	**78**	11	13		14				29
H	Valerianella vesicaria	29	**78**	22	38	43	29				**71**
B	Euphorbia hierosolymitana		**67**								
V	Convolvulus oleifolius		**67**		38						
H	Dactylis glomerata	14	**67**	44	**63**		29				14
H	Anemone coronaria		**67**		25					29	29
H	Astragalus hamosus		**67**	44		29	57				
H	Calendula arvensis		**67**	11	38	14	43			57	29
H	Coronilla scorpioides	57	**67**	44	38	14	29			14	57
H	Hordeum bulbosum		**67**	22	25		29				
H	Malcolmia crenulata		**67**		13						
W	Silene decipiens		**67**		25				14		
H	Centaurea iberica	29	56	11	13	29	14				29
D	Sonchus oleraceus		56		13		14				
R	Picris amalecitana		56	44	13		29				
A	Carex pachystylis		56	22	38	14	57	14			
A	Silene tridentata		56	11			29				
Q	Majorana syriaca	43	56	44	13		43				
W	Herniaria hirsuta		56	11	13	57	29				14
H	Salvia samuelssonii	14	56	56	13		57				
R	Plantago albicans		11	**89**	25		**71**				14
H	Plantago cretica	29	**67**	**78**	50	29	29				14
H	Echium angustifolium			**78**	13	57	**71**				

Table 8. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P
H	Paronychia argentea		33	**78**	13	**71**	43	**71**	14	14	
M	Coridothymus capitatus			**67**	38		29				
A	Atractylis serratuloides			**67**	13		29				14
B	Verbascum fruticulosum		11	11	50	43		14			
H	Catapodium rigidum		56	56	25	**86**	29				14
H	Rostraria smyrnacea	43	11	33	13	**71**	57	29		14	
B	Scrophularia xanthoglossa		11	11		**71**	29				
B	Anchusa strigosa	43	33	56	25	**71**	**71**		14		
Q	Ajuga chamaepitys	29		22	13	**71**					
H	Psilurus incurvus	29		33		**71**					
T	Trigonella hierosolymitana					57					
H	Adonis microcarpa	29	11		25	57	14				57
H	Erodium ciconium		33	33	13		**86**			57	57
H	Lomelosia prolifera		11	44			**86**			43	
W	Trigonella arabica		11	56			**86**			29	
A	Deverra tortuosa			33	13		**71**				
B	Gypsophila arabica	14	33	11		14	**71**	29	**71**	14	
W	Plantago coronopus		22	22	13		**71**			29	
A	Salvia lanigera			56	38		**71**	14	43		
B	Ajuga iva		33	33	25		57	43	14		
A	Astragalus caprinus		11	11	13		57				
A	Astragalus spinosus	14						**86**	43		14
A	Bellevalia desertorum						14	**86**	**71**	14	
A	Loliolum subulatum	29	22		25	14		**71**			14
B	Onopordum palaestinum					29		57	43		
W	Ononis sicula		22	22	25	14	29	57	43		
W	Poa eigii							57	**100**	**100**	
A	Astragalus sanctus		44	11	38	29	29	57	**100**		
H	Gagea chlorantha							14	**86**	57	57
A	Fagonia mollis							29	**71**		
V	Paronychia capitata	29							**71**	14	
M	Fumana thymifolia		11	11			14		57		
S	Salsola vermiculata									**100**	
B	Eruca sativa									**100**	
W	Senecio glaucus								14	**100**	
B	Hyacinthella nervosa									**100**	
W	Anchusa aegyptiaca	43	33			14	14		14	**100**	
H	Chaetosciadium trichospermum	43	22	33	25	29	29		14	**100**	14
H	Silene colorata			11	13	14				**71**	14
W	Scilla hanburyi						14			57	
W	Rumex cyprius									57	
H	Trifolium eriosphaerum		22			43					**86**
H	Bromus tectorum	14				**71**				14	**86**
H	Eryngium creticum	14	33	44	25	29	57				**86**
H	Trifolium dasyurum	43	44	33	25		14			14	**86**
H	Trifolium campestre	57	**67**	33	25	29					**71**
B	Astoma seselifolium	14	11	11	25	43					57
A	Avena wiestii		22	44		43	43			14	57
	Other species										
W	Anagallis arvensis	43	**78**	56	38	**86**	**71**		43	43	**71**
H	Anthemis pseudocotula	29	**89**	**78**	50	**86**	**100**	**86**	**71**	57	57
H	Avena sterilis	**100**	**89**	44	25	14	29	14			57
H	Bromus fasciculatus	**86**	44	11	25	29	14	29		57	**71**
W	Erucaria rostrata		22	11	13	14	57	**71**	**86**	43	29
H	Filago contracta	14	**67**	44	38	**71**	**71**	29	14	**71**	43
H	Gynandriris sisyrinchium	14	**67**	44	38	29	29	14	**86**	**71**	43
H	Helianthemum salicifolium	**71**	**67**	**67**	13	43	**86**	14		**71**	43
H	Hippocrepis unisiliquosa	**86**	**89**	**100**	25	14	**71**	43	14	43	43
H	Hymenocarpos circinnatus	29	44	**67**	25	43	57	**71**		**71**	**86**
H	Ranunculus asiaticus	57	**67**		**63**	29	29	14	29	**100**	14
H	Rhagadiolus stellatus	**71**	**100**	33	38	**71**	57			**71**	**100**

Table 8. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P
H	Asphodelus ramosus	43	**89**	**78**	50	14	**100**	43	43		14
H	Biscutella didyma	43	**89**	22	25	**71**			43	**71**	57
D	Notobasis syriaca	57	44	44		57		14		14	57
H	Hordeum spontaneum	**71**	44			14		29		71	43
W	Stipa capensis	43	**67**	**89**		29	**86**		29	29	
H	Lagoecia cuminoides	**86**	33	22	25	57	14	14		57	
A	Carrichtera annua	**86**	**89**	11	38	14	**71**		**100**	**71**	
H	Linum strictum	**86**	44	44			14		29	43	
A	Noaea mucronata	**71**	**89**	**78**	**75**	**71**	57	**100**	**86**		
H	Allium stamineum	**100**	56	44	25	14	43	57			
H	Bromus lanceolatus	**71**	22	33	25	43	29				43
H	Scorzonera papposa	**71**	**100**	56	38	14	57			29	29
H	Erodium gruinum	57	44	33	25	29	14				
H	Plantago afra	57	56	11	13	57	14			14	14
H	Scorpiurus muricatus	14	44	56	13	14	57	14			43
H	Torilis tenella	**71**	**89**	56	13	43	29			29	14
A	Artemisia sieberi		33		**100**	14		**100**	**100**		
	Low constancy species										
Q	Prasium majus	43									
B	Scutellaria tomentosa	43									
H	Avena barbata	43	22		38						29
H	Crupina crupinastrum	43									29
H	Helianthemum aegyptiacum	43	33		13					14	
H	Nigella unguicularis	43	22		13		14				
H	Ononis ornithopodioides	43	11	11							
H	Sideritis perfoliata	43	11								
H	Vulpia ciliata	43		22		43					
V	Asterolinon linum-stellatum	43	22		25	29					14
V	Podonosma orientalis	43				14					
V	Valantia hispida	43	33	11	13		14			14	
H	Althaea hirsuta	29									
H	Scandix pecten-veneris	29									
T	Aegilops searsii	29									
H	Geropogon hybridus	29	11	11			14				
H	Lactuca tuberosa	29	11								
H	Bellevalia flexuosa	29	11				14			14	
H	Velezia rigida	29	22		13						
Q	Cruciata articulata	29	22		13						
V	Asparagus horridus	29	22	22	13		14				
V	Minuartia decipiens	29	11		13						
T	Clypeola aspera	14	11								
T	Orlaya daucoides	14									
T	Ziziphora capitata	14									
Q	Pyrus syriaca	14									
H	Piptatherum thomasii	14									
H	Scrophularia peyronii	14									
V	Stachys palaestina	14									
H	Torilis leptophylla	14									
V	Caralluma europaea	14									
V	Erophila praecox	14	11								
V	Erophila minima	14	11		13						
H	Plantago lagopus	14				14					
H	Thesium humile	14						14			
A	Alyssum damascenum	14								14	
B	Chardinia orientalis	14	11								14
R	Retama raetam	14			13				14	29	
W	Erodium neuradifolium		11								
H	Thymelaea gussone										
H	Callipeltis cucullaria	29	33				14				
H	Medicago rotata	14	11	11	13						14
H	Convolvulus pentapetaloides	29									

Table 8. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P
B	Calendula palaestina							14		14	
B	Factorovskya aschersoniana		22	11	13	14					
H	Antirrhinum orontium		11				14				
V	Telmissa microcarpa	14	44		13					14	
B	Serratula pusilla	14	44		13	14					14
H	Erodium malacoides	29	44								
Q	Asparagus aphyllus	29	44		13						
B	Astragalus epiglottis		44	22							29
B	Erysimum crassipes		44				14				
H	Alyssum strigosum		44		13						
H	Geranium tuberosum		44		38						29
H	Helianthemum lasiocarpum		44	22	13		14				
H	Matthiola longipetala		44	11	13	43			29		14
H	Papaver hybridum		44	33	38		14				14
W	Roemeria hybrida		44		38	29				14	14
H	Catananche lutea	43	44	33	13						
T	Lathyrus ciliolatus		33								
Q	Amygdalus korschinskii		33								
H	Piptatherum holciforme		33								
V	Arenaria leptoclados		33			29				14	14
H	Centaurea ascalonica		33	22	38		14				14
H	Erucaria hispanica		33	11		43	43				
H	Nonea philistaea		33		13						29
H	Onobrychis squarrosa		33	44	13	29					14
H	Picris altissima		33			14					
H	Theligonum cynocrambe		33		13	14					
H	Vicia peregrina		33		25		14				29
W	Trigonella stellata	14	33	22		14					
V	Ephedra aphylla		33	11	13		29			29	
V	Umbilicus intermedius		33		13						
W	Scorzonera judaica		33		38			14			
H	Mericarpaea ciliata		33								
A	Buglossoides tenuiflora		33		25				29		
Q	Rhamnus lycioides	29	33		13						
H	Erodium cicutarium		22								14
H	Lathyrus hierosolymitanus		22	11	13						
T	Andropogon distachyos		22	22							
T	Thlaspi perfoliatum		22		13						
Q	Ajuga chamaepytis		22								
A	Malabaila secacul		22	22			29	14	14		
B	Anthemis hyalina		22		13						14
H	Trifolium clypeatum		22								
H	Trifolium echinatum		22	11	13						
H	Lotus peregrinus	14	22								
T	Aethionema heterocarpum	14	22								
H	Geranium molle		11								
A	Astragalus palaestinus		11								
A	Buglossoides arvensis		11								
A	Valerianella dufresnia		11								
A	Achillea aleppica		11								
D	Marrubium alysson		11								
H	Phalaris brachystachys		11								
H	Ranunculus millefolius		11								
H	Sherardia arvensis		11								
H	Tragopogon coelesyriacus		11								
H	Urginea maritima		11								
H	Vicia palaestina		11								
W	Parietaria alsinifolia		11								
V	Micromeria myrtifolia		11								
H	Daucus durieua		11								
M	Ophrys umbelliacata		11								
Q	Crataegus aronia		11								

Table 8. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P
Q	Lamium amplexicaule		11								
T	Arabis verna		11								
R	Nigella arvensis		11								
H	Thrincia tuberosa		11	11							
A	Atractylis prolifera			44			14				
T	Linum corymbulosum	43		44							
H	Hyparrhenia hirta		11	44			29			14	
V	Stipa parviflora		22	44			14				
H	Convolvulus althaeoides			44			43				
W	Minuartia picta		11	33	25	14	14				29
H	Asteriscus aquaticus			33							
H	Ainsworthia trachycarpa	14		33		14	29				
T	Aegilops geniculata		11	22		14					
W	Lomelosia porphyroneura			22				14			
B	Astragalus cretaceus		11	22			14				
D	Chrysanthemum coronarium			22			14				
W	Erodium crassifolium			22			14				
H	Phalaris paradoxa			22							
H	Bromus scoparius			11							
H	Picris galilaea			11							
V	Sedum hispanicum			11							
W	Schismus arabicus			11							
A	Centaurea aegyptiaca				25		14				
W	Astragalus tribuloides				25						14
H	Nigella ciliaris	14	22	11	25						
H	Carduus acicularis	14			25						
A	Helianthemum kahiricum				13						
B	Astragalus scorpioides				13						
D	Sinapis alba				13						
H	Adonis aestivalis				13						
H	Bromus japonicus				13						
H	Geranium rotundifolium				13						
H	Iris palaestina				13						
H	Stellaria media				13						
H	Valerianella coronata				13						
H	Vulpia myuros				13						
R	Crepis aculeata				13						
V	Origanum dayi				13						
H	Parentucellia latifolia		11		13	14					14
H	Reseda luteola				13	14					
H	Bromus madritensis				13	14					
H	Fumaria bracteosa		11		13	14	14				
H	Bupleurum lancifolium		33	22	13	43	29				
H	Cynosurus callitrichus		11		13	43					
T	Cicer judaicum					43					
D	Hirschfeldia incana	29	22		13	43	14				
H	Medicago polymorpha		11	22		43	43				
H	Echinaria capitata	14	22			29					29
H	Torilis nodosa					29					
A	Ceratocephala falcata					29					14
A	Glaucium grandiflorum					29					
H	Hypericum triquetrifolium			22		29					
W	Lathyrus pseudocicera		22		13	29	14		14	14	14
H	Medicago orbicularis			11		14					
W	Matthiola livida			11		14					
A	Hypecoum aegyptiacum					14					
R	Launaea fragilis					14					
H	Anchusa undulata					14					
H	Reseda alba					14					
H	Trifolium pilulare					14					
R	Eminium spiculatum					14					
S	Herniaria hemistemon					14					

Table 8. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P
V	Campanula hierosolymitana					14					
D	Ammi majus						29				
W	Aegilops kotschyi						29				
D	Haplophyllum buxbaumii			11			29				
A	Crucianella membranacea			22			29				
A	Astragalus aleppicus			11			29				14
A	Astragalus hispidulus			11			29				14
W	Phalaris minor		22	11			29				
W	Helianthemum ledifolium		11			14	29				
W	Tordylium aegyptiacum		11	11			29			14	14
T	Carlina curetum				25		29				
V	Campanula erinus	14	22	22			29				
A	Achillea santolina						14				14
A	Onosma echinata						14		14	14	
A	Plantago phaeostoma						14				
A	Urginea undulata						14				
W	Medicago radiata			11			14				
D	Malva parviflora						14				
H	Ferula communis						14				
H	Lens orientalis						14				14
H	Muscari commutatum						14				
A	Leontice leontopetalum				13		14				14
H	Verbascum orientale						14				
V	Crassula alata						14				
V	Stipa barbata						14				
W	Neotorularia torulosa				13		14		14		
A	Ixiolirion tataricum		11		13		14				
W	Scariola orientalis						14				14
W	Vicia narbonensis						14				14
B	Eremostachys laciniata		11	11	13		14				14
W	Scrophularia deserti							29			
L	Parapholis incurva		11			14		29			
S	Atriplex leucoclada							14			
B	Calendula pachysperma							14			
A	Onopordum alexandrinum				13			14			
S	Reaumuria hirtella							14	29	14	
H	Cuscuta planiflora								14		
H	Delphinium peregrinum								14	14	
T	Scilla autumnalis									29	
H	Pterocephalus plumosus						14			29	
H	Pisum fulvum										43
H	Scolymus maculatus										43
D	Heptaptera anisoptera										43
H	Bupleurum nodiflorum	29									43
H	Linaria micrantha		11		13						43
H	Medicago tuberculata		22				14				43
A	Ferula biverticillata										29
W	Erodium moschatum										29
W	Linaria haelava										29
H	Phlomis pungens										29
H	Cardaria draba										29
H	Lathyrus blepharicarpos										29
H	Malvella sherardiana										29
H	Ononis hirta										29
H	Phalaris aquatica										29
H	Teucrium parviflorum										29
H	Ornithogalum narbonense		11		13						29
T	Linum mucronatum			11							29
H	Gladiolus atroviolaceus		11								29
H	Pisum sativum		11		13						29
H	Silene dichotoma		11								29
T	Heliotropium europaeum		11								14

Table 8. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P
H	Acanthus syriacus		11								14
H	Silene crassipes		11								14
H	Asperula arvensis										14
A	Holosteum umbellatum										14
A	Vicia monantha										14
D	Convolvulus arvensis										14
D	Gladiolus italicus										14
H	Bellevalia warburgii										14
H	Cynodon dactylon										14
H	Hypecoum dimidiatum										14
H	Mandragora autumnalis										14
H	Muscari neglectum										14
H	Polygonum equisetiforme										14
H	Ranunculus arvensis										14
H	Silene longipetala										14
M	Astragalus deinacanthus										14
M	Hedysarum spinosissimum										14
T	Ornithogalum montanum										14
H	Salvia multicaulis										14
W	Erodium touchyanum										14
D	Convolvulus stachydifolius				13						14
H	Senecio vernalis										14

6.3 A Artemisietea sieberi Zohary 1952 ex Danin et Solomeshch class nov.

Syn.: Artemisietea herbae-albae Zohary 1952 (p.p.)

Diagnostical species: *Artemisia sieberi, Avena wiestii, Carex pachystylis, Lappula spinocarpos, Roemeria hybrida, Scorzonera judaica.*

Nomenclatural type: Artemisietalia sieberi Danin et Solomeshch.

Synoptic tables: Tables 14 and 21.

This class comprises shrub-steppes (Sect. 4.10) and covers most soil types in the area between the isohyets 80 and 250 mm (Fig. 3). The class can only partly be synonymous with Zohary's (1952) Artemisietea herbae-albae because the leading species are only partly synonymic. What was regarded as *A. herba-alba* for the whole area from the Iberian Peninsula to Afghanistan is considered as several species, with *A. sieberi* growing from Israel eastwards, *A. inculta* in N.Africa, and *A. herba-alba* endemic to the Iberian Peninsula.

The Artemisietea sieberi includes the order Artemisietalia sieberi which develop on Brown Lithosol and Loessial Serozems and the order Raeumurietalia hirtellae typical of saline Rendzinic Desert Lithosols or chalk and marl outcrops.

The associations developing on sandy soils in this climatic zone belong to the order Erodio laciniati – Stipagrostietalia plumosae (DS) of the class Retametea raetam (Sect. 6.6.2 and 6.6.3). The associations developing on smooth-faced limestone and dolomite outcrops in the order Artemisio sieberi – Chiliadenetalia iphionoidis (VD) are discussed in Section 6.5.2.

The class bounds the Ballotetea undulatae on the north and west side of the Artemisietea sieberi belt (units 8 and 10 in Fig. 11). This proximity influences the high number of species with the sociotypes B and H in the association tables of those close to this boundary. Similarly, species of Anabasietea articulatae are found in the composition of the associations of the southern and eastern boundaries of the belt (units 10 and 12 in Fig. 11).

The associations of the following alliances are of high affinity to edaphic conditions. The associations of Artemision sieberi (AAA) develop on Brown Lithosol on hard limestones and dolomites, relatively leached soils. Those of the Haloxylion scopariae (AAH) develop on Loessial Serozems, and those of Salsolion vermiculatae (ARS) develop on Rendzinic Desert Lithosols or chalk and marl outcrops; both soils are saline (Sect. 2.4). Local edaphic conditions seem to determine the specific nature of associations which prevail in each locality.

6.3.1 AA Artemisietalia sieberi Danin et Solomeshch ord. nov.

Diagnostical species of the order = Diagnostical species of the class.
Nomenclatural type: Artemision sieberi Eig 1946 ex Danin et Solomeshch.
Synoptic table: Table 14.

The Artemisietalia sieberi is the type order of the class. It contains the alliance Artemision sieberi developing on the relatively leached soils of Brown Lithosol on hard limestones and dolomites, and the alliance Haloxylion scopariae typical of slightly to strongly saline Loessial Serozems.

6.3.1.1 AAA Artemision sieberi Eig 1946 em. Danin et Solomeshch 1998 nom. mut.
Syn.: Artemision herbae-albae palaestinum Eig 1946.
Diagnostical species: *Asphodelus ramosus, Astragalus amalecitanus, Centaurea aegyptiaca, Deverrra tortuosa, Gymnocarpos decander, Helianthemum kahiricum, Helianthemum ventosum, Helianthemum vesicarium, Noaea mucronata, Ranunculus asiaticus, Salvia lanigera, Teucrium capitatum, Thymelaea hirsuta.*
Nomenclatural type: Asphodelo ramosi – Artemisietum sieberi Eig 1946.
Synoptic table: Table 14.

We selected Eig's (1946) "association of Artemisia Herba-alba – Asphodelus microcarpus" as the type association of the alliance and hence of the order and the class. The other choice was Eig's (1946) Artemisietum herbae-albae deserti Judaici. After collecting a few thousand relevés from Israel, Sinai, and Jordan the first author can state that the first choice fits better the overall nature of the class Artemisietea sieberi. Artemisietum herbae-albae deserti Judaici is a very locallized syntaxon which is closer in its composition and its phytogeographical spectrum to the Ballotetea undulatae. We therefore raised the subassociation of that association which could be recorded to an association which belongs to the Ballotetea undulatae (Sect. 6.2.1.3.3).

The associations of this alliance are confined to a rather narrow range of climatic and edaphic conditions, however, these are the main factors influencing the composition of the associations.

The phytogeographical analyses of the associations are presented in Figs. 34 and Fig. 35. Having a high percentage of Mediterranean, and M-IT species, AAA01 is at the Mediterranean side of the complex territory of SA (IT) (Figs. 9 & 10). AAA02 and AA03 which occur further south have a considerable drop in these two chorotypes and an increase in the IT, SA, and the IT-SA chorotypes. This tendency continues in the other associations of the alliance (AAA04 – AAA07) which are typically growing at the Negev Highlands, where the Irano-Turanian and Saharo-Arabian chorotypes (IT, SA, IT-SA) are the most frequent with rather similar percentages (Figs. 9 & 10).

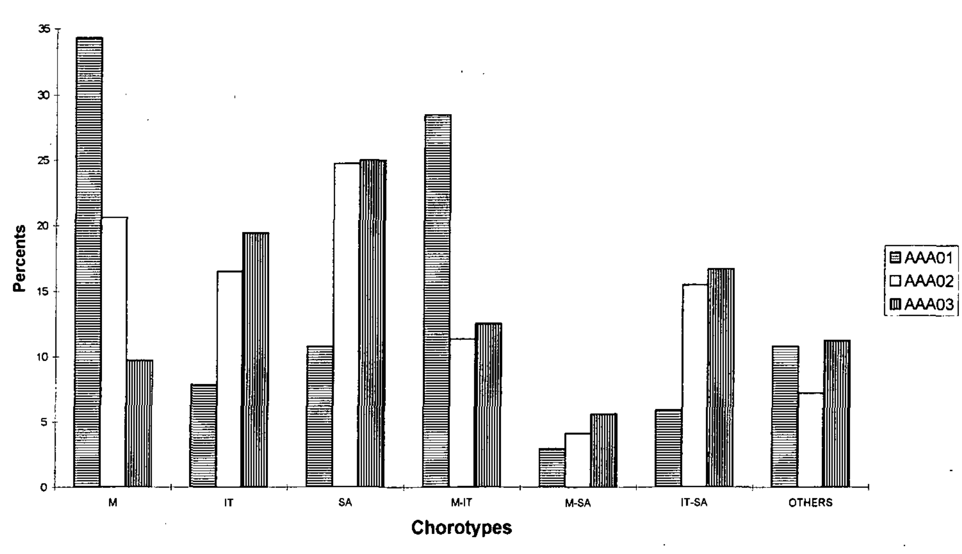

Figure 34. Phytogeographical analysis of associations AAA01, AAA02, and AAA03.

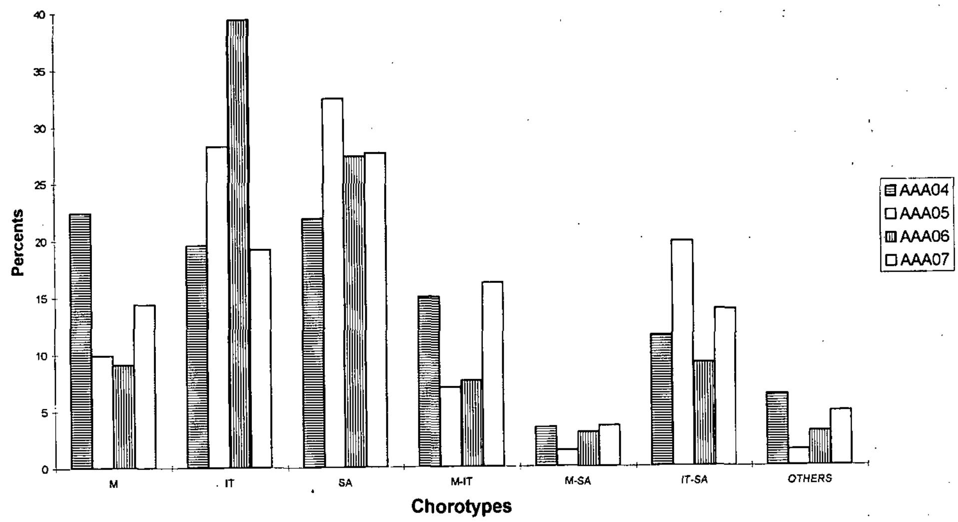

Figure 35. Phytogeographical analysis of associations AAA04 - AAA07.

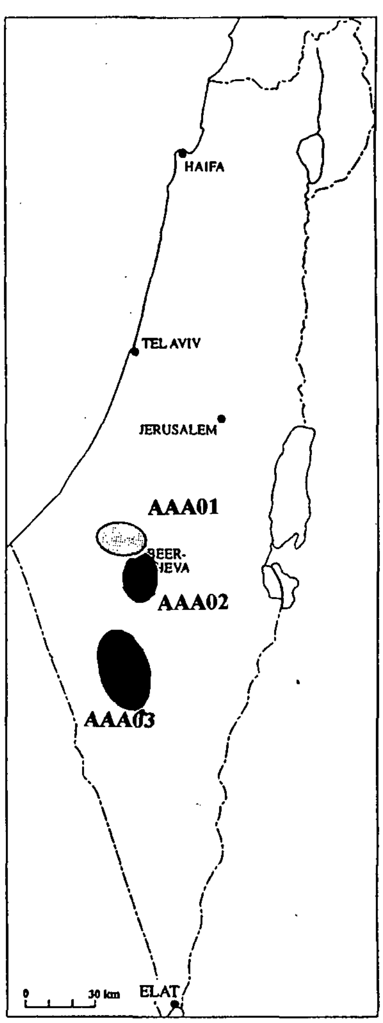

Figure 36. Distribution map of associations AAA01, AAA02, and AAA03.

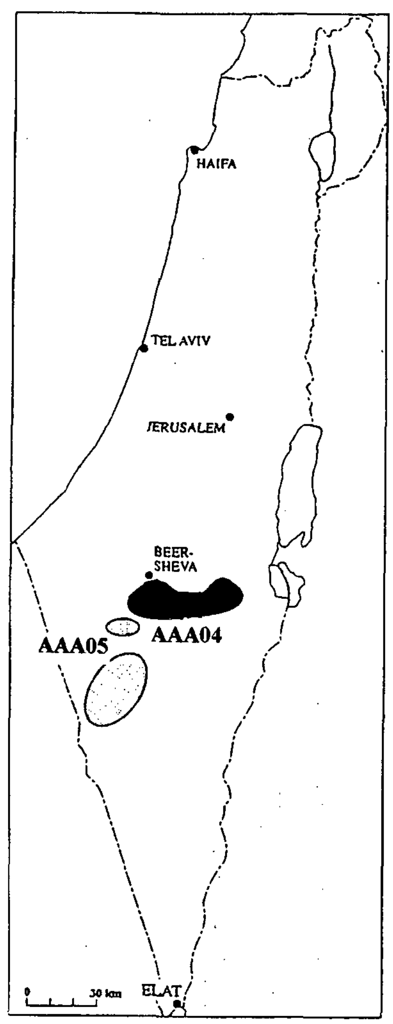

Figure 37. Distribution map of associations AAA04 and AAA05.

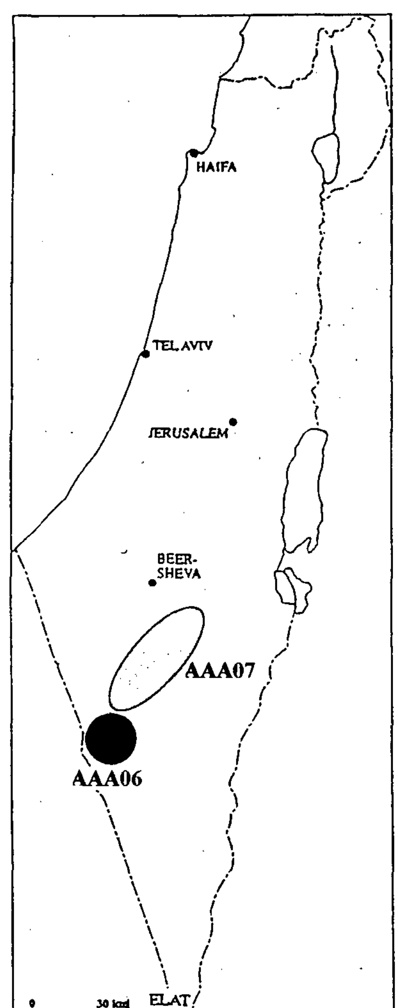

Figure 38. Distribution map of associations AAA06 and AAA07.

6.3.1.1.1 AAA01 Asphodelo ramosi – Deverretum tortuosi Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 9. **Distribution:** Fig. 36.

Ecological notes: The Asphodelo ramosi – Deverretum tortuosi is confined to Brown Lithosol on Tertiary chalk and conglomerates of the Saqiye group (Bartov et al., 1981) west and NW of Beer Sheva. Mean annual rainfall in this area is 200 mm. This area is under a strong pressure of grazing by domestic animals and cutting of lignified plants for burning fuel. This may explain the dominance of *Deverra tortuosa* and *Asphodelus ramosus* which resist these pressures. Most of the surrounding area is plowed every year and stony-rocky substratum of this association, which occur like a few hundred meter squares islands among the fields remain relatively intact as long as the cultivars are present in the fields.

The position of this association at the meeting zone of Artemisietea sieberi and the Ballotetea undulatae is prominent through the wealth of plants from the two syntaxa (A and B) in the association table.

Association dynamics and conservation: Most of the area of this association is under constant process of recovery from overgrazing and cutting. Some 20-30 years ago it was hard to find sufficient sites for recording this association. After some release of grazing pressure in the last decade the chamaephytes recover and the direction of the process seems to be towards a transitional position between the Artemisietea and the Ballotetea vegetation.

Aspects of the association: Persistents – 18 spp.; ephemerals – 83 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	97096	65	15	45	15.04.97	I 2207 5895
2	97097	70	15	39	15.04.97	I 2207 5894
3	97098	70	10	53	15.04.97	I 2207 5893
4	97099	50	20	48	15.04.97	I 2207 5892
5	97100	70	10	26	15.04.97	I 2208 5892
6	97101	70	10	48	15.04.97	I 2206 5891
7	97102	80	10	45	15.04.97	I 2206 5890
Average:		67.9	12.9	43.4		

Table 9. Association tables of AAA01 – Asphodelo ramosi – Deverretum tortuosi, AAA02 – Noaeetum mucronatae, and AAA03 – Helianthemo vesicarii – Artemisietum sieberi

		Species	AAA01 *1234567	C1	C2	%P	AAA02 12345678901234	C1	C2	%P	AAA03 *123456789	C1	C2	%P
	W	Adonis dentata	+......	0	0	14	.....+.......	0	0	8	.....+++.	0	0	33
	W	Aegilops kotschyi	..++0..	2	1	43	.+......+.++.	0	0	31				
	R	Aegilops longissima	..+++++	**0**	**0**	**71**								
*	B	Ajuga iva					.+..+...+++..	0	0	38				
*	H	Alcea acaulis					.....+......+	0	0	˙15				
*	B	Alkanna strigosa	..0+.+.	1	0	43								
	A	Allium negevense									.+.......	0	0	11
	B	Allium orientale	++.+...	0	0	43								
	H	Allium stamineum					.+....+......	0	0	15				
	F	Ammochloa palaestina									.......+.	0	0	11
*	N	Anabasis articulata					+............	0	0	8				
	W	Anagallis arvensis	+......	0	0	14	.+....+++++++	**0**	**0**	**62**	.+....+..	0	0	22
	W	Anchusa aegyptiaca	.....++	0	0	29								
*	B	Anchusa strigosa	..++...	0	0	29	............+	0	0	8				
*	A	Andrachne telephioides					......+..+...	0	0	15				
	H	Androcymbium palaestinum	.++....	0	0	29								
	H	Anemone coronaria	..+....	0	0	14					.....+...	0	0	11
	H	Anthemis hebronica	....+..	0	0	14								
	W	Anthemis melampodina									.......+.	0	0	11
	H	Anthemis pseudocotula	++++++.	**0**	**0**	**86**	.+++.+.+...++	0	0	54	.+++.....	0	0	33
*	F	Argyrolobium uniflorum	....+..	0	0	14	.........+...	0	0	8				

Table 9. continued.

		Species	AAA01 1234567	C1	C2	%P	AAA02 12345678901234	C1	C2	%P	AAA03 123456789	C1	C2	%P
	W	Aristida coerulescens	....+..	0	0	14								
*	A	Artemisia sieberi					0............	5	0	8	572441355	**41**	**41**	**100**
	H	Asphodelus fistulosus					.......+.....	0	0	8				
	H	Asphodelus ramosus	0333753	35	35	**100**	21.4.50331..1	**23**	**16**	**69**	.....3...	30	3	11
	W	Asphodelus tenuifolius					.........++0.	2	0	23				
	N	Asteriscus hierochunticus					+....+..+....	0	0	23	.....+...	0	0	11
	H	Asteriscus aquaticus	+......	0	0	14								
*	V	Astragalus amalecitanus					+............	0	0	8	+.++...++	0	0	56
	W	Astragalus asterias					+....+.......	0	0	15				
	A	Astragalus callichrous					....+........	0	0	8				
	A	Astragalus caprinus					.....+.......	0	0	8				
*	B	Astragalus cretaceus					.+...........	0	0	8				
	A	Astragalus hispidulus					.....+.......	0	0	8				
	R	Astragalus peregrinus					.........+...	0	0	8				
*	A	Astragalus sanctus					.....+.......	0	0	8	.....+...	0	0	11
	W	Astragalus tribuloides					.........+...	0	0	8	.+....+..	0	0	22
	W	Atractylis cancellata					0............	5	0	8				
*	R	Atractylis carduus					...+.........	0	0	8				
*	W	Atractylis phaeolepis									+.+++....	0	0	44
	A	Atractylis prolifera	......+	0	0	14	..1..++.++++.	1	1	54				
*	A	Atractylis serratuloides					20.++...++..+	4	2	54				
	H	Avena sterilis	..+++..	0	0	43								
	A	Avena wiestii	0.+.+0+	**2**	**1**	**71**	..+++.++..+.+	0	0	54	......+..	0	0	11
	A	Bellevalia desertorum					+.......+....	0	0	15	.+.......	0	0	11
	A	Bellevalia eigii	+.....+	0	0	29								
	H	Biscutella didyma	..++.+.	0	0	43								
	H	Bromus fasciculatus	1+++++.	**2**	**1**	**86**	.......0..3..	18	3	15	.+...+43+	14	8	56
	H	Bromus lanceolatus	..++..+	0	0	43								
	H	Bromus scoparius	..+...+	0	0	29								
	H	Bromus tectorum	......+	0	0	14								
	A	Buglossoides arvensis									.+.......	0	0	11
	A	Calendula arvensis	+++..++	**0**	**0**	**71**	++...+.......	0	0	23				
	W	Carex pachystylis	.....+.	0	0	14								
	W	Carrichtera annua					.+...........	0	0	8				
	H	Carthamus nitidus					..........+..	0	0	8				
	A	Carthamus tenuis	++.++++	**0**	**0**	**86**	11.+.++311350	**15**	**13**	**85**				
*	A	Centaurea aegyptiaca					++..+..+++.+.	0	0	54	....+....	0	0	11
	H	Centaurea hyalolepis	.....++	0	0	29	.+++.........	0	0	23				
	D	Chrysanthemum coronarium	+....++	0	0	43	.+...........	0	0	8				
	H	Cichorium endivia	.....+.	0	0	14								
	V	Crassula alata					.....+.......	0	0	8				
	R	Crepis aculeata					...+.........	0	0	8				
	W	Crepis aspera	...++1.	3	1	43								
	A	Crepis sancta									......+..	0	0	11
	W	Crithopsis delileana					.+...........	0	0	8				
	H	Crucianella macrostachya	.....+.	0	0	14								
	H	Cuscuta planiflora									+++++.+++	**0**	**0**	**89**
	R	Cutandia memphitica					...+.........	0	0	8	.++.3+++.	**5**	**3**	**67**
*	H	Cynodon dactylon	...+.+.	0	0	29								
*	A	Deverra tortuosa	9999899	**90**	**90**	**100**	.......+....0	3	0	15	.+...+0..	1	0	33
*	A	Dianthus monadelphus					....+...+....	0	0	15				
*	H	Dianthus strictus	..++...	0	0	29	.+....+......	0	0	15				
	W	Diplotaxis harra									.+.++..++	0	0	56
*	B	Echinops polyceras					....+.+00+0+1	**3**	**2**	**62**	.++..0...	2	1	33
*	H	Echium angustifolium	.+.+.+.	0	0	43	.+.+...+.+..+	0	0	38				
	W	Echium judaeum					+....+......	0	0	15				
*	V	Ephedra aphylla					.......+.....	0	0	8				
	B	Eremostachys laciniata	.+.+...	0	0	29	......+......	0	0	8				
	H	Erodium ciconium	..+..+.	0	0	29								
	W	Erodium crassifolium					+++......+...	0	0	31	++.++0.03	**6**	**4**	**78**
	W	Erodium moschatum	+......	0	0	14								
	W	Erucaria microcarpa					.....+.......	0	0	8	...+.++2+	4	2	56

Table 9. continued.

		Species	AAA01 1234567	C1	C2	%P	AAA02 12345678901234	C1	C2	%P	AAA03 123456789	C1	C2	%P
	W	Erucaria rostrata	+....++	0	0	43								
	H	Eryngium creticum	++++.++	**0**	**0**	**86**	.+....+......	0	0	15				
	D	Euphorbia exigua					.....+.......	0	0	8				
	B	Factorovskya aschersoniana	...+...	0	0	14								
	H	Filago contracta					.+...........	0	0	8	......+..	0	0	11
	W	Filago desertorum					++...0....+..	1	0	31	.+..++.+.	0	0	44
	H	Filago pyramidata	+......	0	0	14								
	H	Gagea chlorantha									+.+..++++	**0**	**0**	**67**
	W	Gastrocotyle hispida					.....+.......	0	0	8				
	H	Geropogon hybridus	++.....	0	0	29								
	H	Gundelia tournefortii	+013...	11	6	57	......+......	0	0	8				
*	N	Gymnocarpos decander					+.......++...	0	0	23	20301..01	**13**	**10**	**78**
	H	Gynandriris sisyrinchium	+....+.	0	0	29					...+.....	0	0	11
*	B	Gypsophila arabica	0..+.+.	1	0	43	....+.+......	0	0	15				
*	A	Haloxylon scoparium									.....+...	0	0	11
	H	Hedypnois cretica	+++..+.	0	0	57	.+........++.	0	0	23				
*	A	Helianthemum kahiricum					+............	0	0	8	0+1..+...	5	2	44
	W	Helianthemum ledifolium	.++.+..	0	0	43					.+.++..++	0	0	56
	H	Helianthemum salicifolium	.++++++	**0**	**0**	**86**	......+......	0	0	8	.......+.	0	0	11
*	A	Helianthemum ventosum									1++1+.+..	**4**	**3**	**67**
*	A	Helianthemum vesicarium									013326312	**25**	**25**	**100**
*	S	Herniaria hemistemon					..++...+.+++.	0	0	46				
	W	Herniaria hirsuta					.....+.......	0	0	8	.......+.	0	0	11
	H	Hippocrepis unisiliquosa	....+++	0	0	43					.++...+.+	0	0	44
	D	Hordeum glaucum	+..+...	0	0	29								
	H	Hymenocarpos circinnatus	+++++..	**0**	**0**	**71**								
*	H	Hyparrhenia hirta	...+...	0	0	14								
*	B	Kickxia aegyptiaca					.......++.+.+	0	0	31				
*	W	Kickxia floribunda					+..0+.+......	1	0	31				
	W	Koelpinia linearis					.....+.......	0	0	8				
	H	Lagoecia cuminoides	1++..++	**2**	**1**	**71**								
	W	Lappula spinocarpos									.+.......	0	0	11
	W	Leontodon laciniatus					.....+.......	0	0	8				
	H	Leopoldia comosa	++++.+.	**0**	**0**	**71**								
	A	Leopoldia longipes	.+++..+	0	0	57	.....+.......	0	0	8				
	W	Linaria haelava									.....++..	0	0	22
	H	Linum strictum	+......	0	0	14								
	W	Lolium rigidum	+.+..+.	0	0	43								
	A	Malabaila secacul					.....+.......	0	0	8				
	W	Matthiola livida					.....+.......	0	0	8	.....++..	0	0	22
	W	Medicago laciniata	.....+.	0	0	14								
	H	Medicago truncatula	.+.....	0	0	14								
*	A	Noaea mucronata	.....+1	5	1	29	6799949978897	**80**	**80**	**100**	11+131311	**14**	**14**	**100**
	W	Onobrychis crista-galli	+.++.++	**0**	**0**	**71**								
	W	Ononis sicula	.++...+	0	0	43					.++..++..	0	0	44
	A	Onosma echinata					......+......	0	0	8				
	A	Ornithogalum trichophyllum					.....+.......	0	0	8	.+..+....	0	0	22
	W	Orobanche cernua					.....+.......	0	0	8				
	H	Pallenis spinosa	+.++..+	0	0	57								
*	H	Paronychia argentea					.+...........	0	0	8				
*	V	Paronychia capitata					.......++.++.	0	0	31				
*	A	Peganum harmala					.+........++.	0	0	23				
*	V	Phagnalon rupestre	++++..+	**0**	**0**	**71**	+.++04+.++.+.	5	3	69				
	H	Picris altissima	...+...	0	0	14								
	W	Picris longirostris	..+++0+	**1**	**1**	**71**					+++++..+3	4	3	78
	H	Plantago afra					.....+.......	0	0	8				
	R	Plantago albicans	.+++++.	**0**	**0**	**71**								
	W	Plantago coronopus	......+	0	0	14	.....+.......	0	0	8	......++.	0	0	22
	H	Plantago cretica	3054+..	**25**	**18**	**71**								
	H	Plantago lagopus	...+...	0	0	14								
	W	Poa sinaica									.++.+.+++	**0**	**0**	**67**
*	H	Polygonum equisetiforme	....+..	0	0	14								

Table 9. continued.

		Species	AAA01				AAA02				AAA03			
			1234567	C1	C2	%P	12345678901234	C1	C2	%P	123456789	C1	C2	%P
	H	Psilurus incurvus	+++..++	**0**	**0**	**71**								
	W	Pterocephalus brevis	..+....	0	0	14					.....+...	0	0	11
	H	Ranunculus asiaticus	++++..+	**0**	**0**	**71**	.....+........	0	0	8	++...+...	0	0	33
*	S	Reaumuria negevensis									+........	0	0	11
*	R	Retama raetam									......+..	0	0	11
	H	Rhagadiolus stellatus	+.++..+	0	0	57								
	W	Roemeria hybrida									....+..+.	0	0	22
	H	Rostraria smyrnacea	..+..++	0	0	43	.....+........	0	0	8	.+.....+.	0	0	22
	W	Rumex cyprius									.......+.	0	0	11
*	S	Salsola vermiculata	.....0.	5	1	14	..........0+.	1	0	15				
	H	Salvia horminum	..++..+	0	0	43	.....+........	0	0	8				
*	A	Salvia lanigera	.....+.	0	0	14	0000+2.++++++	3	3	**92**	+.....+..	0	0	22
	W	Schismus arabicus					.....+........	0	0	8				
	W	Scilla hanburyi									+.+......	0	0	22
	W	Scorzonera judaica									++.++.++.	**0**	**0**	**67**
	H	Scorzonera papposa	++++..+	**0**	**0**	**71**								
*	B	Scrophularia xanthoglossa					.....+........	0	0	8				
	W	Senecio glaucus									..+.++++.	0	0	56
	W	Silene alexandrina									.+.......	0	0	11
	H	Silene colorata	.....+.	0	0	14								
	W	Silene decipiens	......+	0	0	14								
	W	Stipa capensis	460+237	**33**	**33**	**100**	.....29.......	55	8	15	.+...+21+	6	3	56
*	V	Stipa pellita									+.+.+....	0	0	33
*	B	Teucrium capitatum	00011.+	**7**	**6**	**86**	.+..++.++...+	0	0	46	+........	0	0	11
*	B	Thymelaea hirsuta	....1..	10	1	14	0...+++211+1	**7**	**5**	**69**	...+.0...	3	1	22
	H	Torilis tenella	.+...++	0	0	43								
	H	Tragopogon coelesyriacus	+.+....	0	0	29								
	H	Trifolium campestre	++++.++	**0**	**0**	**86**								
	H	Trifolium dasyurum	......+	0	0	14								
	H	Trifolium purpureum	+++++++	**0**	**0**	**100**								
	H	Trifolium stellatum	..+....	0	0	14								
	H	Trifolium tomentosum	++++...	0	0	57								
	W	Trigonella arabica	......+	0	0	14	.....1........	15	1	8	.....1.+.	5	1	22
	W	Trigonella stellata					.....+........	0	0	8	.......+.	0	0	11
	A	Tulipa systola	++++...	0	0	57					+++++11+3	**6**	**6**	**100**
	V	Umbilicus intermedius									.....+...	0	0	11
	H	Urginea maritima									+........	0	0	11
	H	Urospermum picroides	+.+...+	0	0	43					.....+...	0	0	11
*	H	Verbascum sinuatum	..+....	0	0	14								
	H	Vicia sativa	+......	0	0	14								
	H	Vulpia ciliata	.+..+++	0	0	57								
*	N	Zygophyllum dumosum									..+....0.	4	1	22

6.3.1.1.2 AAA02 Noaeetum mucronatae Eig 1946

Diagnostical species: the markers in table 9.

Ecological notes: The Carthamo tenuis – Noaeetum mucronatae is confined to Brown Lithosol on Lower Eocene chalk of Zor'a formation (Bartov et al., 1981) at the vicinity of Beer Sheva. Mean annual rainfall in this area is 200 mm. This area is under a strong pressure of grazing by domestic animals and cutting of lignified plants for burning fuel. The plant indicators for this anthropogenic pressure are *Asphodelus ramosus*, a geophyte with unlignified and non-palatable above-ground parts, the hard to cut and non-palatable shrub *Thymelaea hirsuta,* and the spiny markers *Carthamus tenuis* and *Echinops polyceras.*

Distribution: The patches of this association are presented in detail as AA1 by Danin et al. (1975) in the area shown in Fig. 36 as AAA02.

Association dynamics and conservation: Most of the area of this association is under constant process of recovery from overgrazing and cutting. An area at the memorial monument, overlooking Beer Sheva, protected from excessive human activity display a decrease in the quantity of *Asphodelus ramosus*. These changes were not monitored quantitatively.

Aspects of the association: Persistents – 35 spp.; ephemerals – 69 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00075	30	20	21	30.04.66	I 1832 5748
2	00076	30	20	28	30.04.66	I 1833 5750
3	00169	5	10	9	27.05.66	I 1772 5740
4	00170	10	30	15	29.05.66	I 1639 5739
5	00171	60	10	13	27.05.66	I 1771 5729
6	00283	24	16	40	22.03.67	I 1716 5808
7	00346	72	18	21	26.06.66	I 1718 5833
8	00458	34	6	36	20.03.67	I 1889 5693
9	00510	5	10	19	17.06.66	I 1760 5770
10	00511	5	10	20	17.06.66	I 1768 5776
11	00512	5	10	21	17.06.66	I 1768 5776
12	00513	5	20	20	17.06.66	I 1773 5775
13	00514	8	12	17	17.06.66	I 1773 5775
14	00515	36	24	16	17.06.66	I 1793 5774
Average:		23.5	15.4	21.1		

6.3.1.1.3 AAA03 Helianthemo vesicarii – Artemisietum sieberi Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 9. **Distribution:** Fig. 36.

Ecological notes: The most common habitat of this association is Brown Lithosol on stony colluvium at the pediment of north-facing slopes at elevation of 400-800 m a.s.l. Most specimens of *H. vesicarium* in this association have lilac-coloured petals. By this property it differs from the Moricandio nitentis – Artemisietum sieberi (AAA06) where *H. vesicarium* has populations with many colours of corollas. Many ephemerals of high elevations present in AAA06 are missing in AAA03.

Association dynamics and conservation: Most of the area of this association is under constant process of recovery from a long period of overgrazing.

Aspects of the association: Persistents – 20 spp.; ephemerals – 52 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	84006	1	10	21	14.03.84	I 1788 5311
2	84007	2	30	33	14.03.84	I 1789 5311
3	84008	15	15	22	14.03.84	I 1785 5310
4	84009	1	20	18	14.03.84	I 1785 5311
5	84010	1	30	21	14.03.84	I 1789 5307
6	84011	4	36	30	14.03.84	I 1789 5308
7	84012	5	30	28	14.03.84	I 1788 5308
8	84013	5	12	32	14.03.84	I 1788 5309
9	84014	1	13	17	14.03.84	I 1785 5311
Average:		3.9	21.8	24.7		

6.3.1.1.4 AAA04 Thymelaeo hirsutae – Artemisietum sieberi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov., nom. mut., nom. inv.

Syn.: Artemisia herba-alba – Thymelaea hirsuta association Danin, Orshan et Zohary 1975.

Diagnostical species: the markers in table 10.

Ecological notes: The Thymelaeo hirsutae – Artemisietum sieberi is confined to Brown Lithosol on Eocene chalk north and south of Beer Sheva and on Cenomanian and Turonian limestone near Dimona. Mean annual rainfall in this area is 150 mm. This area is under a strong pressure of grazing by domestic animals and cutting of lignified plants for burning fuel. Most of the surrounding area is plowed every year and stony-rocky substratum of this association, which occur like islands a few hundred meter squares among the fields, remain relatively intact as discussed above for AAA01. The position of this association at the meeting zone of Artemisietea sieberi and the Ballotetea undulatae is prominent through the high contribution of plants from the two syntaxa (A and B) in the association table.

Distribution: The distribution of this association (marked AA2) is illustrated in the vegetation map of Danin et al. (1975) and occur in the area shown in Fig. 37.

Association dynamics and conservation: Most of the area of this association is under constant overgrazing and cutting for many years. Once every few years mass germination and seedling establishment of the leading species *Thymelaea hirsuta* takes place. Shrubs grow for a few years until being cut for fuel. It is not palatable and hard to cut due to strong fibers in its bark that are used for making ropes (Danin, 1983).

Aspects of the association: Persistents – 32 spp.; ephemerals – 107 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00222	12	8	43	14.04.67	I 2060 5573
2	00223	3	3	34	14.04.67	I 2060 5573
3	00224	2	8	51	14.04.67	I 2055 5574
4	00225	8	7	41	14.04.67	I 2055 5574
5	00324	4	16	42	06.04.67	I 2037 5780
6	00328	8	12	57	06.04.67	I 2035 5777
7	00359	2	18	52	06.05.67	I 2042 5678
8	00625	12	13	30	06.04.67	I 2042 5788
9	00630	5	10	55	03.04.67	I 2012 5744
Average:		6.2	10.6	45.0		

Table 10. Association tables of AAA04 – Thymelaeo hirsutae – Artemisietum sieberi, AAA05 Reaumurio negevensis – Artemisietum sieberi, and AAA06 Moricandio nitentis – Artemisietum sieberi

			AAA04				AAA05				AAA06			
			*123456789	C1	C2	%P	*123456789012	C1	C2	%P	*123456789	C1	C2	%P
	W	Adonis dentata	0+++.+++.	**1**	**1**	**78**								
	W	Aegilops kotschyi	.++.....+	0	0	33								
*	B	Ajuga iva	.....++..	0	0	22								
	H	Allium artemisietorum	.+......+	0	0	22	..+.........	0	0	8				
	Q	Allium neapolitanum	......+..	0	0	11								
	A	Alyssum linifolium									.+.+.....	0	0	22
	F	Ammochloa palaestina	..++....+	0	0	33								
*	N	Anabasis articulata	++.......	0	0	22	+...+.++++.+	0	0	58	+.+0...+.	1	1	44
	W	Anagallis arvensis	....+++++	0	0	56								
	H	Anemone coronaria	+...+....	0	0	22								
	W	Anthemis melampodina									..+......	0	0	11
	H	Anthemis palestina					......++++.+	0	0	42				
	H	Anthemis pseudocotula	++++.1+++	**1**	**1**	**89**					....+....	0	0	11
*	A	Artemisia sieberi					445436765666	**52**	**52**	**100**				
	T	Asphodeline lutea									.+.......	0	0	11
	H	Asphodelus ramosus	+++++.3+6	**11**	**10**	**89**								
*	V	Astragalus amalecitanus	..+......	0	0	11	+..++....++.	0	0	42	........+	0	0	11
	W	Astragalus asterias	+...+++.+	0	0	56								

Table 10. continued.

			AAA04				AAA05				AAA06			
			123456789	C1	C2	%P	123456789012	C1	C2	%P	123456789	C1	C2	%P
*	B	Astragalus bethlehemiticus									.++......	0	0	22
	A	Astragalus callichrous	.....+++.	0	0	33								
	A	Astragalus caprinus	....+....	0	0	11								
*	B	Astragalus cretaceus	.....+...	0	0	11								
	A	Astragalus hispidulus	..+.....+	0	0	22								
*	A	Astragalus sanctus	....+.+.+	0	0	33	.+.......+.+	0	0	25				
*	A	Astragalus spinosus					+......++...	0	0	25				
	W	Astragalus tribuloides	+0+++..+.	**1**	**1**	**67**	+.+.+.++.++.	0	0	58	+..+.....	0	0	22
*	W	Atractylis phaeolepis					.+.++++..+++	**0**	**0**	**67**				
*	A	Atractylis serratuloides	.++++.+.+	**0**	**0**	**67**								
	A	Avena wiestii	.+11.....	7	2	33	.......+....	0	0	8				
*	B	Ballota undulata	.....+...	0	0	11								
	A	Bellevalia desertorum	++++++.++	**0**	**0**	**89**	.......++.+.	0	0	25				
	H	Bromus fasciculatus	++.......	0	0	22	.+..........	0	0	8	..+..+...	0	0	22
	A	Buglossoides tenuiflora	+.+......	0	0	22								
	H	Bupleurum lancifolium	+....+..+	0	0	33								
	H	Calendula arvensis	+..+.++++	**0**	**0**	**67**	++..........	0	0	17				
	A	Carex pachystylis	......+..	0	0	11	....+2......	10	2	17	.76788+7.	**61**	**48**	**78**
	B	Carlina libanotica	.....+...	0	0	11								
	W	Carrichtera annua	..+..+++.	0	0	44	..++++......	0	0	33	...+.+.+.	0	0	33
	H	Carthamus tenuis	........+	0	0	11								
	H	Catapodium rigidum	....++...	0	0	22								
*	A	Centaurea aegyptiaca	+1++1+++.	**3**	**2**	**89**	.+....+....+	0	0	25	.++.+..++	0	0	56
	H	Centaurea iberica	........+	0	0	11								
	A	Ceratocephala falcata	+.++.....	0	0	33								
*	V	Chiliadenus iphionoides									..+......	0	0	11
	W	Cnicus benedictus	...+.....	0	0	11								
	A	Colchicum tunicatum					....++.+..++	0	0	42	++1+00.0.	**4**	**3**	**78**
*	V	Convolvulus oleifolius	....++...	0	0	22								
	W	Crithopsis delileana	3....+3..	20	7	33								
	A	Crocus damascenus									......+..	0	0	11
	A	Crucianella membranacea	........+	0	0	11								
	R	Cutandia memphitica	1.1+.....	7	2	33	+...........	0	0	8				
	H	Dactylis glomerata	....+....	0	0	11								
	V	Delphinium ithaburense	.....+...	0	0	11								
*	A	Deverra tortuosa					.........+.+	0	0	17	+00.+..++	**2**	**1**	**67**
*	A	Dianthus monadelphus	....+....	0	0	11								
	W	Diplotaxis harra					+..+.+..++.+	0	0	50	.+.+0..+.	1	1	44
*	B	Echinops polyceras	+...++..+	0	0	44					.++......	0	0	22
*	H	Echium angustifolium	........+	0	0	11								
	H	Erodium ciconium									.....+.+.	0	0	22
	W	Erodium crassifolium	+.11..11+	**7**	**4**	**67**	+++++++++6..	**7**	**5**	**83**	+10+...+.	3	2	56
	W	Erodium neuradifolium	+........	0	0	11								
	W	Erodium touchyanum									.+..+....	0	0	22
	W	Erucaria microcarpa					++..97++83.+	**30**	**23**	**75**	+....+21.	8	3	44
	W	Euphorbia chamaepeplus	+..+.+..+	0	0	44	.......+....	0	0	8				
	A	Ferula biverticillata									.+.+.+...	0	0	33
	H	Filago contracta	..++.0+.+	1	1	56								
	W	Filago desertorum	.++.1++++	**1**	**1**	**78**					.++.+....	0	0	33
	H	Gagea chlorantha					......+.....	0	0	8				
	W	Gagea reticulata	..++++...	0	0	44	...+++...+..	0	0	33	.+++...+.	0	0	44
	W	Gastrocotyle hispida	+.+......	0	0	22	..+.........	0	0	8	..+......	0	0	11
	H	Geranium tuberosum	+........	0	0	11								
	H	Gundelia tournefortii	......+..	0	0	11								
	W	Gymnarrhena micrantha	.+.......	0	0	11	...+........	0	0	8				
*	N	Gymnocarpos decander	.++....+.	0	0	33	+0.1++1+++00	**3**	**3**	**92**	..+.....+	0	0	22
	H	Gynandriris sisyrinchium	.....+..+	0	0	22	....+.......	0	0	8	...+++.+.	0	0	44
*	S	Halothamnus acutifolius	.+.......	0	0	11								
	H	Hedypnois cretica	....++..	0	0	22								
	H	Helianthemum aegyptiacum	........+	0	0	11								
*	A	Helianthemum kahiricum	.+.....+.	0	0	22	+++0+.+.1+++	**2**	**2**	**83**				

Table 10. continued.

			AAA04				AAA05				AAA06			
			123456789	C1	C2	%P	123456789012	C1	C2	%P	123456789	C1	C2	%P
	W	Helianthemum ledifolium	++.+...++	0	0	56	.........++.	0	0	17	++++.10+.	**2**	**2**	**78**
	H	Helianthemum salicifolium	.....+..+	0	0	22								
*	A	Helianthemum ventosum	.+.......	0	0	11	+++++0++++0+	**1**	**1**	**100**	.++++...+	0	0	56
*	A	Helianthemum vesicarium	+.+++++++	**0**	**0**	**89**	++....+0.+.+	1	0	50	210+01..0	**8**	**6**	**78**
	W	Herniaria hirsuta	....+++.+	0	0	44	.++....+.			0	0	33		
	H	Hippocrepis unisiliquosa	..++.++.+	0	0	56	.......+..+.	0	0	17				
	H	Hymenocarpos circinnatus	.....++++	0	0	44								
	A	Iris regis-uzziae					....+.......	0	0	8	..++.+.+.	0	0	44
*	B	Kickxia aegyptiaca	.....+..+	0	0	22								
	W	Koelpinia linearis	...+.....	0	0	11								
	W	Lappula spinocarpos	++++....+	0	0	56	..+++......+	0	0	33	++.+.....	0	0	33
	W	Lasiopogon muscoides									.+.......	0	0	11
	W	Leontodon laciniatus	..+......	0	0	11								
	H	Leopoldia longipes					.....+......	0	0	8				
	A	Leptaleum filifolium									.....+...	0	0	11
*	S	Limonium pruinosum					.++.+.+..+++	0	0	58				
	W	Linaria albifrons	....+++..	0	0	33								
	A	Loliolum subulatum	...+.....	0	0	11					++++++...	**0**	**0**	**67**
	W	Lomelosia porphyroneura	+..+..+..	0	0	33	.......+..+.	0	0	17				
	H	Malcolmia crenulata	....+....	0	0	11								
	W	Malva aegyptia	..+...+..	0	0	22								
	D	Malva parviflora	..+......	0	0	11								
	W	Matthiola livida	+.+......	0	0	22	+.++++.+.+++	**0**	**0**	**75**	+++11....	5	3	56
	W	Medicago laciniata	.....+..+	0	0	22								
	W	Medicago radiata	+........	0	0	11								
	H	Medicago rotata	.+.......	0	0	11								
	W	Minuartia picta	....++..+	0	0	33					+++.++...	0	0	56
*	A	Moricandia nitens					.+..+....+..	0	0	25				
	W	Neotorularia torulosa	..+......	0	0	11					.+.+.+.+.	0	0	44
*	A	Noaea mucronata	++.++++++	**0**	**0**	**89**	10020+12220+	**10**	**10**	**100**	110102321	**14**	**14**	**100**
	D	Notobasis syriaca	......+..	0	0	11								
	W	Onobrychis crista-galli	.....+++.	0	0	33								
	H	Onobrychis squarrosa	....+....	0	0	11								
	H	Ononis mollis					......++....	0	0	17				
	W	Ononis sicula					..........+.	0	0	8				
	H	Ornithogalum narbonense	..++.+..+	0	0	44					.++......	0	0	22
	H	Papaver hybridum	........+	0	0	11								
	L	Parapholis incurva	..+......	0	0	11								
*	H	Paronychia argentea	....+.++.	0	0	33								
*	V	Paronychia sinaica	....+.+..	0	0	22	...........+	0	0	8	....+....	0	0	11
*	B	Phlomis brachyodon	......+..	0	0	11								
	H	Picris altissima					..+...++++.+	0	0	50				
	W	Picris longirostris					++.+.+......	0	0	33	..+++....	0	0	33
*	R	Plantago albicans	....12...	18	4	22								
	W	Plantago coronopus	.+++.4+.+	**7**	**4**	**67**								
	W	Plantago ovata					..++...+..+.	0	0	33				
	A	Plantago phaeostoma	..+......	0	0	11	......+.....	0	0	8	....+....	0	0	11
	H	Poa bulbosa	+.++20+..	**4**	**3**	**67**								
	W	Poa sinaica					++.+++++.+.+	**0**	**0**	**75**	5110.000.	**14**	**11**	**78**
	S	Pteranthus dichotomus					..+.........	0	0	8				
	H	Pterocephalus plumosus	++....+..	0	0	33								
	H	Ranunculus asiaticus	..++++.++	**0**	**0**	**67**	.........+..	0	0	8	+.+.+....	0	0	33
*	S	Reaumuria hirtella	0.++.....	1	0	33	...+......+.	0	0	17				
*	S	Reaumuria negevensis					444253011123	**26**	**26**	**100**	1......+.	5	1	22
	W	Reichardia tingitana	+++.+...+	0	0	56	..........+.	0	0	8				
*	R	Retama raetam	+........	0	0	11								
	H	Rhagadiolus stellatus	....2+...	10	2	22								
	W	Roemeria hybrida	+.+.....+	0	0	33								
	H	Rostraria smyrnacea	+++++.+..	**0**	**0**	**67**					++++..+..	0	0	56
	S	Salsola inermis					..........+.	0	0	8				
*	B	Salvia dominica	.....++..	0	0	22								

Table 10. continued.

			AAA04				AAA05				AAA06			
			123456789	C1	C2	%P	123456789012	C1	C2	%P	123456789	C1	C2	%P
	H	Salvia horminum	.....+.+.	0	0	22								
*	A	Salvia lanigera	.+++++1.+	**1**	**1**	**78**	++++....++.+	0	0	58	.+..+...+	0	0	33
*	T	Sarcopoterium spinosum	....+0...	2	0	22								
	W	Schismus arabicus	..+......	0	0	11	...........+	0	0	8	.++...7..	23	8	33
	W	Scilla hanburyi	.++++.+.+	**0**	**0**	**67**	...++.......	0	0	17	....++.+.	0	0	33
	H	Scorpiurus muricatus	......++.	0	0	22								
	W	Scorzonera judaica	++++++.++	**0**	**0**	**89**	....+.......	0	0	8	++++++++.	**0**	**0**	**89**
	H	Scorzonera papposa	....+++.+	0	0	44					..++++++.	**0**	**0**	**67**
	W	Senecio glaucus	...+.....	0	0	11	....+.......	0	0	8	++++++...	**0**	**0**	**67**
	H	Silene colorata	.......+.	0	0	11								
	A	Silene coniflora									+.++++++.	**0**	**0**	**78**
	W	Silene decipiens	....+....	0	0	11								
	W	Silene linearis									.....++..	0	0	22
	W	Silene vivianii	+........	0	0	11	..+......+..	0	0	17	+++++++1.	**1**	**1**	**89**
*	V	Stipa barbata	......+..	0	0	11	+...+..+..++	0	0	42				
	W	Stipa capensis	38++...+.	22	12	56	+.++.+++.++.	**0**	**0**	**67**				
*	V	Stipa parviflora	..+......	0 .	0	11	..+..+.+++..	0	0	42	+.++..+.+	0	0	56
*	B	Teucrium capitatum	.....++.+	0	0	33					..+......	0	0	11
*	B	Thymelaea hirsuta	++1001000	**5**	**5**	**100**					....+....	0	0	11
	W	Tordylium aegyptiacum	......+..	0	0	11								
	H	Trifolium dasyurum	.....+...	0	0	11								
	H	Trifolium tomentosum	.....+...	0	0	11								
	W	Trigonella arabica	..++..+.+	0	0	44								
	H	Trigonella monspeliaca	.....+..+	0	0	22								
	W	Trigonella stellata	.+.......	0	0	11	++.+....1...	3	1	33				
	A	Tripleurospermum auriculatum									+........	0	0	11
	B	Trisetaria macrochaeta	......+.1	5	1	22								
	A	Tulipa systola	+.++++.++	**0**	**0**	**78**	++..+....+..	0	0	33				
	H	Urginea maritima	......+..	0	0	11	..........+.	0	0	8				
	A	Urginea undulata	........+	0	0	11	.+.....+....	0	0	17				
	H	Valerianella vesicaria	.....+...	0	0	11								
*	B	Verbascum fruticulosum	......+..	0	0	11								
	A	Vicia monantha					....+.......	0	0	8				
	H	Vicia sativa	........+	0	0	11								
	A	Zosima absinthiifolia									...++++..	0	0	44
*	N	Zygophyllum dumosum					++.+.+.+.++.	0	0	58				

6.3.1.1.5 AAA05 Reaumurio negevensis – Artemisietum sieberi Danin, Orshan et Zohary ex Danin et Solomeshch ass. nov., nom. mut., nom. inv.

Syn.: Artemisia herba-alba – Reaumuria negevensis association Danin, Orshan et Zohary 1975.

Diagnostical species: the markers in table 10.

Ecological notes: This association is confined to hard chalk or to a mixture of limestone and chalk of the Avedat Group (Bartov et al., 1981). The affinity of *Reaumuria negevensis* to chalk of the Eocene should be further investigated in the future. This is to be contrasted with that of *R. hirtella* which may occur in occasional individuals in this association but dominates mainly on Senonian chalk and marl (cf. ARS06) and on saline loessial soils (cf. ARR07 and ARR09).

There are prominent fluctuations in the quantity of ephemeral plants in dry years. This association develops in an area with less than 90 mm mean annual rainfall and there are many years when the quantity of available water is not sufficient for the development of ephemerals at all. There are others with slightly more rainfall, when geophytes and hemicryptophytes develop and bloom, and in rainy years all the components are well developed. Even in rainy years the average cover of ephemerals is low (1.6% in our table) when compared to that of the chamaephytes (10.5%).

Distribution: Patches of this association occur in the area shown in Fig. 37. More accurate patches of its distribution are displayed (as AA4) in the vegetation map of the Negev Highlands (Danin et al., 1975).

Association dynamics and conservation: Most of the area of this association is protected in its southern patches (Fig. 37) from excessive grazing at present whereas the northern one is overgrazed by goats and most of the lignified components are cut for fuel.

Aspects of the association: Persistents – 21 spp.; ephemerals – 50 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00716	3	10	25	05.04.69	I 1787 5112
2	00717	2	13	23	05.04.69	I 1788 5112
3	00718	1	10	20	05.04.69	I 1788 5112
4	00719	1	10	24	05.04.69	I 1788 5113
5	00720	2	10	29	05.04.69	I 1789 5138
6	00721	2	10	20	05.04.69	I 1789 5138
7	00722	1	15	21	05.04.69	I 1793 5126
8	00723	1	10	28	05.04.69	I 1793 5126
9	00724	2	8	17	05.04.69	I 1793 5127
10	00725	2	10	31	05.04.69	I 1807 5103
11	00726	1	10	25	05.04.69	I 1807 5103
12	00727	1	10	25	05.04.69	I 1808 5104
Average:		1.6	10.5	24.0		

6.3.1.1.6 AAA06 Moricandio nitentis – Artemisietum sieberi Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 10. **Distribution:** Fig. 38.

Ecological notes: This association occupies the highest elevation where shrub-steppes occur in the study area. It differs from other associations in the assemblage of plants that occur mainly in its area. Such are *Colchicum tunicatum, Loliolum subulatum, Iris regis-uzziae,* and *Crocus damascenus.* In the area of this association *Helianthemum vesicarium* has its highest diversity of petal colour. Whereas in other places they have lilac petals they have here all the range from white with an orange spot at the base of each petal through lilac to dark purple with a yellow spot at the petal base.

Association dynamics and conservation: Most of the area of this association is protected from grazing and cutting for more than 30 years due to the proximity to the international border. The main changes in the association physiognomy follow the annual fluctuation in the amount of rainfall. In years receiving the average amount of annual rainfall there are mainly perennial ephemerals and semishrubs which bloom. In the rare wet years there are many companion annual species represented by a few individuals each.

Aspects of the association: Persistents – 19 spp.; ephemerals – 51 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94330	5	20	25	22.03.94	I 1652 4938
2	94331	5	20	35	22.03.94	I 1652 4939
3	94332	3	20	39	22.03.94	I 1653 4938
4	94333	5	15	32	22.03.94	I 1650 4928
5	94334	5	20	30	22.03.94	I 1651 4928
6	94335	5	15	27	22.03.94	I 1652 4928
7	94336	5	15	17	22.03.94	I 1653 4928
8	94337	5	20	26	22.03.94	I 1650 4929
9	94338	0	15	11	22.03.94	I 1651 4929
Average:		4.2	17.8	26.9		

6.3.1.1.7 AAA07 Asphodelo ramosi – Artemisietum sieberi Eig 1946 nom. mut., nom. inv.

Syn.: association of Artemisia Herba-alba – Asphodelus microcarpus Eig 1946; Artemisia herba-alba – Gymnocarpos decander assoc. Danin, Orshan et Zohary 1975.

Diagnostical species: the markers in table 12. **Distribution:** Fig. 38.

Ecological notes: The most common habitat of this association is outcrops of fissured bedded limestone from the Cenomanian and the Turonian. There are several formations of this kind in the Negev Highlands (Bartov et al., 1981). Therefore, in our first account on the area (Danin et al., 1975) we displayed the vegetation mosaic in the map as an equation where this association is the most common in the area and the others occur in special habitats such as smooth-faced rock outcrops, terraces of Loessial Serozem, and outcrops of chalk.

Phytogeographical analysis: The analysis of the list of species is presented in Fig. 35. The transitional nature of the flora of the Negev Highlands is displayed in the chorotype spectrum of this association. Although dominated by an Irano-Turanian species *Artemisia sieberi,* the most frequent chorotype in the species list is the Saharo-Arabian. The other four chorotypes, each contributing 15-20% are M, IT, M-IT, and IT-SA. This coexistence of plants from different domains seems to be related to the high diversity of habitats constituting the specific type of Brown Lithosol with a certain kind of rock outcrops and stony soil among them.

Association dynamics and conservation: The dynamic processes of this association are similar to those discussed in association AAA06.

Aspects of the association: Persistents – 46 spp.; ephemerals – 122 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00013	30	20	31	21.05.64	I 1861 5312
2	00014	5	15	38	21.05.64	I 1857 5312
3	00015	20	20	30	21.05.64	I 1857 5312
4	00018	10	15	66	22.04.64	I 1859 5517
5	00019	5	15	32	22.04.64	I 1831 5342
6	00020	15	25	42	23.04.64	I 1747 5287
7	00099	3	27	16	15.05.66	I 1781 5219
8	00100	20	20	53	22.05.64	I 1863 5382
9	00101	10	20	36	23.04.64	I 1753 5285
10	00102	20	10	62	27.04.64	I 1903 5465
11	00174	3	27	17	28.04.66	I 1594 5042
12	00253	1	9	44	19.04.67	I 1747 4995
13	00306	1	10	30	01.04.68	I 2182 5709
14	00326	1	14	48	06.04.67	I 2035 5778
Average:		10.3	17.6	38.9		

Table 11. Association table of AAA07 – Asphodelo ramosi – Artemisietum sieberi, AAH04 – Helianthemo ledifolii – Anabasietum syriacae, and AAH03 – Ferulo biverticillatae – Anabasietum syriacae

			AAA07				AAH03				AAH04			
			12345678901234	C1	C2	%P	*1234567	C1	C2	%P	*12345678	C1	C2	%P
	H	Adonis aestivalis									.....+..	0	0	13
	W	Adonis dentata	.........+....	0	0	7	......+	0	0	14	++++....	0	0	50
	W	Aegilops kotschyi	...+..........	0	0	7					.....+++	0	0	38
*	S	Agathophora alopecuroides	.++....+...+..	0	0	29								
	W	Aizoon hispanicum	+.............	0	0	7								
*	Q	Ajuga chamaepitys	...........+..	0	0	7								
	W	Allium ampeloprasum	.....+........	0	0	7								
	A	Allium artemisietorum	++++...+......	0	0	36								
	B	Allium erdelii	.......+......	0	0	7								
	Q	Allium neapolitanum	.......+......	0	0	7								
	A	Allium rothii									.......+	0	0	13

Table 11. continued.

			AAA07				AAH03				AAH04			
			12345678901234	C1	C2	%P	1234567	C1	C2	%P	12345678	C1	C2	%P
	H	Allium stamineum	++.+.+.+.+....	0	0	43					..+.....	0	0	13
	F	Ammochloa palaestina	...+.....+....	0	0	14								
*	N	Anabasis articulata	.+.+.+.++..+..	0	0	43								
*	A	Anabasis syriaca					9899998	**94**	**94**	**100**	99999999	**99**	**99**	**100**
	W	Anagallis arvensis	...+...+.+...+	0	0	29					....+...	0	0	13
	N	Anchusa milleri	...........+..	0	0	7								
*	A	Andrachne telephioides									.+......	0	0	13
	H	Anthemis palestina	0......+.+....	2	0	21								
	H	Anthemis pseudocotula	..++.++......1	2	1	36	1+.+3++	7	6	86	+++++.+.	**0**	**0**	**75**
	W	Arnebia decumbens					.+....+	0	0	29				
	W	Arnebia linearifolia	.......++.....	0	0	14					......+.	0	0	13
*	A	Artemisia sieberi	85536485224368	**50**	**50**	**100**					.1...021	2	5	43
*	V	Asparagus horridus	...+.....+.+..	0	0	21								
	H	Asphodelus ramosus	.+.++..+.+....	0	0	36					+.......	0	0	13
	N	Asteriscus hierochunticus	...+0....+....	2	0	21								
*	V	Astragalus amalecitanus	.++++...+.++..	0	0	50								
	W	Astragalus asterias	.............+	0	0	7	.+.++++	**0**	**0**	**71**	.+..++++	**0**	**0**	**63**
	A	Astragalus callichrous	.......+.+...1	3	1	21					.+..++..	0	0	38
	A	Astragalus corrugatus					.+.....	0	0	14				
	B	Astragalus epiglottis	.............+	0	0	7								
	A	Astragalus hispidulus	.............+	0	0	7					+++++...	**0**	**0**	**63**
*	A	Astragalus sanctus	.....+.......+	0	0	14					.....0.0	1	0	25
	W	Astragalus tribuloides	...+.+..++...+	0	0	36	+++++++	**0**	**0**	**100**	+++0+.+	**1**	**1**	**88**
*	W	Atractylis phaeolepis	.++..+....+++.	0	0	43								
*	A	Atractylis serratuloides	........++...0	0	0	21					.+.+....	0	0	25
*	S	Atriplex glauca	...........+..	0	0	7	.+.....	0	0	14				
*	S	Atriplex leucoclada									....0...	1	0	13
	A	Avena wiestii	...+.+...+....	0	0	21	.+++.+.	0	0	57				
*	B	Ballota undulata	...........+..	0	0	7								
*	S	Bassia arabica	...........+..	0	0	7								
	A	Bellevalia desertorum	........+.....	0	0	7								
	A	Bellevalia eigii	...........+..	0	0	7								
	H	Biarum angustatum	.........+....	0	0	7								
	H	Biscutella didyma	...........+..	0	0	7								
	H	Bromus fasciculatus	...+.....+....	0	0	14								
	A	Buglossoides tenuiflora	...........+..	0	0	7								
	H	Bupleurum lancifolium	.........+....	0	0	7								
	A	Bupleurum semicompositum	.........+....	0	0	7								
	H	Calendula arvensis					....+++	0	0	43	.++1+...	3	1	50
	A	Carex pachystylis	...++.+.......	0	0	21	8861+87	**55**	**55**	**100**	211+.+..	**8**	**5**	**63**
	W	Carrichtera annua	...+...+.....+	0	0	21					++1+++..	**2**	**1**	**75**
	H	Carthamus tenuis	.............+	0	0	7								
	H	Catapodium rigidum	.............+	0	0	7								
*	A	Centaurea aegyptiaca	++++.+++.++.++	**0**	**0**	**79**								
	A	Centaurea ammocyanus	......+.	0	0	13					+0+21+1	**6**	**6**	**100**
	V	Centaurea eryngioides	............+.	0	0	7								
	H	Centaurea hyalolepis									...+.+..	0	0	25
	H	Centaurea iberica	.............+	0	0	7					.+..+...	0	0	25
	A	Ceratocephala falcata	+.............	0	0	7	...+...	0	0	14	......+.	0	0	13
*	V	Chiliadenus iphionoides	............+.	0	0	7								
	W	Cnicus benedictus	.........+....	0	0	7	.+..+++	0	0	57				
	A	Colchicum ritchii									....+...	0	0	13
	A	Colchicum tunicatum	......+.....+.	0	0	14	++..+++	**0**	**0**	**71**				
	R	Crepis aculeata	..+..+.2+.....	5	1	29								
	W	Crepis aspera	...+..........	0	0	7								
	H	Crepis sancta	.......+.+....	0	0	14								
	W	Crithopsis delileana									+..++...	0	0	38
	R	Cutandia memphitica	+.++.1...+....	2	1	36					.......+	0	0	13
	H	Daucus durieua	...+..........	0	0	7								

Table 11. continued.

			AAA07				AAH03				AAH04			
			12345678901234	C1	C2	%P	1234567	C1	C2	%P	12345678	C1	C2	%P
*	A	Deverra tortuosa	.++........++.	0	0	29								
	W	Diplotaxis harra	141.46++837++.	29	25	86								
*	B	Echinops polyceras	........++.++.	0	0	29								
*	H	Echium angustifolium	.............+	0	0	7								
	W	Emex spinosa	...+..........	0	0	7					..+++...	0	0	38
	W	Enarthrocarpus strangulatus					.+.....	0	0	14				
*	V	Ephedra aphylla	...........+..	0	0	7								
	A	Eremopyrum bonaepartis					++++...	0	0	57	......8+	40	10	25
	A	Eremopyrum distans									......+.	0	0	13
	H	Erodium ciconium	.............+	0	0	7	+++++++	0	0	100				
	W	Erodium crassifolium	0+++..++++2++1	3	3	86	+......	0	0	14	...+.+.+	0	0	38
	H	Erodium malacoides									...+....	0	0	13
	W	Erodium touchyanum					.....+.	0	0	14				
	W	Erucaria microcarpa	748742.604.+.4	42	33	79					4757+4..	45	34	75
	W	Euphorbia chamaepeplus	..+..+.+.+...+	0	0	36					.+......	0	0	13
	W	Euphorbia chamaesyce	...+..........	0	0	7								
*	V	Euphorbia ramonensis	...........++.	0	0	14								
	A	Ferula biverticillata					+++++++	0	0	100				
	H	Filago contracta									.+.+....	0	0	25
	W	Filago desertorum	.+.0.+.++0...+	1	1	50	+++..++	0	0	71	+++1+...	2	1	63
*	M	Fumana thymifolia	............+.	0	0	7								
	W	Gagea reticulata	+.++++.+++..++	0	0	71	+++...+	0	0	57	+.......	0	0	13
	W	Gastrocotyle hispida	++.++..+.+....	0	0	43	.....+.	0	0	14	...+++..	0	0	38
	W	Gymnarrhena micrantha	...+..........	0	0	7	....0+.	3	1	29	++++++..	0	0	75
*	N	Gymnocarpos decander	+2132114231211	18	18	100								
	H	Gynandriris sisyrinchium	...+...++..+++	0	0	43	..+...+	0	0	29	+.++.+..	0	0	50
*	B	Gypsophila arabica	............+.	0	0	7								
*	A	Haloxylon scoparium	...+......+...	0	0	14								
	H	Hedypnois cretica	.............+	0	0	7								
	H	Helianthemum aegyptiacum	.............+	0	0	7								
*	A	Helianthemum kahiricum	.0.++10+1412++	8	7	86								
	W	Helianthemum ledifolium	+.....++.+....	0	0	29	+..++1+	2	1	71	.+.+.+..	0	0	38
	H	Helianthemum salicifolium	.........+....	0	0	7	+......	0	0	14				
*	A	Helianthemum ventosum	...++0..+.0+..	2	1	43								
*	A	Helianthemum vesicarium	+....0+..+..++	1	0	43								
*	B	Heliotropium rotundifolium	.............+	0	0	7								
*	S	Herniaria hemistemon	...+......+...	0	0	14								
	W	Herniaria hirsuta	.....+.+.+...+	0	0	29					.+++++..	0	0	63
	H	Hippocrepis unisiliquosa	...++..+++.+.+	0	0	50					+.++....	0	0	38
	D	Hordeum glaucum					.+..+.+	0	0	43	......++	0	0	25
	H	Hymenocarpos circinnatus	.............+	0	0	7					.....+..	0	0	13
	R	Ifloga spicata	...+...+......	0	0	14								
	A	Iris regis-uzziae					.+....+	0	0	29				
	A	Ixiolirion tataricum	..+...........	0	0	7	......+	0	0	14				
*	B	Kickxia aegyptiaca	.............+	0	0	7								
	W	Koelpinia linearis					.+.++..	0	0	43	....1.++	3	1	38
	W	Lamarckia aurea	.............+	0	0	7								
	W	Lappula spinocarpos	++.0++.+++....	1	0	57	..+.+++	0	0	57	...+..++	0	0	38
	A	Leontice leontopetalum					+..+.+.	0	0	43	......+.	0	0	13
	W	Leontodon laciniatus	...+.....+....	0	0	14	....+.+	0	0	29	+...+.++	0	0	50
	A	Leopoldia longipes	+.............	0	0	7								
	A	Leptaleum filifolium					...++..	0	0	29	......+.	0	0	13
*	S	Limonium pruinosum	++...+.+..++..	0	0	43								
	W	Linaria albifrons	...+...+......	0	0	14					.+++....	0	0	38
	W	Linaria haelava	...+.+.+.+....	0	0	29					++++++..	0	0	75
	A	Loliolum subulatum					...+...	0	0	14				
	W	Lolium rigidum					.....+.	0	0	14				
	W	Lomelosia porphyroneura	..+.+..++....1	2	1	36								

Table 11. continued.

			AAA07				AAH03				AAH04			
			12345678901234	C1	C2	%P	1234567	C1	C2	%P	12345678	C1	C2	%P
	W	Malva aegyptia	.......+...+..	0	0	14	++055.+	**18**	**15**	**86**	....++++	0	0	50
	D	Malva parviflora									+++++...	**0**	**0**	**63**
	W	Matthiola livida	.0.+++.1.+....	3	1	43	.0+..+.	2	1	43				
	W	Medicago laciniata	...+.........+	0	0	14					.....+...	0	0	13
	W	Medicago radiata	...+..........	0	0	7								
*	V	Micromeria sinaica	............+.	0	0	7								
	W	Minuartia picta	.......+......	0	0	7								
*	A	Moricandia nitens	...........+2.	10	1	14								
	W	Neotorularia torulosa					+.+.0++	**1**	**1**	**71**	..+.+++0	**1**	**1**	**63**
*	A	Noaea mucronata	111421.12001++	**12**	**11**	**93**								
	H	Nonea philistaea					++..+..	0	0	43				
	W	Onobrychis crista-galli	...+.........1	5	1	14					.+..+...	0	0	25
	H	Onobrychis squarrosa	.............+	0	0	7					...+....	0	0	13
	H	Ononis mollis	.+.....+.0....	2	0	21								
	A	Onopordum alexandrinum									.+.+++..	0	0	50
	H	Ornithogalum narbonense	...........+..	0	0	7								
	A	Ornithogalum trichophyllum									....+...	0	0	13
	W	Papaver humile	.........+....	0	0	7								
	H	Papaver hybridum	......+.......	0	0	7					+.+.....	0	0	25
*	V	Paronychia sinaica	.............+	0	0	7								
*	V	Phagnalon rupestre	.....+.....+..	0	0	14								
	W	Picris longirostris	..........+...	0	0	7	.+...+.	0	0	29	.......+	0	0	13
	W	Plantago coronopus	...1..++.+...+	2	1	36					++++.+..	**0**	**0**	**63**
	W	Plantago ovata	.+.....+......	0	0	14								
	A	Plantago phaeostoma	..+......+...+	0	0	21								
	W	Poa sinaica	+..++..+++..+.	0	0	50	00+++01	**4**	**4**	**100**				
	S	Pteranthus dichotomus	...+.+........	0	0	14								
	H	Pterocephalus brevis	...+..........	0	0	7								
	H	Pterocephalus plumosus	.........+....	0	0	7								
*	V	Pterocephalus pulverulentus	............+.	0	0	7								
	H	Ranunculus asiaticus	+.++.+.+.+....	0	0	43					....+.+..	0	0	25
*	S	Reaumuria hirtella	1..........+..	5	1	14								
*	S	Reaumuria negevensis	.13++1..1.1.+.	9	5	57								
	W	Reichardia tingitana	.+.+...+.+...+	0	0	36					+..+.+..	0	0	38
	W	Reseda decursiva	.+..+.........	0	0	14					.++..+..	0	0	38
	W	Roemeria hybrida	+++....+......	0	0	29	.....+.	0	0	14	++++.+..	**0**	**0**	**63**
	H	Rostraria smyrnacea	0.++0+.+.0.+..	2	1	57					..++++..	0	0	50
	W	Rumex cyprius	...+..........	0	0	7								
	S	Salsola inermis	.++...+...0...	1	0	29	+.+...+	0	0	43				
*	S	Salsola orientalis					....+..	0	0	14				
*	S	Salsola schweinfurthii	...........+..	0	0	7								
*	A	Salvia lanigera	.+.+++..++.+..	0	0	50					.+.+....	0	0	25
	W	Schismus arabicus	++.++++0+0....	**1**	**1**	**64**	....+..	0	0	14	3++++18	**15**	**15**	**100**
	W	Scilla hanburyi	.....+..++..++	0	0	36	+....+.	0	0	29	++++++..	**0**	**0**	**75**
	W	Scorzonera judaica	+..+++...+..++	0	0	50	+++++++	**0**	**0**	**100**	++.+.+..	0	0	50
	H	Scorzonera papposa	....+...+.....	0	0	14	+++++.+	**0**	**0**	**86**	.......+	0	0	13
	H	Sedum caespitosum	...........+..	0	0	7								
	W	Senecio glaucus	..++.+.+.+....	0	0	36	..+..+.	0	0	29	.......+	0	0	13
	H	Silene colorata	+.............	0	0	7								
	A	Silene coniflora					+..+++.	0	0	57				
	W	Silene decipiens	.............+	0	0	7								
	W	Silene vivianii	...+.....+....	0	0	14	......+	0	0	14	....+...	0	0	13
	W	Spergula fallax	..+....+......	0	0	14								
	S	Spergularia diandra	++.......+....	0	0	21					..++++..	0	0	50
*	V	Stachys aegyptiaca	....+.........	0	0	7								
*	V	Stipa barbata	.+......+..+..	0	0	21								
	W	Stipa capensis	.1.++.+.0+.+.+	2	1	57					+1..+2..	8	4	50
*	V	Stipa parviflora	.+..+...+...+.	0	0	29								
*	V	Stipa pellita	....++...+....	0	0	21								
*	F	Stipagrostis ciliata	........+.....	0	0	7								

Table 11. continued.

			AAA07				AAH03				AAH04			
			12345678901234	C1	C2	%P	1234567	C1	C2	%P	12345678	C1	C2	%P
*	B	Teucrium capitatum	.....++....+..	0	0	21								
	H	Thesium humile	...+..........	0	0	7								
*	B	Thymelaea hirsuta	.+.++....+...0	0	0	36								
	W	Tordylium aegyptiacum									....+...	0	0	13
	A	*Tragopogon* collinus					..3..0.	18	5	29				
	W	Trigonella arabica	...+....+.....	0	0	14					++1+2+..	5	4	75
	W	Trigonella stellata	.+.+.+..+..+..	0	0	36					++1+1+.+	3	3	88
	A	Tripleurospermum auriculatum									...+43++	14	9	63
	A	Tulipa systola	++++.0......+.	1	0	43								
	V	Umbilicus intermedius	...........+..	0	0	7								
	H	Urginea maritima	..+++....+.+..	0	0	36								
	A	Urginea undulata	............+.	0	0	7					+..+....	0	0	25
	H	Urospermum picroides	.......+......	0	0	7								
	A	Valerianella dufresnia					..+....	0	0	14				
*	B	Verbascum fruticulosum									.+......	0	0	13
	H	Vicia peregrina									.....+..	0	0	13
	H	Vicia sativa									+....+..	0	0	25
	A	Zosima absinthiifolia	............+.	0	0	7	..+.+..	0	0	29				
*	N	Zygophyllum dumosum	+++..+.+0+++..	1	0	64								

6.3.1.2 AAH Haloxylion scopariae Eig 1946 em. Danin et Solomeshch 1998 nom. mut.

Syn.: Haloxylon articulati Eig 1946.

Diagnostical secies: *Astragalus asterias, Ceratocephala falcata, Hordeum glaucum, Koelpinia linearis, Leontodon laciniatum, Malva aegyptia, Neotorularia torulosa.*

Nomenclatural type: Haloxyletum scopariae Zohary et Feinbrun 1951.

Synoptic table: Table 14.

The associations of this alliance are confined to Loessial Serozem at the climatic range of 80-250 mm mean annual rainfall and at elevation of 250-1000 m a.s.l. The mature Loessial Serozem has a saline layer (Bsa) at a depth of 50-150 cm. The loessial material is mainly air-borne dust deposited on the whole area, trapped on slopes and plains with appropriate conditions (Danin & Ganor, 1991, 1997). Particles are further transported by rain-water downslope (Yair & Danin, 1980) or towards the valleys where they constitute alluvial terraces of the large dry water courses. The fine-grained material passes pedogenetic processes which lead to salts accumulation at depth (Yaalon, 1963). During the process of loess deposition, sand grains derived from the sand dunes of NE Sinai mix with the loess at varying proportions. This process strongly affect soil texture, moisture and salinity regime and thus vegetation composition. When not cultivated or strongly trampled there is a microbiotic crust dominated by filamentous cyanobacteria at the soil surface of this alliance (Danin et al., 1989). The crust has an important role in the moisture regime, by influencing run-off, and of vegetation composition by influencing the penetrability of soil surface to plant diaspores.

The leading species in this alliance are the xerohalophyte chenopods *Anabasis syriaca* and *Haloxylon scoparium* (Danin, 1978b). They seem to replace each other where the former dominates in the less xeric conditions than the latter. The moistest but still saline sites are dominated by the Zygophyllaceae xerohalophyte *Peganum harmala.* When plowed, this habitat supports a weed association dominated by the non-halophytic Asteraceae *Achillea santolina.*

The phytogeographic analyses of the associations are presented in Figs. 39 and 40. The climatic gradient from the boundary of the Mediterranean territory with 250 mm annual rainfall (AAH01) through the associations with higher serial number is reflected in the replacement of the high values of the Mediterranean chorotype by IT, SA, and IT-SA chorotypes. The highest Irano-Turanian score is that of AAH03 which develops at high elevations of the Central Negev where climate is cold and dry. The amelioration of moisture regime as a result of plowing increase much the percentage of the mesophytic chorotypes (M and M-IT) and decrease the success of the xerophytes (IT, SA, and IT-SA).

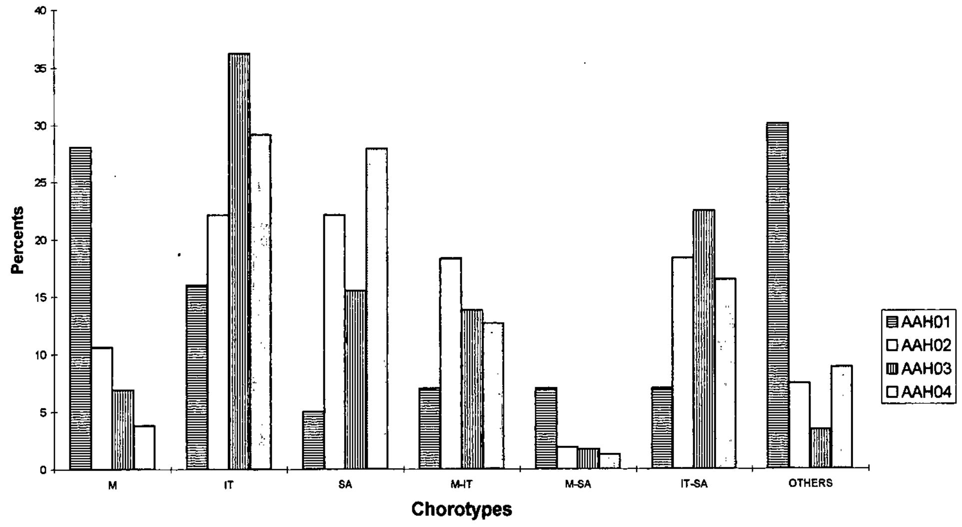

Figure 39. Phytogeographical analysis of associations AAH01 - AAH04.

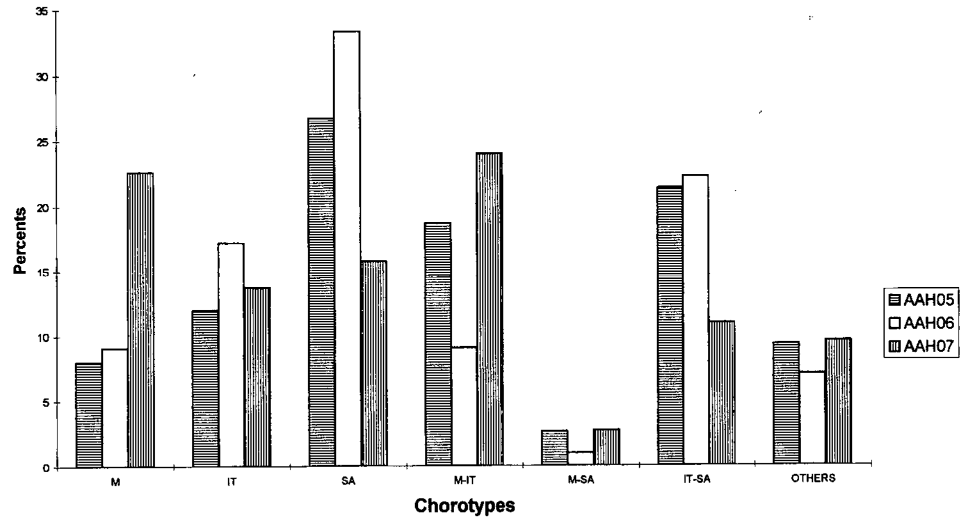

Figure 40. Phytogeographical analysis of associations AAH05- AAH07.

6.3.1.2.1 AAH01 Peganetum harmalae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 12. **Distribution:** Fig. 41.

Ecological notes: This association occurs at elevation of 200-300 m, in wetter areas than AAH02. It is rather rich in annual grasses of steppes in general and as other associations of the alliance it has but a few companions which are not ephemerals. The dominant was regarded (Zohary, 1972) as a plant of "roadsides and other ruderal sites in deserts and steppes", but it looks as a true xerohalophyte. Whereas ruderal plants may be found mainly in sites of garbage heaps or on past Bedouin encampments, *Peganum harmala* dominates in the N Negev in geomorphologically predictable habitats which follow certain ecological rules or sequence. It is the least resistant xerohalophyte on Loessial Serozem and replaces *Anabasis syriaca.* During the last 20-30 years when considerable areas at the vicinity of Beer Sheva left fallow and were not plowed even rarely by Bedouin, *Peganum harmala* returned and became dominant. In N Africa it is already known long ago as a halophyte or ruderal (Lemé, 1965, pers. comm.). Loessial Serozem dominated by *Peganum harmala* occur around Beer Sheva. It could have covered a larger area before intensive cultivation decreased the size of natural habitats and vegetation.

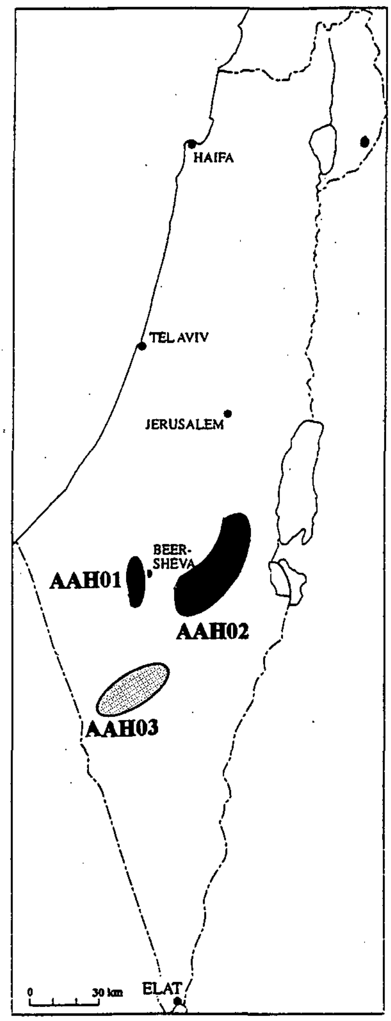

Figure 41. Distribution map of associations AAH01, AAH02, and AAH03.

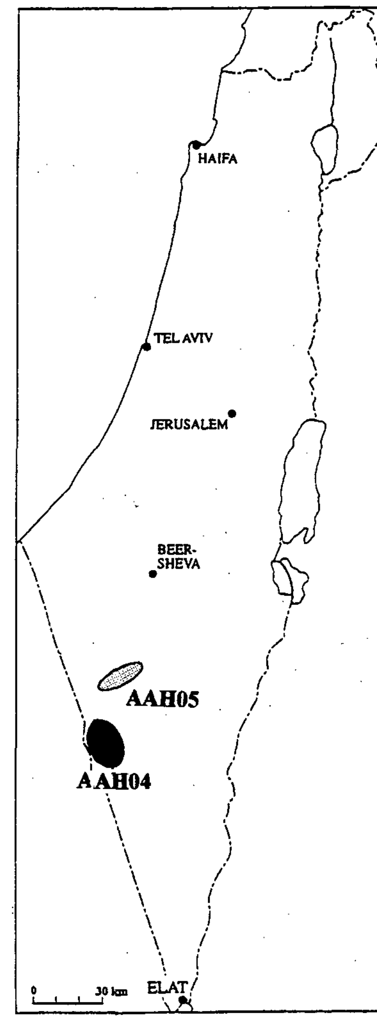

Figure 42. Distribution map of associations AAH04 and AAH05.

Association dynamics and conservation: The area of this association is under intensive overgrazing, trampling, and cutting for many years. Small areas with local protection occur within the belt of afforestation near the highways and enabled the recovery of natural habitat. The relevés were recorded south of Beer Sheva in an area which is not cultivated for a few dozen years.

Aspects of the association: Persistents – 3 spp.; ephemerals – 54 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	97089	20	10	21	09.04.97	I 2311 5642
2	97090	30	10	30	09.04.97	I 2311 5642
3	97091	20	10	30	09.04.97	I 2310 5642
4	97092	25	15	27	09.04.97	I 2310 5643
5	97093	40	20	25	09.04.97	I 2310 5644
6	97094	15	15	29	09.04.97	I 2309 5644
7	97095	15	15	24	09.04.97	I 2309 5645
Average:		23.6	13.6	26.6		

6.3.1.2.2 AAH02 Plantago coronopi – Anabasietum syriacae Eig 1946 nom. mut., nom. inv.

Diagnostical species: the markers in table 12.

Ecological notes: In the southern Judean Desert north of Arad and in southern Judean Mts., south of Yattir, this association developing on Loessial Serozem marks the boundary of persistent xerohalophytes towards the semi-steppe bathas of the Ballotetea. It occurs within the isohyet range of 150-200 mm and may suffer from desiccation in drought years and prosperous vegetation in rainy years. Being a xerohalophyte (Danin, 1978b) *A. syriaca* recycles salts derived from deep soil layers and deposited by the salt containing dry stems on the leached soil surface. As a result, the vicinity of the mother plant may become a site where its seedlings have biological advantage over the herbaceous glycophytes. Circles free of annuals occur around *A. syriaca* plants in many places.

Much of the area of this association is plowed in the average and in rainy years. *A. syriaca* withstands superficial plowing and recover fast after the fields become abandoned. There is not even one additional persistent marker and the occasional persistents have a low value of presence and cover. Zohary (1962; 1982b) regarded it as a postsegetal community. We follow Danin (1970) and Danin et al., (1975) in the view that *A. syriaca* is an indigenous plant of the natural ecosystems of the studied area confined to a certain climatic-edaphic complex; the superficial cultivation of the area does not change this status.

Distribution: Fig. 41. This association occurs at the northern Negev and the southern Judean Desert (AH1 in Danin et al., 1975). Detailed distribution of this association is presented in the vegetation map of Danin et al., (1975: as AH1) north of latitude line 30°50'.

Association dynamics and conservation: There is a tremendous difference in the physiognomy of the association in rainy year when all the area among the semishrubs bloom versus dry years when only *A. syriaca* and its rare persistent companions are seen. Much of the area of this association is under a constant process of recovery from overgrazing and cutting for the last decades. From time to time Bedouin may even go for the lignified base of the plant which gives smoke with an unpleasant smell when burnt. The Bedouin uproot the plants and dry them for a long time.

Aspects of the association: Persistents – 7 spp.; ephemerals – 79 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00309	27	3	30	02.04.67	I 2148 5712
2	00311	38	2	36	02.04.67	I 2142 5717
3	00312	27	3	30	02.04.67	I 2132 5719
4	00313	27	3	43	03.04.67	I 2173 5738
5	00315	27	3	39	05.05.67	I 2158 5738
6	00316	27	3	38	05.04.67	I 2155 5738
7	00372	1	5	19	17.05.67	I 1788 5056
8	00373	1	5	21	17.05.67	I 1788 5056
Average:		21.9	3.4	32.0		

6.3.1.2.3 AAH03 Ferulo biverticillatae – Anabasietum syriacae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 11.

Ecological notes: The area of this association differs from that of AAH02 by the climatic conditions in which they prevail. Although receiving only 80-100 mm of rainfall annually (versus 150-200 mm), AAH03 enjoys lower temperatures at its higher elevation. This might be the explanation to environmental conditions enabling the growth of differential species such as *Ferula biverticillata, Trigonella astroites, Colchicum tunicatum, Tragompogon collinus, Iris regis-uziae, Loliolum subulatum*, and *Valerianella dufresnia.* A common weed of Mediterranean wheat and barley fields, *Leontice leontopetalum*, grows in this association on slopes that were not plowed in this century. It may be regarded as a primary habitat of this plant.

Distribution: Fig. 41. This association occurs in the Central Negev Highlands at elevation of 700-1000 m. Detailed areas of this association are presented in the vegetation map of Danin et al., (1975), marked as AH1 south of latitude 30°45' and north of latitude 30°30', at area unit 8.

Association dynamics and conservation: The area of this association is practically protected from overgrazing and cutting for the last 35 years. Most of the area was not plowed for at least several decades or even more.

Aspects of the association: Persistents – 2 spp.; ephemerals – 57 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94339	20	5	24	22.03.94	I 1652 4938
2	94340	40	7	29	22.03.94	I 1652 4938
3	94341	30	5	23	22.03.94	I 1652 4938
4	94342	30	10	21	22.03.94	I 1652 4938
5	94343	30	10	28	22.03.94	I 1652 4938
6	94344	10	7	32	22.03.94	I 1652 4938
7	94345	20	10	30	22.03.94	I 1652 4938
Average:		25.7	7.7	26.7		

Table 12. Association tables of AAH02 – Plantago coronopi – Anabasietum syriacae, AAH01 – Peganetum harmalae and AAH05 – Erucario microcarpae – Haloxyletum scopariae

			AAH01				AAH02				AAH05			
			*1234567	C1	C2	%P	*12345678	C1	C2	%P	*123456789	C1	C2	%P
	A	Achillea fragrantissima									0........	1	0	11
	A	Achillea santolina	.1+....	8	2	29								
	W	Adonis dentata	+.+++++	**0**	**0**	**86**	.....+..	0	0	13	....++.++	0	0	44
	W	Aegilops kotschyi	+......	0	0	14								
	W	Aizoon hispanicum									...+...++	0	0	33
	W	Allium ampeloprasum									+........	0	0	11
	A	Allium rothii					.....+..	0	0	13				
	A	Alyssum linifolium					..++....	0	0	25				
	A	Alyssum marginatum									......+..	0	0	11
	F	Ammochloa palaestina	.+.0++.	1	1	57	...+++..	0	0	38	..++....+	0	0	33
*	N	Anabasis articulata									.1.......	10	1	11
*	A	Anabasis syriaca					99999999	**99**	**99**	**100**				
	W	Anagallis arvensis	....+++	0	0	43					+...+....	0	0	22
	W	Anchusa aegyptiaca					.....+..	0	0	13	...+.....	0	0	11
	H	Anemone coronaria									....+....	0	0	11
	W	Anthemis melampodina					+1+01++.	**4**	**3**	**88**				
	H	Anthemis pseudocotula	1211221	**16**	**16**	**100**					+.++..+++	**0**	**0**	**67**
	W	Arnebia decumbens									+.....++.	0	0	33
*	A	Artemisia sieberi					......+.	0	0	13	.+0013110	**10**	**8**	**89**
	H	Asphodelus ramosus									.+.......	0	0	11
	A	Asteriscus hierochunticus					+.......	0	0	13	..+....+.	0	0	22
	W	Astragalus asterias	.++++++	**0**	**0**	**86**					+.+......	0	0	22
	A	Astragalus callichrous	+...+..	0	0	29					+........	0	0	11
	A	Astragalus caprinus	..+..+.	0	0	29								
	A	Astragalus hispidulus	.+..++.	0	0	43					+.+..++..	0	0	44
	W	Astragalus tribuloides	..++.+.	0	0	43	++++....	0	0	50	++.+..+++	**0**	**0**	**67**
*	W	Atractylis phaeolepis					.+......	0	0	13	......+..	0	0	11
	A	Avena wiestii	...+...	0	0	14								
	A	Bellevalia desertorum									..+......	0	0	11
	A	Bellevalia eigii									+++......	0	0	33
	A	Bellevalia stepporum					....+...	0	0	13				
	H	Biscutella didyma					.+++....	0	0	38	....++...	0	0	22
	A	Boissiera squarrosa					++.+.++.	**0**	**0**	**63**				
	H	Bromus fasciculatus					+.+.++..	0	0	50	+......+.	0	0	22

Table 12. continued.

			AAH01				AAH02				AAH05			
			1234567	C1	C2	%P	12345678	C1	C2	%P	123456789	C1	C2	%P
	H	Bromus tectorum					+..1+...	3	1	38				
	A	Buglossoides arvensis									.....+...	0	0	11
	A	Buglossoides tenuiflora					+.......	0	0	13				
	H	Bupleurum lancifolium									.....+....	0	0	11
	W	Calendula arvensis	5++1.+.	**12**	**9**	**71**					+........	0	0	11
	N	Calendula tripterocarpa					+..+++..	0	0	50				
	A	Carex pachystylis					++2316+.	**17**	**15**	**88**	..2...5..	35	8	22
	W	Carrichtera annua	++1....	5	2	43					...1+..++	3	1	44
	H	Carthamus tenuis	+++++.+	**0**	**0**	**86**								
	A	Centaurea ammocyanus					.......+	0	0	13				
	H	Centaurea hyalolepis	+++1+21	**6**	**6**	**100**								
	W	Centaurea pallescens					+.+++...	0	0	50				
	A	Ceratocephala falcata					......+.	0	0	13	...++..+0	0	0	44
	H	Chaetosciadium trichospermum									........+	0	0	11
	D	Chrysanthemum coronarium	....+..	0	0	14								
	W	Cnicus benedictus	....+..	0	0	14					..+...++..	0	0	33
	A	Colchicum ritchii	.++..++	0	0	57								
	A	Colchicum tunicatum					+++++.+1	**1**	**1**	**88**				
	A	Crithopsis delileana	2652+12	**26**	**26**	**100**								
	H	Cuscuta planiflora									......+..	0	0	11
	R	Cutandia memphitica	.+++...	0	0	43	..++.++.	0	0	50	.......++	0	0	2
	A	Cymbolaena griffithii					++...+0.	1	1	50				
	W	Diplotaxis harra					++.+++.+	**0**	**0**	**75**	.....+...	0	0	11
	W	Emex spinosa	...+1++	3	1	57					+++++++..	**0**	**0**	**78**
	W	Enarthrocarpus strangulatus									+++++.+..	**0**	**0**	**67**
	A	Eremopyrum bonaepartis					......+.	0	0	13				
	A	Eremopyrum distans					1.++.++..	**2**	**1**	**63**				
	W	Erodium ciconium					+..+.+...	0	0	38	.+.......	0	0	11
	W	Erodium crassifolium	.+..++.	0	0	43	+..+...+	0	0	38	.+.++1+++	**2**	**2**	**78**
	R	Erodium laciniatum	.++....	0	0	29								
	W	Erodium moschatum									++.......	0	0	22
	W	Erodium touchyanum					.++.....	0	0	25				
	W	Erucaria microcarpa	+......	0	0	14					37685+1+0	**34**	**34**	**100**
	W	Euphorbia chamaepeplus					+..++...	0	0	38	.....+...	0	0	11
*	A	Fagonia mollis					0.......	1	0	13				
	W	Filago desertorum	210121+	**11**	**11**	**100**	+1.+++++	**1**	**1**	**88**	++++..+++	**0**	**0**	**78**
	H	Fumaria bracteosa									....+....	0	0	11
	H	Gagea chlorantha									......+.+	0	0	22
	W	Gagea reticulata									.++......	0	0	22
	W	Gastrocotyle hispida	+.++.+.	0	0	57	+++..+..	0	0	50	++.+.....	0	0	33
	W	Gymnarrhena micrantha	.+..+.+	0	0	43					......++9	32	11	33
	H	Gynandriris sisyrinchium	.....+.	0	0	14								
*	S	Halothamnus acutifolius					.0......	1	0	13				
*	A	Haloxylon scoparium									999971859	**77**	**77**	**100**
	H	Hedypnois cretica	.+.....	0	0	14								
	W	Helianthemum ledifolium					+++0++++	**1**	**1**	**100**	..++..++.	0	0	44
	W	Helianthemum salicifolium					.+......	0	0	13	...++....	0	0	22
*	A	Helianthemum ventosum					.+......	0	0	13				
*	A	Helianthemum vesicarium									...0+....	3	1	22
	W	Herniaria hirsuta					.+....+.	0	0	25	+...+....	0	0	22
	H	Hippocrepis unisiliquosa					...++...	0	0	25				
	D	Hordeum glaucum	...++..	0	0	29	....++..	0	0	25	+.......+	0	0	22
	H	Hymenocarpos circinnatus	.....++	0	0	29								
	R	Ifloga spicata	+.....+	0	0	29								
*	W	Kickxia floribunda					.......+	0	0	13				
	W	Koelpinia linearis	.++..+.	0	0	43					..+......	0	0	11
	W	Lappula spinocarpos									+....+++.	0	0	44
	W	Leontodon laciniatus	.+++++.	**0**	**0**	**71**					++++..+.+	**0**	**0**	**67**
	H	Leopoldia comosum	..+....	0	0	14								
	A	Leopoldia longipes					..+.....	0	0	13				
	A	Leptaleum filifolium					....++..	0	0	25				
	C	Leysera leyseroides					.+......	0	0	13				

Table 12. continued.

			AAH01				AAH02				AAH05			
			1234567	C1	C2	%P	12345678	C1	C2	%P	123456789	C1	C2	%P
*	S	Limonium pruinosum									+........	0	0	11
	W	Linaria haelava	.+..+1+	3	1	57	...+.++.	0	0	38	......+.+	0	0	22
	A	Loliolum subulatum					......+.	0	0	13				
	W	Lomelosia porphyroneura					++++.++.	**0**	**0**	**75**	.....+...	0	0	11
	A	Malabaila secacul									+........	0	0	11
	W	Malva aegyptia					..++3+..	8	4	50	+1.....++	3	1	44
	D	Malva parviflora					..+.....	0	0	13	+++.+....	0	0	44
	W	Malva sylvestris									+........	0	0	11
	W	Matthiola livida	....++.	0	0	29	0....0+1	5	3	50	+.++++.++	**0**	**0**	**78**
	W	Medicago laciniata	.....+.	0	0	14					..++.....	0	0	22
	W	Medicago radiata					...++++.	0	0	50				
	H	Medicago rotata									....+....	0	0	11
	W	Minuartia picta									....+....	0	0	11
*	A	Moricandia nitens					......+.	0	0	13				
	W	Neotorularia torulosa	..+++++	**0**	**0**	**71**	...+++++	**0**	**0**	**63**	+.++.....	0	0	33
*	A	Noaea mucronata	..+....	0	0	14	......+.	0	0	13				
	W	Onobrychis crista-galli	+++....	0	0	43					+.+......	0	0	22
	H	Ononis mollis									+........	0	0	11
	W	Ononis sicula									....++...	0	0	22
	A	Onopordum alexandrinum	+++...+	0	0	57								
	H	Ornithogalum neurostegium									.+.......	0	0	11
	A	Ornithogalum trichophyllum									+..+..+++	0	0	56
*	A	Peganum harmala	9999999	**99**	**99**	**100**								
*	V	Phagnalon rupestre	.+.....	0	0	14								
	W	Phalaris minor	...+...	0	0	14	.....+..	0	0	13				
	W	Picris longirostris									......+1+	3	1	33
	H	Pisum sativum									+........	0	0	11
	W	Plantago coronopus	++++312	**9**	**9**	**100**	+.+.....	0	0	25	+++++++++	**0**	**0**	**100**
	W	Plantago notata	...+...	0	0	14					..+......	0	0	11
	W	Plantago ovata	...+...	0	0	14	.+++..+.	0	0	50	.+.++....	0	0	33
	A	Plantago phaeostoma					+..+....	0	0	25	......++.	0	0	22
	W	Poa sinaica					.+.+.+..	0	0	38	...+....+	0	0	22
	S	Pteranthus dichotomus					+++.++80	**12**	**11**	**88**	.......++	0	0	22
	W	Pterocephalus brevis					+.+++..+	**0**	**0**	**63**				
*	S	Reaumuria hirtella					......0.	5	1	13	....+1.00	5	2	44
	W	Reichardia tingitana	.++....	0	0	29					+..+..+.+	0	0	44
	W	Reseda decursiva					++++..++	**0**	**0**	**75**	+...+++.+	0	0	56
	W	Roemeria hybrida					.+....+.	0	0	25	....+++++	0	0	56
	H	Rostraria smyrnacea	++12.+.	**6**	**4**	**71**	.+.++..+	0	0	50	......+.+	0	0	22
	W	Rumex cyprius									....+1...	5	1	22
	S	Salsola inermis					+.+.++..	0	0	50				
*	A	Salvia lanigera					.+......	0	0	13	....+.+..	0	0	22
	W	Schismus arabicus					+...+.+.	0	0	38	+++...++.	0	0	56
	W	Scilla hanburyi									..++.....	0	0	22
	W	Scorzonera judaica					......+.	0	0	13	..+...+..	0	0	22
	H	Scorzonera papposa					...+.+++	0	0	50				
	W	Senecio glaucus	.+....+	0	0	29	.++.+...	0	0	38	311+..+++	**7**	**6**	**78**
	W	Silene alexandrina									....+++..	0	0	33
	A	Silene coniflora					....+.+.	0	0	25				
	W	Silene decipiens	+.+++..	0	0	57								
	W	Silene vivianii	.....++	0	0	29	++++..+.	**0**	**0**	**63**				
	S	Spergularia diandra					+.+.+.+.	0	0	50	........+	0	0	11
	W	Stipa capensis					87855318	**56**	**56**	**100**	..++..180	19	10	56
*	B	Thymelaea hirsuta									+........	0	0	11
	W	Tordylium aegyptiacum									+........	0	0	11
	H	Trifolium tomentosum	+++1+.+	**2**	**1**	**86**								
	W	Trigonella arabica	.+.+.++	0	0	57					3+...++..	8	3	44
	A	Trigonella astroites					...+....	0	0	13				
	H	Trigonella monspeliaca									.....+...	0	0	11
	W	Trigonella stellata	+.++..+	0	0	57					..+...30+	9	4	44
	A	Tulipa systola									........+	0	0	11

Table 12. continued.

		AAH01 1234567	C1	C2	%P	AAH02 12345678	C1	C2	%P	AAH05 123456789	C1	C2	%P
A	Urginea undulata									.+......+	0	0	22
A	Valerianella dufresnia					+.....+.	0	0	25				
A	Vicia monantha									.+.......	0	0	11
W	Vicia narbonensis									+........	0	0	11
H	Vicia peregrina									+........	0	0	11
H	Vicia sativa									+........	0	0	11
A	Zosima absinthiifolia									.....+...	0	0	11
* N	Zygophyllum dumosum									13000	10	6	56

6.3.1.2.4 AAH04 Helianthemo ledifolii – Anabasietum syriacae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 11.

Ecological notes: This association occurs in drier areas than the other Anabasietum syriacae (AAH02 and AAH03) but still at elevation of 700-900 m. It is rather rich in annual grasses of steppes in general, e.g., *Stipa capensis*, and steppe plants of high elevations e.g. *Boissiera squarrosa, Eremopyrum bonaepartis,* and *E. distans.*

Association dynamics and conservation: The area of this association is practically protected from overgrazing and cutting for the last 35 years.

Distribution: Fig. 42. Detailed areas of this association are presented in the vegetation map of Danin et al., (1975), marked as AH1 south of latitude line 30°30' at areas number 8 and 12.

Aspects of the association: Persistents – 11 spp.; ephemerals – 68 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94395	30	5	35	11.04.94	I 1572 4848
2	94396	30	10	31	11.04.94	I 1572 4848
3	94397	35	7	28	11.04.94	I 1572 4848
4	94398	40	7	37	11.04.94	I 1572 4848
5	94399	40	10	29	11.04.94	I 1572 4848
6	94402	30	7	32	11.04.94	I 1572 4848
7	94403	20	5	35	11.04.94	I 1572 4848
8	94439	30	5	16	11.04.94	I 1583 4867
Average:		31.9	7.0	30.4		

6.3.1.2.5 AAH05 Erucario microcarpae – Haloxyletum scopariae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 12. **Distribution:** Fig. 42.

Ecological notes: The typical substratum where this association is found is stony colluvium at the pediment of slopes with fissured limestone. There is a gradual transition from this association to the Haloxyletum scopariae (AAH06) which is confined to Loessial Serozem with hardly any stones. The stony component of the soil contributes moisture to the fine-grained soil leading to a better leaching of the soil. This is expressed by a higher number of species/relevé (33.7) in this association (versus 27 in AAH06) and the lower number of species with sociotype S in this association (4) when compared with AAH06 (8). A salinity profile studied in the Northern Negev is discussed by Danin (1978b).

Association dynamics and conservation: This area has moderate grazing and the most prominent differences are seen between years with low quantity of rainfall, when persistents are seen in the area versus moist years when many ephemeral species with much phytomass develop.

Aspects of the association: Persistents – 11 spp.; ephemerals – 97 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00409	19	1	46	17.03.67	I 1853 5528
2	00420	48	12	26	18.03.67	I 1816 5313
3	00481	45	5	32	21.03.67	I 1785 5305
4	00484	32	8	31	21.03.67	I 1785 5306
5	84001	10	10	32	14.03.84	I 1775 5310
6	84002	10	10	25	14.03.84	I 1780 5305
7	84003	3	7	39	14.03.84	I 1785 5305
8	84004	2	1	33	14.03.84	I 1788 5310
9	84005	10	5	39	14.03.84	I 1789 5310
Average:		19.9	6.6	33.7		

6.3.1.2.6 AAH06 Haloxyletum scopariae Zohary et Feinbrun 1951 nom. mut.

Diagnostical species: the markers in table 13.

Ecological notes: The most common habitat of this association is Loessial Serozem in the valleys and alluvial terraces of large water courses. The association was dealt by Orshan & Zohary (1963) as part of the gradient of loess-sand mixture. In the present system more than one Haloxyletum scopariae is recognized and that of Orshan & Zohary (1963) is placed under Retametea (see DSH01, Sect. 6.6.2.1.2.1). The relevés of the present association are derived from the areas which have rather small quantities of sand. When undisturbed the leached soil among the shrubs support large quantities of *Erodium crassifolium*. This may be associated with the fact that a well developed microbiotic crust rich in filamentous cyanobacteria nearly seal the soil surface from seed penetration; the diaspore of *E. crassifolium* has a drilling mechanism which assists the sharp tip to penetrate into the narrow fissures in the crust. Disturbed habitats exist where borrowing animals such as ants, scorpions, rodents, and porcupines bring up soil from deeper layers. In these places *Salsola inermis* (Semach, 1974; Danin, 1994) and other colonizers prosper after the local crust destruction.

Distribution: Fig. 43. This association occurs at the elevation range of 200-700 m on loessial plains in small or large valleys of the Negev Highlands or its foothills.

Association dynamics and conservation: There is a tremendous difference in the physiognomy of the association in rainy year when all the area among the semishrubs bloom versus dry years when only *Haloxylon scoparium* and its rare persistent companions are seen.

Aspects of the association: Persistents – 22 spp.; ephemerals – 77 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00114	10	20	47	23.04.64	I 1747 5287
2	00419	1	2	13	18.03.67	I 1816 5315
3	00421	1	4	14	18.03.67	I 1816 5313
4	00422	1	4	15	18.03.67	I 1816 5310
5	00467	5	5	32	21.03.67	I 1861 5375
6	00472	8	2	34	21.03.67	I 1791 5312
7	00473	4	4	35	21.03.67	I 1792 5311
8	00474	6	14	35	21.03.67	I 1789 5294
9	00475	8	7	29	21.03.67	I 1788 5294
10	00477	5	5	22	21.03.67	I 1790 5289
11	00478	4	6	26	21.03.67	I 1791 5288
12	00479	4	6	30	21.03.67	I 1790 5289
13	00480	5	5	28	21.03.67	I 1792 5291
14	00483	4	1	20	21.03.67	I 1784 5304
Average:		4.7	6.1	27.1		

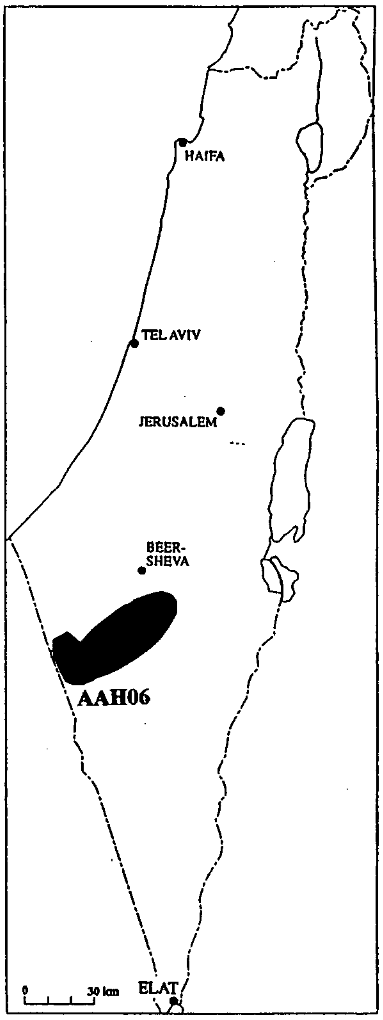

Figure 43. Distribution map of association AAH06.

