

# A revision of *Centaurea argentea* (Compositae, Cardueae), an endemic species of Kriti and Kithira (Greece)

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## Abstract

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*Centaurea argentea*, belonging to *C. sect. Acrolophus*, is endemic to Kriti and the island of Kithira S. of Peloponnisos. It is a highly polymorphic species with a widespread but clustered, discontinuous distribution in Kriti. Two subspecies may be recognized based on geographical distribution and morphology of involucre bract appendages: *C. argentea* subsp. *argentea* (Kithira and N.W. Kriti) and subsp. *macrothysana*, stat. nov. (W., S.C., and E. Kriti). Within the latter subspecies, a variant population-group, *C. argentea* var. *chionantha*, var. nov., occurs in E. Kriti.

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## Introduction

*Centaurea argentea* L. was known to the early Italian botanists (e.g., ALPINI 1627: 116-117, as "*Argentea*"), was collected by Tournefort in 1700 (BM!), and was described, as growing in Kriti, by Linnaeus in his *Species plantarum* (LINNAEUS 1753: 912). This highly polymorphic species, belonging to *C. sect. Acrolophus* (Cass.) DC., remained a presumed endemic of Kriti until 1964, when it was found on the island of Kithira S. of Peloponnisos (GREUTER & RECHINGER 1967: 151; RUNEMARK 1967: 162). GEORGIADIS (1980: 251, 252) considered it a taxonomically isolated species, exhibiting primitive characters, within *C. sect. Acrolophus*.

No author subsequent to Linnaeus gave formal taxonomic recognition to any of the variability found within *Centaurea argentea* until RECHINGER (1944b: 151) described two varieties: *C. argentea* var. *brachythysana* Rech. f. and var. *macrothysana* Rech. f., based on the length of the teeth or spines of the appendages of the phyllaries (involucre bracts) surrounding the capitula. Rechinger's varieties represent the extremes, not only of phyllary appendage morphology but of geographical distribution, found within the species in Kriti. On studying a range of specimens, Rechinger noted that the plants from N.W. Kriti (Ep. Kissamou) have phyllary appendages with very short spines or teeth, whereas those from the Sfakian mountains (i.e., the S. part of Lefka Ori or White Mountains in W. Kriti) have longer spines, and those from Goudouras (far S.E. Kriti) have the longest spines of all.

Rechinger effectively recognized three varieties, the collections he cited under the species (but not under either variety) being presumably intended as examples of the simultaneously established autonym, *Centaurea argentea* var. *argentea*: one from the Lefka Ori, one from the Asterousia Ori in S.C. Kriti, and one from the Korikos

peninsula in N.W. Kriti. Only about 15 populations of *C. argentea* were known in 1944, but many additional localities have been discovered since, particularly in E. Kriti, and the total now stands at about 45. On comparing material from some 50 collections with Rechinger's cited specimens, it became apparent to the present authors that only two infraspecific taxa can be recognized on the basis of geographical distribution and phyllary appendage morphology. While *C. argentea* var. *brachythysana* is distinct, both var. *argentea* sensu Rechinger (not of Linnaeus, see below) and var. *macrothysana* should be regarded as taxonomic synonyms, because they are joined by a complete range of intermediates and any separation would be wholly arbitrary. However, *C. argentea* var. *macrothysana* does not fall into synonymy; the Linnaean type and, by definition, *C. argentea* var. *argentea* actually correspond with var. *brachythysana*, so the latter two names become synonyms instead.

Rechinger did not address the typification of *Centaurea argentea*. That question was settled over half a century later by TURLAND (in JARVIS & TURLAND 1998: 357), who lectotypified the name. The relevant original material for *C. argentea* comprises four elements: a specimen belonging to the species currently known as *C. ragusina* L. (a somewhat similar-looking but not closely related plant from the coast of Croatia), an illustration depicting *C. argentea* but not detailed enough to be identifiable beyond species rank, and two specimens, also of *C. argentea*, both of which match the type of Rechinger's var. *brachythysana*. Turland designated the better of these two specimens as the lectotype of *C. argentea* in order to establish an unambiguous taxonomic basis for, and maintain current usage of, that name.

