

Contributions to the taxonomy of the Italian and northern Balkanic taxa in the *Centaurea rupestris* group (Asteraceae)

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The morphology of the Italian-Balkan populations of the *Centaurea rupestris* group was studied in order to clarify the taxonomy. The names *C. ceratophylla*, *C. arachnoidea*, *C. adonidifolia*, *C. dichroantha*, *C. rupestris* var. *inermis* are lectotypified. The taxonomic status of *C. adonidifolia* was re-evaluated and a new combination is suggested: *C. arachnoidea* subsp. *adonidifolia* (Rchb.) F. Conti, Moraldo & Ricceri, comb. & stat. nov. The new taxa here described include *C. ceratophylla* subsp. *danielae* F. Conti, Moraldo & Ricceri, subsp. *nova* and *C. arachnoidea* subsp. *montis-ferrati* Ricceri, Moraldo & F. Conti, subsp. *nova*.

Introduction

The *Centaurea rupestris* group, as defined for Greece by Routsis and Georgiadis (1999), is an aggregate of taxa found in Italy, the Balkan Peninsula, the former USSR, and Turkey. One of the most critical taxa of this group, from a taxonomic point of view, is *C. rupestris* s. lato. Dostál (1976) listed the following subspecies: subsp. *rupestris* (Italy, W Yugoslavia), subsp. *ceratophylla* (north and central Apennines), subsp. *finazzeri* (south Yugoslavia, west Bulgaria, north Greece), and subsp. *athoa* (north Greece). In addition, recent revisions of the

systematics by Routsis and Georgiadis (1994a, 1994b, 1999), based on specimens from Greece, also recognized *C. rupestris* subsp. *parnonia* and subsp. *kozanii*.

Wagenitz and Gamal-Eldin (1985) and Greuter (2003) suggested the following taxonomic treatment for these taxa: *C. finazzeri* subsp. *finazzeri*, *C. finazzeri* subsp. *kozanii*, *C. athoa* subsp. *athoa* and *C. athoa* subsp. *parnonia*. Those studies provided much new knowledge of this group for the southern part of the Balkan Peninsula, but the situation appears more complicated and is less well known for the northern part of this area and for the Italian Peninsula. According to

Greuter (2008) only *C. rupestris* is present in Slovenia, Croatia and Bosnia-Herzegovina.

In Italy, recent floras list *C. rupestris* subsp. *rupestris* and *C. rupestris* subsp. *ceratophylla* (Pignatti 1982, Conti et al. 2005); the latter subspecies was treated as a distinct species by Feoli Chiapella (1979). *Centaurea arachnoidea* was found in the Apuan Alps, and is considered a synonym of *C. rupestris* subsp. *rupestris* by many authors and, according to Pignatti (1982), is worthy of further investigation. It was recognized as a species by Viegi and Cela Renzoni (1983) and Soldano (2000), who extended its area up to Mt. Ferrato, Mt. Cetona and to Lazio. *Centaurea dichroantha* is another taxon within this group, but it is considered to be a fixed hybrid (*C. rupestris* × *C. scabiosa*). Other taxa considered intraspecific of *C. rupestris* by Fiori (1904, 1927) are *C. rupestris* var. *aculeosa*, *C. rupestris* var. *adonidifolia* and *C. rupestris* var. *hirtella*. These taxa are currently thought by most authors to lack taxonomic meaning.

Recently the distinctness of the genus *Colymbada* was confirmed based on DNA data (ITS and *matK*) (Garcia-Jacas et al. 2001) and on pollen morphology (Hellwig 2004), and the sect. *Acrocentron* is now placed in *Colymbada*. Indeed, recent morphological (Petit 1997) and molecular (Susanna et al. 1995, 1999, Garcia-Jacas et al. 2000, 2001, Font et al. 2002) studies confirmed a high level of polyphyly in *Centaurea*. Banfi et al. (2005) placed the Italian taxa in *Colymbada*, but not all authors accept that split (Greuter 2003, in litt.).

Our interest in studying this group stems from finding several plants in different localities that we could not place in the existing taxa. In this contribution, only the phytogeographic context of the Italian-Balkan (former Yugoslavia) populations is considered, i.e. the taxa identified by several authors by the following names: *Centaurea rupestris*, *C. ceratophylla*, *C. arachnoidea*, *C. dichroantha*, and *C. adonidifolia*.

In order to get a broader taxonomic picture, we examined specimens of the closest SE European taxa: *C. collina*, *C. salonitana*, *C. centauroides*, *C. rumelica*, *C. nikolae*, *C. ornata*, *C. macedonica*, *C. tuntasia*, *C. kosaninii*, and of the Greek taxa in the *C. rupestris* group listed by Routsis and Georgadis (1999).

Material and methods

We studied 420 specimens (approximately 60 per taxon) from the following herbaria (acronyms following Holmgren et al. 1990 and the additions): ANC, APP, CAME, FI, NAP, PESA, RO and TSB. We searched for or examined other specimens in B, BM, CGE, E, G, GB, GDOR, GE, GH, GJO, GOET, H, IB, JE, K, KIEL, L, LZ, M, MO, NY, O, OXF, PAD, PH, PR, PRC, REG, S, SBT, U, UPS, UTV, W, WAG, and WU.

In addition, field trips were made to the type localities of *C. rupestris* (Fiamignano), *C. adonidifolia* (Trieste, Opicina), *C. ceratophylla* (Valle di S. Spirito, Majella), *C. arachnoidea* (Apuan Alps) as well as to numerous Apennine localities, Carso, E Alps and the Balkan Peninsula (Slovenia, Croatia, Bosnia-Herzegovina).

The study involved the following steps: bibliographic data collection, research and consultation of herbarium data, field research, study of morphological characters and achene analysis.

The characters listed in Table 1 were considered. The length of aphyllous stems was measured from the capitula up to the first divided leaf. Measurements of the largest cilia, middle leaf lobe, and flower lobes were carried out. Seed morphology was analyzed by C. Giordano using fresh material and a Fei Quanta 200 Environment Scanning Electron Microscope (ESEM), Fei Corporation, Eindhoven, The Netherlands, operating in low-vacuum mode (the chamber pressure was kept at 1.33 hPa at 25 kV, without pre-treatment of samples).

The following characters were analyzed: achene epidermal cells, hilum lateral and frontal views, pappus bristles and proximal view. The achenes were analyzed in the lateral, frontal and proximal views. Achene epidermal cells were always observed in the same part of the achene: if the single achene was divided into seven horizontal and four vertical segments, the part analyzed was the third horizontal and the second vertical segment opposite the hilum region.

Seeds of several plants were analyzed, three from each locality listed below: from available seeds, those in a more complete stage of development were selected.

Samples used for the seed morphology analysis were collected from the following localities:

Table 1. Comparison of the investigated taxa. Quantitative data are expressed with means \pm standard deviation, and extreme values in brackets.

Characters	<i>C. rupestris</i>	<i>C. ceratophylla</i> ssp. <i>ceratophylla</i>	<i>C. ceratophylla</i> ssp. <i>daniellae</i>	<i>C. arachnoidea</i> ssp. <i>arachnoidea</i>	<i>C. arachnoidea</i> ssp. <i>adonidifolia</i>	<i>C. arachnoidea</i> ssp. <i>montis-ferrati</i>	<i>C. dichroantha</i>
Erect-straight (1) or arcuate-ascending (2) stems	1	1	2	1	1	1	1/2
Leaty above (1) or hardly leafy above (2) stems	2(1)	1	1	2	2	2	2
Length of apophyllous stems (mm)	(22-)140 \pm 77(-340)	(0-)18.9 \pm 15.6(-48)	(1-)5.9 \pm 3.7(-15)	(55-)86 \pm 23(-115)	(45-)152 \pm 87(-435)	(70-)143 \pm 47(-275)	(25-)90 \pm 40(-160)
Length of leafy stems (mm)	(90-)286 \pm 137(-590)	(42-)213 \pm 97(-350)	(30-)183 \pm 82(-330)	(135-)271 \pm 93(-365)	(150-)355 \pm 104(-500)	(90-)247 \pm 112(-460)	(50-)162 \pm 95(-338)
Middle leaf's lobe length (mm)	(5-)16.6 \pm 6.7(-31)	(8-)23.2 \pm 9.6(-55)	(6-)14.2 \pm 5(-22)	(11-)18.6 \pm 6.6(-29)	(10-)27.9 \pm 12.8(-60)	(6-)15.1 \pm 5.1(-25)	(10-)24.4 \pm 8(-45)
width (mm)	(0.7-)1.1 \pm 0.3(-2.5)	(1.2-)3 \pm 1.2(-7)	(1-)1.7 \pm 0.5(-3)	(0.7-)1.8 \pm 1.2(-4.2)	(0.7-)1.4 \pm 0.7(-5)	(0.5-)1 \pm 0.2(-1.4)	(0.8-)1.1 \pm 0.2(-1.6)
Involucre length (mm)	(14-)18.9 \pm 2.1(-24)	(18-)21.8 \pm 2.2(-26)	(14-)17.7 \pm 2.1(-23)	(19-)21.1 \pm 1.8(-26)	(15-)20.7 \pm 2.5(-25)	(13-)17.5 \pm 2.2(-21)	(15-)18.3 \pm 1.5(-22)
width (mm)	(10-)15.3 \pm 2.7(-22)	(14-)19.9 \pm 2.7(-25)	(10-)14.8 \pm 2.6(-20)	(18-)21.3 \pm 2.4(-25)	(12-)19.5 \pm 3.7(-27)	(7-)12.9 \pm 2.4(-18)	(14-)17.5 \pm 2.2(-22)
Not spiny (0) or spiny (1)	0/1	1	1	0	0/1	1	1
middle bracts Length of basal spines (mm)	(0.4-)2 \pm 0.6(-10)	(2-)3.4 \pm 1.5(-9)	(1-)2.6 \pm 1.2(-6)	(0-)0.5 \pm 0.5(-1.3)	(0-)1.2 \pm 0.7(-3.5)	(0.3-)1 \pm 0.4(-3)	(0.8-)1.4 \pm 0.3(-2)
Length of middle spines (mm)	(0-)3.7 \pm 3(-11.5)	(2.5-)11.6 \pm 4.4(-20)	(2-)8.5 \pm 3.3(-14)	(0-)0.1 \pm 0.2(-0.7)	(0-)0.9 \pm 1(-4.7)	(0-)1.1 \pm 1.3(-5)	(0.6-)1.4 \pm 0.5(-2.8)
Number of lateral cilia (middle bracts)	(6-)15 \pm 3.6(-24)	(10-)18.2 \pm 3.9(-28)	(8-)14.3 \pm 3.2(-22)	(0-)12.3 \pm 6.3(-18)	(0-)11.2 \pm 6.3(-28)	(0-)6.8 \pm 3.4(-12)	(10-)12.9 \pm 2.7(18)
Length of lateral cilia (mm)	(0-)1.6 \pm 0.7 (-3.5)	(2-)3.5 \pm 0.6(-5)	(0.7-)2.1 \pm 0.6(-3)	(0-)0.3 \pm 0.4(-1)	(0-)0.4 \pm 0.3(-1)	(0-)0.4 \pm 0.3(-1)	(0.7-)1.4 \pm 0.4(-2)
Flower lobe length (mm)	(5-)5.7 \pm 0.4(-6.3)	(4.2-)6 \pm 0.7(-7)	(4.5-)5.6 \pm 0.5(-6.5)	(5-)5.6 \pm 0.4(-6)	(4.8-)5.8 \pm 0.7(-7)	(4.4-)5.5 \pm 0.6(-6.5)	(4-)5 \pm 0.6(-6)
Flower large tube length (mm)	(3.4-)4.4 \pm 0.5(-5.3)	(5-)5.9 \pm 0.5(-7)	(4-)4.5 \pm 0.4(-5)	(4.8-)5.5 \pm 0.6(-6)	(3.5-)4.9 \pm 0.7(-5.8)	(4-)4.4 \pm 0.3(-5.2)	(3-)3.8 \pm 0.5(-4.5)
Flower narrow tube length (mm)	(9.5-)11.1 \pm 1.4(-14)	(9-)11.9 \pm 1.4(-14)	(6.2-)10.1 \pm 1.8(-14)	(10-)11.9 \pm 1(-13)	(9-)11 \pm 1.2(-12.5)	(10-)11.1 \pm 0.9(-12.5)	(7.6-)9.9 \pm 1.3(-12.5)
Achene length (mm)	(3.5-)4.3 \pm 0.4(-5)	(3.5-)4.4 \pm 0.5(-5.5)	(4-)4.3 \pm 0.3(-5)	(3.4-)4.4 \pm 0.6(-5.5)	(3.2-)4.7 \pm 0.5(-5.7)	(3.7-)4.5 \pm 0.6(-5.4)	(4-)4.5 \pm 0.4(-5.5)
width (mm)	(1.2-)1.8 \pm 0.2(-2.7)	(1.8-)2.1 \pm 0.2(-2.5)	(1.6-)2 \pm 0.2(-2.3)	(1.6-)2.2 \pm 0.3(-2.8)	(1.6-)2.2 \pm 0.2(-2.8)	(1.6-)2 \pm 0.2(-2.5)	(1.6-)1.9 \pm 0.2(-2.3)
Pappus length (mm)	(0.4-)1.4 \pm 0.5(-2.7)	(0.4-)1.4 \pm 0.7(-3)	(0.6-)1 \pm 0.2(-1.5)	(5.5-)6.7 \pm 1.1(-8.1)	(2.8-)4.7 \pm 0.6(-6)	(2-)3.1 \pm 0.5(-4)	(4-)5.5 \pm 0.7(-6.4)
Length/width of the achene	(1.7-)2.4 \pm 0.3(-3.4)	(1.6-)2 \pm 0.3(-2.7)	(1.8-)2.2 \pm 0.2(-3)	(1.5-)2 \pm 0.3(-2.5)	(1.6-)2.1 \pm 0.2(-2.9)	(1.7-)2.2 \pm 0.3(-2.9)	(1.7-)2.4 \pm 0.5(-3.4)
Achene length/pappus length	(1.7-)3.5 \pm 1.6(-10.5)	(1.3-)4.3 \pm 3.1(-12.5)	(2.8-)4.6 \pm 0.8(-7)	(0.5-)0.6 \pm 0.2(-0.9)	(0.8-)1 \pm 0.1(-1.6)	(1.1-)1.5 \pm 0.2(-2.2)	(0.6-)0.8 \pm 0.1(-1.1)

a = Fiamignano (central Italy); b = Valle del Salto (central Italy); c = Gole di Popoli (central Italy); d = Apuan Alps (central Italy); e = Pizzoli (central Italy); f = Mt. Ferrato (central Italy); g = Biokovo (S Dalmatia, Croatia); h = Velebit Mts. (N Dalmatia, Croatia); i = Rupa (N Dalmatia, Croatia); j = Podpec (Slovenia); k = Cellina (NE Italy); l = Materja (Slovenia); m = Campo Giove (central Italy); n = Gole del Furlo (central Italy); o = Gran Sasso (central Italy); p = Mt. Cetona (central Italy); q = Mt. Petrella (central Italy); r = Mt. Sant'Angelo (central Italy); s = Mt. Spaccato (NE Italy); t = Mt. Subasio (central Italy); u = Mt. Vettore (central Italy); v = Piobbico (central Italy); w = Vivaro-Rauscedo (NE Italy); x = Lama dei Peligni (central Italy); y = Trieste (NE Italy); z = Villa Santa Lucia (central Italy).