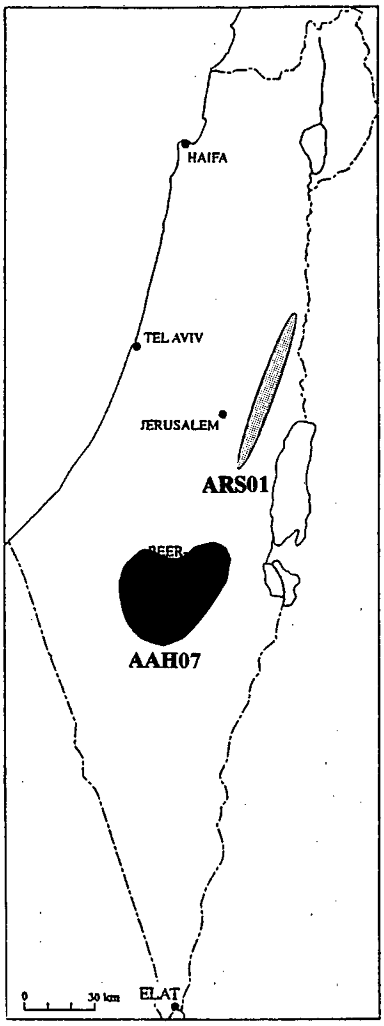

Figure 44. Distribution map of associations AAH07 and ARS01.

Table 13. Association tables of AAH06 – Haloxyletum scopariae and AAH07 – Achilletum santolinae.

		Species	AAH06				AAH07			
			*12345678901234	C1	C2	%P	1234567890	C1	C2	%P
	A	Achillea santolina					5755382862	**52**	**52**	**100**
	H	Adonis aestivalis					...++.....	0	0	20
	W	Adonis dentata	.....+.....+..	0	0	14	++++..++..	0	0	60
	W	Aegilops kotschyi					......+...	0	0	10
	W	Aizoon hispanicum	........+.....	0	0	7				
*	H	Alcea acaulis					...+.+....	0	0	20
*	B	Alkanna strigosa					.....+....	0	0	10
	W	Allium ampeloprasum					..++......	0	0	20
	A	Allium rothii	.....+........	0	0	7				
	F	Allium sindjarense	....+.........	0	0	7				
	H	Allium stamineum	+.............	0	0	7				
	A	Alyssum linifolium	....+...+.++..	0	0	29				
	F	Ammochloa palaestina	.......+......	0	0	7				
*	N	Anabasis articulata	+.111.........	9	3	29				
*	A	Anabasis syriaca	...+..........	0	0	7	+.....9...	50	10	20
	W	Anagallis arvensis					++...++.++	**0**	**0**	**60**
	W	Anchusa aegyptiaca					+.........	0	0	10
*	H	Anchusa azurea					+.........	0	0	10
*	A	Andrachne telephioides					.+.+......	0	0	20

Table 13. continued.

		Species	AAH06				AAH07			
			12345678901234	C1	C2	%P	1234567890	C1	C2	%P
	H	Anemone coronaria	....+.........	0	0	7				
	H	Anthemis palestina	+......+......	0	0	14				
	H	Anthemis pseudocotula	......+.......	0	0	7	.++....+.+	0	0	40
*	F	Argyrolobium uniflorum	+.............	0	0	7				
	W	Arnebia decumbens					....+.+...	0	0	20
	W	Arnebia linearifolia	+....++.......	0	0	21				
*	A	Artemisia sieberi	3..++..++++.+.	4	2	57				
	H	Asphodelus ramosus	+.............	0	0	7				
	W	Asphodelus tenuifolius					.........+	0	0	10
	N	Asteriscus hierochunticus	0....+.......+	2	0	21				
	B	Astoma seselifolium					+......2..	10	2	20
	A	Astragalus aleppicus					...+......	0	0	10
*	V	Astragalus amalecitanus	+.............	0	0	7				
	W	Astragalus asterias	......++...++.	0	0	29	+.....+.+.	0	0	30
	A	Astragalus callichrous					+.........	0	0	10
	A	Astragalus caprinus					+.++++....	0	0	50
	H	Astragalus hamosus					.++..+....	0	0	30
*	A	Astragalus spinosus	+.............	0	0	7				
	R	Astragalus tribuloides	+...+++.+..+++	0	0	57				
*	W	Atractylis phaeolepis	+...........+0	0	0	21				
	A	Atractylis prolifera	.+............	0	0	7				
*	A	Atractylis serratuloides					2	20	2	10
	A	Avena wiestii	......+4..+...	13	3	21	.........+	0	0	10
*	S	Bassia arabica	...1..........	15	1	7				
	A	Bellevalia desertorum	+.............	0	0	7	......+...	0	0	10
	A	Bellevalia eigii					.++.+++...	0	0	50
	H	Bromus fasciculatus					......+...	0	0	10
	H	Bromus scoparius					.........+	0	0	10
	H	Bunium paucifolium					...+......	0	0	10
	H	Bupleurum lancifolium					++++......	0	0	40
	H	Bupleurum nodiflorum					.+........	0	0	10
	H	Calendula arvensis	..+...++...++.	0	0	36	......+++.	0	0	30
	H	Cardaria draba					.22.......	20	4	20
	H	Carduus acicularis	.......+......	0	0	7				
	A	Carex pachystylis	.+..18...+10.2	19	9	50				
	W	Carrichtera annua	+.+...++......	0	0	29	+.....+...	0	0	20
	H	Carthamus tenuis					......+...	0	0	10
*	A	Centaurea aegyptiaca	+.............	0	0	7				
	A	Centaurea ammocyanus	......++++++..	0	0	43				
	H	Centaurea hyalolepis					.+.+....+.	0	0	30
	H	Centaurea iberica					+....+....	0	0	20
	D	Cephalaria syriaca					.+........	0	0	10
	A	Ceratocephala falcata	....++++......	0	0	29				
	H	Chaetosciadium trichospermum					+.........	0	0	10
	H	Cichorium endivia					.......+..	0	0	10
	W	Cnicus benedictus	...+..........	0	0	7	......+...	0	0	10
	A	Colchicum ritchii					+.+.......	0	0	20
	A	Colchicum tunicatum	.21.+..+++.++.	4	2	57				
	R	Consolida flava					.........+	0	0	10
	D	Convolvulus stachydifolius					++..+.....	0	0	30
	H	Coronilla scorpioides					...+......	0	0	10
	R	Crepis aculeata	+......+......	0	0	14				
	W	Crepis aspera					..+.....+.	0	0	20
	R	Cutandia memphitica	......+.......	0	0	7				
	H	Diplotaxis erucoides					.......7..	70	7	10
	W	Diplotaxis harra	7.........+.+ 23	5	21					
*	H	Echium angustifolium					53	40	8	20
	W	Emex spinosa	.....+++.....+	0	0	29				
	W	Erodium crassifolium	.5898042898993	**64**	**60**	**93**	......+...	0	0	10
	R	Erodium laciniatum	..........+++.	0	0	21				
	S	Erodium oxyrhynchum	.++++++...++..	0	0	57				

Table 13. continued.

		Species	AAH06				AAH07			
			12345678901234	C1	C2	%P	1234567890	C1	C2	%P
	W	Erucaria microcarpa	1...+++++....+	1	1	50	+++..1+...	2	1	50
	W	Erucaria rostrata					++++.++...	**0**	**0**	**60**
	H	Eryngium creticum					.+......++	0	0	30
	W	Euphorbia chamaepeplus	+.......+...+.	0	0	21	+.........	0	0	10
	A	Euphorbia grossheimii	.+...++..+.+.+	0	0	43				
	H	Filago contracta					+.........	0	0	10
	W	Filago desertorum	..+.+++++...+.	0	0	50	++++.+0.32	**7**	**6**	**80**
	H	Filago pyramidata					.++.......	0	0	20
	H	Fumaria bracteosa					+....+.+..	0	0	30
	W	Gagea reticulata	+.+.++..++.+..	0	0	50				
	W	Gastrocotyle hispida	.+..+++.++++.+	**0**	**0**	**64**	+++++.+...	**0**	**0**	**60**
	H	Geranium tuberosum					.......+..	0	0	10
	A	Glaucium corniculatum					.+.+.+....	0	0	30
	A	Glaucium grandiflorum					+..2......	10	2	20
	H	Gundelia tournefortii					++...+.+..	0	0	40
	W	Gymnarrhena micrantha	++..+++.+++++4	**4**	**3**	**79**				
*	N	Gymnocarpos decander	+.............	0	0	7				
	H	Gynandriris sisyrinchium	....+.........	0	0	7				
*	B	Gypsophila arabica	...........+..	0	0	7				
	A	Gypsophila pilosa					.++0......	2	1	30
*	A	Haloxylon scoparium	+9877999999999	**85**	**85**	**100**				
*	H	Haplophyllum buxbaumii					.......+..	0	0	10
*	R	Haplophyllum tuberculatum					....+....0	3	1	20
*	A	Helianthemum kahiricum	1.............	15	1	7				
	W	Helianthemum ledifolium	.......++.....	0	0	14				
*	A	Helianthemum ventosum	1.............	10	1	7				
	T	Heliotropium europaeum					+.........	0	0	10
*	B	Heliotropium rotundifolium					.........+	0	0	10
	W	Herniaria hirsuta	.....+.++.....	0	0	21	..+.....++	0	0	30
	H	Hippocrepis unisiliquosa					++++......	0	0	40
	H	Hymenocarpos circinnatus					.+...+....	0	0	20
	A	Hyoscyamus reticulatus					+++++..1..	**3**	**2**	**60**
	R	Ifloga spicata					........0.	5	1	10
	A	Ixiolirion tataricum					+++..+....	0	0	40
*	W	Kickxia floribunda					........++	0	0	20
	W	Koelpinia linearis	.....++.......	0	0	14	..+.......	0	0	10
	W	Lappula spinocarpos	+.+.+++++++++.	**0**	**0**	**79**				
	W	Lathyrus pseudocicera					.++++.....	0	0	40
	C	Launaea nudicaulis					....+...+.	0	0	20
	R	Launaea fragilis					........+.	0	0	10
	A	Leontice leontopetalum	.....+42+.....	15	4	29	++.0++....	1	1	50
	A	Leontodon laciniatus	....++.+..+++.	0	0	43	......+.++	0	0	30
	W	Leopoldia longipes	.........+....	0	0	7	+.+.+.....	0	0	30
*	A	Limonium pruinosum	+.............	0	0	7				
	S	Linaria albifrons	........+.+...	0	0	14	+....++...	0	0	30
	W	Linaria haelava	....+.+.......	0	0	14	......+...	0	0	10
	W	Lomelosia porphyroneura	+.............	0	0	7				
	R	Lotus halophilus					.........+	0	0	10
	A	Malabaila secacul					0.++..+...	1	1	40
	H	Malcolmia crenulata					.......+..	0	0	10
	W	Malva aegyptia	....+++1+.+.+.	1	1	50	.++.+.1...	3	1	40
	D	Malva parviflora					.++.......	0	0	20
	D	Malva sylvestris					.+..+..+..	0	0	30
*	D	Marrubium alysson					.+........	0	0	10
	W	Matthiola livida	0....+.+.++...	1	0	36	........++	0	0	20
	H	Matthiola longipetala					+.........	0	0	10
	W	Medicago laciniata	.....+++...++.	0	0	36				
	H	Medicago polymorpha					+.........	0	0	10
	H	Melilotus sulcatus					..+.......	0	0	10
	S	Mesembryanthemum nodiflorum	+.............	0	0	7				
*	A	Moricandia nitens	..0...........	5	0	7				
	W	Neotorularia torulosa					2+1.+....+	6	3	50

Table 13. continued.

		Species	AAH06				AAH07			
			12345678901234	C1	C2	%P	1234567890	C1	C2	%P
*	A	Noaea mucronata	+.............	0	0	7				
	H	Nonea philistaea					.......+..	0	0	10
	W	Onobrychis crista-galli					.....+....	0	0	10
	H	Ononis mollis					..+.....++	0	0	30
	A	Onopordum alexandrinum					+0++1+1.+1	**4**	**4**	**90**
	A	Onosma echinata					........+.	0	0	10
	A	Ornithogalum trichophyllum	.+.++.....+++.	0	0	43				
	W	Orobanche cernua					+..+......	0	0	20
	H	Pallenis spinosa					......+.0+	2	1	30
	W	Papaver humile					+++.......	0	0	30
	H	Papaver hybridum					+.+.......	0	0	20
*	A	Peganum harmala					0	5	1	10
*	V	Phagnalon rupestre					53	40	8	20
	W	Phalaris minor					..+.....+.	0	0	20
	H	Phalaris paradoxa					...+......	0	0	10
	H	Pimpinella cretica					...+......	0	0	10
	H	Pisum sativum					...++.....	0	0	20
*	R	Plantago albicans					+...+.+.36	18	9	50
	W	Plantago coronopus	+......++++.++	0	0	50	.+....+...	0	0	20
	H	Plantago lagopus					........+.	0	0	10
	W	Plantago ovata	....+.+.......	0	0	14				
	H	Poa bulbosa	+.............	0	0	7				
	H	Prangos ferulacea					...+......	0	0	10
	S	Pteranthus dichotomus	.....+...+..+.	0	0	21				
	W	Pterocephalus brevis					.+......++	0	0	30
*	S	Reaumuria hirtella	.10+1..++++.+.	**3**	**2**	**64**				
*	S	Reaumuria negevensis	2.............	20	1	7				
	W	Reichardia tingitana	......++...+++	0	0	36	........++	0	0	20
	W	Reseda decursiva					++......++	0	0	40
	H	Reseda luteola					+++0......	1	1	40
	H	Rhagadiolus stellatus					.......+..	0	0	10
	W	Roemeria hybrida	.....+......+.	0	0	14	.+++......	0	0	30
	H	Rostraria smyrnacea	+.............	0	0	7	.+.+.....+	0	0	30
	S	Salsola inermis	...+.+..+...++	0	0	36				
*	B	Salvia dominica					.......+..	0	0	10
*	A	Salvia lanigera					.........+	0	0	10
	H	Salvia samuelssonii					.......+..	0	0	10
	A	Salvia spinosa					++++.....+	0	0	50
	W	Schismus arabicus	0...++++..+.++	1	0	57	......+...	0	0	10
	W	Scilla hanburyi	+..++++.++.+.+	**0**	**0**	**64**				
	H	Scorpiurus muricatus					1+.+......	3	1	30
	W	Scorzonera judaica	+2+0-+++1+0+++	**3**	**3**	**100**				
	H	Scorzonera papposa	++0+..+++++++.	**0**	**0**	**79**	+++.......	0	0	30
	W	Senecio glaucus	+...+.++..++..	0	0	43	.++++.....	0	0	40
	B	Serratula pusilla					.+........	0	0	10
	H	Silene longipetala					.......+..	0	0	10
	W	Silene vivianii	..........+..+	0	0	14				
	W	Spergula fallax	+.............	0	0	7				
	S	Spergularia diandra	+.............	0	0	7	.++.......	0	0	20
	W	Stipa capensis	.....++...++.+	0	0	36	67	65	13	20
*	V	Stipa parviflora	+.............	0	0	7				
*	F	Stipagrostis ciliata	+.............	0	0	7				
	W	Tordylium aegyptiacum					++...++...	0	0	40
	H	Torilis nodosa					...+......	0	0	10
	H	Torilis tenella					.++.......	0	0	20
	T	Trifolium tomentosum					........++	0	0	20
	W	Trigonella arabica					.+1+3+3...	**12**	**7**	**60**
	H	Trigonella monspeliaca					+.........	0	0	10
	W	Trigonella stellata	+....++++..++.	0	0	50	......+...	0	0	10
	A	Tulipa systola					+..+......	0	0	20
	A	Urginea undulata	...++....+....	0	0	21				
	D	Vaccaria hispanica					++.+......	0	0	30
*	B	Verbascum fruticulosum					....+.+...	0	0	20

Table 13. continued.

	Species	AAH06 12345678901234	C1	C2	%P	AAH07 1234567890	C1	C2	%P
A	Vicia monantha	....+.++++....	0	0	36	.....+....	0	0	10
W	Vicia narbonensis					++.+1+1...	3	2	60
H	Vicia peregrina					.++++.....	0	0	40
H	Vicia sativa					..+.......	0	0	10
A	Zosima absinthiifolia	....+.........	0	0	7				
* N	Zygophyllum dumosum	2....0.0+++0.	4	2	57				

6.3.1.2.7 AAH07 Achilletum santolinae Eig 1946

Diagnostical species: the markers in table 13. **Distribution:** Fig. 44.

Ecological notes: *Achillea santolina,* which grows without cultivation in Brown Soils of the Ballotetea undulatae area and in wadis of the first order in the loessial plains of the Northern Negev, becomes common in drier habitats that are plowed constantly. It reproduces in these fields vegetatively and constitutes dense clones. There are a few companions, such as *Hyoscyamus reticulatus,* which do not grow elsewhere. The destruction of the microbiotic crust and the increase in roughness of the soil surface increase the penetrability of rain-water into the ground. The productivity of the ephemerals in the cultivated fields increase much when compared to the uncultivated soils.

This association occurs in loessial soils, cultivated for a long time in dry farming and planted with wheat or barley. When cultivated by modern methods the composition vary much from what presented above and the leading species become rare.

Association dynamics and conservation: The area of this association is constantly disturbed. In dry years when it is not plowed, grazing leads to consumption of all the remnants of plants in the area. The on-going plowing increase the proportion of plants resistant to this factor. Such plants are hemicryptophytes and geophytes with deep corm such as *Leontice leontopetalum, Bongardia chrysogonum, Onopordum alexandrinum, Tulipa systola,* and *Ixiolirion tataricum.*

Aspects of the association: Persistents – 17 spp.; ephemerals – 128 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00191	18	1	52	08.04.67	I 1963 5780
2	00280	18	0	53	05.05.67	I 2100 5770
3	00360	12	0	46	06.05.67	I 2115 5759
4	00361	20	0	41	06.05.67	I 2123 5765
5	00416	15	0	23	17.03.67	I 1820 5623
6	00450	18	0	24	20.03.67	I 2050 5742
7	00460	24	1	35	20.03.67	I 1900 5688
8	00856	8	0	19	17.03.70	I 2040 5828
9	00911	15	1	29	10.06.71	I 1715 5835
10	00919	20	1	33	10.06.71	I 1715 5835
Average:		16.8	0.4	35.5		

Table 14. Synoptic table of associations of the Class Artemisietea sieberi, Order Artemisietalia sieberi, Alliance Artemision sieberi: 1- AAA01, 2 – AAA02, 3 – AAA03, 4 – AAA04, 5 – AAA05, 6 – AAA06, 7 – AAA07, and Alliance Haloxylion scopariae: 8 – AAH04, 9 – AAH02, 10 – AAH03, 11 – AAH01, 12 – AAH05, 13 – AAH06

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P
	d.s. Artemisietea sieberi													
A	Artemisia sieberi		8	**100**	**100**	**100**	**100**	**100**		43	13		**89**	57
A	Carex pachystylis	14			11	17	**78**	21	**63**	**100**	**88**		22	50
W	Scorzonera judaica			**67**	**89**	8	**89**	50	50	**100**	13		22	**100**
W	Roemeria hybrida			22	33			29	**63**	14	25		56	14
W	Lappula spinocarpos			11	56	33	33	57	38	57			44	**79**
A	Avena wiestii	**71**	54	11	33	8		21		57		14		21
	d.s. Artemision sieberi													
A	Noaea mucronata	29	**100**	100	89	**100**	**100**	**93**			13	14		7
H	Ranunculus asiaticus	**71**	8	33	**67**	8	33	43	25					
A	Deverra tortuosa	**100**	15	33		17	**67**	29						
A	Centaurea aegyptiaca		54	11	**89**	25	56	**79**						7
A	Helianthemum vesicarium			**100**	**89**	50	**78**	43					22	
B	Teucrium capitatum	**86**	46	11	33		11	21						
B	Thymelaea hirsuta	14	**69**	22	**100**		11	36					11	
A	Helianthemum kahiricum		8	44	22	**83**		86						7
A	Helianthemum ventosum			**67**	11	**100**	56	43			13			7
H	Asphodelus ramosus	**100**	**69**	11	**89**			36	13				11	7
N	Gymnocarpos decander		23	**78**	33	**92**	22	**100**						7
V	Astragalus amalecitanus		8	56	11	42	11	50						7
	d.s. Haloxylion scopariae													
W	Neotorularia torulosa				11		44		**63**	**71**	**63**	**71**	33	
W	Leontodon laciniatus		8		11			14	50	29		**71**	**67**	43
D	Hordeum glaucum	29							25	43	25	29	22	
W	Malva aegyptia				22			14	50	**86**	50		44	50
W	Astragalus asterias		15		56			7	**63**	**71**		**86**	22	29
A	Ceratocephala falcata				33			7	13	14	13		44	29
W	Koelpinia linearis		8		11				38	43		43	11	14
	Marker species of associations													
H	Trifolium purpureum	**100**												
R	Aegilops longissima	**71**												
H	Trifolium campestre	**86**												
H	Bromus fasciculatus	**86**	15	56	22	8	22	14			50		22	
H	Eryngium creticum	**86**	15											
H	Helianthemum salicifolium	**86**	8	11	22			7		14	13		22	
A	Muscari comosum	**71**										14		
H	Hymenocarpos circinnatus	**71**			44			7	13			29		
H	Psilurus incurvus	**71**												
H	Plantago cretica	**71**												
H	Lagoecia cuminoides	**71**												
R	Plantago albicans	**71**												
W	Onobrychis crista-galli	**71**			33			14	25			43	22	
V	Phagnalon rupestre	**71**	**69**					14				14		
H	Gundelia tournefortii	57	8		11									
H	Vulpia ciliata	57												
H	Rhagadiolus stellatus	57			11									
H	Pallenis spinosa	57												
H	Hedypnois cretica	57	23		22			7				14		
A	Leopoldia longipes	57	8								13			
W	Lolium rigidum	43								14				
B	Alkanna strigosa	43												
H	Echium angustifolium	43	38		11			7						
B	Allium orientale	43												
D	Chrysanthemum coronarium	43	8									14		
H	Biscutella didyma	43						7			38		22	
H	Avena sterilis	43												

Table 14. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P
H	Bromus lanceolatus	43												
B	Gypsophila arabica	43	15					7						7
H	Torilis tenella	43												
H	Salvia horminum	43	8		22									
W	Aegilops kotschyi	43	31		33			7	38			14		
H	Urospermum picroides	43		11				7						
W	Erucaria rostrata	43												
W	Crepis aspera	43						7						
H	Tragopogon coelesyriacus	29												
W	Anchusa aegyptiaca	29									13		11	
H	Geropogon hybridus	29												
H	Bromus scoparius	29												
H	Cynodon dactylon	29												
B	Eremostachys laciniata	29	8											
H	Dianthus strictus	29	15											
B	Anchusa strigosa	29	8											
H	Androcymbium palaestinum	29												
H	Trifolium dasyurum	14												
H	Trifolium stellatum	14												
H	Silene colorata	14			11			7						
H	Verbascum sinuatum	14												
B	Factorovskya aschersoniana	14												
W	Aristida coerulescens	14												
H	Filago pyramidata	14												
H	Anthemis hebronica	14												
F	Argyrolobium uniflorum	14	8											7
H	Crucianella macrostachya	14												
H	Asteriscus aquaticus	14												
H	Medicago truncatula	14												
H	Hyparrhenia hirta	14												
H	Plantago lagopus	14												
H	Linum strictum	14												
H	Polygonum equisetiforme	14												
H	Carthamus tenuis	**86**	**85**		11			7				**86**		
W	Anagallis arvensis	14	**62**	22	56			29	13			43	22	
B	Echinops polyceras		**62**	33	44		22	29						
A	Atractylis prolifera	14	54											7
S	Herniaria hemistemon		46					14						
B	Ajuga iva		38		22									
V	Paronychia capitata		31											
W	Kickxia floribunda		31								13			
B	Kickxia aegyptiaca		31		22			7						
W	Asphodelus tenuifolius		23											
A	Andrachne telephioides		15						13					
S	Salsola vermiculata	14	15											
W	Echium judaeum		15											
H	Alcea acaulis		15											
A	Dianthus monadelphus		15		11									
W	Orobanche cernua		8											
H	Plantago afra		8											
H	Euphorbia exigua		8											
B	Scrophularia xanthoglossa		8											
H	Asphodelus fistulosus		8											
A	Onosma echinata		8											
R	Astragalus peregrinus		8											
R	Atractylis carduus		8											
V	Crassula alata		8											
W	Atractylis cancellata		8											
W	Carthamus nitidus		8											
V	Ephedra aphylla		8											

Table 14. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P
A	Tulipa systola	57		**100**	**78**	33		43					11	
A	Cuscuta planiflora			**89**	11								11	
W	Picris longirostris	**71**		**78**		33	33	7	13	29			33	
H	Gagea chlorantha			**67**		8							22	
R	Cutandia memphitica		8	**67**		8		36	13		50	43	22	7
W	Ononis sicula	43		44		8							22	
V	Stipa pellita			33				21						
V	Umbilicus intermedius			11				7						
A	Allium negevense			11										
A	Buglossoides arvensis			11									11	
R	Retama raetam			11	11									
A	Bellevalia desertorum		15	11	**89**	25		7					11	7
A	Atractylis serratuloides		54		**67**			21	25					
H	Filago contracta		8	11	56				25					
H	Ornithogalum narbonense				44		22	7						
W	Euphorbia chamaepeplus				44	8		36	13		38		11	21
A	Astragalus sanctus		8	11	33	25		14	25					
H	Bupleurum lancifolium				33			7					11	
H	Paronychia argentea		8		33									
H	Pterocephalus plumosus				33			7						
H	Scorpiurus muricatus				22									
H	Trigonella monspeliaca				22								11	
W	Anemone coronaria	14		11	22								11	7
V	Convolvulus oleifolius				22									
T	Scandix palaestina				22			7						
V	Paronychia sinaica				22	8	11	7						
B	Salvia dominica				22									
B	Trisetaria macrochaeta				22									
A	Buglossoides tenuiflora				22			7			13			
H	Catapodium rigidum				22			7						
D	Notobasis syriaca				11									
B	Carlina libanotica				11									
B	Phlomis brachyodon				11									
B	Astragalus cretaceus		8		11									
W	Erodium neuradifolium				11									
H	Geranium tuberosum				11									
H	Malcolmia crenulata				11									
B	Ballota undulata				11									
H	Valerianella vesicaria				11									
Q	Allium neapolitanum				11			7						
L	Parapholis incurva				11									
H	Helianthemum aegyptiacum				11			7						
V	Delphinium ithaburense				11									
H	Dactylis glomerata				11									
H	Medicago rotata				11								11	
S	Reaumuria negevensis			11		**100**	22	57						7
W	Atractylis phaeolepis			44		**67**		43			13		11	21
S	Limonium pruinosum					58		43					11	7
H	Picris altissima	14				50								
H	Anthemis palestina					42		21						14
V	Stipa barbata				11	42		21						
A	Astragalus spinosus					25								7
A	Moricandia nitens					25	**100**	14			13			7
W	Silene vivianii				11	17	**89**	14	13	14	**63**	29		14
A	Silene coniflora						**78**			57	25			
A	Loliolum subulatum				11		**67**			14	13			
W	Minuartia picta				33		56	7					11	
V	Stipa parviflora				11	42	56	29						7
A	Iris regis-uzziae					8	44			29				
A	Zosima absinthiifolia						44	7		29			11	7
B	Astragalus bethlehemiticus						22							
W	Silene linearis						22							

Table 14. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P
A	Crocus damascenus						11							
W	Lasiopogon muscoides						11							
T	Asphodeline lutea						11							
V	Chiliadenus iphionoides						11	7						
W	Diplotaxis harra			56		50	44	**86**			75		11	21
W	Gagea reticulata				44	33	44	**71**	13	57			22	50
N	Zygophyllum dumosum			22		58		**64**					56	57
H	Allium stamineum		15					43	13					7
H	Urginea maritima			11	11	8		36						
A	Allium artemisietorum				22	8		36						
S	Agathophora alopecuroides							29						
R	Crepis aculeata		8					29						14
V	Asparagus horridus							21						
H	Ononis mollis					17		21					11	
H	Crepis sancta			11				14						
W	Spergula fallax							14						7
V	Euphorbia ramonensis							14						
B	Allium erdelii							7						
B	Astragalus epiglottis							7						
F	Stipagrostis ciliata							7						7
H	Biarum angustatum							7						
A	Bupleurum semicompositum							7						
D	Euphorbia chamaesyce							7						
W	Papaver humile							7						
V	Micromeria sinaica							7						
S	Bassia arabica							7						7
B	Heliotropium rotundifolium							7						
H	Daucus durieua							7						
M	Fumana thymifolia							7						
H	Sedum caespitosum							7						
H	Thesium humile							7						
W	Lamarckia aurea							7						
N	Anchusa milleri							7						
Q	Ajuga chamaepitys							7						
V	Centaurea eryngioides							7						
V	Pterocephalus pulverulentus							7						
V	Stachys aegyptiaca							7						
A	Anabasis syriaca								**100**	**100**	**100**			7
W	Trigonella stellata		8	11	11	33		36	**88**			57	44	50
W	Carrichtera annua		8		44	33	33	21	**75**			43	44	29
W	Linaria haelava			22				29	**75**		38	57	22	14
W	Trigonella arabica	14	8	22	44			14	**75**			57	44	
A	Tripleurospermum auriculatum						11		**63**					
D	Malva parviflora				11				**63**		13		44	
W	Herniaria hirsuta		8	11	44		33	29	**63**		25		22	21
A	Astragalus hispidulus		8		22			7	**63**			43	44	
S	Spergularia diandra							21	50		50		11	7
W	Linaria albifrons				33			14	38					14
H	Papaver hybridum				11			7	25					
H	Vicia sativa	14			11				25				11	
H	Centaurea iberica				11			7	25					
A	Urginea undulata				11	17		7	25				22	21
H	Adonis aestivalis								13					
B	Verbascum fruticulosum				11				13					
H	Onobrychis squarrosa				11			7	13					
H	Erodium malacoides								13					
S	Atriplex leucoclada								13					
W	Tordylium aegyptiacum				11				13				11	
H	Vicia peregrina								13				11	
A	Allium rothii								13		13			7
A	Ferula biverticillata						33			**100**				

Table 14. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P
A	Centaurea ammocyanus								13	**100**	13			43
H	Erodium ciconium	29					22	7		**100**	38		11	
A	Eremopyrum bonaepartis								25	57	13			
W	Cnicus benedictus				11			7		57		14	33	7
A	Leontice leontopetalum								13	43				29
H	Nonea philistaea									43				
A	Leptaleum filifolium						11		13	29	25			
A	Tragopogon collinus									29				
A	Ixiolirion tataricum							7		14				
A	Astragalus corrugatus									14				
S	Atriplex glauca							7		14				
S	Salsola orientalis									14				
A	Colchicum tunicatum					42	**78**	14		**71**	**88**			57
S	Pteranthus dichotomus					8		14			**88**		22	21
W	Anthemis melampodina			11			11				**88**			
W	Lomelosia porphyroneura				33	17		36			**75**		11	7
W	Reseda decursiva							14	38		**75**		56	
W	Pterocephalus brevis	14		11				7			**63**			
A	Boissiera squarrosa										**63**			
A	Eremopyrum distans								13		**63**			
W	Centaurea pallescens										50			
A	Cymbolaena griffithii				33						50			
N	Calendula tripterocarpa										50			
W	Medicago radiata				11			7			50			
S	Salsola inermis					8		29		43	50			36
W	Plantago ovata					33		14			50	14	33	14
H	Bromus tectorum	14									38			
A	Alyssum linifolium						22				25			
W	Erodium touchyanum						22			14	25			
A	Plantago phaeostoma				11	8	11	21			25		22	
A	Valerianella dufresnia									14	25			
A	Bellevalia stepporum										13			
C	Leysera leyseroides										13			
A	Fagonia mollis										13			
S	Halothamnus acutifolius				11						13			
A	Trigonella astroites										13			
H	Centaurea hyalolepis	29	23						25			**100**		
A	Peganum harmala		23									**100**		
W	Crithopsis delileana		8		33				38			**100**		
H	Trifolium tomentosum	57			11							**86**		
W	Adonis dentata	14	8	33				7	50	14	13	**86**	44	14
A	Onopordum alexandrinum								50			57		
A	Colchicum ritchii								13			57		
W	Silene decipiens	14			11			7				57		
F	Ammochloa palaestina			11	33			14			38	57	33	7
R	Ifloga spicata							14				29		
A	Achillea santolina											29		
A	Astragalus caprinus		8		11							29		
R	Erodium laciniatum											29		21
W	Phalaris minor										13	14		
W	Plantago notata											14	11	
A	Haloxylon scoparium			11				14					**100**	**100**
W	Emex spinosa							7	38			57	**78**	29
W	Enarthrocarpus strangulatus									14			**67**	
A	Ornithogalum trichophyllum		8	22					13				56	43
A	Bellevalia eigii	29						7					33	
W	Silene alexandrina			11									33	
W	Aizoon hispanicum							7					33	7
W	Arnebia decumbens									29			33	
W	Erodium moschatum	14											22	
W	Rumex cyprius			11				7					22	

Table 14. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P
H	Chaetosciadium trichosperu\mum												11	
W	Malva sylvestris												11	
A	Achillea fragrantissima												11	
A	Alyssum marginatum												11	
H	Ornithogalum neurostegium												11	
H	Pisum sativum												11	
H	Fumaria bracteosa												11	
A	Malabaila secacul		8										11	
W	Vicia narbonensis												11	
W	Allium ampeloprasum							7					11	
W	Gymnarrhena micrantha				11	8		7	**75**	29		43	33	**79**
S	Reaumuria hirtella				33	17		14			13		44	**64**
W	Gastrocotyle hispida		8		22	8	11	43	38	14	50	57	33	**64**
S	Erodium oxyrhynchum													57
A	Euphorbia grossheimii													43
A	Vicia monantha					8							11	36
W	Medicago laciniata	14			22			14	13			14	22	36
A	Alyssum linifolium													29
W	Arnebia linearifolia							14	13					21
F	Allium sindjarense													7
H	Carduus acicularis													7
S	Mesembryanthemum nodiflorum													7
H	Muscari longipes					8		7						7
	Other species													
W	Helianthemum ledifolium	43		56	56	17	**78**	29	38	**71**	**100**		44	14
A	Salvia lanigera	14	**92**	22	**78**	58	33	50	25		13		22	
H	Anthemis pseudocotula	**86**	54	33	**89**		11	36	**75**	**86**		**100**	**67**	7
H	Calendula arvensis	**71**	23		**67**	17			50	43		**71**	11	36
W	Erodium crassifolium		31	**78**	67	**83**	56	**86**	38	14	38	43	**78**	**93**
W	Filago desertorum		31	44	**78**		33	50	**63**	**71**	**88**	**100**	**78**	50
H	Rostraria smyrnacea	43	8	22	**67**		56	57	50		50	**71**	22	7
H	Scorzonera papposa	**71**			44		**67**	14	13	**86**	50			**79**
H	Gynandriris sisyrinchium	29		11	22	8	44	43	50	29		14		7
W	Erucaria microcarpa		8	56	**100**	**75**	44	**79**	**75**			14	**100**	50
W	Astragalus tribuloides		8	22	**67**	58	22	36	**88**	**100**	50	43	**67**	57
W	Matthiola livida		8	22	22	**75**	56	43		43	50	29	**78**	36
W	Poa sinaica			**67**	**67**	**75**	**78**	50		**100**	38		22	7
W	Stipa capensis	**100**	15	56	56	**67**		57	50		**100**		56	36
W	Schismus arabicus		8		11	8	33	**64**	**100**	14	38		56	57
W	Scilla hanburyi			22	**67**	17	33	36	**75**	29			22	**64**
W	Plantago coronopus	14	8	22	**67**			36	**63**		25	**100**	**100**	50
W	Senecio glaucus			56	11	8	**67**	36	13	29	38	29	**78**	43
N	Asteriscus hierochunticus		23	11				21			13		22	21
W	Reichardia tingitana				56	8		36	38			29	44	36
H	Hippocrepis unisiliquosa	43		44	56	17		50	38		25			
N	Anabasis articulata		8		22	58	44	43					11	29
A	Astragalus callichrous		8		33			21	38			29	11	

6.3.2 AR Reaumurietalia hirtellae Danin et Solomeshch ord. nov.

Diagnostical species: *Plantago ovata, Pteranthus dichotomus, Reaumuria hirtella, Salsola inermis.*
Nomenclatural type: Eremopyro distans – Reaumurion negevensis Danin et Solomeshch.
Synoptic table: Table 21.

This order comprises associations of two alliances developing in the shrub-steppe climatic zone on soils derived from soft chalk, clay, and marl. These soils are more saline than the soils of Artemisietalia sieberi.

The diagnostical species of the Reaumurietalia are just differential and may be used as typical for this order against Artemisietalia sieberi. However, they have wider distribution and occure also at high constancy in all communities of the class Anabasietea articulatae.

Associations of Salsolion vermiculatae occur mainly in the Judean Desert, whereas those of Eremopyro distans – Reaumurion negevensis flourish mainly in the Negev.

6.3.2.1 ARS Salsolion vermiculatae Eig 1946 nom. mut.
Syn.: Salsolion villosae Eig 1946.

Diagnostical species: *Aegilops peregrina, Anchusa aegyptiaca, Astragalus callichrous, Centaurea hyalolepis, Chaetosciadium trichospermum, Crithopsis delileana, Echium judaicum, Erucaria rostrata, Limonium lobatum, Ononis sicula, Pimpinella cretica, Poa eigii, Salsola vermiculata.*
Nomenclatural type: Poo eigii – Salsoletum vermiculatae Eig 1946.
Synoptic table: Table 21.

Associations of Salsolion vermiculatae (ARS) develop on rendzinic desert lithosols or chalk and marl outcrops. The latter are saline soils (Sect. 2.4). Local edaphic conditions seem to determine the specific nature of associations which prevail in each locality. Most associations of this alliance share the pattern of dominance and in many cases also presence of one species of chamaephyte which seems to be best adapted to the specific salinity of the habitat (Danin, 1976; 1978b). In most sites the surface layer is leached and the ephemeral component of the associations is much more divers than that of the xerohalophytes.

The phytogeographical analyses of the associations of this alliance vary a lot and are therefore discussed separately under each association.

6.3.2.1.1 ARS01 Salsoletum vermiculatae Eig 1946 nom. mut.
Syn.: Salsolion villosae Eig 1946.

Diagnostical species: the markers in table 15. **Distribution:** Fig. 44.

Ecological notes: This association occupies mainly north-facing slopes at the western boundaries of the Judean Desert and at the Samarian Desert. The low solar radiation upon the north-facing slopes enable the success of *Poa eigii* as the main ephemeral companion of *Salsola vermiculata* which is nearly the ultimate semishrub dominant. *Poa eigii* constitute an efficient trap for fine-grained particles (Danin & Ganor, 1997). Its dominance promotes an increase in soil depth which consequently enables the success of many ephemeral plants.

Phytogeographical analysis (Fig. 45): The position of this association at the margins of the Mediterranean and the M (M-IT) territories (Danin & Plitmann, 1987; Fig. 9) is reflected in its chorotype spectrum where both the M and M-IT chorotypes have the highest frequency. The north-facing slopes, where the association occurs, also increase the availability of the rain water and assist the growth of many mesophytic admitting the dominance of an Irano-Turanian – Saharo-Arabian species.

Association dynamics and conservation: Most of the area of this association is under constant grazing pressure which may be strong in dry years and weaker in rainy ones. The vegetation is under constant processes of recovery from overgrazing and cutting of the lignified plants.

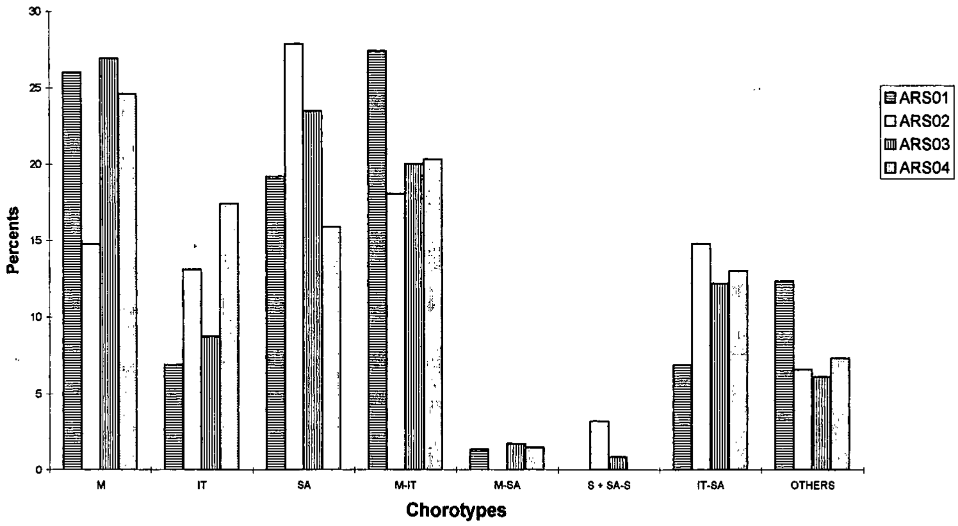

Figure 45. Phytogeographical analysis of associations ARS01-ARS04.

Table 15. Association tables of ARS01 – Poo eigii – Salsoletum vermiculatae, ARS02 – Crithopsio delileanae – Salsoletum vermiculatae ARS03 – Stipo capensis – Salsoletum vermiculatae

			ARS01				ARS02				ARS03			
			123456	C1	C2	%P	*1234567	C1	C2	%P	12345678901234567	C1	C2	%P
	W	Aaronsohnia factorovskyi	...+..	0	0	17	..+....	0	0	14	+.00...2..00+.++.	3	2	53
	W	Adonis dentata	.+0+..	0	0	50					+.+.......0...++.	0	0	29
	W	Aegilops kotschyi					++.....	0	0	29				
	H	Aegilops peregrina	0.0+.+	**1**	**0**	**67**	..3.2.+	17	7	43	0...+...00.0....+	1	0	35
*	S	Agathophora alopecuroides					.+.....	0	0	14				
	W	Aizoon hispanicum	0.....	1	0	17					+001.0+..300.0++.	**5**	**3**	**71**
	B	Allium erdelii									..........+......	0	0	6
	W	Allium hierochuntinum									+.+...+.+...+.++.	0	0	41
	Q	Allium neapolitanum	+++0..	**1**	**0**	**67**								
	N	Amberboa crupinoides									.........+...+...	0	0	12
*	N	Anabasis articulata					+......	0	0	14	............0....	1	0	6
	W	Anagallis arvensis	.+0+..	1	0	50					+...+...0..0+..+.	0	0	35
	W	Anchusa aegyptiaca	...+..	0	0	17	.+.....	0	0	14	....+.......+....	0	0	12
*	B	Anchusa strigosa									..............+..	0	0	6
	H	Androcymbium palaestinum									.....+...........	0	0	6
	H	Anthemis hebronica									........+...1....	5	1	12
	N	Anthemis maris-mortui									1...6...7........	47	8	18
	W	Anthemis pseudocotula	1202..	**15**	**10**	**67**	++++++.	**0**	**0**	**86**	600.220+.00160+3+	**15**	**13**	**88**
	H	Antirrhinum orontium									...+...+.........	0	0	12
	H	Artedia squamata									................+	0	0	6
*	A	Artemisia sieberi					0......	1	0	14				
	W	Asphodelus tenuifolius					..+....	0	0	14	++.0+0.+00.0++.+.	**1**	**0**	**71**
	N	Asteriscus hierochunticus									...0...+.0.....+.	1	0	24
	W	Astragalus asterias									....+............	0	0	6
	A	Astragalus bombycinus					.+.....	0	0	14				
	A	Astragalus callichrous	++0+..	**0**	**0**	**67**	.....+.	0	0	14	+...++.+...0...+.	0	0	35
	W	Atractylis cancellata	..0...	1	0	17					.++..+.+000.++++.	**0**	**0**	**65**
*	A	Atractylis serratuloides					.+.....	0	0	14				
*	S	Atriplex leucoclada	....+.	0	0	17					..0..............	1	0	6
	H	Avena sterilis									....+.......+...+	0	0	18
	A	Avena wiestii					....+..	0	0	14				
	A	Bellevalia desertorum					..++++.	0	0	57	...+.......0...+.	0	0	18
	A	Bellevalia eigii									++..++..++...+...	0	0	41
	H	Bellevalia flexuosa									.......+.........	0	0	6
	H	Beta vulgaris	...+.+	0	0	33	.....+.	0	0	14	.+...............	0	0	6

Table 15. continued.

			ARS01				ARS02				ARS03			
			123456	C1	C2	%P	1234567	C1	C2	%P	12345678901234567	C1	C2	%P
	H	Biscutella didyma	..++..	0	0	33					....+.......+....	0	0	12
	H	Brachypodium distachyon									....+............	0	0	6
	H	Bromus fasciculatus	0+.+.+	**0**	**0**	**67**					....+............	0	0	6
	H	Bromus scoparius	...+..	0	0	17								
	H	Bromus tectorum	.+....	0	0	17								
	A	Buglossoides arvensis	...+..	0	0	17								
	H	Calendula arvensis	.+0+.+	**0**	**0**	**67**	.++++.+	**0**	**0**	**71**	+++.+++.000+.++..	**0**	**0**	**71**
	B	Calendula palaestina	...+..	0	0	17					...............++	0	0	12
	H	Campanula stellaris									............+....	0	0	6
	W	Carthamus nitidus									+...........+....	0	0	12
	H	Carthamus tenuis					.+.....	0	0	14				
*	A	Centaurea aegyptiaca					.+.....	0	0	14				
	H	Centaurea hyalolepis	0+.+++	**0**	**0**	**83**	..+++++	**0**	**0**	**71**	00+0100++000+103.	**5**	**4**	**94**
	W	Centaurea pallescens					.+.....	0	0	14				
	H	Chaetosciadium trichospermum	.+.+..	0	0	33	.....+.	0	0	14	....+...+........	0	0	12
	D	Chenopodium murale	.....+	0	0	17								
	D	Chrysanthemum coronarium	0..2..	13	4	33					0..............0.	3	0	12
	W	Crepis aspera	..0...	1	0	17					....+.+.+...+.+..	0	0	29
	H	Crepis sancta	++0+..	**0**	**0**	**67**					..+.+.+.+00......	0	0	35
	W	Crithopsis delileana	00.+4+	**9**	**8**	**83**	9918788	**73**	**73**	**100**				
	H	Crucianella macrostachya									........+........	0	0	6
	H	Daucus durieua	..+...	0	0	17	...++..	0	0	29	............+....	0	0	6
*	B	Echinops polyceras					.+.....	0	0	14				
	W	Echium judaeum	0000..	**3**	**2**	**67**					000010+000000+++.	**3**	**2**	**94**
	W	Emex spinosa					....++.	0	0	29	..++..+...+..+...	0	0	29
	H	Erodium gruinum	.+0+..	1	0	50					....+......0+....	0	0	18
	W	Erodium neuradifolium									+.......0.+.+....	0	0	24
	W	Erodium touchyanum	...+..	0	0	17					..++..+.......++.	0	0	29
	W	Erucaria microcarpa	0+.+..	0	0	50	++.....	0	0	29	....+0..00..+++..	1	0	41
	W	Erucaria rostrata	03.+++	**7**	**6**	**83**	..+0.11	8	4	57	.+0.+0++000....+.	1	1	59
	W	Euphorbia chamaepeplus	.+0...	1	0	33					........+0.......	1	0	12
	B	Factorovskya aschersoniana									...............+.	0	0	6
	H	Filago contracta	.+++..	0	0	50	+......	0	0	14				
	W	Filago desertorum					....+..	0	0	14	....+.+.++00.+++.	0	0	53
	H	Filago palaestina	.+0+..	0	0	50					......+.....+.+..	0	0	18
	H	Filago pyramidata	...+..	0	0	17					+.+..............	0	0	12
	H	Gagea chlorantha	++++..	**0**	**0**	**67**					+.......+........	0	0	12
	L	Galium hierochuntinum									........+...+....	0	0	12
	H	Galium judaicum									....+............	0	0	6
	W	Gymnarrhena micrantha									......+...+.....0.	1	0	18
*	S	Halothamnus acutifolius					0......	4	1	14				
	H	Hedypnois cretica	.+0+..	0	0	50					+....+...+.......	0	0	18
	W	Helianthemum ledifolium					++.....	0	0	29	..........+...+..	0	0	12
	H	Helianthemum salicifolium									+...............+	0	0	12
	H	Hippocrepis unisiliquosa	.+0+..	1	0	50					.+..+0..+0.+++...	0	0	47
	D	Hordeum glaucum	0.....	1	0	17								
	H	Hordeum spontaneum	...+..	0	0	17					0................	1	0	6
	B	Hyacinthella nervosa									...............+..	0	0	6
	H	Hymenocarpos circinnatus	+...+.	0	0	33	......+	0	0	14	....+.....+......	0	0	12
*	V	Hyoscyamus aureus					..0..00	4	2	43				
	W	Koelpinia linearis									++...+...0...+...	0	0	29
	H	Lagoecia cuminoides	+..+..	0	0	33	.....+.	0	0	14				
	Q	Lamium amplexicaule	...+..	0	0	17								
	S	Limonium lobatum	00.0+.	**3**	**2**	**67**	+..++++	**0**	**0**	**71**	+600.2000420+30++	**13**	**12**	**94**
	W	Linaria haelava	.++...	0	0	33								
	H	Linum strictum									....+.......+....	0	0	12
	W	Lolium rigidum	++.+..	0	0	50								
	W	Lomelosia porphyroneura									....++..++..++...	0	0	35
	H	Lotus peregrinus									....+............	0	0	6
	A	Malabaila secacul									....+............	0	0	6
	D	Malva nicaeensis	...+..	0	0	17					...............+.	0	0	6

Table 15. continued.

			ARS01				ARS02				ARS03			
			123456	C1	C2	%P	1234567	C1	C2	%P	12345678901234567	C1	C2	%P
	D	Malva parviflora					...++..	0	0	29	....+.++..00.....	1	0	29
	W	Matthiola aspera	..0+..	1	0	33					00+0+00+0000++0++	**1**	**1**	**100**
	W	Medicago laciniata	0+0+..	**1**	**0**	**67**	++.....	0	0	29	0+36+0420001++42.	**15**	**14**	**94**
	W	Minuartia picta									..+...+..........	0	0	12
	C	Notoceras bicorne									..+...++..00..++.	0	0	41
	W	Onobrychis crista-galli	0+++..	**0**	**0**	**67**	..1+++.	3	1	57	+.++++0++++0.+++.	**0**	**0**	**82**
	H	Ononis mollis	.+.+..	0	0	33					+...++..00..++...	0	0	41
	W	Ononis sicula	++.+..	0	0	50	+.+.+++	**0**	**0**	**71**	........0......+.	1	0	12
	H	Orobanche aegyptiaca									+...+............	0	0	12
	H	Papaver umbonatum	.+0+..	0	0	50					...++...+..0...+.	0	0	29
	H	Parentucellia latifolia	..++..	0	0	33								
*	H	Paronychia argentea									................+	0	0	6
*	V	Paronychia capitata	....+.	0	0	17								
*	V	Phagnalon rupestre	....0+	3	1	33	...+...	0	0	14	............0....	8	0	6
	W	Picris longirostris	.0....	5	1	17					....+.......0....	3	0	12
	H	Pimpinella cretica	.+0+..	0	0	50					+.......+........	0	0	12
	H	Pimpinella eriocarpa					...++++	0	0	57				
	H	Plantago afra	...+..	0	0	17	....+..	0	0	14	....+............	0	0	6
	B	Plantago bellardii	..0...	1	0	17								
	W	Plantago coronopus	.+.+..	0	0	33	+......	0	0	14	....+..........+.	0	0	12
	H	Plantago cretica									........+........	0	0	6
	W	Plantago ovata	0..+..	1	0	33					0040++310001++1++	**7**	**7**	**100**
	W	Poa eigii	622334	**35**	**35**	**100**	...++..	0	0	29				
	S	Pteranthus dichotomus	+0.+..	2	1	50	++++++.	**0**	**0**	**86**	02+++1+0+001+1++.	4	4	94
	W	Pterocephalus brevis	...+..	0	0	17					+...++...+..+..+.	0	0	35
	H	Pterocephalus plumosus									................+	0	0	6
	H	Ranunculus asiaticus	..0+..	1	0	33					+.........+......	0	0	12
	H	Raphanus rostratus									................+	0	0	6
*	S	Reaumuria hirtella	10	10	3	33	+5.1.01	**16**	**12**	**71**				
	W	Reichardia tingitana	...+..	0	0	17	+......	0	0	14	++++++++.++0.+.+.	**0**	**0**	**76**
	W	Reseda decursiva					.....+.	0	0	14	...++..++.+.+++..	0	0	47
	H	Rhagadiolus stellatus	++0+..	**1**	**0**	**67**					+...+...+.......+	0	0	24
	H	Rostraria smyrnacea	++0+.+	**0**	**0**	**83**	....+.+	0	0	29	...0......0....+.	1	0	18
	W	Rumex cyprius					...+...	0	0	14	...0+..+...0+....	1	0	29
	S	Salsola inermis					++.....	0	0	29				
*	S	Salsola vermiculata	989989	**92**	**92**	**100**	9599998	**86**	**86**	**100**	999999999999999++	**87**	**87**	**100**
	H	Salvia horminum									+...+...0...+....	0	0	24
	W	Schismus arabicus									......+..........	0	0	6
	W	Scilla hanburyi	...+..	0	0	17					...+.............	0	0	6
	H	Scorzonera papposa					......+	0	0	14	..+............+.	0	0	12
	W	Senecio glaucus									..............+...	0	0	6
	H	Senecio vernalis									....+............	0	0	6
	H	Silene colorata									....+...+........	0	0	12
	H	Silene damascena	...+..	0	0	17								
	W	Silene linearis					...+...	0	0	14				
	H	Silene oxyodonta	..++..	0	0	33								
	W	Spergula fallax									......+..........	0	0	6
	S	Spergularia diandra	.+....	0	0	17					......+...0...+..	1	0	18
	W	Stipa capensis	01.034	**18**	**15**	**83**	.+510.1	**15**	**11**	**71**	2121+21110311341+	**15**	**15**	**100**
*	B	Teucrium capitatum	....++	0	0	33					............+....	0	0	6
	W	Tordylium aegyptiacum	+..+..	0	0	33								
	H	Torilis arvensis	.+....	0	0	17								
	H	Torilis tenella	++....	0	0	33					....+............	0	0	6
	W	Trigonella arabica	1+00..	**5**	**3**	**67**					0+..+....0.0.+.+.	2	1	41
	W	Trigonella stellata					..+..+.	0	0	29				
	B	Trisetaria macrochaeta									....+.......+....	0	0	12
	H	Urospermum picroides									...+........+....	0	0	12
*	B	Verbascum fruticulosum					0	2	0	14				
	H	Vicia palaestina	+.....	0	0	17								
	H	Vicia sativa	...+..	0	0	17								
	H	Vulpia ciliata	.+....	0	0	17								

Aspects of association ARS01: Persistents – 6 spp.; ephemerals – 79 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	78120	95	5	33	25.02.87	I 2421 6575
2	78220	98	2	44	25.02.87	I 2420 6575
3	78320	93	7	35	25.02.87	I 2420 6576
4	78420	75	25	63	25.02.87	I 2420 6574
5	94387	70	20	13	31.03.94	I 2371 6359
6	94388	70	20	15	31.03.94	I 2372 6359
Average:		83.5	13.2	33.8		

6.3.2.1.2 ARS02 Crithopsio delileanae – Salsoletum vermiculatae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 15. **Distribution:** Fig. 46.

Ecological notes: This association occupies mainly south-facing slopes at the western boundaries of the Judean Desert and at the Samarian Desert. The high solar radiation upon the south-facing slopes support *Crithopsis delileana* and *Stipa capensis* as the main ephemeral companions of *Salsola vermiculata* which is often accompanied by *Reaumuria hirtella* – a more drought and salt resistant semi-shrub. The soil is more stony than that of ARS01.

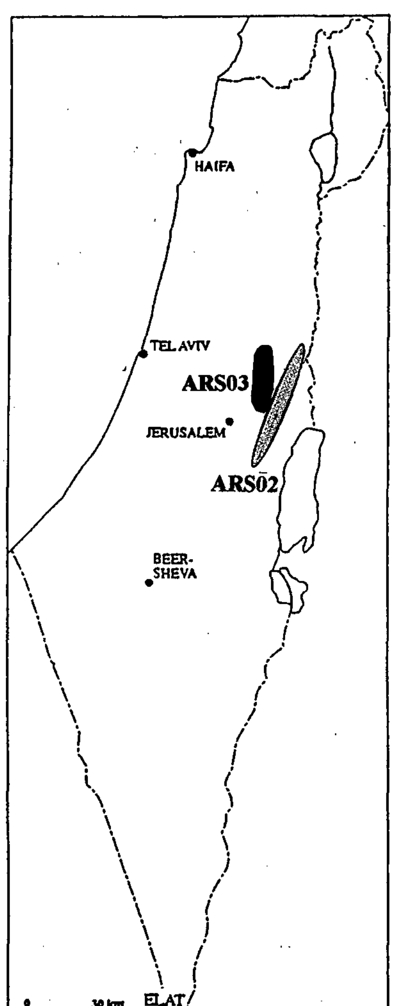

Figure 46. Distribution map of associations ARS02 and ARS03.

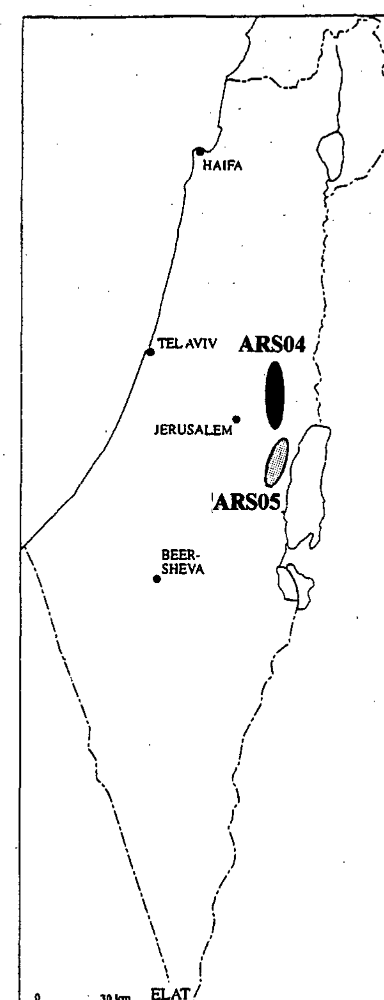

Figure 47. Distribution map of associations ARS04 and ARS05.

Phytogeographical analysis (Fig. 45): The drier microclimatic conditions of this association are well reflected in the spectrum of chorotypes when compared with the spectrum of Poo eigii – Salsoletum vermiculatae (ARS01). In ARS02 the mesic chorotypes M and M-IT are lower than in ARS01 whereas the xeric chorotypes IT, SA, and IT-SA are higher than in the latter.

Association dynamics and conservation: As in ARS01.

Aspects of the association: Persistents – 12 spp.; ephemerals – 45 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00145	32	8	18	20.05.66	I 2223 5739
2	00146	20	5	20	20.05.66	I 2222 5739
3	94382	60	15	16	31.03.94	I 2372 6359
4	94383	50	20	19	31.03.94	I 2372 6359
5	94384	30	25	21	31.03.94	I 2372 6359
6	94385	50	15	20	31.03.94	I 2372 6359
7	94386	50	20	16	31.03.94	I 2372 6359
Average:		41.7	15.4	18.6		

6.3.2.1.3 ARS03 Stipo capensis – Salsoletum vermiculatae Eig 1946 nom. mut., nom. inv.

Syn.: Association of Salsola villosa-Stipa tortilis Eig 1946.

Diagnostical species: the markers in table 15. **Distribution:** Fig. 46.

Ecological notes: This association occupies various slopes in the Judean Desert and in the Samarian Desert. The soil where this association occurs seems to be deeper than that of ARS02. However, as the deep soil where ARS01 develops is on north-facing slopes *Poa eigii* outcompetes many annual companions which are present here and in high relative cover.

Phytogeographical analysis (Fig. 45): In their phytogeographic spectrum ARS03 is closer to ARS01 than to ARS02. The most frequent chorotypes here are M and M-IT whereas the SA is only at the third place.

Association dynamics and conservation: As in ARS01.

Aspects of the association: Persistents – 7 spp.; ephemerals – 109 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	78104	75	25	41	25.02.87	I 2421 6575
2	78105	90	10	21	25.02.87	I 2421 6576
3	78119	85	15	27	25.02.87	I 2421 6577
4	78121	70	30	25	25.02.87	I 2421 6578
5	78204	85	15	55	25.02.87	I 2422 6575
6	78205	95	5	27	25.02.87	I 2422 6576
7	78219	85	15	29	25.02.87	I 2422 6578
8	78221	75	25	24	25.02.87	I 2422 6577
9	78304	90	10	41	25.02.87	I 2422 6579
10	78305	78	22	33	25.02.87	I 2420 6575
11	78319	70	30	31	25.02.87	I 2419 6575
12	78321	75	25	28	25.02.87	I 2419 6576
13	78404	55	45	42	25.02.87	I 2419 6577
14	78405	70	30	28	25.02.87	I 2419 6578
15	78419	60	40	28	25.02.87	I 2418 6575
16	78421	45	55	38	25.02.87	I 2418 6577
17	79098	65	5	15	25.02.87	I 2418 6576
Average:		74.6	23.7	31.4		

6.3.2.1.4 ARS04 Noaeo – Salsoletum vermiculatae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 16. **Distribution:** Fig. 47.

Ecological notes: This association was recorded in the Judean Desert in an area where the chalky rock sequence contains chert in high quantities. The contribution of runoff water from the chert outcrops to the soil enable the development of more persistent species than in the previous associations. The co-dominant *Noaea mucronata* is a species of Artemision sieberi and its contribution to ARS04 displays the special moisture regime here. Other indicators for the same phenomenon are *Teucrium capitatum, Phagnalon rupestre,* and *Eryngium creticum.*

Phytogeographical analysis (Fig. 45): The position of this association at the margins of the Mediterranean and the M (M-IT) territories (Fig. 9) is reflected in chorotype spectrum where both M and M-IT chorotypes have the highest frequency (as in ARS01 and ARS03).

Association dynamics and conservation: Most of the area of this association is recovering in the last few years from constant and prolonged grazing pressure. This is due to changes in the management in the area surrounding Kfar Adumim.

Table 16. Association tables of ARS04 – Noaeo – Salsoletum vermiculatae, ARS05 – Saturejo thymbrifoliae – Salsoletum vermiculatae, and ARS06 – Reaumurietum hirtellae

		Species	ARS04				ARS05				ARS06			
			*1234567	C1	C2	%P	*123456789	C1	C2	%P	*123456789012	C1	C2	%P
	W	Aaronsohnia factorovskyi					+...+.++.	0	0	44				
	W	Aegilops kotschyi									..+..+.432.+	15	8	50
	H	Aegilops peregrina	22+....	13	6	43								
*	S	Agathophora alopecuroides					+...+....	0	0	22				
	B	Allium erdelii					.0.+....+	2	1	33				
	W	Allium hierochuntinum					...+.....	0	0	11	....+.....+.	0	0	17
	W	Anagallis arvensis	..++++.	0	0	57	.+.++..++	0	0	56	....+.......	0	0	8
	W	Anchusa aegyptiaca	++++.+.	**0**	**0**	**71**	........+	0	0	11				
	W	Anthemis pseudocotula	.++.++.	0	0	57	........+	0	0	11	..++.+++...+	0	0	50
	H	Antirrhinum orontium					....+....	0	0	11				
	V	Arenaria leptoclados					........+	0	0	11				
	W	Arnebia decumbens					.....+...	0	0	11				
	W	Asphodelus tenuifolius					.....++..	0	0	22	..........+.	0	0	8
	N	Asteriscus hierochunticus					....+....	0	0	11				
	V	Asterolinon linum-stellatum					........+	0	0	11				
	B	Astoma seselifolium									......+.....	0	0	8
	A	Astragalus callichrous	......+	0	0	14					...+++++.+..	0	0	50
*	A	Astragalus spinosus	...++.+	0	0	43					+...........	0	0	8
	W	Astragalus tribuloides	..+....	0	0	14	..+.+....	0	0	22	..........+.	0	0	8
*	S	Atriplex glauca									.....0..++..	0	0	25
*	B	Ballota undulata									.+..........	0	0	8
*	S	Bassia arabica					2...+402.	17	9	56				
	A	Bellevalia desertorum	+....+.	0	0	29	.+.+++++.	**0**	**0**	**67**	.1+.......++	3	1	33
	H	Beta vulgaris									........+...	0	0	8
	H	Biscutella didyma					........+	0	0	11				
	H	Bromus fasciculatus									..........+.	0	0	8
	H	Bromus scoparius	+......	0	0	14								
	H	Bromus tectorum									.......+....	0	0	8
	A	Buglossoides arvensis									..+....+....	0	0	17
	H	Buglossoides tenuiflora					........+	0	0	11				
	A	Bupleurum lancifolium									...++.......	0	0	17
	A	Bupleurum semicompositum									..+....+.+..	0	0	25
	H	Calendula arvensis	++.+.+.	0	0	57	...+..+++	0	0	44	..+.+++.+++.	0	0	58
	A	Carex pachystylis	.....+.	0	0	14								
	B	Carlina libanotica									....+.......	0	0	8
	W	Carrichtera annua	132.+.+	**12**	**9**	**71**								
	W	Carthamus nitidus					.+..++++.	0	0	56	.+.+.++++..+	0	0	58
	H	Carthamus tenuis	+++.+++	**0**	**0**	**86**					+.+.........	0	0	17
	V	Centaurea eryngioides									++..........	0	0	17
	H	Centaurea hyalolepis	0+1..1+	**5**	**4**	**71**					..++++.++++1	**1**	**1**	**75**

Table 16. continued.

		Species	ARS04				ARS05				ARS06			
			1234567	C1	C2	%P	123456789	C1	C2	%P	123456789012	C1	C2	%P
	W	Centaurea pallescens					......+..	0	0	11				
	A	Ceratocephala falcata					.+......+	0	0	22				
	H	Chaetosciadium trichospermum					........+	0	0	11	.........+.+	0	0	17
	W	Crepis aspera	.....+.	0	0	14								
	W	Crithopsis delileana	1.+1114	**16**	**14**	**86**	...+...+.	0	0	22	..618842+6+4	**40**	**33**	**83**
	D	Cuscuta brevistyla	..+....	0	0	14								
	H	Daucus durieua									...+...+.+..	0	0	25
*	A	Dianthus monadelphus	.....++	0	0	29								
*	H	Dianthus strictus	.....+.	0	0	14								
	W	Diplotaxis harra					+...1+1++	**3**	**2**	**67**				
*	B	Echinops polyceras	.....2+	13	4	29	....+.+++	0	0	44	+0+....0..0.	2	1	42
	W	Echium judaeum	++.+.+.	0	0	57	......+..	0	0	11				
	W	Emex spinosa	..+++..	0	0	43					....+..++.++	0	0	42
	A	Erodium arborescens					...+.....	0	0	11				
	S	Erodium glaucophyllum					67++7+.+.	**29**	**22**	**78**	.......+..+.	0	0	17
	W	Erodium neuradifolium									.......+....	0	0	8
	W	Erodium touchyanum					........+	0	0	11				
	W	Erucaria microcarpa	..+0+2.	6	4	57	.+++.+.++	**0**	**0**	**67**	.+....+.....	0	0	17
	W	Erucaria rostrata	5456554	**49**	**49**	**100**	....+.+.1	3	1	33	9.++11003000	**16**	**15**	**92**
	H	Eryngium creticum	+++++++	**0**	**0**	**100**								
	W	Euphorbia chamaepeplus					.+.+.+...	0	0	33				
*	A	Fagonia mollis					+.+.3....	10	3	33				
	H	Filago contracta	+..+++.	0	0	57					.....+......	0	0	8
	W	Filago desertorum	+.++...	0	0	43	.+......+	0	0	22	.......+....	0	0	8
	W	Gagea reticulata					.+.+..+++	0	0	56	......+.....	0	0	8
	H	Galium judaicum									..1.+.......	5	1	17
	W	Gastrocotyle hispida									..........+.	0	0	8
*	N	Gymnocarpos decander					..0......	5	1	11				
	H	Gynandriris sisyrinchium	+.+.+++	**0**	**0**	**71**								
*	B	Gypsophila arabica	......+	0	0	14	...+.22+1	11	6	56	+.........+.	0	0	17
*	R	Haplophyllum tuberculatum	+....+.	0	0	29	....+1.++	3	1	44	..+.+..+..+.	0	0	33
	H	Hedypnois cretica									....+++.....	0	0	25
*	A	Helianthemum kahiricum					..+.0+++.	1	1	56				
	W	Helianthemum ledifolium					...+.....	0	0	11				
	H	Helianthemum salicifolium					........+	0	0	11	......+.....	0	0	8
*	A	Helianthemum vesicarium									.+..........	0	0	8
*	B	Heliotropium rotundifolium									..+.......+.	0	0	17
*	S	Herniaria hemistemon					.++++....	0	0	44	....+..+..0+	1	0	33
	W	Herniaria hirsuta					.+......+	0	0	22	..+.........	0	0	8
	H	Hippocrepis unisiliquosa					....+.+++	0	0	44	....+..+....	0	0	17
	D	Hordeum glaucum									..+.......+.	0	0	17
	H	Hymenocarpos circinnatus	+00++++	**1**	**1**	**100**					.....+......	0	0	8
*	V	Hyoscyamus aureus									..+...+0+.+.	1	0	42
*	B	Kickxia aegyptiaca	+..0+++	**1**	**1**	**71**								
	S	Limonium lobatum	++.++..	0	0	57	.....+...	0	0	11	....++.++...	0	0	33
	W	Linaria haelava					........+	0	0	11				
	W	Lomelosia porphyroneura	+.+...+	0	0	43					..+.........	0	0	8
	D	Malva parviflora									..+.....+...	0	0	17
	W	Matthiola aspera	....+.+	0	0	29								
	W	Matthiola livida					.++.+2+++	**3**	**2**	**78**				
	H	Matthiola longipetala	++++..+	**0**	**0**	**71**								
	W	Medicago laciniata	..++.+.	0	0	43					.......+....	0	0	8
	H	Muscari commutatum					.+.+...+.+	0	0	44				
	W	Neotorularia torulosa					...+.....	0	0	11	.1..........	10	1	8
*	A	Noaea mucronata	3322121	**21**	**21**	**100**	.......+.	0	0	11	.......+....	0	0	8
	C	Notoceras bicorne									..+....++...	0	0	25
	W	Onobrychis crista-galli	+++13.+	**7**	**6**	**86**	...++....	0	0	22				
*	B	Ononis natrix									+...........	0	0	8
	W	Ononis sicula	...+.++	0	0	43	......+.+	0	0	22	..+++++...++	0	0	58

Table 16. continued.

		Species	ARS04 1234567	C1	C2	%P	ARS05 123456789	C1	C2	%P	ARS06 123456789012	C1	C2	%P
	B	Onopordum palaestinum									...+........	0	0	8
	A	Onosma echinata									...........+	0	0	8
	H	Parentucellia viscosa									...+..+.....	0	0	17
	W	Parietaria alsinifolia					........+	0	0	11	......++...+	0	0	25
*	V	Paronychia capitata	+...+.+	0	0	43								
*	V	Phagnalon rupestre	00.++02	**6**	**5**	**86**					....+.......	0	0	8
	R	Picris amalecitana					...+.....	0	0	11				
	H	Pimpinella cretica	.....+.	0	0	14	........+	0	0	11	....+.++....	0	0	25
	H	Plantago afra	...+.+.	0	0	29								
	W	Plantago coronopus	..+..+.	0	0	29	.+.+....+	0	0	33				
	W	Plantago ovata					+++.+++..	**0**	**0**	**67**				
	W	Poa eigii	.....+.	0	0	14					+7.8+05+.193	**34**	**28**	**83**
	W	Poa sinaica	1	10	1	14	.2.+....8	33	11	33				
	S	Pteranthus dichotomus					+.++.....	0	0	33	..0....+....	3	0	17
	W	Pterocephalus brevis									.....++....+	0	0	25
	H	Ranunculus asiaticus	...++++	0	0	57	.+.+.....	0	0	22	...+..+.....	0	0	17
*	S	Reaumuria hirtella					.+.......	0	0	11	999999989999	**96**	**96**	**100**
	W	Reichardia tingitana									.......+....	0	0	8
*	S	Reseda muricata					.2+01.++.	**6**	**4**	**67**	.......0....	5	0	8
	H	Rostraria smyrnacea					...+....+	0	0	22	..+++.......	0	0	25
	S	Salsola inermis					...+.+...	0	0	22	........++..	0	0	17
*	S	Salsola vermiculata	6687855	**64**	**64**	**100**	5596.275.	**57**	**44**	**78**	.......+.+..	0	0	17
*	B	Salvia dominica									+...........	0	0	8
*	S	Satureja thymbrifolia					33+350+38	**29**	**29**	**100**				
	W	Scariola orientalis									.+..........	0	0	8
	W	Schismus arabicus					.....+...	0	0	11	.......++..+	0	0	25
	W	Scilla hanburyi	..+....	0	0	14					..........+.	0	0	8
	W	Scorzonera judaica	+++++++	**0**	**0**	**100**								
	H	Scorzonera papposa	+.+.+.+	0	0	57	.+.......	0	0	11	...+.......+	0	0	17
	W	Senecio glaucus					++++.++++	**0**	**0**	**89**	....+.+.....	0	0	17
	A	Silene conoidea					........+	0	0	11				
	W	Silene decipiens					......+.+	0	0	22				
	W	Silene linearis					.......+.	0	0	11	..+.........	0	0	8
	W	Stipa capensis	.+11.+.	5	3	57	+++.0778.	**32**	**25**	**78**	..2++++3+.+1	**7**	**5**	**75**
*	B	Teucrium capitatum	00.00+1	**5**	**4**	**86**								
	S	Trigonella schlumbergeri					.+.......	0	0	11				
	W	Trigonella stellata					.+.......	0	0	11	..+.........	0	0	8
	A	Tripleurospermum auriculatum									..+.+..+..++	0	0	42
*	B	Verbascum fruticulosum									..+........+	0	0	17
*	N	Zygophyllum dumosum					..0......	5	1	11				

Aspects of association ARS04: Persistents – 15 spp.; ephemerals – 56 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96094	30	7	31	19.03.96	I 2335 6361
2	96095	40	10	21	19.03.96	I 2335 6362
3	96096	50	10	29	19.03.96	I 2334 6362
4	96097	30	12	28	19.03.96	I 2334 6363
5	96098	30	7	25	19.03.96	I 2333 6363
6	96099	40	10	33	19.03.96	I 2332 6364
7	96100	30	15	30	19.03.96	I 2333 6364
Average:		35.7	10.1	28.3		

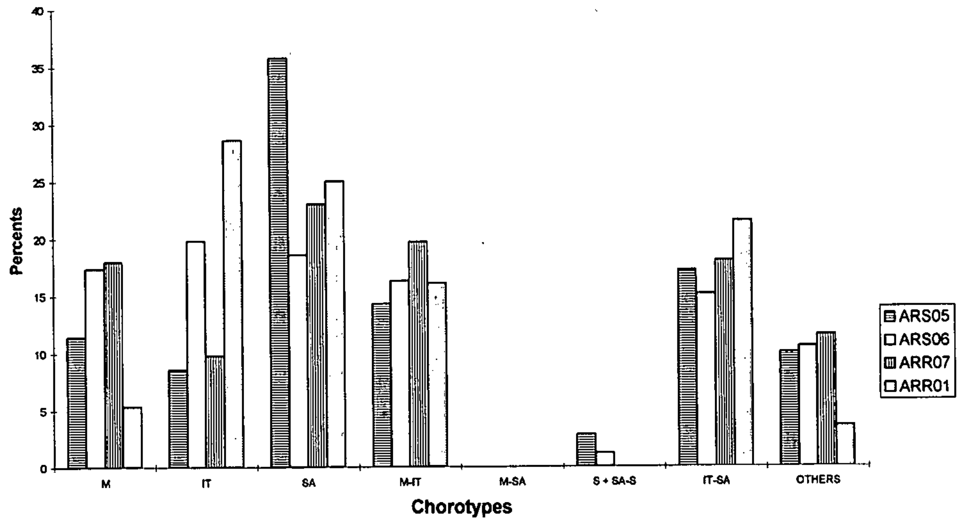

Figure 48. Phytogeographical analysis of associations ARS05-ARS07 and ARR01.

6.3.2.1.5 ARS05 Saturejo thymbrifoliae – Salsoletum vermiculatae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov., nom. inv.

Syn.: Salsola vermiculata – Satureja thymbrifolia association Danin, Orshan et Zohary 1975.

Diagnostical species: the markers in table 16. **Distribution:** Fig. 47.

Ecological notes: This association represents a rare situation in the flora and vegetation of Israel. Its leading species, *Satureja thymbrifolia,* is an endemic species which grows only on a rare type of metamorphic rock – silicified limestone of the Hatrurim formation (Bartov et al., 1981). Its distribution, even along one slope, accurately coincides with that of the silicified limestone. There is hardly any other dominant in the entire vegetation of Israel which is limited in such a way to one association and to one type of substratum. The nature of this soft rock which contains irregular patches of hard rock is expressed in two floristic features; it is developed in an area much more east than all the other associations dominated by *Salsola vermiculata* in a diffused pattern at the same latitude. It includes relatively many persistent species. The two phenomena seem to be associated with amelioration of moisture regime derived from the function of the hard rocks as contributors of water to the soft phase of the substratum. Soft chalk in this climatic belt support Suaedetum asphaltice which is regarded as much more drought and salt resistant.

Phytogeographical analysis (Fig. 48): Occurring as east as the Suaedetum asphaltice belt explains its high percentage of Saharo-Arabian species. The relatively high percentage of more mesophytic species may be related to the edaphic situation.

Association dynamics and conservation: Developing on relatively steep slopes in a dry area not rich in human activity, the pressure of grazing and cutting is relatively moderate in this association.

Aspects of the association: Persistents – 12 spp.; ephemerals – 67 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00594	1	2	12	20.12.67	I 2355 6179
2	00638	1	9	27	24.02.68	I 2395 6302
3	00639	1	9	16	24.02.68	I 2395 6301
4	00640	1	9	28	24.02.68	I 2394 6301
5	00641	3	7	24	24.02.68	I 2345 6248
6	00642	5	10	21	24.02.68	I 2345 6248
7	00643	5	5	25	24.02.68	I 2345 6250
8	00644	3	4	24	24.02.68	I 2343 6252
9	00645	20	10	36	24.02.66	I 2346 6252
Average:		4.4	7.2	23.7		

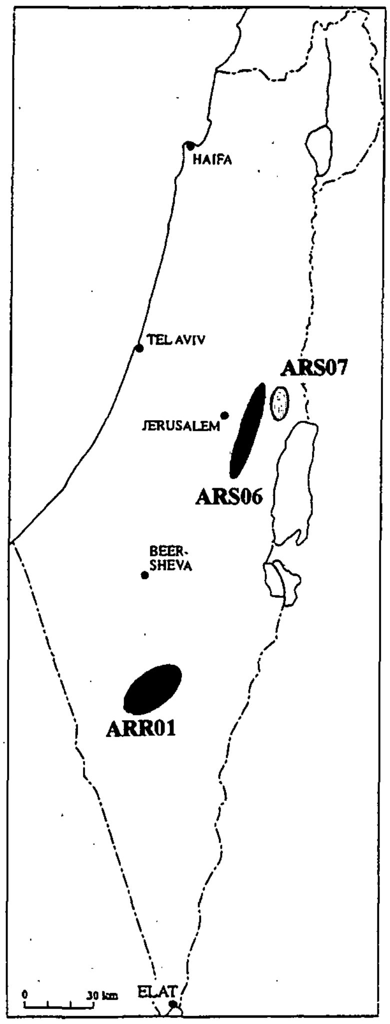

Figure 49. Distribution map of associations ARS06, ARS07, and ARR01.

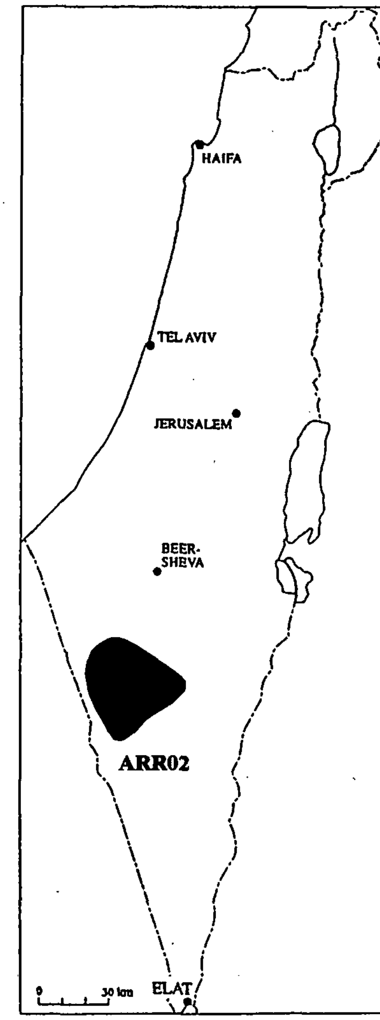

Figure 50. Distribution map of associations ARR02.

6.3.2.1.6 ARS06 Reaumurietum hirtellae Eig 1946 nom. mut.

Syn.: Reaumurietum palaestinae Eig 1946.

Diagnostical species: the markers in table 16. **Distribution:** Fig. 49.

Syntaxonomy: This association was published first by Eig (1946) as Reaumurietum palaestinae with one sample record. Resulting from a taxonomic review (Zohary & Danin, 1970) the name of the leading species was changed into *Reaumuria hirtella* Jaub. et Spach var. *palaestina* (Boiss.) Zohary et Danin. It was later published with an association table in its incomplete form by Danin et al. (1975) as Reaumurietum hirtellae.

Ecological notes: This association represents a more drought and salinity resistant community than those dominated by *Salsola vermiculata*. A study of the edaphic conditions of the dominant species (Danin, 1978b) showed the lowest salinity in the sites dominated by *Salsola vermiculata*, a higher salinity in the sites where *R. hirtella* is the dominant, and the highest under *Suaeda asphaltica* (association MMS04). In many additional unpublished soil analyses we found that soil surface where *Poa eigii* is the dominant are completely leached. Deeper soil layers are saline and act like a filter; there is only one persistent plant in the markers group and its average relative cover is 96%. *R. hirtella* obtains salty water and excretes highly salty solutions through its leaf epidermal glands. Solutions rich in salts and dead leaves containing salts deposited on the soil surface cause local circles free of other plants. There is an active *R. hirtella* and its seedlings in the center of each such circle (Fireman & Hayward, 1952; Danin, 1978b).

This association is found only in the northern Judean Desert. It forms a north-south belt situated east of the *Salsola vermiculata* belt and west of the *Suaeda asphaltica* belt.

Phytogeographical analysis: (Fig. 48): The proximity of the area to the meeting zone of several phytochoria is displayed in the spectrum of the chorotypes by similar percentages of the principle chorotypes (M, M-IT, IT, SA, and IT-SA).

Association dynamics and conservation: Most of the area of this association is under constant grazing and cutting. The sites of our studies (Danin et al., 1975; Danin, 1978b) are under high pressure now and for the last decade *R. hirtella* became a rare plant there after it turned to be a residence area of a few Bedouin families. In the first years after the Bedouin moved to the area they cut many lignified plants. The *R. hirtella* shrubs stopped recycling salts and the ca 150 mm annual rainfall started to leach the soil. Halophytic and glycophytic annuals started to grow in the formerly empty patches. The total destruction of vegetation stopped the process and terminated our ability to investigate it.

Aspects of the association: Persistents – 19 spp.; ephemerals – 66 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00577	36	24	11	04.09.67	I 2266 1193
2	00597	1	9	10	30.12.67	I 2309 1169
3	00654	10	20	29	information lost	
4	00655	60	20	17	"	"
5	00656	20	10	25	"	"
6	00657	60	10	18	"	"
7	00658	70	20	22	"	"
8	00659	10	10	35	"	"
9	00660	20	20	17	"	"
10	00661	20	20	14	"	"
11	00662	10	10	25	"	"
12	00663	25	15	22	"	"
Average:		28.5	15.7	20.4		

Table 17. Association tables of ARS07 – Atriplicetum glaucae, ARR01 – Anthemido melampodinae – Atriplicetum glaucae, and ARR02 – Reaumurietum negevensis

		Species	ARS07				ARR01				ARR02			
			1234567	C1	C2	%P	*12345678	C1	C2	%P	*123456789	C1	C2	%P
	W	Aaronsohnia factorovskyi	+.+..+.	0	0	43								
	W	Adonis dentata	+++.++.	**0**	**0**	**71**								
	H	Aegilops peregrina	...+.+.	0	0	29								
*	S	Agathophora alopecuroides									....++...	0	0	22
	S	Aizoon hispanicum	+++++++	**0**	**0**	**100**								
	W	Allium hierochuntinum	.+...+.	0	0	29								
	A	Allium rothii					.+......	0	0	13				
	F	Allium sindjarense									.+.......	0	0	11
	H	Allium stamineum					..+.....	0	0	13				
	F	Ammochloa palaestina					.+.++.+.	0	0	50				
*	N	Anabasis articulata					.+0.....	3	1	25	..+.1..0.	5	2	33
*	A	Anabasis syriaca					....0.+0	2	1	38				
	W	Anagallis arvensis	+++++++	**0**	**0**	**100**								
	W	Anchusa aegyptiaca	+..+...	0	0	29								
	W	Anthemis melampodina					+0+123+2	**11**	**11**	**100**				
	W	Anthemis pseudocotula	++.++++	**0**	**0**	**86**								
*	A	Artemisia sieberi					.+....0.	3	1	25	1+++.12++	**6**	**5**	**89**
*	V	Asparagus horridus									......+..	0	0	11
	W	Asphodelus tenuifolius	+......	0	0	14								
	A	Astragalus callichrous	+++++.+	**0**	**0**	**86**								
	W	Astragalus tribuloides					....+...	0	0	13				
*	A	Atractylis phaeolepis									...+.....	0	0	11
*	S	Atriplex glauca	1998989	**78**	**78**	**100**	99999899	**90**	**90**	**100**	..0......	5	1	11
*	S	Atriplex leucoclada	+......	0	0	14								

Table 17. continued.

	Species	ARS07 1234567	C1	C2	%P	ARR01 12345678	C1	C2	%P	ARR02 123456789	C1	C2	%P
A	Avena wiestii					+.......	0	0	13				
* S	Bassia arabica					1.......	10	1	13	..0......	5	1	11
A	Bellevalia desertorum	++.++.+	**0**	**0**	**71**								
H	Beta vulgaris	....+..	0	0	14								
H	Biscutella didyma	+..++++	**0**	**0**	**71**								
A	Boissiera squarrosa					.....+..	0	0	13				
H	Bromus fasciculatus	2.+++21	**8**	**7**	**86**	.+...++.	0	0	38				
H	Bromus tectorum	...+...	0	0	14								
H	Calendula arvensis	+21+0.1	**8**	**6**	**86**	..+.....	0	0	13				
N	Calendula tripterocarpa					....+.+.	0	0	25				
A	Carex pachystylis					1...+.3+	10	5	50	+.8+....+	20	9	44
W	Carrichtera annua					.+......	0	0	13	.+.......	0	0	11
* A	Centaurea aegyptiaca									.+....+..	0	0	22
A	Centaurea ammocyanus					+.+.+..1	3	1	50				
H	Centaurea hyalolepis	++.+++.	**0**	**0**	**71**								
A	Ceratocephala falcata	..+.+..	0	0	29								
H	Chaetosciadium trichospermum	..+++++	**0**	**0**	**71**								
A	Colchicum tunicatum					+++..++.	**0**	**0**	**63**	.1.....+.	5	1	22
W	Crithopsis delileana	11+1212	**13**	**13**	**100**								
R	Cutandia memphitica					......+4	23	6	25				
W	Diplotaxis harra									2++...+..	5	2	44
W	Emex spinosa	.+++.++	**0**	**0**	**71**								
A	Eremopyrum distans					...+++.+	0	0	50				
W	Erodium ciconium					..+.....	0	0	13				
W	Erodium crassifolium									07++++.1+	**11**	**9**	**89**
W	Erodium touchyanum	.....++	0	0	29								
W	Erucaria microcarpa					101.....	8	3	38				
W	Erucaria rostrata	4565256	**48**	**48**	**100**								
W	Euphorbia chamaepeplus	++++.+.	**0**	**0**	**71**								
A	Ferula biverticillata					.+......	0	0	13	.....+...	0	0	11
H	Filago contracta	+.+....	0	0	29								
W	Filago desertorum	.+.+...	0	0	29	.+.+..+.	0	0	38				
H	Filago palaestina	..+....	0	0	14								
H	Filago pyramidata	+......	0	0	14								
H	Gagea chlorantha	++.++.+	**0**	**0**	**71**								
W	Gagea reticulata									.++......	0	0	22
W	Gastrocotyle hispida					...+....	0	0	13	.+.......	0	0	11
W	Gymnarrhena micrantha									.+.......	0	0	11
* N	Gymnocarpos decander									++.......	0	0	22
H	Gynandriris sisyrinchium	.+++.+.	0	0	57	....+...	0	0	13				
* A	Haloxylon scoparium									1..+.....	5	1	22
* A	Helianthemum kahiricum									+1.0.....	7	2	33
W	Helianthemum ledifolium					+1.+..1+	**4**	**3**	**63**				
* A	Helianthemum ventosum									...+.....	0	0	11
* A	Helianthemum vesicarium									..++.....	0	0	22
W	Herniaria hirsuta	..+.+..	0	0	29								
H	Hippocrepis unisiliquosa	++..+..	0	0	43					+........	0	0	11
D	Hordeum glaucum					..+.....	0	0	13				
H	Hordeum spontaneum	...+++.	0	0	43								
A	Iris regis-uzziae									..+......	0	0	11
H	Lagoecia cuminoides	+..+...	0	0	29								
W	Lamarckia aurea	...+...	0	0	14								
W	Lathyrus pseudocicera	....0..	5	1	14								
* S	Limonium pruinosum									+..+..+..	0	0	33
W	Lomelosia porphyroneura					.....+.+	0	0	25	+........	0	0	11
W	Malva aegyptia					...4...+	20	5	25				
D	Malva parviflora					..+.....	0	0	13				
W	Matthiola livida					868+31++	**33**	**33**	**100**	.1.......	10	1	11
W	Medicago laciniata					......+.	0	0	13				
W	Medicago radiata					....+..+	0	0	25				
* A	Moricandia nitens					.....+..	0	0	13				

Table 17. continued.

		Species	ARS07 1234567	C1	C2	%P	ARR01 12345678	C1	C2	%P	ARR02 123456789	C1	C2	%P
	W	Neotorularia torulosa					.++.....	0	0	25				
*	A	Noaea mucronata									.....++..	0	0	22
	C	Notoceras bicorne	.+.....	0	0	14								
	W	Onobrychis crista-galli	....+.+	0	0	29								
	W	Ononis sicula	1.+...+	3	1	43								
	W	Parietaria alsinifolia	.+++.++	**0**	**0**	**71**								
	W	Picris longirostris									+........	0	0	11
	H	Pimpinella cretica	+.+.++.	0	0	57								
	W	Plantago coronopus									+........	0	0	11
	W	Plantago ovata					.......+	0	0	13	+........	0	0	11
	A	Plantago phaeostoma									+........	0	0	11
	W	Poa eigii	.+23+0+	**9**	**8**	**86**								
	W	Poa sinaica					+++.....	0	0	38	..2......	20	2	11
	S	Pteranthus dichotomus	1.+++.+	**2**	**1**	**71**	...2+62+	**21**	**13**	**63**	+........	0	0	11
	W	Pterocephalus brevis	++++...	0	0	57	....+.+.	0	0	25				
	H	Ranunculus asiaticus	++..+++	**0**	**0**	**71**								
*	S	Reaumuria hirtella	10+++0+	**3**	**3**	**100**	+000.1.0	**5**	**4**	**75**	.....1...	10	1	11
*	S	Reaumuria negevensis					.....10.	8	2	25	789887799	**81**	**81**	**100**
	W	Roemeria hybrida									.+.......	0	0	11
	H	Rostraria smyrnacea					....3.++	10	4	38				
	S	Salsola inermis	+.+.++.	0	0	57	.+.+....	0	0	25	0+..+..9.	24	11	44
*	S	Salsola oppositifolia									.....+...	0	0	11
*	S	Salsola orientalis					..0......	5	1	13	.......+.	0	0	11
*	S	Salsola vermiculata	10+1111	**8**	**8**	**100**								
*	A	Salvia lanigera									+..+.....	0	0	22
	W	Schismus arabicus	.+.+..+	0	0	43	+20++..+	**4**	**3**	**75**				
	W	Scilla hanburyi	.+.....	0	0	14								
	H	Scorzonera judaica					++.++...	0	0	50	..+......	0	0	11
	H	Scorzonera papposa	+......	0	0	14	++..+.+.	0	0	50				
	W	Senecio glaucus					++......	0	0	25	+........	0	0	11
	A	Silene coniflora					.......+	0	0	13				
	W	Silene decipiens	..+....	0	0	14								
	W	Silene vivianii					.+..+.+.	0	0	38	.+.......	0	0	11
	S	Spergularia diandra					.+......	0	0	13				
	W	Stipa capensis	+++.1++	**2**	**1**	**86**	...22+32	**18**	**11**	**63**	60.......	33	7	22
*	V	Stipa pellita					.....+..	0	0	13				
*	S	Suaeda asphaltica	..00+..	3	1	43								
	H	Torilis tenella	....+..	0	0	14								
	W	Trigonella arabica	+......	0	0	14								
	A	Trigonella astroites					....+...	0	0	13				
	H	Trigonella monspeliaca	..+.++.	0	0	43								
	W	Trigonella stellata	+.+.++.	0	0	57								
	A	Tripleurospermum auriculatum					.++....0	2	1	38				
	A	Tulipa systola									.+.......	0	0	11
	A	Urginea undulata									......+..	0	0	11
	A	Vicia monantha	.....+.	0	0	14								
	A	Zosima absinthiifolia					.+......	0	0	13				
*	N	Zygophyllum dumosum									1+.11+0..	**6**	**4**	**67**

6.3.2.1.7 *ARS07 Atriplicetum glaucae Eig 1946 nom. mut.*

Syn.: Atriplicetum glaucae Eig 1946

Diagnostical species: the markers in table 17. **Distribution:** Fig. 49.

Ecological notes: The common feature of xerohalophyte communities in the shrub-steppes of the area is seen here is well. The most common dominant, accompanied by very few companions is *Atriplex glauca*. It is related to *Salsola vermiculata* as seen from the markers list but also to a much more salt-resistant shrub *Suaeda asphaltica* which dominates the steep slopes of hills around the area where the Atriplicetum was recorded. It develops on chalky ground of the Senonian (Mt. Scopus group, Bartov et al., 1981). It is hard to distinguish the specific edaphic conditions where this association develops, but it has rather sharp boundaries with ARS02 and MMS04.

Phytogeographical analysis: (Fig. 48): The transitional nature of the site and habitat where this association occurs is reflected in the similar percentage of the chorotypes SA, M, and M-IT.

Association dynamics and conservation: Most of the area of this association is under constant process of release from the long pressure of overgrazing by goats and cutting of the lignified components by Bedouin.

Aspects of the association: Persistents – 5 spp.; ephemerals – 60 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	97022	20	10	35	10.03.97	I 2380 6365
2	97023	15	10	28	10.03.97	I 2380 6366
3	97024	30	12	32	10.03.97	I 2381 6366
4	97025	20	10	32	10.03.97	I 2381 6365
5	97026	20	11	34	10.03.97	I 2382 6365
6	97027	30	10	30	10.03.97	I 2379 6365
7	97028	30	10	25	10.03.97	I 2370 6366
Average:		23.6	10.4	30.9		

6.3.2.2 ARR Eremopyro distans – Reaumurion negevensis Danin et Solomeshch all. nov.

Diagnostical species: *Agathophora alopecuroides, Anabasis articulata, Anthemis melampodina, Asteriscus hierochunticus, Atractylis phaeolepis, Atriplex glauca, Bassia arabica, Eremopyron distans, Halothamnus acutifolius, Lomelosia porphyroneura, Reaumuria negevensis, Salsola orientalis, Zygophyllum dumosum.*

Nomenclatural type: Halothamno – Agathophoretum alopecuroidis Danin et Solomeshch.

Synoptic table: Table 21.

This alliance differs from all other alliances of Artemisietea sieberi by the presence of diagnostical species of the class Anabasietea articulatae (*Agathophora alopecuroides, Anabasis articulata, Asteriscus hierochunticus,* and *Zygophyllum dumosum*) which indicate its similarity with the vegetation of the desert. However, it can not be assigned to Anabasietea articulatae because of having diagnostical species of Artemisietea sieberi and many other species which can not survive the desert condition typical to the class Anabasietea articulatae. This alliance differes from the Salsolion vermiculatae by high constancy of diagnostical species of Artemisietea sieberi and its own diagnostical species.

There are many diagnostical species confined to associations developed on soils derived, in the Negev Highlands, from fine-grained rocks such as chalk and marl and to the colluvium and alluvium where their weathering products accumulate. We therefore grouped in the present alliance, by floristic parameters, the Negev associations and separated them from those of the Judean Desert and the Dead Sea areas. This is a result of additional recording of vegetation after the previous account was published (Danin et al., 1975).

6.3.2.2.1 ARR01 Anthemido melampodinae – Atriplicetum glaucae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 17. **Distribution:** Fig. 49.

Ecological notes: The association is confined to Loessial Serozem at the pediment of stony-rocky limestone slopes in the Central Negev Highlands at elevation of 700-1000 m. According to Yair & Danin (1980) this habitat gets relatively small amounts of water and consequently becomes relatively saline. In many places at the Negev Highlands this habitat supports associations of the alliance Haloxylion scoparia (AAH), many of which are of xerohalophyte dominants. For many years this association may appear as composed of scattered plants of *Atriplex glauca*. In rainy years it is accompanied by many ephemeral plants. It has the same fluctuations in vegetation cover as many other xerohalophyte associations (Danin, 1978b).

Phytogeographical analysis: (Fig. 48): The similarity in the frequency of the three most frequent chorotypes (IT, SA, SA-IT) fits the phytochorion in which this association occurs (Fig.10).

Association dynamics and conservation: The area of this association is practically protected from overgrazing and cutting for the last 35 years.

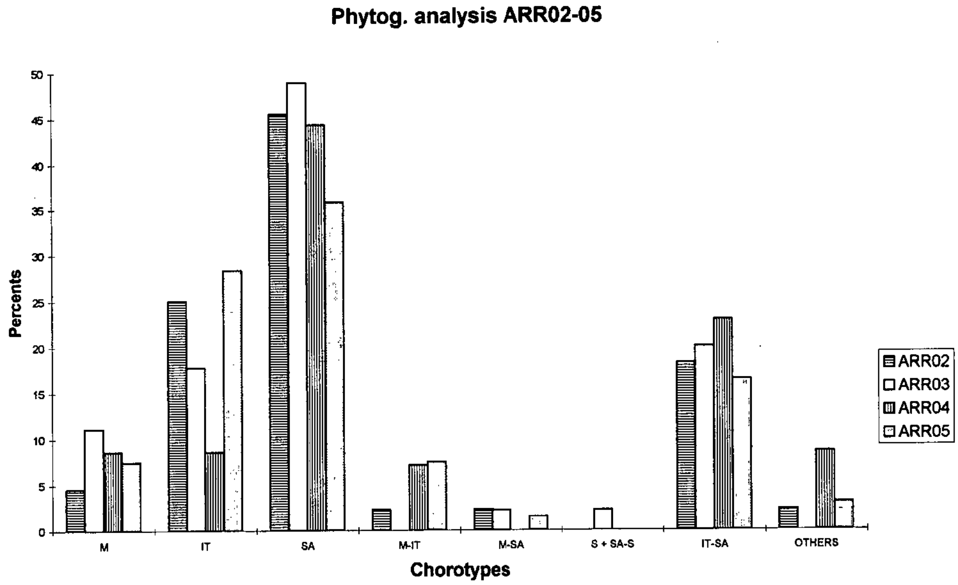

Figure 51. Phytogeographical analysis of associations ARR02-ARR05.

Aspects of the association: Persistents – 10 spp.; ephemerals – 48 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94327	10	10	16	22.03.94	I 1766 5015
2	94328	15	7	27	22.03.94	I 1766 5015
3	94329	10	7	17	22.03.94	I 1766 5015
4	94440	20	15	15	11.04.94	I 1583 4867
5	94441	20	20	20	11.04.94	I 1583 4867
6	94442	10	15	15	11.04.94	I 1583 4867
7	94443	15	20	22	11.04.94	I 1583 4867
8	94444	20	20	20	11.04.94	I 1583 4867
Average:		15.0	14.3	19.0		

6.3.2.2.2 ARR02 Reaumurietum negevensis Danin, Orshan et Zohary ex Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 17. **Distribution:** Fig. 50.

Ecological notes: *Reaumuria negevensis* is confined to chalk and limestone mixed with chalk of the Eocene, Cenoman and Turon. *R. hirtella* var. *palaestina* and var. *brachylepis* are confined to Senonian chalk and marl. The actual reasons which cause this distributional correlation are not known yet. As other associations of xerohalophytes this association is always poor in chamaephyte companions and is nearly devoid of ephemeral companions in average and dry years.

Phytogeographical analysis: (Fig. 51) As in other associations of this area the most frequent chorotypes are IT, SA, and SA-IT.

Association dynamics and conservation: The area of this association is practically protected from overgrazing and cutting for the last 35 years.

Aspects of the association: Persistents – 21 spp.; ephemerals – 27 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00173	8	12	21	28.04.66	I 1594 5042
2	00394	1	5	20	22.03.67	I 1591 4985
3	00436	1	6	13	18.03.67	I 1784 5068
4	00486	1	9	12	29.10.66	I 1559 5103
5	00492	0	3	6	21.12.66	I 1785 5143
6	00494	0	7	9	26.12.66	I 1795 5221
7	00504	0	7	9	30.01.67	I 1758 5245
8	00519	2	8	7	14.08.66	I 1790 5053
9	00554	0	10	4	22.08.66	I 1815 5170
Average:		1.4	7.4	11.2		

6.3.2.2.3 ARR03 Asterisco hierochuntici- Halothamnetum acutifolii Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 18. **Distribution:** Fig. 52.

Ecological notes: This association is confined to Loessial Serozems of the Central Negev Highlands and develop on similar habitats as those of Anthemido melampodinae – Atriplicetum glaucae (ARR01). There are a few annual plants in this association which are rare in other associations of this alliance and grow in Artemision sieberi which occupies the neighbouring rocky slopes. Such are: *Acantholepis orientalis, Eremopyrum distans,* and *Boissiera squarrosa.*

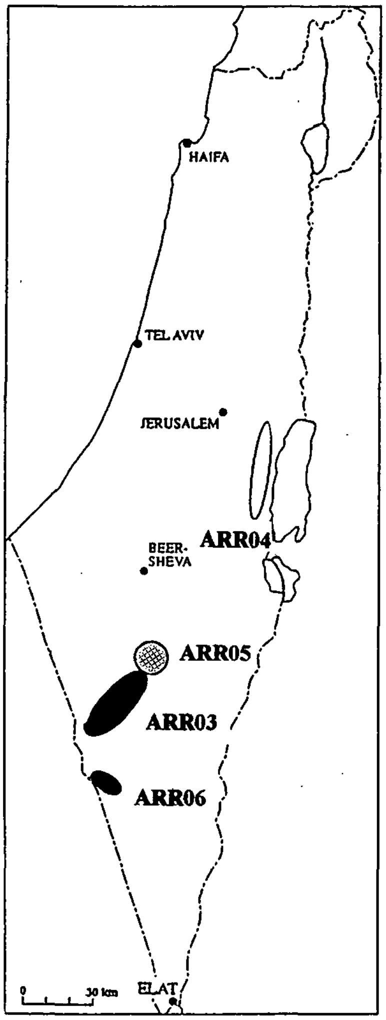

Figure 52. Distribution map of associations ARR03-ARR06.

Phytogeographical analysis: (Fig. 51): The most frequent chorotypes in this association are the Saharo-Arabian and the SA-IT. The Mediterranean and Irano-Turanian are much lower and there are no M-IT species. This spectrum may represent the edaphic impact on plant growth here, where soil salinity increase the moisture stress on plant life. Although existing in an area where the IT chorotype should be higher than the SA or at least equal (Fig. 10), it is in fact lower.

Association dynamics and conservation: The area of this association is practically protected from overgrazing and cutting for the last 35 years.

Table 18. Association tables of ARR03 – Asterisco hierochuntici – Halothamnetum acutifolii, ARR04 – Pterantho dichotomi – Halothamnetum acutifolii, and ARR05 Helianthemo ledifolii – Salsoletum orientalis

		Species	ARR03 *12345678	C1	C2	%P	ARR04 *123456	C1	C2	%P	ARR05 *1234567890	C1	C2	%P
	W	Aaronsohnia factorovskyi					....+.	0	0	17				
	A	Acantholepis orientalis	..+.+.++	0	0	50								
	W	Adonis dentata					...+..	0	0	17				
	W	Aegilops kotschyi									.........+	0	0	10
*	S	Agathophora alopecuroides	40..+.41	**19**	**12**	**63**	+0...+	2	1	50	+112..10..	**9**	**6**	**60**
	Q	Allium neapolitanum	....+...	0	0	13								
	A	Allium rothii									+.+.++....	0	0	40
	H	Allium stamineum					+.....	0	0	17	..++......	0	0	20
	N	Amberboa crupinoides					+.....	0	0	17				
*	N	Anabasis articulata	++0.0112	**7**	**6**	**88**	.+.+.+	0	0	50	10..+.0+3.	**8**	**5**	**60**
*	A	Anabasis syriaca	....+...	0	0	13								
	W	Anthemis melampodina	..+.+...	0	0	25					.+3+5+++.5	**16**	**13**	**80**
	H	Anthemis palestina					...+..	0	0	17				
	H	Anthemis pseudocotula					++.+.+	**0**	**0**	**67**	+.........	0	0	10
	W	Arnebia linearifolia					.....+	0	0	17				
*	A	Artemisia sieberi									+..01..+..	4	2	40
*	V	Asparagus horridus									.+........	0	0	10
	N	Asteriscus hierochunticus	++01+1++	**3**	**3**	**100**	2+..+0	**6**	**4**	**67**	........+.	0	0	10
	A	Astragalus callichrous					+.....	0	0	17				
*	A	Astragalus sanctus									+.........	0	0	10
	W	Astragalus tribuloides					+2+..0	**6**	**4**	**67**				
*	W	Atractylis phaeolepis	.+.....+	0	0	25					+.........	0	0	10
	A	Atractylis prolifera	..++.++.	0	0	50	+.....	0	0	17				
*	S	Atriplex glauca									1.221021.1	**14**	**11**	**80**
*	S	Atriplex leucoclada	..02.++.	6	3	50	.++...	0	0	33				
	A	Avena wiestii									.........+	0	0	10
*	S	Bassia arabica					.2+...	13	4	33	.0.+.+.+..	1	1	40
	A	Bellevalia desertorum	..+.++..	0	0	38	.....+	0	0	17				
	A	Boissiera squarrosa	...++.+.	0	0	38								
	A	Bromus danthoniae	...+....	0	0	13								
	H	Bromus fasciculatus	.....+.+	0	0	25					.+..+..+.+	0	0	40
	H	Calendula arvensis					++...+	0	0	50	.........+	0	0	10
	N	Calendula tripterocarpa	......+.	0	0	13								
	W	Carduus getulus									......+...	0	0	10
	A	Carex pachystylis	......1+	5	1	25					........+1	5	1	20
	W	Carrichtera annua					....+.	0	0	17				
*	A	Centaurea aegyptiaca					+.....	0	0	17	+.........	0	0	10
	A	Centaurea ammocyanus									.........+	0	0	10
	W	Centaurea pallescens	.....+..	0	0	13	...++.	0	0	33				
	A	Colchicum tunicatum									.++..++.++	**0**	**0**	**60**
	W	Diplotaxis harra	+.......	0	0	13					.11.+..1..	8	3	40
	W	Emex spinosa	..+.....	0	0	13								
	A	Eremopyrum bonaepartis									.........+	0	0	10
	A	Eremopyrum distans	...+++.+	0	0	50					......+..+	0	0	20
	W	Erodium ciconium									.........+	0	0	10
	W	Erodium crassifolium	+..+...+	0	0	38	+..+..	0	0	33	-+01+++++.	2	2	90
	A	Erodium glaucophyllum					..+...	0	0	17				
	R	Erodium laciniatum									.+........	0	0	10
	W	Erodium moschatum					..+...	0	0	17				
	W	Erodium touchyanum	.....+..	0	0	13	....+.	0	0	17				

Table 18. continued.

		Species	ARR03 12345678	C1	C2	%P	ARR04 123456	C1	C2	%P	ARR05 1234567890	C1	C2	%P
	W	Erucaria microcarpa	..+...+.	0	0	25	1+12.0	10	8	83	+++.2133+.	12	10	80
	W	Erucaria rostrata					....++	0	0	33				
*	A	Fagonia mollis	1..+..+.	3	1	38								
	A	Ferula biverticillata									..0++3+...	7	4	50
	W	Filago desertorum	..++++..	0	0	50	++...+	0	0	50				
	W	Gagea reticulata					.+....	0	0	17	...++..+..	0	0	30
	W	Gastrocotyle hispida					+.....	0	0	17				
	W	Gymnarrhena micrantha	+.......	0	0	13	.+...+	0	0	33	+.........	0	0	10
	H	Gynandriris sisyrinchium					.+...+	0	0	33	.+........	0	0	10
*	S	Halothamnus acutifolius	46989957	72	72	100	779989	84	84	100	++...1.+..	3	1	40
*	A	Helianthemum kahiricum									...+......	0	0	10
	W	Helianthemum ledifolium	..+.....	0	0	13	02.+.0	8	5	67	3202234633	29	29	100
	H	Helianthemum salicifolium					+.....	0	0	17				
*	S	Herniaria hemistemon					..1...	10	2	17	..+.......	0	0	10
	W	Herniaria hirsuta					+.....	0	0	17				
	H	Hippocrepis unisiliquosa	......+.	0	0	13	+..+..	0	0	33				
	W	Hypecoum pendulum									.........+	0	0	10
*	W	Kickxia floribunda					+.....	0	0	17				
	W	Koelpinia linearis					++....	0	0	33				
	W	Lappula spinocarpos	..+...+.	0	0	25	++...+	0	0	50				
	C	Launaea nudicaulis					...+..	0	0	17				
	A	Leopoldia longipes									.+.+......	0	0	20
	C	Leysera leyseroides	..++.+..	0	0	38								
	S	Limonium lobatum					1+.+.+	3	2	67				
	W	Linaria haelava									...+......	0	0	10
	W	Lomelosia porphyroneura	..++++++	0	0	75	.....+	0	0	17	.+++......	0	0	30
	W	Malva aegyptia									.........+	0	0	10
	W	Matthiola livida	..+011.+	5	3	63	+2..++	5	3	67	3+..++1.3.	12	7	60
	W	Medicago laciniata	...+.+..	0	0	25	++1+.+	2	2	83				
	S	Mesembryanthemum nodiflorum					....++	0	0	33				
*	A	Moricandia nitens									++......+.	0	0	30
	S	Nasturtiopsis coronopifolia					...+..	0	0	17				
	W	Neotorularia torulosa									2.........	20	2	10
	W	Onobrychis crista-galli					++....	0	0	33				
	A	Ornithogalum trichophyllum									......+...	0	0	10
	H	Picris altissima					.....+	0	0	17				
	R	Picris amalecitana					...+..	0	0	17				
	W	Picris longirostris					+.....	0	0	17	1537+.1+2.	24	20	80
	W	Plantago coronopus					.1++.+	3	2	67	........+.	0	0	10
	W	Plantago ovata	..++++..	0	0	50	1++.++	2	2	83	...++.+..+	0	0	40
	H	Poa bulbosa					.+.+..	0	0	33				
	W	Poa sinaica									.++..+...+	0	0	40
	S	Pteranthus dichotomus	..763433	44	33	75	301304	20	20	100				
	H	Ranunculus asiaticus					.+....	0	0	17	....+.....	0	0	10
*	S	Reaumuria hirtella	++......	0	0	25	...+1.	8	3	33	........+2	10	2	20
*	S	Reaumuria negevensis									022.33020.	17	14	80
	W	Reichardia tingitana					++...+	0	0	50				
	A	Rheum palaestinum									+..+.+....	0	0	30
	W	Rumex cyprius									+.........	0	0	10
	S	Salsola inermis	+++.....	0	0	38	.+53.+	21	14	67	+.......++	0	0	30
*	S	Salsola orientalis									7655556667	59	59	100
*	S	Salsola schweinfurthii	0.......	5	1	13								
*	S	Salsola vermiculata					.+....	0	0	17				
	W	Schismus arabicus	...+++..	0	0	38	..+...	0	0	17	..+...++..	0	0	30
	W	Scilla hanburyi					+.....	0	0	17				
	W	Scorzonera judaica					+.....	0	0	17	++++.+++.+	0	0	80
	H	Scorzonera papposa					+..+.+	0	0	50	+.++.+.++0	1	1	70
	W	Senecio glaucus					.+.+++	0	0	67	+.+.+.++1.	2	1	60
	W	Silene vivianii					...+..	0	0	17	+++....++	0	0	50
	W	Spergula fallax	....+...	0	0	13								
	W	Stipa capensis	..222457	37	28	75	++1.73	23	19	83	.1+.....1+	5	2	40
	S	Trigonella schlumbergeri					...+..	0	0	17				
	W	Trigonella stellata	+.......	0	0	13	.1+.1+	5	3	67				

Table 18. continued.

	Species	ARR03 12345678	C1	C2	%P	ARR04 123456	C1	C2	%P	ARR05 1234567890	C1	C2	%P
A	Tulipa polychroma									....++....	0	0	20
A	Tulipa systola									...+......	0	0	10
A	Urginea undulata									.....+....	0	0	10
A	Zosima absinthiifolia	+.......	0	0	13					++.++..+..	0	0	50
* N	Zygophyllum dumosum	.3......	30	4	13	.....+	0	0	17	..++......	0	0	20

Aspects of the association: Persistents – 10 spp.; ephemerals – 35 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00376	1	3	13	18.05.67	I 1644 4729
2	00390	0	3	8	20.05.67	I 1643 4728
3	94411	20	10	20	11.04.94	I 1820 4769
4	94412	20	10	18	11.04.94	I 1820 4769
5	94413	20	7	19	11.04.94	I 1820 4769
6	94414	20	7	19	11.04.94	I 1820 4769
7	94435	20	7	17	11.04.94	I 1820 4769
8	94436	20	5	14	11.04.94	I 1820 4769
Average:		15.1	6.5	16.0		

6.3.2.2.4 ARR04 Pterantho dichotomi – Halothamnetum acutifolii Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 18. **Distribution:** Fig. 52.

Ecological notes: The main habitat of this association in the Judean Desert is ancient alluvial terraces of wadis draining terrain of chalky or marly hillslopes. Situated above the reach of flood water, the soil has its typical salinity profile. Five salinity profiles studied in the southern Judean Desert are discussed by Danin (1978b). As in other associations of Reaumurietalia, there are hardly any persistent companions to the immanent. The occasional persistents contribute only a small percentage of cover.

Phytogeographical analysis (Fig. 51): The phytogeographical spectrum resemble much that of ARR03.

Association dynamics and conservation: Most of the area of this association is under constant grazing.

Aspects of the association: Persistents – 11 spp.; ephemerals – 59 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00288	10	5	34	27.03.67	I 2236 5695
2	00322	8	2	32	05.05.67	I 2239 5698
3	00516	10	5	16	04.07.66	I 2249 5696
4	00580	7	3	24	04.09.67	I 2331 6131
5	00619	13	2	15	04.04.67	I 2281 5655
6	00623	20	5	32	04.04.67	I 2239 5698
Average:		11.3	3.7	25.5		

6.3.2.2.5 ARR05 Helianthemo ledifolii – Salsoletum orientalis Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 18. **Distribution:** Fig. 52.

Ecological notes: The typical habitats of this association are alluvial-colluvial terraces rich in eolian loess, mixed with chalk and marl derived from Turon and Eocene rocks at the Central Negev Highlands, elevation above 700 m a.s.l. Although resembling the other xerohalophyte communities by the high relative cover of the dominant, it differs by the presence of other persistent plants, mainly dominants of the Reaumurietalia, in the relevés of the association.

Phytogeographical analysis: (Fig. 51): The phytogeographical spectrum resembles much that of ARR03 and ARR04.

Association dynamics and conservation: The area of this association is practically protected from overgrazing and cutting for the last 35 years.

Aspects of the association: Persistents – 17 spp.; ephemerals – 51 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94317	10	10	29	22.03.94	I 1785 5018
2	94318	10	7	26	22.03.94	I 1786 5018
3	94319	15	7	24	22.03.94	I 1787 5018
4	94320	10	7	23	22.03.94	I 1785 5019
5	94321	15	10	21	22.03.94	I 1785 5017
6	94322	20	10	19	22.03.94	I 1785 5016
7	94323	10	10	20	22.03.94	I 1787 5016
8	94324	10	10	22	22.03.94	I 1787 5019
9	94325	15	5	19	22.03.94	I 1784 5018
10	94326	15	7	25	22.03.94	I 1784 5019
Average:		13.0	8.3	22.8		

6.3.2.2.6 ARR06 Ferulo daninii – Salsoletum orientalis Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 19. **Distribution:** Fig. 52.

Ecological notes: The dry climatic conditions of an area as south as the area of this association support contracted vegetation at lower elevation. At the north-facing slopes of Har Sagi there is sufficient moisture to support this rare association, at a diffused pattern with several species which hardly grow in other associations. *Ferula daninii* is an endemic species confined mainly to this slope and two other locations of the Negev Highlands. Other species which rarely occur in other associations are *Tulipa polychroma, Cymbolaena griffithii, Bromus danthoniae,* and *Leopoldia longipes* subsp. *negevensis.*

Phytogeographical analysis: (Fig. 53): The most frequent chorotype is the Irano-Turanian, with considerable percentage of the SA and SA-IT chorotypes.

Association dynamics and conservation: The area of this association is practically protected from overgrazing and cutting for the last 35 years.

Aspects of the association: Persistents – 10 spp.; ephemerals – 40 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94415	20	10	22	11.04.94	I 1660 4755
2	94416	20	10	30	11.04.94	I 1661 4755
3	94417	20	15	24	11.04.94	I 1662 4755
4	94418	30	10	33	11.04.94	I 1663 4755
5	94419	20	10	22	11.04.94	I 1663 4754
6	94420	15	10	27	11.04.94	I 1662 4754
7	94421	30	10	23	11.04.94	I 1662 4756
8	94422	15	10	25	11.04.94	I 1660 4756
Average:		21.3	10.6	25.8		

Table 19. Association tables of ARR06 – Ferulo daninii – Salsoletum orientalis, ARR07 Erodio crassifolii – Reaumurietum hirtellae, and ARR08 Halothamno acutifolii – Agathophoretum alopecuroidis

		Species	ARR06 *12345678	C1	C2	%P	ARR07 *1234567890	C1	C2	%P	ARR08 *12345	C1	C2	%P
	W	Aaronsohnia factorovskyi					...+......	0	0	10				
	A	Acantholepis orientalis	+..+....	0	0	25					++...	0	0	40
*	S	Agathophora alopecuroides					+++......+	0	0	40	33566	**46**	**46**	**100**
	W	Aizoon hispanicum					+.........	0	0	10				
	W	Allium ampeloprasum					+.........	0	0	10				
	A	Allium artemisietorum									..+..	0	0	20
	B	Allium erdelii					.0........	5	1	10				
	A	Allium rothii					.+........	0	0	10				
	H	Allium stamineum					..+.......	0	0	10				
*	N	Anabasis articulata	0.0..0+.	4	2	50	++..4+..3.	14	7	50	.3112	**19**	**15**	**80**
*	A	Anabasis syriaca					.......+..	0	0	10				
	W	Anthemis melampodina	25144233	**30**	**30**	**100**					43322	**28**	**28**	**100**
	W	Arnebia linearifolia									...++	0	0	40
*	A	Artemisia sieberi	.++.....	0	0	25	0.....4.++	11	5	40	....+	0	0	20
*	V	Asparagus horridus					......+...	0	0	10				
	N	Asteriscus hierochunticus	.0+031.1	**11**	**8**	**75**	+....+...+	0	0	30	+++.+	**0**	**0**	**80**
	A	Astragalus callichrous					..+.......	0	0	10				
*	A	Astragalus sanctus	.+......	0	0	13					..++.	0	0	40
	W	Astragalus tribuloides	++....++	0	0	50	.++.+.....	0	0	30	++.+.	**0**	**0**	**60**
*	W	Atractylis phaeolepis	....+...	0	0	13	....+.....	0	0	10	.+..+	0	0	40
*	A	Atractylis serratuloides					+.........	0	0	10				
*	S	Atriplex glauca					.......3..	30	3	10	.+...	0	0	20
*	S	Atriplex leucoclada					.........+	0	0	10				
*	S	Bassia arabica					.12.....1.	17	5	30	..10.	8	3	40
	A	Bellevalia desertorum					..+.+.+...	0	0	30				
	A	Boissiera squarrosa									1+++0	**3**	**3**	**100**
	A	Bromus danthoniae	..+..+..	0	0	25								
	H	Bromus fasciculatus	..++.+..	0	0	38	......+...	0	0	10				
	A	Carex pachystylis	0+++++2+	**3**	**3**	**100**	1...25....	27	8	30	+++..	**0**	**0**	**60**
	W	Carrichtera annua					0...+.....	3	1	20				
*	A	Centaurea aegyptiaca					.++0++...+	**0**	**0**	**60**				
	H	Centaurea hyalolepis					....+.....	0	0	10				
	W	Centaurea pallescens					..+.......	0	0	10				
	A	Ceratocephala falcata					..+.......	0	0	10				
	A	Colchicum ritchii					.+........	0	0	10				
	A	Colchicum tunicatum	++++++.+	**0**	**0**	**88**	+...1++...	3	1	40	+++.+	**0**	**0**	**80**
	H	Crepis sancta					..+.......	0	0	10	+....	0	0	20
	W	Crithopsis delileana					..+.......	0	0	10				
	R	Cutandia memphitica					.+........	0	0	10				
	A	Cymbolaena griffithii	.+...+..	0	0	25								
*	A	Deverra tortuosa					.........+	0	0	10				
	W	Diplotaxis harra					3....++...	10	3	30				
*	B	Echinops polyceras					.......+.+	0	0	20				
	W	Emex spinosa					....+.....	0	0	10				
	A	Eremopyrum distans	.+++++++	**0**	**0**	**88**					+++++	**0**	**0**	**100**
	W	Erodium crassifolium	...+++++	**0**	**0**	**63**	.0++.5+..+	**9**	**6**	**60**	+...+	0	0	40
	W	Erucaria microcarpa	2+452322	**25**	**25**	**100**	3.0.......	18	4	20	35555	**46**	**46**	**100**
	W	Euphorbia chamaepeplus					++....+...	0	0	30	...+.	0	0	20
*	A	Fagonia mollis									.+.+.	0	0	40
	A	Ferula daninii	4241+131	**20**	**20**	**100**					+++++	**0**	**0**	**100**
	W	Filago desertorum	++++++.+	**0**	**0**	**88**	+++.+.....	0	0	40	+..++	**0**	**0**	**60**
	W	Gagea reticulata	.+.+++++	**0**	**0**	**75**	+.+.+.....	0	0	30	+.++.	**0**	**0**	**60**
	W	Gastrocotyle hispida					.+........	0	0	10				
	H	Geranium tuberosum					.2........	20	2	10				
	W	Gymnarrhena micrantha	.+.+.+.+	0	0	50	+3+6.+....	18	9	50	++.+.	**0**	**0**	**60**
*	N	Gymnocarpos decander					0+....+..+	1	1	40				
*	S	Halothamnus acutifolius	.+.++..+	0	0	50	.2........	20	2	10	21++0	**7**	**7**	**100**
	H	Helianthemum aegyptiacum									..+..	0	0	20
*	A	Helianthemum kahiricum					+.........	0	0	10				
	W	Helianthemum ledifolium	+0++0++2	**4**	**4**	**100**	..1.+.....	5	1	20	+.+1+	**3**	**2**	**80**
	H	Helianthemum salicifolium					..+.......	0	0	10				
*	A	Helianthemum vesicarium	.......+	0	0	13	+....++...	0	0	30				
*	S	Herniaria hemistemon					..+.......	0	0	10				

Table 19. continued.

