Anatolia. 2n = 32 was counted in plants of garden origin (see references in GREUTER 1973b: 62 and MOORE 1977: 72). A report of 2n = 34 for plants from Mt Pirin (Bulgaria) by KUZMANOV & KOŽUHAROV (in *Taxon* 19: 265, 1970, as *Cirsium aphrum* [JACQ.] DC.) remains somewhat doubtful because other counts suggest a generic basic number of x = 8.

26. Centaurea L.

E. GAMAL-ELDIN AND G. WAGENITZ

Perennial (rarely biennial) herbs, often woody at base, scabrid, hirsute or tomentose with multicellular hairs; sessile glands very frequent. Leaves alternate, rarely all basal, very variable in shape but never spiny, often pinnatifid or pinnatipartite. Capitula heterogamous, the marginal florets inconspicuous to very showy. Involucre variable in size and shape; phyllaries imbricate in several to many series, with a scarious, straw-textured or coriaceous appendage of great variability: orbicular, lanceolate or triangular, the margin entire or fringed to ciliate, obtuse or ending in a mucro, spinule or rigid spine. Receptacle with long, smooth bristles. Florets pink, purple, dark brownish-purple, blue, yellow or whitish; marginal neuter, funnel-shaped with 5-8 or more segments to nearly filiform, central florets tubular, hermaphrodite. Achenes usually glabrous when ripe, ± laterally compressed; apex rounded or truncate, hilum lateral near base, often with elaiosome. Pappus of several series of unequal scabrid to barbellate bristles, gradually elongated towards centre; innermost row usually distinctly shorter and often more scale-like; pappus sometimes absent. – C. 600 species, mainly in the Mediterranean region and the Near East.

Very few *Centaurea* species are restricted to high altitudes only, and close relationships between mountain and lowland species exist in several groups. Taxonomy is made difficult by the great variation shown by most species and the ease of hybridization. The most important characters (except in sect. *Cyanus*) are provided by the appendages of the phyllaries. These are referred to in the following key as "appendages", and are described from the middle series; the outer and inner differ conspicuously, the innermost being rather similar in most species.

Literature: HALÁCSY (1898), STOJANOV & ACHTAROV (1935, Bulgarian species), PHITOS (1970, 1971), DAMBOLDT & MELZHEIMER (1974), PHITOS & DAMBOLDT (1976), GEORGIADIS (1980, 1981, 1983; sect. *Acrolophus*), WAGENITZ & GAMAL-ELDIN (1985, sect. *Acrocentron*). For further references, see under the individual species and in *Fl. Eur.* 4: 254 (1980).

1. Appendages orbicular to ovate, entire or minutely denticulate, often irregularly lacerate, but neither ciliate nor ending in a spine, rarely with 1-2 pairs of cilia near apex 2.

- Appendages distinctly ciliate, at least in the upper part, or consisting of a mucro or spine or several palmately arranged spinules 9.

2. Florets yellow 3.

- Florets rose-purple or whitish 4.

3. Involucre 15-18 mm diam. Leaves densely appressed grey-white tomentose **17. C. musarum**

- Involucre 6-9 mm diam. Leaves sparsely grey-green tomentose **11. C. litochorea**

4. Appendages stramineous in colour and texture, with brownish central part but without hyaline margin **12. C. princeps**

- Appendages with brown to blackish central part and whitish to silvery hyaline margin 5.

5. Appendages nearly orbicular, truncate or emarginate 6.

- Appendages ovate, narrowed into a mucro 7.

6. Leaves densely greyish floccose-tomentose. Appendages 5-8 mm broad. Involucre 15-18 mm **13. C. marmorea**

- Leaves green, sparsely arachnoid and scabrid. Appendages 3-6 mm broad. Involucre 11-14 mm **5. C. lacerata**

7. Basal leaves lyrate or partly undivided; cauline leaves longer than internodes; leaves densely covered with long, soft multicellular hairs. Pappus 2.5-5 mm **16. C. pawlowskii**

- Basal leaves pinnatipartite, rarely lyrate; cauline leaves shorter than or c. equalling internodes; leaves scabrid with short, stiff hairs or indumentum sparsely arachnoid. Pappus 1.5-2 mm 8.

8. Stems prostrate. Leaf indumentum sparsely arachnoid. Basal leaves with 7-10 pairs of densely crowded, pectinate segments **15. C. ptarmicifolia**

- Stems ascending or erect, rarely procumbent. Leaves with very short, stiff hairs, or indumentum sometimes sparsely arachnoid. Basal leaves usually without densely crowded segments **14. C. deustiformis**

9. Appendages attenuate into a fimbriate (plumose), usually recurved tip with numerous pairs of long cilia 10.

- Appendages not as above 13.

10. Leaves linear to nearly filiform, 1-5 mm wide, entire or rarely with few teeth 11.

- Leaves lanceolate to narrowly ovate, broader, denticulate or dentate 12.

11. Leaves c. 1-2 mm broad, involute, very densely arranged (internodes c. 1-8 mm). Pappus 1-2 mm **21. C. parilica**

- Leaves broader, flat or nearly so, not very densely arranged, with longer internodes. Pappus absent **22. C. pangaea**

12. Appendages with lanceolate to triangular basal part (1-3 mm broad); cilia crowded towards base. Involucre 18-23 mm. Stems erect or ascending **20. C. nervosa**

- Appendages very narrow (0.3-0.8 mm broad); cilia not crowded at base. Involucre 13-14 mm. Stems nearly procumbent **19. C. triamularia**

13. Florets dark brownish-purple. Stem nearly leafless **2. C. grbavacensis**

- Florets not dark brownish-purple. Stem with several leaves or very short 14.

14. Appendages with dark brown to blackish margin decurrent to near base of phyllaries (never ending in a spinule or forming hyaline auricles). Florets blue, whitish or rarely pinkish-purple 15.

- Appendages not as above (rather long-decurrent in no. 18). Florets rose-purple, yellow or rarely whitish 20.

15. Roots thickened, oblong to fusiform **28. C. napulifera**

- Roots not thickened 16.

16. Florets whitish 17.

- Florets blue or pinkish-purple 18.

17. Stems very short (up to 2 cm, excluding solitary capitulum). Leaves entire, narrowly lanceolate, only 3-6 mm broad **23. C. baldaccii**

- Stems longer. Leaves broader and usually with a few lobes **24. C. pindicola**

18. Florets light pinkish-purple **27. C. epirota**

- Marginal florets cornflower-blue, central violet-purple 19.

19. Stem scarcely more than 15 cm, simple, lateral, ascending or decumbent. Basal leaf rosette well developed at anthesis **26. C. pichleri**

- Stem usually longer, often branched, erect or slightly bent in basal part. Leaf rosette absent or withered at anthesis **25. C. triumfettii**

20. Florets yellow . 21.

– Florets rose-purple or whitish 23.

21. Leaves distinctly decurrent. Appendage a firm spine with 1-2 pairs of lateral spinules **10. C. idaea**

– Leaves not or scarcely decurrent. Appendages not as above 22.

22. Leaves pinnatisect. Appendages decurrent with a ± ciliate border and ending in a very short spinule **1. C. athoa**

– Leaves entire. Appendages not decurrent, triangular with several palmately arranged spinules **29. C. lancifolia**

23. Stem shorter than basal leaves. Appendages ending in a distinct spine or a short mucro **3. C. raphanina**

– Stem longer than basal leaves 24.

24. Involucre 13-18 mm broad. Cauline leaves lyrate to simple, remotely denticulate or denticulate-serrate **18. C. vlachorum**

– Involucre narrower. Cauline leaves pinnatipartite or pinnatifid, the upper sometimes simple, not denticulate 25.

25. Appendages ending in a short mucro (0.5-1 mm) 26.

– Terminal mucro or spinule of appendages longer 27.

26. Leaf segments only 1-2(-3) mm broad. Appendages triangular or narrowly triangular, usually with distinct hyaline auricles at base **7. C. grisebachii**

– Leaf segments broader. Appendages usually broadly triangular, not auriculate at base **4. C. affinis**

27. Leaves scabrid and slightly araneose, not tomentose. Appendages not auriculate at base **4. C. affinis**

– Leaves ± densely white-tomentose (at least when young). Appendages distinctly auriculate at base 28.

28. Upper leaves linear, simple, entire. Branches few, divaricate **6. C. chalcidicaea**

– Upper leaves pinnatifid to pinnatipartite (only those immediately below capitulum sometimes entire). Branches not distinctly divaricate 29.

29. Appendages with patent or slightly recurved tip. Basal leaves often bipinnatisect, upper leaves pinnatipartite **9. C. ossaea**

– Appendages not patent or recurved. Basal leaves not bipinnatisect, upper leaves pinnatifid **8. C. subsericans**

1. C. athoa DC., *Prodr.* 6: 588 (1838)

Described from Greece, Mt Athos (type: AUCHER 3176, G-DC).

Perennial with branched woody rhizome and several procumbent or ascending stems, (1-)2-30 cm, mostly simple, sometimes with 1-2 long branches. Stem and leaves (on both sides) ± densely arachnoid-tomentose, sometimes glabrescent. Basal and lower leaves distinctly petiolate, *variable, often some pinnatisect, some lyrate or even undivided* and oblong-lanceolate. Pinnatisect leaves with 4-6 pairs of linear-lanceolate, lanceolate or oblong to nearly obovate lateral segments; segments 5-25 × (1.5-)2-4 mm, entire or with 1-2 teeth or lobes, rarely pinnatifid. Middle and upper leaves sessile, similar, upper with few segments. Involucre 15-20 × (8-)10-15 mm, oblong; outer and middle phyllaries sparsely arachnoid at margins. *Appendages small*, triangular with brown central part (sometimes dark brown near base), c. 1.5-3 mm broad at base; cilia (3-)4-9 on each side, (0.5-)1-2.5 mm, white, near base of appendage confluent into a narrow whitish border, sometimes completely absent. *Florets yellow.* Achenes 4-6 mm; pappus 1.5-3 mm.

1. Stems mostly 10-30 cm, usually distinctly procumbent. Segments of basal leaves (5-)10-25 mm, mostly entire **a. ssp. athoa**

– Stems (1-)2-4 cm, ascending. Basal leaves with segments 5-12 mm, at least some of them with 1-2 teeth or lobes, or pinnatifid **b. ssp. parnonia**

a. ssp. athoa

Syn.: *C. rupestris* L. var. *athoa* (DC.) GRISEB., *Spicil. Fl. Rumel.* 2: 242 (1846); *C. rupestris* L. ssp. *athoa* (DC.) GUGLER, *Cent. Ungar. Nat.-Mus.*: 194 (1907); *Colymbada athoa* (DC.) HOLUB in *Folia Geobot. Phytotax.* 7: 315 (1972); *Centaurea parolinii* DC., *Prodr.* 6: 592 (1838), described from Mt Ida (Kaz Dagh) in NW Turkey, leg. WEBB & PAROLINI; *C. trojana* BORNM. in *Repert. Spec. Nov. Regni Veg.* 19: 101 (1923), described from Susuz Dagh (Kaz Dagh range), leg. SINTENIS 1883 no. 508.

Rocky mountain slopes, c. 1400-1800 m, rarely down to 1200 m. Flowering July and August.

PELOPONNISOS: Taygetos!; NORTH EAST: Athos!

Outside Greece known from W Turkey (Kaz Dagh) and S Turkey (Vil. Antalya). 2n = 20 has been reported in material from Athos (STRID in *Taxon* 35: 902, 1986).

b. ssp. parnonia (HALÁCSY) GAMAL-ELDIN & WAGENITZ in *Bot. Jahrb. Syst.* 107: 101 (1985)

Basionym: *C. parnonia* HALÁCSY in *Bull. Herb. Boissier* 6: 648 (1898), described from Mt Parnon (type in WU-Hal!).

Syn.: *C. rupestris* L. var. *minor* BOISS., *Fl. Or.* 3: 663 (1875), described from Mt Parnon; *Colymbada parnonia* (HALÁCSY) HOLUB in *Preslia* 46: 228 (1974); *Centaurea macedonica* BOISS. ssp. *parnonia* (HALÁCSY) DOSTÁL in *Bot. J. Linn. Soc.* 71: 295 (1976).

Stony limestone slopes, around 1900 m. Flowering in July.

PELOPONNISOS: Parnon, summit area of Megali Tourla!

A local endemic closely allied to ssp. *athoa*. Typical specimens of the two subspecies look rather different, but there are plants on Mt Athos with shorter stems and some teeth at the segments which would be difficult to identify without knowledge of their origin. It is doubtful whether ssp. *parnonia* can be maintained as a separate taxon when more material becomes known. There is no close affinity to *C. macedonica* BOISS.

2. C. grbavacensis (ROHLENA) STOJ. & ACHT., *Stud. Cent. Bulg.*: 39 (1935)

Basionym: *C. immanuelis-loewii* DEGEN var. *grbavacensis* ROHLENA in *Věstn. Král. České Společn. Nauk, Tř. Mat.-Přír.* 1935(II): 4 (1935). Described from Jugoslavian Makedonija, "in collibus supra Grbavac pr. Prilep", leg. VANDAS.

Syn.: *Colymbada grbavacensis* (ROHLENA) HOLUB in *Preslia* 46: 228 (1974); *Centaurea atropurpurea* WALDST. & KIT. var. *soskae* STOJ. & ACHT., *Stud. Cent. Bulg.*: 40 (1935), described from Mt Sivec near Prilep (leg. STOJANOV & SOŠKA, 13.6. 1932).

Taprooted perennial with a woody base surrounded by fibrous remains of petioles. *Stems 1-2, occasionally several, 25-75 cm, erect, usually simple, robust, always leafless above.* Basal part of stem and leaf rhachis densely villous, upper part of stem and leaf segments sparsely arachnoid or glabrous. Basal leaves petiolate, pinnatisect to bipinnatisect, 10-38 cm, *with numerous pairs of 3-dimensionally arranged segments*, rarely some smaller leaves lyrate-pinnatifid; ultimate segments linear or linear-lanceolate, often falcate, (10-)15-55 × (1-)1.5-4.5 mm, nearly always entire, very rarely with 1-4 teeth. Cauline leaves (only 1-2 in lower part of stem) pinnatisect. *Involucre 25-30 x 20-30 mm, subglobose.* Phyllaries in several series, 4-8 mm broad, arachnoid, almost completely covered by the appendages. Appendages ± triangular, 5-8 × 3-6 mm, *distinctly decurrent with a black border, ciliate* and ending in a spinule (2-)2.5-6 mm; cilia numerous, c. 15-20 on each side, c. 3-5.5 mm long, dark brown at base, silvery at tips; *Florets dark brownish-purple*, the marginal slightly longer. Achenes 4-5 mm, bearded at base; pappus 6-8(-9) mm, brownish, inner row 1.2-2 mm.

