# THE GENUS ECHINOPS IN PALESTINE

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ABSTRACT. A taxonomic account is given of the genus *Echinops* L. (Compositae) in Palestine. The value of available morphological characters is discussed and it is shown that some of those that have been emphasised in previous accounts, such as stem indumentum, are unreliable; in contrast, the colour of flower heads, a previously neglected character is believed to be important as is the structure of the brush. Six species are recognised in the area; one new subspecific combination is made, *E. viscosus* DC. subsp. *macrolepis* (Boiss.) Feinbr.

This review is based on the author's collecting, photographing and, for many years, observing populations of *Echinops* species throughout Israel; authentic specimens in the herbaria of Boissier and De Candolle at Geneva were also studied. As a result, the following six Palestinian *Echinops* species are recognized: *E. glaberrimus* DC.; *E. polyceras* Boiss.; *E. philistaeus* Feinbr. & Zoh.; *E. adenocaulos* Boiss.; *E. gaillardotii* Boiss.; *E. viscosus* DC. subsp. *macrolepis* (Boiss.) Feinbr.

All the listed taxa belong to sect. *Ritrodes* Bunge characterized by the five innermost phyllaries of the capitulum being connate in the basal half into a scarious cylindrical tube. This character was found to be constant despite some doubts expressed to the contrary (e.g. Davis, 1953; Kozuharov, 1975). Occasional dissolution of the tube into free phyllaries which may be found in young specimens in herbaria is an artefact. The total number of phyllaries in a capitulum varies in different species between 15 and 30.

Delimitation of species within sect. *Ritrodes* in the literature is rather vague due to the want of knowledge of reliable and accepted distinctive characters. The following key to the Palestinian species makes use of several characters which this author regards as reliable. The colour of the heads (phyllaries and flowers) is given much weight as a distinctive character, whereas it has been regrettably neglected by most previous authors, possibly because of lack of adequate information or field experience. The structure and colour of the brush should also be given more attention than hitherto. On the other hand, stem-indumentum, at least in the two Palestinian species related to *E. viscosus* (*E. adenocaulos* and *E. gaillardotii*) cannot serve in delimitation of the taxa, since it varies widely within populations or between populations in the same area.

*E. viscosus* DC. is a rather problematical species which is at the core of the taxonomic treatment of sect. *Ritrodes*. In the recently published *Flora Europaea* (4:213, 1976), Kozuharov calls this species *E. spinosissimus* Turra (syn. *E. viscosus* DC.) but in the absence of conclusive proof about the correct application of this name I prefer to call it *E. viscosus*. Boissier, who described numerous *Echinops* species in his *Diagnoses* (1845, 1849, 1856) later in *Flora*

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*Orientalis* (1875) reduced five of his own species, and several of other authors, to synonyms of *E. viscosus*. Moreover, Boissier doubted whether *E. gaillardotii* Boiss. and *E. blancheanus* Boiss. deserved to be separated from *E. viscosus* (in his words: "An species binae sequentes ab *E. viscoso* specifice differunt in locis natalibus ulterius investigandum"). The geographical range of Boissier's concept of *E. viscosus* extends from Sicily through S Greece, Crete and the Aegean islands to Asia Minor as far east as S Armenia and southwards along the coast of the E Mediterranean from N Syria to Lebanon and Palestine.

It should be pointed out that several species included by Boissier within *E. viscosus* display a wide variability in stem-indumentum ("caule glabrescenti-rubello vel cano setis rubris glanduliferis plus minus copiosis aspero"—Boiss., Fl. Or. 3:429).

Rechinger in *Flora Aegaea* (1943) and Hedge in *Flora of Turkey* (1975) use stem-indumentum (lanate vs non-lanate) for subdividing *E. viscosus* into subspecies.

Since Boissier (1875) included in *E. viscosus* some species based on Palestinian material, it seemed puzzling why no mention was made by him of the brilliant bluish-violet colour of heads of the Palestinian plants described by him. The question then arises as to what actually was the colour of heads and flowers of the authentic *E. viscosus*.

*E. viscosus* was described by De Candolle (1838) from Gussone's Sicilian plants and from plants of the Aegean islands of Cos, Tenedos (Bozca) and Samos; Rechinger (1943) selected the Sicilian plant as the lectotype. Though no mention of flower colour can be found in De Candolle's original description, Gussone contributes the necessary information: "floribus albidis . . . corollae albae, antheris violaceis" (Fl. Siculae Synop. 2:526, 1843).