Subsequent to Rechinger, *Centaurea argentea* was briefly discussed by RUNEMARK (1967: 162), who noted that the species is extremely variable in habit, leaf shape, and the shape of the phyllary appendages, and that this variation is "probably the result of genetic drift in small, isolated cliff populations". (He also mentioned that detailed studies of morphological variation and chromosome morphology were planned, but over 30 years have passed and nothing has yet been published.) Habit is indeed variable: the branches, which bear leaf rosettes at their tips, are often very short and concealed by shrivelled remains of dead leaves so the plant appears almost acaulescent; on the other hand, some plants have longer branches and are obviously subshrubby. Although plants within populations tend to have a similar habit, there is no obvious correlation with geographical distribution, and the variation pattern is reticulate. Leaf shape is also highly variable, but this feature varies both between and within populations. Floret colour is yellow throughout the range of the species except in the Mt Afendis Kavousi area of E. Kriti, where the populations are all white-flowered (with the inner, fertile florets reddish purple at the apex). Floret colour, therefore, has a distinct correlation with geographical distribution. Finally, as was observed by RECHINGER (1944b: 151), there is a more or less clinal variation in phyllary appendage morphology that is also well correlated with geography. Populations in north-westernmost Kriti and on Kithira consistently have crescent-shaped or semicircular, very small appendages bearing teeth or very short spines 0.1-0.6 mm (including the types of *C. argentea* and Rechinger's var. *brachythysana*). Populations further east have triangular or triangular-ovate, larger appendages with longer spines 0.6-2 mm (including *C. argentea* var. *macrothysana* and "var. *argentea*" in the sense of Rechinger). The phyllary appendages of the white-flowered plants from the Mt Afendis Kavousi area fall into the latter group.

The plants with longer-spined appendages occur in four distribution areas: (1) the Lefka Ori in W. Kriti; (2) the Asterousia Ori in S.C. Kriti; (3) the Mt Afendis Kavousi area in E. Kriti; and (4) the Ziros mountains further east still. No evidence could be traced of any populations in the Psiloritis massif N. of the Asterousia Ori, or in the Dikti massif W. of Mt Afendis Kavousi. Between the four areas, there is a slight trend towards longer spines as one moves from west to east, although a few plants from near the western limit are practically indistinguishable on that account from the longest-spined plants from the eastern limit. Moreover, certain other plants from the western limit have short spines and, in this feature, are morphologically close to, but do not quite overlap with, plants from the distribution area of toothed or very short-spined appendages.

In view of the more or less clinal but discontinuous variation in phyllary appendage morphology, well correlated with geographic distribution, it seems appropriate to recognize as two subspecies the toothed or very short-spined entity and the longer-spined entity. The consistently white-flowered populations in the Mt Afendis Kavousi area clearly belong to the longer-spined subspecies under these criteria, but differ markedly in the single character state of floret colour. It therefore seems justifiable to divide that subspecies into two varieties.

### Systematic treatment

*Centaurea argentea* L., Sp. Pl. 2: 912. 1753. – Lectotype (TURLAND in JARVIS & TURLAND 1998: 357): Herb. Clifford: 422, *Centaurea* No. 14 (BM!). – Fig. 2 B (see also WIJNANDS & HENIGER 1991: 136, f. 3).

Whitish or greyish, perennial, rounded subshrub to c. 20 × 40 cm, densely covered with very short tomentum. Branches becoming woody, often very short and