		Species	ARR06 12345678	C1	C2	%P	ARR07 1234567890	C1	C2	%P	ARR08 12345	C1	C2	%P
	H	Hippocrepis unisiliquosa					......+...	0	0	10				
	A	Iris regis-uzziae									..+..	0	0	20
	A	Ixiolirion tataricum	+......+	0	0	25					+++++	**0**	**0**	**100**
*	W	Kickxia floribunda					....+.....	0	0	10				
	W	Koelpinia linearis	++.++.++	**0**	**0**	**75**					+....	0	0	20
	W	Lappula spinocarpos	.+++..+.	0	0	50	..+.+.....	0	0	20	...+.	0	0	20
	A	Leopoldia longipes	.....+..	0	0	13	...+......	0	0	10	..+++	**0**	**0**	**60**
	S	Limonium lobatum					.........+	0	0	10				
*	S	Limonium pruinosum					..+.......	0	0	10				
	W	Lomelosia porphyroneura	++++..++	**0**	**0**	**75**	.....+....	0	0	10	+++.+	**0**	**0**	**80**
	W	Malva aegyptia					....+.+...	0	0	20				
	W	Matthiola livida	+..+.+.+	0	0	50	+.1.......	5	1	20	+.++.	**0**	**0**	**60**
	W	Medicago laciniata					..+.......	0	0	10				
*	A	Moricandia nitens	...+....	0	0	13	.+....+...	0	0	20				
	S	Nasturtiopsis coronopifolia					.3........	30	3	10				
	W	Neotorularia torulosa	.+.+....	0	0	25	..+.......	0	0	10	....+	0	0	20
*	A	Noaea mucronata					..+...+..+	0	0	30				
	W	Onobrychis crista-galli					..+.......	0	0	10				
	H	Ornithogalum neurostegium	++....+.	0	0	38								
*	V	Phagnalon rupestre					..+...+...	0	0	20				
	R	Picris amalecitana					......5...	50	5	10				
	W	Picris longirostris	++1.++.+	**2**	**1**	**75**					.++0+	**1**	**1**	**80**
	W	Plantago coronopus	.+++++..	**0**	**0**	**63**	+.+..+....	0	0	30	+....	0	0	20
	W	Plantago ovata	01+++.+.	**3**	**2**	**75**	......+...	0	0	10	+1100	**6**	**6**	**100**
	W	Poa sinaica	+1.+++++	**1**	**1**	**88**	+.+..+2...	5	2	40	++011	**5**	**5**	**100**
	S	Pteranthus dichotomus	.....2.+	10	3	25	++62......	21	9	40	1...1	10	4	40
	H	Ranunculus asiaticus	....+...	0	0	13	..+.......	0	0	10	.+...	0	0	20
*	S	Reaumuria hirtella	0110.011	**9**	**8**	**88**	6679596657	**69**	**69**	**100**	1+221	**12**	**12**	**100**
*	S	Reaumuria negevensis					........+.	0	0	10				
*	R	Retama raetam					......+..+	0	0	20				
	W	Roemeria hybrida	..++....	0	0	25	.+.+......	0	0	20	.+...	0	0	20
	H	Rostraria smyrnacea									.+++.	**0**	**0**	**60**
	W	Rumex cyprius	+.......	0	0	13					....+	0	0	20
	S	Salsola inermis					.+.......+	0	0	20	++...	0	0	40
*	S	Salsola orientalis									42+..	**20**	**12**	**60**
*	S	Salsola vermiculata					..+....1.2	10	3	30				
*	A	Salvia lanigera					........++	0	0	20				
	W	Schismus arabicus					.+........	0	0	10				
	W	Scilla hanburyi					+.+..+....	0	0	30				
	W	Scorzonera judaica					+...+.....	0	0	20				
	H	Scorzonera papposa	......+.	0	0	13	....+.+...	0	0	20				
	W	Senecio glaucus	+.++.+++	**0**	**0**	**75**	+.+...+...	0	0	30				
	W	Silene vivianii	.....+..	0	0	13								
	S	Spergularia diandra	...+.++.	0	0	38	0.........	5	1	10				
	W	Stipa capensis					+...++2...	5	2	40	....+	0	0	20
	S	Trigonella schlumbergeri					...1......	10	1	10				
	W	Trigonella stellata					+...+.....	0	0	20	+....	0	0	20
	A	Tulipa polychroma	.+++..+.	0	0	50								
	A	Urginea undulata					+.........	0	0	10				
	A	Valerianella dufresnia	.+......	0	0	13					...+.	0	0	20
	A	Zosima absinthiifolia	.++++.+.	**0**	**0**	**63**	........+.	0	0	10	+++++	**0**	**0**	**100**
*	N	Zygophyllum dumosum	...00...	4	1	25	2+......+.	7	2	30	..+.+	0	0	40

6.3.2.2.7 ARR07 Erodio crassifolii – Reaumurietum hirtellae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 19. **Distribution:** Fig. 54.

Ecological notes: *Reaumuria hirtella* var. *brahylepis* is confind to soft chalk and marl of the Mt. Scopus Group, mainly of the Senonian, (Bartov et al., 1981). As other associations of xerohalophytes, there are very few (only one here) persistent companions in the markers group. A salinity profile studied in the Northern Negev is discussed by Danin (1978b).

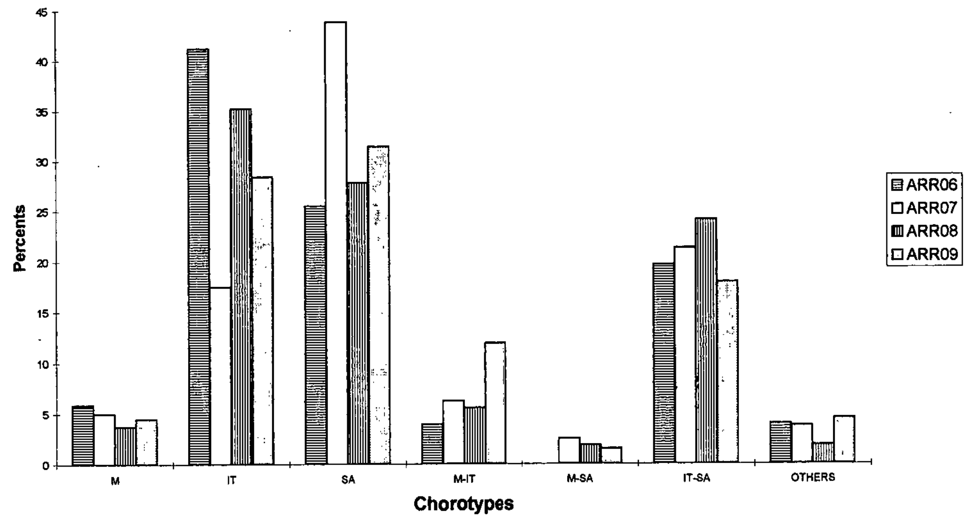

Figure 53.Phytogeographical analysis of associations ARR06-ARR09.

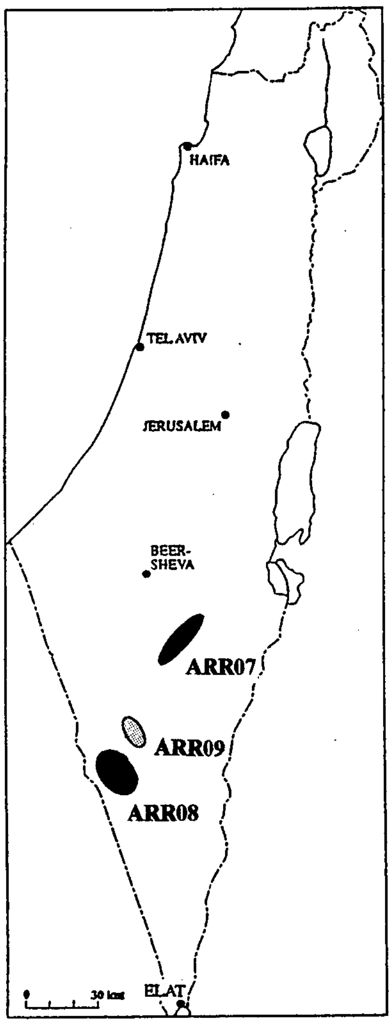

Figure 54. Distribution map of associations ARR07, ARR08, and ARR09.

Phytogeographical analysis: (Fig. 53): The most frequent chorotype is the Saharo-Arabian with considerable percentage of the SA-IT and IT chorotypes.

Association dynamics and conservation: It may grow for many years without any ephemeral companion, and become rich in annuals in rainy years.

Aspects of the association: Persistents – 28 spp.; ephemerals – 65 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00133	5	15	32	27.04.64	I 1848 5352
2	00228	7	3	25	14.04.67	I 1923 5449
3	00286	9	6	35	27.03.67	I 2230 5718
4	00363	1	5	9	07.05.67	I 1763 5279
5	00433	2	8	22	18.03.67	I 1777 5067
6	00435	1	6	14	18.03.67	I 1784 5068
7	00444	1	14	23	18.03.67	I 1786 5123
8	00499	0	10	5	09.01.67	I 2194 5651
9	00548	0	5	8	22.08.66	I 1883 5180
10	00556	1	2	16	26.08.66	I 2210 5700
Average:		2.7	7.4	18.9		

6.3.2.2.8 ARR08 Halothamno acutifolii – Agathophoretum alopecuroidis Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 19. **Distribution:** Fig. 54.

Ecological notes: This association and ARR06 replace each other on the slopes of Har Sagi as edaphic conditions change. This association is confined to more marly conditions. They share several uncommon ephemeral species such as: *Boissiera squarrosa, Eremopyrum distans, Ferula daninii,* and *Ixiolirion tataricum,*

Phytogeographical analysis: (Fig. 53): This association resembles ARR06 in the phytogeographical spectrum where the most frequent chorotype is the Irano-Turanian, with considerable percentage of the SA and SA-IT chorotypes.

Association dynamics and conservation: The area of this association is practically protected from overgrazing and cutting for the last 35 years.

Aspects of the association: Persistents – 12 spp.; ephemerals – 32 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94390	30	7	31	10.04.94	I 1659 4761
2	94391	30	10	30	10.04.94	I 1659 4762
3	94392	30	10	31	10.04.94	I 1659 4763
4	94393	30	10	29	10.04.94	I 1660 4761
5	94394	30	10	30	10.04.94	I 1658 4761
Average:		30.0	9.4	30.2		

Table 20. Association tables of ARR09 – Cymbolaeno griffithii – Reaumurietum hirtellae, MMA01 – Agathophoro alopecuroidis – Anabasietum articulata, and MMA02 – Anabasietum setiferae

		Species	ARR09 *123456	C1	C2	%P	MMA01 *123456789012	C1	C2	%P	MMA02 *1234567	C1	C2	%P
	W	Adonis dentata	+.....	0	0	17								
*	S	Agathophora alopecuroides					1+21+1+.+200	**8**	**8**	**92**	.4.+.30	19	11	57
	C	Aizoon canariense					.......+....	0	0	8				
	H	Allium artemisietorum	.+....	0	0	17	........+...	0	0	8				

Table 20. continued.

		Species	ARR09				MMA01				MMA02			
			123456	C1	C2	%P	123456789012	C1	C2	%P	1234567	C1	C2	%P
	A	Allium rothii	.++..+	0	0	50								
	H	Allium stamineum					+...........	0	0	8				
	F	Ammochloa palaestina	.+....	0	0	17								
*	N	Anabasis articulata	....0.	5	1	17	577887567666	**65**	**65**	**100**	0+....+	2	1	43
*	N	Anabasis setifera									7469579	**68**	**68**	**100**
*	A	Anabasis syriaca	21...0	12	6	50								
	W	Anthemis melampodina	.21.++	**8**	**5**	**67**	.....+.+..+.	0	0	25				
	W	Arnebia linearifolia					..+....+....	0	0	17				
*	A	Artemisia sieberi	..+..0	3	1	33	.+.+.....+.+	0	0	33				
	N	Asteriscus hierochunticus	..0..+	3	1	33	.....+......	0	0	8				
*	C	Asteriscus graveolens									.0+....	3	1	29
*	A	Astragalus sanctus					.+..+.+.+...	0	0	33				
	W	Astragalus tribuloides	++..+.	0	0	50	.......++...	0	0	17				
*	R	Atractylis carduus									.+.....	0	0	14
*	W	Atractylis phaeolepis	..00..	5	2	33	.....+......	0	0	8				
*	S	Atriplex glauca					......+.....	0	0	8				
*	S	Atriplex leucoclada					..........+.	0	0	8				
	A	Avena wiestii	+.....	0	0	17								
*	S	Bassia arabica					++.+++132111	**8**	**8**	**92**				
	A	Bellevalia eigii	..+...	0	0	17								
	A	Boissiera squarrosa	0..+++	**1**	**1**	**67**								
	H	Brachypodium distachyon	..+...	0	0	17								
	A	Bromus danthoniae	...+..	0	0	17	...+..+...+.	0	0	25				
	H	Bromus fasciculatus	3.+++.	**8**	**5**	**67**	++.3+.+21.+1	**8**	**6**	**75**				
	N	Calendula tripterocarpa	..+...	0	0	17	......+.....	0	0	8				
	A	Carex pachystylis	+0++.1	**3**	**3**	**83**								
*	A	Centaurea aegyptiaca	.+...+	0	0	33	...........+	0	0	8				
*	C	Centaurea lanulata									+.0....	3	1	29
	W	Centaurea pallescens	.....+	0	0	17								
	A	Ceratocephala falcata	++....	0	0	33								
	A	Colchicum tunicatum	+.++.+	**0**	**0**	**67**	...........+	0	0	8				
	R	Cutandia memphitica	++++..	**0**	**0**	**67**								
	A	Cymbolaena griffithii	++++++	**0**	**0**	**100**								
	W	Diplotaxis harra	.++.++	**0**	**0**	**67**	...+++.....+	0	0	33				
	A	Eremopyrum bonaepartis	.+....	0	0	17								
	A	Eremopyrum distans	+1.++.	**3**	**2**	**67**	.++.+....+.+	0	0	42				
	H	Erodium ciconium	.+....	0	0	17								
	W	Erodium crassifolium	+...++	0	0	50	1.++0+.+++53	**10**	**8**	**83**				
	W	Erodium touchyanum	+.....	0	0	17								
	W	Erucaria microcarpa					35932+5332.0	**33**	**30**	**92**				
*	A	Fagonia mollis	+.00..	3	2	50					..2.1..	18	5	29
*	N	Fagonia tenuifolia									.+.....	0	0	14
	A	Ferula daninii					.+..........	0	0	8				
	W	Filago desertorum	+++..+	**0**	**0**	**67**	..+.........	0	0	8				
	W	Gastrocotyle hispida	++.++.	**0**	**0**	**67**	..+..+.....+	0	0	25				
	W	Gymnarrhena micrantha					0++++5++3++.	**8**	**7**	**92**				
*	N	Gymnocarpos decander	..++..	0	0	33	.....0+...++	1	0	33	...+...	0	0	14
	H	Gynandriris sisyrinchium					.........+..	0	0	8				
*	S	Halothamnus acutifolius	..+.0+	2	1	50					+.1.+..	3	1	43
*	S	Haplophyllum tuberculatum									....+..	0	0	14
	H	Helianthemum aegyptiacum					......+.....	0	0	8				
*	A	Helianthemum kahiricum					..........+1	5	1	17				
	W	Helianthemum ledifolium	12503.	**23**	**19**	**83**	+++.+11++...	3	2	67				
*	A	Helianthemum ventosum					..........++	0	0	17				
*	A	Helianthemum vesicarium	.+....	0	0	17	++....+.+...	0	0	33				
*	C	Heliotropium maris-mortui									..+....	0	0	14
	W	Herniaria hirsuta	..++..	0	0	33	.........+.+	0	0	17				
	H	Hippocrepis unisiliquosa	...++.	0	0	33								
	D	Hordeum glaucum	++....	0	0	33								
	A	Iris regis-uzziae	..+...	0	0	17								
	W	Koelpinia linearis					.+.....+++.+	0	0	42				
	W	Lappula spinocarpos	.....+	0	0	17	..+......+.+	0	0	25				
	A	Leopoldia longipes					+++++...+...	0	0	50				

Table 20. continued.

		Species	ARR09 123456	C1	C2	%P	MMA01 123456789012	C1	C2	%P	MMA02 1234567	C1	C2	%P
	A	Leptaleum filifolium					......0.....	5	0	8				
*	S	Limonium pruinosum					..........++	0	0	17				
	W	Linaria haelava	+.....	0	0	17								
	W	Lomelosia porphyroneura	.+.+..	0	0	33	........+...	0	0	8				
	W	Malva aegyptia	0	5	1	17								
	W	Matthiola livida	10.6.0	**20**	**13**	**67**	....++...+3+	6	3	42				
*	A	Moricandia nitens	...11.	10	3	33								
	W	*Neotorularia torulosa*	...+..	0	0	17	....+....++.	0	0	25				
*	A	Noaea mucronata					.+.+++2...++	3	2	58				
	H	Ornithogalum neurostegium					.........+..	0	0	8				
*	V	Pennisetum ciliare									....+..	0	0	14
	W	Picris longirostris					+.00++++2+..	**3**	**3**	**75**				
	H	Pimpinella cretica									.+.....	0	0	14
	W	Plantago coronopus	++++..	**0**	**0**	**67**	+..........+	0	0	17				
	W	Plantago ovata	++.+++	**0**	**0**	**83**	44.274351615	**38**	**35**	**92**				
	W	Poa sinaica	.+.+++	**0**	**0**	**67**	++.+++.+.+..	0	0	58				
	S	Pteranthus dichotomus	13+2+1	**13**	**13**	**100**	1.....+.+++.	2	1	42				
	W	Pterocephalus brevis	+.....	0	0	17								
	H	Ranunculus asiaticus					....+...+...	0	0	17				
*	S	Reaumuria hirtella	899889	**85**	**85**	**100**	421.0121112+	**14**	**13**	**92**				
	W	Reseda decursiva	..++..	0	0	33								
*	C	Reseda urnigera									+......	0	0	14
	W	Roemeria hybrida	..+...	0	0	17								
	H	Rostraria smyrnacea	+.++.+	**0**	**0**	**67**								
	W	Rumex cyprius					..+........+	0	0	17				
	S	Salsola inermis	+..+++	**0**	**0**	**67**	.+.+.....+..	0	0	25				
*	S	Salsola schweinfurthii					........+.+.	0	0	17				
*	S	Salsola tetrandra									20.+...	8	4	43
*	A	Salvia lanigera	.+....	0	0	17	..+.........	0	0	8				
	W	Schismus arabicus	...+..	0	0	17	.+..+.....++	0	0	33				
	H	Scorzonera papposa	..+...	0	0	17								
	W	Senecio glaucus					++000++.++.0	**2**	**2**	**83**				
	W	Silene vivianii	.++...	0	0	33	...+......+.	0	0	17				
	S	Spergularia diandra					.....+...+++	0	0	33				
	W	Stipa capensis	312177	**35**	**35**	**100**	.....+......	0	0	8	.....+.	0	0	14
*	V	Stipa pellita	++.+.+	**0**	**0**	**67**	.+..........	0	0	8				
*	R	Stipagrostis raddiana									....3..	30	4	14
*	V	Tetrapogon villosus									......+	0	0	14
	W	*Trichodesma africana*									+......	0	0	14
	W	Trigonella stellata					..+..+......	0	0	17				
	A	Tulipa polychroma					.........+.+	0	0	17				
	A	Tulipa systola	..+..+	0	0	33								
	A	Valerianella dufresnia	++....	0	0	33								
*	N	Zygophyllum dumosum					...01+......	5	1	25	.0.+...	3	1	29

6.3.2.2.9 ARR09 Cymbolaeno griffithii – Reaumurietum hirtellae Danin et Solomeshsch ass. nov.

Diagnostical species: the markers in table 20. **Distribution:** Fig. 54.

Ecological notes: This Reaumurietum is developed in a typical habitat of associations from the Haloxylion scopariae, i.e., on colluvium of Loessial Serozem. The Haloxylion and Salsolion vermiculatae occupy saline substratum of fine-grained soil. It is in the Negev Highlands where there are patches of associations with dominants from Salsolion which develop and constitute association dominated by them among colluvial terraces covered by Helianthemo ledifolii – Anabasietum syriacae (AAH03).

Phytogeographical analysis: (Fig. 53): The phytogeographical analysis of this association resembles much the floristic spectrum of other associations on the same substratum and from the same area (e.g., AAH03, ARR05).

Association dynamics and conservation: The area of this association is practically protected from overgrazing and cutting for the last 35 years.

Aspects of the association: Persistents – 13 spp.; ephemerals – 49 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94400	20	10	32	11.04.94	I 1572 4848
2	94401	30	10	32	11.04.94	I 1573 4848
3	94404	10	10	32	11.04.94	I 1574 4848
4	94405	20	10	31	11.04.94	I 1572 4849
5	94406	20	10	20	11.04.94	I 1573 4849
6	94407	30	10	27	11.04.94	I 1574 4849
Average:		21.7	10.0	29.0		

Table 21. Synoptic table of associations of the Reaumurietalia hirtellae, Salsolion vermiculatae: 1 – ARS01, 2 – ARS02, 3 – ARS03, 4 – ARS04, 5 – ARS05, 6 – ARS06, 7 – ARS07, Eremopyro distantis-Raeumurion negevensis: 8 – ARR01, 9 – ARR02, 10 – ARR03, 11 – ARR04, 12 – ARR05, 13 – ARR06, 14 – ARR07, 15 – ARR08, 16 – ARR09

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P	14 %P	15 %P	16 %P
	d.s. Artemisietea sieberi																
A	Carex pachystylis				14				50	44	25		20	**100**	30	**60**	**83**
A	Artemisia sieberi		14						25	**89**			40	25	40	20	33
W	Scorzonera judaica				**100**				50	11		17	**80**		20		
W	Roemeria hybrida									11				25	20	20	17
W	Lappula spinocarpos										25	50		50	20	20	17
A	Avena wiestii		14						13				10				17
	d.s. Raeumurietalia hirtellae																
S	Pteranthus dichotomus	50	**86**	**94**		33	17	**71**	**63**	11	**75**	**100**		25	40	40	**100**
S	Reaumuria hirtella	33	**71**			11	**100**	**100**	**75**	11	25	33	20	**88**	**100**	**100**	**100**
W	Plantago ovata	33		**100**		**67**			13	11	50	**83**	40	**75**	10	**100**	**83**
S	Salsola inermis		29			22	17	57	25	44	38	**67**	30		20	40	**67**
	d.s. Salsolion vermiculatae																
S	Salsola vermiculata	**100**	**100**	**100**	**100**	**78**	17	**1**				17			30		
H	Centaurea hyalolepis	**83**	**71**	**94**	**71**		**75**	**71**							10		
W	Crithopsis delileana	**83**	**100**		**86**	22	**83**	**100**							10		
W	Erucaria rostrata	**83**	57	59	**100**	33	**92**	**100**				33					
S	Limonium lobatum	**67**	**71**	**94**	57	11	33					**67**			10		
A	Astragalus callichrous	**67**	14	35	14		50	**86**				17			10		
W	Poa eigii	**100**	29		14		**83**	**86**									
H	Aegilops peregrina	**67**	43	35	43			29									
W	Ononis sicula	50	**71**	12	43	22	58	43									
H	Chaetosciadium trichospermum	33	14	12		11	17	**71**									
W	Anchusa aegyptiaca	17	14	12	**71**	11		29									
H	Pimpinella cretica	50		12	14	11	25	57									
W	Echium judaeum	**67**		**94**	57	11											
	d.s. Eremopiro distantis-Reaumurion negevensis																
W	Anthemis melampodina								**100**		25		**80**	**100**		**100**	**67**
N	Anabasis articulata		14	6					25	33	**88**	50	**60**	50	50	**80**	17
W	Lomelosia porphyroneura			35	43		8		25	11	**75**	17	30	**75**	10	**80**	33
A	Eremopyrum distans								50		50		20	**88**		**100**	**67**
S	Halothamnus acutifolius		14								**100**	**100**	40	50	10	**100**	50
N	Asteriscus hierochunticus			24		11					**100**	**67**	10	**75**	30	**80**	33
S	Agathophora alopecuroides		14			22			22	**63**	50	**60**		40	**100**		
S	Reaumuria negevensis								25	**100**			**80**		10		
W	Atractylis phaeolepis									11	25		10	13	10	40	33
S	Atriplex glauca						25	**100**	**100**	11			**80**		10	20	
S	Bassia arabica					56			13	11		33	40		30	40	

Table 21. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P	14 %P	15 %P	16 %P
S	Salsola orientalis								13	11			**100**	**100**		**60**	
N	Zygophyllum dumosum					11				**67**	13	17	20	25	30	40	
	Marker and rare species of associations																
Q	Allium neapolitanum	**67**									13						
H	Rhagadiolus stellatus	**67**		24													
H	Crepis sancta	**67**		35											10	20	
W	Trigonella arabica	**67**		41				14									
H	Erodium gruinum	50		18													
H	Filago palaestina	50		18				14									
H	Hedypnois cretica	50		18			25										
H	Papaver umbonatum	50		29													
W	Lolium rigidum	50															
H	Silene oxyodonta	33															
H	Torilis tenella	33		6				14									
H	Parentucellia latifolia	33															
H	Beta vulgaris	33	14	6			8	14									
W	Linaria haelava	33				11							10				17
H	Lagoecia cuminoides	33	14					29									
W	Tordylium aegyptiacum	33															
D	Chrysanthemum coronarium	33		12													
B	Calendula palaestina	17		12													
B	Plantago bellardii	17															
A	Buglossoides arvensis	17					17										
D	Chenopodium murale	17															
D	Malva nicaeensis	17		6													
H	Bromus scoparius	17			14												
H	Bromus tectorum	17					8	14									
D	Hordeum glaucum	17					17		13								33
H	Filago pyramidata	17		12				14									
Q	Lamium amplexicaule	17															
H	Silene damascena	17															
H	Torilis arvensis	17															
H	Vicia palaestina	17															
H	Vicia sativa	17															
H	Vulpia ciliata	17															
H	Pimpinella eriocarpa		57														
V	Hyoscyamus aureus		43				42										
D	Malva parviflora		29	29			17		13								
H	Daucus durieua	17	29	6			25										
W	Silene linearis		14			11	8										
A	Astragalus bombycinus		14														
A	Atractylis serratuloides		14												10		
W	Matthiola aspera	33		**100**	29												
W	Reichardia tingitana	17	14	**76**			8					50					
W	Asphodelus tenuifolius		14	**71**		22	8	14									
W	Atractylis cancellata	17		**65**													
W	Aaronsohnia factorovskyi	17	14	53		44		43				17			10		
W	Reseda decursiva		14	47													33
H	Ononis mollis	33		41													
A	Bellevalia eigii			41													17
C	Notoceras bicorne			41			25	14									
W	Allium hierochuntinum			41		11	17	29									
W	Rumex cyprius		14	29									10	13		20	
W	Crepis aspera	17		29	14												
W	Erodium neuradifolium			24			8										
H	Salvia horminum			24													
N	Anthemis maris-mortui			18													
H	Avena sterilis			18													
W	Minuartia picta			12													

Table 21. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P	14 %P	15 %P	16 %P
H	Anthemis hebronica			12													
H	Antirrhinum orontium			12		11											
H	Linum strictum			12													
H	Silene colorata			12													
H	Urospermum picroides			12													
L	Galium hierochuntinum			12													
H	Orobanche aegyptiaca			12													
B	Trisetaria macrochaeta			12													
H	Paronychia argentea			6													
H	Plantago cretica			6													
H	Raphanus rostratus			6													
H	Pterocephalus plumosus			6													
H	Artedia squamata			6													
H	Bellevalia flexuosa			6													
H	Campanula stellaris			6													
H	Crucianella macrostachya			6													
B	Hyacinthella nervosa			6													
B	Anchusa strigosa			6													
B	Factorovskya aschersoniana		6														
A	Malabaila secacul			6													
W	Astragalus asterias			6													
H	Androcymbium palaestinum			6													
H	Lotus peregrinus			6													
H	Senecio vernalis			6													
A	Noaea mucronata				**100**	11	8			22					30		
H	Eryngium creticum				**100**												
H	Hymenocarpos circinnatus	33	14	12	**100**		8										
V	Phagnalon rupestre	33	14	6	**86**		8								20		
B	Teucrium capitatum	33		6	**86**												
H	Carthamus tenuis		14		**86**												
H	Gynandriris sisyrinchium				**71**			57	13			33	10				
H	Matthiola longipetala				**71**												
W	Carrichtera annua				**71**				13	11		17			20		
B	Kickxia aegyptiaca				**71**												
H	Filago contracta	50	14		57		8	29									
V	Paronychia capitata	17			43												
A	Astragalus spinosus				43												
H	Plantago afra	17	14	6	29												
A	Dianthus monadelphus				29												
D	Cuscuta brevistyla				14												
H	Dianthus strictus				14												
S	Satureja thymbrifolia					**100**											
S	Erodium glaucophyllum					**78**	17					17					
A	Bellevalia desertorum		57	18	29	**67**	33	71			38	17			30		
W	Diplotaxis harra					**67**				44	13		40		30		**67**
S	Reseda muricata					**67**	8										
B	Gypsophila arabica				14	56	17										
A	Helianthemum kahiricum					56				33			10		10		
S	Herniaria hemistemon					44	33					17	10		10		
R	Haplophyllum tuberculatum				29	44	33										
B	Echinops polyceras		14		29	44	42								20		
H	Muscari commutatum					44											
B	Allium erdelii			6		33									10		
W	Silene decipiens					22		14									
V	Arenaria leptoclados					11											
V	Asterolinon linum-stellatum				11												
W	Arnebia decumbens					11											
A	Silene conoidea					11											
A	Buglossoides tenuiflora					11											
A	Erodium arborescens					11											
W	Carthamus nitidus			12		56	58										

Table 21. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P	14 %P	15 %P	16 %P
W	Aegilops kotschyi		29				50						10				
A	Tripleurospermum auriculatum						42		38								
A	Bupleurum semicompositum						25										
H	Galium judaicum			6			17										
H	Bupleurum lancifolium						17										
V	Centaurea eryngioides						17										
H	Parentucellia viscosa						17										
B	Heliotropium rotundifolium						17										
B	Verbascum fruticulosum		14				17										
B	Salvia dominica						8										
B	Astoma seselifolium						8										
B	Ballota undulata						8										
B	Carlina libanotica						8										
B	Ononis natrix						8										
B	Onopordum palaestinum						8										
W	Scariola orientalis						8										
A	Onosma echinata						8										
W	Aizoon hispanicum	17		**71**				**100**							10		
W	Anagallis arvensis	50		35	57	56	8	**100**									
H	Gagea chlorantha	**67**		12				**71**									
W	Adonis dentata	50		29				**71**				17					17
W	Emex spinosa		29	29	43		42	**71**			13				10		
H	Ranunculus asiaticus	33		12	57	22	17	**71**				17	10	13	10	20	
H	Biscutella didyma	33		12		11		**71**									
W	Parietaria alsinifolia					11	25	**71**									
W	Euphorbia chamaepeplus	33		12		33		**71**							30	20	
W	Pterocephalus brevis	17		35			25	57	25								17
H	Trigonella monspeliaca							43									
H	Hordeum spontaneum	17		6				43									
S	Suaeda asphaltica							43									
W	Lathyrus pseudocicera							14									
W	Lamarckia aurea							14									
A	Vicia monantha							14									
W	Schismus arabicus			6		11	25	43	**75**		38	17	30		10		17
F	Ammochloa palaestina								50								17
A	Centaurea ammocyanus								50				10				
W	Medicago radiata								25								
W	Malva aegyptia								25				10		20		17
A	Silene coniflora								13								
A	Trigonella astroites								13								
S	Limonium pruinosum									33					10		
A	Haloxylon scoparium									22							
A	Salvia lanigera									22					20		17
A	Plantago phaeostoma									11							
F	Allium sindjarense									11							
A	Helianthemum ventosum									11							
S	Salsola oppositifolia									11							
A	Urginea undulata									11			10		10		
V	Asparagus horridus									11			10		10		
S	Atriplex leucoclada	17		6				14			50	33			10		
A	Atractylis prolifera										50	17					
C	Leysera leyseroides										38						
W	Spergula fallax			6							13						
S	Salsola schweinfurthii										13						
W	Trigonella stellata		29			11	8	57			13	**67**			20	20	
S	Mesembryanthemum nodiflorum									33							
W	Centaurea pallescens		14			11					13	33			10		17
W	Erodium moschatum											17					
C	Launaea nudicaulis											17					
H	Helianthemum salicifolium			12		11	8				17			10			
H	Anthemis palestina											17					

Table 21. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P	14 %P	15 %P	16 %P
H	Picris altissima											17					
N	Amberboa crupinoides			12								17					
S	Nasturtiopsis coronopifolia										17			10			
R	Picris amalecitana					11						17			10		
S	Trigonella schlumbergeri					11						17			10		
W	Kickxia floribunda											17			10		
W	Picris longirostris	17		12						11		17	**80**	**75**		**80**	
W	Silene vivianii								38	11		17	50	13			33
A	Ferula biverticillata								13	11			50				
A	Rheum palaestinum												30				
H	Allium stamineum								13			17	20		10		
A	Ornithogalum trichophyllum											10					
R	Erodium laciniatum												10				
W	Hypecoum pendulum												10				
W	Carduus getulus												10				
A	Ferula daninii													**100**		**100**	
W	Gagea reticulata					56	8			22		17	30	**75**	30	60	
W	Koelpinia linearis			29								33		**75**		20	
A	Zosima absinthiifolia								13		13		50	**63**	10	**100**	
A	Tulipa polychroma												20	50			
H	Ornithogalum neurostegium												38				
S	Spergularia diandra	17		18					13					38	10		
A	Bromus danthoniae										13			25			17
A	Centaurea aegyptiaca		14							22		17	10		**60**		33
H	Poa bulbosa					33						33					
N	Gymnocarpos decander					11				22					40		33
W	Scilla hanburyi	17		6	14		8	14				17			30		
A	Helianthemum vesicarium						8		22				13	30		17	
R	Retama raetam														20		
H	Geranium tuberosum														10		
A	Deverra tortuosa														10		
A	Colchicum ritchii														10		
W	Allium ampeloprasum														10		
A	Allium rothii								13				40		10		50
A	Anabasis syriaca								38		13				10		50
A	Ixiolirion tataricum													25		**100**	
A	Boissiera squarrosa								13		38					**100**	**67**
W	Poa sinaica				14				38	11			33	**88**	**40**	**100**	**67**
W	Gymnarrhena micrantha			18						11	13	33	10	50	50	**60**	
A	Leopoldia longipes												20	13	10	**60**	
W	Arnebia linearifolia											17				40	
A	Astragalus sanctus												10	13		40	
A	Allium artemisietorum															20	17
A	Iris regis-uzziae									11						20	17
H	Helianthemum aegyptiacum														20		
A	Cymbolaena griffithii													25			**100**
R	Cutandia memphitica								25						10		**67**
V	Stipa pellita								13								**67**
W	Gastrocotyle hispida						8		13	11		17			10		**67**
A	Fagonia mollis					33					38					40	50
W	Herniaria hirsuta					22	8	29				17					33
A	Ceratocephala falcata					22		29							10		33
A	Tulipa systola									11			10				33
A	Valerianella dufresnia													13		20	33
H	Erodium ciconium								13				10				17
A	Eremopyrum bonaepartis												10				17
N	Calendula tripterocarpa								25		13						17
W	Brachypodium distachyon			6												17	

Table 21. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P	14 %P	15 %P	16 %P
	Other species																
W	Stipa capensis	83	71	100	57	78	75	86	63	22	75	83	40		40	20	100
W	Erucaria microcarpa	50	29	41	57	67	17		38		25	83	80	100	20	100	
H	Bromus fasciculatus	67		6			8	86	38		25		40	38	10		67
W	Plantago coronopus	33	14	12	29	33				11		67	10	63	30	20	67
H	Hippocrepis unisiliquosa	50		47		44	17	43		11	13	33			10		33
H	Rostraria smyrnacea	83	29	18		22	25		38							60	67
W	Senecio glaucus			6		89	17		25	11		67	60	75	30		
W	Filago desertorum		14	53	43	22	8	29	38		50	50		88	40	60	67
H	Scorzonera papposa		14	12	57	11	17	14	50			50	70	13	20		17
W	Erodium touchyanum	17		29		11		29			13	17					17
W	Medicago laciniata	67	29	94	43		8		13		25	83			10		
W	Calendula arvensis	67	71	71	57	44	58	86	13			50	10				
H	Anthemis pseudocotula	67	86	88	57	11	50	86				67	10				
W	Onobrychis crista-galli	67	57	82	86	22		29				33			10		
W	Matthiola livida					78			100	11	63	67	60	50	20	60	67
W	Helianthemum ledifolium		29	12		11			63		13	67	100	100	20	80	83
A	Colchicum tunicatum								63	22			60	88	40	80	67
W	Erodium crassifolium									89	38	33	90	63	60	40	50
W	Astragalus tribuloides				14	22	8		13			67		50	30	60	50
W	Neotorularia torulosa					11	8		25				10	25	10	20	17
A	Moricandia nitens								13				30	13	20		33

6.4 M Anabasietea articulatae Zohary 1952 ex Danin et Solomeshch class nov.

Diagnostical species: *Anabasis articulata, Asteriscus hierochunticus, Agathophora alopecuroides, Zygophyllum dumosum.*

Nomenclatural type: Anabasietalia articulatae Zohary 1955 ex Danin et Solomeshch.

Synoptic tables: Tables 25 and 29.

This class was regarded by Zohary (1973) as comprising the contracted vegetation of the extreme desert areas in the Near East. Following our previous classification of the vegetation of the Negev Highlands (Danin et al., 1975) this class includes also the diffused vegetation. It occurs mainly in the area between the isohyets 50 – 80 mm. The contracted vegetation of the Anabasietea articulatae (*sensu* Zohary, 1955) will be included, as we see it now, under a separate class Zillo spinosae – Anabasietea articulatae, and will be dealt with in depth in a separate volume in the future.

The class, as we see it, is closely connected with Artemisietea sieberi. All diagnostical species of Anabasietea articulatae can grow in less extreme desersts and penetrate into communities of the class Artemisietea sieberi. The Anabasietea articulatae differs from the Artemisietea sieberi by the absence of many Irano-Turanian and other species which can not grow in more xerophilous conditions of the desert.

The synoptic tables we prepared during the analysis of the present data led us to follow Danin et al., (1975) in subdividing Anabasietea articulatae (M) into three syntaxa, but at the lower rank of the alliance. The only order, Anabasietalia articulatae (MM), includes an alliance of associations inhabiting Lithosols (MMA), and an alliance confined to Loessial Serozem both dominated by *Anabasis articulata*. The associations dominated by *Anabasis articulata* on sandy soils belong, in our synopsis, to the Stipagrostio plumosae – Anabasietalia articulatae (DA) of the class Retametea raetam. The associations inhabiting salty soils on chalk and marl outcrops are dominated by xerohalophyte shrubs, most of which belong to the Chenopodiaceae and to the alliance Salsoletalion tetrandrae (MMS). The associations of Zygophyllion dumosi (MMZ) inhabit hard rocks in drier areas of this climatic belt. Most of them are typified by dominance of *Zygophyllum dumosum*.

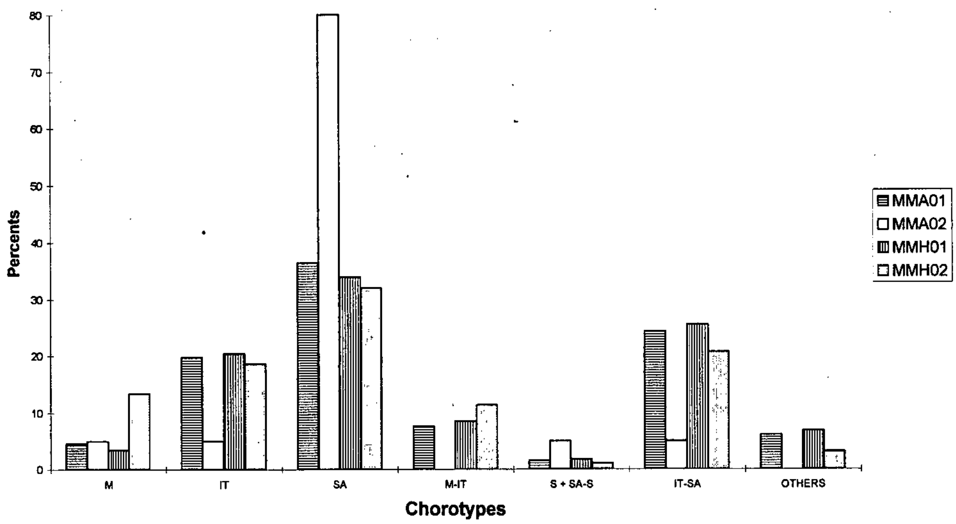

Figure 55. Phytogeographical analysis of associations MMA01-02 and MMH01-02.

6.4.1 MM Anabasietalia articulatae Zohary 1955 ex Danin et Solomeshch ord. nov.

Diagnostical species of the order = Diagnostical species of the class.

Nomenclatural type: Agathophoro – Anabasion articulatae Danin, Orshan et Zohary 1975 ex Danin & Solomeshch

Synoptic table: Table 25.

The associations of this order occur in areas drier than those of the Artemisietalia sieberi but not as dry as those of the Zygophyllion dumosi. There are a few places along the ecotone of decrease in precipitation where the specific position of associations of Anabasietalia articulatae can be found. One is the longitudinal north – south belt in the Judean Desert (unit 11 of the coloured legend of the vegetation map in Danin et al., 1975) and the other is unit 12 in the same map legend.

The phytogeographical spectrum of the associations of this order (Fig. 55) represents their position in the bioclimatic ecotone. The dominants in associations of this class are mostly Saharo-Arabian species whereas dominants of the Artemisietea sieberi are Irano-Turanian species. The most frequent chorotypes, in MMA01, MMH01, and MMH02, are the Saharo-Arabian and IT-SA whereas the third in importance is the Irano Turanian. The value of the SA in the Anabasietum setiferae (MMA02), which occurs on screes at the fault escarpment of the Dead Sea, is much higher than in the other associations that are typical to the Negev Highlands.

6.4.1.1 MMA Agathophoro – Anabasion articulatae Danin, Orshan et Zohary 1975 ex Danin & Solomeshch all. nov.

Diagnostical species of the alliance = Diagnostical species of the class.

Nomenclatural type: Agathophoro alopecuroidis – Anabasietum articulatae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch

Synoptic table: Table 25.

Associations of this alliance do not cover large areas in Israel but represent an important stage in the vegetation of the Near East. In S Sinai there are large areas of diffused vegetation dominated by *Anabasis articulata* as a belt of transition between the shrub-steppes at high elevations and the contracted vegetation at lower ones (Danin, 1983). The associations of this alliance occupy both regular and stable topography of plateaus and slopes as well as screes where the geomorphological activity is high. The alliance Agathophro – Anabasion articulatae does not have its own diagnostical species. Communities of this alliance may be recognized by the presence of diagnostical species of the class Anabasietea articulatae and by the absense of species of the other alliances.

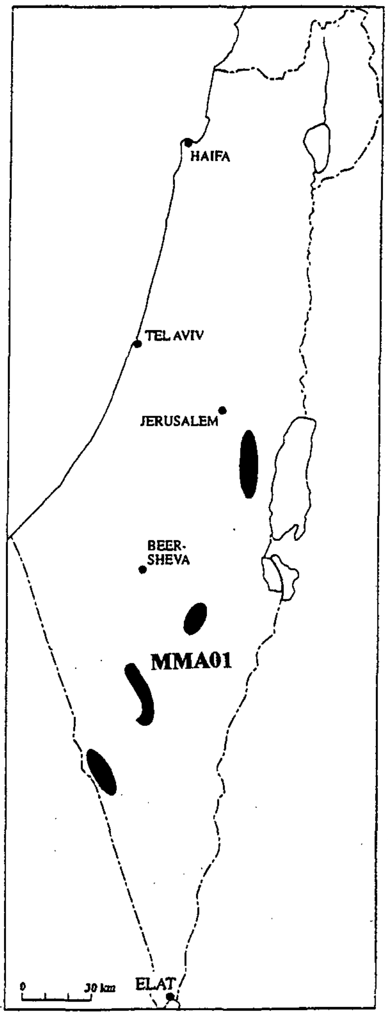

Figure 56. Distribution map of association MMA01.

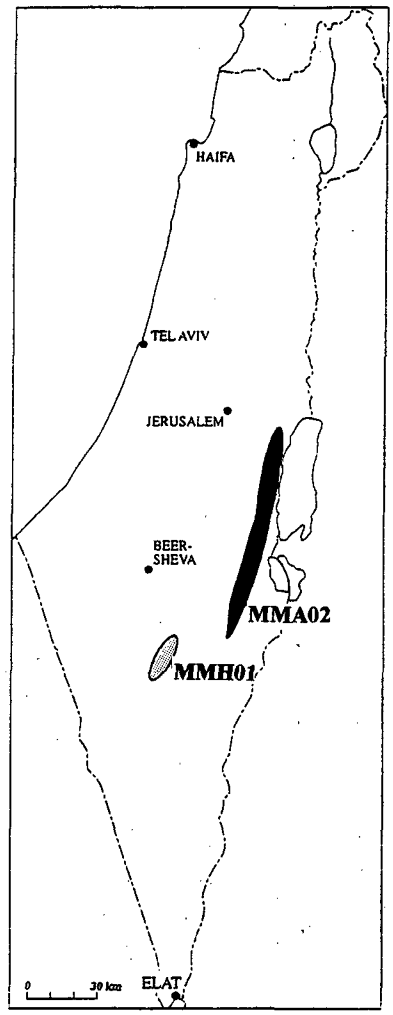

Figure 57. Distribution map of associations MMA02 and MMH01.

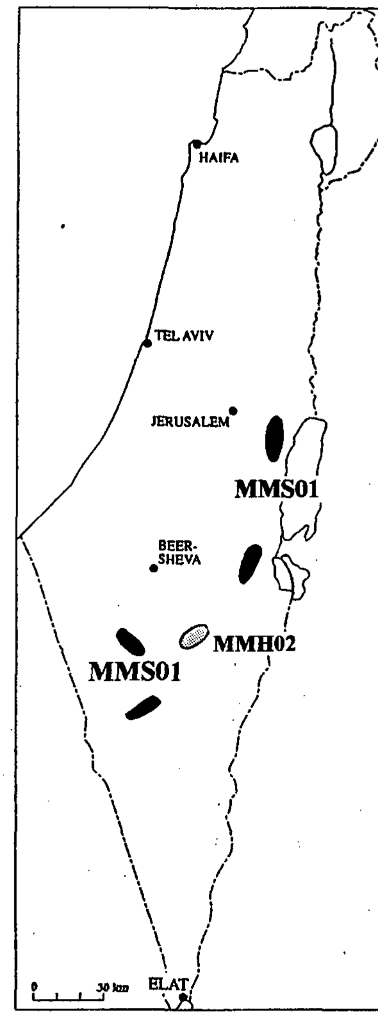

Figure 58. Distribution map of associations MMH02 and MSS01.

6.4.1.1.1 MMA01 Agathophoro alopecuroidis – Anabasietum articulata Danin, Orshan et Zohary 1975 ex Danin & Solomeshch ass. nov., nom. mut., nom. inv.

Syn.: Anabasis articulata – Halogeton alopecuroides association Danin , Orshan et Zohary 1975.

Diagnostical species: the markers in table 20. **Distribution:** Fig. 56.

Ecological notes: This association has a physiognomy of a shrub-steppe as associations from the alliance Artemision sieberi. However, vegetation cover is lower and there are more drought resistant species in the composition. It is developed on hard chalk in the Judean Desert and on Cretaceous or Eocene fissured limestone at the Negev Highlands. The relevés of the association table were recorded mainly on Har Sagi, at the most southern patch in the distribution map (Fig. 56). Most of the companions from Artemisietalia sieberi occur at the vicinity of outcrops of hard rocks. Such sites are moister due to runoff contribution of the rocks.

Association dynamics and conservation: Much of the area of this association is under constant process of recovery from past grazing and cutting; the patches at the Judean Desert are still under exploiting management.

Aspects of the association: Persistents – 20 spp.; ephemerals – 46 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94423	5	10	18	11.04.94	I 1649 4732
2	94424	10	15	22	11.04.94	I 1650 4732
3	94425	10	7	18	11.04.94	I 1651 4732
4	94426	10	10	19	11.04.94	I 1652 4732
5	94427	15	10	23	11.04.94	I 1648 4732
6	94428	10	10	25	11.04.94	I 1648 4730
7	94429	20	15	21	11.04.94	I 1649 4730
8	94430	15	10	16	11.04.94	I 1650 4730
9	94431	10	10	22	11.04.94	I 1651 4730
10	94432	2	10	24	11.04.94	I 1649 4731
11	94433	5	12	24	11.04.94	I 1648 4731
12	94434	5	15	30	11.04.94	I 1650 4731
Average:		9.8	11.2	21.8		

6.4.1.1.2 MMA02 Anabasietum setiferae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 20. **Distribution:** Fig. 57.

Ecological notes: There are many patches of this association in the steep fault escarpments above the Dead Sea Valley, at elevation of (-) 300 m to 50 m below sea level and at the fault escarpments of anticlines of the Negev Highlands at elevation of 200-500 m a.s.l. The dominant plant of this association is a colonizer of extreme desert areas and prevails also on disturbed ground near new roads at the area of the association.

Association dynamics and conservation: This association occurs in sites where the substratum is frequently disturbed. The erosive ability of strong currents of water is high in escarpments and therefore there is frequent renovation of the ground in these places. As the area becomes stable and time passes there is addition of dust to the ground and changes in the edaphic conditions lead to the establishment of other associations. This process is further discussed below in the Trichodesmetum boissierii (MMZ09).

Aspects of the association: Persistents – 16 spp.; ephemerals – 5 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00792	0	5	7	22.08.69	I 2360 5949
2	00794	0	3	9	22.08.69	I 2361 5949
3	00796	0	5	6	23.08.69	I 2345 5798
4	00802	0	2	5	23.08.69	I 2352 5759
5	00809	0	5	6	23.08.69	I 2351 5759
6	00817	0	5	3	24.09.69	I 1866 5294
7	00819	0	5	4	24.09.69	I 1866 5296
Average:		0	4.3	5.7		

6.4.1.2. MMH Haloxylo scopariae – Anabasion articulatae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch all. nov. nom. mut.

Syn.: Hammadeto – Anabasion articulatae Danin, Orshan et Zohary 1975.

Diagnostical species: *Colchicum tunicatum, Euphorbia grossheimii, Haloxylon scoparium, Lappula spinocarpus, Ornithogalum trichophyllum, Scilla hanburyi.*

Nomenclatural type: Haloxylo scopariae – Anabasietum articulatae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch

Associations of this alliance are confined to Loessial Serozems at the water divide between Yeroham and Sede Boqer. They occupy a relatively small area in Israel but may cover larger areas in neighbouring countries where the specific edaphic and climatic conditions prevail over larger areas.

6.4.1.2.1 MMH01 Haloxylo scopariae – Anabasietum articulatae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov., nom. mut, nom. inv.

Syn.: Anabasis articulatae – Hammada scoparia association Danin, Orshan et Zohary 1975.

Diagnostical species: the markers in table 22. **Distribution:** Fig. 57.

Ecological notes: The association was recorded in the plain of Loessial Serozem between Yeroham and Sede Boqer. Most of the plain is dominated by Erucario microcarpae – Haloxyletum scopariae (AAH05). Based on field relationships it is suggested that the edaphic factor associated with the replacement of the Haloxyletum by the Haloxylo scopariae – Anabasietum articulatae is the occurrence of $CaCO_3$ concretions close to the soil surface. These concretions indicate long pedogenetic processes which might have caused edaphic differences. A prominent microbiotic crust is developed in this association containing mainly filamentous cyanobacteria situated most of the time just below the soil surface. When wetted, the cyanobacteria move phototactically towards the soil surface (Danin et al., 1989).

Association dynamics and conservation: Most of the area of this association is under constant process of recovery from overgrazing and cutting in the past.

Aspects of the association: Persistents – 7 spp.; ephemerals – 58 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00226	9	1	23	14.04.67	I 1923 5449
2	00428	2	3	10	18.03.67	I 1811 5304
3	00461	7	3	20	21.03.67	I 1863 5376
4	00462	6	4	33	21.03.67	I 1862 5377
5	00463	7	3	32	21.03.67	I 1861 5379
6	00464	1	4	21	21.03.67	I 1860 5380
7	00468	5	5	30	21.03.67	I 1862 5374
8	00469	3	7	29	21.03.67	I 1863 5375
9	00470	3	5	37	21.03.67	I 1857 5372
10	00471	7	3	26	21.03.67	I 1856 5369
Average:		5.0	3.8	26.1		

Table 22. Association tables of MMH01 – Haloxylo scopariae – Anabasietum articulatae, MMH02 – Haloxylo scopariae – Zygophylletum dumosi, and MMS01 – Bassietum arabicae

			MMH01				MMH02				MMS01			
			*1234567890	C1	C2	%P	*123456789	C1	C2	%P	123456789012345678901234	C1	C2	%P
	W	Aaronsohnia factorovskyi									............++......+++.	0	0	21
	W	Adonis dentata	.......+..	0	0	10					...+....................	0	0	4
	W	Aegilops kotschyi					+........	0	0	11				
*	S	Agathophora alopecuroides									.0+.0....+....+..++.+1+.	2	1	42
	W	Aizoon hispanicum									.......................+	0	0	4
	B	Allium erdelii									........+..+++..........	0	0	17
	A	Allium rothii									............+...........	0	0	4
	F	Allium sindjarense	..+....+..	0	0	20	+.+...+..	0	0	33	......................+.	0	0	4
	H	Allium stamineum					+........	0	0	11	...++...................	0	0	8
	A	Alyssum linifolium	....+.+.+.	0	0	30	......+..	0	0	11				
	F	Ammochloa palaestina	........+.	0	0	10								
*	N	Anabasis articulata	5995318998	**68**	**68**	**100**	.++.121..	10	6	56	..............2..++.....	7	1	13
	H	Anemone coronaria					......+..	0	0	11				
	N	Anthemis maris-mortui									....+....+..............	0	0	8
	W	Anthemis melampodina					+++......	0	0	33				
	H	Anthemis palestina									...........+++......++..	0	0	21

Table 22. continued.

			MMH01				MMH02				MMS01			
			1234567890	C1	C2	%P	123456789	C1	C2	%P	123456789012345678901234	C1	C2	%P
	W	Anthemis pseudocotula	....+.....	0	0	10					.+......................	0	0	4
	W	Arnebia decumbens					..+......	0	0	11	........++...........++.	0	0	17
	W	Arnebia linearifolia					+++......	0	0	33	...........+............	0	0	4
*	A	Artemisia sieberi	..+0320...	12	6	50	+01.3+++.	**6**	**5**	**78**	............0+3.........	11	1	13
*	V	Asparagus horridus					.......+.	0	0	11				
	H	Asphodelus ramosus					.......+.	0	0	11				
	N	Asteriscus hierochunticus					...+...3.	15	3	22	....+..+...........+....	0	0	13
	A	Astragalus corrugatus					+........	0	0	11				
	A	Astragalus hispidulus	....+.....	0	0	10								
*	A	Astragalus sanctus									...+....................	0	0	4
	W	Astragalus tribuloides	1..+++++++	1	1	80	++.+.+++.	0	0	67	1+.++567.+11........2+2	20	11	54
*	R	Atractylis carduus					.+.......	0	0	11				
*	W	Atractylis phaeolepis	...+...++.	0	0	30	+......+.	0	0	22				
*	S	Atriplex glauca									............+...........	0	0	4
*	S	Atriplex leucoclada									........+...........+.+	0	0	13
	A	Avena wiestii					+++......	0	0	33				
*	S	Bassia arabica	.......0+.	3	1	20					988699999999953978896596	80	80	100
	A	Bellevalia desertorum					...2.....	20	2	11	....+.+..+............+.	0	0	17
	A	Bellevalia eigii	......+.+.	0	0	20	..+......	0	0	11				
	H	Bromus fasciculatus									.13++.+.++..+........04.	9	4	42
	H	Calendula arvensis	........+.	0	0	10					......................+.	0	0	4
	A	Carex pachystylis	..432+3151	26	21	80	...51+11.	17	9	56	...+....................	0	0	4
	W	Carrichtera annua									...+....................	0	0	4
*	A	Centaurea aegyptiaca									...+......+......+......	0	0	13
	A	Centaurea ammocyanus	.+........	0	0	10	+++......	0	0	33				
*	C	Centaurea lanulata									.....................+..	0	0	4
	A	Ceratocephala falcata	....+.+.+.	0	0	30	......+..	0	0	11	...+........+...........	0	0	8
	A	Colchicum tunicatum	.+++++++++	0	0	90	....++++.	0	0	44	............+...........	0	0	4
	H	Crepis sancta									...+....................	0	0	4
	R	Cutandia memphitica	2.........	20	2	10	+........	0	0	11	.+3...+.................	10	1	13
	N	Diplotaxis acris									+.......................	0	0	4
	H	Diplotaxis erucoides									........+...............	0	0	4
	W	Diplotaxis harra									.+.+....++......+....+.+	0	0	29
*	B	Echinops polyceras					..+......	0	0	11				
	W	Emex spinosa	...++.+...	0	0	30	.....+.+.	0	0	22	............+...........	0	0	4
	W	Enarthrocarpus strangulatus									............+...........	0	0	4
*	V	Ephedra aphylla									.........+..............	0	0	4
	A	Eremopyrum bonaepartis					++.......	0	0	22				
	H	Erodium ciconium	...+..+...	0	0	20								
	W	Erodium crassifolium	+946794738	59	59	100	9911898++	51	51	100	.++.+++...5310++++.....+	7	4	58
	S	Erodium glaucophyllum									8....++++1........+..+.+	10	4	38
	W	Erodium neuradifolium	+.........	0	0	10					..+.....................	0	0	4
	S	Erodium oxyrhynchum	..+....1++	3	1	40	+.2...+..	7	2	33	.+.........1+...........	3	0	13
	W	Erodium touchyanum									...++...................	0	0	8
	W	Erucaria microcarpa	...++.++++	0	0	60	...1..++.	3	1	33	...++...+..+.......++.++	0	0	33
	W	Erucaria rostrata									...+....................	0	0	4
	W	Euphorbia chamaepeplus	+.........	0	0	10					.+..........+.......+..	0	0	13
	A	Euphorbia grossheimii	....++.+++	0	0	50	+++.+....	0	0	44				
*	A	Fagonia mollis									.....................+..	0	0	4
	A	Ferula daninii									..............+.........	0	0	4
	W	Filago desertorum	..+++.+++.	0	0	60	+++.++++.	0	0	78	.+.+.++..+...........++.	0	0	29
	W	Gagea reticulata	.+.+..+..+	0	0	40	+.....+..	0	0	22	...++...+....+.........+	0	0	21
	W	Gastrocotyle hispida	+.++++++++	0	0	90	..++++++.	0	0	67	..+.........+...........	0	0	8
	W	Gymnarrhena micrantha	1+++++++.+	1	1	90	++0.+++3.	5	4	78	.++...++.+3365.+.....++.+	13	7	54
*	N	Gymnocarpos decander									.........+....+......0..	2	0	13
	H	Gynandriris sisyrinchium	..++++++++	0	0	80	...++++..	0	0	44	............+...........	0	0	4
*	B	Gypsophila arabica									........++..............	0	0	8
*	S	Halothamnus acutifolius									..+..............+.+...	0	0	13
*	S	Haloxylon negevensis									.+0.....................	3	0	8
*	A	Haloxylon scoparium	5014371++1	23	23	100	637001751	35	35	100				

Table 22. continued.

			MMH01				MMH02				MMS01			
			1234567890	C1	C2	%P	123456789	C1	C2	%P	123456789012345678901234	C1	C2	%P
*	R	Haplophyllum tuberculatum									...................+..0..	3	0	8
	H	Helianthemum aegyptiacum									...+....................	0	0	4
*	A	Helianthemum kahiricum									+....++..+...........+..	0	0	21
	W	Helianthemum ledifolium	+.++.+..++	**0**	**0**	**60**	...+++...	0	0	33	...0+...2+.+.+........1+	4	1	33
	H	Helianthemum salicifolium	+.........	0	0	10					...++..+................	0	0	13
*	B	Heliotropium rotundifolium									.....................+..	0	0	4
*	S	Herniaria hemistemon					.++......	0	0	22	+....1+...10+..+..2..+..	5	2	38
	W	Herniaria hirsuta									......+.................	0	0	4
	A	Heterocaryum subsessile									......................+.	0	0	4
	H	Hippocrepis unisiliquosa									.........+...........+.	0	0	8
	D	Hordeum glaucum					+........	0	0	11	.........+..............	0	0	4
	R	Ifloga spicata					+........	0	0	11				
	A	Ixiolirion tataricum	..+.......	0	0	10	....++...	0	0	22				
*	N	Kickxia acerbiana									.....................0..	5	0	4
	W	Koelpinia linearis	1.........	10	1	10	....+....	0	0	11	....1+++++.++.......++..	1	0	42
	W	Lappula spinocarpos	...+++0+++	**1**	**1**	**70**	++++++++.	**0**	**0**	**89**	.++++..++...........+.+	0	0	33
	W	Lasiopogon muscoides									........++...........+.+	0	0	17
	C	Launaea nudicaulis					++.......	0	0	22				
	R	Launaea fragilis					++.......	0	0	22				
	W	Leontodon laciniatus	+..+++.++.	**0**	**0**	**60**	..+...+..	0	0	22				
	A	Leopoldia longipes									.++.........+..........	0	0	13
	A	Leptaleum filifolium									.....0+....+..........+	1	0	17
	W	Linaria albifrons	...+....+.	0	0	20					.+......................	0	0	4
	W	Linaria haelava	+...+.+...	0	0	30	+...+.+..	0	0	33				
	W	Malva aegyptia	...+..0.+.	2	1	30	..+...+..	0	0	22				
	W	Matthiola livida	...+...++.	0	0	30	..+......	0	0	11	.+.++.++++.+.........+1++	1	0	50
	W	Medicago laciniata	........++	0	0	20	+..+.....	0	0	22	.....++0................	2	0	13
	S	Mesembryanthemum nodiflorum									....+.....+..........++3	6	1	21
*	A	Moricandia nitens					.+.......	0	0	11	+.........00............	1	0	13
	H	Muscari commutatum									......+..............+.	0	0	8
	S	Nasturtiopsis coronopifolia	1.........	10	1	10	++6......	20	7	33	..+.....................	0	0	4
	W	Neotorularia torulosa	+.......+.	0	0	20					...+.........+........++	0	0	17
*	A	Noaea mucronata									...0+.........+........	2	0	13
	W	Onobrychis crista-galli									............+...........	0	0	4
	A	Ornithogalum trichophyllum	+.++++++++	**0**	**0**	**90**	+...+++..	0	0	44	....+...................	0	0	4
	L	Parapholis incurva									............+...........	0	0	4
*	V	Phagnalon rupestre									.+..............+.......	0	0	8
	W	Plantago coronopus	...+++++..	0	0	50	+.++++...	0	0	56	...+111..............+.	7	1	21
	W	Plantago ovata	...+......	0	0	10	......+..	0	0	11	...73+0++5.......+++203	16	9	54
	W	Poa sinaica	....+.....	0	0	10					.+.++.......+...........	0	0	17
	S	Pteranthus dichotomus	3........+	15	3	20	+.+......	0	0	22	+.+03++0++..........+00+	4	2	54
	H	Ranunculus asiaticus					....+....	0	0	11	.+.+++0.10............+.	3	1	33
*	S	Reaumuria hirtella	..+++.0++0	**1**	**1**	**70**	021+++1..	**8**	**6**	**78**	.0010.0.++++011001...1+0	**5**	**4**	**75**
*	S	Reaumuria negevensis					..+.....0	3	1	22	................1.......	15	1	4
	W	Reichardia tingitana					.+.......	0	0	11	+....+++.+...........++.	0	0	29
	W	Reseda decursiva									.....................+..	0	0	4
*	S	Reseda muricata					.......+.	0	0	11				
*	R'	Retama raetam									.....+..+..............	0	0	8
	W	Roemeria hybrida	+.........	0	0	10	+........	0	0	11				
	H	Rostraria smyrnacea	+.........	0	0	10	+.+......	0	0	22	....+...++..............	0	0	13
	S	Salsola inermis	+.........	0	0	10	+..+....+	0	0	33	..+.+..+...+..++..+.+.++	0	0	42
*	S	Salsola schweinfurthii									.++................+...	0	0	13

Table 22. continued.

			MMH01				MMH02				MMS01			
			1234567890	C1	C2	%P	123456789	C1	C2	%P	123456789012345678901234	C1	C2	%P
*	S	Salsola tetrandra									....................1...	15	1	4
*	S	Salsola vermiculata									...1....1+............++	5	1	21
*	A	Salvia lanigera					++.......	0	0	22	.+..+...................	0	0	8
	W	Schismus arabicus	...+.++..+	0	0	40	+++.+.+..	0	0	56	..+........+.........+..	0	0	13
	W	Scilla hanburyi	.+++++++++	**0**	**0**	**90**	....++++.	0	0	44	...+......+.............	0	0	8
	W	Scorzonera judaica	.++++.++++	**0**	**0**	**80**	.+..++++.	0	0	56	..+.+......+............	0	0	13
	H	Scorzonera papposa	.+++++..++	**0**	**0**	**70**	+++......	0	0	33				
	W	Senecio glaucus	+......+..	0	0	20	.+..+.+..	0	0	33	.+.0+21+12..........+110	8	4	50
	W	Silene vivianii					+.+......	0	0	22				
	S	Spergularia diandra									...+....................	0	0	4
	W	Stipa capensis					.+++...2.	5	2	44	...+1+.1+0......+.+.+21+	5	3	50
*	S	Suaeda asphaltica									.............4.....1..+.	18	2	13
	W	Trigonella arabica	+.........	0	0	10					........4..123..........	25	4	17
	S	Trigonella schlumbergeri									.........+..........+++	0	0	17
	W	Trigonella stellata	..++++++++	**0**	**0**	**80**	++++++...	**0**	**0**	**67**	0+3+.+....+.+.......+...	4	1	33
	A	Tripleurospermum auriculatum					++.......	0	0	22	...........+............	0	0	4
	A	Tulipa systola									.............+..........	0	0	4
	H	Urginea maritima									.+......................	0	0	4
	A	Urginea undulata	...++..++.	0	0	40	......+..	0	0	11				
	A	Valerianella dufresnia									.+......................	0	0	4
	A	Vicia monantha	....+.+.+.	0	0	30	.....++..	0	0	22				
	A	Zosima absinthiifolia	......10++	4	2	40	.....++..	0	0	22	.7+.....................	38	3	8
*	N	Zygophyllum dumosum	...+11..++	4	2	50	341957.58	**54**	**48**	**89**	.++++........++.0+..2+.2	4	2	46

6.4.1.2.2 MMH02 Haloxylo scopariae – Zygophylletum dumosi Danin, Orshan et Zohary 1975 ex Danin & Solomeshch ass. nov.

Diagnostical species: the markers in table 22. **Distribution:** Fig. 58.

Ecological notes: This association occupies similar habitats to those of MMH01 but develops closer to the water divide of their mutual loessial plain than MMH01.

Association dynamics and conservation: Most of the area of this association is under constant process of recovery from overgrazing and cutting in the past.

Aspects of the association: Persistents – 12 spp.; ephemerals – 68 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00365	6	4	42	07.05.67	I 1793 5289
2	00368	4	2	31	07.05.67	I 1798 5289
3	00369	2	3	34	07.05.67	I 1799 5290
4	00417	7	8	18	18.03.67	I 1811 5326
5	00465	7	3	26	21.03.67	I 1858 5377
6	00466	5	3	24	21.03.67	I 1859 5376
7	00467	5	5	32	21.03.67	I 1861 5375
8	00485	2	4	21	21.03.67	I 1785 5305
9	00496	0	5	5	26.12.66	I 1795 5222
Average:		4.2	4.1	25.9		

6.4.1.3 MMS Salsolion tetrandrae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch all. nov.

Diagnostical species: *Aaronsohnia factorovsky, Bassia arabica, Erodium touchyanum, Erucaria rostrata, Halothamnus acutifolius, Mesembryanthemum nodiflorum, Salsola tetrandra.*

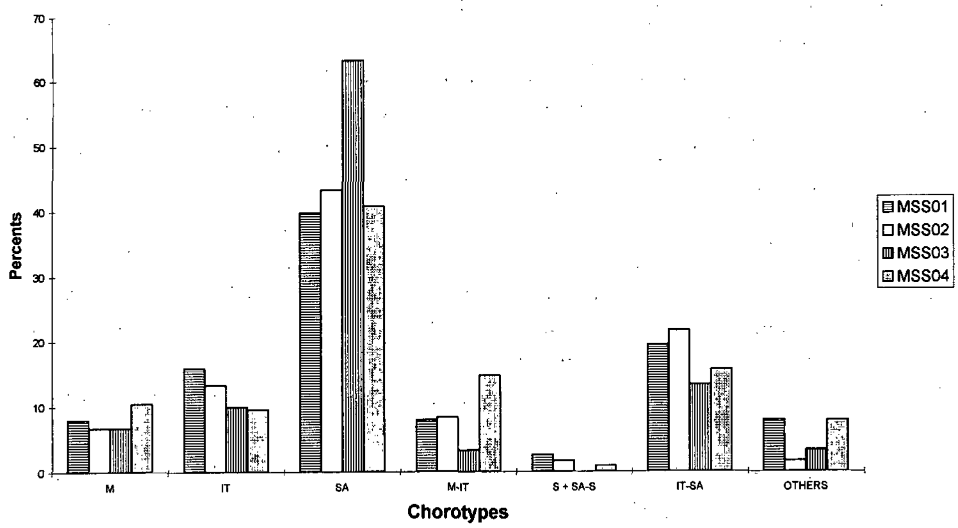

Figure 59. Phytogeographical analysis of associations MSS01-MSS04.

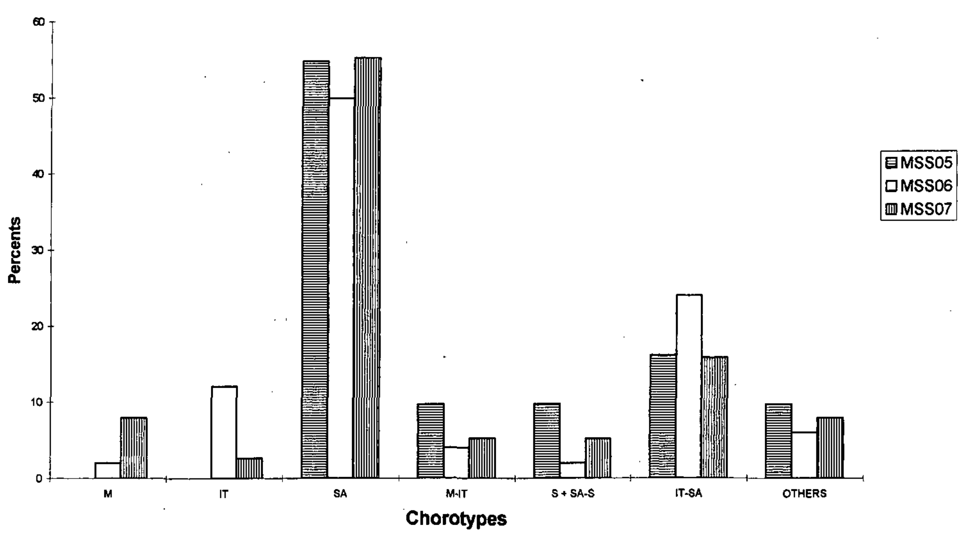

Figure 60. Phytogeographical analysis of associations MSS05-MSS07.

Nomenclatural type: Suaedetum asphalticae Eig 1946 ex Danin et Solomeshch.

The associations of xerohalophytes inhabiting salty soils on chalk and marl outcrops belong to the Salsolion tetrandrae (MMS). The typical feature common to most association in this alliance is the dominance of one, mostly a xerohalophyte semishrub, with hardly any other semishrub companion in the relevé. The cover of annuals is low in most regular years. However, in years with high quantities of rainfall the cover of ephemeral species may be rather high and in many sites the latter are also xerohalophytes.

The phytogeographical spectrum of all the eight associations presented in Fig. 59 and Fig. 60 is rather similar. The Saharo-Arabian chorotype predominates in all the associations and the IT-SA chorotype is the second important. This means that the associations of this alliance are not in a transitional position and are clearly Saharo-Arabian.

6.4.1.3.1 MMS01 Bassietum arabicae Eig 1946 nom. mut.

Syn.: Chenoleetum arabicae Eig 1946.

Diagnostical species: the markers in table 22. **Distribution:** Fig. 58.

Ecological notes: This association occupies outcrops of Senonian chalk in the Judean Desert, phosphorous-rich Senonian chalk at the Negev Highlands near Sede Boqer, and Turonian marl near Mizpe Ramon. Three salinity profiles studied in the Judean Desert are discussed by Danin (1978b).

Most years it is poor in ephemeral companions; in rainy years it may be accompanied by small quantities of annuals. In the Judean Desert it covers slightly saline soils on SW-facing slopes which are better leached by rainfall than the SE-facing slopes; the latter are covered by Suaedetum asphaltice (MMS04; Danin, 1978b) or devoid of persistent vegetation. The tendency of vegetation of the xerohalophytes to be a nearly monospecific community in the persistents layer is prominent in the markers group.

Patches of this association tend to be small in Israel. However, a related association dominated by *Bassia arabica* and *Atriplex glauca* cover large areas of Gebel Igma, central Sinai (Danin, 1983).

Association dynamics and conservation: Most of the area of this association in the Judean Desert and the Negev Highlands is always poor in companions.

Aspects of the association: Persistents – 32 spp.; ephemerals – 87 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00156	2	3	10	28.02.66	I 1985 5329
2	00235	1	4	29	15.04.67	I 1819 5268
3	00236	1	5	22	15.04.67	I 1818 5268
4	00287	20	5	38	27.03.67	I 2239 5699
5	00289	5	3	32	27.03.67	I 2236 5695
6	00290	8	2	20	27.03.67	I 2239 5690
7	00291	14	6	24	27.03.67	I 2239 5690
8	00292	5	5	16	27.03.67	I 2240 5690
9	00293	12	8	26	27.03.67	I 2245 5682
10	00294	6	4	31	27.03.67	I 2245 5682
11	00330	1	4	9	07.04.67	I 1760 5280
12	00331	1	4	22	07.04.67	I 1760 5280
13	00332	1	5	24	07.04.67	I 1760 5280
14	00334	1	5	19	07.04.67	I 1764 5278
15	00392	0	5	11	21.05.67	I 1646 4733
16	00491	0	5	6	21.12.66	I 1761 5281
17	00544	0	3	8	22.08.66	I 1883 5179
18	00546	0	5	7	22.08.66	I 1884 5180
19	00588	0	3	10	28.11.67	I 2301 6015
20	00592	0	3	4	28.11.67	I 2265 6034
21	00607	6	4	19	04.04.67	I 2239 5698
22	00610	10	5	36	04.04.67	I 2247 5679
23	00620	14	6	30	04.04.67	I 2247 5679
24	00621	14	1	26	04.04.67	I 2247 5679
Average:		5.1	4.3	20.0		

6.4.1.3.2 MMS02 Agathophoretum alopecuroidis Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 23. **Distribution:** Fig. 61.

Ecological notes: This association occupies outcrops of Senonian chalk near Arad and of Cretaceous chalk and marl near Mizpe Ramon. Five salinity profiles studied in the southern Judean Desert are discussed by Danin (1978b).

Association dynamics and conservation: Most of the area of this association in the Judean Desert and the Negev Highlands is extremely poor in companions in dry years but is rather rich in ephemeral companions in relatively wet years.

Aspects of the association: Persistents – 24 spp.; ephemerals – 47 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00149	15	15	17	20.05.66	I 2225 5746
2	00150	10	20	23	20.05.66	I 2226 5742
3	00160	0	5	13	29.04.66	I 1719 4805
4	00336	2	0	13	07.04.67	I 1764 5277
5	00337	2	2	11	07.04.67	I 1765 5276
6	00378	0	3	10	18.05.67	I 1643 4731
7	00578	3	7	31	04.09.67	I 2312 6162
Average:		4.6	7.4	16.9		

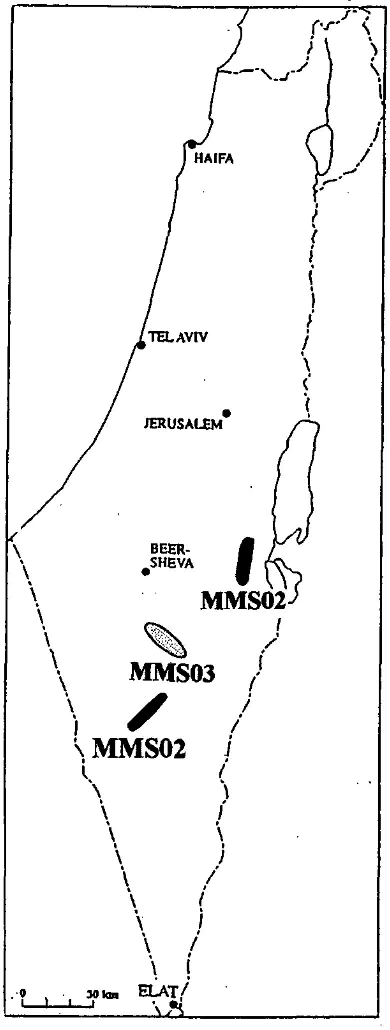

Figure 61. Distribution map of associations MSS02 and MSS03.

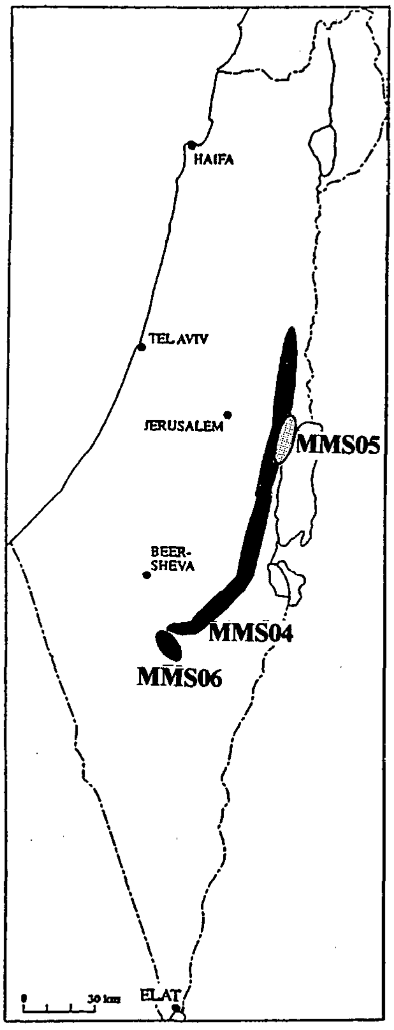

Figure 62. Distribution map of associations MSS04, MSS05, and MSS06.

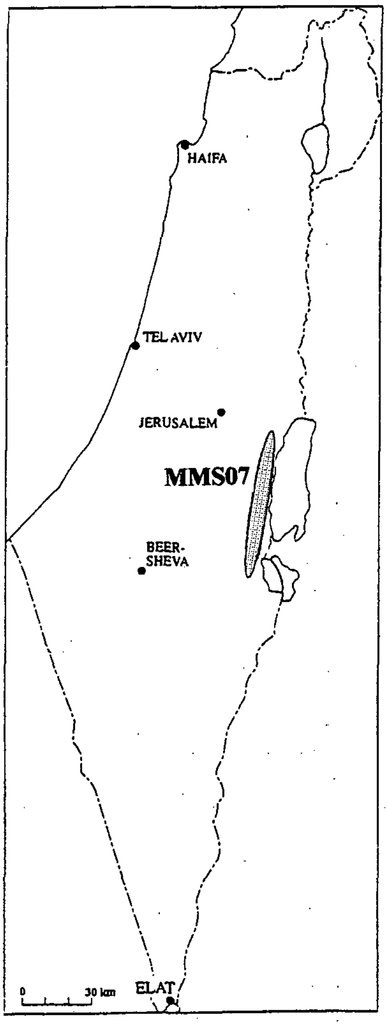

Figure 63. Distribution map of association MSS07.

Table 23. Association tables of MMS02 – Agathophoretum alopecuroidis, MMS03 – Haloxyletum negevensis, and MMS04 – Suaedetum asphalticae

			MMS02				MMS03				MMS04			
			*1234567	C1	C2	%P	*123456789	C1	C2	%P	*1234567890123456789012345	C1	C2	%P
	W	Aaronsohnia factorovskyi									...+...+++++..2+....+.++0	2	1	48
	W	Aegilops kotschyi	++.....	0	0	29								
*	S	Agathophora alopecuroides	987+966	**65**	**65**	**100**					..+........3.+..+0+1+....	6	2	32
	W	Aizoon hispanicum									.........+............++	0	0	12
*	B	Ajuga iva									............+...........	0	0	4
	A	Allium artemisietorum	...++..	0	0	29					.............++.........	0	0	8
	B	Allium erdelii	...+...	0	0	14					.......+................	0	0	4
	F	Allium sindjarense									.+..+...................	0	0	8
	H	Allium stamineum									..+.....................	0	0	4
	N	Amberboa crupinoides	.+.....	0	0	14								
*	N	Anabasis articulata	+.+..1+	3	1	57					............++.+...+....	0	0	16
*	W	Anabasis setifera	....0..	5	1	14					............+...........	0	0	4
	W	Anchusa aegyptiaca									..............+.........	0	0	4
*	B	Anchusa strigosa									............+...........	0	0	4
	W	Anthemis melampodina									..........+.............	0	0	4
	H	Anthemis pseudocotula	.+.....	0	0	14					..1.....................	10	0	4
	W	Arnebia decumbens									...+++++++............++	0	0	36
*	A	Artemisia sieberi					.+.......	0	0	11				
	N	Asteriscus hierochunticus	......+	0	0	14								
	W	Astragalus asterias									..+.....................	0	0	4
	A	Astragalus callichrous									..+...........+1........	3	0	12
*	A	Astragalus spinosus	......+	0	0	14								
	W	Astragalus tribuloides	...++..	0	0	29					..0+..+.+++3+.+.........++	3	1	44
	W	Atractylis cancellata	+......	0	0	14								
*	W	Atractylis phaeolepis	..+....	0	0	14								
*	A	Atractylis serratuloides	+.....+	0	0	29								
*	S	Atriplex glauca									+.1...........20...+....	7	1	20
*	S	Atriplex halimus									.....+..................	0	0	4
*	S	Atriplex leucoclada	...+...	0	0	14					..........+........++...	0	0	12
*	S	Bassia arabica	.....1.	10	1	14	.+.1.+.++	2	1	56	+.++2311..+.0+.....1+....	8	4	48
	A	Bellevalia desertorum	+......	0	0	14					..+.++++.....++.........	0	0	28
	H	Bromus fasciculatus					...1+....	5	1	22	...++.0++......+....0...+	1	0	32
	A	Buglossoides tenuiflora									...+..+.................	0	0	8
	H	Calendula arvensis	++.....	0	0	29					..4.....+.....33......+..	20	4	20
	W	Carrichtera annua									...+.+....+...+.........	0	0	16
	W	Carthamus nitidus	.0.....	5	1	14					....................+.+..	0	0	8
	H	Carthamus tenuis									..............+.........	0	0	4
*	A	Centaurea aegyptiaca	++..+.+	0	0	57					......+...++............	0	0	12
	H	Centaurea hyalolepis									..+.....................	0	0	4
	W	Centaurea pallescens	++.....	0	0	29					.++.+.........1+........	2	0	20
	A	Ceratocephala falcata									...+....................	0	0	4

Table 23. continued.

			MMS02				MMS03				MMS04			
			1234567	C1	C2	%P	123456789	C1	C2	%P	1234567890123456789012345	C1	C2	%P
	H	Chaetosciadium trichospermum									...............+.........	0	0	4
	N	Cistanche salsa									.....++..................	0	0	8
	W	Crithopsis delileana	++....+	0	0	43					..+......................	0	0	4
	N	Diplotaxis acris					..+.++.+.	0	0	44	.....10+++.............10	5	1	28
	W	Diplotaxis harra	..+....	0	0	14	...+.....	0	0	11	..............++.........	0	0	8
*	B	Echinops polyceras	..+...+	0	0	29								
*	H	Echium angustifolium									.............+...........	0	0	4
	W	Emex spinosa	.+.....	0	0	14								
*	V	Ephedra aphylla					........+	0	0	11	........................+	0	0	4
	W	Erodium crassifolium	..+.+.+	0	0	43	.+.875++.	**34**	**23**	**67**	..+++33.32.++.+.+......+0	9	5	52
	S	Erodium glaucophyllum					+........	0	0	11	......++2...............+	5	1	16
	W	Erodium neuradifolium									...+.....................	0	0	4
	S	Erodium oxyrhynchum	...+...	0	0	14					....+.++.................	0	0	12
	W	Erodium touchyanum									..+...........+2.........	8	1	12
	W	Erucaria microcarpa	2+....3	17	7	43	...+.....	0	0	11	..++2.+2.+++........+.++.	4	2	44
	W	Erucaria rostrata	4	40	6	14					..............++.........	0	0	8
	W	Euphorbia chamaepeplus	...+...	0	0	14								
*	V	Euphorbia ramonensis	.....+.	0	0	14	.0.......	2	0	11				
*	A	Fagonia mollis	......+	0	0	14								
	A	Ferula biverticillata					.+.......	0	0	11				
	A	Ferula daninii	....++.	0	0	29								
	W	Filago desertorum	1	10	1	14					..++..+++++.........2...+	2	1	36
	W	Gagea reticulata									..........+...++.........	0	0	12
	W	Gastrocotyle hispida	.+.....	0	0	14	....+....	0	0	11				
	W	Gymnarrhena micrantha	...98..	85	24	29	...++5++.	10	6	56	..3.+1++.+567..+.........	23	9	40
*	N	Gymnocarpos decander	..+....	0	0	14								
*	B	Gypsophila arabica									..........+..+.......+...	0	0	12
*	S	Halothamnus acutifolius	..+...+	0	0	29					..+++.........11..+++.0..	2	1	36
*	S	Haloxylon negevensis					599678399	**74**	**74**	**100**				
	W	Helianthemum aegyptiacum									...+...........+.........	0	0	8
*	A	Helianthemum kahiricum	..+....	0	0	14					.....+.+1...............2	8	1	16
	W	Helianthemum ledifolium	......+	0	0	14					..+0+.++++.+..+........++	0	0	44
	H	Helianthemum salicifolium									.......+.................	0	0	4
*	C	Heliotropium maris-mortui									........................+	0	0	4
*	S	Herniaria hemistemon					...+.....	0	0	11	.+..+.....+..............	0	0	12
	W	Herniaria hirsuta	......+	0	0	14								
	A	Heterocaryum szovitsianum									...++.++...............+.	0	0	20
	H	Hippocrepis unisiliquosa	+......	0	0	14								
*	N	Kickxia acerbiana									......+.+................	0	0	8
	W	Koelpinia linearis	...+...	0	0	14					...+++++.................	0	0	20

Table 23. continued.

			MMS02				MMS03				MMS04			
			1234567	**C1**	**C2**	**%P**	**123456789**	**C1**	**C2**	**%P**	**1234567890123456789012345**	**C1**	**C2**	**%P**
	W	Lappula spinocarpos					....+....	0	0	11	..+.........0.++.........	1	0	16
	W	Lasiopogon muscoides									..+...+.+.+.............+.	0	0	20
	H	Leopoldia longipes					.+.+2....	8	3	33				
	A	Leptaleum filifolium									.....+++.2.............++	3	1	24
	S	Limonium lobatum	......+	0	0	14					......................+..	0	0	4
*	S	Limonium pruinosum					......1..	10	1	11				
	W	Linaria haelava									.......++.+..............	0	0	12
	W	Lomelosia porphyroneura									..+...........+..........	0	0	8
	A	Malabaila secacul									...............+.........	0	0	4
	W	Malva aegyptia									..........+..............	0	0	4
	D	Malva parviflora									..+...............+....	0	0	8
	W	Matthiola livida	.+.....	0	0	14					..+++..+..+.+.+..........	0	0	28
	W	Medicago laciniata	+......	0	0	14					..+..+...............+.+..	0	0	16
	S	Mesembryanthemum nodiflorum									.+.......+.............+..	0	0	12
*	A	Moricandia nitens					+..+.....	0	0	22	+........................	0	0	4
	H	Muscari commutatum									....++.+.+.....+.........	0	0	20
	S	Nasturtiopsis coronopifolia	...02..	12	3	29					9.........0..............	52	4	8
	W	Neotorularia torulosa	...+...	0	0	14					..+2.+02.+.+...........0+	6	2	36
*	A	Noaea mucronata	0+...+0	2	1	57								
	C	Notoceras bicorne	0	5	1	14					......................+..	0	0	4
	W	Onobrychis crista-galli	......+	0	0	14					...............++........	0	0	8
	A	Onopordum alexandrinum	......+	0	0	14								
	H	Ornithogalum narbonense					...+.....	0	0	11				
	A	Ornithogalum trichophyllum									..+....+....+............	0	0	12
*	V	Phagnalon rupestre	..+....	0	0	14								
	R	Picris amalecitana									...................+.....	0	0	4
	W	Plantago coronopus					...+.....	0	0	11	....+.1+.........+.+....	3	1	20
	W	Plantago ovata									..+2.0++43....33...++..16	18	9	52
	W	Poa sinaica									....................+....	0	0	4
	S	Pteranthus dichotomus	.1.0+.+	4	2	57	..+......	0	0	11	.1++4++2++++..+...+...+50	**8**	**5**	**64**
	H	Ranunculus asiaticus									...+++.+......++.........	0	0	24
*	S	Reaumuria hirtella	..+..1+	3	1	43	...0.+++.	1	1	44	401...0+...+.++++04.+....	8	4	52
	W	Reichardia tingitana	++.....	0	0	29					.++...+.......+.........	0	0	16
*	S	Reseda muricata					...+.....	0	0	11				
*	R	Retama raetam									..................+......	0	0	4
	W	Roemeria hybrida									..+......................	0	0	4
	H	Rostraria smyrnacea									......+..................	0	0	4
	W	Rumex cyprius	.+.....	0	0	14					...............++........	0	0	8
	S	Salsola inermis	.+.+.+0	1	1	57	.++++..+.	0	0	56	...1+0+..+..+.......6.+++	8	3	40
*	S	Salsola schweinfurthii	.....+3	15	4	29	......+..	0	0	11	...........+.............	0	0	4
*	S	Salsola tetrandra					1	10	1	11	0............32+.1.+.....	12	3	24
*	S	Salsola vermiculata	02.....	12	3	29					...........+..00+...+3...	7	2	24
*	B	Salvia dominica	.+.....	0	0	14								
*	A	Salvia lanigera	......+	0	0	14					............+............	0	0	4
	F	Schimpera arabica									........................+.	0	0	4
	W	Schismus arabicus	.+.....	0	0	14					.++...+..................	0	0	12

Table 23. continued.

			MMS02				MMS03				MMS04			
			1234567	C1	C2	%P	123456789	C1	C2	%P	1234567890123456789012345	C1	C2	%P
	W	Scilla hanburyi									............++..+........	0	0	12
	W	Scorzonera judaica	......+	0	0	14					..+...........+..........	0	0	8
	H	Scorzonera papposa									..+......................	0	0	4
	W	Senecio glaucus	......+	0	0	14					.+.33233++.....+....+..00	13	6	48
	H	Silene colorata									..+............+.........	0	0	8
	W	Silene decipiens									....................+....	0	0	4
	W	Silene linearis	.+.....	0	0	14								
	W	Silene vivianii	......+	0	0	14								
	W	Spergula fallax									........................+	0	0	4
	S	Spergularia diandra									..+............+....+.+..	0	0	16
	W	Stipa capensis	88....+	53	23	43					.8:++++++0+.+.........+..	8	3	44
*	S	Suaeda asphaltica					5.....4..	45	10	22	5979577999979666986796996	**78**	**78**	**100**
*	S	Suaeda vera					......+..	0	0	11				
*	N	Telephium sphaerospermum	..+....	0	0	14								
*	B	Teucrium capitatum	......+	0	0	14					.............+...........	0	0	4
	W	Trigonella arabica					...+.....	0	0	11				
	S	Trigonella schlumbergeri									..++........+...+........	0	0	16
	W	Trigonella stellata									.+...+..+03.1............	8	2	24
	V	Umbilicus intermedius									....................+....	0	0	4
	H	Urginea maritima					.+..+....	0	0	22	.............+...........	0	0	4
	A	Zosima absinthiifolia					........+	0	0	11				
*	N	Zygophyllum dumosum	..2.00.	12	5	43	...23211.	19	11	56	+..+3+1+..+...+.+.......1	5	2	40

6.4.1.3.3 MMS03 Haloxyletum negevensis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov, nom. mut

Syn.: Hammadetum negevensis Danin, Orshan et Zohary 1975.

Diagnostical species: the markers in table 23. **Distribution**: Fig. 61.

Ecological notes: This association occupies chalk, marl, and clay outcrops in the Negev Highland where it grows at a diffused pattern. It is dominating on the steep escarpments of the Ghareb and Taqiya Formations (Bartov et al., 1981) above Nahal Zin. Patches of this association which developed on phosphorite at the Oron Valley disappeared as a result of development of quarries in the area. A similar association, but at a contracted pattern covers large areas of the same rocks in the extreme desert of the southern Negev at Har Yahav – Sapir area, 30 km east of Mizpe Ramon.

Association dynamics and conservation: Most of the area of this association is always poor in companions. Occasional ephemeral companions occur in the association in relatively wet years.

Aspects of the association: Persistents – 14 spp.; ephemerals – 19 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00155	0	3	4	28.02.66	I 1939 5302
2	00158	1	10	9	06.03.66	I 1782 5271
3	00239	0	3	4	15.04.67	I 1818 5265
4	00240	2	5	17	15.04.67	I 1819 5250
5	00241	2	5	11	15.04.67	I 1819 5250
6	00242	1	3	7	15.04.67	I 1819 5250
7	00243	0	5	9	15.04.67	I 1819 5250
8	00244	0	7	8	15.04.67	I 1819 5250
9	00351	0	3	5	08.02.67	I 1804 5275
Average:		0.7	4.9	8.2		

6.4.1.3.4 MMS04 Suaedetum asphalticae Eig 1946

Diagnostical species: the markers in table 23. **Distribution:** Fig. 62.

Ecological notes: This association occupies the driest longitudinal belt on chalk in the Judean Desert. Its extends into the Samarian Desert, as north as 20 km N of Jericho where it occupies a steep south-facing slope. The Suaedetum asphalticae is confined to salty habitats and display the most salty profiles among the xerohalophytes studied (Danin, 1978b). When growing on north-facing slopes it may be accompanied by a wealth of glycophytes including carpets of *Poa eigii* which efficiently trap airborne silt and clay (Danin & Ganor, 1997). There are circular to oval patches free of companions below the *S. asphaltica* shrubs resulting from recycling of salts by this plant (Danin, 1978b). This is similar to the phenomenon described from shrub-steppes in western USA (Fireman & Hayward, 1952). There is also increased erosion below the *S. asphaltica* shrubs because of absence of microbiotic crust which otherwise protects the soil.

Association dynamics and conservation: There is a several years rhythm with regard to glycophyte and halophyte companions which was observed in the last decade at the vicinity of Sea Level sign on the Jerusalem – Jericho highway. At the spring of the wet year, 1990-1991, when precipitation was twice as high as the mean annual rainfall, the north-facing slopes were densely covered with glycophytes including spectacular red carpets derived from blooming of dense stands of the geophyte *Ranunculus asiaticus*. The summer halophyte *Salsola inermis* was a relatively rare plant and was found mainly in association with scorpion burrows (Danin, 1994). At the beginning of winter, 1996-1997, following two consecutively dry years, the number of *S. inermis* plants was high and there were hardly any glycophytes developing in the same area. At the beginning of winter 1997-1998 there are green carpets of *Poa eigii* with many tufts of *Ranunculus asiaticus*.

Aspects of the association: Persistents – 28 spp.; ephemerals – 86 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00157	1	5	8	28.02.66	I 2031 5385
2	00159	1	9	12	09.05.66	I 2032 5390
3	00285	22	8	40	27.03.67	I 2230 5718
4	00295	12	8	29	27.03.67	I 2250 5675
5	00297	14	6	25	27.03.67	I 2257 5672
6	00298	5	3	24	27.03.67	I 2258 5671
7	00299	4	4	34	27.03.67	I 2262 5671
8	00300	16	4	32	27.03.67	I 2262 5671
9	00301	4	6	20	27.03.67	I 2265 5666
10	00318	8	2	21	05.04.67	I 2261 5670
11	00335	1	6	22	07.04.67	I 1762 5279
12	00338	1	4	16	07.04.67	I 1764 5276
13	00339	1	4	13	07.04.67	I 1765 5279
14	00354	0	5	15	08.02.67	I 1802 5289
15	00398	3	4	30	13.03.67	I 2309 5814
16	00399	3	7	34	13.03.67	I 2309 5814
17	00501	0	5	9	09.01.67	I 2215 5610
18	00539	0	3	5	18.08.66	I 1945 5224
19	00587	0	3	6	28.11.67	I 2299 6020
20	00589	0	5	7	28.11.67	I 2308 6003
21	00591	0	5	24	28.11.67	I 2266 6034
22	00593	0	1	4	20.12.67	I 2355 6176
23	00595	2	1	14	20.12.67	I 2365 6164
24	00608	14	1	18	04.04.67	I 2261 5670
25	00622	15	15	22	04.04.67	I 2261 5670
Average:		5.1	5.0	19.4		

6.4.1.3.5 MMS05 Salsolo tetrandrae – Suaedetum palaestinae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 24. **Distribution:** Fig. 62.

Ecological notes: This association occupies a mixture of marl and conglomerate of the Lisan Formation at a facies typical to the Lisan Lake coastal area. In the study area there are also terraces dominated by *Salsola tetrandra*, probably indicating some similarity in the ecological range of the latter and of *Suaeda palaestina.* The paucity of halophytes in this association indicate relatively good leaching of at least the surface layers.

Association dynamics and conservation: Most of the area where this association occurs is in the Nature Reserve of the Dead Sea.

Aspects of the association: Persistents – 4 spp.; ephemerals – 28 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94371	15	15	13	31.03.94	I 2420 6207
2	94372	10	15	15	31.03.94	I 2420 6208
3	94373	10	15	15	31.03.94	I 2421 6207
4	94374	5	15	15	31.03.94	I 2407 6190
5	94375	10	15	11	31.03.94	I 2408 6190
6	94376	5	10	8	31.03.94	I 2382 6070
7	94377	5	20	14	31.03.94	I 2382 6071
8	94378	10	20	13	31.03.94	I 2383 6070
Average:		8.8	15.6	13.0		

Table 24. Association tables of MMS05 – Salsolo tetrandrae – Suaedetum palaestinae, MMS06 – Salsoletum tetrandrae, and MMS07 – Stipo capensis – Salsoletum tetrandrae

		Species	MMS05				MMS06				MMS07			
			*12345678	C1	C2	%P	*123456789	C1	C2	%P	*1234567890	C1	C2	%P
	W	Aaronsohnia factorovskyi	00+5.637	**31**	**28**	**88**	....0..4.	27	6	22	.+.+00++23	**8**	**6**	**80**
*	S	Agathophora alopecuroides					......+.+	0	0	22				
	C	Aizoon canariense	.+......	0	0	13					......+...	0	0	10
	W	Aizoon hispanicum					+........	0	0	11				
	A	Allium artemisietorum					....+....	0	0	11				
	N	Amberboa crupinoides	......+.	0	0	13					...+......	0	0	10
*	N	Anabasis articulata	.++12112	**10**	**9**	**88**	...+.+..+	0	0	33	01101...0.	**8**	**5**	**60**
*	N	Anabasis setifera	......+.	0	0	13					........+.	0	0	10
	N	Anchusa milleri									....++....	0	0	20
	H	Androcymbium palaestinum									...+......	0	0	10
	N	Anthemis maris-mortui	...+....	0	0	13								
	N	Asteriscus hierochunticus	..+1..+.	3	1	38	......+.+	0	0	22	0+0+++.0+0	**2**	**2**	**90**
	W	Astragalus tribuloides					+++1.....	3	1	44				
*	R	Atractylis carduus									....+.....	0	0	10
*	S	Atriplex halimus					0...+....	2	0	22				
*	S	Atriplex leucoclada					+........	0	0	11				
*	S	Bassia arabica					.1.1..+..	8	3	33				
	A	Bellevalia desertorum	......+.	0	0	13	....++..+	0	0	33	+...+.....	0	0	20
	H	Brachypodium distachyon	+4+.....	13	5	38					...+.+....	0	0	20
	H	Bromus fasciculatus					.++......	0	0	22				
	H	Campanula stellaris									...+......	0	0	10
*	V	Caralluma sinaica									......+...	0	0	10
	W	Centaurea pallescens					.......+.	0	0	11				
	H	Cuscuta planiflora									........+.	0	0	10
	R	Cutandia memphitica					...+.....	0	0	11				
	N	Diplotaxis acris					.+++...+.	0	0	44				
	W	Diplotaxis harra					....+....	0	0	11				
	W	Emex spinosa									....+.....	0	0	10
	W	Erodium crassifolium					.+206++.+	**12**	**9**	**78**	+..++.+...	0	0	40
	S	Erodium oxyrhynchum					...+.....	0	0	11				

Table 24. continued.

		Species	MMS05 12345678	C1	C2	%P	MMS06 123456789	C1	C2	%P	MMS07 1234567890	C1	C2	%P
	W	Erodium touchyanum	..+.....	0	0	13					.....+....	0	0	10
	W	Erucaria microcarpa					....+....	0	0	11				
	W	Erucaria rostrata	.+1.++++	**2**	**1**	**75**	.......+.	0	0	11	+..0.+++++	**1**	**1**	**70**
	W	Euphorbia chamaepeplus					....+....	0	0	11	...+......	0	0	10
*	A	Fagonia mollis					.....+.+.	0	0	22				
	W	Filago desertorum									...+....+.	0	0	20
	W	Gymnarrhena micrantha					+964+.+.+	**28**	**22**	**78**				
*	N	Gymnocarpos decander									.....+....	0	0	10
	H	Gynandriris sisyrinchium					...+.+...	0	0	22				
*	S	Halothamnus acutifolius					...+..+3+	8	3	44				
*	S	Haloxylon negevensis					..4..+...	20	4	22				
	W	Helianthemum ledifolium					..+......	0	0	11				
	H	Helianthemum salicifolium									+..+......	0	0	20
*	S	Herniaria hemistemon					...+.....	0	0	11				
*	N	Kickxia acerbiana					.......+.	0	0	11				
*	W	Kickxia floribunda					.......+.	0	0	11				
	W	Lamarckia aurea	...1+...	5	1	25								
	W	Lappula spinocarpos					.+.+.....	0	0	22				
	C	Launaea nudicaulis	...1....	10	1	13								
	A	Leptaleum filifolium					..+......	0	0	11				
	S	Limonium lobatum	642.7..+	**38**	**24**	**63**					++21+++743	**18**	**18**	**100**
	W	Matthiola aspera	...++...	0	0	25					++0+0+++.+	**1**	**1**	**90**
	W	Medicago laciniata	+++.....	0	0	38					01.+....++	3	2	50
	S	Mesembryanthemum nodiflorum	3.5++.++	**13**	**10**	**75**	+...+....	0	0	22	+.+...3+..	8	3	40
	S	Nasturtiopsis coronopifolia					+........	0	0	11				
	W	Neotorularia torulosa					5++......	17	6	33				
	C	Notoceras bicorne	.+.+...2	7	3	38					.+.......+	0	0	20
	W	Picris longirostris					....1....	10	1	11	...+......	0	0	10
	W	Plantago coronopus	...+....	0	0	13								
	W	Plantago ovata	++++.31.	**7**	**5**	**75**	..+.+..4.	15	5	33	11.+++.+0+	**3**	**3**	**80**
	S	Pteranthus dichotomus	+..+2+..	5	3	50	4+..+..+.	10	4	44	++++1+++..	**1**	**1**	**80**
*	S	Reaumuria hirtella					0+.+2+++0	**4**	**4**	**89**				
	W	Reichardia tingitana	.+......	0	0	13	....+....	0	0	11	........+.	0	0	10
	W	Reseda decursiva	..+...+.	0	0	25								
*	S	Reseda muricata					.......+.	0	0	11				
*	C	Reseda urnigera									....+.....	0	0	10
	H	Rostraria smyrnacea					.+.......	0	0	11				
	W	Rumex cyprius	....+.++	0	0	38	.......+.	0	0	11	..+..++...	0	0	30
	S	Salsola inermis					+++...+..	0	0	44				
*	S	Salsola schweinfurthii	.1...+2..	10	3	33								
*	S	Salsola tetrandra	23313211	**20**	**20**	**100**	976857466	**65**	**65**	**100**	9977999999	**89**	**89**	**100**
*	S	Salsola vermiculata					.......0.	5	1	11				
*	A	Salvia lanigera					...+.....	0	0	11				
	F	Schimpera arabica					+........	0	0	11				
	W	Schismus arabicus	++......	0	0	25	.+1+.....	3	1	33				
	W	Scilla hanburyi					.....+..+	0	0	22				
	W	Senecio glaucus					..+......	0	0	11				
	W	Silene linearis	.......+	0	0	13								
	W	Spergula fallax	.++..+.+	0	0	50								
	S	Spergularia diandra	+......+	0	0	25								
	W	Stipa capensis	012++.40	**11**	**10**	**88**	.+.+2..+.	5	2	44	8878887233	**62**	**62**	**100**
*	S	Suaeda asphaltica					....2+...	10	2	22				
*	S	Suaeda palaestina	87785787	**71**	**71**	**100**					..22+1....	14	6	40
	W	Trigonella stellata	+.......	0	0	13	.+.3+....	10	3	33	++...+.+++	**0**	**0**	**60**
	H	Urginea maritima					...+.....	0	0	11	...+..+...	0	0	20
	A	Urginea undulata					...+.....	0	0	11				
*	N	Zygophyllum dumosum					.1.++23+3	**13**	**10**	**78**	0.++++0...	**1**	**1**	**60**

6.4.1.3.6 MMS06 Salsoletum tetrandrae Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 24. **Distribution**: Fig. 62.

Ecological notes: It is confined mainly to outcrops of Senonian chalk close to the boundary of the diffused and the contracted vegetation. The salinity of the soil is indicated by the occurrence of many species of the sociotype S, and the low vegetation cover.

Association dynamics and conservation: There is no direct hazard to this association as it has poor carrying capacity and is not visited much by herds of domestic animals.

Aspects of the association: Persistents – 18 spp.; ephemerals – 39 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00233	1	3	13	15.04.67	I 1818 5272
2	00234	2	3	18	15.04.67	I 1818 5268
3	00237	2	3	14	15.04.67	I 1818 5268
4	00245	2	8	21	15.04.67	I 1818 5265
5	00302	1	4	20	27.03.67	I 2278 5654
6	00353	0	5	12	08.02.67	I 1802 5289
7	00388	0	3	11	20.05.67	I 1646 4727
8	00400	1	3	17	13.03.67	I 2308 5814
9	00500	1	5	11	09.01.67	I 2201 5630
Average:		1.1	4.1	15.2		

6.4.1.3.7 MMS07 Stipo capensis – Salsoletum tetrandrae ex Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 24. **Distribution:** Fig. 63.

Ecological notes: This association is found mainly in areas where the Lisan marl is rich in large pebbles and boulders which contribute the water not absorbed by them to the soil and leaching it. In soils poor in such stones there are only annuals and only in relatively wet years (e.g., Danin, 1976).

Association dynamics and conservation: There is no direct danger to this association as it comprises part of the Dead Sea Nature Reserve and developed close to the steep slopes of the valley margins.

Aspects of the association: Persistents – 7 spp.; ephemerals – 32 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94361	10	5	16	31.03.94	I 2320 6211
2	94362	10	10	13	31.03.94	I 2321 6211
3	94363	10	15	11	31.03.94	I 2322 6211
4	94364	10	20	23	31.03.94	I 2323 6211
5	94365	10	10	18	31.03.94	I 2320 6212
6	94366	10	10	17	31.03.94	I 2321 6212
7	94367	20	5	14	31.03.94	I 2322 6212
8	94368	20	2	12	31.03.94	I 2323 6212
9	94369	15	10	14	31.03.94	I 2320 6213
10	94370	10	10	11	31.03.94	I 2321 6213
Average:		12.5	9.7	14.9		

Table 25. Synoptic table of the Anabasietalia articulatae, Agathophoro alopecuroidis-Anabasion articulatae: 1 – MMA01, 2 – MMA02, Haloxylo scopariae-Anabasion articulatae: 3 – MMH01, 4 – MMH02, and Salsolion tetrandrae: 5 – MMS01, 6 – MMS02, 7 – MMS03, 8 – MMS04, 9 – MMS05, 10 – MMS06, 11 – MMS07

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P
	d.s. Anabasietea articulatae											
N	Anabasis articulata	**100**	43	**100**	56	13	57		16	**88**	33	**60**
N	Zygophyllum dumosum	25	29	50	**89**	46	43	56	40		**78**	**60**
S	Agathophora alopecuroides	**92**	57			42	**100**		32		22	
N	Asteriscus hierochunticus	8			22	13	14			38	22	**90**
	d.s. Haloxylo scopariae-Anabasion articulatae											
A	Haloxylon scoparium			**100**	**100**							
A	Ornithogalum trichophyllum			**90**	44	4			12			
A	Colchicum tunicatum	8		**90**	44	4						
A	Euphorbia grossheimii			50	44							
W	Scilla hanburyi			**90**	44	8			12		22	
W	Lappula spinocarpos	25		**70**	**89**	33		11	16		22	
	d.s. Salsolion tetrandrae											
S	Salsola tetrandra		43			4		11	24	**100**	**100**	**100**
N	Aaronsohnia factorovskyi					21			48	**88**	22	**80**
W	Erucaria rostrata					4	14		8	**75**	11	**70**
S	Mesembryanthemum nodiflorum					21			12	**75**	22	40
S	Bassia arabica	**92**		20		**100**	14	56	48		33	
W	Erodium touchyanum					8			12	13		10
S	Halothamnus acutifolius		43			13	29		36		44	
	Marker and rare species of associations											
W	Picris longirostris	**75**									11	10
H	Bromus fasciculatus	**75**				42		22	32		22	
W	Poa sinaica	58		10		17			4			
A	Noaea mucronata	58				13	57					
A	Leopoldia longipes	50										
A	Eremopyrum distans	42										
A	Helianthemum vesicarium	33										
A	Astragalus sanctus	33				4						
S	Spergularia diandra	33				4			16	25		
A	Bromus danthoniae	25										
A	Tulipa polychroma	17										
S	Limonium pruinosum	17						11				
A	Helianthemum ventosum	17										
W	Herniaria hirsuta	17				4	14					
H	Ornithogalum neurostegium	8										
H	Helianthemum aegyptiacum					4			8			
W	Lomelosia porphyroneura	8							8			
N	Calendula tripterocarpa	8										
V	Stipa pellita	8										
N	Anabasis setifera		**100**				14		4	13		10
C	Asteriscus graveolens		29									
A	Fagonia mollis		29			4	14				22	
C	Centaurea lanulata		29			4						
R	Atractylis carduus		14		11							10
C	Heliotropium maris-mortui		14						4			
R	Haplophyllum tuberculatum		14			8						
V	Pennisetum ciliare		14									
H	Pimpinella cretica		14									
C	Reseda urnigera		14	10								
R	Stipagrostis raddiana		14									
V	Tetrapogon villosus		14									
N	Fagonia tenuifolia		14									
W	Trichodesma africana		14									
W	Gastrocotyle hispida	25		**90**	**67**	8	14	11				
H	Gynandriris sisyrinchium	8		**80**	44	4					22	
A	Carex pachystylis			**80**	56	4						

Table 25. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P
W	Scorzonera judaica			**80**	56	13	14		8			
H	Scorzonera papposa			**70**	33				4			
W	Leontodon laciniatus			**60**	22							
S	Erodium oxyrhynchum			40	33	13	14		12		11	
W	Gagea reticulata			40	22	21			12			
A	Urginea undulata			40	11						11	
A	Zosima absinthiifolia			40	22	8		11				
A	Vicia monantha			30	22							
W	Malva aegyptia			30	22				4			
W	Atractylis phaeolepis	8		30	22		14					
W	Emex spinosa			30	22	4	14					10
A	Ceratocephala falcata			30	11	8			4			
W	Linaria albifrons			20		4						
H	Erodium ciconium			20								
A	Bellevalia eigii			20	11							
A	Astragalus hispidulus			10								
F	Ammochloa palaestina			10								
W	Adonis dentata			10		4						
W	Erodium neuradifolium			10		4			4			
A	Artemisia sieberi	33		50	**78**	13		11				
W	Filago desertorum	8		60	**78**	29	14		36			20
W	Schismus arabicus	33		40	56	13	14		12	25	33	
W	Plantago coronopus	17		50	56	21		11	20	13		
S	Nasturtiopsis coronopifolia			10	33	4	29		8		11	
A	Centaurea ammocyanus			10	33							
A	Arnebia linearifolia		17			33	4					
A	Avena wiestii				33							
W	Anthemis melampodina	25			33				4			
W	Linaria haelava			30	33				12			
F	Allium sindjarense			20	33	4			8			
A	Ixiolirion tataricum			10	22							
C	Launaea nudicaulis			22					13			
R	Launaea fragilis				22							
S	Reaumuria negevensis				22	4						
A	Eremopyrum bonaepartis				22							
H	Rostraria smyrnacea			10	22	13			4		11	
A	Salvia lanigera	8			22		8	14		4	11	
W	Silene vivianii	17			22		14					
A	Tripleurospermum auriculatum				22	4						
D	Hordeum glaucum				11	4						
R	Ifloga spicata				11							
S	Reseda muricata				11			11			11	
W	Roemeria hybrida			10	11				4			
H	Allium stamineum	8			11	8			4			
H	Anemone coronaria				11							
A	Alyssum linifolium			30	11							
V	Asparagus horridus				11							
H	Asphodelus ramosus				11							
A	Astragalus corrugatus				11							
W	Matthiola livida	42		30	11	50	14		28			
S	Erodium glaucophyllum					38		11	16			
S	Herniaria hemistemon				22	38		11	12		11	
H	Ranunculus asiaticus	17			11	33			24			
A	Helianthemum kahiricum	17				21	14		16			
H	Anthemis palestina					21						
W	Trigonella arabica			10		17		11				
S	Trigonella schlumbergeri					17			16			
B	Allium erdelii					17	14		4			
R	Cutandia memphitica			10	11	13					11	
R	Retama raetam					8			4			

Table 25. continued.

		1	2	3	4	5	6	7	8	9	10	11
		%P	%P	%P	%P	%P	%P	%P	%P	%P	%P	%P
W	Enarthrocarpus strangulatus				4							
H	Diplotaxis erucoides					4						
H	Crepis sancta					4						
A	Allium rothii					4						
A	Valerianella dufresnia					4						
B	Heliotropium rotundifolium					4						
A	Heterocaryum subsessile					4						
L	Parapholis incurva					4						
A	Tulipa systola					4						
A	Centaurea aegyptiaca		8				13	57		12		
W	Crithopsis delileana						43		4			
W	Calendula arvensis			10		4	29		20			
A	Ferula daninii	8				4	29					
B	Echinops polyceras				11		29					
W	Aegilops kotschyi				11		29					
A	Allium artemisietorum	8					29		8		11	
A	Atractylis serratuloides						29					
W	Centaurea pallescens						29		20		11	
S	Salsola vermiculata				21	29		24		11		
W	Atractylis cancellata						14					
S	Atriplex leucoclada	8				13	14		12		11	
W	Carthamus nitidus						14		8			
W	Euphorbia chamaepeplus			10		13	14				11	10
V	Euphorbia ramonensis						14	11				
H	Hippocrepis unisiliquosa					8	14					
W	Onobrychis crista-galli					4	14		8			
A	Onopordum alexandrinum						14					
B	Salvia dominica						14					
N	Telephium sphaerospermum						14					
B	Teucrium capitatum						14		4			
W	Silene linearis						14			13		
V	Phagnalon rupestre					8	14					
N	Amberboa crupinoides						14			13		10
H	Anthemis pseudocotula			10		4	14		4			
A	Astragalus spinosus						14					
S	Haloxylon negevensis					8		**100**			22	
N	Diplotaxis acris					4		44	28		44	
A	Leopoldia longipes					13		33				
H	Urginea maritima					4		22	4		11	20
A	Moricandia nitens				11	13		22	4			
H	Ornithogalum narbonense							11				
S	Suaeda vera							11				
A	Ferula biverticillata							11				
V	Ephedra aphylla					4		11	4			
S	Suaeda asphaltica					13		22	**100**		22	
A	Arnebia decumbens			11	17			36				
W	Neotorularia torulosa	25		20		17	14		36		33	
A	Leptaleum filifolium	8				17			24		11	
H	Muscari commutatum					8			20			
A	Heterocaryum szovitsianum								20			
W	Lasiopogon muscoides				17			20				
S	Atriplex glauca	8		4			20					
W	Carrichtera annua				4			16				
A	Astragalus callichrous								12			
B	Gypsophila arabica					8			12			
W	Aizoon hispanicum					4			12	11		
A	Buglossoides tenuiflora								8			
D	Malva parviflora								8			
H	Silene colorata								8			
W	Astragalus asterias								4			
H	Echium angustifolium								4			

Table 25. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P
B	Ajuga iva								4			
W	Anchusa aegyptiaca								4			
B	Anchusa strigosa								4			
H	Carthamus tenuis								4			
H	Chaetosciadium trichospermum								4			
H	Centaurea hyalolepis								4			
Q	Majorana syriaca								4			
A	Malabaila secacul								4			
R	Picris amalecitana								4			
W	Silene decipiens								4			
V	Umbilicus intermedius							4				
S	Suaeda palaestina									**100**		40
W	Spergula fallax								4	50		
H	Brachypodium distachyon									38	20	
C	Notoceras bicorne						14		4	38		20
W	Rumex cyprius	17					14		8	38	11	30
W	Reseda decursiva					4				25		
W	Lamarckia aurea									25		
N	Anthemis maris-mortui					8				13		
C	Aizoon canariense	8								13		10
S	Salsola schweinfurthii	17				13	29	11	4		33	
R	Schimpera arabica								4		11	
S	Atriplex halimus								4		22	
N	Kickxia acerbiana					4			8		11	
W	Kickxia floribunda										11	
S	Limonium lobatum						14		4	63		100
W	Matthiola aspera									25		90
W	Medicago laciniata			20	22	13	14		16	38		50
N	Anchusa milleri											20
H	Helianthemum salicifolium			10		13			4		20	
H	Androcymbium palaestinum											10
H	Campanula stellaris											10
V	Caralluma sinaica											10
H	Cuscuta planiflora											10
	d.s. Reaumurietalia hirtellae											
S	Pteranthus dichotomus	42		20	22	54	57	11	**64**	50	44	**80**
S	Reaumuria hirtella	**92**		**70**	**78**	**75**	43	44	52		**89**	
S	Salsola inermis	25		10	33	42	57	56	40		44	
W	Plantago ovata	**92**		10	11	54			52	**75**	33	**80**
	Other species											
W	Erodium crassifolium	**83**		**100**	**100**	58	43	**67**	52		**78**	40
W	Erucaria microcarpa	**92**		**60**	33	33	43	11	44		11	
W	Gymnarrhena micrantha	**92**		**90**	**78**	54	29	56	40		78	
W	Trigonella stellata	17		**80**	**67**	33			24	13	33	**60**
W	Stipa capensis	8	14		44	50	43		44	**88**	44	**100**
A	Bellevalia desertorum				11	17	14	28	13	33	20	
W	Astragalus tribuloides	17		**80**	**67**	54	29		44		44	
W	Helianthemum ledifolium	**67**		**60**	33	33	14		44		11	
W	Koelpinia linearis	42	10	11	42	14		20				
W	Senecio glaucus	**83**		20	33	50	14		48		11	
N	Gymnocarpos decander	33	14			13	14					10
N	Diplotaxis harra	33				29	14	11	8		11	
W	Reichardia tingitana				11	29	29		16	13	11	10

6.4.1.4 MMZ Zygophyllion dumosi Eig 1946 ex Danin & Solomeshch all. nov.

Diagnostical species: *Anthemis melampodina, Asteriscus hierochunticus, Gymnocarpos decander, Helianthemum kahiricum, Zygophyllum dumosum* (dom.).

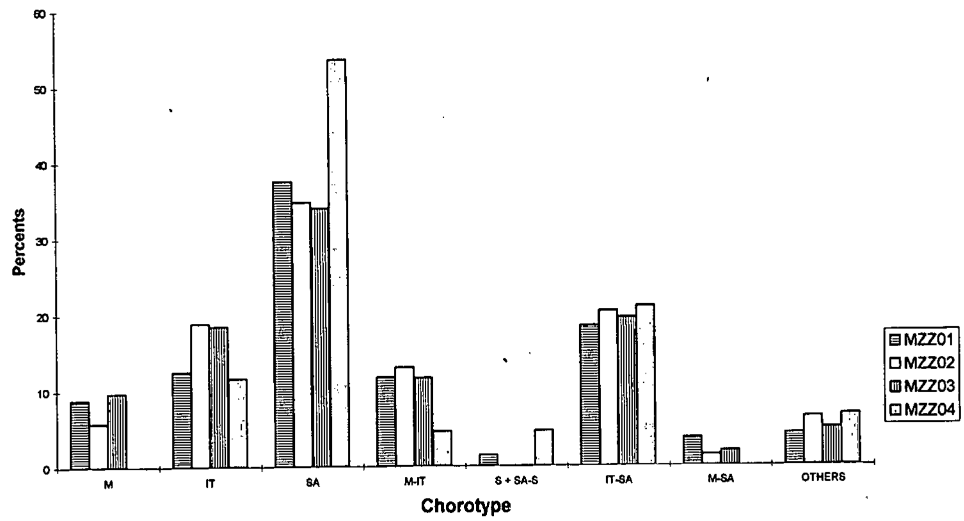

Figure 64. Phytogeographical analysis of associations MZZ01-MZZ04.

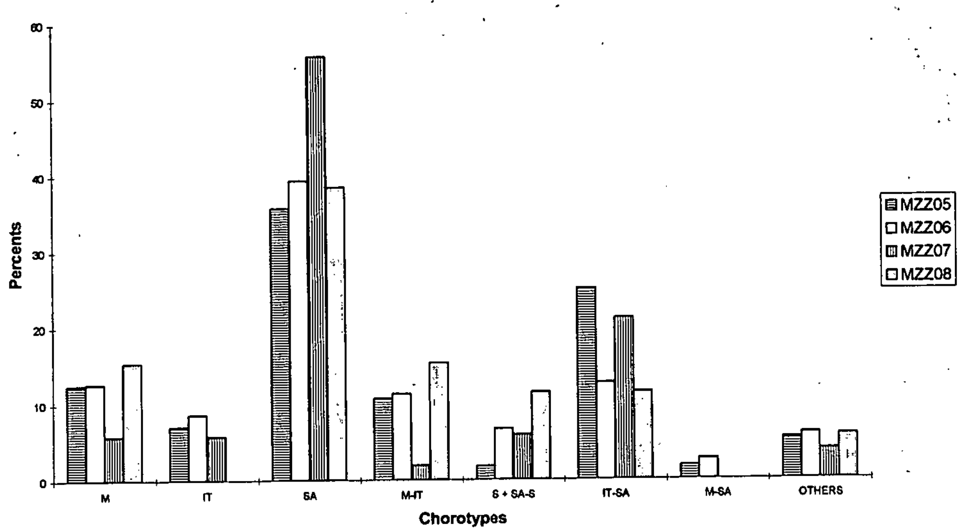

Figure 65. Phytogeographical analysis of associations MZZ05-MZZ08.

Nomenclatural type: Zygophylletum dumosi Eig 1946.

Synoptic table: Table 29.

Zygophylletum dumosi Eig (1946) was not recorded again in our present study, but being recorded by the first author, we keep it as the type. Following Eig's view that *Zygophyllum dumosum* is the dominant, we gathered into the alliance Zygophyllion dumosi associations which are confined in the area where mean annual rainfall is less than 100 mm to various types of hard calcareous rocks. Each of the associations occupies a certain set-up of climatic and edaphic conditions. On hard and fissured limestone and dolomite of the Cenoman-Turonian MMZ01 dominates a large area of eastern Judean Desert and the eastern Negev Highlands. MMZ02 occurs in an area less arid closer to the shrub-steppe (AAA) area, and MMZ07 typify the driest zone of the extreme desert where mean annual rainfall is around 30 mm; softer substrata in that area support only contracted vegetation. In the same area, where the quantities of soft rocks interbedded with the hard layers of limestone or flint are small, step-like topography of hard and fissured rocks occur and the association is MMZ06.

