10

Egypt. J. Bot. **Vol. 59,** No.1, pp. 107 - 138 (2019)

Computer-generated Keys to the Flora of Egypt. 9. The Spiny Taxa of Asteraceae

Adel El-Gazzar[(1)#], Nahed El-Husseini[(2)], Azza A. Khafagi[(3)], Nashua A.M. Mostafa[(1)]

[(1)]Department of Botany and Microbiology, Faculty of Science, El-Arish University, N. Sinai, Egypt; [(2)]The Herbarium, Botany Department, Faculty of Science, Cairo University, Giza, Egypt; [(3)]Botany Department, Faculty of Science, Al-Azhar University (Girls Branch), Cairo, Egypt.

MANUALLY constructed keys for identification of plants leave much to be desired. Keys to the Asteraceae of Egypt are no exception and depend largely on floral minutiae while vegetative morphology is a much richer source of characters suitable for key construction. Inspection of some 3000 specimens showed that the most obvious feature of the plants is the presence or absence of spines on leaves, leaf axils, stem internodes, margins of stem wings and phyllaries. This feature was selected to divide species of this family into two main groups: spiny and spineless. Nomenclature of all taxa was updated and those with names reduced to synonyms of others were eliminated. This article deals only with the 65 species belonging to 20 genera of the first group. A total of 51 characters describing variation in spine distribution and other characters of vegetative morphology were recorded for each of the 65 spiny species and the key-generating program DELTA was applied to the data matrix. The result is a much improved automated key, a detailed description of every species in terms of the entire set of 51 characters, and the same description but in terms of the serial numbers assigned to these characters and their states.

Keywords: Asteraceae, DELTA, Egypt, Flora, Identification, Morphology, Spiny taxa.

Introduction

The Asteraceae Bercht. et J. Presl, *nom. cons.* (Compositae Giseke *nom. cons. et nom. alt.*) are among the largest five families of angiosperms. According to the websites of The Plant List (2016) and The Missouri Botanical Garden (2017), this family includes 1911 genera and 32913 accepted species names. The Asteraceae are cosmopolitan, occupy nearly every habitat type and range from small annual herbs to relatively large shrubs and trees, with some spiny cactus-like species in the deserts of Central America. The most distinctive feature of the composites is the structure of the inflorescence or capitulum. The invariably epigynous flowers are arranged on a flat to convex receptacle and surrounded by one or more whorls of phyllaries known collectively as the involucre. The flowers are essentially of the same structure except that the central flowers may have tubular corolla (hence the names tubular or disc flowers), while the peripheral ones may have their corollas split along one side to take a flat linear shape (hence the names ray or ligulate flowers). The species vary considerably in the type of flowers in their capitula. A capitulum may contain only tubular flowers, ray flowers, or both. Furthermore, each of the two flower types may be hermaphrodite or functionally male with empty ovaries. In *Xanthium* species, the plant is monoecious and male and female capitula are carried on the same peduncle. When present, the calyx is usually reduced into a pappus of scales, bristles or plumes. Stamens 5, with free filaments and connate anthers. Ovary unilocular, style single with two stigmatic arms; achenes 1-seeded or sterile.

The Asteraceae are represented in the flora of Egypt by 98 genera and 227 species with 15 subspecies and 15 varieties (Boulos, 2002). Previous keys to taxa of the Asteraceae in Egypt include those by Muschler (1912), Montasir & Hassib (1956), Täckholm (1956, 1974) and Boulos

#Corresponding author email: elgazzar_adel@hotmail.com
DOI: 10.21608/ejbo.2018.4536.1191
Edited by: Prof. Dr. Monier M. Abd El-Ghani, Faculty of Science, Cairo University, Cairo, Egypt.

(2002). The first couplet in those keys uses almost invariably the difference in flower types in the capitulum (such as: "all florets ligulate vs. at least central flowers tubular") to divide all taxa into two major groups. The flower type is impossible to determine with any degree of accuracy in species of many large genera with minute capitula (e.g. *Artemisia*, *Filago*, *Gnaphalium*, *Pulicaria*). Similarly, variation in the plants' perennation and functional sexuality of flowers and achenes are most difficult to observe by the user of any key, but they feature prominently in the succeeding couplets and entries of the traditional keys of Asteraceae. Taking any further steps in such keys would, therefore, be fraught with difficulty and the ultimate result is usually shrouded in doubt. A substitute of characters, other than flower types and a range of similarly unsuitable characters, which would be easily observable, as genetically stable as can be ascertained by examining the widest possible range of specimens of the same taxon, and whose character-states are as widely separated as possible, had to be found, especially that the plants exhibit almost every conceivable aspect of variation in vegetative morphology. Cursory inspection of about 3000 specimens of the Asteraceae in the herbaria of Cairo and Alexandria Universities led to selecting the distribution of spines on the various parts of plants as a potential candidate for the required substitute. The spines may be found in leaf axils, on stem internodes or on apices and margins of leaves and phyllaries; in *Iphiona* species the entire leaf is modified into a spine. Bases of leaf blades may extend to form flappy wings fused to the sides of stem internodes and the spines may be arranged along the margins of those wings. Hence the primary division of the species of Asteraceae in Egypt into two groups: spiny and spineless.

The present article deals only with taxa of the spiny group, where the widest possible range of variation in vegetative morphology is coupled with the pattern of distribution of spines on different parts of the plants to form the basis of a new key to the species and their infra-specific taxa. Highly efficient computer programs designed for generation of identification keys are widely available and avoid the drawbacks of manually constructed keys. Such programs are highly flexible and the keys produced by them lead consistently to easily repeatable results. They were previously used to generate much improved keys to various groups in the flora of Egypt (El-Gazzar et al., 2008 a, 2008 b, 2009 a, 2009 b, 2012, 2015 a, 2015 b, 2019).

Materials and Methods

This study is based on the specimens of 65 species and infra-specific taxa belonging to 20 genera kept in the herbaria of Cairo and Alexandria Universities (CAI and ALEX, respectively) and representing the spiny members of the Asteraceae in the flora of Egypt. Apart from the taxa represented by their type specimens in CAI, identity of all other taxa was verified with the help of local floras of Egypt and some neighboring countries (e. g. Andrews, 1956; Feinbrun-Dothan, 1977, 1978 and Boulos, 2002). Nomenclature of all taxa was updated according to the data bases of The Plant List (2016) and The Missouri Botanical Garden (2017), where synonyms of the currently accepted names can be found.

States of 51 characters were recorded comparatively for each taxon and the DELTA suit of computer programs (Dallwitz et al., 1993 onwards and Dallwitz & Paine, 2005) was used in key construction. This program suit produces a conventional identification key, a description of each taxon in terms of the recorded characters in natural language (detailed descriptions), and in the serial numbers assigned to characters and character-states (item descriptions).

Results

The outcome of inspecting approximately 1200 specimens of spiny members of the Asteraceae collected from Egypt and neighboring countries was the recording of the states of the following list of 51 characters for each of the 65 taxa. The character-states were defined in the simplest possible terms so that none of them needs further explanation or illustration.

#1. Plant/1. herb/2. shrub/

#2. Stem/1. erect/2. prostrate/3. dwarf/

#3. Stem/1. gland-dotted/2. not gland-dotted/

#4. Stem/1. grooved/2. not grooved/

#5. Stem/1. solid/2. hollow/

#6. Stem/1. with spiny wings/2. with spinless wings/3. wingless/

#7. Axillary bi-trifurcate spine/1. present/2. absent/

#8. 2–4 spines at leaf base/1. present/2. absent/

#9. Leaf apex/1. spiny/2. spineless/

#10. Leaf margin/1. spiny/2. spineless/

#11. Outer phyllaries apex/1. spiny/2. spineless/

#12. Outer phyllaries margin/1. spiny/2. spineless/

#13. Inner phyllaries apex/1. spiny/2. spineless/

#14. Inner phyllaries margin/1. spiny/2. spineless/

#15. Leaves/1. basal/2. cauline/3. basal and cauline/

#16. Cauline leaves/1. simple/2. 3-lobed/3. pinnatifid-pinnate/

#17. Outline of cauline leaves/1. linear-lanceolate/2. ovate/3. rhombic/4. spathulate/

#18. Cauline leaves/1. canaliculate-cylindrical/2. flat/

#19. Cauline leaf upper surface/1. glabrous/2. hairy/3. white woolly/4. prickly/

#20. Cauline leaf lower surface/1. glabrous/2. hairy/3. white woolly/4. prickly/

#21. Cauline leaves/1. petiolate/2. sessile/

#22. Leaf veins/1. prominent/2. not prominent/

#23. Leaf veins/1. green/2. white/

#24. Leaves/1. gland-dotted/2. not gland-dotted/

#25. Leaf blade/1. soft/2. rigid/

#26. Leaf blade length/1. 7.5cm or less/2. 8.5–18cm/3. 22cm or more/

#27. Leaf blade width/1. 0.7cm or less/2. 1–2.8cm/3. 3.5cm or more/

#28. Inflorescence/1. an aggregate of 6-flowered capitula/2. an aggregate of 1-flowered capitula/3. many-flowered capitula/

#29. Capitula/1. solitary terminal/2. in terminal glomerules/3. basal/

#30. Capitula/1. globular/2. elongate/

#31. Whorl of bracts subtending inflorescence/1. present/2. absent/

#32. Peduncle/1. longer than capitulum/2. shorter than capitulum/3. absent/

#33. Ray flowers/1. conspicuous/2. inconspicuous or absent/

#34. Outer phyllaries/1. longer than inner/2. as long as inner/3. shorter than inner/