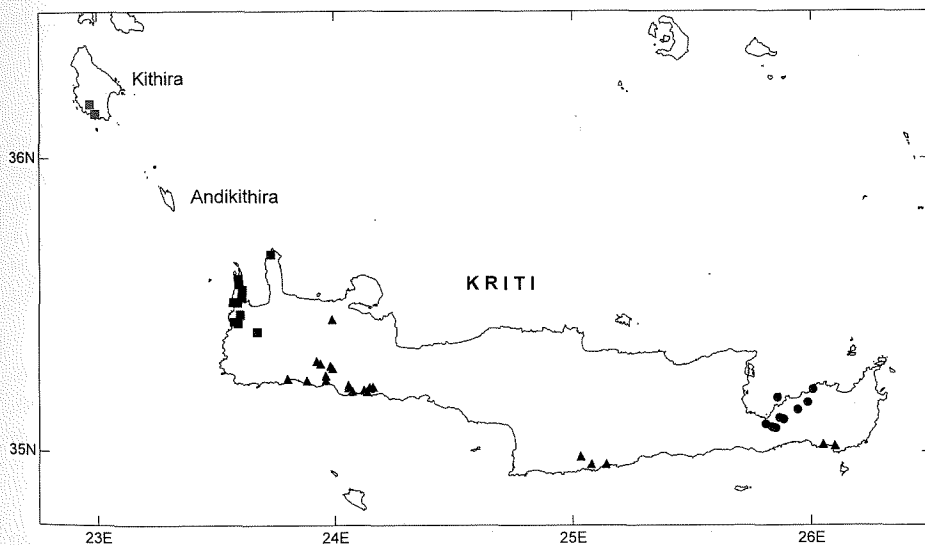


Fig. 1. Distribution of *Centaurea argentea*: subsp. *argentea* (■), var. *macrothysana* (▲), and var. *chionantha* (●).

concealed by shrivelled remains of dead leaves so that the plant appears almost acaulescent. Leaves borne in terminal rosettes, very variable, lyrate, pinnatifid, pinnatisect, or sometimes bipinnatisect,  $3-12 \times 1.5-5$  cm; lobes or segments linear, oblong, elliptic, or suborbicular, the terminal one often larger and broader than the others. Flowering stems erect or ascending, slender, 10-50 cm, sparsely leafy, sparingly branched towards the apex; branches terminating in solitary or clustered capitula; cauline leaves like the rosette leaves but with fewer lobes or segments. Involucres at anthesis  $10-15 \times 8-12$  mm, ellipsoid-globose; median phyllaries pale green to straw-coloured, with a few darker, longitudinal veins, narrowly to broadly oblong or elliptic,  $3.5-8 \times 2-3$  mm (excluding the appendage); appendages pale to dark brown, either crescent-shaped (when curved around the distal end of the phyllary) or semicircular, 0.6-1 mm including teeth or very short spines 0.1-0.6 mm (subsp. *argentea*); or triangular to triangular-ovate, larger, 1.4-3.5 mm including longer spines 0.6-2 mm (subsp. *macrothysana*); teeth or spines 9-19, the terminal one shorter to slightly longer than the others. Florets yellow or white, extending 6-8 mm beyond the involucre; outer, sterile florets scarcely spreading; inner, fertile florets of white-flowered plants reddish purple at the apex. Achenes grey, pale brown, or straw-coloured, with darker banding, oblong, 7-8 mm including the white, 4-5 mm long pappus.

*Ecology.* – An obligate chasmophyte of rock-crevices and ledges of vertical calcareous cliffs; very rarely in ungrazed woodland of *Pinus brutia* Ten.; from sea-level to 900 m, occasionally higher, exceptionally to 1800 m; flowering from April to July.

*Distribution.* – The species is endemic to Kriti and the island of Kithira S. of Peloponnisos (Fig. 1). No records could be traced by the authors from the small island of Andikithira, between Kithira and N.W. Kriti, although the species might indeed occur there if suitable habitat exists. A single report of *Centaurea argentea* in S. Peloponnisos (ZAFFRAN 1990: 328, citing RUNEMARK 1967), although not implausible, is based on a misunderstanding: Runemark noted the discovery of the species in "Kithera, S of Peloponnisos", which Zaffran quoted as "Kithira et dans le Sud du Peloponèse".

*Key to the infraspecific taxa*

- 1 Appendages of median phyllaries crescent-shaped or semicircular, 0.6-1 mm including teeth or short spines 0.1-0.6 mm ..... subsp. *argentea*
- 1\* Appendages of median phyllaries triangular to triangular-ovate, 1.4-3.5 mm including spines 0.6-2 mm ..... subsp. *macrothysana* 2
- 2 Florets yellow ..... var. *macrothysana*
- 2\* Florets white, fertile ones reddish purple at apex ..... var. *chionantha*

*Centaurea argentea* L. subsp. *argentea*

- = *C. argentea* var. *brachythysana* Rech. f. in Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr. 105(2,1): 151. 1944. – Holotype: Greece, Kriti, Nom. Hanion, Ep. Kissamou: Korikos peninsula, "Kalkfelsritzen am östlichen Strand 'Petronia'", 20 Apr 1942, *Rechinger 12131* (W; isotypes: BM!, G, LD). Icons: Fig. 2 A-C; RUNEMARK (1967: 163, f. 1 C, F).

