

A TAXONOMIC SURVEY OF ECHINOPS L. TRIBE ECHINOPEAE (ASTERACEAE) IN IRAN: 14 NEW SPECIES AND DIAGNOSTIC KEYS

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Fourteen new species of *Echinops* (viz. *Echinops abazariae*, *E. austro-iranicus*, *E. avajensis*, *E. delicatus*, *E. kazerunensis*, *E. kermanshahnicus*, *E. khansaricus*, *E. khuzistanicus*, *E. laricus*, *E. leiopolyceroides*, *E. psammophilus*, *E. sabzevarensis*, *E. shulabadensis* and *E. viscidulus*) are described and illustrated. Notes on the taxonomic characteristics of the genus, and a revised diagnostic key to the species of *Echinops* L. are given. The new described species belong to Sect. *Oligolepis* Bunge, and Sect. *Rytrodes* Bunge, and are endemic to Iran.

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Key words. *Echinops*, *Asteraceae* description, geographical distribution, diagnostic key, Sect. *Oligolepis*, Bunge, Sect. *Rytrodes* Bunge, taxonomy, Iran.

نگرش تاکسونومیک بر جنس *Echinops* L. از قبیله *Echinopeae* و تیره *Asteraceae*

در ایران، ۱۴ گونه جدید و کلید شناسایی

ولی‌اله مظفریان

در میان جنس‌های تیره *Asteraceae* جنس *Echinops* L. در ایران از وسعت و دامنه گسترش جغرافیایی زیادی برخوردار است و در عین حال اطلاعات گیاهشناسی در مورد آن منحصر به چند مقاله و فلورا ایرانیکا می‌باشد. در طی سالها مطالعه گیاهشناسی، این جنس مورد توجه مؤلف بوده و در یک کار منسجم مورد بررسی و بازنگری تاکسونومیکی قرار گرفته است. در این مقاله با نگاهی به صفات و خصوصیات تاکسونومیکی این جنس، کلید شناسایی بخش‌ها و کلید شناسایی گونه‌های آن ارائه می‌گردد. در ضمن چهارده گونه جدید از این جنس که متعلق به Sect. *Oligolepis* Bunge و Sect. *Rytrodes* Bunge می‌باشند به جهان گیاهشناسی معرفی می‌گردد. نامهای گونه‌های جدید که به مجموعه نامهای ۵۴ گونه‌ای فلورا ایرانیکا از ایران اضافه می‌گردد عبارتند از:

Echinops abazariae Mozaff., *E. austro-iranicus* Mozaff., *E. avajensis* Mozaff., *E. delicatus* Mozaff., *E. kazerunensis* Mozaff., *E. kermanshahanicus* Mozaff., *E. khansaricus* Mozaff., *E. khuzistanicus* Mozaff., *E. laricus* Mozaff., *E. leiopolyceroides* Mozaff., *E. psammophilus* Mozaff., *E. sabzevarensis* Mozaff., *E. shulabadensis* Mozaff., *E. viscidulus* Mozaff.

در ضمن یادآوری می‌نماید که چهار گونه از این جنس در مجلات علمی گیاهشناسی بچاب رسیده که تعداد گونه‌های این جنس در ایران را به ۷۰ گونه ارتقاء می‌دهد، که نامهای آنها عبارتست از:

E. longipenicillatus Mozaff. & Ghahr., *E. procerus* Mozaff., *E. shahrudensis* Mozaff. & Ghahr., *E. taftanicus* Mozaff. & Ghahr.

در ضمن اطلاعات ارائه شده در متن مقاله به‌مراه گونه‌های معرفی شده در فلور ایران به زبان فارسی قبیله *Echinopeae* ارائه شده است.

INTRODUCTION

Echinops L. (*Asteraceae*) is one of the most problematic genera of the Iranian flora. It shows a predominantly Irano-Turanian and Sudano-Zambezian distribution which penetrate into the Mediterranean and Euro-Siberian regions. Most species are prevalent in secondary plant communities as ruderal species along roads and degraded lands, and rarely do they occur in climax natural vegetation. The genus was reviewed by von Bunge (1863), Boissier (1875), and Bornmüller (1918). According to Rechinger (1979) a total of 74 species have been recorded from the Flora Iranica area, of which 54 species including 35 endemics were known from Iran. The Iranian species are classified into three sections: *Echinops*, *Oligolepis* Bunge and *Rytrodes* Bunge, among which Sect. *Oligolepis* with 27 species is the largest one in Iran.

As pointed out by Rechinger there are great difficulties in identifying most species because of variability in morphological characters and due to the prickliness of the species. Usually most botanists avoid to collect such very spiny and tall-growing plants. Many herbarium specimens are only fragmentary or are young specimens lacking most of the important taxonomic features. Also the fully grown plants are extremely difficult to handle, because the heads readily break down. Rechinger (1979) remarks that many specimens gathered by early collectors lack capitula.

In order to do a taxonomic survey of *Echinops* L. in Iran all specimens deposited in herbaria of Research Institute of Forests and Rangelands (TARI) and of Plant Pests and Diseases Research Institute (IRAN) in Tehran were examined. Because of poor collections of the genus *Echinops* there, a comprehensive plant collection was undertaken for 90 days in 1998-99. In order to provide a better knowledge of the taxonomy of the genus, in

addition to the characters previously considered by taxonomists some new features have been taken into consideration.

It was attempted to collect most of the species from the already known and recorded localities. Many of the critical groups were examined during field studies. A total of 2000 specimens have been collected and studied. A large part of these collections is currently preserved in TARI. According to this study a total of 70 species of *Echinops* growing in Iran, which are belonging to 3 different sections; 40 species of them belong to Sect. *Oligolepis* Bunge, of which 27 species were already accounted for in the Flora Iranica, and 17 species belong to Sect. *Rytrodes* Bunge of which 14 species were already accounted for in the Flora Iranica, 13 species belong to Sect. *Echinops* of which were already accounted for in the Flora Iranica. Previously species have already been described by the author (Mozaffarian & Ghahreman 2002a, 2002b). This paper completes the survey of *Echinops*, including an identification key to all species, and further describes 14 new species.

NOTES ON THE TAXONOMIC CHARACTERS AND THEIR VARIATION

Life form

All members of *Echinops* are perennial, but some species, including *E. delicatus* Mozaff., *E. polygamus* Bunge, *E. ecbatanus* Bornm. ex Rech. f. and *E. khuzistanicus* Mozaff., may bear flowers in the first year, and so they may look like pseudo-annuals.

Habit

Most *Echinops* species have erect, ascending stems with divaricate branches which arise from the base or from the upper part of the stem. Some many-stemmed species such as *E. ritrodes* Bunge, *E. macrophyllus* Boiss. & Hausskn. and *E. procerus* Mozaff., or prostrate ones such as *E. cephalotes* DC. are also known in this genus.

Due to the variability of habits and branching systems there are no good taxonomically important differences between the species.

Indumentum

The type and abundance of indumentum on stems, leaves and phyllaries are among the most important taxonomic characters in the genus. Most *Echinops* species have various kinds of hairy stems, such as arachnoid-tomentose, arachnoid-setose, glandulose-villose, glandulose-araneose, glandulose-papillose, arachnoid-glandulose and crisped-glandulose hairs; exceptions are *E. heteromorphus* Bunge, *E. shahrudensis* Mozaff. & Ghahr., *E. procerus* Mozaff. and *E. taftanicus* Mozaff. & Ghahr. with stems glabrous below and hairy in upper parts, or wholly glabrous as in *E. ilicifolius* Bunge.

The indumentum of the upper surface of leaves provides a taxonomically useful character. Whereas in many species the indumentum of the upper and lower surfaces are quite different and the leaves seem to be bicolor, various kinds of hairs can be observed on the upper surface such as arachnoid, arachnoid-tomentose, glandulose-setose, glandulose-punctate and arachnoid-floccose, on the contrary, the lower surface may be dense white tomentose, and without great taxonomic relevance. There are some distinct species with dense white indumentum around nerves on the upper surface, so called 'marmorate hairy' such as *E. shahrudensis* Mozaff. & Ghahr., *E. lalesarensis* Bornm., *E. austro-iranicus* Mozaff., *E. jesdianus* Boiss. & Buhse, *E. villissimus* Bunge, *E. leucograpuhs* Bunge; exceptions are *E. ilicifolius* Bunge and *E. cyanocephalus* Boiss. & Hausskn. with a single colour and mostly glabrous leaves on the upper and lower surfaces.

Leaves

The shape and size of leaves can be used for specific distinction in several species. There

are mostly 2-4 pinnatisect or pinnatipartite leaves, with impressed nerves on the upper surface and prominent on the lower. Some species, such as *E. ilicifolius* Bunge, *E. lasiolepis* Bunge, *E. laricus* Mozaff., *E. iranshahri* Rech. f., *E. shulabadensis* Mozaff. have sinuate-dentate leaves.

Inflorescence

Single-flowered capitula are congested into globose heads (synflorescence) around a globose receptacle subtended by small membranaceous bracts which are called 'common involucre'. These heads may be homomorphous (i. e., consisting of lower and upper homogamous, hermaphrodite, non-cornigerous or equally cornigerous capitula), heteromorphous and heterogamous (consisting of lower hermaphrodite fertile flowers and sterile cornigerous flowers in the upper part of the heads).

Having a cornigerous or non-cornigerous capitulum is taxonomically important for including different species into distinct groups. (plate 1. C, D)

Capitulum

Each capitulum consists of only one flower subtended by 4 series of phyllaries. The outermost ones are changed into brushes, and the innermost series of brushes becomes wider and coloured at the top called "intermediate pappus (pseudopappus)" (plate 1. A, it is neither really brushes nor phyllaries); the outer and middle series of phyllaries have different shapes, which may be linear, lanceolate, ovate, elliptic, etc., membranaceous or not. In cornigerous species the middle series of phyllaries is well developed and changed into horns (plate 1. B). The 5 innermost layers of phyllaries are connected to each other and cover the achenes in Sect. *Oligolepis* (plate 1. E). The position of different kinds of capitulum as to their indumentum (the upper one hairy, the lower glabrous, or vice-versa, or

wholly glabrous) is a very important taxonomic factor in distinguishing the different groups and species of *Echinops*.

Receptacle

The globose receptacle is concealed by the capitulum, which after falling, remains the scars of fallen capitulum on the receptacle. The shape of receptacle and scars are not taxonomically important (plate 1. F).

Flowers

They are hermaphrodite or sterile, tubular blue to white, similar in most species, thus taxonomically unimportant.

Achenes

The achenes are oblong-cylindrical, densely villous, with coroniform short pappus which are more or less connate or free scale-like. Achenes are taxonomically relevant for separating the sections, but not important for separating the rank of different species.

DIAGNOSTIC KEY TO THE SECTIONS OF ECHINOPS L. IN IRAN

1- Phyllaries (12-)13-16 (-20); five inner phyllaries connate, making a prominent five angled tube

Sect. *Oligolepis* Bunge

-Phyllaries 15-30; five inner phyllaries entirely free or slightly connate, then producing a cylindrical membranaceous tube 2

2- Phyllaries 15-28; five inner phyllaries free

Sect. *Echinops*

- Phyllaries 16-30; five inner phyllaries connate at base or to the middle, forming a membranaceous tube **Sect. *Rytrodes*** Bunge

DIAGNOSTIC KEYS AND NEW SPECIES

Sect. *Oligolepis* Bunge, Bull. Acad. Scienc. Petersbg 6: 403 (1863).

Type section: *E. leucographus* Bunge

1- Heads non cornigerous 2

- Heads consisting of lower and upper cornigerous capitula or only upper capitula cornigerous 12

2- Phyllaries of lower and upper capitula of a head lanate 3

- Phyllaries of lower and upper capitula of a head glabrous or only upper ones lanate 6

3- Leaves arachnoid above and distinctly marbled **30. *E. leucographus*** Bunge

- Leaves arachnoid or subglabrous above, not marbled 4

4- Outer and median phyllaries of a capitula lanate **31. *E. hebelepis*** DC.

- All phyllaries of a capitula lanate 5

5- Upper surface of leaves sparsely arachnoid, densely setose-glandulose

33. *E. khuzistanicus* Mozaff.

- Upper surface of leaves arachnoid-tomentose, **32. *E. shulabadensis*** Mozaff.

6- Phyllaries of Lower capitula of a head glabrous, upper ones lanate 7

- Phyllaries of Lower and upper capitula of a head glabrous 8

7- Upper surface of leaves greenish-yellow, densely setose and stipitate glandulose

34. *E. delicatus* Mozaff.

- Upper surface of leaves arachnoid and setose, sparsely glandulose-villose

35. *E. polygamus* Bunge

8- Lower and upper surface of leaves rarely somewhat concolour. Lower capitula of a head thick, ± 30 mm long, deeply blue to violet; upper capitulum in young heads with long phyllaries, very rarely cornigerous

39. *E. cyanocephalus* Boiss. & Hausskn.

- Lower and upper surface of leaves distinctly discolour; lower capitulum of a head less than 30 mm long; heads non cornigerous 9

9- Plant 10-40 cm high; all leaves olive green or yellowish-green above, arachnoid-tomentose and sparsely setose

36. *E. ecbatanus* Bornm. ex Rech. f.

- Plants more than 30 cm high; leaves sparsely arachnoid to marbled above or not 10

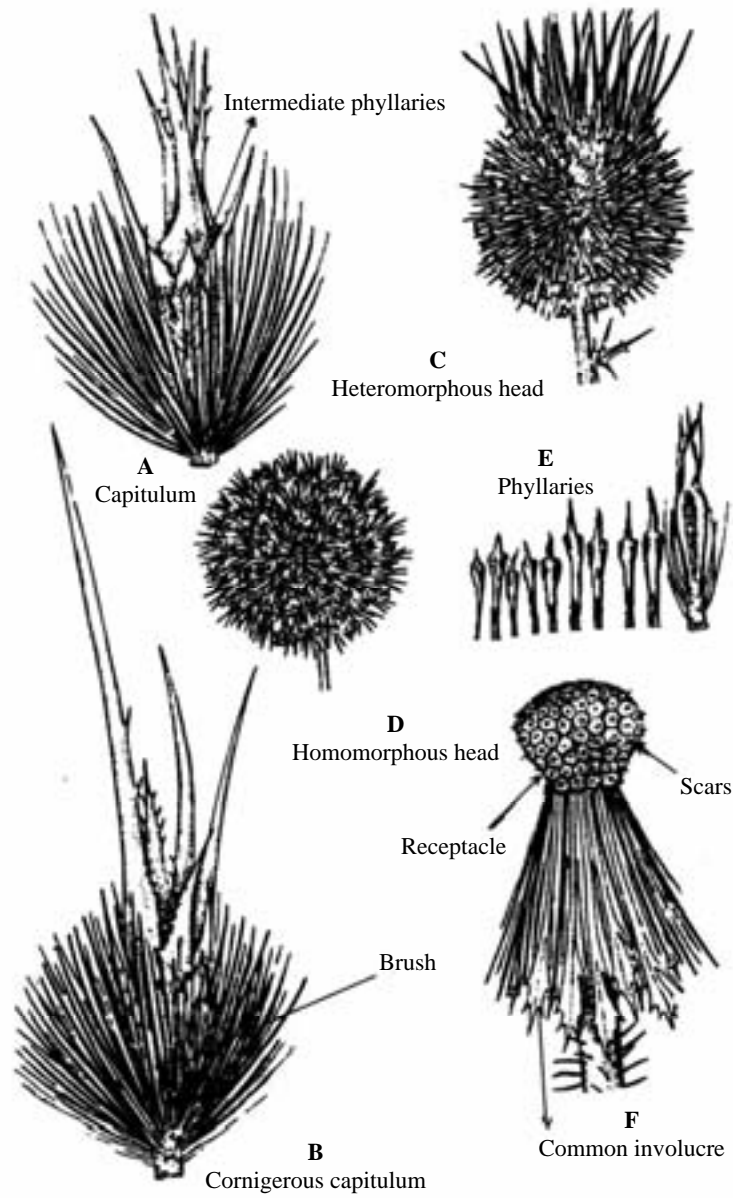


Plate 1, A, B. Single non cornigerous and cornigerous capitulum; C, D. Heteromorphous and Homomorphous heads; E. Phyllaries in a cappitulum of *Echinops* Sect. *Oligolepis*; F. Receptacle, scars and common involucre.