Rocky outcrops in meadows, exposed limestone ridges, generally at low altitudes, but collected at 1700-1900 m on Mt Tzena (cf. STRID & PAPANICOLAOU 1981: 78-79). Flowering June to mid-August.

NORTH CENTRAL: Olimbos!, Voras (VOLIOTIS 1981b: 78), Tzena!

Also in Jugoslavian Makedonija from hills SW of Skopje to an area SE of Prilep.

This species was collected for the first time in Greece by STRID & KJELLSON in 1976 on the N foothills of Olimbos. Described as a variety of *C. immanuelis-loewii* by ROHLENA, it differs markedly from that species by the larger capitula on stout, almost leafless stems and the larger appendages which cover the phyllaries to a considerable extent. The form of the appendages in *C. grbavacensis* varies from narrowly to broadly triangular but both forms may be present in the same population. ROHLENA mentions plants with a longer spine (5-10 mm) and describes them as var. *spinescens* ROHLENA, but no collection corresponding to this description has been seen. The chromosome number of *C. grbavacensis* is 2n = 22 (STRID & ANDERSSON 1985: 205, material from Tzena). In the experimental garden at Copenhagen a spontaneous hybrid between *C. grbavacensis* (2n = 22) and *C. graeca* BOISS. & SPRUNER (2n = 20) has been observed (STRID & ANDERSSON loc. cit.).

3. C. raphanina SIBTH. & SM., *Fl. Gr. Prodr.* 2: 205 (1813)

Described from Crete, "montibus Sphacioticis". Type probably in OXF.

Syn.: *Colymbada raphanina* (SIBTH. & SM.) HOLUB in *Preslia* 46: 228 (1974).

Perennial with *thickened, conical or fusiform taproot c. 1-2 cm diam.*, bearing a *rosette of leaves and 1-4 (rarely more) subsessile capitula* (sometimes on a short stem 1-4 or rarely up to 12 cm). Leaves petiolate, *interruptedly lyrate-pinnatisect*, 5-12(-25) cm, with numerous, often densely crowded, very unequal, lanceolate or oblong lateral segments and a larger, nearly rhomboid to triangular or elliptic terminal segment, sometimes some or rarely all leaves undivided. Involucre cupuliform, ovoid or nearly funnel-shaped; phyllaries in many rows. Florets rose-purple or whitish, the marginal scarcely radiant. Achenes 4-5 mm; pappus 3-5(-6) mm, the inner row 1.5-2 mm.

Two subspecies occur in Greece:

1. Appendage a mucro or short spinule c. 1-6 mm, with few, very short (0.5-2 mm) spinules or cilia **a. ssp. raphanina**

– Appendage a spine, usually 8-15(-20) mm, with several pairs of lateral spinules 2-7 mm in lower part **b. ssp. mixta**

a. ssp. raphanina

Capitula subsessile or stem very short (1-4 cm). Leaves ± densely hairy (multicellular hairs), sometimes glabrescent or glabrous, but always scabrid at margin. Leaf segments entire, rarely the terminal with few short teeth. Involucre 15-21 × 10-17(-20) mm. Appendage a mucro or short spine, c. 1-6(-8) mm long, sometimes with 1-2 pairs of short spinules near base, the narrow decurrent margin scarcely distinguishable from the phyllary, entire or with several very short (0.5-2 mm) and thin cilia.

In crevices of limestone (rarely schistose) rocks from sea level to 2000 m. Flowering from April (at low altitudes) to July. Only mountain localities are listed:

CRETE: Levka Ori!, Volakias!, Psiloritis!, Nida!, Afendis Christos!, Afendis Kavousi!

Typical specimens are found only in Crete and Karpathos; in the Cyclades forms intermediate between this and the following subspecies prevail. The chromosome number is $2n = 20$ in both subspecies (RUNEMARK 1967c: 168, PHITOS 1971: 258).

b. ssp. mixta (DC.) RUNEM. in *Bot. Not.* 120: 486 (1967)

Basionym: *C. mixta* DC., *Prodr.* 6: 594 (1838). Described from Greece and Anatolia. Syntypes: "Attica, monte Hymetto", AUCHER 8563 (G-DC); "circa Theben Graecorum", ZUCCARINI (G-DC). A third specimen, "Asia minori", AUCHER 3187 (G-DC) belongs to *C. urvillei* DC.

Syn.: *Colymbada mixta* (DC.) HOLUB in *Preslia* 45: 144 (1973); *Centaurea hellenica* BOISS. & SPRUNER in BOISS., *Diagn.* ser. 1, 6: 131 (1845), several syntypes from Sterea Ellas and Peloponnisos; *C. myconia* BOISS. & SART. in BOISS., *Diagn.* ser. 2, 6: 113 (1859), described from the island of Mikonos; *C. mixta* var. *myconia* (BOISS. & SART.) HAYEK, *Prodr. Fl. Penins. Balcan.* 2: 755 (1931); *C. hellenica* f. *intermedia* HELDR. in schedis (cum diagn.) ad *Herb. Gr. Norm.* no. 1047b (c. 1890).

Capitula nearly sessile or on short stem 1-5(-12) cm. Leaves subglabrous, scabrid with short hairs at margins and sometimes with few hairs on veins. Larger leaf segments often irregularly dentate or even pinnatifid. Involucre (18-)20-25(-30) × (10-)15-25 mm. Appendage a spine (6-)8-15 (-20) mm, broadened at base and with 2-6 pairs of thin lateral spinules 2-5(-7) mm long in lower part. Decurrent margin distinct, with several cilia 2-4 mm on each side.

On calcareous rocks and stony slopes from sea level to 2200 m. Flowering from end of April (at low altitudes) to July. Only mountain localities are listed:

PELOPONNISOS: Taygetos!, Parnon!, Menalon!, Oligirtos!, Killini!, Chelmos!, Erimanthos!, Panachaikon!; STEREA ELLAS: Yerania!, Pateras!, Kitheron!, Pendeli!, Parnis!

Endemic to Greece: Peloponnisos, Sterea Ellas (Attiki, Euboea), Cyclades.

This subspecies is more variable than ssp. *raphanina* in characters such as height of stem, size of involucre and length of spines. The leaves are only very rarely undivided, and may be nearly bipinnatisect in some populations. In the Cyclades there is besides typical ssp. *mixta* a bewildering array of forms intermediate between the two subspecies (cf. RUNEMARK 1967c).

4. C. affinis FRIV. in *Flora* 19: 435 (1836)

Described from Rumelia (S Bulgaria). Type: FRIVALDSZKY (BP!, W!).

Syn.: *C. stereophylla* BESSER var. *affinis* (FRIV.) GRISEB., *Spicil. Fl. Rumel.* 2: 237 (1846); *C. dissecta* TEN. ssp. *affinis* (FRIV.) GUGLER in *Cent. Ungar. Nat.-Mus.*: 141 (1907) = *Ann. Hist.-Nat. Mus. Natl. Hung.* 6: 141 (1908); *Acosta affinis* (FRIV.) SOJÁK in *Čas. Nár. Muz., Odd. Přír.* 140: 133 (1972).

Perennial with ascending, rarely erect stems. Leaves grey-tomentose or scabrid and slightly araneose; size and shape very variable (see subspecies). Involucre 11-18 × 6-13 mm. Appendages blackish-brown to brown, triangular, ciliate; cilia 1.5-3 mm, ending in a mucro or spinule 0.5-2 mm (shorter than cilia). Achenes 3-3.5 mm; pappus 1-2 mm.

C. affinis is very difficult to delimit and to divide into natural units. There is enormous variation as to height, leaf shape, indumentum, size of capitula, shape of appendages, etc., sometimes within a limited area, e.g. on Parnassos. Five subspecies can be distinguished in Greece, three occurring at higher altitudes, but critical specimens not clearly referable to any of these are not rare, especially in N Greece. Some specimens also approach *C. grisebachii* (no. 7) and *C. stoebe* L.

1. Leaves scabrid beneath or on both sides, often only slightly araneose. Appendages often narrowly triangular with mucro 1 mm or more **b. ssp. laconiae**

– Leaves ± tomentose or araneose. Appendages triangular to broadly triangular with mucro less than 0.5 mm . 2.

2. Involucre 6-8 mm broad; appendages light brown to brown, rarely blackish-brown. Stems erect or ascending **c. ssp. pallidior**

– Involucre broader; appendages usually blackish-brown. Stems procumbent or ascending **a. ssp. affinis**

a. ssp. affinis

Stem usually ascending, rarely erect, (5-)15-30(-50) cm, branched at or below middle. Leaves greyish-green, often densely *grey-tomentose when young*, nearly always appressed-araneose above, only minutely scabrid beneath. Lower leaves pinnatisect to ± distinctly lyrate, larger segments c. 3-10 mm broad; middle leaves pinnatisect or pinnatifid, upper entire. Involucre 13-15(-17) × 8-13 mm. Phyllaries with conspicuous longitudinal veins. *Appendages broadly triangular*, 2.5-3 mm broad at base (excl. cilia), blackish-brown, with (6-)8-10(-12) cilia on each side, the lower sometimes confluent and forming indistinct auricles. Cilia 1.5-2.5 mm long, *terminal mucro 0.5-1 mm*. Achenes 3-4 mm; pappus 1.5-2 mm.

Subalpine to alpine meadows, 1500-2400 m (occasionally lower), on various substrates. Flowering July and August.

STEREA ELLAS: Parnassos!, Giona!, Oxia!, Chelidon!, Timfristos!; S PINDHOS: Kazarma!, Kakarrdhitsa!; NORTH CENTRAL: Olimbos! (atypical, with large auricles), Kajmakčalan!, Pinovon!, Tzena!; NORTH EAST: Belles!, Pangeon!

According to GEORGIADIS (1980: 35, 1983) this subspecies is tetraploid (2n = 36). Some populations from NE Greece are referable to ssp. *serbica* PRODAN (syn.: *C. vatevii* DEGEN & al., *C. affinis* FRIV. var. *vatevii* [DEGEN & al.] HAYEK, *C. pallidior* HALÁCSY ssp. *vatevii* [DEGEN & al.] DOSTÁL). At least some of the specimens identified as ssp. *tartarea* (VELEN.) GEORGIADIS by GEORGIADIS should be included in ssp. *serbica*. They have erect stems, leaves with very narrow segments and a sparse indumentum; the typical form of ssp. *serbica* scarcely occurs above 1500 m.

b. ssp. laconiae PRODAN, *Centaur. Roman.*: 137 (1930)

Described from Mt Taygetos. Type: LEONIS 128 (B!, BP!, W!).

Syn.: *C. affinis* var. *peloponnesiaca* HALÁCSY in *Bull. Herb. Boissier* 6: 593 (1898), described from Parnon, Chelmos (leg. ORPHANIDES) and Killini (leg. HELDREICH); *C. affinis* ssp. *peloponnesiaca* (HALÁCSY) DOSTÁL in *Bot. J. Linn. Soc.* 71: 196 (1976), sphalm. "*peloponesiaca*".

Stems c. 15-60 cm, procumbent or ascending, divaricately branched with several, usually simple branches from near base. *Leaves scabrid* on both sides and slightly to moderately araneose. Lower leaves pinnatisect or lyrate with oblong or lanceolate segments, terminal 3-5 mm broad (up to 12 mm in lyrate leaves); upper leaves pinnatifid to entire. Involucre 12-18 × 6-9 mm. *Appendages brown to blackish-brown, triangular or narrowly triangular*, 1.5-2.5 mm broad at base, usually with 5-8 cilia c. 2-3 mm and ending in a *mucro or spinule (0.5-)1-2 mm.*

Along mountain roads and in subalpine meadows, mainly 600-1200 m, occasionally up to 1500-1700 m. Flowering June and July. Only high-altitude records are listed.

PELOPONNISOS: Taygetos!, Parnon!, Killini!, Chelmos!, Erimanthos!, Panachaikon!

PERSSON (unpubl.) found 2n = 36 in material from Chelmos and Erimanthos. While specimens from the north (Chelmos and Panachaikon) are rather different from ssp. *affinis* on account of the narrow appendages with long spines (some collections approach *C. attica* ssp. *pentelica* in this respect), those from Taygetos are much more diverse and sometimes rather similar to ssp. *affinis*, but differ in the type of indumentum. According to GEORGIADIS (1980: 40, 1983) ssp. *peloponnesiaca* is diploid (2n = 18), and the tetraploid ssp. *affinis* also occurs in Peloponnisos. However, the morphological criteria given are not clear, and there is some confusion as to the distribution of the two subspecies. Some collections from Parnassos approach ssp. *laconiae*. Very remarkable is S 15196 (C!) from the southern part of Taygetos, which has short prostrate stems

arising from a rosette, and small capitula. Further observations are necessary to decide if this is a purely local form or a separate subspecies.

c. ssp. pallidior (HALÁCSY) HAYEK, *Prodr. Fl. Penins. Balcan.* 2: 766 (1931)

Basionym: *C. pallidior* HALÁCSY in *Bull. Herb. Boissier* 6: 594 (1898). Described from Karpenisi and Mt Korax (syntypes in WU-Hal!).

Syn.: *C. affinis* FRIV. var. *pallidior* (HALÁCSY) HALÁCSY, *Consp. Fl. Gr.* 2: 146 (1902); *Acosta pallidior* (HALÁCSY) HOLUB in *Preslia* 46: 226 (1974); *C. pallidior* HALÁCSY var. *pallidissima* HALÁCSY in *Bull. Herb. Boissier* 6: 595 (1898).

Stem erect or more rarely ascending, c. 15-30(-60) cm, branched from middle or below. Leaves ± floccose-tomentose; segments up to 5 mm broad. Involucre c. 12-14 × 5-7(-8) mm. *Appendages triangular to broadly triangular, light to dark brown*, with 4-8 cilia on each side; auricles small or indistinct; *terminal mucro c. 0.5 mm.*

Stony slopes and pastures, usually on limestone, (900-)1000-2100 m. Flowering July and August.

STEREA ELLAS: Parnassos!, Giona!, Iti!, Vardousia!, Korax!, Kalliakouda!, Timfristos!; S PINDHOS: Svoni!, Tringia!, Tsoumerka! (approaching ssp. *affinis*), Kakarrdhitsa!

