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Systematic review of *Centaurea rupestris* L., section *Acrocentron* (Cass.) DC., in Greece

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RÉSUMÉ

ROUTSI, E. & T. GEORGIADIS (1994). Révision systématique de *Centaurea rupestris* L., section *Acrocentron* (Cass.) DC., en Grèce. *Candollea* 49: 359-368. En anglais, résumés français et anglais.

Révision de *Centaurea rupestris* L. en Grèce en fonction des données de la morphologie, de la cytologie et de la taxonomie numérique. Une sous-espèce nouvelle (subsp. *kozanii*) est décrite. Le taxon du Mont Parnon (*C. parnonia* Hal.) est traité comme une sous-espèce de *C. rupestris*. La population du Mont Taygète est également incluse dans cette sous-espèce. En conséquence, *C. rupestris* est représenté en Grèce par 4 sous-espèces, la sous-espèce *athoa* (du Mont Athos avec $2n = 20$), la sous-espèce *finazzeri* (Mont Voras avec $2n = 20$), la sous-espèce *kozanii* (de la région de Kozani avec $2n = 40$) et la sous-espèce *parnonia* (des Monts Parnon et Taygète avec $2n = 20$).

ABSTRACT

ROUTSI, E. & T. GEORGIADIS (1994). Systematic review of *Centaurea rupestris* L., section *Acrocentron* (Cass.) DC., in Greece. *Candollea* 49: 359-368. In English, French and English abstracts.

According to the morphological and cytological data as well as the results obtained by a numerical taxonomy method, the systematics of *Centaurea rupestris* L. in Greece is reviewed. A new subspecies (subsp. *kozanii*) is described. The taxon from Mt. Parnon (*C. parnonia* Hal.) is classified as a subspecies of *C. rupestris*; the population from Mt. Taygetos is also included in this subspecies. Thus, *C. rupestris* is considered to be represented in Greece by 4 subspecies: subsp. *athoa* (Mt. Athos, $2n = 20$), subsp. *finazzeri* (Mt. Voras, $2n = 20$), subsp. *kozanii* (Kozani area, $2n = 40$) and subsp. *parnonia* (Mt. Parnon, Mt. Taygetos, $2n = 20$).

KEY-WORDS: *Centaurea* — Section *Acrocentron* — Systematics — Greece.

Introduction

The *C. rupestris* group, which is represented in Greece by four taxa found in N Greece and S Peloponnese, has so far been a subject of controversial taxonomic views because of the close relationships of the taxa involved (Tab. 1).

In Flora Europaea (DOSTÁL, 1976) two subspecies of *C. rupestris* i.e. subsp. *athoa* and subsp. *finazzeri* are recorded from the Greek area, while the typical subspecies of *C. rupestris* is referred to from Yugoslavia and Italy but not from Greece. The taxon referred to from Mt. Parnon (*C. parnonia* Hal.) which definitely belongs to this species is erroneously classified by Dostál as a subspecies of *C. macedonica* Boiss.

WAGENITZ (1972) considers *C. athoa* DC. from Mt. Athos to be a distinct species.

	Boissier	Halacsy	Hayek	Stojanoff & Acharoff	Wagenitz & Gamal-Eldin
1. Mt. Athos	<i>C. rupestris</i> L. var. <i>subinermis</i> Boiss.	—	<i>C. rupestris</i> L. subsp. <i>athoa</i> (DC.) Gugler	<i>C. rupestris</i> L. subsp. <i>athoa</i> (DC.) Gugler	<i>C. athoa</i> DC. subsp. <i>athoa</i>
2. Mt. Voras	—	—	<i>C. rupestris</i> L. subsp. <i>finazzeri</i> (Adamovic) Hayek	—	<i>C. finazzeri</i> Adamovic
3. Kozani	—	—	—	—	<i>C. finazzeri</i> Adamovic
4. Mt. Taygetos	—	—	—	—	<i>C. athoa</i> DC. subsp. <i>athoa</i>
5. Mt. Parnon	<i>C. rupestris</i> L. var. <i>minor</i> Boiss.	<i>C. parnonia</i> Hal.	—	—	<i>C. athoa</i> DC. subsp. <i>parnonia</i> (Hal.) Gamal-Eldin & Wagenitz

Table 1. — Classifications of the taxa belonging to *Centaurea rupestris* L.