10- Leaves appressed greyish-green tomentose and brownish glandulose punctate above and marbled

40. E. glanduloso-punctatus Rech. f.

- Leaves not glandulose punctate above 11

11- Leaves yellowish green to dark green above, setose-glandulose to arachnoid-setose-glandulose; brush longer than half of the capitulum

37. E. haussknechtii Boiss.

- Leaves yellowish-green above, very sparsely arachnoid, glandulose-setose; brush ± equal to capitulum

38. E. chorassanicus Bunge

12- Phyllaries of lower and upper capitula of a head lanate 13

- Phyllaries of lower capitula of a head glabrous, in upper cornigerous capitula lanate, lanatulate or glabrous 20

13- Heads consisting of lower and upper capitula equally cornigerous 14

- Heads consisting of lower non cornigerous and upper cornigerous capitula 16

14- Heads hardly dehiscent; lower and upper surface of leaves bicolor 15

- Heads easily dehiscent, upper and lower surface of leaves concolor; brush with few setae, often remaining on the receptacle

3. E. lasiolepis Bunge

15- Plant ascendent; lower and upper cauline leaves amplexicaul

2. E. robustus Bunge

- Plant usually prostrate on the ground; lower leaves narrowing towards the base and auriculate, upper ones amplexicaul

1. E. cephalotes DC.

16- Leaves yellowish green, glandulose-pilose above or sparsely arachnoid to ± marbled along nerves; outer phyllaries of lower and upper capitula of a head lanulate

21. E. lalesarensis Bornm.

- Leaves arachnoid, or glandulose setose, or glandulose above, but not marbled; outer phyllaries of lower and upper capitula of a head lanate 17

17- Horn of cornigerous capitula glabrous; 5 inner connate phyllaries glabrous or lanate 18

- Horn of cornigerous capitula lanate; 5 inner connate phyllaries lanate 19

18- Leaves greyish-green above, wholly arachnoid-tomentose; 5 inner connate phyllaries glabrous

8. E. khansaricus Mozaff.

- Leaves greenish above, densely glandulose – papillose; 5 inner connate phyllaries lanate

9. E. iranshahri Rech. f.

19- Leaves brownish-green above, loosely glandulose-villose; stem 50-60 cm high, much branched above. Horn of cornigerous capitulum lanate throughout

6. E. erioceras Bornm.

- Leaves loosely arachnoid-tomentose and densely glandulose-setose above. Horn of cornigerous capitulum yellowish-white and glabrous at apex

7. E. elymaiticus Bornm.

20- Phyllaries of cornigerous capitula lanate, (rarely glabrous in *E. gedrosiacus* var. *glabrus* Mozaff.) 21

- Phyllaries of non cornigerous and cornigerous capitula glabrous 33

21- Leaves arachnoid or glandulose setose above, but not marbled along nerves 22

- Leaves arachnoid above or glandulose-papillose, prominently marbled along nerves 24

22- Stem and leaves glandulose or setose-glutinose-viscid

12. E. viscidulus Mozaff.

- Stem and leaves loosely arachnoid or glandulose-setose, but not viscid 23

23- Leaves dark green above, rather loosely arachnoid, and shortly spreading setose, with ± glabrous nerves

11. E. keredjensis Rech. f.

- Leaves yellowish-green above, loosely arachnoid, and with ± yellowish setose nerves

10. E. kazerunensis Mozaff.

24- Stems glabrous at least below 25

- Stems arachnoid, glandulose-papillose or arachnoid floccose 26

25- Leaves green, glandulose-papillose above, rarely along nerves marbled then loosely arachnoid above; phyllaries of sterile cornigerous and delicate capitula of a head lanate

13. E. heteromorphus Bunge

- Leaves grayish, wholly arachnoid above, marbled along nerves; phyllaries of sterile cornigerous capitula arachnoid

14. E. shahrudensis Mozaff. & Ghahr.

26- Brush equal to or longer than capitulum

24. E. villosissimus Bunge

- Brush shorter than capitulum 27

27- Lower cauline leaves large simple lanceolate, sessile, \pm amplexicaul, or with few lobes or coarsely dentate 28

- Lower cauline leaves pinnatisect to bipinnatisect 30

28- Stem glandulose; phyllaries of upper capitula of a head lanate 29

- Stem without glandular hairs, arachnoid-floccose or whitish tomentose; phyllaries of upper capitula of a head lanate to glabrous

17. E. gedrosiacus Bornm.

29- Lower cauline leaves large simple lanceolate with few teeth

19. E. laricus Mozaff.

- Lower cauline leaves lanceolate with numerous teeth

18. E. austro-iranicus Mozaff.

30- Leaves glandulose or setose above, arachnoid or marbled along nerves 31

- Leaves arachnoid above, conspicuously marbled along nerves, without glandulose hairs, setose or non-setose 32

31- Basal leaves narrowly long-lanceolate, pinnatisect, all leaves yellowish setose above, just along nerves loosely arachnoid to marbled

20. E. ceratophorus Boiss.

- Basal leaves lanceolate in outline, pinnatisect or bipinnatifid, all leaves glandulose above, somewhat loosely arachnoid, along nerves arachnoid or marbled

21. E. lalesarensis Bornm.

32- Horn of cornigerous capitulum deep blue. Upper cauline leaves pinnatisect, with small lanceolate-triangular segments

22. E. farsicus Rech. f.

- Horn of cornigerous capitulum yellowish white or pale blue. Upper cauline leaves amplexicaul and with remote long spiny segments **23. E. jazdianus** Boiss. & Buhse

33- Lower and upper capitula of a head equally short cornigerous 34

- Only upper capitula of a head cornigerous 35

34- Upper and lower surfaces of leaves bicolour **4. E. sabsevarensis** Mozaff.

- Upper and lower surfaces of leaves concolour. Brush with few seta, often remaining on the receptacle

5. E. ilicifolius Bunge

35- Stems at least in lower part glabrous 36

- Stems with various shape of indumentum 37

36- Leaves yellowish-green above, mainly glabrous or loosely glandulose above, then along nerves whitish marbled

16. E. taftanicus Mozaff. & Ghahr.

- Leaves yellowish green above, glabrous or loosely arachnoid, but not marbled along the nerves **15. E. procerus** Mozaff.

37- Brush longer than capitulum

25. E. longipenicillatus Mozaff. & Ghahr.

- Brush shorter than capitulum 38

38- Leaves entire or obscurely to broadly sinuate-dentate **29. E. pabotii** Rech. f.

- Leaves 1-2 pinnatisect, arachnoid glandulose to setose above 39

39- Stem up to 40 cm high; leaves arachnoid-glandulose and glandulose-villose above

26. E. avajensis Mozaff.

- Stem more than 50 cm tall 40

40- Leaves sparsely arachnoid and long glandulose setose above, deeply and narrowly dissected **27. E. leiopolyceras** Bornm.

- Leaves very sparsely arachnoid to non arachnoid above, densely glandulose setose, shallowly dissected and yellowish nerved

28. E. leiopolyceroides Mozaff.

New species of Echinops L. Sect. Oligolepis Bunge

Echinops austro-iranicus Mozaff., **sp. nov.**; (Fig. 1)

Planta perennis. Caulis erectus, usque ad 80 cm altus, plus minusve sulcatus, dense araneoso-glandulosus, supra medium paniculato-ramosus, tota longitudine copiose

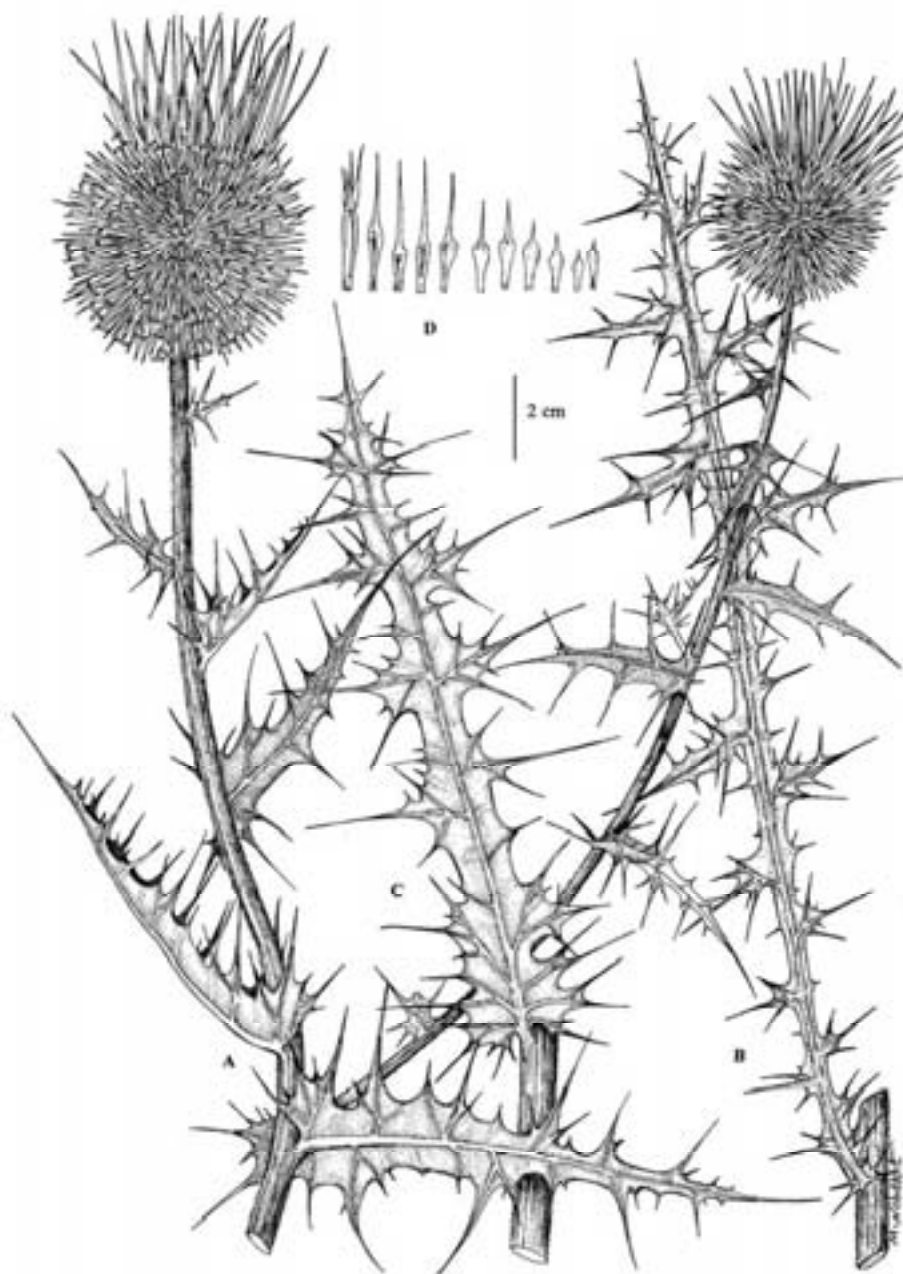


Fig. 1. *Echinops austro-iranicus*. A, flowering branch; B, lower cauline leaf; C, upper cauline leaf; D, phyllaries (from outer to inner, right to left); (Mozaffarian 79373).

foliatus. Folia omnia herbaceo-coriacea, supra dense araneosa et flavescens-setosa, secus nervos appresse araneoso-lanata et albomarmorata, subtus dense albo-araneoso-lanata; folia basalia ignota; caulina basalia ambitu lanceolata, 20-28 cm longa et 4-5 cm lata, pinnatisecta; segmenta majora 5 juga, plus minusve inter se remota; rhachis anguste alata; segmenta inferiora interdum plus minusve libera, ad spinas reducta; folia caulina inferiora sessilia, ambitu lanceolata, pinnatisecta; segmenta plus minusve triangularia, crebre flavescens-spinosa; folia caulina superiora et ramos fulcrantia foliis inferioribus similia sed minora, amplexicaulia, plus minusve auriculata, auriculis plus minusve dense spinosis; folia ramealia diminuta, lanceolato-triangularia, longe et laxe spinosa, Glomerulus plus minusve 5-6 cm diametro, e capitulis inferioribus glabris non cornigeris et capitulis superioribus lanatis et cornigeris compositus; receptaculum globosum, 6-8 mm diametro, albo-flavescens, cicatricibus albidis polygonalibus; involucrium commune 10-12 mm longum, e phyllis membranaceis antice paulo dilatatis, spinoso-acuminatis et paucidentatis, apicem versus virentibus glabris compositum. Capitula inferiora usque ad 20-26 mm longa; penicillum usque ad 10-18 mm longum, multiradiatum, albidum. Phylla 13-16, omnia glabra, nigra, exteriora plus minusve e basi lineari apicem versus cuneato-elliptica, mucronata, membranaceo-marginata; phylla intermedia plus minusve navicularia, anguste elliptica, longe spinosa; phylla intima 5, supra medium in tubum pentagonum nigrum concreta, parte libera lanceolata, albo-caerulea, 8-10 mm longa, spinosa, marginibus plus minusve integra; capitula superiora phyllis intermedis in cornubus rigidis laevibus albo-flavescensibus ad 2-3.5 cm longis transformatis, e phyllis plus minusve lanatulis composita; penicillum valde abbreviatum. Corolla 22 mm longa, laciniis 8 mm longis, caerulea.

Typus. Iran: Fars, ca. 3 km from Ghier to Firuzabad, 880 m, 22. V. 1999, Mozaffarian 79373 (holotypus TARI).

Other specimens seen: Fars: ca. 40 km from Ghier to Firuzabad, 1240 m, Mozaffarian 79377 (TARI); Jahrum, ca. 5 km from Ghotbabad to Khafr 1050 m, V. Mozaffarian 79342 (TARI); Estahbanat to Darab, Eij, 1460 m, V. Mozaffarian 79308 (TARI); ca. 15 km from Jahrum to Juium, 1320 m, V. Mozaffarian 79344 (TARI); Jahrum, 1050 m, V. Mozaffarian 79343 (TARI); 12 km from Ewaz to Khunj to Jahrum, 1050 m, V. Mozaffarian 79363 (TARI); 25 km from Ewaz to Khunj to Jahrum, 800 m, V. Mozaffarian 79367 (TARI); Lar, Ewaz, 1000 m, V. Mozaffarian 79359 (TARI); Darab, ca. 10 km from Darab to Hajiabad, 1200 m, V. Mozaffarian 79305 (TARI); Darab, Furk, 100 km from Gahkum to Darab, 950 m, Mozaffarian 79296 (TARI); Darab, Furk to Darab, 1280 m, Mozaffarian 79298, 79895 (TARI); Jahrum, ca. 60 km from Khunj to Ghier, after Saeifabad, 650 m, Mozaffarian 79370 (TARI); Jahrum to Juium, Gardane Bezan, 1100 m, Mozaffarian 79352 (TARI).

Plant perennial. Stem erect, up to 80 cm high, \pm sulcate, densely arachnoid-glandulose, paniculately branched above the middle, densely leafy throughout. All leaves herbaceous-coriaceous, densely arachnoid and yellowish setose above, along the nerves whitish-marbled, densely whitish araneose-woolly below. Basal leaves unknown; basal cauline leaves lanceolate in outline, pinnatisect, with 5 pairs or large distant segments; rachis narrowly winged; lower segments \pm far from each other, diminishing to spines; lower cauline leaves sessile, lanceolate in outline, pinnatisect, with \pm triangular segments, with densely yellowish spines; upper cauline and subtending leaves of branches similar to lower cauline leaves, but smaller, amplexicaul, \pm auriculate; auricles \pm densely spiny; leaves of branches

diminished, lanceolate-triangular, long and loosely spiny, towards the tips reduced. Heads \pm 5-6 cm in diameter, cornigerous, consisting of lower glabrous non cornigerous and upper lanate cornigerous capitula; receptacle capitate, 6-8 mm in diameter, whitish-yellow, with many angled whitish scales; common involucre 10-12 mm long; involucre bracts membranaceous with a little broadened spiny-acuminate and few toothed tips, towards the tip greenish, glabrous. Lower capitulum of a head up to 20-26 mm long; brush up to 10-18 mm long, many rayed, whitish; phyllaries 13-16, wholly glabrous, black, outer linear at base, towards the tip cuneate-elliptic, mucronate, with membranaceous margin; median \pm canaliculate, narrowly elliptic, long spiny; innermost 5, upper than the middle connate to a five angled black tube, in free part lanceolate, whitish blue, 8-10 mm long, spiny, with entire margins. Upper capitulum of a head with median phyllaries changed to rigid smooth whitish yellow up to 2-3.5 cm long horns, consisting of lanulate phyllaries; brush strongly abbreviated. Corolla up to 22 mm long, with up to 8 mm long blue lobes.

Notes: *Echinops austro-iranicus* differs from *E. gedrosiacus* Bornm. in having densely araneose-glandulose long stems (not papillose to sparsely arachnoid at base) and larger heads 5-6 cm in diameter (not 3-4 cm., and larger lower capitulum 20-26 mm long (not 18-22 mm)).

***Echinops avajensis* Mozaff., sp. nov.**; (Fig. 2).

Planta perennis. Caulis 30-40 cm altus, sulcatus, dense arenoso-glandulosus et glanduloso-villosus, breviter appresse araneosus, a basi corymboso-ramosus, dense foliatus. Folia omnia herbacea, discoloria, supra laxe araneosa et flavescens setosa, subtus dense araneoso-tomentosa, nervis crasse prominentibus; folia basalia ambitu oblongo-lanceolata, pinnatisecta, segmentis majoribus

utrinque plus minusve 3-4, plus minusve remotis, triangulari-lanceolatis, in spinas flavas 10-25 mm longas excurrentibus, segmentis basalibus brevius spinuliferis divisis, ad basin dilatata, crebre spinosa; folia caulina inferiora basalibus similia sed segmentis majoribus 20 cm longa et 8 cm lata, e basi auriculato-amplexicaulia plus minusve plurispinosa, rhachide late alata; folia ramealia ambitu lanceolato-triangularia, nervis crasse prominentibus, non-profundo-lobata; folia ramealia superiora diminuta, sessilia plus minusve auriculato-amplexicaulia, longe spinosa. Glomerulus cornigerus, absque cornibus 5-8 cm diametro; e capitulis inferioribus glabris non cornigeris et capitulis superioribus glabris et cornigeris compositus; receptaculum globosum, orbiculato-faveolosum; involucre commune ca. 10-12 mm longum, e phyllis membranaceis pallidis, uniseriatis, apice triangulatis plus minusve denticulatis et mucronulatis compositum. Capitula inferiora usque ad 26 mm longa, glabra; penicillum usque ad 18 mm longum; phylla 15, exteriora e basi lineari-filiformia apice elliptico-triangularia; phylla intermedia longe oblongo-lanceolata, in media dilatato-elliptica; phylla intima quinque inferne in tubum coriaceum atratum obtuse pentagonum concreta, inaequalia, intus viridia. Capitula superiora cornigera, sterilia; phyllis omnino glabra. Corolla alba, in sicco sordide brunnea, 22-22 mm longa, lacinis 10-12 mm longis.

Typus. Iran: Hamadan, Gardan-e Avaj, after Sultan-Bolagh, 2300 m, 14. VII. 1999 V. Mozaffarian & Maassoumi 79653 (holotypus TARI).

Other specimens seen: Azarbaijan: 20 km from Abhar to Gheidar, after Kine Vars, ca. 1950 m, Mozaffarian & Maassoumi 78151 (TARI); Hamadan: Ganjname to Pist ski, 2350 m, Mozaffarian & Maassoumi 79649 (TARI); 5 km from Razan to Damagh, 1950 m, Mozaffarian & Maassoumi 79652 (TARI); ca. 10 km from Razan to Hamadan, 1750 m,

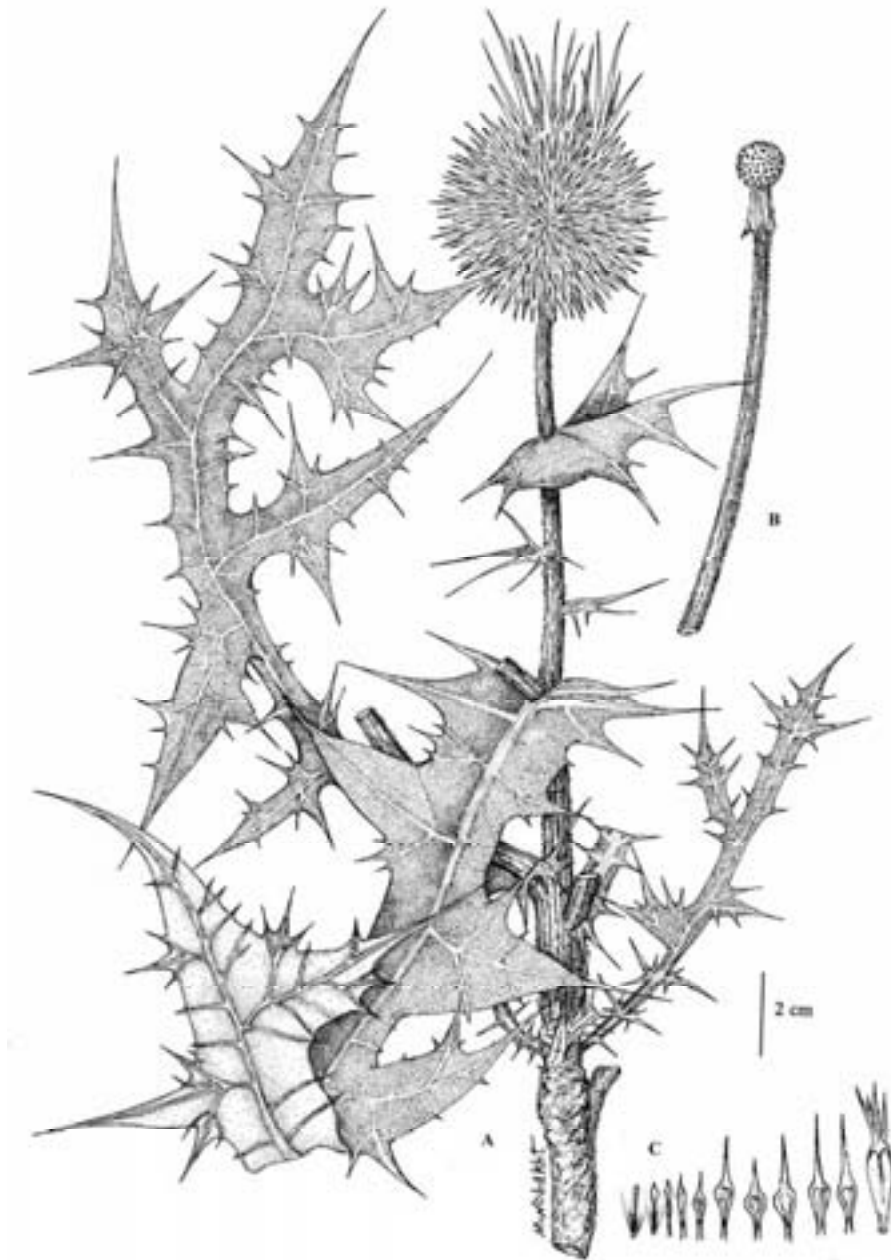


Fig. 2. *Echinops avajensis*. A, habit; B, a branch with receptacle and common involucre; C, phylaries (from outer to inner, left to right); (Mozaffarian 79630).