GEORGIADIS (1980: 41) reported both 2n = 18 and 2n = 36 in this subspecies, but these numbers are not mentioned in his list (1980: 85-89) nor in his publication from 1983.

5. C. lacerata (HAUSSKN.) HALÁCSY in *Bull. Herb. Boissier* 6: 591 (1898)

Basionym: *C. affinis* FRIV. var. *lacerata* HAUSSKN. in *Mitth. Thüring. Bot. Vereins* N.F. 7: 43 (1895). Described from the Pindhos, near Malakasi (Metsovon area). Orig. coll.: HAUSSKNECHT a. 1885 (lectotype in WU-Hal!).

Syn.: *C. affinis* FRIV. ssp. *lacerata* (HAUSSKN.) MAIRE & PETITMENGIN in *Matér. Étude Fl. Géogr. Bot. Orient* 4: 130 (1908).

Perennial, green, sparsely arachnoid and scabrid. Stems 10-35(-65) cm, ascending or erect, branched from near base or at middle, with few, relatively long branches, sparsely leafy. Basal leaves lyrate-lobate to (lyrate-)pinnatipartite, segments entire or with few teeth or lobes; middle leaves sessile, mostly pinnatipartite with 3-7 pairs of linear-lanceolate or linear segments; the upper with 1-2 pairs of segments or entire. Involucre 11-14 × 5-9 mm (at fruiting time ovoid or cup-shaped). Phyllaries in several series, sparsely glandular, with conspicuous longitudinal veins, the middle sometimes purplish. Appendages ovate to suborbicular, 3-5(-6) mm broad, shortly decurrent, almost or entirely covering basal part of phyllary, with firm, triangular to ovate or orbicular, *black or dark brown central part* (sometimes with pale middle vein) and broad hyaline margin, *emarginate*, ending in a mucro (0.2-)0.5-1 mm long; *margin irregularly*

dentate-lacerate (sometimes with 1-3 cilia near apex). Florets rose-purple, the marginal radiant. Achenes 3-3.5 mm; pappus 1-1.5 mm.

Rocky and stony meadows, (1400-)1500-2100 m, on limestone or serpentine. Flowering July and August.

S PINDHOS: Boumistos (MAIRE & PETITMENGIN 1908: 130), Dhokimi!, Perivouli!, Boutaï!, Trapos in mt. Peristeri!; N PINDHOS: Mitsikeli!, Aspra Litharia!, Malakasi!, Katara Pass!, Milea!, Fleka!, Aftia!, Tsouka Arosia!, Timfi!, Astraka!, Smolikas!

Endemic to the Pindhos (we could find no evidence for its occurrence in Sterea Ellas as indicated by GEORGIADIS 1980: 38). The species is variable and not easy to delimit. Especially in the area of the Katara Pass there are many plants with ± distinct hyaline cilia, which we interpret as hybrids with *C. grisebachii* ssp. *occidentalis* (no. 7).

6. C. chalcidicaea HAYEK in *Oesterr. Bot. Z.* 64: 359 (1914)

Described from Mt Athos, SE slopes, 1500-1950 m. Type: E. HARTMANN, 18.7. 1913 (GB).

Syn.: *Acosta chalcidicaea* (HAYEK) HOLUB in *Preslia* 46: 226 (1974); *Centaurea affinis* FRIV. ssp. *chalcidicaea* (HAYEK) GEORGIADIS, *Contr. Étude Centaurea*: 38 (1980); ?*C. sanctae-annae* J. WAGNER in *Repert. Spec. Nov. Regni Veg.* 38: 287 (1935), described from the lower slopes of Mt Athos.

Perennial with several stems from a woody base. Stems ascending or procumbent, rarely suberect, (12-)20-30 cm, *branched from near base or below middle*, with few, rather *long divaricate branches*. Stem and leaves *densely white-tomentose* when young, later sparsely grey-tomentose. Basal and lower leaves pinnatipartite or bipinnatipartite (occasionally partly sublyrate), long-petiolate, the segments mostly linear to narrowly lanceolate, c. 4-10 mm broad, entire or with few teeth; middle leaves pinnatipartite with linear-lanceolate segments; upper leaves linear and undivided. Involucre (11-)12-15 × (6-)7-10 mm, cup-shaped. Phyllaries glabrous, with weak longitudinal ridges, sometimes suffused purple. Appendages not completely covering basal part of phyllary, triangular with brown to dark brown central part and lighter brownish or whitish cilia; cilia 5-7 on each side, 2-2.5 mm long; *base of appendages with distinct hyaline auricles* (rarely divided into several additional cilia); *terminal spinule 1-1.5 mm.* Florets rose-purple, the marginal strongly radiant with rather broad lobes. Central florets 25 or more. Achenes 3.5-4 mm; pappus (2-)2.5-3 mm.

Rocky slopes, (600-)1100-1950 m, on limestone. Flowering in July.

NORTH EAST: Athos!

Endemic. 2n = 18 (DAMBOLDT & MELZHEIMER 1974: 385, GEORGIADIS 1981, 1983). The species is rather variable in shape of leaves and structure of appendages, and there is some intergradation with *C. huljakii* J. WAGNER, an endemic of the lower slopes of Mt Athos which is probably

much more closely allied to *C. chalcidicaea* than their current positions in different sections (sect. *Phalolepis* and sect. *Acrolophus* respectively) would seem to indicate. Another allied species is *C. ossaea* HALÁCSY (no. 9). *C. sanctae-annae* J. WAGNER is probably synonymous with *C. chalcidicaea*; according to WAGNER's description there are no clear differences between the two and, since the latter was not even mentioned by WAGNER, he was probably not aware of it. In any case, it is very improbable that *C. sanctae-annae* should be a hybrid between *C. huljakii* and *C. diffusa* LAM. as suggested in the original paper. Specimens from Olimbos determined as *C. chalcidicaea* are rather different in habit; they may represent a form of *C. affinis*.

7. C. grisebachii (NYMAN) HELDR. in *Sched. Herb. Gr. Norm.* no. 1155 (c. 1891)

Based on the type of *C. paniculata* L. var. *macedonica* GRISEB., *Spicil. Fl. Rumel.* 2: 240 (1846). Described from Macedonia near Thessaloniki and Chortiatis. Syntypes: GRISEBACH (GOET!) and FRIEDRICHSTHAL (W!).

Syn.: *C. graeca* BOISS. & SPRUNER var. *macedonica* (GRISEB.) BOISS., *Fl. Or.* 3: 644 (1875); *C. macedonica* (GRISEB.) HALÁCSY, *Consp. Fl. Gr.* 2: 147 (1902), nom illegit. (non *C. macedonica* BOISS. 1845); *C. graeca* BOISS. & SPRUNER ssp. *grisebachii* NYMAN, *Consp.*: 427 (1879).

Perennial with ± erect stems and divaricate branches. Leaves sparsely to moderately araneose-tomentose. Lower leaves pinnatipartite to bipinnatipartite with linear or linear-lanceolate segments 1-4 mm broad (the terminal sometimes larger); middle leaves pinnatipartite, upper simple or with a pair of lobes at base. Involucre (10-)11-14 × 5-8 mm. *Appendages small, triangular or narrowly triangular*, brown to blackish-brown, with 4-8 pairs of cilia and small but *usually distinct hyaline auricles* at base, *terminal mucro 0.5-1 mm.* Achenes 2.5-3.5 mm; pappus 1-1.5 mm.

Three subspecies occur in Greece. Ssp. *grisebachii* and ssp. *confusa* (HALÁCSY) DOSTÁL (syn.: *C. confusa* HALÁCSY, *C. affinis* FRIV. var. *microcephala* HALÁCSY) are typically found at low altitudes in N and C Greece, but ssp. *grisebachii* occurs sporadically in the mountains up to c. 1700 m (Ossa!, Tringia!, Boutsi!). Both are tetraploid with 2n = 36 (GEORGIADIS 1980: 46, 1983, STRID & FRANZÉN 1981: 841). A third subspecies is chiefly found on serpentine at high altitudes:

Ssp. occidentalis GAMAL-ELDIN & WAGENITZ, ssp. nova

Orig. coll.: Macedonia occ., prov. & distr. Grevena, ad occidentem pagi Kranea, in latere boreo-orientali montis Simandro, loco "Baltsa" vocato, alt. 1500 m, 16.8. 1974, CHARPIN 11126 = GREUTER & al. 12295 (C, holotype).

Folia indistincte scabridula in pagina inferiore, supra laevia et vix visibile laxe araneosa; pinnatipartita (inferiora interdum bipinnatipartita, suprema indivisa) segmentis linearibus 1-2(-3) mm latis. Appendices (anguste) triangulares, basi 1.5-2.5 mm longis, basi auriculis parvis provisae, mucro terminalis 0.5-1 mm.

Stem erect or ascending, rarely prostrate, c. 15-50 cm, branched from middle or below. Leaves green, only sparsely araneose-tomentose and *very slightly scabrid* beneath. Lower leaves pinnatipartite to bipinnatipartite with sublinear segments only 1-2(-3) mm broad. Involucre 12-14 × 6-8 mm. *Appendages triangular to narrowly triangular* (1.5-2.5 mm broad at base), *blackish-brown with small hyaline auricles.* Cilia usually 6-8 on each side, 1.5-2 mm long; *terminal mucro 0.5-1 mm.* Achenes 3-3.5(-4) mm; pappus 1-1.5 mm.

In his publication and in herbaria GEORGIADIS determined these specimens as *C. affinis* FRIV. (ssp. *affinis*). Initially we assigned this ssp. to *C. affinis*, but later it was decided by one of us (G.W.) to put it under *C. grisebachii* on account of its narrowly triangular appendages with rather distinct auricles. It resembles *C. lacerata* (no. 5) and hybridizes with the latter.

Common in a variety of habitats but usually in subalpine and alpine meadows, (900-)1500-2000 m, generally on serpentine, rarely on limestone. Flowering July and August.

S PINDHOS: Perivouli!; N PINDHOS: By Malakasi!, Katara Pass! (and other localities in this area), Milea!, Pirostia!, Smolikas!, Vasilitsa!; NORTH CENTRAL: Vourinos!, Vermion!

Probably endemic in this area.

8. C. subsericans HALÁCSY in *Magyar Bot. Lapok* 11: 164 (1912)

Described from Mt Pateras. Type: TUNTAS no. 848 (W!, WU!).

Syn.: *Acosta subsericans* (HALÁCSY) HOLUB in *Preslia* 46: 227 (1974).

Perennial with a rosette of leaves and one to several stems 10-35 cm, ascending or procumbent, simple or with 1-2 short branches in upper part. Leaves *appressed white-tomentose* or sometimes floccose-tomentose, the lower 3-10 cm, pinnatisect with lanceolate lateral segments 5-20 × 2-6 mm and broader terminal segment (c. 5-10 mm broad), the segments entire or more rarely with 1-3 teeth or lobes; middle and upper leaves much smaller, sessile, pinnatipartite or the upper entire; *cauline leaves usually shorter than internodes.* Capitula solitary. Involucre 15-17 × 6-8(-10) mm, oblong. Phyllaries in several series. Appendages not completely covering basal part of phyllary; central part dark brown to blackish, narrowly triangular, slightly convex; cilia usually 5-6(-7) pairs, c. 1.5-2.5 mm; *distinct hyaline auricles present at base*; sometimes only 2-4 indistinct cilia and whole lower part of margin confluent into a broad hyaline border; *terminal spinule 1.5-3 mm.* Florets rose-purple, the marginal slightly radiant. Achenes c. 4 mm; pappus 1.5-2.5 mm.

Rocky mountain slopes, 1100-1740 m, on limestone. Flowering in July.

STEREA ELLAS: Pateras!, Elikon!

Endemic. We have seen only the type collection from Pateras and several recent collections from Elikon. In both localities the populations show remarkable variation in the structure of the appendages. These may have the appearance typical for section *Acrolophus* with several, well differentiated lateral cilia and hyaline auricles at base, or they may approach those of section *Phalolepis* with very broad hyaline margin and only a few, rather indistinct cilia in the apical part. In this respect the species resembles *C. pseudocadmea* WAGENITZ (sect. *Phalolepis*) from Kitheron. It is possible that these two should be treated as a single variable species; on the other hand the variability may be due to hybridization between two basically distinct species (WAGENITZ 1989). There is also a close affinity to *C. ipsaria* STOJ. & KITANOV from the island of Thasos and to *C. attica* NYMAN.

9. C. ossaea HALÁCSY in *Bull. Herb. Boissier* 6: 591 (1898)

Described from summit area of Mt Ossa. Type: HELDREICH s.n. (WU-Hal!).

Syn.: *C. attica* NYMAN ssp. *ossaea* (HALÁCSY) DOSTÁL in *Bot. J. Linn. Soc.* 71: 198 (1976).

Perennial with a rosette of leaves. Stems one to several, 10-30 cm, prostrate or ascending, *simple or often with up to 5 short branches in upper part. Leaves densely white-tomentose* or less densely greyish-green-tomentose and scabrid from multicellular hair-bases; lower leaves petiolate, pinnatisect to bipinnatisect, the segments lanceolate or oblong, c. 5-7 × 1-3 mm; middle and upper leaves sessile, pinnatipartite, the middle usually with 4 pairs of linear-lanceolate, sometimes dentate segments, the upper with a single pair of lobes or entire, the uppermost at or near base of involucre. Involucre 13-15 × 7-10 mm, cup-like. Phyllaries in several series, sparsely arachnoid, without conspicuous longitudinal veins, the middle ones sometimes purple. Appendages not completely covering basal part of phyllary, with triangular, black or blackish-brown central part, patent or slightly recurved at apex, 1.5-2.5 mm broad at base; cilia 5-7 on each side, c. 2-3 mm, brownish with white tips; *distinct basal auricles present; apical spinule 1.5-2(-3) mm*, slightly firmer than cilia. Florets rose-purple, the marginal radiant; hermaphrodite flowers c. 30-40. Achenes 2.8-3.3 mm; pappus 1.5-2 mm.

Stony mountain slopes, c. 1900-2100 m, on limestone. Flowering from mid-June to end of August.

EAST CENTRAL: Ossa!; NORTH CENTRAL: Siniatsikon!