Results

The analysis of morphological features (Table 1) identified seven taxa in Italy and the northern part of the Balkan Peninsula. The length of the pappus, the achene size, the achene length/pappus length ratio, flower large tube length and its habitus (flower heads with long aphyllous peduncles or leafy and short peduncles) were the best characters for recognizing the taxa. The length of leaf segments was significant and did not always depend on environmental factors. The size of the flower heads was variable and depended on the year. The morphology of the involucre bracts was also variable and difficult to describe, so they were not investigated. The presence of spines on the involucre bracts may be important for distinguishing some taxa even though the length varied. Hairiness often depended on the period in which the plant was observed.

The analysis of the achenes enabled samples with similar features but different geographic origins to be divided into seven groups:

Group 1. *Centaurea rupestris*: localities a, b, i, l and s.

Group 2. *Centaurea arachnoidea* subsp. *arachnoidea*: locality d.

Group 3. *Centaurea arachnoidea* subsp. *adonidifolia*: localities e, n, q, t, u, v, p, j and y.

Group 4. *Centaurea arachnoidea* subsp. *montis-*

ferrati: locality f.

Group 5. *Centaurea dichroantha*: localities k and w.

Group 6. *Centaurea ceratophylla* subsp. *ceratophylla*: localities c, m, r, x and z.

Group 7. *Centaurea ceratophylla* subsp. *danielae*: locality g.

The micromorphological characters shown in Figs. 1–6 are summarized in Tables 2 and 3. The terminology used to describe the epidermal cells of the achene is based on that used by Pichi Sermolli (1986) for description of the spore. The terminology for the bristles is based on Cassini (1826).

Regarding the hilum characters (Figs. 3 and 4), we considered the rim of the hilum formed by the crossing of two segments. The angle and the proportion between these two segments were analyzed. The rim of the hilum region is sometimes angular, sometimes arched.

The pappus, depending on the origin, is 1/6 to 6/5 of the seed length and is formed by flattened bristles, with a ribbon or scale shape, often of different lengths, never with entire margins. Regarding the bristles (Fig. 5) there are differences in the shape and in the length of the short stiff hairs on the margin. The pappus in proximal view (Fig. 6) presents an external crown formed by one or two rows of different length bristles. Inside this crown there are scale-like bristles laid down over each other, or arranged in a suberect-connivent way, or forming a central tuft. Interpretation of the bristles on the hilum is difficult, because they are caducous.

Taxonomic treatment

Centaurea rupestris L. (Fig. 7)

Sp. Pl., ed. 2: 1298. 1763. — LECTOTYPE (designated by Baldini 2007): [icon] "*Iacea montana lutea min: tenuifol:*" in Colonna, Ekphr.: 35. 1616. — EPITYPE (designated here): Lazio, Fiamignano (Rieti), Monte Sant'Angelo, near ruderal environments, pastures with outcropped calcareous stone, 1300–1310 m a.s.l., 29.VI.1997 *Moraldo* (APP!; isoeotype FI!).

Centaurea variabilis Bartl., in Bartl & H. Wendl., Beitr. Bot. ii. 114. 1825.

Centaurea rupestris var. *aculeosa* DC., Prodr. 6: 393.

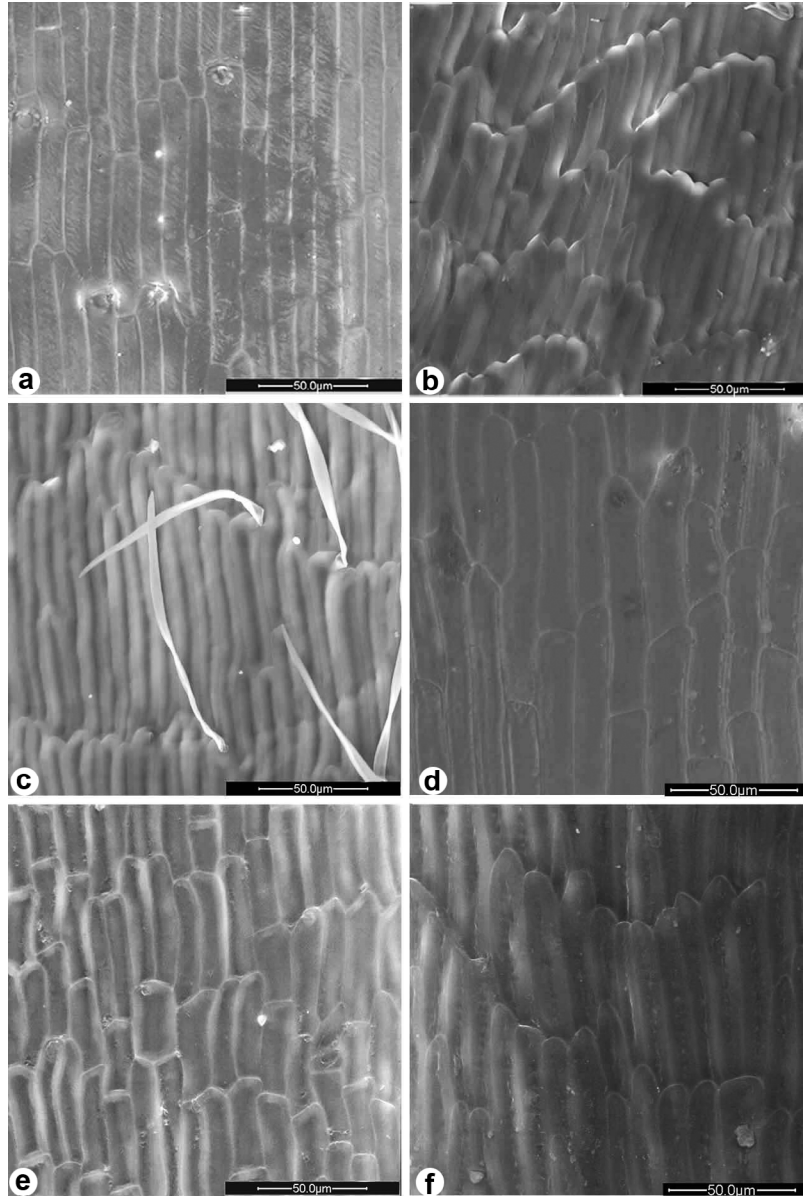


Fig. 1. Achene epidermis.
 — **a:** Group 1, location a. — **b:** Group 2, location d.
 — **c:** Group 3, location e. — **d:** Group 3, location y.
 — **e:** Group 4, location f. — **f:** Group 5, location w.
 For location codes see Material and methods.

1838. — LECTOTYPE (designated here): *Centaurea rupestris* ?, ad (?) *Collina*, Ex (?) Carniolia, *Moricand* 1813 (G-DC!).

Centaurea rupestris var. *armata* Koch, *Syn. fl. germ. helv.*, ed. 2(2): 474. 1844.

Centaurea rupestris subsp. *aculeata* Arcang., *Comp. Fl. Ital.*: 393. 1882.

? *Acrocentron tenuifolium* Cass., *Dict. Sci. Nat.*, ed. 2. [F. Cuvier] 50: 254. 1827

Perennial herb. Stems 5–70 cm, erect, simple or more frequently branched from base, usually

without leaves above; in smaller individuals few leaves occur also in upper part of stems. Leaves sublanate to glabrescent, 1–2 pinnatisect cauline, 2 pinnatisect basal; lateral segments similar to terminal one, oblong lanceolate to linear, 4–30 × 1–5 mm in basal leaves, (5–)9.6–28(–31) × (0.7–)1–1.5(–2.5) mm in middle leaves, acute. Capitula long pedunculate. Involucre (14–)16–21.7(–24) × (10–)12–18.7(–22) mm. Appendages of basal bracts with apical spine (0.4–)1.5–3(–10) mm,

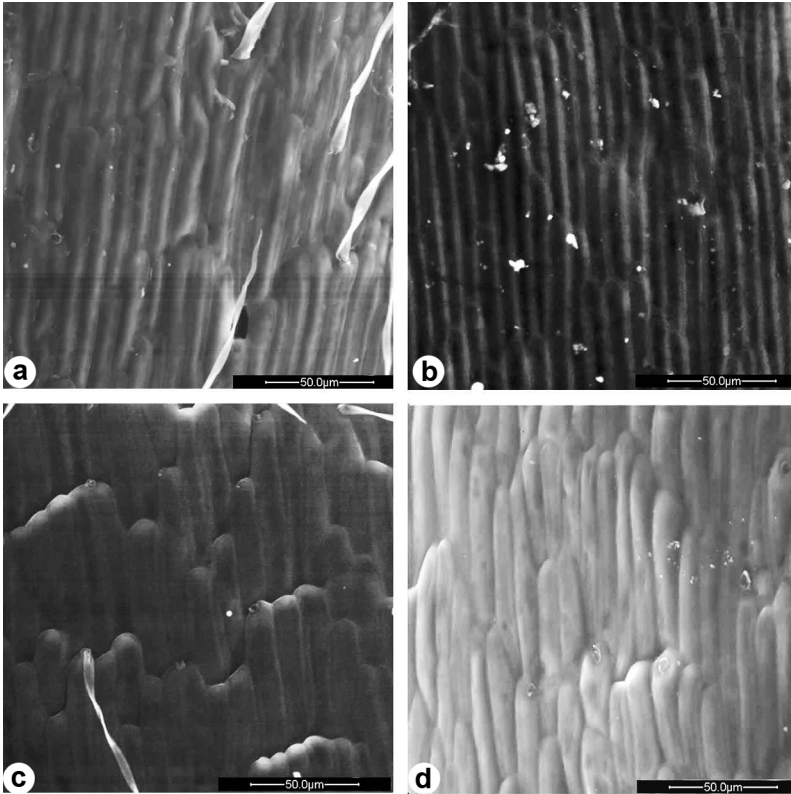


Fig. 2. Achene epidermis: — **a:** Group 5, location k. — **b:** Group 6, location r. — **c:** Group 6, location x. — **d:** Group 7, location g. For location codes see Material and methods.

middle bracts with apical spine (0–)1–7(–11.5) mm and with (6–)10–19(–24) lateral cilia (0–)0.7–2.6(–3.5) mm long. Florets yellow, lobes (5–)5.2–6(–6.3) mm long, large tube (3.4–)4–5(–5.3) mm long, narrow tube (9.5–)10–13.5(–14) mm long. Achenes (3.5–)3.8–5 × (1.2–)1.5–2.1(–2.7) mm; pappus (0.4–)0.8–2.1(–2.7) mm.

CHROMOSOME NUMBER: $2n = 20$ from ex-Yugoslavia (Gardou 1969, Nilsson & Lassen 1971, Van Loon & Kieft 1980, Lovrić 1982), $2n = 20 + 4-6Bs$ (Lovka & Susnik 1973). Gardou's count on samples from the surroundings of Trieste could represent *C. arachnoidea* subsp. *adonidifolia*.

HABITAT: Dry grasslands and rocky places on limestone.

DISTRIBUTION: Lazio and Abruzzo (Terminillo, Torrecane, Fiamignano, lowest slopes of Mt. Duchessa and Mt. Velino), Friuli-Venezia Giulia (Italian Carso), Slovenia, NW Croatia up to Velebit Mts. (Fig. 1). Erroneously recorded in Albania (Cecchi *et al.* 2007); after a revision of the specimens by one of us (FC) the new finding was attributed to *C. salonitana*.

NOTES: The lectotype was designated by Baldini (2007). We found the species in the locality mentioned by Colonna (1616): “*prope D. Angeli dirutum ibi templum, supra villam Flaminianum*” (“Monte Sant’Angelo above Fiamignano, close to the ancient ruin on which stood a little church consecrated to Sant’Angelo”; nowadays consecrated to Alpino’s Virgin Mary). It must be noted that the achene represented in Colonna’s illustration, which has been indicated as the lectotype, shows, because of an inaccurate illustration, the pappus as being longer than the body of the achene. In fact all of the specimens observed by us in the *locus classicus* had a shorter pappus. In order to ensure the unambiguous application of this name, an epitype with ripe achenes from Monte Sant’Angelo is designated here.

In the *locus classicus* the plants are smaller, probably because of an adaptation to the altitude, and have larger flower heads and achenes than specimens from the slopes of Mt. Duchessa. In Friuli-Venezia Giulia, Slovenia and Croatia,

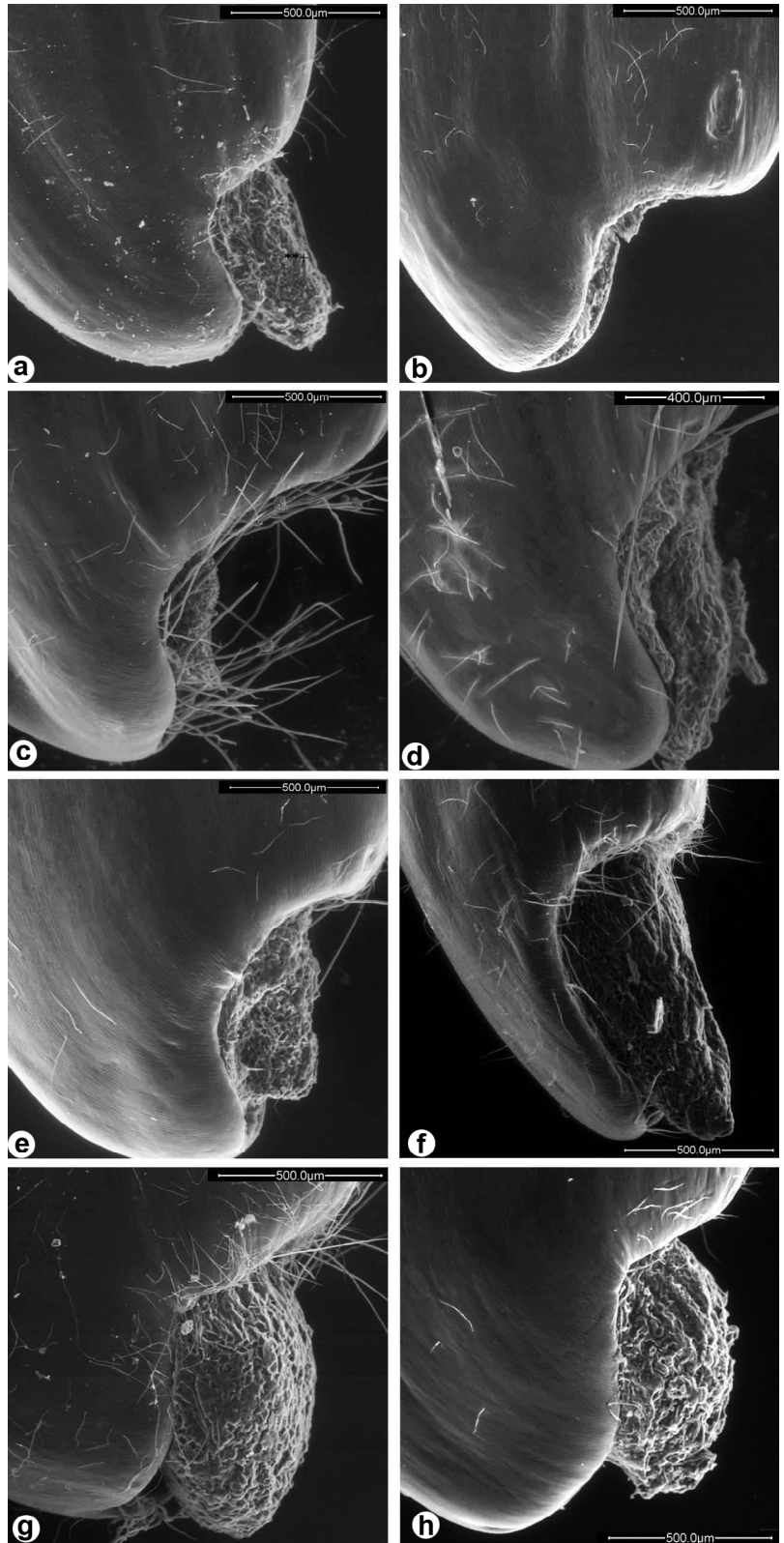


Fig. 3. Hilum in lateral view: — **a**: Group 1, location a. — **b**: Group 2, location d. — **c**: Group 3, location t. — **d**: Group 3, location y. — **e**: Group 4, location f. — **f**: Group 5, location w. — **g**: Group 6, location x. — **h**: Group 7, location g. For location codes see Material and methods.