#35. Outer phyllaries/1. united/2. free/

#36. Outer phyllaries/1. gland-dotted/2. not gland-dotted/

#37. Outer phyllaries body/1. convex/2. flat/

#38. Outer phyllaries margin/1. scarious/2. not scarious/

#39. Outer phyllaries veins/1. prominent/2. not prominent/

#40. Inner phyllaries/1. linear-lanceolate/2. ovate/

#41. Inner phyllaries/1. gland-dotted/2. not gland-dotted/

#42. Apex of inner phyllaries/1. with membrane/2. without membrane/

#43. Pappus/1. feathery/2. bristles or scales/3. absent/

#44. Achenes/1. hairy/2. glabrous/

#45. Achenes/1. united with paleae/2. not united with paleae/

#46. Achenes/1. obpyramidal-obovate/2. oblong/

#47. Achene apex/ 1. long-beaked/ 2. round-truncate/

#48. Achene base/ 1. symmetrical/2. asymmetrical/

#49. Achene surface/ 1. smooth/2. streaked/

#50. Achenes/ 1. unilocular, 1-seeded/2. bilocular, 2-seeded/

#51. Achene surface/ 1. with hooked spines/2. without hooked spines/

The conventional key

Characters: 51 indata, 51 included, 32 in key.
Items: 65 in data, 65 included, 65 in key.
Parameters: Rbase = 1.40 Abase = 2.00 Reuse = 1.01 Varywt =.80
Characters included: 1–51
Character reliabilities: 1–52,5.0

1.	Outer phyllaries longer than inner	2
	Outer phyllaries as long as inner	22
	Outer phyllaries shorter than inner	29
2(1).	Leaf blade width 0.7 cm or less	3
	Leaf blade width 1-2.8 cm	12
	Leaf blade width 3.5 cm or more	21
3(2).	Pappus feathery	4

Pappus bristles or scales 11
Pappus absent ..... ***Anvillea garcinii* (Burm.*f.*) DC.**

4(3). Peduncle shorter than capitulum 5
Peduncle absent 8

5(4). Leaves cauline 6
Leaves basal and cauline 7

6(5). Stem erect; capitula solitary terminal; inner phyllaries margin spiny; capitula globular ..... ***Carthamus mareoticus* Delile**
Stem prostrate; capitula in terminal glomerules; inner phyllaries margin spineless; capitula elongate ..... ***Atractylis serratuloides* (Cass.) Sieber ex Cass.**

7(5). Cauline leaf upper surface hairy; leaf blade soft; outer phyllaries margin not scarious; inner phyllaries linear-lanceolate ..... ***Atractylis boulosii* Täckh.**
Cauline leaf upper surface white woolly; leaf blade rigid; outer phyllaries margin scarious; inner phyllaries ovate ..... ***Atractylis carduus* (Forssk.) C. Chr.**

8(4). Cauline leaf upper surface hairy 9
Cauline leaf upper surface white woolly 10

9(8). Leaf blade soft; inner phyllaries linear-lanceolate ..... ***Atractylis cancellata* L.**
Leaf blade rigid; inner phyllaries ovate ..... ***Atractylis aristata* Batt.**

10(8). Cauline leaf lower surface hairy; leaf veins prominent; stem grooved; ray flowers inconspicuous or absent ..... ***Atractylis mernephthae* Asch., Schweinf. & Letourn.**
Cauline leaf lower surface white woolly; leaf veins not prominent; stem not grooved; ray flowers conspicuous ..... ***Atractylis prolifera* Boiss.**

11(3). Capitula solitary terminal ..... ***Carthamus tenuis* (Boiss. & Blanche) Bornm.**
Capitula in terminal glomerules ..... ***Carthamus tenuis* subsp. *foliosus* (Boiss.) Hanelt**

12(2). Leaves basal ..... ***Centaurea furfuracea* Coss. & Durieu**
Leaves cauline 13
Leaves basal and cauline 16

13(12). Pappus feathery ..... ***Notobasis syriaca* (L.) Cass.**
Pappus bristles or scales 14
Pappus absent ..... ***Scolymus maculatus* L.**

14(13). Outer phyllaries margin spiny; outline of cauline leaves linear-lanceolate; cauline leaf upper surface hairy; cauline leaf lower surface hairy 15
Outer phyllaries margin spineless; outline of cauline leaves ovate; cauline leaf upper surface glabrous; cauline leaf lower surface glabrous ..... ***Carthamus tinctorius* L.**

15(14). Outer phyllaries margin scarious; inner phyllaries linear-lanceolate; stem not grooved; outer phyllaries gland-dotted ..... ***Carthamus glaucus* subsp. *alexandrinus* (Boiss. & Heldr.) Hanelt**
Outer phyllaries margin not scarious; inner phyllaries ovate; stem grooved; outer phyllaries not gland-dotted ..... ***Carthamus glaucus* M. Bieb.**

16(12). Peduncle longer than capitulum ..... ***Pallenis spinosa* (L.) Cass.**
Peduncle shorter than capitulum 17
Peduncle absent 18

17(16). Capitula solitary terminal; inner phyllaries linear-lanceolate; inner phyllaries gland-dotted; cauline leaves simple ..... ***Carthamus lanatus* L.**
Capitula in terminal glomerules; inner phyllaries ovate; inner phyllaries not gland-dotted; cauline leaves pinnatifid-pinnate ..... ***Carthamus nitidus* Boiss.**

18(16). Inner phyllaries gland-dotted 19
Inner phyllaries not gland-dotted 20

19(18). Inner phyllaries apex spiny; inner phyllaries margin spiny; cauline leaves pinnatifid-pinnate; capitula solitary terminal ..... ***Carthamus eriocephalus*** **(Boiss.) Greuter**
Inner phyllaries apex spineless; inner phyllaries margin spineless; cauline leaves simple; capitula in terminal glomerules ..... ***Carlina involucrata*** **Poir.**

20(18). Stem with spiny wings; inner phyllaries apex spiny; capitula elongate; stem grooved ..... ***Scolymus hispanicus*** **L.**
Stem wingless; inner phyllaries apex spineless; capitula globular; stem not grooved ..... ***Carlina sicula*** **subsp.** ***mareotica*** **(Asch. & Schweinf.) Greuter**

21(2). Cauline leaf lower surface glabrous; pappus absent ..... ***Gundelia tournefortii*** **L.**
Cauline leaf lower surface hairy; pappus bristles or scales ..... ***Centaurea benedicta*** **(L.) L.**
Cauline leaf lower surface white woolly; pappus feathery ..... ***Cynara cornigera*** **Lindl.**

22(1). Leaf blade width 0.7 cm or less ..... ***Centaurea aegyptiaca*** **L.**
Leaf blade width 1-2.8 cm 23
Leaf blade width 3.5 cm or more 26

23(22). Stem with spiny wings 24
Stem with spinless wings ..... ***Centaurea dimorpha*** **Viv.**
Stem wingless 25

24(23). Stem solid; leaves cauline; peduncle absent; inner phyllaries linear-lanceolate ..... ***Picnomon acarna*** **(L.) Cass.**
Stem hollow; leaves basal and cauline; peduncle shorter than capitulum; inner phyllaries ovate ..... ***Onopordum alexandrinum*** **Boiss.**

25(23). Stem solid; leaf margin spineless; outer phyllaries apex spineless; leaves cauline ***Xanthium spinosum*** **L.**
Stem hollow; leaf margin spiny; outer phyllaries apex spiny; leaves basal and cauline ..... ***Echinops galalensis*** **Schweinf.**

26(22). Cauline leaf lower surface glabrous ..... ***Carlina acaulis*** **L.**
Cauline leaf lower surface hairy ..... ***Echinops glaberrimus*** **DC.**
Cauline leaf lower surface white woolly 27

27(26). Stem with spiny wings; capitula in terminal glomerules; pappus feathery; leaf blade soft 28
Stem wingless; capitula solitary terminal; pappus bristles or scales; leaf blade rigid ..... ***Echinops hussonii*** **Boiss.**

28(27). Peduncle longer than capitulum; inner phyllaries linear-lanceolate; inner phyllaries gland-dotted; stem grooved ..... ***Onopordum ambiguum*** **Fresen.**
Peduncle shorter than capitulum; inner phyllaries ovate; inner phyllaries not gland-dotted; stem not grooved ..... ***Onopordum acanthium*** **L.**

29(1). Cauline leaf lower surface glabrous 30
Cauline leaf lower surface hairy 31
Cauline leaf lower surface white woolly 40
Cauline leaf lower surface prickly 46

30(29). Leaf blade width 0.7 cm or less; stem solid; leaf margin spineless; outer phyllaries apex spineless ..... ***Launaea spinosa*** **(Forssk.) Sch.Bip. Ex Kuntze**
Leaf blade width 3.5 cm or more; stem hollow; leaf margin spiny; outer phyllaries apex spiny ..... ***Silybum marianum*** **(L.) Gaertn.**

31(29). Leaves basal 32
Leaves cauline 33

Leaves basal and cauline 35

32(31). Stem erect ..... ***Centaurea eryngioides* Lam.**
Stem prostrate ..... ***Centaurea glomerata* Vahl**
Stem dwarf ..... ***Centaurea pumilio* L.**

33(31). Outline of cauline leaves linear-lanceolate; pappus feathery; leaf apex spiny; cauline leaves canaliculate-cylindrical 34
Outline of cauline leaves ovate; pappus bristles or scales; leaf apex spineless; cauline leaves flat ..... ***Dicoma schimperi* (DC.) Baill. ex O.Hoffm.**

34(33). Stem grooved; capitula solitary terminal; outer phyllaries margin scarious; inner phyllaries not gland-dotted ..... ***Iphiona mucronata* (Forssk.) Asch. & Schweinf.**
Stem not grooved; capitula in terminal glomerules; outer phyllaries margin not scarious; inner phyllaries gland-dotted ..... ***Iphiona scabra* DC. ex Decne.**

35(31). Pappus feathery 36
Pappus bristles or scales 38
Pappus absent ..... ***Centaurea calcitrapa* L.**

36(35). Stem solid; stem wingless; leaf apex spineless; leaf margin spineless 37
Stem hollow; stem with spiny wings; leaf apex spiny; leaf margin spiny ..... ***Carduus getulus* Pomel**

37(36). Outer phyllaries margin spiny; inner phyllaries apex spiny; cauline leaves pinnatifid-pinnate; stem prostrate ..... ***Centaurea alexandrina* Delile**
Outer phyllaries margin spineless; inner phyllaries apex spineless; cauline leaves simple; stem erect ..... ***Centaurea scoparia* Sieber ex Spreng.**