Endemic; allied to *C. affinis* FRIV., *C. chalcidicaea* HAYEK and the *C. attica* group, especially *C. subsericans* HALÁCSY (no. 8). A record of this species from Mt Athos (BORNMÜLLER, cf. *Fl. Aeg.*: 669, 1943) probably

refers to *C. chalcidicaea*. The specimens recently collected on Siniatsikon agree in the essential characters, but are less densely tomentose, the appendages are slightly narrower and show some variation in colour and size of auricles. *C. ossaea* from Mt Ossa is diploid with 2n = 18 (GEORGIADIS 1980: 52, 1983).

10. C. idaea BOISS. & HELDR. in BOISS., *Diagn.* ser. 1, 10: 119 (1849)

Orig. coll.: "in saxosis regionis sylvaticae montis Idae et montium Sphacioticorum, alt. 3-5000 ped.". HELDREICH, v. 1846 (G, holotype!).

Syn.: *C. solstitialis* L. var. *idaea* (BOISS. & HELDR.) BALD. in *Malpighia* 9: 329 (1855); *C. solstitialis* ssp. *idaea* (BOISS. & HELDR.) GUGLER, *Cent. Ungar. Nat.-Mus.*: 203 (1907).

Perennial (probably flowering in the first year). Stems erect, c. 5-30 cm, several from a woody base, branched from near base or middle, floccose-tomentose, branches often overtopping main stem. Leaves densely whitish appressed-tomentose below, laxly floccose-tomentose above. *Rosette of basal leaves well developed at anthesis; basal leaves petiolate, lyrate* with nearly triangular terminal segment (truncate or subcordate at base) and 4-5 pairs of lanceolate lateral segments decreasing in size towards base; lowermost cauline leaves similar with fewer segments, *middle and upper ones lanceolate to linear-lanceolate, decurrent,* mucronate, rapidly decreasing in size upwards. Involucre 11-15 × 6-8 mm; phyllaries in several series, coriaceous, straw-coloured, *ending in a spine 15-22 mm*, with usually 2 pairs of short spinules (3-5 mm) near base. Spines yellowish, lateral spinules and appendages of innermost phyllaries reddish-brown. *Florets yellow*, marginal not radiant. Achenes 2-2.5 mm, heteromorphic, marginal ones few (sometimes probably absent), dull, without pappus, central ones glossy with pappus 2.5-3 mm.

Stony and rocky ground, (300-)800-2000 m. Flowering mainly in June and July.

CRETE: Many records from the three main massifs as well as Afendis Kavousi, and occasionally in the lowland.

C. idaea is closely related to the widespread *C. solstitialis*, a species of low altitudes nearly absent from Crete. *C. idaea* can in most cases easily be recognized by the perennial habit with a well-developed rosette of leaves and on the type of branching. Involucre and achenes are smaller, and the pappus is shorter, but there is some overlap with *C. solstitialis* in these quantitative characters. The chromosome number is the same as in *C. solstitialis* (2n = 16; PHITOS & KAMARI 1984, MONTMOLLIN 1986).

11. C. litochorea GEORGIADIS & PHITOS in *Rev. Biol. Écol. Médit.* 5: 31 (1978)

Described from near Stavros above Litochoron, Olimbos, c. 950 m. Orig. coll.: PHITOS, GEORGIADIS & TZANOUDAKIS 13724 (holotype in UPA, n.v.).

Perennial, *greyish-green tomentose* and scabrid, with 1-4 procumbent or ascending stems 5-25 cm, sparingly branched from near base or middle, sparsely leafy. Basal leaves 2-5(-8) cm, lyrate-lobate to lyrate-pinnatipartite, segments sometimes with few lobes; middle leaves pinnatipartite, segments 0.8-1 mm broad. Involucre 11-15(-18) × (6-)8-9(-10) mm (at fruiting time open, nearly campanulate). Phyllaries light green, glabrous. *Appendages suborbicular*, 3-5 × 3-6 mm, shortly decurrent, covering basal part of phyllary, hyaline with firmer, triangular to ovate, straw-coloured to light brown or even dark brown central part; *margin irregularly dentate-lacerate*, sometimes with 1-3 cilia near apex, ending in a mucro (1-)1.5-2 mm long. *Florets lemon-yellow*, sometimes with pinkish tips (when dry), marginal ones radiant. Achenes c. 3.5 mm; pappus 1-2.5 mm.

Rocky slopes, 950-1800 m, on limestone. Flowering July and August.

NORTH CENTRAL: Olimbos! Endemic and known only from a few collections on the eastern and southern slopes (cf. STRID 1979: 51-52).

C. litochorea belongs to sect. *Acrolophus* according to the traditional subdivision of the genus, but appears to be closely related to *C. incompleta* HALÁCSY (sect. *Phalolepsis*), another rare endemic of the lower eastern slopes of Olimbos (cf. STRID 1979: 51, 1980: 329-330). One collection of *C. litochorea* (S 1355 from the vicinity of Refuge B at c. 1800 m) is very variable in leaf shape, colour of appendages, length of mucro, etc; a plant with pink florets and broader, deep brown central part of the appendage is abberant and probably represents a hybrid with a red-flowered member of sect. *Acrolophus*. There is some discrepancy concerning the chromosome number of *C. litochorea*; it was given as 2n = 18 in the original description, whereas STRID & FRANZÉN (1981: 841) have counted 2n = 16.

12. C. princeps BOISS. & HELDR. in BOISS., *Diagn.* ser. 2, 6: 111 (1859)

Orig. coll.: "In summo jugi Petra montis Veluchi Eurytaniae" [Timfristos]. SAMARITANI & GUICCIARDI in HELDREICH, *Pl. Exs. Gr.* no. 3298 (holotype in G-Boiss!, isotypes in BP! and G!).

Syn.: *C. alba* L. var. *princeps* (BOISS. & HELDR.) BOISS., *Fl. Or.* 3: 621 (1875); *C. alba* ssp. *princeps* (BOISS. & HELDR.) GUGLER, *Cent. Ungar. Nat.-Mus.*: 31 (1907).

Biennial, or sometimes flowering a second time? Stem erect, or erect from an ascending base, c. 20-35 cm, *densely glandular and with crisp, long multicellular hairs,* much branched from near base or middle, some branches themselves ± branched, forming a dense corymb of capitula; rarely several stems arising from base. *Leaves viscid* with dense sessile glands on both sides, especially beneath, with short multicellular hairs; lower leaves ± withered at anthesis, bipinnatipartite with c. 7 pairs of segments or pinnatisect, the segments with few lobes or entire; middle leaves pinnatipartite or pinnatifid; the upper undivided or with 1-2 pairs of lobes near base. Involucre 18-22 × 15-18 mm, subglobose. *Appendages*

very large, completely covering basal part of phyllary, *suborbicular*, c. 7 mm long (excl. mucro) and 8-10 mm broad, slightly convex, ending in a mucro 1-2 mm, *straw-coloured with brownish central part, the broad margin not hyaline*, minutely denticulate. *Florets whitish*, the marginal slightly radiant. Achenes 3-3.5 mm; pappus c. 1-1.5 mm.

Limestone cliffs and screes, c. 1500-1850 m. Flowering from mid-July through August.

STEREA ELLAS: Timfristos!

Endemic. Closely related to the recently described *C. chrysocephala* PHITOS & GEORGIADIS which is endemic to the region near Kalambaka. The latter is distinguished from *C. princeps* by the narrower involucre (9-15 mm diam.), smaller, distinctly convex appendages which are uniformly straw-coloured, and a slightly longer mucro (2-3 mm). Together the two species form a distinct group in the section, remarkable by the whitish florets and the appendages lacking a hyaline margin.

13. C. marmorea BORNM. & SOŠKA in *Repert. Spec. Nov. Regni Veg.* 42: 127 (1937)

Described from Mt Sivec near Prilep, S Jugoslavia. Type: O. BEHR, 5.7. 1936 (B!, W!).

Perennial with woody rhizome and several erect stems 20-40 cm, with several branches below middle, each with 1-3 capitula. Stem and leaves *greyish floccose-tomentose*. Basal and lower leaves petiolate, c. 5-8 cm, pinnatisect with 4-6 pairs of segments; segments linear-lanceolate, entire or some with a single lobe, terminal lobe up to 4 mm broad, the others 2-3 mm; middle leaves sessile with fewer segments 0.5-2 mm broad; upper leaves linear, simple or with very small basal lobes. Involucre 15-18 × 7-12 mm, ovoid. Phyllaries partly tinged purple, slightly tomentose and with longitudinal ridges, *for the greater part covered by the appendages*. Appendages large, c. 5-7(-8) mm broad, nearly orbicular, strongly decurrent, with a *firm, deep brown to blackish (rarely light brown) triangular or ovate-triangular central part* 1.5-3 mm broad, and a hyaline denticulate margin c. 2-3 mm broad, *emarginate and ending in a mucro c. 0.2-0.8 mm.* Florets rose-purple, the marginal radiant. Achenes c. 3.5 mm; pappus 1-2.5 mm.

Rocky slopes and meadows, 1450-1700 m, on limestone. Flowering in July.

NORTH EAST: ?Athos!, Orvilos!

NE Greece and S Jugoslavia. This species shows a remarkable disjunction between the Prilep area and Orvilos. The capitula are slightly larger in most collections from Orvilos, but S 13234 is so similar to the type even in this respect that a distinction at the subspecific level seems impossible. *C. marmorea* is related to C. *vandasii* VELEN. occurring in the Rodhopi mountains, but the latter is fairly distinct although also perennial (not

biennial as stated in *Fl. Eur.* 4: 289, 1976). In *C. vandasii* the lower leaves are bipinnatipartite, the appendages only partly cover the phyllaries and their central part is nearly orbicular or broadly triangular. One specimen said to be have been collected on the N side of Mt Athos by FRIEDRICHSTHAL is very close to *C. marmorea*, but no recent collection of a similar plant is known from this area.

14. C. deustiformis ADAMOVIĆ in *Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl.* 74: 145 (1904)

Described from Pelister, Bic, Bukova et Babuna Planina in Jugoslavia, leg. PILTZ (BEO?, n.v.).

Perennial; stems several, usually prostrate or ascending, more rarely erect, c. 10-40 cm long, with several branches at or below middle (rarely simple). Leaves ± sparsely arachnoid and *with ± distinct short, stiff hairs* (hair-bases) especially below; the lower pinnatipartite or bipinnatipartite with lanceolate to linear-lanceolate segments 6-15 × 1-2.5 mm, rarely lyrate with broader, lanceolate terminal segment; middle leaves pinnatipartite. Involucre 13-18 × (7-)8-10(-13) mm. Appendages ovate-orbicular, c. 5-7 mm broad, *completely covering phyllaries, with triangular, dark brown to almost black central part usually narrower than the hyaline whitish margins;* margin subentire (minutely denticulate), scarcely decurrent; apical mucro c. 1(-1.5) mm. Florets rose-purple, rarely whitish, the marginal radiant. Achenes 3-3.5 mm; *pappus 1-2(-2.5) mm.*

Rocks and screes, on various substrates, (1200-)1400-2200 m. Flowering June to August.

S PINDHOS: Boumistos!; N PINDHOS: Dhouskon!, Stouros!, Voïon!, Bouchetsi!, Kato Arena!, Epano Arena!, Gramos!, Souflikas!, Levkasia!; NORTH CENTRAL: Boutsi!, Varnous!, Kalo Nero!, Vitsi!, Prekopana!

Greece, Albania and S Jugoslavia. Variable in habit, division of leaves, indumentum and size of capitula. A subdivision of the species proved to be impossible as it would easily lead to the description of single populations. Especially noteworthy is H 7188 from Gramos with erect villous stems and very large capitula. Closely allied species are *C. pawlowskii* (no. 16), *C. ptarmicifolia* (no. 15) and *C. ipecensis* RECH. FIL. All efforts to find a type specimen have been in vain. The interpretation is in accordance with the description (and the traditional use of the name) but we have refrained from designating a neotype, as no good collections from the type locality were available. 2n = 16 has been reported by STRID & FRANZÉN (in *Taxon* 32: 139, 1983) in material from Gramos.

15. C. ptarmicifolia HALÁCSY ex HAYEK, *Prodr. Fl. Penins. Balcan.* 2: 781 (1931)

Based on the type of *C. deusta* TEN. var. *epirotica* BALD. in *Nuovo Giorn. Bot. Ital.* n.s. 6: 181 (1899). Orig. coll.: Mt Smolikas above Kerasovo, BALDACCI 243 (lectotype in WU-Hal!; isotypes in BP! and W!).

Syn.: *C. epirotica* (BALD.) HALÁCSY, *Consp. Fl. Gr.* 2: 134 (1902), non *C. epirota* HALÁCSY in *Bull. Herb. Boissier* 6: 581 (1898); *C. deustiformis* ADAMOVIĆ ssp. *ptarmicifolia* (HALÁCSY ex HAYEK) DOSTÁL in *Bot. J. Linn. Soc.* 71: 205 (1976).

Perennial with a rosette of leaves and one to several *prostrate stems arising below the rosette leaves*. Stems 8-12(-15) cm, simple or rarely with a short branch in upper part, bent upwards below capitulum. Leaves greyish, firm, densely glandular on both sides, arachnoid-tomentose, usually without distinct multicellular hair-bases beneath. Basal leaves petiolate, pinnatipartite to bipinnatipartite *with 7-10 pairs of crowded, oblanceolate to oblong segments*, basal ones shorter; middle leaves 1.2-2 cm, sessile, pinnatipartite to pinnatifid with 3-8 pairs of segments; uppermost undivided or with 1-2 lobes at base. Involucre 14-18 × 11-14 mm, ovoid-globose. *Appendages completely covering basal part of phyllary*, suborbicular, 4.5-6(-7) mm broad with ovate to oblong or orbicular, *black or blackish-brown central part* c. 2-3(-4) mm broad and *mostly broader than the hyaline, shortly decurrent margin*; apical mucro 0.7-1 mm. *Florets whitish or pale violet* (the central with lilac anther-tube). Achenes 3.5-4 mm; pappus c. 1.5-2.2 mm.

Serpentine rocks and screes, 2200-2700 m. Flowering July to mid-August.

N PINDHOS: Smolikas! – A record from Timfi (QUÉZEL & CONTANDRIOPOULOS 1965b: 84) needs confirmation.

Endemic. Closely related to *C. deustiformis*, but distinguished by the completely prostrate habit, the shape of the leaves with many crowded segments, the hair type, and the broader central part of the appendages. In cultivation the stems are longer and more often branched but retain their prostrate habit.