Taxon	x	2n	Locality
<i>C. rupestris</i> subsp. <i>parnonia</i>	10	20	Peloponnese: Mt. Taygetos / Mt. Parnon
<i>C. rupestris</i> subsp. <i>athoa</i>	10	20	Athos peninsula: Mt. Athos
<i>C. rupestris</i> subsp. <i>finazzeri</i>	10	20	Prov. Pella: Mt. Voras; Ano Garefi
<i>C. rupestris</i> subsp. <i>kozani</i>	10	40	Prov. Kozani: Kozani / Grevena

Table 2. — Chromosome numbers of the Greek subspecies of *Centaurea rupestris* L., section *Acrocentron* (Cass.) DC.

STOJANOFF & ACHTAROFF (1935) accept the classification of the taxon from Mt. Athos as *C. rupestris* L. subsp. *athoa* (DC.) Gugler and include *C. finazzeri* Adam. in it.

DE CANDOLLE (1837) described *C. athoa* as a plant with erect stems and glabrous achenes, while Adamovic described *C. finazzeri* as a plant showing procumbent stems and puberulent achenes. These descriptions seem to be in contrast to those of Flora Europaea, where the subsp. *athoa* is referred to as having either erect or procumbent stems and the subsp. *finazzeri* as having erect stems. Studying populations of these northern taxa in nature, we observed that both forms can co-exist. However, this feature is constant within the subsp. *parnonia* which has procumbent stems and the subsp. *kozanii* which has erect stems. As for the achenes hairiness it depends either on the stage of the maturity of the fruit or on the technical means of observation and thus, it is a doubtful taxonomic character.

Another taxonomic problem concerns the classification (WAGENITZ & GAMAL-ELDIN, 1985) of the population from Mt. Taygetos (S Peloponnese) as *C. athoa* DC. subsp. *athoa*, while the one from Mt. Parnon (S Peloponnese) is considered to be a different subspecies of *C. athoa* "*C. athoa* DC. subsp. *parnonia* (Hal.) Gamal-Eldin & Wagenitz". Except for the short stems of the latter, there are no other characteristics which differentiate the two populations of the Peloponnese; thus, they seem to belong to the same taxon.

Within the populations referred to as *C. finazzeri* Adam., some morphological differences, supported by cytological data (Tab. 2) allowed us to separate them into two different subspecies of *C. rupestris* subsp. *finazzeri* from Mt. Voras and subsp. *kozanii* from the areas of Kozani and Grevena.

To solve all the above mentioned taxonomic problems we studied the cytology, cytogeography and morphology of the Greek populations of the *C. rupestris* group. We also submitted the measurements of the morphological features to a factor analysis of the correspondences, which helped us to classify these taxa.

Cytology — Cytogeography

The *C. rupestris* group is mainly distributed in Bulgaria, Yugoslavia, Italy and France, having its southern limits of distribution (Fig. 2) in Greece (S Peloponnese). No relation to eastern taxa has been reported up to date, despite the existence of one taxon of the group in NW Turkey (WAGENITZ, 1975).

Six Greek populations were cytologically studied (Tab. 2) and two of them were found tetraploid.

The taxa from Mt. Voras and Mt. Athos (Fig. 1) are diploid ($2n = 20$). The taxon from Peloponnese is a Greek endemic and is diploid ($2n = 20$), too. The taxon from Kozani and Grevena is also a Greek endemic and it is tetraploid ($2n = 40$). This is the only polyploid population of this group reported up to now.

Numerical taxonomy

The group was submitted to a multivariate analysis method, "the factor analysis of the correspondences" (CORDIER, 1965; BENZÉCRI, 1973). The program used was Biomeco, version 3.7, group Cepes, Montpellier.