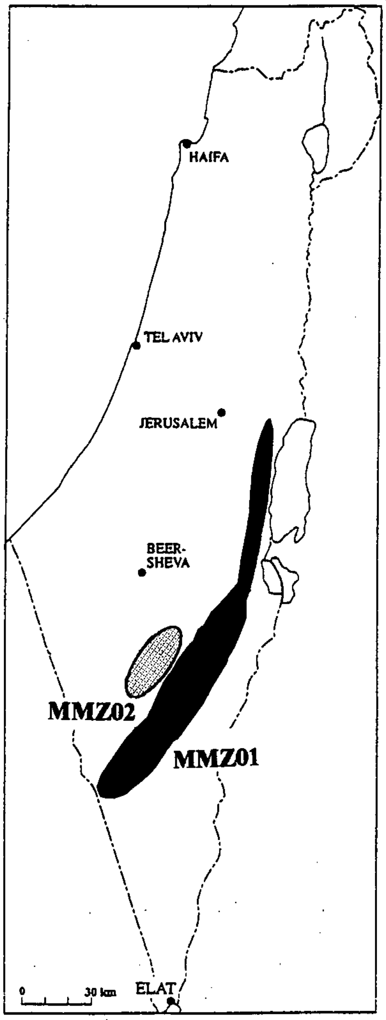

Figure 66. Distribution map of associations MZZ01and MZZ02.

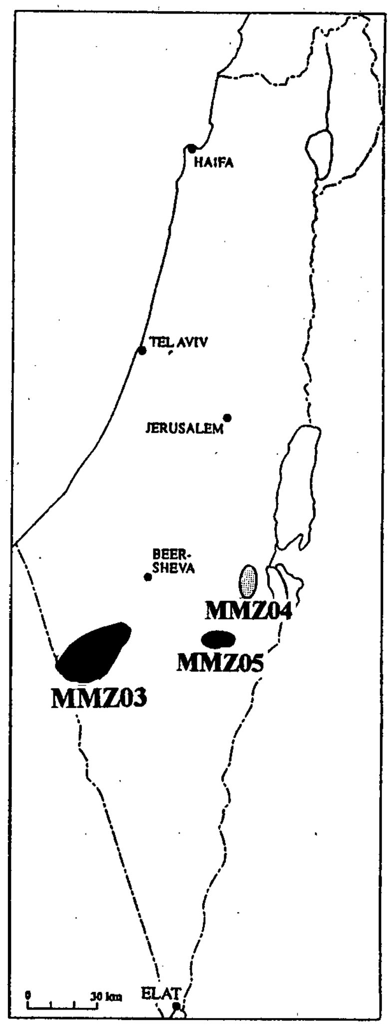

Figure 67. Distribution map of associations MZZ03-MZZ05.

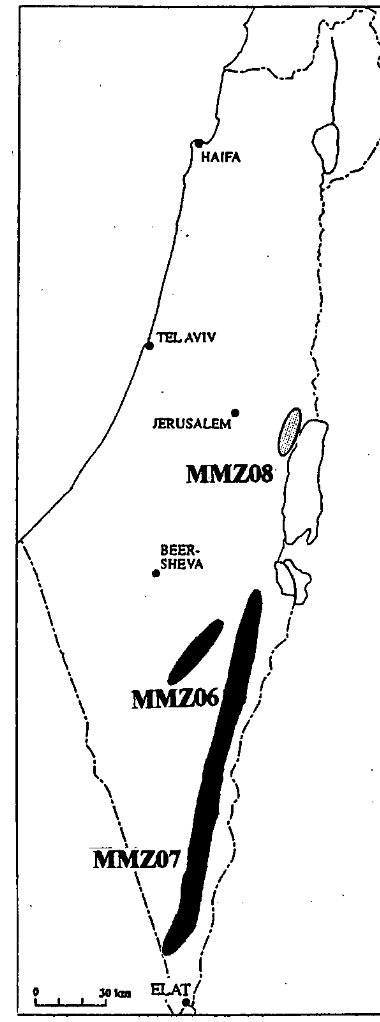

Figure 68. Distribution map of associations MZZ06-MZZ08.

In areas of the alliance where the ground is chalky the importance of xerohalophytes increases. MMZ03, in which *Reaumuria negevensis* is the companion, is typical to hard chalk of the Eocene whereas *Salsola tetrandra* is the companion on the south facing slopes of the silicified chalk of the southern Judean Desert. Trichodesmetum boissieri (MMZ08) is confined to screes on the steep fault escarpment of the Dead Sea Valley. Schimpero arabicae – Zygophylletum dumosi (MMZ05) occupies wind-protected slopes of Neogene conglomerate in the Rotem plain, where wind-borne sand have been accumulated and thus influence ecological conditions and vegetation composition.

The two most frequent chorotypes in the phytogeographical spectrum of all associations of this alliance are the SA and the IT-SA (Figs. 64 and 65). The associations MMZ04 and MMZ07, which occur in the warmest and driest parts of the alliance, have the SA chorotype in exceeding proportions, as compared with the other associations. The highest frequency of the IT chorotype is in two associations which occur in the main shrub-steppe zone (Sect. 4.10).

6.4.1.4.1 MMZ01 Reaumurio hirtellae – Zygophylletum dumosi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov., nom. inv.

Syn.: Zygophyllum dumosum – Reaumuria hirtella association Danin, Orshan et Zohary 1975.

Diagnostical species: the markers in table 26. **Distribution:** Fig. 66.

Ecological notes: The two species in the association name reflect its edaphic conditions. Hard and fissured limestone outcrops support *Zygophyllum dumosum* whereas interbedded marl and chalk favors the xerohalophyte

Reaumuria hirtella. The large number of plants of the Artemisietalia sieberi and plants of wide desert habitats reflect the generalist nature of this association. It is one of the associations which cover the largest area in Israel; other associations are more restricted in distribution.

Association dynamics and conservation: Most of the area of this association is under constant but low stress of grazing probably due to its low vegetation cover.

Aspects of the association: Persistents – 36 spp.; ephemerals – 107 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00027	10	5	42	27.04.64	I 1900 5465
2	00034	10	10	40	23.04.64	I 1789 5289
3	00035	15	7	27	22.04.64	I 1906 5453
4	00037	10	5	35	23.04.64	I 1753 5287
5	00118	5	5	19	09.05.66	I 2030 5390
6	00136	3	1	37	13.03.67	I 2314 5811
7	00140	10	10	52	13.03.67	I 2315 5816
8	00141	2	2	35	13.03.67	I 2312 5815
9	00144	1	1	29	13.03.67	I 2314 5812
10	00231	4	1	18	14.04.67	I 1844 5528
11	00366	3	3	26	07.05.67	I 1797 5289
12	00367	3	3	24	07.05.67	I 1798 5289
13	00370	2	3	26	07.05.67	I 1801 5290
14	00401	2	3	23	13.03.67	I 2324 5808
15	00402	1	4	25	13.03.67	I 2325 5808
16	00418	5	10	16	18.03.67	I 1810 5326
Average:		5.4	4.6	29.6		

Table 26. Association tables of MMZ01- Reaumurio hirtellae – Zygophylletum dumosi and MMZ02 – Gymnocarpo decandri – Zygophylletum dumosi

		Species	MMZ01				MMZ02			
			*1234567890123456	C1	C2	%P	*123456789	C1	C2	%P
	W	Aaronsohnia factorovskyi	....+........4..	20	3	13				
	W	Adonis dentata	..+.............	0	0	6				
	W	Aegilops kotschyi	............+...	0	0	6				
*	S	Agathophora alopecuroides	....+...........	0	0	6	....+....	0	0	11
	W	Aizoon hispanicum	1+7+....+.......	16	5	31				
	A	Allium artemisietorum	.+.....+.....++.	0	0	25				
	F	Allium sindjarense	.......+..+.....	0	0	13				
	H	Allium stamineum	+..+............	0	0	13	...+...+.	0	0	22
	N	Amberboa crupinoides	....+...........	0	0	6				
	F	Ammochloa palaestina					.....++..	0	0	22
*	N	Anabasis articulata	...00...+..++++.	1	1	44				
*	N	Anabasis setifera	....+...........	0	0	6				
	W	Anagallis arvensis	....+.+.........	0	0	13				
	W	Anchusa aegyptiaca	......+.......+.	0	0	13				
	W	Anthemis melampodina	.+.+......+++...	0	0	31	+.+.+....	0	0	33
	H	Anthemis pseudocotula	.....+.......+..	0	0	13	..+..+++1	2	1	56
	W	Arnebia decumbens	..+........+....	0	0	13				
	W	Arnebia linearifolia	++...+.+..+.+...	0	0	38	+........	0	0	11
*	A	Artemisia sieberi	+.+++..+..+++...	0	0	50	++.....0.	2	1	33
*	V	Asparagus horridus	......+.........	0	0	6				
	H	Asphodelus ramosus					.0.....1.	8	2	22
	N	Asteriscus hierochunticus	+++2++.1++.....+	**3**	**2**	**63**	+++++++.+	**0**	**0**	**89**
*	C	Asteriscus graveolens	..............+.	0	0	6				
	V	Asterolinon linum-stellatum	......+.........	0	0	6				
*	V	Astragalus amalecitanus					...+.....	0	0	11
	W	Astragalus asterias	+...............	0	0	6				
	A	Astragalus callichrous					...+.+...	0	0	22
*	A	Astragalus sanctus					+........	0	0	11

Table 26. continued.

		Species	MMZ01 1234567890123456	C1	C2	%P	MMZ02 123456789	C1	C2	%P
*	A	Astragalus spinosus	......3.........	30	2	6				
	W	Astragalus tribuloides	++.............+	0	0	19	++..++..+	0	0	56
	W	Atractylis cancellata	+...............	0	0	6				
*	R	Atractylis carduus	.....+..........	0	0	6				
*	W	Atractylis phaeolepis	+....++...+.+..+	0	0	38	++00+++.+	**1**	**1**	**89**
*	S	Atriplex glauca	....+...........	0	0	6				
	W	Avena wiestii	..........+.....	0	0	6	+...+..++	0	0	44
*	B	Ballota undulata	......1.........	10	1	6				
*	S	Bassia arabica					...+.....	0	0	11
	A	Bellevalia desertorum	...0...++......1	5	1	25				
	H	Biscutella didyma	......+.........	0	0	6				
	H	Bromus fasciculatus	......3...+...1.	13	3	19	725415625	**41**	**41**	**100**
	A	Buglossoides tenuiflora	......+.........	0	0	6				
	H	Calendula arvensis	......+.........	0	0	6				
	N	Calendula tripterocarpa					..+...+++	0	0	44
	V	Campanula erinus	......+.........	0	0	6				
*	V	Capparis aegyptia	..........+.....	0	0	6				
	A	Carex pachystylis	0++2...........6	17	5	31	.3......1	20	4	22
	W	Carrichtera annua	+.++...++.....+.	0	0	38	+..++++..	0	0	56
	W	Carthamus nitidus	....+........+..	0	0	13				
*	A	Centaurea aegyptiaca	+....1+.+..+....	2	1	31				
	A	Centaurea ammocyanus	.+........+++...	0	0	25				
	V	Centaurea eryngioides	.............+..	0	0	6				
*	C	Centaurea lanulata	.......+.....+..	0	0	13				
	W	Centaurea pallescens	......+..	0	0	11				
	H	Chaetosciadium trichospermum	......1.......+.	5	1	13				
*	V	Cheilanthes acrostica	......+.........	0	0	6				
	W	Cnicus benedictus					.2...+.+.	7	2	33
	W	Crepis aspera					....+....	0	0	11
	H	Crepis sancta	.......+........	0	0	6				
	W	Crithopsis delileana	.........+......	0	0	6				
	R	Cutandia memphitica					1+.+.++.+	**2**	**1**	**67**
	W	Diplotaxis harra	3..+.6++2..+.14.	18	10	56	....+..++	0	0	33
*	B	Echinops polyceras	......+.........	0	0	6				
*	V	Ephedra aphylla	.....+........+.	0	0	13				
	W	Erodium crassifolium	+5+++++.318982.+	**26**	**23**	**88**	.0+42323+	**18**	**16**	**89**
	W	Erodium moschatum	.....+++......+.	0	0	25				
	S	Erodium oxyrhynchum	.4........1+1...	16	4	25				
	W	Erodium touchyanum	......++........	0	0	13				
	W	Erucaria microcarpa	4.20..1.........	19	5	25	021++++0	**4**	**4**	**100**
	W	Erucaria rostrata	....+.+.........	0	0	13				
	W	Euphorbia chamaepeplus	+.....+..+..+...	0	0	25				
	A	Euphorbia grossheimii	..........+++...	0	0	19				
*	A	Fagonia mollis	.....+..........	0	0	6				
*	C	Farsetia aegyptia	...+...++.......	0	0	19				
	H	Ferula communis	.+..............	0	0	6				
	H	Filago contracta	......+.........	0	0	6				
	W	Filago desertorum	0+.+.+.++++.....	1	0	50	+..++++.+	**0**	**0**	**67**
	W	Gagea reticulata	++.+.+.+++...+.+	0	0	56				
	W	Gastrocotyle hispida	++.+......++....	0	0	31				
	W	Gymnarrhena micrantha	++.2.1.518+.+...	19	11	56				
*	N	Gymnocarpos decander	.....++++.....+.	0	0	31	334150511	**27**	**27**	**100**
	H	Gynandriris sisyrinchium	.+....++.......+	0	0	25	.......+.	0	0	11
*	B	Gypsophila arabica	.....+..........	0	0	6				
*	S	Halothamnus acutifolius	.....0..........	5	0	6				
*	A	Haloxylon scoparium	..+.......1+....	3	1	19	.+.+11.++	**4**	**3**	**67**
	H	Helianthemum aegyptiacum	.............+..	0	0	6				
*	A	Helianthemum kahiricum	+....+.+3.....+.	6	2	31	3.23..153	**29**	**19**	**67**
	W	Helianthemum ledifolium	.+.0.+++.+...+.+	1	0	50				
	H	Helianthemum salicifolium	.....+3+........	10	2	19				
*	A	Helianthemum ventosum					+.....+0+	1	1	44
*	A	Helianthemum vesicarium	.....+..........	0	0	6				

Table 26. continued.

		Species	MMZ01 1234567890123456	C1	C2	%P	MMZ02 123456789	C1	C2	%P
*	C	Heliotropium maris-mortui	........+.......	0	0	6				
*	S	Herniaria hemistemon	.+........++....	0	0	19	...+.....	0	0	11
	H	Hippocrepis unisiliquosa	.....++.......+.	0	0	19	+..+++++.	**0**	**0**	**67**
	H	Hymenocarpos circinnatus	......+.........	0	0	6				
	R	Ifloga spicata					+....+...	0	0	22
	A	Ixiolirion tataricum	.+..............	0	0	6				
*	W	Kickxia floribunda	.+....++........	0	0	19				
	W	Koelpinia linearis	............+...	0	0	6				
	W	Lappula spinocarpos	++++.......+....	0	0	31				
	C	Launaea nudicaulis	..........+++...	0	0	19				
	W	Leontodon laciniatus	+...........+...	0	0	13	.....+...	0	0	11
	S	Limonium lobatum	.........+......	0	0	6				
*	S	Limonium pruinosum	..+.............	0	0	6				
	W	Linaria haelava	++.+............	0	0	19				
	W	Lomelosia porphyroneura	.....+..........	0	0	6	....+.+..	0	0	22
	W	Malva aegyptia					+++0.+++1	**2**	**2**	**89**
	D	Malva parviflora					......+..	0	0	11
	D	Matricaria aurea	......+.........	0	0	6				
	W	Matthiola livida	++++.+.+........	0	0	38	+......+.	0	0	22
	W	Medicago laciniata	...............+	0	0	6				
	W	Medicago radiata					.....+..+	0	0	22
	S	Mesembryanthemum nodiflorum	...+............	0	0	6				
*	A	Moricandia nitens	.+.........14...	17	3	19				
	S	Nasturtiopsis coronopifolia	.1.......++++...	2	1	31				
	W	Neotorularia torulosa	+..........+....	0	0	13				
*	A	Noaea mucronata					120.+.1+2	**9**	**7**	**78**
	C	Notoceras bicorne	......+.........	0	0	6				
	W	Onobrychis crista-galli	.........+......	0	0	6				
	W	Ononis sicula					..+.+...+	0	0	33
	A	Ornithogalum narbonense					........+	0	0	11
	H	Ornithogalum trichophyllum	.....+.+........	0	0	13				
	W	Parietaria alsinifolia	.....+..........	0	0	6				
*	V	Phagnalon rupestre	......+.........	0	0	6	...+.+...	0	0	22
	W	Picris longirostris	............++..	0	0	13	.......++	0	0	22
	H	Pimpinella cretica	......0.......+.	3	0	13				
	H	Plantago afra	..............+.	0	0	6				
	W	Plantago coronopus	++..+.+........+	0	0	31	+23+0.+02	**10**	**9**	**89**
	W	Plantago ovata	+....2+23....2..	15	6	38	....+....	0	0	11
	W	Poa sinaica	......+.....+...	0	0	12	.+......+	0	0	22
	S	Pteranthus dichotomus	++.+...++0+++++.	**0**	**0**	**69**	0.+++.++.	**1**	**1**	**67**
	W	Pterocephalus brevis	.+..............	0	0	6	+.+.+...+	0	0	44
	H	Pterocephalus plumosus	...+............	0	0	6				
	H	Ranunculus asiaticus	.....++++....++.	0	0	38				
*	S	Reaumuria hirtella	++0+++++++441++0	**6**	**6**	**100**	...0010+0	**5**	**3**	**67**
*	S	Reaumuria negevensis					+1.+.....	3	1	33
	W	Reichardia tingitana	+...++..++......	0	0	31	...++.+..	0	0	33
	W	Reseda decursiva	+...............	0	0	6				
*	R	Retama raetam	......1.........	10	1	6				
	W	Roemeria hybrida	.+++.....+......	0	0	25				
	H	Rostraria smyrnacea	..+.............	0	0	6	+++..+.+.	0	0	56
	W	Rumex cyprius	......+.+.......	0	0	13	..+......	0	0	11
	S	Salsola inermis	..++.+....+....+	0	0	31	..+......	0	0	11
*	S	Salsola tetrandra	....+..+........	0	0	13				
*	S	Salsola vermiculata	......+.+....0..	2	0	19				
*	A	Salvia lanigera	+....++.+.++....	0	0	38	.++.++..+	0	0	56
	W	Schismus arabicus	++0+.......++...	1	0	38	.......+.	0	0	11
	W	Scilla hanburyi	.+...++.+.....+.	0	0	31	+++..++..	0	0	56
	W	Scorzonera judaica	++++...+.......1	3	1	38	+........	0	0	11
	H	Scorzonera papposa	.+....++.++++.+.	0	0	50	.+.++..+.	0	0	44
	A	Scorzonera pusilla	............+...	0	0	6				

Table 26. continued.

	Species	MMZ01 1234567890123456	C1	C2	%P	MMZ02 123456789	C1	C2	%P
W	Senecio glaucus	++++.++++...+++.	0	0	69	+++..++.+	0	0	67
H	Silene colorata	..+.............	0	0	6				
W	Silene vivianii	.+.+............	0	0	13				
W	Sisymbrium erysimoides	.....+..........	0	0	6				
D	Sonchus oleraceus	....+.+.........	0	0	13				
W	Spergula fallax	+.++............	0	0	19				
S	Spergularia diandra	++0+....+.......	1	0	31				
W	Stipa capensis	++1.+..+++...+3.	6	3	56	+++16210+	12	12	100
* V	Stipa parviflora					+........	0	0	11
W	Trigonella arabica	......+.........	0	0	6	......+..	0	0	11
W	Trigonella stellata	+++0.+..+...+.++	1	0	56	+++..++3.	5	3	67
V	Umbilicus intermedius	......+.........	0	0	6				
H	Urginea maritima	+.....+......++.	0	0	25				
A	Urginea undulata	..........+.....	0	0	6				
A	Zosima absinthiifolia					1+....+..	3	1	33
* N	Zygophyllum dumosum	9999974979555999	80	80	100	233537223	33	33	100

6.4.1.4.2 MMZ02 Gymnocarpo decandri – Zygophylletum dumosi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov,. nom. inv.

Syn.: Zygophyllum dumosum – Gymnocarpos decander association Danin, Orshan et Zohary 1975.

Diagnostical species: the markers in table 26. **Distribution:** Fig. 66.

Ecological notes: This association prevails in relatively dry habitats in the area of the shrub-steppes (AAA). Such a habitat may be south-facing slopes which receive higher solar radiation than other slopes. Yair & Danin (1980) displayed the relatively dry moisture regime of the lower part of rocky slopes of the Negev Highlands, supporting MMZ02. In these places the colluvium section of the slope gets relatively small amount of runoff and due to its finer soil texture its loses to direct evaporation are higher than those of fissured limestone with Brown Lithosols of the upper part of the slope.

Association dynamics and conservation: Most of the area of this association is under constant process of modest grazing due to a decrease in Bedouin herds size in the main area where the association occurs.

Aspects of the association: Persistents – 17 spp.; ephemerals – 36 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94284	20	15	34	22.03.94	I 1710 5390
2	94285	15	10	27	22.03.94	I 1711 5390
3	94286	10	7	25	22.03.94	I 1712 5390
4	94287	10	10	27	22.03.94	I 1713 5390
5	94288	15	10	29	22.03.94	I 1710 5391
6	94289	10	10	29	22.03.94	I 1710 5392
7	94290	20	10	31	22.03.94	I 1710 5393
8	94291	20	15	31	22.03.94	I 1711 5393
9	94292	10	10	31	22.03.94	I 1711 5392
Average:		14.4	10.8	29.3		

6.4.1.4.3 MMZ03 Reaumurio negevensis – Zygophylletum dumosi Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov., nom. inv.

Syn.: Zygophyllum dumosum – Reaumuria negevensis association Danin, Orshan et Zohary 1975.

Diagnostical species: the markers in table 27. **Distribution:** Fig. 67.

Ecological notes: The main habitat of this association is the low hills of Eocene chalk of the lowlands south of Shivta – Nizzana line. The edaphic factors influencing the occurrence of *Reaumuria negevensis* in other alliances seem to function here as well; where Senonian chalk or marl outcrops occur *R. negevensis* is replaced by *Reaumuria hirtella.* The limestone nature of the hard chalk affects the dominance of *Zygophyllum dumosum* here. The large number of plants of the Artemisietalia sieberi and plants of wide desert habitats reflect the generalist nature of this association.

Association dynamics and conservation: Most of the area of this association is under light pressure of grazing.

Aspects of the association: Persistents – 17 spp.; ephemerals – 89 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00023	30	7	33	06.05.64	I 1886 5455
2	00025	20	10	33	27.04.64	I 1908 5466
3	00029	30	5	51	27.04.64	I 1878 5465
4	00032	10	20	50	23.04.64	I 1789 5316
5	00115	10	20	34	23.05.64	I 1838 5451
6	00200	1	6	22	11.04.67	I 1619 5375
7	00349	0	5	12	09.08.66	I 1637 5375
8	00518	0	5	5	07.07.66	I 1832 5520
9	94278	2	10	14	22.03.94	I 1630 5382
10	94279	1	15	17	22.03.94	I 1631 5382
11	94280	1	10	12	22.03.94	I 1632 5382
12	94281	1	15	13	22.03.94	I 1630 5381
13	94282	1	15	14	22.03.94	I 1630 5382
14	94283	1	10	17	22.03.94	I 1630 5383
Average:		7.7	10.9	23.4		

Table 27. Association tables of MMZ03 – Reaumurio negevensis – Zygophylletum dumosi, MMZ04 – Salsolo tetrandrae – Zygophylletum dumosi, MMZ05 – Schimpero arabicae – Zygophylletum dumosi

		Species	MMZ03				MMZ04				MMZ05			
			*12345678901234	C1	C2	%P	*1234567	C1	C2	%P	*1234567	C1	C2	%P
	W	Adonis dentata	...+..........	0	0	7					..+....	0	0	14
	W	Aegilops kotschyi	..+...........	0	0	7					.+.++..	0	0	43
*	S	Agathophora alopecuroides	......+......+	0	0	14								
	W	Aizoon hispanicum	+++...........	0	0	21								
	A	Allium artemisietorum	....+.........	0	0	7								
	F	Allium sindjarense	.........+....	0	0	7					.+++..+	0	0	57
	H	Allium stamineum	.++.+.........	0	0	21								
	F	Ammochloa palaestina	..++..........	0	0	14					.00....	5	1	29
*	N	Anabasis articulata	.+0...........	3	0	14					1233321	**22**	**22**	**100**
	W	Anthemis melampodina	+.100...+.1+0.	4	3	57					0+2+.++	**4**	**4**	**86**
	W	Arnebia decumbens	..........+...	0	0	7					..+.+.+	0	0	43
	W	Arnebia linearifolia	....+.........	0	0	7					.....+.	0	0	14
*	A	Artemisia sieberi	.+.1++0.......	3	1	36					23111..	**16**	**11**	**71**
	H	Asphodelus ramosus	+.+...........	0	0	14					134+++.	**13**	**11**	**86**
	N	Asteriscus hierochunticus	....1.+.85.+.+	23	10	43								
	A	Astragalus callichrous	+..+..........	0	0	14								
	H	Astragalus hamosus	...+..........	0	0	7								
*	A	Astragalus sanctus	.+............	0	0	7								
	W	Astragalus tribuloides					+.+++..	0	0	57				
*	W	Atractylis phaeolepis	....+...+....1	3	1	21								
*	S	Atriplex glauca					.....+.	0	0	14				
*	S	Atriplex halimus					.+.....	0	0	14				
	A	Avena wiestii	.++......+....	0	0	21								
*	S	Bassia arabica	.......+......	0	0	7								
	A	Bellevalia desertorum									......+	0	0	14
	R	Brassica tournefortii									......+	0	0	14

Table 27. continued.

	Species	MMZ03 12345678901234	C1	C2	%P	MMZ04 1234567	C1	C2	%P	MMZ05 1234567	C1	C2	%P
H	Bromus fasciculatus	........+442+2	20	9	43								
H	Bupleurum lancifolium	..+...........	0	0	7								
A	Bupleurum semicompositum	.....+........	0	0	7								
H	Calendula arvensis	..+...........	0	0	7	+++++++	**0**	**0**	**100**				
N	Calendula tripterocarpa	.............+	0	0	7								
* R	Calligonum comosum									+.0..0.	3	1	43
H	Carduus acicularis	..+...........	0	0	7								
A	Carex pachystylis	+..+00........	3	1	29								
W	Carrichtera annua	+++...........	0	0	21	++•1+..	**2**	**1**	**71**				
* A	Centaurea aegyptiaca	++.++..+......	0	0	36								
W	Centaurea pallescens									.....++	0	0	29
A	Ceratocephala falcata	..++..........	0	0	14								
A	Colchicum ritchii									..++.++	0	0	57
W	Crepis aspera	...+..........	0	0	7								
A	Crepis sancta	+.............	0	0	7								
R	Cutandia memphitica	...+.+........	0	0	14	......+	0	0	14				
H	Daucus durieua	..+...........	0	0	7								
W	Diplotaxis harra	0.11..+.......	6	2	29								
W	Emex spinosa	..+...........	0	0	7	.++..++	0	0	57				
R	Eminium spiculatum									+......	0	0	14
A	Eremopyrum bonaepartis	...+..........	0	0	7								
W	Erodium crassifolium	..+++....+...0	1	0	36	0	5	1	14	+++++++	**0**	**0**	**100**
S	Erodium glaucophyllum					27157+.	**38**	**32**	**86**				
R	Erodium laciniatum									..+..++	0	0	43
S	Erodium oxyrhynchum	.............+	0	0	7	2..++..	7	3	43				
W	Erodium touchyanum	.....+........	0	0	7								
W	Erucaria microcarpa	775.6....+.+.+	36	18	50								
F	Erucaria pinnata									1312444	**28**	**28**	**100**
W	Euphorbia chamaepeplus	+..+..........	0	0	14								
* A	Fagonia mollis					.+.....	0	0	14				
H	Filago contracta	..+...........	0	0	7								
W	Filago desertorum	++++++........	0	0	43	1110.++	**6**	**5**	**86**				
E	Gagea dayana									+++++..	**0**	**0**	**71**
W	Gagea reticulata	+++++.........	0	0	36								
W	Gastrocotyle hispida	.++.++....+...	0	0	36					......+	0	0	14
W	Gymnarrhena micrantha	.1.1.5........	23	5	21	5284++.	**32**	**27**	**86**	...+...	0	0	14
* N	Gymnocarpos decander	.++.+.+.......	0	0	29					+...+..	0	0	29
H	Gynandriris sisyrinchium	....++........	0	0	14					+++++..	**0**	**0**	**71**
R	Gypsophila viscosa									.++.+..	0	0	43
* A	Haloxylon scoparium	...+..+.......	0	0	14								
* A	Helianthemum kahiricum	....+..+.++.+++	0	0	50								
W	Helianthemum ledifolium	+.20..........	8	2	21	+++...+	0	0	57				
* R	Helianthemum stipulatum									+......	0	0	14
* A	Helianthemum ventosum	.........+....	0	0	7								
* A	Helianthemum vesicarium	...+..........	0	0	7								
W	Herniaria hirsuta	++............	0	0	14								
H	Hippocrepis unisiliquosa	...++.........	0	0	14								
R	Ifloga spicata	..+.0.........	3	0	14					31101.1	**13**	**11**	**86**
A.	Iris regis-uzziae	........+.....	0	0	7								
W	Koelpinia linearis	..+...........	0	0	7								
W	Lappula spinocarpos	+0+++.........	1	0	36					...+.+.	0	0	29
W	Leontodon laciniatus	.+........+.+.	0	0	21								
A	Leopoldia longipes	........+..+..	0	0	14								
S	Limonium lobatum	+.+...........	0	0	14								
* S	Limonium pruinosum	....+.+..1..00	4	1	36								
W	Linaria albifrons	...+..........	0	0	7								
W	Linaria haelava	.+++..........	0	0	21					++++.++	**0**	**0**	**86**
W	Lomelosia porphyroneura	..++..........	0	0	14								
W	Malva aegyptia	....+++.......	0	0	21								
D	Malva parviflora									..+....	0	0	14
W	Matthiola livida	+++......+....	0	0	29					+1+222.	**12**	**10**	**86**

Table 27. continued.

		Species	MMZ03 12345678901234	C1	C2	%P	MMZ04 1234567	C1	C2	%P	MMZ05 1234567	C1	C2	%P
	W	Medicago laciniata	+.+...........	0	0	14								
	W	Medicago radiata	..+...........	0	0	7								
	S	Mesembryanthemum nodiflorum									+......	0	0	14
	W	Minuartia picta	...+..........	0	0	7								
	W	Neotorularia torulosa	.++...........	0	0	14								
*	A	Noaea mucronata	...+.+0.0+0220	**8**	**5**	**64**					....+..	0	0	14
	H	Ononis mollis	...+..........	0	0	7								
	A	Onopordum alexandrinum									....++.	0	0	29
	F	Pancratium sickenbergeri									+++.++.	**0**	**0**	**71**
	W	Papaver humile	..++..........	0	0	14								
	F	Picris asplenioides									.+.....	0	0	14
	W	Picris longirostris	.............+	0	0	7								
	W	Plantago coronopus	+++3+.........	6	2	36					..++...	0	0	29
	W	Plantago ovata	..++.+....0++.	1	0	43								
	W	Poa sinaica	....+.........	0	0	7								
	R	Polycarpon succulentum									+......	0	0	14
	S	Pteranthus dichotomus	.++..2..2+.030	10	6	57								
	W	Pterocephalus brevis	............+.	0	0	7								
	H	Pterocephalus plumosus	....+.........	0	0	7								
	H	Ranunculus asiaticus	..++..........	0	0	14								
*	S	Reaumuria hirtella					1311200	**13**	**13**	**100**				
*	S	Reaumuria negevensis	0201574+462335	**31**	**31**	**100**								
	W	Reichardia tingitana	..+........+..	0	0	14					.+.....	0	0	14
	W	Roemeria hybrida	+++1..........	3	1	29								
	H	Rostraria smyrnacea	+.+++.........	0	0	29								
	R	Rumex pictus									3++3122	**16**	**16**	**100**
	S	Salsola inermis	+.++.++.+0+.++	**1**	**0**	**71**								
*	S	Salsola tetrandra					51271.0	**28**	**24**	**86**				
*	A	Salvia lanigera	....++...++...	0	0	29								
	F	Schimpera arabica									00++11+	**4**	**4**	**100**
	W	Schismus arabicus	00.+++.++...+.	1	1	57					.+....+	0	0	29
	W	Scilla hanburyi	.+.+..........	0	0	14								
	W	Scorzonera judaica	+++++.........	0	0	36					..+....	0	0	14
	H	Scorzonera papposa	...2..........	20	1	7								
	W	Senecio glaucus	++++++........	0	0	43					.++..+.	0	0	43
	H	Silene colorata									.++....	0	0	29
	W	Silene vivianii	.+.+.+........	0	0	21					..+....	0	0	14
	W	Spergula fallax	+.++.+........	0	0	29	..+....	0	0	14				
	S	Spergularia diandra	1+0.+.........	4	1	29								
	W	Stipa capensis	+..+++..++4767	**24**	**17**	**71**	+1.+3+9	**23**	**19**	**86**	...++..	0	0	29
*	V	Stipa pellita									+......	0	0	14
*	F	Stipagrostis obtusa									++.....	0	0	29
	W	Trigonella arabica	.++...........	0	0	14								
	W	Trigonella stellata	+0+.0.........	3	1	29					+.+++++	**0**	**0**	**86**
	A	Tulipa systola	...0..........	5	0	7								
	V	Umbilicus intermedius	...+..........	0	0	7								
	H	Urginea maritima	+.............	0	0	7								
*	N	Zygophyllum dumosum	98974349537443	**58**	**58**	**100**	4672799	**63**	**63**	**100**	7556678	**63**	**63**	**100**

6.4.1.4.4 MMZ04 Salsolo tetrandrae – Zygophylletum dumosi Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 27. **Distribution:** Fig. 67.

Ecological notes: The silicified chalk of Hatrurim Formation (Bartov et al., 1981) is a rare rock type which occurs only in the Judean Desert. Its north-facing slopes east of Arad support vegetation dominated by the xerohalophyte *Suaeda asphaltica* whereas the south-facing slopes have outcrops of hard rocks and are populated by the Salsolo tetrandrae – Zygophylletum dumosi. The two dominants display the edaphic nature of the habitat where both hard limestone and chalk are mixed in a rare combination. The low number of species in this association reflects the extreme environmental conditions where it develops. A related association, *Zygophyllum dumosum – Herniaria hemistemon* assoc. was published in its incomplete form by Danin et al. (1975). Both occur in the same area but that of 1975 could not be detected again in 1997. New relevés were recorded in 1997, most likely in a drier area where *Herniaria hemistemon* does not grow.

Association dynamics and conservation: Most of the area of this association is under constant grazing.

Aspects of the association: Persistents – 6 spp.; ephemerals – 8 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	97078	1	7	8	24.03.97	I 2282 5653
2	97079	1	7	8	24.03.97	I 2272 5653
3	97080	2	7	8	24.03.97	I 2262 5653
4	97081	1	7	8	24.03.97	I 2292 5653
5	97082	1	7	9	24.03.97	I 2302 5653
6	97083	1	6	6	24.03.97	I 2282 5654
7	97084	1	5	6	24.03.97	I 2282 5655
Average:		1.1	6.6	7.6		

6.4.1.4.5 MMZ05 Schimpero arabicae – Zygophylletum dumosi Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 27. **Distribution:** Fig. 67.

Ecological notes: The association is restricted to areas where sand blown from the sandy plain is deposited on conglomerates or chert within the plain or at its periphery. Through its high permeability the sandy surface ameliorates the moisture regime considerably. Although in neighbouring sites where the fissured limestone supports a species-poor association such as MMZ07, the composition here is rich and rather peculiar. *Artemisia sieberi*, the leading species of the Artemisietea is among the markers of this association. There are many psammophytes among the markers and the other companions as is expected from the substratum. Many components of the association are also the main species of the associations in the alliance Stipagrostio plumosae – Anabasion articulatae (DAA).

A somewhat related association "Zygophylletum dumosi arenarium" was described in an incomplete table by Danin et al., (1964) from the same area. That association was confined to conglomerate of chert pebbles with sandy matrix. However, there was no access to the area of that association in 1997.

Association dynamics and conservation: The area where the relevés of this association were recorded is under moderate protection from grazing as it is at the periphery of an area of private property.

Aspects of the association: Persistents – 9 spp.; ephemerals – 47 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	97071	20	15	28	24.03.97	I 2169 5496
2	97072	20	20	30	24.03.97	I 2168 5496
3	97073	20	15	34	24.03.97	I 2167 5496
4	97074	15	15	25	24.03.97	I 2166 5496
5	97075	20	15	22	24.03.97	I 2165 5496
6	97076	20	10	23	24.03.97	I 2165 5498
7	97077	20	15	24	24.03.97	I 2166 5498
Average:		19.3	15.0	26.6		

6.4.1.4.6 MMZ06 Helianthemo kahirici – Gymnocarpetum decandri Eig 1946.

Syn.: Gymnocarpetum fruticosi 1946.

Diagnostical species: the markers in table 28. **Distribution:** Fig. 68.

Ecological notes: The Gymnocarpetum is confined in the study area to rather fissured hard limestone or chert outcrops. Small patches of this habitat occur at the steep flanks of anticlines, mainly the southeastern ones of the Negev Highlands. The high number of companions of rock outcrops (type V) and the presence of many plants of the shrub-steppes in this association (type A) may be explained by the specific edaphic conditions which also enable the dominance of *Gymnocarpos decander.*

Aspects of the association: Persistents – 39 spp.; ephemerals – 85 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00045	1	5	25	06.05.64	I 1876 5413
2	00113	10	15	35	21.05.64	I 1897 4425
3	00128	20	15	59	22.05.64	I 1865 5382
4	00129	10	15	43	27.04.64	I 1896 5447
5	00130	1	5	24	28.02.66	I 2031 5402
6	00397	2	3	31	13.03.67	I 2310 5813
7	00672	0	5	21	17.03.69	I 1900 5001
Average:		6.3	9.0	34.0		

Table 28. Association tables of MMZ06 – Helianthemo kahirici – Gymnocarpetum decandri, MMZ07 – Diplotaxio acris – Zygophylletum dumosi, and MMZ08 – Trichodesmetum boissierii

			MMZ06				MMZ07				MMZ08			
			1234567	**C1**	**C2**	**%P**	***123456789012345**	**C1**	**C2**	**%P**	***12345678**	**C1**	**C2**	**%P**
	W	Aaronsohnia factorovskyi	.....+.	0	0	14	..........+....	0	0	7	.......+	0	0	13
*	S	Agathophora alopecuroides	..+....	0	0	14	....+0.........	3	0	13				
	W	Aizoon hispanicum	..+..+.	0	0	29	2...+..........	10	1	13				
	W	Allium ampeloprasum	+......	0	0	14								
	A	Allium artemisietorum	..+...+	0	0	29								
	Q	Allium neapolitanum	..+....	0	0	14								
	H	Allium stamineum	...+...	0	0	14								
	N	Amberboa crupinoides					.............+.	0	0	7				
*	N	Anabasis articulata	.02++.+	**6**	**4**	**71**								
*	N	Anabasis setifera	....+..	0	0	14								
	W	Anchusa aegyptiaca	..+....	0	0	14								
	N	Anchusa milleri					...2..........	20	1	7				
	H	Androcymbium palaestinum					..........+.++.	0	0	20				
	N	Anthemis maris-mortui									......++	0	0	25
	W	Anthemis melampodina	.+.+...	0	0	29	........+1.....	5	1	13				
	H	Antirrhinum orontium	+......	0	0	14								
	W	Aristida coerulescens	....+..	0	0	14								
	W	Arnebia linearifolia	.+++...	0	0	43								
*	A	Artemisia sieberi	.+.++..	0	0	43								
*	V	Asparagus horridus	..+.+.+	0	0	43								
	H	Asphodelus ramosus	+..+...	0	0	29								
	W	Asphodelus tenuifolius									.......+	0	0	13
	N	Asteriscus hierochunticus	.110+4.	**13**	**9**	**71**	....1.+...+.+.+	2	1	33				
*	C	Asteriscus graveolens					...++..........	0	0	13	.......+	0	0	13
	A	Astragalus callichrous	...+...	0	0	14								
*	A	Astragalus spinosus					.............+.	0	0	7				
	W	Astragalus tribuloides	.++..+.	0	0	43								
*	W	Atractylis phaeolepis	....++.	0	0	29	...+..0.....+..	2	0	20				
	A	Avena wiestii									.+......	0	0	13
*	B	Ballota undulata	+......	0	0	14								
	A	Bellevalia desertorum	.+.+.++	0	0	57	........+......	0	0	7				
*	B	Blepharis ciliaris	....+..	0	0	14								

Table 28. continued.

			MMZ06 1234567	C1	C2	%P	MMZ07 123456789012345	C1	C2	%P	MMZ08 12345678	C1	C2	%P
	H	Brachypodium distachyon									398+.1.0	**36**	**27**	**75**
	H	Bromus fasciculatus	......+	0	0	14	.....+.........	0	0	7	+...1..+	5	2	38
	A	Buglossoides tenuiflora	..+....	0	0	14								
	A	Carex pachystylis	.0+1...	5	2	43								
	W	Carrichtera annua	.....+.	0	0	14								
	W	Carthamus nitidus									.++++...	0	0	50
*	A	Centaurea aegyptiaca	..++...	0	0	29	............+..	0	0	7				
*	V	Chiliadenus iphionoides	....+..	0	0	14								
	W	Crepis aspera	..++...	0	0	29								
	N	Diplotaxis acris					788855293164677	**158**	**58**	**100**				
	W	Diplotaxis harra	.+.2+..	7	3	43	.........+...+.	0	0	13				
*	B	Echinops polyceras	+.+.+..	0	0	43								
	W	Emex spinosa	..++...	0	0	29								
*	V	Ephedra aphylla	..++...	0	0	29								
	W	Erodium crassifolium	+.+++++	**0**	**0**	**86**	+.......0+++1+1	3	2	53				
	S	Erodium glaucophyllum	......+	0	0	14	...+...........	0	0	·7				
	W	Erodium touchyanum	..++...	0	0	29	..............+	0	0	7	....+...	0	0	13
	W	Erucaria microcarpa	.++2...	7	3	43								
	W	Erucaria rostrata	.....+.	0	0	14	......+........	0	0	7	.+.+...+	0	0	38
*	B	Eryngium glomeratum	0......	5	1	14								
	W	Euphorbia chamaepeplus	..+....	0	0	14								
*	A	Fagonia mollis	.0++++.	**1**	**1**	**71**	.1.++00+.......	3	1	40				
*	N	Fagonia scabra	......+	0	0	14								
*	C	Farsetia aegyptia					.............2.	20	1	7				
	W	Filago desertorum	.0+..+.	2	1	43	....1+2....+.++	5	2	40				
	C	Forsskaolea tenacissima									....+...	0	0	13
*	M	Fumana thymifolia	+......	0	0	14								
	W	Gagea reticulata	.0...0.	5	1	29	.........+.....	0	0	7				
	H	Galium judaicum									...+.+..	0	0	25
	W	Gastrocotyle hispida	..++...	0	0	29	..............+	0	0	7				
*	V	Globularia arabica	....+..	0	0	14								
	W	Gymnarrhena micrantha	.01..2.	12	5	43	+++.+++06+....+	**7**	**4**	**67**				
*	N	Gymnocarpos decander	6579876	**69**	**69**	**100**	+..11.3...++21.	10	5	53				
	H	Gynandriris sisyrinchium	.....++	0	0	29								
*	S	Halothamnus acutifolius					.....22........	23	3	13				
*	F	Haloxylon salicornicum					.............+.	0	0	7				
*	R	Haplophyllum tuberculatum									+...0...	3	1	25
	H	Helianthemum aegyptiacum	..+....	0	0	14								
*	A	Helianthemum kahiricum	++..++2	**5**	**4**	**71**	...1211..+0110+	**8**	**5**	**67**				
	W	Helianthemum ledifolium	.1+0...	5	2	43	........++11...	5	1	27				
	H	Helianthemum salicifolium	..+....	0	0	14								
	W	Herniaria hirsuta	..+..+.	0	0	29								
	H	Hippocrepis unisiliquosa					...........+...	0	0	7				
	H	Hordeum spontaneum									.+0.....	3	1	25
*	H	Hyparrhenia hirta	5......	50	7	14	...........+.+.	0	0	13				
	R	Ifloga spicata					...........+...	0	0	7				
*	W	Kickxia floribunda	.+++...	0	0	43								
	W	Lamarckia aurea					..............+	0	0	7				
	W	Lappula spinocarpos	.++....	0	0	29	+..............	0	0	7				
	W	Leontodon laciniatus	+......	0	0	14	...........+...	0	0	7				
	C	Leysera leyseroides	......+	0	0	14								
	S	Limonium lobatum	..+0...	3	1	29								
*	S	Limonium pruinosum	+......	0	0	14								
	W	Linaria albifrons	...+...	0	0	14								
	W	Lomelosia porphyroneura	.+++...	0	0	43								
*	C	Lycium shawii					.........+.0..	3	0	13				
	W	Matthiola livida	.+++.0.	1	1	57	......3........	30	2	7				
	W	Medicago laciniata	.+++...	0	0	43								
	W	Medicago radiata	...+...	0	0	14								
	H	Mercurialis annua									++1002+1	**7**	**7**	**100**

Table 28. continued.

			MMZ06				**MMZ07**				**MMZ08**			
			1234567	**C1**	**C2**	**%P**	**123456789012345**	**C1**	**C2**	**%P**	**12345678**	**C1**	**C2**	**%P**
	S	Mesembryanthemum nodiflorum	....+..	0	0	14								
*	A	Noaea mucronata	.+.....	0	0	14								
	C	Notoceras bicorne	..+..+.	0	0	29								
	W	Onobrychis crista-galli	.+.+...	0	0	29								
	W	Ononis sicula	..+....	0	0	14								
*	V	Origanum dayi	0...+..	3	1	29								
	H	Ornithogalum narbonense	..+....	0	0	14								
	W	Papaver humile	...+...	0	0	14								
	W	Parietaria alsinifolia	..+....	0	0	14					...++.0+	1	1	50
*	V	Pennisetum ciliare	+...+..	0	0	29	..........+.+++	0	0	27				
*	V	Phagnalon barbeyanum	1	10	1	14								
*	V	Phagnalon rupestre	+....+.	0	0	29								
	H	Pimpinella cretica									+...++..	0	0	38
	W	Plantago coronopus					...........+...	0	0	7				
	W	Plantago notata	..+....	0	0	14								
	W	Plantago ovata	.+++.+.	0	0	57	...++.+..6.++++	8	4	53				
	A	Plantago phaeostoma	+......	0	0	14								
	W	Poa sinaica	..+..++	0	0	43								
*	V	Podonosma orientalis	0......	5	1	14								
	S	Pteranthus dichotomus	.6...+.	30	9	29	+.21++.0+1....+	**6**	**3**	**60**	...+..+.	0	0	25
	H	Pterocephalus plumosus	...+...	0	0	14								
*	C	Pulicaria incisa									+.......	0	0	13
	H	Ranunculus asiaticus	.....+.	0	0	14								
*	S	Reaumuria hirtella	...++.+	0	0	43	.+.++0+11001000	**5**	**4**	**87**				
*	S	Reaumuria negevensis	.0.....	5	1	14								
	W	Reichardia tingitana	..+....	0	0	14					...+....	0	0	13
*	C	Reseda stenostachya	......+	0	0	14								
*	C	Reseda urnigera					+..++++........	0	0	33				
*	R	Retama raetam	+......	0	0	14	...........+...	0	0	7				
	W	Roemeria hybrida	.++....	0	0	29								
	H	Rostraria smyrnacea	..+....	0	0	14								
	W	Rumex cyprius	++++.++	**0**	**0**	**86**	.....+...+.....	0	0	13	...+..+0	2	1	38
	R	Rumex pictus					....1..........	10	1	7				
	S	Salsola inermis					........+......	0	0	7				
*	S	Salsola schweinfurthii	....+..	0	0	14								
*	S	Salsola vermiculata	.....+.	0	0	14								
*	C	Salvia aegyptiaca	+...+..	0	0	29								
*	C	Salvia lanigera	..+..+.	0	0	29								
	W	Schismus arabicus	..+....	0	0	14								
*	W	Scrophularia deserti									0....0.+	3	1	38
	W	Senecio glaucus	.+++.++	**0**	**0**	**71**	....+...+.++++.	0	0	40				
*	W	Silene linearis									+.......	0	0	13
	D	Sonchus oleraceus									...+....	0	0	13
	W	Spergula fallax	...0...	5	1	14	.........+.....	0	0	7				
	S	Spergularia diandra	..+....	0	0	14								
	W	Stipa capensis	.065.1+	**25**	**18**	**71**	.+.+..++.+24221	**12**	**8**	**67**	71+98798	**61**	**61**	**100**
*	V	Stipa parviflora	+.+....	0	0	29								
*	N	Telephium sphaerospermum	......+	0	0	14								
*	V	Tetrapogon villosus	....+..	0	0	14								
*	B	Teucrium capitatum	+.+....	0	0	29								
*	B	Thymelaea hirsuta	...+...	0	0	14								
	C	Trichodesma boissieri									99999999	**96**	**96**	**100**
*	C	Tricholaena teneriffae	..+....	0	0	14								
	W	Trigonella arabica	..+....	0	0	14								
	W	Trigonella stellata	.+0+.++	**1**	**1**	**71**	....+++.+....++	0	0	40				
	H	Urginea maritima	.++....	0	0	29					.+...+++	0	0	50
	H	Urospermum picroides									.+.+...+	0	0	38
	V	Valantia hispida	....+..	0	0	14								
	A	Valerianella dufresnia	...+...	0	0	14								
*	N	Zygophyllum dumosum	.3++.3.	15	9	57	998865399998669	**77**	**77**	**100**	1	10	1	13

6.4.1.4.7 MMZ07 Diplotaxio acris – Zygophylletum dumosi Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 28. **Distribution:** Fig. 68.

Ecological notes: This is one of the most drought resistant associations growing in a diffused pattern in extreme desert areas of the eastern and the southern Negev. It is confined to hard limestone and dolomite outcrops where most other edaphic types support contracted vegetation. The footslope or pediment below the hard rock layer is devoid of persistent vegetation which make the large *Zygophyllum dumosum* shrubs even more prominent. The association is rather poor in companions and many years, when mean annual rainfall is regular it is devoid of ephemeral companions. In such years and in drier ones the *Z. dumosum* shrubs may not produce any new leaves and display the living petioles of previous years.

Association dynamics and conservation: Most of the area of this association is well preserved from human disturbance because of the low carrying capacity which in a special way protects the area.

Aspects of the association: Persistents – 14 spp.; ephemerals – 37 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94070	1	1	9	09.03.94	I 1995 4238
2	94071	1	1	6	09.03.94	I 1996 4238
3	94073	1	1	4	09.03.94	I 1996 4239
4	94074	1	1	13	09.03.94	I 1995 4239
5	94075	2	1	19	09.03.94	I 1999 4246
6	94076	2	2	14	09.03.94	I 1998 4246
7	94077	2	1	17	09.03.94	I 1998 4247
8	94078	1	2	7	09.03.94	I 1999 4247
9	94186	2	3	12	19.03.94	I 2107 5360
10	94187	7	5	15	19.03.94	I 2107 5361
11	94188	10	3	14	19.03.94	I 2112 5355
12	94189	10	5	17	19.03.94	I 2112 5356
13	94190	10	7	15	19.03.94	I 2111 5356
14	94191	10	7	19	19.03.94	I 2111 5355
15	94192	5	5	16	19.03.94	I 2113 5355
Average:		4.3	3.0	13.1		

***6.4.1.4.8** MMZ08 Trichodesmetum boissierii Danin et Solomeshch ass. nov.*

Diagnostical species: the markers in table 28. **Distribution:** Fig. 68.

Ecological notes: This association is confined to stabilizing scree slopes of the Dead Sea Valley faults. It is a rare habitat which does not occur anywhere else in Israel. Stones weathered from the rock outcrops of the fault escarpment move down as a result of strong floods which rarely occur in this dry area. While in movement the ground is composed of stones from 5 cm to 50 cm in diameter. When reaching stability the stones function as an efficient trap for air-borne dust. Once there is enough fine-grained particles in the ground, *Trichodesma boissieri,* the dominant of the newly stabilized substratum, is replaced by *Zygophyllum dumosum* community in composition which resembles MMZ01. This is the first reason for placing this association in this alliance; the second is its phytogeographical spectrum.

Association dynamics and conservation: The dynamic aspects of this association are its main ecological features. It is hardly influenced by human disturbance.

Aspects of the association: Persistents – 6 spp.; ephemerals – 18 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94346	10	5	10	31.03.94	I 2435 6244
2	94347	20	10	10	31.03.94	I 2435 6245
3	94348	10	5	6	31.03.94	I 2435 6246
4	94349	10	5	13	31.03.94	I 2434 6244
5	94350	10	10	10	31.03.94	I 2434 6245
6	94351	5	10	8	31.03.94	I 2434 6246
7	94352	5	8	8	31.03.94	I 2435 6247
8	94353	5	7	16	31.03.94	I 2434 6247
Average:		9.4	7.5	10.1		

Table 29. Synoptic table of associations of the Zygophyllion dumosi: 1 – MMZ01, 2 – MMZ02, 3 – MMZ03, 4 – MMZ04, 5 – MMZ05, 6 – MMZ06, 7 – MMZ07, 8 – MMZ08

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P
	d.s. Anabasietea articulatae							
N	Asteriscus hierochunticus	**63**	**89**	43		**71**	33	
N	Anabasis articulata	44		14		**100**	**71**	
S	Agathophora alopecuroides	6	11	14			14	13
	d.s. Zygophyllion dumosi							
N	Zygophyllum dumosum	**100**	**100**	**100**	**100**	**100**	57	**100**
W	Anthemis melampodina	31	33	57		**86**	29	13
N	Gymnocarpos decander	31	**100**	29		29	**100**	53
A	Helianthemum kahiricum	31	**67**	50			**71**	**67**
Marker and rare species of associations								
W	Gagea reticulata	56		36			29	7
W	Diplotaxis harra	56	33	29			43	13
H	Scorzonera papposa	50	44	7				
W	Scorzonera judaica	38	11	36		14		
H	Ranunculus asiaticus	38		14			14	
S	Nasturtiopsis coronopifolia	31						
W	Erodium moschatum	25						
A	Centaurea ammocyanus	25						
W	Euphorbia chamaepeplus	25		14			14	
A	Euphorbia grossheimii	19						
C	Launaea nudicaulis	19						
S	Salsola vermiculata	19					14	
S	Herniaria hemistemon	19	11					
C	Farsetia aegyptia	19						7
H	Helianthemum salicifolium	19					14	
A	Moricandia nitens	19						
C	Centaurea lanulata	13						
H	Chaetosciadium trichospermum	13						
W	Carthamus nitidus	13						
A	Ornithogalum trichophyllum	13						
W	Anagallis arvensis	13						
D	Sonchus oleraceus	13						
H	Pimpinella cretica	13						
W	Reseda decursiva	6						
H	Plantago afra	6						
W	Atractylis cancellata	6						
W	Sisymbrium erysimoides	6						
C	Heliotropium maris-mortui	6						
H	Biscutella didyma	6						
W	Astragalus asterias	6						
V	Asterolinon linum-stellatum	6						
R	Atractylis carduus	6						

Table 29. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P
V	Campanula erinus	6						
V	Capparis aegyptia	6						
A	Ixiolirion tataricum	6						
H	Hymenocarpos circinnatus	6						
D	Matricaria aurea	6						
A	Urginea undulata	6						
V	Centaurea eryngioides	6						
A	Scorzonera pusilla	6						
V	Cheilanthes acrostica	6						
W	Crithopsis delileana	6						
H	Ferula communis	6						
B	Gypsophila arabica	6						
W	Erucaria microcarpa	25	**100**	50			43	
H	Bromus fasciculatus	19	**100**	43			14	7
W	Atractylis phaeolepis	38	**89**	21			29	20
W	Malva aegyptia		**89**	21				
W	Plantago coronopus	31	**89**	36		29		7
A	Noaea mucronata		**78**	**64**		14	14	
R	Cutandia memphitica		**67**	14		14		
A	Haloxylon scoparium	19	**67**	14				
H	Hippocrepis unisiliquosa	19	**67**	14				7
H	Anthemis pseudocotula	13	56					
W	Scilla hanburyi	31	56	14				
A	Salvia lanigera	38	56	29			29	
H	Rostraria smyrnacea	6	56	29			14	
A	Helianthemum ventosum		44	7				
W	Pterocephalus brevis	6	44	7				
N	Calendula tripterocarpa		44	7				
A	Avena wiestii	6	44	21				
A	Zosima absinthiifolia		33					
W	Cnicus benedictus		33					
W	Ononis sicula		33			14		
W	Picris longirostris	13	22	7				
A	Astragalus callichrous		22	14			14	
W	Medicago radiata		22	7			14	
V	Astragalus amalecitanus		11					
A	Astragalus sanctus		11	7				
S	Bassia arabica		11	7				
S	Reaumuria negevensis		33	**100**			14	
W	Schismus arabicus	38	11	57		29	14	
S	Limonium pruinosum	6		36			14	
A	Leopoldia longipes			14				
A	Ceratocephala falcata			14				
W	Neotorularia torulosa	13		14				
W	Silene vivianii	13		21		14		
W	Trigonella arabica	6	11	14		14		
W	Papaver humile		14			14		
A	Tulipa systola			7				
V	Umbilicus intermedius	6	7					
H	Ononis mollis	7						
A	Iris regis-uzziae			7				
W	Koelpinia linearis	6		7				
A	Helianthemum vesicarium	6		7				
A	Eremopyrum bonaepartis			7				
H	Crepis sancta	6		7				
W	Minuartia picta			7				
H	Carduus acicularis		7					
H	Daucus durieua			7				
H	Bupleurum lancifolium			7				
A	Bupleurum semicompositum			7				
H	Astragalus hamosus			7				
H	Filago contracta	6		7				

Table 29. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P
S	Salsola tetrandra	13		**86**				
S	Erodium glaucophyllum				**86**		14	7
W	Gymnarrhena micrantha	56		21	**86**	14	43	**67**
W	Arnebia decumbens	13		7	43			
S	Erodium oxyrhynchum	25		7	43			
S	Atriplex halimus				14			
S	Atriplex glauca	6			14			
F	Erucaria pinnata					**100**		
F	Schimpera arabica					**100**		
R	Rumex pictus				**100**		7	
H	Calendula arvensis	6		7	**100**			
H	Asphodelus ramosus		22	14		**86**	29	
R	Ifloga spicata		22	14		**86**		7
W	Linaria haelava	19		21		**86**		
W	Matthiola livida	38	22	29		**86**	57	7
F	Pancratium sickenbergeri					**71**		
E	Gagea dayana					**71**		
W	Carrichtera annua	38	56	21		**71**	14	
H	Gynandriris sisyrinchium	25	11	14		**71**	29	
A	Artemisia sieberi	50	33	36		**71**	43	
A	Colchicum ritchii					57		
F	Allium sindjarense	13		7	57			
W	Emex spinosa			7		57	29	
R	Erodium laciniatum					43		
R	Calligonum comosum					43		
R	Gypsophila viscosa					43		
W	Aegilops kotschyi	6		7		43		
A	Onopordum alexandrinum				29			
W	Centaurea pallescens		11			29		
H	Silene colorata	6				29		
F	Stipagrostis obtusa					29		
F	Ammochloa palaestina		22	14		29		
R	Polycarpon succulentum					14		
F	Picris asplenioides					14		
V	Stipa pellita					14		
R	Brassica tournefortii					14		
R	Eminium spiculatum					14		
W	Adonis dentata	6		7		14		
D	Malva parviflora		11			14		
S	Mesembryanthemum nodiflorum	6			14	14		
R	Helianthemum stipulatum					14		
w	Rumex cyprius	13	11				**86**	13
A	Fagonia mollis	6			14		**71**	40
A	Bellevalia desertorum	25				14	57	7
V	Asparagus horridus	6					43	
B	Echinops polyceras	6					43	
W	Kickxia floribunda	19					43	
W	Lomelosia porphyroneura	6	22	14			43	
W	Medicago laciniata	6		14			43	
W	Arnebia linearifolia	38	11	7		14	43	
A	Carex pachystylis	31	22	29			43	
V	Phagnalon rupestre	6	22				29	
W	Herniaria hirsuta			14			29	
V	Ephedra aphylla	13					29	
W	Crepis aspera		11	7			29	
S	Limonium lobatum	6		14			29	
A	Allium artemisietorum	25		7			29	
C	Salvia aegyptiaca						29	
H	Urginea maritima	25		7		29		
V	Pennisetum ciliare						29	27
C	Notoceras bicorne	6					29	
W	Onobrychis crista-galli	6					29	

Table 29. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P
V	Origanum dayi						29	
B	Teucrium capitatum						29	
W	Poa sinaica	12	22	7			43	
V	Stipa parviflora		11				29	
W	Parietaria alsinifolia	6					14	
C	Blepharis ciliaris						14	
H	Antirrhinum orontium						14	
W	Aaronsohnia factorovskyi	13					14	7
N	Anabasis setifera	6					14	
H	Hyparrhenia hirta						14	13
W	Erucaria rostrata	13					14	7
C	Tricholaena teneriffae						14	
V	Tetrapogon villosus						14	
H	Ornithogalum narbonense		11				14	
H	Onobrychis squarrosa					14		
W	Plantago notata						14	
V	Phagnalon barbeyanum						14	
A	Plantago phaeostoma						14	
V	Podonosma orientalis						14	
S	Salsola schweinfurthii					14		
C	Reseda stenostachya						14	
H	Pterocephalus plumosus	6		7			14	
R	Retama raetam	6					14	7
B	Thymelaea hirsuta						14	
V	Valantia hispida						14	
A	Valerianella dufresnia						14	
N	Telephium sphaerospermum							14
C	Leysera leyseroides						14	
W	Linaria albifrons			7			14	
V	Chiliadenus iphionoides						14	
B	Eryngium glomeratum						14	
M	Fumana thymifolia						14	
V	Globularia arabica						14	
H	Helianthemum aegyptiacum	6					14	
W	Allium ampeloprasum						14	
Q	Allium neapolitanum						14	
W	Aristida coerulescens						14	
B	Ballota undulata	6					14	
A	Buglossoides tenuiflora	6					14	
N	Fagonia scabra						14	
W	Anchusa aegyptiaca	13					14	
N	Diplotaxis acris							**100**
C	Reseda urnigera							33
H	Androcymbium palaestinum							20
S	Halothamnus acutifolius	6						13
C	Lycium shawii							13
C	Asteriscus graveolens	6						13
F	Haloxylon salicornicum							7
W	Lamarckia aurea							7
A	Astragalus spinosus	6						7
N	Amberboa crupinoides	6						7
N	Anchusa milleri							7
	d.s. Reaumurietalia hirtellae							
S	Pteranthus dichotomus	**69**	**67**	57			29	**60**
S	Reaumuria hirtella	**100**	**67**		**100**		43	**87**
W	Plantago ovata	38	11	43			57	53
S	Salsola inermis	31	11	**71**				7

Table 29. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P
Other species								
W	Stipa capensis	56	100	71	86	29	71	67
W	Erodium crassifolium	88	89	36	14	100	86	53
W	Trigonella stellata	56	67	29		86	57	40
W	Filago desertorum	50	67	43		86	43	40
W	Senecio glaucus	69	67	43		43	71	40
W	Lappula spinocarpos	31		36		29	29	7
W	Helianthemum ledifolium	50		21		57	43	27
W	Aizoon hispanicum	31		21			29	13
W	Erodium touchyanum	13		7			29	7
W	Reichardia tingitana	31	33	14		14	14	
W	Spergula fallax	19		29	14		14	7
S	Spergularia diandra	31		29			14	
W	Astragalus tribuloides	19	56		57		43	
A	Centaurea aegyptiaca	31		36			29	7
W	Gastrocotyle hispida	31		36		14	29	7
W	Leontodon laciniatus	13	11	21			14	7
W	Roemeria hybrida	25		29			29	
H	Allium stamineum	13	22	21		14		

6.5 V Chiliadenetea iphionoidis Zohary 1955 ex Danin et Solomeshch class nov.

Syn.: Varthemietea iphionoidis Zohary.

Diagnostical species: *Ballota undulata, Carlina libanotica, Chiliadenus iphionoides, Hyparrhenia hirta, Ornithogalum narbonense, Podonosma orientalis, Urginea maritima, Valantia hispida.*

Nomenclatural type: Podonosmo – Chiliadenetalia iphionoidis Danin et Solomeshch.

Synoptic table: Table 34.

The class of rock vegetation is azonal with representative associations in several climatic zones of the country. It comprises the Mediterranean order Podonosmo – Chiliadenetalia iphionoidis (VM) and the desert Artemisio sieberi – Chiliadenetalia iphionoidis (VD). In the present volume we discuss the alliances of rock vegetation which develop within the bioclimatic zones of Ballotetea undulatae, i.e., Balloto – Chiliadenion iphionoidis (VMB). These are associations which are confined to smooth-faced rock outcrops in the area where other edaphic types are populated with semi-steppes bathas. The rock vegetation of the shrub-steppe and the desert areas of the Negev Highlands comprises the associations of the alliance Origano dayi – Chiliadenion iphionoidis (VDN). The associations of Retamo – Phlomion brachyodontis (VDJ) are confined to cliffs and limestone blocks, mainly in the Judean Desert and the Dead Sea Valley.

The class was mentioned by Zohary (1973) who named it Vartemietea montanae after the older synonym of *Chiliadenus montanus*. At the time he wrote his book, the flora of Israel was under review for the preparation of Flora Palaestina (Feinbrun-Dothan, 1978). The epithet *Varthemia montana* was a temporary name for both *C. iphionoides* and *C. montanus*. The taxonomical conclusions of Prof. N. Feinbrun were published in 1978 where the two species are independent. In addition, Zohary's (1973) sample records are incomplete, including 14-15 species whereas the average number of species in associations listed below is 43-61. We therefore do not use Zohary's confusing and illegitimate name in the present synopsis.

6.5.1 VM Podonosmo – Chiliadenetalia iphionoidis Danin et Solomeshch ord. nov.

Diagnostical species: *Aegilops peregrina, Anchusa aegyptiaca, Anthemis pseudocotula, Atractylis cancellata, Brachypodium distachyon, Carlina libanotica, Chaetosciadium trichospermum, Cichorium endivia, Crucianella macrostachya, Dianthus strictus, Emex spinosa, Eryngium creticum, Euphorbia chamaepeplus, Filago contracta,*

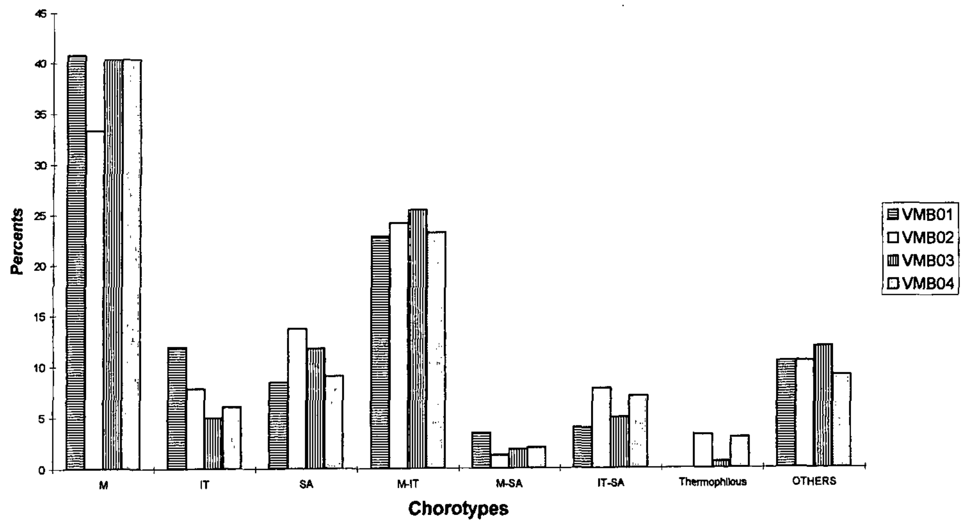

Figure 69. Phytogeographical analysis of associations VMB01-VMB04.

Hymenocarpos circinnatus, Kickxia aegyptiaca, Lagoecia cuminoides, Medicago coronaria, Medicago laciniata, Minuartia decipiens, Onobrychis crista-galli, Ononis natrix, Rhagadiolus stellatus, Salvia dominica, Salvia horminum.

Nomenclatural type: Balloto undulatae – Chiliadenion iphionoidis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch.

6.5.1.1 VMB Balloto – Chiliadenion iphionoidis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch all. nov., nom. mut.

Syn.: Balloto – Varthemion iphionoidis Danin, Orshan et Zohary 1975.

Diagnostical species of the alliance = diagnostical species of the order.

Nomenclatural type: Balloto undulatae – Chiliadenetum iphionoidis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch.

Synoptic table: Table 34.

Communities of this alliance have many species common with the class Ballotetea and many species of this class were used as diagnostical for the alliance Balloto – Chiliadenion. They are differential for this alliance against Origano dayi-Chiliadenion iphionoidis and Podonosmo orientalis – Retamion.

The phytogeographical spectrum of the associations of this alliance (Fig. 69) resembles that of the associations of Ballotetea undulatae (Figs. 26, 30, and 31). The main features in these spectra are the highest frequencies of species with the M and M-IT chorotypes and only low quantities of other chorotypes, displaying the general nature of the area where they occur (Danin & Plitmann, 1987; Fig. 9).

The impact of the rocky habitat as enabling the development of mesophytic flora in dry areas is seen in this alliance mostly by the presence of Mediterranean trees and shrubs in the area of semi-steppe bathas which supports mainly semi-shrubs.

***6.5.1.1.1** VMB01 Majorano syriacae – Chiliadenetum iphionoidis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov, nom. mut., nom. inv.*

Syn.: Varthemia iphionoidis – Majorana syriacae association Danin, Orshan et Zohary 1975.

Diagnostical species: the markers in table 30. **Distribution:** Fig. 70.

Ecological notes: The typical habitat of this association is outcrops of chert with patches of nari crust on the chalk which accompany the chert. It is developed on north-facing slopes along Alon Road at the eastern boundary of the Ballotetea. Outcrops of chalk on south-facing slopes in the same area support Salsoletum vermiculatae or Reaumurietum hirtellae. However, due to the good moisture regime deriving from large proportions of water con-

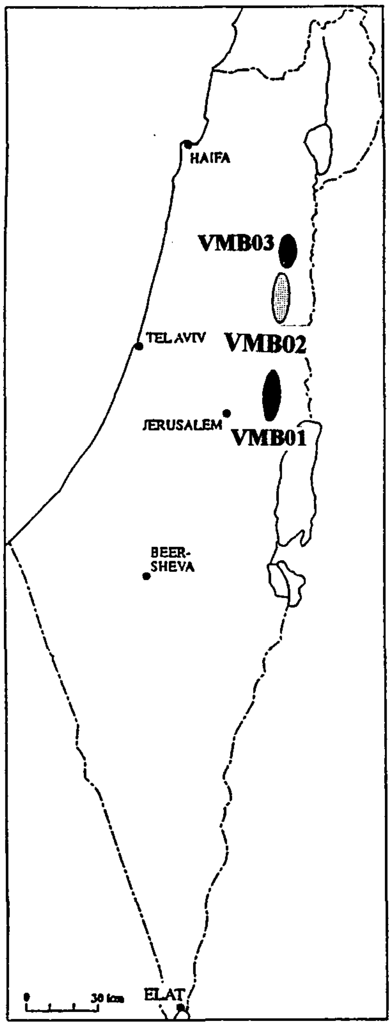

Figure 70. Distribution map of associations VMB01, VMB02, and VMB03.

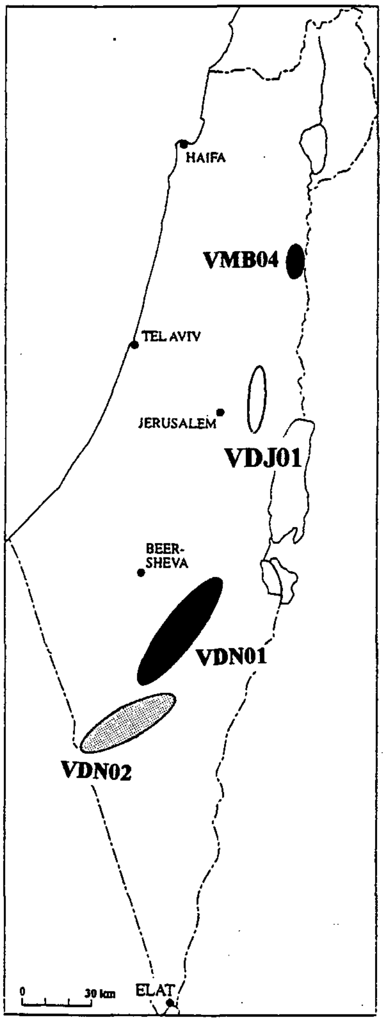

Figure 71. Distribution map of associations VMB04, VDJ01, VDN01, and VDN02.

tributing/receiving areas, there are many typical Mediterranean species here. The most common companions of this association are species which grow in herbaceous formation of the Mediterranean zone. Such are a few *Trifolium* species, *Brachypodium distachyon,* and *Medicago coronaria.*

Association dynamics and conservation: Most of the area of this association is protected from grazing and cutting for the last decade as a private land.

Aspects of the association: Persistents – 22 spp.; ephemerals – 100 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	97029	50	15	55	10.03.97	I 2320 6367
2	97030	60	15	64	10.03.97	I 2321 6367
3	97031	30	15	65	10.03.97	I 2322 6367
4	97032	30	10	61	10.03.97	I 2323 6367
5	97033	30	20	54	10.03.97	I 2324 6367
6	97034	40	20	60	10.03.97	I 2325 6367
7	97035	30	20	62	10.03.97	I 2326 6367
Average:		38.6	16.4	60.1		

Table 30. Association tables of VMB01 – Balloto undulatae – Chiliadenetum iphionoidis, VMB02 – Hyparrhenio hirtae – Chiliadenetum iphionoidis, and VMB03 – Podonosmo orientalis – Chiliadenetum iphionoidis

			VMB01				VMB02				VMB03			
			*1234567	C1	C2	%P	*12345678901	C1	C2	%P	*1234567	C1	C2	%P
	W	Adonis dentata	++..+..	0	0	43	......+....	0	0	9	+..++..	0	0	43
	H	Aegilops peregrina	+......	0	0	14	00++++.++++	**1**	**0**	**91**	.0.+++.	0	0	57
	H	Ainsworthia trachycarpa	.....++	0	0	29	0.+.0+...++	1	1	55	+.++...	0	0	43
	W	Aizoon hispanicum									...+...	0	0	14
*	Q	Ajuga chamaepitys	..++..+	0	0	43	......+....	0	0	9	.....+.	0	0	14
	Q	Allium neapolitanum									..+++..	0	0	43
	H	Allium nigrum	+++....	0	0	43								
	H	Allium pallens	...+++.	0	0	43								
	A	Alyssum damascenum	..++++.	0	0	57	.........+.	0	0	9				
	A	Alyssum strigosum	++++++.	**0**	**0**	**86**	......+....	0	0	9	+++++..	**0**	**0**	**71**
	W	Anagallis arvensis	.+.++++	**0**	**0**	**71**	++.+++++.+.	**0**	**0**	**73**	+++++..	**0**	**0**	**71**
	W	Anchusa aegyptiaca	++++.++	**0**	**0**	**86**	..+++++.+..	0	0	55	.++++..	0	0	57
	H	Androcymbium palaestinum					+.+...+.+..	0	0	36				
	H	Anemone coronaria	.....+.	0	0	14								
	N	Anthemis maris-mortui									...+2..	10	3	29
	H	Anthemis palestina									.2.....	20	3	14
	H	Anthemis pseudocotula	++++1++	**1**	**1**	**100**	00.1+++++1+	**3**	**3**	**91**	5.1+5..	29	16	57
	H	Antirrhinum orontium					.+++.+++.+.	**0**	**0**	**64**	..+....	0	0	14
	V	Arenaria leptoclados					.+.........	0	0	9	+++++..	**0**	**0**	**71**
	W	Aristida coerulescens	+++....	0	0	43	...0++++.0+	**1**	**1**	**64**	+0++...	1	1	57
	H	Artedia squamata					0+++++++.14	**6**	**5**	**91**	.+..+..	0	0	29
	H	Asphodelus ramosus									0	5	1	14
	W	Asphodelus tenuifolius					++++++++++.	**0**	**0**	**91**	++++++.	**0**	**0**	**86**
	H	Asteriscus aquaticus					...0..+..+.	2	0	27	.0.....	1	0	14
	V	Asterolinon linum-stellatum									..+++..	0	0	43
	A	Astragalus bombycinus	.....+.	0	0	14								
	A	Astragalus callichrous					.......+...	0	0	9	...++..	0	0	29
	W	Atractylis cancellata	.+++++.	**0**	**0**	**71**	++..+++++++	**0**	**0**	**82**	.+.++..	0	0	43
	H	Avena sterilis	.....+.	0	0	14	.....+.+...	0	0	18	..++..+	0	0	43
	A	Avena wiestii	.....1.	10	1	14								
*	B	Ballota undulata	3233322	**26**	**26**	**100**					..2+0.+	5	3	57
	A	Bellevalia desertorum	++.+..+	0	0	57	...+.......	0	0	9				
	A	Bellevalia eigii					.+..+.++.+.	0	0	45	..+....	0	0	14
	H	Biscutella didyma	+++++++	**0**	**0**	**100**	+++.++++.+.	**0**	**0**	**73**	+..++..	0	0	43
*	B	Blepharis attenuata	+......	0	0	14	.0.++.++.++	0	0	63				
	W	Brachypodium distachyon	+++++0+	**1**	**1**	**100**	.0++.++++..	**0**	**0**	**64**	..+++.+	0	0	57
	H	Bromus fasciculatus	2+03+55	**22**	**22**	**100**	0.++.+++.+.	**1**	**0**	**64**	0.++++.	**0**	**0**	**71**
	H	Bromus madritensis					.....+.....	0	0	9				
	H	Bromus tectorum	++++.++	**0**	**0**	**86**								
	A	Buglossoides arvensis									....+..	0	0	14
	A	Buglossoides tenuiflora	..+...+	0	0	29								
	H	Calendula arvensis	+.+.+++	**0**	**0**	**71**	..+....+.+.	0	0	27	...++..	0	0	29
	B	Calendula pachysperma					........+..	0	0	9				
	B	Calendula palaestina					...+..+....	0	0	18	...++..	0	0	29
	H	Callipeltis cucullaria	+......	0	0	14	...+..+....	0	0	18	+.++...	0	0	43
	V	Campanula erinus	++.+...	0	0	43								
	H	Campanula stellaris					++.++++++++	**0**	**0**	**91**	.++++..	0	0	57
	B	Campanula strigosa									++....+	0	0	43
	B	Carlina libanotica	..++.++	0	0	57					...++.0	2	1	43
	W	Carrichtera annua									.....+.	0	0	14
	H	Carthamus glaucus					...++.++...	0	0	36	...++..	0	0	29
	W	Carthamus nitidus	.+..+..	0	0	29	..++++++.++	**0**	**0**	**73**	..+.++.	0	0	43
	H	Carthamus tenuis	+...+..	0	0	29					0	5	1	14
	H	Catapodium rigidum					......+....	0	0	9	...+...	0	0	14
	V	Centaurea eryngioides	.+++..+	0	0	57								
	H	Centaurea hyalolepis	+...+..	0	0	29	..+...+..+.	0	0	27	.+..+..	0	0	29
	H	Centaurea iberica									......+	0	0	14
	L	Centaurium tenuiflorum					.+...+.....	0	0	18				

Table 30. continued.

			VMB01				VMB02				VMB03			
			1234567	C1	C2	%P	12345678901	C1	C2	%P	1234567	C1	C2	%P
	H	Chaetosciadium trichospermum	1121311	14	14	100	..+.....+..	0	0	18	..++...	0	0	29
*	V	Cheilanthes acrostica									....+..	0	0	14
*	V	Chiliadenus iphionoides	6665666	59	59	100	41120++216+	17	17	100	4154433	35	35	100
	H	Cichorium endivia	..+....	0	0	14	+++++.++.++	0	0	82	++...++	0	0	57
	H	Clypeola jonthlaspi	+++++.+	0	0	86					..+....	0	0	14
	B	Convolvulus dorycnium					...+.....+.	0	0	18	.0.....	3	0	14
	D	Convolvulus pentapetaloides	.+.....	0	0	14					+++++..	0	0	71
	V	Crassula alata	+++..++	0	0	71					..++...	0	0	29
	W	Crepis aspera	....++.	0	0	28	.+.++++..++	0	0	64	.21+0..	10	6	57
	H	Crepis sancta	....+..	0	0	14	...0+.+....	2	0	27	0.1+0..	4	2	57
	W	Crithopsis delileana					.........+.	0	0	9	..+.++.	0	0	43
	H	Crucianella macrostachya	..+++..	0	0	43	++.+.+++.+.	0	0	64	..+....	0	0	14
	H	Crupina crupinastrum					...+.......	0	0	9				
	H	Daucus durieua	.++++.+	0	0	71	..++.++....	0	0	36	..+.+..	0	0	29
	H	Delphinium peregrinum	..+....	0	0	14								
*	W	Dianthus strictus	+++++++	0	0	100	...++.++.+.	0	0	45	.++++..	0	0	57
*	B	Echinops polyceras	++.++.+	0	0	71								
	W	Echium judaeum	...+...	0	0	14	00221+++.5.	13	11	82	.01+0+.	3	2	71
	W	Emex spinosa	+.+....	0	0	29	..+..+.....	0	0	18	...++..	0	0	29
*	V	Ephedra aphylla	.0.....	1	0	14								
	H	Erodium cicutarium					.........+.	0	0	9				
	H	Erodium gruinum	.+..+..	0	0	29	.......++..	0	0	18	....+..	0	0	14
	H	Erodium malacoides	....++.	0	0	29	.....+.....	0	0	9	..+....	0	0	14
	W	Erodium neuradifolium					..+...++.+.	0	0	36	++.++..	0	0	57
	W	Erodium touchyanum	++.+...	0	0	43								
	V	Erophila minima	....++.	0	0	29								
	B	Eruca sativa					...+.......	0	0	9	..+....	0	0	14
	H	Erucaria hispanica									.....+.	0	0	14
	W	Erucaria microcarpa									00+....	1	0	43
	W	Erucaria rostrata	4555221	34	34	100	00++++++..+	0	0	82	0.++0..	1	0	57
	H	Eryngium creticum	+++++++	0	0	100	......++...	0	0	18	...+..+	0	0	29
*	B	Eryngium glomeratum									0	5	1	14
	W	Euphorbia chamaepeplus	.++..++	0	0	57	..++..++++.	0	0	55	..+.+..	0	0	29
*	B	Euphorbia hierosolymitana									+......	0	0	14
	B	Factorovskya aschersoniana					..........+	0	0	9				
	H	Filago contracta	+++++++	0	0	100	......+....	0	0	9	...++..	0	0	29
	W	Filago desertorum	..+..+.	0	0	29	+.+...+....	0	0	27				
	H	Filago palaestina	...++.+	0	0	43	........++.	0	0	18	..+.+..	0	0	29
	H	Filago pyramidata	.+.....	0	0	14	..+........	0	0	9	+...+..	0	0	29
	H	Gagea chlorantha	....+.+	0	0	29								
	L	Galium hierochuntinum					.....+.....	0	0	9				
	H	Galium judaicum	0++0+++	1	1	100								
	H	Galium setaceum					..+.++++...	0	0	45	+..++..	0	0	43
	H	Geranium rotundifolium	....+.+	0	0	29								
	H	Gundelia tournefortii					.........+.	0	0	9	..+.+..	0	0	29
*	R	Haplophyllum tuberculatum					.0.....+.+.	0	0	27	.0.....	1	0	14
	H	Hedypnois cretica					.+++..++.+.	0	0	55	++++++.	0	0	86
	H	Helianthemum salicifolium					+++...+....	0	0	36	+..++..	0	0	43
*	B	Heliotropium rotundifolium	+......	0	0	14	+...+.+...+	0	0	36				
	H	Hippocrepis unisiliquosa	.+.....	0	0	14	+++++++++++	0	0	100	+.+++..	0	0	57
	D	Hirschfeldia incana					.......+...	0	0	9	...+...	0	0	14
	D	Hordeum glaucum					.........+.	0	0	9				
	H	Hordeum spontaneum					.0.+++++..+	0	0	64	..0...+	3	1	29
	B	Hyacinthella nervosa									+..++..	0	0	43
	H	Hymenocarpos circinnatus	+++++++	0	0	100	+++.++++...	0	0	64	+++++..	0	0	71
	V	Hyoscyamus aureus	...+...	0	0	14								
*	H	Hyparrhenia hirta					43244++4814	32	32	100	.2..+++	5	3	57

Table 30. continued.

			VMB01				VMB02				VMB03			
			1234567	**C1**	**C2**	**%P**	**12345678901**	**C1**	**C2**	**%P**	**1234567**	**C1**	**C2**	**%P**
*	B	Kickxia aegyptiaca	..+....	0	0	14					.....1.	10	1	14
	H	Lagoecia cuminoides	..+.+.+	0	0	43	+....+..+..	0	0	27	+.+++..	0	0	57
	W	Lamarckia aurea					.....+.....	0	0	9	..+.+..	0	0	29
	H	Lathyrus aphaca									....+..	0	0	14
	S	Limonium lobatum	++.....	0	0	29	0+0+1++++++	**1**	**1**	**100**	.+.++..	0	0	43
	H	Linum strictum					.+.........	0	0	9	..+...+	0	0	29
	W	Lolium rigidum					.........+.	0	0	9	+.+....	0	0	29
	H	Lomelosia palaestina					.+.++.++.++	**0**	**0**	**64**	.+.....	0	0	14
	W	Lomelosia porphyroneura	..+....	0	0	14	+....+..+..	0	0	27				
	H	Lotus peregrinus					...+..+....	0	0	18	...+...	0	0	14
*	Q	Majorana syriaca	1	10	1	14					..0++..	2	1	43
	W	Matthiola aspera					..+0+++++++	**1**	**0**	**82**	++0++..	**1**	**1**	**71**
	H	Medicago coronata	.++....	0	0	29	0++.++++..+	**0**	**0**	**73**	+++++..	**0**	**0**	**71**
	W	Medicago laciniata	++++.+.	**0**	**0**	**71**	.+.++.++.+1	**1**	**1**	**64**	+.++++.	**0**	**0**	**71**
	H	Medicago minima					.0.++....+0	2	1	45	+++++..	**0**	**0**	**71**
	H	Medicago polymorpha									.+.....	0	0	14
	H	Medicago rotata					...+.+.....	0	0	18				
	H	Medicago truncatula	....+++	0	0	43	.+.++.++..+	0	0	55	+++++..	**0**	**0**	**71**
	H	Mercurialis annua	+.+....	0	0	29	..++.++.++.	0	0	55	0+.++..	0	0	57
	V	Minuartia decipiens	.+.+..+	0	0	43	...++++++..	0	0	55	..+++..	0	0	43
	T	Muscari parviflorum									..+....	0	0	14
	H	Nonea philistaea	.+.....	0	0	14								
	C	Notoceras bicórne					.++++.+..++	**0**	**0**	**64**	.++....	0	0	29
	W	Onobrychis crista-galli	++.++++	**0**	**0**	**86**	.0+++++++0	**1**	**1**	**91**	+++++..	**0**	**0**	**71**
	H	Ononis mollis					.++..+.++..	0	0	45	..+++..	0	0	43
*	B	Ononis natrix	+++0+++	**1**	**1**	**100**					0	5	1	14
	H	Ononis ornithopodioides	..+....	0	0	14								
	W	Ononis sicula	.++++.+	**0**	**0**	**71**	...+.+..+.+	0	0	36	...+...	0	0	14
	B	Onopordum palaestinum	.+.....	0	0	14					.0.+...	1	0	29
	H	Ornithogalum narbonense	..++...	0	0	29	...+..+..+.	0	0	27	+++++..	**0**	**0**	**71**
	A	Ornithogalum trichophyllum	.....+.	0	0	14								
	H	Orobanche aegyptiaca					......++.+.	0	0	27				
*	Q	Osyris alba									......+	0	0	14
	N	Pallenis spinosa	......+	0	0	14	...+.....+.	0	0	18				
	H	Papaver umbonatum					....+.+..+.	0	0	27	..++...	0	0	29
	H	Parentucellia latifolia	......+	0	0	14								
	W	Parietaria alsinifolia	++++..+	**0**	**0**	**71**	+.+.+......	0	0	27	..+....	0	0	14
*	V	Parietaria judaica	.....+.	0	0	14								
	H	Parietaria lusitanica					.......+...	0	0	9				
*	V	Paronychia capitata	+.++.++	**0**	**0**	**71**	...+..++...	0	0	27	.++++..	0	0	57
*	V	Pennisetum asperifolium					....0+..0+.	2	1	36				
*	V	Pennisetum ciliare					...+...+..+	0	0	27				
*	V	Phagnalon rupestre	++++0++	**1**	**1**	**100**	0.0+.++.0..	2	1	55	..+....	0	0	14
*	B	Phlomis brachyodon	..+..2+	7	3	43	0........0.	6	1	18				
	H	Picris altissima					...+...+.+.	0	0	27	..+....	0	0	14
	W	Picris longirostris	....+.+	0	0	29	.++..++.+..	0	0	45	.+0....	3	1	29
	H	Pimpinella cretica	..1+.+.	3	1	43	+....+....+	0	0	27	.++....	0	0	29
	H	Plantago afra	+++.+++	**0**	**0**	**86**	0++++++++++	**0**	**0**	**100**	++++++.	**0**	**0**	**86**
	B	Plantago bellardii	.+.....	0	0	14	..+++.++.+.	0	0	55	++.++..	0	0	57
	W	Plantago coronopus	+..++..	0	0	43								
	W	Plantago ovata					.+.++.++..+	0	0	55	.+.++..	0	0	43
	H	Poa bulbosa					4..++.+	10	6	57				
	W	Poa eigii	+.++3.2	**10**	**7**	**71**								
*	V	Podonosma orientalis	11+0..+	**5**	**4**	**71**	.2.11.++.11	**10**	**6**	**64**	3313443	**31**	**31**	**100**
	S	Pteranthus dichotomus					.........++	0	0	18	....+..	0	0	14
	W	Pterocephalus brevis	+.+....	0	0	29	..+...+...+	0	0	27	.++++..	0	0	57
	H	Pterocephalus plumosus					...+.......	0	0	9	.....+.	0	0	14
	H	Ranunculus asiaticus	....++.	0	0	29					+..++..	0	0	43
	W	Reichardia tingitana					.++++.++.++	**0**	**0**	**73**	+++++..	**0**	**0**	**71**
	W	Reseda decursiva					..+.....+..	0	0	18				
*	R	Retama raetam	.+.....	0	0	14					..+...+	0	0	29

Table 30. continued.

			VMB01				VMB02				VMB03			
			1234567	C1	C2	%P	12345678901	C1	C2	%P	1234567	C1	C2	%P
	H	Rhagadiolus stellatus	..++++1	**2**	**1**	**71**	0..+.++..+.	0	0	45	0.0++.+	**1**	**1**	**71**
	H	Rostraria smyrnacea					...+..++.+.	0	0	36	++++++.	**0**	**0**	**86**
	W	Rumex cyprius	.++....	0	0	29	.0++0++++++	**1**	**1**	**91**	++++++.	**0**	**0**	**86**
*	S	Salsola vermiculata	++++...	0	0	57	0.5..+..0..	13	5	36	...+...	0	0	14
*	C	Salvia aegyptiaca					+2003++2++3	**12**	**12**	**100**	.0.....	5	1	14
*	B	Salvia dominica	..+10++	**3**	**2**	**71**					1.+.0..	5	2	43
	H	Salvia horminum					........+..	0	0	9	....+..	0	0	14
*	T	Sarcopoterium spinosum									2	20	3	14
	T	Scilla autumnalis									...+...	0	0	14
	W	Scilla hanburyi	++++.++	**0**	**0**	**86**	..+.+..++++	0	0	55				
	H	Scorpiurus muricatus					.+.+..++.+.	0	0	45	.+.+...	0	0	29
	V	Sedum hispanicum	++++.++	**0**	**0**	**86**	+.+.++.+++.	**0**	**0**	**64**	..++...	0	0	29
	V	Sedum palaestinum									......+	0	0	14
	W	Senecio glaucus	..++.+.	0	0	43	....+..+...	0	0	18	...+...	0	0	14
	H	Senecio vernalis					+.+........	0	0	18				
*	T	Sideritis pullulans									0	5	1	14
	H	Silene colorata									+..+...	0	0	29
	H	Silene damascena					......++.+.	0	0	27	..+++..	0	0	43
	W	Silene decipiens	.+..+..	0	0	29					..+..+.	0	0	29
	W	Sisymbrium erysimoides					..........+	0	0	9				
	D	Sonchus oleraceus	+......	0	0	14	.....+.....	0	0	9	+......	0	0	14
	W	Spergula fallax	....+......	0	0	9								
	W	Stipa capensis	231+.++	**11**	**9**	**86**	76746+++.14	**37**	**33**	**91**	051+0..	**15**	**10**	**71**
	V	Telmissa microcarpa	......+	0	0	14					+..+...	0	0	29
*	V	Tetrapogon villosus					.0.++.++..+	0	0	55				
*	B	Teucrium capitatum	+00+.++	**2**	**1**	**86**	0.01.++10+0	**4**	**3**	**82**	22010+.	**11**	**9**	**86**
	H	Thymelaea gussonei									..+....	0	0	14
*	B	Thymelaea hirsuta									....+..	0	0	14
	W	Tordylium aegyptiacum	.....+.+...	0	0	18	...+...	0	0	14				
	H	Torilis arvensis	.+.....	0	0	14								
	H	Torilis tenella	++.++.+	**0**	**0**	**71**	..+........	0	0	9	..+.+..	0	0	29
*	C	Tricholaena teneriffae					.0..0+.+..0	2	1	45				
	H	Trifolium campestre									+......	0	0	14
	H	Trifolium dasyurum									+......	0	0	14
	H	Trigonella monspeliaca	.+.++++	**0**	**0**	**71**	..++....+..	0	0	27				
	V	Umbilicus intermedius									..+++..	0	0	43
	H	Urginea maritima	.+.....	0	0	14	....++++...	0	0	36	..1....	10	1	14
	H	Urospermum picroides	...+.+.	0	0	29	.+.+.++++++	**0**	**0**	**73**	..+++..	0	0	43
	V	Valantia hispida	..+...+	0	0	29	..++++++++.	**0**	**0**	**73**	+++++..	**0**	**0**	**71**
	H	Valerianella vesicaria									...+...	0	0	14
	H	Velezia rigida					...+..+++++	0	0	55	.++....	0	0	29
*	A	Verbascum eremobium					.........+.	0	0	9				
	H	Verbascum orientale	+.+....	0	0	29	.++++..++.+	**0**	**0**	**64**				
	H	Vicia monantha	.....+.	0	0	14								
	H	Vicia sativa	...++++	0	0	57								
	H	Vulpia ciliata					..+........	0	0	9	..+....	0	0	14
	H	Vulpia myuros					......+....	0	0	9	...+...	0	0	14

6.5.1.1.2 VMB02 Hyparrhenio hirtae – Chiliadenetum iphionoidis iphionoidis Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 30. **Distribution:** Fig. 70.

Ecological notes: The hard limestone and dolomite rocks on south-facing slopes of the eastern Samarian Desert enable the coexistence of typical rock plants with plants of the Acacietea such as *Salvia aegyptiaca* and *Tricholaena teneriffae* and a few more perennial grasses which grow also in savannas. Such are *Hyparrhenia hirta, Pennisetum asperifolium,* and *Pennisetum ciliare.* All these are accompanied by a wealth of herbaceous species of the Mediterranean area and common desert species.

Association dynamics and conservation: Most of the area of this association is under constant cutting and overgrazing.

Aspects of the association: Persistents – 22 spp.; ephemerals – 129 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	78103	90	10	38	24.02.87	2420 6620
2	78115	80	20	50	24.02.87	2421 6620
3	78203	90	10	58	24.02.87	2421 6621
4	78214	90	10	73	24.02.87	2420 6621
5	78215	70	30	58	24.02.87	2421 6622
6	78303	60	40	62	24.02.87	2421 6623
7	78314	70	30	84	24.02.87	2419 6620
8	78315	60	40	74	24.02.87	2419 6621
9	78403	50	50	42	24.02.87	2419 6619
10	78414	55	45	73	24.02.87	2419 6622
11	78415	40	60	47	24.02.87	2419 6623
Average:		68.6	31.4	60		

6.5.1.1.3 VMB03 Podonosmo orientalis – Chiliadenetum iphionoidis Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 30. **Distribution:** Fig. 70.

Ecological notes: The hard limestone and dolomite outcrops at an elevation above sea level in the Samarian Desert, especially those in steep wadis, form small or large cliffs which support VMB04. As in other associations of the rock vegetation in the Ballotetea area, many companions are typical to herbaceous formation of the Mediterranean zone.

Association dynamics and conservation: Most of the area of this association is protected from grazing and cutting due to its physical conditions which provide natural protection.

Aspects of the association: Persistents – 25 spp.; ephemerals – 139 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	78110	5	95	55	24.02.87	2412 6630
2	78114	85	15	57	24.02.87	2411 6630
3	78210	40	60	87	24.02.87	2412 6631
4	78310	60	40	93	24.02.87	2411 6631
5	78410	90	90	90	24.02.87	2412 6632
6	79107	10	10	22	24.02.87	2412 6633
7	89525	10	15	24	20.02.89	2411 6650
Average:		42.9	46.4	61.1		

6.5.1.1.4 VMB04 Periplocetum aphyllae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 31. **Distribution:** Fig. 71.

Phytogeographical analysis: (Fig. 69) Although being dominated by a Sudanian shrub, the Periplocetum aphyllae agrees with the phytogeographical spectrum of the rest of the alliance. It resembles VMB03 in its slightly higher column of "thermophilous" species a column comprised from the contribution of the chorotypes S, S-SA, S-African.

Ecological notes: The large proportion of water contributing phase (rock outcrops) over the water receiving phase enable the coexistence of Sudanian plants which enjoy the high temperatures and the sufficient moisture in a few soil pockets or crevices and many Mediterranean ephemerals which sustain due to the sufficient moisture in the crevices. It seems that the two components utilize different depths of moisture in their rhizosphere.

Association dynamics and conservation: Most of the area of this association is constantly under heavy grazing. *Periploca aphylla* may be poisonous as many other Asclepiadaceae and is therefore naturally protected.

Table 31. Association table of Periplocetum aphyllae.

	*1234567	C1	C2	%P
Markers:				
* V-Periploca aphylla	8389588	70	70	100
W-Stipa capensis	8357557	57	57	100
* H-Hyparrhenia hirta	0411411	19	19	100
W-Senecio glaucus	1332201	18	18	100
H-Plantago afra	+3+++++	4	4	100
B-Factorovskya aschersoniana	+++++++	0	0	100
W-Onobrychis crista-galli	+++++++	0	0	100
H-Pimpinella cretica	+++++++	0	0	100
H-Ranunculus asiaticus	+++++++	0	0	100
* B-Teucrium capitatum	+10.++0	3	3	86
H-Bromus fasciculatus	.0+++0+	2	1	86
W-Echium judaeum	.++++1+	2	1	86
* W-Aristida coerulescens	++++0.+	1	1	86
W-Anchusa aegyptiaca	++++++.	0	0	86
H-Biscutella didyma	+++++.+	0	0	86
* V-Phagnalon rupestre	+++.+++	0	0	86
H-Pterocephalus plumosus	.++++++	0	0	86
H-Urospermum picroides	.++++++	0	0	86
H-Crepis sancta	+.0.121	9	6	71
V-Valantia hispida	.++0.01	4	3	71
W-Brachypodium distachyon	++1..++	2	1	71
H-Torilis tenella	.++.1++	2	1	71
H-Urginea maritima	.++0+.+	1	1	71
* Q-Ajuga chamaepitys	.+++++.	0	0	71
W-Anagallis arvensis	++.++.+	0	0	71
H-Eryngium creticum	++++.+.	0	0	71
H-Gundelia tournefortii	+.+++.+	0	0	71
H-Sedum caespitosum	++.+++.	0	0	71
H-Theligonum cynocrambe	+++++..	0	0	71
B Species of semisteppe bathas				
Carlina libanotica	+.++.+.	0	0	57
Plantago bellardii	++.+.+.	0	0	57
Convolvulus dorycnium	+...++.	0	0	43
* Kickxia aegyptiaca	+....+.	0	0	29
* Phlomis brachyodon	....+.+	0	0	29
Onopordum palaestinum	......+	0	0	14
C Thermophilous species				
* Salvia aegyptiaca	++....+	0	0	43
* Tricholaena teneriffae	......+	0	0	14
H Species of herbaceous plant communities				
Filago contracta	.+.++.+	0	0	57
Hymenocarpos circinnatus	++.+.+.	0	0	57
Medicago truncatula	+.+.++.	0	0	57
Rhagadiolus stellatus	..++++.	0	0	57
Verbascum orientale	.+.+.++	0	0	57
Anthemis pseudocotula	+..+.+.	0	0	43
Carthamus tenuis	.++.+..	0	0	43
Crucianella macrostachya	+++....	0	0	43
Helianthemum salicifolium	+.+.+..	0	0	43
Ornithogalum narbonense	.++..+.	0	0	43
Picris altissima	..++..+	0	0	43
Callipeltis cucullaria	..++...	0	0	29
Campanula strigosa	.+....+	0	0	29
Chaetosciadium trichospermum	++.....	0	0	29
* Dianthus strictus	.....++	0	0	29
Filago pyramidata	+....+.	0	0	29

Table 31. continued.

	1234567	C1	C2	%P
Hippocrepis unisiliquosa	...+..+	0	0	29
Lagoecia cuminoides	.+...+.	0	0	29
Linum strictum	...+.+..	0	0	29
Lotus peregrinus	++.....	0	0	29
Medicago coronata	....+.+	0	0	29
Vicia sativa	+.+....	0	0	29
Ainsworthia trachycarpa	..+....	0	0	14
Anthemis hebronica	+......	0	0	14
Avena sterilis	...+...	0	0	14
Centaurea hyalolepis	.....+.	0	0	14
Cichorium endivia	..+....	0	0	14
Galium setaceum	.+.....	0	0	14
Gynandriris sisyrinchium	+......	0	0	14
Hedypnois cretica	...+...	0	0	14
Hordeum spontaneum	...+...	0	0	14
Lomelosia prolifera	+......	0	0	14
Medicago minima	..+....	0	0	14
Mercurialis annua	...+...	0	0	14
Pallenis spinosa	+......	0	0	14
Rostraria smyrnacea	....+..	0	0	14
Salvia horminum	+......	0	0	14
Trigonella monspeliaca	......+	0	0	14
R Species of sandy soils				
* Retama raetam	1.++.0+	4	2	57
S Xerohalophytes				
Limonium lobatum	++..+..	0	0	43
V Species of hard rock outcrops				
* Chiliadenus iphionoides	.1++..0	4	2	57
* Pennisetum ciliare	+++..+.	0	0	57
Crassula alata	+...++.	0	0	43
* Podonosma orientalis	.1...+.	5	1	29
* Cheilanthes acrostica	..+....	0	0	14
* Kickxia judaica	......+	0	0	14
Minuartia decipiens	......+	0	0	14
* Pennisetum asperifolium	......+	0	0	14
W Common desert species				
Erucaria rostrata	+.++.+.	0	0	57
Atractylis cancellata	+...++.	0	0	43
Erodium ciconium	++..+..	0	0	43
Scilla hanburyi	.+.+.+.	0	0	43
Reichardia tingitana	.++....	0	0	29
Crepis aspera	1......	10	1	14
Euphorbia chamaepeplus	.+.....	0	0	14
Lathyrus pseudocicera	....+..	0	0	14
Matthiola aspera	....+..	0	0	14
Ononis sicula	......+	0	0	14
Plantago coronopus	....+..	0	0	14
Plantago ovata	+......	0	0	14
Rumex cyprius	.+.....	0	0	14

Aspects of the association: Persistents – 18 spp.; ephemerals – 80 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	97043	60	10	49	13.03.97	I 2493 6750
2	97044	39	10	50	13.03.97	I 2492 6750
3	97045	30	10	46	13.03.97	I 2491 6750
4	97046	20	15	43	13.03.97	I 2490 6750
5	97047	30	10	43	13.03.97	I 2490 6751
6	97048	20	10	47	13.03.97	I 2491 6751
7	97049	20	7	42	13.03.97	I 2492 6751
Average:		31.3	10.3	46		

6.5.2 VD Artemisio sieberi – Chiliadenetalia iphionoidis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ord. nov.

Syn.: Varthermietalia iphionoidis deserta Danin, Orshan et Zohary 1975.

Synoptic table: Table 34.

Diagnostical species: *Centaurea eryngioides, Echinops polyceras, Ephedra aphylla, Gymnocarpos decander.*

Nomenclatural type: Origano dayi – Chiliadenion iphionoidis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch.

The order is divided into two alliances the flora and vegetation of which agree with geomorphology and geography. The associations of the Origano dayi – Chiliadenion iphionoidis occur at the Negev Highlands on smooth-faced outcrops of limestone and dolomite on slopes or plateaus. The associations of the Retamo – Phlomion brachyodontis (VDJ) are confined to the Judean and Samarian Deserts, and develop on cliffs, mostly at the proximity of canyons which typify the topography of these two desert areas.

6.5.2.1 VDN Origano dayi – Chiliadenion iphionoidis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch all. nov.

Syn.: Varthemion iphionoidis negevense Danin, Orshan et Zohary 1975.

Diagnostical species: *Ankyropetalum gypsophiloides, Artemisia sieberi, Deverra tortuosa, Diplotaxis harra, Eryngium glomeratum, Globularia arabica, Helianthemum kahiricum, Helianthemum ventosum, Umbilicus intermedius.*

Nomenclatural type: Origano dayi – Chiliadenetum iphionoidis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch assoc. nov.

Synoptic table: Table 34.

The rock vegetation of the Negev Highlands is influenced by the flora and vegetation of the area in which it develops and also supports relict species which arrived to the area under different climatic conditions of the past and sustained in the rock refugia (Danin, 1972). The phytogeographical spectrum of each association (Fig. 72) reveals the impact of the surrounding vegetation which is dominated by the IT and the SA chorotypes and that of the relicts which are mainly species of the M and M-IT chorotypes. VDN02, which occurs at the Mizpe Ramon area have the IT as the most frequent chorotype; VDN03 which occurs close to the eastern boundary of the diffused vegetation (Fig. 73), displays prevalence of the Saharo-Arabian and the "thermophilous" chorotypes.

6.5.2.1.1 VDN01 Origanetum dayi Eig 1946.

Diagnostical species: the markers in table 32. **Distribution:** Fig. 71.

Ecological notes: The smooth-faced outcrops of limestone or dolomite supporting this association occur mainly on north-facing slopes where epilithic lichens protect the rocks from direct physical weathering and thus induce their smooth faces (Danin, 1972, 1986b). The most prominent endemic species of this association is *Origanum dayi* which have five vicariants in similar rock outcrops elsewhere in the Near East (Danin & Künne, 1996). Many of the markers are plants of the Ballotetea (B) which dominate the vegetation in areas with twice the mean annual rainfall, and of the Artemisietea (A). Of the dozens of Mediterranean relicts recorded here *Sarcopoterium spinosum, Narcissus tazetta,* and *Sternbergia clusiana* may display the situation in the best way.

Association dynamics and conservation: Most of the area of this association is under moderate pressure of grazing and cutting. However, in many sites the rock outcrops are physically protected from such hazards by inconvenient topography.

Aspects of the association: Persistents – 65 spp.; ephemerals – 107 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00038	5	2	33	24.01.65	I 2055 5545
2	00039	5	5	36	28.01.65	I 2025 5565
3	00043	5	5	58	23.05.64	I 1858 5434
4	00044	5	5	50	23.05.64	I 1853 5434
5	00046	3	5	75	06.05.64	I 1876 5418
6	00047	1	5	59	06.05.64	I 1876 5419
7	00049	5	5	59	21.05.64	I 1896 5428
8	00050	1	5	46	21.05.64	I 1896 5423
9	00051	1	5	24	14.05.65	I 2095 5577
10	00053	1	5	12	14.05.65	I 2068 5555
11	00054	1	5	22	14.05.65	I 2068 5556
Average:		3.0	4.7	43.1		

Table 32. Association tables of VDN01- Origanetum dayi, VDN02 – Pistacio atlanticae – Chiliadenetum iphionoidis, and VDN03 – Helianthemo kahirici – Chiliadenetum iphionoidis

			VDN01				VDN02				VDN03			
			*12345678901	C1	C2	%P	*1234567890123	C1	C2	%P	*1234567	C1	C2	%P
*	A	Achillea fragrantissima	....+......	0	0	9								
	W	Adonis dentata	......+....	0	0	9								
	R	Aegilops longissima	......+....	0	0	9								
*	S	Agathophora alopecuroides	...+.......	0	0	9					...+...	0	0	14
*	Q	Ajuga chamaepitys	+++.+++....	0	0	55	...+.++.+....	0	0	31				
*	B	Ajuga iva	.......+...	0	0	9								
*	V	Alcea rufescens	.....+..+..	0	0	18								
	W	Allium ampeloprasum	......+....	0	0	9								
	A	Allium artemisietorum	..++.......	0	0	18								
	B	Allium erdelii	....+++....	0	0	27								
	Q	Allium neapolitanum	..++...++..	0	0	36					2+53232	**24**	**24**	**100**
	N	Amberboa crupinoides	...+...+...	0	0	18								
*	V	Amygdalus ramonensis					+....+.......	0	0	15				
*	N	Anabasis articulata	..+.++.....	0	0	27					+++1+..	**2**	**1**	**71**
	W	Anagallis arvensis	....+......	0	0	9					...+...	0	0	14
	W	Anchusa aegyptiaca	..+.+.++...	0	0	36								
	N	Anchusa milleri									++++.++	**0**	**0**	**86**
	H	Anemone coronaria	.+.........	0	0	9								
*	V	Ankyropetalum gypsophiloides	+++..+++..+	**0**	**0**	**64**	++++.++.+++++	**0**	**0**	**8**				
	W	Anthemis melampodina									..+..++	0	0	43
	H	Anthemis pseudocotula	......+....	0	0	9								
	W	Aristida coerulescens	.......+...	0	0	9								
*	A	Artemisia sieberi	+.++++++..+	**0**	**0**	**73**	+++.+57767555	**39**	**36**	**92**				
*	V	Asparagus horridus	...+.......	0	0	9	...+...+.++..	0	0	31	+++++++	**0**	**0**	**100**
	T	Asphodeline lutea					+..+.........	0	0	15				
	H	Asphodelus ramosus	8+.++++.++.	**10**	**7**	**73**								
*	V	Asplenium ceterach					............+	0	0	8				
	N	Asteriscus hierochunticus									..+....	0	0	14

Table 32. continued.

			VDN01				VDN02				VDN03			
			12345678901	**C1**	**C2**	**%P**	**1234567890123**	**C1**	**C2**	**%P**	**1234567**	**C1**	**C2**	**%P**
	V	Asterolinon linum-stellatum	....+......	0	0	9								
	B	Astoma seselifolium	+++..++...+	0	0	55	+............	0	0	8				
*	V	Astragalus amalecitanus	...+++.....	0	0	27	++..+........	0	0	23				
*	B	Astragalus bethlehemiticus					+..++0+++++++	**0**	**0**	**85**				
	A	Astragalus bombycinus	..........+	0	0	9								
*	A	Astragalus sanctus	...+.......	0	0	9	..........++.	0	0	15	++.....	0	0	29
*	A	Astragalus spinosus	++..+.....+	0	0	36					...+.+.	0	0	29
*	R	Atractylis carduus									.1.....	10	1	14
*	W	Atractylis phaeolepis	...+.......	0	0	9	...++....+...	0	0	23	++...++	0	0	57
	A	Atractylis prolifera	...+.......	0	0	9								
*	S	Atriplex halimus	..+..+++...	0	0	36								
*	B	Ballota undulata	+++.1+2++.+	**4**	**3**	**82**	+.+.+++++++++	**0**	**0**	**85**	++11+02	**6**	**6**	**100**
	A	Bellevalia desertorum									.+.....	0	0	14
	H	Biscutella didyma	......+....	0	0	9					+++++++	**0**	**0**	**100**
	W	Brachypodium distachyon	....+.+..+.	0	0	27	..+..........	0	0	8				
	H	Bromus fasciculatus	....++.....	0	0	18					+..+...	0	0	29
	H	Bromus lanceolatus	....+......	0	0	9								
	A	Buglossoides tenuiflora	....+.+....	0	0	18					....++.	0	0	29
	H	Calendula arvensis	......+....	0	0	9					+.+..++	0	0	57
	V	Campanula erinus	....++++...	0	0	36								
	H	Campanula stellaris	..........+	0	0	9								
*	V	Capparis aegyptia									...+...	0	0	14
*	V	Capparis spinosa	+.........+	0	0	18								
*	V	Caralluma europaea	...+...+.+.	0	0	27	............+	0	0	8				
	H	Carduus acicularis	..+........	0	0	9								
	W	Carduus getulus									..+...+	0	0	29
	B	Carlina libanotica	+.+.+.+.+..	0	0	45								
	W	Carrichtera annua	....+......	0	0	9					.+.....	0	0	14
	W	Carthamus nitidus	...+...++..	0	0	27								
	H	Catapodium rigidum	....+.+....	0	0	18								
*	A	Centaurea aegyptiaca	...+...+...	0	0	18	....+........	0	0	8	+.++.++	**0**	**0**	**71**
*	V	Centaurea damascena					............+	0	0	8				
	V	Centaurea eryngioides	+++++++....	**0**	**0**	**64**	+.+++++++++++	**0**	**0**	**92**	.2.+3.0	14	8	57
	H	Chaetosciadium trichospermum	....+.+....	0	0	18					.....++	0	0	29
*	V	Cheilanthes acrostica					............+	0	0	8				
*	V	Chiliadenus iphionoides	++ ++++033++++	**6**	**6**	**100**	+++++21111222	**10**	**10**	**100**	+.24++4	**17**	**14**	**86**
*	V	Colutea istria	..+..+.....	0	0	18	++...........	0	0	15				
*	V	Convolvulus oleifolius	..+..+.....	0	0	18	.++..+....+++	0	0	46				
	V	Crassula alata									..++...	0	0	29
	W	Crepis aspera	...+.......	0	0	9								
	H	Crepis sancta									+.++.+.	0	0	57
	A	Crucianella membranacea	....+......	0	0	9								
	H	Crupina crupinastrum	........+.+	0	0	18								
	R	Cutandia memphitica	.....+.....	0	0	9								
*	H	Cynodon dactylon	.......+...	0	0	9								
	H	Daucus durieua	....+...+..	0	0	18								
	V	Delphinium ithaburense	.+....+....	0	0	18								
	H	Delphinium peregrinum	...+.......	0	0	9								
*	A	Deverra tortuosa	.+++0+.++..	**1**	**0**	**64**	.++.+++0++++.	**1**	**0**	**77**	....2..	20	3	14
*	V	Dianthus sinaicus	..++.+.....	0	0	27	+..+.++++++++	**0**	**0**	**77**				
*	H	Dianthus strictus	.+..+.+.+..	0	0	36	...+.........	0	0	8				
	W	Diplotaxis harra	..++++.+...	0	0	45	..+..........	0	0	8	+.0...+	2	1	43
*	B	Echinops polyceras	++++..3++++	**3**	**3**	**82**	..+..+++++.++	**0**	**0**	**62**	0+.++..	1	1	57
	W	Echium judaeum	..+....+...	0	0	18								
*	V	Ephedra aphylla	+.+.+.+..++	0	0	55	.+++.++++...+	**0**	**0**	**62**	0+21221	**12**	**12**	**100**
	B	Eremostachys laciniata	.......+...	0	0	9								

Table 32. continued.

			VDN01				VDN02				VDN03			
			12345678901	C1	C2	%P	1234567890123	C1	C2	%P	1234567	C1	C2	%P
	H	Erodium ciconium									......+	0	0	14
	H	Erodium cicutarium	.......+...	0	0	9								
	W	Erodium crassifolium	..+..+.....	0	0	18					52.23.3	**30**	**21**	**71**
	W	Erodium touchyanum									++++.++	**0**	**0**	**86**
	W	Erucaria microcarpa	..+.++.....	0	0	27					......+	0	0	14
	W	Erucaria rostrata									+++..++	**0**	**0**	**71**
	H	Eryngium creticum	+..........	0	0	9								
*	B	Eryngium glomeratum	++++0.+.+..	**1**	**0**	**64**	+.++.++++.+.0	**1**	**0**	**69**	...++.+	0	0	43
	W	Euphorbia chamaepeplus									....++.	0	0	29
*	V	Euphorbia ramonensis	.+++0++....	1	0	55								
*	C	Farsetia aegyptia									..++...	0	0	29
	W	Filago desertorum	....+......	0	0	9					.++..+.	0	0	43
	H	Filago pyramidata	....+......	0	0	9								
*	M	Fumana thymifolia	..+..+.....	0	0	18	++++++..+.0+.	**1**	**0**	**69**				
	H	Gagea chlorantha									+++.+++	**0**	**0**	**86**
	W	Gagea reticulata	+..........	0	0	9								
	H	Galium setaceum	........+..	0	0	9								
	H	Gastridium ventricosum	....+......	0	0	9								
	W	Gastrocotyle hispida	......++...	0	0	18								
*	V	Globularia arabica	+++......++	0	0	45	+++..........	0	0	23	.....+.	0	0	14
*	N	Gymnocarpos decander	.+++0......	1	0	36	+++.+01++++0+	**2**	**2**	**92**	3+1+023	**14**	**14**	**100**
*	B	Gypsophila arabica					........+....	0	0	8				
*	A	Haloxylon scoparium	....+......	0	0	9	....+........	0	0	8				
*	V	Haplophyllum poorei					+..++...+.+..	0	0	38				
	H	Helianthemum aegyptiacum									+......	0	0	14
*	A	Helianthemum kahiricum	.+++.+.....	0	0	36	+...+.+..+++.	0	0	46	36+0521	**25**	**25**	**100**
	H	Helianthemum lasiocarpum	..+........	0	0	9								
	W	Helianthemum ledifolium	.....+.....	0	0	9					++.+...	0	0	43
	H	Helianthemum salicifolium	....++.+...	0	0	27					+.1+.+1	**4**	**3**	**71**
*	A	Helianthemum ventosum	.++.+..+...	0	0	36	+..++......+.	0	0	31	+2.....	10	3	29
*	A	Helianthemum vesicarium	.++..+.....	0	0	27	+++.+0+++0+++	**1**	**1**	**92**				
	H	Herniaria hirsuta	.......+...	0	0	9								
	R	Hippocrepis unisiliquosa	.....+.....	0	0	9					+..+++.	0	0	57
*	V	Hyoscyamus aureus	..+........	0	0	9								
*	H	Hyparrhenia hirta	..+++..+++.	0	0	55								
	R	Ifloga spicata	.......+...	0	0	9								
	W	Lamarckia aurea	....+.+....	0	0	18								
	W	Lappula spinocarpos	...+.+.....	0	0	18					......+	0	0	14
	C	Launaea nudicaulis	....++.....	0	0	18								
	S	Limonium lobatum					...........+.	0	0	8				
*	S	Limonium pruinosum	..+++......	0	0	27	.+.......+..	0	0	15				
	W	Matthiola livida	...+.+.....	0	0	18	.....+........	0	0	8				
	W	Medicago radiata	....+..++..	0	0	27								
	S	Mesembryanthemum nodiflorum	.....+.....	0	0	9								
*	V	Micromeria sinaica	+.+.+.++..+	0	0	55	++++.++++++++	**0**	**0**	**92**				
*	A	Moricandia nitens	....+.+...+.+	0	0	31	....+..	0	0	14				
	H	Muscari commutatum									.+..+++	0	0	57
	V	Narcissus tazetta	1..........	10	1	9								
*	A	Noaea mucronata	++.+.+.....	0	0	36	....+++++++0.	**1**	**0**	**62**				
	D	Notobasis syriaca									.....++	0	0	29
	W	Onobrychis crista-galli	.....+.....	0	0	9								
*	V	Onobrychis ptolemaica	..++.......	0	0	18								
	H	Ononis mollis	....++.+...	0	0	27								
	H	Ononis ornithopodioides	......+....	0	0	9								
*	V	Origanum dayi	++++05+++++	**5**	**5**	**100**								
*	V	Origanum ramonense					+.........00.	3	1	23				
	H	Ornithogalum narbonense	..+...+....	0	0	18	..++.........	0	0	15	++.+++.	**0**	**0**	**71**
	H	Pallenis spinosa	.++.....+..	0	0	27	....+..	0	0	14				
	W	Papaver humile	......++...	0	0	18								
	H	Papaver hybridum	....+.+....	0	0	18								
	L	Parapholis incurva	......+....	0	0	9								
	W	Parietaria alsinifolia	....++....+	0	0	27					+.+.+.+	0	0	57

Table 32. continued.

			VDN01				VDN02				VDN03			
			12345678901	C1	C2	%P	1234567890123	C1	C2	%P	1234567	C1	C2	%P
*	H	Paronychia argentea	+..........	0	0	9								
*	V	Paronychia sinaica	.+.+++.....	0	0	36	+.+++++++.+++	**0**	**0**	**85**				
*	V	Phagnalon rupestre	++++..+.+..	0	0	55	++.+++++++++0	**0**	**0**	**92**	+11++++	**3**	**3**	**100**
*	B	Phlomis platystegia	++.......++	0	0	36								
	R	Picris amalecitana	....++.....	0	0	18								
*	H	Piptatherum miliaceum	..+++.+++.+	**0**	**0**	**64**	...+......+..	0	0	15	....+.+	0	0	29
*	V	Pistacia atlantica					+++++0000000	**3**	**3**	**100**				
	H	Pisum fulvum	......+....	0	0	9								
	H	Plantago afra									.+++.++	**0**	**0**	**71**
	W	Plantago coronopus									11.213.	**17**	**12**	**71**
	A	Plantago phaeostoma	..+.+......	0	0	18								
	H	Poa bulbosa	.+..+++....	0	0	36								
	W	Poa sinaica					+............	0	0	8	++.+.++	**0**	**0**	**71**
*	V	Podonosma orientalis	..+++1.....	3	1	36	+.........++.	0	0	23				
*	Q	Prasium majus					............+	0	0	8				
	S	Pteranthus dichotomus	...+.......	0	0	9								
	W	Pterocephalus brevis	......+....	0	0	9								
	H	Pterocephalus plumosus	...+++.....	0	0	27								
*	V	Pterocephalus pulverulentus	++++..++.++++	**0**	**0**	**77**								
	H	Ranunculus asiaticus	++..++.+...	0	0	45					+++.+0+	**1**	**1**	**86**
*	S	Reaumuria hirtella	.++....+...	0	0	27	+............	0	0	8	++.+++.	**0**	**0**	**71**
	W	Reichardia tingitana	.....+.....	0	0	9					......+	0	0	14
*	S	Reseda muricata	...+.......	0	0	9								
*	R	Retama raetam	++++++.+...	**0**	**0**	**64**	.+...........	0	0	8	.+12.3+	**12**	**9**	**71**
	H	Rhagadiolus stellatus	....+.+....	0	0	18								
*	V	Rhamnus disperma	..+......++	0	0	27	++.+.++.+..+.	0	0	54				
	W	Roemeria hybrida	......+....	0	0	9								
	H	Rostraria smyrnacea	....+.+....	0	0	18					.....+.	0	0	14
	W	Rumex cyprius	...+...+...	0	0	18					...+...	0	0	14
*	S	Salsola oppositifolia	..+.++.+...	0	0	36								
*	S	Salsola vermiculata	.+.........	0	0	9	...........++	0	0	15	......+	0	0	14
*	B	Salvia dominica	+++..+.....	0	0	36								
*	A	Salvia lanigera	.+.+..0....	2	0	27					..+.+++	0	0	57
	H	Salvia palaestina					............+	0	0	8				
*	T	Sarcopoterium spinosum	....4......	40	4	9								
	W	Scilla hanburyi									++++...	0	0	57
	W	Scorzonera judaica	.......+...	0	0	9								
	W	Scorzonera papposa	...+.......	0	0	9								
*	V	Scrophularia xylorrhiza					+.........+++	0	0	31				
	W	Senecio glaucus	....+++....	0	0	27								
	H	Silene damascena	..+...+....	0	0	18								
	W	Silene linearis	.......+.+.	0	0	18								
	W	Sisymbrium erysimoides									+.....+	0	0	29
	D	Sonchus oleraceus	....+++....	0	0	27								
	Q	Sternbergia clusiana	......++...	0	0	18								
*	V	Stipa barbata	..+.+.+....	0	0	27								
	W	Stipa capensis	..++++.+...	0	0	45	....+........	0	0	8	..+..+.	0	0	29
*	V	Stipa parviflora	...+++..+.+	0	0	45	.++++++++++++	**0**	**0**	**92**	..+.++.	0	0	43
*	V	Stipa pellita	..........+	0	0	9								
*	F	Stipagrostis ciliata	.......+...	0	0	9								
*	V	Tanacetum santolinoides					+..+.++01++++	**2**	**1**	**77**				
	V	Telmissa microcarpa	....+.+....	0	0	18								
*	B	Teucrium capitatum	++++.+.+...	0	0	55	++++++++++++.	**0**	**0**	**92**	.1.+++.	3	1	57
*	B	Thymelaea hirsuta	+.++.+.....	0	0	36								
	H	Torilis tenella									......+	0	0	14
	H	Trifolium campestre	....+......	0	0	9								
	W	Trigonella arabica	....+...+..	0	0	18								
	S	Trigonella schlumbergeri	...+.+.....	0	0	18								
	W	Trigonella stellata	....+++....	0	0	27					++++...	0	0	57
	B	Trisetaria macrochaeta	.....++....	0	0	18								
	A	Tulipa systola	+..........	0	0	9	..+..........	0	0	8				

Table 32. continued.