In 1965 I collected an *Echinops* from a population on a rocky hillside on Samos and found the flowers to be white, the phyllaries green. *E. creticus* Boiss. (1849), included in *Flora Orientalis* in *E. viscosus* and regarded by Davis (1953) as synonymous with subsp. *viscosus*, was described by Boissier as "floribus albidis". A Davis specimen from Antalya in SW Anatolia (*D.* 14218) bears the remark "Flowers white, rarely pale blue". All this seems good evidence for the statement that *E. viscosus* subsp. *viscosus* in Sicily, Crete, Samos and parts of S Turkey has white flowers. *E. viscosus* subsp. *bithynicus* from NW Turkey has according to Boissier's description of *E. bithynicus* "capitulis caerulescentibus" (Diagn. 1, 6:100, 1845).

Rechinger (1952) discussing Samuelsson's plants of Palestine and Transjordan says: "*E. viscosus* ist bekanntlich eine sehr polymorphe Art, deren Verhältnis zu den nächst verwandten Arten, wie z.B. *E. Gaillardotii* Boiss. und *E. Blancheanus* Boiss. noch nicht hinreichend geklärt ist. Für die ägäischen Rassen habe ich in *Flora Aegaea* 641 (1943) eine geographische Gliederung versucht. Die palästinensischen Formen scheinen von einander sowohl wie von den ägäischen Rassen verschieden zu sein". Indeed, the two Palestinian species of this group, *E. gaillardotii* Boiss. and *E. adenocaulos* Boiss. are clearly distinct from the Sicilian, Aegean and Turkish plants by their violet heads. The heads of *E. gaillardotii* were originally described by Boissier (1856) as "capitulis violaceis" but, unfortunately, in *Flora Orientalis* this important particular was left out. As to *E. adenocaulos* from Nablus (Palestine), there are no data by Boissier on the colour of the heads.

At present there is no doubt as to the constancy of the head colour in *E. adenocaulos* and *E. gaillardotii*. These two species are common in the vegetation all over the Mediterranean territories of Palestine and well known to local botanists.

A striking *Echinops* taxon was found a few years ago in the northernmost parts of the country (Hula Plain, Dan Valley, Golan). It is a tall thick-stemmed plant with giant heads (8–10 cm in diameter), with white, pale blue or blue flowers. The description of *E. viscosus* var. *macrolepis* Boiss. in the *Supplement* to *Flora Orientalis*, based on plants from S Lebanon and the Beqaa, suits our plants with regard to the size of the heads and of partial involucre as well as in the white to blue flower colour. I propose according it subspecific rank, calling it *E. viscosus* DC. subsp. *macrolepis* (Boiss.) Feinbr. It differs from subsp. *viscosus* and subsp. *bithynicus* in the large heads and in geography. Much more information on the taxa of *Echinops* in the area between N Palestine and S Turkey is needed to decide whether this plant should be accorded the status of a species.

Ecologically the *Echinops* species of Palestine comprise: a, steppe and desert plants in areas with 50–250 mm annual rain (*E. glaberrimus* and *E. polyceras*); b, an endemic confined to sand dunes in the S part of the coastal plain with annual rain ranging from 250 mm to 400 mm (*E. philistaeus*); c, species of the Mediterranean territories, mainly in the hill country with 500–800 (–1000) mm annual rain (*E. adenocaulos* and *E. gaillardotii*). *E. viscosus* subsp. *macrolepis* is apparently connected with areas in which winter temperatures are fairly low, while annual rain amounts are 700–1000 mm.

## Key to the palestinian species of Echinops

1. Compound head 8–10 cm in diameter; partial involucre 3·5–4·5 cm . . . . . 6. *E. viscosus* subsp. *macrolepis*
+ Compound head at most 7 cm in diameter (not including cornigerous phyllaries); partial involucre 1·5–3 cm . . . 2
2. Phyllaries, corolla and anthers bluish-violet . . . . 3
+ Phyllaries pale green or yellowish; corolla white or cream, sometimes faintly pale violet or bluish; anthers greyish-brown or greyish-violet . . . . . 4
3. Base of middle cauline leaves (at least of some of them) widened, forming auricles which are palmately divided down to ½ or at most to ⅔ into triangular spiny-tipped lobes . . 5. *E. gaillardotii*
+ Base of all cauline leaves pinnatisect into linear-subulate spines; sometimes base widened and divided to ¾ into narrow spiny-tipped lobes . . . . . 4. *E. adenocaulos*
4. Lower cauline leaves pinnatilobed; lobes contiguous, ovate-deltoid, dentate, with rounded sinuses and teeth ending in long rigid yellow spines; nerves elevated on lower face. Stems mostly glabrous . . . . . 1. *E. glaberrimus*
+ Lower cauline leaves and lobes not as above. Stems and leaves mostly canescent-arachnoid . . . . . 5