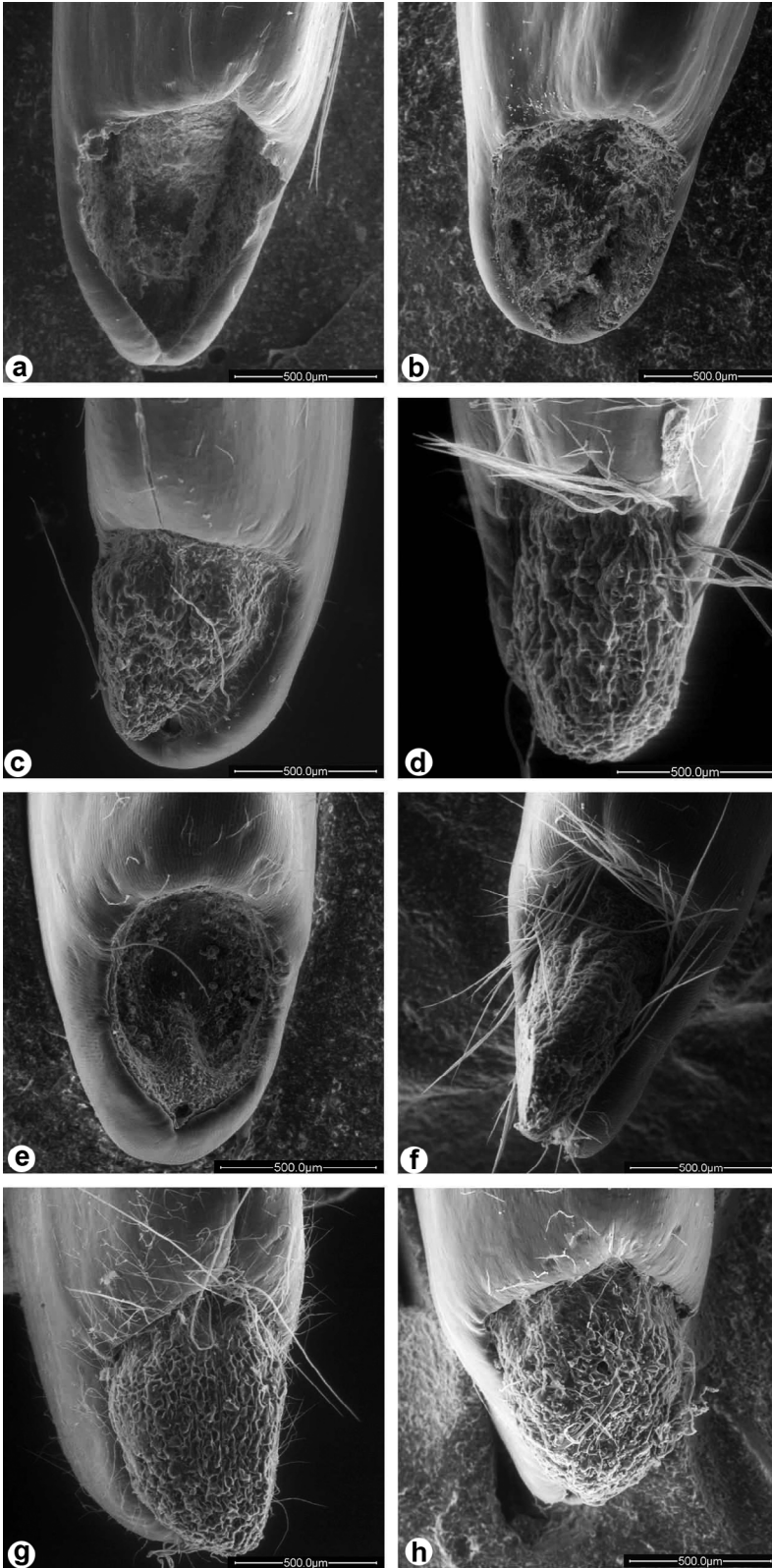


Fig. 4. Hilum in frontal view: — **a:** Group 1, location a. — **b:** Group 2, location d. — **c:** Group 3, location v. — **d:** Group 3, location y. — **e:** Group 4, location f. — **f:** Group 5, location w. — **g:** Group 6, location x. — **h:** Group 7, location g. For location codes see Material and methods.

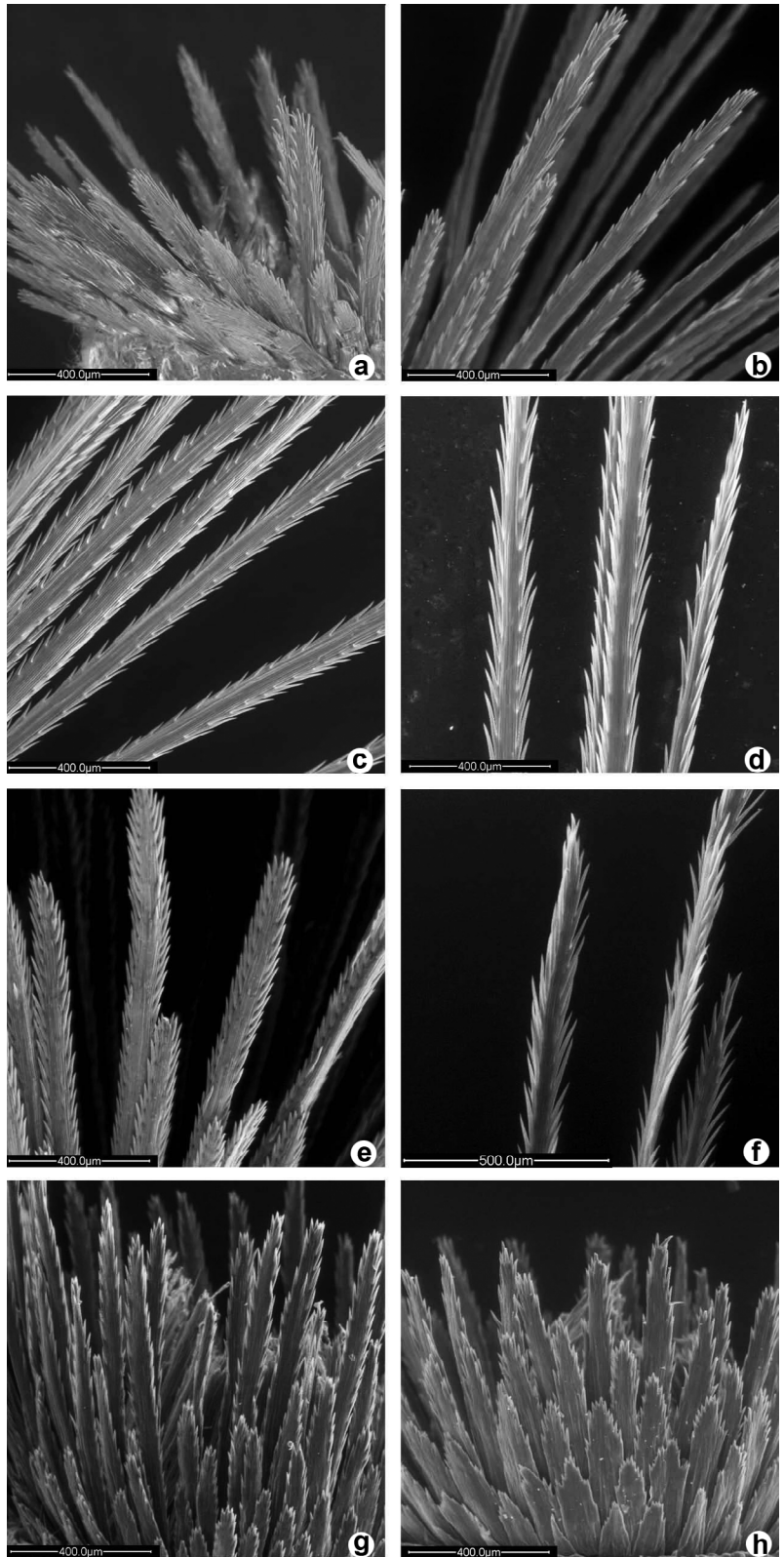


Fig. 5. Pappus bristles:
 — **a:** Group 1, location a. — **b:** Group 1, location l. — **c:** Group 2, location y. — **d:** Group 3, location y. — **e:** Group 4, location f. — **f:** Group 5, location w. — **g:** Group 6, location x. — **h:** Group 7, location g. For location codes see Material and methods.

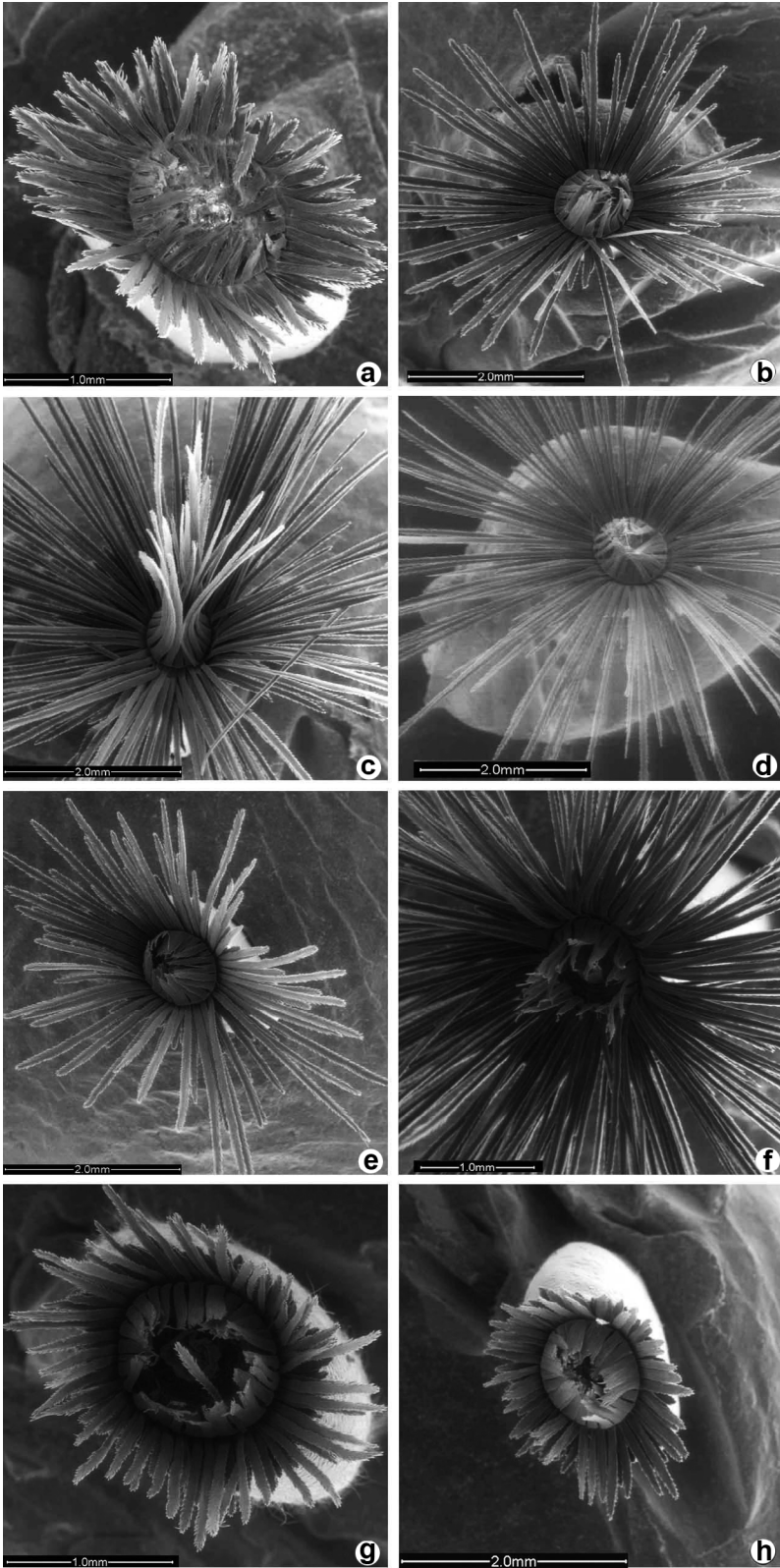


Fig. 6. Pappus in proximal view: — **a:** Group 1, location a. — **b:** Group 1, location l. — **c:** Group 2, location d. — **d:** Group 3, location y. — **e:** Group 4, location f. — **f:** Group 5, location w. — **g:** Group 6, location x. — **h:** Group 7, location g. For location codes see Material and methods.

Table 2. Micromorphological characters. ¹ samples from location y; ² samples from location r. For location codes see Material and methods.