			VDN01				VDN02				VDN03			
			12345678901	C1	C2	%P	1234567890123	C1	C2	%P	1234567	C1	C2	%P
	V	Umbilicus intermedius	+.+.+++....	0	0	45	...+.........	0	0	8	11+++2+	**6**	**6**	**100**
	H	Urginea maritima	+++++.+...+	**0**	**0**	**64**	+.+..........	0	0	15	....+.1	8	2	29
	A	Urginea undulata	.....+.....	0	0	9								
	H	Urospermum picroides	....+.+++..	0	0	36								
	V	Valantia hispida	.++.+.+.+..	0	0	45					....++.	0	0	29
*	B	Verbascum fruticulosum	+..........	0	0	9								
*	N	Zygophyllum dumosum									2.+.+.0	6	4	57

6.5.2.1.2 VDN02 Pistacio atlanticae – Chiliadenetum iphionoidis Danin, Orshan et Zohary 1975 ex Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 32. **Distribution:** Fig. 71.

Ecological notes: This is the only association of diffused vegetation which supports trees and shrubs that otherwise grow under much moister conditions. The *Pistacia atlantica* trees grow in the NE Galilee under mean annual rainfall of 500-700 mm whereas here it is only 80-100 mm, but with large runoff contributing area (Danin & Orshan, 1970; Danin, 1983). As in VDN01 there are many species of Ballotetea and Artemisietea in this association. In addition to the endemic *Origanum ramonense, Ferula negevensis,* and *Amygdalus ramonensis* there are the Mediterranean relicts *Prasium majus, Astoma seselifolius,* and *Ankyropetalum gypsophiloides.* Fossil charcoal from around 12000 years ago indicate the past occurrence of *Juniperus phoenicea* and *Paliurus spina-christi* in this area (Baruch & Goring-Morris, 1997).

Association dynamics and conservation: Most of the area of this association is protected from excessive grazing by both low populations of Bedouin and steep topography.

Aspects of the association: Persistents – 53 spp.; ephemerals – 14 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00060	1	5	33	22.03.65	I 1615 4870
2	00062	1	5	20	15.05.66	I 1821 5133
3	00063	1	5	26	15.05.66	I 1821 5132
4	00064	1	5	28	28.04.66	I 1640 4894
5	00065	1	5	25	28.04.66	I 1573 4893
6	00646	0	10	26	27.09.66	I 1617 4928
7	00647	0	10	26	27.09.66	I 1618 4929
8	00648	0	10	22	27.09.66	I 1615 4927
9	00649	0	1	2	27.09.66	I 1615 4926
10	00650	0	10	22	27.09.66	I 1615 4928
11	00651	0	10	32	27.09.66	I 1616 4938
12	00652	0	10	31	27.09.66	I 1616 4937
13	00653	0	10	29	27.09.66	I 1616 4935
Average:		0.4	8.1	26.6		

6.5.2.1.3 VDN03 Helianthemo kahirici – Chiliadenetum iphionoidis Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 32. **Distribution:** Fig. 73.

Phytogeographical analysis: (Fig. 72) The high contrast of the phytogeographical spectra of VDN03 and MZZ07 (Fig. 65), which inhabits the same area, is exemplified by comparison of the columns of the SA chorotype (55% in MZZ07 and only 35% in VDN03) and the M columns (5% in MZZ07 and 11% in VDN03). These differences are explained by the amelioration of the local moisture regime discussed below.

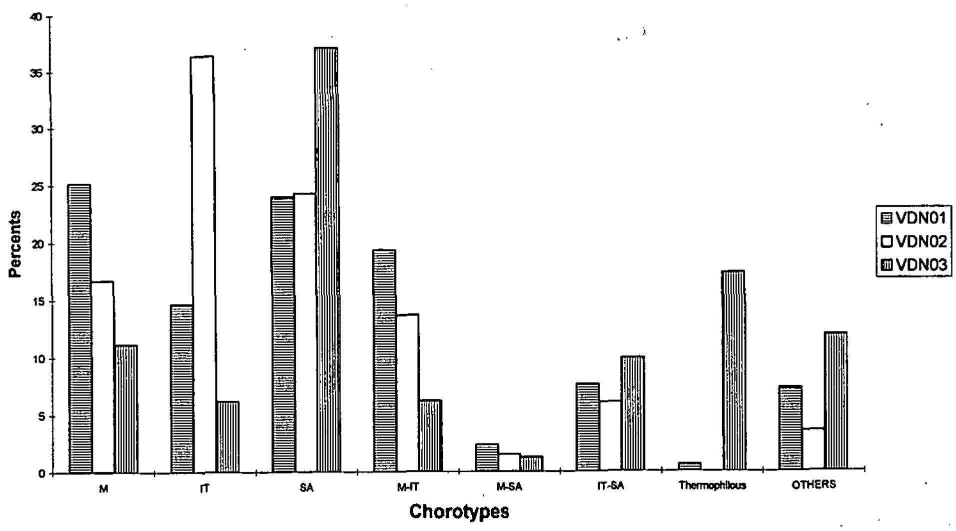

Figure 72. Phytogeographical analysis of associations VDN01-VDN03.

Ecological notes: The impact of smooth-faced rocks here is strong since the colluvial pediment of the hills supporting this association are devoid of vegetation most years. In addition to many Mediterranean relicts the smooth rocks can be observed from afar by shrubs of *Retama raetam* and *Ephedra aphylla* which otherwise grow here in wadis which drain large quantities of runoff water. Soil pockets in or below rock outcrops support large quantities of the Mediterranean geophytes *Allium neapolitanum* and *Umbilicus intermedius.*

Association dynamics and conservation: Most of the area of this association is protected from grazing and cutting due to the low density of Bedouin populations associated with the low carrying capacity of the area.

Aspects of the association: Persistents – 27 spp.; ephemerals – 68 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	97057	5	3	39	24.03.97	I 2108 5372
2	97058	5	5	37	24.03.97	I 2109 5372
3	97059	5	3	37	24.03.97	I 2110 5372
4	97060	5	3	39	24.03.97	I 2111 5372
5	97061	3	5	35	24.03.97	I 2112 5372
6	97062	5	10	42	24.03.97	I 2113 5372
7	97063	5	5	43	24.03.97	I 2113 5373
Average:		4.7	4.9	38.9		

6.5.2.2 VDJ Retamo – Phlomion brachyodontis Eig 1945.

Diagnostical species of the alliance = diagnostical species of the order.

Nomenclatural type: Assoc. Reatama Duriaei (= R. raetam) – Rhus oxyacantha (=Rh. tripartita) Eig 1946.

The first association (VDJ01) was described by a sample record (Eig 1946) and was not studied in detail yet. The two other associations recorded in this alliance occur in two different climatic zones which can be clearly seen in their phytogeographical spectrum (Fig. 74). VDJ02 was recorded in the Judean and Samarian Deserts and reflect the bioclimatic conditions of the Ballotetea undulatae, i.e., high percent of the M and the M-IT chorotypes. VDJ03 was recorded at lower elevation of the escarpments of the Dead Sea Valley and has high frequency of the SA, IT-SA and thermophilous species (S, SA-S, and S-African chorotypes). There is also a relatively high percent of Mediterranean species which has to be compared to that of associations growing in non-rocky habitats such as MZZ01.

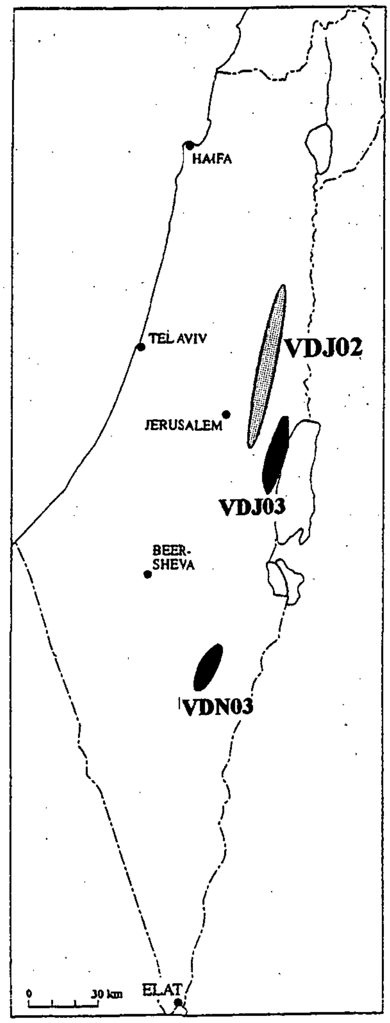

Figure 73. Distribution map of associations VDN03, VDJ02, and VDJ03.

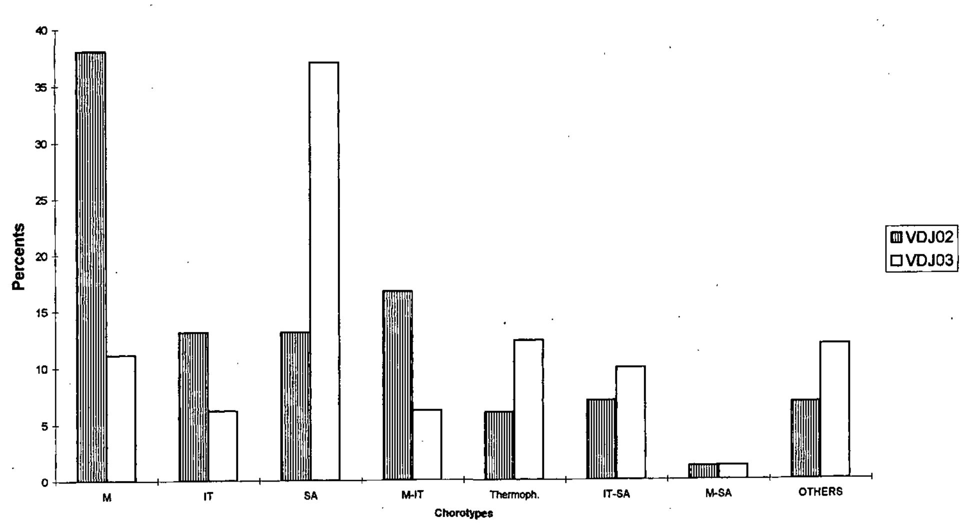

Figure 74. Phytogeographical analysis of associations VDJ02 and VDJ03.

6.5.2.2.1 VDJ02 Podonosmo orientalis – Kickxietum judaicae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 33. **Distribution:** Fig. 73.

Ecological notes: *Kickxia judaica* which is endemic to Israel and confined to limestone outcrops and cliffs of the Judean and Samarian Deserts occurs mainly in this association. Other plants in this association display its special composition. The status of a few plants which are typical components of the Mediterranean maquis, e.g., *Rhamnus lycioides* susbsp. *graecus, Prasium majus, Rubia tenuifolia*, and *Arum palaestinum* may be regarded as similar to these species in VDN. When climatic shifts took place towards the Negev they should have influenced the Judean and Samarian Deserts as well. The role of *Cyclamen persicum*, a typical Mediterranean geophyte, in VDJ03 may be comparable to that of *Narcissus tazetta* in VDN01. South-facing cliffs which have relatively warm microclimate support thermophilous plants such as *Ochradenus baccatus*.

Association dynamics and conservation: Most of the area of this association is under constant excessive grazing but most rock outcrops are protected from this hazard by being in steep topography.

Aspects of the association: Persistents – 43 spp.; ephemerals – 31 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	00889	5	5	27	11.03.71	I 2043 6329
2	00890	5	5	23	11.03.71	I 2042 6330
3	00891	3	3	16	11.03.71	I 2041 6331
4	00892	30	30	24	11.03.71	I 2040 6328
5	00925	0	5	27	11.03.71	I 2042 6328
6	00926	0	5	15	11.03.71	I 2041 6328
7	00927	0	10	9	11.03.71	I 2043 6327
8	00933	0	5	21	11.03.71	I 2043 6326
9	00938	0	5	16	11.03.71	I 2042 6325
Average:		4.8	8.1	19.8		

Table 33. Association tables of VDJ02 – Podonosmo orientalis – Kickxietum judaicae and VDJ03 – Tricholaeno tenerrifae – Gymnocarpetum decandri.

		Species	VDJ02				VDJ03			
			*123456789	C1	C2	%P	*123456789	C1	C2	%P
	W	Aaronsohnia factorovskyi					+.+.++0+1	**2**	**2**	**78**
*	C	Abutilon fruticosum					+001++0++	**3**	**3**	**100**
*	C	Abutilon indicum	.....+++.	0	0	33				
	C	Aizoon canariense					+.+++....	0	0	44
	W	Aizoon hispanicum					+........	0	0	11
*	Q	Ajuga chamaepitys	+....+...	0	0	22				
	H	Alcea setosa	....+....	0	0	11				
	Q	Allium neapolitanum	...++....	0	0	22				
	H	Allium nigrum	....+..+.	0	0	22				
*	N	Anabasis articulata					0.1.11.+2	**9**	**6**	**67**
*	W	Anabasis setifera					1..+++...	3	1	44
	W	Anagallis arvensis					..+......	0	0	11
	N	Anchusa milleri					.++...++.	0	0	44
*	C	Andrachne aspera					....+..+.	0	0	22
	H	Androcymbium palaestinum	+........	0	0	11				
	N	Anthemis maris-mortui					.......0+	3	1	22
	H	Antirrhinum orontium					.+.+.....	0	0	22
*	C	Anvillea garcinii					3++.0+10..	**7**	**6**	**78**
*	W	Aristida coerulescens	.......+.	0	0	11	..+......	0	0	11
	Q	Arum palaestinum	.+.++....	0	0	33				
	W	Asphodelus tenuifolius					..+......	0	0	11
*	V	Asplenium ceterach	++.+.....	0	0	33				
*	C	Asteriscus graveolens					.+..++...	0	0	33

Table 33. continued.

	Species	VDJ02 123456789	C1	C2	%P	VDJ03 123456789	C1	C2	%P
N	Asteriscus hierochunticus					++++1+...	**2**	**1**	**67**
B	Astoma seselifolium	...+.....	0	0	11				
W	Atractylis cancellata					++.+.....	0	0	33
* B	Ballota undulata	...+1+.++	2	1	56				
A	Bellevalia desertorum					..+......	0	0	11
A	Bellevalia eigii	....+....	0	0	11				
H	Bellevalia flexuosa	..+......	0	0	11				
* B	Blepharis attenuata	.....+...	0	0	11				
* C	Blepharis ciliaris					..+..++..	0	0	33
W	Brachypodium distachyon					+.+...143	17	9	56
H	Bromus fasciculatus					........+	0	0	11
H	Campanula stellaris					++++.++.+	**0**	**0**	**78**
* V	Capparis aegyptia	++++0.1+1	**3**	**3**	**89**	+.+0.+...	1	1	44
B	Carlina libanotica	.....+...	0	0	11				
V	Centaurea eryngioides	+200+...+	**5**	**3**	**67**				
* C	Centaurea lanulata					+........	0	0	11
* V	Cheilanthes acrostica	+.......+	0	0	22				
D	Chenopodium murale					.+.......	0	0	11
* V	Chiliadenus iphionoides	5331+.+..	**20**	**13**	**67**				
W	Cnicus benedictus					..+......	0	0	11
* V	Cosentinia vellea	....+...+	0	0	22	+........	0	0	11
V	Crassula alata	....+....	0	0	11	.+.......	0	0	11
W	Crepis aspera					.+.......	0	0	11
V	Cyclamen persicum	++++.....	0	0	44				
Q	Cynoglossum creticum	.+.......	0	0	11				
* H	Dianthus strictus	.+..+...+	0	0	33				
* B	Echinops polyceras	........+	0	0	11				
W	Echium judaeum	.......+.	0	0	11				
* V	Enneapogon persicus					......+..	0	0	11
* V	Ephedra aphylla	.+..1+..+	3	1	44	.+....+.+	0	0	33
W	Erodium crassifolium					.....+...	0	0	11
B	Erodium touchyanum					+..+..+..	0	0	33
W	Erucaria rostrata					2+20+++01	**7**	**7**	**100**
* B	Eryngium glomeratum	.+..+....	0	0	22				
* B	Euphorbia hierosolymitana	.326.....	37	12	33				
* A	Fagonia mollis	.......+.	0	0	11	.....+..+	0	0	22
H	Ferula communis	+++++...+	**0**	**0**	**67**				
V	Fibigia clypeata	.+.+.....	0	0	22				
W	Filago desertorum					0..+0+.+0	**3**	**2**	**67**
C	Forsskaolea tenacissima					.+.+..+..	0	0	33
H	Galium setaceum	.......+.	0	0	11	+++..++.+	**0**	**0**	**67**
* C	Grewia villosa					......+..	0	0	11
* N	Gymnocarpos decander	.......+.	0	0	11	557478787	**65**	**65**	**100**
* A	Helianthemum kahiricum					.....0..+	3	1	22
H	Helianthemum salicifolium					.....+...	0	0	11
* C	Heliotropium arbainense					.+.......	0	0	11
* B	Heliotropium rotundifolium	+........	0	0	11				
* C	Hibiscus micranthus					++100+00+	**3**	**3**	**100**
H	Hordeum spontaneum	...+.....	0	0	11				
* V	Hyoscyamus aureus	+.1+3....	10	4	44				
* H	Hyparrhenia hirta	+....+.+.	0	0	33	.++...+1.	3	1	44
* V	Iphiona maris-mortui					.....+...	0	0	11
* V	Kickxia judaica	20+++6547	**27**	**27**	**100**				
C	Launaea nudicaulis					......+.+	0	0	22
* C	Lavandula coronopifolia					........+	0	0	11
* C	Lavandula pubescens	.....+.0.	3	1	22				
S	Limonium lobatum					+++.+....	0	0	44
* C	Lycium shawii					...41.+..	17	6	33
A	Malcolmia africana	+........	0	0	11				
V	Malcolmia chia	....+....	0	0	11				
W	Matthiola aspera					+.+.+++..	0	0	56
* V	Micromeria myrtifolia	++.+.....	0	0	33				

Table 33. continued.

		Species	VDJ02 123456789	C1	C2	%P	VDJ03 123456789	C1	C2	%P
	H	Muscari commutatum	++++.....	0	0	44				
*	A	Noaea mucronata	........+	0	0	11				
	C	Notoceras bicorne					+++++...+	0	0	67
*	C	Ochradenus baccatus	.....++++	0	0	44	.2......+	10	2	22
	W	Orobanche cernua					...+.....	0	0	11
	W	Parietaria alsinifolia	....+....	0	0	11	.+.+...+.	0	0	33
	V	Parietaria lusitanica	+........	0	0	11				
*	V	Pennisetum asperifolium	......24.	33	7	22	..+......	0	0	11
*	V	Pennisetum ciliare	.......+.	0	0	11	.++...++.	0	0	44
*	V	Periploca aphylla					.......++	0	0	22
*	V	Phagnalon rupestre	+.+++..++	0	0	67	.......+.	0	0	11
	W	Picris longirostris					++.+++...	0	0	56
	H	Pimpinella cretica					.+.....+.	0	0	22
*	H	Piptatherum thomasii	...+.....	0	0	11				
	H	Plantago afra					..++...+.	0	0	33
	W	Plantago coronopus					+.++..+.3	6	3	56
	W	Plantago ovata					0.000130.	9	7	78
*	V	Podonosma orientalis	0+2.331.0	16	12	78				
	H	Polycarpon tetraphyllum					.+.......	0	0	11
*	Q	Prasium majus	+..++....	0	0	33				
	S	Pteranthus dichotomus					+.+++....	0	0	44
	W	Reichardia tingitana					.....+..+	0	0	22
	W	Reseda decursiva					+........	0	0	11
*	R	Retama raetam	.....+..+	0	0	22				
*	Q	Rhamnus lycioides	.1++.....	3	1	33				
*	V	Rhus tripartita	++..+++..	0	0	56	0	5	1	11
*	Q	Rubia tenuifolia	+........	0	0	11				
	W	Rumex cyprius	.......+.	0	0	11	++1++.+++	1	1	89
*	S	Salsola orientalis	......+..	0	0	11				
*	S	Salsola tetrandra					.....+...	0	0	11
*	S	Salsola vermiculata	.....+.00	3	1	33				
*	C	Salvia aegyptiaca	.....+...	0	0	11	++.++0+++	1	1	89
*	B	Salvia dominica	....+....	0	0	11				
*	T	Sarcopoterium spinosum	....+....	0	0	11				
	W	Schismus arabicus					....+...+	0	0	22
	W	Scilla hanburyi					..+......	0	0	11
*	B	Scrophularia xanthoglossa	1+.2.....	10	3	33				
	H	Sedum caespitosum					.+.......	0	0	11
	V	Silene grisea	++++.....	0	0	44				
	W	Sisymbrium erysimoides					.+.+.....	0	0	22
	Q	Sonchus aspera	.......+.	0	0	11				
	D	Sonchus oleraceus	....+....	0	0	11	.+...+...	0	0	22
	W	Spergula fallax					...++....	0	0	22
	S	Spergularia diandra					....+....	0	0	11
	W	Stipa capensis	.......+.	0	0	11	756888531	57	57	100
*	V	Tetrapogon villosus					+.+++++++	0	0	89
*	W	Trichodesma africana					.+.......	0	0	11
*	C	Tricholaena teneriffae					0+0+0++++	1	1	100
	W	Trigonella stellata					.+0+++..+	1	1	67
	T	Tulipa agenensis	....+....	0	0	11				
	V	Umbilicus intermedius	++++.....	0	0	44				
	H	Urginea maritima	+.+......	0	0	22	..+++1+++	1	1	78
	H	Urospermum picroides	.......+.	0	0	11	++.+.++.+	0	0	67
	V	Valeriana dioscoridis	++.......	0	0	22				
*	C	Ziziphus spina-christi					.2.......	20	2	11
*	N	Zygophyllum dumosum					...+.+0++	1	1	56

6.5.2.2.2 VDJ03 Tricholaeno tenerrifae – Gymnocarpetum decandri Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 33. **Distribution:** Fig. 73.

Ecological notes: The composition of this association differs from that of all other associations of the alliance. On one hand the dominant shrub *Gymnocarpos decander* is an important component of other associations of Anabasietea articulatae and Artemisietea sieberi. On the other hand it is accompanied by many thermophilous species which were not recorded in any association of these or other classes. Such plants are most of the companions from the Acacietea raddianae, which have *C sign in Table 33, and a few rock plants (V). The Mediterranean fern *Cosentinia vellea,* the tree *Ziziphus spina-christi*, and the endemic semishrub *Iphiona maris-mortui* make this association floristically unique.

Association dynamics and conservation: Most of the area of this association is protected from grazing and cutting by its position in an area with low human density and hence with low external pressures.

Aspects of the association: Persistents – 35 spp.; ephemerals – 53 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94354	10	5	34	31.03.94	I 2420 6211
2	94355	10	7	38	31.03.94	I 2420 6212
3	94356	10	10	37	31.03.94	I 2420 6213
4	94357	10	10	34	31.03.94	I 2421 6211
5	94358	15	10	30	31.03.94	I 2421 6212
6	94359	5	1	34	31.03.94	I 2421 6213
7	94379	10	15	31	31.03.94	I 2382 6102
8	94380	10	10	27	31.03.94	I 2381 6102
9	94381	10	7	33	31.03.94	I 2382 6103
Average:		10.0	9.9	33.1		

Table 34. Synoptic table of the associations in Chiliadenetea iphionoidis: 1 – VMB01, 2 – VMB02, 3 – VMB03, 4 – VMB04, 5 – VDN01, 6 – VDN02, 7 – VDN03, 8 – VDJ02, and 9 – VDJ03.

		%P 1	%P 2	%P 3	%P 4	%P 5	%P 6	%P 7	%P 8	%P 9
	d.s. of Chiliadenetea iphionoides									
V	Chiliadenus iphionoides	**100**	**100**	**100**	57	**100**	**100**	**86**	**67**	
V	Podonosma orientalis	**71**	**64**	**100**	29	36	23		**78**	
H	Urginea maritima	14	36	14	**71**	**64**	15	29	22	78
V	Valantia hispida	29	**73**	**71**	**71**	45		29		
H	Ornithogalum narbonense	29	27	**71**	43	18	15	**71**		
H	Hyparrhenia hirta		**100**	57	**100**	55			33	44
	d.s. Podonosmo - Chiliadenetalia iphionoidis									
H	Anthemis pseudocotula	**100**	**91**	57	43	9				
H	Dianthus strictus	**100**	45	57	29	36	8		33	
W	Brachypodium distachyon	**100**	**64**	57	**71**	27	8			56
H	Chaetosciadium trichospermum	**100**	18	29	29	18		29		
H	Eryngium creticum	**100**	18	29	**71**	9				
B	Ononis natrix	**100**		14						
H	Hymenocarpos circinnatus	**100**	**64**	**71**	57					
H	Lagoecia cuminoides	43	27	57	29					
H	Filago contracta	**100**	9	29	57					
W	Anchusa aegyptiaca	**86**	55	57	**86**	36				
H	Rhagadiolus stellatus	**71**	45	**71**	57	18				
W	Medicago laciniata	**71**	**64**	**71**						
B	Carlina libanotica	57		43	57	45			11	
W	Onobrychis crista-galli	**86**	**91**	**71**	**100**	9				
B	Salvia dominica	**71**		43		36			11	
H	Crucianella macrostachya	43	**64**	14	43					
W	Atractylis cancellata	**71**	**82**	43	43				33	

Table 34. continued.

		%P 1	%P 2	%P 3	%P 4	%P 5	%P 6	%P 7	%P 8	%P 9
H	Cichorium endivia	14	**82**	57	14					
H	Medicago coronata	29	**73**	**71**	29					
H	Aegilops peregrina	14	**91**	57						
W	Euphorbia chamaepeplus	57	55	29	14			29		
W	Emex spinosa	29	18	29						
H	Salvia horminum		9	14	14					
V	Minuartia decipiens	43	55	43	14					
B	Kickxia aegyptiaca	14		14	29					
	d.s. Artemisio - Chiliadenetalia iphionoidis									
V	Ephedra aphylla			14		55	**62**	**100**	44	33
N	Gymnocarpos decander				36		**92**	**100**	11	**100**
V	Centaurea eryngioides	57				**64**	**92**	57	**67**	
B	Echinops polyceras	**71**				**82**	**62**	57	11	
	d.s. Origano - Chiliadenetalia iphionoidis									
B	Eryngium glomeratum			14		**64**	**69**	43	22	
V	Umbilicus intermedius			43		45	8	**100**	44	
A	Helianthemum kahiricum					36	46	**100**		22
A	Artemisia sieberi					**73**	**92**			
A	Deverra tortuosa					**64**	**77**	14		
V	Ankyropetalum gypsophiloides					**64**	**85**			
A	Helianthemum ventosum					36	31	29		
W	Diplotaxis harra					45	8	43		
V	Globularia arabica					45	23	14		
Marker and rare species of associations										
H	Galium judaicum	**100**								
H	Bromus tectorum	**86**								
H	Clypeola jonthlaspi	**86**		14						
H	Alyssum strigosum	**86**	9	71						
W	Scilla hanburyi	**86**	55	43				57		11
V	Sedum hispanicum	**86**	**64**	29						
W	Parietaria alsinifolia	**71**	27	14		27		57	11	33
W	Ononis sicula	**71**	36	14	14					
W	Poa eigii	**71**								
H	Calendula arvensis	**71**	27	29		9		57		
H	Daucus durieua	**71**	36	29		18				
H	Trigonella monspeliaca	**71**	27		14					
H	Torilis tenella	**71**	9	29	**71**			14		
V	Crassula alata	**71**		29	43			29	11	11
V	Paronychia capitata	**71**	27	57						
H	Vicia sativa	57			29					
A	Alyssum damascenum	57	9							
A	Bellevalia desertorum	57	9					14		11
V	Campanula erinus	43				36				
H	Allium nigrum	43							22	
H	Allium pallens	43								
W	Adonis dentata	43	9	43		9				
H	Filago palaestina	43	18	29						
H	Erodium gruinum	29	18	14						
H	Erodium malacoides	29	9	14						
W	Silene decipiens	29		29						
H	Centaurea hyalolepis	29	27	29	14					
V	Erophila minima	29								
A	Buglossoides tenuiflora	29				18	29			
H	Geranium rotundifolium	29								
A	Astragalus bombycinus	14				9				
A	Avena wiestii	14								
A	Vicia monantha	14								
A	Ornithogalum trichophyllum	14								
W	Anemone coronaria	14				9				
H	Delphinium peregrinum	14				9				

Table 34. continued.

		%P 1	%P 2	%P 3	%P 4	%P 5	%P 6	%P 7	%P 8	%P 9
H	Nonea philistaea	14								
H	Torilis arvensis	14								
H	Ononis ornithopodioides	14				9				
H	Parentucellia latifolia	14								
R	Crepis aculeata	14				9				
V	Parietaria judaica	14								
W	Lolium rigidum		9	29						
H	Erucaria hispanica			14						
H	Bellevalia flexuosa								11	
W	Carrichtera annua			14		9		14		
B	Calendula pachysperma		9							
B	Gypsophila arabica						8			
S	Limonium lobatum	29	**100**	43	43		8			44
H	Hippocrepis unisiliquosa	14	**100**	57	29	9		57		
C	Salvia aegyptiaca		**100**	14	43				11	**89**
H	Artedia squamata		**91**	29						
H	Campanula stellaris		**91**	57		9				**78**
W	Asphodelus tenuifolius		**91**	**86**						11
W	Matthiola aspera		**82**	71	14					56
W	Reichardia tingitana		**73**	**71**	29	9		14		22
W	Carthamus nitidus	29	**73**	43		27				
H	Hordeum spontaneum		**64**	29	14				11	
H	Verbascum orientale	29	**64**		57					
H	Antirrhinum orontium		**64**	14						22
H	Lomelosia palaestina		**64**	14						
W	Crepis aspera	14	**64**	57	14					11
H	Ainsworthia trachycarpa	29	55	43	14					
H	Velezia rigida		55	29						
H	Scorpiurus muricatus		45	29						
H	Ononis mollis		45	43		27				
A	Bellevalia eigii		45	14					11	
V	Pennisetum asperifolium		36		14				22	11
B	Blepharis attenuata	14	63						11	
B	Heliotropium rotundifolium	14	36						11	
H	Carthamus glaucus		36	29						
H	Androcymbium palaestinum		36						11	
H	Orobanche aegyptiaca		27							
H	Asteriscus aquaticus		27	14						
R	Haplophyllum tuberculatum		27	14						
W	Lomelosia porphyroneura	14	27							
W	Reseda decursiva		18							11
W	Tordylium aegyptiacum		18	14						
H	Medicago rotata		18							
H	Senecio vernalis		18							
L	Centaurium tenuiflorum		18							
L	Galium hierochuntinum		9							
H	Bromus madritensis		9							
D	Hordeum glaucum		9							
A	Verbascum eremobium		9							
H	Rostraria smyrnacea		36	**86**	14	18		14		
H	Hedypnois cretica		55	**86**	14					
H	Convolvulus pentapetaloides	14		**71**						
H	Medicago minima		45	**71**	14					
H	Medicago truncatula	43	55	**71**	57					
V	Arenaria leptoclados		9	**71**						
W	Pterocephalus brevis	29	27	57		9				
W	Erodium neuradifolium		36	57						
B	Plantago bellardii	14	55	57	57					
H	Mercurialis annua	29	55	57	14					
H	Poa bulbosa			57		36				
W	Erucaria microcarpa			43		27		14		
V	Asterolinon linum-stellatum			43		9				

Table 34. continued.

		%P 1	%P 2	%P 3	%P 4	%P 5	%P 6	%P 7	%P 8	%P 9
B	Hyacinthella nervosa			43						
H	Callipeltis cucullaria	14	18	43	29					
W	Crithopsis delileana		9	43						
H	Campanula strigosa			43	29					
Q	Majorana syriaca	14		43						
H	Silene damascena		27	43		18				
H	Silene colorata			29						
B	Calendula palaestina		18	29						
A	Astragalus callichrous		9	29						
H	Papaver umbonatum		27	29						
H	Filago pyramidata	14	9	29	29	9				
H	Linum strictum		9	29	29					
B	Onopordum palaestinum	14		29	14					
N	Anthemis maris-mortui			29						22
V	Telmissa microcarpa	14		29		18				
W	Lamarckia aurea		9	29		18				
T	Scilla autumnalis			14						
T	Sideritis pullulans			14						
B	Eruca sativa		9	14						
D	Hirschfeldia incana		9	14						
H	Anthemis palestina			14						
A	Buglossoides arvensis			14						
H	Thymelaea gussonei			14						
H	Trifolium dasyurum			14						
H	Medicago polymorpha			14						
H	Lathyrus aphaca			14						
Q	Osyris alba			14						
T	Muscari parviflorum			14						
S	Salsola orientalis								11	
H	Valerianella vesicaria			14						
H	Vulpia ciliata		9	14						
H	Vulpia myuros		9	14						
W	Aizoon hispanicum			14						11
B	Phlomis brachyodon	43	18		29					
H	Centaurea iberica			14						
T	Sarcopoterium spinosum			14		9			11	
H	Avena sterilis	14	18	43	14					
H	Trifolium campestre			14		9				
H	Paronychia argentea					9				
H	Bromus lanceolatus					9				
V	Sedum palaestinum			14						
B	Factorovskya aschersoniana		9		100					
V	Periploca aphylla				100					22
W	Senecio glaucus	43	18	14	100	27				
H	Pimpinella cretica	43	27	29	100					22
H	Ranunculus asiaticus	29		43	100	45		86		
H	Pterocephalus plumosus		9	14	86	27				
W	Echium judaeum	14	82	71	86	18			11	
W	Aristida coerulescens	43	64	57	86	9			11	11
H	Sedum caespitosum				71					11
H	Theligonum cynocrambe				71					
Q	Ajuga chamaepitys	43	9	14	71	55	31		22	
H	Crepis sancta	14	27	57	71			57		
H	Gundelia tournefortii		9	29	71					
V	Pennisetum ciliare		27		57				11	44
H	Picris altissima		27	14	43					
B	Convolvulus dorycnium		18	14	43					
H	Erodium ciconium				43			14		
H	Carthamus tenuis	29		14	43					
H	Lotus peregrinus		18	14	29					
H	Lomelosia prolifera				14					
W	Lathyrus pseudocicera				14					

Table 34. continued.

		%P 1	%P 2	%P 3	%P 4	%P 5	%P 6	%P 7	%P 8	%P 9
H	Gynandriris sisyrinchium				14					
H	Anthemis hebronica				14					
V	Origanum dayi					100				
H	Asphodelus ramosus			14		73				
H	Piptatherum thomasii					64	15		11	
B	Astoma seselifolium					55	8		11	
V	Euphorbia ramonensis					55				
S	Salsola oppositifolia					36				
S	Atriplex halimus					36				
B	Phlomis platystegia					36				
B	Thymelaea hirsuta			14		36				
B	Allium erdelii					27				
W	Medicago radiata					27				
V	Astragalus amalecitanus					27	23			
V	Caralluma europaea					27	8			
S	Limonium pruinosum					27	15			
V	Stipa barbata					27				
W	Silene linearis					18				
W	Trigonella arabica					18				
Q	Sternbergia clusiana					18				
H	Papaver hybridum					18				
A	Allium artemisietorum					18				
A	Plantago phaeostoma					18				
N	Amberboa crupinoides					18				
B	Trisetaria macrochaeta					18				
V	Onobrychis ptolemaica					18				
V	Alcea rufescens					18				
V	Delphinium ithaburense					18				
V	Capparis spinosa					18				
R	Picris amalecitana					18				
S	Trigonella schlumbergeri					18				
W	Lappula spinocarpos					18		14		
W	Gastrocotyle hispida					18				
W	Papaver humile					18				
W	Matthiola livida					18	8			
V	Colutea istria					18	15			
H	Crupina crupinastrum		9			18				
H	Catapodium rigidum		9	14		18				
L	Parapholis incurva					9				
B	Verbascum fruticulosum					9				
A	Tulipa systola					9	8			
A	Urginea undulata					9				
W	Roemeria hybrida					9				
W	Scorzonera judaica					9				
A	Atractylis prolifera					9				
A	Achillea fragrantissima					9				
B	Eremostachys laciniata					9				
A	Haloxylon scoparium					9	8			
A	Crucianella membranacea					9				
B	Ajuga iva					9				
F	Stipagrostis ciliata					9				
H	Carduus acicularis					9				
H	Erodium cicutarium		9			9				
H	Helianthemum lasiocarpum					9				
R	Aegilops longissima					9				
H	Cynodon dactylon					9				
H	Gastridium ventricosum					9				
H	Pisum fulvum					9				
H	Scorzonera papposa					9				
R	Cutandia memphitica					9				
R	Ifloga spicata					9				
S	Mesembryanthemum nodiflorum					9				

Table 34. continued.

		%P 1	%P 2	%P 3	%P 4	%P 5	%P 6	%P 7	%P 8	%P 9
S	Reseda muricata					9				
V	Narcissus tazetta					9				
W	Allium ampeloprasum					9				
V	Stipa pellita					9				
W	Gagea reticulata					9				
W	Herniaria hirsuta					9				
H	Pistacia atlantica						**100**			
A	Helianthemum vesicarium					27	**92**			
V	Micromeria sinaica					55	**92**			
V	Stipa parviflora					45	**92**	43		
V	Paronychia sinaica					36	**85**			
B	Astragalus bethlehemiticus						**85**			
V	Pterocephalus pulverulentus						**77**			
V	Tanacetum santolinoides						**77**			
V	Dianthus sinaicus					27	**77**			
M	Fumana thymifolia					18	**69**			
A	Noaea mucronata					36	**62**		11	
V	Rhamnus disperma					27	54			
V	Convolvulus oleifolius					18	46			
V	Haplophyllum poorei						38			
A	Moricandia nitens						31	14		
V	Scrophularia xylorrhiza						31			
V	Origanum ramonense						23			
V	Amygdalus ramonensis						15			
T	Asphodeline lutea						15			
A	Astragalus sanctus					9	15	29		
H	Salvia palaestina						8			
V	Centaurea damascena						8			
Q	Allium neapolitanum			43		36		**100**	22	
V	Asparagus horridus					9	31	**100**		
H	Gagea chlorantha	29						**86**		
N	Anchusa milleri							**86**		44
W	Erodium touchyanum	43						**86**		33
S	Reaumuria hirtella					27	8	**71**		
W	Plantago coronopus	43			14			**71**		56
H	Helianthemum salicifolium		36	43	43	27		**71**		11
N	Anabasis articulata					27		**71**		**67**
W	Poa sinaica						8	**71**		
W	Erodium crassifolium					18		**71**		11
A	Centaurea aegyptiaca					18	8	**71**		
A	Salvia lanigera					27		57		
W	Atractylis phaeolepis					9	23	57		
N	Zygophyllum dumosum							57		56
H	Muscari commutatum							57	44	
W	Anthemis melampodina							43		
W	Helianthemum ledifolium						9		43	
W	Sisymbrium erysimoides		9					29		22
W	Carduus getulus							29		
T	Piptatherum miliaceum							29		
C	Farsetia aegyptia							29		
D	Notobasis syriaca							29		
H	Helianthemum aegyptiacum							14		
R	Atractylis carduus							14		
S	Agathophora alopecuroides					9		14		
V	Kickxia judaica							14	**100**	
V	Capparis aegyptia							14	**89**	44
H	Ferula communis								**67**	
V	Rhus tripartita								56	11
V	Cyclamen persicum								44	
V	Hyoscyamus aureus	14				9			44	
V	Silene grisea								44	
C	Ochradenus baccatus								44	22

Table 34. continued.

		%P 1	%P 2	%P 3	%P 4	%P 5	%P 6	%P 7	%P 8	%P 9
B	Euphorbia hierosolymitana				14				33	
B	Scrophularia xanthoglossa								33	
Q	Arum palaestinum								33	
Q	Prasium majus						8		33	
Q	Rhamnus lycioides								33	
C	Abutilon indicum								33	
V	Micromeria myrtifolia								33	
V	Asplenium ceterach						8		33	
V	Fibigia clypeata								22	
C	Lavandula pubescens								22	
V	Cheilanthes acrostica			14	14		8		22	
V	Cosentinia vellea								22	11
V	Valeriana dioscoridis								22	
V	Parietaria lusitanica		9						11	
V	Malcolmia chia								11	
Q	Rubia tenuifolia								11	
Q	Cynoglossum creticum								11	
H	Alcea setosa								11	
A	Malcolmia africana								11	
T	Tulipa agenensis								11	
L	Sonchus aspera								11	
C	Abutilon fruticosum									**100**
C	Hibiscus micranthus									**100**
C	Tricholaena teneriffae		45		14					**100**
V	Tetrapogon villosus		55							**89**
W	Aaronsohnia factorovskyi									**78**
C	Anvillea garcinii									**78**
W	Plantago ovata		55	43	14					**78**
H	Galium setaceum		45	43	14	9			11	**67**
W	Filago desertorum	29	27			9		43		**67**
N	Asteriscus hierochunticus							14		**67**
W	Trigonella stellata					27		57		**67**
C	Notoceras bicorne		**64**	29						67
W	Picris longirostris	29	45	29						56
N	Anabasis setifera									44
C	Aizoon canariense									44
S	Pteranthus dichotomus		18	14		9				44
C	Forsskaolea tenacissima									33
C	Lycium shawii									33
C	Asteriscus graveolens									33
C	Blepharis ciliaris		27							33
W	Schismus arabicus									22
W	Spergula fallax		9							22
C	Andrachne aspera									22
A	Fagonia mollis								11	22
C	Launaea nudicaulis					18				22
W	Trichodesma africana									11
C	Centaurea lanulata									11
C	Grewia villosa									11
C	Heliotropium arbainense									11
C	Ziziphus spina-christi									11
D	Chenopodium murale									11
C	Lavandula coronopifolia									11
W	Orobanche cernua									11
H	Polycarpon tetraphyllum									11
V	Enneapogon persicus									11
V	Iphiona maris-mortui									11
W	Cnicus benedictus									11
S	Salsola tetrandra									11
S	Spergularia diandra									11

Table 34. continued.

		%P 1	%P 2	%P 3	%P 4	%P 5	%P 6	%P 7	%P 8	%P 9
	d.s. Ballotetea undulatae									
B	Ballota undulata	100		57		82	85	100	56	
V	Phagnalon rupestre	100	55	14	86	55	92	100	67	11
B	Teucrium capitatum	86	82	86	86	55	92	57		
	d.s. Retametea and its orders									
R	Retama raetam	14		29	57	64	8	71	22	
Other species										
H	Bromus fasciculatus	100	64	71	86	18		29		11
H	Urospermum picroides	29	73	43	86	36			11	67
W	Stipa capensis	86	91	71	100	45	8	29	11	100
W	Anagallis arvensis	71	73	71	71	9		14		11
H	Biscutella didyma	100	73	43	86	9		100		
H	Plantago afra	86	100	86	100			71		33
W	Erucaria rostrata	100	82	57	57			71		100
W	Rumex cyprius	29	91	86	14	18		14	11	89
H	Pallenis spinosa	14	18		14	27		14		
D	Sonchus oleraceus	14	9	14		27			11	22
S	Salsola vermiculata	57	36	14		9	15	14	33	
A	Astragalus spinosus					36		29		

6.6 D Retametea raetam Eig 1939 ex Danin et Solomeshch class nov.

Diagnostical species: *Artemisia monosperma, Atractylis carduus, Cutandia memephitica, Cyperus macrorrhizus, Hormuzakia aggregata, Ifloga spicata, Lotus halophilus, Moltkiopsis ciliata, Neurada procumbens, Ononis serrata, Polycarpon succulentum, Pseudorlaya pumila, Retama raetam, Rumex pictus.*

Nomenclatural type: Retametalia raetam Eig 1939.

Synoptic tables: Tables 40, 47, 53 and 59.

Retametea raetam is an azonal class, divided into orders which are best correlated with climatic conditions. The order Retametalia raetam (DM) is that of the Mediterranean coastal sands. The sands of the western and northern Negev, in the area under 100-150 mm mean annual rainfall, support the associations of the Stipagrostio scopariae – Artemisietalia monospermae (DS). The sands of the Tertiary sedimentation basins near Dimona (Fig. 8) belong to the Stipagrostio plumosae – Anabasietalia articulatae (DA). They are situated in the bioclimatic zone of the transition between the Artemisietea sieberi and the Anabasietea articulatae. The sands of the extreme desert areas of the southern Negev and the Arava Valley differ floristically from the vegetation of the sands of Retametea raetam. They should be included in a different class which is not discussed in the present volume.

Whereas macro-climatic conditions were discussed above in relation to the subdivision of the class into orders, the syntaxa of lower hierarchical rank are best correlated with local edaphic conditions.

Eig (1939) distinguished a few syntaxa that are not included in Retametea raetam as we see it. Lotion cretici has the diagnostical species of Ammophiletea arenariae Br.-Bl. et R.Tx. ex Westhoff, Dijk et Passchier and is therefore discussed later (Sect. 6.7). The associations of the alliance Eragrostion bipinnatae, confined by Eig (1939) to soils developed on calcareous sandstones (Kurkar) and sandy-loam (Hamra), are hard to find at present. Intensive urbanization and agricultural development of the coastal plain led to almost complete destruction of these habitats. Further investigation is needed for evaluation of what is left from these habitats in the area studied by Eig and in the southern coastal plain that was not sufficiently studied.

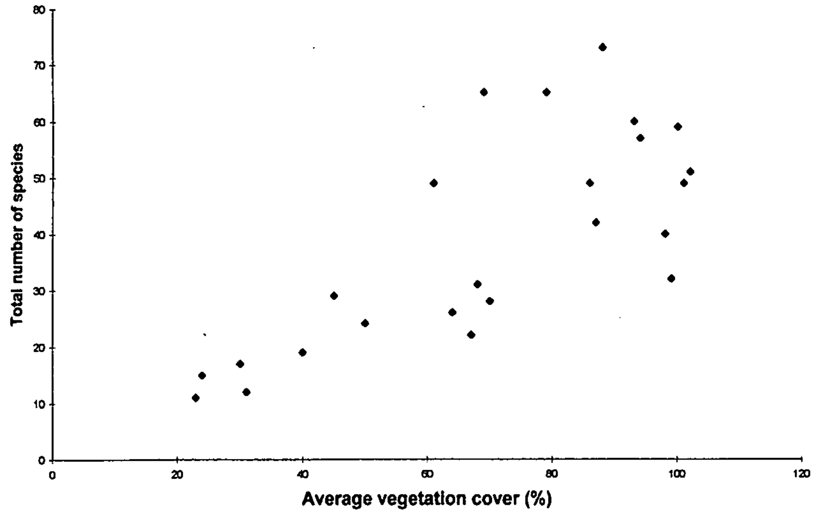

Figure 75. Relationships between vegetation cover and number of species in the associations of Retametalia raetam.

6.6.1 DM Retametalia raetam Eig 1939.

Diagnostical species of the order: *Crepis aculeata, Maresia pulchella, Senecio joppensis, Stipagrostis lanata.*
Nomenclatural type: Artemision monospermae Eig 1939.
Synoptic tables: Tables 40 and 47.

The order is divided into alliances which are mostly related to sand stability and texture. The first suborder Ammophilo – Artemisienalia monospermae comprises two alliances of associations of the first stages of plant succession on the sand dunes. The Artemision monospermae (DMA) includes the pioneer associations of the most mobile sand dunes. The associations are characterized by *Ammophila arenaria* which is the first colonizer of the mobile sand; it is accompanied by psammophytes alone. *A. arenaria* occupies similar habitats along beaches in many countries of the Mediterranean and Europe (Gehu, 1985) and as established alien in western USA (Breckon & Barbour, 1974).

The second stage of plant succession is of semishrubs resistant to sand cover and deflation (Danin & Yaalon, 1982; Danin, 1996). To this category belong most associations of the alliance Senecioni joppensis – Artemision monospermae (DMB). There are only psammophytes in the youngest associations whereas non-psammophytes are more than half of their components in the most developed and oldest associations. Humus formed below dense shrubs and air-borne dust trapped in their canopy and among the annuals eventually become incorporated into the soil, ameliorate the moisture and nutrients regimes, and enable the development of this vegetation composition.

The suborder Geranio robertiani – Artemisienalia monospermae includes alliances of advanced successional stages. Associations in the alliance Trifolio palaestini – Helianthemion stipulati (DMH) represent a later successional stage of higher sand stability which prevails over a longer period. The percentage of psammophytes is smaller here and the shade of *Retama raetam* shrubs is the main microhabitat where non-psammophytes get established. The alliance Phagnalo rupestri – Retamion raetam (DMR) is a more advanced stage of plant succession which comprises dense shrubby vegetation. Its associations support high number of species that are not psammophytes and grow also in the zonal Mediterranean vegetation. The most advanced associations have only remnants of the former psammophytes which gave place to the zonal vegetation.

An analysis of the relationships between total percentage of vegetation cover and the number of species of all the associations representing the succession of vegetation on the Mediterranean sands is presented in Fig. 75. The estimated correlation coefficient is positive, and is highly significant ($r= 0.7550$, $t_{22} = 5.4004$, $P = 6.3 \times 10^{-6}$). There are several points at the 100% vegetation cover which look like "noise" by having a low number of species. One has to remember that as succession proceeds, especially in its advanced stages, the formerly opened area becomes

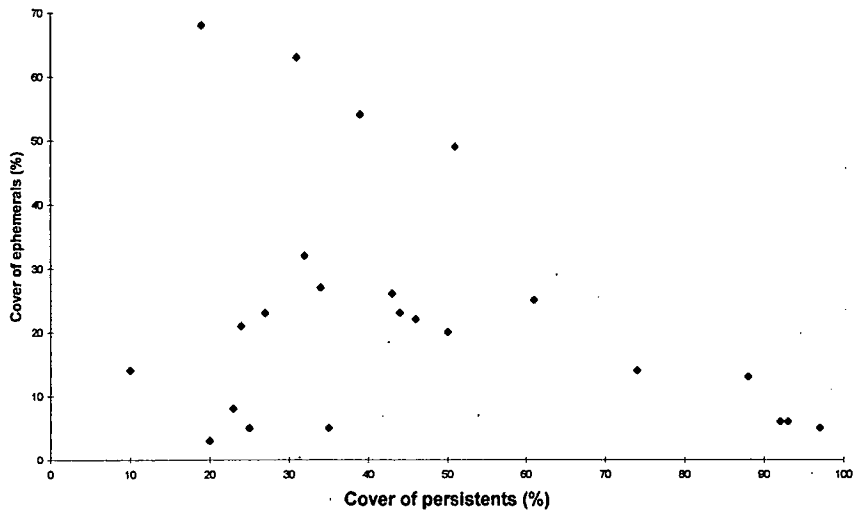

Figure 76. Relationships between the total cover of persistent and ephemeral species in the associations of Retametalia raetam.

densely populated by shrubs. These overshade much of the area, thus decreasing the number of species capable of growing in the area. Edaphic changes associated with changes in the vegetation were studied by Kutiel et al., (1979/80, 1987).

The relation between the cover of ephemeral species and that of persistents is presented in Fig. 76. The estimated correlation coefficient is negative, but not significant ($r= - 0.3170$, $t_{22} = -1.5678$, $P = 0.0656$). Apart from four, all associations constitute a curve which shows a low cover of the ephemerals at the beginning of succession when the resources are poor, increasing when the cover of persistent species increases and getting low again when persistents cover is high.

Sites where sand stability was disturbed, and are exposed to wind erosion support associations of the alliance Scrophularion hypericifoliae (DMS). This alliance displays an impoverished composition in comparison with Senecioni joppensis – Artemision monospermae as a result of the stress caused by wind erosion.

6.6.1.1 Ammophilo – Artemisienalia monospermae Danin et Solomeshch subord. nov.

Diagnostical species: *Launaea fragilis, Polygonum palaestinum.*

Nomenclatural type: Senecioni joppensis – Artemision monospermae Danin et Solomeshch.

6.6.1.1.1 DMA Artemision monospermae Eig 1939

Diagnostical species: *Ammoplila arenaria, Silene succulenta.*

Nomenclatural type: Cypero macrorrhizi – Ammophiletum arenariae Eig 1939.

Synoptic table: Table 40.

The associations of this alliance display a clear bimodal phytogeographical spectrum where M and SA are the most frequent chorotypes (Fig. 77). There are no Irano-Turanian or bi-regional M-IT species. This situation reflects the edaphic impact of the fresh sand before it passed pedogenetic processes including enrichment with air-borne dust (Danin & Yaalon, 1982). The xeric conditions enable the coexistence of Mediterranean plants adapted to sand, such as *Ammophila arenaria,* and Saharo-Arabian psammophytes such as *Artemisia monosperma.* During the succession, which is also reflected in the other alliances of Retametalia raetam, the proportion of Saharo-Arabian species decreases.

Ammophila arenaria, one of the dominants in communities of this alliance, is also typical for vegetation of the class Ammophiletea arenariae growing on coastal dunes. This alliance differes from communities of Ammophiletea by presence of many desert species diagnostical for the class Retametea raetam and by the absence of coastal species which in Israel can not grow in dunes that are not under the limiting factor of the sea spray.

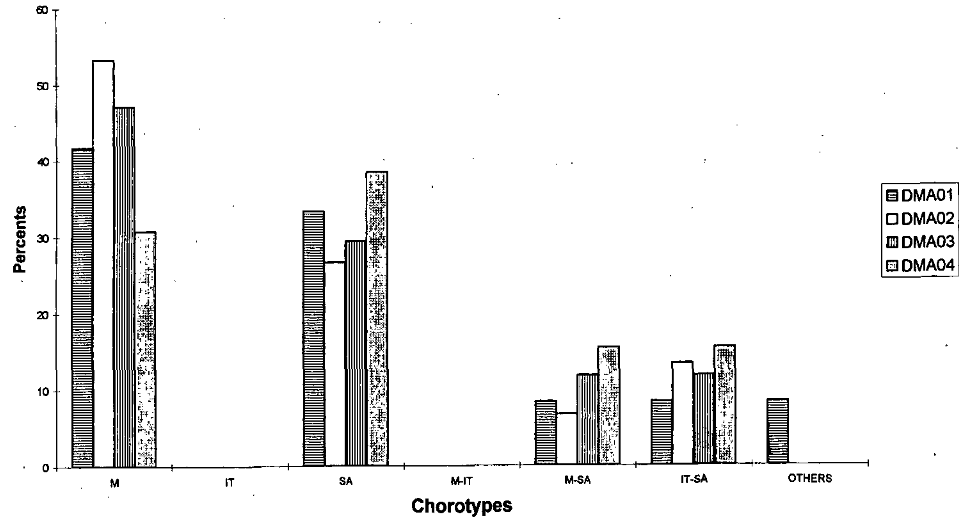

Figure 77. Phytogeographical analysis of associations DMA01-DMA04.

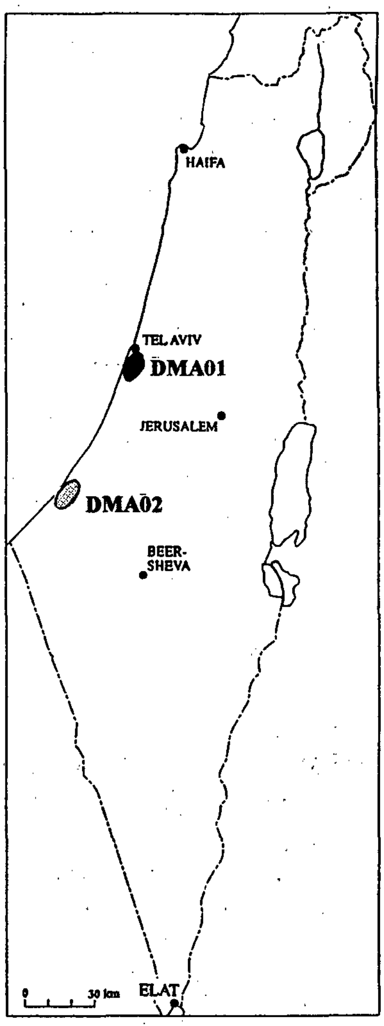

Figure 78. Distribution map of associations DMA01 and DMA02.

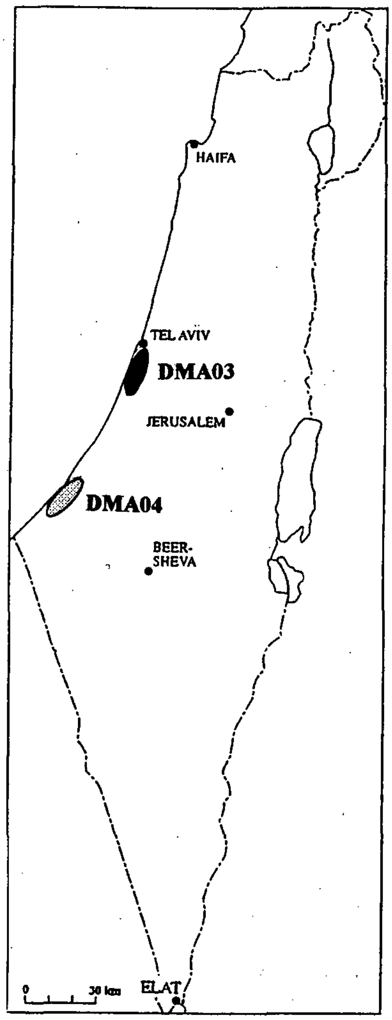

Figure 79. Distribution map of associations DMA03 and DMA04.

6.6.1.1.1.1 DMA01 Cypero macrorrhizi – Ammophiletum arenariae Eig 1939 nom. mut., nom. inv.

Syn.: Ammophila arundinaceañCyperus conglomeratus association Eig 1939.

Diagnostical species: the markers in table 35. **Distribution:** Fig. 78.

Ecological notes: The high mobility of the sand in this association as in the other associations of the alliance is indicated by the fact that all plants in the association are psammophytes. Even the alien perennial composite *Heterotheca subaxillaris,* which represent the special floristic features of this association, is a psammophyte. It was introduced from N America to Israel a few decades ago as a sand-binder and penetrated several sandy habitats since then. It is one of the only adventive species in the flora of Israel which penetrate into undisturbed habitats, thus out-competing the indigenous flora. It might have not arrived yet to its southern boundary or might be limited in mobile sand in Israel to stands which are north of a certain threshold. *Cyperus macrorrhizus* (known in the past as *C. conglomeratus* which does not grow in Israel according to Danin & Kukkonen, 1995) was used as a characteristic species for mobile sand association by Eig (1946).

Association dynamics and conservation: Most of the area of this association is endangered by building urban areas over the last dunes of the coastal plain and by illegal digging and quarrying of fresh sand.

Aspects of the association: Persistents – 7 spp.; ephemerals – 5 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96069	5	20	8	28.02.96	I 1775 6538
2	96070	2	20	5	28.02.96	I 1775 6539
3	96071	2	18	6	28.02.96	I 1776 6538
4	96072	2	18	7	28.02.96	I 1776 6539
5	96073	3	17	7	28.02.96	I 1775 6537
6	96074	2	18	6	28.02.96	I 1775 6536
7	96075	3	27	7	28.02.96	I 1776 6536
Average:		2.7	19.7	6.6		

Table 35. Association tables of DMA01 – Cypero macrorrhizi – Ammophiletum arenariae and DMA02 – Cutando memphiticae – Ammophiletum arenariae

			DMA01				DMA02		
		1234567	C1	C2	%P	*12345678	C1	C2	%P
* E	Alkanna tinctoria					......1.	10	1	13
* R	Ammophila arenaria	9998999	**92**	**92**	**100**	49999978	**85**	**85**	**100**
* R	Artemisia monosperma	0..0..0	4	2	43	00	5	1	25
* R	Atractylis carduus					......1.	15	2	13
* F	Centropodia forsskalii					6.......	60	8	13
R	Cutandia memphitica	5421111	**21**	**21**	**100**	.3.31310	**22**	**16**	**75**
* R	Cyperus capitatus	.....0.	3	0	14				
* R	Cyperus macrorrhizus	+00..0.	2	1	57				
* R	Echinops philistaeus					0	6	1	13
* D	Heterotheca subaxillaris	...1+30	11	6	57				
R	Ifloga spicata					...14321	**25**	**16**	**63**
R	Launaea fragilis	1	10	1	14	...2..23	27	10	38
R	Polycarpon succulentum	0++.+..	1	1	57	43..022.	**24**	**15**	**63**
* R	Polygonum palaestinum	..0.1..	7	2	29	4.......	40	5	13
R	Rumex pictus					......1.	15	2	13
* R	Scrophularia hypericifolia	0..0...	5	1	29				
R	Senecio joppensis	4688968	**71**	**71**	**100**	.39342.4	**44**	**33**	**75**
* Y	Silene succulenta	0..0+.0	3	1	57	2..0....	13	3	25
R	Trisetaria koelerioides					...0....	5	1	13

6.6.1.1.1.2 DMA02 Cutando memphiticae – Ammophiletum arenariae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 30. **Distribution:** Fig. 78.

Ecological notes: All plants in this association are psammophytes as in DMA01, indicating high sand mobility. *Cyperus macrorrhizus, C. capitatus* and *Heterotheca subaxillaris*, important companions of DMA01 are missing here. Other psammophytes accompany *Ammophila arenaria* in this association typifying one of the last assemblages of companions of *A. arenaria* before it is replaced towards the arid zone of N. Sinai and the W. Negev by the sand-binder *Stipagrostis scoparia*.

Association dynamics and conservation: The dynamical aspects of this association and its related associations between 1945 and 1990 are discussed at length by Danin & Nokrian (1991).

Aspects of the association: Persistents – 8 spp. ephemerals – 7 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	91017	1	1	5	25.02.91	I15776092
2	91021	1	9	4	25.02.91	I15776090
3	91022	2	28	2	25.02.91	I15786090
4	91023	3	17	7	25.02.91	I15796090
5	91024	10	90	5	25.02.91	I15766090
6	91025	10	5	5	25.02.91	I15776091
7	91026	20	20	9	25.02.91	I15776092
8	91027	6	59	7	25.02.91	I15776093
Average:		6.6	28.6	5.5		

6.6.1.1.1.3 DMA03 Scrophulario hypericifoliae – Ammophiletum arenariae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 36. **Distribution:** Fig. 79.

Ecological notes: This association displays a more drought resistant type of vegetation as indicated by the absence of *Cyperus capitatus* which grows in DMA01 and by the presence of *Centropodia forsskalii* which grows on mobile or stabilizing sand even in extreme desert areas (Danin, 1996). *Echinops philistaeus, Corynephorus divaricaus* indicate that this association is developed on slightly more stable sand than DMA01 and DMA04. In a similar way to DMA01, all species of this association are psammophytes of either Retametalia, of desert sands or of the spray zone (*Silene succulenta).*

Association dynamics and conservation: endangered as discussed in DMA01.

Aspects of the association: Persistents – 8 spp.; ephemerals – 9 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96167	10	20	14	02.04.96	I 2049 6109
2	96168	5	20	13	02.04.96	I 2048 6109
3	96169	5	30	9	02.04.96	I 2048 6110
4	96170	2	28	8	02.04.96	I 2048 6111
5	96171	1	20	6	02.04.96	I 2048 6112
6	96172	5	25	8	02.04.96	I 2047 6112
7	96173	5	25	8	02.04.96	I 2047 6113
8	96174	5	30	9	02.04.96	I 2048 6113
Average:		4.8	24.8	9.4		

Table 36. Association tables of DMA03 – Scrophulario hypericifoliae – Ammophiletum arenariae and DMA04 – Centropodio forsskali – Ammophiletum arenariae

			DMA03				DMA04		
		*12345678	C1	C2	%P	*123456	C1	C2	%P
*	R Ammophila arenaria	87788878	79	79	100	676664	58	58	100
*	R Artemisia monosperma	11.+0..0	7	4	63	323234	28	28	100
*	F Centropodia forsskalii	+++0+..+	1	1	75	1.10+1	8	7	83
	R Corynephorus divaricatus	..1..+..	5	1	25				
	R Cutandia memphitica	+++21111	8	8	100	563745	51	51	100
*	R Cyperus macrorrhizus	10.....+	5	2	38	+++010	3	3	100
*	R Echinops philistaeus	+0.0....	3	1	38				
	R Ifloga spicata	2.1..+0.	11	6	50	..0..+	3	1	33
	R Launaea fragilis	++......	0	0	25				
	R Maresia pulchella	+.......	0	0	13				
	R Polycarpon succulentum	011..300	11	8	75	+13+1+	8	8	100
*	R Polygonum palaestinum	+0...01.	5	3	50	.++.++	0	0	67
	R Rumex pictus	01......	8	2	25	.+....	0	0	17
*	R Scrophularia hypericifolia	..301111	15	11	75	...1+.	5	2	33
	R Senecio joppensis	68689688	74	74	100	533345	39	39	100
*	Y Silene succulenta	+++.....	0	0	38	...++.	0	0	33
	R Trisetaria linearis	.+.+..00	3	1	50	..0++.	2	1	50

6.6.1.1.1.4 DMA04 Centropodio forsskali – Ammophiletum arenariae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 36. **Distribution:** Fig. 79.

Phytogeographical analysis: The analysis of the list of species of this association indicates a higher percentage of Saharo-Arabian species, which means a more xeric spectrum than in the two preceding associations.

Ecological notes: In a similar way to DMA01, all species of this association are psammophytes of either Retametalia, of desert sands, or of the spray zone.

Association dynamics and conservation: endangered as discussed in DMA01.

Aspects of the association: Persistents – 7 spp.; ephemerals – 6 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96130	1	5	7	31.03.96	I 2159 6309
2	96131	1	9	8	31.03.96	I 2159 6308
3	96132	10	10	10	31.03.96	I 2159 6307
4	96133	5	15	10	31.03.96	I 2158 6307
5	96134	2	13	11	31.03.96	I 2158 6308
6	96135	1	9	9	31.03.96	I 2158 6309
Average:		3.3	10.2	9.2		

6.6.1.1.2 DMB Senecioni joppensis – Artemision monospermae Danin et Solomeshch all. nov.

Diagnostical species of alliance: *Corynephorus divaricatus, Echium angustifolium, Hormuzakia aggregata.*

Nomenclatural type: Centropodio forsskali – Artemisietum monospermae Danin et Solomeshch.

Synoptic table: Table 40.

Associations of this alliance represent the second stage in sand stabilization via succession. *Artemisia monosperma* is a Saharo-Arabian species which dominates the sandy soils due to the edaphic impact on moisture regime. In a similar way many other Saharo-Arabian companions have their influence on the phytogeographical spectrum of all associations in this alliance. In most associations of this alliance the M chorotype has the highest frequency and the SA is second. However, differing from the alliance DMA, there is a considerable contribution of additional chorotypes such as M-IT, M-SA, and IT-SA (Figs. 80 and 81). This change may be explained by the edaphic changes

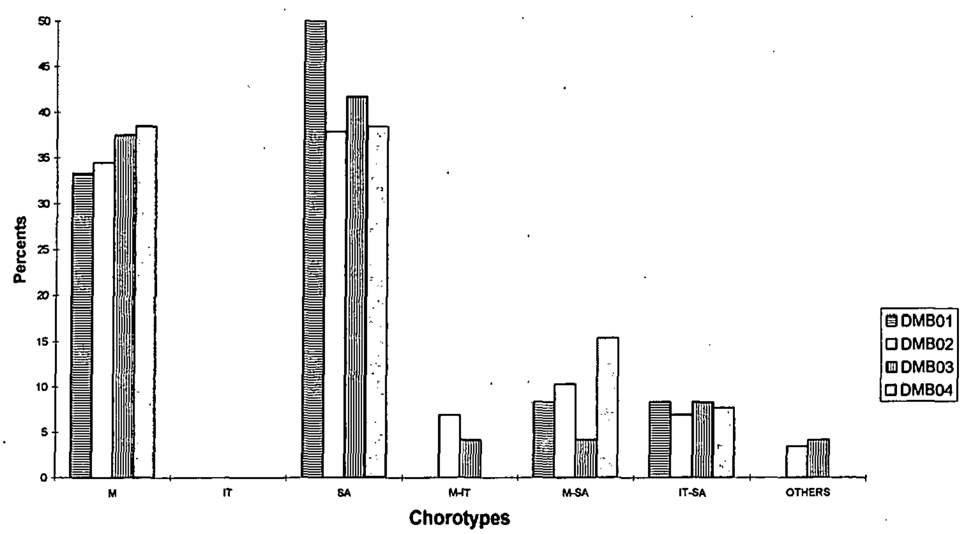

Figure 80. Phytogeographical analysis of associations DMB01-DMB04.

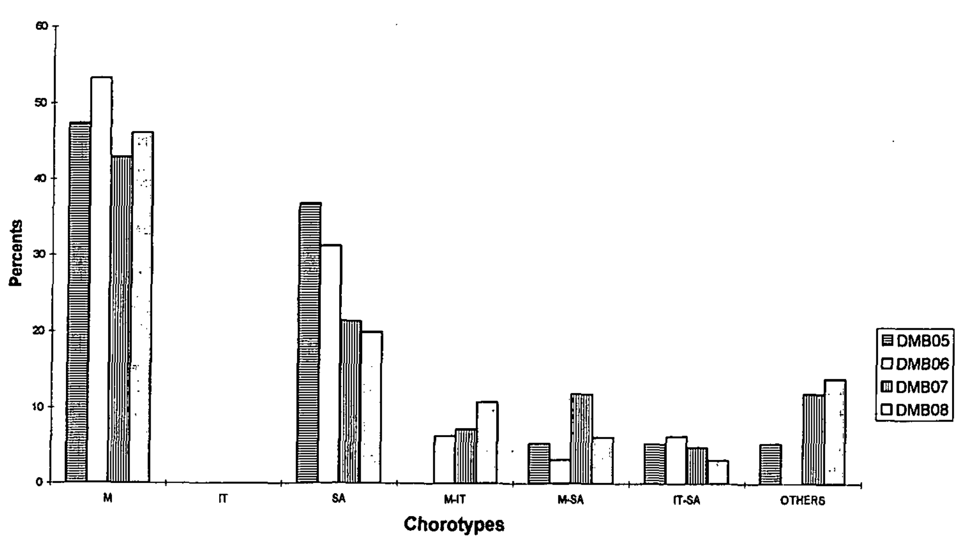

Figure 81. Phytogeographical analysis of associations DMB05-DMB08.

through plant succession (Danin & Yaalon, 1982) which enable species from a wider ecological range to grow together. There is also less movement of sand because of more effective obstacle to wind passing in the canopy of vegetation. Plants of the first stage (DMA associations) are adapted to sand accretion, have an opened canopy and do not interfere much with wind velocity (Danin, 1996). At the more advanced stage, where *Artemisia monosperma* and other plants of the second stage dominate, wind velocity at the ground surface is decreased and air-borne dust can be trapped in the vegetation and remain in the stand. The minute changes of moisture holding capacity associated with the textural changes enable colonizing cyanobacteria to form microbiotic crust which efficiently increases sand stability. These changes promote the development of higher plants which could not establish themselves under the conditions of mobile sand. The number of species in these associations is therefore higher than that of the Artemision monospermae associations (DMA) and the percentage of psammophytes becomes lower than 100 %. As the general number of species during the psammosere in Israel was found to be correlated with amelioration of the sandy environment (Danin, 1978a, Danin & Yaalon, 1982; Sect. 6.6.1.1) the order of associations in the alliance follows this parameter. Another parameter used in the organization of associations in this and the alliances DMR and

DMH is the percentage of psammophytes (sociotypes R and F and psammophytes among species of Y). The order is reflected also in the gradual increase of the Mediterranean chorotype (M) from DMB01 to DMB04 (Fig. 80) and the gradual decrease of the Saharo-Arabian chorotype (SA) from DMB05 to DMB08 (Fig. 81).

6.6.1.1.2.1 DMB01 Polygono palaestini – Artemisietum monospermae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 37. **Distribution:** Fig. 82.

Phytogeographical analysis (Fig. 80): The most frequent chorotype in this association is the Saharo-Arabian, its value is even higher than that of the Mediterranean species.

Ecological notes: Sand is still mobile in the stands of this association as can be testified by ripples on the sand surface (Danin, 1996), and by the dominance of *Artemisia monosperma* and *Polygonum palaestinum* which are adapted to sand accretion and deflation. Additional indicator is the list of species where most are psammophytes except for *Ephedra aphylla* which grows in desert rocks. In the Mediterranean territory it is mostly a psammophyte. Supplementary indicator is the wealth of annuals of mobile sand, such as *Cutandia memphitica* and *Polycarpon succulentum,* and of plants of almost stable sand but poor in fine-grained particles such as *Senecio joppensis* and *Maresia pulchella.* The only place in Israel where a road-sign warning from sand covering the road exists is at the place where a dune covered by this association crosses road No. 2, a few hundred meters north of Caesarea interchange.

Association dynamics and conservation: Most of the area of this association is under constant process of sand stabilization. It is not influenced by human activity due to its proximity to road No. 2.

Aspects of the association: Persistents – 7 spp.; ephemerals – 5 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96023	10	20	10	23.02.96	I 2415 7092
2	96024	10	20	9	23.02.96	I 2415 7091
3	96025	5	25	6	23.02.96	I 2416 7092
4	96026	10	40	6	23.02.96	I 2416 7091
5	96027	5	25	6	23.02.96	I 2417 7092
6	96028	10	20	8	23.02.96	I 2417 7091
7	96029	5	20	7	23.02.96	I 2415 7093
8	96030	5	15	7	23.02.96	I 2416 7093
Average:		7.5	23.1	7.4		

Table 37. Association tables of DMB01 – Polygono palaestini – Artemisietum monospermae and DMB02 – Centropodio forsskali – Artemisietum monospermae

			DMB01				DMB02			
			*12345678	C1	C2	%P	*12345678901234	C1	C2	%P
*	R	Ammophila arenaria					.......+.+....	0	0	14
*	R	Artemisia monosperma	98999889	**89**	**89**	**100**	48768797656667	**66**	**66**	**100**
*	R	Atractylis carduus					+++.+......+..	0	0	36
*	F	Centropodia forsskalii					2122120+011++.	**11**	**10**	**93**
	R	Corynephorus divaricatus					.......++.1210	8	3	43
	R	Crepis aculeata					3673433.+.....	36	21	57
	R	Cutandia memphitica	+0211424	**18**	**18**	**100**	+1+3+12++.+210	**8**	**8**	**93**
*	R	Cyperus capitatus	++......	0	0	25				
*	R	Cyperus macrorrhizus					+++0+++101100+	**4**	**4**	**100**
*	R	Echiochilon fruticosum	..0.....	5	1	13	.+........+...	0	0	14
*	H	Echium angustifolium					..+..+........	0	0	14
*	V	Ephedra aphylla	0.......	5	1	13				
	R	Erodium laciniatum					+..+..........	0	0	14
*	D	Heterotheca subaxillaris					+++++.+.......	0	0	43
	R	Hormuzakia aggregata					.++0..++++..++	**1**	**0**	**64**

Table 37. continued.

		DMB01				DMB02			
		12345678	C1	C2	%P	12345678901234	C1	C2	%P
R	Ifloga spicata					11021324375655	**33**	**33**	**100**
R	Lotus halophilus					.++.....+..+.+	0	0	36
R	Maresia pulchella	+11+++3+	**6**	**6**	**100**	..++.+........	0	0	21
* R	Moltkiopsis ciliata					++01++........	3	1	43
R	Neurada procumbens					...+..........	0	0	7
R	Polycarpon succulentum	10++1111	**7**	**7**	**100**	1+.+++++++.1+	**2**	**2**	**86**
* R	Polygonum palaestinum	+1111110	**9**	**9**	**100**	......++.1.101	6	3	43
R	Pseudorlaya pumila					........++....	0	0	14
* R	Retama raetam	0+...00.	3	2	50	..++.+...+....	0	0	29
R	Rumex pictus					1.0.0+212110.1	**10**	**8**	**79**
* L	Scirpus holoschoenus					..+...........	0	0	7
* R	Scrophularia hypericifolia					2322231	21	11	50
R	Senecio joppensis	98798545	**69**	**69**	**100**	31214115523.33	**27**	**25**	**93**
* Y	Silene succulenta	.....+.+	0	0	25				
R	Silene villosa	+.......	0	0	13				
* R	Stipagrostis lanata					3100100.......	10	5	50
R	Trisetaria linearis					...........++.	0	0	14
H	Urospermum picroides					........+.....	0	0	7

6.6.1.1.2.2 DMB02 Centropodio forsskali – Artemisietum monospermae Danin et Solomeshch ass. nov.
Diagnostical species: the markers in table 37. **Distribution:** Fig. 82.

Ecological notes: The psammophytes account here for 90 % of the species. The few non-psammophytes which occur here in small quantities include *Scirpus holoschoenus,* a hydrophyte which belongs to the wet local superficial aquifer formed by clayey soil covered by the mobile sand (which is stable now).

Association dynamics and conservation: Most of the area of this association is under constant extinction as a result of urbanization.

Aspects of the association: Persistents – 13 spp.; ephemerals – 16 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96076	20	30	14	28.02.96	I 2204 6393
2	96077	20	20	16	28.02.96	I 2205 6394
3	96078	30	25	18	28.02.96	I 2205 6395
4	96079	30	20	16	28.02.96	I 2206 6396
5	96080	20	30	13	28.02.96	I 2206 0397
6	96081	20	30	14	28.02.96	I 2207 6398
7	96082	20	30	13	28.02.96	I 2208 6399
8	96117	20	20	13	31.03.96	I 2174 6306
9	96118	20	20	15	31.03.96	I 2173 6306
10	96119	20	15	13	31.03.96	I 2173 6307
11	96120	15	25	11	31.03.96	I 2173 6308
12	96121	25	25	12	31.03.96	I 2174 6308
13	96122	20	30	12	31.03.96	I 2175 6305
14	96123	20	20	12	31.03.96	I 2175 6304
Average:		21.4	24.3	13.7		

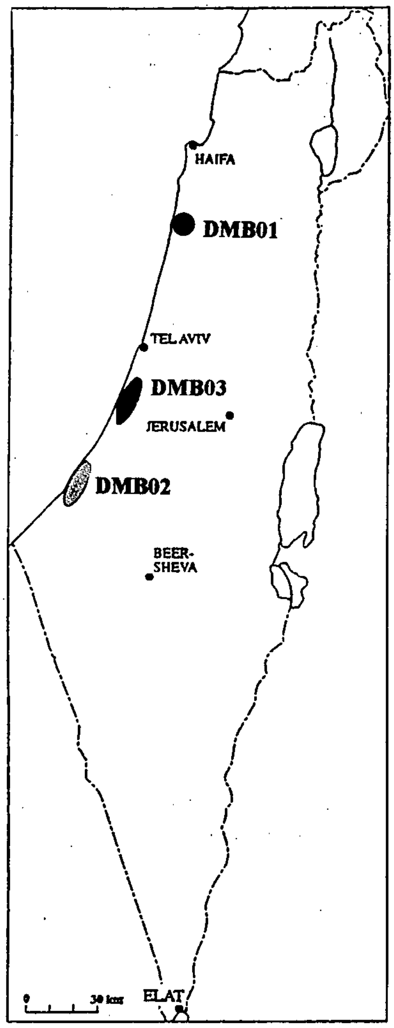

Figure 82. Distribution map of associations DMB01-DMB03.

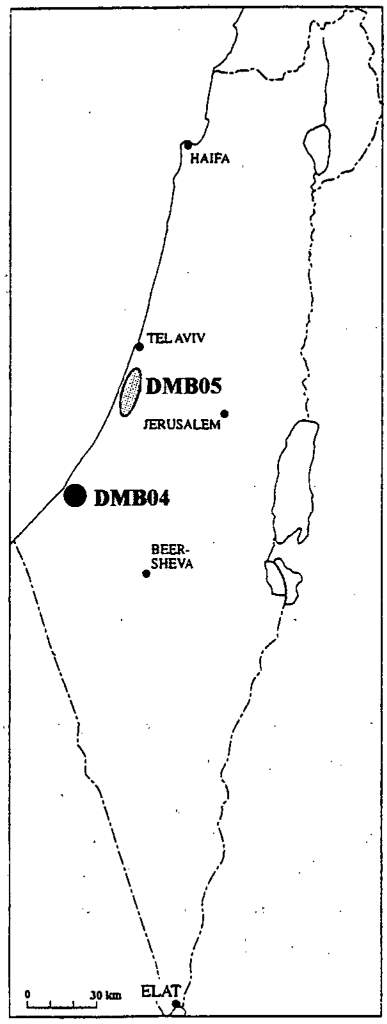

Figure 83. Distribution map of associations DMB04 and DMB05

6.6.1.1.2.3 DMB03 Stipagrostio lanatae – Artemisietum monospermae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 38. **Distribution:** Fig. 82.

Ecological notes: The most frequent group of companions in this association is that of the Retametea raetam (R). Altogether psammophytes contribute 85 % of the species in the association, thus indicating the early stage of succession to which it belongs.

Association dynamics and conservation: Most of the area of this association is under constant extinction as a result of urbanization.

Aspects of the association: Persistents – 11 spp.; ephemerals – 13 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96068	20	30	11	27.02.96	I 2221 6447
2	96076	20	30	14	28.02.96	I 2204 6393
3	96077	20	20	16	28.02.96	I 2205 6394
4	96078	30	25	18	28.02.96	I 2205 6395
5	96079	30	20	16	28.02.96	I 2206 6396
6	96080	20	30	13	28.02.96	I 2206 6397
7	96081	20	30	14	28.02.96	I 2207 6398
8	96082	20	30	13	28.02.96	I 2208 6399
Average:		22.5	26.9	14.4		

Table 38. Association tables of DMB03 – Stipagrostio lanatae – Artemisietum monospermae, DMB04 – Senecioni joppensis – Ononidetum natricis subsp. stenophyllae, and DMB05 – Echinopo philistaei - Artemisietum monospermae

			DMB03				DMB04				DMB05			
			*12345678	C1	C2	%P	*1234567	C1	C2	%P	*1234567	C1	C2	%P
*	R	Ammophila arenaria					22110..	15	10	71	+..+...	0	0	29
*	R	Artemisia monosperma	04876879	62	62	100	.221..2	19	11	57	4357646	50	50	100
*	V	Asparagus horridus									...+...	0	0	14
*	R	Atractylis carduus	.+++.+..	0	0	50	.....0.	7	1	14				
*	E	Centaurea procurrens	+.......	0	0	13								
*	F	Centropodia forsskalii	32122120	18	18	100	0.3..1.	17	7	43	+000+0+	3	3	100
	R	Corynephorus divaricatus					...2...	20	3	14				
	R	Crepis aculeata	13673433	38	38	100					24111.2	19	16	86
	H	Crepis sancta									.....3.	30	4	14
	R	Cutandia memphitica	.+1+3+12	10	9	88					4445545	45	45	100
*	R	Cyperus macrorrhizus	++++0+++	1	1	100	1.1.111	12	9	71	+++++++	0	0	100
*	R	Echinops philistaeus					111.10.	10	7	71	3122220	18	18	100
*	R	Echiochilon fruticosum	..+.....	0	0	13								
*	H	Echium angustifolium	...+..+.	0	0	25	.0..0..	5	1	29				
	R	Erodium laciniatum	.+..+...	0	0	25								
*	R	Helianthemum stipulatum									..+....	0	0	14
*	D	Heterotheca subaxillaris	.+++++.+	0	0	75								
	R	Hormuzakia aggregata	..++0..+	1	1	50	.1...1.	10	3	29				
	R	Ifloga spicata	51102132	19	19	100	1.341..	23	13	57	0++011.	5	4	86
*	L	Imperata cylindrica					1..3101	14	10	71				
	R	Launaea fragilis					.5..638	58	33	57	......+	0	0	14
	R	Lotus halophilus	1.++....	3	1	38	.2.....	20	3	14	0.+++..	1	1	57
	R	Maresia nana									+++++0+	1	1	100
	R	Maresia pulchella	1..++.+.	3	1	50								
*	R	Moltkiopsis ciliata	.++01++.	3	2	75								
	R	Neurada procumbens	....+...	0	0	13	5....3.	45	13	29				
*	B	Ononis natrix					.344634	41	35	86	+11..+1	6	4	71
	R	Polycarpon succulentum	.1+.++++	3	2	75	0	5	1	14	+1+.+++	2	1	86
*	R	Polygonum palaestinum	.......+	0	0	13	0....11	13	5	43	00++..+	2	1	71
	R	Pseudorlaya pumila									.+.....	0	0	14
*	R	Retama raetam	0..++.+.	1	1	50					+11.+30	9	8	86
	R	Rumex pictus	21.0.0+2	11	8	75								
	F	Schimpera arabica									....+..	0	0	14
*	L	Scirpus holoschoenus	...+....	0	0	13								
*	R	Scrophularia hypericifolia									22+0102	12	12	100
	R	Senecio joppensis	.3121411	19	17	88	3244301	25	25	100	3043313	25	25	100
	R	Silene modesta									++++++.	0	0	86
*	Y	Silene succulenta									......+	0	0	14
*	C	Solanum sinaicum									.+.....	0	0	14
*	R	Stipagrostis lanata	63100100	17	17	100	01.0.10	7	5	71	.00+0.+	3	2	71

6.6.1.1.2.4 DMB04 Senecioni joppensis – Ononidetum natricis subsp. stenophyllae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 38. **Distribution:** Fig. 83.

Ecological notes: The habitat of this association is stabilizing sand which covers sandstone and ancient soils (Danin & Nokrian, 1991). The psammophytes account for 84% of the species in this association. There is a possibility that the dominance of *Ononis natrix* subsp. *stenophylla* in most relevés is related to some specific local edaphic conditions.

Association dynamics and conservation: Most of the area of this association is protected from trampling, grazing, and cutting for the last 2-3 decades (Danin & Nokrian, 1991).

Aspects of the association: Persistents – 10 spp.; ephemerals – 9 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	91031	2	38	10	25.02.91	I 1577 6090
2	91032	3	27	10	25.02.91	I 1578 6090
3	91033	3	22	8	25.02.91	I 1579 6090
4	91034	3	42	8	25.02.91	I 1576 6090
5	91035	8	32	9	25.02.91	I 1577 6091
6	91036	13	32	12	25.02.91	I 1577 6092
7	91037	6	49	9	25.02.91	I 1577 6093
Average:		5.4	34.6	9.4		

6.6.1.1.2.5 DMB05 Echinopo philistaei – Artemisietum monospermae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 38. **Distribution:** Fig. 83.

Ecological notes: The sandy nature of this habitat is expressed by the presence of 80% psammophytes. The non-psammophytes are plants which grow at the shade of old shrubs which had sufficient time to accumulate humus and fine-grained particles. The changes in the soil properties are expressed by the presence of plants such as *Solanum sinaicum* which is limited in its distribution in Israel to this kind of habitat in the coastal plain. Its quantities increase at later stages of the succession. In Sinai this plant is growing in wadis of warm desert areas.

Association dynamics and conservation: Most of the area of this association is under constant process of extinction because of urbanization.

Aspects of the association: Persistents – 13 spp.; ephemerals – 13 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96052	40	20	17	27.02.96	I 2306 6554
2	96053	20	40	18	27..02.96	I 2305 6554
3	96054	30	20	18	27.02.96	I 2304 6555
4	96055	30	30	16	27.02.96	I 2303 6555
5	96056	40	30	16	27.02.96	I 2299 6556
6	96057	30	40	14	27.02.96	I 2298 6557
7	96058	30	45	16	27.02.96	I 2299 6558
Average:		31.4	32.1	16.4		

6.6.1.1.2.6 DMB06 Launaeo fragilis – Artemisietum monospermae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 39. **Distribution:** Fig. 83

Ecological notes: The psammophytes account here for only 71 % of the species. The nine non-psammophytes which occur here include the hydrophyte *Dittrichia viscosa* which plays the same role as *Scirpus holoschoenus* in DMB05. Other species which may be using these ameliorated edaphic conditions are plants which occur on sand in later stages of succession (Danin & Yaalon, 1982), e.g., *Phagnalon rupestre, Aetheorhiza bulbosa,* and *Calicotome villosa.* The combination of changes at the surface texture with the texture of deep soil layers enable the progress of the tendency of psammophyte replacement with non-psammophytes.

Association dynamics and conservation: Most of the area of this association is protected from trampling, grazing, and cutting for the last 2-3 decades (Danin & Nokrian, 1991).

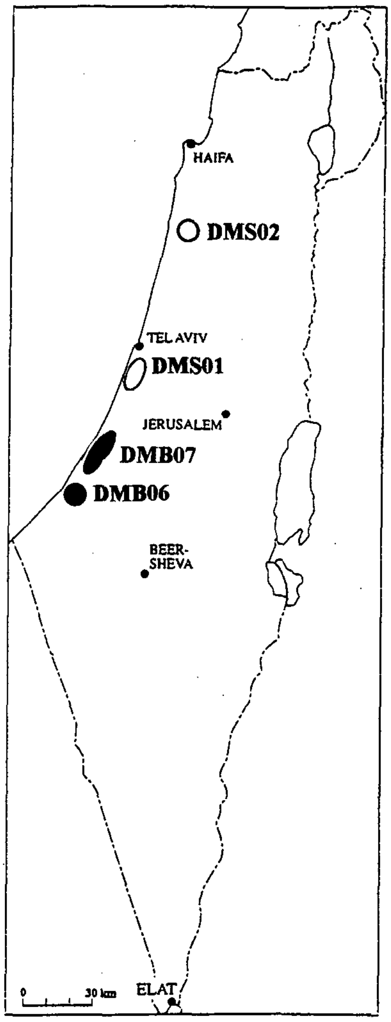

Figure 84. Distribution map of associations DMB06, DMB07, DMS01, and DMS02.

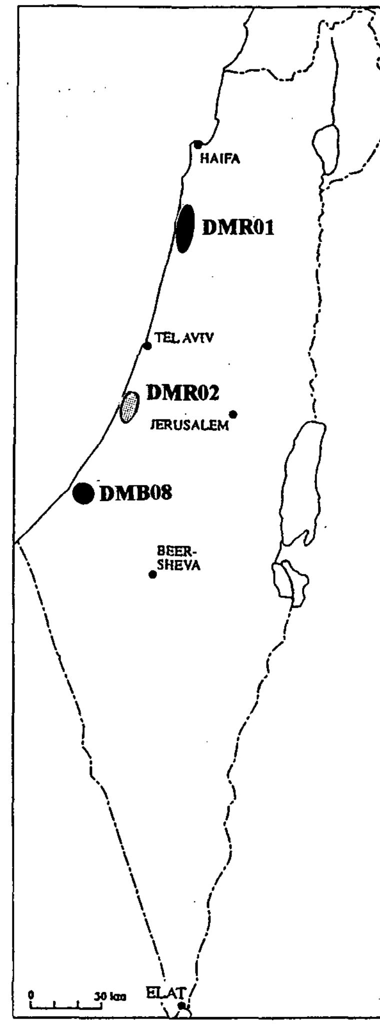

Figure 85. Distribution map of associations DMB08, DMR01, and DMR02.

Aspects of the association: Persistents – 15 spp.; ephemerals – 16 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	91051	10	40	11	25.02.91	I 1573 6093
2	91052	5	45	10	25.02.91	I 1573 6094
3	91053	6	74	9	25.02.91	I 1573 6095
4	91054	0	60	9	25.02.91	I 1573 6096
5	91055	9	51	11	25.02.91	I 1574 6093
6	91056	12	65	15	25.02.91	I 1574 6094
7	91057	9	76	14	25.02.91	I 1574 6095
8	91061	72	18	8	25.02.91	I 1575 6093
9	91062	72	13	9	25.02.91	I 1575 6094
10	91063	24	16	7	25.02.91	I 1576 6095
Average:		21.9	45.8	10.3		

Table 39. Association tables of DMB06 – Launaeo fragilis – Artemisietum monospermae, DMB07 Echio angustifoliae – Artemisietum monospermae, and DMB08 – Convolvulo lanati – Artemisietum monospermae

			DMB06 *1234567890	C1	C2	%P	DMB07 *123456	C1	C2	%P	DMB08 *1234567	C1	C2	%P
	Q	Aetheorhiza bulbosa	.....3....	30	3	10					...0...	5	1	14
*	E	Alkanna tinctoria	......0...	2	0	10								
	W	Anagallis arvensis					.....+	0	0	17	....+..	0	0	14
	V	Arenaria leptoclados					....+.	0	0	17	......+	0	0	14
*	R	Artemisia monosperma	7552444445	**45**	**45**	**100**	777666	**65**	**65**	**100**	5677887	**69**	**69**	**100**
*	V	Asparagus horridus					.+....	0	0	17	.+++..+	0	0	57
	H	Asphodelus ramosus									......+	0	0	14
	W	Asphodelus tenuifolius									.++..0+	1	1	57
	R	Astragalus annularis					.....+	0	0	17				
	R	Astragalus fruticosus									.+....+	0	0	29
	R	Astragalus peregrinus									.....+.	0	0	14
*	R	Atractylis carduus									+.+++.+	**0**	**0**	**71**
	H	Avena barbata									.++...+	0	0	43
	H	Avena sterilis									..9....	90	13	14
	E	Bilacunaria boissieri									..+....	0	0	14
	H	Biscutella didyma									.+..+..	0	0	29
	H	Brachypodium distachyon					.....+	0	0	17				
	R	Brassica tournefortii					.+....	0	0	17				
	H	Bromus rigidus					14.+++	**10**	**8**	**83**	..+..+.	0	0	29
*	Q	Calicotome villosa	.....0....	8	1	10								
	E	Campanula sulphurea									++1114.	**12**	**10**	**86**
*	E	Centaurea procurrens					.+..0.	3	1	33	.+++...	0	0	43
*	F	Centropodia forsskalii	1..93..132	**34**	**20**	**60**	0..0+0	**4**	**3**	**67**	1021112	**14**	**14**	**100**
*	F	Convolvulus lanatus	0...0.023.	13	6	50	.+.+..	0	0	33	0+.+++.	**1**	**1**	**71**
	R	Corynephorus divaricatus	2.....100.	9	4	40	112131	**15**	**15**	**100**	+.54418	**38**	**32**	**86**
	R	Crepis aculeata					526343	**38**	**38**	**100**	+1..0+.	4	2	57
	R	Crucianella herbacea									.++....	0	0	29
	R	Cutandia memphitica	.......00.	5	1	20	+..+..	0	0	33	0......	5	1	14
*	R	Cyperus capitatus					.....+	0	0	17				
*	R	Cyperus macrorrhizus	...010...1	9	3	40	...+..	0	0	17	0++0000	**4**	**4**	**100**
	E	Daucus glaber									.+..+..	0	0	29
*	L	Dittrichia viscosa	.0........	4	0	10								
*	R	Echinops philistaeus	000..0....	5	2	40								
*	H	Echium angustifolium	01.0100...	**7**	**4**	**60**	123333	**26**	**26**	**100**	.++++..	0	0	57
	R	Erodium laciniatum					.0+.++	**1**	**1**	**67**				
	D	Euphorbia peplus									.....+.	0	0	14
*	E	Euphorbia terracina									.+....	0	0	17
	R	Hormuzakia aggregata	.....1....	10	1	10	++++++	**0**	**0**	**100**	+0+.+++	**1**	**1**	**86**
	R	Ifloga spicata	......2...	20	2	10	1	10	2	17	1+11..+	**6**	**4**	**71**
	H	Lagurus ovatus									.++..++	0	0	57
	H	Lathyrus marmoratus									.+.+...	0	0	29
	R	Launaea fragilis	763.33.013	**34**	**27**	**80**					+.+...+	0	0	43
	W	Lolium rigidum					++++0	**1**	**1**	**100**				
*	Y	Lotus creticus	......1...	10	1	10								
	R	Lotus halophilus	..5....744	51	21	40	+.131+	**10**	**8**	**83**	++1++0+	**2**	**2**	**100**
	H	Lotus peregrinus									.....++	0	0	29
	R	Maresia pulchella									1++.+++	**2**	**1**	**86**
	F	Maresia pygmaea	......1...	10	1	10								
	H	Mercurialis annua									..+....	0	0	14
*	R	Moltkiopsis ciliata	...0......	5	1	10					...+..+	0	0	29
	R	Neurada procumbens	....3.2...	25	5	20								
*	B	Ononis natrix	.122.00...	13	7	50					+..+...	0	0	29
	H	Ononis serrata					..++..	0	0	33	..+....	0	0	14
	W	Orobanche cernua									..+....	0	0	14
	Y	Pancratium maritimum					.+....	0	0	17				
*	F	Panicum turgidum					+.....	0	0	17				
	W	Papaver humile									.++....	0	0	29
*	H	Paronychia argentea					.+....	0	0	17				
*	V	Phagnalon rupestre	0010.00...	**6**	**4**	**60**					.++.+++	**0**	**0**	**71**
	Y	Plantago sarcophylla					2..+.4	20	10	50	......+	0	0	14

Table 39. continued.

			DMB06 1234567890	C1	C2	%P	DMB07 123456	C1	C2	%P	DMB08 1234567	C1	C2	%P
	R	Polycarpon succulentum	......3..1	20	4	20	...+.+	0	0	33	+.+.+1+	**2**	**1**	**71**
*	H	Polygonum equisetiforme					..+...	0	0	17	..++...	0	0	29
*	R	*Polygonum palaestinum*	.1.....4..	25	5	20								
*	Q	Prasium majus									.+++++.	**0**	**0**	**71**
	R	Pseudorlaya pumila					+..++.	0	0	50	+++...+	0	0	57
*	R	Retama raetam	1.12102..3	**16**	**12**	**70**	0..+..	3	1	33	22110.0	**13**	**11**	**86**
	E	Rumex *bucephalophorus*									.3+1...	13	6	43
	R	Rumex pictus	........0.	5	1	10	1+++1.	**4**	**3**	**83**	210.120	**12**	**10**	**86**
*	R	Scrophularia hypericifolia					...+..	0	0	17	++...+.	0	0	43
	R	Senecio joppensis	....111...	10	3	30	.++300	**8**	**7**	**83**	44121.1	**23**	**20**	**86**
	H	Silene modesta									+......	0	0	14
*	Y	Silene succulenta	00..00..3.	9	5	50								
	D	Sonchus oleraceus									.++...+	0	0	43
	V	Sonchus tenerrimus									.++....	0	0	29
	H	Stellaria pallida					.+....	0	0	17	.+.....	0	0	14
*	L	Stipagrostis lanata	0..020....	8	3	40	1.+0.0	**5**	**3**	**67**	11++++.	**3**	**3**	**86**
*	H	Tolpis virgata	.41..2....	25	8	30					+..+...	0	0	29
	H	Tragopogon coelesyriacus	..0.......	5	1	10								
	E	Trifolium palaestinum					+...+.	0	0	33	..+....	0	0	14
	H	Trifolium tomentosum					+....+	0	0	33	....+..	0	0	14
	R	Trisetaria linearis					..++0+	**1**	**1**	**67**	+.+.++.	0	0	57
	H	Urospermum picroides									.++.++.	0	0	57
	H	Veronica cymbalaria					.+....	0	0	17	..+...+	0	0	29
	H	Vicia sativa									......+	0	0	14
	E	Vulpia fasciculata					+11+++	**3**	**3**	**100**	..+...+	0	0	29

6.6.1.1.2.7 DMB07 Echio angustifoliae – Artemisietum monospermae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 39. **Distribution:** Fig. 84

Ecological notes: This association is developed in an area where sand mobility ceased long ago and the sand is completely stable. The percentage of psammophyte is lowest (55 %) when compared with that of previous ones and follow the trend of increasing stability, amelioration of moisture regime, and increase in non-psammophytes. The gradual change in the edaphic conditions through plants succession enables plants of herbaceous Mediterranean habitats (H) to grow in increasing number of species and of individuals. *Echium angustifolium,* recorded here as a co-dominant, have a few sites in the coastal area near Hadera where it is the dominant.

Association dynamics and conservation: Most of the area of this association is under constant trampling of visiting people in an area protected from serious disturbance near the urban area of Ashdod.

Aspects of the association: Persistents – 15 spp.; ephemerals – 27 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96124	60	20	20	31.03.96	I 2176 6305
2	96125	75	25	20	31.03.96	I 2176 6306
3	96126	65	15	15	31.03.96	I 2177 6305
4	96127	60	20	23	31.03.96	I 2177 6304
5	96128	80	15	18	31.03.96	I 2177 6303
6	96129	70	20	22	31.03.96	I 2176 6303
Average:		68.3	19.2	19.7		

6.6.1.1.2.8 DMB08 Convolvulo lanati – Artemisietum monospermae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 39. **Distribution:** Fig. 85.

Ecological notes: The high sand stability and the long time passed since sand stabilization is expressed here by the lowest percentage of psammophytes (42%) in the alliance. The relevés of this association were recorded on dunes that have been stabilized and not disturbed long ago and it shows. *Prasium majus,* a typical vine of the Mediterranean woodlands, is near with many *Retama raetam* shrubs. The fruits are bird-dispersed and presumably birds were using the tall *R. raetam* shrubs as observation points, thus excreting the hard-coated seeds at their shade. Many plants which are known in the non-sandy soils of the Mediterranean territory of Israel as plants of human-disturbed habitats occur here at the shade of *R. raetam* shrubs. Such plants are *Stellaria pallida, Veronica cymbalaria, Biscutella didyma,* and *Arenaria leptoclados.* There are many species of herbaceous plant communities (H) and of bathas on sandy soils (E), which represent the decreasing impact of sand as crucial edaphic factor.

Convolvulus lanatus is an important component of vegetation of sand sheets in the desert of N. Sinai (Danin, 1983) where sand deflation takes place. The southern coastal plain is its northern boundary in Israel, but occurs north of here as a very rare plant in southern Turkey (Parris, 1978).

Association dynamics and conservation: Most of the area of this association is under constant trampling of visitors to the beach.

Aspects of the association: Persistents – 15 spp.; ephemerals – 50 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96143	30	50	25	01.04.96	I 1594 6167
2	96144	30	40	35	01.04.96	I 1594 6166
3	96145	40	40	42	01.04.96	I 1594 6165
4	96146	20	40	23	01.04.96	I 1595 6164
5	96147	20	50	25	01.04.96	I 1595 6163
6	96148	20	30	25	01.04.96	I 1595 6162
7	96149	20	50	30	01.04.96	I 1596 6162
Average:		25.7	42.9	29.3		

Table 40. Synoptic table of the associations in Artemision monospermae: 1 – DMA01, 2 – DMA02, 3 – DMA03, 4 – DMA04, Senecioni joppensis- Artemision monospermae: 5 – DMB01,6 – DMB02, 7 – DMB03, 8 – DMB04, 9 – DMB05, 10 – DMB06, 11 – DMB07, 12 – DMB08, 13 – DMS01, 14 – DMS02.

		1 %P	2 %P	3 %P	4 %P	10 %P	5 %P	6 %P	7 %P	8 %P	11 %P	12 %P	9 %P	13 %P	14 %P
	d.s. Retametea raetam														
R	Artemisia monosperma	43	25	100	63	100	100	100	100	57	100	100	100	100	100
R	Cutandia memphitica	100	75	100	100	100	88	20	14		93	33	100	100	78
R	Polycarpon succulentum	57	63	100	75	100	75	20	71	14	86	33	86	86	100
F	Centropodia forsskalii		13	83	75		100	60	100	43	93	67	100	57	
R	Cyperus macrorrhizus	57		100	38		100	40	100	71	100	17	100	100	
R	Ifloga spicata		63	33	50		100	10	71	57	100	17	86	57	
R	Rumex pictus		13	17	25		75	10	86		79	83		100	
R	Retama raetam					50	50	70	86		29	33	86	86	100
R	Lotus halophilus						38	40	100	14	36	83	57	29	33
R	Pseudorlaya pumila								57		14	50	14	57	33
R	Neurada procumbens						13	20		29	7				33
R	Atractylis carduus		13				50		71	14	36				
H	Ononis serrata								14			33			11
	d.s. Retametalia raetam														
R	Senecio joppensis	100	75	100	100	100	88	30	86	100	93	83	100	100	100
R	Maresia pulchella				13	100	50		86		21				67

Table 40. continued.

		1 %P	2 %P	3 %P	4 %P	10 %P	5 %P	6 %P	7 %P	8 %P	11 %P	12 %P	9 %P	13 %P	14 %P
R	Stipagrostis lanata						**100**	40	**86**	71	50	**67**	**71**		
R	Crepis aculeata						**100**		57		57	**100**	**86**		
H	Polygonum equisetiforme								29			17			
	d.s. Ammophilo - Artemisienalia monospermae														
R	Polygonum palaestinum	29	13	**67**	50	**100**	13	20		43	43		**71**	57	
R	Launaea fragilis	14	38		25			**80**	43	57			14	14	
	d.s. Artemision monospermae														
R	Ammophila arenaria	**100**	**100**	**100**	**100**					**71**	14		29		
Y	Silene succulenta	57	25	33	38	25		50					14	29	
	d.s. Senecioni jopensis - Artemision monospermae														
H	Echium angustifolium						25	**60**	57	29	14	**100**			
R	Hormuzakia aggregata						50	10	**86**	29	**64**	**100**	29	22	
R	Corynephorus divaricatus				25			40	**86**	14	43	**100**			
	d.s. Scrophularion hypericifoliae														
R	Scrophularia hypericifolia	29		33	**75**				43		50	17	**100**	**100**	**89**
H	Silene modesta								14				**86**	27	44
R	Echiochilon fruticosum					13	13				14			29	**100**
Marker and rare species of associations															
R	Trisetaria koelerioides		13												
E	Alkanna tinctoria		13					10							
R	Silene villosa					13									
D	Heterotheca subaxillaris	57					**75**				43				
R	Moltkiopsis ciliata						**75**	10	29		43			57	
L	Scirpus holoschoenus						13				7				
H	Tolpis virgata							30	29						
H	Tragopogon coelesyriacus							10							
F	Maresia pygmaea							10							
L	Dittrichia viscosa							10							
Q	Calicotome villosa							10							
Y	Lotus creticus							10							
V	Phagnalon rupestre							**60**	**71**						
E	Campanula sulphurea								**86**						
Q	Prasium majus								**71**						
F	Convolvulus lanatus							50	**71**			33			
W	Asphodelus tenuifolius								57						
V	Asparagus horridus								57			17	14		11
H	Lagurus ovatus								57						11
H	Urospermum picroides								57		7				
D	Sonchus oleraceus								43						
E	Rumex bucephalophorus								43						
H	Avena barbata								43						
E	Centaurea procurrens						13		43			33			11
V	Sonchus tenerrimus								29						
W	Papaver humile								29						
E	Daucus glaber								29						
H	Veronica cymbalaria								29			17			11
H	Biscutella didyma								29						
R	Crucianella herbacea								29						
R	Astragalus fruticosus								29						
H	Lathyrus marmoratus								29						
H	Lotus peregrinus								29						
H	Mercurialis annua								14						
H	Asphodelus ramosus								14						
H	Vicia sativa								14						
H	Avena sterilis								14						
E	Bilacunaria boissieri								14						

Table 40. continued.

		1 %P	2 %P	3 %P	4 %P	10 %P	5 %P	6 %P	7 %P	8 %P	11 %P	12 %P	9 %P	13 %P	14 %P
W	Orobanche cernua								14						
D	Euphorbia peplus								14						
R	Astragalus peregrinus								14						
Q	Aetheorhiza bulbosa							10	14						
B	Ononis natrix							50	29	86			71	29	
L	Imperata cylindrica									71				14	
W	Lolium rigidum											100			
E	Vulpia fasciculata								29			100			
H	Bromus rigidus								29			83			
R	Trisetaria linearis			50	50				57		14	67			
R	Erodium laciniatum						25				14	67			
Y	Plantago sarcophylla								14			50			100
H	Trifolium tomentosum								14			33			
E	Trifolium palaestinum								14			33			
R	Astragalus annularis											17			
F	Panicum turgidum											17			
Y	Pancratium maritimum											17			
H	Paronychia argentea											17			
W	Brachypodium distachyon											17			
R	Brassica tournefortii											17			
E	Euphorbia terracina											17			
H	Stellaria pallida								14			17			
V	Arenaria leptoclados								14			17			
W	Anagallis arvensis								14			17			
R	Echinops philistaeus		13		38			40		71			100		
R	Maresia nana												100	71	
H	Crepis sancta												14		
F	Schimpera arabica												14		
C	Solanum sinaicum												14		
R	Helianthemum stipulatum												14		100
R	Cyperus capitatus	14				25						17			33
V	Ephedra aphylla					13									56
V	Umbilicus intermedius														22
E	Sixalix arenaria														11
F	Ononis variegata														11
H	Geranium robertianum														11
H	Phleum subulatum														11
Q	Rhamnus alaternus														11

6.6.1.1.3 DMS Scrophularion hypericifoliae Danin et Solomeshch all. nov.

Diagnostical species: *Echiochilon fruticosum* (dom.), *Scrophularia hypericifolia* (dom.), *Silene modesta*.

Nomenclatural type: Moltkiopsio ciliatae – Scrophularietum hypericifoliae Eig 1939.

Synoptic table: Table 47.

Associations in this alliance are confined to sites where sand was stable due to successional processes (as discussed in the four preceding alliances) and as a result of sudden devastating destruction became mobile again. Blowouts are sites of intensive such deflation which may be from a few dozens to a few hundreds of meters square. Blowouts are rather common in coastal sandy areas (Watt, 1937; Barrere, 1992; Jungerius et al., 1992). The direct initiator of the localized wind erosion under certain circumstances is a whirlwind traveling at a relatively high speed and having considerable lifting and carrying powers, similar to a miniature tornado or cyclone (Watt, 1937). Early seral communities in the coastal dunes do not have extensive vegetation cover and are thus much more susceptible to blowouts than later stages of succession. Detailed mechanisms of formation and the forms of blowouts in European coastal dunes are discussed by Barrere (1992).

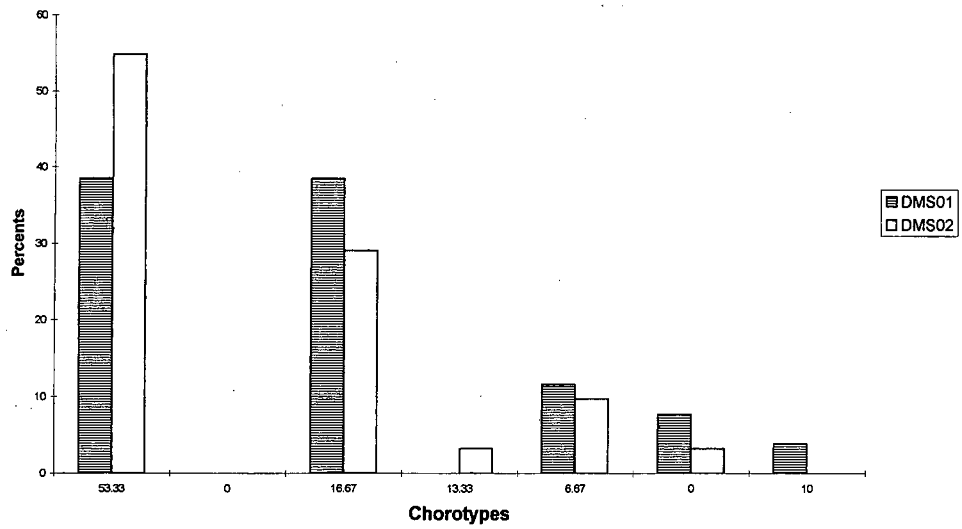

Figure 86. Phytogeographical analysis of associations DMS01 and DMS02.

As a result of the lost of vegetation cover by blowouts and sand recycling, the nature of the secondary vegetation resembles that of the sand at the early successional stages. Thus the phytogeographical spectrum of DMS01 displays almost equal percentage of Mediterranean and Saharo-Arabian species. That of DMS02 shows more Mediterranean species (Fig. 86). As many plants here are susceptible to sand deflation, at least the dominants are resistant to that kind of hazard (Danin, 1996).

6.6.1.1.3.1 DMS01 Moltkiopsio ciliatae – Scrophularietum hypericifoliae Eig 1939 nom mut.

Syn.: Lithospermum cllosum – Scrophularia hypericifolia association Eig 1939.

Diagnostical species: the markers in table 41. **Distribution:** Fig. 84.

Ecological notes: A simple mode of adaptation to sand deflation represented in this association is the passive resistance of roots that are not harmed by their exposure. This is part of the survival syndrome of *Scrophularia hypericifolia, Artemisia monosperma,* and *Echinops philistaeus.* The other was named "species actively resistant to sand deflation" (Danin, 1996). When exposed the roots of *Moltkiopsis ciliata* and of *Echiochilon fruticosum* produce adventitious shoots. There are instances when new root-borne shoots sprout whereas the old mother plant dies.

There is much similarity in the list of species found in this association and the one surrounding it, Echinopo philistaei – Artemisietum monospermae (DMB05). However, the percentage of cover of the plants adapted to the exposure of their roots is higher.

Association dynamics and conservation: Most of the area of this association is under danger of disappearance because of the rapid urbanization of the sandy area near Rishon Lezion.

Aspects of the association: Persistents – 14 spp.; ephemerals – 12 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96059	20	25	20	27.02.96	I 2299 6558
2	96060	35	25	12	27.02.96	I 2300 6558
3	96061	10	30	13	27.02.96	I 2301 6557
4	96090	10	20	16	12.03.96	I 2294 6555
5	96091	10	30	17	12.03.96	I 2293 6556
6	96092	10	25	14	12.03.96	I 2294 6556
7	96093	20	10	17	12.03.96	I 2295 6555
Average:		16.4	23.6	15.6		

Table 41. Association tables of DMS01 – Moltkiopsio ciliatae – Scrophularietum hypericifoliae and DMS02 – Echiochilo fruticosae – Artemisietum monospermae

		Species	DMS01 1234567	C1	C2	%P	DMS02 *123456789	C1	C2	%P
*	R	Artemisia monosperma	0123013	**15**	**15**	**100**	625555766	**53**	**53**	**100**
*	V	Asparagus horridus					......+..	0	0	11
*	E	Centaurea procurrens					.....+...	0	0	11
*	F	Centropodia forsskalii	+.++..0	1	1	57				
	R	Crepis aculeata	7.43745	**51**	**44**	**86**	112223001	**16**	**16**	**100**
	H	Crepis sancta	.1.....	10	1	14				
	R	Cutandia memphitica	+2+212+	**10**	**10**	**100**	.1.+0++++	**2**	**2**	**78**
*	R	Cyperus capitatus					....++.0.	2	1	33
*	R	Cyperus macrorrhizus	+++00++	**1**	**1**	**100**				
*	R	Echinops philistaeus	++++0++	**1**	**1**	**100**				
*	R	Echiochilon fruticosum	2+.....	10	3	29	010212021	**12**	**12**	**100**
*	V	Ephedra aphylla					+0...10+.	4	2	56
*	F	Euphorbia terracina					.......+.	0	0	11
	H	Geranium robertianum					......+..	0	0	11
*	R	Helianthemum stipulatum					100+21100	**8**	**8**	**100**
	R	Hormuzakia aggregata	....++.	0	0	29	......++.	0	0	22
	R	Ifloga spicata	+..10.+	4	2	57				
*	L	Imperata cylindrica	....+..	0	0	14				
	H	Lagurus ovatus					......+..	0	0	11
	R	Launaea fragilis	....+..	0	0	14				
	R	Lotus halophilus	0..+...	3	1	29	...+..+.+	0	0	33
	R	Maresia nana	+..+++0	**1**	**1**	**71**				
	R	Maresia pulchella					.++++0+..	**1**	**1**	**67**
*	R	Moltkiopsis ciliata	+0..+0.	3	1	57				
	R	Neurada procumbens					..0....+1	5	2	33
*	B	Ononis natrix	+.....+	0	0	29				
	H	Ononis serrata					........+	0	0	11
	F	Ononis variegata					.......+.	0	0	11
	H	Phleum subulatum					......+..	0	0	11
	Y	Plantago sarcophylla					816724897	**58**	**58**	**100**
	R	Polycarpon succulentum	++10+.+	**3**	**2**	**86**	+301++++0	**6**	**6**	**100**
*	R	Polygonum palaestinum	+..00.+	3	1	57				
	R	Pseudorlaya pumila	+..+.++	0	0	57	++......+	0	0	33
*	R	Retama raetam	+010.21	**9**	**7**	**86**	011011100	**8**	**8**	**100**
*	Q	Rhamnus alaternus					......+..	0	0	11
	R	Rumex pictus					+++++++++	**0**	**0**	**100**
*	R	Scrophularia hypericifolia	7875855	**65**	**65**	**100**	25320++.2	**18**	**16**	**89**
	R	Senecio joppensis	2743144	**37**	**37**	**100**	121+52101	**15**	**15**	**100**
	H	Silene modesta	0+.+..0	3	1	57	..++..++.	0	0	44
*	Y	Silene succulenta	..+.+..	0	0	29				
	E	Sixalix arenaria					........+	0	0	11
*	C	Solanum sinaicum	..+..+.	0	0	29				
*	R	Stipagrostis lanata	0.+.010	**5**	**3**	**71**	+...0.++.	1	1	44
	V	Umbilicus intermedius					+.....+..	0	0	22
	H	Veronica cymbalaria					......+..	0	0	11

6.6.1.1.3.2 DMS02 Echiochilo fruticosae – Artemisietum monospermae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 41. **Distribution:** Fig. 84.

Ecological notes: The same features discussed in DMS01 can be seen here. The floristic composition of the associations surrounding the vegetation of blowouts near Caesarea is reflected in the present association by the presence of 19 species which do not grow in DMS01. The dominant species which produces root-borne shoots here is *Echiochilon fruticosum*. The psammophytes account here for 59 % whereas that of the first association in the alliance is 81%.

Association dynamics and conservation Most of the area of this association is under danger of disappearance because of the development of sand quarries and urbanization of the area.

Aspects of the association: Persistents – 12 spp.; ephemerals – 20 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96009	30	30	14	23.02.96	I 1940 7110
2	96010	20	40	14	23.02.96	I 1941 7110
3	96011	20	40	13	23.02.96	I 1940 7109
4	96012	20	30	14	23.02.96	I 1941 7109
5	96013	30	40	14	23.02.96	I 1940 7108
6	96014	50	30	15	23.02.96	I 1940 7107
7	96016	45	40	25	23.02.96	I 1941 7109
8	96017	30	40	18	23.02.96	I 1942 7109
9	96018	40	20	16	23.02.96	I 1942 7109
Average:		31.7	34.4	15.9		

6.6.1.2 Geranio robertiani – Artemisienalia monospermae Danin et Solomeshch subord. nov.

Diagnostical species of the suborder: *Aetheorhiza bulbosa, Calicotome villosa, Centaurea procurrens, Geranium robertianum, Paronychia argentea, Prasium majus.*

Nomenclatural type: Trifolio palaestini – Helianthemion stipulati Danin et Solomeshch.

The species which is used to display the nature of the associations in this suborder, *Geranium robertianum*, is a common shade plant of the Mediterranean woodlands. It implies that the amelioration of the soil below the shrubs in the associations of this alliance got to a stage that non-psammophytes may be found in this habitat.

6.6.1.2.4 DMR Phagnalo rupestri – Retamion raetam Danin et Solomeshch all. nov.

Diagnostical species: *Phagnalon rupestre, Urospermum picroides.*

Nomenclatural type: Corynephoro divaricati – Retametum raetam Danin et Solomeshch.

Synoptic table: Table 45.

The phytogeographical spectrum of the associations (Figs. 87, 88) display the prevalence of the Mediterranean chorotype, a lower importance of the Saharo-Arabian chorotype and increasing importance of other biregional chorotypes such as M-IT and M-SA. In associations DMR04 to DMR07 the Mediterranean chorotype accounts for more than 50 % of the species, whereas the SA chorotype accounts for around 10% of the species. These changes display the amelioration of the substratum through the succession which started in the associations of DMA and had almost equal proportions of M and SA chorotypes.

6.6.1.2.4.1 DMR01 Senecioni joppensis – Retametum raetam Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 42. **Distribution:** Fig. 85.

Ecological notes: The area where this association was recorded is at the margin of large sand dunes, part of which were mobile. Most of these dunes were removed when the sand was taken away. This association as a third stage of succession assumed to have been preceded by association such as the pioneer Ammophiletum DMA01 and the second stage of an Artemisietum monospermae such as DMB01, DMB03, or DMB06. After the establishment of *Retama raetam,* additional non-psammophytes such as *Prasium majus, Geranium robertianum, Silene muscipula, Sonchus microcephalus,* and *Urospermum picroides* can grow in the area.

Association dynamics and conservation: Most of the area of this association is endangered by urbanization and other "developmental" hazards.

Aspects of the association: Persistents – 8 spp.; ephemerals – 14 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96045	30	40	14	23.02.96	I 2384 7007
2	96046	30	40	12	23.02.96	I 2385 7007
3	96047	30	40	11	23.02.96	I 2385 7007
4	96048	20	40	9	23.02.96	I 2384 7008
5	96049	20	50	15	23.02.96	I 2383 7009
6	96050	10	50	10	23.02.96	I 2383 7009
7	96051	20	50	13	23.02.96	I 2383 7008
Average:		22.9	44.3	12.0		

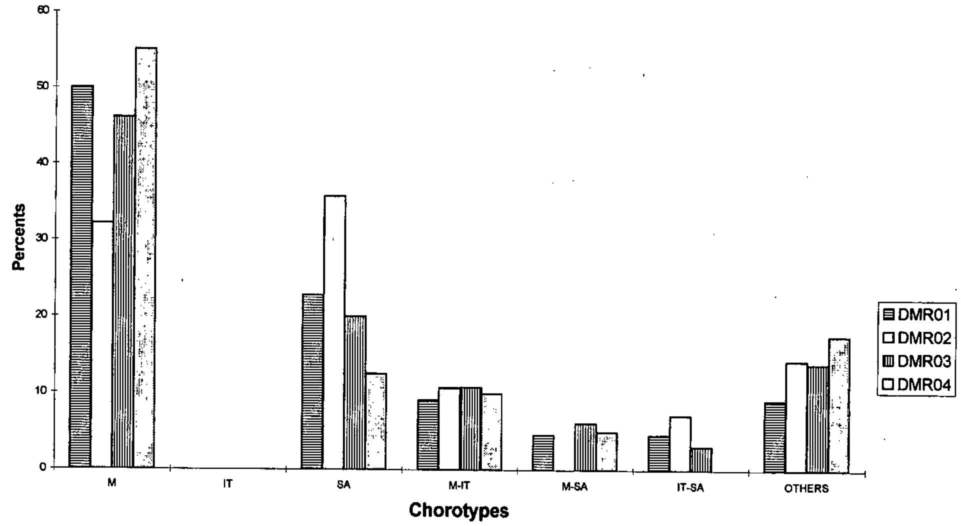

Figure 87. Phytogeographical analysis of associations DMR01-DMR04.