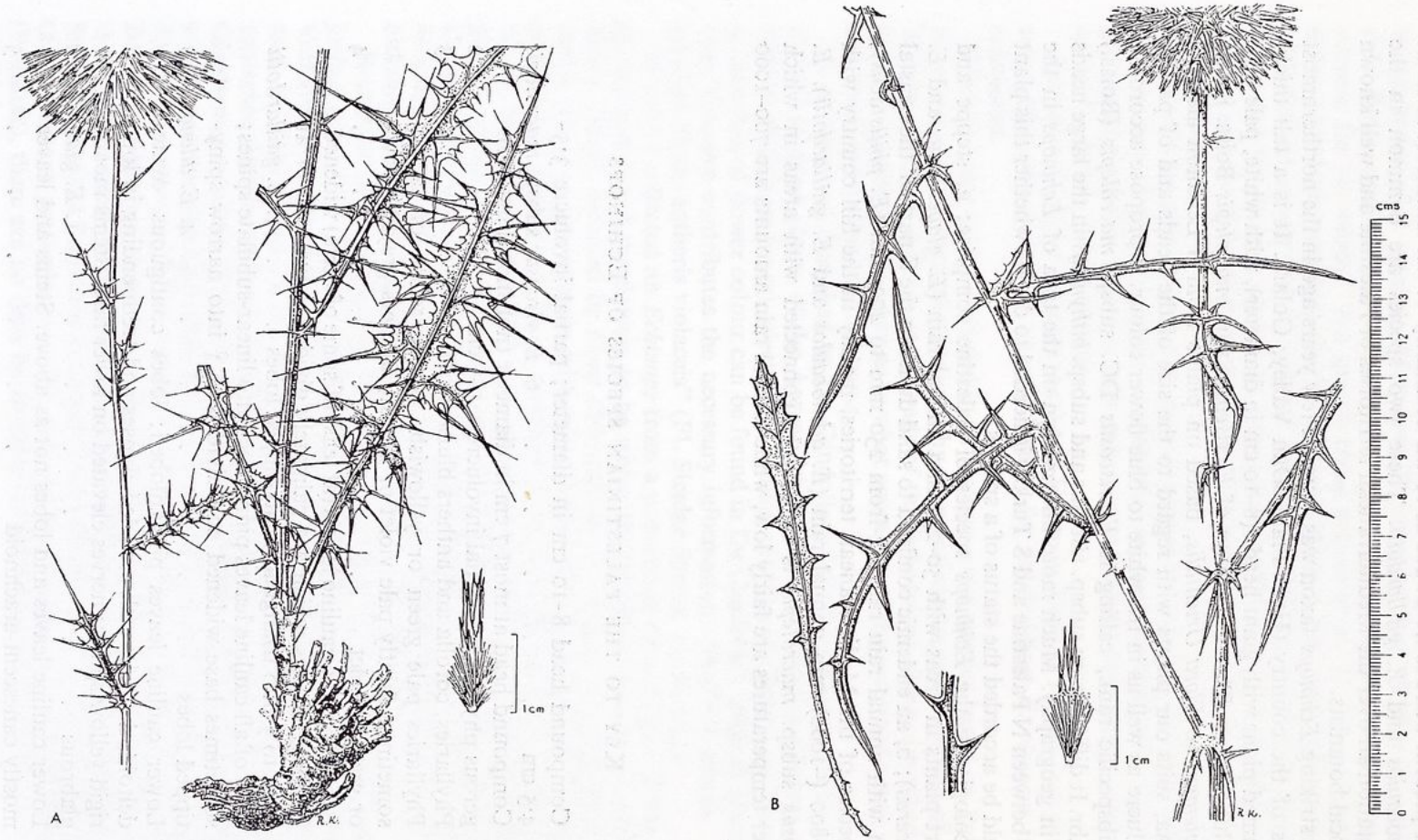


FIG. 1. A, *Echinops glaberrimus* DC., showing basal parts, inflorescence and capitulum. B, *E. philistaeus* Feinbr. & Zohary showing leaves, inflorescence and capitulum.