Mozaffarian 79447 (TARI); Lorestan: ca. 5 km from Zalian neek Mount, to Hendudar and Malamir and Hashyon, 2350 m, Mozaffarian & Maassoumi, 79630 (TARI).

Perennial, stem 30-40 cm high, sulcate, densely covered by areneose glandulose and gladulose-villose together with short appressed arachnoid hairs, corymbose branched from base, densely leafy. All leaves herbaceous, bicolor, loosely araneose and yellowish setose above; densely araneose-tomentose below, with thick prominent nerves; basal leaves oblong-lanceolate in outline, pinnatisect, with large segments up to 3-4 pairs, \pm distant, triangular-lanceolate, with \pm 1-2 large teeth, excurrent to 10-25 mm long yellow spine; lower segments reduced to spiny lobes; rhachis broadened at base and densely spiny; lower cauline leaves similar to basal but with larger segments, 20 \times 8 cm, auriculate-amplexicaul at base and \pm many spined, with broadly winged rhachis, and very prominent nerves, excurrent to yellowish short or long spines; leaves of branches lanceolate-triangular with shallowly lobed and long spiny tip; upper leaves of branches \pm similar to basal ones but much reduced. Heads cornigerous, without horn up to 5-8 cm in diameter, consisting of lower glabrous non cornigerous and upper glabrous and cornigerous capitulum; receptacle globose, with orbicular scars; common involucre up to 10-12 mm long, consisting of pale membranaceous, uniseriate, triangular, \pm small, toothed and mucronulate tips bracts. Lower capitulum of a head up to 26 mm long, glabrous; brush up to 18 mm long; phyllaries 15, outer ones linear-filiform at base and elliptic-triangular at tip; median oblong-lanceolate, close to the middle broadened-elliptic; 5 innermost phyllaries connate in five-angled dark tube, unequal at top, each phyllary green at inner side. Upper capitulum of a head cornigerous, phyllaries glabrous. Corolla white, in dry state dirty brown, up to 22 mm long, with up to 10-12 mm long lobes.

Notes: *Echinops avajensis* is in habitat similar to *E. ecbatanus* Bornm. ex Rech. f. and *E. haussknechtii* Boiss. but these have no horns, and \pm similar to *E. leiopolyceras* but this differs in having very wide cauline leaves 20 \times 8 (not 15-20 \times 3-5 cm) and very short stem 30-40 cm (not 50-100 cm) and by shape and size of phyllaries of lower capitulum 26 mm (not 20-22 mm).

***Echinops delicatus* Mozaff., sp. nov.;**
(Fig. 3).

Planta verosimiliter annua, demum perennis. Caulis humilis, tenuis, 15-30 cm altus, 3-4 mm crassus, simplex vel supra medium pauciramosus, tenuiter sulcatus, breviter albotomentosus et manifeste glanduloso-villosus. Folia omnia herbaceo-coriacea, discoloria, supra flavescenti-viridia, dense setosa et stipitato-glandulosa, nervis plus minusve prominentibus, in spinas terminales tenues 1-2 cm longas excurrentibus, subtus dense albotomentosa, secus nervos glanduloso-villosa; folia basalia et caulina inferiora ambitu oblongo-lanceolata, ultra medium pinnatisecta, 10-14 cm longa, plus minusve 5 cm lata; segmenta majora utrinque 3-4, oblongo-triangularia, dentata vel lobata, longe et breviter spinosa; segmenta infima plus minusve ad spinas liberas reducta, rhachide ad basin versus dilatata plus minusve auriculata, copiose spinosa; folia caulina media et superiora oblongo-lanceolata, leviter lobata vel grosse dentata, dentibus longe spinosis, ad basim dilatato-auriculata, apicem versus sensim reducta. Glomerulus plus minusve 4 cm diametro, homomorphus, e capitulis inferioribus glabris non cornigeris et capitulis superioribus lanatis non cornigeris compositus; receptaculum 6-8 mm diametro, depresso-capitatum, pallide brunneum, annulato-favosum; involucre commune ca. 8 mm longum, e phyllis lineari-lanceolatis, hyaline marginatis et longe fimbriatis, antice paucidentatis et mucronatis compositum.



Fig. 3. *Echinops delicatus*. A, Habit, B, Phyllaries (from outer to inner, left to right); (Mozaffarian 79431).

Capitula inferiora plus minusve ad 20-22 m longa, omnia glabra; penicillum ad 10-14 mm longum; phylla 19, exteriora a basi cuneata, rhomboidea, margine late membranacea, sparse ciliolata, acuminata, intermedia anguste elliptica, ad basin atrobrunnea, ad apicem anguste hyalina, ciliata, in spinam longam attenuata; phylla intima intermediis breviora, usque ad medium in tubum pentagonum atratum concreta. Capitula superiora subtile lanata: Phylla 18, usque ad 22 mm longa, intima excepta floccoso-lanata; penicillum pauciradiatum, involucris-phyllis intermediis brevior; phylla exteriora rhomboidea, ad basin longe cuneata, hyaline marginata, manifeste ciliata, plus minusve late acuminata, intermedia oblongo-lanceolata, basi anguste cuneata, apicem versus in spinam longam attenuata, appresse ciliata; quina intima in tubum longum plus minusve membranaceum concreta, intermdiis breviora. Corolla caerulea
Typus. Iran: Khuzestan, Dezful, ca. 13 km from Sardasht to Shahyun, 380 m 25. V. 1999 V. Mozaffarian 79431 (holotypus. TARI).

Plant very likely annual, at length perennial. Stem short, thin, 15-30 cm high, 3-4 mm thick, simple or in upper part few branched, shallowly sulcate, short whitish-tomentose and conspicuously glandulose villose. All leaves heraceous-coriaceous, bicolour, yellowish-green, densely setose and stipitate glandulose above, with prominent nerves, excurrent to a terminal up to 1-2 cm long spines; densely whitish-tomentose below, along the nerves glandulose-villose; basal and lower cauline leaves oblong-lanceolate in outline, above the middle pinnaticect, 10-14 cm long, \pm 5 cm wide, with 3-4 pairs of large segments; segments oblong-triangular, irregularly toothed or lobed, with long and short spines; lower segments reduced to \pm far from each other spines; rhachis broadened and \pm auriculate at base, densely spiny; median and upper cauline leaves oblong-lanceolate, shallowly lobed or

with long spiny teeth, broadened and auriculate at base, towards the tip gradually reduced. Heads \pm 4 cm in diameter, hetroomorphous, consisting of lower non cornigerous glabrous and upper non cornigerous lanate capitulum; receptacle 6-8 mm in diameter, depressed-capitate, pale brown, with circular foveate scars; common involucre ca. 8 mm long, consisting of linear lanceolate, hyaline margins and long fimbriate bracts, with few tooth and mucronate tip. Lower capitulum \pm up to 20-22 mm long, wholly glabrous; brush up to 10-14 mm long; phyllaries 19, outer cuneate at the base, rhomboid, with wide membranaceous margin, sparsely ciliate, acuminata, median narrowly elliptic at the base, dark brown, towards the tip narrowly hyaline, ciliate, decurrent to long spine, 5 innermost phyllaries shorter than median, connate to 5 angled dark brown tube. Upper capitulum delicate and lanate; phyllaries 18, up to 22 mm long, except innermost ones floccose-lanate; brush few rayed, shorter than the intermediate phyllaries; outer rhomboid, long cuneate at base, hyaline margined, conspicuously ciliate, broadly acuminate; median oblong-lanceolate, narrowly cuneate at base, decurrent to long spiny tip, with appressed ciliate margins; 5 innermost connate to a long membranaceous tube, shorter than the median ones. Corolla pale or deep blue.

Notes. *Echinops delicatus* differs from *E. polygamus* Bunge, in having dense setose and stipitate-glandulose (not loose to dense arachnoid and glandulose-setose) hairs in upper surface of leaves and 19 (not 14-15) of phyllaries in lower capitulum.

***Echinops kazerunensis* Mozaff., sp. nov.; (Fig. 4).**

Planta perennis. Caulis 50-60 cm altus, ab infra medium ramosus, costato-sulcatus, dense appresse crispule villosus et stipitato-glandulosus. Folia basalia perpusilla, pinnatifida, segmentis multo minoribus,

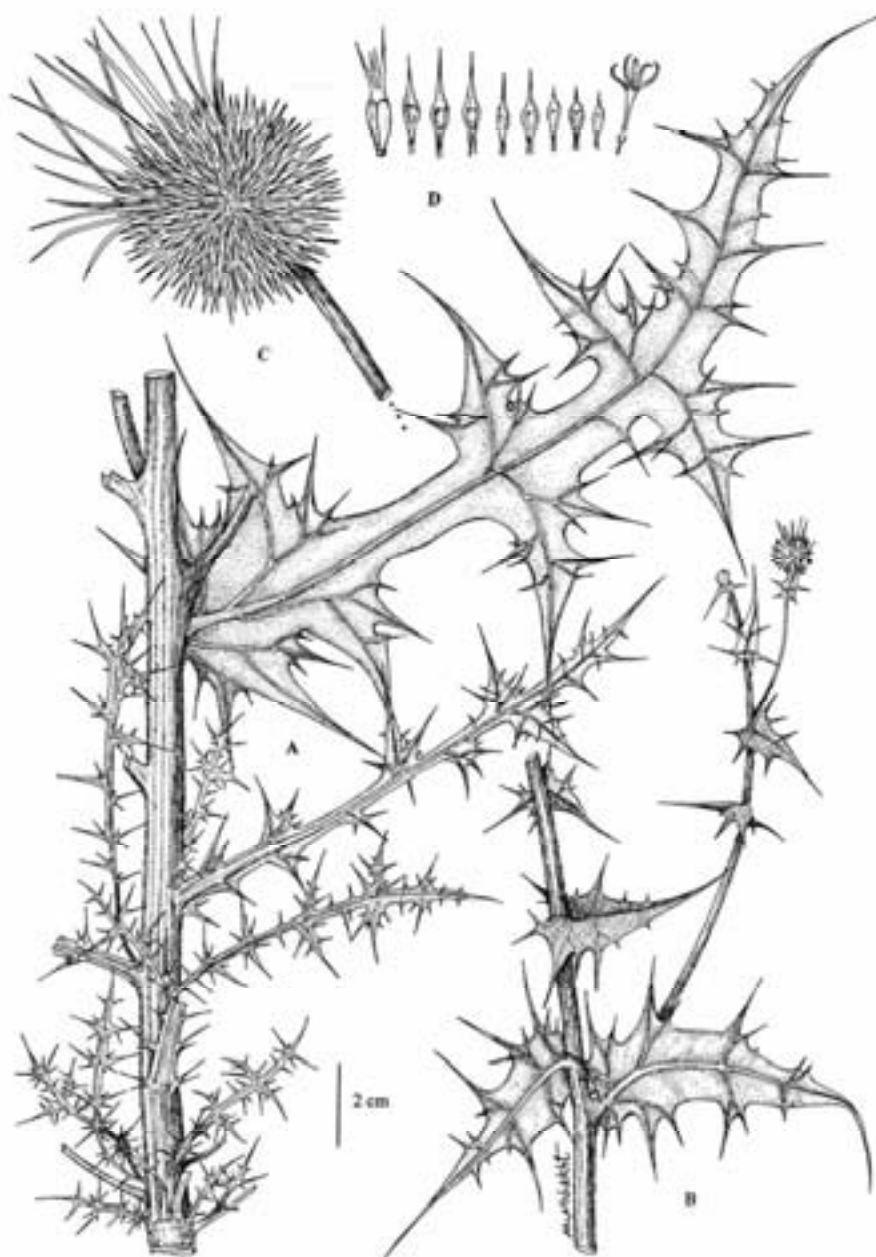


Fig. 4. *Echinops kazerunensis*. A, stem with lower and upper cauline leaves; B, upper part of stem; C, a head; D, phyllariis; (outer to inner, right to left); (Mozaffarian 79385).

spinosissimis, 7×2 cm; folia caulina inferiora ignota; folia omnia consistentia herbaceo-coriacea, supra flavescenti-viridia, laxe araneosa, secus nervos densiore et plus minusve dense flavo-setosa, subtus dense appresse albotoomentosa, nervis crasse prominentibus, laxe albo-villosis; folia caulina superiora et ramos fulcrantia ambitu oblongo-lanceolata, 27×8 cm, pinnatisecta, segmentis majoribus utrinque 4-5, remotis, triangularibus, nervis crassis, albo-flavis, in spinas terminales 5-10 mm longas excurrentibus, sinibus inter segmenta plus minusve inermibus, segmenta basalia valde dilatata et decurrentia plus minusve amplexicaulia, segmenta superiora valde diminuta, verosimiliter dentata vel parvilobata; folia inferiora ramealia ambitu oblongo-triangularia, paucilobata, lobis anguste triangularibus, in spinas longas excurrentibus; folia ramealia summa valde decrescentia. Pedunculo nudo. Glomerulus cornigerus, absque cornibus 5-6 cm diametro, heteromorphus; receptaculum 7-10 mm diametro, globosum; involucre commune e phyllis membranaceo-lanceolatis, antice triangularis, paucidentatis compositum. Capitula inferiora glabra, usque ad 26 mm longa; penicillum album, usque ad 16 mm longum; phylla 13, glabra, exteriora cuneato-elliptica, late albo marginata, plus minusve mucronata, intermedia anguste lanceolato-elliptica, apicem versus ciliato-dentata; phylla intima in tubum obtuse pentagonum atrobrunneum concreta, parte libera lanceolata, inaequilonga, fimbriato-marginata. Capitula media lanata, usque ad 20 mm longa; penicillum album usque ad 8 mm longum; phylla 16, omnia laxe lanatula; exteriora cuneato-elliptica, plus minusve breviter mucronata; intermedia longe lanceolato-elliptica, navicularia, in spinam terminalem attenuata, ciliato-fimbriata, quina intima in tubum obtuse pentagonum plus minusve membranaceum concreta, parte libera lanceolata, inaequilonga, irregulariter ciliato-fimbriata. Capitula superiora saepe cornigera,

20-40 mm longa; penicillum ca. 8 mm longum, laxum, phylla excepta 2 longe cornigera lanata. Corolla pallide coerulea, 18 mm longa, laciniis 12 mm longis.

Typus. Iran: Fars, ca. 16 km from Kazerun to Farashband, 880 m, 22. V. 1999 V. Mozaffarian 79385. (holotypus. TARI).

Perennial. Stems 50-60 cm high, in lower part many branched, costate-sulcate, densely appressed by crispule villose and stipitate glandular hairs. Basal leaves very small, pinnatifid, with very small spiny segments, 7 × 2 cm., lower cauline leaves unknown; all leaves with herbaceous-coriaceous texture, greenish yellow, loosely arachnoid above, with denser arachnoid hairs on veins and ± densely yellowish setose, dense appressed white-tomentose below, with very prominent thick nerves, with white villose hairs; upper cauline leaves and subtending leaves of branches oblong-lanceolate in outline, 27 × 8 cm, pinnatisect; with 4-5 pairs of large distant segments, with thick whitish-yellow nerves, excurrent to 5-10 mm long terminal spines, the sinus between segments ± without spine, lower or basal segments decurrent and broadened at base, ± amplexicaul, upper segments reduced and look like teeth or very small lobes; lower leaves of branches oblong-triangular in outline, with few lobes, each lobe narrowly triangular, excurrent to long spine; upper branches leaves very small, below the heads naked. Head cornigerous, without horn 5-6 cm in diameter, heteromorphous; receptacle 7-10 mm in diameter, capitate. Common involucre with membranaceous and lanceolate bracts, triangular at tip and with few teeth. Lower capitulum of a head glabrous, up to 26 mm long; brush white, up to 16 mm long; phyllaries 13, glabrous, outer cuneate-elliptic, with broad white margin, ± long mucronate, median narrowly lanceolate-elliptic, towards the tip ciliate-dentate, innermost connate to a five obtuse angled dark brown tube, with unequal

free upper part, fringed at margins. Median capitulum lanate, up to 20 mm long; brush white, up to 8 mm long; phyllaries 16, wholly loosely lanate; outer cuneate-elliptic, \pm shortly mucronate, median long lanceolate-elliptic, canaliculate, narrowed towards the terminal spines, ciliate-fimbriate; five inner ones connected to membranaceous five obtuse angled tube, with free unequal lanceolate irregularly ciliate fimbriate upper part. Upper capitulum of a head often cornigerous, up to 30-40 cm long; brush up to ca. 8 mm long, loose; phyllaries except those 2 long horned lanate. Corolla pale blue, 18 mm long, with up to 12 mm lacinate part.

Notes. *Echinops kazerunensis* with heteromorphous capitula and very small basal leaves with deeply lacinate segments is very characteristic and near to *E. iranshahri* Rech. f., but this differs in having yellowish-green loosely arachnoid, densely yellowish-setose leaves (not pale green with short dense glandular-papillose hairs) and in shape, size and number of phyllaries in lower capitulum.