38(35). Stem solid; stem prostrate; inner phyllaries apex spineless; outer phyllaries margin scarious ..... ***Centaurea sinaica* DC.**
Stem hollow; stem erect; inner phyllaries apex spiny; outer phyllaries margin not scarious 39

39(38). Outer phyllaries margin spiny; inner phyllaries margin spiny; stem wingless; leaf blade width 3.5 cm or more ..... ***Centaurea hyalolepis* Boiss.**
Outer phyllaries margin spineless; inner phyllaries margin spineless; stem with spinless wings; leaf blade width 0.7 cm or less ..... ***Centaurea melitensis* L.**

40(29). Leaf blade width 0.7 cm or less 41
Leaf blade width 1-2.8 cm 44
Leaf blade width 3.5 cm or more ..... ***Carduus pycnocephalus* L.**

41(40). Leaf apex spiny; leaf margin spiny; outer phyllaries margin spiny; inner phyllaries not gland-dotted 42
Leaf apex spineless; leaf margin spineless; outer phyllaries margin spineless; inner phyllaries gland-dotted 43

42(41). Stem grooved; inner phyllaries margin spineless; cauline leaves pinnatifid-pinnate; leaf veins prominent ..... ***Echinops taeckholmianus* Amin**
Stem not grooved; inner phyllaries margin spiny; cauline leaves simple; leaf veins not prominent ..... ***Dicoma tomentosa* Cass.**

43(41). Stem with spinless wings; inner phyllaries apex spiny; stem erect; capitula solitary terminal ..... ***Centaurea solstitialis* L.**
Stem wingless; inner phyllaries apex spineless; stem prostrate; capitula in terminal glomerules ..... ***Centaurea ammocyanus* Boiss.**

44(40). Outline of cauline leaves linear-lanceolate ..... ***Carduus argentatus* L.**
Outline of cauline leaves ovate 45
Outline of cauline leaves spthulate ..... ***Centaurea pallescens* Delile**

45(44). Leaf apex spiny; leaf margin spiny; inner phyllaries apex spiny; cauline leaves

pinnatifid-pinnate..... ***Echinops spinosissimus* Turra**
Leaf apex spineless; leaf margin spineless; inner phyllaries apex spineless; cauline leaves simple..... ***Centaurea procurrens* Sieber ex Spreng.**

46(29). Outline of cauline leaves linear-lanceolate; peduncle longer than capitulum; inner phyllaries linear-lanceolate 47
Outline of cauline leaves rhombic; peduncle absent; inner phyllaries ovate..... ***Helminthotheca comosa* (Boiss.) Holub**

47(46). Outer phyllaries body convex; achenes hairy; achene apex long-beaked ..... ***Helminthotheca echioides* (L.) Holub**
Outer phyllaries body flat; achenes glabrous; achene apex round-truncate..... ***Helminthotheca balansae* (Coss. & Durieu) Lack**

Detailed Descriptions

Anvillea garcinii (Burm.*f.)* DC. Plant shrub. Stem erect. Stem gland-dotted. Stem not grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spineless. Inner phyllaries margin spineless. Leaves cauline. Cauline leaves simple. Outline of cauline leaves spathulate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves petiolate. Leaf veins not prominent. Leaf veins green. Leaves gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers conspicuous. Outer phyllaries longer than inner. Outer phyllaries united. Outer phyllaries gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries gland-dotted. Apex of inner phyllaries without membrane. Pappus absent. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Atractylis aristata Batt. Plant herb. Stem prostrate. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence present. Peduncle absent. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Atractylis boulosii Täckh. Plant herb. Stem prostrate. Stem not gland-dotted. Stem not grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves petiolate. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer

phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Atractylis cancellata L. Plant herb. Stem prostrate. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula solitary terminal, or in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence present. Peduncle absent. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Atractylis carduus (Forssk.) C. Chr. Plant herb. Stem prostrate. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula elongate. Whorl of bracts subtending inflorescence present. Peduncle shorter than capitulum. Ray flowers conspicuous. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Atractylis mernephthae Asch., Schweinf. & Letourn. Plant herb. Stem prostrate. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula elongate. Whorl of bracts subtending inflorescence present. Peduncle absent. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries united. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Atractylis prolifera Boiss. Plant herb. Stem prostrate. Stem not gland-dotted. Stem not

grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula elongate. Whorl of bracts subtending inflorescence present. Peduncle absent. Ray flowers conspicuous. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Atractylis serratuloides (Cass.) Sieber ex Cass. Plant shrub. Stem prostrate. Stem not gland-dotted. Stem not grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence present. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Carduus argentatus L. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem hollow. Stem with spiny wings. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle longer than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries united. Outer phyllaries gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Carduus getulus Pomel Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem hollow. Stem with spiny wings. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula elongate. Whorl of

bracts subtending inflorescence absent. Peduncle longer than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries united. Outer phyllaries gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Carduus pycnocephalus L. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem hollow. Stem with spiny wings. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 3.5cm or more. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle absent. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries united. Outer phyllaries gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Carlina acaulis L. Plant herb. Stem dwarf. Stem not gland-dotted. Stem not grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spineless. Inner phyllaries margin spineless. Leaves basal. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface glabrous. Cauline leaf lower surface glabrous. Cauline leaves sessile. Leaf veins prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 3.5cm or more. Inflorescence many-flowered capitula. Capitula basal. Capitula globular. Whorl of bracts subtending inflorescence present. Peduncle absent. Ray flowers conspicuous. Outer phyllaries as long as inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries with membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Carlina involucrata Poir. Plant herb. Stem erect. Stem not gland-dotted. Stem not grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spineless. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula globular. Whorl of bracts subtending inflorescence present. Peduncle absent. Ray flowers conspicuous. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries gland-dotted. Apex of inner phyllaries with membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Carlina sicula subsp. *mareotica* (Asch. &

Schweinf.) Greuter Plant herb. Stem erect. Stem not gland-dotted. Stem not grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spineless. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula globular. Whorl of bracts subtending inflorescence present. Peduncle absent. Ray flowers conspicuous. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries with membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Carthamus eriocephalus (Boiss.) Greuter Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spiny. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 8.5–18cm. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula elongate. Whorl of bracts subtending inflorescence present. Peduncle absent. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins prominent. Inner phyllaries ovate. Inner phyllaries gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Carthamus glaucus M. Bieb. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spiny. Leaves cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus bristles or scales. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Carthamus glaucus subsp. *alexandrinus* (Boiss. & Heldr.) Hanelt Plant herb. Stem erect. Stem not gland-dotted. Stem not grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spiny. Leaves cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula.

Capitula solitary terminal. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus bristles or scales. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Carthamus lanatus L. Plant herb. Stem erect. Stem not gland-dotted. Stem not grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spiny. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins prominent. Inner phyllaries linear-lanceolate. Inner phyllaries gland-dotted. Apex of inner phyllaries without membrane. Pappus bristles or scales. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Carthamus mareoticus Delile Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spiny. Leaves cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries with membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Carthamus nitidus Boiss. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spiny. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus bristles or scales. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Carthamus tenuis (Boiss. & Blanche) Bornm. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spiny. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins prominent. Leaf veins green. Leaves gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins prominent. Inner phyllaries ovate. Inner phyllaries gland-dotted. Apex of inner phyllaries without membrane. Pappus bristles or scales. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Carthamus tenuis subsp. *foliosus* (Boiss.) Hanelt Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spiny. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins prominent. Leaf veins green. Leaves gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins prominent. Inner phyllaries ovate. Inner phyllaries gland-dotted. Apex of inner phyllaries without membrane. Pappus bristles or scales. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Carthamus tinctorius L. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves cauline. Cauline leaves simple. Outline of cauline leaves ovate. Cauline leaves flat. Cauline leaf upper surface glabrous. Cauline leaf lower surface glabrous. Cauline leaves sessile. Leaf veins prominent. Leaf veins green. Leaves gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence present. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries gland-dotted. Apex of inner phyllaries without membrane. Pappus bristles or scales. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea aegyptiaca L. Plant herb. Stem prostrate. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spineless. Inner phyllaries margin spiny. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered

capitula. Capitula in terminal glomerules. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries as long as inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries with membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea alexandrina Delile Plant herb. Stem prostrate. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries with membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea ammocyanus Boiss. Plant herb. Stem prostrate. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spineless. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle absent. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin scarious. Outer phyllaries veins prominent. Inner phyllaries linear-lanceolate. Inner phyllaries gland-dotted. Apex of inner phyllaries with membrane. Pappus bristles or scales. Achenes hairy. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea benedicta (L.) L. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spiny. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins prominent. Leaf veins white. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 3.5cm or more. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence present. Peduncle absent. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus bristles or scales. Achenes glabrous. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded.

Achene surface without hooked spines.

Centaurea calcitrapa L. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spineless. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula solitary terminal, or in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle absent. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries with membrane. Pappus absent. Achenes glabrous. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea dimorpha Viv. Plant herb. Stem prostrate. Stem not gland-dotted. Stem grooved. Stem hollow. Stem with spinless wings. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries as long as inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus bristles or scales. Achenes glabrous. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea eryngioides Lam. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spineless. Inner phyllaries margin spineless. Leaves basal. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle longer than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries gland-dotted. Outer phyllaries body flat. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries with membrane. Pappus bristles or scales. Achenes glabrous. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea furfuracea Coss. & Durieu Plant herb. Stem dwarf. Stem not gland-dotted. Stem grooved. Stem hollow. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves spathulate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves

petiolate. Leaf veins not prominent. Leaf veins green. Leaves gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula elongate. Whorl of bracts subtending inflorescence present. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries gland-dotted. Apex of inner phyllaries with membrane. Pappus bristles or scales. Achenes hairy. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea glomerata Vahl Plant herb. Stem prostrate. Stem gland-dotted. Stem grooved. Stem hollow. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spineless. Inner phyllaries margin spineless. Leaves basal. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle longer than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries gland-dotted. Apex of inner phyllaries with membrane. Pappus bristles or scales. Achenes glabrous. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea hyalolepis Boiss. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem hollow. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spiny. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 3.5cm or more. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence present. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries with membrane. Pappus bristles or scales. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea melitensis L. Plant herb. Stem erect. Stem gland-dotted. Stem grooved. Stem hollow. Stem with spinless wings. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence present. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane.