*Chromosome number.* – Diploid,  $2n = 18$  (MONTMOLLIN 1986: 437, based on material from the Topolia gorge; ROUTSI & GEORGIADIS in LÖVE 1988: 399, based on material from Kithira).

*Distribution.* – N.W. Kriti (Ep. Kissamou) and the island of Kithira.

*Material examined.* – KITHIRA: Lionis hill N.W. of Hora Kithiron, 36°09'00"N, 22°59'20"E, 14 May 1964, *Greuter 6655* (Herb. Greuter). – KRITI: Nom. Hanion, Ep. Kissamou: Korikos peninsula, E. coast ["litoris occidentalis" on label] at "Petronia", 35°33'10"N, 23°36'40"E, 20 Apr 1942, *Rechinger 12131* (BM); Azogiras to Falasarna, 35°30'30"N, 23°35'30"E, 29 May 1982, *Greuter 19386 & Risse* (B, Herb. Greuter, UPA); Mt Profitis Ilias [Mt Manna] S. of Platanos, 35°26'30"N, 23°34'50"E, 22 Jun 1893, *Baldacci 25* (BM, K); gorge S. of Topolia, 35°24'30"N, 23°40'30"E, 28 Mar 1972, *Kaae* (C); same locality, 30 May 1942, *Rechinger 13422* (BM); N.W. end of Rodopos peninsula, Akrofarango gorge, 35°40'20"N, 23°43'50"E, 22 Apr 1942, *Rechinger 12211* (BM). – CULTIVATED: Netherlands, early 1700s, Herb. Clifford: 422, *Centaurea* No. 14 (BM).

*Other recorded localities.* – KITHIRA: Agia Elesia N.W. of Hora Kithiron, 36°11'00"N, 22°58'00"E, *Yannitsaros 934* (ATHU; YANNITSAROS 1969: 104). – KRITI: Nom. Hanion, Ep. Kissamou: base of Korikos peninsula, "Grawussi" area, 35°31'30"N, 23°36'30"E, 19 Apr 1942, *Rechinger 12049* (W; RECHINGER 1944b: 151); same area, N. of Kaliviani, 29 Mar 1989, *Strasser obs.* (STRASSER 1989: 5, 6); N.W. part of Korikos peninsula, Tigani bay, 35°35'20"N, 23°35'40"E, 5 May 1992, *Jahn obs.* (R. JAHN, pers. comm.); Korikos peninsula, N. of Mt Geroskinos, 35°34'10"N, 23°35'40"E, 5 Apr 1987, *Strasser obs.* (STRASSER 1988: 22, 24); Falasarna bay, 35°30'40"N, 23°34'30"E,