***Echinops khansaricus* Mozaff., sp. nov.;** (Fig. 5).

Planta perennis. Caulis solitarius, basi crassus dense foliatus, sulcato-costatus, 30-50 cm altus, a medio vel superne paniculato-ramosus, dense araneosus vel in superne laxo araneosus et crispule villosus. Folia omnia herbaceo-coriacea, supra araneosa, flavescendo-viridia, subtus dense appresse albido-tomentosa, nervis valde prominentibus; folia basalia anguste oblanceolata, 1-2 pinnatisecta, ad basin dilatata, dense spinifera; segmentis inferioribus plus minusve liberis, ad spinas reductis; folia caulina inferiora basalibus similia, sed majora, 28×8 cm; segmentis majoribus supra medium 3-4 jugis, oblongo-lanceolatis, margine revolutis, non profunde sinuato-lobatis, in spinas plures 10-12 mm longas flavescendo-vulnerantes excurrentibus; segmentis basim versus ad spinas reductis, rhachis ad basim plus minusve anguste

alata; folia caulina superiora et ramos fulcrantia basi dilatata, auriculato-amplexicaulia, minus disseeta; segmentis in spinas longas excurrentibus; folia ramealia mox reducta, late lanceolata, sinuato-spinosa. Glomerulus cornigerus, absque cornibus 4-5 cm diametro, e capitulis inferioribus lanatis non cornigeris et capitulis superioribus cornigeris et lanatis compositus; receptaculum 6-7 mm diametro, globosum, albidum, cicatricibus albidis regulariter elevatis; involucri commune 10-14 mm longum, e phyllis membranaceis lineari-spathulatis antice inciso-dentatis vel longe fimbriatis compositum. Capitula inferiora usque ad 20 mm longa; penicillum 18 mm longum, radiis sordide albis basim versus brunnescentibus, numerosissimis, obsolete scabridis; phylla 13-14, exteriora et intermedia in parte superiore albo-tomentosa, exteriora apice rhomboidea, intermedia sensim longiora, lineari-lanceolata, margine minutissime usque obsolete spinuloso-ciliata; phylla intima longissima usque ultra medium in tubum coriaceum pentagonum atrobrunnescentem concreta, accurate glabra. Capitulis subtilis phyllis exterioribus lanatis. Capitula superiora cornigera, sterilia, phyllis 7-8, lanatis, 3-5 cm longis, cornibus glabris, apicem versus flavido-elongatis. Corolla pallide coerulea.

Typus. Iran: Esfahan: ca. 35 km from Damane to Tiran to Esfahan, 2200 m, 11. VIII. 1999, V. Mozaffarian 79810, (holotypus. TARI).

Other specimens seen. Iran: Esfahan, Faridan, ca. 5 km from Damane to Esfahan, 2300 m, V. Mozaffarian 79811 (TARI); 15 km from Damane to Khunsar, 2400 m, V. Mozaffarian 79813 (TARI); between Tiran and Saman, ca. 15 km from Tiran to Saman, ca. 2000 m, V. Mozaffarian & A. A. Maassoumi 77955 (TARI); Ghamishlou protected area, 2200 m, Assadi & Khatamsaz 76405 (TARI); ca. 5 km from Damane to Khansar, 2300 m, V. Mozaffarian 79812 (TARI); Ghameshloo protected area, Baghak, 2100 m, Uosofi 1665 (TARI); between Tiran and Saman, ca. 15 km from Tiran to Saman, Ca. 2000 m, V. Mozaffarian & Maassoumi 77957 (TARI).

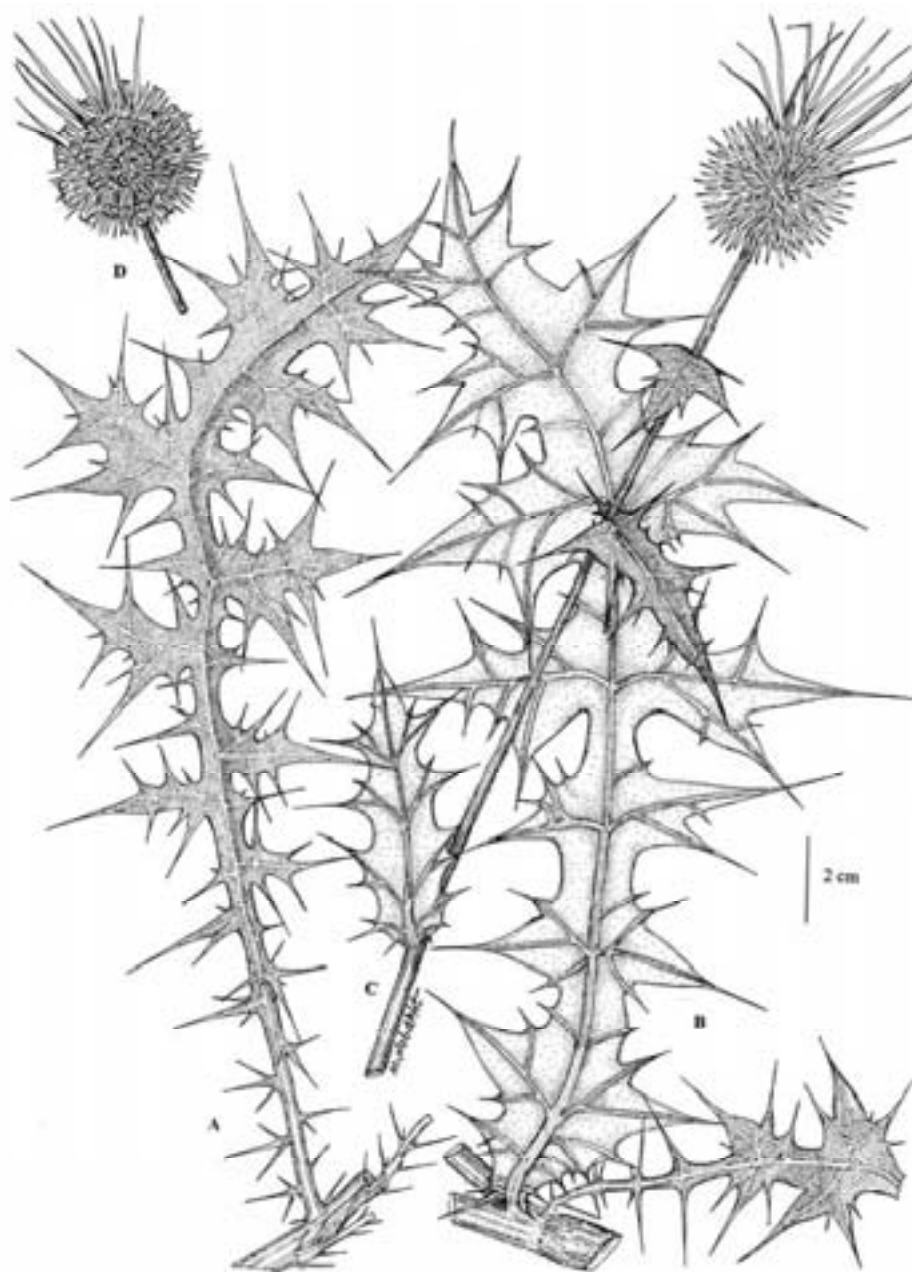


Fig. 5. *Echinops khansaricus*. A, upper cauline leaf; B, lower cauline leaf; C, a branch with a head; D, a head; (Mozaffarian 79811).

Perennial; stem thick, solitary, at base thick, densely leafy, sulcate-costate, 30-50 cm high, from the middle or in upper part paniculately-branched, densely arachnoid or in upper part loosely arachnoid and rarely villose. All leaves arachnoid, yellowish-green above, densely appressed white tomentose below, with very prominent nerves; basal leaves narrowly oblanceolate, 1-2 pinnatisect, towards the base broadened and densely spiny, with basal segments \pm loose and distant, reduced to spines; lower cauline leaves similar to basal but larger, 28 \times 8 cm; with 3-4 pairs of oblong-lanceolate larger segments above the middle of rachis, each segments revolute at margins, shallowly sinuate-lobate, with many spines, up to 10-12 mm long, yellowish and wounding; segments towards the base reduced to spines; rachis towards the base narrowly winged; upper cauline leaves and subtending branches broadened at the base, auriculate and amplexicaul, shallowly dissected and with long spines at the margin; leaves of branches much reduced, broadly lanceolate, sinuate-spinose. Head cornigerous, without horns up to 4-5 cm in diameter, consisting of lower capitulum lanate non cornigerous, and upper capitulum cornigerous and with lanate outer phyllaries; receptacle 6-7 mm in diameter, globose, whitish, with regular elevated scars; common involucre up to 10-14 mm long, involucral bracts membranaceous, linear-spathulate, at tip incised-dentate or long fimbriate. Lower capitulum of a head up to 20 mm long; upper capitulum horn-bearing, up to 3-5; brush up to 18 mm long, with many dirty white rays, towards the base brownish and scarcely scabrous; phyllaries 13-14, outer and median ones at upper part white tomentose, outer ones with rhomboideous tip, median gradually longer, linear-lanceolate, at the upper margins scarcely spiny ciliate, innermost very long, connate up to above the middle in coriaceous five angled tube; wholly glabrous, deeply brownish; delicate capitulum with outer lanate phyllaries. Upper capitulum

cornigerous, sterile, with 7-8 woolly phyllaries and up to 3-5 cm long, wholly glabrous yellowish horns. Corolla pale blue.

Notes. *Echinops khansaricus* differs from *E. elymaiticus* Bornm. in having bipinnatisect (not sinuate-dentate to sinuate-pinnatifid) leaves, glabrous (not lanate) inner connate phyllaries, glabrous (not lanate horns of sterile capitulum), and pale blue (not white flowers), wholly arachnoid tomentose leaf in upper side (not greenish-yellow with yellowish bristly hairs and loosely arachnoid) and from *E. erioceras* Bornm. in having lower capitulum up to 20 mm and up to 18 mm long brush (not 24-26 mm capitulum and up to 16-17 mm. long brush), and from *E. hebelepis* DC. in having cornigerous capitulum.

***Echinops khuzistanicus* Mozaff., sp. nov.; (Fig. 6).**

Planta verosimiliter annua sed perennis. Caulis usque ad 5-6 mm crassus, striato-costatus, 30-45 cm altus, omnino breviter albolanatus et parcissime villosus, supra medium pauciramosus, plus minusve aequaliter foliatus. Folia omnia consistentia herbaceo-coriacea, discoloria, supra flavescenti-viridia, parcissime araneosa, densissime setosoglandulosa, nervatibus obsolete prominentibus; subtus dense albo-tomentosa, nervatibus valde prominentibus, secus nervos longe albopilosa; folia basalia ambitu oblongolanceolata, 15-25 \times 5-10 cm., pinnatisecta; segmenta majora 3-5 juga, inter se plus minusve remota, oblongo-lanceolata, in spinas validas usque ad 1 cm longas spinoso-lobata proferentia; rhachide anguste alata; segmenta inferiora plus minusve libera, ad spinas reducta; folia caulina inferiora ambitu oblongo-lanceolata, leviter lobata vel pinnatisecta; rhachide basin versus plus minusve late alata; segmenta basalia dilatata plus minusve auriculata, longe spinosa; folia caulina superiora oblongo-lanceolata, paucidentata, ad basin plus minusve

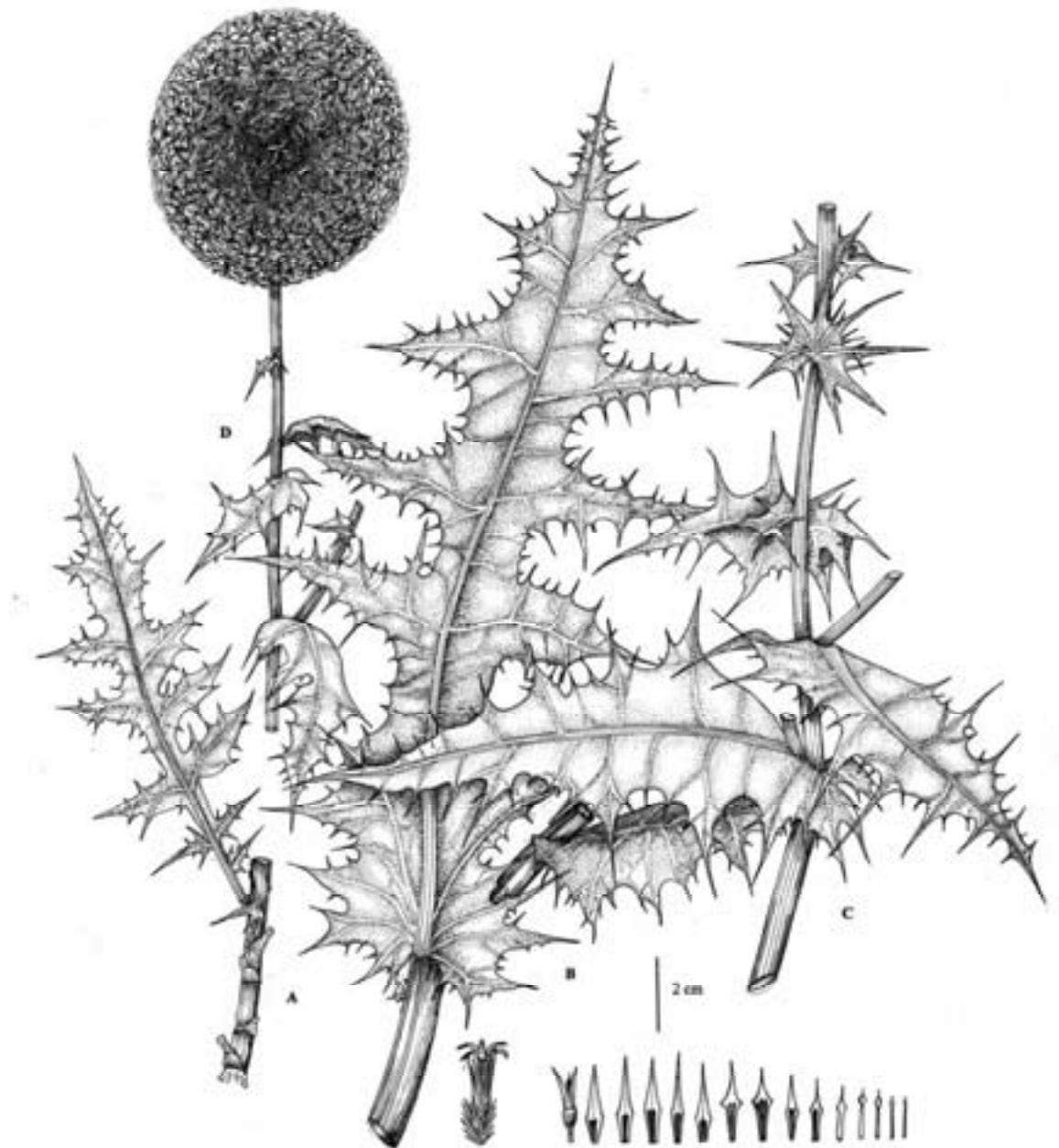


Fig. 6. *Echinops khuzistanicus*. A, lower cauline leaf; B, upper cauline leaf; C, a branch with leaves; D, a branch with a head; (Mozaffarian 79420).

amplexicaulia; folia ramos caulibus superioribus similia sed minora et apicem versus valde diminuta, semiorbicularia, longe spinosa. Glomerulus 4-6 cm diametro, non cornigerus, e capitulis superioribus et inferioribus similis, non cornigeris, aequaliter lanatis compositus; receptaculum ca. 7 mm diametro, depresso-globosum, cicatricibus elevato-orbicularibus; involucrum commune 10 mm longum, e phyllis membranaceis lineari-lanceolatis, antice plus minusve dilatatis, spinuliferis et mucronatis compositum. Capitula inferiora usque ad 22 mm longa; penicillus usque ad 12 mm longus; phylla plus minusve 17-19, imprimis in parte superiore floccoso-lanata; exteriora late linearia tenuiter hyaline marginata, apicem versus sensim rhomboideo-dilatata, apiculata, integra vel fimbriato-ciliata; phylla intermedia elliptico-cuneata, e basi cuneatis, atrobrunnea, prope medium late hyaline marginata, fimbriato-ciliata, in spinam terminalem longam pallide caeruleam attenuata; phylla intima 5, ad medium in tubum pentagonum atrobrunneum concreta, parte libera lanceolata inaequilonga, appresse fimbriato-ciliata. Capitula superiora basalia similia. Corolla caerulea.

Typus. Iran: Khuzestan, ca. 25 km from Masjed Soleyman to Haftgel, 400 m, 24. V. 1999. V. Mozaffarian 79420 (holotypus. TARI).

Other specimens seen. Khuzestan: ca. 25 km from Masjed Soleyman to Shushtar, 160 m, V. Mozaffarian 79423 (TARI); beginning of the road to Haftgel from Masjed Solyeman, 250 m, V. Mozaffarian 79417 (TARI).

Plant very likely annual but perennial. Stems up to 5-6 mm thick, 30-45 cm high, striate-costate, shortly whitish-lanate and sparingly villose throughout, above the middle somewhat branched and leafy throughout. All leaves with herbaceous-coriaceous texture, bicolor, yellowish-green, sparingly arachnoid and densely glandulose setose above, with scarcely apparent veins, densely whitish tomentose below, with prominent veins, along

main vein long whitish-villose; basal leaves oblong-lanceolate in outline, 15-25 cm long and 5-10 cm wide, pinnatisect, larger segment 3-5 pairs, remote, oblong-lanceolate, with rigid spines up to 1 cm long, and spiny lobed, rachis narrowly winged, with lower segments far from each other and reduced to spine; lower cauline leaves oblong-lanceolate in outline, slightly lobed or pinnatisect, with broadly winged rachis towards the base, broadly auriculate and long spiny; upper cauline leaves oblong-lanceolate, with few toothed, amplexicaul; leaves of branches similar to upper cauline leaves but smaller and towards the apex prominently reduced, \pm semiorbicular and long spiny. Heads 4-6 cm in diameter, non cornigerous, with lower and upper capitulum of a head similar, equally lanate; receptacle ca. 7 mm in diameter, depressed globose, with elevated orbicular scars; common involucre 10 mm long, involucral bracts linear-lanceolate, membranaceous, broadened at tip and short spiny-mucronate. Lower capitulum up to 22 mm long, brush up to 12 mm; phyllaries 17-19, in upper part floccose-lanate; outer broadly linear, thin hyaline margined, towards the tip broadened apiculate rhomboid, entire or fimbriate-ciliate; median elliptic-cuneate at base, dark brown, broadly hyaline margined at the middle and fimbriate-ciliate, with long attenuate pale blue spiny tip; 5 innermost phyllaries up to the middle connate to a five angled dark brown tube, with free lanceolate fimbriate-ciliate upper part; upper capitulum of a head similar to basal. Corolla blue.