16. C. pawlowskii PHITOS & DAMBOLDT in *Veröff. Geobot. Inst. ETH Stiftung Rübel Zürich* 56: 185 (1976)

Orig. coll.: "Prov. Ipiros: prope vicum Monodendrion ad muros monast. Hagia Paraskevi, ca. 1100 m". PHITOS no. 11716 (holotype in UPA, isotype in M!).

Perennial with strong woody taproot and usually several stems from base. Stems (10-)15-40 cm, ascending or (on steep slopes) pendent, simple or often with several branches from middle, *leafy to apex*, slightly thickened below capitulum, *densely covered with long, soft multicellular hairs*. Leaves on both sides densely hirsute with moderately long, multicellular hairs. Basal leaves often variable in a single plant, usually at least partly lyrate-lobate or undivided, otherwise lyrate-pinnatipartite to pinnatipartite, c. 10-15 cm in larger plants; segments narrowly oblong to lanceolate, entire or with 1-2 lobes or teeth, rarely distinctly dentate with 3-4 pairs of teeth. Middle and upper leaves lyrate-pinnatilobate or pinnatipartite,

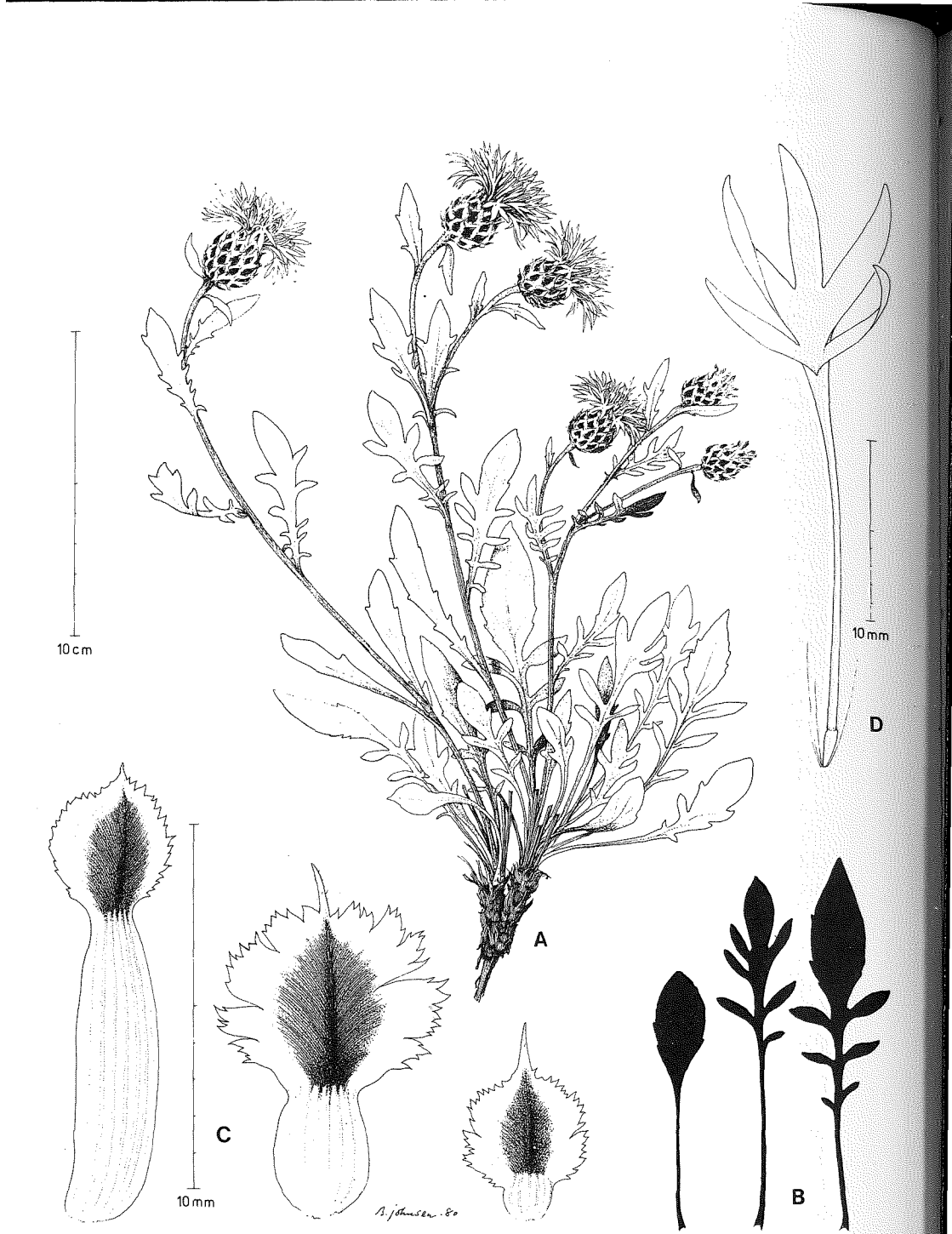

Fig. 29. *Centaurea pawlowskii*. A: Habit. – B: Leaves. – C: Phyllaries, from left: inner, middle, outer. – D: Marginal floret.

mostly with linear lobes, uppermost usually undivided, entire and sessile. Involucre 14-20 × (10-)12-18 mm. Appendages suborbicular to ovate, 5-8 × 5-7 mm, shortly decurrent, *completely covering basal part of phyllary*, with ovate to elliptic or broadly triangular, (1.5-)2-3.5 mm broad, *dark brown or blackish central part passing into hyaline, denticulate-lacerate margin*, sometimes with few cilia near apex, ending in a mucro 0.5-1.5(-1.8) mm. Florets pale violet, marginal distinctly radiant. Achenes 3-4.5 mm; *pappus (2.5-)3-5 mm*, inner row of scales c. 1 mm. – Fig. 29.

Crevices of limestone rocks, 1700-2350 m, also in the Vikos gorge between 900 and 1300 m. Flowering July and August.

N PINDHOS: Timfi!, Trapezitsa!

N Pindhos and SW Jugoslavia (Pelister, leg. BORNMÜLLER 1350, B!). Closely related to *C. deustiformis* (no. 14) and differing especially in hair type, length of pappus, and broader central part of appendages. The leaves are extremely variable. Specimens from high altitudes on Timfi tend to have short stems, lyrate-lobate or undivided lower leaves and a longer mucro of the appendages, but intergrade with those from the type locality. 2n = 18+1B (DAMBOLDT & MATTHÄS 1979).

17. C. musarum BOISS. & ORPH. in BOISS., *Diagn.* ser. 2, 5: 112 (1856)

Orig. coll.: "In regione media Parnassi prope Clistozasteno alt. 5000 ped.", leg. ORPHANIDES (lectotype in G; isotypes in GZU! and W!).

Perennial; stems and leaves densely *appressed white-tomentose*. Stems several, ascending or procumbent, 10-20 cm, simple or with 1-2 branches in upper part, mostly densely leafy up to the capitulum. Basal leaves 6-10 cm, petiolate, lyrate-lobate to lyrate-pinnatipartite, with 2-4 pairs of oblanceolate to ovate or oblong lateral segments or lobes c. 3.5-6 mm broad and entire, terminal segment entire or with few teeth; middle leaves pinnatipartite, sessile, upper mostly lyrate-lobate or undivided. *Involucre c. 17-20 x 15-18 mm, subglobose. Appendages large, suborbicular, completely covering basal part of phyllary*, shortly decurrent, distinctly convex, c. 7-9 mm broad, with triangular to oblong, light brown to brown (sometimes blackish-brown at base) central part c. 2-3.5 mm broad, and a broad hyaline denticulate margin, *obtuse (without mucro)*. *Florets yellow*, the marginal slightly radiant. Achenes 3.5-4.5 mm; pappus 2-2.5 mm.

Rock crevices, c. 1600 m, on limestone. Flowering July and August.

STEREA ELLAS: Parnassos!

A rare species endemic to Parnassos and possibly extinct. The material seen was collected by ORPHANIDES in 1854 and by GUICCIARDI in 1855. No recent collection seems to be known. *C. musarum* is one of the few really distinct species in the section *Phalolepis*, without any close relatives.

18. C. vlachorum HARTVIG in *Nordic J. Bot.* 1: 705 (1982)

Orig. coll.: Mt Milea (Salatoura), 12 km N of Metsovon, meadow on SW-facing rocky slope, 1870 m, ophiolitic substrate. HARTVIG & al. 6185, 23.7. 1976 (holotype in C!; isotypes in ATH, G, and W).

Perennial with a short rhizome often bearing 2-3 flowering stems and a sterile leaf rosette. Stems simple, ascending to erect, 15-35 cm, leafy to apex, slightly thickened below the single capitulum. Leaves with sessile glands and dense multicellular hairs on both sides, very slightly arachnoid. *Basal leaves lanceolate with long slender petiole*, ± distinctly denticulate, 6-12 × 1.5-2 cm. *Lower and middle cauline leaves lyrate* with 1-2 pairs of linear-lanceolate lobes in basal part, lower petiolate, middle sessile; upper leaves similar to middle but smaller or simple; all cauline leaves remotely denticulate or more rarely denticulate-serrate. Involucre 17-20 × 13-18 mm, ovoid; phyllaries in several series, greenish, slightly striate. *Appendages triangular*, c. 4 × 3 mm (excl. cilia), black to blackish-brown, *decurrent, only partially covering basal part of phyllary, ciliate*; cilia numerous, c. 2-3 mm, black to brown or silvery at tips; terminal mucro similar to cilia, 1.5-2 mm. Florets rose-violet, marginal strongly radiant. Achenes c. 4 mm; pappus 1.5-2.5(-3) mm, inner series indistinct. – Fig. 30.

Meadows, open woodland and rocky slopes, 1700-2150 m, on serpentine. Flowering July and August.

N PINDHOS: Milea!, Aftia!

Endemic. A very distinct species without any close relative, easily recognized by its leaf shape and the very characteristic appendages. The triangular, ciliate and distinctly decurrent appendages are reminiscent of those in sect. *Cyanus* or of some species in sect. *Acrocentron* (e.g. *C. grbavacensis*, no. 2), but other characters (leaf shape, achenes, pollen morphology) exclude the possibility of such a taxonomic position. HARTVIG placed *C. vlachorum* in sect. *Jacea*, but here too it is very isolated. There is some variability in the division of the leaf blade and the form of the appendages which may be broadly or narrowly triangular. According to HARTVIG (loc. cit.) plants from Aftia differ from those of Milea by the silvery cilia and less divided cauline leaves.

19. C. triamularia ALDÉN in *Bot. Not.* 129: 303 (1976)

Described from Mt Pachtourion, supra pagum Athamania in Aspropotamos, Thessalia, c. 1700 m. ALDÉN 4729, 31.7. 1974 (LD, holotype!).

Low-growing perennial with slender rhizome and procumbent to ascending stems. Stems c. 8-20 cm, usually with 2-3 branches at or below middle, sparsely leafy up to capitula. Leaves glandular on both sides, hirsute and sparsely arachnoid. Basal leaves obovate-lanceolate, withered at anthesis; lower cauline leaves lanceolate or oblong-ovate, narrowed at base, denticulate in upper half; *middle and upper leaves lanceolate to oblong-lanceolate*, entire or with 1-2 small teeth, sessile, slightly auriculate

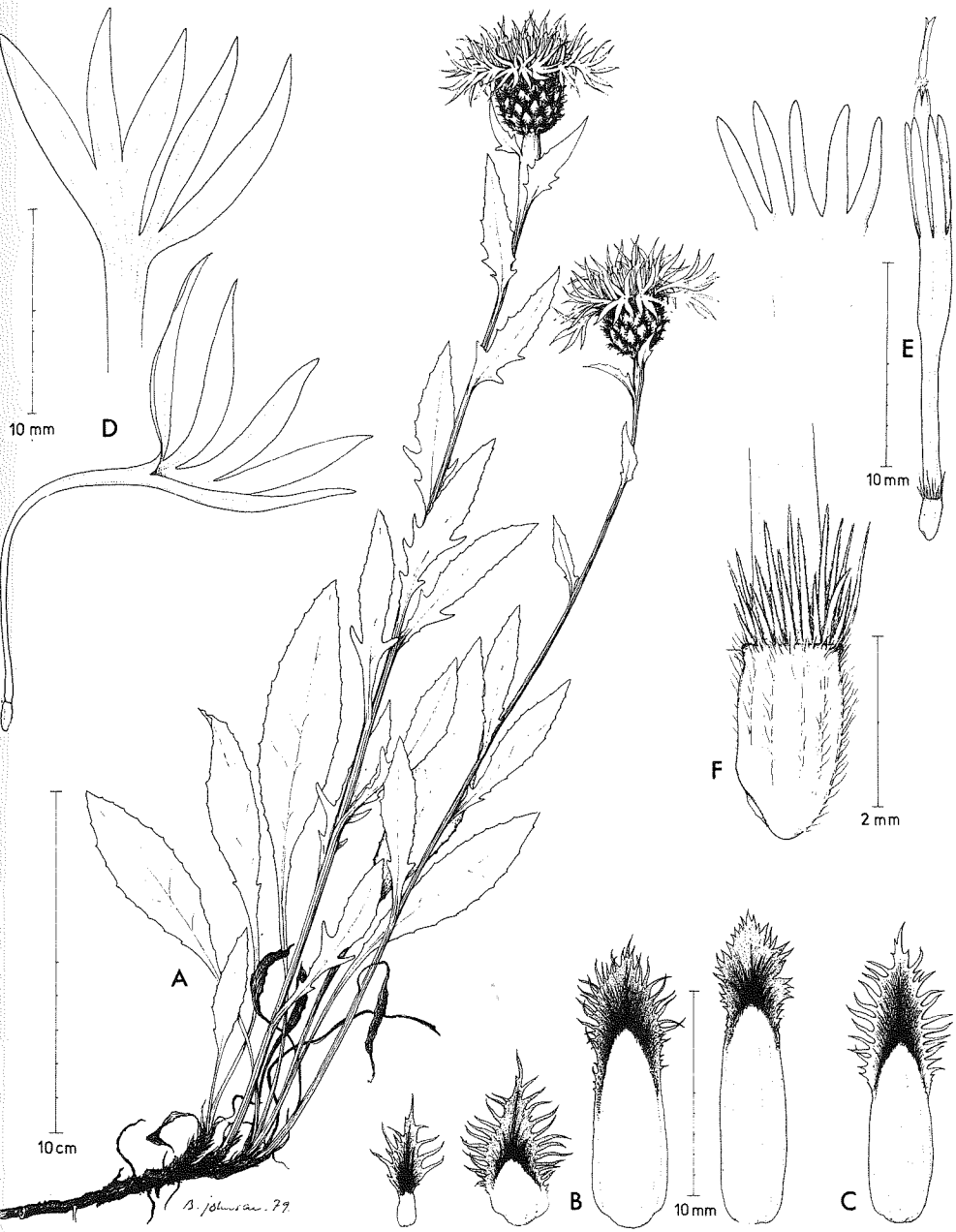

Fig. 30. *Centaurea vlachorum*. A: Habit. – B-C: Phyllaries. – D: Marginal, radiant floret. – E: Central floret. – F: Achene. From *Nordic J. Bot.* 1: 706 (1982).

and semi-amplexicaul with 1-2 lobes at base. Involucre 13-14 × 6-8 mm, nearly cylindrical; phyllaries sparsely arachnoid. Appendages very narrowly triangular to almost linear and 0.3-0.8 mm broad at base, 7-9 mm long, blackish-brown, *gradually attenuate into a filiform, recurved, pectinate-ciliate tip*; cilia 7-9 pairs, brown to dark brown, c. 3-5 mm, not crowded near base. *Appendages not completely covering basal part of phyllary*. Florets pale purple, marginal slightly radiant. Achenes c. 4 mm, puberulent, with several pale lines; pappus c. 1 mm, violet-brown.