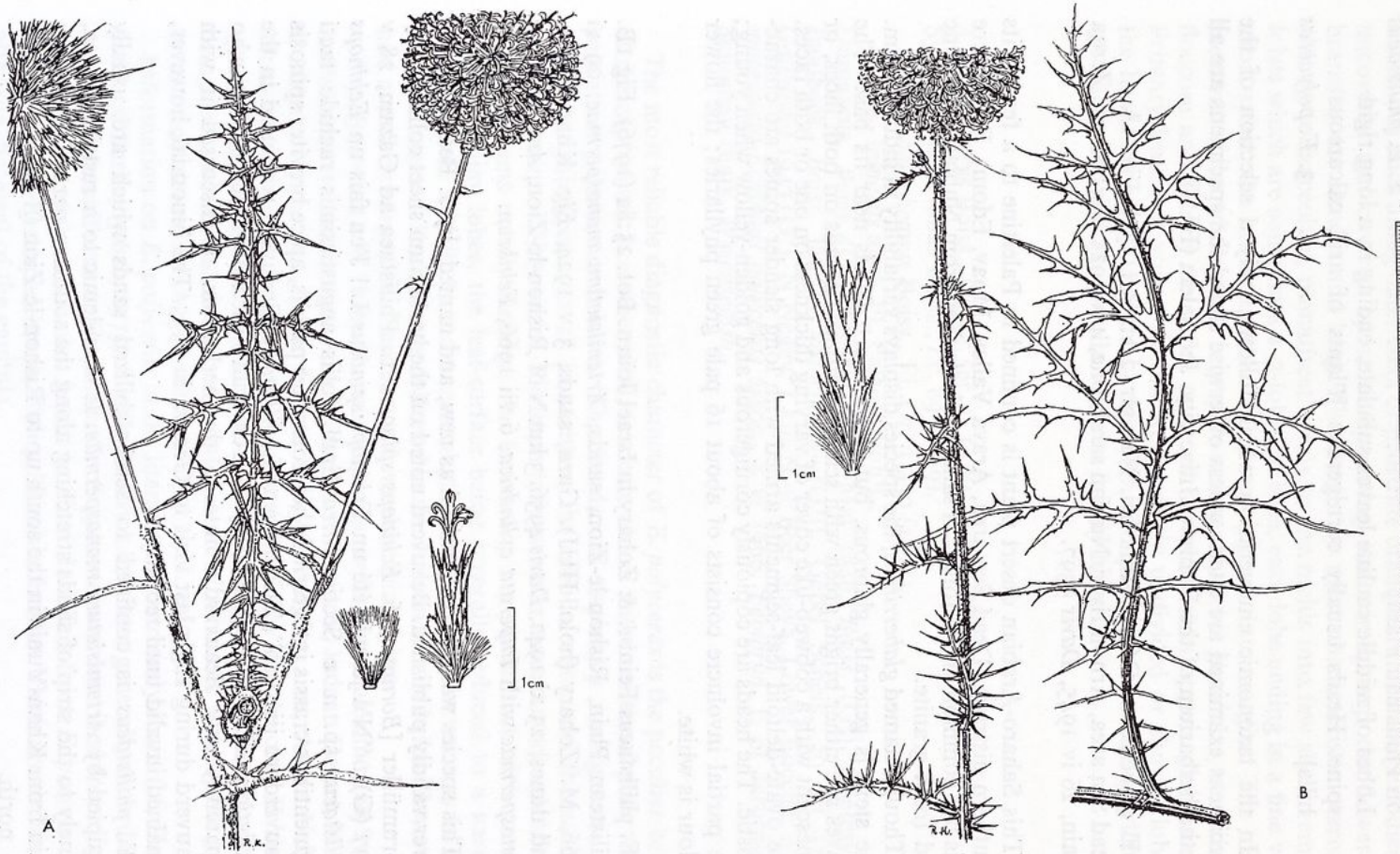


FIG. 2. A, *Echinops polyceras* Boiss. and B, *E. adenocaulos* Boiss. showing leaves, inflorescence, capitulum and brush.

5. Lobes of middle cauline leaves oblong, ending in a short weak spinule. Heads rarely and sparingly cornigerous [Plants of sand on Philistean Plain] . . . . . 2. *E. philistaeus*

\+ Lobes of middle cauline leaves subulate, ending in a long rigid spine. Heads usually cornigerous [Plants of arid calcareous hills] . . . . . 3. *E. polyceras*

In the taxonomic enumeration which follows, only a selection of the specimens examined are cited; unless otherwise stated the specimens are all in the herbarium of the Hebrew University, Jerusalem (HUJ).