Pappus bristles or scales. Achenes hairy. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea pallescens Delile Plant herb. Stem prostrate. Stem gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spineless. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves spathulate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula in terminal glomerules, or basal. Capitula elongate. Whorl of bracts subtending inflorescence present. Peduncle absent. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries with membrane. Pappus bristles or scales. Achenes hairy. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea procurrens Sieber ex Spreng. Plant herb. Stem prostrate. Stem gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spineless. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves ovate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence present. Peduncle absent. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries with membrane. Pappus bristles or scales. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea pumilio L. Plant herb. Stem dwarf. Stem not gland-dotted. Stem grooved. Stem hollow. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves spathulate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries with membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea scoparia Sieber ex Spreng. Plant herb. Stem erect. Stem not gland-dotted. Stem not grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spineless. Inner phyllaries margin spineless. Leaves basal

and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries with membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea sinaica DC. Plant herb. Stem prostrate. Stem gland-dotted. Stem grooved. Stem solid. Stem with spinless wings. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spineless. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence present. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries with membrane. Pappus bristles or scales. Achenes glabrous. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Centaurea solstitialis L. Plant herb. Stem erect. Stem gland-dotted. Stem grooved. Stem solid. Stem with spinless wings. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries gland-dotted. Apex of inner phyllaries with membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base asymmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Cynara cornigera Lindl. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves ovate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 22cm or more. Leaf blade width 3.5cm or more. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries

veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface streaked. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Dicoma schimperi (DC.) Baill. ex O.Hoffm. Plant herb. Stem erect. Stem gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves cauline. Cauline leaves simple. Outline of cauline leaves ovate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves petiolate. Leaf veins prominent. Leaf veins green. Leaves gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula solitary terminal, or in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus bristles or scales. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Dicoma tomentosa Cass. Plant herb. Stem erect. Stem not gland-dotted. Stem not grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spiny. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface white woolly. Cauline leaves petiolate. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence present. Peduncle absent. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface streaked. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Echinops galalensis Schweinf. Plant herb. Stem erect. Stem gland-dotted. Stem grooved. Stem hollow. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins prominent. Leaf veins white. Leaves gland-dotted. Leaf blade rigid. Leaf blade length 8.5–18cm. Leaf blade width 1–2.8cm. Inflorescence an aggregate of 1-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries as long as inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface streaked. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Echinops glaberrimus DC. Plant herb. Stem erect. Stem gland-dotted. Stem grooved. Stem hollow. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf

apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins prominent. Leaf veins white. Leaves gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 3.5cm or more. Inflorescence an aggregate of 1-flowered capitula. Capitula in terminal glomerules. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries as long as inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus bristles or scales. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Echinops hussonii Boiss. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem hollow. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves ovate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins prominent. Leaf veins white. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 8.5–18cm. Leaf blade width 3.5cm or more. Inflorescence an aggregate of 1-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries as long as inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus bristles or scales. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Echinops spinosissimus Turra Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves ovate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins prominent. Leaf veins white. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 8.5–18cm. Leaf blade width 1–2.8cm. Inflorescence an aggregate of 1-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Echinops taeckholmianus Amin Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins prominent. Leaf veins white. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence an aggregate of

1-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus bristles or scales. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Gundelia tournefortii L. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem hollow. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface glabrous. Cauline leaf lower surface glabrous. Cauline leaves sessile. Leaf veins prominent. Leaf veins white. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 8.5–18cm. Leaf blade width 3.5cm or more. Inflorescence an aggregate of 6-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence present. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus absent. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Helminthotheca balansae (Coss. & Durieu) Lack Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spiny. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface prickly. Cauline leaf lower surface prickly. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle longer than capitulum. Ray flowers conspicuous. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Helminthotheca comosa (Boiss.) Holub Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spiny. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves rhombic. Cauline leaves flat. Cauline leaf upper surface prickly. Cauline leaf lower surface prickly. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle absent. Ray flowers conspicuous. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes oblong. Achene apex long-beaked. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Helminthotheca echioides (L.) Holub Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spiny. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface prickly. Cauline leaf lower surface prickly. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle longer than capitulum. Ray flowers conspicuous. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes oblong. Achene apex long-beaked. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Iphiona mucronata (Forssk.) Asch. & Schweinf. Plant shrub. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves canaliculate-cylindrical. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Iphiona scabra DC. ex Decne. Plant shrub. Stem erect. Stem gland-dotted. Stem not grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base present. Leaf apex spiny. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves canaliculate-cylindrical. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins not prominent. Leaf veins green. Leaves gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Launaea spinosa (Forssk.) Sch.Bip. Ex Kuntze Plant shrub. Stem dwarf. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spineless. Outer phyllaries apex spineless. Outer phyllaries margin spineless. Inner phyllaries apex spineless. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves canaliculate-cylindrical. Cauline leaf upper surface glabrous. Cauline leaf lower surface glabrous. Cauline leaves sessile. Leaf

veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 0.7cm or less. Inflorescence many-flowered capitula. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers conspicuous. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base symmetrical. Achene surface streaked. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Notobasis syriaca (L.) Cass. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem hollow. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spineless. Inner phyllaries margin spineless. Leaves cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins prominent. Leaf veins white. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Onopordum acanthium L. Plant shrub. Stem erect. Stem not gland-dotted. Stem not grooved. Stem hollow. Stem with spiny wings. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves ovate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins prominent. Leaf veins white. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 8.5–18cm. Leaf blade width 3.5cm or more. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries as long as inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Onopordum alexandrinum Boiss. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem hollow. Stem with spiny wings. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins prominent. Leaf veins white. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 22cm or more. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries as long as inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries ovate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus

feathery. Achenes glabrous. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Onopordum ambiguum Fresen. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem hollow. Stem with spiny wings. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves ovate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins prominent. Leaf veins white. Leaves gland-dotted. Leaf blade soft. Leaf blade length 22cm or more. Leaf blade width 3.5cm or more. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle longer than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries as long as inner. Outer phyllaries free. Outer phyllaries gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes hairy. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Pallenis spinosa (L.) Cass. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spineless. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves petiolate. Leaf veins not prominent. Leaf veins green. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula solitary terminal. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle longer than capitulum. Ray flowers conspicuous. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus bristles or scales. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Picnomon acarna (L.) Cass. Plant herb. Stem erect. Stem not gland-dotted. Stem not grooved. Stem solid. Stem with spiny wings. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spineless. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface white woolly. Cauline leaf lower surface white woolly. Cauline leaves sessile. Leaf veins prominent. Leaf veins white. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 8.5–18cm. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence present. Peduncle absent. Ray flowers inconspicuous or absent. Outer phyllaries as long as inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Scolymus hispanicus L. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem hollow. Stem with spiny wings. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves basal and

cauline. Cauline leaves simple. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins prominent. Leaf veins white. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 7.5cm or less. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle absent. Ray flowers conspicuous. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus bristles or scales. Achenes glabrous. Achenes united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Scolymus maculatus L. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem hollow. Stem with spiny wings. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spineless. Leaves cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface hairy. Cauline leaves sessile. Leaf veins prominent. Leaf veins white. Leaves not gland-dotted. Leaf blade rigid. Leaf blade length 8.5–18cm. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle absent. Ray flowers conspicuous. Outer phyllaries longer than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus absent. Achenes glabrous. Achenes united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Silybum marianum (L.) Gaertn. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem hollow. Stem wingless. Axillary bi-trifurcate spine absent. 2–4 spines at leaf base absent. Leaf apex spiny. Leaf margin spiny. Outer phyllaries apex spiny. Outer phyllaries margin spiny. Inner phyllaries apex spiny. Inner phyllaries margin spiny. Leaves basal and cauline. Cauline leaves pinnatifid-pinnate. Outline of cauline leaves linear-lanceolate. Cauline leaves flat. Cauline leaf upper surface glabrous. Cauline leaf lower surface glabrous. Cauline leaves sessile. Leaf veins prominent. Leaf veins white. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 22cm or more. Leaf blade width 3.5cm or more. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula globular. Whorl of bracts subtending inflorescence absent. Peduncle shorter than capitulum. Ray flowers inconspicuous or absent. Outer phyllaries shorter than inner. Outer phyllaries free. Outer phyllaries not gland-dotted. Outer phyllaries body convex. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without membrane. Pappus feathery. Achenes glabrous. Achenes not united with paleae. Achenes obpyramidal-obovate. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes unilocular, 1-seeded. Achene surface without hooked spines.

Xanthium spinosum L. Plant herb. Stem erect. Stem not gland-dotted. Stem grooved. Stem solid. Stem wingless. Axillary bi-trifurcate spine present. 2–4 spines at leaf base absent. Leaf apex spineless. Leaf margin spineless. Outer phyllaries apex spineless. Leaves cauline. Cauline leaves 3-lobed. Outline of cauline leaves rhombic. Cauline leaves flat. Cauline leaf upper surface hairy. Cauline leaf lower surface white woolly. Cauline leaves petiolate. Leaf veins prominent. Leaf veins white. Leaves not gland-dotted. Leaf blade soft. Leaf blade length 7.5cm or less. Leaf blade width 1–2.8cm. Inflorescence many-flowered capitula. Capitula in terminal glomerules. Capitula elongate. Whorl of bracts subtending inflorescence absent. Peduncle absent. Ray flowers inconspicuous or absent. Outer phyllaries as long as inner. Outer phyllaries united. Outer phyllaries not gland-dotted. Outer phyllaries body flat. Outer phyllaries margin not scarious. Outer phyllaries veins not prominent. Inner phyllaries linear-lanceolate. Inner phyllaries not gland-dotted. Apex of inner phyllaries without

membrane. Pappus absent. Achenes glabrous. Achenes not united with paleae. Achenes oblong. Achene apex round-truncate. Achene base symmetrical. Achene surface smooth. Achenes bilocular, 2-seeded. Achene surface with hooked spines.