Fifty three morphological characters were used (Tab. 3). Other features measured did not show any variability between the taxa of the group and were not taken into consideration.

In the diagrams resulting from the analysis (ROUTSI, 1993) to which the group was submitted, — together with all the section's *Acrocentron* species — the populations did not clearly separate from each other but rather looked like being one species. A partial analysis of this group showed 4 different diagrams.



Fig. 1. — Mitotic metaphases of *Centaurea rupestris* subsp. *athoa* (a) and *C. rupestris* subsp. *kozanii* (b).

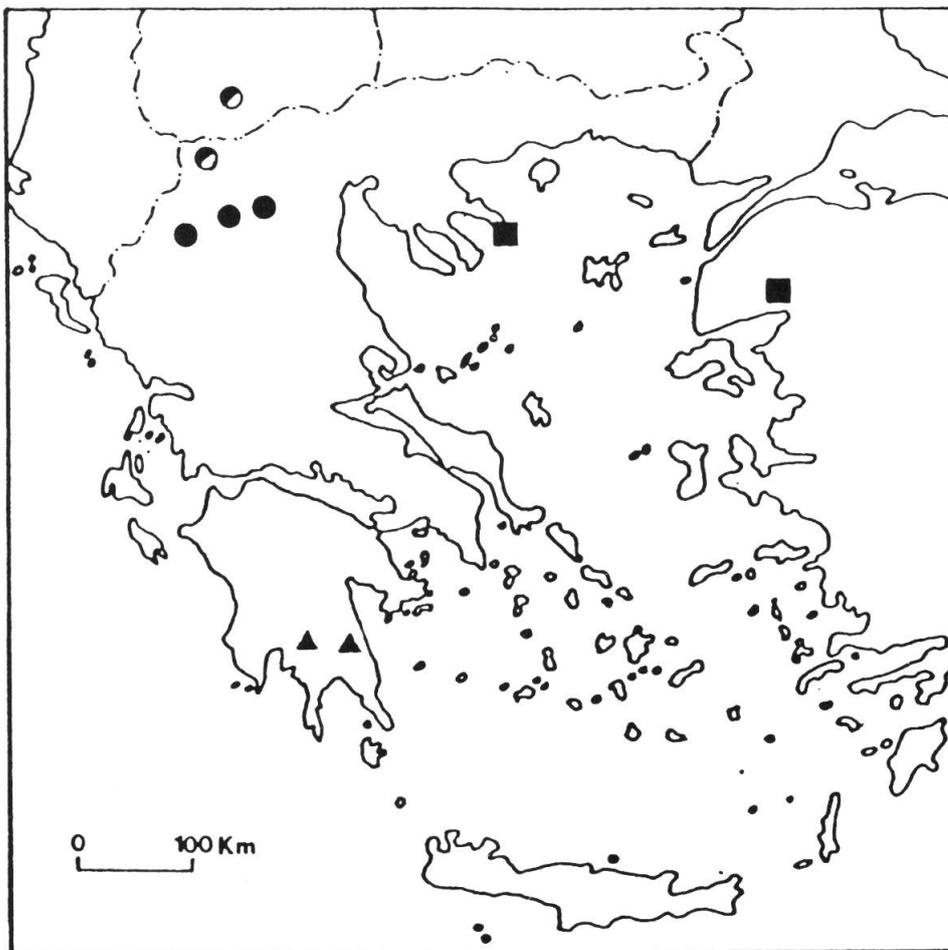


Fig. 2. — Geographical distribution of *Centaurea rupestris* (section *Acrocentron*) in Greece and the neighbouring countries. *C. rupestris* subsp. *athoa* ■; *C. rupestris* subsp. *finazzeri* ●; *C. rupestris* subsp. *kozanii* ●; *C. rupestris* subsp. *parnonia* ▲.

Table 3. — List of the morphological characters used in the factor analysis of the correspondences of *Centaurea rupestris* L., section *Acrocentron* (Cass.) DC., in Greece.