Notes. *Echinops khuzistanicus* Mozaff. in having homomorphous heads with lower and upper lanate capitula is similar to *E. shulabadensis* Mozaffarian, but differs by shape of leaves, oblong-lanceolate 12-25 \times 5-10 cm (not lanceolate 20-25 \times 5-8 cm), number 17-19 (not 14-17) and shape of phyllaries in lower capitula and indumentum of upper surface of leaves.

Echinops laricus Mozaff., **sp. nov.**; (Fig. 7).

Perennis. Caulis 80-120 cm altus, sulcatus, breviter araneoso-glandulosus, superne corymboso- ramosus. Folia omnia herbaceo-coriacea, discoloria, reticulato-nervosa, breviter araneosa, laxe setosa, secus nervos appresse araneoso-lanata, albo-marmorata, subtus dense breviter araneosa, nervis valde prominentibus; folia basalia mox decidua; caulina inferiora late lanceolata, sessilia, plus minusve amplexicaulia, 40×10 cm., paucilobata, lobis triangularis, longe spinosis, spinis inclusis usque ad 4 cm latis; folia caulina superiora et ramos fulcrantia plus minusve caulinibus inferioribus similia sed minima; folia ramealia lanceolato-triangularia, panucidentata, apicem versus diminuta. Glomerulus cornigerus, absque cornibus 4-5 cm diametro, e capitulis inferioribus glabris non cornigeris et capitulis superioribus lanatis et cornigeris compositus; receptaculum globosum, 8 mm diametro, cicatricibus albidis orbicularibus paulo elevatis; involucre commune 8 mm longum, e phyllis membranaceis antice dilatatis triangulari-acuminatis compositum. Capitula inferiora usque ad 22 mm longa; penicillum usque ad 14 mm longum, multiradiatum, albidum; phylla 17, omnia glabra, exteriora basi anguste linearia, apicem versus triangularia, pectinato-fimbriata; phylla intermedia basi anguste linearia nigricantia, in medio subelliptico-dilatata, nigra, albo-marginata in spinam validam 5-8 mm longam attenuata, plus minusve pallide caerulea; phylla intima 5, in tubum fere pentagonum nigrum concreta. Capitula superiora saepe cornigera, 4-5 cm longa, sterilia, e phyllis plus minusve lanatulis composita. Corolla caerulea.

Typus. Iran: Fars, Lar, Ewaz, ca. 15 km from Ewaz to Juim, between Kuhne and kureh, 840 m, 21. V. 1999, V. Mozaffarian 79357 (holotypus. TARI).

Other specimens seen. Fars: Jahrum, Juim, Fereshtejun 850 m, V. Mozaffarian 79353 (TARI); Jahrum, Juim to Lar, Banaruieh, V. Mozaffarian 79354 (TARI).

Perennial. Stem 80-120 cm high, sulcate, shortly arachnoid glandulose, corymbosely branched above. All leaves herbaceous-coriaceous, bicolor, reticulately nerved; indumentum in upper surface shortly arachnoid lanate, whitish-marbled along nerves, in lower surface densely short arachnoid, with very prominent nerves; basal leaves soon deciduous; lower cauline leaves large lanceolate, sessile, ± amplexicaul, 40 × 10 cm, few lobed, each lobe triangular, yellowish spiny, each lobe together with spine up to 4 cm wide; upper cauline and subtending branches leaves similar to basal cauline leaves, but smaller; leaves of branches lanceolate triangular, few toothed, towards the tip diminished, below the capitula naked. Heads up to 4-5 cm in diameter; lower capitula glabrous and non cornigerous, and upper capitula often sterile, cornigerous, lanatulate; receptacle capitate, up to 8 mm in diameter, with elevated whitish orbicular scars; common involucre 8 mm long, involucre bracts membranaceous, broadened triangular, acuminate at tip. Lower capitulum of a head 22 mm long; brush many rayed, whitish, up to 14 mm long; phyllaries 17, glabrous; outer narrowly linear at base, towards the tip triangular, pectinate-fimbriate; with broadened whitish-green margined, shortly mucronate, shorter than brush; median black, narrowly linear at base, nearly elliptic, with 5-8 mm long spiny tip; 5 innermost phyllaries tightly connate together, nearly five angled. Upper capitulum of a head mostly cornigerous, up to 4-5 cm long, sterile, with short ±woolly outer phyllaries; corolla caeruleous.

Notes. *Echinops laricus* is very characteristic, because of having large lanceolate lower cauline leaves and the most approximate species to it are *E. austro-iranicus* Mozaffarian



Fig. 7. *Echinops laricus*. A, lower cauline leaf; B, upper cauline leaf; C, upper part of the plant with heads; D, phyllaries (from outer to inner, left to right); (Mozaffarian 79375).

and *E. gedrosiacus* Bornm. which is different with them in number and size of phyllaries of lower capitulum.

***Echinops leiopolyceroides* Mozaff., sp. nov.;** (Fig. 8).

Planta perennis. Caulis 50-70 cm altus, sulcato-costatus, appresse araneosus, glanduloso-arenaceus; infra glomerulo longe glanduloso-villosus, superne corymbosoramosus, tota longitudine foliatus. Folia omnia herbaceo-coriacea, discoloria, supra flavescenti-viridia, parcissime vel non araneosa, dense glanduloso-setosa, manifeste flavo-nervosa, subtus dense araneosotomentosa, albido-cinerea, manifeste nervosa, secus nervos prominentes minus pubescentes et glanduloso-villosa; folia caulina inferiora 30-35 cm longa et 10-15 cm lata, ambitu oblongo-lanceolata, pinnatisecta; segmenta majores utrinque 3-4, oblongo-triangularia, paucidentata, crebre spinosa, spinis usque ad 1 cm longis, segmenta inferiora interdum libera, ad spinas reducta, basi plus minusve dilatata plus minusve auriculata spinifera; folia caulina superiora et ramos fulcrantia late oblongo-lanceolata, paucilobata, lobis triangularibus paucispinosis, spinis terminalibus usque ad 2-2.5 cm longis, basi late auriculato-amplexicaulia; folia ramealia late trianglari-flabellata, longe spinosa, apicem versus reducta. Glomerulus 5-7 cm diametro, cornigerus, glaber, e capitulis inferioribus glabris non cornigeris et superioribus glabris, cornigeris compositus; receptaculum depressoglobosum, usque ad 10 mm diametro, cicatricibus elevato-orbicularibus; involucrium commune 10-12 mm longum, e phyllis membranaceis antice dilatatis spinuloso-acuminatis compositum. Capitula inferiora usque ad 22 mm longa; penicillum longissimum, usque ad 16-20 mm longum, multiradiatum, candidum, basi brunnescens; phylla 15, glabra; exteriora e basi linearia, infra apicem elliptico-dilatata, subintegra vel

minutissime ciliata, phylla intermedia e basi longe lineari, in medio circiter dilatato-albo-marginata, apicem versus in spinam validam 6-8 mm longam attenuata, margine appresse paucidentata; phylla intima 5, basi in tubum pentagonum atrobrunneum concreta, superne libera, lanceolata, inequilonga. Capitula superiora cornigera, 3-5 cm longa; penicillum 10-14 mm longum; phylla omnia glabra. Corolla alba vel pallide caerulea, c. 19 mm longa, laciniis 6 mm longis.

Typus. Iran: Khorassan, Torbate heydarieh, between Robate Sang and Kadkan, 1750 m, 3. 8. 1999, V. Mozaffarian 79742 (holotypus. TARI).

Other specimen seen. Gorgan: ca. 5 km from Robate Gharabil to Bujnurd, 1400 m, V. Mozaffarian & A. A. Maassoumi 79114 (TARI); 21 km from Mirzabailu on the road to Bujnurd, 1400 m, Assadi & Azadi 76097 (TARI). Khorassan: Mashhad, ca. 40 km from Mashhad to Kalat-e Naderi, Gujaki neck Mount. 1720 m, V. Mozaffarian 79724 (TARI); ca. 15 km from Ghuchan to Darregaz 1550 m, V. Mozaffarian 79157 (TARI); Shirvan, Ziarat to Gulul, after Ziarat 1200 m, Mozaffarian & Maassoumi 79123 (TARI); Bakharz to Torbat-e Heydarieh, between Jaafarabad and Sarguloun (ca. 70 km from Torbat-e Heydarieh to Torbat-e Jam) 1580 m, V. Mozaffarian 79737 (TARI); Shirvan to Bajgiran, around Ghara-Chaghe and Bardar 1640 m, V. Mozaffarian & A. A. Maassoumi, 79132 (TARI); Bakharz to Torbat-e Heydarieh, Chahrtagh, 1450 m, V. Mozaffarian 79734 (TARI); ca. 15 km from Fariman to Mashhad, 1460 m, V. Mozaffarian 79732 (TARI); ca. 22 km from Kashmar to Neishabour, near Mount. befor Rivash, 1900 m, V. Mozaffarian 79754 (TARI); 35 km from Torbate Heydarieh to Mashhad, after Robate Sang 1600 m, V. Mozaffarian 80442 (TARI); ca. 25 km from Mashhad to Torbat-e Heydarieh, 1140 m, V. Mozaffarian 80437 (TARI).

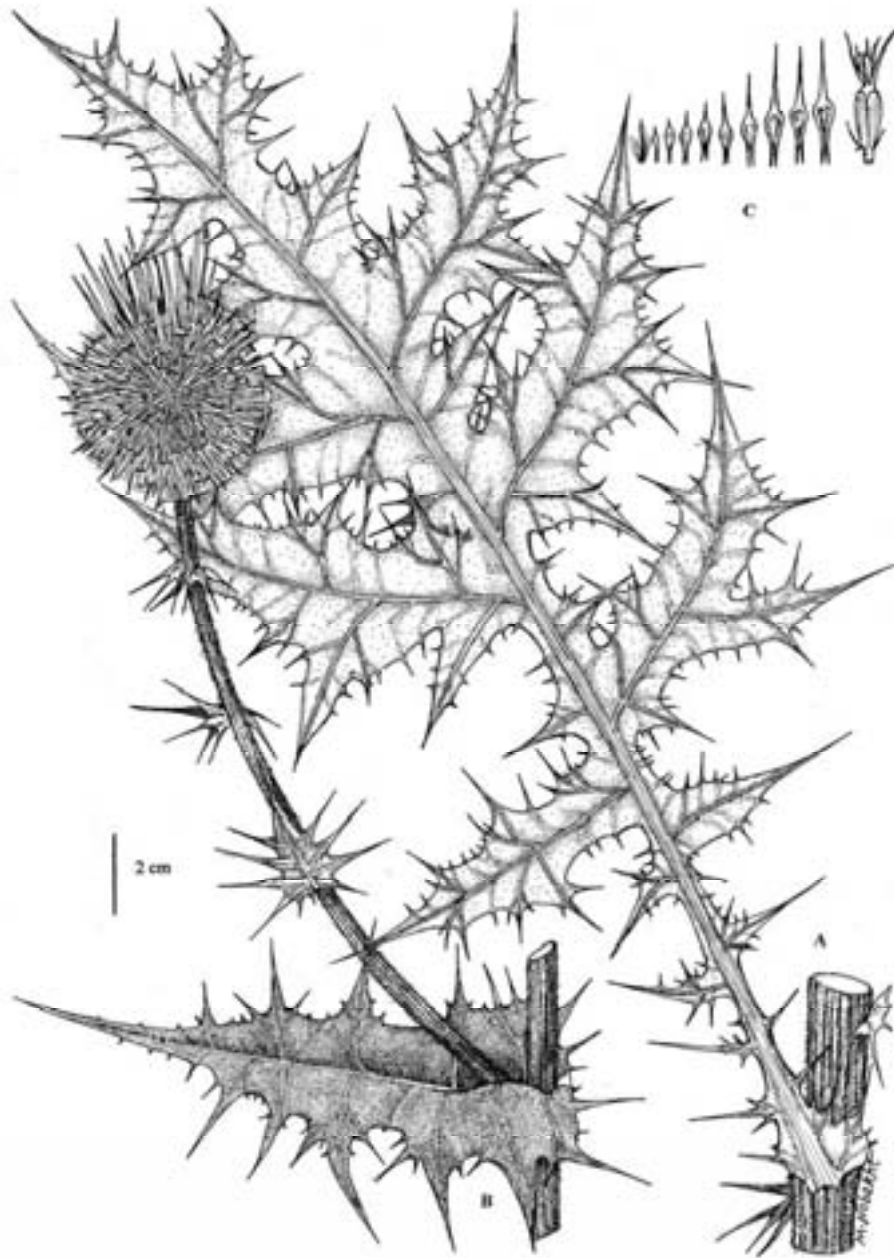


Fig. 8. *Echinops leiopolyceroides*. A, lower cauline leaf; B, upper part of stem with a flowering branch; C, phyllaries (from outer to inner, left to right); (Mozaffarian 79742).

Plant perennial. Stems up to 50-70 cm high, sulcate-costate, appressed arachnoid, glandulose-sandy shaped, at the lower part of capitula long glandulose-villose, corymbosely branched, leafy throughout. All leaves herbaceous-coriaceous, bicolour, yellowish-green, very loosely or without arachnoid hairs, densely glandulose setose above, prominently yellowish nerved, densely arachnoid - tomentose and whitish-grey below, prominently nerved, along the nerves prominently loosely pubescent and glandulose-villose; lower cauline leaves 30-35 mm long and 10-15 mm wide, oblong-lanceolate in outline, pinnatisect, with 3-4 pairs of larger segments; each segment oblong-triangular, with few teeth and many spines, with up to 1 cm long spines; segments of lower part of rachis loose and apart from each other, reduced to spines, rachis at the base \pm broadened and \pm auriculate spiny; upper stem and subtending branches leaves widely oblong-lanceolate, few lobed, with triangular few spiny lobes, with terminal spine up to 2-2.5 cm long, at the base auriculate-amplexicaul; leaves of branches widely triangular-flabellate, long spiny at margins, towards the tip reduced. Heads 5-7 cm in diameter, cornigerous, glabrous; consisting of lower glabrous non cornigerous and upper cornigerous glabrous capitula; receptacle depressed-globose, up to 10 mm in diameter, with elevated-orbicular scars; common involucre up to 10-12 mm long, with membranaceous bracts, dilated at tip, and spiny acuminate. Lower capitulum of a head up to 22 mm long; brush up to 18 mm, many rayed, greyish-white, brownish at base; phyllaries 15, wholly glabrous; outer linear at the base, below the tip broadend elliptic \pm entire or very shortly ciliate; median long linear at the base and becoming brownish, at the medium almost widened with white margins, towards the tip with \pm sturdy up to 6-8 mm long spine, at the margin with few appressed teeth; innermost 5, at the base connate to a 5 angular dark brown tube, with

free lanceolate unequal upper part. Upper capitulum of a head sterile, cornigerous, up to 3-5 cm long; brush up to 10-14 mm long; phyllaries wholly glabrous. Corolla white to pale blue, ca. 19 mm long, with up to 6 mm long lobes.

Notes. *Echinops leiopolyceroides* differs from *E. leiopolyceras* in having very sparse to not arachnoid upper surface of leaves, less divided basal and cauline leaves 30-35 \times 10-15 cm (not 20 \times 3-5 cm) and much larger heads 5-7 cm (not up to 5 cm) and longer horn. 3-5 cm (not up to 2-3 cm long).

***Echinops sabzevarensis* Mozaff., sp. nov.; (Fig. 9).**

Planta perennis. Caulis prostratus, usque ad 30-35 cm altus, sulcato-costatus, dense araneoso-tomentosus, supra medium pauciramosus, tota longitudine foliatus. Folia omnia coriacea, supra dense vel laxe araneosa, secus nervos glabra vel laxe papillosa, subtus dense albo-araneoso-tomentosa; costa mediana crassissima, nervis secundariis prominentibus in spinas terminales validas excurrentibus; folia basalia ignota; caulina basalia et media ambitu lanceolata, spinis inculsis 20-28 cm longa et 5-7 cm lata, sinuato-lobata; lobis majoribus 5-6jugis inter se remotis, late triangularibus, spinosis, in spinam terminalem validam 6-12 mm longam excurrentibus, spinis lateralibus plerumque paucis plus minusve validis; rhachide late alata; segmenta inferiora libera, minora, ad basin auriculata, spinosa; folia caulina superiora plus minusve basalibus et medianis similia, sed minora; folia ramos fulcrantia basim versus late alata, amplexicaula; folia ramealia diminuta, lanceolato-lineararia, longe et laxe spinosa. Glomerulus 7-10 cm diametro, e capitulis inferioribus et superioribus aequaliter cornigeris et aliquantum non cornigeris, glabris compositus; receptaculum globosum, 14-18 mm diametro, album, cicatricibus albidis

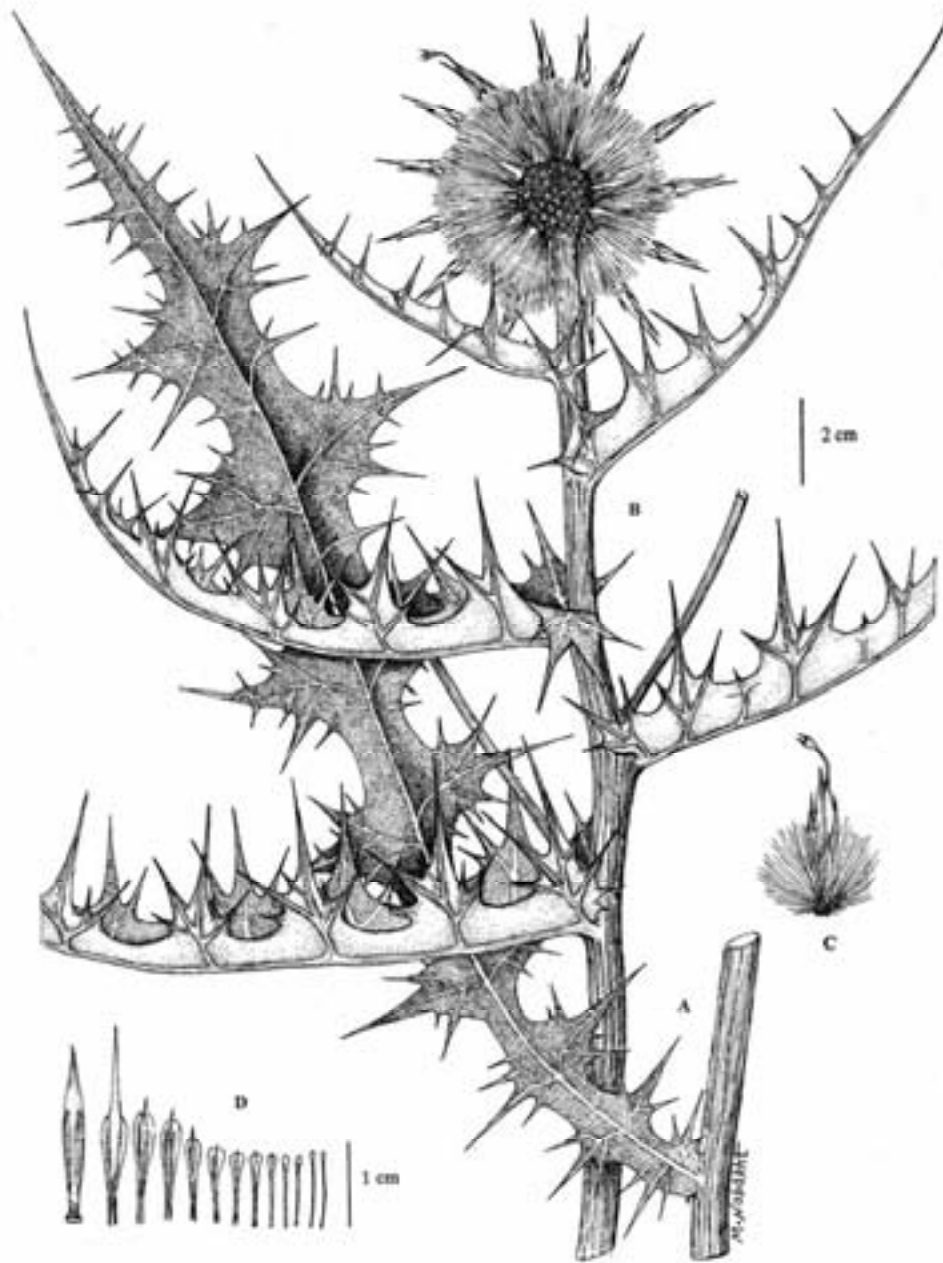


Fig. 9. *Echinops sabzevarensis*. A, lower cauline leaf; B, a part of upper stem with opened receptacle; C, a capitulum; D, phyllaries (outer to inner, right to left); (Mozaffarian 79760).

polygonalibus; involucri commune 10-12 mm longum, e phyllis membranaceis antice paulo dilatatis spinosis et paucidentatis glabris compositum. Capitula inferiora usque ad 20-24 mm longa; penicillum usque ad 12-18 mm longum, multiradiatum, albidum; pappus intermedius (pseudopappus) longe linearis; phylla 15-18, omnia glabra; exteriora e basi lineari, apicem versus cuneata, truncata, membranaceo-marginata; phylla intermedia plus minusve navicularia, elliptica, 1-3 in cornum rigidum laeveum 1-3 cm longum transformata; phylla intima 5, supra medium in tubum pentagonum nigrum concreta, parte libera lanceolato-triangularis, integra. Capitula superiora inferioribus similia. Corolla alba vel dilute caerulea, 18-20 mm longa, laciniis 8-10 mm longis. Achenia 8-10 mm longa; pappus ca. 2 mm longus, setis usque ad medium concretis.