Item Descriptions

 # \b\i{}*Anvillea garcinii* \i0{}(Burm.\i{}f\i0{}.) DC. \b0{}/

1,2 2,1 3,1 4,2 5,1 6,3 7,2 8,2 9,2 10,2 11,1 12,2 13,2 14,2 15,2 16,1 17,4 18,2 19,2 20,2 21,1 22,2 23,1 24,1 25,1 26,1 27,1 28,3 29,1 30,2 31,2 32,2 33,1 34,135,1 36,1 37,2 38,2 39,2 40,1 41,1 42,2 43,3 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Atractylis aristata* \i0{}Batt.\b0{}/

1,1 2,2 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,2 15,3 16,1 17,1 18,2 19,2 20,2 21,2 22,2 23,1 24,2 25,2 26,1 27,1 28,3 29,2 30,2 31,1 32,3 33,2 34,135,2 36,2 37,1 38,1 39,2 40,2 41,2 42,2 43,1 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Atractylis boulosii* \i0{}Täckh.\b0{}/

1,1 2,2 3,2 4,2 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,2 15,3 16,1 17,1 18,2 19,2 20,2 21,1 22,2 23,1 24,2 25,1 26,1 27,1 28,3 29,1 30,2 31,2 32,2 33,2 34,135,2 36,2 37,1 38,2 39,2 40,1 41,2 42,2 43,1 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Atractylis cancellata* \i0{}L.\b0{}/

1,1 2,2 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,2 15,3 16,1 17,1 18,2 19,2 20,2 21,2 22,2 23,1 24,2 25,1 26,1 27,1 28,3 29,1/2 30,2 31,1 32,3 33,234,1 35,2 36,2 37,1 38,1 39,2 40,1 41,2 42,2 43,1 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Atractylis carduus*\i0{} (Forssk.) C. Chr. \b0{}/

1,1 2,2 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,2 15,3 16,1 17,1 18,2 19,3 20,2 21,2 22,1 23,1 24,2 25,2 26,1 27,1 28,3 29,1 30,2 31,1 32,2 33,1 34,135,2 36,2 37,1 38,1 39,2 40,2 41,2 42,2 43,1 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Atractylis mernephthae* \i0{}Asch., Schweinf. & Letourn.\b0{}/

1,1 2,2 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,2 15,3 16,1 17,1 18,2 19,3 20,2 21,2 22,1 23,1 24,2 25,2 26,1 27,1 28,3 29,1 30,2 31,1 32,3 33,2 34,135,1 36,2 37,1 38,1 39,2 40,2 41,2 42,2 43,1 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Atractylis prolifera* \i0{}Boiss.\b0{}/

1,1 2,2 3,2 4,2 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,2 15,3 16,1 17,1 18,2 19,3 20,3 21,2 22,2 23,1 24,2 25,2 26,1 27,1 28,3 29,1 30,2 31,1 32,3 33,1 34,135,2 36,2 37,1 38,1 39,2 40,2 41,2 42,2 43,1 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Atractylis serratuloides* \i0{}(Cass.) Sieber ex Cass.\b0{}/

1,2 2,2 3,2 4,2 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,2 15,2 16,1 17,1 18,2 19,2 20,2 21,2 22,2 23,1 24,2 25,2 26,1 27,1 28,3 29,2 30,2 31,1 32,2 33,2 34,135,2 36,2 37,1 38,1 39,2 40,2 41,2 42,2 43,1 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Carduus argentatus*\i0{} L.\b0{}/

1,1 2,1 3,2 4,1 5,2 6,1 7,2 8,2 9,1 10,1 11,1 12,2 13,1 14,2 15,1 16,3 17,1 18,2 19,2 20,3 21,2 22,1 23,1 24,2 25,1 26,2 27,2 28,3 29,1 30,2 31,2 32,1 33,2 34,335,1 36,1 37,2 38,2 39,2 40,2 41,1 42,2 43,1 44,2 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Carduus getulus* \i0{}Pomel\b0{}/

1,1 2,1 3,2 4,1 5,2 6,1 7,2 8,2 9,1 10,1 11,1 12,2 13,1 14,2 15,3 16,3 17,1 18,2 19,2 20,2 21,2 22,2 23,1 24,2 25,1 26,2 27,2 28,3 29,2 30,2 31,2 32,1 33,2 34,335,1 36,1 37,2 38,2 39,2 40,2 41,2 42,2 43,1 44,2 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Carduus pycnocephalus*\i0{} L.\b0{}/

1,1 2,1 3,2 4,1 5,2 6,1 7,2 8,2 9,1 10,1 11,1 12,2 13,1 14,2 15,3 16,3 17,1 18,2 19,2 20,3 21,2 22,2 23,1 24,2 25,1 26,2 27,3 28,3 29,2 30,2 31,2 32,3 33,2 34,335,1 36,1 37,2 38,2 39,2 40,1 41,2 42,2 43,1 44,2 45,2 46,1 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Carlina acaulis*\i0{} L.\b0{}/

1,1 2,3 3,2 4,2 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,2 14,2 15,1 16,3 17,1 18,2 19,1 20,1 21,2 22,1 23,1 24,2 25,1 26,2 27,3 28,3 29,3 30,1 31,1 32,3 33,1 34,235,2 36,2 37,2 38,2 39,2 40,1 41,2 42,1 43,1 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Carlina involucrata*\i0{} Poir.\b0{}/

1,1 2,1 3,2 4,2 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,2 14,2 15,3 16,1 17,1 18,2 19,2 20,2 21,2 22,1 23,1 24,2 25,2 26,1 27,2 28,3 29,2 30,1 31,1 32,3 33,1 34,135,2 36,2 37,2 38,2 39,2 40,1 41,1 42,1 43,1 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Carlina sicula*\i0{} subsp. \i{}*mareotica*\i0{} (Asch. & Schweinf.) Greuter\b0{}/

1,1 2,1 3,2 4,2 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,2 14,2 15,3 16,1 17,1 18,2 19,2 20,2 21,2 22,1 23,1 24,2 25,2 26,1 27,2 28,3 29,2 30,1 31,1 32,3 33,1 34,135,2 36,2 37,2 38,2 39,2 40,1 41,2 42,1 43,1 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Carthamus eriocephalus*\i0{} (Boiss.) Greuter\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,1 15,3 16,3 17,1 18,2 19,2 20,2 21,2 22,1

23,1 24,2 25,2 26,2 27,2 28,3 29,1 30,2 31,1 32,3 33,2 34,135,2 36,2 37,1 38,1 39,1 40,2 41,1 42,2 43,1 44,2 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Carthamus glaucus*\i0{} M. Bieb.\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,1 15,2 16,1 17,1 18,2 19,2 20,2 21,2 22,1 23,1 24,2 25,2 26,1 27,2 28,3 29,1 30,2 31,2 32,2 33,2 34,135,2 36,2 37,1 38,2 39,1 40,2 41,2 42,2 43,2 44,2 45,2 46,1 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Carthamus glaucus* \i0{}subsp.\i{} *alexandrinus* \i0{}(Boiss. & Heldr.) Hanelt\b0{}/

1,1 2,1 3,2 4,2 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,1 15,2 16,1 17,1 18,2 19,2 20,2 21,2 22,1 23,1 24,2 25,2 26,1 27,2 28,3 29,1 30,2 31,2 32,2 33,2 34,135,2 36,1 37,1 38,1 39,1 40,1 41,2 42,2 43,2 44,2 45,2 46,1 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Carthamus lanatus*\i0{} L.\b0{}/

1,1 2,1 3,2 4,2 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,1 15,3 16,1 17,1 18,2 19,2 20,2 21,2 22,1 23,1 24,2 25,2 26,1 27,2 28,3 29,1 30,2 31,2 32,2 33,2 34,135,2 36,1 37,1 38,1 39,1 40,1 41,1 42,2 43,2 44,2 45,2 46,1 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Carthamus mareoticus* \i0{}Delile\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,1 15,2 16,1 17,1 18,2 19,2 20,2 21,2 22,2 23,1 24,2 25,2 26,1 27,1 28,3 29,1 30,1 31,2 32,2 33,2 34,135,2 36,2 37,1 38,1 39,1 40,2 41,2 42,1 43,1 44,2 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Carthamus nitidus*\i0{} Boiss.\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,1 15,3 16,3 17,1 18,2 19,2 20,2 21,2 22,2 23,1 24,1 25,2 26,1 27,2 28,3 29,2 30,1 31,2 32,2 33,2 34,135,2 36,2 37,1 38,1 39,2 40,2 41,2 42,2 43,2 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Carthamus tenuis*\i0{} (Boiss. & Blanche) Bornm.\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,1 15,3 16,1 17,1 18,2 19,2 20,2 21,2 22,1 23,1 24,1 25,2 26,1 27,1 28,3 29,1 30,1 31,2 32,2 33,2 34,135,2 36,1 37,1 38,1 39,1 40,2 41,1 42,2 43,2 44,2 45,2 46,1 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Carthamus*\i0{} \i{}*tenuis*\i0{} subsp. \i{} *foliosus*\i0{} (Boiss.) Hanelt\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,1 15,3 16,1 17,1 18,2 19,2 20,2 21,2 22,1 23,1 24,1 25,2 26,1 27,1 28,3 29,2 30,1 31,2 32,2 33,2 34,135,2 36,1 37,1 38,1 39,1 40,2 41,1 42,2 43,2 44,2 45,2 46,1 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Carthamus tinctorius*\i0{} L.\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,2 13,1 14,2 15,2 16,1 17,2 18,2 19,1 20,1 21,2 22,1 23,1 24,1 25,1 26,2 27,2 28,3 29,1 30,1 31,1 32,2 33,2 34,135,2 36,2 37,2 38,2 39,2 40,2 41,1 42,2 43,2 44,2 45,2 46,1 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Centaurea aegyptiaca*\i0{} L.\b0{}/