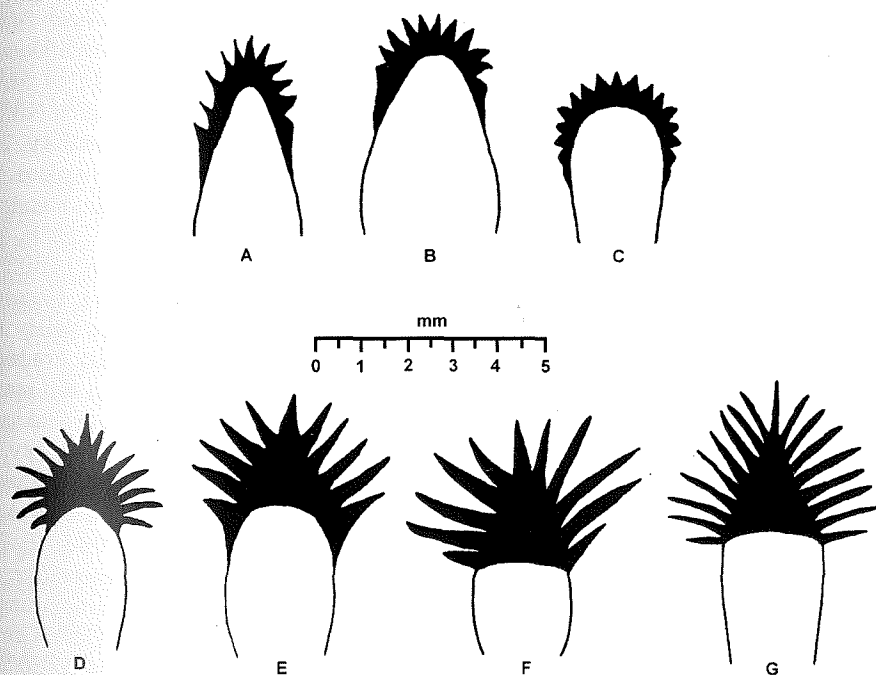


Fig. 2. Phyllary appendages of *Centaurea argentea*. – A-C, subsp. *argentea* (A, *Greuter 6655* (B), B, lectotype, C, isotype of var. *brachythysana* (BM)). D-F, var. *macrothysana* (D, *Georgiadis 1767* (UPA), E, *Baldacci 128* (BM), F, isotype of var. *macrothysana* (BM)). G, var. *chionantha*, holotype.

8 Apr 1987, *Strasser obs.* (STRASSER 1988: 22, 24); same locality, 27 Mar 1989, *Turland obs.*; Platanos, 35°28'00"N, 23°36'20"E, 27 Mar 1989, *Turland obs.*; Platanos to Sfinari W. of Mt Manna, 35°26'20"N, 23°35'40"E, 15 Jul 1991, *Chilton obs.*

***Centaurea argentea* subsp. *macrothysana*** (Rech. f.) Turland & L. Chilton, **stat. nov.**  
 ≡ *C. argentea* var. *macrothysana* Rech. f. in Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr. 105(2,1): 151. 1944. – Holotype: Greece, Kriti, Nom. Lasithiou, Ep. Sitias: "Kalkfelsritzen der Schlucht bei Guduras, gegen die Südküste", 10 May 1942, *Rechinger 12806* (W; isotypes: BM!, G).

*Distribution.* – W. Kriti (Lefka Ori), S.C. Kriti (Asterousia Ori), and E. Kriti (Mt Afendis Kavousi area and Ziros mountains).

***Centaurea argentea* var. *macrothysana*** Rech. f. [see above].

Icons: Fig. 2 D-F; RUNEMARK (1967: 163, f. 1 B, E).

*Chromosome number.* – Diploid,  $2n = 18$  (RUNEMARK 1967: 162, based on material from near Hora Sfakion; GEORGIADIS 1980: 85, based on material from the Imbros gorge).

*Distribution.* – Throughout the range of the subspecies, but only in the Ziros mountains in E. Kriti.