Dry and stony slopes, c. 1700 m. Flowering in July.

S PINDHOS: Pachtourion!

A local endemic which according to the structure of the appendages seems closest to *C. stenolepis* A. KERNER, but habit, leaf shape and the arrangement of the capitula are very different. 2n = 22 (ALDÉN, op. cit.).

20. C. nervosa WILLD., *Enum. Pl. Horti Berol.* 2: 925 (1809)

Described from "Europa australi". Type in B-Willd (no. 16545).

Perennial; stems c. 15-35 cm, ascending to erect, usually simple, rarely with 1-2 branches, mostly densely leafy up to the capitulum. Stem and leaves with sparse to moderately dense, crisp hairs. Basal and lower cauline leaves lanceolate, gradually narrowed into a petiole-like base; middle leaves narrowly ovate to oblong, *mostly distinctly auriculate (semi-amplexicaul) at base and with several coarse teeth in basal part*; upper leaves oblong to nearly triangular. Involucre (16-)18-23 × 12-18 mm. Phyllaries in many series, their basal part completely covered by the appendage. Appendages with lanceolate-triangular to ovate, blackish basal part, *attenuate into a long, filiform, erect or recurved part* with 15-24 cilia c. 3-6 mm long on each side, crowded towards base; appendages with minute hairs on both sides and on cilia. Florets purple, the marginal strongly radiant. Achenes 3-4.5 mm; pappus 2-3 mm, reddish.

Two subspecies can be recognized in Greece:

1. Appendages with lanceolate-triangular basal part (c. 1-2 mm broad), attenuate into a long, distinctly recurved brownish thread; whole appendage 10-15 mm **a. ssp. nervosa**

– Appendages with broadly triangular to ovate basal part (c. 1.5-3 mm broad), ending in an erect or slightly curved blackish tip; whole appendage 6-10 mm **b. ssp. promota**

a. ssp. nervosa

Syn.: *C. uniflora* TURRA ssp. *nervosa* (WILLD.) BONNIER & LAYENS, *Tabl. Syn. Pl. Vasc.*: 180 (1894); *C. uniflora* var. *nervosa* (WILLD.) BRIQ., *Monogr. Centaur. Alp. Marit.*: 101 (1902); *C. uniflora* ssp. *nervosa* var. *valida* GUGLER, *Cent. Ungar. Nat.-Mus.*: 86 (1907); *Jacea nervosa* (WILLD.) LÖVE & LÖVE in *Bot. Not.* 114: 44 (1961); *J. plumosa* LAM., *Fl. Fr.* 2: 51

(1779) p.p., nom. illegit., (based on *C. phrygia* L.); *C. plumosa* (LAM.) A. KERNER in *Oesterr. Bot. Z.* 22: 44 (1872) (sensu KERNER).

Damp meadows and rocky places by streams, 1500-2000 m, on non-calcareous substrates. Flowering July and August.

NORTH CENTRAL: Kajmakčalan!; NORTH EAST: Rodhopi (Zagradenia!).

Alps, N Apennines, S Carpathians and mountains of the N and C parts of the Balkan Peninsula. A number of related taxa have been described from Bulgaria and Jugoslavia. The chromosome number is 2n = 22 as determined by various authors in non-Greek material.

b. ssp. promota GAMAL-ELDIN & WAGENITZ, ssp. nova

Orig. coll.: Greece, Phocis, Mt Vardousia, 3 km W of Athanasios Diakos, slope facing N-NE, scree, c. 1650 m. GUSTAVSSON 1360 (LD, holotype!).

Pars basalis appendicum late lanceolata vel ovata (c. 1.5-3 mm lata), acumine nigro erecto vel leviter curvato terminata. Appendices in phyllis mediis 6-10 mm longae.

Stony meadows, c. 1400-2200 m. Flowering July to mid-August.

STEREA ELLAS: Iti!, Vardousia!; S PINDHOS: Baros!, Peristeri (Lakmos!); N PINDHOS: Between Metsovon and Katara Pass!

Probably present also in Jugoslavia (one slightly atypical collection seen). This subspecies represents the southernmost taxon of sect. *Jacea* in the Balkan Peninsula. It shows some similarities in structure of involucre to ssp. *ferdinandii* (GREN.) NYMAN from the SW Alps, probably due to parallel evolution. Two collections (G 1852 from Iti and BADEN & al. 817 from Vardousia) differ from the others by the branched stem and more coriaceous leaves which are scabrid with shorter hairs. The record of *C. nigrescens* WILLD. from Iti (HALÁCSY 1902: 137) may refer to this taxon.

21. C. parilica STOJ. & STEFANOV in *Oesterr. Bot. Z.* 72: 92 (1923)

Described from the Bulgarian side of Mt Orvilos (Ali-Botuš, Ali-botusch), "in rupestribus calcareis montis Ali-Botuš, supra vicos Paril et Golešovo, 1200 m. N. STOJANOV s.n. [11.7. 1920] (holotype in SOM?, isotypes in B and GB?).

Syn.: *Jacea parilica* (STOJ. & STEFANOV) HOLUB in *Preslia* 46: 229 (1974).

Caespitose perennial with few to many herbaceous stems arising laterally from axils of previous year's leaves. Stems 5-35 cm, erect or ascending, simple, rarely branched in upper part or below middle (with one to several short, non-flowering shoots); *internodes of middle part of stem short* (c. 1-8 mm). Leaves sparsely arachnoid to nearly glabrous, slightly scabrid below from multicellular hair-bases or ± greyish-green tomentose, with sessile glands on both sides. *All leaves linear, slightly involute, c. 1-2 mm wide,* lower ones withered at anthesis, entire or sometimes denticulate, middle

15-60 mm, upper 10-35 mm, entire. Involucre 12-22 × 7-12 mm, ovoid-cylindrical. Phyllaries glabrous, violet in upper part. Appendages not completely covering basal part of phyllary, brown to violet-brown, sometimes dark brown at base, (4-)6-12 mm, triangular to narrowly lanceolate and 0.5-0.8 mm broad at base, *attenuate into a filiform, recurved, pectinate-fimbriate tip* with (10-)12-16 pairs of slender cilia c. 1.5-4 mm. Florets rose-purple or white, marginal ± strongly radiant. Achenes 3.2-4.5 mm, puberulent; *pappus 1-2 mm.* – Fig. 31 G-I.

Grassy, rocky slopes and alpine meadows, 1200-2200 m, on limestone. Flowering July and August.

NORTH EAST: Orvilos!, Falakron!

NE Greece and SW Bulgaria. Material from Orvilos (both Greek and Bulgarian sides) varies in stature and degree of hairiness, and three varieties have been recognized by STOJANOV & al. (1967). We share the opinion of GREUTER & PAPANICOLAOU (1979) that these varieties are rather ill-defined. Plants from Falakron are lower with smaller capitula; some populations with fairly dense greyish-green indumentum look rather different but are scarcely worth formal taxonomic recognition. 2n = 22 was reported by KUZMANOV & GEORGIEVA (in *Taxon* 36: 284, 1987) in Bulgarian material.

C. parilica is closely related to the recently discovered *C. pangaea* (no. 22), but differs by its more densely arranged, narrower and involute leaves, the presence of a pappus, etc. S 13270 from Orvilos has slightly broader leaves and thus approaches *C. pangaea*, but the achenes have a pappus.

22. C. pangaea GREUTER & PAPANIC. in *Bot. Not.* 132: 471 (1979)

Described from Mt Pangeon, NE Greece. Orig. coll.: GREUTER 16055 (holotype in B, isotypes in ATH, C!, GOET!, UPA).

Perennial with woody taproot, ± caespitose with flowering and non-flowering stems. Stems c. 20-50 cm, simple or with 1-2 branches in upper part, with numerous leaves (less densely arranged than in no. 21), *internodes c. 8-18 mm.* Leaves sparsely arachnoid, with sessile glands on both sides, not or only very sparsely scabrid. *All leaves linear, flat or slightly involute*, entire (lower rarely with 1-2 teeth), lower c. 10 cm long and *2-4.5 mm wide*, middle 4-6 cm × 2-3 mm, upper 1.5-3 cm long, all with subulate tips. Involucre 16-22 × 6-8.5 mm. Appendages linear-triangular and 0.5-0.6 mm broad at base, 7-10 mm, pale brown or straw-coloured, *attenuate into a filiform, recurved, pectinate-fimbriate (plumose) tip* with 11-16 pairs of cilia 2.5-3.5 mm. Florets rose-purple, marginal strongly radiant. Achenes 3.5-4.5 mm, hairy (denser in upper part); *pappus absent.* – Fig. 31A-F.

Rocky outcrops in montane to alpine meadows, 1250-1870 m, on limestone. Flowering July and August.

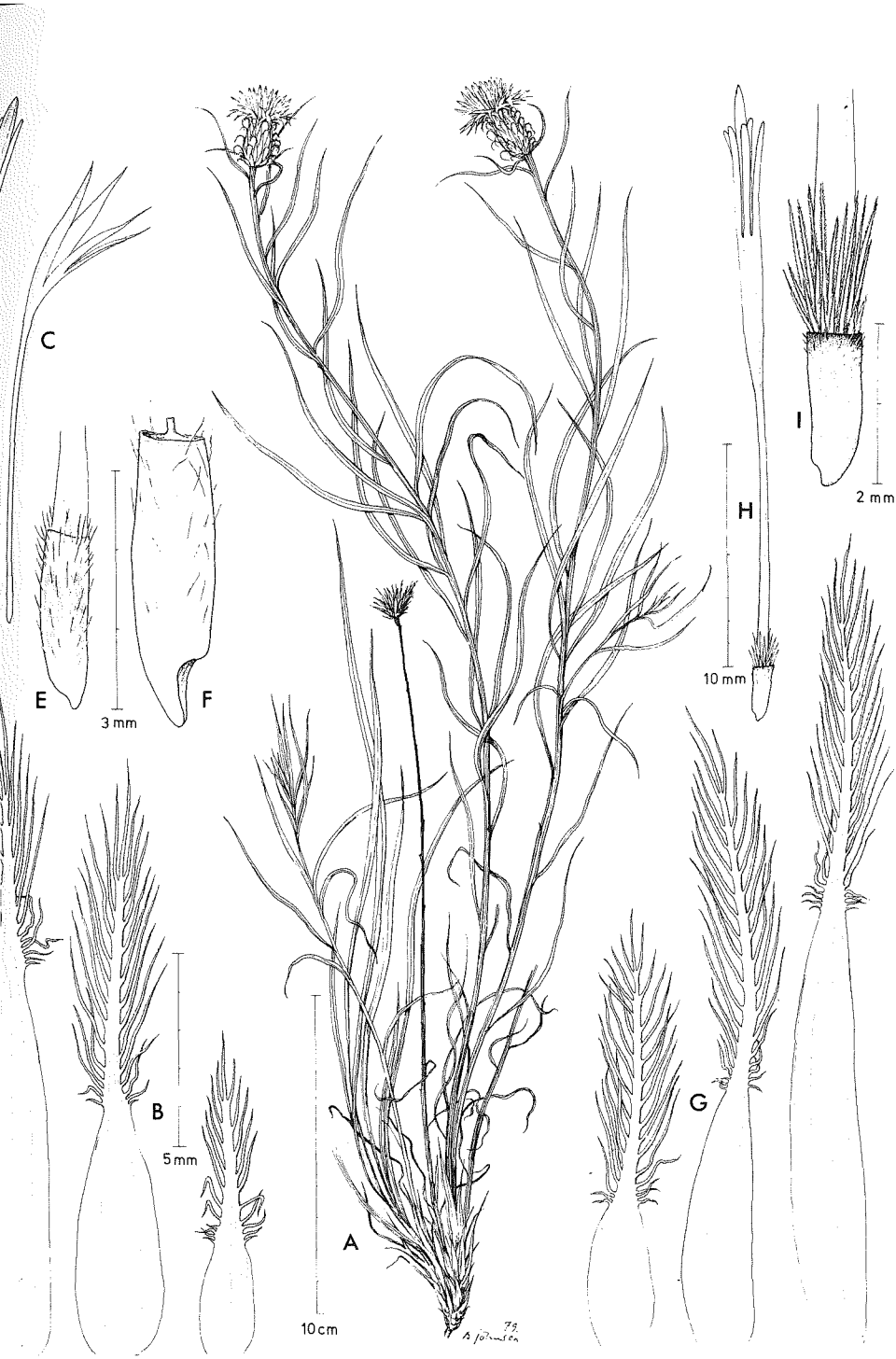

Fig. 31. A-F: *Centaurea pangaea*. A: Habit. – B: Phyllaries (straightened), from right to left: outer, middle, inner (not innermost). – C: Marginal, sterile floret. – D: Central, fertile floret. – E: Young achene. – F: Ripe achene. – G-I: *C. parilica*. G: Phyllaries. – H: Central floret. – I: Young achene. C, D & H, and

NORTH EAST: Pangeon! A local endemic related to *C. parilica* (no. 21). The few collections seen are from montane levels, but it has been recorded up to 1870 m.

23. C. baldaccii DEGEN ex HALÁCSY in *Bull. Herb. Boissier* 6: 582 (1898)

Described from W Crete, "in summis m. Gigilos Volakia distr. Sphakia", leg. BALDACCI no. 76 (lectotype in WU-Hal!, isotypes in W! and WU!).