1,1 2,2 3,2 4,1 5,1 6,3 7,2 8,2 9,2 10,2 11,1 12,2 13,2 14,1 15,3 16,3 17,1 18,2 19,3 20,3 21,2 22,2 23,1 24,2 25,1 26,1 27,1 28,3 29,2 30,1 31,2 32,2 33,2 34,235,2 36,2 37,1 38,1 39,2 40,1 41,2 42,1 43,1 44,2 45,2 46,2 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Centaurea alexandrina*\i0{} Delile \b0{}/

1,1 2,2 3,2 4,1 5,1 6,3 7,2 8,2 9,2 10,2 11,1 12,1 13,1 14,2 15,3 16,3 17,1 18,2 19,2 20,2 21,2 22,2 23,1 24,2 25,1 26,2 27,1 28,3 29,1 30,1 31,2 32,2 33,2 34,335,2 36,1 37,2 38,2 39,2 40,2 41,2 42,1 43,1 44,2 45,2 46,2 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Centaurea ammocyanus*\i0{} Boiss.\b0{}/

1,1 2,2 3,2 4,1 5,1 6,3 7,2 8,2 9,2 10,2 11,1 12,2 13,2 14,2 15,3 16,1 17,1 18,2 19,3 20,3 21,2 22,2 23,1 24,2 25,1 26,1 27,1 28,3 29,2 30,2 31,2 32,3 33,2 34,335,2 36,2 37,2 38,1 39,1 40,1 41,1 42,1 43,2 44,1 45,2 46,2 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Centaurea*\i0\~\i{}*benedicta*\i0\~(L.) L.\ b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,2 13,1 14,1 15,3 16,3 17,1 18,2 19,2 20,2 21,2 22,1 23,2 24,2 25,1 26,2 27,3 28,3 29,1 30,1 31,1 32,3 33,2 34,135,2 36,2 37,2 38,2 39,2 40,1 41,2 42,2 43,2 44,2 45,2 46,2 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Centaurea calcitrapa*\i0{} L.\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,2 10,2 11,1 12,1 13,2 14,2 15,3 16,1 17,1 18,2 19,2 20,2 21,2 22,2 23,1 24,2 25,1 26,1 27,1 28,3 29,1/2 30,2 31,2 32,3 33,234,3 35,2 36,2 37,1 38,2 39,2 40,1 41,2 42,1 43,3 44,2 45,2 46,2 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Centaurea*\i0\~\i{}*dimorpha*\i0\~Viv.\b0{}/

1,1 2,2 3,2 4,1 5,2 6,2 7,2 8,2 9,2 10,2 11,1 12,2 13,1 14,2 15,3 16,1 17,1 18,2 19,3 20,3 21,2 22,2 23,1 24,2 25,1 26,2 27,2 28,3 29,1 30,1 31,2 32,2 33,2 34,235,2 36,2 37,1 38,2 39,2 40,2 41,2 42,2 43,2 44,2 45,2 46,2 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Centaurea eryngioides*\i0{} Lam.\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,2 10,2 11,1 12,2 13,2 14,2 15,1 16,3 17,1 18,2 19,2 20,2 21,2 22,2 23,1 24,2 25,1 26,2 27,2 28,3 29,1 30,1 31,2 32,1 33,2 34,335,2 36,1 37,2 38,1 39,2 40,1 41,2 42,1 43,2 44,2 45,2 46,2 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Centaurea furfuracea*\i0{} Coss. & Durieu\b0{}/

1,1 2,3 3,2 4,1 5,2 6,3 7,2 8,2 9,2 10,2 11,1 12,2 13,1 14,2 15,1 16,3 17,4 18,2 19,2 20,2 21,1 22,2 23,1 24,1 25,1 26,1 27,2 28,3 29,1 30,2 31,1 32,2

33,2 34,135,2 36,1 37,1 38,1 39,2 40,2 41,1 42,1 43,2 44,1 45,2 46,2 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Centaurea glomerata*\i0{} Vahl\b0{}/

1,1 2,2 3,1 4,1 5,2 6,3 7,2 8,2 9,2 10,2 11,1 12,2 13,2 14,2 15,1 16,3 17,1 18,2 19,2 20,2 21,2 22,2 23,1 24,1 25,1 26,1 27,2 28,3 29,2 30,2 31,2 32,1 33,2 34,335,2 36,2 37,1 38,1 39,2 40,1 41,1 42,1 43,2 44,2 45,2 46,2 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Centaurea hyalolepis*\i0{} Boiss.\b0{}/

1,1 2,1 3,2 4,1 5,2 6,3 7,2 8,2 9,2 10,2 11,1 12,1 13,1 14,1 15,3 16,1 17,1 18,2 19,2 20,2 21,2 22,2 23,1 24,1 25,1 26,2 27,3 28,3 29,1 30,1 31,1 32,2 33,2 34,335,2 36,2 37,1 38,2 39,2 40,2 41,2 42,1 43,2 44,2 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Centaurea melitensis*\i0{} L.\b0{}/

1,1 2,1 3,1 4,1 5,2 6,2 7,2 8,2 9,2 10,2 11,1 12,2 13,1 14,2 15,3 16,1 17,1 18,2 19,2 20,2 21,2 22,2 23,1 24,1 25,1 26,1 27,1 28,3 29,2 30,2 31,1 32,2 33,2 34,335,2 36,2 37,1 38,2 39,2 40,1 41,2 42,2 43,2 44,1 45,2 46,2 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Centaurea pallescens*\i0{} Delile \b0{}/

1,1 2,2 3,1 4,1 5,1 6,3 7,2 8,2 9,2 10,2 11,1 12,2 13,2 14,2 15,3 16,1 17,4 18,2 19,3 20,3 21,2 22,2 23,1 24,1 25,1 26,2 27,2 28,3 29,2/3 30,2 31,1 32,3 33,234,3 35,2 36,2 37,1 38,1 39,2 40,1 41,2 42,1 43,2 44,1 45,2 46,2 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Centaurea procurrens*\i0{} Sieber ex Spreng.\b0{}/

1,1 2,2 3,1 4,1 5,1 6,3 7,2 8,2 9,2 10,2 11,1 12,2 13,2 14,2 15,3 16,1 17,2 18,2 19,3 20,3 21,2 22,2 23,1 24,1 25,1 26,1 27,2 28,3 29,1 30,1 31,1 32,3 33,2 34,335,2 36,2 37,1 38,1 39,2 40,2 41,2 42,1 43,2 44,2 45,2 46,1 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Centaurea pumilio*\i0{} L. \b0{}/

1,1 2,3 3,2 4,1 5,2 6,3 7,2 8,2 9,2 10,2 11,1 12,2 13,1 14,2 15,1 16,3 17,4 18,2 19,2 20,2 21,2 22,2 23,1 24,2 25,1 26,2 27,2 28,3 29,2 30,2 31,2 32,2 33,2 34,335,2 36,2 37,1 38,1 39,2 40,1 41,2 42,1 43,1 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Centaurea scoparia*\i0{} Sieber ex Spreng.\b0{}/

1,1 2,1 3,2 4,2 5,1 6,3 7,2 8,2 9,2 10,2 11,1 12,2 13,2 14,2 15,3 16,1 17,1 18,2 19,2 20,2 21,2 22,2 23,1 24,2 25,1 26,1 27,1 28,3 29,1 30,1 31,2 32,2 33,2 34,335,2 36,2 37,1 38,2 39,2 40,1 41,2 42,1 43,1 44,1 45,2 46,2 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Centaurea sinaica*\i0{} DC. \b0{}/

1,1 2,2 3,1 4,1 5,1 6,2 7,2 8,2 9,2 10,2 11,1 12,2 13,2 14,2 15,3 16,1 17,1 18,2 19,2 20,2 21,2 22,2 23,1 24,1 25,1 26,2 27,1 28,3 29,1 30,1 31,1 32,2 33,2 34,335,2 36,2 37,1 38,1 39,2 40,1 41,2 42,1 43,2 44,2 45,2 46,2 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Centaurea solstitialis*\i0{} L.\b0{}/

1,1 2,1 3,1 4,1 5,1 6,2 7,2 8,2 9,2 10,2 11,1 12,2 13,1 14,2 15,3 16,1 17,1 18,2 19,3 20,3 21,2 22,2 23,1 24,1 25,1 26,1 27,1 28,3 29,1 30,1 31,2 32,2 33,2 34,335,2 36,1 37,1 38,2 39,2 40,2 41,1 42,1 43,1 44,2 45,2 46,2 47,2 48,2 49,1 50,1 51,2

 # \b\i{}*Cynara cornigera*\i0{} Lindl.\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,2 13,1 14,2 15,3 16,3 17,2 18,2 19,2 20,3 21,2 22,1 23,1 24,2 25,1 26,3 27,3 28,3 29,2 30,1 31,2 32,2 33,2 34,135,2 36,2 37,2 38,2 39,2 40,2 41,2 42,2 43,1 44,2 45,2 46,1 47,2 48,1 49,2 50,1 51,2

 # \b\i{}*Dicoma schimperi*\i0{} (DC.) Baill. ex O.Hoffm.\b0{}/

1,1 2,1 3,1 4,1 5,1 6,3 7,2 8,2 9,2 10,2 11,1 12,2 13,1 14,2 15,2 16,1 17,2 18,2 19,2 20,2 21,1 22,1 23,1 24,1 25,1 26,1 27,1 28,3 29,1/2 30,2 31,2 32,2 33,234,3 35,2 36,2 37,2 38,2 39,2 40,1 41,2 42,2 43,2 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Dicoma tomentosa*\i0{} Cass.\b0{}/