**1. E. glaberrimus** DC. in Ann. Sci. Nat. ser. 2,2:260 (1834). Fig. 1A. Dead Sea area, Arnon river, Nubian sandstone, 4 iv 1925, *Eig*; Moav, Zerqa Main, 26 iv 1945, *Davis* 9397.

This Saharo-Arabian desert plant is confined in Palestine to a few of its southern districts (Dead Sea area, Arava Valley, Moav, Edom). Even there it is not common and is found in sandy soils derived from Nubian sandstone and from granite.

Though named *glaberrimus*, the species displays variability in indumentum. The stem is generally glabrous, but bears short glands near its base. The leaves are either bright green with scattered minute glands on both faces, or canescent with a cobweb-like cover of varying thickness on one or both faces. The ovate-deltoid leaf-segments armed with long slender spines are characteristic. The heads are copiously cornigerous and golden-yellow when young; the partial involucre consists of about 16 pale green phyllaries; the flower colour is white.

**2. E. philistaeus** Feinbr. & Zohary in Israel Journ. Bot. 25:82 (1976). Fig 1B. Philistean Plain, Rishon-le-Zion, sands, *Artemisietum monospermae*, 29 vi 1966, M. Zohary (holo. HUJ). Gaza, sands, 3 v 1924, *Eig*. Khan Yunis, sand dunes, 23 xi 1942, *Davis* 4956. 3 km N of Rishon-le-Zion, *Artemisietum monospermae* with *Imperata cylindrica*, 6 vii 1966, *Feinbrun*.

This species was first recognized as new, and named, by J. Beauverd but never validly published. Beauverd noted on the herbarium sheet collected by Bornmüller [*Bornm.* 916. *Echinops spinosus* L. Philistaea ad Gazam, 28 v 1897 (G)]: "N'a jamais été un *Echinops spinosus* L.! J'en fais un *Echinops philistaeus* sp. n. e Sectio *Ritro* Endl. foliis angustissimis rachide tacti segmentibus crassis integerrimis horizontaliter patulis, apice breviter spinosis Beauverd 12 iii 1920". The nomen *E. philistaeus* Beauverd was used in the *Analytical Flora* by Eig, Zohary & Feinbrun based on notes by Eig who apparently saw Beauverd's note in the herbarium or discussed it with Beauverd during Eig's last visit to Geneva in 1935. The binomial, however, remained invalid until recently.

*E. philistaeus* is confined to semi-stabilized sands which are usually occupied by *Artemisietum monospermae*. It is endemic to a restricted area, namely to the strip of sands stretching along the southern part of Philistean Plain from Khan-Yunis in the south up to Rishon-le-Zion (S of Tel-Aviv) in the north.

The general habit of this psammophyte differs from all the other *Echinops* species of our region. It is a chamaephyte prominent by its sprouting from numerous buds along older erect or prostrate branches which are periodically uncovered and covered by sand. Sprouting starts in spring; the flowering branches are slender and long. The leaves are most characteristic: narrow, oblong to lanceolate, pinnatisect nearly to the rachis into few short remote lobes which are sometimes 2–3-lobed at base, each lobe ending in a fine very short spine; the leaves are thick with strongly revolute margins. The indumentum of the whole plant is greyish-arachnoid, never glandular, sometimes floccose and mostly detersile; parts of the plant thus appear glabrescent. Primary leaves of young shoots are generally undivided or shortly lobed; the heads are about 4–5 cm in diameter, rarely cornigerous; the phyllaries are pale green and the corolla white or faintly bluish.

**3. E. polyceras** Boiss., Diagn. ser. 1, 10:85 (1849). Fig. 2A.
Syn.: *E. lasioclinius* Boiss., *l.c.* 89 (1849).
*E. blancheanus* Boiss., Fl. Or. 3:430 (1875).
*E. spinosus* auct. Fl. Palaest. non L.
Damascus, *Boiss.* (G!). Tiberias, Apr.-Mai 1846, *Boiss.* (G!). Caelesyria, Baalbeck, *Boiss.* [as *E. lasioclinius*—(G!)]. Gebel Scheik, 20 vii 1856, *Gaillardot* 1947 (G!). N Negev, 1 km N of Beer Sheva, Lower Eocene, *Noea mucronata-Echinops polyceras* assoc., 8 vi 1966, *Feinbrun*. E of Jerusalem, Senonian chalk, *Weichselfish*.