A. Florets

1.	LT	length of the central florets
2.	LR	length of the marginal florets
3.	DD	length of the lobes of the marginal florets
4.	PP	= 11/12. 11 = length of the lobes of the central florets, 12 = length of the rest part of the corolla
5.	QQ	= 11/LT
6.	RR	= DD/LR
7.	NT	number of the central florets (in one head)
8.	NR	number of the marginal florets
9.	NI	number of marginal florets with 6 lobes
10.	NH	number of marginal florets with 5 lobes
11.	NG	number of marginal florets with 4 lobes
12.	NF	number of marginal florets with 3 lobes
13.	NE	number of marginal florets with 2 lobes
14.	ND	number of marginal florets of intermediate forms
15.	MM	= NR/NT
16.	KK	= LR/LT
17.	FI	= 13/DD, 13 = width of the marginal florets lobes
18.	AA	evolutionary levels of the marginal florets development: 1. almost discoid, 2. intermediate, 3. a little radiate, 4. radiate

B. Bracts and appendages

19.	LB	length of the bract
20.	WB	width of the bract
21.	LA	length of the appendage
22.	WA	width of the appendage
23.	LC	length of the coloured part of the appendage
24.	LS	length of the terminal spine
25.	LF	length of the cilia
26.	JJ	= LS/LF
27.	BB	= WA/WB
28.	EE	= LB/LA
29.	NC	number of cilia on each side

C. Flower-heads

30.	LH	length of the head
31.	WH	width of the head
32.	LI	length of the involucre
33.	WI	width of the involucre
34.	HH	= LH/WH
35.	II	= LI/WI
36.	SI	shape of the involucre: 1. ovate, 2. globose, 3. ovoid, 4. oval.

D. Stems and leaves

37.	LM	length of the leaves' mucron
38.	VV	= length/width of the leaf's lobe
39.	HC	length of the stem
40.	SL	shape of the middle leaves: 1. entire, 2. pinnatilobed, 3. pinnatifid, 4. pinnatipartite, 5. pinnatisect, 6. pinnate
41.	SS	shape of the leaf's terminal lobe: 1. ovate rounded, 2. oval, 3. ovoid, 4. obovate, 5. lanceolate, 6. long lanceolate, 7. linear
42.	UU	shape of the leaves' lobes: 1. elliptical, 2. ovate, 3. oval, 4. obovate, 5. lanceolate, 6. long lanceolate, 7. linear
43.	YY	stems erect (1) or procubent (2)

D. Fruit

44.	LP	length of the pappus (central achenes)
45.	LE	length of the achene (central achenes)
46.	WE	width of the achene
47.	LD	length of the inner row of pappus (central achenes)
48.	WP	width of the pappus
49.	LU	length of the pappus (marginal achenes)
50.	LN	length of the achene (marginal achenes)
51.	WN	width of the achene (marginal achenes)
52.	NN	= LE/LP
53.	OO	= LN/LU

The representation of the group in the axes 1.2 and 1.3 (Fig. 3, 4) showed the following:

- The populations from Mt. Parnon and Mt. Taygetos do not separate at all.
- The populations from N Greece form three diagrams (Mt. Athos / Mt. Voras / Kozani, Grevena) and are well distinguished from one another.
- The four diagrams seem to represent four different taxa.

Taxonomy

All the data from the cytological, cytogeographical and morphological study, as well as the results of the numerical taxonomy suggest, that the best classification of the taxa belonging to the *C. rupestris* group is the subspecies level (Tab. 4).

<i>Taxon</i>	<i>Locality</i>
1. <i>C. rupestris</i> L. subsp. <i>athoa</i> (DC.) Gugler	Mt. Athos
2. <i>C. rupestris</i> L. subsp. <i>finazzi</i> (Adamović) Hayek	Mt. Voras
3. <i>C. rupestris</i> L. subsp. <i>kozani</i> Routsis & Georgiadis	Kozani / Grevena
4. <i>C. rupestris</i> L. subsp. <i>parnonia</i> (Hal.) Routsis & Georgiadis	Mt. Parnon / Mt. Taygetos

Table 4. — Classification of the Greek taxa of *Centaurea rupestris* L.