1,1 2,1 3,2 4,2 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,1 15,3 16,1 17,1 18,2 19,3 20,3 21,1 22,2 23,1 24,2 25,1 26,1 27,1 28,3 29,2 30,2 31,1 32,3 33,2 34,335,2 36,2 37,2 38,2 39,1 40,1 41,2 42,2 43,1 44,1 45,2 46,1 47,2 48,1 49,2 50,1 51,2

 # \b\i{}*Echinops galalensis*\i0{} Schweinf.\b0{}/

1,1 2,1 3,1 4,1 5,2 6,3 7,2 8,2 9,1 10,1 11,1 12,2 13,1 14,2 15,3 16,3 17,1 18,2 19,2 20,3 21,2 22,1 23,2 24,1 25,2 26,2 27,2 28,2 29,1 30,1 31,2 32,2 33,2 34,235,2 36,2 37,1 38,2 39,2 40,2 41,2 42,2 43,1 44,2 45,2 46,1 47,2 48,1 49,2 50,1 51,2

 # \b\i{}*Echinops glaberrimus*\i0{} DC.\b0{}/

1,1 2,1 3,1 4,1 5,2 6,3 7,2 8,2 9,1 10,1 11,1 12,2 13,1 14,2 15,3 16,3 17,1 18,2 19,3 20,2 21,2 22,1 23,2 24,1 25,1 26,2 27,3 28,2 29,2 30,1 31,2 32,2 33,2 34,235,2 36,2 37,1 38,2 39,2 40,2 41,2 42,2 43,2 44,2 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Echinops hussonii*\i0{} Boiss.\b0{}/

1,1 2,1 3,2 4,1 5,2 6,3 7,2 8,2 9,1 10,1 11,1 12,2 13,1 14,2 15,3 16,3 17,2 18,2 19,3 20,3 21,2 22,1 23,2 24,2 25,2 26,2 27,3 28,2 29,1 30,1 31,2 32,2 33,2 34,235,2 36,2 37,1 38,2 39,2 40,1 41,2 42,2 43,2 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Echinops spinosissimus*\i0{} Turra\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,2 13,1 14,2 15,3 16,3 17,2 18,2 19,3 20,3 21,2 22,1 23,2 24,2 25,2 26,2 27,2 28,2 29,1 30,1 31,2 32,2 33,2 34,335,2 36,1 37,1 38,2 39,2 40,1 41,2 42,2 43,1 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Echinops taeckholmianus*\i0{} Amin\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,2 15,3 16,3 17,1 18,2 19,3 20,3 21,2 22,1 23,2 24,2 25,2 26,1 27,1 28,2 29,1 30,1 31,2 32,2 33,2 34,335,2 36,2 37,1 38,2 39,2 40,1 41,2 42,2 43,2 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Gundelia tournefortii*\i0{} L.\b0{}/

1,1 2,1 3,2 4,1 5,2 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,2 15,2 16,3 17,1 18,2 19,1 20,1 21,2 22,1 23,2 24,2 25,2 26,2 27,3 28,1 29,1 30,1 31,1 32,2 33,2 34,135,2 36,2 37,2 38,2 39,2 40,2 41,2 42,2 43,3 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Helminthotheca balansae*\i0{} (Coss. & Durieu) Lack\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,1 15,3 16,1 17,1 18,2 19,4 20,4 21,2 22,2 23,1 24,2 25,1 26,1 27,2 28,3 29,2 30,2 31,2 32,1 33,1 34,335,2 36,2 37,2 38,2 39,2 40,1 41,2 42,2 43,1 44,2 45,2 46,2 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Helminthotheca*\i0\~\i{}*comosa*\i0\~(Boiss.) Holub\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,1 15,3 16,1 17,3 18,2 19,4 20,4 21,2 22,2 23,1 24,2 25,1 26,1 27,2 28,3 30,2 31,2 32,3 33,1 34,3 35,236,2 37,2 38,2 39,2 40,2 41,2 42,2 43,1 44,1 45,2 46,2 47,1 48,1 49,1 50,1 51,2

 # \b\i{}*Helminthotheca echioides* \i0{}(L.) Holub\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,1 15,3 16,1 17,1 18,2 19,4 20,4 21,2 22,2 23,1 24,2 25,1 26,1 27,2 28,3 29,2 30,2 31,2 32,1 33,1 34,335,2 36,2 37,1 38,2 39,2 40,1 41,2 42,2 43,1 44,1 45,2 46,2 47,1 48,1 49,1 50,1 51,2

 # \b\i{}*Iphiona mucronata*\i0{} (Forssk.) Asch. & Schweinf.\b0{}/

1,2 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,2 11,1 12,2 13,1 14,2 15,2 16,1 17,1 18,1 19,2 20,2 21,2 22,2 23,1 24,2 25,1 26,1 27,1 28,3 29,1 30,2 31,2 32,2 33,2 34,335,2 36,2 37,2 38,1 39,2 40,1 41,2 42,2 43,1 44,1 45,2 46,2 47,2 48,1 49,1 50,151,2

 # \b\i{}*Iphiona scabra*\i0{} DC. ex Decne.\b0{}/

1,2 2,1 3,1 4,2 5,1 6,3 7,2 8,1 9,1 10,2 11,1 12,2 13,1 14,2 15,2 16,1 17,1 18,1 19,2 20,2 21,2 22,2 23,1 24,1 25,1 26,1 27,1 28,3 29,2 30,2 31,2 32,2 33,2 34,335,2 36,1 37,2 38,2 39,2 40,1 41,1 42,2 43,1 44,1 45,2 46,2 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Launaea spinosa* \i0{}(Forssk.) Sch.Bip. Ex Kuntze \b0{}/

1,2 2,3 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,2 11,2 12,2 13,2 14,2 15,3 16,1 17,1 18,1 19,1 20,1 21,2 22,2 23,1 24,2 25,2 26,1 27,1 28,3 30,2 31,2 32,2 33,1 34,3 35,236,2 37,2 38,2 39,2 40,1 41,2 42,2 43,1 44,2 45,2 46,2 47,2 48,1 49,2 50,1 51,2

 # \b\i{}*Notobasis syriaca*\i0{} (L.) Cass.\b0\par{}/

1,1 2,1 3,2 4,1 5,2 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,2 14,2 15,2 16,3 17,1 18,2 19,2 20,2 21,2 22,1 23,2 24,2 25,1 26,2 27,2 28,3 29,2 30,1 31,2 32,2 33,2 34,135,2 36,2 37,1 38,2 39,2 40,2 41,2 42,2 43,1 44,2 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Onopordum acanthium* \i0{}L.\b0\par{}/

1,2 2,1 3,2 4,2 5,2 6,1 7,2 8,2 9,1 10,1 11,1 12,2 13,1 14,2 15,3 16,3 17,2 18,2 19,3 20,3 21,2 22,1 23,2 24,2 25,1 26,2 27,3 28,3 29,2 30,1 31,2 32,2 33,2 34,235,2 36,2 37,1 38,2 39,2 40,2 41,2 42,2 43,1 44,2 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Onopordum alexandrinum*\i0{} Boiss.\b0\par{}/

1,1 2,1 3,2 4,1 5,2 6,1 7,2 8,2 9,1 10,1 11,1 12,2 13,1 14,2 15,3 16,1 17,1 18,2 19,3 20,3 21,2 22,1 23,2 24,2 25,1 26,3 27,2 28,3 29,2 30,1 31,2 32,2 33,2 34,235,2 36,2 37,1 38,2 39,2 40,2 41,2 42,2 43,1 44,2 45,2 46,2 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Onopordum ambiguum* \i0{}Fresen\i{}. \b0\i0{}/

1,1 2,1 3,2 4,1 5,2 6,1 7,2 8,2 9,1 10,1 11,1 12,2 13,1 14,2 15,3 16,3 17,2 18,2 19,3 20,3 21,2 22,1 23,2 24,1 25,1 26,3 27,3 28,3 29,2 30,1 31,2 32,1 33,2 34,235,2 36,1 37,1 38,2 39,2 40,1 41,1 42,2 43,1 44,1 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Pallenis*\i0{} \i{}*spinosa*\i0{} (L.) Cass. \b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,2 8,2 9,1 10,2 11,1 12,2 13,1 14,2 15,3 16,1 17,1 18,2 19,2 20,2 21,1 22,2 23,1 24,2 25,1 26,1 27,2 28,3 29,1 30,1 31,2 32,1 33,1 34,135,2 36,2 37,1 38,2 39,1 40,1 41,2 42,2 43,2 44,2 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Picnomon acarna*\i0{} (L.) Cass. \b0{}/

1,1 2,1 3,2 4,2 5,1 6,1 7,2 8,2 9,1 10,1 11,1 12,2 13,1 14,2 15,2 16,1 17,1 18,2 19,3 20,3 21,2 22,1 23,2 24,2 25,2 26,2 27,2 28,3 29,2 30,2 31,1 32,3 33,2 34,235,2 36,2 37,2 38,2 39,2 40,1 41,2 42,2 43,1 44,2 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Scolymus hispanicus*\i0{} L. \b0{}/

1,1 2,1 3,2 4,1 5,2 6,1 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,2 15,3 16,1 17,1 18,2 19,2 20,2 21,2 22,1 23,2 24,2 25,2 26,1 27,2 28,3 29,2 30,2 31,2 32,3 33,1 34,135,2 36,2 37,2 38,2 39,1 40,1 41,2 42,2 43,2 44,2 45,1 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Scolymus maculatus*\i0{} L. \b0{}/

1,1 2,1 3,2 4,1 5,2 6,1 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,2 15,2 16,3 17,1 18,2 19,2 20,2 21,2 22,1 23,2 24,2 25,2 26,2 27,2 28,3 29,2 30,1 31,2 32,3

33,1 34,135,2 36,2 37,1 38,2 39,1 40,1 41,2 42,2 43,3 44,2 45,1 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Silybum marianum* \i0{}(L.) Gaertn. \ b0{}/

1,1 2,1 3,2 4,1 5,2 6,3 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,1 15,3 16,3 17,1 18,2 19,1 20,1 21,2 22,1 23,2 24,2 25,1 26,3 27,3 28,3 29,2 30,1 31,2 32,2 33,2 34,335,2 36,2 37,1 38,2 39,2 40,1 41,2 42,2 43,1 44,2 45,2 46,1 47,2 48,1 49,1 50,1 51,2