*Specimens examined.* – KRITI: Nom. Hanion, Ep. Kidonias: Venizelos gorge between Perivolia and Theriso, 35°27'00"N, 23°59'30"E, May 1915, *Gandoger 7486* (K); same locality, 26 Apr 1977, *Tzanoudakis 2590* (UPA); Ep. Selinou/Sfakion: Tripiti gorge between Sougia and Agia Roumeli, 35°14'30"N, 23°53'00"E, 14 May 1967, *Barclay 263* (K); Ep. Sfakion: Samaria gorge, Xiloskala pass to Agios Nikolaos, 35°18'20"N, 23°55'30"E, 28 May 1972, *Petamidis 1411* (C); same locality, 28 Jun 1979, *Strid & Papanicolaou 15152* (B, C); Samaria gorge, Agios Nikolaos to Samaria, 35°18'00"N, 23°56'30"E, 14 Jun 1942, *Rechinger 13751* (BM); Samaria gorge, Sideroportas between Samaria and Agia Roumeli, 35°15'30"N, 23°57'50"E, 17 Aug 1973, *Tzanoudakis 833* (UPA); Samaria gorge, Agia Roumeli, 35°14'30"N, 23°57'40"E, Jun 1932, *Atchley 1388* [in part] (K); same locality, 10 Jul 1961, *Greuter 3832* (Herb. Greuter); same locality, Jun 1932, *Guiol 2156* (BM); Potamos valley E. of Samaria gorge, 35°17'00"N, 23°59'30"E, 19 Sep 1983, *Risse 1366* (B); Aradena gorge, 35°13'30"N, 24°03'30"E, 22 Sep 1966, *Greuter 7566* (Herb. Greuter, K); same locality, 8 Jun 1966, *Zaffran* (Herb. Greuter); Kavi gorge 1.5 km W. of Hora Sfakion, 35°12'30"N, 24°07'30"E, 27 Apr 1960, *Greuter 2777* (Herb. Greuter); same locality, 7 Oct 1966, *Greuter 7674* (Herb. Greuter); gorge near Hora Sfakion [ambiguous locality], Jun 1932, *Atchley 1388* [in part] (K); Hora Sfakion, 35°12'10"N, 24°08'20"E, 3 Apr 1972, *Hansen KRI860* (C, Herb. Greuter); Imbros gorge, 35°13'10"N, 24°09'50"E, 22 Jun 1976, *Georgiadis 1767* (C, UPA); same locality, 26 Sep 1975, *Merxmüller & Podlech 30859* (UPA); Nom. Irakliou, Ep. Monofatsiou: gorge near Fournofarango N.W. of Mt Kofinas, 34°59'00"N, 25°02'00"E, 24 May 1962, *Greuter 4545* (Herb. Greuter); same locality, 1 Jul 1942, *Rechinger 14142* (BM, K); Mt Kofinas, 34°57'30"N, 25°04'40"E, 20 Jun 1899, *Baldacci 128* (B, BM, MO) [still there 19 Mar 1989, *Chilton & Turland obs.*]; Nom. Lasithiou, Ep. Sitias: Moni Kapsa gorge S.S.E. of Kato Perivolakia, 35°01'30"N, 26°03'00"E, 8 May 1962, *Greuter 4438* (Herb. Greuter); same locality, 26 Jun 1994, *Turland 778* (BM); same locality, 22 Apr 1976, *Tzanou-*



*dakis* 2640 (UPA); gorge near Goudouras, 35°01'10"N, 26°06'00"E, 10 May 1942, *Rechinger 12806* (BM).

*Other recorded localities.* – KRITI: Nom. Hanion, Ep. Selinou: small gorge between Lissos and Sougia, 35°14'50"N, 23°48'10"E, 7 Aug 1989, *Chilton obs.*; Ep. Sfakion: Mt Vokino S. of Korifi Avlimonakou 4 km W. of Mt Pahnēs, 1800 m, 35°17'30"N, 23°59'00"E, 1964–1972, *Zaffran 4650* (MARS; ZAFFRAN 1976: 182; 1990: 328); above Livaniana, 35°13'00"N, 24°03'40"E, 30 Mar 1989, *Kalheber obs.* (R. JAHN pers. comm.); environs of Loutro, 35°12'20"N, 24°04'30"E, 1964–1972, *Zaffran 4646* (MARS; ZAFFRAN ll.cc.); Sfakiano gorge E. of Hora Sfakion, 35°13'00"N, 24°09'00"E, 1964–1972, *Zaffran 4647* (MARS; ZAFFRAN ll.cc.); Nom. Irakliou, Ep. Monofatsiou: exit of gorge E. of Tris Ekklesies E. of Mt Kofinas, 34°57'30"N, 25°08'30"E, 22 May 1994, *Jahn obs.* (R. JAHN, pers. comm.).

*Centaurea argentea* var. *chionantha* Turland & L. Chilton, var. nov. – Holotype: Greece, Kriti, Nom. Lasithiou, Ep. Ierapetras: "Schluchtausgang nordöstlich von Monastyraki", 300–400 m, 29 May 1981, *Pleger & Risse* (UPA!; isotypes: B!, Herb. Greuter!).

Icons: Fig. 2 G; RUNEMARK (1967: 163, f. 1 A, D); JAHN & SCHÖNFELDER (1995: t. 80).