***Centaurea rupestris* L., Sp. Pl. ed. 2: 1298 (1763).**

Key for the Greek subspecies of *C. rupestris*

1. Stems high (> 15 cm).
2. Pappus 2-3 mm.
3. Appendages dark brown with 8-10 cilia, involucre ovate, diameter 12-14 mm, hair at the side of the bracts, achenes 4.5-5.5 mm subsp. **athoa** ($2n = 20$)
- 3*. Appendages light brown (– brown) with 7-8 cilia, involucre ovoid, diameter 11-13 mm, bracts without hair, achenes ca. 4 mm subsp. **finazzi** ($2n = 20$)
- 2*. Pappus 1.2-2 mm, appendages dark brown, almost triangular, bracts without hair
subsp. **parnonia** ($2n = 20$)
- 1*. Stems short (< 15 cm).
4. Stems procumbent, involucre ovoid, with a diameter of 9-12(-13) mm
subsp. **parnonia** ($2n = 20$)
- 4*. Stems erect, involucre ovate, with a diameter of 12-16 mm subsp. **kozani** ($2n = 40$)

subsp. **athoa** (DC.) Gugler, Cent. Ungar. Nat.-Mus.: 194 (1907).

syn.: *Centaurea athoa* DC., Prodr. 6: 588 (1838).

Centaurea rupestris L. var. *athoa* (DC.) Griseb., Spic. Fl. Rumel 2: 242 (1844).

Colymbada athoa (DC.) Holub in Folia Geobot. Phytotax. 7: 315 (1972).

Centaurea parolinii DC., Prodr. 6: 592 (1838).

Centaurea trojana Bornm. in Repert. Spec. Nov. Regni Veg. 19: 101 (1923).

Typus: in Graecia mt. Athone, *Aucher 3176* (G-DC).

Specimens examined

Athos peninsula: Mt. Athos (Ag. Oros): S of the summit, 1600-1800 m, *Papanikolaou 1291* (UPA); S side, along the path from Ag. Anna to the chapel of Panagia, 1200-1500 m, *Papanikolaou 7620* (UPA); prope Panagia 1300-1500 m, *Georgiadis 179, 3558* (UPA).