The most reliable diagnostic character of *E. polyceras* is the peculiar brush of the capitulum. It is obconical, truncate above and consists of pure white persistent paleaceous bristles. The heads are copiously cornigerous, the phyllaries pale green, 22–28 in number, the corolla white and the anthers greyish-brown or dirty violet. The stem-indumentum is arachnoid, eglandular and the stems mostly slender; the leaves are 2–3-pinnatisect with narrow subulate spiny lobes, the leaf-surface being generally reduced to a narrow rim along the midrib. In more mesophytic conditions the leaves may be less deeply dissected. Basal leaves collected in the Judean Desert before flowering had a well-developed leaf-surface with weakly spiny lobes.

*E. polyceras* is a W Irano-Turanian species confined to Palestine and Syria. In Palestine its distribution area comprises E Samaria, Judean Desert, N and C Negev, Upper and Lower Jordan Valley, Dead Sea area, Arava Valley, Moav and Edom. In the Judean Desert and the Negev it is the only *Echinops* species. It grows on arid Senonian or Eocenian chalky hillsides, as a common component of several desert associations of the alliances *Echinopion polyceratis* and *Artemision herbae-albae* (Danin et al., 1975).

Information on *E. polyceras* in the literature is extremely scant (cf. Hedge in Fl. of Turkey 5:620, 1975). Until recently it has been generally recorded as *E. spinosissimus* Turra or *E. spinosus* L. *E. spinosus* was described from Egypt (Mant. 119, 1767), and is also found in Sinai. It differs from *E. polyceras* in its lax irregularly shaped brush of dirtyish-white bristles which are deciduous after the dispersal of the capitula.

**4. E. adenocaulos** Boiss., Diagn. ser. 1, 10:88 (1849). Fig. 2B.
Syn.: *E. macrochaetus* Boiss., *l.c.* 85 (1849) non Fresen.
*E. viscosus* sensu Boiss., Fl. 3:429 quoad pl. palaest. non DC.
Samaria, Naplouse, Apr.-Mai 1846, *Boiss.* (lecto.—designated here, G!). Samaria, Wadi Fara, NE of Nablus, 170 m, N slope, 26 vi 1934, *Eig, Feinbrun & Zohary*. Mt Gilboa near Yesreel, hillslope, among rocks, 17 iv 1966, *Grizi*. Jerusalem, near University Campus, *Poterietum spinosi*, terra rossa, 9 vi 1966, *Feinbrun*. Hebron, batha, *Poterietum spinosi*, terra rossa, 28 vii 1967, *Danin*. Tel Aviv to Ramath Gan, Yarkon bridge, wet sandy loam, 6 vii 1966, *Feinbrun*.

Both *E. adenocaulos* Boiss. and *E. gaillardotii* Boiss. are conspicuous among other Palestinian *Echinops* species by the striking deep bluish-violet colour of their heads. Both grow in abundance all over the Mediterranean territories of the country, from Judea and Moav in the south to Golan and Dan Valley in the north and they are prominent members of the summer landscape (June to July) against the yellow background of dried grasses, especially *Avena sterilis*. The colour of the heads is due to the coloration of both phyllaries and corolla; the anthers are of a deeper violet and the heads of *E. adenocaulos* are usually cornigerous; the height of the plants is 50–80 (–120) cm. Stem-indumentum presents a wide range of variability. In Boissier's type specimen from Naplouse, the stem is dark-red with dense dark-red glandular hairs. However, observation of populations, especially around Jerusalem, showed that stem-indumentum in this species varies widely from densely white-lanate with or without red hairs or bristles to a cover of sparse or dense red bristles. Such a variation range is often found within and between populations. The leaves are 2–3-pinnatisect armed with strong spines and have narrow ultimate lobes and narrow rachis.

*E. adenocaulos* is widespread in Judea and Samaria. Its main habitat there is batha and stony ground with terra rossa. In districts north of Samaria, especially in Eastern Galilee and Upper Jordan Valley, it grows as a rule in more arid habitats, such as basalt soils, Pleistocene chalk and among hard rocks on slopes overlooking Upper Jordan Valley. On terra rossa it is generally replaced from Mt Carmel northward by *E. gaillardotii*.