	Group 1 <i>C. rupestris</i>	Group 2 <i>C. arachnoidea</i> ssp. <i>arachnoidea</i>	Group 3 <i>C. arachnoidea</i> ssp. <i>adonidifolia</i>	Group 4 <i>C. arachnoidea</i> ssp. <i>montis-ferrati</i>	Group 5 <i>C. dichroantha</i>	Group 6 <i>C. ceratophylla</i> ssp. <i>ceratophylla</i>	Group 7 <i>C. ceratophylla</i> ssp. <i>danielae</i>
Seed epidermis							
Type of surface	netlike, reticulum borders prominent	ectovermiculate cells with straight edge	reticulum (netlike ¹)	reticulum, borders prominent-swollen	rectangular slightly ectovermiculate cells	reticulum (reticulum/ectovermiculate cells ²)	straight, botulinum
Cell shape	stretched cells, more or less rectangular sometimes trapezoidal	rectangular	rectangular, straight ectovermiculate edges (rectangular or trapezoidal cells ¹)	rectangular cells disorderly placed	rectangular slightly ectovermiculate cells	cells have straight edges longitudinally joint together	straight, botulinum shape cells
Cells in tile plates	no	yes	yes	no	yes	yes	no
Cell size (μm)	35–140 × 8–15	50–75 × 8–10	55–135 × 9–16 (45–110 × 9–20 ¹)	30–65 × 9–18	30–170 × 7–18	40–105 × 12–16	45–95 × 8–12.5
Pappus bristles							
Adaxial face	concave	concave	concave	canaliculated	canaliculated linear,	concave	concave
Shape	linear thin, ribbon- or scale-shaped unequal in lengths	linear, sub-equal in length	linear long, with slightly rounded tip irregularly barbellate margins	linear, on average long, unequal in length with rounded–apiculate apex	on average long, equal in length with rounded–apiculate apex	linear, short, ribbon- or scale-shaped, variable in length, spatula-like apex, irregularly dentate	very short, unequal in length, with rounded, oblancoolate apex
Stiff hairs	short, thorn-shaped with hyaline tips, relatively close together, slightly wide apart and rarely overlapping	short, more or less as long as their sinus, slightly diverging with thorn-shaped tips	short, overlap each other for 1/4. Tip hyaline thorn-shaped, diverging in the terminal part	lacinate, erect, tight to the margin, overlapping for 3/4 of the length	short, ending with a diverging, hyaline, thorn-shaped tip	short, slightly wide apart, ending in hyaline thorn-like tip	present only in the upper part of the bristles: irregular thorn-like, short
Pappus							
Disc size (mm)	0.7 × 1	0.7 × 0.8	0.8 × 1.2	0.8 × 0.9	0.8 × 1.1	0.9 × 1.15	0.9 × 0.05
Ray bristles	erect-patent	erect-patent	erect-patent	suberect-divergent	erect-patent	suberect, slightly wide apart at the apex	suberect ray bristles
Central bristles	subcoricate to suberect-connivent	often long, erect, assembled in a whorl	suberect-connivent	suberect-connivent	suberect-connivent	coricate	suberect-connivent

Table 3. Micromorphological characters of hilum. ⁽¹⁾ refers to the samples from Slovenia (locations j and l); ⁽²⁾ refers to the samples of Piobbico and Mt. Cetona (locations p and v). For location codes see Material and methods.

	Group 1 <i>C. rupestris</i>	Group 2 <i>C. arachnoidea</i> ssp. <i>arachnoidea</i>	Group 3 <i>C. arachnoidea</i> ssp. <i>adonidifolia</i>	Group 4 <i>C. arachnoidea</i> ssp. <i>montis-ferrati</i>	Group 5 <i>C. dichroantha</i>	Group 6 <i>C. ceratophylla</i> ssp. <i>ceratophylla</i>	Group 7 <i>C. ceratophylla</i> ssp. <i>daniellae</i>
Angle in lateral view	slightly to markedly obtuse	slightly obtuse angle	right to obtuse to arched angle	markedly obtuse to arched angle	obtuse to arched angle	slightly to markedly obtuse angle	markedly obtuse to arched angle
Angle segments in lateral view	upper segment shorter than lower one	two equal segments	sub-equal segments, sometimes, upper shorter than lower one	–	–	upper segment shorter than lower one	upper segment shorter than lower one
Bristle hairs	often in tufts in the lower part	often in tufts in the upper part	occasionally present	occasionally present	present in the upper part	hairiness present	present
Strophiole	evident	scarcely delimited	well-rendered	small one	evident	evident	evident
Firm	entire to slightly eroded	minutely eroded	sporadically eroded	entire	entire	occasionally eroded	entire
Shape in frontal view	subtriangular, with convoluted edges and wavy upper edge	sub-triangular obovate-rounded	sub-triangular, with convoluted edges (ovate with wavy upper edge to form lines ¹ ; sub-obovate with slightly convoluted edges ²)	obovate shape	sub-triangular shape, with convoluted edges	trapezoidal shape, with or without slightly convoluted edges	sub-triangular shape with slightly convoluted edges
Lower and upper incisure	both present upper one not so evident	no	only lower one is evident (only basal one and not so evident ²)	no	lower one small, sometimes slight to evident	lower incisure present, with slight to evident	lower incisure present, upper incisure almost lacking
Groove	no	no	in the upper part (almost lacking ¹)	no	short groove in the upper part	short groove in the upper part	no

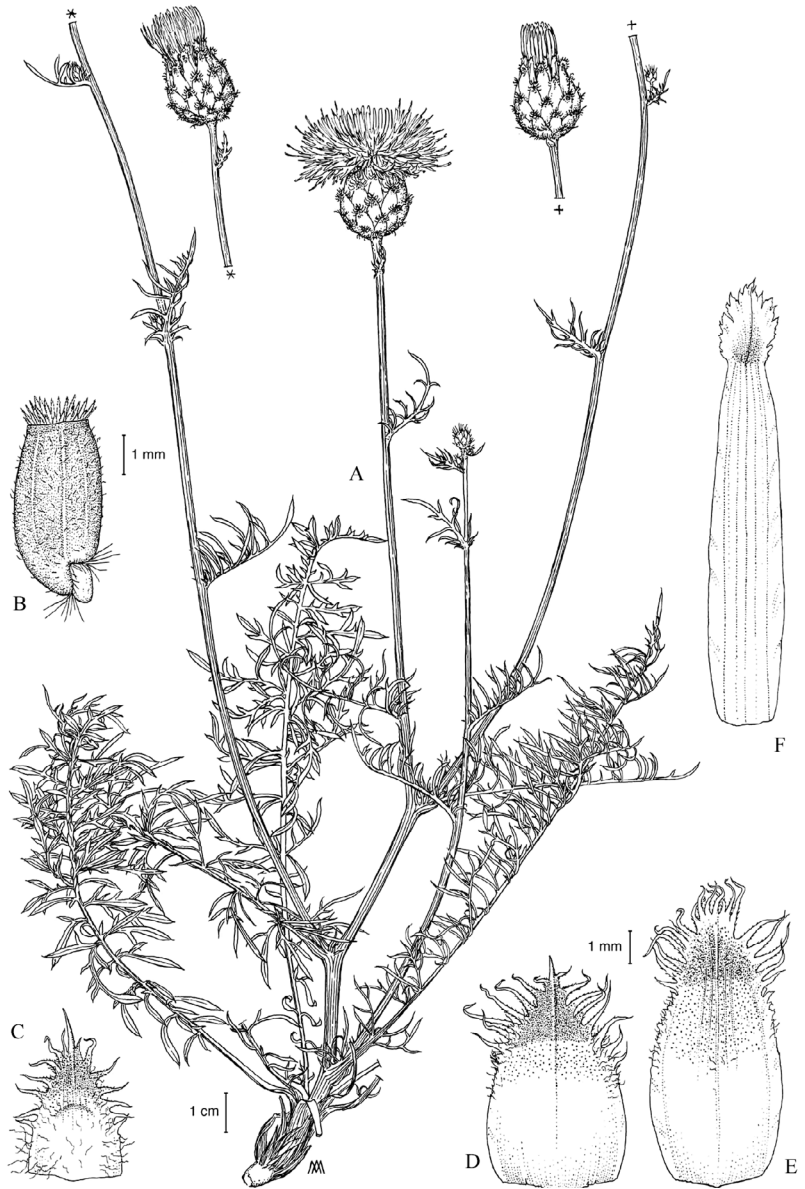


Fig. 7. *Centaurea rupestris* (drawn from the epitype). — **A:** Habit. — **B:** Achene. — **C:** Basal bract. — **D:** Middle-basal bract. — **E:** Middle-internal bract. — **F:** Internal bract.

there is much variability, which includes these two morphotypes.

The name *Acrocentron tenuifolium* was doubtfully considered a synonym of *C. rupestris* var. *aculeosa* by de Candolle (1838). It is based on an incomplete specimen without achenes or indication of the locality where it was collected. According to Cassini (1826) the specimen is in Herb. Gay, but despite searches we have not found it from there nor from any other herbaria.

Centaurea rupestris var. *inermis* Groves,

Nuovo Giorn. Bot. Ital. 19: 164. 1887. LECTOTYPE (designated here): *Centaurea rupestris* L. var. *inermis*, ad rupes Montis Serra prope Gallipoli, Japygia, 09.83, H. Groves (FI!). — NOTE: In our opinion this does not belong to the *C. rupestris* group but the incomplete specimen did not permit a certain determination. The only specimen we observed in FI is probably the one already noted by Fiori (1904). According that author it is not possible to give it a name, it is not *C. rupestris* but it should be placed in *C.* sect.

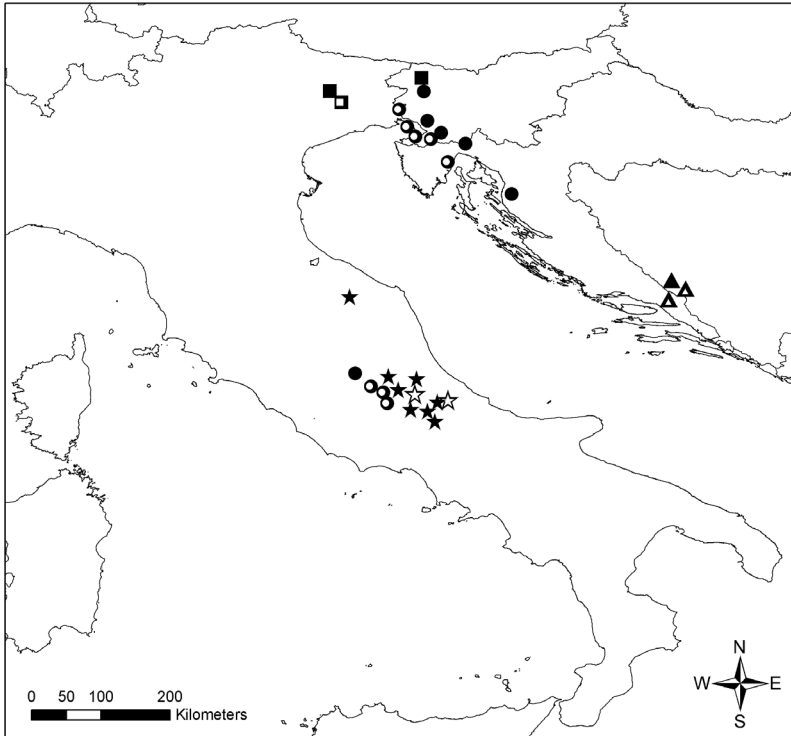


Fig. 8. ● *Centaurea rupestris*, ★ *C. ceratophylla* subsp. *ceratophylla*, ▲ *C. ceratophylla* subsp. *danie-lae*, ■ *C. dichroantha*. Empty symbols indicate localities of the specimens analyzed morphometrically.

centaurium close to *C. alpina* (Fiori 1904) or to *C. salonitana* (Fiori 1927, Pignatti 1982). We exclude that it could be attributed to *C. salonitana*, correctly not listed in the checklist of the Italian vascular flora (Conti et al. 2005).

We did not find original material for the name *C. variabilis* and on the basis of the description we consider it a synonym of *C. rupestris*.

Centaurea × *sordida* Willd., type in B! (<http://ww2.bgbm.org/herbarium/>; ImageId: 267432), was considered a recent hybrid of *C. rupestris* and *C. scabiosa* subsp. *fritschii* (Hayek) Hayek (Pavletić & Trinajstić 1983, Pavletić 1987). Other hybrids were observed along the Apennines: *C. arachnoidea* subsp. *adonidifolia* × *C. scabiosa* (Brilli-Cattarini 1968 as *C. rupestris* subsp. *rupestris* × *C. scabiosa* subsp. *scabiosa*) and *C. ceratophylla* subsp. *ceratophylla* × *C. scabiosa*.

SELECTED SPECIMENS EXAMINED: — **Italy.** Friuli-Venezia Giulia: Opicina, 14.VI.1964 S. Pignatti (TSB); Ferneti, 17.VI.1968 S. Pignatti (TSB); Cattinara (Trieste), 19.VI.1972 G. Mortin, det. L. Chiappella Feoli, 6935 Soc. Ech. pl. vasc. Europ. et Bass. Médit. (TSB); Pesek, S. Dorigo della Valle (TS), 31.V.2001 F. Conti & L. Gubellini (APP); M. Sabotino, S. Mauro (Gorizia), 12.VII.2006 F.

Conti & A. Manzi (APP). Lazio: loc. Cesa Lunga, sopra Città Ducale (RI), 7.VII.1998 A. Scoppola (UTV); Vallone della Ruana, Borgorose (RI), 9.VI.2006 F. Conti (APP); Valle del Salto, dall'uscita dall'autostrada 2 km verso la riserva della Duchessa, F. Conti (APP); tra S. Anatolia e Torano (RI), 8.VIII.2004 F. Conti & D. Tinti (APP). Abruzzo: Marano dei Marsi (lungo l'A25), 13.VII.1986 B. Moraldo (APP). — **Slovenia.** M. Caven (Nova Gorica), 8.VII.1966 G. Skof (TSB); Regio carstica Tergestina, 7.VII.1981 F. Cernoch 38874 Soc. Ech. pl. vasc. Europ. et Bass. Médit. (TSB); Sesana, 14.VIII.1959 L. Poldini (TSB, as *C. rupestris* var. *armata*); presso Razdrto (Prevallo), 25.VIII.1979 D. Marchetti (APP); sopra Golac, 31.V.2001 F. Conti & L. Gubellini (APP); Materja, 23.VII.2002 F. Conti, L. Gubellini & D. Tinti (APP); Herpelle-Kozina, 11.VII.2006 F. Conti, A. Manzi & A. Pezzetta (APP). — **Croatia.** Monte Obruč (Istria), 22.VII.1969 G. Cristofolini (TSB); A 7 km à l'W de Lovran (Yougoslavie, Istrie), 10.VIII.1971 P. Van der Veken, 9686 Soc. Ech. pl. vasc. Europ. et Bass. Médit. (TSB); M. Maggiore presso la fontana di Giuseppe II, 11.VII.2006 F. Conti, A. Manzi & A. Pezzetta (APP); Istria, Lanisce, 11.VII.2006 F. Conti, A. Manzi & A. Pezzetta (APP); Velebit, tra Krasno Polje e Oltari, 24.VII.2002 F. Conti, L. Gubellini & D. Tinti (APP).

Centaurea ceratophylla Ten. (Fig. 9)

Fl. Napol. Prodr. 1(1): LI–LII. 1812. — LECTOTYPE (designated here): Italy. Valle di S. Spirito, Tenore (FI!). — *Centaurea rupestris* L. subsp. *ceratophylla* (Ten.) Gugler, Ann.