A var. *macrothysana* recedit flosculis niveis, flosculorum interiorum apicibus rubro-purpureis.

*Chromosome number.* – Diploid,  $2n = 18$  (RUNEMARK 1967: 162, based on material from near Kavousi; GEORGIADIS 1980: 85, based on material from the Monastiraki ["Cha"] gorge).

*Distribution.* – E. Kriti (Mt Afendis Kavousi area).

*Specimens examined.* – KRITI: Nom. Lasithiou, Ep. Ierapetras: Monastiraki gorge, 35°05'00"N, 25°50'00"E, 22 Jun 1974, *Barclay 3183* (K); same locality, Sep 1938, *Davis & Barneby* (K); same locality, 24 Mar 1961, *Greuter 3353* (Herb. Greuter); same locality, 26 Sep 1966, *Greuter 7593* (Herb. Greuter); same locality, 21 May 1982, *Greuter & al. 19227* (B, Herb. Greuter); same locality, 9 Apr 1971, *Hansen KRI334* (C, Herb. Greuter); same locality, 29 May 1981, *Pleger & Risse* (B, Herb. Greuter, UPA); same locality, 21 Apr 1976, *Tzanoudakis 2344* (UPA); gorge E. of Kavousi, 35°06'50"N, 25°52'00"E, 12 Oct 1971, *Kaae* (C, Herb. Greuter); same locality, 26 Apr 1989, *Turland 88* (BM); same locality, 23 Apr 1976, *Tzanoudakis 2637* (UPA); Ep. Ierapetras/Sitias: N. side of Mt Kliros Peponas S.E. of Kavousi, 35°06'30"N, 25°53'00"E, 25 Jun 1994, *Turland 773* (BM); Ep. Sitias: island of Psira, 35°11'00"N, 25°51'30"E, 27 Sep 1966, *Greuter 7599* (Herb. Greuter); S. of Tourloti, 35°08'30"N, 25°56'30"E, 13 May 1962, *Runemark & al. 17270* (LD); Liopetro headland N. of Hamezi, 35°12'40"N, 26°00'20"E, 2 Oct 1966, *Greuter 7654* (Herb. Greuter).

*Other recorded localities.* – KRITI: Nom. Lasithiou, Ep. Ierapetras: gorge c. 2 km S.E. of Pahia Ammos, 35°05'30"N, 25°48'30"E, 1 Jun 1992, *Muer* (herb. Muer; Flora Hellenica Database); 2 km W.S.W. of Thripti, burnt woodland of *Pinus brutia*, 35°04'40"N, 25°51'00"E, 26 Apr 1989, *Turland obs.*; Ep. Sitias: Mouliana, 35°10'00"N, 25°59'00"E, 1845, *Raulin* (RECHINGER 1944a: 666).

## Hybridization with other species

No record of a naturally occurring hybrid involving *Centaurea argentea* could be traced. However, *C. argentea* subsp. *argentea* readily hybridized with *C. poculato-ris* Greuter in cultivation in Britain, in the first author's garden, without any directly human-induced pollination. *C. poculato-ris* is a locally endemic species with three known populations in the S.E. part of Ep. Sfakion in S.W. Kriti (GREUTER 1967: 252-253; TURLAND 1992: 346; also: lower part of gorge 0.5 km N.E. of Skaloti, 200 m, crevices of calcareous rock, 17 Apr 1991, *Turland 419* (BM), confirming a record of "*Centaurea* cf. *poculato-ris*" made at the same locality on 2 Apr 1987 by STRASSER 1988: 26, 28). The two species do not grow together in nature, and their distribution areas do not overlap, although respective populations occur as close as 4 km. The hybrid plants are more or less intermediate between the parents in appearance, e.g., with suffruticose habit and orange-yellow florets. *C. poculato-ris*, the female parent, is acaulescent, has florets yellow at the base, shading through orange, to dark red at the apex and, like *C. argentea*, is a diploid with  $2n = 18$  chromosomes (MONTMOLLIN 1986: 437; ROUTSI & GEORGIADIS in LÖVE 1988: 399).

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