**5. E. gaillardotii** Boiss., Diagn. ser. 2,3:38 (1856); Boiss., Fl. Or. 3: (1875). Fig. 3.
Lebanon, Saida, 10 vii 1856, *Gaillardot* 1941 A (lecto.—designated here, G!). Beitmeri, 19 viii 1881, *Peyron* 1387 (G!). Upper Galilee, Ayelet Hashachar, Pleistocene hill, 7 vii 1967, *Feinbrun*. Between Rosh Pinna and Zefat, terra rossa 29 vi 1966, *Grizi*. Mt Carmel, Zichron-Yaacov, maquis border, 6 vii 1966, *Feinbrun*.

Apart from the deep violet heads ("Capitulis violaceis"—Boissier) in which respect this species is similar to *E. adenocaulos*, it also has a diagnostic feature in the shape of the leaf-bases. Cauline leaves, lanceolate or ovate, have a peculiar widened leaf-base forming auricles to the leaf; the leaf-base may be dentate or palmately lobed or -partite, but usually not divided beyond its upper half (rarely in the upper 2/3). Leaves are 2-pinnatisect leaving an area of green tissue along the midrib. The indumentum of the lower leaf-surface

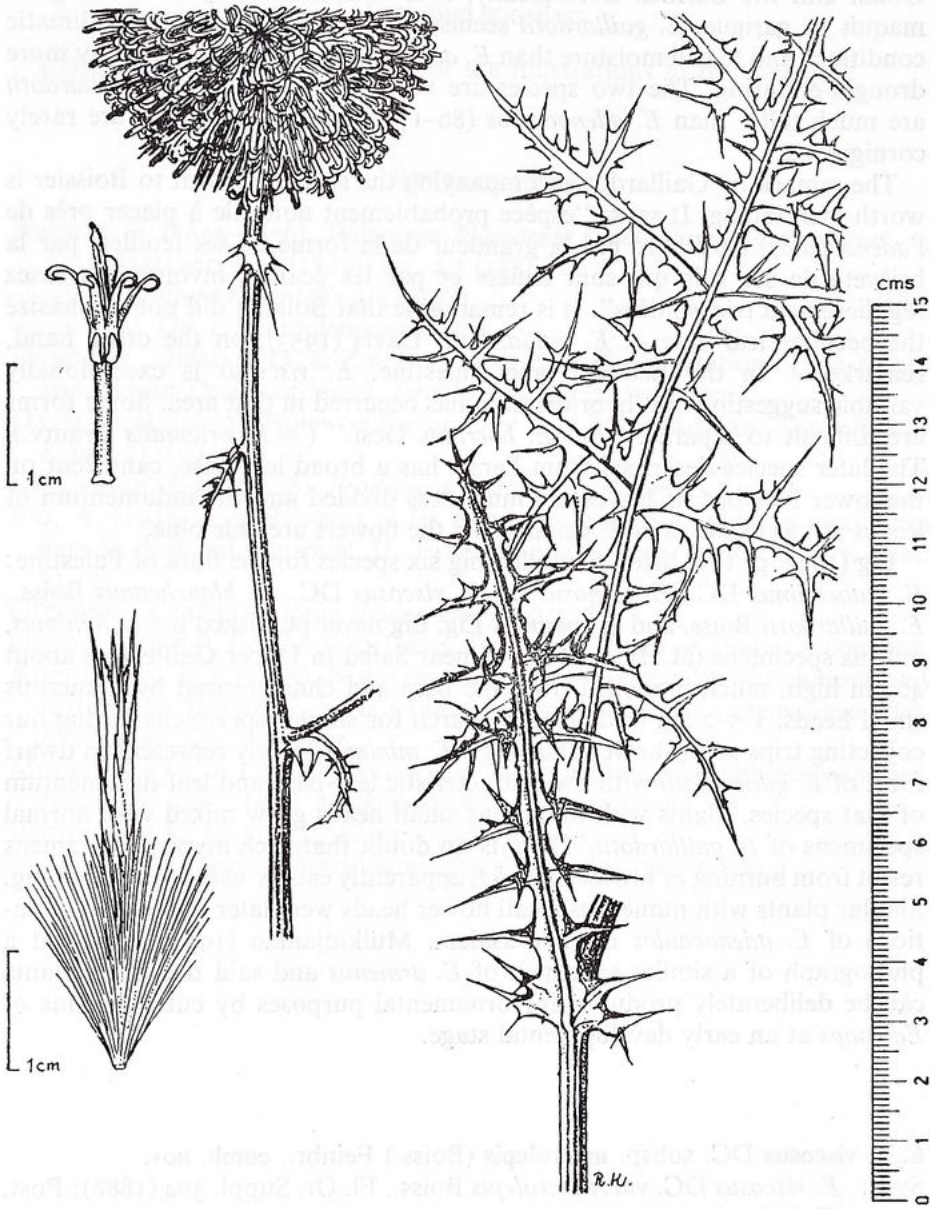


FIG. 3. *Echinops gaillardotii* Boiss. showing leaves, inflorescence, flower and capitulum.