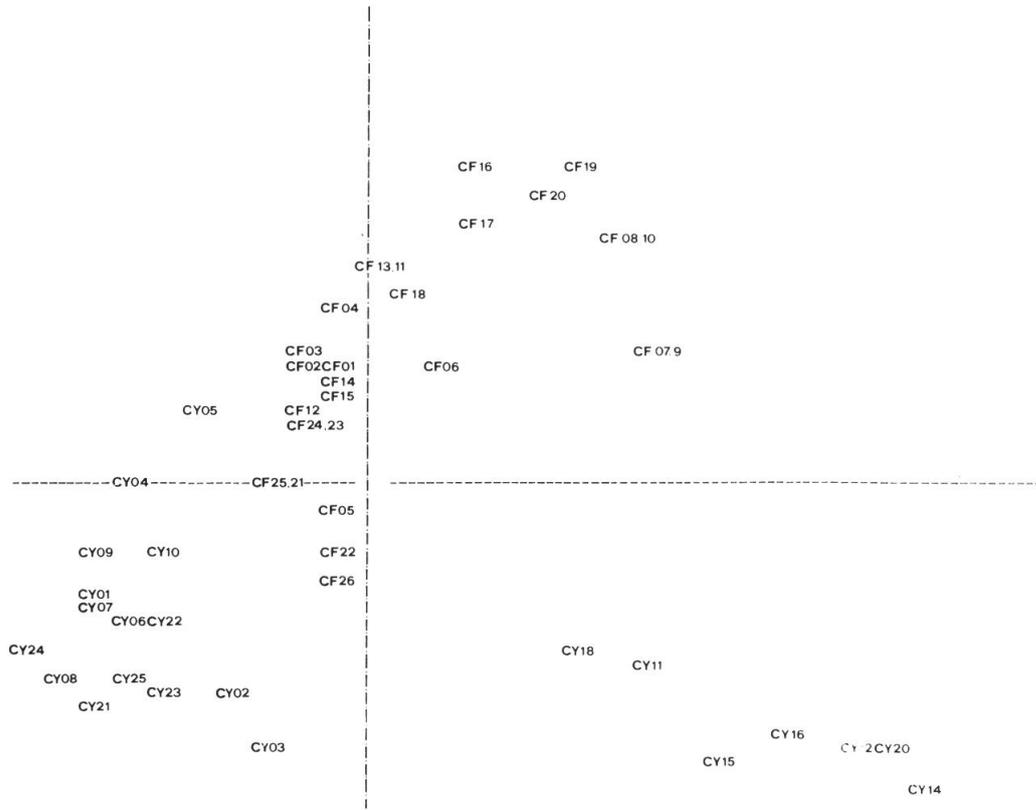


Fig. 3. — Factor analysis of the correspondences. Representation of *Centaurea rupestris* (axes 1, 2). *C. rupestris* subsp. *athoa* CY11-CY20, *C. rupestris* subsp. *finazzeri* CF21-CF26, *C. rupestris* subsp. *kozanii* CF01-CF20, *C. rupestris* subsp. *parnonia* CY01-CY10, CY21-CY25.

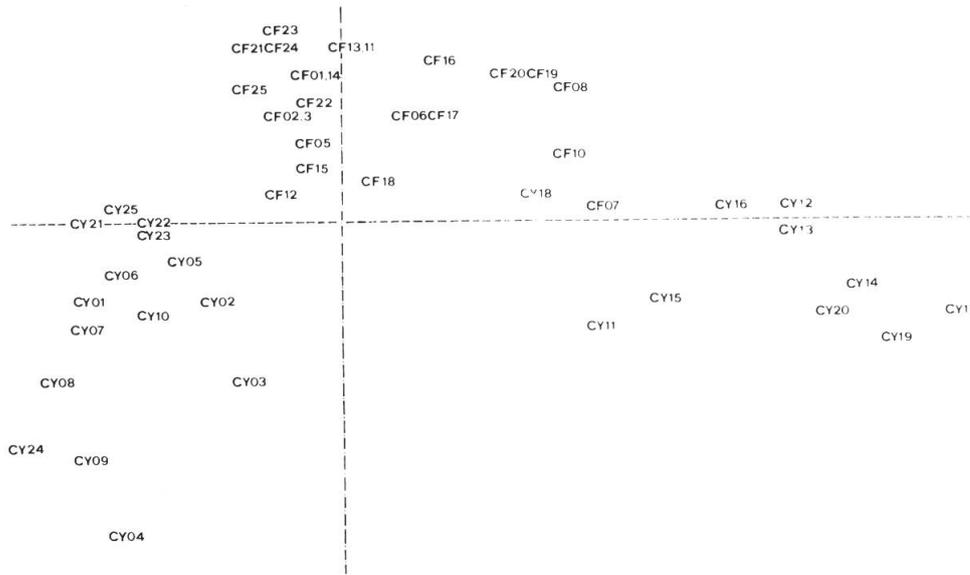


Fig. 4. — Factor analysis of the correspondences. Representation of *Centaurea rupestris* (axes 1, 3).

subsp. **parnonia** (Hal.) Routsis & Georgiadis, **comb. nov.**

- syn.: *Centaurea parnonia* Hal. in Bull. Herb. Boissier 6: 648 (1898).
Colymbada parnonia (Hal.) Holub in Preslia 46: 228 (1974).
Centaurea macedonica subsp. *parnonia* (Hal.) Dostál in Bot. J. Linn. Soc. 71: 195 (1976).
Centaurea athoa subsp. *parnonia* (Hal.) Gamal-Eldin & Wagenitz in Bot. Jahrb. Syst. 107: 101 (1985).
Centaurea rupestris var. *minor* Boiss., Fl. Orient. 3: 668 (1875).