Typus. Iran: Khorassan, ca. 5 km from Sabzevar to Esferayen, 1250 m, 4. VIII .1999, V. Mozaffarian 79760 (holotypus. TARI).

Other specimens seen. Esfahan: ca. 25 km from Shahreza to Esfahan, 1700 m, V. Mozaffarian, 79769 (TARI); Natanz, Tar and Kashe, kuh-e Karkas, ca. 2000 m, V. Mozaffarian & A. A. Maassoumi 78347 (TARI); Khorassan: 9 km from Sabzevar to Esferayen, 1150 m, Mozaffarian, 80426 (TARI).

Perennial. Stems prostrate, up to 30-35 cm, sulcate-costate, densely arachnoid-tomentose, above the middle few-branched, leafy throughout. All leaves coriaceous, densely or loosely arachnoid above, along with nerves glabrous or loosely papillose, whitish arachnoid-tomentose below, median nerve thicker, secondary nerves prominent, decurrent to terminal thick spine; basal leaves unknown; basal and median cauline leaves lanceolate in outline, together with the spines 20-28 × 5-7 cm, sinuate-lobate; larger lobes 5-6 pairs, ± far from each other, broadly triangular, spinose, decurrent to up to 6-12 mm long thick terminal

spine; lateral spines often few, thick; rachis widely winged; lower segments ± far from each other, smaller, at the base auriculate, spiny; upper cauline leaves similar to basal and median, but smaller; leaves of subtending branches towards the base broadly winged, amplexicaul; leaves of branches diminished, lanceolate-linear, long and loosely spiny. Heads ± 7-10 cm in diameter, consisting of lower and upper glabrous, equally conigerous and some non conigerous capitula; receptacle capitate, 14-18 mm in diameter, white, with white polygonal scars; common involucre 10-12 mm long, consisting of glabrous membranaceous involucrial bracts with a little broadened spiny tip and few toothed. Lower capitulum of a head up to 20-24 mm long; brush up to 12-18 mm, many rayed, white; phyllaries 15-18, entirely glabrous, intermediate ones 1-3, long linear; outer linear at base, towards the tip cuneate, truncate, with membranaceous margins; median ± boat shaped, elliptic, 1-3 of them changed to up to 1-3 cm long horns; inner ones 5. up to above the middle concreting to black five-angled tube, upper free part lanceolate, entire. Upper capitulum of a head similar to lower. Corolla white or pale blue, 18-20 mm long, with up to 8-10 mm long lobes. Achene 8-10 mm long; pappus ca. 2 mm long, with up to the middle connected to setae.

Notes. *E. sabzevarensis* is closely related to *E. cephalotes* DC. and *E. robustus* Bunge, but differs from them in having lower and upper glabrous capitula (not lanate) and easily dehiscent (not with difficulty dehiscent) heads.

Echinops shulabadensis Mozaff., **sp. nov.**; (Fig. 10).

Planta perennis. Caulis 35-45 cm altus, supra medium plus minusve stricte pauciramosus, striato-costatus, omnino arachnoideo-tomentosus, tota longitudine laxae aequaliter foliatus. Folia omnia crasse coriacea, supra arachnoideo-tomentosa, plus minusve flavescenti-viridia, flavescenti-nervosa, subtus

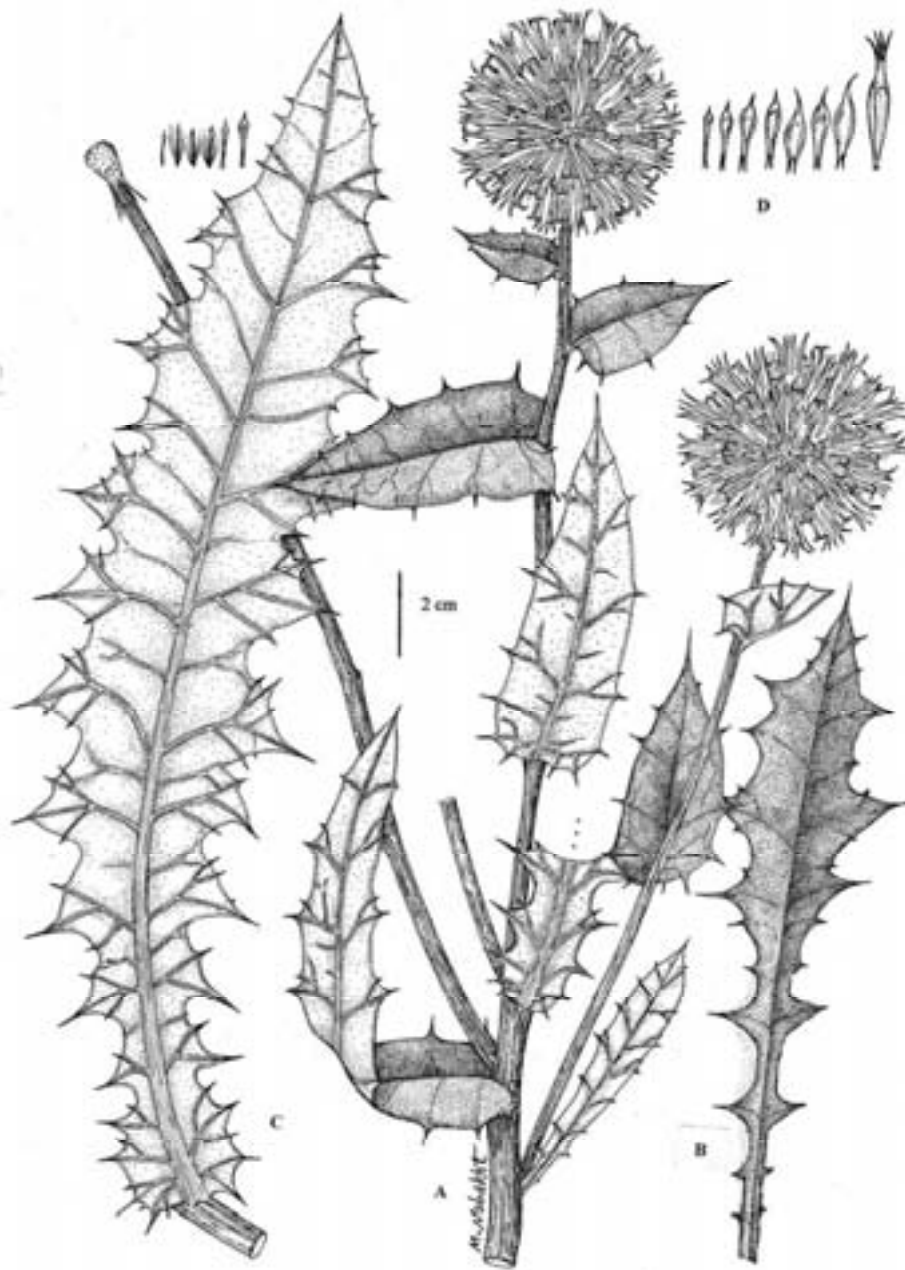


Fig. 10. *Echinops shulabadensis*. A, upper part of a plant; B, lower cauline leaf; C, upper cauline leaf; D, phyllaries (outer to inner, left to right); (Mozaffarian 80418).

appresse albo-tomentosa, manifeste crasse nervosa; folia basalia lanceolata, mox decidua; caulina inferiora lanceolata, 20-28×5-8 cm, grosse dentata, omnia dentibus infimis plus minusve ad spinas subliberas reductis, dentibus superioribus perlate triangularibus, regulariter spinosis; folia caulina superiora basalibus plus minusve similia; ramos fulcrantia ad basin dilatata, semiamplexicaulia, sessilia, triangulari-lanceolata; folia ramealia apicem caulis versus magis decrescentia, laminis abbreviatis, breviter dentato-spinosis, dentibus proportione brevioribus. Glomerulus plus minusve sublaxus, non cornigerus, 5-6 cm diametro, homomorphus, e capitulis inferioribus et superioribus dense lanatis compositus; receptaculum globosum, elevate foveolato-favosum, 4-5 mm diametro; involucre commune 10-12 mm longum, e bracteis membranaceis lineari-spathulatis vel lanceolato-fimbriatis compositum. Capitula inferiora 18-28 mm longa, valde lanata, bene evoluta: penicillum multiradiatum usque ad 22 mm longum; phylla 14-17, usque ad 28 mm longa, omnia apicem versus dense lanata; exteriora longe lineari-spathulata, plus minusve late membranaceo-marginata, brunnea, antice minute mucronulata; intermedia oblongo-elliptica, apice ciliato-fimbriata, in mucronem plus minusve longe attenuata; intima in tubum pentagonum ad medium concreta, atrobrunnea, apicem versus dense lanata, ciliato-fimbriata. Capitula superiora subtile; penicillum multiradiatum, brevissimum, ca. 5-8 mm longum, basi plus minusve brunnesens, 2/3 capituli aequans; phylla 17-19, usque ad 18-20 mm longa, omnia apicem versus et margine dense lanata; exteriora e basi longe attenuata, in appendicem triangularem deltoideum margine lanatum dilatata, intermedia lanceolato-elliptica; phylla intima ad medium in tubum plus minusve membranaceum album plus minusve pentagonum concreta. Corolla coerulea

Typus. Iran: Luristan, ca. 25 km from Sepiddasht to Shulabad, between Heyeh and Shulabad, 1800 m, 12. VII. 2000, V. Mozaffarian 80418 (holotypus. TARI)

Perennial. Stem solitary to several, 35-45 cm high, simple or in upper part ± straight few branched, striate-costate; loosely and regularly leafy throughout all part of the plant arachnoid tomentose. All leaves thick leathery, arachnoid-tomentose above, ± yellowish-green, with yellowish nerves; appressed white tomentose below, with prominent nerves, basal leaves lanceolate, soon deciduous; lower cauline leaves lanceolate, 20-28 × 5-8 cm, with large teeth, all lower teeth ± remote, diminishing to almost separate spines, upper teeth broadly triangular, regularly spinose; upper cauline leaves ± similar to basal; subtending branches leaves broadened at base, semiamplexicaul, sessile, triangular-lanceolate; leaves of the branches towards the tip much more reduced, with short blade, with short spiny teeth. Heads ± loose, without horns, up to 5-6 cm in diameter, homomorphous, consisting of lower and upper densely lanate capitulum; receptacle globose, with elevated foveolate scars, up to 4-5mm in diameter; common involucre 10-12 mm long, densely lanate, well developed capitulum with multiradiate brushes, up to 22 mm; phyllaries 14-17, up to 28 mm long, wholly towards the tip densely lanate; outer long linear-spathulate, ± broadly membranaceous margined, brownish, with short mucronulate tip; median oblong-elliptic, ciliate-fimbriate at tip, narrowed to a ± long mucro, innermost connate to a 5 angled tube, dark brown, towards the tip densely lanate, ciliate-fimbriate; upper capitulum delicate; brush multiradiate very short, ca. 5-8 mm long ± brownish at base, up to 14 mm.; phyllaries 17-19, up to 20 mm long, wholly densely lanate at tip and margins; outer narrowed towards the base, with triangular deltoideum appendage,

woolly at margins; median lanceolate-elliptic, innermost connate up to the middle, tubular, \pm membranaceous, \pm angled, \pm white. Corolla bluish-violet.

Notes. *Echinops shulabadensis* by having large lanceolate arachnoid- tomentose cauline leaves 20-28 \times 5-8 cm (not 0.15 \times 7 cm) and homomorphous glomerules with lower capitulum wholly lanate phyllaries (not just outer and intermediate layer of phyllaries lanate) is different with *E. hebelepis* DC.

***Echinops viscidulus* Mozaff., sp. nov.;**
(Fig. 11).

Planta perennis. Caulis 40-60 cm altus, a medio vel superne ramosus, sulcato-costatus, breviter appresse glandulosus et glanduloso-villosus, albo-flavescentis, tota longitudine foliatus et viscidulus. Folia omnia herbaceo-coriacea, discoloria, supra viridi-flavescentia, glanduloso-setosa, subtus sordide albo-tomentosa et sparsim glandulosa, nervis crasse prominentibus, in spinas validas flavas usque ad 10-30 mm longas excurrentibus; folia caulina inferiora ambito oblongo-lanceolata, bipinnatisecta usque ad 15-30 \times 10-15 cm longa et lata, segmenta majora 4-5-juga, inter se remota; rhachide alata, spinas nonnullas intercalares proferentibus, segmentis infimis plus minusve ad spinas simplicibus vel trifidis subliberis reductis, segmentis majoribus late lanceolato-triangularibus lobis triangularo-spinosis; folia caulina superiora basalibus similia sed segmentis infimis basin versus alatis et plus minusve amplexicaulo-spinosa; folia ramos fulcrantia late lanceolata, non profunde lobata, ad basin auriculato-amplexicaula, folia ramealia apicem caulis versus gradatim decrescentia et triangularo-lanceolata, apicem longe spinosa; caulis infra glomeruli subnudus. Glomerulus cornigerus, absque cornibus 3-6 cm diametro, e capitulis inferioribus glabris non cornigeris et capitulis superioribus plus minusve lanatis et cornigeris

compositus; receptaculum 10-12 mm diametro, globosum, cicatricibus albidis irregularibus subelevatis; involucri commune 10-12 mm longum, e bracteis pallidis membranaceis antice paulo dilatatis paucidentatis compositum. Capitula inferiora usque ad 20-22 mm longa, glabra; penicillum usque ad 14-22 mm longum; phylla 14-16, exteriora e basi lineari, apicem versus elliptico-triangularia integra, breviter acuminata, plus minusve pallide flavo-viridia; phylla intermedia longe lanceolato-elliptica, plus minusve longe acuminata, pallide flavo-viridia, basin versus plus minusve nigra, apice margine ciliatodentata; phylla quina intima basi in tubum pentagonum atrobrunneum concreta, parte libra inaequalia plus minusve lanceolata, integra vel pauciciliata. Capitula superiora phyllis intermediis partim in cornu laeve plus minusve pallide caeruleo, ad apicem plus minusve dilute flavo vel albo ad 4-5 cm longo transformatis; phyllis exterioribus albis, pallide caeruleis, mucronatis, et plus minusve apicem versus laxe lanatulis. Corolla caerulea, pallide caerulea vel raro alba usque ad 16 mm longa, laciniis 8 mm longis.

Typus. Iran: Kuhgiluye and Boirahmad, ca. 44 km from Yasuj to Sepidan 2050 m, 29. 6. 2000 V. Mozaffarian 80357 (holotypus. TARI)

Other specimens seen. Fars: 54 km from Sepidan to Shiraz, Kelestan, 1870 m, V. Mozaffarian 80353 (TARI); ca. 10 km from Sepidan to Shiraz, 1950 m, V. Mozaffarian 80355 (TARI); Kuhgiluye and Boirahmad: ca. 8 km from Sisakht to Yasuj, 1950 m, V. Mozaffarian 80359 (TARI); ca. 5 km from Meimand to Yasuj, 1700 m, V. Mozaffarian 80364 (TARI); 12 km from Meimand to Yasuj, 2260 m, V. Mozaffarian 79800 (TARI); 5-15 km from Yasuj to Gachsaran, around Dasht-e room, 2100 m, V. Mozaffarian 79796 (TARI);



Fig. 11. *Echinops viscidulus*. A, lower cauline leaf; B, upper part of stem with a head; (Mozaffarian 80358).

ca. 40 km from Yasuj to Semirum, between Sartang and Korre, 1560 m, V. Mozaffarian 79791 (TARI); Yasuj to Sepidan, Vazg, 1950 m, V. Mozaffarian 80358 (TARI); between Yasuj and Sepidan, Gardane Jelugir, 2450 m, V. Mozaffarian 80356 (TARI); Yasuj to Semirum, Patave, Maregun, 2300 m, V. Mozaffarian 79787 (TARI). Chahramahale Bakhtiari: Falard to Lordegan, between Dehgolabi and Chenar-e Mahmudi, 2200 m, V. Mozaffarian 79802, 79803 (TARI); Brujen to Lordegan around tunele Abvanak, 1940 m, V. Mozaffarian 79805, 79806 (TARI). Esfahan: 20 km from Semirum to Yasuj, 2150 m, V. Mozaffarian 79780 (TARI).