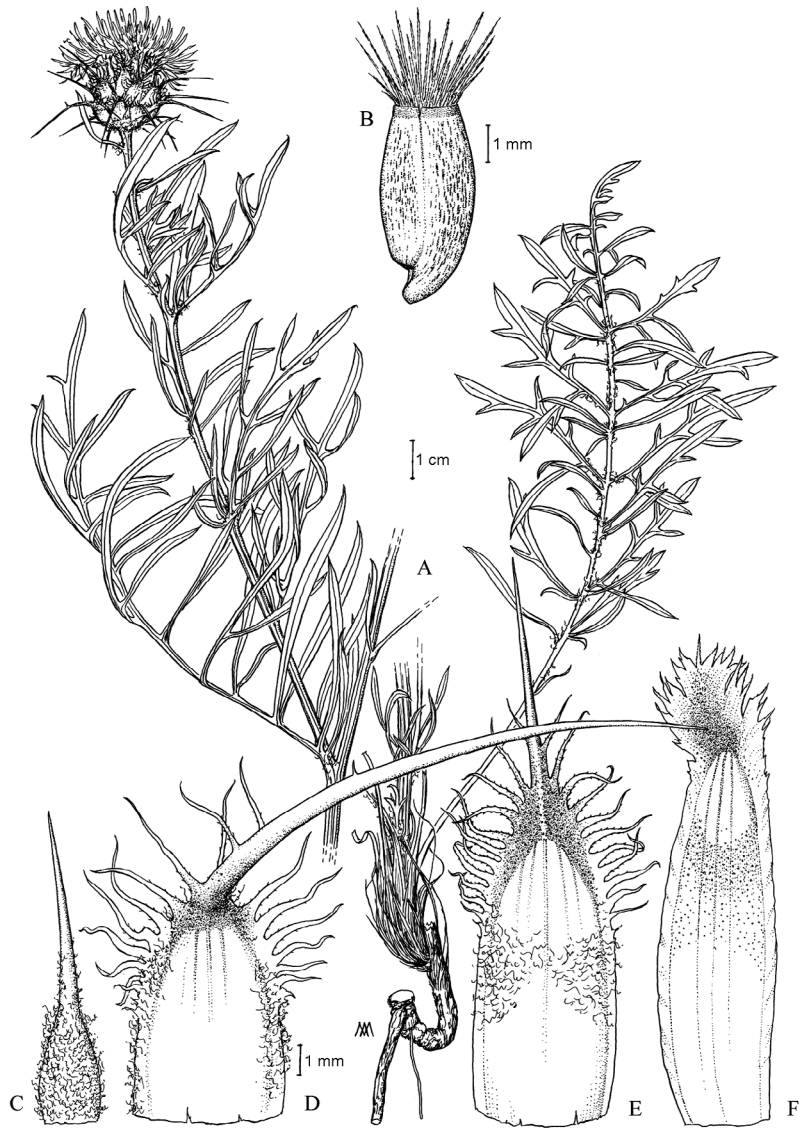


Fig. 9. *Centaurea ceratophylla* subsp. *ceratophylla* (drawn from a specimen collected on Mt. Morrone by F. Conti, APP). — **A:** Habit. — **B:** Achene. — **C:** Basal bract. — **D:** Middle-basal bract. — **E:** Middle-internal bract. — **F:** Internal bract.

Hist.-Nat. Mus. Natl. Hung. 6: 194. 1908. — *Colymbada ceratophylla* (Ten.) Holub, Folia Geobot. Phytotax. 7(3): 315 (1972). — *Colymbada rupestris* L. subsp. *ceratophylla* (Ten.) Banfi, Galasso & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano 146(2): 224. 2005.

Centaurea ceratophylla subsp. *pumila* (Ten.) Arcang. p.p., Comp. Fl. Ital.: 393. 1882.

? *Centaurea eriophylla* Spreng., Syst. veg. ed. 16, 3: 404. 1826.

Perennial herb. Stems erect or straight, 5–70 cm, simple or more frequently branched from base, leafy above. Leaves sublanate to glabrescent, 1–2 pinnatisect cauline, 2 pinnatisect basal;

lateral segments similar to terminal one, oblong lanceolate, 7–30 × 3–6 mm in basal leaves, (8–)14.2–33.4(–55) × (1.2–)2–4.2(–7) mm in middle leaves, acute. Capitula short pedunculate or sessile. Involucre (18–)19–25(–26) × (14–)16–24(–25) mm. Appendages of basal bracts undivided with apical spine 2–5(–9) mm, middle bracts with apical spine (2.5–)5.4–18(–20) mm and with (10–)14–23(–28) lateral fimbriae (2–)3–4(–5) mm long. Internal bracts linear with enlarged, irregularly toothed apex. Florets yellow, lobes (4.2–)5.4–7 mm long, large tube 5–6.5(–7) mm long, narrow tube (9–)11–14 mm long. Achenes

(3.5–)3.7–5(–5.5) × (1.8–)2–2.4(–2.5) mm; pappus (0.4–)0.5–2(–3) mm.

CHROMOSOME NUMBER: $2n = 20$ (Chichiriccò *et al.* 1980 from the surroundings of Popoli). Lovrić (1982) indicates $2n = 20$ from Velebit Mts.

HABITAT: Rock crevices and stony slopes on limestone.

DISTRIBUTION: Endemic to central Apennines: Marche (Mt. Catria, Mt. Acuto), Abruzzo (common) and Lazio (Val di Teve) (Fig. 8). In Velebit Mts., a population with many characters of *C. ceratophylla* occurs. It differs from *C. ceratophylla s. stricto* and *C. ceratophylla* subsp. *danielae* as well, and may deserve an independent status, but this needs further study.

NOTES: Tenore (1812) described *Centaurea ceratophylla* for the first time and as was his practice, he did not cite any collection locality. The first time that he provided a locality was when he wrote: *prope Sacellum S. Spirito* in his Synopsis (Tenore 1815).

In Tenore (1812), the synonymy with the Colonna polynomial is doubtful and two varieties are reported: var. *calycibus subinermibus, floribus luteis* and var. *calycinis spinis validis, floribus ochroleucis*. Subsequently Tenore (1820) distinguished: var. A “*Spinis validioribus, floribus luteis*”; var. B “*Calycibus subinermis, floribus luteis*”, to which the Colonna polynomial was doubtfully synonymized, i.e. *Centaurea rupestris*; and var. C “*Spinis validioribus, floris croceis*”; he specified that: “*Tutte le varietà le ho raccolte alla Maiella, lungo le siepi presso l'Eremo di S. Spirito; fioriscono in luglio; sono perenni*”.

Studies on exsiccata of *Centaurea ceratophylla* collected in this locality and stored in several herbaria have not provided confirmation, except for one specimen conserved in the Florence Herbarium (FI-HCI). The sheet, which is missing a label and reference marks, has pinholes, and it was supposedly attached to the original label or to another sheet with a label. It is marked, on the right bottom corner, by the number 1 (one) written in ink; this number corresponds to a note from the time, “*Majella, vallone di S. Spirito (Tenore 1844)*”, reported in the internal page of the folder containing the sheet. The transcription of the locality was written, certainly, by an amanuensis when the sample was inserted in the herbarium,

as indicated by a signature of Tenore accompanying the material; the inscription “(Tenore 1844)”, rather than indicating the collector’s name and the collection data, may indicate the donor’s name and the date of access to the museum. In fact, it is plausible that the same specimen, like many others, was given, at that time by Tenore to his friend and colleague Filippo Parlatore.

The name *Centaurea eriophylla* was doubtfully considered a synonym of *C. ceratophylla* by de Candolle (1838). We did not manage to find the original material.

SELECTED SPECIMENS EXAMINED: — **Italy.** Marche: Gruppo del M. Catria, 31.V.1969 A. Brilli-Cattarini, R. Sialm & F. Tschudi (PESA, as *C. rupestris* subsp. *rupestris*); Gruppo del M. Catria, 20.VII.1983 A. Brilli-Cattarini & L. Gubellini (PESA); M. Acuto (Pesaro-Urbino), 1.IX.2004 M. Allegranza, 18089 (ANC, as *C. rupestris*). Lazio: Vallone di Teve (Bocca di Teve), 9.VI.2006 F. Conti (APP). Abruzzo: Velino, s.d., M. Tenore (NAP); Gole di Celano (L’Aquila), 9.VII.1997 F. Conti (APP); Fondo della Salsa, Castelli (Teramo), 28.VII.2004 F. Conti (APP); Colle Macchie, Arschia (L’Aquila), 28.V.2003 F. Conti & F. Bartolucci (APP); M. Offermo, Acciano (L’Aquila), 21.IV.2007 F. Conti (APP); Vallicella, Barisciano (L’Aquila), 16.VI.2003 I. Londrillo (APP); M. della Selva, Barisciano (L’Aquila), 7.VII.2005 S. Torcoletti & G. Santoni (APP); presso S. Stefano di Sessanio (L’Aquila), 29.VI.2002 F. Conti *et al.* (APP); Rocca Calascio (L’Aquila), 23.VII.1999 F. Conti, D. Lakusic & Ph. Küpfer (APP); Castelvechio Calvisio (L’Aquila), 19.VI.1997 A. Manzi (APP); Ofena (L’Aquila), loc. Le Vigne, 2.IV.2006 F. Conti (APP); presso Capestrano (L’Aquila), 13.V.2000 F. Conti (APP); M. Capo di Serre, Villa Santa Lucia (L’Aquila) 21.VI.2005, F. Conti *et al.* (APP); Gole di Popoli verso Bussi (Pescara), 13.VII.1986 B. Moraldo (APP); Gole di Popoli, Castiglione a Casauria (Pescara), 17.VI.2005 F. Conti (APP); Villetta Barrea salendo verso il Lago di Scanno, 10.VII.1986 B. Moraldo & W. Rossi (APP); Gole del Sagittario, tra Anversa degli Abruzzi e Pizzo Marcello (L’Aquila), 17.VI.1997 F. Conti (APP); Gole di S. Venanzio, Molina Aterno (L’Aquila), 22.VIII.2005 F. Conti (APP); presso Castelvechio Subequo (L’Aquila), 19.VII.2007 F. Conti & K. Cianfaglione (APP); Morrone presso l’Eremo di S. Onofrio (sopra Badia) Sulmona (L’Aquila), 19.IV.1988 F. Conti (APP); Morrone di Pacentro, lungo la strada tra Passo S. Leonardo e Pacentro (L’Aquila), 18.VI.2003 F. Conti *et al.* (APP); Monte Porrara, Palena (Chieti), 20.VI.2003 F. Conti *et al.* (APP); Valle di Selva Romana, Pennapiedimonte (Chieti), 1.VIII.2002 F. Conti (APP); da Lama dei Peligni al Rifugio di Fonte Tari (Chieti), 22.VII.1995 F. Conti (APP); Vallone di Izzo, Palena-Lettopalena (Chieti), 21.VI.2004 A. Di Renzo (APP); presso Bisegna (L’Aquila), 4.VI.1997 F. Conti (APP); Gioia Vecchio (L’Aquila), Fosso Macrana, 28.V.1995 F. Conti (APP); Serra Lunga, sopra Civita d’Antino (L’Aquila), 29.VII.1997 F. Conti (APP).

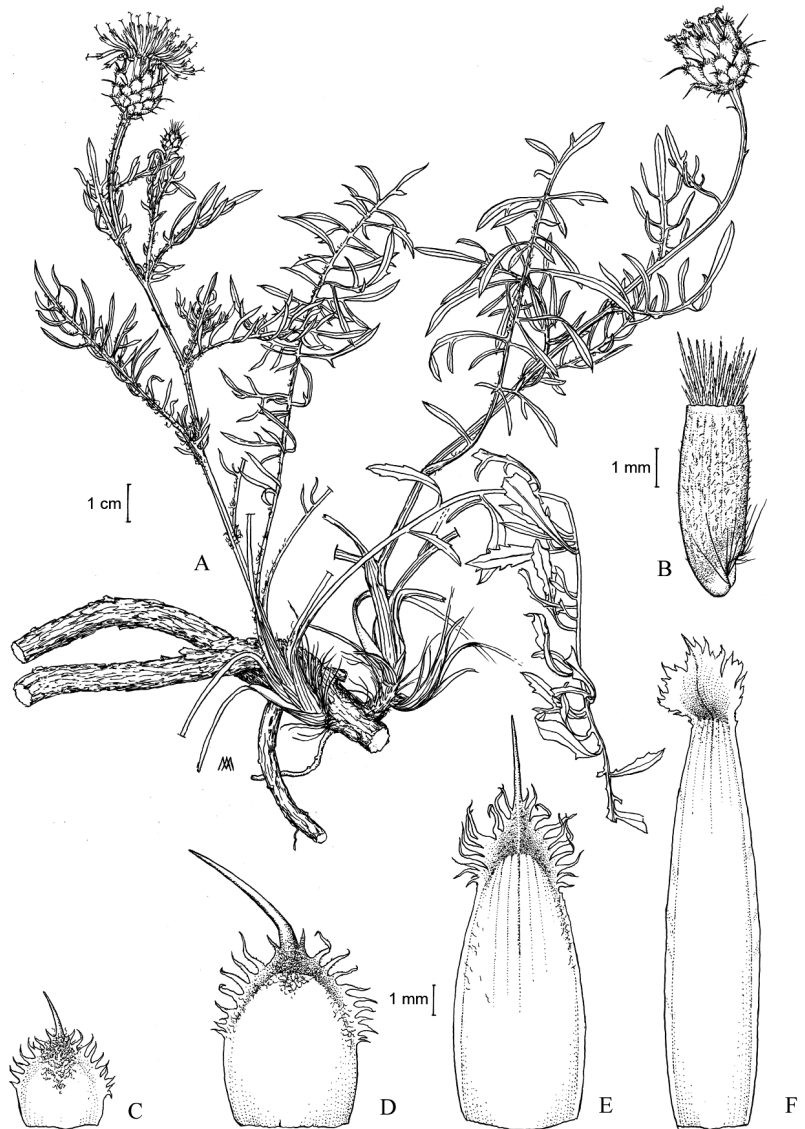


Fig. 10. *Centaurea ceratophylla* subsp. *danielae* (drawn from a specimen collected on Mt. Zavelim by F. Conti, APP). — **A:** Habit. — **B:** Achene. — **C:** Basal bract. — **D:** Middle-basal bract. — **E:** Middle-internal bract. — **F:** Internal bract.

Centaurea ceratophylla* subsp. *danielae
 F. Conti, Moraldo & Ricceri, *subsp. nova*
 (Fig. 10)

A C. ceratophylla caulibus arcuato-erectis, diametro involucri 2 cm, squamis involucri ciliis (1.5–)1.9–3 mm longis, differt.

HOLOTYPE: Croatia. Biokovo on the road from Makarska to Sv. Jure, Makarska (Hrvatska), ca. 1000 m a.s.l., stony calcareous pastures, 22.VII.2001 F. Conti, M.E. Solic & D. Tinti 7842 (APP!; isotype: same locality and collectors, 7839, FI!).

ETYMOLOGY: Dedicated to Daniela Tinti, a botanist at the

Centro Ricerche Floristiche dell'Appennino and a faithful partner of the author Conti in botanic research and in life.