Typus: Lakonia: in cacumine montis Malevo Laconiae, 19./31.7.1858, Orphanides (WU-HAL, ATHU).

Specimens examined

Prov. Lakonia: Mt. Parnon, summit area of Megali Tourla, 1700 m up to the top 1935 m, *Stamatiadou 13333* (ATH); area of Megali Tourla, 1900 m, *Baden & Franzen 649* (ATH), *Georgiadis & Routsis 7329* (UPA); Megali Tourla, ca. 1850 m, *Routsis & Karanasis 208* (UPA); in cacumine montis Malevo Laconiae, alt. 6000', Orphanides (ATHU) / Mt. Taygetos: alt. 1200-1250 m, *Iatrou 490, 2151* (UPA); infra refugium EOS, 1200-1600 m, *Phitos 2529* (UPA).

subsp. **finazzeri** (Adamović) Hayek, Prodr. Fl. Penins. Balc. 2: 754 (1931).

- syn.: *Centaurea finazzeri* Adamović in Österr. Bot. Z. 55: 235 (1905).
Colymbada finazzeri (Adamović) Holub in Folia Geobot. Phytotax. 7: 315 (1972).

Typus: Yugoslavien: in pascuis saxosis et asperis regionis collinae ad Veles (Koprili), Finazzer.

Specimens examined

Greece: Mt. Voras: Ano Garefi, *Georgiadis 6940, 6945* (UPA). **Yugoslavia:** Titov Veles, in clivo aprico argiloso in valle fluminis Vardar, ad viam publican inter opp. Gradsko et Titov Veles, ca. 6 km ab Gradsko, crescit unacum *Scabiosa ucranica* et *Tremastelma palaestinum*, 100 m s.m., *Ger-noch 27298* (UPA).

subsp. **kozanii** Routsis & Georgiadis, **subsp. nov.**

Perennis. Caulis erectus, 5-10(-15) cm altus, simplex vel parum ramosus. Folia pinnatisecta, arachnoidea, segmentis lanceolatis. Involucrum ovatum, 12-16 mm latum. Phylla involucri pallide viridia, ovata, 4-5 mm lata. Appendices phyllorum obscure fuscae, triangulares, pectinato-ciliatae; ciliis utrinque 8-10, 1-2 mm longis, in spinam 0.7-1.5 mm longam abeuntes. Flores flavi; marginales steriles vix radiantes. Achaenia fusca, glabra, 4.5-5.2 mm longa, pappus duplex, externus 1.5-2.5(-3) mm, internus 0.5-1.2 mm longus. In pratis rupestribus et ad margines viarum.

Numerus chromosomatum $2n = 40$.

Typus (Holo): Prov. Kozani: ca. 6 km ab oppido Kozani versus Ptolemais; in pratis rupestribus et ad margines viarum, 5.7.1989, *Georgiadis & Routsis 7320* (UPA) (Fig. 5).

Perennial. Stems erect, short 5-10(-15) cm, usually simple or sparingly branched. Leaves pinnatisect (-pinnate), arachnoid, with lanceolate segments. Involucres ovate, diameter 12-16 mm. Bracts ovoid, 4-5 mm wide. Appendages almost triangular, dark brown, with an apical spine 0.7-



Fig. 5. — *Centaurea rupestris* subsp. *kozanii* Routsis & Georgiadis (holotypus).

1.5 mm and 8-10 cilia on each side, 1-2 mm long. Florets yellow, the marginal rather radiant, bigger than the central ones, with 3, 4, 5 lobes. Achenes glabrous, brown, 4.5-5.2 mm, with a double pappus, external brownish, 1.5-2.5(-3) mm and inner row 0.5-1.2 mm.

Specimens examined

Prov. Kozani: road from Grevena to Neapolis, near the river Aliakmon, *Georgiadis & Routsis* 7319 (UPA); Kalomeri and Neapolis, between Kozani and Kastoria, NW of the bridge over the river Aliakmon, *Stamatiadou* 15621 (ATH) / road to Ptolemais, outside Kozani, *Georgiadis & Routsis* 7320 (UPA).

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