Plant perennial. Stem up to 40-60 cm high; from the middle or upper part branched, sulcate-costate, whitish-yellow, shortly appressed glandulose and glandulose-villose; all part of stem equally leafy; stems and leaves viscid. All leaves herbaceous-coriaceous, bicolor, greenish-yellow and glandulose-setose above, dirty white tomentose and sparsely glandulose below, with thick prominent nerves, running to strong yellow up to 10-30 mm long spines; lower cauline leaves oblong-lanceolate in outline, bipinnatisect, 15-30 × 10-15 cm, with 4-5 pairs of ± loose and large segments, with winged rhachis and some spines between the segments; lower segments reduced to simple or trifid spines; large segments widely lanceolate-triangular, with triangular spiny lobes; upper cauline leaves similar to basal ones, but lower segments towards the base winged and ± amplexicaul, and ± with many spines; leaves of subtending branches widely lanceolate, shallowly lobed, with auriculate-amplexicaul basal parts; leaves of branches towards the tip gradually diminishing and triangular-lanceolate, rarely with 3 lobes at base, with long spiny tip, below the heads naked. Heads cornigerous, without horns up to 3-6 cm in diameter, glabrous; consisting of lower glabrous, non cornigerous

and upper cornigerous, lanate capitulum; receptacle 10-12 mm diameter, globose, with ± irregularly elevated white scars; common involucre 10-12 mm long, with plae membranaceous bracts; bracts with ± broadened few toothed tip. Lower capitulum of a head up to 20-22 mm long, glabrous; brush up to 14-22 mm long; phyllaries 14-16, outer linear at base, towards the tip elliptic-triangular, ± entire, shortly acuminate, ± pale yellowish-green; median long lanceolate-elliptic, ± long acuminate, pale yellowish-green, toward the base ± dark brown, at the apex with ciliate-dentate margin; innermost 5, connate to a five angled dark brown tube, with unequal ± free part, entire or few toothed. Upper capitulum with median phyllaries changed to smooth horns, ± pale blue, or whitish-yellow, towards the tip pale yellow or white, up to 4-5 cm long; outer phyllaries white or pale blue, mucronate, ± at tips loosely lanulate. Corolla blue, pale blue or rarely white, up to 16 mm, with 8 mm long lacinia.

Notes. *Echinops viscidulus* is characteristic because of the viscid stem and leaves, the yellowish-green upper surface of leaves, and the very narrow lanceolate-elliptic, ciliate-dentate phyllaries. The nearest species to it are *E. karedjensis* Rech. f. which differs with it in having viscidulose glandulose and glandulose setose stem and leaves (not loosely arachnoid and shortly spreading setose), and *E. leiopolyceras* Bornm. which is different with it in having viscidulose leaves and stem and different shape of phyllaries of lower capitulum.

Sect. *Rytrodes* Bunge, Bull. Acad. Scienc. Petersbg 6: 406 (1863).

Syn.: Sect. *Ritropsis* Greuter & Rech. f., in Flora Iranica 139a: 49 (1979).

Type sect. *E. ritrodes* Bunge

1- Heads cornigerous 2

- Heads non cornigerous 5

2- Cauline leaves clearly petiolate, ovate-lanceolate or oblong-lanceolate in outline. Heads equally cornigerous

42. E. pachyphyllus Rech. f.

- Cauline leaves sessile. Only upper capitulum of a head cornigerous 3

3- Lower and upper capitula of a head glabrous

54. E. tenuisectus Rech. f.

- Lower and upper capitula of a head lanate 4

4- Leaves broadly oblong-lanceolate in outline, pinnati-lobate or pinnatifid

56. E. kermanshahanicus Mozaff.

- Leaves oblong-lanceolate in outline, 1-2 pinnatisect **55. E. abazariae** Mozaff.

5- Phyllaries of lower and upper capitula of a head glabrous 6

- Phyllaries of lower and upper capitula of a head equally lanate 12

6- Leaves glabrous above

47. E. polychromus Rech. f.

- Leaves papillose-glandulose, tomentose-glandulose above 7

7- Upper capitula of a head with some well developed phyllaries, due to this head appearance cornigerous 8

- Upper and lower capitula of a head with similar phyllaries, often shorter 10

8- Stems entirely covered by appressed permanent white tomentose hairs, together with long multicellular articulate purpureous glandular hairs **45. E. bithynicus** Boiss.

- Stems glabrous to shortly tomentose or glandulose-papillose but without long articulate glandular hairs 9

9- Leaves conspicuously arachnoid-tomentose above, marbled along nerves, often blistered or obsoletly bullate **44. E. mosulensis** Rech. f.

- Leaves with dense short glandular hairs above; upper cauline ones clearly lanceolate, sinuate-dentate, amplexicaul- auriculate, with rather broad to narrow rachis

43. E. macrophyllus Boiss. & Hausskn.

10- Lower capitula of a head up to 10-14 mm; phyllaries prominently fimbriate-ciliate

41. E. ritrodes Bunge

- Lower capitula of a head up to 14-32 mm 11

11- Plant usually very tall; lower cauline leaves nearly 2. pinnatipartite, papillose-glandulose above **46. E. orientalis** Trautv.

- Plant usually low, with straight branches, spreading over the ground and psammophilous; lower cauline leaves oblong-lanceolate, sinuate-dentate, papillose above

57. E. psammophilus Mozaff.

12- Leaves arachnoid above, along nerves prominently white marbled 13

- Leaves glabrous to arachnoid above but not marbled 15

13- Heads 5-9 cm in diameter; lower capitulum of a head up to 33-38 mm long

51. E. sojakii Rech. f.

- Heads smaller, lower capitulum of a head up to 25 mm long 14

14- Leaves finely dissected. Phyllaries of a single capitulum lanate inside

53. E. endotricus Rech. f.

- Leaves with broad rachis. Phyllaris of a single capitulum glabrous inside

52. E. persepolitani Rech. f.

15- Leaves glabrous above or with sessile glandular hairs. Median phyllaries of upper capitulum terminating to yellow spine, due to spiny phyllaries it looks cornigerous

48. E. dichorus Boiss. & Hausskn.

- Leaves equally arachnoid above 16

16- Leaves wholly arachnoid to glabrescent above, large 35×16cm, with large segments and broad rachis, often long spiny

49. E. disfulensis Bornm.

- Leaves wholly arachnoid above, lanceolate in outline 15-20×9-6 cm, with very small segments and short spines

59. E. bakhtiaricus Rech. f.

New species of Echinops L. Sect. Rytrodes

E. abazariae Mozaff., **sp. nov.**; Fig. 12.

Planta perennis. Caulis usque ad 40-60 cm altus, plerumque ad basin papillosus et stricte ramosus, supra dense araneoso-tomentosus et raro floccosus, striato-costatus, plus minusve dense foliatus, infra glomerulus subnudus.

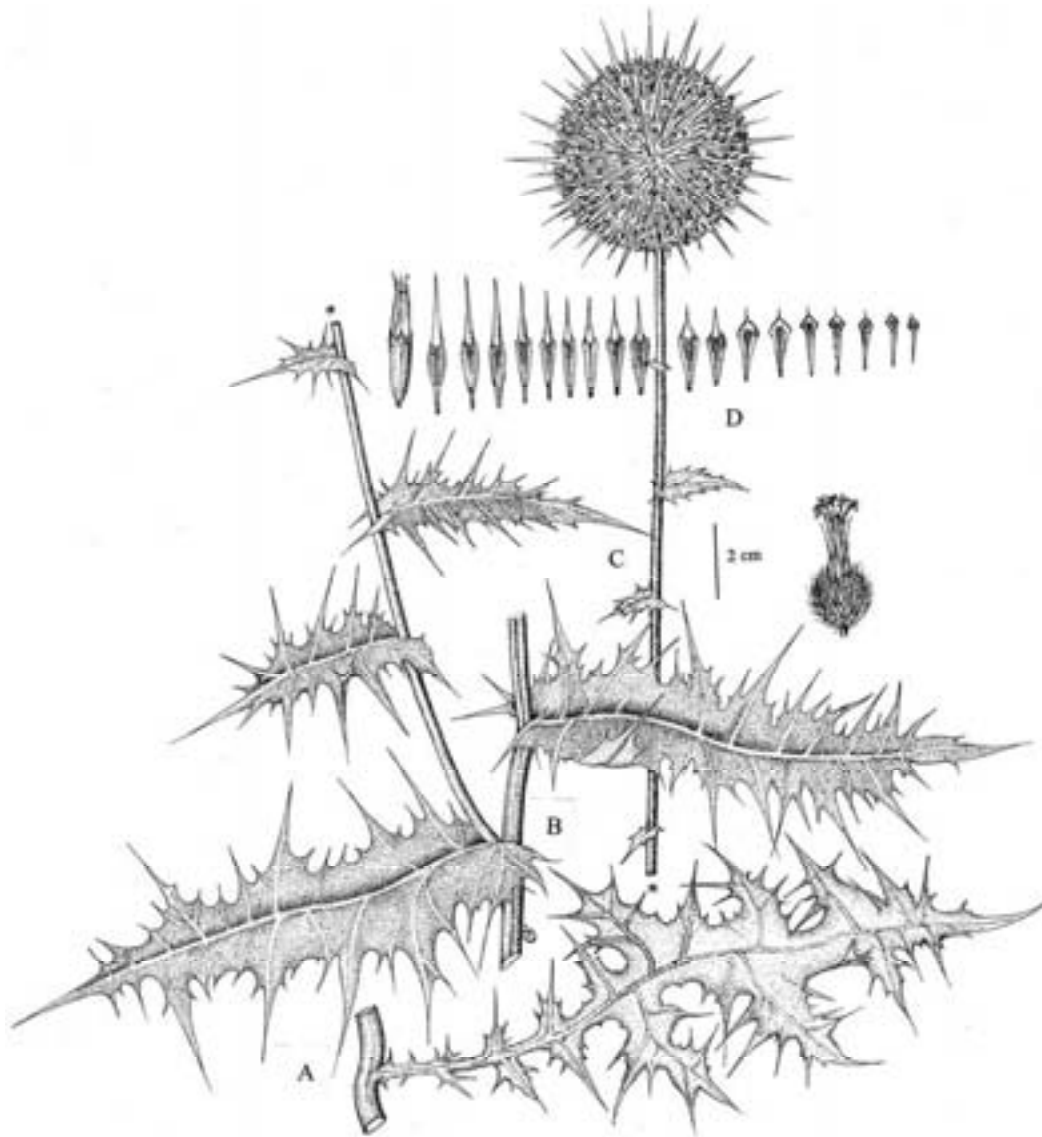


Fig. 12. *Echinops abazariae*. A, lower cauline leaf; B, a part of stem; C, upper part of stem with a head; D, phyllaries (from outer to inner, right to left): (Mozaffarian 79481)

Folia omnia coriacea vel coriaceo-herbacea, supra dense vel laxe araneoso-tomentosa, canescentia vel atroviridia, subtus dense albo-araneoso-tomentosa, manifeste nervosa, nervis in spinas excurrentibus; folia basalia 1-2 pinnatisecta, ambitu late oblongo-lanceolata, cum petiolo 14-20 cm longa; folia caulina inferiora 1-2 pinnatisecta, ambitu oblongo-lanceolata, segmentis majoribus 4-6 jugis, oblongo-lanceolatis, irregulariter dentato-spinosis, plus minusve runcinatis, segmentis basalibus ad spinas foliaceas reductis, rachidi anguste vel non alato, segmentis superioribus cum rhachidibus conjunctis, longe spinosis; folia caulina superiora et ramos fulcrantia caulina superiora similia, sed sessilia et auriculato-amplexicaulia; folia ramealia apicem versus reducta, oblongo-triangularia, dentato spinosa, infra glomerulus subnuda. Glomerulus plus minusve 4-6 cm diametro, e capitulis inferioribus et superioribus lanatis et irregulariter cornigeris compositus; receptaculum globosum, 4-6 mm diametro; involucrum commune 6-8 mm longum, e phyllis membranaceis antice triangularibus, ciliatis, compositum. Capitula inferiora usque ad 20 mm longa, non cornigera, lanata; penicillum usque ad 12 mm longum, album; radii plurimi: pappus intermedius (pseudopappus) 3 membranaceus apice triangularis, pallide brunneus, pectinato-fimbriatus phylla 22, lanata, exteriora ad basin lineata, late membranacea, apice cuneato-rhomboida, ciliato-acuminata; intermedia anguste elliptica, apicem versus gradatim angustiora, marginis appresse ciliata; intima 5 in tubum pallide brunneum membranaceum coalita, glabra; capitulis cornigeris 1-2 phyllis medianis in cornua transeuntis, 2-3 cm longis et apicem versus glabris. Corolla caerulea.

Typus. Kermanshah: Javanrud, Azgale, 750 m, 8. 6. 1999, V. Mozaffarian 79481 (holotypus. TARI).

Other specimens seen. Kermanshah: between Sar-e Pole Zahab and Kerend, Tange Patagh, close to diviation to Rijab, 1070 m, V.

Mozaffarian 79497; 79499, 70 km S. of Islamabad Gharb to Elam, 1120-1220 m, Hamzehee & Hatami 1489; 63km to Elam on the road from Islamabad, 1700 m, Assadi 60919.

Perennial. Stems up to 40-60 cm high, usually at the base papillose and straightly branched, in the upper part arachnoid-tomentose and rarely floccose, striate-ribbed, densely leafy, below the heads nearly naked. All leaves coriaceous or coriaceous-herbaceous, densely or loosely arachnoid-tomentose above, canescent or dark green, densely white arachnoid-tomentose below, prominently nerved; nerves decurrent to spines; basal leaves 1-2 pinnatisect, broadly oblongo-lanceolate in outline, together with the petiole 14-20 cm long; lower cauline leaves 1-2 pinnatisect, oblong-lanceolate in outline, with 4-6 pairs of large segments; segments oblong-lanceolate or triangular-lanceolate, irregularly dentate spinose, runcinate; lower segments reduced to leafy spines; rachis narrowly winged or not winged; upper segments conjugating to the rachis, long spiny; upper cauline and subtending branches leaves similar to upper cauline leaves but sessile and auriculate amplexicaul; leaves of branches towards the tip reduced, oblong, triangular, dentate-spiny, below the heads nearly naked. Heads 4-6 cm in diameter, consisting of lower and upper lanate and irregularly cornigerous capitulum; receptacle globose, 4-6 mm in diameter; common involucre 6-8 mm long, consisting of membranaceous bracts with triangular ciliate tips. Lower capitula of a head up to 20 mm long, non cornigerous, lanate; brush up to 12 mm long, white, with many ciliate rays; phyllaries 22, lanate; intermediate ones linear, membranaceous, triangular, pale brown at tip, pectinate-fimbriate; outer linear at base, broadly membranaceous, towards the tip cuneate-rhomboid, ciliate-acuminate; median narrowly elliptic, towards the tip gradually narrowed, appressed ciliate at

margins; inner 5 connate to a membranaceous pale brown glabrous tube. Upper capitulum of a head similar to basal, lanate and non cornigerous; cornigerous capitula with 1-2 median phyllaries changed to horns, 2-3 cm long and towards the tip glabrous. Corolla caerulea.

Notes. *E. abazariae* because of having lanate capitula of a head (not glabrous) differs from *E. tenuisectus* Rech. f., and by having 1-2 pinnatisect leaves differs from *E. kermanshahanicus* Mozaff. (not pinnatilobate or sinuate-dentate). The new species is named in the honour of my wife Mrs. M. Abazari.

***E. kermanshahanicus* Mozaff., sp. nov.;** (Fig. 13).

Planta perennis. caulis erectus, usque ad 40-50 cm altus, sulcatus, dense araneoso-tomentosus, ad basin vel supra medium ramosus, imprimis in parte inferiore dense foliatus, ramis saepe subnudis. Folia omnia consistentia coriacea, supra viridio-flavescentia, dense vel laxe floccoso-arachnoidea (in var. *kermanshahanicus*) vel non arachnoidea sed papillosa (in var. *papillosus* (Rech. f.) Mozaff. comb. nov.), subtus dense albo-tomentosa, manifeste nervosa; nervis crassis in spinas validiores excurrentibus; folia basalia ambitu oblongo-lanceolata, pinnatifida vel pinnatilobata, segmentis majoribus 3-5 jugis, segmentis inferioribus ad spinas separatis reductis; folia caulina inferiora ambitu oblongo-lanceolata, 14-17 cm longa, 5-8 cm lata, pinnatisecta, segmentis majoribus 5-6 jugis, triangulari-dentatis, in spinas longas decurrentibus, rhachidibus alatis, basin versus decurrentibus, segmentis basalibus ad spinas foliaceas reductis; folia caulina superiora et ramos fulcrantia ambitu oblongo-lanceolata, grosse lobato-dentata, ad basin auriculato-amplexicaulia; folia ramealia ramealia fulcrantia similia, sed minora, ad apicem versus gradatim reducta, infra glomerulus subnudus. Glomerulus plus minusve 4-8 cm diametro, e capitulis inferioribus glabris non cornigeris et superioribus lanatulis non vel

cornigris et aliquantum capitulis cornigeris compositus; receptaculum globosum, 8-10 mm diametro; involucri commune 6-8 mm longum, e Phyllis membranaceis antice flabellato-dentatis compositum. Capitula inferiora usque ad 20-26 mm longa, non cornigera; penicillum usque ad 12-14 mm longum, multiradiatum, albidum; pappus intermedius (pseudopappus) linearis, antice minute spathulatus; phylla 19-20, excepto exteriora lanatula et glandulosa, glabra; exteriora e basi lineari, apicem versus cuneato-elliptica, acuminata; phylla intermedia e basi cuneato-elliptica, brunnea, apicem versus longe acuminato-cuspidata, straminea; phylla intima 5, in tubum membranaceum coalita, glabra. Capitulis superioribus basalibus similis non cornigeris et in capitulis cornigeris phylla mediana in cornua longa transeuntibus.

Typus. Kermanshah, Beginning of the road from Gilan-e Gharb to Ghasr-e Shirin, 850 m, V. Mozaffarian 79516. (holotypus TARI).

1. Folia supra dense vel laxe arachnoidea et floccosa **var. kermanshahanicus** - Folia supra non arachnoidea sed papillosa **var. papillosus** (Rech. f.) Mozaff. comb. nov.

var. kermanshahanicus

Other specimens seen. Kermanshah: 26 km from Ghasr-e Shirin to Gilane-Gharb, Ruybane Bozorg village, 620 m, V. Mozaffarian 79511; Ghasr-e Shirin, 470 m, V. Mozaffarian 79494; ca. 6 km from Ghasr-e Shirin to Sar-e Pole Zahab, 490 m, V. Mozaffarian 79489; 46 km from Gilane Gharb to Sumar, 550 m, V. Mozaffarian 79530; 35 km from Azgale to Sar-e Pole Zahab after Sarab-e Zahab, 640 m, V. Mozaffarian, 79485; Javanrud, Azgale, 720 m, V. Mozaffarian 79482. -Elam: Salehabad to Sumar, Sarnei, 670 m, V. Mozaffarian 79548.

var. papillosus (Rech. f.) Mozaffarian, **comb. nov.**

Syn.: *Echniops armatus* Boiss. & Hausskn. var. *papillosus* Rech. f., Fl. Iranica 139a: 45(1979).