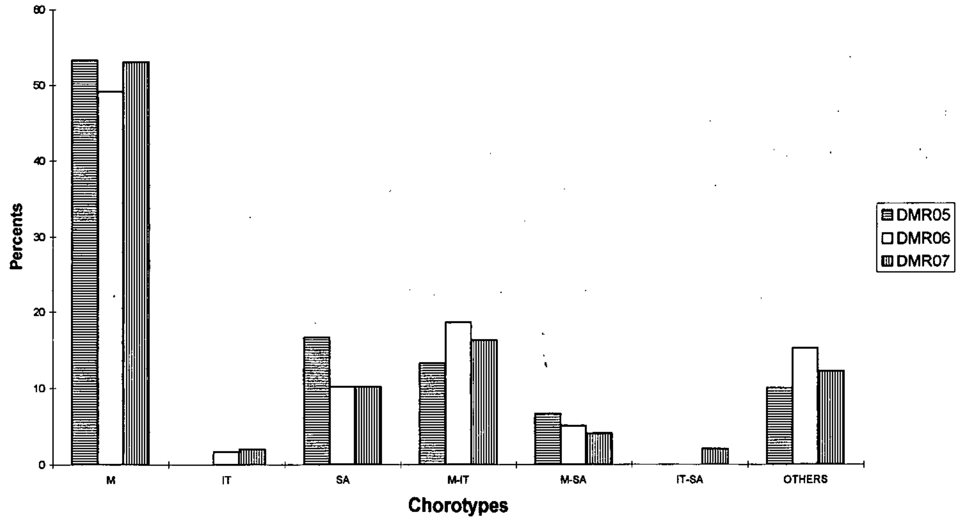

Figure 88. Phytogeographical analysis of associations DMR05-DMR07.

Table 42. Association tables of DMR01 – Senecioni joppensis – Retametum raetam and DMR02 – Centropodo forsskali – Retametum raetam

			DMR01				DMR02			
			*1234567	C1	C2	%P	*1234567	C1	C2	%P
*	R	Artemisia monosperma	6799679	**76**	**76**	**100**	3365445	**44**	**44**	**100**
*	R	Atractylis carduus					+......	0	0	14
	H	Avena sterilis					+.+....	0	0	29
	E	Bilacunaria boissieri					....+..	0	0	14
*	E	Centaurea procurrens					....+..	0	0	14
*	F	Centropodia forsskalii					10++1+1	**6**	**6**	**100**
	R	Crepis aculeata	....+..	0	0	14	2423.22	**25**	**21**	**86**
	R	Cutandia memphitica	13+0+.1	**9**	**8**	**86**	23.0233	**23**	**20**	**86**
*	R	Cyperus macrorrhizus					++.+.++	**0**	**0**	**71**
*	V	Ephedra aphylla					+.....+	0	0	29
	H	Geranium molle					+......	0	0	14
	H	Geranium robertianum	+++.+.+	**0**	**0**	**71**	0......	2	0	14
	H	Geranium rotundifolium	.....+.	0	0	14				
*	D	Heterotheca subaxillaris	+......	0	0	14	..+.0.+	2	1	43
	R	Hormuzakia aggregata	..+...+	0	0	29	.+++1+0	**3**	**2**	**86**
	R	Ifloga spicata	201623.	**24**	**21**	**86**	3213333	**26**	**26**	**100**
	R	Lotus halophilus					....+..	0	0	14
	R	Maresia pulchella	+110112	**9**	**9**	**100**				
*	R	Moltkiopsis ciliata					2...0+0	8	4	57
	R	Neurada procumbens	.+...+.	0	0	29				
*	H	Paronychia argentea	....+..	0	0	14				
*	V	Phagnalon rupestre	+......	0	0	14				
	R	Polycarpon succulentum	210+011	**9**	**9**	**100**	.+.0.1+	5	3	57
*	R	Polygonum palaestinum	+......	0	0	14				
*	Q	Prasium majus	....+..	0	0	14				
*	R	Retama raetam	4311431	**24**	**24**	**100**	4534453	**41**	**41**	**100**
	R	Rumex pictus	.11+1++	**5**	**4**	**86**	1+..+0+	**3**	**2**	**71**
	R	Senecio joppensis	3463556	**46**	**46**	**100**	11631.1	**22**	**19**	**86**
	H	Silene muscipula	+.+++.+	**0**	**0**	**71**				
*	Y	Silene succulenta	.+....+	0	0	29				
*	C	Solanum sinaicum					++++.++	**0**	**0**	**86**
	L	Sonchus microcephalus	++..+++	**0**	**0**	**71**	..+.+..	0	0	29
	D	Sonchus oleraceus					..1++..	3	1	43
	H	Stellaria pallida					..+.+..	0	0	29
*	R	Stipagrostis lanata					+1+1+1+	**4**	**4**	**100**
	H	Urospermum picroides	+...+..	0	0	29	..+....	0	0	14
	D	Urtica membranacea					..+....	0	0	14

6.6.1.2.4.2 DMR02 Centropodo forsskali – Retametum raetam Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 42. **Distribution:** Fig. 85.

Ecological notes: As discussed in DMR01, the site of the establishment of non-psammophytes on the once mobile sand is the shade of *Retama raetam* shrubs. As in the previous association there is a vine (*Ephedra aphylla)*, the diaspores of which could had arrived with birds. Ruderal plants that occur in slightly enriched soils and found here are: *Geranium robertianum; Geranium molle, Stellaria pallida,* and *Urospermum picroides.* Ruderal plants of even richer soils are *Urtica membranacea* which occur in sandy enriched soils and *Solanum sinaicum* which in Israel is confined to the shade of *Retama raetam* on stable sand sheets.

Association dynamics and conservation: Most of the area of this association is protected from grazing and trampling but is highly vulnerable to total destruction as a result of expanding of agricultural or urbanization activities.

Aspects of the association: Persistents – 10 spp.; ephemerals – 18 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96083	20	40	17	28.02.96	I 2208 6399
2	96084	20	40	13	28.02.96	I 2208 6400
3	96085	10	80	16	28.02.96	I 2207 6400
4	96086	30	50	13	28.02.96	I 2206 6399
5	96087	20	50	17	28.02.96	I 2205 6397
6	96088	20	50	13	28.02.96	I 2203 6396
7	96089	20	40	16	28.02.96	I 2203 6397
Average:		20.0	50.0	15.0		

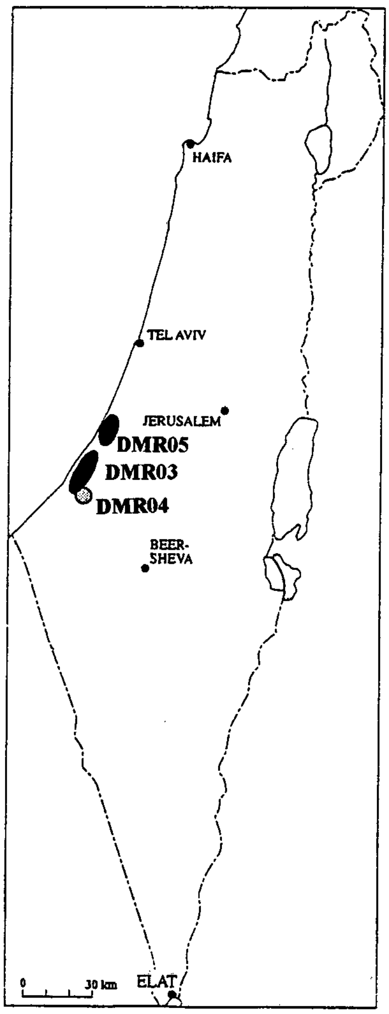

Figure 89. Distribution map of associations DMR03, DMR04, and DMR05.

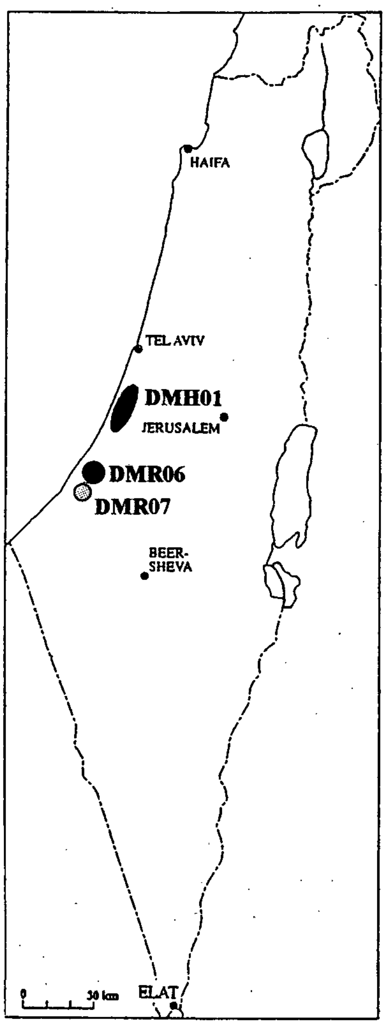

Figure 90. Distribution map of associations DMR06, DMR07 and DMH01.

6.6.1.2.4.3 DMR03 Corynephoro divaricati – Retametum raetam Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 43. **Distribution:** Fig. 89.

Ecological notes: The tendency of enrichment of the vegetation by non-psammophytes during the course of plant succession is stronger here despite the southern and thus the drier location. The older sand, forming a shallow sand sheet on fine-grained soil or sandstone enables the development of an association so rich in species of herbaceous plant communities (H) and even *Aetheorhiza bulbosa* which accompanies the shadow of shrubs in many Mediterranean associations including those on old stable sandy ground.

Association dynamics and conservation: Most of the area of this association is protected from grazing and trampling but is highly vulnerable to total destruction as a result of expanding of agricultural or urbanization activities.

Aspects of the association: Persistents – 14 spp.; ephemerals – 51 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96143	30	50	25	01.04.96	I 2094 6167
2	96144	30	40	35	01.04.96	I 2094 6166
3	96145	40	40	42	01.04.96	I 2094 6165
4	96146	20	40	23	01.04.96	I 2095 6164
5	96147	20	50	25	01.04.96	I 2095 6163
6	96148	20	30	25	01.04.96	I 2095 6162
7	96149	20	50	30	01.04.96	I 2096 6162
Average:		25.7	42.9	29.3		

Table 43. Association tables of DMR03 – Corynephoro divaricati – Retametum raetam and DMR04 – Dittricho viscosi – Retametum raetam

			DMR03				DMR04			
			*1234567	C1	C2	%P	1234567	C1	C2	%P
	Q	Aetheorhiza bulbosa	...0...	5	1	14	447984+	**52**	**52**	**100**
*	R	Ammophila arenaria					+.++...	0	0	43
	W	Anagallis arvensis	....+..	0	0	14	..+...+	0	0	29
	V	Arenaria leptoclados	......+	0	0	14	....+..	0	0	14
*	R	Artemisia monosperma	5677887	**69**	**69**	**100**	0101+00	**6**	**6**	**100**
*	V	Asparagus horridus	.+++..+	0	0	57	....+..	0	0	14
	H	Asphodelus ramosus	......+	0	0	14				
	W	Asphodelus tenuifolius	.++..0+	1	1	57				
	R	Astragalus fruticosus	.+....+	0	0	29				
	R	Astragalus peregrinus	.....+.	0	0	14				
*	R	Atractylis carduus	+.+++.+	**0**	**0**	**71**				
	H	Avena barbata	.++...+	0	0	43	....2..	20	3	14
	H	Avena sterilis	..9....	90	13	14				
	E	Bilacunaria boissieri	..+....	0	0	14				
	H	Biscutella didyma	.+..+..	0	0	29				
	H	Bromus rigidus	..+..+.	0	0	29				
*	Q	Calicotome villosa					3336354	**39**	**39**	**100**
	E	Campanula sulphurea	++1114.	**12**	**10**	**86**				
*	E	Centaurea procurrens	.+++...	0	0	43				
*	F	Centropodia forsskalii	1021112	**14**	**14**	**100**				
*	F	Convolvulus lanatus	0+.+++.	**1**	**1**	**71**	..+....	0	0	14
	R	Corynephorus divaricatus	+.54418	**38**	**32**	**86**	++1+...	3	1	57
	R	Crepis aculeata	+1..0+.	4	2	57				
	R	Crucianella herbacea	.++....	0	0	29	.+.....	0	0	14
	R	Cutandia memphitica	0......	5	1	14				
*	H	Cynodon dactylon					....+..	0	0	14
*	R	Cyperus capitatus					..+....	0	0	14
*	R	Cyperus macrorrhizus	0++0000	**4**	**4**	**100**				
	E	Daucus glaber	.+..+..	0	0	29				
*	R	Echinops philistaeus					....+..	0	0	14
*	H	Echium angustifolium	.++++..	0	0	57	...+.+.	0	0	29
*	V	Ephedra aphylla					....++.	0	0	29
	D	Euphorbia peplus	.....+.	0	0	14				
*	E	Euphorbia terracina					....+..	0	0	14
	Q	Galium aparine					....+..	0	0	14
	R	Hormuzakia aggregata	+0+.+++	**1**	**1**	**86**	....+..	0	0	14
*	H	Hyparrhenia hirta					......+	0	0	14
	R	Ifloga spicata	1+11..+	**6**	**4**	**71**				
	D	Lactuca serriola					....+..	0	0	14

Table 43. continued.

			DMR03				DMR04			
			1234567	C1	C2	%P	1234567	C1	C2	%P
	H	Lagurus ovatus	.++..++	0	0	57				
	H	Lathyrus marmoratus	.+.+...	0	0	29	44.....	43	12	29
	H	Lathyrus sphaericus					......+	0	0	14
	R	Launaea fragilis	+.+...+	0	0	43	...+...	0	0	14
*	Y	Lotus creticus					+01..+0	4	3	71
	R	Lotus halophilus	++1++0+	2	2	100				
	H	Lotus peregrinus	.....++	0	0	29				
	R	Maresia pulchella	1++.+++	2	1	86				
	H	Mercurialis annua	..+....	0	0	14				
*	R	Moltkiopsis ciliata	...+..+	0	0	29				
*	B	Ononis natrix	+..+...	0	0	29	132++1.	12	10	86
	H	Ononis serrata	..+....	0	0	14				
	W	Orobanche cernua	..+....	0	0	14				
	W	Papaver humile	.++....	0	0	29				
*	V	Phagnalon rupestre	.++.+++	0	0	71	3131+01	14	14	100
	Y	Plantago sarcophylla	......+	0	0	14				
	R	Polycarpon succulentum	+.+.+1+	2	1	71				
*	H	Polygonum equisetiforme	..++...	0	0	29				
*	R	Polygonum palaestinum					+0.++++	1	1	86
*	Q	Prasium majus	.+++++.	0	0	71	..++++.	0	0	57
	R	Pseudorlaya pumila	+++...+	0	0	57				
*	R	Retama raetam	22110.0	13	11	86	0001+01	6	6	100
	E	Rumex bucephalophorus	.3+1...	13	6	43				
	R	Rumex pictus	210.120	12	10	86				
*	R	Scrophularia hypericifolia	++...+.	0	0	43				
	R	Senecio joppensis	44121.1	23	20	86	1+..+.+	3	1	57
	H	Silene modesta	+......	0	0	14				
*	Y	Silene succulenta					+......	0	0	14
*	C	Solanum sinaicum					...+...	0	0	14
	L	Sonchus maritimus					....+..	0	0	14
	D	Sonchus oleraceus	.++...+	0	0	43				
	V	Sonchus tenerrimus	.++....	0	0	29				
	H	Stellaria pallida	.+.....	0	0	14	...+...	0	0	14
*	L	Stipagrostis lanata	11++++.	3	3	86				
*	H	Tolpis virgata	+..+...	0	0	29	1010+67	23	23	100
	H	Tragopogon coelesyriacus					+.++...	0	0	43
	E	Trifolium palaestinum	..+....	0	0	14				
	H	Trifolium tomentosum	....+..	0	0	14				
	R	Trisetaria linearis	+.+.++.	0	0	57				
	H	Urospermum picroides	.++.++.	0	0	57	.+.++..	0	0	43
	H	Veronica cymbalaria	..+...+	0	0	29				
	H	Vicia sativa	......+	0	0	14	.+.....	0	0	14
	E	Vulpia fasciculata	..+...+	0	0	29				

6.6.1.2.4.4 DMR04 Dittricho viscosi – Retametum raetam Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 43. **Distribution:** Fig. 89.

Ecological notes: This association was recorded near the area of DMR03. However, the soil or rock covered by sand at the valleys is possibly less permeable to water. Water available in summer at the rhizosphere is the main environmental factor needed by *Dittrichia viscosa.* The sandy soil with dense vegetation cover harbor the wealth of plants belonging to herbaceous plant communities (H) including the rare *Lathyrus sphaericus* which is very rarely found in the coastal area of Israel.

Association dynamics and conservation: Most of the area of this association is protected from disturbance since 1948 because of its proximity to the border with Gaza strip. There is a threat of turning this land into agricultural or urban areas.

Aspects of the association: Persistents – 20 spp.; ephemerals – 20 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96175	5	85	16	02.04.96	I 2049 6113
2	96176	10	90	16	02.04.96	I 2049 6112
3	96177	5	95	16	02.04.96	I 2049 6111
4	96178	5	95	18	02.04.96	I 2049 6110
5	96179	10	90	23	02.04.96	I 2050 6109
6	96180	5	95	13	02.04.96	I 2050 6108
7	96181	5	95	13	02.04.96	I 2050 6107
Average:		6.4	92.1	16.4		

6.6.1.2.4.5 DMR05 Prasio maji – Retametum raetam Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 44. **Distribution:** Fig. 89.

Ecological notes: The earlier successional stage which leads to this association is DMR01 recorded at slightly elevated area where the sand was arrested later than in the sites of the present association. The stability over a long period enabled the pedogenetic processes to proceed and function more effectively; this means accumulation of higher amounts of silt, clay, and humus sedimentation and decalcification (Danin & Yaalon, 1982). The indicators for the better edaphic conditions are the many companions from Mediterranean maquis (Q) and herbaceous plant communities (H) and the few species of the Retametea.

Association dynamics and conservation: Most of the area of this association is protected in a nature reserve near highway No. 2, but endangered by pollution from the road and the hazard of expansion of the highways in the future.

Aspects of the association: Persistents – 12 spp.; ephemerals – 18 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96038	5	90	14	23.02.96	I 2385 7003
2	96039	5	95	17	23.02.96	I 2386 7003
3	96040	5	95	18	23.02.96	I 2387 7003
4	96041	5	95	17	23.02.96	I 2388 7003
5	96042	10	90	12	23.02.96	I 2385 7004
6	96043	10	90	10	23.02.96	I 2385 7005
7	96044	5	95	13	23.02.96	I 2385 7006
Average:		6.4	92.9	14.4		

Table 44. Association tables of DMR05 – Prasio maji – Retametum raetam, DMR06 – Bilacunario boissieri – Retametum raetam, and DMR07 – Solano sinaici – Retametum raetam

			DMR05				DMR06				DMR07			
			*1234567	C1	C2	%P	*1234567	C1	C2	%P	*12345678	C1	C2	%P
	Q	Aetheorhiza bulbosa					..+....	0	0	14	++.00++3	**6**	**5**	**88**
	W	Anagallis arvensis					0.+++.+	**1**	**1**	**71**	.4+.++33	**17**	**13**	**75**
	V	Arenaria leptoclados					+...++.	0	0	43				
*	F	Argyrolobium uniflorum									.....+..	0	0	13
*	R	Artemisia monosperma	5553357	**48**	**48**	**100**	4434443	**38**	**38**	**100**	200400+.	**11**	**10**	**88**
	Q	Arum dioscoridis	...+...	0	0	14								
*	V	Asparagus horridus					..+..+.	0	0	29				
	W	Asphodelus tenuifolius					+......	0	0	14	....+..+	0	0	25
	R	Astragalus annularis					....+..	0	0	14				
	H	Astragalus boeticus					+......	0	0	14				
	H	Avena barbata					++211++	**6**	**6**	**100**	+.+.++3+	**5**	**4**	**75**

Table 44. continued.

			DMR05				DMR06				DMR07			
			1234567	C1	C2	%P	1234567	C1	C2	%P	12345678	C1	C2	%P
	E	Bilacunaria boissieri					7534554	**47**	**47**	**100**	+...++.+	0	0	50
	H	Biscutella didyma					.+++...	0	0	43	+.+..+..	0	0	38
	H	Brachypodium distachyon					.4+....	20	6	29	9.7885..	**75**	**47**	**63**
	R	Brassica tournefortii					.+...++	0	0	43	....+...	0	0	13
	H	Bromus rigidus	...+...	0	0	14	+0+.345	**21**	**18**	**86**	+51.+53.	**23**	**18**	**75**
*	Q	Calicotome villosa					1	10	1	14	79959899	**83**	**83**	**100**
	E	Campanula sulphurea					+..+...	0	0	29				
*	E	Centaurea procurrens					00200+.	**7**	**6**	**86**	.....++.	0	0	25
*	F	Centropodia forsskalii									......+0	1	0	25
	H	Convolvulus althaeoides									+...++..	0	0	38
*	F	Convolvulus lanatus					..++..+	0	0	43				
	R	Corynephorus divaricatus					+..+...	0	0	29				
	R	Crepis aculeata									..+.....	0	0	13
	H	Crucianella macrostachya					+..++..	0	0	43				
	H	Daucus carota	..+....	0	0	14	...+.+.	0	0	29				
	E	Daucus glaber					+.+....	0	0	29	+.......	0	0	13
*	R	Echiochilon fruticosum					..+....	0	0	14				
*	H	Echium angustifolium					.+1+0+1	**4**	**4**	**86**	+.......	0	0	13
*	V	Ephedra aphylla	1.+00.+	**4**	**3**	**71**					+.......	0	0	13
	R	Erodium laciniatum					.+++...	0	0	43	.+......	0	0	13
	D	Euphorbia peplus					..+....	0	0	14				
	E	Euphorbia terracina	.++....	0	0	29					....++.+	0	0	38
	Q	Filago eriocephala									....+...	0	0	13
	Q	Galium aparine	.10+0.+	**4**	**3**	**71**								
	H	Geranium molle					.....+.	0	0	14	...+....	0	0	13
	H	Geranium robertianum	33.3233	**28**	**24**	**86**								
	H	Hordeum spontaneum					.+.....	0	0	14				
	R	Hormuzakia aggregata	..++.+.	0	0	43	.....++	0	0	29	+++.....	0	0	38
	H	Lagurus ovatus					++2+0++	**4**	**4**	**100**	..1...+.	5	1	25
	Q	Lamium amplexicaule					.....+.	0	0	14				
	H	Lathyrus marmoratus					++.++10	**3**	**2**	**86**	...+....	0	0	13
	H	Lathyrus sphaericus					....++0	1	0	43				
	W	Lolium rigidum					.+.....	0	0	14				
	H	Lotus peregrinus					...++.+	0	0	43	.....+..	0	0	13
	E	Lupinus palaestinus					.0.+...	3	1	29				
*	R	Lycium schweinfurthii	.0.....	5	1	14								
	R	Maresia pulchella	0+..+++	**1**	**1**	**71**								
	E	Medicago littoralis									.+......	0	0	13
*	B	Ononis natrix					+...+..	0	0	29	+.......	0	0	13
	H	Ononis serrata									...+....	0	0	13
*	Q	Osyris alba	.....0.	5	1	14								
	H	Pallenis spinosa					.+.....	0	0	14	....+...	0	0	13
*	W	Paronychia argentea					+......	0	0	14	.....+..	0	0	13
*	V	Phagnalon rupestre	..+....	0	0	14	+00++.+	**2**	**1**	**86**	+..+++..	0	0	50
*	R	Plantago albicans					..+....	0	0	14				
	R	Polycarpon succulentum	+......	0	0	14	...+...	0	0	14				
*	H	Polygonum equisetiforme					+....+.	0	0	29	.......+	0	0	13
*	R	Polygonum palaestinum	.+....+	0	0	29								
*	Q	Prasium majus	+.00+.+	**2**	**1**	**71**	0101111	**9**	**9**	**100**	+..++00+	**1**	**1**	**75**
	R	Pseudorlaya pumila	++10.31	**9**	**8**	**86**								
*	R	Retama raetam	4445643	**44**	**44**	**100**	5434444	**41**	**41**	**100**	10010000	**6**	**6**	**100**
*	Q	Rubia tenuifolia	.000...	5	2	43								
	E	Rumex bucephalophorus					1.11..+	8	4	57				
	R	Senecio joppensis	+...+2+	5	3	57	+++..++	**0**	**0**	**71**	.++..+..	0	0	38
	H	Senecio vernalis	23503.3	**28**	**24**	**86**								
	H	Silene muscipula	.++....	0	0	29								
	H	Solanum nigrum	+......	0	0	14								
*	C	Solanum sinaicum	.++++..	0	0	57					+.++.+++	**0**	**0**	**75**
	L	Sonchus microcephalus	3233413	**27**	**27**	**100**								
	D	Sonchus oleraceus					0+.+..+	1	1	57	+++00+++	**1**	**1**	**100**
	V	Sonchus tenerrimus					0+.++.+	**1**	**1**	**71**	+++0.+++	**1**	**1**	**88**
	H	Stellaria pallida	++++0++	**1**	**1**	**100**	+.++++0	**1**	**0**	**86**	+.......	0	0	13
*	H	Tolpis virgata					+.++.++	**0**	**0**	**71**	...+.+..	0	0	25

Table 44. continued.

		DMR05 1234567	C1	C2	%P	DMR06 1234567	C1	C2	%P	DMR07 12345678	C1	C2	%P
H	Tragopogon coelesyriacus					.....+.	0	0	14	....+...	0	0	13
H	Trifolium campestre					++....+	0	0	43	.....+..	0	0	13
E	Trifolium palaestinum					+.+1.++	2	1	71	.+.....+	0	0	25
E	Trifolium philistaeum					...+...	0	0	14				
H	Trifolium tomentosum					++1+..+	3	2	71	.+......	0	0	13
H	Urospermum picroides	++++...	0	0	57	+++++++	0	0	100	+.1+++.+	2	1	75
V	Valantia hispida	.+.....	0	0	14								
* H	Verbascum sinuatum	..+....	0	0	14								
H	Veronica cymbalaria									.......+	0	0	13
W	Vicia narbonensis									...+....	0	0	13
H	Vicia peregrina					++.....	0	0	29				
H	Vicia sativa	...+...	0	0	14	++..+++	0	0	71				

6.6.1.2.4.6 DMR06 Bilacunario boissieri – Retametum raetam Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 44. **Distribution:** Fig. 90.

Ecological notes: The sand covering the ancient sandy soil buried here is rich in fine-grained components and support many more non-psammophytes than psammophytes. This is seen mainly by the contribution of plants from the herbaceous plant communities (H) and of bathas on sandy soils (E). The high percentage of presence of *Prasium majus* expresses the long time that *Retama raetam* shrubs functioned as observation spots for birds in an area where the soil is rich enough to support this vine of the Mediterranean woodlands.

Association dynamics and conservation: Most of the area of this association was not disturbed by excessive human activity since 1948. Before that it could have been cultivated.

Aspects of the association: Persistents – 14 spp.; ephemerals – 45 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96182	10	90	34	02.04.96	I 2105 6158
2	96183	30	70	28	02.04.96	I 2105 6159
3	96184	60	40	27	02.04.96	I 2106 6157
4	96185	50	50	31	02.04.96	I 2104 6157
5	96186	60	40	22	02.04.96	I 2104 6156
6	96187	60	40	26	02.04.96	I 2104 6155
7	96188	70	30	28	02.04.96	I 2104 6154
Average:		48.6	51.4	28.0		

6.6.1.2.4.7 DMR07 Solano sinaici – Retametum raetam Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 44. **Distribution:** Fig. 90.

Ecological notes: The association is developed on shallow sand covering calcareous sandstone (Kurkar). It is indicated by the importance of *Calicotome villosa* which replaces the psammophyte shrubs of *Retama raetam* in the course of succession. The high number of non-psammophytes in the association also indicates the status of the substratum.

Association dynamics and conservation: Most of the area of this association is under constant process of destruction in quarries and it is possible that by the time this book is published the stands of this association do not exist any more.

Aspects of the association: Persistents – 15 spp.; ephemerals – 34 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96150	20	80	22	02.04.96	I 2069 6161
2	96151	20	80	14	02.04.96	I 2068 6161
3	96152	15	90	16	02.04.96	I 2069 6162
4	96153	15	85	16	02.04.96	I 2067 6151
5	96154	15	85	20	02.04.96	I 2067 6150
6	96155	10	90	25	02.04.96	I 2067 6149
7	96156	5	95	14	02.04.96	I 2066 6149
8	96157	5	95	17	02.04.96	I 2066 6148
Average:		13.1	87.5	18.0		

6.6.1.2.5 DMH Trifolio palaestini – Helianthemion stipulati Danin et Solomeshch.

Diagnostical species: *Aegilops sharonensis, Alkanna tinctoria, Arenaria leptocaldos, Asparagus horridus, Brassica tournéfortii, Convolvulus secundus, Crepis aculeata, Cyclamen persicum, Ephedra aphylla, Euphorbia terracina, Helianthemum stipulatum, Hippocrepis multisiliquosa, Plantago sarcophylla, Rumex bucephalophorus, Senecio vernalis, Trifolium palaestinum, Umbilicus intermedius, Urginea maritima, Valantia hispida.*

Nomenclatural type: Plantago sarcophyllae – Helianthemetum stipulati Danin et Solomeshch.

Synoptic table: Table 47.

In most associations of this alliance the Mediterranean chorotype contributes to more than 60% of the phytogeographical spectrum (Figs. 91, 92). Most other chorotypes that are represented in the associations have a frequency lower than 10 %, thus displaying the shift of the phytogeographical spectrum from M and SA in the first colonization stages (alliance DMA) to the present one where non-Mediterranean species are clearly in a minority.

The dominant species in the associations of this alliance is *Helianthemum stipulatum* and not *Artemisia monosperma* as was in most associations of the three preceding alliances. There are not many areas left where vegetation dominated by one of the two dominants contains individual plants of the other species. Sites where *A. monosperma* occurs in an association dominated by *H. stipulatum* were observed in the Caesarea sands where wind erosion took place. It is therefore assumed that the removal of the aging soil by erosion enabled the establishment of *A. monosperma.* Sites dominated by *A. monosperma* which became populated by *H. stipulatum* were aging stands as indicated by the mosses growing below shrubs and by non-psammophytes inhabiting these microhabitats. Unfortunately most of these sites in Caesarea area disappeared due to intensive urbanization in the 1980s and the 1990s. This situation seems to indicate the relationships between the alliance DMH and the preceding alliances, i.e. it is a later stage in the succession. However, an idea presented in the 1960s by G. Orshan (unpublished pers. comm.) that *A. monosperma* is a relatively new invader to Israel can not be excluded. No dating was presented with this assumption but it means that the two species may represent similar role in the succession of vegetation on sand with *A. monosperma* being the most important shrub of the present succession and *H. stipulatum* played the same role in the past.

Another problem that rises with the phytosociological analysis of the Retametea is that *H. stipulatum* as recognized in the contemporary taxonomic treatments of the regional flora (Zohary, 1972; Feinbrun-Dothan & Danin, 1991) grows in two completely different kinds of habitats. It is the dominant of the present alliance under more than 300 mm of mean annual rainfall but grows on sandy soils at the 100 mm zone and in vegetation on magmatic rocks in S. Sinai with even less rainfall (Danin et al., 1985). The desert individuals seem morphologically different from the coastal ones but this taxonomic complex was not sufficiently studied yet.

Helianthemetum elliptici Eig 1939 is not synonymous to any of the associations discussed in this volume, although *H. ellipticum* is an older synonym used for *H. stipulatum* (Zohary, 1972). Eig's association was recorded on Kurkar hills which is a totally different habitat than those discussed here and has a completely different assemblage of companions.

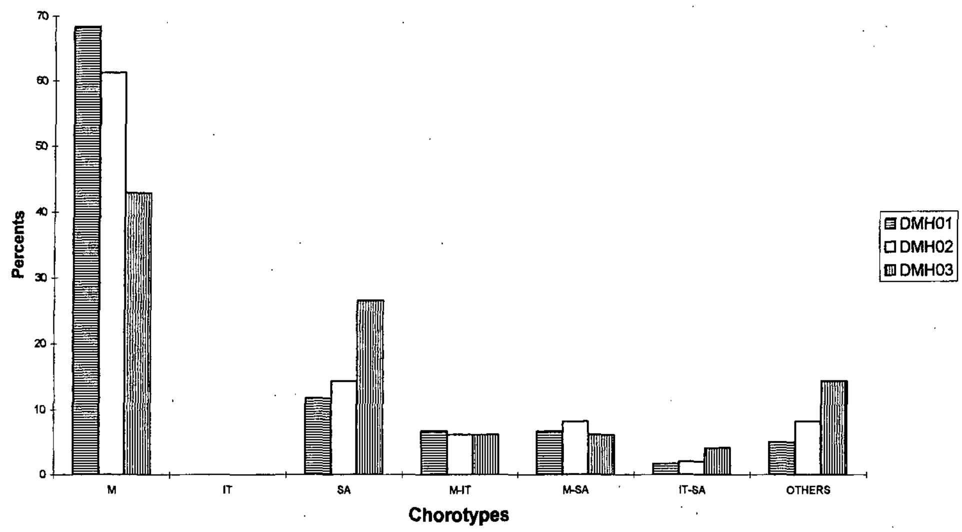

Figure 91. Phytogeographical analysis of associations DMH01-DMH03.

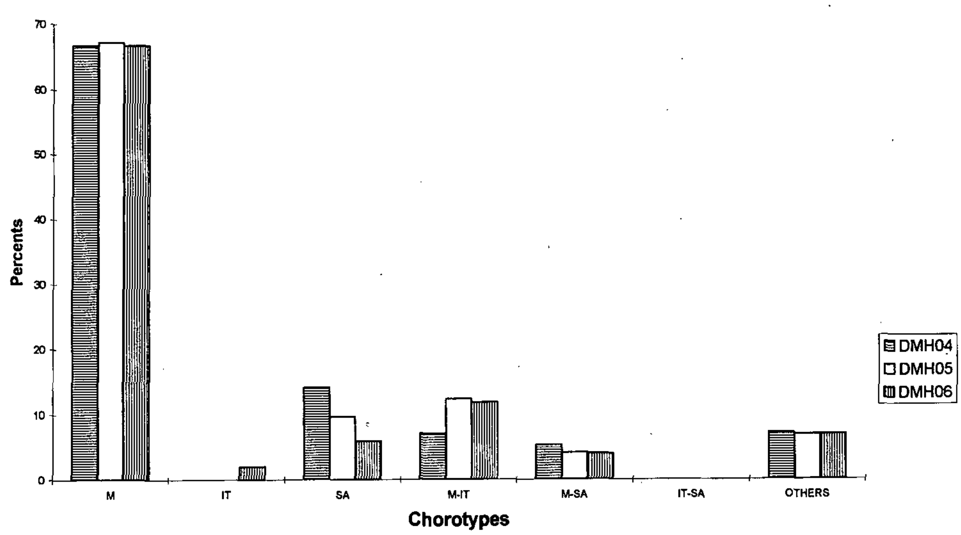

Figure 92. Phytogeographical analysis of associations DMH04-DMH06.

6.6.1.2.5.1 DMH01 Ephedro aphyllae – Helianthemetum stipulati Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 45. **Distribution:** Fig. 90.

Ecological notes: The tendency of non-psammophytes to occur in associations of old stable sand sheets as seen in the alliance DMR repeats itself here. There are many species of the herbaceous plant communities (H) here as well as bird-dispersed vines such as *Ephedra aphylla* and *Asparagus horridus*. Moss patches below the *Retama raetam* plants support the typical Mediterranean rock plant *Arenaria leptoclados.* These are associated with the local edaphic amelioration at the foot of the *Retama* shrubs. An interesting rare plant of the bathas on sandy soils (E), is the endemic *Iris atropurpurea* which reaches here its southernmost extension. In the few other places it survives and protected by the law it occurs only on more mature soils developed on Hamra and Kurkar. There are 43 % psammophyte species in the association table.

Association dynamics and conservation: Most of the area of this association is protected in a private fenced land but is endangered by sand quarries at its vicinity.

Aspects of the association: Persistents – 15 spp.; ephemerals – 34 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96062	30	40	29	27.02.96	I 1719 6445
2	96063	20	30	22	27.02.96	I 1720 6445
3	96064	30	30	22	27.02.96	I 1721 6446
4	96065	20	30	25	27.02.96	I 1722 6446
5	96066	30	25	23	27.02.96	I 1723 6446
6	96067	30	50	23	27.02.96	I 1720 6447
Average:		26.7	34.2	24.0		

Table 45. Association tables of DMH01 – Ephedro aphyllae – Helianthemetum stipulati, DMH02 – Retamo raetam – Echiochiletum fruticosi, and DMH03 – Plantago sarcophyllae – Helianthemetum stipulati

			DMH01				DMH02				DMH03			
			*123456	C1	C2	%P	*1234567	C1	C2	%P	*1234567	C1	C2	%P
	E	Aegilops sharonensis					.+.+.+.	0	0	43	+1++..+	**2**	**1**	**71**
	Q	Aetheorhiza bulbosa	...+..	0	0	17					+.....+	0	0	29
*	E	Alkanna tinctoria					.+++...	0	0	43	00.++++	**2**	**1**	**86**
	W	Anagallis arvensis	...+.1	5	2	33								
	E	Anthemis leucanthemifolia									++....+	0	0	43
	V	Arenaria leptoclados	...0.+	3	1	33					.+....+	0	0	29
*	R	Artemisia monosperma	++++0+	**1**	**1**	**100**	0202102	**12**	**12**	**100**	..0+1+.	4	2	57
*	Q	Asparagus aphyllus									......+	0	0	14
*	V	Asparagus horridus	++++++	**0**	**0**	**100**	+++++..	**0**	**0**	**71**	+..+..+	0	0	43
	H	Asphodelus ramosus	6	60	10	17					+......	0	0	14
	W	Asphodelus tenuifolius	...1.2	15	5	33								
	R	Astragalus berytheus									....+..	0	0	14
*	R	Atractylis carduus	..+...	0	0	17								
	H	Avena sterilis	.....+	0	0	17								
*	Q	Ballota philistaea					..+....	0	0	14				
	H	Biscutella didyma	+..+.+	0	0	50								
	R	Brassica tournefortii					..+....	0	0	14	++.+...	0	0	43
	H	Bromus rigidus	.+....	0	0	17	..+.+++	0	0	57	.+.+...	0	0	29
	L	Bryonia syriaca					....+..	0	0	14				
*	Q	Calicotome villosa					.0.....	5	1	14	......+	0	0	14
*	E	Centaurea procurrens	.+..+.	0	0	33	++++00.	**2**	**1**	**86**	+.....+	0	0	29
*	F	Centropodia forsskalii	+++++.	**0**	**0**	**83**								
	R	Chrysanthemum viscosum									..+...+	0	0	29
*	R	Convolvulus secundus									...+...	0	0	14
	R	Crepis aculeata	0+2+1+	**6**	**6**	**100**	1+150.2	**17**	**14**	**86**	.+++01.	**3**	**2**	**71**
	R	Crucianella herbacea	.+..+.	0	0	33	.+..+++	0	0	57	...+...	0	0	14
	D	Cuscuta brevistyla									++.0...	2	1	43
	R	Cutandia memphitica	00+21.	**8**	**7**	**83**	..+...+	0	0	29	...++..	0	0	29
	V	Cyclamen persicum									++...++	0	0	57
*	H	Cynodon dactylon	+.+...	0	0	33								
*	R	Cyperus capitatus					.+....+	0	0	29	..++...	0	0	29
*	R	Cyperus macrorrhizus	++++..	**0**	**0**	**67**								
*	R	Echiochilon fruticosum	....+.	0	0	17	4442234	**34**	**34**	**100**	.00++..	3	1	57
*	H	Echium angustifolium	++0++.	**1**	**1**	**83**								
*	V	Ephedra aphylla	211++3	**12**	**12**	**100**	.+0+0++	**2**	**1**	**86**	+010.+0	**4**	**4**	**86**
	H	Erodium botrys									.+.+...	0	0	29
	R	Erodium laciniatum	...++.	0	0	33								
*	E	Euphorbia terracina					.+.+...	0	0	29	..++.++	0	0	57
	Q	Galium aparine					..+....	0	0	14				
	H	Galium murale					+++....	0	0	43				
	Q	Geranium lucidum					...+...	0	0	14				
	H	Geranium robertianum	.....+	0	0	17	+++.+++	**0**	**0**	**86**	..+....	0	0	14
	H	Geranium rotundifolium									.+.....	0	0	14
*	R	Helianthemum stipulatum	664764	**56**	**56**	**100**	1	10	1	14	8767778	**73**	**73**	**100**
	H	Hippocrepis multisiliquosa	.....+	0	0	17								
	R	Hormuzakia aggregata	+.+++.	**0**	**0**	**67**	.+.+..0	2	1	43	...+.++	0	0	43

Table 45. continued.

			DMH01				DMH02				DMH03			
			123456	C1	C2	%P	1234567	C1	C2	%P	1234567	C1	C2	%P
	R	Ifloga spicata	14446+	**32**	**32**	**100**								
	E	Iris atropurpurea	+.+...	0	0	33								
	R	Lotus halophilus	++....	0	0	33	.+.....	0	0	14				
*	R	Lycium schweinfurthii					..+....	0	0	14				
	R	Maresia pulchella	11110.	**9**	**8**	**83**	++0+0+.	**2**	**1**	**86**	+....+.	0	0	29
	R	Neurada procumbens	+++...	0	0	50								
	R	Onobrychis squarrosa					.+.....	0	0	14				
*	B	Ononis natrix	...++.	0	0	33								
	H	Ononis serrata	+.....	0	0	17	.+...+.	0	0	29	.....+.	0	0	14
	F	Ononis variegata									....+..	0	0	14
*	Q	Osyris alba					..++++.	0	0	57	+.+..++	0	0	57
	Y	Pancratium maritimum	...+..	0	0	17								
*	F	Panicum turgidum	+..++.	0	0	50								
	W	Papaver humile	+....+	0	0	33								
	H	Paronychia argentea					....++.	0	0	29	+......	0	0	14
*	V	Phagnalon rupestre									+......	0	0	14
	H	Phleum subulatum									.+.....	0	0	14
*	Q	Pistacia lentiscus					.+.....	0	0	14	......+	0	0	14
	Y	Plantago sarcophylla					655346+	**41**	**41**	**100**	7477978	**70**	**70**	**100**
	R	Polycarpon succulentum					.+.....	0	0	14				
*	H	Polygonum equisetiforme					...+...	0	0	14				
*	Q	Prasium majus					+++++0+	**0**	**0**	**100**	+.+...+	0	0	43
	R	Pseudorlaya pumila	.....+	0	0	17	00+.++0	3	2	86	..++++.	0	0	57
*	R	Retama raetam	131232	**21**	**21**	**100**	5355563	**46**	**46**	**100**	1222021	**16**	**16**	**100**
*	Q	Rhamnus lycioides									+.....+	0	0	29
*	Q	Rubia tenuifolia					.++....	0	0	29	......+	0	0	14
	E	Rumex bucephalophorus	.....+	0	0	17	+....2.	10	3	29	21+++1+	**6**	**6**	**100**
	R	Rumex occultans									.+++..+	0	0	57
	R	Rumex pictus	54111.	**25**	**21**	**83**	+1010+5	**12**	**12**	**100**	....+..	0	0	14
*	L	Scirpus holoschoenus	0++...	2	1	50								
	H	Sedum caespitosum									......+	0	0	14
	R	Senecio joppensis	1.1.0.	8	4	50	1221212	**16**	**16**	**100**	0212011	**11**	**11**	**100**
	H	Senecio vernalis					1.++21.	**8**	**6**	**71**	++++...	0	0	57
	H	Silene colorata	+.....	0	0	17					.+.+...	0	0	29
	H	Silene modesta					.+.....	0	0	14				
	L	Sonchus microcephalus	++..++	**0**	**0**	**67**								
	D	Sonchus oleraceus	++.+.+	**0**	**0**	**67**	.++..+.	0	0	43				
	H	Stellaria media	+...+.	0	0	33								
	H	Stellaria pallida					..+....	0	0	14				
*	R	Stipagrostis lanata	0030+0	**8**	**8**	**100**	...+...	0	0	14	0+.+0.+	**2**	**1**	**71**
	E	Trifolium palaestinum	.....+	0	0	17					.1++.+1	**4**	**3**	**71**
	H	Trifolium tomentosum									...+...	0	0	14
	R	Trigonella cylindracea					....+..	0	0	14	.+.+...	0	0	29
	V	Umbilicus intermedius					+..+.++	0	0	57	.++..++	0	0	57
	H	Urginea maritima									.+.....	0	0	14
	A	Urginea undulata	.....+	0	0	17								
	V	Valantia hispida					++.++++	**0**	**0**	**86**	.+.....	0	0	14
	H	Veronica cymbalaria									......+	0	0	14

6.6.1.2.5.2 DMH02 Retamo raetam – Echiochiletum fruticosi Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 45. **Distribution:** Fig. 93.

Ecological notes: There are only a few *Helianthemum stipulatum* individuals in this association, but the habitat of this association (stabilized old sand dunes) and the structure of vegetation looks rather similar to other associations in this alliance (DBH). The moss-covered microhabitat at the foot of *R. raetam* shrubs supports several bird-dispersed vines such as *Prasium majus, Bryonia syriaca,* and *Rubia tenuifolia*. Two additional interesting components are the bird-dispersed semi-parasite *Osyris alba* and the woodlands shrub *Pistacia lentiscus*. Many species which belong to herbaceous plant communities (H) and bathas on sand soils (E), play the same role as discussed

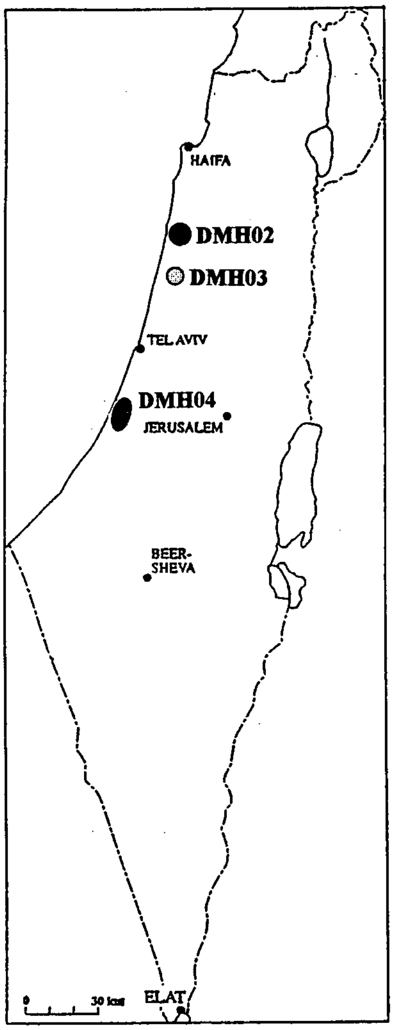

Figure 93. Distribution map of associations DMH02, DMH03, and DMH04.

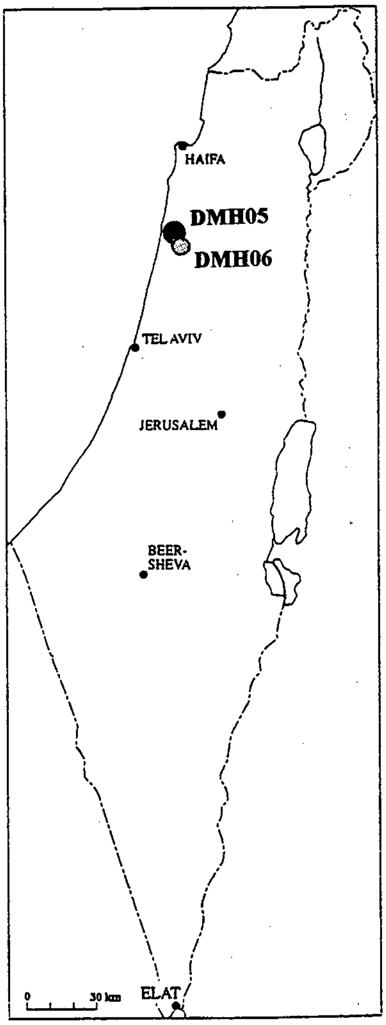

Figure 94. Distribution map of associations DMH05 and DMH06.

already in many associations of advanced status in plant succession. There are 41 % psammophyte species in the association table.

The common role of *Echiochilon fruticosum* in the vegetation is of a plant adapted to sand deflation (Danin, 1996) in the coastal plain and in the desert, and as a dominant in a certain combination of texture in ancient alluvial terraces of Nahal Besor (Sect. 6.6.2.1.2.5).

Association dynamics and conservation: Most of the area of this association is under constant process.

Aspects of the association: Persistents – 20 spp.; ephemerals – 29 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96031	5	90	18	23.02.96	I 2396 7003
2	96032	30	50	31	23.02.96	I 2396 7002
3	96033	30	60	27	23.02.96	I 2395 7003
4	96034	20	50	23	23.02.96	I 2395 7002
5	96035	30	65	22	23.02.96	I 2397 7003
6	96036	30	60	23	23.02.96	I 2397 7002
7	96037	30	50	19	23.02.96	I 2398 7003
Average:		25.0	60.7	23.3		

6.6.1.2.5.3 DMH03 Plantago sarcophyllae – Helianthemetum stipulati Danin et Solomeshch ass. nov.
Diagnostical species: the markers in table 45. **Distribution:** Fig. 93.

Ecological notes: This relatively young association of *H. stipulatum* and *R. raetam* in the Caesarea area has typically psammophyte annuals such as *Plantago sarcophylla, Senecio joppensis* and *Maresia pulchella* and others accounting for 38 % of the species in the association table. The microhabitat of the *R. raetam* shadow populated by mosses and many typical non-psammophytes starts to develop here and not all the *Retama* shrubs have it. There might be a high similarity between this association and the following (DMH04), but we wish to stress the changes in one place with the aging of the stabilized dune. The phytogeographical spectrum of the two associations differs remarkably especially with the percentages of the M and SA chorotypes. Studies of the edaphic changes in this area displayed prominent gradual changes in the soil (Danin & Yaalon, 1982) during the succession.

Association dynamics and conservation: Most of the area of this association is protected at the vicinity of high power electricity line. It is a rare and endangered plant community.

Aspects of the association: Persistents – 21 spp.; ephemerals – 39 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96002	50	40	25	23.02.96	I 1935 7107
2	96005	65	52	29	23.02.96	I 1938 7108
3	96007	55	35	22	23.02.96	I 1938 7109
4	96008	55	35	31	23.02.96	I 1937 7109
5	96015	45	35	15	23.02.96	I 1940 7107
6	96021	50	40	19	23.02.96	I 1941 7107
7	96022	55	35	30	23.02.96	I 1942 7107
Average:		53.6	38.9	24.4		

6.6.1.2.5.4 DMH04 Trifolio palaestini – Helianthemetum stipulati Danin et Solomeshch ass. nov.
Diagnostical species: the markers in table 46. **Distribution:** Fig. 93.

Ecological notes: This is a more advanced aspect of the vegetation dominated by *H. stipulatum* and *R. raetam.* The two prominent annual companions are *Trifolium palaestinum* and *Aegilops sharonensis* – both endemic species of sandy-loam soils (Hamra) of the coastal plain of Israel and S. Lebanon. Their occurrence here in high quantities indicate the affinity of these sandy soils to the old Hamra soils. The importance in this association of plants common to rock crevices is high. Such species are *Cyclamen persicum, Umbilicus intermedius,* and *Sedum caespitosum.* A prominent feature of this association is the death of *R. raetam* shrubs and their replacement by bird-dispersed vines such as *Ephedra aphylla* and *Asparagus horridus*. The high percentage of Mediterranean plants and the low Saharo-Arabian and psammophytes (32 %) indicate the amelioration of edaphic conditions.

Under these conditions shrubs of the Mediterranean woodlands may survive the first years and succeed to establish themselves. Such shrubs are *Rhamnus lycioides, Rhamnus alaternus,* and *Pistacia lentiscus.*

Association dynamics and conservation: As the previous association (DMH03).

Aspects of the association: Persistents – 18 spp.; ephemerals – 39 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96001	65	30	32	23.02.96	I 1935 7107
2	96003	60	30	30	23.02.96	I 1936 7107
3	96004	65	30	37	23.02.96	I 1937 7108
4	96006	65	30	29	23.02.96	I 1938 7108
5	96019	65	30	32	23.02.96	I 1940 7108
6	96020	60	35	26	23.02.96	I 1941 7108
Average:		63.3	30.8	31.0		

Table 46. Association tables of DMH04 – Trifolio palaestini – Helianthemetum stipulati, DMH05 – Pistacio lentisci – Helianthemetum stipulati, and DMH06 – Pistacio lentisci – Calicotometum villosae

		Species	DMH04				DMH05				DMH06			
			*123456	C1	C2	%P	*1234567	C1	C2	%P	*1234567	C1	C2	%P
	E	Aegilops sharonensis	245727	45	45	100	11+++..	4	3	71				
	Q	Aetheorhiza bulbosa	++...+	0	0	50	.+1+.++	2	1	71	5+33335	31	31	100
*	E	Alkanna tinctoria	++0+++	1	1	100	+++++++	0	0	100	+.+.+.+	0	0	57
	H	Alopecurus utriculatus					.+++...	0	0	43				
	H	Alyssum simplex					..+....	0	0	14				
	W	Anagallis arvensis	...+..	0	0	17	....++.	0	0	29				
*	Q	Anagyris foetida									.+..+..	0	0	29
	E	Anthemis leucanthemifolia	++.+.+	0	0	67	++.++..	0	0	57				
	V	Arenaria leptoclados	++++++	0	0	100	.+.++++	0	0	71	++.++++	0	0	86
*	Q	Artemisia arborescens					....+..	0	0	14				
*	R	Artemisia monosperma	...++.	0	0	33	.+.....	0	0	14				
	Q	Arum palaestinum					+......	0	0	14				
*	Q	Asparagus aphyllus					++..+++	0	0	71	+++...+	0	0	57
*	V	Asparagus horridus	+0++++	1	1	100	++..+++	0	0	71	+++++++	0	0	100
	V	Asterolinon linum-stellatum					.+..+..	0	0	29				
	H	Brachypodium distachyon					..1....	10	1	14				
	R	Brassica tournefortii	+.+.++	0	0	67	+++++++	0	0	100	++.+.++	0	0	71
	H	Bromus rigidus	4.+++.	10	7	67								
	H	Bromus sterilis					1..6...	35	10	29				
*	Q	Calicotome villosa					..+....	0	0	14	4445224	36	36	100
*	E	Centaurea procurrens	.+..++	0	0	50	.+.+...	0	0	29	.+.+...	0	0	29
	R	Chrysanthemum viscosum	+...++	0	0	50	++.++0+	1	1	86				
*	M	Cistus salviifolius									.....++	0	0	29
*	R	Convolvulus secundus	+.+...	0	0	33	..+....	0	0	14	...+...	0	0	14
	R	Crepis aculeata	...+..	0	0	17	.++++++	0	0	86				
	R	Crucianella herbacea	..+...	0	0	17								
	H	Crucianella macrostachya					.....+.	0	0	14				
	D	Cuscuta brevistyla	..+.+.	0	0	33								
	R	Cutandia memphitica									..+....	0	0	14
	V	Cyclamen persicum	+++.++	0	0	83	+.++++.	0	0	71	.+33331	22	19	86
*	R	Cyperus capitatus	....++	0	0	33	+++++++	0	0	100				
	E	Daucus glaber					.+.++.+	0	0	57				
	E	Desmazeria philistaea					....+..	0	0	14				
*	R	Echiochilon fruticosum	...11.	10	3	33								
*	V	Ephedra aphylla	10+++0	3	3	100	0+.++0+	2	1	86	+......	0	0	14
*	Q	Ephedra foeminea					++++.+.	0	0	71	.+0+.+.	1	0	57
	H	Erodium botrys	+.+++.	0	0	67								
	R	Erodium laciniatum	+.....	0	0	17								
	E	Erodium telavivense					++.+...	0	0	43				
	D	Euphorbia peplus									.+.....	0	0	14
*	E	Euphorbia terracina	++++.+	0	0	83	.++.+++	0	0	71	..+....	0	0	14
	Q	Galium aparine	+++...	0	0	50								
	Q	Galium murale	.++...	0	0	33								
	H	Galium setaceum									...+...	0	0	14
	L	Geranium dissectum					...+...	0	0	14				
	Q	Geranium lucidum					.+.+++.	0	0	57	+.+....	0	0	29
	H	Geranium robertianum	+++++.	0	0	83	+..+...	0	0	29	...+++.	0	0	43
	H	Geranium rotundifolium	..+...	0	0	17								
*	R	Helianthemum stipulatum	757778	69	69	100	+110030	9	9	100	+.....+	0	0	29
	H	Hippocrepis multisiliquosa					..+....	0	0	14				
	R	Hormuzakia aggregata	...++.	0	0	33	+.....+	0	0	29				
	R	Ifloga spicata					......+	0	0	14				
	H	Lagurus ovatus	++.+..	0	0	50	++.+...	0	0	43	+..+..+	0	0	43
	W	Lolium rigidum					.....++	0	0	29				
*	Q	Lonicera etrusca					....+..	0	0	14				
	R	Maresia pulchella	....+.	0	0	17	1	10	1	14	++.....	0	0	29
	E	Medicago littoralis	.+....	0	0	17	..+.+..	0	0	29	+......	0	0	14
	H	Ononis serrata					+......	0	0	14				
*	Q	Osyris alba	.+....	0	0	17	++.0+++	1	1	86	.+.+++.	0	0	57
	H	Pallenis spinosa									.+...+.	0	0	29

Table 46. continued.

		Species	DMH04 123456	C1	C2	%P	DMH05 1234567	C1	C2	%P	DMH06 1234567	C1	C2	%P
*	H	Paronychia argentea					+..+++.	0	0	57	++....+	0	0	43
*	V	Phagnalon rupestre	..+...	0	0	17	+++.+.+	**0**	**0**	**71**	+.+++++	**0**	**0**	**86**
	H	Phleum subulatum	..+.++	0	0	50								
*	H	Piptatherum miliaceum					..+.+..	0	0	29	++++++.	**0**	**0**	**86**
*	Q	Pistacia lentiscus					5888869	**77**	**77**	**100**	4454355	**43**	**43**	**100**
	Y	Plantago sarcophylla	+12.2+	10	**8**	**83**	7552573	**49**	**49**	**100**	1......	10	1	14
*	H	Polygonum equisetiforme									......+	0	0	14
*	Q	Prasium majus	.++.++	**0**	**0**	**67**	+++++++	**0**	**0**	**100**	.10+0+0	**4**	**3**	**86**
	R	Pseudorlaya pumila	++++++	**0**	**0**	**100**								
*	R	Retama raetam	241121	**20**	**20**	**100**	100+000	**5**	**5**	**100**				
*	Q	Rhamnus alaternus	..+...	0	0	17	++++0++	**1**	**1**	**100**	000+31+	**8**	**8**	**100**
*	Q	Rhamnus lycioides	..+...	0	0	17	+++++++	**0**	**0**	**100**	+0++01+	**2**	**2**	**100**
*	Q	Rubia tenuifolia	..+.+.	0	0	33	+++.+++	**0**	**0**	**86**	..+....	0	0	14
	E	Rumex bucephalophorus	+100+2	**7**	**7**	**100**	+1++11+	**4**	**4**	**100**	.+++.+1	**2**	**1**	**71**
	R	Rumex occultans	..+++.	0	0	50	+......	0	0	14				
	R	Rumex pictus	.+....	0	0	17	+.....5	25	7	29				
*	Q	Ruta chalepensis					...0+++	1	1	57	00++010	**4**	**4**	**100**
	H	Sedum caespitosum	+.++.+	**0**	**0**	**67**								
	V	Sedum hispanicum					++.+.+.	0	0	57	.+.+.++	0	0	57
	E	Sedum litoreum									.+.....	0	0	14
	R	Senecio joppensis					+....++	0	0	43	....+..	0	0	14
	H	Senecio vernalis	132120	**16**	**16**	**100**	+12111+	**9**	**9**	**100**	......+	0	0	14
	H	Silene colorata	.++...	0	0	33	+.++++.	**0**	**0**	**71**	+......	0	0	14
	H	Silene dichotoma					....+..	0	0	14	.+..1+.	3	1	43
	E	Sixalix arenaria	++....	0	0	33	+++..++	**0**	**0**	**71**				
*	Q	Smilax aspera									.....+.	0	0	14
	L	Sonchus microcephalus	...+..	0	0	17								
*	R	Stipagrostis lanata	.+1+.+	**3**	**2**	**67**	+......	0	0	14	+......	0	0	14
	E	Trifolium palaestinum	2+0130	**13**	**13**	**100**	+1+.++.	**2**	**1**	**71**				
	R	Trigonella cylindracea	+++0..	**1**	**1**	**67**	+.++...	0	0	43				
	V	Umbilicus intermedius	++++++	**0**	**0**	**100**	+++++++	**0**	**0**	**100**	1+33331	**21**	**21**	**100**
	H	Urginea maritima					..+....	0	0	14	..+....	0	0	14
	D	Urtica membranacea									...+...	0	0	14
	V	Valantia hispida	+..++.	0	0	50	..+++++	**0**	**0**	**71**	1+.++11	**5**	**4**	**86**
*	H	Verbascum sinuatum					....+..	0	0	14	.+.....	0	0	14
	H	Veronica cymbalaria	+.+.++	**0**	**0**	**67**	.+..++.	0	0	43				

6.6.1.2.5.5 DMH05 Pistacio lentisci – Helianthemetum stipulati Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 46. **Distribution:** Fig. 94.

Ecological notes: The establishment of *Pistacia lentiscus* from germination on the sand dune is rather clear. The shrubs of *H. stipulatum* occur at the periphery of each *P. lentiscus* shrub and some ethiolant specimens of the former are even found among the latter stems, thus indicating the growth of *P. lentiscus* into a stand of *H. stipulatum*. There is enrichment of the soil below the *P. lentiscus* plants but with sandwich-like colouring of the soil (Danin & Yaalon, 1982). The uppermost soil layer is dark and rich in silt, clay, and organic matter. There is dunal light coloured sand below it indicating its origin. The shaded microhabitat inside the *P. lentiscus* shrub hosts the establishment of several woodland shrubs and vines of the Mediterranean maquis. The amelioration of soil conditions in the entire dune is indicated by the occurrence of *Calicotome villosa*, a shrub which is not a psammophyte and replaces many of the psammophytes towards the last stage. There are only 23 % psammophyte species in the association table.

Association dynamics and conservation: As the previous association DMH03.

Aspects of the association: Persistents – 27 spp.; ephemerals – 46 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	97001	20	60	42	03.03.97	I 1933 7105
2	97002	10	80	41	03.03.97	I 1932 7105
3	97003	15	80	35	03.03.97	I 1931 7105
4	97004	15	80	40	03.03.97	I 1931 7106
5	97005	10	80	43	03.03.97	I 1932 7106
6	97006	15	70	38	03.03.97	I 1933 7107
7	97007	10	70	34	03.03.97	I 1932 7107
Average:		13.6	74.3	39.0		

6.6.1.2.5.6 DMH06 Pistacio lentisci – Calicotometum villosae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 46. **Distribution:** Fig. 95.

Ecological notes: This is almost the most advanced stage of plant succession in the sand dunes of Caesarea area. The density of *P. lentiscus* and *C. villosa* shrubs increases and leads to almost replacement of the psammophytes. The latter still exist in disturbed habitats such as sand mounds of borrowing animals, paths of animals such as porcupines which pass in the association area and lead to recycling of sand, thus enabling the limited success of a few psammophytes (16 %). The area covered by this association is composed of both deep dune sand which passed the whole succession and sites where sand cover was only about 1 m (Danin & Yaalon, 1982).

Association dynamics and conservation: As the previous association DMH03.

Aspects of the association: Persistents – 26 spp.; ephemerals – 25 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	97008	5	95	25	3.03.97	I 1933 7105
2	97009	5	90	28	3.03.97	I 1934 7105
3	97010	5	99	21	3.03.97	I 1935 7105
4	97011	5	99	25	3.03.97	I 1933 7106
5	97012	5	99	20	3.03.97	I 1933 7107
6	97013	5	99	24	3.03.97	I 1934 7107
7	97014	5	99	24	3.03.97	I 1935 7108
Average:		5.0	97.1	23.9		

Table 47. Synoptic table of the associations in Trifolio palaestini - Helianthemion stipulati: 1- DMH01, 2- DMH02, 3- DMH03, 4- DMH04, 5- DMH05, 6- DMH06, and Phagnalo rupestri – Retamion raetam: 7- DMR01, 8- DMR02, 9- DMR03, 10- DMR04, 11- DMR05, 12- DMR06, 13- DMR07

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P
	d.s. Retametea raetam													
R	Retama raetam	100	100	100	100	100		100	100	86	100	100	100	100
R	Artemisia monosperma	100	100	57	33	14		100	100	100	100	100	100	88
R	Hormuzakia aggregata	67	43	43	33	29		29	86	86	14	43	29	38
R	Rumex pictus	83	100	14	17	29		86	71	86				
R	Cutandia memphitica	83	29	29			14	86	86	14				
R	Pseudorlaya pumila	17	86	57	100					57		86		
R	Ifloga spicata	100				14		86	100	71				
R	Polycarpon succulentum		14					100	57	71		14	14	
H	Ononis serrata	17	29	14		14				14				13
R	Atractylis carduus	17							14	71				
R	Neurada procumbens	50						29						

Table 47. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P
	d.s. Retametalia raetam													
R	Senecio joppensis	50	**100**	**100**		43	14	**100**	**86**	86	57	57	**71**	38
R	Maresia pulchella	**83**	**86**	29	17	14	29	**100**		**86**		**71**		
R	Stipagrostis lanata	**100**	14	**71**	**67**	14	14		**100**	**86**				
H	Polygonum equisetiforme		14				14			29			29	13
R	Crepis aculeata	**100**	**86**	**71**	17	**86**		14	**86**	57				13
	d.s. Geranio robertiani-Artemisietalia monospermae													
H	Geranium robertianum	17	**86**	14	**83**	29	43	**71**	14			**86**		
Q	Aetheorhiza bulbosa	17		29	50	**71**	**100**			14	**100**		14	**88**
E	Centaurea procurrens	33	**86**	29	50	29	29		14	43			**86**	25
Q	Prasium majus		**100**	43	**67**	**100**	**86**	14		**71**	57	**71**	**100**	**75**
Q	Calicotome villosa		14	14		14	**100**				**100**		14	**100**
H	Paronychia argentea		29	14		57	43	14					14	13
	d.s. Phagnalo rupestri - Retamion raetam													
H	Urospermum picroides							29	14	57	43	57	**100**	**75**
V	Phagnalon rupestre			14	17	**71**	**86**	14		**71**	**100**	14	**86**	**50**
	d.s. Trifolio palaestini-Helianthemion stipulati													
V	Asparagus horridus	**100**	**71**	43	**100**	**71**	**100**			57	14		29	
V	Ephedra aphylla	**100**	**86**	**86**	**100**	**86**	14		29		29	**71**		13
R	Helianthemum stipulatum	**100**	14	**100**	**100**	**100**	29							
E	Rumex bucephalophorus	17	29	**100**	**100**	**100**	**71**			43			57	
Y	Plantago sarcophylla		**100**	**100**	**83**	**100**	14			14				
V	Umbilicus intermedius		57	57	**100**	**100**	**100**							
H	Senecio vernalis		**71**	57	**100**	**100**	14					**86**		
E	Alkanna tinctoria		43	**86**	**100**	**100**	57							
V	Valantia hispida		**86**	14	50	**71**	**86**					14		
V	Arenaria leptoclados	33		29	**100**	**71**	**86**			14	14		43	
R	Brassica tournefortii		14	43	**67**	**100**	**71**						43	13
V	Cyclamen persicum			57	**83**	**71**	**86**							
E	Euphorbia terracina		29	57	**83**	**71**	14				14	29		38
E	Trifolium palaestinum	17		**71**	**100**	**71**				14			**71**	25
E	Aegilops sharonensis		43	**71**	**100**	**71**								
R	Convolvulus secundus			14	33	14	14							
H	Hippocrepis multisiliquosa	17			17	14								
H	Urginea maritima			14		14	14							
	Marker and rare species of associations													
H	Silene muscipula							**71**				29		
Y	Silene succulenta							29			14			
F	Centropodia forsskalii	**83**							**100**	**100**				25
C	Solanum sinaicum								**86**		14	57		**75**
R	Moltkiopsis ciliata								57	29				
D	Heterotheca subaxillaris							14	43					
H	Avena sterilis	17							29	14				
D	Urtica membranacea						14		14					
H	Geranium molle								14				14	13
R	Lotus halophilus	33	14						14	**100**				
R	Cyperus macrorrhizus	**67**							**71**	**100**				
R	Corynephorus divaricatus									**86**	57		29	
E	Campanula sulphurea									**86**			29	
F	Convolvulus lanatus									**71**	14		43	
R	Trisetaria linearis									57				
W	Asphodelus tenuifolius	33								57			14	25
R	Scrophularia hypericifolia									43				
R	*Launaea fragilis*									43	14			
E	Vulpia fasciculata									29				
R	Astragalus fruticosus									29				
R	Astragalus peregrinus									14				
W	Orobanche cernua									14				
H	Mercurialis annua									14				

Table 47. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P
H	Silene modesta		14							14				
D	Euphorbia peplus						14			14			14	
L	Dittrichia viscosa										**100**			
H	Tolpis virgata									29	**100**		71	25
B	Ononis natrix	33								29	**86**		29	13
R	Polygonum palaestinum							14			**86**	29		
Y	Lotus creticus										**71**			
R	Ammophila arenaria										43			
H	Tragopogon coelesyriacus										43		14	13
R	Echinops philistaeus										14			
L	Sonchus maritimus										14			
H	Hyparrhenia hirta										14			
D	Lactuca serriola										14			
H	Stellaria pallida		14						29	14	14	**100**	**86**	13
L	Sonchus microcephalus	**67**			17			**71**	29			**100**		
Q	Galium aparine		14		50						14	**71**		
Q	Arum dioscoridis											14		
H	Solanum nigrum											14		
E	Bilacunaria boissieri								14	14			**100**	50
H	Avena barbata									43	14		**100**	**75**
H	Lagurus ovatus				50	43	43			57			**100**	25
H	Lathyrus marmoratus									29	29		**86**	13
H	Echium angustifolium	**83**								57	29		**86**	13
H	Bromus rigidus	17	57	29	**67**					29		14	**86**	**75**
H	Trifolium tomentosum			14						14			**71**	13
H	Vicia sativa									14	14	14	**71**	
R	Erodium laciniatum	33			17								43	13
H	Lathyrus sphaericus										14		43	
H	Lotus peregrinus									29			43	13
H	Crucianella macrostachya					14							43	
H	Trifolium campestre												43	13
H	Daucus carota											14	29	
E	Lupinus palaestinus												29	
H	Vicia peregrina												29	
R	Plantago albicans												14	
R	Astragalus annularis												14	
Q	Lamium amplexicaule												14	
H	Hordeum spontaneum												14	
E	Trifolium philistaeum												14	
A	Astragalus spinosus												14	13
D	Sonchus oleraceus	**67**	43						43	43			57	**100**
V	Sonchus tenerrimus									29			**71**	**88**
W	Anagallis arvensis	33			17	29				14	29		**71**	**75**
W	Brachypodium distachyon					14							29	**63**
H	Astragalus boeticus												14	
H	Convolvulus althaeoides													38
Q	Filago eriocephala													13
F	Argyrolobium uniflorum													13
W	Vicia narbonensis													13
L	Scirpus holoschoenus	50												
F	Panicum turgidum	50												
H	Biscutella didyma	50								29			43	38
H	Stellaria media	33												
H	Cynodon dactylon	33									14			
E	Iris atropurpurea	33												
W	Papaver humile	33								29				
Y	Pancratium maritimum	17												
A	Urginea undulata	17												
H	Asphodelus ramosus	17		14						14				
R	Echiochilon fruticosum	17	**100**	57	33								14	
R	Crucianella herbacea	33	57	14	17					29	14			
H	Galium murale		43		33									
R	Lycium schweinfurthii		14									14		

Table 47. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P
Q	Ballota philistaea		14											
L	Bryonia syriaca		14											
H	Onobrychis squarrosa		14											
E	Sixalix arenaria			**71**	33	**71**								
R	Rumex occultans			57	50	14								
D	Cuscuta brevistyla			43	33									
R	Astragalus berytheus			14										
F	Ononis variegata			14										
E	Anthemis leucanthemifolia			43	**67**	57								
H	Erodium botrys			29	**67**									
H	Sedum caespitosum			14	**67**									
H	Veronica cymbalaria			14	**67**	43				29				13
R	Trigonella cylindracea		14	29	**67**	43								
H	Phleum subulatum			14	50									
H	Geranium rotundifolium			14	17			14						
R	Cyperus capitatus		29	29	33	**100**					14			
Q	Pistacia lentiscus		14	14		**100**	**100**							
Q	Rhamnus alaternus				17	**100**	**100**							
Q	Rhamnus lycioides			29	17	**100**	**100**							
Q	Rubia tenuifolia		29	14	33	**86**	14					43		
Q	Osyris alba		57	57	17	**86**	57					14		
R	Chrysanthemum viscosum			29	50	**86**								
Q	Ephedra foeminea					**71**	57							
H	Silene colorata	17		29	33	**71**	14							
Q	Asparagus aphyllus			14		**71**	57							
V	Sedum hispanicum					57	57							
Q	Geranium lucidum		14			57	29							
E	Daucus glaber					57				29			29	13
E	Erodium telavivense					43								
H	Alopecurus utriculatus					43								
W	Lolium rigidum					29							14	
V	Asterolinon linum-stellatum					29								
H	Bromus sterilis					29								
E	Medicago littoralis				17	29	14							13
E	Desmazeria philistaea					14								
H	Alyssum simplex					14								
H	Verbascum sinuatum					14	14					14		
L	Geranium dissectum					14								
Q	Lonicera etrusca					14								
Q	Artemisia arborescens					14								
Q	Arum palaestinum					14								
Q	Ruta chalepensis					57	**100**							
H	Piptatherum miliaceum					29	**86**							
H	Silene dichotoma					14	43							
H	Pallenis spinosa						29							
M	Cistus salviifolius						29							
Q	Anagyris foetida						29							
Q	Smilax aspera						14							
H	Galium setaceum						14							
E	Sedum litoreum						14							

6.6.2 DS Erodio laciniati – Stipagrostietalia plumosae Danin et Solomeshch ord. nov.

Diagnostical species: *Ammochloa palaestina, Anthemis melampodina, Argyrolobium uniflorum, Asphodelus ramosus, Astragalus annularis, Avena wiestii, Bromus fasciculatus, Carduus getulus, Erodium laciniatum, Erucaria pinnata, Gymnocarpos decander,Helianthemum sessiliflorum, Matthiola livida, Noaea mucronata, Pancratium sickenbergeri, Paronychia arabica, Picris asplenioides, Plantago ovata, Salvia lanigera, Schimpera arabica, Senecio glaucus, Stipagrostis plumosa.*

Nomenclatural type: Stipagrostio scopariae – Artemision monospermae Danin et Solomeshch.

The sandy areas of the Negev were hardly studied in the past and only one plant community, *Artemiaia monosperma – Aristida scoparia* association, was recognized by Orshan & Zohary (1963). The diversity of vegetation is so much higher that in the present study 17 different associations are recognized in the same area. The vegetation of the stable sand of the northeastern Negev, studied by Danin et al., (1964), has higher floristic similarity and affinity to the Stipagrostietalia plumosae than to the Anabasietea articulatae. The former order is therefore divided into two suborders; Artemisienalia monospermae is confined to the sandy areas of Pleistocene origin of the western Negev whereas the Anabasienalia articulatae occupy the Neogene sands of the northeastern Negev.

6.6.2.1 Stipagrostio scopariae – Artemisienalia monospermae Danin et Solomeshch subord. nov.

Diagnostical species: *Artemisia monosperma, Hippocrepis areolata, Plantago cylindrica, Sixalix eremophila, Vulpia brevis.*

Nomenclatural type: Stipagrostio scopariae – Artemisietum monospermae Danin et Solomeshch.

Synoptic table: Table 53.

The associations of this suborder occur at the western Negev (Fig. 1, No. 14) and comprise systems of linear dunes which partially covered alluvial plains rich in silty material or hills of hard chalk and limestone. The alluvial plains of Nahal Nizzana, Nahal Lavan, Nahal Besor, Nahal Rut and others, partially covered by these sands, were sedimented from ca 35,000 to 25,000 BP (Zilberman, 1982, Zilberman, 1989, Goring-Morris & Goldberg, 1990). The sediments included mainly silt, clay, and fluviatile sand deposits. The linear dunes and sand sheets of the western Negev were sedimented during the period of 25,000 to 18,000 years BP and continued long after the main incursion took place, via a gradual time-transgressive, relatively rapid process that progressively advanced from west to east (Goring-Morris & Goldberg, 1990). According to Rendell et al., (1993) the dunes were sedimented 6,000 to 10,000 years ago. Limestone and chalk hills in this area were influenced during the pedogenetic processes of their weathering and differ from the brown lithosols in the areas which were far away from the sources of air-borne sand.

The suborder comprises alliances which agree mostly with the results of the three main kinds of geomorphological processes. Stipagrostio scopariae – Artemision monospermae (DSA) includes the associations of the psammosere. This is a series of associations representing plant succession from fresh mobile sand in dunes, poorly inhabited by plants, through the establishment of colonizers, stabilizers, and plants inducing sand amelioration by trapping air-borne materials and nutrients fixation. Several associations are characterized by *Stipagrostis scoparia* which is the first colonizer of the mobile sand accompanied by psammophytes alone. *S. scoparia* dominates large areas of mobile sand dunes in N Sinai (Danin, 1983) and in N Africa (Le Houerou, 1995). The other dominant is *Artemisia monosperma* which is also a leading species in many associations of stabilizing and stable sand along the Mediterranean coast. Associations confined to sites with sand deflation are also included here. We regard Orshan & Zohary (1963) *Artemiaia monosperma – Aristida scoparia* association as an alliance.

Associations of the second alliance Stipagrostio plumosae – Helianthemion sessilifloris (DSH) occupy ancient terraces of large alluvial waterways. These wadis drained the area between the Negev Highlands and the Mediterranean Sea, carried sandy-silty alluvium and organized the material of varying texture in terraces which have locally a rather similar texture extending over an area of a few square kilometer. Concluding from a few soil samples made in several terraces we assume that each association has its typical soil profile. This issue needs further investigation.

Associations of the third alliance Erucario pinnatae – Noaeion mucronatae (DSN) are developed on soils resembling the Brown Lithosols which cover limestone and hard chalk of non-sandy areas. However, the air-borne sand particles trapped by the vegetation among the dunes and alluvial terraces lead to the enrichment of the soil profile in these particles. Consequently, a special moisture regime is developed in these soils. Water infiltration capacity of the sandy soils is higher than that of neighbouring loessial soil. The water holding capacity of the chalk and the loessial Brown Lithosol developed above it is higher than that of sandy soils.

Microbiotic crust, composed mainly of filamentous cyanobacteria, cyanophilous lichens, and mosses, plays an important role in plant succession and sand stabilization C. Danin et al., 1989). When destroyed by human activity

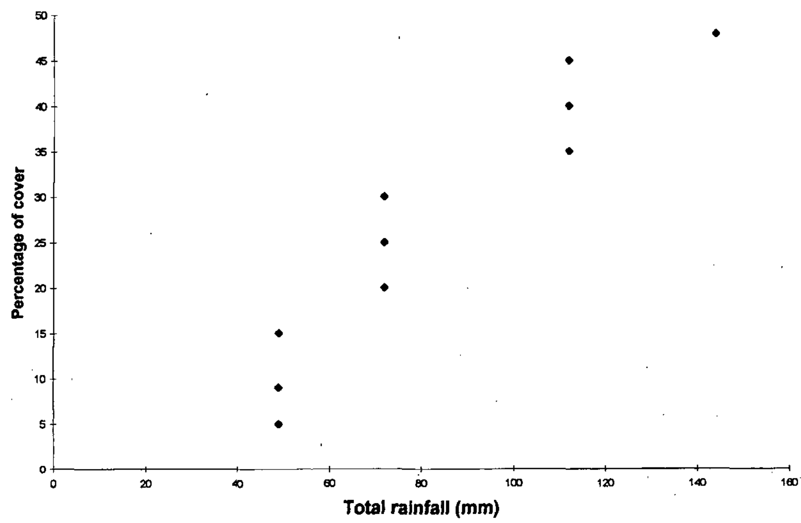

Figure 95. Cover of ephemeral species as related to rainfall on silty-sandy soils in Spring 1994.

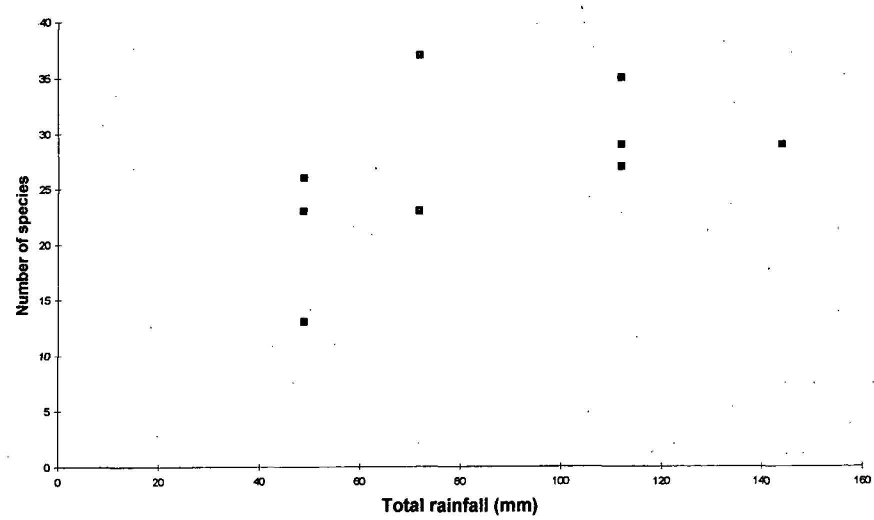

Figure 96. Number of ephemeral species as related to rainfall on silty-sandy soils in Spring 1994.

and by trampling of his domestic animals, sand mobility increases and plant succession may start again in places where vegetation and environment were already stable.

The relations between average cover of the ephemeral plants per relevé in 10 groups of relevés belonging to 9 associations of this suborder which had considerable percentage of silt plus clay in at least one component of the profile, are presented in Fig. 95. The coefficient of linear regression for the precipitation data (in Fig. 3) is $r = 0.916$, $p << 0.001\%$. The equation relating ephemeral vegetation cover (C) to the amount of rainfall (P) is:

$$C = 0.47P - 13.1$$

In addition to the stations mentioned above, a rain collector in coordinates 34°24' E/ 30°51'N measured the total of 28 mm in 1994. This is the area where nearly no annuals were found on the silty-sandy ground dominated by *Cornulaca monacantha* (Sect. 6.6.2.1.2.2). The predicted percentage of cover of ephemerals there is:

$$C_{28} = 0.47 \times 28 - 13.1 = 0.06$$

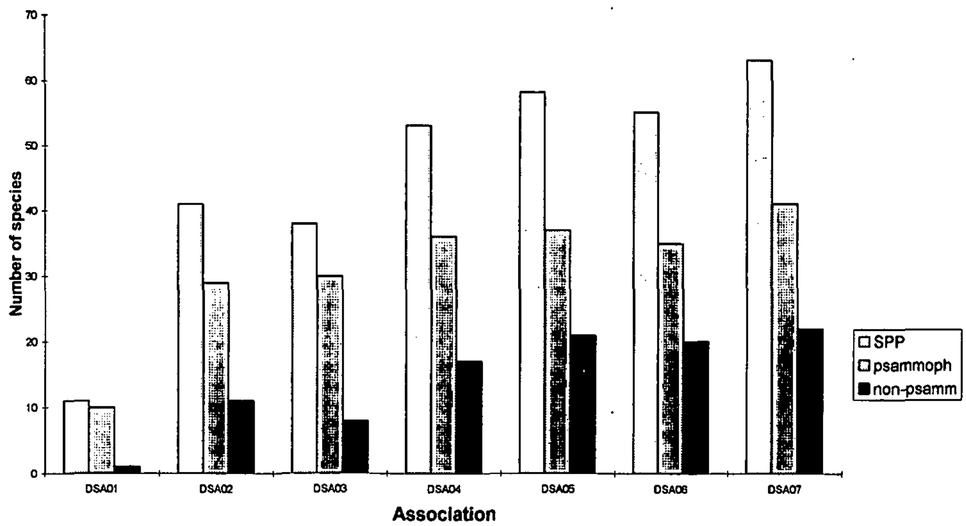

Figure 97. Changes in the number of species and of psammophytes during psammosere in the NW Negev.

This result is practically 0 which was actually the situation found in the field.

The relations between the number of species per relevé, in the same groups of relevés mentioned above, and the amount of rainfall in 1994, is presented in Fig. 96. The coefficient of linear regression for the data in Fig. 96 is $r = 0.492$, $p =$ non-significant. The correlation between the cover of annual species and the number of species per relevé is also not significant ($r = 0.43$, $p =$ non-significant).

The cover of ephemerals increases during the processes of plant succession in the Negev with the increasing percentage of fine grained particles as found in a small area (Danin, 1978a) and in the larger area of the present study. However, when the amount of silt plus clay reaches a certain value the cover of ephemeral plants becomes much influenced by the annual quantity of rainfall. The highly significant correlation found in the study area (Fig. 95) enables us to predict, in the area with 100-200 mm annual rainfall, what will be the ephemeral plants cover under a certain amount of rainfall. Similarly, one could use in such areas the maximal cover of ephemerals to estimate the total amount of rainfall. The values and slope of the curves for more silty or more clayey soils than those studied here are expected to be different.

6.6.2.1.1 DSA Stipagrostio scopariae – Artemision monospermae (Orshan et Zohary 1963) Danin et Solomeshch all. nov.

Syn.: *Artemiaia monosperma – Aristida scoparia* association Orshan et Zohary 1963.

Diagnostical species: *Artemisia monosperma* (dom.), *Cyperus macrorrhizus, Echinops philistaeus, Eremobium aegyptiacum, Heliotropium digynum, Moltkiopsis ciliata, Stipagrostis scoparia.*

Nomenclatural type: Stipagrostio scopariae – Artemisietum monospermae Danin et Solomeshch.

Synoptic table: Table 53.

The associations found on dunes of various ages are listed below in the suggested sequence of the psammosere. Geomorphological relationships of the succession seral associations, as concluded from our previous research (Danin, 1978a), were used for choosing the sites for recording the vegetation (Danin, 1996: p. 116). The number of species increases from the first associations of the psammosere to the later stages as discussed for the coastal dunes (Sect. 6.6.1). Changes from the first stage of succession to the second and third were observed in many places during the last 30 years and a few sites were studied in detail together with the edaphic changes (Danin, 1976). The gradual changes in the number of species, seen in Fig. 97, support the assumptions based on geomorphology and field relationships which led us to construct the order of psammosere.

The phytogeographical analyses of the species lists of the associations in this alliance (Figs. 98 and 99) display a rather simple pattern. The most frequent chorotype is the Saharo-Arabian. There is a slight increase in the Mediterranean species as the succession proceeds from DSA01 to DSA06.

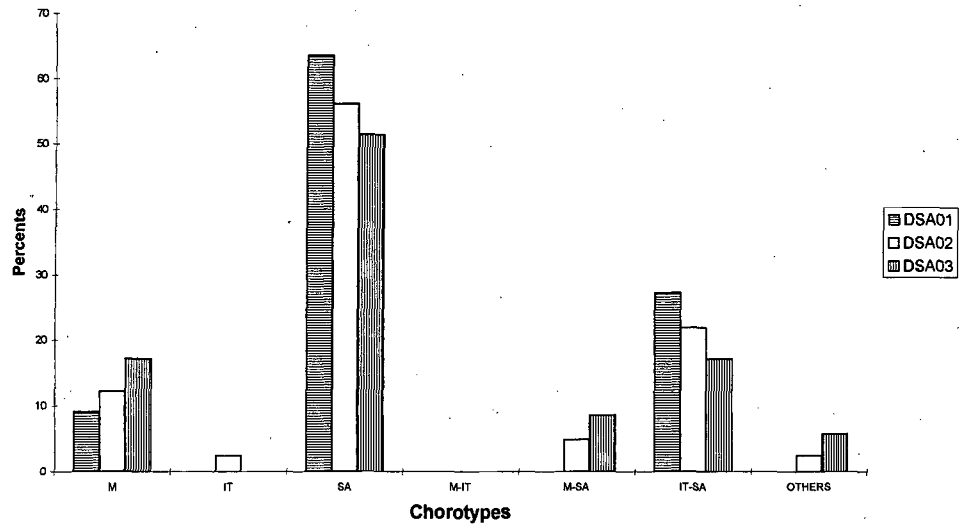

Figure 98. Phytogeographical analysis of associations DSA01, DSA02, and DSA03.

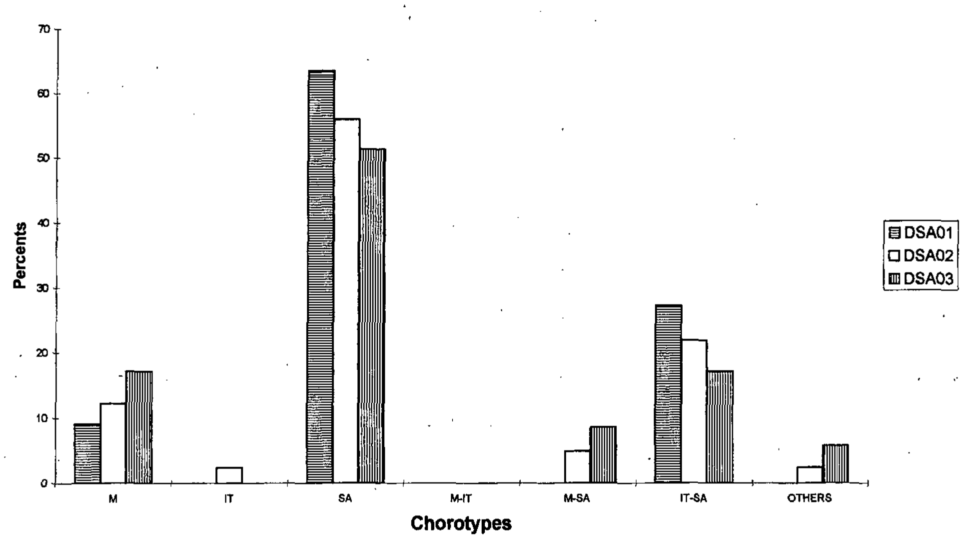

Figure 99. Phytogeographical analysis of associations DSA04, DSA05, and DSA06.

6.6.2.1.1.1 DSA01 Heliotropio digyni – Stipagrostietum scopariae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 48. **Distribution:** Fig. 100.

Ecological notes: Stands of this association were recorded along the crests of several linear dunes which are active and mobile at present. There are large parts of the opened area with ripples which indicate sand mobility. Many annual and perennial plants have exposed roots or are covered with sand. There is no sign of microbiotic crust of any kind in this area. The number of species in this association (11 spp.) is the lowest in the alliance (38-62 spp.). Of the two most common persistent species *Stipagrostis scoparia* is adapted to sand accretion whereas *Heliotropium digynum* is adapted to live in areas with considerable sand deflation (Danin, 1996). The higher importance of the former in the community may indicate which of the two processes is prevailing in areas dominated by this association. Young *S. scoparia* plants occur in flat area but older ones have a nebka accumulated among the stems buried in the sand (Fig. 21). Buried nodes produce new shoot-borne roots and the entire plant creates a sand

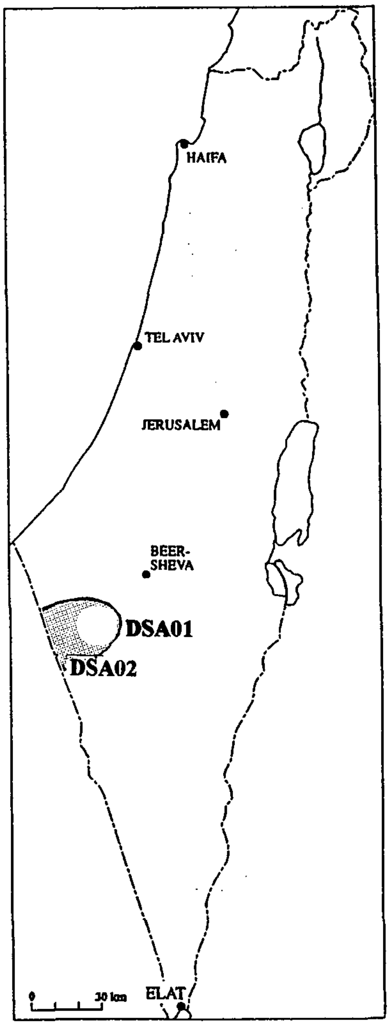

Figure 100. Distribution map of associations DSA01 and DSA02.

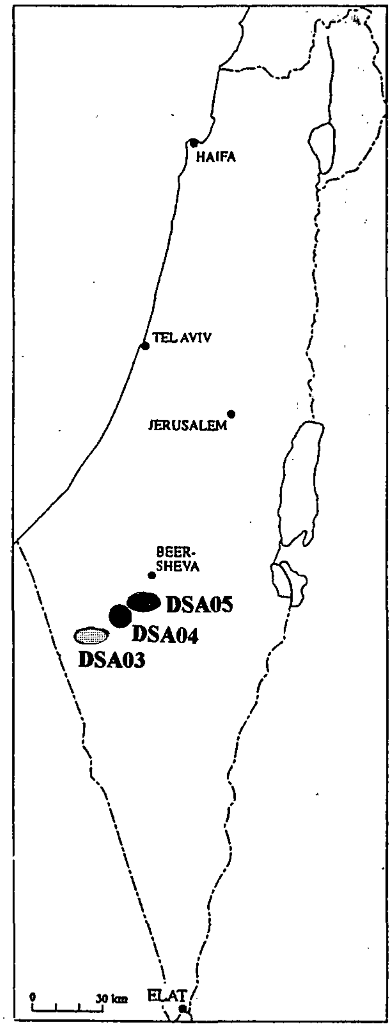

Figure 101. Distribution map of associations DSA03-DSA05.

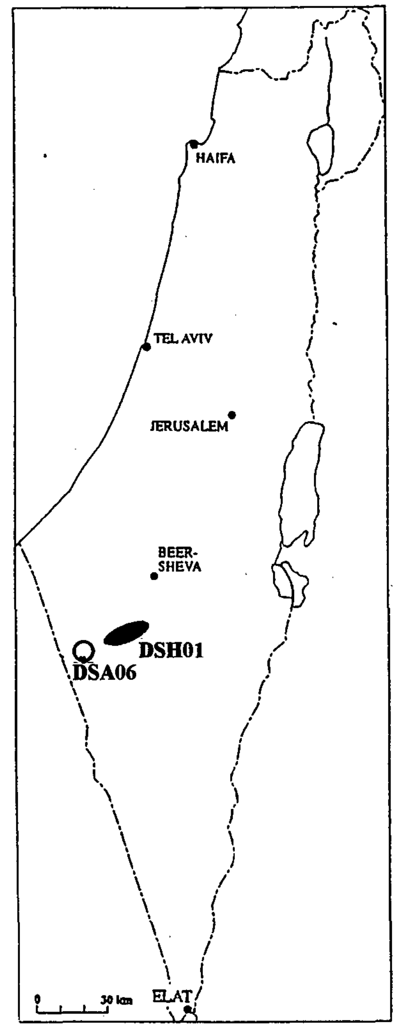

Figure 102. Distribution map of associations DSA06 and DSH01.

mound in which it is buried. Near compact and tall mounds moats are found too. *Artemisia monosperma* which may outcompete *S. scoparia* in the next seral stage is already present here.

The two most common annuals which accompany the persistent plants of this habitat are *Eremobium aegyptiacum* and *Cutandia memphitica*. Both may be seen in the field during winter and spring when 5-10 cm of their stems are buried in sand or 5-10 cm of their root system is exposed.

Association dynamics and conservation: Most of the area of this association is under occasional pressure of grazing and cutting.

Aspects of the association: Persistents – 6 spp.; ephemerals – 5 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94039	5	5	6	26.02.94	I 1601 5408
2	94041	1	10	4	26.02.94	I 1550 5367
3	94043	5	5	4	26.02.94	I 1551 5367
4	94044	5	5	5	26.02.94	I 1552 5367
5	94046	3	7	6	26.02.94	I 1553 5367
6	94047	2	8	5	26.02.94	I 1554 5367
7	94048	2	10	5	26.02.94	I 1551 5368
8	94051	5	10	4	26.02.94	I 1552 5368
9	94052	5	15	7	26.02.94	I 1553 5368
10	94053	5	10	5	26.02.94	I 1554 5368
11	94054	5	10	7	26.02.94	I 1550 5369
Average:		3.9	8.6	5.3		

Table 48. Association tables of DSA01 – Heliotropio digyni - Stipagrostietum scopariae, DSA02 – Stipagrostio scopariae - Artemisietum monospermae, and DSA03 – Echinopo philistaei – Moltkiopsietum ciliatae

		Species	DSA01				DSA02				DSA03			
			*12345678901	C1	C2	%P	*12345678901	C1	C2	%P	*1234567	C1	C2	%P
*	N	Anabasis articulata					.........+.	0	0	9				
	W	Anthemis melampodina									+...++0	1	1	57
*	R	Artemisia monosperma	..111.0.0.0	7	4	55	54255644666	48	48	100	3457646	**50**	**50**	**100**
	R	Astragalus annularis					.......+...	0	0	9				
*	R	Atractylis carduus					.+.....+++.	0	0	36	+...+++	0	0	57
	A	Avena wiestii					..........+	0	0	9				
	R	Bassia muricata					....+..+++.	0	0	36	......+	0	0	14
	H	Bromus fasciculatus					..........+	0	0	9				
*	R	Calligonum comosum	........0..	5	0	9	........00.	5	1	18				
	W	Carduus getulus					+++1+.++...	**1**	**1**	**64**	.++0.++	**1**	**1**	**71**
*	F	Centropodia forsskalii									......+.	0	0	14
*	F	Convolvulus lanatus					+..........	0	0	9	.+.++..	0	0	43
	R	Corynephorus divaricatus					..........+	0	0	9				
	A	Crucianella membranacea									....+..	0	0	14
	R	Cutandia memphitica	39569889999	**77**	**77**	**100**	7545675460+	45	45	100	..+..++	0	0	43
*	R	Cyperus macrorrhizus	+...0......	3	0	18	0+10+00+..+	**3**	**3**	**82**	.+.++++	**0**	**0**	**71**
*	R	Echinops philistaeus					++3.+..+...	6	3	45	4432222	**27**	**27**	**100**
	F	Eremobium aegyptiacum	61541221111	**23**	**23**	**100**	+0.+.1.+..+	3	1	55	..+....	0	0	14
	R	Erodium laciniatum	0	5	0	9	+++.201+25+	**11**	**10**	**91**	.0+24++	**11**	**9**	**86**
	F	Erucaria pinnata	0....+...+.	2	0	27	10++++2+.1+	**5**	**4**	**91**	1+1++1.	**5**	**4**	**86**
*	R	Haplophyllum tuberculatum					.....+.....	0	0	9				
*	F	Heliotropium digynum	20.21211131	**16**	**15**	**91**	...+++0+110	**4**	**3**	**73**	.+...3+	10	4	43
	F	Hippocrepis areolata									......+	0	0	14
	R	Ifloga spicata					++300.+++1+	**5**	**5**	**91**	5+15555	**37**	**37**	**100**
	R	Launaea fragilis									...+...	0	0	14
	W	Linaria haelava					+..........	0	0	9				
	R	Lotus halophilus									....+..	0	0	14
*	R	Lycium schweinfurthii									0	5	1	14
	W	Matthiola livida					.....+.+...	0	0	18	......+	0	0	14
*	R	Moltkiopsis ciliata	0	2	0	9	+1110+21020	**9**	**9**	**100**	2110211	**14**	**14**	**100**
*	A	Noaea mucronata					..........+	0	0	9				
	H	Ononis serrata					.+++...+..+	0	0	45	+++..++	0	0	71
	W	Orobanche cernua					.....+...+.	0	0	18	...++.+	0	0	43
	F	Pancratium sickenbergeri									....+..	0	0	14
	W	Papaver humile					.......+..+	0	0	18				
	F	Picris asplenioides					.......+...	0	0	9	+..+.+.	0	0	43

Table 48. continued.

		Species	DSA01 12345678901	C1	C2	%P	DSA02 12345678901	C1	C2	%P	DSA03 1234567	C1	C2	%P
	F	Plantago cylindrica					++12.+1+113	9	8	91	.12+++0	7	6	86
	W	Plantago ovata					+1.........	5	1	18				
	R	Polycarpon succulentum					.......+...	0	0	9				
	R	Pseudorlaya pumila					........++.	0	0	18	+++.+.+	0	0	71
*	R	Retama raetam					......+....	0	0	9	0.+0+.+	2	1	71
	R	Rumex pictus					+1..+.+5+++	8	5	73	+++++++	0	0	100
	F	Schimpera arabica					..+........	0	0	9	....+..	0	0	14
	W	Schismus arabicus					+..........	0	0	9				
	W	Senecio glaucus	........+..	0	0	9	222111.2.++	12	10	82	2322021	18	18	100
	R	Silene villosa					.......+...	0	0	9				
	R	Sixalix eremophila									.++++..	0	0	57
*	F	Stipagrostis plumosa					...+......+	0	0	18	.+.++++	0	0	71
	F	Stipagrostis scoparia	89977888878	80	80	100	44334335113	31	31	100	0.+..++	1	1	57
	H	Trifolium tomentosum									......+	0	0	14
	R	Vulpia brevis					+.+.......+	0	0	27	143+.13	21	18	86
	F	Vulpia pectinella					+......3106	21	10	45	.....0.	5	1	14

6.6.2.1.1.2 DSA02 Stipagrostio scopariae – Artemisietum monospermae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 48. **Distribution:** Fig. 100.

Ecological notes: The relevés of this association were recorded in linear dunes which some 10 years before their recording were still mobile. In a few places younger and mobile dunes covered by the Stipagrostietum scopariae (DSA01) exist at the crests above this association. At present sand mobility is at a low intensity as indicated by the presence of ripples here and there. A crust of cyanobacteria is seen in closed areas surrounded by grass tufts or by lignified plants. Cyanobacteria are not seen above the ground but sand grains are already attached to each other and to filaments by the mucilaginous polysaccharide sheath of the organisms.

The former stage of the sere is easily recognized by the dead or partially dead tufts of *S. scoparia* in sites of this association. Sand mounds in places where *S. scoparia* was living may be recognized by the deteriorating remnants of this grass' stems. Plants of *Artemisia monosperma* often grow on these mounds. Vegetation cover and the number of species are higher than in the previous association. The decreasing importance (as seen by cover and presence) of *S. scoparia* and the increasing importance of *A. monosperma* and *Moltkiopsis ciliata* indicate increasing stability or sand deflation which take place in the area at this stage. The dominant annuals accompanying *Cutandia memphitica* are *Senecio glaucus* and *Erodium laciniatum*. There are patches where *Vulpia (Ctenopsis) pectinella* is the dominant.

This association is not synonymous with *Artemisia monosperma – Aristida scoparia* association (Orshan & Zohary, 1963) . Even if it could be a part of the latter, it is not possible to draw the similarity lines because Orshan & Zohary (1963) did not present relevés from which the presence values of the plants in their table were derived.

Association dynamics and conservation: Most of the area of this association is under occasional pressure of grazing and cutting.

Aspects of the association: Persistents – 13 spp.; ephemerals – 28 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94002	20	20	20	26.02.94	I 1641 5418
2	94003	15	15	17	26.02.94	I 1642 5418
3	94004	15	15	15	26.02.94	I 1643 5418
4	94005	15	15	14	26.02.94	I 1644 5418
5	94006	15	30	14	26.02.94	I 1641 5418
6	94007	10	20	14	26.02.94	I 1642 5417
7.	94008	10	20	13	26.02.94	I 1643 5417
8	94040	20	20	26	26.02.94	I 1601 5408
9	94049	10	20	14	26.02.94	I 1550 5367
10	94050	10	20	18	26.02.94	I 1550 5366
11	94249	20	20	22	22.03.94	I 1719 5441
Average:		14.6	19.6	17.0		

6.6.2.1.1.3 DSA03 Echinopo philistaei – Moltkiopsietum ciliatae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 48. **Distribution:** Fig. 101.

Ecological notes: The relevés were recorded in the same linear dune as most relevés of the previous association (DSA02), but on relatively older parts of the dune. The stages of sand accretion in the form of young dunes covering pre-existing older dunes can be easily seen in the field. Following dune morphology the sites for recording this association were chosen in lower topographic position than those of the previous association. *Echinops philistaeus* and *Artemisia monosperma* share several properties enabling them to dominate in this nearly stable sand (Danin, 1996). The two species withstand sand cover by producing shoot-borne roots and new branches from the buried stems; their lignified deep tap roots can withstand considerable time of exposure. Sand deflation is indicated in the composition of this association by the importance of *Moltkiopsis ciliata* which is adapted to sand deflation (Danin, 1996). The association is named after the latter species to differentiate this association from an association dominated by the same dominants in the coastal plain (DMB05). Stability and age of the site is indicated by the high presence of *Lycium schweinfirthii, Retama raetam,* and *Stipagrostis plumosa. Stipagrostis scoparia, Eremobium aegyptiacum* and *Cutandia memphitica* are found in small quantities. *Ifloga spicata, Senecio glauca, Vulpia brevis* and *Plantago cylindrica* are the dominant annuals of this association.

Association dynamics and conservation: Most of the area of this association is under occasional pressure of grazing and cutting.

Aspects of the association: Persistents – 11 spp.; ephemerals – 27 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94023	20	20	15	26.02.94	I 1641 5418
2	94024	20	20	18	26.02.94	I 1642 5418
3	94025	20	20	18	26.02.94	I 1643 5418
4	94026	10	20	19	26.02.94	I 1631 5405
5	94027	25	20	22	26.02.94	I 1631 5406
6	94028	30	20	22	26.02.94	I 1631 5407
7	94029	30	20	26	26.02.94	I 1631 5408
Average:		22.1	20.0	20.0		

6.6.2.1.1.4 DSA04 Stipagrostio plumosae – Artemisietum monospermae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 49. **Distribution:** Fig. 101.

Ecological notes: Most relevés of this association were recorded in sand sheets covering the oldest surfaces in the vicinity of the previous associations in the alliance (DSA01, DSA02, and DSA03). From its geomorphological position it is not clear if this association is older or synchronic with the Echinopo – Artemisietum (DSA03). The most important persistent companions are *Stipagrostis plumosa, Moltkiopsis ciliata*, and *Retama raetam*. These indicate slight mobility of the sand, some deflation or accretion. The dominant annuals of the previous association are accompanied here by *Picris asplenioides*.

There are patches of well developed microbiotic crust composed of cyanobacteria which do not grow above the soil surface.

Association dynamics and conservation: Most of the area of this association is under occasional pressure of grazing and cutting.

Aspects of the association: Persistents – 14 spp.; ephemerals – 39 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94016	35	15	17	26.02.94	I 1641 5418
2	94017	20	30	22	26.02.94	I 1642 5418
3	94018	20	20	22	26.02.94	I 1643 5418
4	94019	20	20	20	26.02.94	I 1641 5417
5	94020	25	25	20	26.02.94	I 1641 5416
6	94021	25	25	23	26.02.94	I 1642 5417
7	94022	15	15	28	26.02.94	I 1642 5416
8	94042	5	15	19	26.02.94	I 1550 5367
9	94045	10	20	19	26.02.94	I 1550 5368
10	94055	10	20	19	26.02.94	I 1550 5369
11	94250	60	15	24	22.03.94	I 1719 5441
Average:		22.3	20.0	21.2		

Table 49. Association tables of DSA04 – Stipagrostio plumosae – Artemisietum monospermae, DSA05 – Stipagrostio plumosae – Convolvuletum lanati, and DSA06 – Convolvulo lanati – Moltkiopsietum ciliatae

		Species	DSA04 *12345678901	C1	C2	%P	DSA05 *123456789	C1	C2	%P	DSA06 *12345678	C1	C2	%P
	W	Adonis dentata	.+.....+...	0	0	18	......+..	0	0	11				
	F	Allium sindjarense									...+....	0	0	13
	F	Ammochloa palaestina	..........+	0	0	9	......+..	0	0	11	......+.	0	0	13
*	N	Anabasis articulata	.........+.	0	0	9	+........	0	0	11	.0.+...+	2	1	38
	W	Anthemis melampodina	+++++++...+	**0**	**0**	**73**	.+++..++.	0	0	56	+.......	0	0	13
*	F	Argyrolobium uniflorum									.......+	0	0	13
	W	Arnebia linearifolia									.......+	0	0	13
*	R	Artemisia monosperma	56657637774	**57**	**57**	**100**	02.21200+	**11**	**10**	**89**	2.1+01+.	**8**	**6**	**75**
	H	Asphodelus ramosus					.......++	0	0	22	.......+	0	0	13
	W	Asphodelus tenuifolius									...+..+.	0	0	25
	R	Astragalus annularis	....+....+.	0	0	18					.....++.	0	0	25
	A	Astragalus caprinus	.......+...	0	0	9	.+.....+.	0	0	22	....+...	0	0	13
	W	Astragalus tribuloides									.......+	0	0	13
	R	Astragalus trimestris									......+.	0	0	13
*	R	Atractylis carduus	0+.+++++.++	**1**	**0**	**82**	+++++++.+	**0**	**0**	**89**	...+....	0	0	13
	A	Avena wiestii	+..........	0	0	9								
	R	Bassia muricata	......+....	0	0	9								
	R	Brassica tournefortii									.+.+....	0	0	25
	H	Bromus fasciculatus	..........+	0	0	9					++.+..28	**20**	**13**	**63**
*	R	Calligonum comosum	.......011.	8	2	27								
	W	Carduus getulus	++++....+..	0	0	45	+.+......	0	0	22	......+.	0	0	13
*	F	Centropodia forsskalii	.+.........	0	0	9					++...+..	0	0	38
	A	Colchicum ritchii					........+	0	0	11				

Table 49. continued.

		Species	DSA04 12345678901	C1	C2	%P	DSA05 123456789	C1	C2	%P	DSA06 12345678	C1	C2	%P
*	F	Convolvulus lanatus	.+..+.+....	0	0	27	331+5.+11	**18**	**16**	**89**	30.+.531	**21**	**16**	**75**
*	F	Cornulaca monacantha									2	20	3	13
	A	Crucianella membranacea	+..........	0	0	9	++.......	0	0	22	++.0+3..	**7**	**4**	**63**
	R	Cutandia memphitica	..++.+..1..	3	1	36	++.+..+..	0	0	44	.+.1+.1.	5	3	50
*	R	Cyperus macrorrhizus	.0+++1+.+.+	**2**	**1**	**73**	+0+0.++.+	**1**	**1**	**78**	.++0++++	**1**	**1**	**88**
	H	Delphinium peregrinum	.........+.	0	0	9								
	F	Dipcadi erythraeum									..+.....	0	0	13
*	R	Echinops philistaeus	..+.+++....	0	0	36	..+....0+	2	1	33	..+...+.	0	0	25
*	R	Echiochilon fruticosum					++....516	24	13	56	..125133	**25**	**19**	**75**
	F	Eremobium aegyptiacum	........+..	0	0	9								
	W	Erodium crassifolium	......+....	0	0	9	+.......+	0	0	22				
	R	Erodium laciniatum	0.1+1+20325	**15**	**14**	**91**	553112152	**28**	**28**	**100**	++2+3.++	**7**	**6**	**88**
	F	Erucaria pinnata	1.+1.12+++0	**6**	**5**	**82**	21+2111+.	**11**	**9**	**89**	.+.++.+1	**2**	**1**	**63**
	W	Filago desertorum	..........+	0	0	9	....+.+..	0	0	22				
	E	Gagea dayana	.......+...	0	0	9	......+.+	0	0	22				
*	N	Gymnocarpos decander									++30++..	**6**	**4**	**75**
*	R	Helianthemum sessiliflorum					+.+....++	0	0	44				
*	R	Helianthemum stipulatum					+........	0	0	11	0	5	1	13
*	F	Heliotropium digynum	..+1.+1111.	**8**	**5**	**64**	.+22.+...	11	5	44				
	F	Hippocrepis areolata	++.+..+....	0	0	36	.+.+.+...	0	0	33				
	R	Ifloga spicata	526566252++	**36**	**36**	**100**	+1.1+3+24	**14**	**12**	**89**	+3+00...	**8**	**5**	**63**
	R	Launaea fragilis	.......2++.	7	2	27	.......+.	0	0	11	...+....	0	0	13
	W	Linaria haelava					.+.......	0	0	11	+++...++	**0**	**0**	**63**
	R	Linaria tenuis	..........+	0	0	9	......+..	0	0	11	.+......	0	0	13
	F	Lobularia arabica	......+....	0	0	9	......+..	0	0	11	.....++.	0	0	25
	R	Lotus halophilus	.+..+++...+	0	0	45	......++.	0	0	22	+++++1+.	1	1	88
*	R	Lycium schweinfurthii	..+.++.0...	1	0	36	..++.+0..	1	1	44				
	W	Matthiola livida					......+..	0	0	11	..++..++	0	0	50
*	R	Moltkiopsis ciliata	1212202.+03	**15**	**13**	**91**	+.31+3+5+	**15**	**13**	**89**	05+1000+	**10**	**10**	**100**
	R	Neurada procumbens	..+.......+	0	0	18	..+.1++++	**2**	**1**	**67**	+......+	0	0	25
*	A	Noaea mucronata	.......+..1	5	1	18	.+....+..	0	0	22	++.....+	0	0	38
	H	Ononis serrata	.....++.++.	0	0	36	.++.....+	0	0	33	....+..+	0	0	25
	W	Orobanche cernua	..+........	0	0	9	....+....	0	0	11				
	F	Pancratium sickenbergeri	.+....+....	0	0	18	++++..+++	**0**	**0**	**78**	..+....+	0	0	25
	W	Papaver humile									....+....	0	0	13
	R	Paronychia arabica					....+.+..	0	0	22	......+.	0	0	13
	F	Picris asplenioides	22000+.++21	**9**	**8**	**91**	1+5+525+.	**23**	**21**	**89**	86886371	**59**	**59**	**100**
	W	Plantago coronopus									......+.	0	0	13
	F	Plantago cylindrica	+++++011+3.	**6**	**5**	**91**	+.12+1.13	**11**	**9**	**78**	.+++0++.	**1**	**1**	**75**
	W	Plantago ovata									+.......	0	0	13
	R	Pseudorlaya pumila	.....++++10	3	1	55	..+.+++..	0	0	44				
	S	Pteranthus dichotomus					..+......	0	0	11				
	W	Reseda decursiva									+.......	0	0	13
*	C	Reseda urnigera									+.......	0	0	13
*	R	Retama raetam	1++1+1+0.+.	**4**	**3**	**82**	10.+011++	**5**	**4**	**89**	33432+21	**23**	**23**	**100**
	W	Rumex cyprius									.......+	0	0	13
	R	Rumex pictus	++++.+++.++	**0**	**0**	**82**	+++.+++..	**0**	**0**	**67**	.+.++++.	**0**	**0**	**63**
*	A	Salvia lanigera									......++	0	0	25
	F	Schimpera arabica	..+...+....	0	0	18	.++......	0	0	22				
	W	Senecio glaucus	1322221.+.0	**15**	**12**	**82**	.2+.102.0	**10**	**7**	**67**	+++.+++.	**0**	**0**	**75**
	H	Silene colorata	......+...+	0	0	18	...+.....	0	0	11				
	R	Silene villosa									.+.+.+..	0	0	38
	R	Sixalix eremophila					+.....+.+	0	0	33	+.++++..	**0**	**0**	**63**
	W	Stipa capensis									+.......	0	0	13
*	F	Stipagrostis ciliata					....+.+..	0	0	22	2	20	3	13
*	F	Stipagrostis plumosa	10201130..2	**13**	**11**	**82**	544323312	**30**	**30**	**100**	10+3++10	**8**	**8**	**100**
*	F	Stipagrostis scoparia	.+..+++.0..	1	0	45								
*	B	Thymelaea hirsuta					1	10	1	11	0.0+2+0.	**6**	**4**	**75**
	H	Trifolium tomentosum	2	20	2	9								
	W	Trigonella arabica					......+..	0	0	11				
	R	Trisetaria linearis									.+.+.++.	0	0	50
	R	Vulpia brevis	.++1+++...+	**1**	**1**	**64**	++.3+.1.+	**7**	**4**	**67**				
	F	Vulpia pectinella	.+......4+0	11	4	36					.+.+....	0	0	25

6.6.2.1.1.5 DSA05 Stipagrostio plumosae – Convolvuletum lanati Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 49. **Distribution:** Fig. 101.

Ecological notes: The vegetation, landscape features, and extent of development of microbiotic crust display features of much older terrain than that of the previous associations. In this respect one should argue if this association belongs to the present alliance (including seral sequence from mobile to stable sand) or to the following alliance where vegetation of sand sheets covering limestone hills or alluvial terraces is discussed. The reasons to comprise it here are primarily geographical- geomorphological ones; all the previously discussed associations in the alliance are superimposed on the landscape covered by this association.

There are several plants adapted to sand deflation in the list of markers of this association. Such are *Artemisia monosperma, Convolvulus lanatus, Echiochilon fruticosum, Heliotropium digynum,* and *Moltkiopsis ciliata.* They reflect events of sand deflation that took place in this human managed ecosystem. The annuals with high importance are *Erodium laciniatum, Erucaria pinnata, Ifloga spicata, Picris asplenioides,* and *Plantago cylindrica.* This assemblage resembles the list of species in the advanced stages of the succession.

The microbiotic crust is well developed here and is composed of cyanobacteria which produce a considerable part of their thalus above the ground, thus contributing to the dark colour of the soil surface with their dark protective pigments (Dor & Danin, 1996). There are many patches of mosses covering the surface too. The otherwise continuous crust cover is interrupted in patches of activity of borrowing animals such as rodents, ants, other insects, or reptiles. In all these microsites the borrowing animals bring up fresh sand from below the crust. Hence these microsites are devoid of microbiotic crust and there are dominant plants other than those of the non-interrupted surfaces. *Vulpia brevis* is the dominant of the new ground above many such borrowing sites. A local microsuccession seems to take place near these disturbance sites, the details of which should be further investigated.

Association dynamics and conservation: Most of the area of this association is under occasional pressure of grazing and cutting.

Aspects of the association: Persistents – 16 spp.; ephemerals – 39 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94009	10	30	24	26.02.94	I 1641 5418
2	94010	15	15	26	26.02.94	I 1642 5418
3	94011	20	20	23	26.02.94	I 1643 5418
4	94012	20	20	20	26.02.94	I 1641 5417
5	94013	10	20	20	26.02.94	I 1642 5419
6	94014	20	20	18	26.02.94	I 1643 5417
7	94015	10	20	34	26.02.94	I 1641 5419
8	94030	20	20	20	26.02.94	I 1631 5405
9	94031	20	20	24	26.02.94	I 1632 5405
Average:		16.1	20.6	23.2		

6.6.2.1.1.6 DSA06 Convolvulo lanati – Moltkiopsietum ciliatae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 49. **Distribution:** Fig. 102.

Ecological notes: Wind erosion is a common factor influencing vegetation of sandy areas. In most areas deflation of sand is a temporary process which changes in time and space with sand accretion, as for example in mobile dunes. Slopes of ancient dunes, some of which may be 10,000 to 6,000 years old (Rendell et al., 1993), cut by dry water courses or windward end of such old linear dunes are habitats with constant wind deflation. Hardly any sedimentation takes place in this habitat and thus it is expected to support special vegetation. The relevés for this association were recorded on the eastern banks of Nahal Nizzana. A slope, 2-3 km long and built of several west-east old linear dunes, cut by Nahal Nizzana long ago, is subject to constant wind erosion. Most species in the list of persistent markers are resistant to sand deflation. A group of species which withstand removal of sand from their roots includes: *Artemisia monosperma, Convolvulus lanatus, Retama raetam,* and *Thymelaea hirsuta.* Shrubs of *Retama raetam* with 1-2 m of exposed tap root are not uncommon in the area covered by this association (Danin, 1996: Fig. 50). *Echiochilon fruticosum* and *Moltkiopsis ciliata,* which produce adventitious shoots from exposed roots, belong also to the group of persistent markers. The annual markers do not share any special interesting property or kind of adaptation which could be regarded as specific to this habitat.

Association dynamics and conservation: Most of the area of this association is under constant process of wind erosion as may be indicated by long exposed roots of many shrubs and semishrubs.

Aspects of the association: Persistents – 18 spp.; ephemerals – 44 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94266	10	20	24	22.03.94	I 1435 5378
2	94267	10	20	26	22.03.94	I 1436 5378
3	94268	10	20	20	22.03.94	I 1437 5378
4	94269	15	20	32	22.03.94	I 1436 5376
5	94270	10	15	22	22.03.94	I 1437 5377
6	94271	10	15	21	22.03.94	I 1438 5379
7	94272	10	10	30	22.03.94	I 1436 5379
8	94273	15	20	26	22.03.94	I 1425 5380
Average:		11.3	17.5	25.1		

6.6.2.1.2 DSH Stipagrostio plumosae – Helianthemion sessilifloris Danin et Solomeshch all. nov.

Diagnostical species: *Helianthemum sessiliflorum.*

Nomenclatural type: Stipagrostio plumosae – Helianthemetum sessiliflori Danin et Solomeshch.

Synoptic table: Table 53.

The old terraces of the large wadis are situated high above their present level where floods flow. The vegetation on these terraces is supplied only by direct rainfall on the area and are thus influenced directly and reflect the impact of soil texture on the local moisture regime. All the stands of associations in this alliance have a prominent microbiotic crust of cyanobacteria. In most sites their development is inside the ground throughout most days of the year, except for the rainy days when they move from their sheath and emerge above the ground (Danin et al., 1989; Dor & Danin, 1997). In one association they have permanent above-ground parts. Geomorphological relationships of the vegetation on alluvial terraces of Nahal Besor (coordinates 34°42'30" E/ 30°59'N), 6 km S of Revivim, are presented in Fig. 103.

The phytogeographical spectra of the associations in this alliance (Figs. 104 & 105) display a rather simple pattern. The most frequent chorotypes are the Saharo-Arabian and the bi-regional IT-SA. There is a slight increase in the frequency of the Mediterranean species in DSH03 and DSH05.

This alliance does not have good diagnostical species, probably because of having an intermidiate position between two syntaxa. It may be recognized by simultaneous presence of diagnostical species of the suborders Stipagrostio scopariae-Artemisienalia monospermae and Stipagrostio plumosae – Anabasienalia articulatae.

6.6.2.1.2.1 DSH01 Retamo raetam – Haloxyletum scoparia Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 50. **Distribution:** Fig. 102.

Ecological notes: The relevés of this association were recorded in small valleys 12 km SW of Revivim, among rounded hard chalk hills. Such valleys in most of the N Negev which are not influenced by the proximity to the Shunra or Haluza sands are filled up with Loessial Serozem and support one or another kind of Haloxyletum scopariae (AAH05 or AAH06). The addition of sand to the loess during the processes of sedimentation has led to better water infiltration capacity of these soils. In rainy years the areas of this association are prominent from afar by the carpets of blooming annuals many of which have a higher productivity than the same species when growing on non-sandy loess. Such species are *Matthiola livida, Leontodon laciniatum,* and *Erucaria microcarpa.*

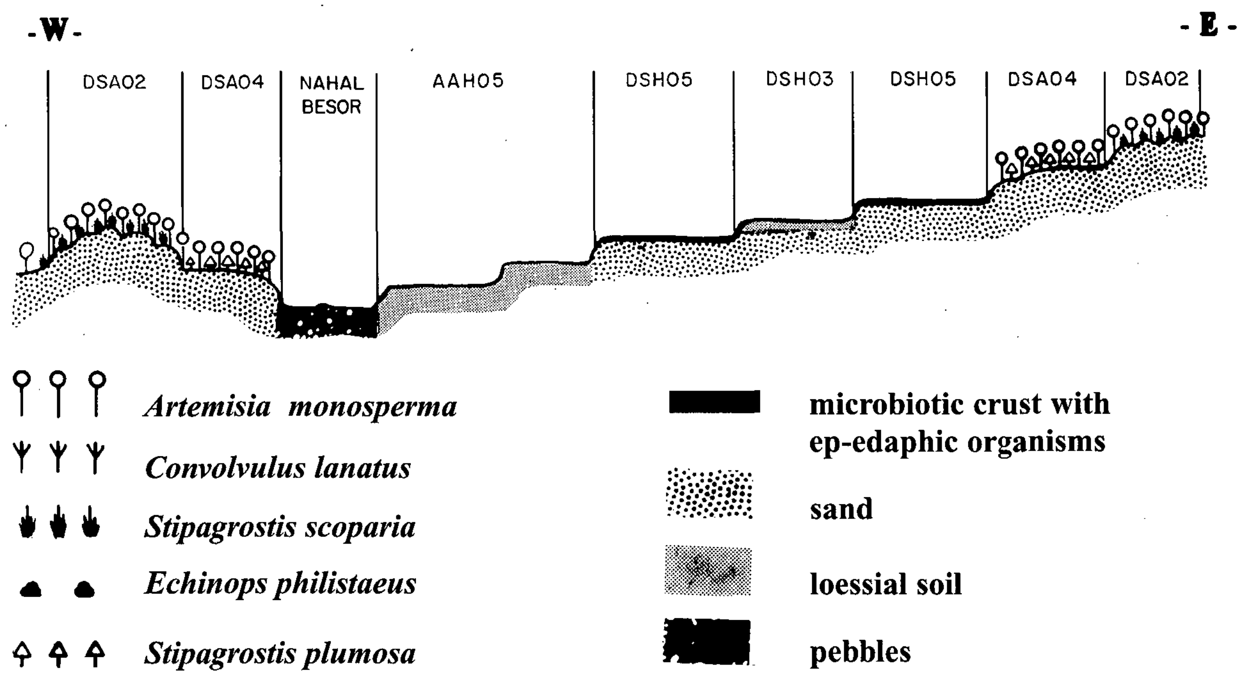

Figure 103. Schematic presentation of the vegetation on alluvial terraces of Nahal Besor, 6 km S of Revivim. Associations marked as in the text.