Perennial herb. Stems arcuate ascending, 10–35 cm, branched from base, leafy above. Leaves sublanate to glabrescent, 1–2 pinnatisect cauline, 2 pinnatisect basal; lateral segments similar to terminal one, oblong lanceolate, 10–30 × 2–6 mm in basal leaves, (6–)7.8–21.2(–22) × (1–)1.1–2.2(–3) mm in middle leaves, acute. Capitula short pedunculate or sessile. Involucre (14–)15–20(–23) × (10–)11–18(–20) mm. Appendages of basal bracts with apical spine

(1–)1.4–4.3(–6) mm, middle bracts with apical spine (2–)3.4–12.6(–14) mm and with (8–)11–18(–22) lateral cilia (0.7–)1.4–3 mm long. Florets yellow, lobes (4.5–)5.1–6.3(–6.5) mm long, large tube 4–5 mm long, narrow tube (6.2–)8.7–12.3(–14) mm long. Achenes 4–4.8(–5) × (1.6–)1.8–2.2(–2.3) mm; pappus (0.6–)0.8–1.2(–1.5) mm.

CHROMOSOME NUMBER: $2n = 20$ (Siljak-Yakovlev *et al.* 2005, from Biokovo). The count for *C. rupestris* ($2n = 20$), from Bosnia Herzegovina, near Livno (Siljak 1977) should be mentioned here.

HABITAT: Stony slopes on limestone.

DISTRIBUTION: Endemic to SW Bosnia-Herzegovina (Busko Jezero, Zavelim and hills towards Mostar) and S Croatia (Biokovo) (Fig. 8).

SELECTED SPECIMENS EXAMINED: — **Bosnia-Herzegovina.** Ad pedem montis Tušnica prope Buško Jezero, 16.VII.1986 *I. Trinajstić* (TSB, as *C. rupestris*); presso Posuje, tra Citluk e Mesihovina, 5.VIII.2005 *F. Conti, E. Scassellati & D. Di Santo* (APP); M. Zavelim presso Rasko Polje, 5.VIII.2005 *F. Conti, E. Scassellati & D. Di Santo* (APP); M. Zavelim sopra Rasko Polje, 5.VIII.2005 *F. Conti, E. Scassellati & D. Di Santo* (APP). — **Croatia.** Biokovo, Vošac, 21.VIII.2000 *F. Conti, D. Tinti & M.E. Solic* (APP); Biokovo, sulla strada da Makarska allo Sv. Jure, 22.VII.2001 *F. Conti, D. Tinti & M.E. Solic* (APP).

Centaurea arachnoidea Viv. (Fig. 11)

Ann. Bot. (Genova) 1(2): 183–184. 1804. — LECTOTYPE (designated here by Mauro Mariotti): *Centaurea orientalis*, in rupibus marmoris Carrarae [Viviani's handwriting] (GDOR! righthand specimen). — *Colymbada arachnoidea* (Viv.) Banfi, Galasso & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano 146(2): 223. 2005. — *Centaurea rupestris* var. *arachnoidea* (Viv.) Fiori, Nuova Fl. Anal. It. 735. 1927.

Perennial herb. Stems erect, 10–35 cm, branched and aphyllous above. Leaves arachnoid-lanate, 1–2 pinnatisect cauline, 2 pinnatisect basal; lateral segments similar to terminal one, oblong lanceolate to linear, 10–25 × 1–5 mm in basal leaves, (11–)12.4–26.2(–29) × (0.7–)0.8–3.9(–4.2) mm in middle leaves, acute. Capitula long pedunculate. Involucre (19–)20–22.7(–26) × (18–)18.3–24(–25) mm wide. Appendages of basal bracts with apical spine 0–1(1.3) mm, middle bracts without apical spine and with

(0–)6–18 lateral short fimbriae 0–0.77(–1) mm long. Florets yellow, lobes (5–)5.1–6 mm long, large tube (4.8–)4.9–6 mm long, narrow tube (10–)10.5–13 mm long. Achenes (3.4–)3.9–5.4(–5.5) × (1.6–)1.8–2.6(–2.8) mm; pappus (5.5–)6–7.7(–8.1) mm.

CHROMOSOME NUMBER: $2n = 20$ (Viegi & Cela Renzoni 1983).

HABITAT: Stony slopes on limestone.

DISTRIBUTION: Endemic to Apuan Alps (Fig. 12).

NOTES: The specific epithet on the label of the type was most probably crossed out by Viviani.

SELECTED SPECIMENS EXAMINED: — **Italy.** Toscana: M. Uccelliera, Alpi Apuane (Massa), 15.VIII.2005 *D. Marchetti* (APP); presso la galleria del M. Pelato, Alpi Apuane, 10.VII.1998 *D. Marchetti* (APP); presso i Vallini, verso Foce Luccica, Alpi Apuane (Massa), 8.VII.2006 *D. Marchetti* (APP); Miseglia, 28.VII.1989 *B. Moraldo & D. Vitiello* (APP); tra Miseglia e Ponti di Vara, sopra Carrara, Alpi Apuane (Massa), 17.VI.2000 *D. Marchetti* (APP).

Centaurea arachnoidea subsp. *adonidifolia* (Rchb.) F. Conti, Moraldo & Ricceri, *comb. & stat. nov.* (Fig. 13)

Centaurea adonidifolia Rchb. in Mössler, Handb. Gewächsk., ed. 2: 1545. 1829 — LECTOTYPE (designated here): *Centaurea rupestris*, Felsen = Flockenblume. Bei Obschina unweit Triest, den 29.06.1812. s.c. (W!; isotypes K! lefthand specimen, L!).

Centaurea rupestris var. *hirtella* Posp., Fl. oesterr. Küstenl. 2: 930. 1899.

Centaurea collina *sensu* Scopoli, Fl. carniol., ed. 2(2): 141. 1772, non L.

Perennial herb. Stems erect, 30–80 cm, branched, aphyllous above. Leaves arachnoid-lanate to glabrescent, 1–2 pinnatisect cauline, 2 pinnatisect basal; lateral segments similar to terminal one, oblong lanceolate to linear, 15–37 × 1.7–2 mm in the basal leaves, (10–)10.9–45.3(–60) × (0.7–)1–1.8(–5) mm in the middle leaves, acute. Capitula long pedunculate. Involucre (15–)17.9–25 × (12–)15–25(–27) mm wide. Appendages of basal bracts with apical spine (0–)0.5–2(–3.5) mm, middle bracts without or with apical spine 0–2.3(–4.7) mm and with 0–18(–28) lateral cilia 0–0.9(–1) mm long. Florets yellow, lobes (4.8–)5–6.9(–7) mm long, large tube (3.5–)4–5.5(–5.8) mm long, narrow

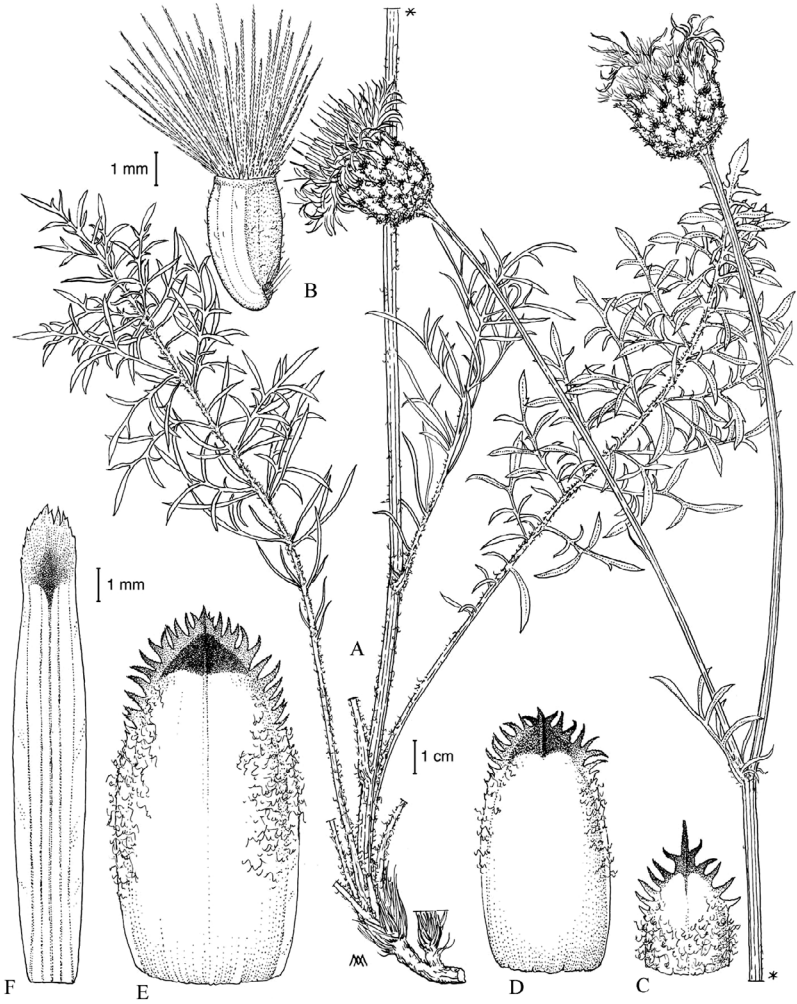


Fig. 11. *Centaurea arachnoidea* subsp. *arachnoidea* (drawn from a specimen collected in the *locus classicus* by Marchetti, FI). — **A:** Habit. — **B:** Achene. — **C:** Basal bract. — **D:** Middle-basal bract. — **E:** Middle-internal bract. — **F:** Internal bract.

tube (9–)9.3–12.1(–12.5) mm long. Achenes (3.2–)4–5.3(–5.7) × (1.6–)1.9–2.5(–2.8) mm; pappus (2.8–)4–5.3(–6) mm.

CHROMOSOME NUMBER: $2n = 20$ from the Apennines (Aurunci Mts., Mt. Pizzoli, Mt. Vetore, Mt. Subasio) and $2n = 26$ from Aurunci Mts. (Mt. Petrella) as *C. rupestris* s. lato (Boracchia *et al.* 2008).

HABITAT: Stony slopes on limestone.

DISTRIBUTION: Carso (Italy and Slovenia), central Apennines from Mt. Nerone to Aurunci Mts. (Marche, Umbria, Lazio and Abruzzo) (Fig. 12).

NOTES: The locality reported on the printed label of the type is the same quoted by Reichenbach in the protologue. The label does not report the collectors' names cited in the protologue:

Wiesen, Sieber, Heinhöf. Anyway A. Igersheim identified Sieber as the collector. In 2006 he added a label to the specimen kept in W with the indication "leg. Franz Wilhelm Sieber 1812". The correspondence between the locality and the date lead us to suppose the samples are at least duplicates of the specimen studied by Reichenbach.

The frequency of prickles on the leaves, and the presence and the contingent abundance of sessile glands that characterizes var. *hirtella*, can vary within the area. The presence of glands does not seem to be linked to other morphological characters.

In the Marche Apennines between the Carso and Abruzzo populations, which have an apparently indistinguishable morphology, are found

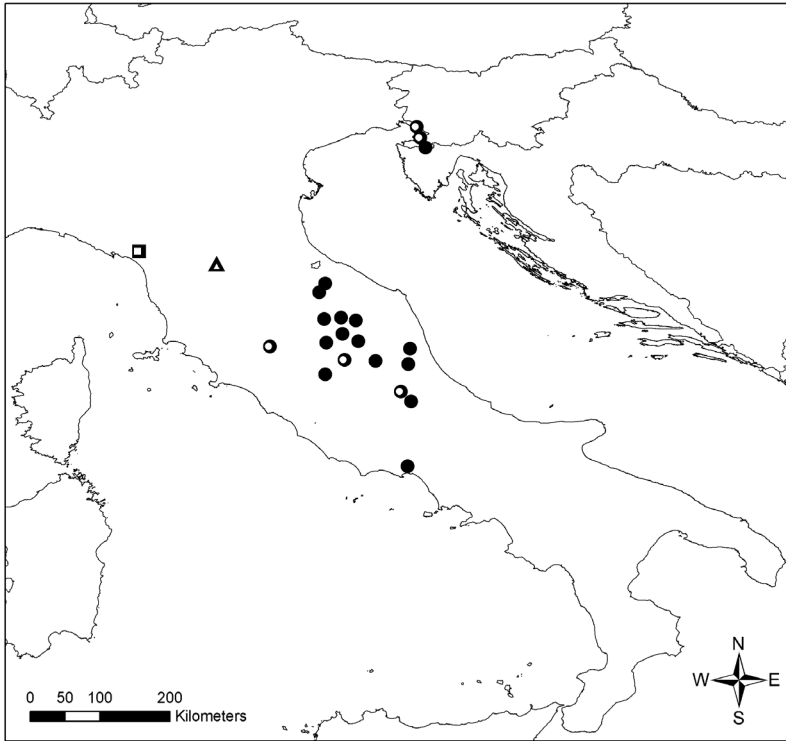


Fig. 12. ■ *Centaurea arachnoidea* subsp. *arachnoidea*, ▲ *C. arachnoidea* subsp. *montisferrati*, ● *C. arachnoidea* subsp. *adonidifolia*. Empty symbols indicate localities of the specimens analyzed morphometrically.

plants that often have leaves thickened to the base of the stem and bracts with well-developed spines. However these characters appear variable in these populations; therefore even if they are not found at other localities, they do not, according to current knowledge, allow recognition of a new taxon. At the moment populations that show high variability are included in this taxon.