 # \b\i{}*Xanthium spinosum* \i0{}L.\b0{}/

1,1 2,1 3,2 4,1 5,1 6,3 7,1 8,2 9,2 10,2 11,2 15,2 16,2 17,3 18,2 19,2 20,3 21,1 22,1 23,2 24,2 25,1 26,1 27,2 28,3 29,2 30,2 31,2 32,3 33,2 34,2 35,1 36,2 37,238,2 39,2 40,1 41,2 42,2 43,3 44,2 45,2 46,2 47,2 48,1 49,1 50,2 51,1

Discussion

The present study is the first attempt to benefit from the inherent advantages of the suit of computer programs DELTA to construct an automated conventional key to the Asteraceae of Egypt. This key is evidently superior to all its predecessors in a number of respects: (i) It leads directly to the full scientific name of an unknown taxon, thus obviating the need for a key to the genera and another key to the species as in all previous studies; (ii) It is accompanied by detailed descriptions of every taxon in terms of all the recorded characters so that the user can verify the results obtained from the key by applying the characters not used in the key to achieve these results; (iii) It avoids such unobservable characters as the duration of the plants (annual vs. perennial), and the ambiguous sexuality of flowers (e. g., functionally male vs. hermaphrodite); (iv) It depends largely and for the first time on the unmistakable distribution of spines on different plant parts instead of the traditional use of flower type (ray and disc flowers) in the first couplets of the key which can be highly difficult to determine by the user especially in taxa with minute flowers; (v) It deliberately avoids all microscopic characters and other vegetative and floral minutiae; (vi) It includes couplets separated from each other mostly by sets of correlated characters instead of the states of a single character; (vii) It is based on an exceedingly rich data matrix as can be seen in the prelude of the key where only 32 of the 51 characters recorded for the taxa were sufficient to single out every one of the 65 taxa; and (viii) While traditional keys need complete reconstruction to comprise any additional taxa, the present computer-generated key is highly flexible and can be easily expanded to accommodate any additional taxa/and or characters which might in the future come to light.

The spiny species and infra-specific taxa included in the present key are evidently fewer than those mentioned by Boulos (2002). This discrepancy is due to: (i) No specimens of a few species could be traced in any of the larger local herbaria; (ii) While re-identifying the specimens kept in CAI and ALEX, some of the taxa proved con-specific with others and had to be eliminated and (iii) The four varieties of *Atractylis carduus* (var. *angustifolia* Täckh. & Boulos, var. *latifolia* Täckh. & Boulos, var. *marmarica* Täckh. & Boulos and var. *glabrescens* (Boiss.) Täckh. & Boulos) mentioned by Boulos (2002) were deliberately omitted because they were reduced to synonymy of the type variety by The Plant List (2016) and The Missouri Botanical Garden (2017). To this extent, the present study has the added advantage of partially updating the representation of Asteraceae in the flora of Egypt.

Acknowledgements: We wish to thank Prof. Hasnaa A. Hosny (Cairo University) and Prof. Selim Zeidan Heneidy and Prof. Leila Beidak (Alexandria University) for permission to inspect all specimens of the Asteraceae in their respective herbaria.

References

Andrews, F.W. (1956) "*The Flowering Plants of the Sudan*", Vol. 3. (Compositae-Gramineae). T. Buncle & Co., Ltd., Abroath, Scotland.

Boulos, L. (2002) "*Flora of Egypt*", Vol. 3 (Verbenaceae-Compositae), pp. 134-317. Al Hadara Publishing, Cairo, Egypt.

Dallwitz, M.J. and Paine, T.A. (2005) Definition of the DELTA format. [http://delta-intkey.com/standard.htm]

Dallwitz, M.J., Paine, T.A. and Zurcher, E.J. (1993) onwards. "*User's Guide to the DELTA System: A General System for Processing Taxonomic Descriptions*". 4th ed. [http://delta-intkey.com]

El-Gazzar, A., El-Saied, A.S.M., Hammouda, A.A. and Soliman, M.A. (2008 a) Computer-generated keys to the flora of Egypt. 1. The Leguminosae

(Mimosoideae and Caesalpinioideae). *Taeckholmia*, **28**, 185-208.

El-Gazzar, A., Rabei, S.H., Aboel Atta, A.I., Kamel, E.A., Loutfy, M.H.A. and Shalabi, L.F. (2008 b) Computer-generated keys to the flora of Egypt. 2. The Chenopodiaceae. *Taeckholmia*, **28**, 209-225.

El-Gazzar, A., El-Ghareeb, R. and Toto, S.M. (2009 a) Computer-generated keys to the flora of Egypt. 3. The Solanaceae. *Taeckholmia*, **29**, 47-73.

El-Gazzar, A., Abdel-Ghani, M.M., Aboel Atta, A.I. and Shalabi, L.F.A. (2009b) Computer-generated keys to the flora of Egypt. 4. The Plantaginaceae. *Taeckholmia*, **29**, 115-131.

El-Gazzar, A., Abdel-Ghani, M.M., El-Husseini, N.M. and Khattab, A.A. (2012) Computer-generated keys to the flora of Egypt. 5. The Leguminosae-Papilionoideae. *Assiut University Journal of Botany,* **41**(2), 129-181.

El-Gazzar, A., El-Ghamery, A., El-Saied, A., Khattab, A.H. and El-Kady, A.A. (2015 a) Computer-generated keys to the flora of Egypt. 6. The Boraginaceae. *Annals of Agricultural Science*, **60**(1), 67-85.

El-Gazzar, A., Khafagi, A.A., El-Husseini, N. and Mostafa, N.A.M. (2015 b) Computer-generated keys to the flora of Egypt. 7. The Acanthaceae *s.l.*. *Annals of Agricultural Science*, **60**(2), 257-277.

El-Gazzar, A., El-Ghamery, A., Khattab, A.H., El-Saeid, B.S. and El-Kady, A.A. (2019) Computer-generated keys to the flora of Egypt. 8. *The* Lamiaceae. *Egyptian Journal of Botany,* **59**(1), 209-232.

Feinbrun-Dothan, N. (1977) "*Flora Palaestina*", Part 3-Plates. Ericaceae-Compositae, pp. 490-757. The Israel Academy of Science and Humanities, Jerusalem.

Feinbrun-Dothan, N. (1978) "*Flora Palaestina*", Part 3-Text. Ericaceae-Compositae, pp. 285-447. The Israel Academy of Science and Humanities, Jerusalem.

Montasir, A.H. and Hassib, M. (1956) "*Illustrated Manual Flora of Egypt*". Part 1, Dicotyledons. Imprimerie Misr S.A.E., Cairo. 615 pp.

Muschler, R. (1912) "*A Manual Flora of Egypt*". Vol. 2. R. Friedlaender & Sohn, Berlin.

Täckholm, V. (1956) "*Students' Flora of Egypt*". Anglo-Egyptian Bookshop, Cairo. 649pp.

Täckholm, V. (1974) "*Students' Flora of Egypt*". 2nd ed. Beirut. 888pp.

The Plant List (2016) Compositae. [theplantlist. org]. Royal Botanic Gardens, Kew, retrieved 18 November 2016.

The Missouri Botanical Garden (2017) Compositae. [www.tropicos.org], retrieved on 14 July 2017.

(*Rececived* 22/ 7/2018;
accepted 11/10/2018)

مفاتيح مبنية بالحاسب الآلي لتعريف الفلوره المصرية. 9. الأنواع الشوكية في الفصيلة المركبة

عادل إبراهيم الجزار[1]، ناهد الحسيني[2]، عزة أحمد فهمي خفاجي[3] ونشوى عبد الله مصطفى[1]
[1] قسم النبات والميكروبيولوجي - كلية العلوم - جامعة العريش - شمال سيناء - مصر،[2] المعشبة - قسم النبات- كلية العلوم - جامعة القاهرة - الجيزه - مصر و[3] قسم النبات والميكروبيولوجي - كلية العلوم - جامعة الأزهر (فرع البنات) - القاهرة - مصر.

المفاتيح المبنية يدوياً لتعريف النباتات لا تخلو من عيوب علمية، والمفاتيح المتاحة لتعريف نباتات الفصيلة المركبة في الفلوره المصرية ليست إستثناءاً من ذلك وتعتمد أساساً على صفات الأزهار التي تكون شديدة الضآلة في عدد كبير من الأجناس والأنواع، بينما الإختلافات في الصفات الظاهرية الواضحة للأعضاء الخضرية تُعَد مصدراً غنياً للصفات الملائمة لبناء مفاتيح لتعريف النباتات. وبفحص حوالي ثلاثة آلاف من العينات التي جمعت من مصر والبلدان المجاورة تبين أن أكثر هذه الصفات وضوحاً هو وجود أو غياب الأشواك على قمم وحواف الأوراق وفي آباط الأوراق وعلى سلاميات السوق وعلى حواف الأجنحة الملاصقة للسلاميات وعلى قلافات النورة لذلك تم إختيار هذه الصفة الواضحة لتقسيم أنواع الفصيلة المركبة في مصر إلى مجموعتين رئيسيتين: شوكية وغير شوكية، وتم تحديث الأسماء العلمية لجميع النباتات لاستبعاد المرادفات منها. هذه الدراسة تتناول نباتات المجموعة الأولى فقط وعددهم 65 نوع تنتمي إلى 20 جنس وفيها تم تسجيل التباين في 51 صفة خاصة بتوزيع الأشواك والعديد من الصفات المورفولوجية الأخرى للأعضاء الخضرية لكل نبات في مصفوفة بيانات واستخدام برنامج «دلتا» المتخصص في بناء مفاتيح التعريف. جاءت النتيجة على هيئة مفتاح آلي لتعريف نباتات هذه المجموعة أفضل كثيراً من كل سابقيه ومعه وصف تفصيلي لكل نوع على أساس جميع الصفات ونسخة أخرى من هذا الوصف ولكن بالأرقام المسلسلة المعطاة للصفات وحالاتها.