Syn.: *Cyanus baldaccii* (HALÁCSY) HOLUB in *Preslia* 46: 228 (1974); *Centaurea cana* SIBTH. & SM. var. *albiflora* RAULIN in *Actes Soc. Linn. Bordeaux* 24: 484 (1869), nom. nudum.

Perennial with long creeping rhizome and *very short stems* (0.8-2 cm excl. capitulum). *Leaves densely greyish-white tomentose* on both sides. Basal leaves narrowly lanceolate, 25-65 × 3-6 mm, entire, narrowed into a short petiole-like base; upper ones smaller, only c. 2.5 mm broad. Capitulum solitary, shorter than basal leaves. Involucre 16-18 × 7-8(-9) mm, ovoid. Phyllaries oblong-ovate, c. 2.5-3 mm broad. Appendages triangular, c. 2.5-4 × 1.5-2.5 mm, dark brown, distinctly decurrent with a border 0.4-0.7 mm broad, ciliate; cilia numerous (13-16 on each side), silvery-white, c. (1.5-)2-3.5 mm. *Florets white*, rarely pale rose-lilac, the marginal radiant; anther-tube pale violet. Achenes 4.5 mm; pappus 1.2-1.5 mm.

Alpine pastures and rocky outcrops, 1900-2100 m, on limestone. Flowering in July.

CRETE: Gingilos!, Volakias!, Trocharis (GANDOGER, cf. RECHINGER 1943a: 662).

A rare endemic of Levka Ori and the only representative of the sect. *Cyanus* in Crete. In addition to the type material we have seen only one recent collection by GREUTER made in 1962. Two further collections are mentioned by RECHINGER (loc. cit.). The name *C. baldaccii* was first published by BALDACCI (in *Malpighia* 9: 277, 1895) with a description taken from a letter by DEGEN. BALDACCI did not formally take up the name, but discussed it under *C. cana*; however, the citation is more detailed than that of HALÁCSY who quotes the BALDACCI reference in synonymy (using the page number of the separate).

24. C. pindicola (GRISEB.) GRISEB. ex BOISS., *Fl. Or.* 3: 637 (1875)

Basionym: *C. cana* SIBTH. & SM. var. *pindicola* GRISEB., *Spicil. Fl. Rumel.* 2: 236 (1846). Described from Mt Nidgé (Piperitsa, see STRID & FRANZÉN 1982: 14), leg. GRISEBACH (type in GOET!).

Syn.: *C. pindicola* GRISEB., *Reise* 2: 164 (1841), nom. nudum; *C. triumfettii* ALL. var. *pindicola* (GRISEB.) STOJ. & ACHT., *Stud. Cent. Bulg.*: 17 (1935).

Perennial with rather thick rhizome, sometimes several stems crowded together. Stem (excl. capitulum) (1-)5-22 cm, nearly always simple, erect or ascending, only sparsely leafy in upper part. *Leaves greyish-tomentose*

on both sides. Lower leaves petiolate, *lyrate-pinnatilobate to lyrate-pinnatifid* with (1-)2-3(-4) lobes on each side, rarely lanceolate, entire; lateral segments oblong to nearly triangular, the terminal triangular to subor-bicular. Middle leaves in larger plants sessile with broad base, with 1-2 pairs of lobes or undivided. Involucre 18-22 mm × (8-)10-15 mm, ovoid. Appendages triangular, blackish, ciliate, (2.5-)3-5 × 1.5-3 mm, broadly decurrent, border c. (0.3-)0.5-0.8 mm broad; cilia numerous, (1-)1.5-3(-4) mm, mostly silvery-white in upper part. *Florets whitish* (later cream-coloured) to yellowish, rarely deep violet; anther-tube of central florets steel-blue to dark violet; marginal florets strongly radiant. Achenes 4-5 mm; pappus 1-1.5(-2) mm.

Stony slopes and meadows, mainly between 1800 and 2100 m, on limestone (according to STRID 1980: 330 on Olimbos 1500-2400 m, but occasionally up to 2750 m or down to 600 m). Flowering from mid-May to mid-August, depending on the altitude.

EAST CENTRAL: Ossa!; NORTH CENTRAL: Siniatsikon!, Kato Olimbos!, Olimbos!, Vermion!, Piperitsa! – One collection from Voïon (N Pindhos) may belong to *C. pindicola*, but the material is insufficient.

SW part of the Balkan Peninsula. Closely related to *C. epirota* HALÁCSY (no. 27). 2n = c.44 has been reported in material from Olimbos (STRID & FRANZÉN 1981: 841).

25. C. triumfettii ALL., *Auct. Syn. Stirp. Horti Taur.*: 16 (1773)

Described from the Western Alps and Italy.

Syn.: *Cyanus triumfettii* (ALL.) DOSTÁL ex LÖVE & LÖVE in *Bot. Not.* 114: 44(1961); *Centaurea variegata* LAM., *Encycl. Méth. Bot* 1: 668 (1785), nom. illegit., based on *Jacea graminifolia* LAM.; *C. axillaris* WILLD., *Sp. Pl.* 3(3): 2290 (1803), nom. illegit., based on *C. seusana* CHAIX and *C. variegata* LAM.; *C. cana* SIBTH. & SM., *Fl. Gr. Prodr.* 2: 198 (1813), p.p., described from Ulu Dagh.

Greek specimens differ from *C. pichleri* (no. 26) mainly in the following characters: Stem usually taller, erect or slightly bent below, sometimes branched. *Central basal rosette of leaves absent or ± withered at anthesis.* Leaves laxly floccose-tomentose, ± glabrescent, the middle distinctly decurrent.

Stony meadows and clearings in forest, mainly between 1000 and 1800 m.

PELOPONNISOS: Taygetos!, Parnon!, Menalon!; STEREA ELLAS: Parnassos!, Giona!, Iti!, Timfristos!; S PINDHOS: Tomaros; N PINDHOS: Mitsikeli!, Dhouskon!; EAST CENTRAL: Pilion!, Ossa!; NORTH CENTRAL: Boutsi!, Vourinos (GOULIMIS 1960a: 28), Olimbos!, Kajmakčalan (RECHINGER 1936: 641, as *C. cana*); NORTH EAST: Cholomon!, Athos!, Pangeon!, Falakron (QUÉZEL & CONTANDRIOPOULOS 1968: 35).

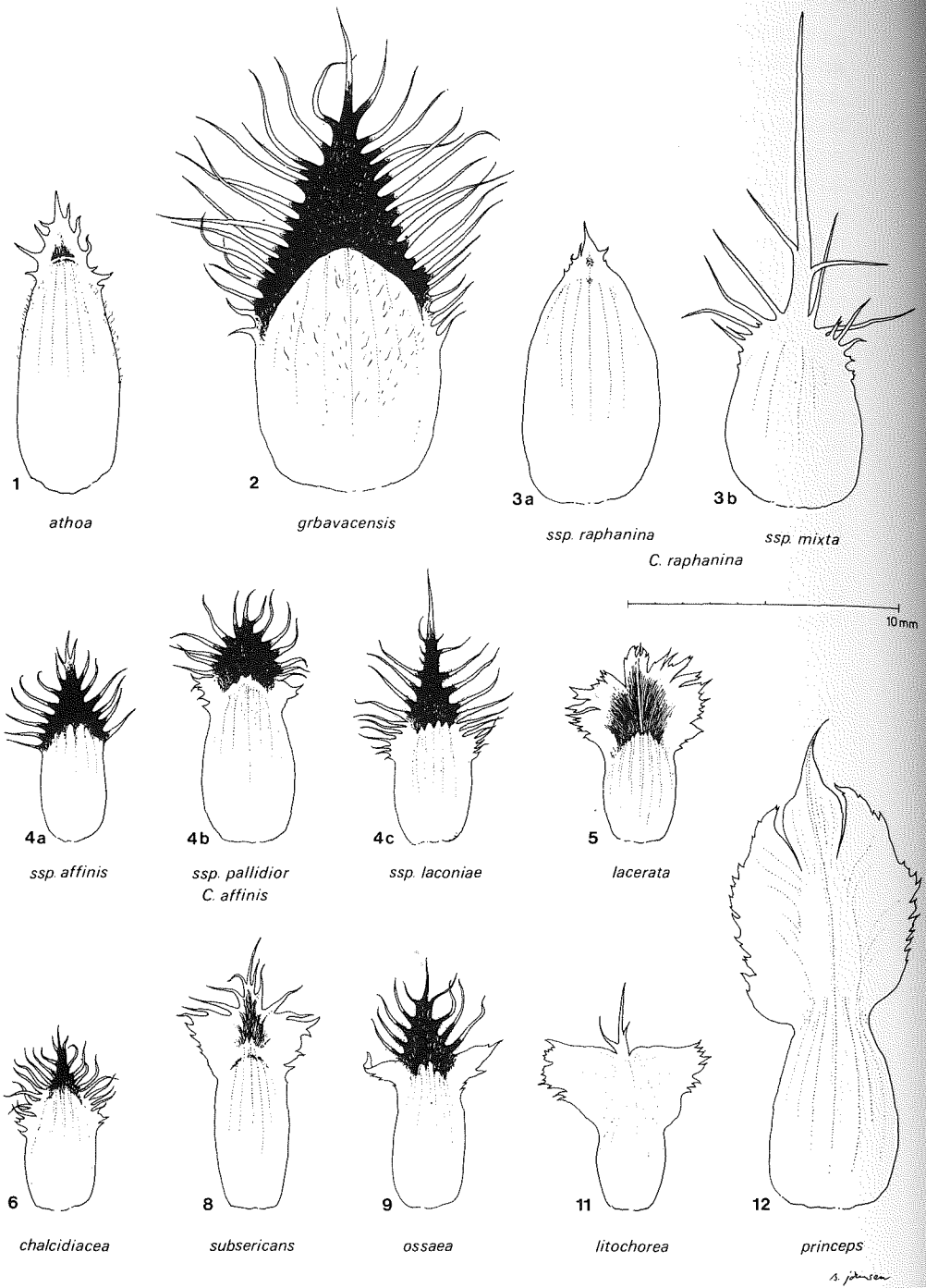

Fig. 32. Middle phyllaries of *Centaurea* spp. Numbers and names as in text.

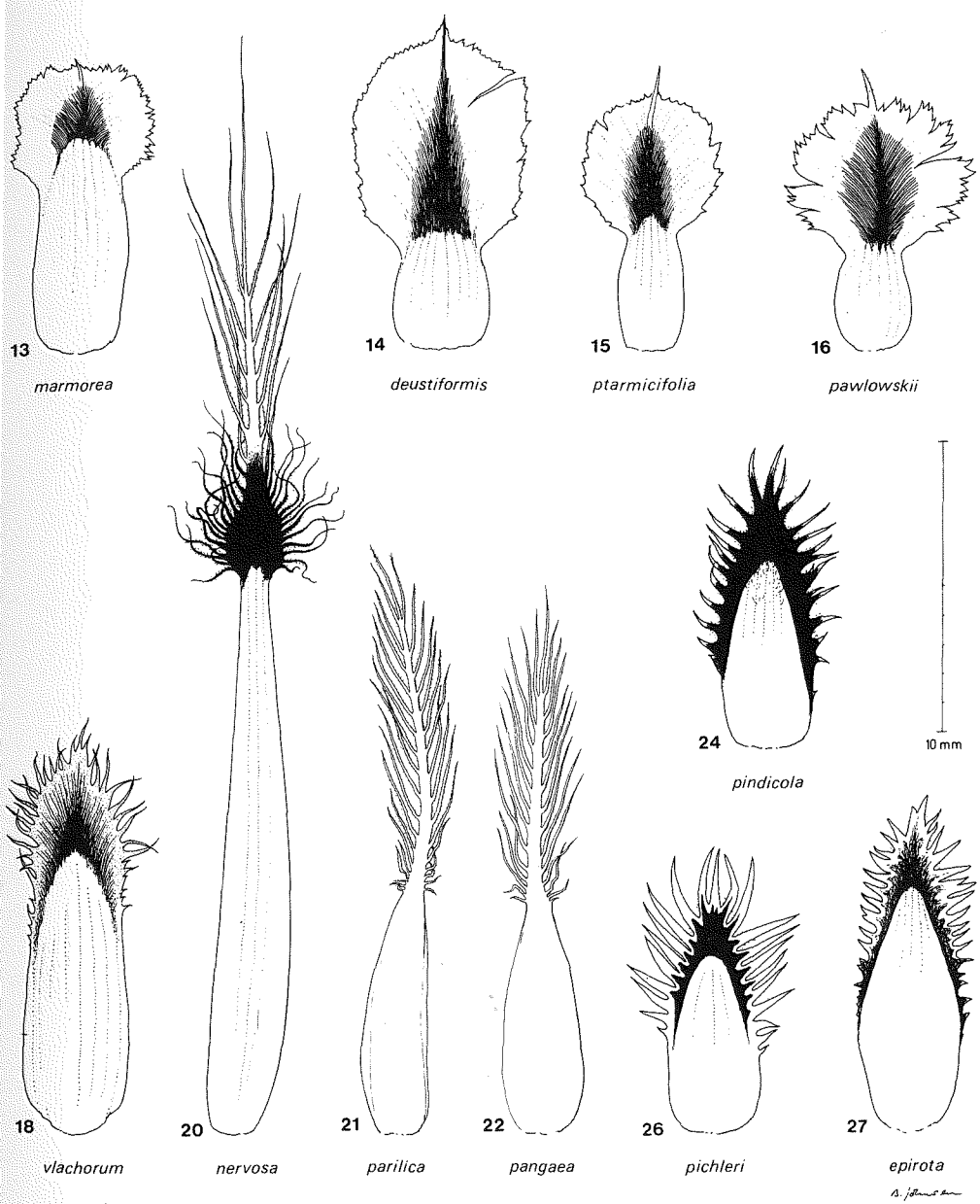

Fig. 33. Middle phyllaries of *Centaurea* spp. Numbers and names as in text.

Records from Killini (QUÉZEL & CONTANDRIOPOULOS 1965a: 147), Chelmos (QUÉZEL & KATRABASSA 1974: 17) and Thasos (STOJANOV & KITANOV 1950: 71, as *C. cana*) probably belong to *C. pichleri* (no. 26).