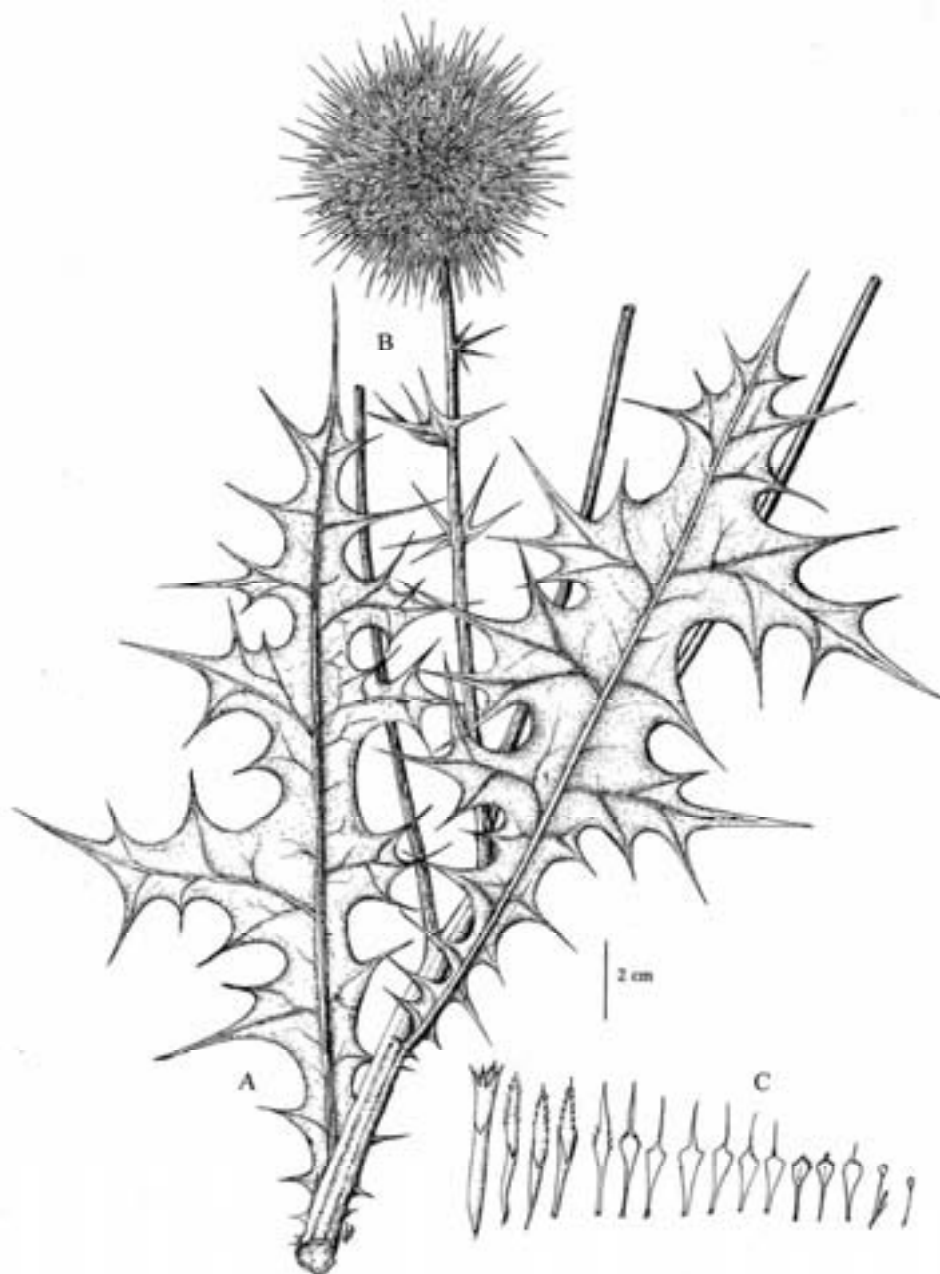


Fig. 13. *Echinops kermanshahnicus* var. *kermanshahanicus*. A, a part of stem with stem leaves; B, upper part of stem with a head; C, phyllareis (from outer to inner, right to left); (Mozaffarian 79516).

Specimens seen: Kermanshah: 35 km from Azgale to Sar-e Pole Zahab after Sarabe Zahab, 640 m, V. Mozaffarian 79486. Sumar, 370 m, V. Mozaffarian 79533; 10 km from Ghasr-e Shirin to Gilane Gharb, 460 m, V. Mozaffarian 79509. Elam: Salehabad to Sumar, Sarnei, 670 m, V. Mozaffarian 79549; ca. 27 km from Elam to Salehabad, close to Banrushan, 1000 m, V. Mozaffarian 79540, 79546.

Perennial. Stems straight, up to 40-50 m, sulcate, densely arachnoid-tomentose, from the base or above the middle branched, mainly in lower part densely leafy; branches nearly naked. All leaves coriaceous, yellowish green above, densely or loosely floccose-arachnoid (in var. *kermanshahanicus*) or non-arachnoid but papillose in var. *papillosus* (Rech. f.) Mozaffarian, dense white-tomentose below and prominently nerved, with thick nerves terminating to sturdy spines; basal leaves oblong lanceolate in outline, pinnatifid or pinnatilobate, with 3-5 pairs of large segments, lower segments diminishing to distant spines; lower cauline leaves oblong-lanceolate in outline, 14-17×5-8cm, pinnatisect, with 5-6 pairs of large segments, triangular, dentate, decurrent to long spines, with broadly winged rachis, decurrent towards the base; lower segments reduced to leafy spines; upper cauline and subtending branches leaves oblong-lanceolate in outline, coarsely lobate-dentate, auriculate-amplexicaul at base; leaves of branches similar to subtending branches leaves, but smaller, towards the tip gradually diminished, below the heads nearly naked. Heads 4-8 cm in diameter, consisting of lower glabrous and not cornigerous capitula and upper lanatulate not or cornigerous capitula sometimes prominently cornigerous; receptacle globose, 8-10 mm in diameter, common involucre 6-8 mm long, consisting of membranaceous bracts, flabellate-dentate at tip. Lower capitulum of a head up to 20-26 mm long; brush up to 12-14 mm, many-rayed, white; phyllaries 19-20, except lanatulate and glandulose outer ones glabrous; intermediate

phyllaries linear with small spatulate tip, outer linear at base, towards the tips cuneate-elliptic, acuminate, median cuncate-elliptic at base, brownish, towards the tips long acuminate-cuspidate, straw-yellow; 5 inners connected to a membranaceous tube, glabrous, upper capitulum of a head similar to lower, lanatulate and non-cornigerous, in cornigerous capitulum median phyllaries changed to long horns.

Notes. *E. kermanshahanicus* by having 20-25 involucre bracts with 5 inner ones slightly connate to a membranaceous tube (not with 11-15 involucre bracts with 5 inner ones connate to a five angled tube) belong to the sect. *Rytrodes* Bunge and by having slightly lanatulate outer involucre bracts (not white lanatulate) is different with *Echinops armatus* Boiss. & Hausskn. sensu Rech. f., Fl. Iranica, 139: 36 (1979). The most approximate species to it are *E. psammophilus* Mozaff. which differs from it by having cornigerous upper capitulum of a head (not non-cornigerous) and *E. tenuisectus* Rech. f., and *E. abazariae* Mozaff. which differs from them by the shape of leaves and characters of capitula.

***Echinops psammophilus* Mozaffarian, sp. nov.;** Fig. 14.

Planta perennis. Caulis usque ad 40-50 cm altus, plerumque prope basin stricte multiramosus et prostratus. Caulis plus minusve sulcatus, arachnoideo-tomentosus, dense foliatus, infra glomerulus subndus. Folia omnia consistentia coriacea, supra laxe araneoso-floccosa vel papillosa, subtus dense araneoso-tomentosa, alba, manifeste crasse nervosa; nervis in spinas validiores excurrentibus; folia caulina inferiora ambitu oblongo-lanceolata, 25-30×5-8 cm, pinnatilobata, lobis majoribus 3-4, late triangulari-grosse dentatis, lobis basalibus ad spinas foliaceas reductis; folia caulina superiora et ramealia fulcrantia late oblongo-lanceolata, grosse dentata, ad basin versus late decurrentia et plus minusve auriculata; folia ramealia oblongo-triangularata, grosse dentata,

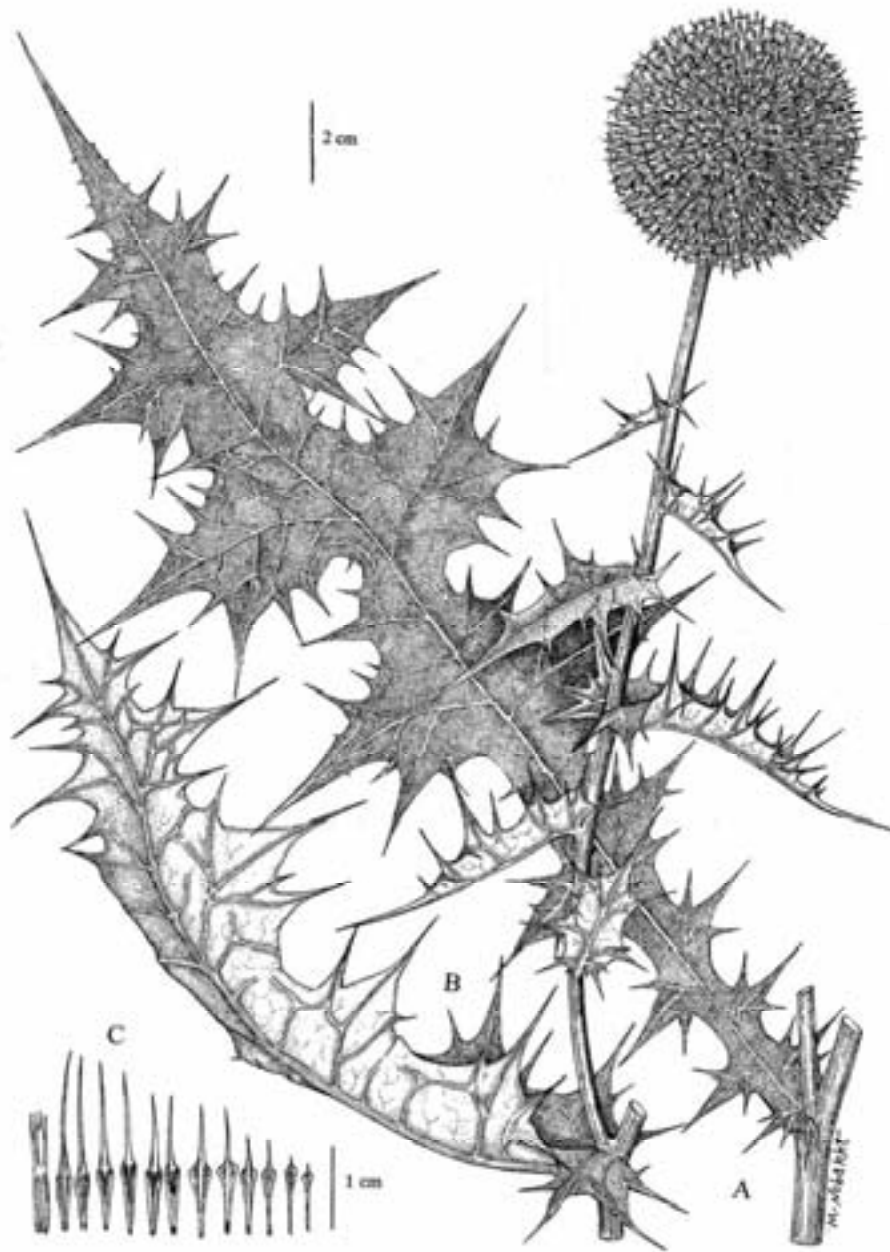


Fig. 14. *Echinops psammophilus*. A, lower cauline leaf; B, upper part of stem with a head; C, phyllareis (from outer to inner, right to left); (Mozaffarian 79410)

plus minusve auriculato-amplexicaulia, vel truncata, apicem versus reducta, infra glomerulus subnuda. Glomerulus 5-8 cm diametro, e capitulis inferioribus et superioribus glabris vel glandulosis vel sparse lanatulis et non cornigeris compositus; receptaculum obconico-globosum, 8-10 mm diametro; involucre commune 6-12 mm longum, e phyllis membranaceis antice triangulari-spathulatis, dentato-acuminatis compositum. Capitula inferiora usque ad 27-28 mm longa, non cornigera, glabra; penicillum usque ad 12-14 mm longum, in capitulum bene evolutum usque ad 24 mm longum, multiradiatum, albidum; pappus intermedius (pseudopappus) linearis, pectinato-fimbriatus; phylla 17-20, glabra, exteriora e basi linearibus, apicem versus elliptica, longe stramineo-acuminata; phylla intermedia longe elliptica, longe acuminata, verosimiliter cornigera; phylla intima 5, in tubum atrobrunneum membranaceum connatum glabra, quam phylla media breviora, capitulis superioris inferioris similis, glabris et non cornigeris. Corolla coerulea. Achenia villosa, pappi setae basi tantum concretae

Typus: Khuzestan: Ahvaz, sand dunes of Karkhe, N. W. of Karkhe dam, 80 m, 24.5.1999 V. Mozaffarian 79410 (TARI).

Other specimens Seen. Khuzestan: sand dunes W. of Abdulkhan, 80 m, V. Mozaffarian 79412; N. of Ahavz, sand dunes of Karkhe, Pabot 1070; ca. 10 km from Mullasani to Masjed Soleyman ca. 80 m, V. Mozaffarian 77872; ca. 4 km from Mullasani to Masjed Soleyman, 100 m, V. Mozaffarian 79409. ca. 40 km from Shushtar to Dezful, 130 m, V. Mozaffarian 79413.

Perennial. Stems up to 40-50 cm, nearly from near the base with erect branches and prostrate; stems sulcate, arachnoid-tomentose, densely leafy, below the heads, nearly naked. All leaves coriaceous, loosely arachnoid-floccose or papillose above, densely white arachnoid-tomentose below, with prominent nerves, nerves decurrent to rather sturdy spines; lower cauline leaves oblong-lanceolate in outline, 25-30 cm long, 5-8 cm wide, pinnatilobate; large lobes 3-4 pairs, broadly triangular-dentate; basal lobes

reduced to leafy spines; upper cauline and subtending branches leaves broadly oblong-lanceolate, with large teeth, broadly decurrent towards the base and auriculate; leaves of branches oblong-triangular, with large teeth auriculate-amplexicaul to nearly truncate at base, towards the tip diminished, below the heads nearly naked. Heads 5-8 cm in diameter; consisting of lower and upper glabrous or glandulose or sparsely lanatulate and non cornigerous capitulum; receptacle obconical-globose, 8-10 mm in diameter; common involucre 6-12 mm long, consisting of membranaceous bracts, with triangular-spathulate, dentate-acuminate tips. Lower capitulum of a head up to 27-28 mm long, non cornigerous, glabrous; brush up to 12-14 mm long, in well developed capitulum up to 24 mm, many-rayed, whitish; phyllaries 17-20, glabrous; intermediate phyllaries linear, pectinate-fimbriate; outer linear at base, towards the tip elliptic, long straw-coloured, acuminate; median phyllaries long elliptic, long acuminate, looking like horns; 5 inner phyllaries connected to a membranaceous glabrous tube, shorter than the median phyllaries. Upper capitulum similar to basal, non cornigerous and glabrous. Corolla caerulescent. Achenes villose; pappous nearly connected at base.

Notes. *Echinops psammophilus* because of the being in Section *Rytrodes* and having non cornigerous capitulum is different from *E. armatus* Boiss. & Hausskn. var. *papillosus* Rech. f., in *Flora Iranica* 139 a: 45 (1979). The most approximate species to it is *Echinops kermanshahanicus* Mozaff., which differs from it in having non cornigerous upper capitula and shape, size and other character of phyllaries in lower capitula.

Sect. Echinops

Syn.: Sect. *Ritro* Bunge, Bull. Acad. Scienc. Petersbg. 6: 401 (1863), Sect. *Sphaerocephalus* Bunge, l. c.

Type section *E. ritro* L.

1- Plant caespitose; basal cauline leaves linear to linear-lanceolate, petiolate

60. E. aucheri Boiss.

- Plants non caespitose; leaves different 2
 2- Plant conspicuously heterophyllous; basal leaves with prominent leaf sheaths; rootstock densely covered by petiolar remains

61. E. heterophyllus P.H. Davis

- Basal and upper cauline leaves similar, basal leaves lacking leaf sheaths, or leaf sheaths inconspicuous 3

3- Heads ± large, up to 4-8 cm in diameter. Lower capitulum of a head up to 16-38 mm 4

- Heads small, 2-6 cm in diameter. Lower capitulum of a head up to 10-22 mm 5

4- Leaves glandulose-setose above. Heads 6-8 cm in diameter; phyllaries recurved in fruit

62. E. tournefortii Ledeb. ex Trautv.

- Leaves glandulose-setose above. Heads 4-8 cm in diameter; phyllaries straight in fruit

63. E. pungens Trautv.

5- Leaves conspicuously herbaceous, often non spinose or spiny but not pungent 6

- Leaves conspicuously coriaceous or coriaceous herbaceous, often with pungent spines 8

6- Phyllaries of lower capitulum of a head glabrous, not glandulose and not villose

67. E. kurdicus Boiss. & Hausskn.

- Phyllaries of lower capitulum of a head glandulose- pilose or papillose 7

7- Stems loosely leafy, often monocephalous, densely glandulose-papillose. Phyllaries of lower capitulum of a head up to 22-28 mm, glandulose at tip

68. E. inermis Boiss. & Hausskn.

- Stems densely leafy, often with several heads, glandulose-villose; phyllaries of lower capitulum of a head up to 20-22 mm, glandulose at tip

69. E. koelzii Rech.f.

8- Phyllaries of lower capitulum of a head villose

70. E. arachniolepis Rech. f.

- Phyllaries of lower capitulum of a head glabrous 9

9- leaves conspicuously densely arachnoid-tomentose to loosely arachnoid above 10

- Leaves loosely arachnoid to glandulose, finally glabrescent 12

10- Leaves lanceolate in outline, sinuate-lobate

64. E. elbursensis Rech. f.

- Leaves pinnatifid to 2-pinnatisect 11
 11- Leaves thick coriaceous, narrowly pinnatifid with pungent spines

66. E. Kotschyi Boiss.

- Leaves coriaceous or herbaceous-coriaceous, broadly pinnatisect

65. E. nizvanus Rech. f.

12- Stems densely arachnoid-tomentose to floccose

58. E. ritro L.

- Stems densely glandulose-papillose

59. E. freitagii Rech. f.

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