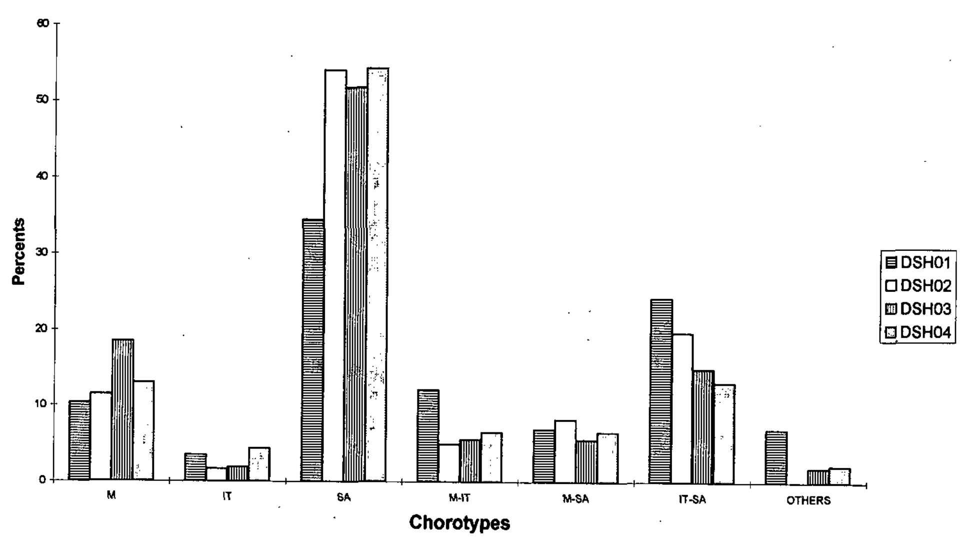

Figure 104. Phytogeographical analysis of associations DSH01-DSH04.

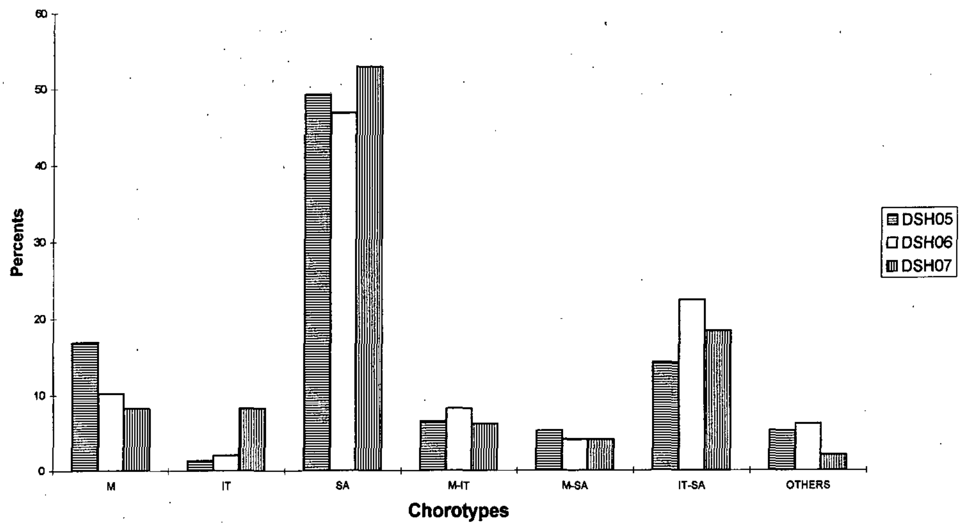

Figure 105. Phytogeographical analysis of associations DSH05, DSH06, and DSH07.

Association dynamics and conservation: Most of the area of this association is occasionally under moderate pressure of cutting and grazing.

Aspects of the association: Persistents – 9 spp.; ephemerals – 57 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	95008	80	7	31	17.02.95	I 1645 5425
2	95009	75	10	23	17.02.95	I 1646 5425
3	95010	83	7	34	17.02.95	I 1647 5425
4	95011	90	7	22	17.02.95	I 1646 5426
5	95012	80	10	28	17.02.95	I 1647 5426
6	95013	83	7	26	17.02.95	I 1648 5427
Average:		81.8	8.0	27.3		

Table 50. Association tables of DSH01 – Retamo raetam – Haloxyletum scopariae, DSH02 – Atractylido cardui – Cornulacetum monacanthae, and DSH03 – Stipagrostio plumosae – Helianthemetum sessiliflori

		Species	DSH01				DSH02				DSH03			
			*123456	C1	C2	%P	*123456789	C1	C2	%P	*1234567	C1	C2	%P
	W	Adonis dentata					.....+..+	0	0	22	+.++.+.	0	0	57
	W	Aegilops kotschyi					+........	0	0	11	....+..	0	0	14
	F	Ammochloa palaestina	1+.+00	**4**	**3**	**83**								
*	N	Anabasis articulata					+.+......	0	0	22	.0++.11	**5**	**4**	**71**
	W	Anthemis melampodina	+...+.	0	0	33	.+...+...	0	0	22	...+..+	0	0	29
*	F	Argyrolobium uniflorum					.....+..+	0	0	22	..++.++	0	0	57
	W	Arnebia decumbens	+.++++	**0**	**0**	**83**	......++.	0	0	22				
*	R	Artemisia monosperma	...4+.	20	7	33	.....0...	5	1	11	.++....	0	0	29
*	A	Artemisia sieberi	0	1	0	17								
	H	Asphodelus ramosus	+...+.	0	0	33	...1.+..+	3	1	33	+.1++++	**2**	**1**	**86**
	W	Asphodelus tenuifolius	+....+	0	0	33								
	F	Asphodelus viscidulus					......+..	0	0	11				
	R	Astragalus annularis	+++.++	**0**	**0**	**83**	++.....+.	0	0	33	......+	0	0	14
	W	Astragalus asterias	..++.+	0	0	50								
	H	Astragalus boeticus	....+.	0	0	17								
	A	Astragalus caprinus					.++..+...	0	0	33	....+.+	0	0	29
	W	Astragalus tribuloides	..+...	0	0	17								

Table 50. continued.

		Species	DSH01				DSH02				DSH03			
			123456	C1	C2	%P	123456789	C1	C2	%P	1234567	C1	C2	%P
*	R	Atractylis carduus	+.....	0	0	17	.0+0++0++	**2**	**2**	**89**	.+.....	0	0	14
	A	Atractylis prolifera					+........	0	0	11				
	A	Avena wiestii	..+.+.	**0**	**0**	**33**	..+......	0	0	11				
	R	Bassia muricata					.......+.	0	0	11				
	A	Bellevalia eigii	..++..	0	0	33					..+....	0	0	14
	R	Brassica tournefortii	...+..	0	0	17	.....+..+	0	0	22				
	H	Bromus fasciculatus					.....++..	0	0	22	.2532+7	**32**	**27**	**86**
	H	Calendula arvensis	+.....	0	0	17	.+.......	0	0	11	++.+.++	**0**	**0**	**71**
	W	Carduus getulus	+.+++.	**0**	**0**	**67**	...+...+.	0	0	22	...+.++	0	0	43
	W	Centaurea pallescens					.++++..+.	0	0	56				
*	F	Convolvulus lanatus					....++...	0	0	22	.+...+.	0	0	29
*	F	Cornulaca monacantha					787987899	**82**	**82**	**100**				
	W	Crepis aspera					........+	0	0	11				
	A	Crucianella membranacea									....++.	0	0	29
	R	Cutandia memphitica	1.+...	5	2	33	+501++1.1	**11**	**9**	**89**	+......	0	0	14
*	H	Cynodon dactylon	..+3..	15	5	33								
*	R	Cyperus macrorrhizus									..+++..	0	0	43
	H	Delphinium peregrinum									...+...	0	0	14
*	A	Deverra tortuosa	....0.	2	0	17								
*	R	Echinops philistaeus									..+..+.	0	0	29
*	R	Echiochilon fruticosum					....+2...	13	3	22	..+.+.0	2	1	43
	W	Emex spinosa	++++++	**0**	**0**	**100**								
	R	Eminium spiculatum									......+	0	0	14
	W	Enarthrocarpus strangulatus	+.++..	0	0	50								
	H	Erodium ciconium	.....+	0	0	17								
	W	Erodium crassifolium									..0...+	3	1	29
	R	Erodium laciniatum	++++++	**0**	**0**	**100**	+1..+..++	2	1	56	11+++1+	**4**	**4**	**100**
	W	Erucaria microcarpa	13343.	**28**	**23**	**83**	......+..	0	0	11				
	F	Erucaria pinnata					.22++.+..	9	5	56	..32101	**15**	**11**	**71**
	W	Filago desertorum	....+0	3	1	33	+..+.....	0	0	22	....+..	0	0	14
	E	Gagea dayana	..+...	0	0	17					......+	0	0	14
	W	Gastrocotyle hispida	....+.	0	0	17	...+.....	0	0	11				
*	A	Haloxylon scoparium	678589	**74**	**74**	**100**								
	W	Helianthemum ledifolium	.....+	0	0	17	.....+...	0	0	11				
	H	Helianthemum salicifolium	.....+	0	0	17								
*	R	Helianthemum sessiliflorum	..+...	0	0	17	..1......	10	1	11	8867578	**70**	**70**	**100**
*	R	Helianthemum stipulatum					1.1.++...	6	3	44	..303.0	18	10	57
	F	Hippocrepis areolata	++...+	0	0	50	.0+0+3+04	**11**	**9**	**89**				
	D	Hordeum glaucum	++.+..	0	0	50	.......+.	0	0	11				
	R	Hormuzakia aggregata									+.++...	0	0	43
	A	Hypecoum aegyptiacum					+1.......	8	2	22				
	R	Ifloga spicata	..+...	0	0	17	0......0+	3	1	33	...+++.	0	0	43
	F	Iris mariae									....+++	0	0	43
	W	Koelpinia linearis	+.....	0	0	17								
	R	Launaea fragilis									..+...+	0	0	29
	W	Leontodon laciniatus	1.1213	**17**	**14**	**83**	.+.+....+	0	0	33				
	W	Linaria haelava	+++.++	**0**	**0**	**83**	.++......	0	0	22				
	R	Lotus halophilus	.+....	0	0	17	0..+.....	3	1	22	+......	0	0	14
*	R	Lycium schweinfurthii									0.+...+	2	1	43
	W	Malva aegyptia	.+....	0	0	17								
	W	Matthiola livida	345.55	**44**	**37**	**83**	4.+++3..1	**13**	**9**	**67**	+++++++	**0**	**0**	**100**
	W	Medicago laciniata					+........	0	0	11				
*	R	Moltkiopsis ciliata					....0+0+1	4	2	56	..00...	5	1	29
	W	Neotorularia torulosa	+++...	0	0	50								
	R	Neurada procumbens					3+6793753	**49**	**49**	**100**	.+.+...	0	0	29
*	A	Noaea mucronata					11.0..+..	7	3	44	00+.00.	**4**	**3**	**71**
	H	Ononis serrata	.+....	0	0	17	+++.++.++	**0**	**0**	**78**	.0++...	2	1	43
	A	Ornithogalum trichophyllum	...+.+	0	0	33								
	F	Pancratium sickenbergeri					+.++.+..+	0	0	56	++..+++	**0**	**0**	**71**
	R	Paronychia arabica	+.....	0	0	17								
	F	Picris asplenioides	21....	18	6	33	+.++..++.	0	0	56	53.4111	**25**	**21**	**86**

Table 50. continued.

		Species	DSH01				DSH02				DSH03			
			123456	C1	C2	%P	123456789	C1	C2	%P	1234567	C1	C2	%P
*	R	Plantago albicans									....55.	50	14	29
	W	Plantago coronopus	.++..+	0	0	50								
	F	Plantago cylindrica					.....++.+	0	0	33	.....+.	0	0	14
	W	Plantago ovata	+.+.++	**0**	**0**	**67**								
	R	Polycarpon succulentum	+.....	0	0	17								
	R	Pseudorlaya pumila									....+..	0	0	14
	W	Reseda decursiva	++++++	**0**	**0**	**100**								
*	R	Retama raetam	432.1.	**25**	**17**	**67**	..+..000.	4	2	44	...+00.	3	1	43
	H	Rostraria smyrnacea	+.+.+.	0	0	50	..++.....	0	0	22				
	R	Rumex pictus					.+++.++++	**0**	**0**	**78**	2+++++.	**3**	**3**	**86**
*	A	Salvia lanigera	..+...	0	0	17	........+	0	0	11				
	F	Schimpera arabica	.++...	0	0	33	....0..+.	3	1	22	...+.+.	0	0	29
	W	Schismus arabicus	....+.	0	0	17	++....+++	0	0	56				
	W	Senecio glaucus	+11..0	**6**	**4**	**67**	1.000.24.	**14**	**9**	**67**	.++.11+	**4**	**3**	**71**
	W	Silene alexandrina	.....+	0	0	17								
	H	Silene colorata	..+...	0	0	17								
	R	Silene villosa					........+	0	0	11				
	R	Sixalix eremophila					.....+.+.	0	0	22	...+...	0	0	14
	W	Stipa capensis	++.+.+	**0**	**0**	**67**					.3+....	15	4	29
*	V	Stipa pellita									.....+.	0	0	14
*	F	Stipagrostis plumosa					..1.1....	10	2	22	.1+211+	**8**	**7**	**86**
*	B	Thymelaea hirsuta	...00.	4	1	33	.....+0..	3	1	22				
	H	Trifolium tomentosum	.++++.	**0**	**0**	**67**					++.+...	0	0	43
	W	Trigonella arabica	.+++++	**0**	**0**	**83**	........+	0	0	11				
	W	Trigonella stellata	..+.+.	0	0	33	.....+...	0	0	11				
	A	Urginea undulata	...+..	0	0	17								
	A	Vicia monantha	..+...	0	0	17								
	H	Vicia sativa	.....+	0	0	17								
	R	Vulpia brevis									+..+...	0	0	29

6.6.2.1.2.2 DSH02 Atractylido cardui – Cornulacetum monacanthae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 50. **Distribution:** Fig. 106.

Ecological notes: The occurrence of *Cornulaca monacantha* in Israel was recorded first in 1981 by Danin (1982). It is known as an important dominant in the steppe and desert vegetation of sandy soils in N Sinai (Danin, 1983). The area dominated by this association, at the vicinity of Nizzana, was visited in 1994, but due to low precipitation that year (28 mm) no ephemerals developed and the association was recorded in 1995 (cf. Fig. 95 and Sect. 6.6.2.1.1). The dominant ephemeral plant that year was *Neurada procumbens* which is rather common throughout most areas of the Retametea raetam, but in small quantities. At the vicinity of Nizzana, old terraces of Nahal Nizzana and Nahal Lavan, with different soil profile, support other associations of the same alliance (e.g., DSH03, DSH04, DSH06, and DSH07).

Association dynamics and conservation: Most of the area of this association is at the vicinity of the international border with Egypt and thus protected from many kinds of human disturbances. However, having a good proportion of sand in its texture it favors irrigated agriculture. Much of the agriculture of Nitzanei Sinai is on areas which were populated by this association. In the Spring of 1998 it was hard to find any living shrub of *C. monacantha* at the vicinity of Nizzana.

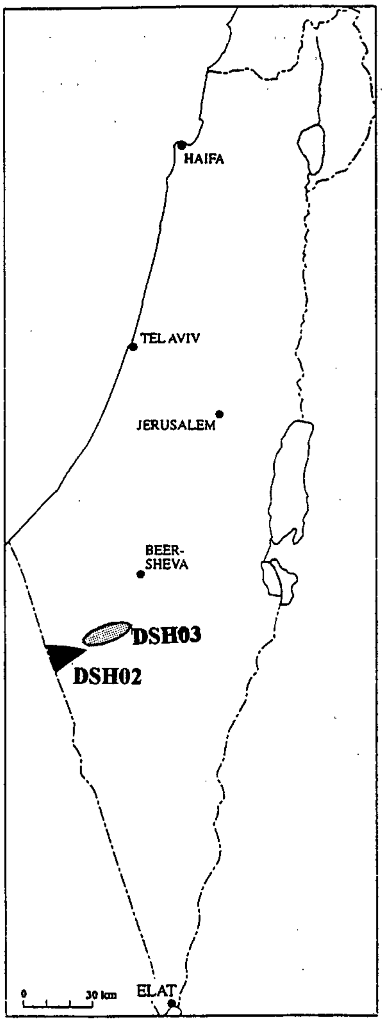

Figure 106. Distribution map of associations DSH02 and DSH03.

Aspects of the association: Persistents – 14 spp.; ephemerals – 48 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	95014	40	20	21	17.02.95	I 1435 5370
2	95015	40	10	19	17.02.95	I 1436 5370
3	95016	30	20	22	17.02.95	I 1437 5370
4	95017	30	15	20	17.02.95	I 1438 5370
5	95018	15	20	17	17.02.95	I 1436 5371
6	95019	20	15	27	17.02.95	I 1437 5371
7	95020	30	20	19	17.02.95	I 1436 5372
8	95021	30	15	21	17.02.95	I 1436 5373
9	95022	40	15	23	17.02.95	I 1437 5372
Average:		30.6	16.7	21.0		

6.6.2.1.2.3 DSH03 Stipagrostio plumosae – Helianthemetum sessiliflori Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 50. **Distribution:** Fig. 106.

Ecological notes: There are larger areas where *Helianthemum sessiliflorum* dominates the vegetation. However, not all the diversity of association of this plant could be recorded so far. This species importance is in its symbiotic mycorrhitic relationships with fungi which bear truffles as fruiting bodies (Rayss, 1953, 1959; Binyamini, 1980).

These are edible and are sold for a high price in the markets of Israel and of neighbouring countries. Small patches dominated by *H. sessiliflorum* occur throughout the entire area of the alliance, however the relevés represented in this table were recorded in small valleys 18 km SW of Revivim, among rounded hard chalk hills where associations of the three alliances of the order Stipagrostio scopariae – Artemisietalia monospermae (DS) occur.

Association dynamics and conservation: The area of this association at the vicinity of the international border with Egypt is protected from many kinds of human disturbances.

Aspects of the association: Persistents – 16 spp.; ephemerals – 37 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94032	20	40	16	26.02.94	I 1629 5408
2	94033	20	40	19	26.02.94	I 1629 5407
3	94034	10	50	26	26.02.94	I 1629 5406
4	94035	10	40	28	26.02.94	I 1628 5407
5	94036	10	50	24	26.02.94	I 1628 5406
6	94037	10	40	28	26.02.94	I 1627 5408
7	94038	5	65	25	26.02.94	I 1627 5406
Average:		12.1	46.4	23.7		

6.6.2.1.2.4 DSH04 Stipagrostio plumosae – Helianthemetum stipulati Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 51. **Distribution:** Fig. 107.

Ecological notes: The terrace of Nahal Nizzana, near Kemehin dominated by Helianthemetum stipulati (DSH04) differs in its soil texture and its profile from both the Anabasietum (DSH06) and Helianthemetum sessiliflori (DSH03) which inhabit neighbouring terraces. This organization of the profile was controlled by geomorphological processes and not by plant-induced successional processes.

During the recording of the relevés of this association in the Nizzana area (February 1994) truffles, which are not named yet, were discovered in association with *Helianthemum stipulatum* for the first time. When the truffles develop below the ground they raise and break the microbiotic crust in a rather prominent way. There were many foot-prints of gazelles (resembling those of *Gazella dorcas* as illustrated in Mendelson & Yom-Tov, 1987: p. 268). Some of the lines of foot-prints ended in holes dug by the gazelles. Most holes were empty, however, a few had at a depth a truffle. It is interpreted as follows: gazelles dig for the truffles, eat them when reached, thus producing the empty holes observed. Later they distribute the hard coated fungal spores in their faeces. When reaching sites where the truffle was too deep the gazelles dug but did not succeed to obtain the truffle. Comprehensive reviews of the dispersal of mycorrhizal fungi inoculum by animals are those of MacMahon & Warner (1984) and of Allen (1991).

A general problem concerning the taxonomy of *Helianthemum stipulatum* in Israel brings some doubts as for the future name of this association and those of associations in the order Retametalia raetam. There are morphological and ecological differences between *H. stipulatum* in the deserts of Israel, Jordan, and Sinai and those of the same species in the coastal areas of Israel. Further taxonomical investigations are essential for solving this question.

Association dynamics and conservation: Most of the area of this association is at the vicinity of the international border with Egypt and thus protected from many kinds of human disturbances.

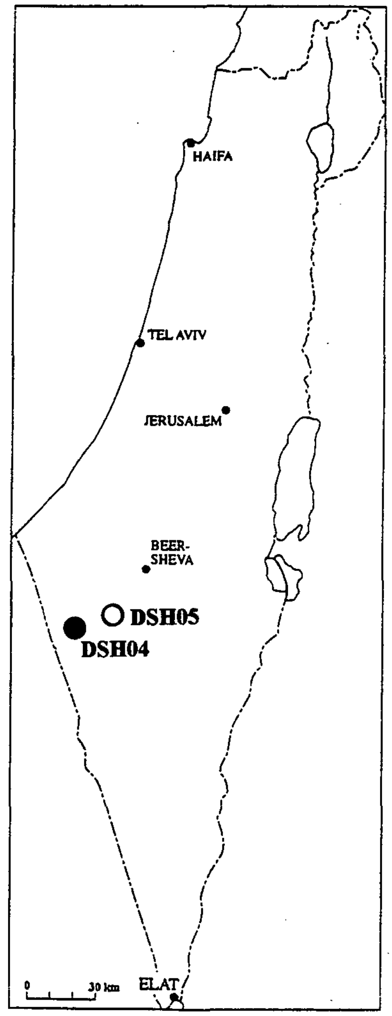

Figure 107. Distribution map of associations DSH04 and DSH05.

Aspects of the association: Persistents – 12 spp.; ephemerals – 35 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94063	10	25	28	26.02.94	I 1445 5360
2	94064	10	50	25	26.02.94	I 1446 5360
3	94065	10	30	22	26.02.94	I 1447 5360
4	94066	10	40	20	26.02.94	I 1448 5360
5	94067	10	30	18	26.02.94	I 1446 5361
6	94068	5	35	24	26.02.94	I 1447 5361
7	94069	10	30	28	26.02.94	I 1448 5361
Average:		9.3	34.3	23.6		

Table 51. Association tables of DSH04 – Stipagrostio plumosae – Helianthemetum stipulati and DSH05 – Erucario pinnatae – Echiochiletum fruticosi

	Species	DSH04				DSH05			
		*1234567	C1	C2	%P	*12345678	C1	C2	%P
W	Adonis dentata					..+.+...	0	0	25
W	Aegilops kotschyi	.....++	0	0	29				
F	Allium sindjarense					...+....	0	0	13
F	Ammochloa palaestina					.+0++.++	1	1	75

Table 51. continued.

		Species	DSH04 1234567	DSH04 C1	DSH04 C2	DSH04 %P	DSH05 12345678	DSH05 C1	DSH05 C2	DSH05 %P
*	N	Anabasis articulata	2.22212	18	16	86	++++....	0	0	50
	W	Anthemis melampodina	.....+.	0	0	14	++++....	0	0	50
*	F	Argyrolobium uniflorum	++.+.+.	0	0	57				
	W	Arnebia linearifolia					.......+	0	0	13
*	R	Artemisia monosperma	...+...	0	0	14	..+2....	10	3	25
*	A	Artemisia sieberi	+......	0	0	14				
	H	Asphodelus ramosus	+62331+	22	22	100	21+.+.2+	8	6	75
	W	Asphodelus tenuifolius	+......	0	0	14				
	R	Astragalus annularis	.+.....	0	0	14	+...++..	0	0	38
	A	Astragalus caprinus	.+.+.++	0	0	57	......+.	0	0	13
	R	Astragalus kahiricus	.....++	0	0	29	.....+++	0	0	38
*	R	Atractylis carduus	+++.+..	0	0	57	..+....+	0	0	25
	A	Atractylis prolifera					++++.++1	1	1	88
	A	Avena wiestii	......+	0	0	14				
	R	Biarum olivieri					...+....	0	0	13
	H	Bromus fasciculatus	4355665	49	49	100	3.+8+716	36	31	88
	H	Calendula arvensis	.+0+..+	1	1	57	.+......	0	0	13
	W	Carduus getulus	+......	0	0	14	+.......	0	0	13
	W	Centaurea pallescens	+.+....	0	0	29				
*	F	Convolvulus lanatus	..+....	0	0	14	...++...	0	0	25
	V	Crassula alata					+.+.....	0	0	25
	A	Crucianella membranacea					......+.	0	0	13
	R	Cutandia memphitica					++++++.+	0	0	88
*	R	Cyperus macrorrhizus					+++.....	0	0	38
	F	Dipcadi erythraeum					......++	0	0	25
*	R	Echiochilon fruticosum	.....+0	3	1	29	87778767	71	71	100
	R	Eminium spiculatum					.....+..	0	0	13
	W	Erodium crassifolium	+++..+.	0	0	57				
	R	Erodium laciniatum	+.+.+.+	0	0	57	+++++1.	1	1	88
	W	Erucaria microcarpa					.+......	0	0	13
	F	Erucaria pinnata	++21023	12	12	100	012+++0+	5	5	100
	W	Erucaria rostrata					.....+..	0	0	13
	W	Filago desertorum					121+2000	9	9	100
	E	Gagea dayana	..+....	0	0	14	+++++++.	0	0	88
	W	Gastrocotyle hispida					.......+	0	0	13
*	N	Gymnocarpos decander	.0+00++	3	2	86				
	H	Gynandriris sisyrinchium					...+....	0	0	13
*	F	Haloxylon salicornicum					..1.....	10	1	13
*	A	Haloxylon scoparium					...+....	0	0	13
*	R	Haplophyllum tuberculatum					.+......	0	0	13
	E	Hedysarum spinosissimum					......+.	0	0	13
*	R	Helianthemum sessiliflorum	11.....	10	3	29	+0+++020	4	4	100
*	R	Helianthemum stipulatum	6677786	68	68	100	+0++100.	4	3	88
	F	Hippocrepis areolata	+......	0	0	14	...+.+++	0	0	50
	D	Hordeum glaucum	......+	0	0	14				
	R	Hormuzakia aggregata	++0++.+	1	1	86	++++++.+	0	0	88
	R	Ifloga spicata	.+.....	0	0	14	.++..0++	1	1	63
	F	Iris mariae					.+.+....	0	0	25
	R	Launaea fragile					.+..+...	0	0	25
	W	Linaria haelava					..+...+.	0	0	25
	R	Linaria tenuis					.++.+.++	0	0	63
	F	Lobularia arabica					....+...	0	0	13
	R	Lotus halophilus	.+.+++.	0	0	57	+.+.+.++	0	0	63
*	R	Lycium schweinfurthii					011+0111	9	9	100
	W	Matthiola livida	3+1+0+0	7	7	100	.++..+.+	0	0	50
	S	Nasturtiopsis coronopifolia	+....+.	0	0	29				
	R	Neurada procumbens	+.+1+++	2	1	86	121++1+1	8	8	100
	R	Nigella arvensis					++++++++	0	0	100
*	A	Noaea mucronata	+++.0+0	2	1	86	...+....	0	0	13
	D	Notobasis syriaca					..+.....	0	0	13
	H	Ononis serrata	++.+.+.	0	0	57	.+.++...	0	0	38
	F	Pancratium sickenbergeri	+++++++	0	0	100	+++.++++	0	0	88

Table 51. continued.

		Species	DSH04				DSH05			
			1234567	C1	C2	%P	12345678	C1	C2	%P
	W	Papaver humile					+...+...	0	0	25
	R	Paronychia arabica					++1+++++	1	1	100
	F	Picris asplenioides	++.+.+.	0	0	57	++1+21.+	6	5	88
	W	Plantago coronopus					0++++.+.	1	1	75
	F	Plantago cylindrica	++....+	0	0	43	...+.+.+	0	0	38
	W	Plantago ovata	+++.+.0	1	1	71	....+...	0	0	13
	R	Polycarpon succulentum					....+...	0	0	13
	R	Pseudorlaya pumila					...+....	0	0	13
*	R	Retama raetam					11+1000+	6	6	100
	H	Rostraria smyrnacea					..+...+.	0	0	25
	R	Rumex pictus	..+....	0	0	14	1++1+.+.	3	3	75
*	A	Salvia lanigera	.+.+.++	0	0	57	...+....	0	0	13
	W	Schismus arabicus	......+	0	0	14				
	H	Senecio glaucus	...+..+	0	0	29	+++1+..+	2	1	75
	H	Silene colorata					+++++.++	0	0	88
	R	Sixalix eremophila	+......	0	0	14	+++...++	0	0	63
*	V	Stipa pellita					......+.	0	0	13
*	F	Stipagrostis plumosa	0010+00	5	5	100	0+0+.++1	3	3	88
	H	Trifolium tomentosum					....+.+1	3	1	38
	W	Trigonella arabica					..++.+..	0	0	38
	W	Trigonella stellata	+++.+++	0	0	86				
	R	Trisetaria linearis					.....+..	0	0	13
	A	Urginea undulata					..+.....	0	0	13
	R	Vulpia brevis					+22+6.5+	21	19	88
	F	Vulpia pectinella					++.+.+++	0	0	75

6.6.2.1.2.5 DSH05 Erucario pinnatae – Echiochiletum fruticosi Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 51. **Distribution:** Fig. 107.

Ecological notes: The relevés of this association were recorded on two alluvial terraces of Nahal Besor (Fig. 103). In this area there are terraces populated by Haloxyletum scopariae (Danin et al., 1975; AAH05), other associations of the alliance such as DSH03, DSH04, and an Artemisietum monospermae (DSA04). Each association is confined to a certain textural composition of the ground. The Echiochiletum is confined to sandy loessial terrain and there are components in the association table indicating the sandy nature of the soil. Among the important persistent markers the psammophytes are: *Echiochilon fruticosum, Helianthemum sessiliflorum, Helianthemum stipulatum, Lycium schweinfurthii,* and *Retama raetam.* The important ephemeral psammophytes are: *Ammochloa palaestina, Erodium laciniatum, Erucaria pinnata, Gagea dayana, Hormuzakia aggregata, Neurada procumbens, Paronychia arabica, Picris asplenioides,* and *Vulpia brevis.* Among the marker species there are no persistents confined to loessial soils, however some ephemerals are. These include *Atractylis prolifera, Bromus fasciculatus, Filago desertorum, Plantago coronopus,* and *Silene colorata.*

Crassula alata is a very special plant found in the study area. It is a common plant of Mediterranean habitats confined mainly to shallow soil on hard rocks. It is found in the Erucario – Echiochiletum fruticosae in small patches where the microbiotic crust is well developed and contains cyanophilous lichens and mosses in addition to cyanobacteria with above-ground thallus parts.

Association dynamics and conservation: Most of the area of this association is under constant grazing and cutting pressure.

Aspects of the association: Persistents – 16 spp.; ephemerals – 63 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94245	10	20	35	22.03.94	I 1712 5442
2	94246	10	20	41	22.03.94	I 1713 5442
3	94247	15	20	44	22.03.94	I 1714 5442
4	94248	20	15	42	22.03.94	I 1712 5443
5	94252	10	20	36	22.03.94	I 1710 5443
6	94253	40	20	30	22.03.94	I 1710 5442
7	94254	30	25	37	22.03.94	I 1710 5441
8	94255	40	20	35	22.03.94	I 1711 5443
Average:		21.9	20.0	37.5		

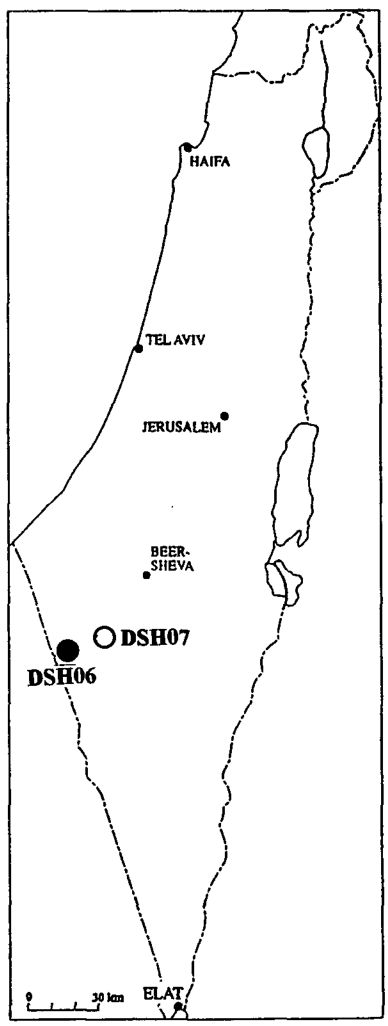

Figure 108. Distribution map of associations DSH06 and DSH07.

6.6.2.1.2.6 DSH06 Iflogo spicatae – Anabasietum articulatae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 52. **Distribution:** Fig. 108.

Ecological notes: The relevés of this association were recorded in an old alluvial terrace of Nahal Rut, 2 km north of Nizzana. The ground of this terrace is rather loessial, containing less sand than that of the Helianthemetum stipulati (DSH04) which is situated only 2-5 m above the terrace of the Anabasietum. The paucity of sand is reflected by the absence of true psammophytes from the persistent markers. However, the ephemeral psammophytes among the markers are: *Ifloga spicata, Neurada procumbens, Pancratium sickenbergeri, Paronychia arabica,* and *Picris asplenioides*. There is a higher contribution of species confined to loessial ground. Such are: *Erodium crassifolium, Matthiola livida, Nasturtiopsis coronopifolia,* and *Stipa capensis.* The microbiotic crust is of end-edaphic cyanobacteria.

Association dynamics and conservation: Most of the area of this association is under occasional moderate grazing pressure.

Aspects of the association: Persistents – 8 spp.; ephemerals – 42 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94258	10	10	24	22.03.94	I 1442 5361
2	94259	15	15	33	22.03.94	I 1442 5362
3	94260	20	10	24	22.03.94	I 1442 5363
4	94261	10	10	25	22.03.94	I 1442 5364
5	94262	10	7	14	22.03.94	I 1437 5360
6	94263	10	7	26	22.03.94	I 1437 5361
7	94274	15	15	14	22.03.94	I 1425 5380
Average:		12.9	10.6	22.9		

Table 52. Association tables of DSH06 – Iflogo spicatae – Anabasietum articulatae and DSH07 – Ferulo sinaicae – Salsoletum tetrandrae.

		Species	DSH06				DSH07			
			*1234567	C1	C2	%P	*1234567	C1	C2	%P
	W	Adonis dentata					+....+.	0	0	29
	W	Aegilops kotschyi					++.+.+.	0	0	57
	F	Ammochloa palaestina	...+...	0	0	14	00+++.+	2	1	86
*	N	Anabasis articulata	9768999	84	84	100	4434356	41	41	100
	W	Anthemis melampodina	++..+++	0	0	71	+..+.++	0	0	57
	W	Arnebia decumbens	...+...	0	0	14				
	W	Arnebia linearifolia					...+...	0	0	14
	H	Asphodelus ramosus	..+...+	0	0	29	1+++0++	2	2	100
*	C	Asteriscus graveolens					....+..	0	0	14
	R	Astragalus annularis					+..++..	0	0	43
	R	Astragalus kahiricus	...+...	0	0	14				
*	R	Atractylis carduus					++++..+	0	0	71
*	W	Atractylis phaeolepis	....+..	0	0	14	....++.	0	0	29
	A	Atractylis prolifera	.+....+	0	0	29				
	A	Avena wiestii	++++..+	0	0	71	...+...	0	0	14
*	S	Bassia arabica					...+0..	3	1	29
	A	Bellevalia eigii					....+..	0	0	14
	H	Bromus fasciculatus	.+.....	0	0	14				
	H	Calendula arvensis					++++.++	0	0	86
	R	Carthamus persicus					..+.+.+	0	0	43
	A	Centaurea ammocyanus					.+.+...	0	0	29
	W	Centaurea pallescens	++++.+.	0	0	71				
	A	Colchicum ritchii					++.+.++	0	0	71
	W	Crepis aspera	.++..+.	0	0	43				
	R	Cutandia memphitica	.+.....	0	0	14				
	H	Erodium ciconium	..+..+.	0	0	29				
	W	Erodium crassifolium	8141.31	30	26	86	0++11++	4	4	100
	R	Erodium laciniatum	.++..+.	0	0	43	..++.++	0	0	57
	S	Erodium oxyrhynchum	+...+..	0	0	29				
	F	Erucaria pinnata	.1+1.+.	5	3	57	.+++.+0	1	1	71
	R	Ferula sinaica					3266865	51	51	100
	W	Filago desertorum	+.++.+.	0	0	57				
	E	Gagea dayana					..++...	0	0	29
	W	Gastrocotyle hispida	.....+.	0	0	14	.++....	0	0	29
*	N	Gymnocarpos decander	0121.0.	11	8	71				
	H	Gynandriris sisyrinchium					..+....	0	0	14

Table 52. continued.

		Species	DSH06				DSH07			
			1234567	C1	C2	%P	1234567	C1	C2	%P
*	R	Haplophyllum tuberculatum					....+.+	0	0	29
*	A	Helianthemum kahiricum	...+...	0	0	14				
*	R	Helianthemum stipulatum	....0..	5	1	14				
*	S	Herniaria hemistemon					....+..	0	0	14
	F	Hippocrepis areolata	+......	0	0	14	...+...	0	0	14
	D	Hordeum glaucum	.+.....	0	0	14	...+...	0	0	14
	R	Ifloga spicata	+7++1+.	**13**	**11**	**86**				
	W	Lappula spinocarpos					+..+.+.	0	0	43
	R	Launaea fragilis	...+...	0	0	14	341.+22	**21**	**18**	**86**
	W	Leontodon laciniatus	.++++++	**0**	**0**	**86**				
	S	Limonium lobatum	+......	0	0	14				
	W	Linaria haelava	+....+.	0	0	29				
	R	Lotus halophilus	.+.....	0	0	14				
	W	Matthiola livida	+++1++1	**3**	**3**	**100**	+...+..	0	0	29
*	A	Moricandia nitens					1+....0	5	2	43
	S	Nasturtiopsis coronopifolia	+++++.+	**0**	**0**	**86**	+......	0	0	14
	R	Neurada procumbens	+1.+.+0	**3**	**2**	**71**				
*	A	Noaea mucronata	0010.+.	**6**	**4**	**71**	...+++.	0	0	43
	F	Pancratium sickenbergeri	++++++.	**0**	**0**	**86**	++++.+.	**0**	**0**	**71**
	R	Paronychia arabica	+++..+.	0	0	57	..+....	0	0	14
	F	Picris asplenioides	.++++.+	**0**	**0**	**71**	1121+11	**11**	**11**	**100**
	W	Plantago coronopus	.+.....	0	0	14				
	W	Plantago ovata	++1..+.	3	1	57	++.+.++	**0**	**0**	**71**
	S	Pteranthus dichotomus	+.+.++.	0	0	57	......+	0	0	14
	W	Reichardia tingitana	.+.....	0	0	14	..+..+.	0	0	29
	H	Rostraria smyrnacea	.+...++	0	0	43				
	W	Rumex cyprius	.+.+.+.	0	0	43				
	R	Rumex pictus					+..+...	0	0	29
	S	Salsola inermis					+..++.+	0	0	57
*	S	Salsola tetrandra					4465643	**46**	**46**	**100**
	A	Salvia lanigera	++.+.+.	0	0	57	.++..++	0	0	57
	C	Savignya parviflora	+......	0	0	14	....++.	0	0	29
	W	Schismus arabicus					+++...+	0	0	57
	W	Scorzonera judaica					....+..	0	0	14
	W	Senecio glaucus	++++.++	**0**	**0**	**86**	+.0++10	**3**	**3**	**86**
	R	Sixalix eremophila					...+...	0	0	14
	W	Stipa capensis	2+47+77	**39**	**39**	**100**				
*	F	Stipagrostis plumosa	.1.0+..	6	2	43				
*	S	Traganum nudatum					110.00+	**6**	**5**	**86**
	W	Trigonella arabica					.++....	0	0	29
	W	Trigonella stellata	.+1....	5	1	29	.++++.+	**0**	**0**	**71**
	A	Urginea undulata					....+..	0	0	14
	A	Zosima absinthiifolia					....+..	0	0	14

6.6.2.1.2.7 DSH07 Ferulo sinaicae – Salsoletum tetrandrae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 52. **Distribution:** Fig. 108.

Ecological notes: The composition of this association is outstanding for the entire area studied. There are halophytes known from the order Salsoletalia tetrandrae, such as *Salsola tetrandra, S. inermis, Traganum nudatum, Pteranthus dichotomus,* and *Bassia arabica.* On the other hand there are psammophytes such as *Ferula sinaica, Erodium laciniatum*, *Astragalus annularis, Carthamus persicus, Haplophyllum tuberculatum, Rumex pictus, Paronychia arabica*, and *Sixalix eremophila.* This special situation might be a result of layer arrangement in the alluvial terrace and need further investigations. We assume that deep salt containing layers support the halophytes whereas superficial sandy layers support the psammophytes.

Association dynamics and conservation: Most of the area of this association is protected from grazing and cutting due to its proximity to private land.

Aspects of the association: Persistents – 10 spp.; ephemerals – 45 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94056	15	10	26	26.02.94	I 1527 5358
2	94057	20	15	23	26.02.94	I 1528 5358
3	94058	10	10	26	26.02.94	I 1529 5358
4	94059	10	15	31	26.02.94	I 1528 5356
5	94060	10	15	26	26.02.94	I 1529 5357
6	94061	15	15	24	26.02.94	I 1527 5356
7	94062	15	15	25	26.02.94	I 1526 5358
Average:		13.6	13.6	25.9		

Table 53. Synoptic table of Stipagrostio scopariae – Artemision monospermae: 1- DSA01, 2- DSA02, 3- DSA03, 4- DSA04, 5- DSA05, 6- DSA06, and Stipagrostio plumosae – Helianthemion sessilifloris: 7- DSH01, 8- DSH02, 9- DSH03, 10- DSH04, 11- DSH05, 12- DSH06, 13- DSH07.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P
	d.s. Retametea raetam and other constant species													
R	Cutandia memphitica	100	100	43	36	44	50	33	89	14		88	14	
R	Ifloga spicata		91	100	100	89	63	17	33	43	14	63	86	
R	Retama raetam		9	71	82	89	100	67	44	43		100		
R	Rumex pictus		73	100	82	67	63		78	86	14	75		29
R	Atractylis carduus		36	57	82	89	13	17	89	14	57	25		71
H	Ononis serrata		45	71	36	33	25	17	78	43	57	38		
R	Lotus halophilus			14	45	22	88	17	22	14	57	63	14	
R	Neurada procumbens				18	67	25		100	29	86	100	71	
R	Pseudorlaya pumila		18	71	55	44				14		13		
R	Echiochilon fruticosum					56	75		22	43	29	100		
R	Hormuzakia aggregata									43	86	88		
F	Centropodia forsskalii			14	9		38							
R	Polycarpon succulentum		9					17						
	d.s. Erodio laciniati – Stipagrostietalia plumosae													
W	Senecio glaucus	9	82	100	82	67	75	67	67	71	29	75	86	86
R	Erodium laciniatum	9	91	86	91	100	88	100	56	100	57	88	43	57
F	Erucaria pinnata	27	91	86	82	89	63		56	71	100	100	57	71
F	Stipagrostis plumosa		18	71	82	100	100		22	86	100	88	43	
F	Picris asplenioides		9	43	91	89	100	33	56	86	57	88	71	100
W	Anthemis melampodina			57	73	56	13	33	22	29	14	50	71	57
W	Carduus getulus		64	71	45	22	13	67	22	43	14	13		
W	Matthiola livida		18	14		11	50	83	67	100	100	50	100	29
F	Pancratium sickenbergeri			14	18	78	25		56	71	100	88	86	71
F	Ammochloa palaestina				9	11	13	83				75	14	86
R	Astragalus annularis		9		18		25	83	33	14	14	38		43
H	Asphodelus ramosus					22	13	33	33	86	100	75	29	100
H	Bromus fasciculatus		9		9		63		22	86	100	88	14	
A	Noaea mucronata		9		18	22	38		44	71	86	13	71	43
A	Salvia lanigera						25	17	11		57	13	57	57
A	Avena wiestii		9		9			33	11		14		71	14
W	Plantago ovata		18				13	67			71	13	57	71
R	Helianthemum sessiliflorum					44		17	11	100	29	100		
N	Gymnocarpos decander						75				86		71	
R	Paronychia arabica					22	13	17				100	57	14
F	Schimpera arabica		9	14	18	22		33	22	29				
F	Argyrolobium uniflorum						13		22	57	57			
	d.s Stipagrostio scopariae – Artemisienalia monospermae													
R	Artemisia monosperma	55	100	100	100	89	75	33	11	29	14	25		
F	Plantago cylindrica		91	86	91	78	75		33	14	43	38		
F	Hippocrepis areolata			14	36	33		50	89		14	50	14	14
R	Sixalix eremophila			57		33	63		22	14	14	63		14
R	Vulpia brevis		27	86	64	67				29		88		

Table 53. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P
	d.s. Stipagrostio scopariae - Artemision monospermae													
R	Cyperus macrorrhizus	18	**82**	**71**	**73**	**78**	**88**			43		38		
R	Moltkiopsis ciliata	9	**100**	**100**	**91**	**89**	**100**		56	29				
F	Heliotropium digynum	**91**	**73**	43	64	44								
F	Stipagrostis scoparia	**100**	**100**	57	45									
F	Eremobium aegyptiacum	**100**	55	14	9									
R	Echinops philistaeus		45	**100**	36	33	25			29				
	d.s. Stipagrostio plumosae - Helianthemion sessilifloris													
	Stipagrostio plumosae - Anabasion articulatae													
N	Anabasis articulata		9		9	11	38		22	**71**	**86**	50	**100**	**100**
W	Adonis dentata				18	11			22	57		25		29
W	Gastrocotyle hispida							17	11			13	14	29
W	Helianthemum ledifolium							17	11					
W	Aegilops kotschyi								11	14	29			57
	Marker and rare species of associations													
R	Bassia muricata		36	14	9				11					
R	Corynephorus divaricatus		9											
W	Orobanche cernua		18	43	9	11								
R	Calligonum comosum	9	18		27									
F	Convolvulus lanatus		9	43	27	**89**	**75**		22	29	14	25		
F	Stipagrostis ciliata					22	13							
B	Thymelaea hirsuta					11	**75**	33	22					
A	Crucianella membranacea			14	9	22	**63**			29		13		
R	Trisetaria linearis						50					13		
R	Silene villosa		9				38		11					
F	Lobularia arabica				9	11	25					13		
R	Brassica tournefortii						25	17	22					
R	Astragalus trimestris						13							
C	Reseda urnigera						13							
F	Allium sindjarense						13					13		
W	Reseda decursiva						13	**100**						
A	Haloxylon scoparium							**100**				13		
W	Emex spinosa							**100**						
W	Erucaria microcarpa							**83**	11			13		
W	Arnebia decumbens							**83**	22				14	
W	Linaria haelava		9			11	**63**	**83**	22			25	29	
W	Trigonella arabica					11		**83**	11			38		29
H	Trifolium tomentosum			14	9			**67**		43		38		
W	Astragalus asterias							50						
W	Enarthrocarpus strangulatus							50						
D	Hordeum glaucum							50	11		14		14	14
H	Rostraria smyrnacea							50	22			25	43	
W	Neotorularia torulosa							50						
W	Asphodelus tenuifolius						25	33			14			
A	Ornithogalum trichophyllum							33						
A	Bellevalia eigii							33		14				14
H	Cynodon dactylon							33						
W	Koelpinia linearis							17						
A	Artemisia sieberi							17			14			
A	Deverra tortuosa							17						
A	Urginea undulata							17				13		14
A	Vicia monantha							17						
W	Silene alexandrina							17						
W	Astragalus tribuloides						13	17						
W	Malva aegyptia							17						
H	Helianthemum salicifolium							17						
H	Astragalus boeticus							17						
H	Vicia sativa							17						
F	Cornulaca monacantha						13		**100**					
A	Hypecoum aegyptiacum								22					
W	Medicago laciniata								11					

Table 53. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P	12 %P	13 %P
F	Asphodelus viscidulus								11					
F	Iris mariae									43		25		
R	Plantago albicans									29				
V	Stipa pellita									14		13		
H	Delphinium peregrinum				9					14				
R	Eminium spiculatum									14		13		
R	Helianthemum stipulatum					11	13		44	57	**100**	**88**	14	
W	Trigonella stellata							33	11		**86**		29	**71**
A	Astragalus caprinus				9	22	13		33	29	57	13		
W	Filago desertorum				9	22		33	22	14		**100**	57	
R	Lycium schweinfurthii			14	36	44				43		**100**		
R	Nigella arvensis											**100**		
H	Silene colorata				18	11		17				**88**		
E	Gagea dayana				9	22		17		14	14	**88**		29
A	Atractylis prolifera								11			**88**	29	
F	Vulpia pectinella		45	14	36		25					**75**		
W	Plantago coronopus						13	50				**75**	14	
R	Linaria tenuis				9	11	13					**63**		
R	Astragalus kahiricus										29	38	14	
V	Crassula alata											25		
F	Dipcadi erythraeum						13					25		
W	Papaver humile		18				13					25		
D	Notobasis syriaca											13		
F	Haloxylon salicornicum											13		
M	Hedysarum spinosissimum											13		
R	Biarum olivieri											13		
W	Erucaria rostrata											13		
W	Stipa capensis						13	**67**		29			**100**	
S	Nasturtiopsis coronopifolia										29		**86**	14
W	Leontodon laciniatus							**83**	33				**86**	
W	Centaurea pallescens								56		29		**71**	
S	Pteranthus dichotomus					11							57	14
W	Crepis aspera								11				43	
W	Rumex cyprius						13						43	
H	Erodium ciconium							17					29	
S	Erodium oxyrhynchum												29	
A	Helianthemum kahiricum												14	
S	Limonium lobatum												14	
W	Erodium crassifolium				9	22				29	57		**86**	**100**
R	Ferula sinaica													**100**
S	Salsola tetrandra													**100**
H	Calendula arvensis							17	11	**71**	57	13		**86**
R	Launaea fragilis			14	27	11	13			29		25	14	**86**
S	Traganum nudatum													**86**
A	Colchicum ritchii					11								**71**
S	Salsola inermis													57
W	Schismus arabicus		9					17	56		14			57
W	Lappula spinocarpos													43
A	Moricandia nitens													43
R	Carthamus persicus													43
W	Reichardia tingitana												14	29
W	Atractylis phaeolepis												14	29
S	Bassia arabica													29
A	Centaurea ammocyanus													29
C	Savignya parviflora												14	29
R	Haplophyllum tuberculatum		9									13		29
A	Zosima absinthiifolia													14
S	Herniaria hemistemon													14
C	Asteriscus graveolens													14
H	Gynandriris sisyrinchium											13		14
W	Arnebia linearifolia						13					13		14
W	Scorzonera judaica													14

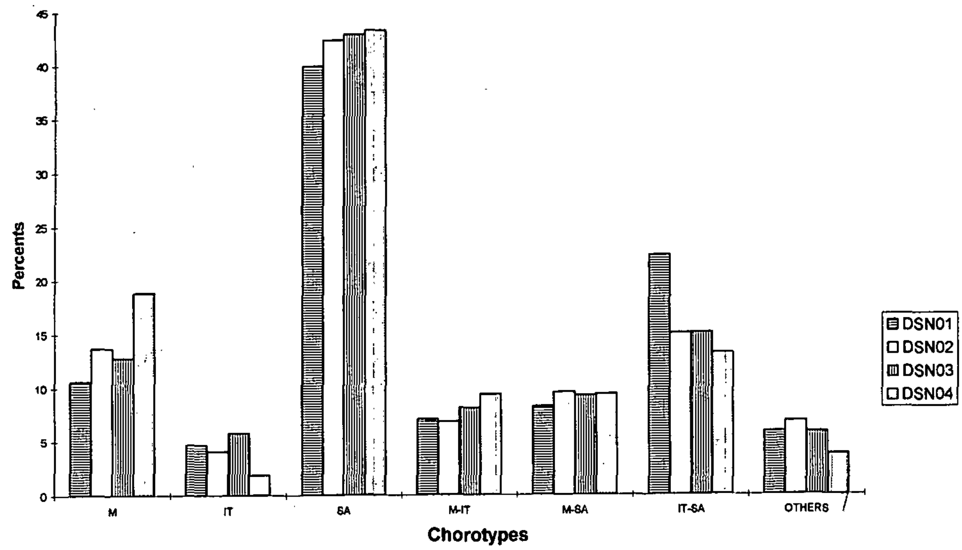

Figure 109. Phytogeographical analysis of associations DSN01-DSN04.

6.6.2.1.3 DSN Atractylido proliferae – Noaeion mucronatae Danin et Solomeshch all. nov.

Diagnostical species: *Atractylis prolifera, Haloxylon scoparium.*

Nomenclatural type: Iflogo spicatae – Noaetum mucronatae Danin et Solomeshch.

Synoptic table: Table 59.

The associations of this alliance are confined in the western Negev to the sandy-loess layer which covers chalk and limestone rocky hills in the area where sand dunes covered considerable part of the land. Sand grains which were blown up away from the main sand body, and are naturally fine sand particles, are mixed with air-borne silt plus clay particles which are the main contributors to the Brown Lithosol developed here (Danin & Ganor, 1997). The soil composition and its depth influence the nature of vegetation and the distribution of associations. The order in this alliance follows the size of the dominant plants from low to high and agrees also with the soil depth.

The phytogeographical spectrum of the associations in this alliance (Fig. 109) resembles that of a few of the associations in the previous alliance (DSH, Figs. 104 and 105) in the prevalence of the Saharo-Arabian chorotype. However, the associations of DSN have a more even contribution of several other chorotypes, such as M, M-IT, M-SA, and IT-SA. This might be related to the proximity of fissured limestone to the soil surface which may enable a higher diversity of plant strategies to coexist.

6.6.2.1.3.1 DSN01 Helianthemio stipulati – Artemisietum sieberi Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 57. **Distribution:** Fig. 110.

Ecological notes: This association was recorded 15 km SW of Revivim, an area where fissured limestone is covered by one or another association of the Zygophyllion dumosi. The dominance of *Artemisia sieberi* and the absence of *Zygophyllum dumosum* and ecologically related species proves the amelioration of moisture regime through the addition of sand to the soil mantle during pedogenesis. Species richness as expressed by the total number of species in the association table is much higher here than in the associations of the Artemision monospermae (DSA) covering sand in dunes in the same area. The high number of species may be explained by the presence of species that are related to the rocky substratum (and belong to the sociotypes A and V) and of species of the sandy soil cover (and belong to the sociotypes F and R).

Association dynamics and conservation: Most of the area of this association is under moderate grazing and cutting pressure occasionally.

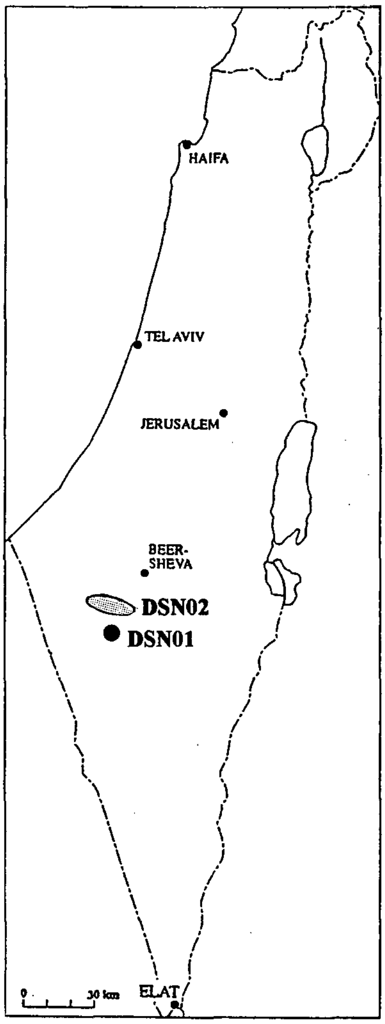

Figure 110. Distribution map of associations DSN01 and DSN02.

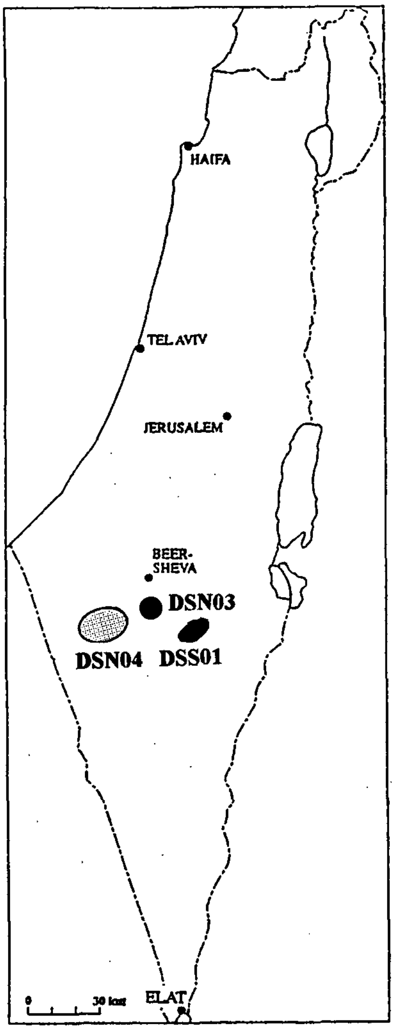

Figure 111. Distribution map of associations DSN03, DSN04, and DSS01.

Aspects of the association: Persistents – 23 spp.; ephemerals – 67 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	95001	50	20	40	13.02.95	I 1645 5425
2	95002	20	20	39	17.02.95	I 1646 5425
3	95003	30	15	36	17.02.95	I 1647 5425
4	95004	30	20	44	17.02.95	I 1648 5425
5	95005	25	15	45	17.02.95	I 1646 5426
6	95006	10	20	30	17.02.95	I 1647 5426
7	95007	20	20	29	17.02.95	I 1645 5427
Average:		26.4	18.6	37.6		

Table 54. Association tables of DSN01 – Helianthemio stipulati – Artemisietum sieberi and DSN02 – Iflogo spicatae – Noaetum mucronatae.

		Species	DSN01 *1234567	C1	C2	%P	DSN02 *1234567	C1	C2	%P
	W	Aegilops kotschyi	+......	0	0	14	.....+.	0	0	14
	F	*Allium sindjarense*	.+++.++	**0**	**0**	**71**				
	H	Allium stamineum					......+	0	0	14
	F	Ammochloa palaestina	3+++..+	**6**	**4**	**71**	+..0++0	**2**	**1**	**71**
*	N	Anabasis articulata	...01.0	7	3	43	0+0....	3	1	43
	W	Anthemis melampodina	.3.++..	10	4	43	+.+++.1	**2**	**1**	**71**
*	F	Argyrolobium uniflorum	...+...	0	0	14	..+.+..	0	0	29
	W	Arnebia decumbens	++.+++.	**0**	**0**	**71**	....+++	0	0	43
	W	Arnebia linearifolia	...+.+.	0	0	29				
*	R	Artemisia monosperma					1...+..	5	1	29
*	A	Artemisia sieberi	8787687	**73**	**73**	**100**	....1+2	12	5	43
	H	Asphodelus ramosus	+....+0	2	1	43	+......	0	0	14
*	V	Astragalus amalecitanus	.....+.	0	0	14				
	R	Astragalus annularis	..+.++.	0	0	43	...+..+	0	0	29
	W	Astragalus asterias	+......	0	0	14				
	H	Astragalus boeticus	...+...	0	0	14				
	A	Astragalus caprinus	.++....	0	0	29	+......	0	0	14
	R	Astragalus kahiricus					....+.+	0	0	29
	W	Astragalus tribuloides	.++.+..	0	0	43	.....+.	0	0	14
	R	Atractylis carduus					+++..+.	0	0	57
*	W	Atractylis phaeolepis	....+..	0	0	14	....+0.	3	1	29
	A	Atractylis prolifera	.++.+.+	0	0	57	.+....+	0	0	29
*	A	Atractylis serratuloides	..+.0+.	2	1	43				
	A	Avena wiestii	...++..	0	0	29				
	A	Bellevalia eigii	+......	0	0	14	......+	0	0	14
	R	Brassica tournefortii	..+++..	0	0	43	+......	0	0	14
	H	Bromus fasciculatus	...++..	0	0	29	+++..+.	0	0	57
	H	Calendula arvensis	+...+..	0	0	29				
	W	Carduus getulus	++.+..+	0	0	57	...++++	0	0	57
	A	Colchicum ritchii	...+...	0	0	14	...+++.	0	0	43
	W	Consolida incana					......+	0	0	14
*	F	Convolvulus lanatus					....+..	0	0	14
	R	Cutandia memphitica	+353+41	**23**	**23**	**100**	+..++++	**0**	**0**	**71**
*	H	Cynodon dactylon	..1...+	5	1	29				
*	F	Cyperus macrorrhizus					+......	0	0	14
	R	Dipcadi erythraeum					+......	0	0	14
*	W	Echinops philistaeus					.++....	0	0	29
	W	Emex spinosa	0.+++++	**1**	**1**	**86**				
	R	Eminium spiculatum	+......	0	0	14				
	H	Erodium ciconium					..+....	0	0	14
	W	Erodium crassifolium	+++.1+.	**2**	**1**	**71**	......+	0	0	14
	R	Erodium laciniatum	+++++.+	**0**	**0**	**86**	.33503+	**24**	**21**	**86**
	W	Erucaria microcarpa	..++6+.	15	9	57	..+.++2	5	3	57
	F	Erucaria pinnata	4......	40	6	14	2.+....	10	3	29
	W	Filago desertorum	+...++.	0	0	43	1+.+++.	**2**	**1**	**71**
	E	Gagea dayana	+.+.+.+	0	0	57	......+	0	0	14
	W	Gastrocotyle hispida	++.+...	0	0	43	.....++	0	0	29
	W	Gymnarrhena micrantha	.+.....	0	0	14				
	H	Gynandriris sisyrinchium	+.+....	0	0	29	...+.+.	0	0	29
*	H	Haloxylon scoparium	211+.+.	**8**	**6**	**71**	...114+	15	9	57
*	R	*Haplophyllum tuberculatum*	.1.....	10	1	14				
	H	Hedypnois cretica					...++0.	2	1	43
*	A	Helianthemum kahiricum	..0++01	**4**	**3**	**71**				
	W	Helianthemum ledifolium	++.....	0	0	29				
*	R	Helianthemum sessiliflorum	.1+.1++	**4**	**3**	**71**	.20.+..	8	4	43
*	R	Helianthemum stipulatum	.1+++10	**4**	**4**	**86**	.0+....	3	1	29
*	A	Helianthemum ventosum	....+..	0	0	14				
*	S	Herniaria hemistemon					....+..	0	0	14
	F	Hippocrepis areolata	+++++++	**0**	**0**	**100**	..+.+++	0	0	57
	H	*Hippocrepis unisiliquosa*					....+..	0	0	14
	D	Hordeum glaucum	....+..	0	0	14	...++++	0	0	57

Table 54. continued.

		Species	DSN01				DSN02			
			1234567	C1	C2	%P	1234567	C1	C2	%P
	R	Ifloga spicata	++.++++	**0**	**0**	**86**	++12535	**24**	**24**	**100**
	A	Ixiolirion tataricum					...+++.	0	0	43
	W	Koelpinia linearis	...+...	0	0	14				
	W	Lappula spinocarpos	....+..	0	0	14	....+.+	0	0	29
	R	Launaea fragilis	.++....	0	0	29	.+++...	0	0	43
	W	Leontodon laciniatus	++..+.+	0	0	57	.+.+++.	0	0	57
	W	Linaria haelava	++.+.+.	0	0	57	...+.++	0	0	43
	R	Linaria tenuis	..++...	0	0	29				
	R	Lotus halophilus					+..+..+	0	0	43
	W	Matthiola livida	++.+1..	3	1	57	++++..+	**0**	**0**	**71**
	W	Medicago laciniata	....++.	0	0	29	....+.+	0	0	29
	W	Neotorularia torulosa					...+...	0	0	14
	R	Neurada procumbens	....+..	0	0	14	+0+....	2	1	43
	R	Nigella arvensis					....++.	0	0	29
*	A	Noaea mucronata	..0...+	3	1	29	4669857	**65**	**65**	**100**
	H	Ononis serrata	++.+.+.	0	0	57	+++....	0	0	43
	A	Ornithogalum trichophyllum	.+..+..	0	0	29				
	F	Pancratium sickenbergeri					+......	0	0	14
	R	Paronychia arabica	+......	0	0	14	0..++.+	1	1	57
*	V	Pennisetum ciliare	...21..	15	4	29				
	F	Picris asplenioides	+++1+.+	**2**	**1**	**86**	66521.+	**33**	**29**	**86**
*	R	Plantago albicans	..+..+3	10	4	43	..+....	0	0	14
	W	Plantago coronopus	..+....	0	0	14	...+.0+	2	1	43
	F	Plantago cylindrica					+++.++.	**0**	**0**	**71**
	W	Plantago ovata	++..+..	0	0	43				
	R	Polycarpon succulentum					++.....	0	0	29
	R	Pseudorlaya pumila					+0+....	2	1	43
	S	Pteranthus dichotomus	....+..	0	0	14				
	W	Pterocephalus brevis	....+..	0	0	14				
	W	Reichardia tingitana					.+.+++.	0	0	57
	W	Reseda decursiva	+..+...	0	0	29	....+..	0	0	14
*	R	Retama raetam					001.+..	5	3	57
	H	Rostraria smyrnacea	.+++...	0	0	43	...++3+	8	4	57
	R	Rumex pictus	+.+...+	0	0	43	++++...	0	0	57
*	S	Salsola vermiculata	...+...	0	0	14				
*	A	Salvia lanigera	.+++.+.	0	0	57	..++.+.	0	0	43
	F	Schimpera arabica	0......	5	1	14	+++....	0	0	43
	W	Schismus arabicus					..+.+.+	0	0	43
	W	Senecio glaucus	1323145	**27**	**27**	**100**	+...211	10	6	57
	H	Silene colorata	++.++++	**0**	**0**	**86**	+++++++	**0**	**0**	**100**
	R	Sixalix eremophila					.++.+++	0	0	71
	W	Stipa capensis	....+++	0	0	43				
*	V	Stipa pellita	++....+	0	0	43	.+.....	0	0	14
*	F	Stipagrostis obtusa	...0+..	3	1	29				
*	F	Stipagrostis plumosa	...+...	0	0	14	412....	23	10	43
*	B	Thymelaea hirsuta	0	5	1	14	....+..	0	0	14
*	S	Traganum nudatum	...+...	0	0	14				
	H	Trifolium tomentosum	+.+....	0	0	29	.+..+..	0	0	29
	W	Trigonella arabica	+++++++	**0**	**0**	**100**	...++..	0	0	29
	W	Trigonella stellata	.++2++.	**4**	**3**	**71**	....+.+	0	0	29
	R	Trisetaria linearis					++.++++	**0**	**0**	**86**
	B	Trisetaria macrochaeta					....+..	0	0	14
	A	Tulipa systola	......+	0	0	14				
	A	Urginea undulata	++.++..	0	0	57				
	R	Vulpia brevis					++.....	0	0	29
	F	Vulpia pectinella					++.....	0	0	29
	A	Zosima absinthiifolia	.++....	0	0	29	....+.+	0	0	29

6.6.2.1.3.2 DSN02 Iflogo spicatae – Noaetum mucronatae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 54. **Distribution:** Fig. 110.

Ecological notes: The relevés were recorded at the margin of a loessial plain east of Revivim where on the slope of the nearby hill there was a mantle of sandy soil covered with Vulpio-Thymelaetum hirsutae (DSN03) The loessial nature of the substratum is indicated by persistent markers confined to lithosols and loessial plains such as: *Artemisia sieberi, Haloxylon scoparium,* and *Noaea mucronata.* Most psammophytes in the markers group are ephemerals such as: *Ammochloa palaestina, Cutandia memphitica, Erodium laciniatum, Ifloga spicata, Picris asplenioides,* and *Lomelosia eremophila.* The microbiotic crust found in the area of this association is disturbed as a result of intensive trampling. In the few places where found, it is mostly of end-edaphic cyanobacteria without above ground parts. This association was mapped by Danin et al., (1975) as Noaeetum mucronatae arenarium but was not described by relevés.

Association dynamics and conservation: Most of the area of this association is under constant grazing and cutting pressure.

Aspects of the association: Persistents – 19 spp.; ephemerals – 71 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94275	50	15	35	22.03.94	I 1645 5423
2	94276	30	10	32	22.03.94	I 1640 5415
3	94277	30	10	31	22.03.94	I 1641 5415
4	94293	50	10	31	22.03.94	I 1757 5486
5	94294	30	13	47	22.03.94	I 1757 5485
6	94295	35	15	35	22.03.94	I 1757 5484
7	94299	30	15	39	22.03.94	I 1750 5480
Average:		36.4	12.6	35.7		

6.6.2.1.3.3 DSN03 Vulpio brevis – Thymelaetum hirsutae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 55. **Distribution:** Fig. 111.

Ecological notes: Several relevés were recorded on a slope of a hill, others in a plain with a common character – a sand mantle of 1-2 m above the hard chalk of Zor'a formation (Lower Eocene, Bartov et al., 1981). The intensive cutting of lignified plants for fuel left depauperate stands of this association. The common persistents are *Noaea mucronata* and *Thymelaea hirsuta* which are not restricted to sandy soils and are therefore not true psammophytes. The sandy nature is indicated by the ephemeral markers: *Ammochloa palaestina, Cutandia memphitica, Hippocrepis areolata, Ifloga spicata, Lotus halophilus, Paronychia arabica, Picris asplenioides, Plantago cylindrica, Trifolium tomentosum,* and *Vulpia brevis.* Psammophytes are much more common among the ephemeral markers than plants of any other edaphic preferences. The microbiotic crust is hardly found in this human affected habitat.

Association dynamics and conservation: Most of the area of this association is under constant overgrazing, trampling, and cutting pressures.

Aspects of the association: Persistents – 19 spp.; ephemerals – 57 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94296	40	20	32	22.03.94	I 1257 5486
2	94297	50	20	35	22.03.94	I 1258 5486
3	94298	40	15	32	22.03.94	I 1259 5486
4	94300	40	15	30	22.03.94	I 1260 5500
5	94308	50	10	29	22.03.94	I 1259 5478
6	94310	50	20	32	22.03.94	I 1315 5588
7	94311	50	15	26	22.03.94	I 1315 5589
Average:		45.7	16.4	30.9		

Table 55. Association tables of DSN03 – Vulpio brevis – Thymelaetum hirsutae and DSN04 – Vulpio brevis – Retametum raetam

		Species	DSN03				DSN04			
			*1234567	C1	C2	%P	*1234567	C1	C2	%P
	W	Aegilops kotschyi	...+...	0	0	14				
	F	Ammochloa palaestina	+++.+++	0	0	86	++++.++	0	0	86
	W	Anthemis melampodina	++..+..	0	0	43				
*	F	Argyrolobium uniflorum	+.++.+.	0	0	57	...++..	0	0	29
	W	Arnebia decumbens	..+....	0	0	14				
*	R	Artemisia monosperma	+.+..0.	2	1	43	5033412	26	26	100
*	A	Artemisia sieberi	...1...	15	2	14				
	H	Asphodelus ramosus	..1.1.+	8	4	43	...+...	0	0	14
	R	Astragalus annularis	++++...	0	0	57	.+.++..	0	0	43
	A	Astragalus caprinus					.+.....	0	0	14
	A	Astragalus hispidulus	..+....	0	0	14				
	W	Astragalus tribuloides	.+.....	0	0	14				
*	R	Atractylis carduus					..+.+.+	0	0	43
	A	Atractylis prolifera					.+++.++	0	0	71
*	A	Atractylis serratuloides	...+...	0	0	14				
	R	Brassica tournefortii	+....+.	0	0	29	00211+1	9	9	100
	H	Bromus fasciculatus	...++++	0	0	57	++++2++	3	3	100
	A	Bupleurum semicompositum	....+..	0	0	14				
	H	Calendula arvensis	.+..++.	0	0	43	.++...+	0	0	43
	N	Calendula tripterocarpa	+......	0	0	14				
	W	Carduus getulus	+.+....	0	0	29	.+...++	0	0	43
	W	Centaurea pallescens	....+..	0	0	14				
*	F	Centropodia forsskalii					......+	0	0	14
	A	Colchicum ritchii	+++...+	0	0	57				
*	F	Convolvulus lanatus					.++++..	0	0	57
	W	Crepis aspera	...+.++	0	0	43	....+..	0	0	14
	A	Crucianella membranacea					+......	0	0	14
	R	Cutandia memphitica	+0+++++	1	1	100	+++++..	0	0	71
*	H	Cynodon dactylon	.....+.	0	0	14				
*	R	Cyperus macrorrhizus					..+.+++	0	0	57
*	A	Deverra tortuosa	...+...	0	0	14				
*	R	Echinops philistaeus	.....+.	0	0	14	...++.+	0	0	43
*	R	Echiochilon fruticosum	....+..	0	0	14				
	R	Eminium spiculatum	......+	0	0	14				
*	V	Ephedra aphylla					.....++	0	0	29
	R	Erodium laciniatum	.1+.+++	2	1	71	5541530	34	34	100
	W	Erucaria microcarpa	....+..	0	0	14				
	W	Filago desertorum					+.+.+..	0	0	43
	E	Gagea dayana					.+.....	0	0	14
*	N	Gymnocarpos decander	...2...	20	3	14				
*	A	Haloxylon scoparium	.01....	8	2	29				
	H	Hedypnois cretica	++++.11	3	3	86				
	E	Hedysarum spinosissimum					...+...	0	0	14
*	A	Helianthemum kahiricum	...+...	0	0	14				
*	R	Helianthemum sessiliflorum	....+..	0	0	14	+0.++.+	1	1	71
*	R	Helianthemum stipulatum					...++..	0	0	29

Table 55. continued.

		Species	DSN03 1234567	DSN03 C1	DSN03 C2	DSN03 %P	DSN04 1234567	DSN04 C1	DSN04 C2	DSN04 %P
	F	Hippocrepis areolata	++++++.	0	0	86	......+	0	0	14
	D	Hordeum glaucum	++.+...	0	0	43	.....+.	0	0	14
	R	Ifloga spicata	133323+	21	21	100	.+.++++	0	0	71
	F	Iris mariae					.+.....	0	0	14
	A	Ixiolirion tataricum	.+....+	0	0	29				
	W	Koelpinia linearis	++.+.+.	0	0	57				
	C	Launaea nudicaulis	.+...+.	0	0	29				
	W	Leontodon laciniatus	.+.+.0+	1	1	57				
	W	Linaria haelava	.++...+	0	0	43	++.+.++	0	0	71
	R	Lotus halophilus	+++.+++	0	0	86	++.+.++	0	0	71
*	R	Lycium schweinfurthii					..20..1	12	5	43
	W	Malva aegyptia	......+	0	0	14				
	W	Matthiola livida	+++.+..	0	0	57				
	W	Medicago laciniata	...+...	0	0	14				
	R	Neurada procumbens					+.0++11	4	4	86
	R	Nigella arvensis	....+..	0	0	14				
*	A	Noaea mucronata	00++2+3	10	10	100	....+.+	0	0	29
	W	Onobrychis crista-galli	...+.+.	0	0	29				
	H	Ononis serrata	+++..++	0	0	71	+++.++1	2	1	86
	R	Paronychia arabica	++++.+6	10	9	86	++++++.	0	0	86
*	F	Pennisetum divisum					.....2.	20	3	14
	F	Picris asplenioides	11+4++.	10	9	86	+.+...+	0	0	43
*	R	Plantago albicans	.....3.	30	4	14				
	W	Plantago coronopus	.....++	0	0	29				
	F	Plantago cylindrica	7+5.+..	30	17	57	...+.++	0	0	43
	R	Pseudorlaya pumila					.+..+.+	0	0	43
	W	Reichardia tingitana	......+	0	0	14	...+...	0	0	14
	W	Reseda decursiva					+......	0	0	14
*	R	Retama raetam	0.++2..	6	3	57	4632354	39	39	100
	H	Rostraria smyrnacea	.+1.++0	3	2	71	.....+.	0	0	14
	R	Rumex pictus	+..++..	0	0	43	+++0+++	1	1	100
*	A	Salvia lanigera	.....+.	0	0	14				
	F	Schimpera arabica	++.....	0	0	29	...+...	0	0	14
	W	Schismus arabicus	+++....	0	0	43				
	W	Senecio glaucus	...2.++	7	3	43	0234142	24	24	100
	H	Silene colorata	+++.+++	0	0	86	++.++++	0	0	86
	R	Sixalix eremophila	.+.....	0	0	14	...+...	0	0	14
	W	Stipa capensis					....++.	0	0	29
*	V	Stipa pellita	...+...	0	0	14				
*	F	Stipagrostis ciliata					.+.....	0	0	14
*	F	Stipagrostis plumosa	....+..	0	0	14	1314223	24	24	100
*	B	Thymelaea hirsuta	9996.97	83	71	86				
	W	Trifolium tomentosum	...1402	19	11	57	3+02+.4	16	14	86
	H	Trigonella arabica	.+++...	0	0	43				
	R	Trisetaria linearis	0+..+..	2	1	43	0.+.1..	5	2	43
	H	Urginea maritima					.....1.	10	1	14
	R	Vulpia brevis	++++12+	4	4	100	+2+1+++	4	4	100
	F	Vulpia pectinella	+++.+..	0	0	57	.+++..+	0	0	57

6.6.2.1.3.4 DSN04 Vulpio brevis – Retametum raetam Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 55. **Distribution:** Fig. 111.

Ecological notes: The vast areas of sand sheets west of Revivim are covered to a large extent by this association. Due to the relatively continuous sand cover in the flat topography it is not clear which type of substratum the sandy soil covers. All the persistent markers are psammophytes and so are most of the ephemerals excluding *Bromus fasciculatus, Linaria haelava, Senecio glaucus*, and *Silene colorata*. The grazing and trampling pressure caused here, among other effects, disturbance of the microbiotic crust. However, in a few locally protected sites there is a well developed crust composed of cyanobacteria, cyanophilous lichens, and mosses. The relatively high quantity of rainfall in 1994 locally influenced the high cover of ephemerals in this association.

An association which could be related to this Artemisietum monospermae (DSN04) is developed along the road west of Revivim to Gvulot. It is typified by the presence of *Prosopis farcta*. This species is a phreatophyte which grows mainly in summer. The area where it occurs resembles superficially that covered by Retamo raetam – Artemisietum monospermae, but with many individuals of *P. farcta*. The special environmental conditions indicated by this plant are that it is possible that water carrying layer at depth support this plant. In other words this is an underground river covered by sand. Relevés of this Prosopidetum or Prosopio – Artemisietum monospermae were not recorded yet.

Association dynamics and conservation: Most of the area of this association is under constant grazing and cutting

Aspects of the association: Persistents – 15 spp.; ephemerals – 43 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94301	70	15	24	22.03.94	I 1710 5540
2	94302	60	15	30	22.03.94	I 1711 5540
3	94303	60	10	25	22.03.94	I 1708 5543
4	94304	50	10	33	22.03.94	I 1709 5543
5	94305	50	15	30	22.03.94	I 1709 5544
6	94306	50	15	27	22.03.94	I 1708 5545
7	94307	50	15	33	22.03.94	I 1709 5545
Average:		55.7	13.6	28.9		

6.6.2.2 Stipagrostio plumosae – Anabasienalia articulatae Danin et Solomeshch subord. nov.

Diagnostical species: *Adonis dentata, Aegilops kotschyi, Anabasis articulata (dom.), Carrichtera annua, Emex spinosa, Erucaria rostrata, Gastrocotyle hispida, Helianthemum ledifolium, Iris petrana, Neotorularia torulosa, Onobrychis crista-galli, Onopordum alexandrinum, Stipagrostis obtusa.*

Nomenclatural type: Stipagrostio plumosae – Anabasion articulatae Danin et Solomeshch.

Synoptic table: Table 59.

The associations of this suborder are confined to substratum developed from Neogene sands, mainly in the area of the synclines of Rotem-Yamin and Yeroham-Dimona and the Mamshit Valley connecting them (Bartov, 1994). These were sedimentation basins during the Tertiary and the main sediments were sands, sandstones, clays and conglomerates. During the processes of weathering loose sand covered the relief of the old rocks at the Rotem-Yamin plains by a layer of a few centimeters to 5 m deep (Danin et al., 1964; Danin, 1983: Fig. 26; Danin, 1996: Fig. 74). The depth of this sand mantle or the nature of the exposed rock are the main predictors for dividing this area to homogeneous ecological units. The dominance of small shrubs of *Anabasis articulata* or large shrubs of *Calligonum comosum,* as seen in aerial photographs, were the main parameter used in delimiting the distribution of vegetation in this area (Danin et al., 1964). The amount of air-borne silt and clay and that of sand involved in the pedogenesis of the weathered Neogene rocks seem to be the main predictors for ecologic division of the Yeroham-Dimona Valley (Danin et al., 1964). Large shrubs seen in aerial photographs in this area were those of *Thymelaea hirsuta* which are confined to outcrops of loose sandstone, and small shrubs of *Anabasis articulata* were used here as well. The extent of this kind of substratum is relatively small and only one alliance have been recognized in this suborder. The view of Danin et al., (1964) that all the vegetation of this area is one association divided into several variants was not followed here.

Communities of this suborder have some similarity with the class Anabasietea articulatae (M) having the following common species *Anabasis articulata, Erucaria rostrata, Helianthemum ledifolium, Neotorularia torulosa.* However, the present suborder differs by presence of many psammophytes indicating the sandy nature of the Retametea (e.g., *Ammochloa palaestina, Atractylis carduus, Convolvulus spicatus, Cutandia memphitica, Erodium* *laciniatum, Ifloga spicata, Iris petrana, Plantago albicans, Polycarpon succulentum, Schimpera arabica*) and by the absence of species of the Anabasietea. Such differential species which do not occur in Stipagrostio – Anabasienalia are: *Zygophyllum dumosum, Asteriscus hierochunticus, Agathophora alopecuroides, Diplotaxis harra, Pteranthus dichotomus, Reaumuria hirtella, Salsola inermis.* Inhabiting the same geographical area these differences indicate ecological differences.

6.6.2.2.1 DSS Stipagrostio plumosae – Anabasion articulatae Danin et Solomeshch all. nov.

Diagnostical species of alliance = d.s. of the suborder.

Nomenclatural type: Stipagrostio obtusae – Anabasietum articulatae Danin et Solomeshch.

Synoptic table: Table 59.

The phytogeographical spectrum of the associations in this alliance is rather homogeneous, with dominance of the Saharo-Arabian chorotype (Figs. 112 and 113). Geographically, the alliance occurs in a transition between the area dominated by associations of the Artemisietea sieberi and those of the Anabasietea articulatae. The three associations of the Yeroham-Dimona Valley (DSS01-DSS03) are in a moister area and hence display a higher percentage of the chorotypes IT, M-IT, and IT-SA than the four associations of the Rotem-Yamin area. The complementary percentages in the four latter associations are of Saharo-Arabian species.

The affinity of the associations of the alliances to sand as expressed by the percentage of psammophytes in the list of species increases in the order of the associations as follows: 15% in DSS01, 17% in DSS02, 20% in DSS03, 27% in DSS04, 38% in DSS05, 38% in DSS06, and 47% in DSS07.

6.6.2.2.1.1 DSS01 Irido petranae – Artemisietum sieberi Danin, Orshan et Zohary ex Danin et Solomeshch ass. nov.

Syn.: Anabasidetum articulatae arenarium artemisietosum Danin, Orshan et Zohary

Diagnostical species: the markers in table 56. **Distribution:** Fig. 111.

Ecological notes: This association is developed on a mixture of loess and sandy soil near Yeroham. The amount of sand does not seem to be high as indicated by the low percentage of psammophytes here (15%), but it is much higher than in the Loessial Serozem of the neighbouring areas dominated by Haloxyletum scopariae (AAH05 or AAH06). The latter contain xerohalophytes in their list whereas none were recorded here. There are patches which are devoid of vegetation in the middle of areas covered by this association; these are places where the Bca horizon of the soil is exposed. The three semishrubs in the markers list *Artemisia sieberi, Noaea mucronata,* and *Anabasis articulata* occur as dominants on lithosols but also dominate on sandy substrata. The endemic *Iris petrana* which occurs in several other associations of this alliance has its highest frequency in this association which is situated not far from the main nature reserve of *Iris petrana* in Israel. In this reserve the *I. petrana* density is higher than of most other components of the vegetation.

Association dynamics and conservation: Most of the area of this association is under constant overgrazing and cutting pressure. Parts of the area of this association are plowed in rainy years and planted with barley.

Aspects of the association: Persistents – 10 spp.; ephemerals – 70 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94207	20	20	22	21.03.94	I 1975 5485
2	94208	10	30	34	21.03.94	I 1975 5486
3	94209	15	20	41	21.03.94	I 1976 5486
4	94210	30	20	35	21.03.94	I 1976 5484
5	94211	15	20	34	21.03.94	I 1977 5484
6	94212	20	20	33	21.03.94	I 1977 5483
7	94213	20	20	25	21.03.94	I 1978 5483
Average:		18.6	21.4	32.0		

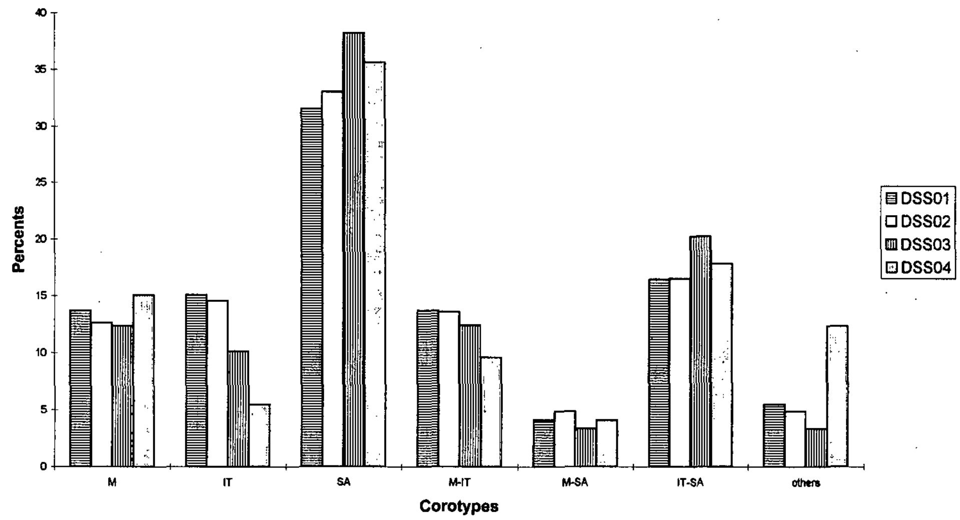

Figure 112. Phytogeographical analysis of associations DSS01-DSS04.

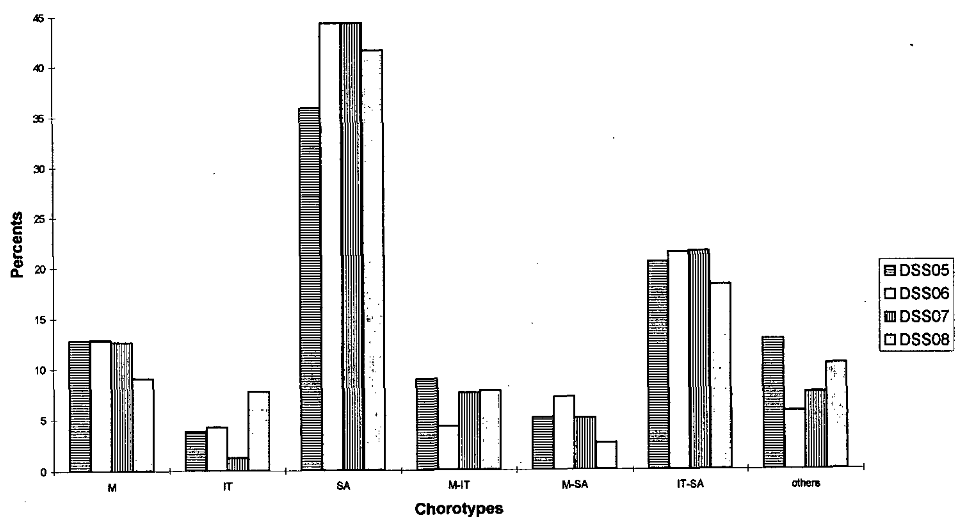

Figure 113. Phytogeographical analysis of associations DSS05-DSS08.

Table 56. Association tables of DSS01- Irido petranae – Artemisietum sieberi, DSS02 – Artemisio sieberi – Anabasietum articulatae, and DSS03 – Convolvulo spicati – Thymelaetum hirsutae

			DSS01				DSS02				DSS03			
			*1234567	C1	C2	%P	*123456789012	C1	C2	%P	*1234567	C1	C2	%P
	W	Aaronsohnia factorovskyi									......+	0	0	14
	W	Adonis dentata	++++++.	**0**	**0**	**86**	...+.++++++.	0	0	58	....+..	0	0	14
	W	Aegilops kotschyi	+.+.+..	0	0	43	+++.+.+.+.+.	0	0	58	+.+..++	0	0	57
	F	Allium sinaiticum					+...........	0	0	8				
	F	Allium sindjarense					..++...+....	0	0	25	..+....	0	0	14
	F	Ammochloa palaestina	.++.+.+	0	0	57	+0++++.+++..	**1**	**0**	**75**	.2+..++	5	3	57
*	N	Anabasis articulata	0000100	**6**	**6**	**100**	698645666786	**65**	**65**	**100**	5122210	**20**	**20**	**100**
	W	Anthemis melampodina	...++.+	0	0	43	++++.+..++..	0	0	58	..+0+++	**1**	**1**	**71**
	H	Anthemis pseudocotula	..+....	0	0	14	+++++.++++++	**0**	**0**	**92**	......+	0	0	14

Table 56. continued

			DSS01				DSS02				DSS03			
			1234567	C1	C2	%P	123456789012	C1	C2	%P	1234567	C1	C2	%P
*	F	Argyrolobium uniflorum									.....+.	0	0	14
	W	Arnebia decumbens									.....+.	0	0	14
	W	Arnebia *linearifolia*	.....+.	0	0	14								
*	A	Artemisia sieberi	8888899	**83**	**83**	**100**	200020113213	**15**	**15**	**100**	+1.+.3.	10	6	57
*	V	Asparagus horridus					......+...+.	0	0	17	......+	0	0	14
	H	Asphodelus ramosus	342..0.	24	14	57	.....635..+.	35	12	33	.2..11.	13	6	43
*	V	Astragalus amalecitanus									.+.....	0	0	14
	W	Astragalus asterias					....+.......	0	0	8				
	A	Astragalus caprinus	.+.....	0	0	14	....++0.....	2	0	25	....++.	0	0	29
	R	Astragalus kahiricus	....+..	0	0	14								
*	A	Astragalus sanctus									.+.....	0	0	14
*	A	Astragalus spinosus									.++....	0	0	29
	W	Astragalus tribuloides	.+.....	0	0	14	++..++..+..+	0	0	50	++++..+	**0**	**0**	**71**
*	R	Atractylis carduus	....+..	0	0	14	....+.+.....	0	0	17	....++.	0	0	29
*	W	Atractylis phaeolepis	..+++++	**0**	**0**	**71**	+...+......+	0	0	25	+.....+	0	0	29
	A	Avena wiestii					+.+...+...++	0	0	42	...+..+	0	0	29
	A	Bellevalia eigii	....+..	0	0	14								
	H	Biarum angustatum	..+....	0	0	14	+........+..	0	0	17	...+...	0	0	14
	H	Biscutella didyma									..+....	0	0	14
	H	Bromus fasciculatus	.+....+	0	0	29	+.+.++++..+.	0	0	58	++2..++	**4**	**3**	**71**
	H	Bupleurum nodiflorum					.....+......	0	0	8				
	H	Calendula arvensis	3.+1...	13	6	43	+++2+22+11+.	**8**	**7**	**92**	+13233+	**17**	**17**	**100**
	N	Calendula *tripterocarpa*	20	13	4	29								
	W	Carduus getulus					..+++...+...	0	0	33	+....+.	0	0	29
	A	Carex pachystylis	0.346..	34	19	57	+..+..01..2.	7	3	42				
	W	Carrichtera annua	.+..+..	0	0	29	.+....+.++52	12	6	50	++....4	13	6	43
*	A	Centaurea aegyptiaca					++++........	0	0	33	+...+..	0	0	29
	A	Ceratocephala falcata									.+.....	0	0	14
	W	Cnicus benedictus	+...++.	0	0	43	.+...+......	0	0	17	..+.++.	0	0	43
	A	Colchicum ritchii	.+++.+.	0	0	57	+..+++..++++	**0**	**0**	**67**	++++.++	**0**	**0**	**86**
*	F	Convolvulus spicatus					...0........	5	0	8	0.00++0	**3**	**3**	**86**
	W	Crithopsis delileana					3	30	3	8	......+	0	0	14
	R	Cutandia memphitica	.+..1+2	8	4	57	...+.+.+...+	0	0	33	.++21++	**5**	**4**	**86**
*	A	Deverra tortuosa									.+.....	0	0	14
*	B	Echinops polyceras									.+.....	0	0	14
*	R	Echiochilon fruticosum									.22+..1	14	8	57
	W	Emex spinosa	+.++.++	**0**	**0**	**71**	+++++0++.+.+	**1**	**0**	**83**	+++.+++	**0**	**0**	**86**
	R	Eminium spiculatum									+......	0	0	14
	W	Enarthrocarpus stranulatus					...........+	0	0	8	+......	0	0	14
	H	Erodium ciconium					......+.....	0	0	8				
	W	Erodium crassifolium	...+.+.	0	0	29	++....+.+.++	0	0	50	.+++...	0	0	43
	R	Erodium laciniatum	.++.+.+	0	0	57	+++++++.++.+	**0**	**0**	**83**	+++..++	**0**	**0**	**71**
	W	Erucaria microcarpa	.+00+.+	**2**	**1**	**71**	201.1++03235	**16**	**15**	**92**	.+.+...	0	0	29
	W	Erucaria rostrata	1.1.++1	**6**	**4**	**71**	.+++0+++2...	**3**	**2**	**67**	.+.+13+	**8**	**6**	**71**
	W	Euphorbia chamaepeplus	+......	0	0	14					.+.+...	0	0	29
	H	Filago contracta					.......+....	0	0	8				
	W	Filago desertorum	.12+.+1	**8**	**6**	**71**	+++.++++.+.+	**0**	**0**	**75**	.++++.+	**0**	**0**	**71**
	W	Gagea reticulata					....+.......	0	0	8	......+	0	0	14
	W	Gastrocotyle hispida	..+.++.	0	0	43	.++..+++++++	**0**	**0**	**75**	++...+.	0	0	43
	W	Gymnarrhena micrantha					57665.+336..	**46**	**34**	**75**	8+32..3	**32**	**23**	**71**
*	N	Gymnocarpos decander	...+...	0	0	14	+..+0.+2....	5	2	42	++.+.++	**0**	**0**	**71**
	H	Gynandriris sisyrinchium	.++.+..	0	0	43	...+.+.+++++	0	0	58	.+..+..	0	0	29
*	B	Gypsophila arabica					0..++.......	2	0	25				
*	R	Haplophyllum tuberculatum					...........+	0	0	8				
	H	Hedypnois cretica	..+++.+	0	0	57	..+..++...++	0	0	42	.++.++.	0	0	57
	W	Helianthemum ledifolium	++.+.+.	0	0	57	+.++++1+.+..	**1**	**1**	**67**	.+.....	0	0	14

Table 56. continued

			DSS01				DSS02				DSS03			
			1234567	C1	C2	%P	123456789012	C1	C2	%P	1234567	C1	C2	%P
	H	Helianthemum salicifolium	.+.....	0	0	14								
*	R	Helianthemum stipulatum									.+++.++	**0**	**0**	**71**
*	A	Helianthemum vesicarium	...+...	0	0	14	...........+	0	0	8				
*	S	Herniaria hemistemon					..........++	0	0	17				
	W	Herniaria hirsuta					.+.......+..	0	0	17				
	H	Hippocrepis unisiliquosa	..+....	0	0	14								
	D	Hordeum glaucum	..+..+.	0	0	29	+.++.++.....	0	0	42	+.+.+++	**0**	**0**	**71**
	H	Hypecoum pendulum					........+...	0	0	8				
	R	Ifloga spicata	++++.+2	**3**	**3**	**86**	++++++0+0+.+	**1**	**1**	**92**	+.++01+	**3**	**2**	**86**
	F	Iris petrana	24+42+1	**19**	**19**	**100**	.....+2.++..	5	2	33	.+..1+.	3	1	43
	A	Ixiolirion tataricum	....+..	0	0	14	..........+.	0	0	8				
	W	Koelpinia linearis	....+..	0	0	14	.........+++	0	0	25				
	W	Lamarckia aurea	.+.....	0	0	14								
	W	Lappula spinocarpos	..+....	0	0	14	........+.++	0	0	25	.+.....	0	0	14
	R	Launaea fragilis	..+....	0	0	14					..++++.	0	0	57
	W	Leontodon laciniatus	..+....	0	0	14					.....+.	0	0	14
	A	Leopoldia longipes					........+...	0	0	8	....+..	0	0	14
	W	Linaria haelava	++.++..	0	0	57	++++++++++++	**0**	**0**	**100**	...++++	0	0	57
	H	Linaria micrantha	.+.....	0	0	14								
	W	Lomelosia porphyroneura									....+..	0	0	14
	R	Lotus halophilus					.....+......	0	0	8	.....+.	0	0	14
	W	Malva aegyptia					.......++...	0	0	17	.+...++	0	0	43
	D	Malva parviflora					.........+++	0	0	25	....+..	0	0	14
	W	Matthiola livida	..+++..	0	0	43	.+++++++.1++	**1**	**1**	**83**	+1++2+1	**6**	**6**	**100**
	W	Neotorularia torulosa	...++..	0	0	29	......+.++..	0	0	25	.+...+.	0	0	29
*	A	Noaea mucronata	1111100	**11**	**11**	**100**	1012342100.0	**15**	**14**	**92**	+20001+	**6**	**6**	**100**
	W	Onobrychis crista-galli	.+++.++	**0**	**0**	**71**	++++..+...++	0	0	58	+.+.+++	**0**	**0**	**71**
	A	Onopordum alexandrinum	...++++	0	0	57	...++++++++.	**0**	**0**	**67**	++1++..	**2**	**1**	**71**
	A	Ornithogalum trichophyllum	.+.....	0	0	14								
	W	Papaver humile					.+..........	0	0	8				
	R	Paronychia arabica					...+++...+..	0	0	33	.+.....	0	0	14
*	A	Peganum harmala									....++.	0	0	29
	F	Picris asplenioides	.+.+.++	0	0	57	........+...	0	0	8	.+.++2+	**4**	**3**	**71**
	W	Picris longirostris					...+++++....	0	0	42	+3.....	15	4	29
*	H	Piptatherum thomasii					...........+	0	0	8				
*	R	Plantago albicans	+.+..72	23	13	57	.+..+.......	0	0	17				
	W	Plantago coronopus	..1....	10	1	14	22213..+.+..	14	8	58	....+.+	0	0	29
	W	Plantago notata					...+........	0	0	8				
	R	Polycarpon succulentum	++++...	0	0	57	.....0++.+..	1	0	33	.+..+++	0	0	57
	W	Pterocephalus brevis	.....+.	0	0	14	.........+..	0	0	8				
	H	Ranunculus asiaticus	...+...	0	0	14	......++..++	0	0	33				
*	S	Reaumuria hirtella									+......	0	0	14
	W	Reichardia tingitana	..+....	0	0	14	.++...+.+..+	0	0	42	+...+.+	0	0	43
*	R	Retama raetam					.........+.+	0	0	17	....+..	0	0	14
	W	Roemeria hybrida					...+..+.....	0	0	17				
	H	Rostraria smyrnacea	..+....	0	0	14	.......+.+..	0	0	17	.....+.	0	0	14
*	A	Salvia lanigera	.+.+++.	0	0	57	+..+.++.+.++	0	0	58	+++.+.+	**0**	**0**	**71**
	F	Schimpera arabica	..++++.	0	0	57	.....+..+...	0	0	17	..++...	0	0	29
	W	Schismus arabicus	.+.....	0	0	14	+....+...+..	0	0	25	..+..+.	0	0	29
	W	Scilla hanburyi					...........+	0	0	8				
	W	Scorzonera judaica	..+++..	0	0	43	........+.++	0	0	25	.....++	0	0	29
	W	Senecio glaucus	...+...	0	0	14	.......+....	0	0	8	+++.+..	0	0	57
	H	Silene colorata	.++..++	0	0	57	++.++++++...	**0**	**0**	**67**	...+++.	0	0	43
	A	Silene coniflora	.....+.	0	0	14								
	W	Stipa capensis					.+....++....	0	0	25				

Table 56. continued

			DSS01				DSS02				DSS03			
			1234567	C1	C2	%P	123456789012	C1	C2	%P	1234567	C1	C2	%P
*	V	Stipa pellita	.+.+.+.	0	0	43	......+..+..	0	0	17	.....+.	0	0	14
*	F	Stipagrostis ciliata	.+..+..	0	0	29	.......+.+..	0	0	17	..+...2	10	3	29
*	B	Thymelaea hirsuta	++.+.++	**0**	**0**	**71**	...100+++0++	**3**	**2**	**75**	4357746	**51**	**51**	**100**
	H	Trifolium tomentosum					...++.......	0	0	17				
	W	Trigonella arabica	.++++..	0	0	57	+.+.....+...	0	0	25	..++...	0	0	29
	W	Trigonella stellata	..+.+.+	0	0	43	1+0+++++++++	**1**	**1**	**100**	10+2+.+	**6**	**5**	**86**
	A	Tulipa systola	+......	0	0	14	...........+	0	0	8				
	A	Urginea undulata	+......	0	0	14	..+...+...+.	0	0	25	+..+..+	0	0	43
	A	Valerianella szovitsiana					.......+....	0	0	8	...+...	0	0	14
	A	Vicia monantha					...........+	0	0	8				
	H	Vicia sativa					..........+.	0	0	8				
	R	Vulpia brevis					...+........	0	0	8				
	H	Vulpia ciliata	.....+.	0	0	14								
	A	Zosima absinthiifolia	...+.+.	0	0	29								

6.6.2.2.1.2 DSS02 Artemisio sieberi – Anabasietum articulatae Danin, Orshan et Zohary 1964 ex Danin et Solomeshch ass. nov.

Syn.: Artemisietum herbae-albae arenarium Danin, Orshan et Zohary 1964.

Diagnostical species: the markers in table 56. **Distribution:** Fig. 114.

Ecological notes: This association develops on a similar substratum which is richer in sand; it has other proportions of the marker semishrubs and the dominant is *Anabasis articulata* and not *Artemisia sieberi.* The percentage of psammophytes is slightly higher than in the previous association.

Association dynamics and conservation: Most of the area of this association is under high pressure of grazing and cutting. Parts of the area of this association are plowed in rainy years and are planted with barley.

Aspects of the association: Persistents – 19 spp.; ephemerals – 87 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94193	20	10	36	21.03.94	I 1942 5450
2	94194	15	10	32	21.03.94	I 1942 5451
3	94195	20	10	32	21.03.94	I 1942 5452
4	94196	20	10	40	21.03.94	I 1942 5453
5	94197	25	15	37	21.03.94	I 1941 5450
6	94199	30	10	41	21.03.94	I 1970 5475
7	94200	20	15	48	21.03.94	I 1971 5475
8	94201	20	10	39	21.03.94	I 1970 5476
9	94214	20	20	38	21.03.94	I 1975 5485
10	94215	20	10	40	21.03.94	I 1976 5485
11	94216	30	7	34	21.03.94	I 1997 5504
12	94217	25	15	41	21.03.94	I 1998 5504
Average:		22.1	11.8	38.2		

6.6.2.2.1.3 DSS03 Convolvulo spicati – Thymelaetum hirsutae Danin, Orshan et Zohary 1964 ex Danin et Solomeshch ass. nov.

Syn. Anabasidetum articulatae arenarium thymelaeetosum Danin, Orshan et Zohary 1964.

Diagnostical species: the markers in table 56. **Distribution:** Fig. 114.

Ecological notes: This association occurs on outcrops of loose sandstone mainly at the area of the water divide of the Yeroham-Dimona plain. There are more psammophytes in this association than in the previous ones and many

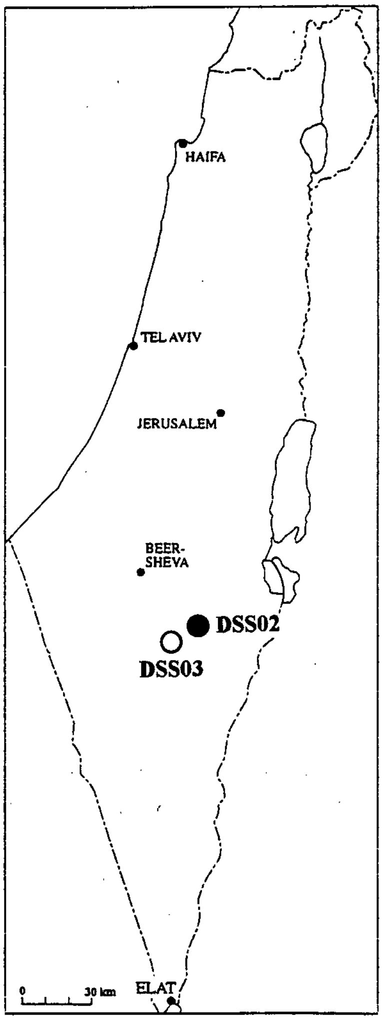

Figure 114. Distribution map of associations DSS02 and DSS03.

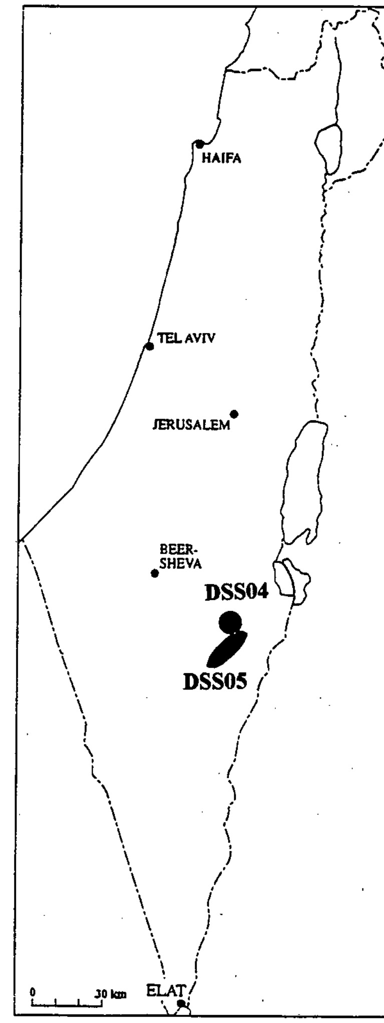

Figure 115. Distribution map of associations DSS04 and DSS05.

of them are persistents. Such are *Convolvulus spicatus, Echiochilon fruticosum, Argyrolobium uniflorum*, and *Helianthemum stipulatum*.

Association dynamics and conservation: Most of the area of this association is under high pressure of grazing and cutting.

Aspects of the association: Persistents – 23 spp.; ephemerals – 71 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94198	15	15	33	21.03.94	I 1942 5450
2	94202	20	10	46	21.03.94	I 1970 5475
3	94203	20	15	37	21.03.94	I 1970 5476
4	94204	20	15	34	21.03.94	I 1970 5477
5	94205	25	20	39	21.03.94	I 1975 5485
6	94206	30	15	45	21.03.94	I 1976 5485
7	94218	10	15	43	21.03.94	I 2001 5505
Average:		20.0	15.0	39.6		

6.6.2.2.1.4 DSS04 Erucario pinnatae – Haloxyletum salicornicae Danin, Orshan et Zohary 1964 ex Danin et Solomeshch ass. nov.

Syn.: Anabasidetum articulatae arenarium haloxyletosum Danin, Orshan et Zohary 1964.

Diagnostical species: the markers in table 57. **Distribution:** Fig. 115.

Ecological notes: *Haloxylon salicornicum* is one of the most important contributors to the vegetation cover of drier and warmer areas (Danin, 1983) than the eastern end of the Mamshit Valley toward the northwestern section of Rotem-Yamin plain. In these areas it is not accompanied by so many species with the chorotypes M, M-IT, IT, and IT-SA. There are no evident environmental factors which seem to be associated with the dominance of *H. salicornicum* here. There are also small patches of this association at the southern sandy area of the Rotem-Yamin plain.

Association dynamics and conservation: Most of the area of this association is under moderate grazing pressure.

Aspects of the association: Persistents – 7 spp.; ephemerals – 68 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94219	20	20	25	21.03.94	I 2065 5497
2	94220	30	10	20	21.03.94	I 2066 5497
3	94221	30	10	31	21.03.94	I 2067 5497
4	94222	30	10	18	21.03.94	I 2068 5497
5	94223	25	10	21	21.03.94	I 2065 5498
6	94224	30	15	20	21.03.94	I 2065 5499
7	94225	20	10	28	21.03.94	I 2066 5498
8	94226	30	8	37	21.03.94	I 2066 5499
9	94227	30	15	29	21.03.94	I 2067 5498
Average:		27.2	12.0	25.4		

Table 57. Association tables of DSS04 – Erucario pinnatae – Haloxyletum salicornicae, DSS05 – Stipagrostio obtusae – Anabasietum articulatae, and DSS06 – Retamo raetam – Calligonetum comosi

		Species	DSS04				DSS05				DSS06			
			*123456789	C1	C2	%P	*12345678	C1	C2	%P	*1234567	C1	C2	%P
*	C	Acacia raddiana									...0...	3	0	14
	W	Adonis dentata	.+.......	0	0	11	.++....+	0	0	38	.....++	0	0	29
	W	Aegilops kotschyi	..+....+.	0	0	22	.+++....	0	0	38	.....+.	0	0	14
	F	Ammochloa palaestina	121...+++	**8**	**5**	**67**	..++....	0	0	25	..++..+	0	0	43
*	N	Anabasis articulata	+.1......	5	1	22	69675646	**62**	**62**	**100**	1+21112	**14**	**14**	**100**
	W	Anthemis melampodina	..++.++++	**0**	**0**	**67**	1.1220+0	**11**	**9**	**88**	++++.+1	**2**	**1**	**86**
*	F	Argyrolobium uniflorum					...+.++.	0	0	38				
	W	Arnebia decumbens	.......+.	0	0	11								
	W	Arnebia linearifolia					+.......	0	0	13	+......	0	0	14
	H	Asphodelus ramosus	.......+.	0	0	11	.1+.2123	**15**	**11**	**75**	2112+11	**12**	**12**	**100**
	R	Astragalus annularis	.....++..	0	0	22	++++..++	**0**	**0**	**75**	+......	0	0	14
	W	Astragalus tribuloides	+..++.+++	**0**	**0**	**67**	++...++.	0	0	50				
*	R	Atractylis carduus	..+......	0	0	11	+.+++.++	**0**	**0**	**75**	.++...+	0	0	43
*	S	Atriplex leucoclada									.+.....	0	0	14
	A	Avena wiestii	.......+.	0	0	11	.+++....	0	0	38				
	R	Bassia muricata									.+.....	0	0	14
	R	Biarum olivieri					......+.	0	0	13	..+..+.	0	0	29
*	C	Blepharis ciliaris					+++..+..	0	0	50	......+	0	0	14
	R	Brassica tournefortii					....+..+	0	0	25	+1++.++	**2**	**1**	**86**
	H	Bromus fasciculatus	.+.+...+.	0	0	33	+.......	0	0	13				
	H	Bromus tectorum					++.+++++	**0**	**0**	**88**	...+.+.	0	0	29
	H	Calendula arvensis	++..+...+	0	0	44					+++.+++	**0**	**0**	**86**
	N	Calendula tripterocarpa					.++.++.+	**0**	**0**	**63**				

Table 57. continued.

		Species	DSS04 123456789	C1	C2	%P	DSS05 12345678	C1	C2	%P	DSS06 1234567	C1	C2	%P
*	R	Calligonum comosum					..10..+..	5	2	38	6525465	**47**	**47**	**100**
	W	Carduus getulus									++...+.	0	0	43
	A	Carex pachystylis									....3..	30	4	14
	W	Carrichtera annua									++....+	0	0	43
	W	Centaurea pallescens	+...+.+.+	0	0	44	++++++++	**0**	**0**	**100**	++++++.	**0**	**0**	**86**
	A	Colchicum ritchii	.......+.	0	0	11					......+	0	0	14
	W	Consolida incana					.++...+.	0	0	38				
*	F	Convolvulus spicatus	...+.....	0	0	11	.+......	0	0	13				
	R	Corynephorus divaricatus					.....+..	0	0	13				
	V	Crassula alata	.....+...	0	0	11					...+++.	0	0	43
	A	Crucianella membranacea					.......+	0	0	13				
	R	Cutandia memphitica	1+++00+++	**2**	**2**	**100**	++++....	0	0	50	++.+...	0	0	43
*	H	Cynodon dactylon									..+....	0	0	14
*	R	Echiochilon fruticosum					+.......	0	0	13				
	W	Emex spinosa	++5..++.+	**8**	**6**	**67**	.++....+	0	0	38	+++++1+	**1**	**1**	**100**
	W	Enarthrocarpus strangulatus									..+.+..	0	0	29
*	V	Ephedra aphylla									...0+2.	7	3	43
	H	Erodium ciconium					.+....++	0	0	38				
	W	Erodium crassifolium					......+.	0	0	13				
	R	Erodium laciniatum	+5.++++01	**8**	**7**	**89**	..+....+	0	0	25	++.++++	**0**	**0**	**86**
	W	Erucaria microcarpa	......+..	0	0	11								
	F	Erucaria pinnata	1+1433232	**21**	**21**	**100**	++023.+3	**12**	**11**	**88**	33122++	**16**	**16**	**100**
	W	Erucaria rostrata	..+.....0	3	1	22	533+.32.	**28**	**21**	**75**	.....++	0	0	29
*	C	Farsetia aegyptia					....+...	0	0	13	...+...	0	0	14
	W	Filago desertorum	..+.+.+++	0	0	56	.++++++.	**0**	**0**	**75**	.+.++.+	0	0	57
	E	Gagea dayana									......+	0	0	14
	W	Gastrocotyle hispida	......+..	0	0	11	....+...	0	0	13	.....++	0	0	29
	W	Gymnarrhena micrantha	.......+.	0	0	11					......+	0	0	14
*	N	Gymnocarpos decander					+02.....	8	3	38	+......	0	0	14
	H	Gynandriris sisyrinchium	.++....+.	0	0	33					+.+....	0	0	29
*	B	Gypsophila arabica	.......+.	0	0	11								
*	F	Haloxylon salicornicum	999999989	**93**	**93**	**100**					.2+.0..	8	3	43
*	R	Haplophyllum tuberculatum					++..++..	0	0	50				
	H	Hedypnois cretica	..+.+....	0	0	22								
	W	Helianthemum ledifolium	..+....+.	0	0	22	++++++++	**0**	**0**	**100**	++2.++.	**4**	**3**	**71**
	H	Helianthemum salicifolium	..+......	0	0	11								
*	R	Helianthemum sessiliflorum					1+012212	**14**	**14**	**100**	..+....	0	0	14
*	R	Helianthemum stipulatum	....+..+.	0	0	22	...+0.11	6	3	50				
	W	Herniaria hirsuta	+......+.	0	0	22								
	F	Hippocrepis areolata	+......+.	0	0	22	+..+....	0	0	25				
	H	Hordeum glaucum	..+......	0	0	11	..+.....	0	0	13	.+.++++	**0**	**0**	**71**
	H	Hordeum spontaneum					..+....	0	0	14				
	R	Hormuzakia aggregata	...+.+...	0	0	22					++.++..	0	0	57
	R	Ifloga spicata	1+++01++0	**3**	**3**	**100**	+0+0.+.+	**2**	**1**	**75**	++.++.+	**0**	**0**	**71**
	W	Lappula spinocarpos					.+..+...	0	0	25	+.....+	0	0	29
	F	Launaea mucronata	.......+.	0	0	11								
	W	Leontodon laciniatus	........+	0	0	11	.++.+..+	0	0	50	.....++	0	0	29
	W	Linaria haelava	..++..+++	0	0	56	++++++.+	**0**	**0**	**88**	+++++++	**0**	**0**	**100**
	H	Linaria micrantha	...+.....	0	0	11								
	R	Lotus halophilus	+++++0+.+	**1**	**1**	**89**	+..++.++	**0**	**0**	**63**	++..+..	0	0	43
*	R	Lycium schweinfurthii									......+	0	0	14
	D	Malva parviflora	.....+.++	0	0	33					.+..+.+	0	0	43
	W	Matthiola livida	+.+..++++	**0**	**0**	**67**	...+.+.+	0	0	38	+..+++.	0	0	57
	W	Medicago laciniata					+.......	0	0	13				
*	A	Moricandia nitens					0...00.+	4	2	50	+.3.0++	**6**	**5**	**71**
	W	Neotorularia torulosa	.......+.	0	0	11	+.......	0	0	13	...+...	0	0	14
	R	Neurada procumbens	......2..	20	2	11	+...+.+.	0	0	38	+..+...	0	0	29

Table 57. continued.

		Species	DSS04 123456789	C1	C2	%P	DSS05 12345678	C1	C2	%P	DSS06 1234567	C1	C2	%P
*	A	Noaea mucronata					.....+..	0	0	13	.....+.	0	0	14
	W	Onobrychis crista-galli	+++.+....	0	0	44	+.+.+.+.	0	0	50				
	H	Ononis serrata	........+	0	0	11	...++.+.	0	0	38	...+...	0	0	14
	W	Ononis sicula	+........	0	0	11								
	A	Onopordum alexandrinum	...+.....	0	0	11	.++.....	0	0	25				
	F	Pancratium sickenbergeri					.++.....	0	0	25	++.++++	0	0	86
	W	Papaver humile	..+......	0	0	11	.++.+..+	0	0	50				
	R	Paronychia arabica	.1....++.	3	1	33	...+....	0	0	13	+++++.1	2	1	86
*	H	Paronychia argentea	+........	0	0	11								
*	A	Peganum harmala									.+.....	0	0	14
	F	Picris asplenioides	5+0565465	41	41	100	42541422	31	31	100	3224.2.	26	19	71
	W	Plantago coronopus	.++...1..	3	1	33	.++..+..	0	0	38	1+...1+	5	3	57
	F	Plantago cylindrica					+.......	0	0	13				
	W	Plantago ovata	+....+...	0	0	22	.++++++.	0	0	75	1+4+5.2	20	17	86
	R	Polycarpon succulentum	+0+.+++.+	1	1	78					...+...	0	0	14
	S	Pteranthus dichotomus					..+.....	0	0	13				
	H	Ranunculus asiaticus	..+......	0	0	11								
	W	Reichardia tingitana	....+....	0	0	11	....+...	0	0	13				
	W	Reseda decursiva									....+..	0	0	14
*	R	Retama raetam	...011020	9	6	67	.++..+.+	0	0	50	3133403	25	25	100
	W	Roemeria hybrida					..++....	0	0	25	.....+.	0	0	14
	H	Rostraria smyrnacea	0+....+.+	1	1	44	..+...+.	0	0	25				
	R	Rumex pictus					..+++.++	0	0	63	+1.1..+	5	3	57
*	A	Salvia lanigera					...+.+.+	0	0	38	......+	0	0	14
	F	Schimpera arabica	+.++...++	0	0	56	+.+.+.+.	0	0	50	++++.+.	0	0	71
	W	Schismus arabicus	.....+...	0	0	11	...+....	0	0	13	+.++...	0	0	43
	W	Scilla hanburyi	+.+....+.	0	0	33								
	W	Senecio glaucus	.....+...	0	0	11					02+.+.1	7	5	71
	H	Silene colorata	..+++.+++	0	0	67	++++++++	0	0	100	+.+++..	0	0	57
	W	Silene vivianii	....+..+.	0	0	22								
	W	Sisymbrium erysimoides									....+..	0	0	14
	D	Sonchus oleraceus	........+	0	0	11								
	S	Spergularia diandra	+.....+..	0	0	22								
	W	Stipa capensis	....++..+	0	0	33	++++++++	0	0	100	+++1+43	11	11	100
*	V	Stipa pellita					..+.+...	0	0	25	.....+.	0	0	14
*	F	Stipagrostis obtusa					2+011131	12	12	100	..+..++	0	0	43
*	F	Stipagrostis plumosa					+++.0.++	1	1	75	.1..+.+	3	1	43
*	B	Thymelaea hirsuta									..+....	0	0	14
	H	Trifolium tomentosum	.12...+.+	8	3	44					+......	0	0	14
	W	Trigonella arabica					..+.....	0	0	13				
	W	Trigonella stellata	..+.+.0++	1	1	56	+2.0+130	10	9	88	+.++.++	0	0	71
	R	Trisetaria linearis	.......+.	0	0	11								
	A	Urginea undulata									..+....	0	0	14
	R	Vulpia brevis					...++...	0	0	25				
	A	Zosima absinthiifolia	.......+.	0	0	11								

6.6.2.2.1.5 DSS05 Stipagrostio obtusae – Anabasietum articulatae Danin, Orshan et Zohary 1964 ex Danin et Solomeshch ass. nov.

Syn.: Anabasidetum articulatae arenarium retametosum Danin, Orshan et Zohary 1964.

Diagnostical species: the markers in table 57. **Distribution:** Fig. 115.

Ecological notes: This is the most common association of the Rotem -Yamin plain, confined to places where a layer of loose sand, 10-100 cm deep covers the old sandstone or the consolidated Bca horizon of ancient soils. The soil surface is covered by a well developed microbiotic crust of end-edaphic cyanobacteria. Occasional small clumps of the moss *Pterygoneurum sp.* occur here as well.

The long stability of the association is exemplified by at least two plants; *Asphodelus ramosus* grows here in circles up to 4-5 m in diameter (Danin, 1996) indicating a clump age of about 500 years. The most common companion of the genus *Stipagrostis* is *S. obtusa* which indicates stability or limited sand deflation but not accretion (Danin, 1996). This plant also constitutes circles in the area of this association.

Association dynamics and conservation: Most of the area of this association is protected as private land and there is hardly any grazing and trampling in most of the area. However, a considerably strong activity of borrowing animals brings about this factor in the natural cycle of the biotop.

Aspects of the association: Persistents – 18 spp.; ephemerals – 69 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94228	40	15	35	21.03.94	I 2075 5460
2	94229	40	10	39	21.03.94	I 2076 5460
3	94230	40	15	46	21.03.94	I 2077 5460
4	94231	30	15	36	21.03.94	I 2075 5461
5	94239	20	20	37	22.03.94	I 2075 5462
6	94242	30	20	29	22.03.94	I 2135 5465
7	94243	30	25	34	22.03.94	I 2135 5466
8	94244	30	20	34	22.03.94	I 2136 5465
Average:		32.5	17.5	36.3		

6.6.2.2.1.6 DSS06 Retamo raetam – Calligonetum comosi Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 57. **Distribution:** Fig. 116.

Ecological notes: This association was recorded in wide shallow wadis draining the Rotem -Yamin plain. In addition to most components of other associations it has a rather unique situation with a few trees of *Acacia raddiana* occurring in these wadis. This plant is confined to large wadis of the extreme desert areas of the Negev and Sinai (Halevy & Orshan, 1972; Danin, 1983). *Calligonum comosum* and *Retama raetam* are the plants which contribute the most to the vegetation cover. They also create a local special habitat at their shadow. This habitat becomes enriched by litter, which is nitrates-rich in the case of the Leguminosae *R. raetam* and enjoy the contribution of organic matter and seeds by birds using the tall shrubs as observation points. These are thus populated by several ruderal plants such as *Sisymbrium irio, Enarthrocarpus strangulatus,* and *Carduus getulus*.

Association dynamics and conservation: Most of the area of this association is protected as private land.