Several authors have tried to subdivide this polymorphic species, but these attempts have proved to be taxonomically unsatisfactory. In Greece *C. triumfettii* shows considerable variation even when *C. pichleri* is excluded. Plants from Olimbos, Ossa and Athos may have a central rosette like *C. pichleri*, obscuring the difference between the two species, but are much taller with broader leaves and sometimes branched stems. In Sterea Ellas some populations are remarkable by their branched stems and capitula. There are numerous chromosome counts for this species especially from France and Spain; their variability (2n = 20, 40, 22, 44) corresponds to the morphological one, but is of little aid for a taxonomic subdivision as no correlation has been detected.

26. C. pichleri BOISS., *Fl. Or.* 3: 638 (1875)

Described from Ulu Dagh in NW Turkey, "in rupestribus meridionalibus Olympi Bithyni", leg. PICHLER no. 62 (holotype in G-Boiss!).

Syn.: *C. lanigera* DC. ssp. *pichleri* (BOISS.) DOSTÁL in *Preslia* 10: 67 (1931); *Cyanus pichleri* (BOISS.) HOLUB in *Preslia* 45: 144 (1973).

Perennial with a rhizome ending in a well-developed rosette of leaves; stolons often present. *Flowering stems lateral, ascending or decumbent, c. 5-15(-30) cm, usually simple*, rarely with a short branch. Leaves rather densely ± appressed grey-tomentose; rosette leaves lanceolate and entire or *mostly at least some of them with 1-2(-3) pairs of short lateral lobes* or coarse teeth; cauline leaves few, lanceolate to narrowly lanceolate, the lower narrowed into a petiole and similar to rosette leaves, the middle sessile or shortly decurrent with narrow wings. Involucre 15-20 × 9-13 (-15) mm. Appendage a narrow, dark brown or blackish-brown border with numerous silvery cilia 1.5-3 mm. *Marginal florets strongly radiant, cornflower-blue, central florets violet-purple*. Achenes 4-5 mm; pappus 1-2 mm.

The description refers to ssp. *pichleri* which is the only subspecies in our area.

Dry meadows and stony slopes, (700-)1000-2100 m, on limestone. Flowering mainly May and June.

PELOPONNISOS: Killini!, Chelmos!, Erimanthos!, Panachaikon!; STEREA ELLAS: Yerania!, Parnis!, Kandhilion!, Xiron Oros! (Euboea), Elikon!, ?Parnassos!, Oxia!, Timfristos!, Onion!; EAST CENTRAL: Othris!; AEGEAN ISLANDS: Thasos!

Scattered in Turkey where another subspecies also occurs.

C. pichleri was recognized as a species distinct from *C. triumfettii* by BOISSIER primarily because of the terminal rosette with lateral flowering stems ("caules extrarosulares"). This character is adequate in Turkey but

seems insufficient as a criterion in SE Europe. One possible solution would have been to unite *C. pichleri* and *C. triumfettii*, but this would have made *C. triumfettii* a still more polymorphic species. We decided to define *C. pichleri* by a combination of characters which make a distinction possible in most cases. Some plants from lower altitudes are similar in all characters and have only taller stems with more numerous leaves; they are included here. There are a few borderline cases and critical specimens, possibly due to hybridization, e.g. on Timfristos and Olimbos. On the last-mentioned mountain some of the plants have a distinct terminal rosette but differ by the taller stems with much broader, distinctly decurrent and less tomentose leaves.

27. C. epirota HALÁCSY in *Bull. Herb. Boissier* 6: 581 (1898)

Described from Mt Mitsikeli and Mt Kakarrdhitsa in Epirus and Mt Kudesi in Albania, based on collections by BALDACCI (nos. 1895: 73 and 1896: 82, syntypes in BP! and WU!).

Syn.: *C. triumfettii* ALL. var. *epirota* (HALÁCSY) STOJ. & ACHT., *Stud. Cent. Bulg.*: 18 (1935); *Cyanus epirotus* (HALÁCSY) HOLUB in *Preslia* 45: 144 (1973).

Perennial with slender rhizome. Stems simple, erect, (1-)2-12(-19) cm (excl. the single capitulum). Leaves densely whitish- to grey-tomentose on both sides, the lower with short petiole, *lyrate-pinnatilobate to -pinnatifid* with 2-4 pairs of oblong lateral segments and broadly triangular or rhombic to lanceolate terminal segment; segments usually with a very short mucro, entire or the terminal with few minute teeth. Upper leaves 1-2, similar to lower but with fewer segments or undivided. Involucre 17-20 × 8-11 mm, nearly funnel-shaped. Appendages triangular, blackish-brown, ciliate, 3-4(-5) mm, decurrent with a narrow border c. 0.3-0.5 (-0.7) mm broad; cilia numerous, (0.8-)1-1.8(-2) mm, mostly light brown, sometimes silvery at tips. *Florets light pinkish-purple* (anther-tube of central florets steel-blue to dark violet), marginal strongly radiant. Achenes 4-5 mm; pappus 1-2 mm.

Subalpine meadows and rocky slopes, 1600-2500 m, rarely down to 1200-1500 m, chiefly on limestone, sometimes on serpentine, Flowering June and July.

S PINDHOS: Tsoumerka!, Kakarrdhitsa!, Korouna!; N PINDHOS: Mitsikeli!, Dhouskon!, Timfi!, Gamila!, Astraka!, Gramos (ZAGANIARIS 1940: 78), Levkasia! (see map by VOLIOTIS in *Bauhinia* 8: 24, 1984).

W Greece and S Albania.

C. epirota is closely related to *C. pindicola* (no. 24) and shows a vicarious distribution. The main difference is the flower colour: light pinkish-purple in *C. epirota*, white to cream or yellowish (rarely dark violet) in *C. pindicola*. In addition, specimens of *C. epirota* are often smaller and more slender with smaller capitula, the rhizome is thinner, the appendages have

a narrower border and the leaf segments are ± distinctly mucronate, sometimes with minute teeth.

28. C. napulifera ROCHEL in FRIV., *Magyar Tud. Társ. Évk.* 2: 250 (1835)

Described from the Balkan mountains in Bulgaria, based on a collection by FRIVALDSZKY (lectotype in BP!).

Syn.: *Cyanus napuliferus* (ROCHEL) SOJÁK in *Čas. Nár. Muz., Odd. Přír.* 140: 131 (1972).

Perennial with thickened roots (oblong to fusiform, rarely moniliform), mostly with slender rhizome. Stem 2-30 cm tall, usually simple, rarely with 1-2 short branches in upper part. Leaves ± densely appressed greyish-white sericeous or tomentose on both sides, margin sometimes slightly revolute; lower leaves usually narrowly lanceolate and entire or often with 2-3 pairs of distant lateral lobes or teeth; cauline leaves narrowly lanceolate or almost linear and only 2-5 mm broad. Involucre 15-22 × 8-12 mm. Appendages triangular, decurrent with a narrow blackish-brown border, with numerous cilia c. 2-3.5 mm long (longer than width of border), silvery-white at tips. Florets differently coloured (see subspecies), the marginal strongly radiant. Achenes 4-5 mm; pappus (1.5-)2-3 mm.

Two subspecies can be recognized in Greece:

1. Florets whitish (yellowish-white when dry), rarely rose-pink **a. ssp. napulifera**

– Marginal florets cornflower-blue, central ones purple **b. ssp. velenovskyi**

a. ssp. napulifera

Syn.: *C. orbelica* VELEN. in *Sitzungsber. Königl. Böhm. Ges. Wiss Prag, Math.-Naturwiss. Cl.* 1890, 1: 51 (1890), described from SW Bulgaria; *C. nyssana* PETROVIĆ ssp. *orbelica* (VELEN.) HAYEK in STOJ. & STEFANOV, *Fl. Bălg.* 2: 1181 (1925); *C. napulifera* ROCHEL subf. *orbelica* (VELEN.) STOJ. & ACHT., *Stud. Cent. Bulg.*: 20 (1935); *Cyanus orbelicus* (VELEN.) SOJÁK in *Čas. Nár. Muz, Odd. Přír.* 140: 131 (1972).

Grassy, rocky slopes and alpine meadows, usually 1300-2200 m, on limestone. Flowering June and July.

EAST CENTRAL: Mt Porta SE of Farsala!; NORTH CENTRAL: Kajmakčalan!; NORTH EAST: Chortiatis!, Belles!, Pangeon, Menikion!, Vrondous!, Orvilos!, Falakron!, Rodhopi!

Jugoslavia, Bulgaria and N Greece.

The type material (BP!, W!) is not uniform; it includes white- and rose-flowered specimens and also some plants of *C. thirkei* SCHULTZ BIP. As a lectotype a white-flowered specimen (conforming to the plate!) of *C. napulifera* has been chosen. *C. thirkei*, which is a species of lower altitudes in E Bulgaria, Thrace and W Turkey, is primarily distinguished by the type of hairs which have distinct multicellular bases and are randomly

arranged, not parallel to the main axis giving the leaf a sericeous type of indumentum as in *C. napulifera*. The stems are always short in *C. thirkei*, the leaves often broader, and the pappus shorter(?). We find it impossible to distinguish *C. orbelica* as a separate taxon. Plants with very short stems and rose-coloured florets have been described from Bulgaria as *C. adamovicii* VELEN.; they should probably be included in ssp. *napulifera*. According to HAYEK, *C. napulifera* differs from the related species by the presence of glandular hairs. No such hairs could be found and even the nearly ubiquitous sessile glands seem to be lacking or very sparse in this species.

b. ssp. velenovskyi (ADAMOVIĆ) WAGENITZ & GAMAL-ELDIN, comb. nova

Basionym: *C. velenovskyi* ADAMOVIĆ in *Oesterr. Bot. Z.* 43: 172 (1893). Described from Jugoslavia, Mt Midžor (E of Niš, near Bulgarian border), based on a collection by ADAMOVIĆ, "in apricis alpinis montis Midžor (Stara Planina) ad altit. m. 1600-2000 s.m." (types in BP! and PRC!).

Syn.: *C. nyssana* PETROVIĆ ssp. *velenovskyi* (ADAMOVIĆ) HAYEK in STOJ. & STEFANOV, *Fl. Bălg.* 2: 1181 (1925).

N PINDHOS: Gramos!; NORTH CENTRAL: Varnous!, Vitsi!, Pieria!, Vermion!, Kajmakčalan!

Alpine meadows, c. 1800-2000 m, on non-calcareous substrates.

N Greece and Jugoslavia.

Length of stems and shape of leaves are very variable in the Greek representatives of this subspecies. *C. napulifera* s.lato. has been subdivided in very different ways (HAYEK 1925, STEFANOV & GEORGIEV 1931, STOJANOV & ACHTAROV 1935, DOSTÁL 1976). In particular, the height of the plants and the leaf shape vary even within populations, and seem to be ill-suited as taxonomic characters (perhaps with the exception of *C. nyssana* s.str.). The colour of the florets shows on the whole a geographical pattern of variation and has thus been used as the main criterion for separating the subspecies. Plants from lower altitudes in the coastal areas of Jugoslavia seem to differ by the lack of a rhizome and should be assigned to a separate subspecies: ssp. *tuberosa* (VIS.) STOJ. & ACHT. $2n = 20$ has been reported in *C. napulifera* from Jugoslavian Makedonija (ŠOPOVA & SEKOVSKI 1982) and in ssp. *velenovskyi* from Mt Vitsi in N Greece (STRID & ANDERSSON 1985).

29. C. lancifolia SIEBER ex SPRENGEL, *Syst. Veg.* ed. 16, 3: 406 (1826)

Described from Crete, based on a collection by SIEBER (types in G-DC!, KIEL! and W!).

Syn.: *Amberboa lancifolia* (SPRENGEL) DC., *Prodr.* 6: 561 (1838); *Chartolepis lancifolia* (SPRENGEL) FENZL, *Diagn. Pl. Or.*: 66 (1860) et in TCHIHAT., *Asie Min. 3 (Bot.)*: 327 (1860); *Wagenitzia lancifolia* (SPRENGEL) DOSTÁL in *Acta Bot. Acad. Sci. Hung.* 19: 76 (1953).

Perennial with woody base which may be very stout with several flowering stems and sterile rosettes. Stems erect or slightly ascending, 20-35 cm,

with light brown remains of petioles at base. Leaves with very short stiff hairs and sessile glands, *entire and linear-lanceolate to nearly linear*, basal indistinctly petiolate, middle and upper sessile and shortly decurrent; middle leaves c. 4-6 × 0.4-0.8 cm, with distinct veins. Involucre cupulate, c. 20-25 × 15-20 mm. Phyllaries in several series, coriaceous, yellowish when dry. *Appendages blackish-brown, broadly triangular*, small, not decurrent, often reflexed, *with (4-)5-7(-8) pairs of spinules 2-4 mm and a terminal spinule of approximately the same length.* Florets yellow, marginal not radiant. Achenes c. 6 mm; pappus 5-7 mm, inner row 2-4 mm.

Crevices of limestone rocks, 1700-1900 m.

CRETE: Levka Ori (Drakona!, Andrachos!, Mavri; cf. ZAFFRAN 1976: 183).

Endemic. A rare species of Levka Ori, which has recently only been collected by ZAFFRAN. It is most closely related to a group of Anatolian species with ± restricted distribution areas. 2n = 18 (TZANOUDAKIS 1986a).

27. Hypochoeris L.

H.W. LACK AND N. KILIAN

Perennial herbs with leaves in a basal rosette. Stems one to several, sparingly branched, with scale-like leaves. Phyllaries in several rows, imbricate. Receptacle flat, with long linear hyaline scales. Ligules yellow. Anthers shortly caudate below and with rounded terminal appendages. Achenes cylindrical, ribbed, at least the inner beaked; pappus at least partly with plumose hairs. – C. 70 species in Eurasia, N and S America.

1. Involucre up to 10 mm; flowering capitula 10 mm or less diam. **2. H. tenuiflora**

– Involucre up to 25 mm; flowering capitula more than 40 mm diam. 2.

2. Pappus hairs in one row, all plumose **1. H. maculata**

– Pappus hairs in two rows, the outer dentate, the inner plumose **3. H. radicata**

1. H. maculata L., *Sp. Pl.*: 810 (1753)

Described from living material in the Hortus Cliffortianus. "Habitat in Europae frigidioris pratis asperis".

Stems one or few, robust, erect, simple or with 1-2 branches, 15-60(-90) cm long, not or scarcely thickened below capitula, ± hispid-hirsute, *often with one ± well-developed leaf* and a few small scale-like leaves. Rosette leaves 4-20 × 1.5-7 cm, elliptic to ovate or obovate, subentire to sinuate-dentate, ± hispid, *often streaked or spotted dark purple*. Capitula 1-3,