SELECTED SPECIMENS EXAMINED: — **Italy.** Friuli-Venezia Giulia: Pietraia a Rupinpiccolo (Trieste), 27.VII.1966 *L. Talarico* (TSB, as *C. rupestris*); Opicina (Trieste), 16.VI.1964 *D. Lausi* (TSB, as *C. rupestris* var. *inermis*); Basovizza, Carso Triest., VI.1957 *D. Lausi* (TSB, as *C. rupestris*); M. Lanaro, Monrupino (TS), 31.V.2001 *F. Conti & L. Gubellini* (APP); Val Rosandra (TS), 31.V.2001 *F. Conti & L. Gubellini* (APP); Trieste presso l'obelisco, 10.VII.2006 *F. Conti & A. Manzi* (APP). Toscana: M. Cetona, crinale di Poggio il Varco, 30.VI.2005 *C. Ricceri, G. Bettini & B. Gargani* (APP). Umbria: M. Subasio (Perugia), 11.V.1996 *E. Biondi* 11950 (ANC, as *C. rupestris*); Cascata delle Marmore (Terni), 7.VI.2001 *E. Biondi*, 12761 (ANC, as *C. ceratophylla*); Castelluccio (Perugia), 12.XI.2000 *F. Conti* (APP). Marche: Gruppo del M. Nerone: destra della bassa Val del Canale, 4.VII.1969 *A. Brillii-Cattarini, R. Sialm & F. Tschudi* (PESA, as *C. rupestris* subsp. *rupestris*); M.ti del Furlo: versante E del M. Pietralata, 11.VI.1961 *A. Brillii-*

Cattarini (PESA, as *C. rupestris* var. *typica*); Gole del Furlo, 2.VII.1987 *B. Moraldo* (APP, as *C. rupestris*); M. Gioco del Pallone (Ancona), 23.VI.2004 *L. Nanni, E. Ferroni & M. Pinzi* 17777 (ANC as *C. rupestris rupestris*); Pioraco (Macerata), 16.VI.1978 *E. Biondi* 15541 (ANC, as *C. rupestris*); Gruppo del M. Gemmo: versante N del Pizzo Torto, 30.VI.1972 *A. Brillii-Cattarini, J. Coaz & R. Sialm* (PESA, as *C. rupestris* subsp. *rupestris*); Gruppo del M. di Rotondo: versante E del M. Romano presso la Madonna del Sasso, 20.V.1970 *A. Brillii-Cattarini, R. Sialm & P. Weiss* (PESA, as *C. rupestris* subsp. *rupestris*); Gruppo del M. Pennino: versante SW del M. Vermenone, 2.VII.1971 *A. Brillii-Cattarini & R. Sialm* (PESA, as *C. rupestris* subsp. *rupestris*); Gruppo del M. Murano: basso versante S del M. di Frasassi, 24.V.1969 *A. Brillii-Cattarini, R. Sialm & F. Tschudi* (PESA, as *C. rupestris* subsp. *rupestris*); Gruppo del M. Sanvicino: versante E del M. Revellone, 11.VI.1964 *A. Brillii-Cattarini* (PESA, as *C. rupestris* cfr. var. *ceratophylla*); M. Rogedano (Ancona), *E. Biondi* 8155 (ANC, as *C. rupestris* subsp. *rupestris*); M. Serra Santa Fabiano (Ancona), 23.VII.1998 *G. Bacchetta & S. Bagella* 6015 (ANC, as *C. rupestris*); M. Ascensione (Ascoli Piceno), 6.VII.1992 *F. Taffetani* 11950 (ANC, as *C. rupestris*); tra Arquata e Forca Canapine (Ascoli Piceno), 5.VII.2006 *F. Conti* (APP); Passo Forca Canapine (Ascoli Piceno), 22.VII.1987 *B. Moraldo* (APP as *C. rupestris*); Valle del fiume Aso (Ascoli Piceno), 23.VII.1987 *B. Moraldo* (APP as *C. rupestris*). Abruzzo: M. dei Fiori, Vallone (Teramo), 28.V.1999 *F. Conti, G. Capecci & D. Tinti* (APP); loc. Tarignano, Barete (L'Aquila), 5.VIII.2004

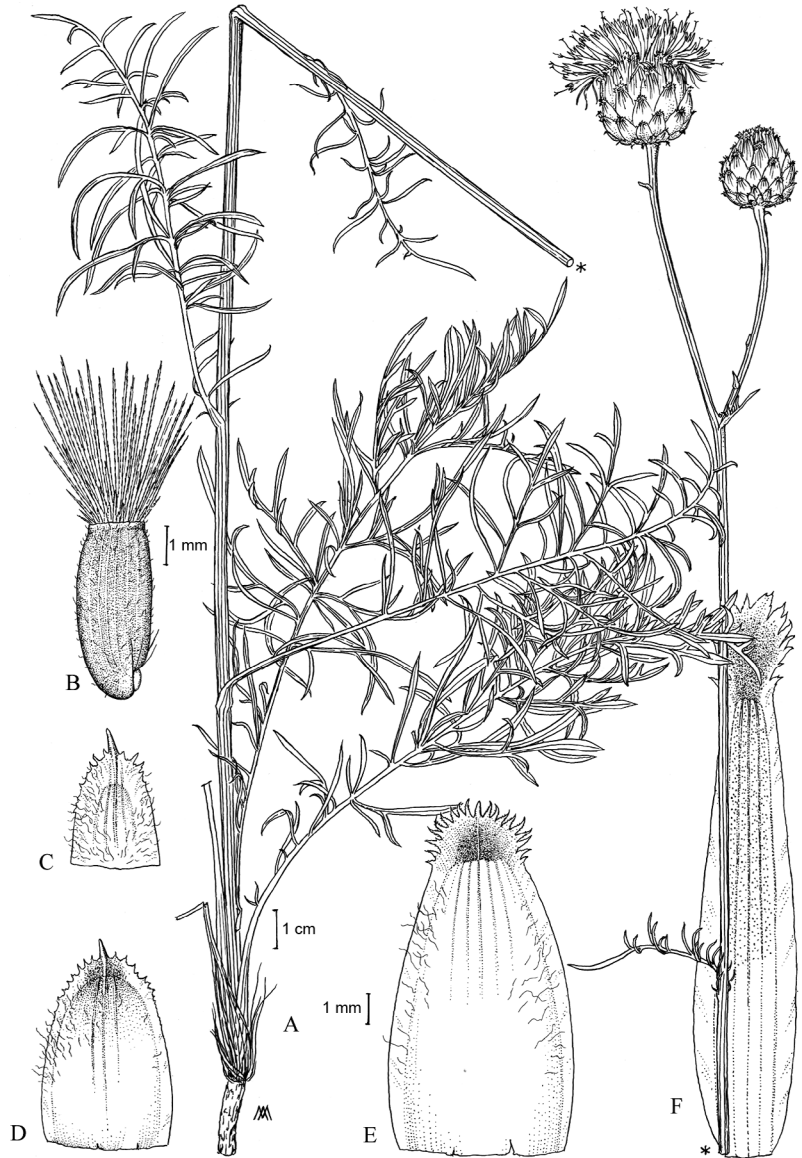


Fig. 13. *Centaurea arachnoidea* subsp. *adonidifolia* (drawn from a specimen collected on Mt. dei Fiori by F. Conti, APP). — **A:** Habit. — **B:** Achene. — **C:** Basal bract. — **D:** Middle-basal bract. — **E:** Middle-internal bract. — **F:** Internal bract.

F. Conti & N. Ranalli (APP); Pizzoli, 24.VII.1986 *B. Moraldo* (APP as *C. rupestris*); Castello di Pizzoli (L'Aquila), 5.VIII.2004 *F. Conti & N. Ranalli* (APP); S.Pio delle Camere (L'Aquila), 8.VIII.2005 *F. Conti, D. Tinti & A. Manzi* (APP); Castelvechio Calvisio (L'Aquila), 19.VI.1997 *A. Manzi* (APP). Lazio: Monti Aurunci (Latina), 16.VII.1983 *B. Moraldo & F. Banaudi* (APP as *C. rupestris*); M. Altino (Gruppo del M. Petrella), *B. Moraldo, F. Banaudi & L. Collacchi* (APP, RO, FI as *C. rupestris*). — **Slovenia.** Istria, Ciceria, M. Lipnik (Rabitović), 8.VIII.1968 *Pertot* (TSB, as *C. rupestris* var. *hirtella* Posp.); Podpec (Popecchio), 11.VII.2006 *F. Conti, A. Manzi & A. Pezzetta* (APP). — **Croatia.** Istria montana, M. Žbevnica-Kavčice, 21.VI.1982, *L. Poldini* (TSB, as *C. rupestris* var. *hirtella*).

Centaurea arachnoidea* subsp. *montisferrati Ricceri, Moraldo & F. Conti, *subsp. nova* (Fig. 14)

A. Centaurea arachnoidea subsp. *arachnoidea* pappi minore (2–)2.2–3.7(–3.9) mm, achenii longitudine pappi majore (1.1–)1.3–1.8(–1.9), differt.

HOLOTYPE: Italy. Pendici meridionali del M. Ferrato, Galletti (Prato), suolo ofiolitico, 150–250 m a.s.l., 12.VII.2007 *C. Ricceri* (APP!; isotypes FI!).

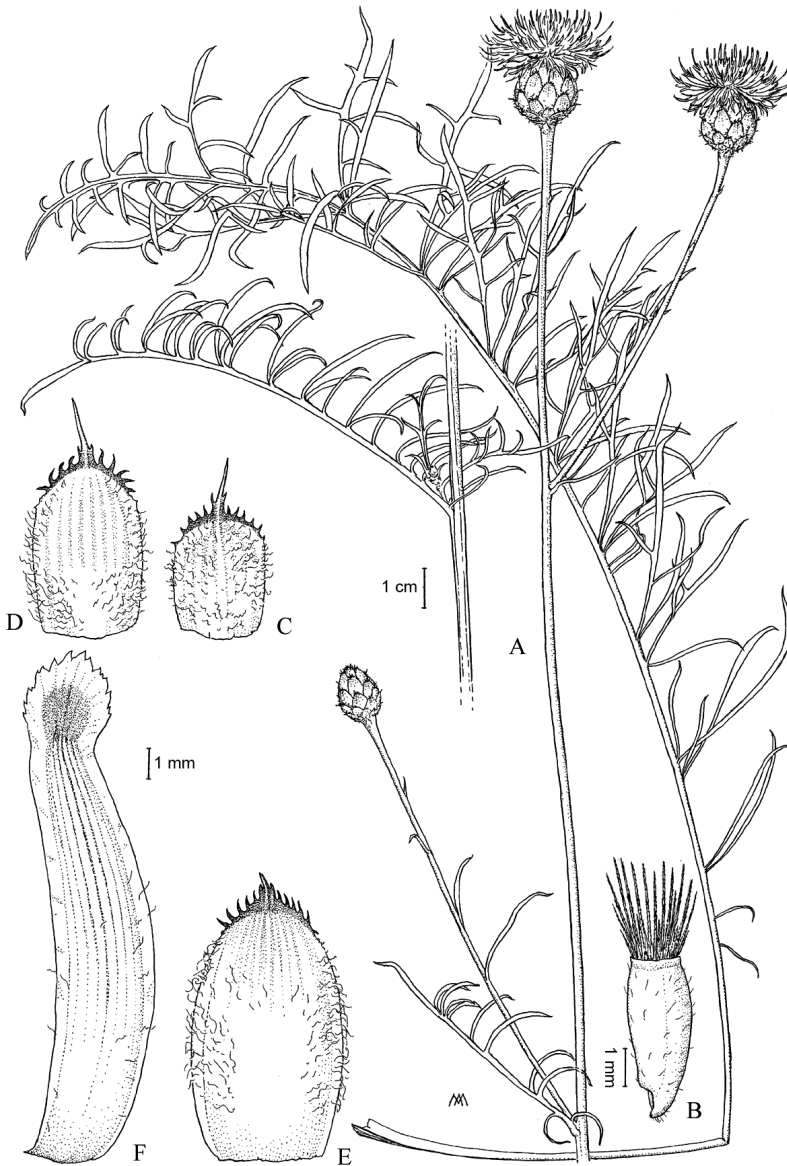


Fig. 14. *Centaurea arachnoidea* subsp. *montis-fer-rati* (drawn from specimen collected in the *locus classicus* by C. Ricceri, APP). — **A:** Habit. — **B:** Achene. — **C:** Basal bract. — **D:** Middle-basal bract. — **E:** Middle-internal bract. — **F:** Internal bract.

Perennial herb, rosulate. Rosette sterile in first year and floriferous in second year. Stems erect, 30–60(90) cm, branched. Leaves arachnoid-lanate to glabrescent, 2 pinnatisect basal, 1–2 pinnatisect cauline. Basal and middle leaf segments linear, acute, middle ones (6–)9.8–22 (25) × (0.5–)0.8–1.2(1.4) mm. Capitula long pedunculate. Involucre (13–)14.9–20(–21) long × (7–)10.9–16(–18) wide. Appendages of basal bracts rounded-spathulate and dentate with apical spine (0.3–)0.7–1.5(–3) mm; middle inferior bracts with apical spine (0–)0.1–3(–5) mm and with 0–10(–12) lat-

eral cilia; middle superior bracts ovato-lanceolate dentate to apex; upper inside bracts linear-spathulate. Florets yellow, lobes (4.4–)4.9–6(–6.5) mm long, large tube 4–4.6(–5.2) mm long, narrow tube 10–12.5 mm long. Achenes (3.7–)3.8–5.2(–5.4) × (1.6–)1.9–2.2(–2.5) mm; pappus (2–)2.2–3.7(–4) mm. Blooms from June to August.

CHROMOSOME NUMBER: $2n = 20$ as *C. rupestris* s. *lato* (Boracchia et al. 2008).

HABITAT: Ophiolites and stony environments covered by a maritime pine plantation with a brushwood of Mediterranean scrub.

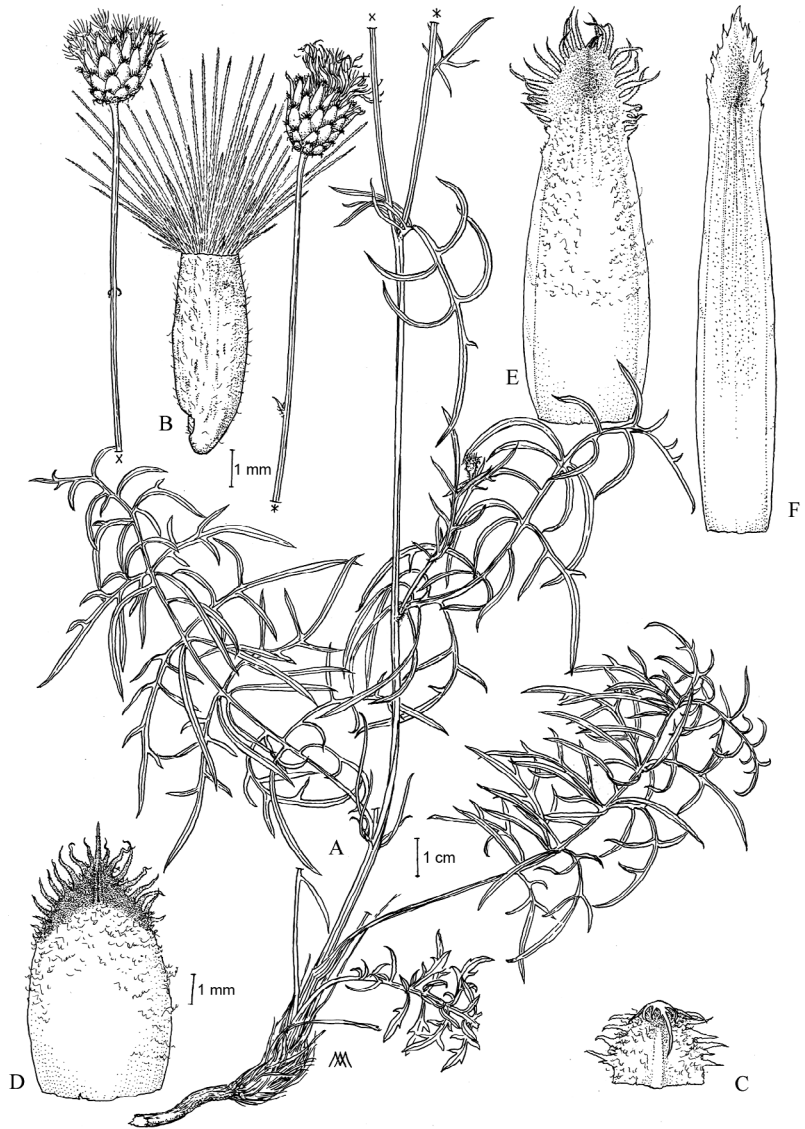


Fig. 15. *Centaurea dichroantha* (drawn from a specimen collected in Udine, between Cimolais and Barcis by Huter, Fl). — **A:** Habit. — **B:** Achene. — **C:** Basal bract. — **D:** Middle-basal bract. — **E:** Middle-internal bract. — **F:** Internal bract.

DISTRIBUTION: Endemic of Mt. Ferrato (Prato) (Fig. 12).