Aspects of the association: Persistents – 21 spp.; ephemerals – 62 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	97064	30	15	40	24.03.97	I 2071 5450
2	97065	40	20	37	24.03.97	I 2072 5450
3	97066	30	15	34	24.03.97	I 2073 5450
4	97067	30	20	37	24.03.97	I 2074 5451
5	97068	30	25	33	24.03.97	I 2075 5452
6	97069	40	20	37	24.03.97	I 2075 5460
7	97070	30	15	40	24.03.97	I 2076 5460
Average:		32.9	18.6	36.9		

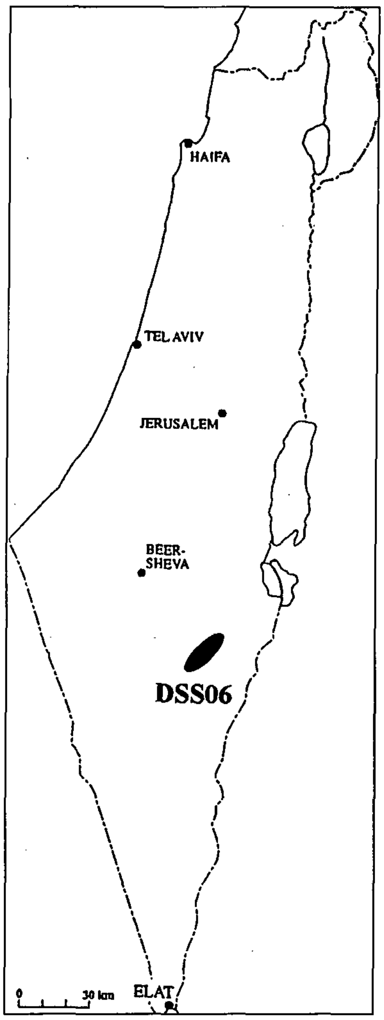

Figure 116. Distribution map of association DSS06.

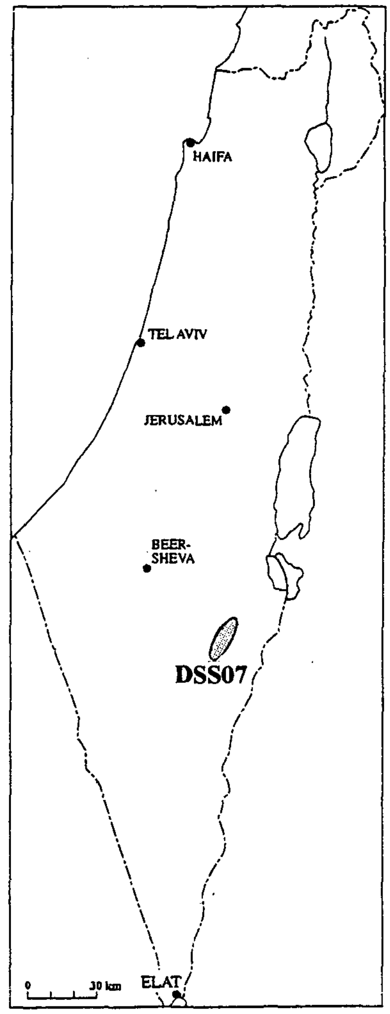

Figure 117. Distribution map of association DSS07.

6.6.2.2.1.7 DSS07 Stipagrostio plumosae – Calligonetum comosi Danin, Orshan et Zohary 1964 ex Danin et Solomeshch ass. nov.

Syn.: Anabasidetum articulatae arenarium calligonetosum Danin, Orshan et Zohary 1964.

Diagnostical species: the markers in table 58. **Distribution:** Fig. 117.

Ecological notes: The depth of loose sand in sites of this association is estimated as 2-5 m (Danin et al., 1964). The dominant, *Calligonum comosum,* is a rare plant in the area covered by the present volume and is confined to this association, to that of mobile sands of the western Negev (of the alliance DSA), to that of fresh sand covering lithosols at the northern margins of Rotem-Yamin plain (MZZ05) and that of wadis (DSS06). The plant is well adapted to accumulating, stabilizing, and to stable sand (Danin, 1996). It produces adventitious roots from thick stems when covered by sand. Owing to this property it may produce circles, some of which may rich 5-10 m in diameter (in case of elliptic clumps). It tends to build up nebkas and its diaspores are dispersed by wind by rolling on the sand (Danin 1996).

Of the companions, *Stipagrostis plumosa* indicates moderate sand accretion or deflation (Danin, 1996) and circular clumps of *Asphodelus ramosus* indicate that such sand accretion took place long ago. In other words, the high percentage of psammophytes, deep sand, companions of semi-stable sand indicate sand mobility in the past and its present stability.

Association dynamics and conservation: Most of the area of this association is protected as private land.

Aspects of the association: Persistents – 16 spp.; ephemerals – 54 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	94232	40	15	36	21.03.94	I 2075 5460
2	94233	30	10	37	21.03.94	I 2075 5461
3	94234	30	20	28	21.03.94	I 2075 5462
4	94235	30	15	34	22.03.94	I 2075 5463
5	94236	30	20	33	22.03.94	I 2076 5460
6	94237	25	20	39	22.03.94	I 2076 5461
7	94238	25	20	36	22.03.94	I 2076 5462
8	94240	20	20	38	22.03.94	I 2077 5463
9	94241	30	20	27	22.03.94	I 2078 5460
Average:		28.9	17.8	34.2		

Table 58. Association tables of DSS07 – Stipagrostio plumosae – Calligonetum comosi, DSS08 Anastatico hierochunticae – Anabasietum articulatae

			DSS07				DSS08			
			*123456789	C1	C2	%P	*1234567	C1	C2	%P
	W	Aaronsohnia factorovskyi					+..+...	0	0	29
	H	Adonis dentata	.....+...	0	0	11				
	C	Aizoon canariense					..+....	0	0	14
	W	Aizoon hispanicum					...+...	0	0	14
	F	Allium sindjarense	.....+...	0	0	11				
	F	Ammochloa palaestina	.+.......	0	0	11				
*	N	Anabasis articulata	211101111	**11**	**11**	**100**				
	N	Anastatica hierochuntica					3400388	**39**	**39**	**100**
	W	Anthemis melampodina	1+00.12..	**8**	**6**	**67**	+0+0+++	**1**	**1**	**100**
*	F	Argyrolobium uniflorum	.......+.	0	0	11				
	W	Arnebia linearifolia	.+.+...+.	0	0	33	.+++++.	**0**	**0**	**71**
	H	Asphodelus ramosus	400121+22	**14**	**14**	**100**	...+...	0	0	14
	W	Asphodelus tenuifolius					++++...	0	0	57
	R	Astragalus annularis	++.....++	0	0	44	++....+	0	0	43
	R	Astragalus peregrinus					.++....	0	0	29
	W	Astragalus tribuloides	.+.....+.	0	0	22	+.++...	0	0	43
*	R	Atractylis carduus	++...+...	0	0	33				
	A	Avena wiestii	....++.+.	0	0	33	+......	0	0	14
	R	Biarum olivieri	...+.....	0	0	11				
*	C	Blepharis ciliaris	.+.......	0	0	11				
	R	Brassica tournefortii	+.+++..+.	0	0	56	+......	0	0	14
	H	Bromus tectorum	+1+++.+.+	**1**	**1**	**78**				
	H	Calendula arvensis					.+.+...	0	0	29
	N	Calendula tripterocarpa	....+++..	0	0	33				
*	R	Calligonum comosum	666666556	**58**	**58**	**100**				
	W	Carduus getulus	+...+..+.	0	0	33				
	A	Carex pachystylis					...0...	5	1	14
	R	Carrichtera annua					++.+.+.	0	0	57
	W	Centaurea pallescens	+++++++.+	**0**	**0**	**89**	......+	0	0	14
	D	Chenopodium murale					...+...	0	0	14
	R	Corynephorus divaricatus	..+++++++	**0**	**0**	**78**				
	A	Crucianella membranacea	...+.....	0	0	11				
	R	Cutandia memphitica	.+.+.+++.	0	0	56	.+.....	0	0	14
*	R	Echiochilon fruticosum	++0121+1+	**7**	**7**	**100**				
	W	Emex spinosa	.......+.	0	0	11	..+....	0	0	14
*	V	Ephedra aphylla	...+....+	0	0	22				
	W	Erodium crassifolium					+......	0	0	14
	R	Erodium laciniatum	..++++.++	**0**	**0**	**67**	+......	0	0	14
	S	Erodium oxyrhynchum					+49+310	**26**	**26**	**100**
	W	Erodium touchyanum					+..+...	0	0	29
	F	Erucaria pinnata	+23322123	**21**	**21**	**100**	++..+++	**0**	**0**	**71**
	W	Erucaria rostrata					+..+...	0	0	29
	W	Euphorbia chamaepeplus	....++...	0	0	22				

Table 58. continued.

			DSS07 123456789	C1	C2	%P	DSS08 1234567	C1	C2	%P
*	R	Fagonia glutinosa	.......+.	0	0	11				
	W	Filago desertorum	++....++.	0	0	44	+..+..+	0	0	43
	H	Filago pyramidata					.+.....	0	0	14
	W	Gagea reticulata					+......	0	0	14
	W	Gastrocotyle hispida	+........	0	0	11	+++....	0	0	43
	W	Gymnarrhena micrantha					1++++++	**1**	**1**	**100**
*	W	Gymnocarpos decander	++.......	0	0	22				
	N	Gynandriris sisyrinchium					++.++..	0	0	57
	R	Gypsophila viscosa	.......+.	0	0	11				
	W	Helianthemum ledifolium	++.....+.	0	0	33	...+...	0	0	14
	H	Helianthemum salicifolium					...+...	0	0	14
*	R	Helianthemum sessiliflorum	1211+1321	**14**	**14**	**100**				
*	R	Helianthemum stipulatum	+1101+++.	**4**	**4**	**89**				
*	S	Herniaria hemistemon					..+....	0	0	14
	W	Herniaria hirsuta					...+...	0	0	14
	F	Hippocrepis areolata	.+....++.	0	0	33	..+....	0	0	14
	D	Hordeum glaucum	....+....	0	0	11				
	R	Hormuzakia aggregata	+++++++..	**0**	**0**	**78**				
	R	Ifloga spicata	+0+1+++++	**2**	**2**	**100**	+++0..0	**2**	**1**	**71**
	F	Iris petrana	....+....	0	0	11				
	W	Lappula spinocarpos					+++++++	**0**	**0**	**100**
	W	Leontodon laciniatus	....+....	0	0	11				
	W	Linaria haelava	+++++++++	**0**	**0**	**100**	++.+...	0	0	43
	R	Lotus halophilus	++++1++++	**1**	**1**	**100**	.+.....	0	0	14
	D	Malva parviflora					..++...	0	0	29
	F	Maresia pygmaea	..+++++..	0	0	56				
	W	Matthiola livida	+0.....0.	3	1	33	++++..+	**0**	**0**	**71**
	S	Mesembryanthemum nodiflorum					...+.++	0	0	43
	W	Minuartia picta					+..+...	0	0	29
*	A	Moricandia nitens	1	10	1	11				
	S	Nasturtiopsis coronopifolia					....3..	30	4	14
	W	Neotorularia torulosa					...+...	0	0	14
	R	Neurada procumbens	++++..++.	**0**	**0**	**67**	.++.+++	**0**	**0**	**71**
*	A	Noaea mucronata	.+.......	0	0	11				
	W	Notoceras bicorne					0..+...	3	1	29
	R	Oligomeris linifolia					+..+...	0	0	29
	H	Ononis serrata	+++.+++..	**0**	**0**	**67**				
	A	Onopordum alexandrinum	.....+...	0	0	11				
	A	Ornithogalum trichophyllum					+......	0	0	14
	F	Pancratium sickenbergeri	++.+++.++	**0**	**0**	**78**	+......	0	0	14
	W	Papaver humile	........+	0	0	11	...+...	0	0	14
	R	Paronychia arabica					...+...	0	0	14
	F	Picris asplenioides	453333233	**33**	**33**	**100**	+.++.++	**0**	**0**	**71**
	W	Plantago coronopus					2+.0...	8	4	43
	W	Plantago ovata	.+...+...	0	0	22	0+++...	1	1	57
	R	Polycarpon succulentum	+.++.++++	**0**	**0**	**78**				
	S	Pteranthus dichotomus					++.+..+	0	0	57
	W	Reichardia tingitana	....+++..	0	0	33	+.++.++	**0**	**0**	**71**
	W	Reseda decursiva					..++...	0	0	29
	W	Roemeria hybrida	.......+.	0	0	11	+..+...	0	0	29
	H	Rostraria smyrnacea					...+...	0	0	14
	W	Rumex cyprius					+......	0	0	14
	R	Rumex pictus	0:3013421	**19**	**17**	**89**				
*	A	Salvia lanigera	+........	0	0	11				
	F	Schimpera arabica	+.+++++.+	**0**	**0**	**78**	++...+.	0	0	43
	W	Schismus arabicus					+++++0	**1**	**1**	**100**
	W	Scilla hanburyi					+..+...	0	0	29
	W	Scorzonera judaica					+......	0	0	14
	W	Senecio glaucus	.+.1.+..+	3	1	44	+..+...	0	0	29
	H	Silene colorata	.....+++.	0	0	33	.+...+.	0	0	29
	W	Silene vivianii	+........	0	0	11				
	R	Sixalix eremophila	+........	0	0	11				

Table 58. continued.

		DSS07				DSS08			
		123456789	C1	C2	%P	1234567	C1	C2	%P
S	Spergularia diandra	2..7.+.	30	13	43				
W	Stipa capensis	++++1++++	1	1	100	.+.+.+.	0	0	43
* F	Stipagrostis ciliata	......+..	0	0	11				
* F	Stipagrostis obtusa	.+++.++0+	1	1	78				
* F	Stipagrostis plumosa	0+0000000	5	5	100				
W	Trigonella arabica	......+..	0	0	11				
W	Trigonella stellata					+1++++.	2	1	86
W	Trisetaria linearis	.....++.+	0	0	33				
A	Urginea undulata					...+...	0	0	14
R	Vulpia brevis	++++++++.	0	0	89				

6.6.2.2.1.8 DSS08 Anastatico hierochunticae – Anabasietum articulatae Danin, Orshan et Zohary 1964 ex Danin et Solomeshch ass. nov.

Syn.: Anabasidetum articulatae arenarium anastaticetosum Danin, Orshan et Zohary 1964.

Diagnostical species: the markers in table 58. **Distribution:** Patches of this association occur in the area of DSS06 and DSS07, Figs. 116 and 117.

Ecological notes: This association is characterized by Danin et al., (1964) as having *Anastatica hierochuntica* in its composition. This is an interesting plant famous for its special dispersal mechanisms (Evenari et al., 1982; Danin, 1983). This community, indicated by the special assemblage of annuals growing in a diffused pattern and confined to outcrops of sandstone, was poorly recorded by Danin et al., (1964) due to consequent dry years before that publication. The relevés listed above were recorded in a rainy season and are rich in annual species, most of which belong to the group W. The paucity of psammophytes (18%) indicate the non-sandy nature of this habitat.

Association dynamics and conservation: Most of the area of this association is protected as private land.

Aspects of the association: Persistents – 4 spp.; ephemerals – 73 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	01001	10	1	44	10.03.64	I 2125 5498
2	01002	15	1	30	05.04.64	I 2138 5452
3	01003	15	5	26	05.04.64	I 2132 5452
4	01004	7	0	48	10.03.64	I 2125 5498
5	01005	20	5	13	05.04.64	I 2145 5453
6	01006	8	1	20	06.04.64	I 2158 5467
7	01007	10	1	18	05.04.64	I 2132 5452
Average:		12.1	2.0	28.4		

Table 59. Synoptic table of Atractylido proliferae - Noaeion mucronatae and Stipagrostio plumosae – Anabasion articulatae: 1 – DSN01, 2 – DSN02, 3 – DSN03, 4 – DSN04, 5 – DSS01, 6 – DSS02, 7 – DSS03, 8 – DSS04, 9 – DSS05, 10 – DSS06, 11 – DSS07

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P
d.s. Retametea raetam												
R	Ifloga spicata	86	100	100	71	86	92	86	100	75	71	100
R	Cutandia memphitica	100	71	100	71	57	33	86	100	50	43	56
R	Atractylis carduus		57		43	14	17	29	11	75	43	33
R	Lotus halophilus		43	86	71		8	14	89	63	43	100
R	Retama raetam		57	57	100		17	14	67	50	100	

Table 59. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P
R	Rumex pictus	43	57	43	**100**					63	57	**89**
H	Ononis serrata	57	43	**71**	**86**				11	38	14	**67**
R	Neurada procumbens	14	43		**86**				11	38	29	**67**
R	Cyperus macrorrhizus		14		57							
R	Pseudorlaya pumila		43		43							
F	Centropodia forsskalii				14							
R	Polycarpon succulentum		29			57	33	57	**78**		14	**78**
R	Echiochilon fruticosum			14				57		13		**100**
R	Hormuzakia aggregata								22		57	**78**
	d.s. Erodio laciniati -Stipagrostietalia plumosae											
F	Ammochloa palaestina	**71**	**71**	**86**	**86**	57	**75**	57	**67**	25	43	11
R	Erodium laciniatum	**86**	**86**	**71**	**100**	57	**83**	**71**	**89**	25	**86**	**67**
F	Picris asplenioides	**86**	**86**	**86**	43	57	8	**71**	**100**	**100**	**71**	**100**
H	Asphodelus ramosus	43	14	43	14	57	33	43	11	**75**	**100**	**100**
F	Schimpera arabica	14	43	29	14	57	17	29	56	50	**71**	**78**
W	Matthiola livida	57	**71**	57		43	**83**	**100**	**67**	38	57	33
A	Salvia lanigera	57	43	14		57	58	**71**		38	14	11
A	Noaea mucronata	29	**100**	**100**	29	**100**	**92**	**100**		13	14	11
W	Anthemis melampodina	43	**71**	43		43	58	**71**	**67**	**88**	**86**	**67**
R	Paronychia arabica	14	57	**86**	**86**		33	14	33	13	**86**	
H	Bromus fasciculatus	29	57	57	**100**	29	58	**71**	33	13		
F	Argyrolobium uniflorum	14	29	57	29			14		38		11
W	Senecio glaucus	**100**	57	43	**100**	14	8	57	11		71	44
W	Carduus getulus	57	57	29	43		33	29			43	33
F	Stipagrostis plumosa	14	43	14	**100**					**75**	43	**100**
R	Astragalus annularis	43	29	57	43				22	**75**	14	44
R	Helianthemum sessiliflorum	**71**	43	14	**71**					**100**	14	**100**
A	Avena wiestii	29					42	29	11	38		33
W	Plantago ovata	43							22	**75**	**86**	22
F	Erucaria pinnata	14	29						**100**	**88**	**100**	**100**
F	Pancratium sickenbergeri		14							25	**86**	**78**
	d.s. Stipagrosio scopariae-Artemisienalia monospermae											
F	Hippocrepis areolata	**100**	57	**86**	14				22	25		33
F	Plantago cylindrica		**71**	57	43					13		
R	Vulpia brevis		29	**100**	**100**		8			25		**89**
R	Sixalix eremophila		**71**	14	14							11
R	Artemisia monosperma		29	43	**100**							
	d.s. Atractylido proliferae-Noaeion mucronatae											
A	Atractylis prolifera	57	29		**71**							
A	Haloxylon scoparium	**71**	57	29								
	d.s. Stipagrostio plumosae -Anabasienalia articulatae											
	Stipagrostio plumosae-Anabasion articulatae											
N	Anabasis articulata	43	43			**100**	**100**	**100**	22	**100**	**100**	**100**
W	Emex spinosa	**86**				**71**	**83**	**86**	**67**	38	**100**	11
W	Adonis dentata					**86**	58	14	11	38	29	11
W	Erucaria rostrata					**71**	**67**	**71**	22	**75**	29	
W	Gastrocotyle hispida	43	29			43	**75**	43	11	13	29	11
W	Helianthemum ledifolium	29				57	**67**	14	22	**100**	**71**	33
W	Neotorularia torulosa		14			29	25	29	11	13	14	
W	Aegilops kotschyi	14	14	14		43	58	57	22	38	14	
A	Onopordum alexandrinum					57	67	**71**	11	25		11
W	Onobrychis crista-galli			29		**71**	58	**71**	44	50		
W	Carrichtera annua					29	50	43			43	
D	Malva parviflora						25	14	33		43	
F	Stipagrostis obtusa	29								**100**	43	**78**

Table 59. continued.

	1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P
Marker and rare species of associations											
F Allium sindjarense	**71**					25	14				11
A Helianthemum kahiricum	**71**		14								
W Arnebia decumbens	**71**	43	14				14	11			
A Urginea undulata	57				14	25	43			14	
E Gagea dayana	57	14		14						14	
W Asphodelus tenuifolius	43	14									
A Atractylis serratuloides	43		14								
R Linaria tenuis	29										
H Cynodon dactylon	29		14							14	
A Ornithogalum trichophyllum	29				14						
V Pennisetum ciliare	29										
W Reseda decursiva	29	14		14						14	
W Medicago laciniata	29	29	14						13		
A Zosima absinthiifolia	29	29			29			11			
A Bellevalia eigii	14	14			14						
A Helianthemum ventosum	14										
A Tulipa systola	14				14	8					
H Astragalus boeticus	14										
R Eminium spiculatum	14		14				14				
S Pteranthus dichotomus	14								13		
S Salsola vermiculata	14										
S Traganum nudatum	14										
V Astragalus amalecitanus	14						14				
W Pterocephalus brevis	14				14	8					
W Astragalus asterias	14					8					
R Trisetaria linearis		**86**	43	43				11			33
A Ixiolirion tataricum		43	29		14	8					
R Astragalus kahiricus		29			14						
R Nigella arvensis		29	14								
F Dipcadi erythraeum		14									
H Hippocrepis unisiliquosa		14			14						
B Trisetaria macrochaeta		14									
H Allium stamineum		14									
F Vulpia pectinella		29	57	57							
W Koelpinia linearis	14		57		14	25					
W Crepis aspera			43	14							
C Launaea nudicaulis			29								
A Astragalus hispidulus			14								
A Bupleurum semicompositum			14								
A Deverra tortuosa			14				14				
F Convolvulus lanatus		14		57							
R Echinops philistaeus		29	14	43							
R Lycium schweinfurthii				43						14	
A Crucianella membranacea				14					13		11
F Pennisetum divisum				14							
F Iris mariae				14							
H Urginea maritima				14							
E Hedysarum spinosissimum				14							
F Iris petrana					**100**	33	43				11
R Plantago albicans	43	14	14		57	17					
W Cnicus benedictus					43	17	43				
F Stipagrostis ciliata				14	29	17	29				11
A Helianthemum vesicarium					14	8					
A Silene coniflora					14						
H Helianthemum salicifolium					14			11			
H Linaria micrantha					14			11			
H Vulpia ciliata					14						
W Lamarckia aurea					14						
W Anthemis pseudocotula					14	**92**	14				
W Gymnarrhena micrantha	14					**75**	**71**	11		14	
W Picris longirostris						42	29				

Table 59. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P
A	Centaurea aegyptiaca						33	29				
H	Ranunculus asiaticus					14	33		11			
B	Gypsophila arabica						25		11			
V	Asparagus horridus						17	14				
H	Biarum angustatum					14	17	14				
S	Herniaria hemistemon		14				17					
A	Leopoldia longipes						8	14				
A	Valerianella szovitsiana						8	14				
A	Vicia monantha						8					
F	Allium sinaiticum						8					
H	Bupleurum nodiflorum						8					
H	Filago contracta						8					
W	Vicia sativa						8					
W	Hypecoum pendulum						8					
W	Plantago notata						8					
F	Convolvulus spicatus						8	**86**	11	13		
R	Launaea fragilis	29	43			14		57				
W	Malva aegyptia			14			17	43				
A	Astragalus spinosus							29				
A	Peganum harmala							29			14	
W	Euphorbia chamaepeplus					14		29				22
A	Astragalus sanctus							14				
A	Ceratocephala falcata							14				
B	Echinops polyceras							14				
H	Biscutella didyma							14				
S	Reaumuria hirtella							14				
W	Aaronsohnia factorovskyi							14				
W	Lomelosia porphyroneura							14				
W	Crithopsis delileana						8	14				
W	Gagea reticulata						8	14				
F	Haloxylon salicornicum								**100**		43	
W	Scilla hanburyi						8		33			
S	Spergularia diandra								22			
W	Silene vivianii								22			11
W	Herniaria hirsuta						17		22			
D	Sonchus oleraceus								11			
F	Launaea mucronata								11			
H	Paronychia argentea								11			
W	Ononis sicula								11			
N	Calendula tripterocarpa			14		29				63		33
R	Haplophyllum tuberculatum	14					8			50		
W	Papaver humile						8		11	50		11
C	Blepharis ciliaris									50	14	11
W	Consolida incana		14							38		
H	Erodium ciconium		14				8			38		
W	Centaurea pallescens			14					44	**100**	**86**	**89**
W	Stipa capensis	43			29		25		33	**100**	**100**	**100**
H	Bromus tectorum									**88**	29	**78**
R	Calligonum comosum									38	**100**	**100**
A	Moricandia nitens									50	**71**	11
V	Crassula alata								11		43	
V	Ephedra aphylla				29						43	22
W	Enarthrocarpus strangulatus						8	14			29	
R	Biarum olivieri									13	29	11
C	Acacia raddiana										14	
H	Hordeum spontaneum										14	
R	Bassia muricata										14	
S	Atriplex leucoclada										14	
W	Sisymbrium erysimoides										14	
C	Farsetia aegyptia									13	14	
R	Corynephorus divaricatus									13		**78**
F	Maresia pygmaea											56

Table 59. continued.

		1 %P	2 %P	3 %P	4 %P	5 %P	6 %P	7 %P	8 %P	9 %P	10 %P	11 %P
R	Fagonia glutinosa											11
R	Gypsophila viscosa											11
	d.s. Artemisietea sieberi											
A	Artemisia sieberi	**100**	43	14		**100**	**100**	57				
W	Lappula spinocarpos	14	29			14	25	14		25	29	
W	Scorzonera judaica					43	25	29				
A	Carex pachystylis					57	42				14	
W	Roemeria hybrida						17			25	14	11
Other species												
H	Silene colorata	**86**	**100**	**86**	**86**	57	**67**	43	**67**	**100**	57	33
W	Filago desertorum	43	**71**		43	**71**	**75**	**71**	**56**	**75**	57	44
W	Trigonella arabica	**100**	29	43		57	25	29		13		11
W	Linaria haelava	57	43	43	**71**	57	**100**	57	56	**88**	**100**	**100**
D	Hordeum glaucum	14	57	43	14	29	42	71	11	13	**71**	11
R	Helianthemum stipulatum	**86**	29		29			71	22	50		**89**
H	Calendula arvensis	29		43	43	43	**92**	**100**	44		**86**	
W	Astragalus tribuloides	43	14	14		14	50	**71**	**67**	50		22
W	Plantago coronopus	14	43	29		14	58	29	33	38	57	
W	Trigonella stellata	**71**	29			43	**100**	**86**	56	**88**	**71**	
W	Reichardia tingitana		57	14	14	14	42	43	11	13		33
W	Schismus arabicus		43	43		14	25	29	11	13	43	
A	Colchicum ritchii	14	43	57		57	**67**	**86**	11		14	
W	Erodium crassifolium	**71**	14			29	50	43		13		
H	Gynandriris sisyrinchium	29	29			43	58	29	33		29	
H	Hedypnois cretica		43	86		57	42	57	22			
H	Rostraria smyrnacea	43	57	**71**	14	14	17	14	44	25		
R	Brassica tournefortii	43	14	29	**100**					25	**86**	56
H	Trifolium tomentosum	29	29	57	86		17		44		14	
V	Stipa pellita	43	14	14		43	17	14		25	14	
W	Leontodon laciniatus	57	57	57		14		14	11	50	29	11
B	Thymelaea hirsuta	14	14	**86**		**71**	75	**100**			14	
W	Erucaria microcarpa	57	57	14		**71**	92	29	11			
W	Atractylis phaeolepis	14	29			**71**	25	29				
A	Astragalus caprinus	29	14		14	14	25	29				
N	Gymnocarpos decander			14		14	42	**71**		38	14	22
W	Arnebia linearifolia	29				14				13	14	33

6.7 L Ammophiletea arenariae Br.-Bl. et R.Tx. ex Westhoff, Dijk et Passchier 1946

6.7.1. LA Ammophiletalia arenariae Br.-Bl. (1931)1933

Diagnostical species of the class and the order: *Ammophila arenaria, Elymus farctus, Eryngium maritimum, Euphorbia paralis, Medicago maritima, Otanthus maritimus, Pancratium maritimum.*

The class and the order comprise pioneer vegetation on mobile or fixed coastal sand dunes in Atlantic and Mediterranean Europe.

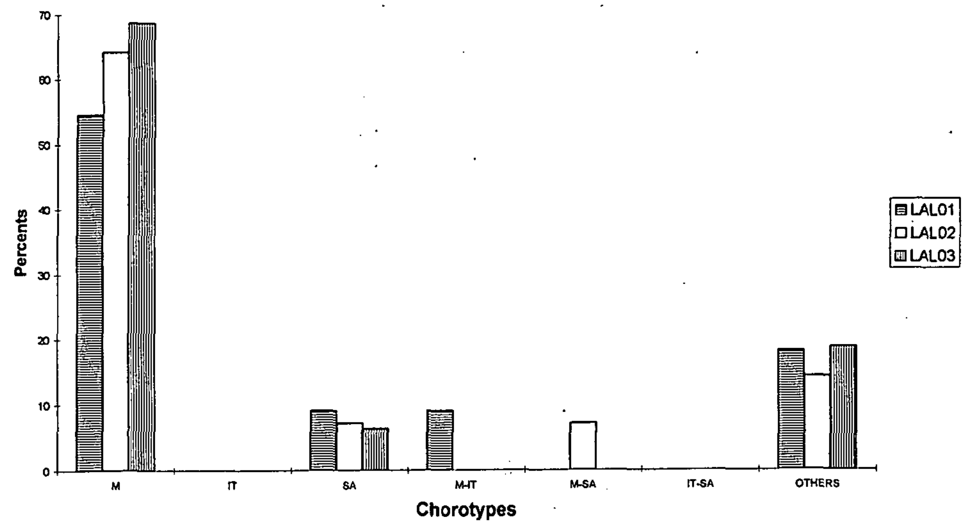

Figure 118. Phytogeographical analysis of associations LAL01-LAL04.

6.7.1.1 LAL Lotion cretici Eig 1939

Diagnostical species: *Senecio joppensis, Lotus creticus, Crithmum maritimum.*

Lectotype – ass. Sporobolo pungentis – Lotetum cretici Eig 1939.

Synoptic table: Table 62.

The alliance Lotion cretici comprises the strand vegetation which develop in many Israeli Mediterranean coasts on sandy soils. However, the most important limiting factor affecting plant life here is the constant spray of sea water. It differs from other alliances of Ammophiletalia, mainly European, by the presence with high constancy and abundance of *Senecio joppensis*. The range of the alliance will probably correspond to the range of *S. joppensis* and will cover Israeli and probably Egyptian Mediterranean strand vegetation. The alliance was described by Eig (1939) and included four associations without indication of holotypes. The lectotypes of these associations are: 1. Sporobolo pungentis-Lotetum cretici Eig 1939 (relevé 9, tab. 1), 2. Helianthemo stipulati-Lotetum cretici Eig 1939 (relevé 1, tab. 2), 3. Salsolo kali-Ipomoetum imperati Eig 1939 (relevé 2, tab. 3), 4) Atractylido cardui – Crucianelletum maritimae Eig 1939 (relevé 3, tab. 7).

The associations of this alliance have a clear prevalence of Mediterranean species (Figs. 118 and 119) although a few hundred meters east of their belt, sandy soils support vegetation with bimodal chorotype spectrum of Mediterranean and Saharo-Arabian species. Plants growing in this habitat have to be salt-spray resistant; mechanisms and morphological adaptations to these constrains are discussed by Boyce (1954). The nature of the vegetation is influenced much by the substratum exposed at the strand zone.

Lotion cretici was originally assigned to Retametea raetam (Eig 1939). Communities of Lotion cretici are connected with Retametea due to similar sandy soils which is reflected in the presence of some common species such as *Retama raetam* and *Artemisia monosperma*. However, taking into account its main limiting factor, being in the spray zone of sea shore, the dominance of Ammophiletea species leads us to place it in the latter. Important species of Retametea that are absent or in very low constancy are: *Centropodia forsskalii, Cutandia memphitica, Cyperus macrorrhizus, Echiochilon fruticosum, Hormuzakia aggregata, Ifloga spicata*, and *Lotus halophilus.*

6.7.1.1.1 LAL01 Lotio cretici – Ammophiletum arenariae Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 60. **Distribution:** Fig. 119.

Ecological notes: The species developing in this habitat are either confined to this habitat (characteristic species of the alliance) or ecotypes of inland species (Waisel, 1960b). *Ammophila arenaria,* which is the dominant plant in this association, is not recorded in other associations of the alliance. It is well known as both psammophyte and plant of the strand in the Old World and as an established alien in the western coast of USA (Breckon & Barbour, 1974; Danin, 1996). The sandy nature of the habitat is expressed by the fact that 72% of the species are psammophytes.

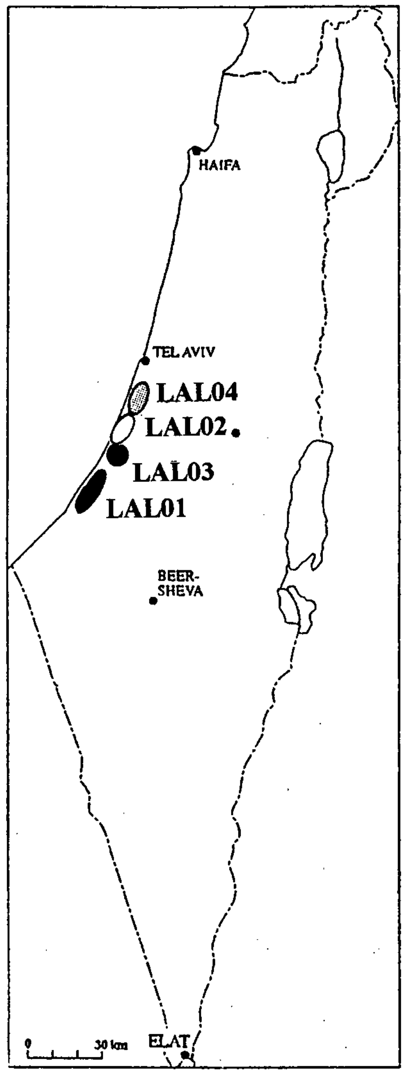

Figure 119. Distribution map of associations LAL01-LAL04.

Association dynamics and conservation: Most of the area of this association is under constant pressure of trampling of people visiting the beach. The presence of high water table in depressions of the coast at hind of the strand is expressed by the presence of the phreatophyte *Alhagi grecorum*. Following removal of sand by wind erosion the quantity of *A. grecorum* in the stands of this association may increase.

Aspects of the association: Persistents – 6 spp.; ephemerals – 5 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96158	1	15	5	02.04.96	I 1530 6135
2	96159	1	15	6	02.04.96	I 1529 6134
3	96160	1	19	5	02.04.96	I 1530 6134
4	96161	5	15	5	02.04.96	I 1529 6133
5	96162	5	20	5	02.04.96	I 1529 6132
6	96163	2	23	6	02.04.96	I 1529 6131
7	96164	1	20	5	02.04.96	I 1528 6131
Average:		2.3	18.1	5.3		

Table 60. Association tables of LAL01 – Lotio cretici – Ammophiletum arenariae and LAL02 – Elymo farcti – Cackiletum maritimi

		Species	LAL01 *1234567	LAL01 C1	LAL01 C2	LAL01 %P	LAL02 *1234567	LAL02 C1	LAL02 C2	LAL02 %P
*	P	Alhagi graecorum	...+0+0	2	1	57				
*	R	Ammophila arenaria	9999999	**96**	**96**	**100**				
*	R	Artemisia monosperma	0....0.	5	1	29				
	Y	Cakile maritima	..+32116	**22**	**19**	**86**	9999999	**94**	**94**	**100**
	Y	Cutandia maritima					++....+	0	0	43
*	R	Echinops philistaeus	.+.....	0	0	14				
*	Y	Elymus farctus					7593..3	**54**	**39**	**71**
*	Y	Eryngium maritimum					......+	0	0	14
*	Y	Euphorbia paralias	.....0.	5	1	14				
*	Y	Ipomoea imperati	.0.....	1	0	14	....0..	1	0	14
*	Y	Lotus creticus	0......	5	1	14				
*	Y	Medicago marina					...+...	0	0	14
*	Y	Otanthus maritimus					3..1...	20	6	29
	Y	Pancratium maritimum	554+1.+	**25**	**21**	**86**	+++1+.+	**2**	**1**	**86**
	R	Pseudorlaya pumila					..1...1	10	3	29
	D	Salsola kali	..+....	0	0	14	.+....+	0	0	29
	R	Senecio joppensis	5538794	**59**	**59**	**100**	1+..+..	3	1	43
*	Y	Silene succulenta					+.03..1	11	6	57
*	P	Zygophyllum album					+......	0	0	14

6.7.1.1.2 LAL02 Elymo farcti – Cackiletum maritimi Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 60. **Distribution:** Fig. 119.

Differentiation: The dominance of *Cakile maritima* and the presence of *Salsola kali* which are diagnostical species of the class Cakiletea maritimae R.Tx. et Preising in R.Tx., 1950 make this association intermediate between the classes Ammophiletea and Cakiletea.

Ecological notes: The dominants here are characteristic species of Lotion cretici which are not restricted to, but prefer, sandy soils. *Elymus farctus* is developed well on various soil or rock types which suffer from deflation associated with wind erosion; however, it is characteristically covered, in the protected sides of the tuft, by a small or a large nebka (Danin, 1996: p. 7).

The occurrence of *Zygophyllum album* here may be regarded as casual. It is an important dominant of the coastal vegetation of areas with salty soil further west and southwest of here at the salt marshes of N Sinai (Danin, 1983).

Association dynamics and conservation: Most of the area of this association is under constant trampling stress at the swimming beach of Kibbutz Palmachim.

Aspects of the association: Persistents – 8 spp.; ephemerals – 6 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96110	10	10	8	31.03.96	I 1722 6492
2	96111	9	1	7	31.03.96	I 1722 6493
3	96112	9	1	6	31.03.96	I 1723 6493
4	96113	1	4	7	31.03.96	I 1723 6494
5	96114	5	2	5	31.03.96	I 1723 6495
6	96115	20	0	1	31.03.96	I 1722 6494
7	96116	8	5	9	31.03.96	I 1722 6495
Average:		8.9	3.3	6.1		

6.7.1.1.3 LAL03 Otanthetum maritimis Danin et Solomeshch ass. nov.

Diagnostical species: the markers in table 61. **Distribution:** Fig. 119.

Differentiation: This association differs from other associations of the alliance by the high constancy of *Otanthus maritimum, Medicago marina,* and *Silene succulenta.*

Ecological notes: As expected the highest percentage of species here belong to the sociotypes of the strand vegetation, plants that resist and well develop in sites with salt spray of the sea. Others, belonging to the Retametea are species that also resist the salt spray. Such is the case with *Senecio joppensis* and *Ammophila arenaria.*

Association dynamics and conservation: Most of the area of this association is under constant trampling pressure.

Aspects of the association: Persistents – 8 spp.; ephemerals – 8 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	96136	40	40	10	31.03.96	I 1644 6323
2	96137	5	35	8	31.03.96	I 1644 6324
3	96138	10	25	9	31.03.96	I 1644 6325
4	96139	2	28	10	31.03.96	I 1645 6325
5	96140	2	30	7	31.03.96	I 1645 6324
6	96141	3	30	11	31.03.96	I 1645 6323
7	96142	1	30	5	31.03.96	I 1644 6322
8	96189	1	39	5	02.04.96	I 1640 6318
9	96190	20	30	6	02.04.96	I 1640 6317
Average:		9.3	31.9	7.9		

Table 61. Association tables of LAL03 – Otanthetum maritimis, LAL04 – Helianthemo stipulati – Lotetum cretici

		Species	LAL03				LAL04			
			*123456789	C1	C2	%P	1234567	C1	C2	%P
*	R	Ammophila arenaria	3..23..86	44	24	56				
	W	Anagallis arvensis					10123.2	**16**	**14**	**86**
*	R	Artemisia monosperma					+++..+.	0	0	57
	H	Brachypodium distachyon					+..+...	0	0	29
	H	Bromus rigidus					+..+.+.	0	0	43
	Y	Cakile maritima	.....+...	0	0	11	..+++1+	**2**	**1**	**71**
*	F	Convolvulus lanatus					..00.++	3	1	57
	R	Crepis aculeata					+.0++..	1	1	57
*	Y	Crucianella maritima					+.+++.+	**0**	**0**	**71**
	Y	Cutandia maritima	1...+....	5	1	22	....++.	0	0	29
*	R	Cyperus capitatus					.....+.	0	0	14
*	H	Echium angustifolium					+++.++.	**0**	**0**	**71**
*	Y	Elymus farctus	+33+.11..	**14**	**9**	**67**	++++001	**3**	**3**	**100**
*	V	Ephedra aphylla					+......	0	0	14
*	R	Helianthemum stipulatum					7878887	**77**	**77**	**100**
	R	Hormuzakia aggregata					++..+..	0	0	43
*	Y	Ipomoea imperati	+.++.....	0	0	33				
	R	Launaea fragilis	.....+...	0	0	11	++.....	0	0	29
*	Y	Lotus creticus					011+000	**6**	**6**	**100**
*	Y	Medicago marina	102103..0	**12**	**9**	**78**	+++....	0	0	43
*	Y	Oenothera drummondii	1.+..+...	3	1	33	..00..+	3	1	43
*	Y	Otanthus maritimus	554665823	**50**	**50**	**100**				
	Y	Pancratium maritimum	++075+313	**22**	**22**	**100**	+0+.+.+	**1**	**1**	**71**
*	V	Phagnalon rupestre					1+.....	5	1	29
	Y	Plantago sarcophylla					8985547	**66**	**66**	**100**
	R	Polycarpon succulentum	.2...3...	25	6	22				
	R	Pseudorlaya pumila					+++2.+.	**4**	**3**	**71**
*	R	Retama raetam					++++.+0	**1**	**1**	**86**
	R	Rumex pictus	.+.+.+.2.	5	2	44	...+...	0	0	14

Table 61. continued.

	Species	LAL03				LAL04			
		123456789	C1	C2	%P	1234567	C1	C2	%P
D	Salsola kali					..+......	0	0	11
R	Senecio joppensis	969357377	62	62	100	+++++++	0	0	100
* Y	Silene succulenta	+10++1..0	4	3	78				
* Y	Sporobolus virginicus	...+..1..	5	1	22	1001111	9	9	100
* B	Thymelaea hirsuta					...+...	0	0	14
H	Urospermum picroides					++..+.+	0	0	57
V	Valantia hispida					.0..+51	16	9	57

6.7.1.1.4 LAL04 Helianthemo stipulati – Lotetum cretici Eig 1939 nom. mut.

Syn.: Helianthemum ellipticum – Lotus creticus association (Eig 1939).

Diagnostical species: the markers in table 61. **Distribution:** Fig. 119.

Lectotype: relevé 1, table 2 (Eig 1939). This association was described by Eig as *Helianthemum ellipticum – Lotus creticus* association.

Differentiation: This association differs from other associations of the alliance by the high constancy of *Lotus creticus, Sporobolus virginicus, Plantago sarcophylla, Helianthemum stipulatum, Anagallis arvensis, Crucianella maritima, Echium angustifolium, Pseudorlaya pumila, Convolvulus lanatus, Valantia hispida,* and *Urospermum picroides.*

Ecological notes: The association was recorded on a slope of a weathered sandstone at the strand near Kibbutz Palmachim. The various microhabitats of this habitat are expressed by the composition of the vegetation. The large number of spray resistant plants indicate the main limiting factor. A few plants of the Retametea indicate the process of sand sedimentation and its trapping by the plants resistant to the strong winds and the spray. The dominant semishrub, *Helianthemum stipulatum* dominates in other places along the Mediterranean coast of Israel on consolidated stable sand (Sect. 6.6.1.2.5) and in small patches of weathered sandstone (which were not recorded and are nearly extinct due to urban development). There are several plants which express the small sandstone outcrops which support plants of rocky habitats such as *Phagnalon rupestre* and *Valantia hispida.*

Association dynamics and conservation: Much of the area of this association is endangered by deterioration caused by off road vehicles the activity of which is restricted by the land owners.

Aspects of the association: Persistents – 15 spp.; ephemerals – 15 spp.

No.	Relevé	%E	%P	Species	Date	Grid
1	97015	5	25	22	07.03.97	I 1722 6494
2	97016	5	20	18	07.03.97	I 1723 6494
3	97017	5	20	18	07.03.97	I 1724 6494
4	97018	5	25	18	07.03.97	I 1724 6495
5	97019	3	20	16	07.03.97	I 1723 6495
6	97020	5	20	16	07.03.97	I 1721 6494
7	97021	3	17	15	07.03.97	I 1721 6496
Average:		4.4	21.0	17.6		

Table 62. Synoptic table of the associations in Lotion cretici: 1 – LAL01, 2 – LAL02, 3 – LAL03, 4 – LAL04

		1 %P	2 %P	3 %P	4 %P
	d.s. Ammophiletea, Ammophiletalia				
Y	Pancratium maritimum	**86**	**86**	**100**	**71**
Y	Elymus farctus		**71**	**67**	**100**
	d.s. Lotion cretici				
R	Senecio joppensis	**100**	43	**100**	**100**
Y	Lotus creticus	14			**100**
Y	Cutandia maritima		43	22	29
	d.s. Cakiletea maritimae				
Y	Cakile maritima	**86**	**100**	11	**71**
D	Salsola kali	14	29	11	
Marker and rare species of associations					
R	Ammophila arenaria	**100**		56	
P	Alhagi graecorum	57			
Y	Euphorbia paralias	14			
P	Zygophyllum album		14		
Y	Eryngium maritimum		14		
Y	Otanthus maritimus		29	**100**	
Y	Medicago marina		14	**78**	43
Y	Silene succulenta		57	**78**	
Y	Ipomoea imperati	14	14	33	
Y	Sporobolus virginicus		**71**	22	**100**
R	Polycarpon succulentum			22	
Y	Plantago sarcophylla				**100**
R	Helianthemum stipulatum				**100**
R	Retama raetam				**86**
W	Anagallis arvensis				**86**
Y	Crucianella maritima				**71**
H	Echium angustifolium				**71**
R	Pseudorlaya pumila		29		**71**
R	Crepis aculeata				57
F	Convolvulus lanatus				57
V	Valantia hispida				57
H	Urospermum picroides				57
R	Artemisia monosperma	29			57
H	Bromus rigidus				43
Y	Oenothera drummondii			33	43
R	Hormuzakia aggregata				43
W	Brachypodium distachyon				29
V	Phagnalon rupestre				29
R	Launaea fragilis			11	29
B	Thymelaea hirsuta				14
R	Echinops philistaeus	14			
R	Rumex pictus			44	14
R	Maresia pulchella				
V	Ephedra aphylla				14
R	Neurada procumbens				
R	Cyperus capitatus				14

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SUBJECT INDEX

SYNTAXA INDEX

9. APPENDICES

9.1 List of species, author names, chorotype, growth form, summer shedding type, habitats, and affinity to human-made habitats

Column 1 – Chorotypes:

A Saharo-Arabian
B Sudanian-African
C Subtropical -Tropical
D Euro-Siberian – Med – Saharo-Arabian
E Euro-Siberian
F S. African
G exotic, planted, escaped from cultivation
H American
I Irano-Turanian
J Sino-Japanese
K Med – Irano-Turanian
L Med – Saharo-Arabian
M Mediterranean
N Tropical – Med – Euro-Siberian
O Irano-Turanian – Saharo-Arabian
P Saharo-Arabian – Sudanian
Q Med – Irano-Turanian – Saharo-Arabian
R Australian
S Sudanian
T Tropical
V Oro Mediterranean
W unclear
X plurireginal bor-trop
Y Med – Euro-Siberian
Z Euro-Siberian – Med – Irano-Turanian

Column 2 – Life form Raunkiaer:

A tree
B biennial
C chamaephyte
G geophyte
H hemicryptophyte
I helophyte
P phanerophyte shrub
T annual
S parasite

Column 3 – Summer shedding:

E ephemeral
P persistent

Column 4 – Affinity of plants to habitats:

A Species of shrub-steppes.
B Species of semi-steppe shrublands.
C Thermophilous plants.
D Species of nutrient-rich soils, ruderal.
E Species of sandy habitats of the Mediterranean coastal area.
F Species of the mobile and stable sand dunes of the Negev Desert.
G Species of tragacanth shrub vegetation (oro-Mediterranean).
H Species of herbaceous plant communities of the Mediterranean region.
L Species confind to banks of rivers and vicinity of springs.
M Species growing on chalk and marl in the Mediterranean region.
N Species of desert on hard limestones
O Hydrophytes floating or anchored fresh-water species.
P Hydrohalophytes, plants of wet and salty habitats.
Q Species of the Mediterranean maquis and forest communities.
R Species of sandy soils of the entire country.
S Xerohalophytes of steppe and desert areas.
T Species of bathas on red Mediterranean soils.
V Species of hard rock outcrops.
W Common desert species.
Y Species of the Mediterranean strand vegetation.

Column 5 – affinity to human-made habitats

A obligate natural
B mostly natural, also synanthropic
C approximately ½ synanthropic ½ natural
D mostly synanthropic, also natural
E obligate synanthropic

Genus	Species	Author	Variables 1	2	3	4	5
Aaronsohnia	*factorovskyi*	Warburg et Eig	A	T	E	W	A
Abutilon	*fruticosum*	Guillemin et Perrottet	S	C	P	C	A
Abutilon	*indicum*	(L.) Sweet	T	C	P	C	A
Acacia	*raddiana*	Savi	S	A	P	C	A
Acantholepis	*orientalis*	Less.	I	T	E	A	A
Acanthus	*syriacus*	Boiss.	M	H	P	H	A
Achillea	*aleppica*	DC.	I	C	P	B	B
Achillea	*fragrantissima*	(Forssk.) Schultz Bip.	O	H	P	A	A
Achillea	*santolina*	L.	I	H	E	A	D
Adonis	*aestivalis*	L.	Z	T	E	H	A
Adonis	*dentata*	*Delile*	O	T	E	W	A
Adonis	*microcarpa*	DC.	M	T	E	H	A
Aegilops	*geniculata*	Roth	M	T	E	T	A
Aegilops	*kotschyi*	Boiss.	O	T	E	W	A
Aegilops	*longissima*	Schweinf. et Muschler	M	T	E	R	A
Aegilops	*peregrina*	(Hackel) Maire et Weiller	M	T	E	H	A
Aegilops	*searsii*	Hammer	I	T	E	T	A
Aegilops	*sharonensis*	Eig	M	T	E	E	A
Aetheorhiza	*bulbosa*	(L.) Cass.	M	H	E	Q	A
Aethionema	*heterocarpum*	Trev.	I	T	E	T	A
Agathophora	*alopecuroides*	(Delile) Bunge	A	C	P	S	A
Ainsworthia	*trachycarpa*	Boiss.	M	T	E	H	B
Aizoon	*canariense*	L.	S	T	E	C	A
Aizoon	*hispanicum*	L.	A	T	E	W	A
Ajuga	*chamaepitys*	(L.) Schreber	K	H	P	Q	A
Ajuga	*iva*	(L.) Schreber	M	C	P	B	A
Alcea	*acaulis*	(Cav.) Alef.	M	C	P	H	A
Alcea	*galilaea*	Zohary	M	H	P	B	A
Alcea	*rufescens*	(Boiss.) Boiss.	A	H	P	V	A
Alcea	*setosa*	(Boiss.) Alef.	M	H	P	H	A
Alhagi	*graecorum*	Boiss.	K	H	P	P	D
Alkanna	*strigosa*	Boiss. et Hohen.	M	C	P	B	A
Alkanna	*tinctoria*	Tausch	M	C	P	E	A
Allium	*ampeloprasum*	L.	K	G	E	W	B
Allium	*artemisietorum*	Eig et Feinbrun	I	G	E	A	A
Allium	*daninianum*	Brullo, Pavone & Salmeri	N	G	E	H	A
Allium	*erdelii*	Zucc.	K	G	E	B	A
Allium	*hierochuntinum*	Boiss.	O	G	E	W	A
Allium	*neapolitanum*	Cyr.	M	G	E	Q	B
Allium	*negevense*	Kollmann	I	G	E	A	A
Allium	*nigrum*	L.	M	G	E	H	A
Allium	*orientale*	Boiss.	M	G	E	B	A
Allium	*pallens*	L.	M	G	E	H	A
Allium	*rothii*	Zucc.	I	G	E	A	A
Allium	*sinaiticum*	Boiss.	A	G	E	F	A
Allium	*sindjarense*	Regel	O	G	E	E	A
Alopecurus	*utriculatus*	Banks et Solander	M	T	E	H	B
Althaea	*hirsuta*	L.	Z	T	E	H	A
Alyssum	*damascenum*	Boiss. et Gaill.	I	T	E	A	A
Alyssum	*linifolium*	Willd.	I	T	E	A	A
Alyssum	*marginatum*	Boiss.	I	T	E	A	A
Alyssum	*simplex*	Rudolphi	K	T	E	H	A
Alyssum	*strigosum*	Banks et Solander	K	T	E	H	B
Amberboa	*crupinoides*	(Desf.) DC.	A	T	E	N	A
Ammi	*majus*	L.	M	T	E	D	D
Ammochloa	*palaestina*	Boiss.	Q	T	E	F	A
Ammophila	*arenaria*	(L.) Link	M	H	P	R	A
Amygdalus	*korschinskii*	(Hand.-Mazzetti) Bornm.	I	A	P	Q	A
Amygdalus	*ramonensis*	Danin	I	A	P	V	A
Anabasis	*articulata*	(Forssk.) Moq.	A	C	P	N	A
Anabasis	*setifera*	Moq.	A	C	P	N	B
Anabasis	*syriaca*	Iljin	I	C	P	A	B
Anagallis	*arvensis*	L.	Z	T	E	W	B

Genus	Species	Author	Variables 1	2	3	4	5
Anagyris	*foetida*	L.	K	P	P	Q	A
Anastatica	*hierochuntica*	L.	A	T	E	N	A
Anchusa	*aegyptiaca*	(L.) DC.	A	T	E	W	A
Anchusa	*azurea*	Mill.	Z	H	P	H	A
Anchusa	*milleri*	Sprengel	O	T	E	N	A
Anchusa	*strigosa*	Banks et Solander	K	H	P	B	B
Anchusa	*undulata*	L.	M	H	E	H	A
Andrachne	*aspera*	Sprengel	S	C	P	C	A
Andrachne	*telephioides*	L.	K	H	P	A	B
Androcymbium	*palaestinum*	Baker	A	G	E	H	A
Andropogon	*distachyos*	L.	X	H	P	T	B
Anemone	*coronaria*	L.	M	G	E	W	A
Ankyropetalum	*gypsophiloides*	Fenzl	I	C	P	V	A
Anthemis	*hebronica*	Boiss. et Kotschy	I	T	E	H	A
Anthemis	*hyalina*	DC.	I	T	E	B	A
Anthemis	*leucanthemifolia*	Boiss. et Blanche	M	T	E	E	A
Anthemis	*maris-mortui*	Eig	A	T	E	N	A
Anthemis	*melampodina*	Delile	A	T	E	W	A
Anthemis	*palestina*	Boiss.	M	T	E	H	B
Anthemis	*pseudocotula*	Boiss.	Q	T	E	H	B
Antirrhinum	*orontium*	L.	M	T	E	H	B
Anvillea	*garcinii*	(Burm. fil.) DC.	A	C	P	C	A
Arabis	*verna*	(L.) R. Br.	M	T	E	T	A
Arenaria	*leptoclados*	(Reichenb.) Guss.	Z	T	E	V	A
Argyrolobium	*uniflorum*	(Decaisne) Jaub. et Spach	A	C	P	F	A
Aristida	*coerulescens*	Desf.	Q	H	E	W	A
Arnebia	*decumbens*	(Vent.) Cosson et Kralik	O	T	E	W	A
Arnebia	*linearifolia*	DC.	O	T	E	W	A
Arnebia	*tinctoria*	Forssk.	A	T	E	F	A
Arrhenatherum	*palaestinum*	Boiss.	M	G	E	T	A
Artedia	*squamata*	L.	M	T	E	H	A
Artemisia	*arborescens*	L.	M	C	P	Q	B
Artemisia	*monosperma*	Delile	A	C	P	R	A
Artemisia	*sieberi*	Besser	I	C	P	A	A
Arum	*dioscoridis*	Sm.	M	G	E	Q	A
Arum	*palaestinum*	Boiss.	M	G	E	Q	A
Asparagus	*aphyllus*	L.	M	G	P	Q	A
Asparagus	*horridus*	L.	L	G	P	V	A
Asperula	*arvensis*	L.	K	T	E	H	B
Asphodeline	*lutea*	(L.) Reichenb.	M	H	E	T	A
Asphodelus	*fistulosus*	L.	M	T	E	H	B
Asphodelus	*ramosus*	L.	M	H	E	H	B
Asphodelus	*tenuifolius*	Cav.	P	T	E	W	A
Asphodelus	*viscidulus*	Boiss.	A	T	E	F	A
Asplenium	*ceterach*	L.	Z	H	P	V	A
Asteriscus	*aquaticus*	(L.) Less.	M	T	E	H	B
Asteriscus	*graveolens*	(Forssk.) Less.	A	C	P	C	A
Asteriscus	*hierochunticus*	(Michon) Wikl.	A	T	E	N	A
Asterolinon	*linum-stellatum*	(L.) Duby	K	T	E	V	A
Astoma	*seselifolium*	DC.	K	G	E	B	D
Astragalus	*aaronii*	(Eig) Zohary	K	T	E	B	A
Astragalus	*aleppicus*	Boiss.	I	H	E	A	B
Astragalus	*amalecitanus*	Boiss.	I	C	P	V	A
Astragalus	*annularis*	Forssk.	A	T	E	R	A
Astragalus	*asterias*	Steven	L	T	E	W	A
Astragalus	*berytheus*	Boiss. et Blanche	M	T	E	R	A
Astragalus	*bethlehemiticus*	Boiss.	I	C	P	B	A
Astragalus	*boeticus*	L.	M	T	E	H	B
Astragalus	*bombycinus*	Boiss.	A	T	E	A	A
Astragalus	*callichrous*	Boiss.	A	T	E	A	B
Astragalus	*caprinus*	L.	A	H	E	A	B
Astragalus	*corrugatus*	Bertol.	O	T	E	A	A
Astragalus	*cretaceus*	Boiss. et Kotschy	I	H	P	B	A
Astragalus	*deinacanthus*	Boiss.	I	C	P	M	A

Genus	Species	Author	Variables 1	2	3	4	5
Astragalus	*epiglottis*	L.	M	T	E	B	A
Astragalus	*fruticosus*	Forssk.	A	H	E	R	A
Astragalus	*hamosus*	L.	M	T	E	H	B
Astragalus	*hauarensis*	Boiss.	A	T	E	C	A
Astragalus	*hispidulus*	DC.	A	T	E	A	B
Astragalus	*intercedens*	Rech. fil.	A	T	E	A	A
Astragalus	*kahiricus*	DC.	A	H	E	R	A
Astragalus	*palaestinus*	Eig	K	H	E	A	A
Astragalus	*peregrinus*	Vahl	A	T	E	R	A
Astragalus	*sanctus*	Boiss.	I	C	P	A	A
Astragalus	*spinosus*	(Forssk.) Muschler	I	C	P	A	A
Astragalus	*tribuloides*	Delile	O	T	E	W	A
Astragalus	*trimestris*	L.	A	T	E	R	A
Atractylis	*cancellata*	L.	M	T	E	W	A
Atractylis	*carduus*	(Forssk.) C. Chr.	A	C	P	R	A
Atractylis	*phaeolepis*	Pomel	A	C	P	W	A
Atractylis	*prolifera*	Boiss.	A	T	E	A	A
Atractylis	*serratuloides*	Cass.	A	C	P	A	A
Atriplex	*dimorphostegia*	Kar. et Kir.	O	T	E	C	A
Atriplex	*glauca*	L.	O	C	P	S	A
Atriplex	*halimus*	L.	L	P	P	S	B
Atriplex	*leucoclada*	Boiss.	O	C	P	S	C
Avena	*barbata*	Link	M	T	E	H	B
Avena	*sterilis*	L.	K	T	E	H	B
Avena	*wiestii*	Steudel	O	T	E	A	B
Ballota	*philistaea*	Bornm.	M	C	P	Q	A
Ballota	*undulata*	(Fresen.) Bentham	M	C	P	B	A
Bassia	*arabica*	(Boiss.) Maire et Weiler	A	C	P	S	A
Bassia	*muricata*	(L.) Ascherson	O	T	E	R	A
Bellevalia	*desertorum*	Eig et Feinbrun	O	G	E	A	A
Bellevalia	*eigii*	Feinbrun	A	G	E	A	B
Bellevalia	*flexuosa*	Boiss.	M	G	E	H	B
Bellevalia	*longipes*	Post	I	G	E	H	B
Bellevalia	*stepporum*	Feinbrun	I	G	E	A	A
Bellevalia	*warburgii*	Feinbrun	M	G	E	H	B
Beta	*vulgaris*	L.	Z	T	E	H	C
Biarum	*angustatum*	(Hooker fil.) N.E. Brown	M	G	E	H	A
Biarum	*olivieri*	Blume	A	G	E	R	A
Bilacunaria	*boissieri*	(Reuter et Huasskn.) Pimenov et Tichomirov	K	H	E	E	A
Biscutella	*didyma*	L.	K	T	E	H	B
Blepharis	*attenuata*	Napper	O	C	P	B	A
Blepharis	*ciliaris*	(L.) B.L. Burtt	P	C	P	C	A
Boissiera	*squarrosa*	(Banks et Solander) Nevski	I	T	E	A	A
Bongardia	*chrysogonum*	(L.) Griseb.	K	G	E	D	D
Brachypodium	*distachyon*	(L.) Beauvois	K	T	E	W	C
Brassica	*tournefortii*	Gouan	L	T	E	R	B
Briza	*maxima*	L.	M	T	E	H	A
Briza	*minor*	L.	Z	T	E	L	A
Bromus	*alopecuros*	Poiret	M	T	E	H	A
Bromus	*danthoniae*	Trin.	I	T	E	A	A
Bromus	*fasciculatus*	C. Presl	M	T	E	H	A
Bromus	*japonicus*	Murrey	Z	T	E	H	A
Bromus	*lanceolatus*	Roth	K	T	E	H	A
Bromus	*madritensis*	L.	K	T	E	H	A
Bromus	*rigidus*	Roth	M	T	E	H	A
Bromus	*rubens*	L.	K	T	E	H	A
Bromus	*scoparius*	L.	K	T	E	H	A
Bromus	*tectorum*	L.	Q	T	E	H	B
Bryonia	*syriaca*	Boiss.	M	H	E	Q	A
Buglossoides	*arvensis*	(L.) I.M. Johnston	Z	T	E	A	A
Buglossoides	*tenuiflora*	(L. fil.) I.M. Johnston	K	T	E	A	A
Bunium	*paucifolium*	DC.	K	G	E	H	A
Bupleurum	*lancifolium*	Hornem.	K	T	E	H	B
Bupleurum	*nodiflorum*	Sm.	M	T	E	H	A

Genus	Species	Author	Variables 1	2	3	4	5
Bupleurum	*semicompositum*	L.	Q	T	E	A	A
Cakile	*maritima*	Scop.	Y	T	E	Y	A
Calendula	*arvensis*	L.	K	T	E	H	B
Calendula	*pachysperma*	Zohary	M	T	E	B	A
Calendula	*palaestina*	Boiss.	M	T	E	B	A
Calendula	*tripterocarpa*	Rupr.	A	T	E	N	A
Calicotome	*villosa*	(Poiret) Link	M	P	P	Q	B
Calligonum	*comosum*	L'Her.	O	P	P	R	A
Callipeltis	*cucullaria*	(L.) Steven	O	T	E	H	A
Campanula	*erinus*	L.	K	T	E	V	A
Campanula	*hierosolymitana*	Boiss.	M	T	E	V	A
Campanula	*stellaris*	Boiss.	M	T	E	H	A
Campanula	*strigosa*	Banks et Solander	K	T	E	H	A
Campanula	*sulphurea*	Boiss.	M	T	E	E	A
Capparis	*aegyptia*	Lam.	O	C	P	V	A
Capparis	*spinosa*	L.	M	C	P	V	C
Caralluma	*europaea*	(Guss.) N.E. Brown	M	H	P	V	A
Caralluma	*sinaica*	(Decaisne) A. Berger	A	H	P	V	A
Cardaria	*draba*	(L.) Desv.	K	T	E	H	D
Carduus	*acicularis*	Bertol.	M	T	E	H	C
Carduus	*getulus*	Pomel	A	T	E	W	B
Carex	*pachystylis*	J. Gay	I	G	E	A	A
Carlina	*curetum*	Halacsy	M	H	E	T	A
Carlina	*libanotica*	Boiss.	M	H	E	B	A
Carrichtera	*annua*	(L.) DC.	A	T	E	W	A
Carthamus	*glaucus*	MB.	M	T	E	H	C
Carthamus	*nitidus*	Boiss.	A	T	E	W	A
Carthamus	*persicus*	Willd.	I	T	E	R	A
Carthamus	*tenuis*	(Boiss. et Blanche) Bornm.	M	T	E	H	C
Catananche	*lutea*	L.	M	T	E	H	A
Catapodium	*rigidum*	(L.) C.E. Hubbard	M	T	E	H	B
Centaurea	*aegyptiaca*	L.	A	C	P	A	A
Centaurea	*ammocyanus*	Boiss.	A	T	E	A	A
Centaurea	*ascalonica*	Bornm.	M	H	E	H	A
Centaurea	*damascena*	Boiss.	I	C	P	V	A
Centaurea	*eryngioides*	Lam.	I	H	E	V	A
Centaurea	*hyalolepis*	Boiss.	K	T	E	H	C
Centaurea	*iberica*	Sprengel	K	T	E	H	B
Centaurea	*lanulata*	Eig	A	H	E	C	A
Centaurea	*pallescens*	Delile	A	T	E	W	B
Centaurea	*procurrens*	Sprengel	M	C	P	E	B
Centaurium	*tenuiflorum*	(Hoffmanns. et Link) Fritsch	K	T	E	L	A
Centropodia	*forsskalii*	(Vahl) Cope	O	H	E	F	A
Cephalaria	*syriaca*	(L.) Schrader	K	T	E	D	E
Ceratocephala	*falcata*	(L.) Pers.	K	T	E	A	A
Chaetosciadium	*trichospermum*	(L.) Boiss.	M	T	E	H	B
Chardinia	*orientalis*	(L.) O. Kuntze	I	T	E	B	A
Cheilanthes	*acrostica*	(Balbis) Tod.	M	H	P	V	A
Chenopodium	*murale*	L.	X	T	E	D	E
Chiliadenus	*iphionoides*	(Boiss. et Blanche) Brullo	M	H	P	V	A
Chrysanthemum	*coronarium*	L.	M	T	E	D	C
Chrysanthemum	*viscosum*	Desf.	M	T	E	R	B
Cicer	*judaicum*	Boiss.	M	T	E	T	A
Cichorium	*endivia*	L.	K	T	E	H	C
Cistanche	*salsa*	(C.A. Meyer) G. Beck	I	S	E	N	A
Clypeola	*aspera*	(Grauer) Turrill	I	T	E	T	A
Clypeola	*jonthlaspi*	L.	K	T	E	H	A
Cnicus	*benedictus*	L.	K	T	E	W	A
Colchicum	*ritchii*	R. Br.	A	G	E	A	A
Colchicum	*tunicatum*	Feinbrun	I	G	E	A	A
Colutea	*istria*	Miller	I	P	P	V	A
Consolida	*flava*	(DC.) Schroedinger	A	T	E	R	A
Consolida	*incana*	(E.D. Clarke) Munz	M	T	E	W	A
Convolvulus	*althaeoides*	L.	M	G	E	H	C

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Convolvulus	*arvensis*	L.	X	G	E	D	E
Convolvulus	*dorycnium*	L.	M	H	E	B	A
Convolvulus	*lanatus*	Vahl	A	C	P	F	A
Convolvulus	*oleifolius*	Desr.	M	C	P	V	A
Convolvulus	*palaestinus*	Boiss.	M	G	E	D	D
Convolvulus	*pentapetaloides*	L.	M	T	E	H	A
Convolvulus	*secundus*	Desr.	M	C	P	R	A
Convolvulus	*spicatus*	Haller fil.	A	C	P	F	A
Convolvulus	*stachydifolius*	Choisy	K	G	E	D	D
Coridothymus	*capitatus*	(L.) Reichenb. fil.	M	C	P	M	A
Cornulaca	*monacantha*	Delile	A	C	P	F	A
Coronilla	*scorpioides*	(L.) Koch	M	T	E	H	A
Corynephorus	*divaricatus*	Pourret) Breistr.	M	T	E	R	A
Cosentinia	*vellea*	(Aiton) Tod.	M	H	P	V	A
Crassula	*alata*	(Viv.) A. Berger	M	T	E	V	A
Crataegus	*aronia*	(L.) DC.	K	A	P	Q	B
Crepis	*aculeata*	(DC.) Boiss.	M	T	E	R	A
Crepis	*aspera*	L.	M	T	E	W	B
Crepis	*sancta*	(L.) Bornm.	L	T	E	H	B
Crithopsis	*delileana*	(Schultes et Schultes fil.) Roshev.	K	T	E	W	A
Crocus	*moabiticus*	Bornm. et Dinsmore	I	G	E	A	A
Crucianella	*herbacea*	Forssk.	M	T	E	R	A
Crucianella	*macrostachya*	Boiss.	M	T	E	H	A
Crucianella	*maritima*	L.	M	C	P	Y	A
Crucianella	*membranacea*	Boiss.	A	T	E	A	A
Cruciata	*articulata*	(L.) Ehrend.	M	T	E	Q	B
Crupina	*crupinastrum*	(Moris) Vis.	K	T	E	H	A
Cuscuta	*brevistyla*	A. Braun	K	S	E	D	A
Cuscuta	*planiflora*	Ten.	L	S	E	H	A
Cutandia	*maritima*	(L.) W. Barbey	M	T	E	Y	A
Cutandia	*memphitica*	(Sprengel) K. Richter	O	T	E	R	A
Cyclamen	*persicum*	Miller	M	G	E	V	A
Cymbolaena	*griffithii*	(A. Gray) Wagenitz	I	T	E	A	A
Cynodon	*dactylon*	(L.) Pers.	X	G	P	H	C
Cynoglossum	*creticum*	Miller	K	H	E	Q	B
Cynoglossum	*montanum*	L.	M	T	E	H	A
Cyperus	*capitatus*	Vandelli	M	H	P	R	A
Cyperus	*macrorrhizus*	Nees	A	H	P	R	A
Dactylis	*glomerata*	L.	Z	H	E	H	A
Daucus	*broteri*	Ten.	M	T	E	H	B
Daucus	*carota*	L.	M	T	E	H	B
Daucus	*durieua*	Lange	K	T	E	H	A
Daucus	*glaber*	(Forssk.) Thell.	M	T	E	E	A
Delphinium	*ithaburense*	Boiss.	M	G	E	V	A
Delphinium	*peregrinum*	L.	K	T	E	H	A
Desmazeria	*philistaea*	(Boiss.) H. Scholz	M	T	E	E	A
Deverra	*tortuosa*	(Desf.) Vent.	A	C	P	B	A
Dianthus	*monadelphus*	Vent.	I	C	P	A	A
Dianthus	*sinaicus*	Boiss.	I	C	P	V	A
Dianthus	*strictus*	Banks et Solander	M	H	P	H	B
Dipcadi	*erythraeum*	Webb et Berth.	A	G	E	F	A
Diplotaxis	*acris*	(Forssk.) Boiss.	A	T	E	N	A
Diplotaxis	*erucoides*	(L.) DC.	M	T	E	H	C
Diplotaxis	*harra*	(Forssk.) Boiss.	A	H	E	W	A
Dittrichia	*viscosa*	(L.) Greuter	M	C	P	L	C
Echinaria	*capitata*	(L.) Desf.	M	T	E	H	A
Echinops	*adenocaulos*	Boiss.	M	H	P	H	B
Echinops	*philistaeus*	Feinbrun et Zohary	M	C	P	R	A
Echinops	*polyceras*	Boiss.	I	H	P	B	B
Echiochilon	*fruticosum*	Desf.	A	C	P	R	A
Echium	*angustifolium*	Miller	M	C	P	H	B
Echium	*judaeum*	Lacaita	M	T	E	W	A
Elymus	*farctus*	(Viv.) Melderis	M	H	P	Y	A
Emex	*spinosa*	(L.) Campd.	M	T	E	W	B

Genus	Species	Author	Variables 1	2	3	4	5
Eminium	*spiculatum*	(Blume) Schott	M	G	E	R	A
Enarthrocarpus	*strangulatus*	Boiss.	A	T	E	W	B
Enneapogon	*persicus*	Boiss.	I	H	P	V	A
Ephedra	*alata*	*Decaisne*	A	C	P	F	A
Ephedra	*aphylla*	Forssk.	A	P	P	V	B
Ephedra	*foeminea*	Forssk.	M	P	P	Q	B
Eremobium	*aegyptiacum*	(Sprengel) Boiss.	A	H	P	F	A
Eremopyrum	*bonaepartis*	(Sprengel) Nevski	I	T	E	A	A
Eremopyrum	*distans*	(C. Koch) Nevski	I	T	E	A	A
Eremostachys	*laciniata*	(L.) Bunge	K	H	E	B	A
Erodium	*arborescens*	(Desf.) Willd.	A	H	E	A	A
Erodium	*botrys*	(Cav.) Bertol.	M	T	E	H	A
Erodium	*ciconium*	(L.) L'Her.	K	T	E	W	B
Erodium	*cicutarium*	(L.) L'Her.	Z	T	E	H	A
Erodium	*crassifolium*	L'Her.	A	H	E	W	A
Erodium	*glaucophyllum*	(L.) L'Her.	A	H	E	S	A
Erodium	*gruinum*	(L.) L'Her.	M	T	E	H	B
Erodium	*laciniatum*	(Cav.) Willd.	M	T	E	R	A
Erodium	*malacoides*	(L.) L'Her.	K	T	E	H	B
Erodium	*moschatum*	(L.) L'Her.	K	T	E	W	B
Erodium	*neuradifolium*	Delile	A	T	E	W	A
Erodium	*oxyrhynchum*	MB.	P	T	E	S	A
Erodium	*telavivense*	Eig	M	T	E	E	A
Erodium	*touchyanum*	Delile	A	T	E	W	A
Erophila	*minima*	C.A. Meyer	K	T	E	V	B
Erophila	*praecox*	(Steven) DC.	Z	T	E	V	B
Eruca	*sativa*	Miller	K	T	E	B	C
Erucaria	*hispanica*	(L.) Druce	M	T	E	H	B
Erucaria	*microcarpa*	Boiss.	A	T	E	W	B
Erucaria	*pinnata*	(Viv.) Taeckh. et Boulus	A	T	E	F	A
Erucaria	*rostrata*	(Boiss.) Greuter	A	T	E	W	B
Eryngium	*creticum*	Lam.	M	H	E	H	A
Eryngium	*glomeratum*	Lam.	M	H	P	B	A
Eryngium	*maritimum*	L.	M	H	P	Y	A
Erysimum	*crassipes*	Fischer et C.A. Meyer	I	H	P	B	A
Euphorbia	*chamaepeplus*	Boiss. et Gaill.	O	T	E	W	B
Euphorbia	*chamaesyce*	L.	K	T	E	D	E
Euphorbia	*exigua*	L.	Y	T	E	H	A
Euphorbia	*grossheimii*	Prokh.	A	T	E	A	A
Euphorbia	*hierosolymitana*	Boiss.	M	C	P	B	A
Euphorbia	*paralias*	L.	M	C	P	Y	A
Euphorbia	*peplus*	L.	Z	T	E	D	D
Euphorbia	*ramonensis*	Baum	I	C	P	V	A
Euphorbia	*retusa*	Forssk.	A	T	E	R	A
Euphorbia	*terracina*	L.	M	H	P	E	A
Factorovskya	*aschersoniana*	(Urban) Eig	M	T	E	B	A
Fagonia	*glutinosa*	Delile	A	C	P	R	A
Fagonia	*mollis*	Delile	A	C	P	A	A
Fagonia	*scabra*	Forssk.	A	C	P	N	A
Fagonia	*tenuifolia*	Hochst.	A	C	P	N	A
Farsetia	*aegyptia*	Turra	S	C	P	C	A
Ferula	*biverticillata*	Thieb.	M	H	E	A	A
Ferula	*communis*	L.	M	H	E	H	A
Ferula	*daninii*	Zohary	I	H	E	A	A
Ferula	*sinaica*	Boiss.	I	H	E	R	A
Fibigia	*clypeata*	(L.) Medicus	K	H	P	V	A
Filago	*contracta*	(Boiss.) Chrtek et Holub	I	T	E	H	A
Filago	*desertorum*	Pomel	O	T	E	W	A
Filago	*eriocephala*	Guss.	M	T	E	Q	A
Filago	*palaestina*	(Boiss.) Chrtek et Holub	I	T	E	H	A
Filago	*pyramidata*	L.	M	T	E	H	B
Forsskaolea	*tenacissima*	L.	P	C	P	C	A
Fumana	*thymifolia*	(L.) Webb	M	C	P	M	A
Fumaria	*bracteosa*	Pomel	M	T	E	H	B

Genus	Species	Author	Variables 1	2	3	4	5
Gagea	*chlorantha*	(MB.) Schultes et Schultes fil.	I	G	E	H	A
Gagea	*dayana*	Chodat et Beauverd	K	G	E	E	A
Gagea	*reticulata*	(Pallas) Schultes et Schultes fil.	I	G	E	W	A
Galium	*aparine*	L.	Z	T	E	Q	B
Galium	*hierochuntinum*	Bornm.	A	T	E	L	A
Galium	*judaicum*	Boiss.	M	T	E	H	A
Galium	*murale*	(L.) All.	M	T	E	H	B
Galium	*setaceum*	Lam.	I	T	E	H	A
Galium	*tricornutum*	Dandy	K	T	E	D	D
Gastridium	*ventricosum*	(Gouan) Schinz et Thell.	M	T	E	H	A
Gastrocotyle	*hispida*	(Forssk.) Bunge	O	G	E	W	A
Geranium	*dissectum*	L.	Y	T	E	L	A
Geranium	*lucidum*	L.	Y	T	E	Q	A
Geranium	*molle*	L.	Y	T	E	H	A
Geranium	*robertianum*	L.	M	T	E	H	A
Geranium	*rotundifolium*	L.	Z	T	E	H	A
Geranium	*tuberosum*	L.	Z	G	E	H	B
Geropogon	*hybridus*	(L.) Schultz Bip.	K	T	E	H	A
Gladiolus	*atroviolaceus*	Boiss.	I	G	E	H	B
Gladiolus	*italicus*	Miller	K	G	E	D	B
Glaucium	*corniculatum*	(L.) J.H. Rudolph	K	T	E	A	C
Glaucium	*grandiflorum*	Boiss. et Huet	I	H	P	A	C
Glinus	*lotoides*	L.	K	T	E	L	A
Globularia	*arabica*	Jaub. et Spach	A	C	P	V	A
Grewia	*villosa*	Willd.	T	P	P	C	A
Gundelia	*tournefortii*	L.	I	H	E	H	A
Gymnarrhena	*micrantha*	Desf.	A	T	E	W	A
Gymnocarpos	*decander*	Forssk.	A	C	P	N	A
Gynandriris	*sisyrinchium*	(L.) Parl.	K	G	E	H	B
Gypsophila	*arabica*	Barkoudah	I	C	P	B	A
Gypsophila	*pilosa*	Hudson	I	T	E	A	A
Gypsophila	*viscosa*	Murray	I	T	E	R	A
Halothamnus	*acutifolius*	(Moq.) Botsch.	I	C	P	S	A
Haloxylon	*negevensis*	(Iljin et Zohary) Danin	A	C	P	S	A
Haloxylon	*persicum*	Bunge	I	P	P	F	A
Haloxylon	*salicornicum*	(Moq.) Boiss.	S	C	P	F	A
Haloxylon	*scoparium*	Pomel	O	C	P	A	A
Haplophyllum	*buxbaumii*	(Poiret) G. Don Fil.	K	C	P	H	A
Haplophyllum	*poorei*	C.C. Townsend	I	C	P	V	A
Haplophyllum	*tuberculatum*	(Forssk.) Ad. Juss.	A	C	P	R	A
Hedypnois	*cretica*	(L.) Dum.-Courset	M	T	E	H	B
Hedysarum	*spinosissimum*	L.	M	T	E	E	A
Helianthemum	*aegyptiacum*	(L.) Miller	K	T	E	H	A
Helianthemum	*kahiricum*	Delile	A	C	P	A	A
Helianthemum	*lasiocarpum*	Jacques et Herincq	Z	T	E	H	A
Helianthemum	*ledifolium*	(L.) Miller	M	T	E	W	A
Helianthemum	*salicifolium*	(L.) Miller	Z	T	E	H	B
Helianthemum	*sessiliflorum*	(Desf.) Pers.	A	C	P	R	A
Helianthemum	*stipulatum*	(Forssk.) C. Chr.	A	C	P	R	A
Helianthemum	*ventosum*	Boiss.	A	C	P	A	A
Helianthemum	*vesicarium*	Boiss.	I	C	P	A	A
Heliotropium	*arbainense*	Fresen.	A	C	P	C	B
Heliotropium	*digynum*	(Forssk.) C. Chr.	A	C	P	F	A
Heliotropium	*europaeum*	L.	K	T	E	D	D
Heliotropium	*maris-mortui*	Zohary	A	C	P	C	B
Heliotropium	*rotundifolium*	Lehm.	I	C	P	B	B
Heptaptera	*anisoptera*	(DC.) Tutin	M	H	E	T	A
Herniaria	*hemistemon*	Gay	A	H	P	S	A
Herniaria	*hirsuta*	L.	Z	T	E	W	B
Heterocaryum	*subsessile*	Vatke	I	T	E	A	A
Heterocaryum	*szovitsianum*	(Fischer et C.A. Meyer) A. DC.	I	T	E	A	A
Heterotheca	*subaxillaris*	(Lam.) Britton et Rusby	H	H	E	D	D
Hibiscus	*micranthus*	L. fil.	T	C	P	C	A
Hippocrepis	*areolata*	Desv.	L	T	E	F	A

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Hippocrepis	*multisiliquosa*	L.	M	T	E	H	A
Hippocrepis	*unisiliquosa*	L.	M	T	E	H	A
Hirschfeldia	*incana*	(L.) Lagreze-Fossat	K	T	E	D	B
Holosteum	*umbellatum*	L.	K	T	E	A	A
Hordeum	*bulbosum*	L.	K	H	E	H	A
Hordeum	*glaucum*	Steudel	K	T	E	D	C
Hordeum	*spontaneum*	C. Koch	K	T	E	H	B
Hormuzakia	*aggregata*	(Lehm.) Gusuleac	M	T	E	R	A
Hyacinthella	*nervosa*	(Bertol.) Chouard	I	G	E	B	A
Hymenocarpos	*circinnatus*	(L.) Savi	M	T	E	H	B
Hyoscyamus	*aureus*	L.	K	C	P	V	B
Hyoscyamus	*reticulatus*	L.	I	H	P	A	E
Hyparrhenia	*hirta*	(L.) Stapf	Q	H	P	H	C
Hypecoum	*aegyptiacum*	(Forssk.) Ascherson et Schweinf.	A	T	E	A	A
Hypecoum	*dimidiatum*	Delile	K	T	E	H	B
Hypecoum	*pendulum*	L.	K	T	E	W	A
Hypericum	*triquetrifolium*	Turra	K	H	E	H	C
Ifloga	*spicata*	(Forssk.) Schultz Bip.	A	T	E	R	A
Imperata	*cylindrica*	(L.) Raeuschel	Q	H	P	L	B
Iphiona	*maris-mortui*	Feinbrun	A	C	P	V	A
Ipomoea	*imperati*	(Vahl) Griseb.	N	H	P	Y	A
Iris	*atropurpurea*	Dinsmore	M	G	E	E	A
Iris	*mariae*	W. Barbey	A	G	E	F	A
Iris	*palaestina*	(Baker) Boiss.	M	G	E	H	A
Iris	*petrana*	Dinsmore	I	G	E	F	A
Iris	*regis-uzziae*	Feinbrun	I	G	E	A	A
Ixiolirion	*tataricum*	(Pallas) Herbert	I	G	E	A	B
Kickxia	*acerbiana*	(Boiss.) Taeckholm et Boulos	A	H	P	N	A
Kickxia	*aegyptiaca*	(L.) Nabelek	L	C	P	B	A
Kickxia	*floribunda*	(Boiss.) Taeckholm et Boulos	A	C	P	W	A
Kickxia	*judaica*	Danin	A	C	P	V	A
Koelpinia	*linearis*	Pallas	O	T	E	W	A
Lactuca	*serriola*	L.	Z	T	E	D	E
Lactuca	*tuberosa*	Jacq.	K	H	E	H	A
Lagoecia	*cuminoides*	L.	M	T	E	H	A
Lagurus	*ovatus*	L.	M	T	E	H	A
Lamarckia	*aurea*	(L.) Moench	K	T	E	W	B
Lamium	*amplexicaule*	L.	Z	T	E	Q	C
Lappula	*spinocarpos*	(Forssk.) Ascherson	O	T	E	W	A
Lasiopogon	*muscoides*	(Desf.) DC.	A	T	E	W	A
Lathyrus	*aphaca*	L.	Z	T	E	H	B
Lathyrus	*blepharicarpos*	Boiss.	M	T	E	H	A
Lathyrus	*ciliolatus*	Rech. fil.	M	T	E	T	A
Lathyrus	*hierosolymitanus*	Boiss.	M	T	E	H	B
Lathyrus	*marmoratus*	Boiss. et Blanche	M	T	E	H	A
Lathyrus	*pseudocicera*	Pamp.	M	T	E	W	B
Lathyrus	*sphaericus*	Retz.	M	T	E	H	A
Launaea	*angustifolia*	(Desf.) O. Kuntze	A	T	E	C	A
Launaea	*mucronata*	(Forssk.) Muschler	A	T	E	F	A
Launaea	*nudicaulis*	(L.) Hooker fil.	A	H	P	C	A
Launaea	*fragilis*	(Asso) Pau	M	H	E	R	A
Lavandula	*coronopifolia*	Poiret	P	C	P	C	A
Lavandula	*pubescens*	Decaisne	P	C	P	C	B
Lens	*orientalis*	(Boiss.) Smal'g.	K	T	E	H	B
Leontice	*leontopetalum*	L.	M	G	E	A	C
Leontodon	*laciniatus*	(Bertol.) Widder	O	T	E	W	A
Leopoldia	*comosa*	(L.) Parl.	K	G	E	H	A
Leopoldia	*longipes*	(Boiss.) Losnik.	O	G	E	A	A
Leptaleum	*filifolium*	(Willd.) DC.	I	T	E	A	A
Leysera	*leyseroides*	(Desf.) Maire	P	T	E	C	A
Limonium	*lobatum*	(L. fil.) Chaz.	A	T	E	S	A
Limonium	*pruinosum*	(L.) Chaz.	A	C	P	S	A

Genus	Species	Author	Variables 1	2	3	4	5
Linaria	*albifrons*	(Sm.) Sprengel	I	T	E	W	A
Linaria	*haelava*	(Forssk.) Delile	A	T	E	W	A
Linaria	*micrantha*	(Cav.) Hoffmanns. et Link	K	T	E	H	A
Linaria	*tenuis*	(Viv.) Sprengel	A	T	E	R	A
Linum	*corymbulosum*	Reichenb.	K	T	E	T	A
Linum	*mucronatum*	Bertol.	I	C	P	T	A
Linum	*pubescens*	Banks et Solander	M	T	E	H	B
Linum	*strictum*	L.	M	T	E	H	A
Lobularia	*arabica*	(Boiss.) Muschler	A	T	E	F	A
Loliolum	*subulatum*	(Banks et Solander) Eig	I	T	E	A	A
Lolium	*rigidum*	Gaudin	K	T	E	W	C
Lomelosia	*palaestina*	(L.) Rafin	K	T	E	H	A
Lomelosia	*porphyroneura*	(Blakelok) Greuter et Burdet	O	T	E	W	A
Lomelosia	*prolifera*	(L.) Greuter et Burdet	M	T	E	H	B
Lonicera	*etrusca*	G. Santi	M	P	P	Q	A
Lotus	*creticus*	L.	M	C	P	Y	A
Lotus	*halophilus*	Boiss. et Spruner	M	T	E	R	A
Lotus	*peregrinus*	L.	M	T	E	H	A
Lupinus	*palaestinus*	Boiss.	M	T	E	E	A
Lycium	*schweinfurthii*	Dammer	M	P	P	R	A
Lycium	*shawii*	Roemer et Schultes	P	P	P	C	A
Majorana	*syriaca*	(L.) Kostel.	M	C	P	Q	A
Malabaila	*secacul*	(Banks et Solander) Boiss.	I	H	E	A	B
Malcolmia	*africana*	(L.) R. Br.	O	T	E	A	A
Malcolmia	*chia*	(L.) DC.	M	T	E	V	A
Malcolmia	*crenulata*	(DC.) Boiss.	M	T	E	H	B
Malva	*aegyptia*	L.	A	T	E	W	A
Malva	*nicaeensis*	All.	K	T	E	D	E
Malva	*parviflora*	L.	K	T	E	D	D
Malva	*sylvestris*	L.	Y	H	E	W	C
Malvella	*sherardiana*	(L.) Jaub. et Spach	K	H	P	H	B
Mandragora	*autumnalis*	Bertol.	M	H	E	H	A
Maresia	*nana*	(DC.) Batt.	M	T	E	R	A
Maresia	*pulchella*	(DC.) O.E. Schulz	M	T	E	R	A
Maresia	*pygmaea*	(DC.) O.E. Schulz	A	T	E	F	A
Marrubium	*alysson*	L.	L	C	P	D	D
Matricaria	*aurea*	(Loefl.) Schultz Bip.	K	T	E	D	C
Matthiola	*aspera*	Boiss.	A	T	E	W	A
Matthiola	*livida*	(Delile) DC.	A	T	E	W	A
Matthiola	*longipetala*	(Vent.) DC.	K	T	E	H	B
Medicago	*coronata*	(L.) Bartal	M	T	E	H	A
Medicago	*laciniata*	(L.) Miller	A	T	E	W	A
Medicago	*littoralis*	Loisel.	M	T	E	E	B
Medicago	*marina*	L.	M	C	P	Y	A
Medicago	*minima*	(L.) L.	Y	T	E	H	A
Medicago	*orbicularis*	(L.) Bartal	K	T	E	H	B
Medicago	*polymorpha*	L.	Z	T	E	H	B
Medicago	*radiata*	L.	I	T	E	W	A
Medicago	*rotata*	Boiss.	M	T	E	H	B
Medicago	*truncatula*	Gaertner	M	T	E	H	B
Medicago	*tuberculata*	(Retz.) Willd.	M	T	E	H	A
Melilotus	*sulcatus*	Desf.	M	T	E	H	A
Mercurialis	*annua*	L.	Y	T	E	H	C
Mericarpaea	*ciliata*	(Banks et Sol.) Eig	I	T	E	H	B
Mesembryanthemum	*forsskalii*	Boiss.	S	T	E	S	A
Mesembryanthemum	*nodiflorum*	L.	D	T	E	S	B
Micromeria	*myrtifolia*	Boiss. et Hohen.	K	C	P	V	A
Micromeria	*nervosa*	Desf.	M	C	P	V	A
Micromeria	*sinaica*	Bentham	A	C	P	V	A
Minuartia	*decipiens*	(Fenzl) Bornm.	M	T	E	V	A
Minuartia	*picta*	(Sm.) Bornm.	I	T	E	W	A
Moltkiopsis	*ciliata*	(Forssk.) I.M. Johnston	A	C	P	R	A
Monsonia	*nivea*	(Decaisne) Webb	P	T	E	R	A
Moricandia	*nitens*	(Viv.) E.A. Durand et Barratte	A	C	P	A	A

Genus	Species	Author	Variables 1	2	3	4	5
Muscari	*commutatum*	Guss.	K	G	E	H	A
Muscari	*neglectum*	Ten.	K	G	E	H	A
Muscari	*parviflorum*	Desf.	M	G	E	T	A
Narcissus	*tazetta*	L.	M	G	E	V	B
Nasturtiopsis	*coronopifolia*	(Desf.) Boiss.	A	T	E	S	A
Neotorularia	*torulosa*	(Desf.) Hedge et Leonard	I	T	E	W	A
Neurada	*procumbens*	L.	A	T	E	R	A
Nigella	*arvensis*	L.	Z	T	E	R	A
Nigella	*ciliaris*	DC.	M	T	E	H	B
Nigella	*unguicularis*	(Poiret) Spenner	M	T	E	H	A
Noaea	*mucronata*	(Forssk.) Ascherson et Schweinf.	I	C	P	A	A
Nonea	*philistaea*	Boiss.	M	T	E	H	B
Notobasis	*syriaca*	(L.) Cass.	M	T	E	D	D
Notoceras	*bicorne*	(Aiton) Amo	A	T	E	C	A
Ochradenus	*baccatus*	Delile	B	P	P	C	B
Oenothera	*drummondii*	Hooker	H	C	P	Y	C
Oligomeris	*linifolia*	(Hornem.) Macbride	S	T	E	C	A
Onobrychis	*caput-galli*	(L.) Lam.	M	T	E	H	B
Onobrychis	*crista-galli*	(L.) Lam.	A	T	E	W	A
Onobrychis	*ptolemaica*	(Delile) DC.	O	C	P	V	A
Onobrychis	*squarrosa*	Viv.	M	T	E	H	B
Ononis	*hirta*	Poiret	M	T	E	H	A
Ononis	*mollis*	Savi	K	T	E	H	A
Ononis	*natrix*	L.	M	C	P	B	A
Ononis	*ornithopodioides*	L.	M	T	E	H	A
Ononis	*serrata*	Forssk.	L	T	E	H	A
Ononis	*sicula*	Guss.	Q	T	E	W	A
Ononis	*spinosa*	L.	K	H	P	H	C
Ononis	*variegata*	L.	M	T	E	F	A
Onopordum	*alexandrinum*	Boiss.	O	H	E	A	B
Onopordum	*palaestinum*	Eig	K	H	E	B	B
Onosma	*echinata*	Desf.	I	H	E	A	A
Ophrys	*umbelicta*	Desf.	K	G	E	M	A
Origanum	*dayi*	Post	I	C	P	V	A
Origanum	*ramonense*	Danin	I	C	P	V	A
Orlaya	*daucoides*	(L.) Greuter	M	T	E	T	B
Ornithogalum	*montanum*	Cyr.	K	G	E	T	A
Ornithogalum	*narbonense*	L.	K	G	E	H	A
Ornithogalum	*neurostegium*	Boiss. et Blanche	K	G	E	H	A
Ornithogalum	*trichophyllum*	Boiss. et Heldr.	O	G	E	A	A
Orobanche	*aegyptiaca*	Pers.	I	S	E	H	D
Orobanche	*cernua*	Loefl.	Q	S	E	W	B
Osyris	*alba*	L.	M	S	P	Q	A
Otanthus	*maritimus*	(L.) Hoffmanns. et Link	M	C	P	Y	A
Pallenis	*spinosa*	(L.) Cass.	M	H	E	H	A
Pancratium	*maritimum*	L.	M	G	E	Y	A
Pancratium	*sickenbergeri*	C. et W. Barbey	A	G	E	F	A
Panicum	*turgidum*	Forssk.	P	H	P	F	A
Papaver	*humile*	Fedde	A	T	E	W	B
Papaver	*hybridum*	L.	K	T	E	H	B
Papaver	*umbonatum*	Boiss.	M	T	E	H	B
Parapholis	*incurva*	(L.) C.E. Hubbard	K	T	E	L	A
Parentucellia	*latifolia*	(L.) Caruel	K	S	E	H	A
Parentucellia	*viscosa*	(L.) Caruel	M	T	E	H	A
Parietaria	*alsinifolia*	Delile	A	T	E	W	A
Parietaria	*judaica*	L.	K	H	P	V	D
Parietaria	*lusitanica*	L.	M	T	E	V	B
Paronychia	*arabica*	(L.) DC.	A	T	E	R	A
Paronychia	*argentea*	Lam.	M	H	P	H	B
Paronychia	*capitata*	(L.) Lam.	M	H	P	V	A
Paronychia	*sinaica*	Fresen.	I	H	P	V	B
Peganum	*harmala*	L.	O	H	P	A	C
Pennisetum	*asperifolium*	(Desf.) Kunth	B	H	P	V	C

Genus	Species	Author	Variables 1	2	3	4	5
Pennisetum	*ciliare*	(L.) Link	A	H	P	V	A
Pennisetum	*divisum*	(J.F. Gmelin) Henrard	A	H	P	F	A
Periploca	*aphylla*	Decaisne	S	P	P	V	A
Phagnalon	*barbeyanum*	Ascherson et Schweinf.	A	C	P	V	A
Phagnalon	*rupestre*	(L.) DC.	K	C	P	V	B
Phalaris	*aquatica*	L.	M	H	P	H	B
Phalaris	*brachystachys*	Link	M	T	E	H	D
Phalaris	*minor*	Retz.	K	T	E	W	B
Phalaris	*paradoxa*	L.	K	T	E	H	D
Phleum	*subulatum*	(Savi) Ascherson et Graebner	M	T	E	H	B
Phlomis	*brachyodon*	(Boiss.) Zohary	I	C	P	B	A
Phlomis	*platystegia*	Post	I	C	P	B	A
Phlomis	*pungens*	Willd.	K	H	E	H	B
Picris	*altissima*	Delile	M	T	E	H	B
Picris	*amalecitana*	(Boiss.) Eig	M	T	E	R	A
Picris	*asplenioides*	L.	A	T	E	F	A
Picris	*galilaea*	(Boiss.) Eig	M	T	E	H	A
Picris	*longirostris*	Schultz Bip.	I	T	E	W	A
Pimpinella	*cretica*	Poiret	M	T	E	H	A
Pimpinella	*eriocarpa*	Banks et Solander	I	T	E	A	A
Piptatherum	*blancheanum*	Boiss.	M	H	P	T	A
Piptatherum	*holciforme*	(MB.) Roemer et Schultes	K	H	P	H	A
Piptatherum	*miliaceum*	(L.) Coss.	M	H	P	H	B
Piptatherum	*thomasii*	(Duby) Kunth	M	H	P	H	C
Pistacia	*atlantica*	Desf.	I	A	P	V	B
Pistacia	*lentiscus*	L.	M	P	P	Q	B
Pisum	*fulvum*	Sm.	M	T	E	H	A
Pisum	*sativum*	L.	I	T	E	H	A
Plantago	*afra*	L.	K	T	E	H	A
Plantago	*albicans*	L.	L	H	P	R	A
Plantago	*bellardii*	All.	K	T	E	B	A
Plantago	*coronopus*	L.	Z	T	E	W	A
Plantago	*cretica*	L.	M	T	E	H	A
Plantago	*cylindrica*	Forssk.	A	T	E	F	A
Plantago	*lagopus*	L.	M	T	E	H	A
Plantago	*notata*	Lag.	O	T	E	W	A
Plantago	*ovata*	Forssk.	O	T	E	W	A
Plantago	*phaeostoma*	Boiss. et Heldr.	A	T	E	A	A
Plantago	*sarcophylla*	Zohary	M	T	E	Y	A
Poa	*bulbosa*	L.	Z	H	E	H	B
Poa	*eigii*	Feinbrun	I	H	E	W	A
Poa	*sinaica*	Steudel	I	H	E	W	A
Podonosma	*orientalis*	(L.) Feinbrun	K	C	P	V	B
Polycarpon	*succulentum*	(Delile) Gay	A	T	E	R	A
Polycarpon	*tetraphyllum*	(L.) L.	Y	T	E	H	C
Polygonum	*equisetiforme*	Sm.	K	C	P	H	C
Polygonum	*palaestinum*	Zohary	L	C	P	R	A
Prangos	*ferulacea*	(L.) Lindley	M	H	E	H	B
Prasium	*majus*	L.	M	C	P	Q	A
Pseudorlaya	*pumila*	(L.) Grande	L	T	E	R	A
Psilurus	*incurvus*	(Gouan) Schinz et Thell.	K	T	E	H	A
Pteranthus	*dichotomus*	Forssk.	A	T	E	S	A
Pterocephalus	*brevis*	Coulter	K	T	E	W	A
Pterocephalus	*plumosus*	(L.) Coulter	K	T	E	H	A
Pterocephalus	*pulverulentus*	Boiss. et Balansa	I	C	P	V	A
Pulicaria	*incisa*	(Lam.)DC.	P	C	P	C	B
Pyrus	*syriaca*	Boiss.	K	A	P	Q	B
Ranunculus	*arvensis*	L.	Z	T	E	H	D
Ranunculus	*asiaticus*	L.	M	G	E	H	A
Ranunculus	*millefolius*	Banks et Solander	K	G	E	H	A
Raphanus	*rostratus*	DC.	M	T	E	H	A
Reaumuria	*hirtella*	Jaub. et Spach	O	C	P	S	A
Reaumuria	*negevensis*	Zohary et Danin	A	C	P	S	A
Reichardia	*tingitana*	(L.) Roth	K	T	E	W	A

Genus	Species	Author	Variables 1	2	3	4	5
Reseda	*alba*	L.	K	T	E	H	C
Reseda	*decursiva*	Forssk.	A	T	E	W	B
Reseda	*luteola*	L.	Z	T	E	H	B
Reseda	*muricata*	C. Presl	A	C	P	S	A
Reseda	*stenostachya*	Boiss.	A	C	P	C	A
Reseda	*urnigera*	Webb	A	C	P	C	A
Retama	*raetam*	(Forssk.) Webb	A	P	P	R	A
Rhagadiolus	*stellatus*	(L.) Gaertner	K	T	E	H	A
Rhamnus	*alaternus*	L.	M	A	P	Q	B
Rhamnus	*disperma*	Boiss.	A	P	P	V	A
Rhamnus	*lycioides*	L.	M	P	P	Q	A
Rheum	*palaestinum*	Feinbrun	I	H	E	A	A
Rhus	*tripartita*	(Ucria) Grande	I	P	P	V	A
Roemeria	*hybrida*	(L.) DC.	K	T	E	W	A
Rostraria	*smyrnacea*	(Trin.) H. Scholz	K	T	E	H	C
Rubia	*tenuifolia*	Dum.-Urville	M	P	P	Q	B
Rumex	*bucephalophorus*	L.	M	T	E	E	A
Rumex	*cyprius*	Murb.	O	T	E	W	A
Rumex	*occultans*	Sam.	M	T	E	R	A
Rumex	*pictus*	Forssk.	M	T	E	R	A
Ruta	*chalepensis*	L.	M	C	P	Q	A
Salsola	*vermiculata*	L.	O	C	P	S	A
Salsola	*imbricata*	Forssk.	S	P	P	C	D
Salsola	*inermis*	Forssk.	A	T	E	S	B
Salsola	*kali*	L.	X	T	E	D	D
Salsola	*oppositifolia*	Desf.	A	C	P	S	A
Salsola	*orientalis*	S.G. Gmelin	I	C	P	S	A
Salsola	*schweinfurthii*	Solms-Laub.	A	C	P	S	A
Salsola	*tetrandra*	Forssk.	A	C	P	S	A
Salvia	*aegyptiaca*	L.	A	C	P	C	A
Salvia	*dominica*	L.	M	C	P	B	A
Salvia	*horminum*	L.	M	T	E	H	A
Salvia	*judaica*	Boiss.	I	C	P	V	A
Salvia	*lanigera*	Poiret	L	C	P	A	A
Salvia	*palaestina*	Bentham	K	H	E	V	A
Salvia	*samuelssonii*	Rech. fil.	K	H	E	H	A
Salvia	*spinosa*	L.	I	H	E	A	A
Salvia	*syriaca*	L.	I	H	E	D	B
Sarcopoterium	*spinosum*	(L.) Spach	M	C	P	T	B
Satureja	*thymbrifolia*	Hedge et Feinbrun	O	C	P	S	A
Savignya	*parviflora*	(Delile) Webb	A	T	E	C	A
Scandix	*pecten-veneris*	L.	Z	T	E	H	B
Scariola	*orientalis*	(Boiss.) Sojak	I	H	P	W	A
Schimpera	*arabica*	Hochst. et Steudel	A	T	E	F	A
Schismus	*arabicus*	Nees	O	T	E	W	A
Scilla	*autumnalis*	L.	M	G	E	T	A
Scilla	*hanburyi*	Baker	I	G	E	W	A
Scirpus	*holoschoenus*	L.	K	I	P	L	A
Sclerocephalus	*arabicus*	Boiss.	A	T	E	W	A
Sclerochloa	*dura*	(L.) Beauvois	M	T	E	H	D
Scorpiurus	*muricatus*	L.	M	T	E	H	A
Scorzonera	*judaica*	Eig	I	H	E	W	A
Scorzonera	*papposa*	DC.	I	H	E	H	A
Scorzonera	*pusilla*	Pallas	I	H	E	A	A
Scrophularia	*deserti*	Delile	A	C	P	N	A
Scrophularia	*hypericifolia*	Wydler	A	C	P	R	A
Scrophularia	*peyronii*	Post	K	C	P	H	A
Scrophularia	*xanthoglossa*	Boiss.	K	C	P	B	A
Scrophularia	*xylorrhiza*	Boiss. et Hausskn.	I	C	P	V	A
Scutellaria	*tomentosa*	Bertol.	I	C	P	B	A
Sedum	*caespitosum*	(Cav.) DC.	M	T	E	H	A
Sedum	*hispanicum*	L.	Y	T	E	V	A
Sedum	*litoreum*	Guss.	M	T	E	E	A

Genus	Species	Author	Variables 1	2	3	4	5
Sedum	*palaestinum*	Boiss.	M	T	E	V	A
Senecio	*glaucus*	L.	O	T	E	W	A
Senecio	*joppensis*	Dinsmore	M	T	E	R	A
Senecio	*vernalis*	Waldst. et Kit.	K	T	E	H	C
Serratula	*pusilla*	(Labill.) Dittrich	I	H	E	B	A
Sherardia	*arvensis*	L.	K	T	E	H	A
Sideritis	*perfoliata*	L.	M	H	P	H	A
Sideritis	*pullulans*	Vent.	M	H	P	T	A
Silene	*alexandrina*	(Ascherson) Danin	K	T	E	W	A
Silene	*colorata*	Poiret	M	T	E	H	B
Silene	*coniflora*	Otth	I	T	E	A	B
Silene	*conoidea*	L.	K	T	E	A	B
Silene	*crassipes*	Fenzl	M	T	E	H	A
Silene	*damascena*	Boiss. et Gaill.	M	T	E	H	B
Silene	*decipiens*	Barc.	K	T	E	W	B
Silene	*dichotoma*	Ehrh.	M	H	E	H	B
Silene	*grisea*	Boiss.	M	H	E	V	A
Silene	*linearis*	Decaisne	S	T	E	W	C
Silene	*longipetala*	Vent.	M	H	E	H	B
Silene	*modesta*	Boiss. et Blanche	M	T	E	H	A
Silene	*muscipula*	L.	M	T	E	H	A
Silene	*oxyodonta*	W. Barbey	M	T	E	H	A
Silene	*succulenta*	Forssk.	M	C	P	Y	B
Silene	*tridentata*	Desf.	I	T	E	A	A
Silene	*villosa*	Forssk.	A	T	E	R	A
Silene	*vivianii*	Steudel	A	T	E	W	A
Sinapis	*alba*	L.	Z	T	E	D	C
Sisymbrium	*erysimoides*	Desf.	L	T	E	W	B
Sixalix	*arenaria*	(Forssk.) Greuter et Burdet	A	T	E	E	A
Sixalix	*eremophila*	(Boiss.) Greuter et Burdet	A	T	E	R	A
Smilax	*aspera*	L.	M	P	P	Q	A
Solanum	*nigrum*	L.	Z	H	E	H	C
Solanum	*sinaicum*	Boiss.	A	C	P	C	C
Sonchus	*aspera*	(L.) Hill.	M	T	E	L	A
Sonchus	*maritimus*	L.	K	H	P	L	A
Sonchus	*microcephalus*	Mejias	M	T	E	L	A
Sonchus	*oleraceus*	L.	Z	T	E	D	D
Sonchus	*tenerrimus*	L.	K	T	E	V	A
Spergula	*fallax*	(Lowe) Krause	A	T	E	W	C
Spergularia	*diandra*	(Guss.) Boiss.	Q	T	E	S	C
Sporobolus	*virginicus*	(L.) Kunth	M	H	P	Y	A
Stachys	*aegyptiaca*	Pers.	A	C	P	V	A
Stachys	*palaestina*	L.	M	C	P	V	A
Stellaria	*media*	(L.) Vill.	X	T	E	H	C
Stellaria	*pallida*	(Dumort.) Pire	Y	T	E	H	D
Sternbergia	*clusiana*	(Ker-Gawler) Sprengel	K	G	E	Q	A
Stipa	*barbata*	Desf.	I	H	P	V	A
Stipa	*capensis*	Thunb.	O	T	E	W	A
Stipa	*parviflora*	Desf.	I	H	P	V	A
Stipa	*pellita*	(Trin. et Rupr.) Tzvelev	K	H	P	V	A
Stipagrostis	*ciliata*	(Desf.) de Winter	A	H	P	F	A
Stipagrostis	*lanata*	(Forssk.) de Winter	A	H	P	R	A
Stipagrostis	*obtusa*	(Delile) Nees	P	H	P	F	A
Stipagrostis	*plumosa*	(L.) T. Andersson	O	H	P	F	A
Stipagrostis	*raddiana*	(Savi) de Winter	A	H	P	R	A
Stipagrostis	*scoparia*	(Trin. et Rupr.) de Winter	A	H	P	F	A
Suaeda	*asphaltica*	(Boiss.) Boiss.	A	C	P	S	A
Suaeda	*palaestina*	Eig et Zohary	P	C	P	P	A
Suaeda	*vera*	J.F. Gmelin	L	C	P	S	A
Tanacetum	*santolinoides*	(DC.) Feinbrun et Fertig	I	C	P	V	A
Telephium	*sphaerospermum*	Boiss.	P	H	P	N	A
Telmissa	*microcarpa*	(Sm.) Boiss.	M	T	E	V	A
Tetrapogon	*villosus*	Desf.	P	H	P	V	A
Teucrium	*capitatum*	L.	K	C	P	B	A

Genus	Species	Author	Variables 1	2	3	4	5
Teucrium	*parviflorum*	Schreber	I	H	E	H	A
Theligonum	*cynocrambe*	L.	M	T	E	H	B
Thesium	*humile*	Vahl	M	S	E	H	A
Thlaspi	*perfoliatum*	L.	K	T	E	T	A
Thrincia	*tuberosa*	(L.) DC.	M	H	E	H	B
Thymelaea	*gussonei*	Boreau	I	T	E	H	A
Thymelaea	*hirsuta*	(L.) Endl.	L	P	P	B	A
Thymelaea	*passerina*	(L.) Cosson et Germ.	Z	T	E	H	A
Tolpis	*virgata*	(Desf.) Bertol.	M	H	P	H	C
Tordylium	*aegyptiacum*	(L.) Lam.	K	T	E	W	B
Torilis	*arvensis*	(Huds.) Link	Z	T	E	H	A
Torilis	*leptophylla*	(L.) Reichenb.	K	T	E	H	A
Torilis	*nodosa*	(L.) Gaertner	Z	T	E	H	A
Torilis	*tenella*	(Delile) Reichenb.	K	T	E	H	A
Tragopogon	*coelesyriacus*	Boiss.	K	H	E	H	B
Tragopogon	*collinus*	DC.	I	H	E	A	A
Trichodesma	*africana*	(L.) Lehm.	A	T	E	W	A
Trichodesma	*boissieri*	Post	A	H	E	C	B
Tricholaena	*teneriffae*	(L. fil.) Link	P	H	P	C	B
Trifolium	*campestre*	Schreber	M	T	E	H	A
Trifolium	*clypeatum*	L.	M	T	E	H	A
Trifolium	*dasyurum*	C. Presl	M	T	E	H	A
Trifolium	*echinatum*	MB.	M	T	E	H	A
Trifolium	*eriosphaerum*	Boiss.	M	T	E	H	A
Trifolium	*palaestinum*	Boiss.	M	T	E	E	A
Trifolium	*philistaeum*	Zohary	M	T	E	E	A
Trifolium	*pilulare*	Boiss.	M	T	E	H	A
Trifolium	*prophetarum*	Hossain	M	T	E	T	A
Trifolium	*purpureum*	Loisel.	M	T	E	H	A
Trifolium	*resupinatum*	L.	K	T	E	H	A
Trifolium	*scabrum*	L.	M	T	E	H	A
Trifolium	*stellatum*	L.	M	T	E	H	A
Trifolium	*tomentosum*	L.	Z	T	E	H	A
Trigonella	*arabica*	Delile	A	T	E	W	B
Trigonella	*astroites*	Fischer et C.A. Meyer	I	T	E	A	A
Trigonella	*cylindracea*	Desv.	M	T	E	R	A
Trigonella	*hierosolymitana*	Boiss.	M	T	E	T	A
Trigonella	*monspeliaca*	L.	M	T	E	H	A
Trigonella	*schlumbergeri*	Boiss.	A	T	E	S	A
Trigonella	*stellata*	Forssk.	A	T	E	W	A
Tripleurospermum	*auriculatum*	(Boiss.) Rech. fil.	I	T	E	A	A
Trisetaria	*koelerioides*	(Bornm. et Hackel) Melderis	M	T	E	R	A
Trisetaria	*linearis*	Forssk.	L	T	E	R	B
Trisetaria	*macrochaeta*	(Boiss.) Maire	A	T	E	B	A
Tulipa	*agenensis*	DC.	M	G	E	T	A
Tulipa	*polychroma*	Stapf	I	G	E	A	A
Tulipa	*systola*	Stapf	I	G	E	A	A
Umbilicus	*intermedius*	Boiss.	K	G	E	V	B
Urginea	*maritima*	(L.) Baker	M	G	E	H	A
Urginea	*undulata*	(Desf.) Steinh.	A	G	E	A	A
Urospermum	*picroides*	(L.) F.W. Schmidt	K	T	E	H	C
Urtica	*membranacea*	Poiret	M	T	E	D	C
Vaccaria	*hispanica*	(Miller) Rauschert	M	T	E	D	B
Valantia	*hispida*	L.	M	T	E	V	B
Valeriana	*dioscoridis*	Sm.	M	H	E	V	A
Valerianella	*coronata*	(L.) DC.	Z	T	E	H	A
Valerianella	*dufresnia*	Boiss.	I	T	E	A	A
Valerianella	*szovitsiana*	Fischer et C.A. Meyer	I	T	E	A	A
Valerianella	*vesicaria*	(L.) Moench	K	T	E	H	A
Velezia	*rigida*	L.	M	T	E	H	A
Verbascum	*eremobium*	Murb.	I	C	P	A	A
Verbascum	*fruticulosum*	Post	I	C	P	B	A

Genus	Species	Author	Variables				
			1	2	3	4	5
Verbascum	*orientale*	(L.) All.	M	T	E	H	A
Verbascum	*sinaiticum*	Bentham	K	H	P	H	B
Verbascum	*sinuatum*	L.	K	H	P	H	B
Veronica	*cymbalaria*	Bodard	M	T	E	H	B
Vicia	*narbonensis*	L.	M	T	E	W	A
Vicia	*palaestina*	Boiss.	M	T	E	H	B
Vicia	*peregrina*	L.	K	T	E	H	B
Vicia	*sativa*	L.	M	T	E	H	B
Vulpia	*brevis*	Boiss. et Kotschy	O	T	E	R	A
Vulpia	*ciliata*	Dumort.	K	T	E	H	B
Vulpia	*fasciculata*	(Forssk.) Samp.	M	T	E	E	A
Vulpia	*myuros*	(L.) C.C. Gmelin	Z	T	E	H	B
Vulpia	*pectinella*	(Delile) Boiss.	A	T	E	F	A
Zilla	*spinosa*	(L.) Prantl	A	C	P	Č	A
Ziziphora	*capitata*	L.	K	T	E	T	A
Ziziphus	*spina-christi*	(L.) Desf.	S	A	P	C	B
Zosima	*absinthiifolia*	(Vent.) Link	I	H	E	A	A
Zygophyllum	*album*	L. fil.	A	C	P	P	A
Zygophyllum	*dumosum*	Boiss.	A	C	P	N	A

9.2 List of synonymes for the most common species

When variant scientific names are given to the same species by different authors, the name that was given first, according to the rules of nomenclature, is the "correct" or legitimate name. Names published later are synonyms. Scientific publications concerning the flora of the area (e.g. Zohary 1966, 1972; Feinbrun-Dothan 1978, 1986) present briefly the naming history of each species with references to their dates and places of publication. In the following appendix we list names of the most common species, especially those used in syntaxomy in previous phytosociological work of the study area.

Names printed in Roman and **bold** type are those used in contemporary scientific literature as the correct ones. Names in *italics* are those used in previous Israeli Floras. These names are not necessarily synonyms; some of them are mis-identifications. In a few cases we listed new names as "synonyms" (in our sense) pending their full acceptance by the international scientific community.

Agropyrum junceum Beauvois → **Elymus farctus** (Viv.) Meldris
Ammophila arenaria (L.) Link ← *Ammophila arundinacea* Host
Ammophila arundinacea Host → **Ammophila arenaria** (L.) Link
Anabasis haussknechtii auct. → **Anabasis syriaca** Iljin
Anabasis syriaca Iljin ← *Anabasis haussknechtii* auct.
Andropogon hirtus L. → **Hyparrhenia hirta** (L.) Stapf
Aristida lanata Forssk. → **Stipagrostis lanata** (Forssk.) de Winter
Aristida plumosa L. → **Stipagrostis plumosa** (L.) T. Anderson
Aristida scoparia Trin. et Rupr. → **Stipagrostis scoparia** (Trin. et Rupr.) de Winter
Artemisia herba-alba Asso → **Artemisia sieberi** Besser
Artemisia sieberi Besser ← *Artemisia herba-alba* Asso
Asphodelus microcarpus Salzm. → **Asphodelus ramosus** L.
Asphodelus ramosus L. ← *Asphodelus microcarpus* Salzm.
Atractylis carduus (Forssk.) C. Chr. ← *Atractylis flava* Desf.
Atractylis flava Desf. → **Atractylis carduus** (Forssk.) C. Chr.
Bilacunaria boissieri (Reuter et Hausskn.) Pimenov et Tichomir ← *Hippomarathrum boissieri* Reuter et Hausskn.
Centropodia forsskalii (Vahl) Cope ← *Danthonia forsskalii* (Vahl) R. Br.
Chiliadenus iphionoides (Boiss. et Blanche) Brullo ← *Varthemia iphionoides* Boiss. et Blanche
Corynephorus articulatus (Desf.) P. Beauv. → **Corynephorus divaricatus** (Pourret) Breistr

Corynephorus divaricatus (Pourret) Breistr. ← *Corynephorus articulatus* (Desf.) P. Beauv.
Cyperus conglomeratus Rottb. → **Cyperus macrorrhizus** Nees
Cyperus macrorrhizus Nees ← *Cyperus conglomeratus* Rottb.
Danthonia forsskalii (Vahl) R. Br. → **Centropodia forsskalii** (Vahl) Cope
Deverra tortuosa (Desf.) Vent. ← *Pituranthos tortuosus* (Desf.) Ascerson et Schweinf.
Diotis maritima (L.) Sm. → **Othantus maritimus** (L.) Hoffmanns. et Link
Dittrichia viscosa (L.) Greuter ← *Inula viscosa* (L.) Aiton
Echinops blancheanus Boiss. → **Echinops polyceras** Boiss.
Echinops polyceras Boiss. ← *Echinops blancheanus* Boiss.
Elymus farctus (Viv.) Meldris ← *Agropyrum junceum* Beauvois
Ephedra alte C.A. Meyer → **Ephedra aphylla** Forssk.
Ephedra aphylla Forssk. ← *Ephedra alte* C.A. Meyer
Erucaria pinnata (Viv.) Taeckh. et Boulos ← *Erucaria uncata* (Boiss.) Ascherson et Schweinf.
Erucaria uncata (Boiss.) Ascherson et Schweinf. → **Erucaria pinnata** (Viv.) Taeckh. et Boulos
Gymnocarpos decander Forssk. ← *Gymnocarpus fruticosus* (Vahl) Pers.
Gymnocarpus fruticosus (Vahl) Pers. → **Gymnocarpos decander** Forssk.
Haloxylon articulatum (Cav.) Bge. → **Haloxylon scoparium** Pomel
Haloxylon negevensis (Iljin et Zohary) Danin ← *Hammada negevensis Iljin et Zohary*
Haloxylon salicornicum (Moq.) Boiss. ← *Hammada salicornica* (Moq.) Iljin
Haloxylon scoparium Pomel Bge. ← Hammada scoparia (Pomel) Iljin
Hammada negevensis Iljin et Zohary → **Haloxylon negevensis** (Iljin et Zohary) Danin
Hammada salicornica (Moq.) Iljin → Haloxylon salicornicum (Moq.) Boiss.
Hammada scoparia (Pomel) Iljin → **Haloxylon scoparium** Pomel
Helianthemum ellipticum (Desf.) Pers. → **Helianthemum stipulatum** (Forssk.) C. Chr.
Helianthemum stipulatum (Forssk.) C. Chr. ← *Helianthemum ellipticum* (Desf.) Pers.
Heliotropium digynum (Forssk.) C. Chr. ← *Heliotropium luteum* Poiret
Heliotropium luteum Poiret → **Heliotropium digynum** (Forssk.) C. Chr.
Hippomarathrum boissieri Reuter et Hausskn. → **Bilacunaria boissieri** (Reuter et Hausskn.) Pimenov et Tichomir
Hyparrhenia hirta (L.) Stapf ← *Andropogon hirtus* L.
Inula viscosa (L.) Aiton → **Dittrichia viscosa** (L.) Greuter
Ipomaea littoralis (Cyr.) J.F. Gmelin → **Ipomoea imperati** (Vahl) Griseb.
Ipomoea imperati (Vahl) Griseb. ← *Ipomaea littoralis* (Cyr.) J.F. Gmelin
Lithospermum callosum Vahl → **Moltkiopsis ciliata** (Forssk.) I.M. Johnston
Moltkiopsis ciliata (Forssk.) I.M. Johnston ← *Lithospermum callosum* Vahl
Othantus maritimus (L.) Hoffmanns. et Link ← *Diotis maritima* (L.) Sm.
Pituranthos tortuosus (Desf.) Ascerson et Schweinf. → **Deverra tortuosa** (Desf.) Vent.
Podonosma orientalis (L.) Feinbrun ← *Podonosma syriacum* (Labill.) Boiss.
Podonosma syriacum (Labill.) Boiss. → **Podonosma orientalis** (L.) Feinbrun
Poterium spinosum L. → **Sarcopoterium spinosum** (L.) Spach
Reaumuria hirtella Jaub. et Spach var. **palaestina** (Boiss.) Zohary et Danin ← *Reaumuria palaestina* Boiss.
Reaumuria palaestina Boiss. → **Reaumuria hirtella** Jaub. et Spach var. **palaestina** (Boiss.) Zohary et Danin
Salsola damascena Botsch. → **Salsola vermiculata** L.
Salsola vermiculata L. ← *Salsola damascena* Botsch.
Salsola vermiculata L. ← *Salsola villosa* Roemer et Schultes
Salsola villosa Roemer et Schultes → **Salsola vermiculata** L.
Salvia dominica L. ← *Salvia graveolens* Vahl
Salvia fruticosa Miller ← *Salvia triloba* L. fil.
Salvia graveolens Vahl → **Salvia dominica** L.
Salvia triloba L. fil. → **Salvia fruticosa** Miller
Sarcopoterium spinosum (L.) Spach ← *Poterium spinosum* L.

Sporobolus arenarius (Gouan) Duv.- Jouve → **Sporobolus pungens** (Schreber) Kunth
Sporobolus pungens (Schreber) Kunth ← *Sporobolus arenarius* (Gouan) Duv.- Jouve
Stipa capensis Thunb. ← *Stipa tortilis* Desf.
Stipa tortilis Desf. → **Stipa capensis** Thunb.
Stipagrostis lanata (Forssk.) de Winter ← *Aristida lanata* Forssk.
Stipagrostis plumosa (L.) T. Anderson ← *Aristida plumosa* L.
Stipagrostis scoparia (Trin. et Rupr.) de Winter ← *Aristida scoparia* Trin. et Rupr.
Varthemia iphionoides Boiss. et Blanche → **Chiliadenus iphionoides** (Boiss. et Blanche) Brullo