is also characteristic: a short white tomentum densely matted and completely smooth. On the other hand the indumentum of the stem varies from densely cobwebbed or tomentose to non-tomentose, with glandular or non-glandular hairs varying in amount.

Boissier described *E. gaillardotii* from Gaillardot's specimens collected near Saida (coast of S Lebanon). In Israel it has been collected and observed in an area adjacent to the Lebanon, comprising mainly Upper and Lower Galilee,

Golan and Mt Carmel. Ecologically, it is confined chiefly to clearings in maquis or garigue. *E. gaillardotii* seems to be more demanding to climatic conditions and to soil moisture than *E. adenocaulos* which is apparently more drought-enduring. The two species are vicariants. Plants of *E. gaillardotii* are much taller than *E. adenocaulos* (80–170 cm), and the heads are rarely cornigerous.

The remark by Gaillardot accompanying the specimens sent to Boissier is worth mentioning. It says: "espèce probablement nouvelle à placer près de l'*adenocaulos*! en diffère par la grandeur de la forme de ses feuilles, par la brièveté de ses sois qui sont rousse et par les écailles involucrales assez régulierement tricuspidées". It is remarkable that Boissier did not emphasize the peculiar leaf-base of *E. gaillardotii*. Davis (1953), on the other hand, remarked: "In the Lebanon and Palestine, *E. viscosus* is exceptionally variable suggesting that hybridization has occurred in that area. Some forms are difficult to separate from *E. horridus* Desf." (=*E. orientalis* Trautv.). The later species described from Persia has a broad leaf-base, canescent on the lower face but its leaves are much less divided and the indumentum of leaves not as dense as in *E. gaillardotii*; the flowers are pale blue.

Eig (1932, p. 113) listed the following six species for the flora of Palestine: *E. glaberrimus* DC., *E. spinosus* L., *E. viscosus* DC., *E. blancheanus* Boiss., *E. gaillardotii* Boiss. and *E. minimus* Eig. Eig never published his *E. minimus*, but his specimens (at HUJ) collected near Safed in Upper Galilee are about 40 cm high, much branched from the base and characterized by numerous small heads, 1·5–2 cm in diameter. Search for similar specimens during our collecting trips soon showed that Eig's *E. minimus* merely represents a dwarf form of *E. gaillardotii* with the characteristic leaf-base and leaf-indumentum of that species. Plants with numerous small heads grow mixed with normal specimens of *E. gaillardotii*. There is no doubt that such atypical specimens result from burning or browsing which apparently causes excessive branching. Similar plants with numerous small flower heads were later found in populations of *E. adenocaulos* near Jerusalem. Mulkidjanian (1951) published a photograph of a similar specimen of *E. armenus* and said that such plants can be deliberately produced for ornamental purposes by cutting stems of *Echinops* at an early developmental stage.

**6. E. viscosus** DC. subsp. **macrolepis** (Boiss.) Feinbr., **comb. nov.**

Syn.: *E. viscosus* DC. var. *macrolepis* Boiss., Fl. Or. Suppl. 304 (1888); Post, Fl. Pal. ed. 2, 2:75 (1932).

Hula Plain, Shamir, 25 viii 1968, *Zohary & Peri*. Dan Valley, E branch of the Jordan, 10 viii 1971, *Peri*. Golan, 2 kms NW of Banias, 700 m, 20 vi 1973, *Shmida*.

This taxon was described by Boissier as var. *macrolepis* from Abeih and Schtora (*Schweinfurth* 968 & 969—G!) and from Bscherre (*Kotschy* 760—G!) in the Lebanon. Photographs of subsp. *macrolepis* in a population near Shamir (Hula Plain) were taken and kindly shown to me by Mr A. Shmida. On them the giant heads can be seen with white to bluish corolla-lobes and a purplish corolla-tube; the phyllaries also are purplish.

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