SELECTED SPECIMENS EXAMINED: — **Italy.** Toscana: Serpentine del Monte Ferrato sopra Prato, 20.VI.1984 *B. Moraldo & A. Voarino* (APP sub. *C. rupestris*); Pendici meridionali del M. Ferrato, Galceti (Prato), 12.VII.2007 *C. Ricceri* (APP).

***Centaurea dichroantha* A. Kern. (Fig. 15)**

Österr. Bot. Zeit. 24: 104. 1874. — **LECTOTYPE** (designated

here by Dreyer): *Centaurea dichroantha* Kerner, *sordida* Willd., β *purpurascens*, Venetia dit. d'Udine in glarea torrentis Zelline pr. Claut., sol. calcar. ca. 1700–1800', 14.VII.1873 *Huter et Porta* (WU!).

Perennial herb. Stems erect or arcuate ascending, 25–70 cm, branched from base and aphyllous above. Leaves glabrous, 1–2 pinnatisect cauline, 2 pinnatisect basal; lateral segments similar to terminal one, linear, 15–30 \times 1–1.7 mm in basal leaves, (10–)16.5–30(–45) \times (0.8) 1–1.5(–1.6) mm in middle leaves, acute. Capitula pedunculate

to long pedunculate. Involucre (15–)17–20(–22) × (14–)14.5–20(–22) mm. Appendages of basal bracts with apical spine (0.8–)1–2 mm, middle bracts with apical spine (0.6–)0.9–1.9(–2.8) mm and with 10–16(–18) lateral cilia (0.7–)1–2 mm long. Florets pale yellow or purple, lobes (4–)4.1–5.5(–6) mm long, large tube 3–4.4(–4.5) mm long, narrow tube (7.6–)8.5–11.8(–12.5) mm long. Achenes 4–4.9(–5.5) × 1.6–2(–2.3) mm; pappus (4–)4.6–6.3(–6.4) mm.

CHROMOSOME NUMBER: 2n = 20 on Italian and Slovenian specimens (Cusma Velari & Feoli Chiappella 1984, Nilsson & Lassen 1971, Lovka *et al.* 1972, Lovka & Susnik 1973 as *C. dichroantha* var. *julica* A. Kern., Siljak-Yakovlev 1982).

HABITAT: Dry grassland, “magredi” (alluvial soil very permeable and poor in vegetation, typical of the Friuli region).

DISTRIBUTION: Friuli and W Slovenia (Fig. 10).

NOTES: In WU there are two other specimens from the same locality as var. β *purpurascens* and var. α *lutescens*. Kerner quoted specimens of Huter & Porta collected in two localities: “zwischen Cimolais und Barces, dann im Thale des Zelline bei Claut”. WU and FI have some specimens from the first locality, collected by Huter.

A paleohybrid of *C. rupestris* and *C. scabiosa* subsp. *fritschii* (Pavletić & Trinajstić 1983, Pavletić 1987) has been considered, but we do not have the evidence to exclude the possibility that one of the parents could be *C. arachnoidea* subsp. *adonidifolia* instead of *C. rupestris*.

SELECTED SPECIMENS EXAMINED: — **Italy**. Friuli-Venezia Giulia: Udine, in Canale inter Cimolais et Barcis, 11.VII.1872 Huter (FI); magredo del Cellina, presso Vivaro (Udine), 13.VII.2006 F. Conti & A. Manzi (APP); magredo tra Vivaro e Rauscedo (Udine), 13.VII.2006 F. Conti & A. Manzi (APP).

Key to the investigated taxa

1. Pappus distinctly shorter than body of achene 2
1. Pappus from slightly shorter to longer than body of achene 4
2. Stem in upper part aphyllous (or with bracts or very small leaves), cauline leaves with leaflets (0.7–)1–1.5(–2.5) mm width, flower large tube length (3.4–)4–5(–5.3) mm *C. rupestris*
2. Stem leafy up to upper part, cauline leaves with leaflets (1.2–)2–4.2(–7) mm width, flower large tube length 5–6.5(–7) mm 3

3. Stem straight, involucre bracts with cilia (2–)3–4(–5) mm long, flower large tube length 5–6.5(–7) mm *C. ceratophylla* subsp. *ceratophylla*
3. Stem arcuate ascending, involucre bracts with cilia (0.7–)1.4–3 mm long, flower large tube length 4–5 mm *C. ceratophylla* subsp. *daniellae*
4. Florets yellow or purple, involucre bracts with cilia (0.7–)1–2 mm long, leaves glabrous *C. dichroantha*
4. Florets yellow, involucre bracts with cilia 0–0.9(–1) mm long, leaves arachnoid-lanate to glabrescent 5
5. Pappus (2–)2.2–3.7(–4) mm long, achene length/pappus length (1.1–)1.2–1.8(–2.2) *C. arachnoidea* subsp. *montis-ferrati*
5. Pappus on average longer, achene length/pappus length shorter 6
6. Pappus (2.8–)4–5.5(–6) mm, achene length/pappus length 0.8–1.2(–1.6) *C. arachnoidea* subsp. *adonidifolia*
6. Pappus (5.5–)6–7.8(–8.1) mm, achene length/pappus length 0.5(–0.8) *C. arachnoidea* subsp. *arachnoidea*

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References

- Baldini, R. M. 2007: *Centaurea rupestris* Linnaeus. — In: Jarvis, C. (ed.), *Order out of chaos. Linnaean plant names and their types*: 402. Linnean Society of London and Natural History Museum, London.
- Banfi, E., Galasso, G. & Soldano, A. 2005: Notes on systematics and taxonomy for the Italian vascular flora. 1. — *Atti Soc. it. Sci. nat. Museo civ. Stor. nat. Milano* 146: 219–244.
- Boracchia, M., Vangelisti, R. & Viegi, L. 2008: Numeri Cromosomici per la Flora Italiana. — *Inform. Bot. Ital.* 40: 93–95.
- Brilli-Cattarini, A. 1968: Su alcune piante ibride raccolte nella regione marchigiana. — *Giorn. Bot. Ital.* 102: 121–131.

- Cassini, M. H. 1826: *Opuscoles phytologiques. Quatrième Mémoire. Sur l'ordre des Synanthères, contenant l'analyse de l'ovaire et des accessories. Dix-septième tribu. 1*: 213–214. — Levrault, Paris.
- Cecchi, L., Coppi, A. & Selvi, F. 2007: Erborizzazioni nell'Albania settentrionale, con particolare riferimento alla flora serpentinicola del bacino del Drin. — *Inform. Bot. Ital.* 39: 313–323.
- Chichiricò, G., Frizzi, G. & Tammara, F. 1980: Numeri cromosomici per la Flora Italiana: 598–601. *Centaurea rupestris* L. subsp. *ceratophylla* (Ten.) Gugler. — *Inform. Bot. Ital.* 11: 34, 36.
- Colonna, F. 1616: *Minus cognitarum rariorumque nostro coelo orientium stirpium [ekphrasis]: qua non paucae ab antiquioribus Theophrasto, Dioscoride, Plinio, Galeno alijs[que] descriptae praeter illas etiam in [Phytobasano] editas disquiruntur ac declarantur. Item de aquatilibus aliisque nonnullis animalibus libellus.* — Jacobum Mascardum, Roma.
- Conti, F., Abbate, G., Alessandrini, A. & Blasi, C. (eds.) 2005: *An annotated checklist of the Italian vascular flora.* — Palombi Editori, Roma.
- Cusma Velari, T. & Feoli Chiapella, L. 1984: Numeri cromosomici per la Flora Italiana: 906–909. *Centaurea dichroantha* Kerner. — *Inform. Bot. Ital.* 14: 262–263.
- de Candolle, A. P. 1838: *Prodromus systematis naturalis regni vegetabilis sive enumeratio contracta ordinum, generum specierumque plantarum huc usque cognitarum, juxta methodi naturalis normas digesta* 6: 565–605. — Sumptibus Sociorum Treuttel et Würtz, Parisii.
- Dostál, J. 1976: *Centaurea* L. — In: Tutin, T. G., Heywood, V. H., Burges, N. A., Moore, D. M., Valentine, D. H., Walters, S. M. & Webb, D. A. (eds.), *Flora Europaea* 4, Plantaginaceae to Compositae (and Rubiaceae): 254–301. Cambridge University Press, Cambridge.
- Feoli Chiapella, L. 1979: Biosistemica di alcune centauree della sezione *Acrocentron* Cass. — *Giorn. Bot. Ital.* 113: 237–252.
- Fiori, A. 1904: *Centaurea* L. — In: Fiori, A. & Paoletti, G. (eds.), *Flora Analitica d'Italia* 3: 321–349. — Tip. del Seminario, Padova.
- Fiori, A. 1927: *Centaurea* L. *Nuova Flora Analitica d'Italia* 2: 713–743. — Ricci, Firenze.
- Font, M., Garnatje, T., Garcia-Jacas, N. & Susanna, A. 2002: Delineation and phylogeny of *Centaurea* sect. *Acrocentron* based on DNA sequences: a restoration of the genus *Crocodylium* and indirect evidence of introgression. — *Pl. Syst. Evol.* 234: 15–26.
- Garcia-Jacas, N., Susanna, A., Garnatje, T. & Vilatersana, L. 2001: Generic delimitation and phylogeny of the subtribe *Centaureinae* (Asteraceae): a combined nuclear and chloroplast DNA analysis. — *Ann. Bot. (Oxford)* 87: 503–515.
- Garcia-Jacas, N., Susanna, A., Mozaffarian, V. & Ilarslan, R. 2000: The natural delimitation of *Centaurea* (Asteraceae: Cardueae): ITS sequence analysis of the *Centaurea jacea* group. — *Pl. Syst. Evol.* 223: 185–199.
- Gardou, C. 1969: Caryosistématique des Centaurées de la section *Acrocentron* Cass. — *Bull. Soc. Bot. France* 116: 29–38.
- Greuter, W. 2003: The Euro+Med treatment of Cardueae (Compositae) — generic concepts and required new names. — *Willdenowia* 33: 49–61.
- Greuter, W. (ed.) 2008: *The Euro+Med Plantbase — the information resource for Euro-Mediterranean plant diversity.* — Available on the web at <http://www.emplantbase.org/home.html>.
- Hellwig, F. H. 2004: Centaureinae (Asteraceae) in the Mediterranean — history of ecogeographical variation. — *Pl. Syst. Evol.* 246: 137–162.
- Lovka, M. & Susnik, F. 1973: IOPB chromosome numbers reports. XL. — *Taxon* 22: 285–289.
- Lovka, M., Susnik, F., Löve, Á. & Löve, D. 1972: IOPB chromosome numbers reports. XXXVI. — *Taxon* 21: 337–339.
- Lovrić, A. Z. 1982: In IOPB chromosome numbers reports. LXXVII. — *Taxon* 31: 762–763.
- Nilsson, O. & Lassen, P. 1971: Chromosome numbers of vascular plants from Austria, Mallorca and Yugoslavia. — *Bot. Notiser* 124: 270–276.
- Pavletić, Z. 1987: *Centaurea* × *sordida* Willd. — *C. dichroantha* Kerner, confronto comparativo-morfologico. — *Biogeographia* 13: 417–419.
- Pavletić, Z. & Trinajstić, I. 1983: Istraživanja taksonomskih odnosa između vrsta *Centaurea rupestris* L. i *C. fritschii* Hayek, te njihovog prirodnog hibrida *C. × sordida* Willd. (Asteraceae, sect. *Acrocentron* Cass.). — *Acta Bot. Croat.* 42: 137–143.
- Petit, D. P. 1997: Generic interrelationships of *Tolpis* (Asteraceae: Lactuceae) based on *nadhF* sequence data. — *Pl. Syst. Evol.* 226: 23–33.
- Pichi Sermolli, R. E. G. 1986: Glossario dei principali termini palinologici usati in pteridologia. — *Webbia* 40: 168–202.
- Pignatti, S. 1982: *Flora d'Italia.* — Edagricole, Bologna.
- Routsis, E. & Georgiadis, T. 1994a: Systematic review of *Centaurea rupestris* L., section *Acrocentron* (Cass.) DC., in Greece. — *Candollea* 49: 359–368.
- Routsis, E. & Georgiadis, T. 1994b: Contribution to the systematics of the genus *Centaurea* section *Acrocentron* (Asteraceae) in Greece. — *Nordic J. Bot.* 14: 369–378.
- Routsis, E. & Georgiadis, T. 1999: Cytogeographical study of *Centaurea* L. sect. *Acrocentron* (Cass.) DC. (Asteraceae) in Greece. — *Bot. Helv.* 109: 139–151.
- Siljak, S. 1977: IOPB chromosome numbers reports. LIII. — *Taxon* 26: 447–448.
- Siljak-Yakovlev, S. 1982: IOPB chromosome numbers reports. LXXVI. — *Taxon* 31: 768.
- Siljak-Yakovlev, S., Solic, M. E., Catrice, O., Brown, S. C. & Papes, D. 2005: Nuclear DNA content and chromosome number in some diploid and tetraploid *Centaurea* (Asteraceae: Cardueae) from the Dalmatia Region. — *Plant Biol. (Stuttg.)* 7: 397–404.
- Soldano, A. 2000: *Centaurea* L. — In: Ferrarini, E. (ed.), *Prodromo della flora della Regione Apuana. Parte terza* (Compositae–Orchidaceae): 302–306. Accademia Luni-gianese di Scienze Giovanni Capellini, La Spezia.
- Susanna, A., Garnatje, T. & Garcia-Jacas, N. 1999: Molecular phylogeny of *Cheirolophus* (Asteraceae: Cardueae–Centaureinae) based on ITS sequences of nuclear ribos-

- omal DNA. — *Pl. Syst. Evol.* 214: 147–160.
- Susanna, A., Garcia-Jacas, N., Soltis, D. E. & Soltis, P. S. 1995: Phylogenetic relationships in tribe *Cardueae* (*Asteraceae*) based on ITS sequences. — *Am. J. Bot.* 82: 1056–1068.
- Tenore, M. 1812: Prodomo della flora Napolitana, 1(1). — *Flora Napolitana* I: LI–LII. Stamperia Francese, Napoli.
- Tenore, M. 1815: Synopsis Novarum Plantarum, quae in Prodomo Florae Neapolitanae, anno 1811–1813 edito, describuntur. — In: *Ad Catalogum plantarum Horti regii neapolitani anno 1813 editum. Appendix prima*. Typ. Amuliana, Neapoli.
- Tenore, M. 1820: *Flora Napolitana, ossia descrizione delle piante indigene del Regno di Napoli e delle più rare specie di piante esotiche coltivate nei giardini* 1(2): 274. — Tip. del Giornale Enciclopedico, Neapoli.
- Van Loon, J. C. & Kieft, B. 1980: IOPB chromosome numbers reports. LXVIII. — *Taxon* 29: 533–547.
- Viegi, L. & Cela Renzoni, G. 1983: Numeri cromosomici per la Flora Italiana: 831–835. *Centaurea arachnoidea* Viv. Inform. — *Bot. Ital.* 13: 169.
- Wagenitz, G. & Gamal-Eldin, E. 1985: Zur Kenntnis der griechischen *Centaurea*-Arten der Sektion *Acrocentron*. — *Bot. Jahrb.* 107: 95–127.