

CENTAUREA SUBG. CENTAUREA (COMPOSITAE): DELIMITATION AND DISTRIBUTION OF SECTIONS AND SUBSECTIONS

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Abstract

On the basis of morphological features, three sections can be distinguished within *Centaurea* subg. *Centaurea*, two of which comprise two species each, whereas the third is polymorphic and includes the remaining 28 species, here assigned to five subsections. For sectional delimitation, characters of the pappus, cypsela and corolla of marginal flowers proved to be most useful. Subsections are defined mainly by size and shape of the capitulum, quality of the involucre bracts and their appendage, and flower size and colour. The two small sections are confined to the Ibero-Maghrebine area in the SW Mediterranean: *Centaurea* sect. *Vicentinae* (two species) is endemic to S.W. Portugal, *C. sect. Africanae* (2 species) ranges from Galicia through Portugal, S. Spain and the Maghreb countries to W. Sicily. *C. sect. Centaurea* extends from S. Europe to S.W. and Middle Asia. Two of its species, purple-flowered and mesophilous, form *C. subsect. Centaurea*, a clear-cut, N.E. Mediterranean taxon with a disjunct relict distribution in S. Italy, ?Albania, S.W. Bulgaria, the N. Peloponnisos, and N.W. Anatolia. The four other are more xeromorphic, steppe-inhabiting, and yellow-flowered. *C. subsect. Ruthenicae* (14 species) is widespread, ranging from N.E. Spain through S. Europe and Anatolia east to Mongolia and N.W. China; *C. subsect. Aralocaspicae* (5 species) is centred on Kazakhstan and neighbouring areas; *C. subsect. Turkestanicae* (1 species) is confined to S.E. Kazakhstan and N.E. Afghanistan; and *C. subsect. Iranicae* (6 species) is found throughout the northern half of the *Flora iranica* area, just extending westward into the Caucasus. Apart from the presumably ancient stock of purple-flowered, mesophilous Mediterranean representatives, the diversification of the group probably has its roots in some local, hardly xeromorphic W. Anatolian endemics and took place in the realm of primary steppes that covered vast land surfaces in S.W. Eurasia in the geological past.

Introduction

Centaurea L. subg. *Centaurea* is a characteristic and well delimited group within the polymorphic assemblage of taxa traditionally assigned to a widely defined genus *Centaurea*. In fact, it would have as strong a claim of being treated as generically distinct as any other segregate that has been so recognized, except for the unfortunate fact that it includes the type of the generic name, so that its segregation would leave all other *Centaurea* subunits in search of another generic name. As long as the taxonomic disposition of these other groups is in a state of flux, a conservative approach and wide generic definition are therefore desirable in the interest of nomenclatural stability.

Characteristic features of *Centaurea* subg. *Centaurea* as a whole include the coriaceous, normally exappendiculate involucre bracts with a wide or narrow, entire or lacerate margin (Fig. 4); biseriate pappus slightly shorter to more than twice as long

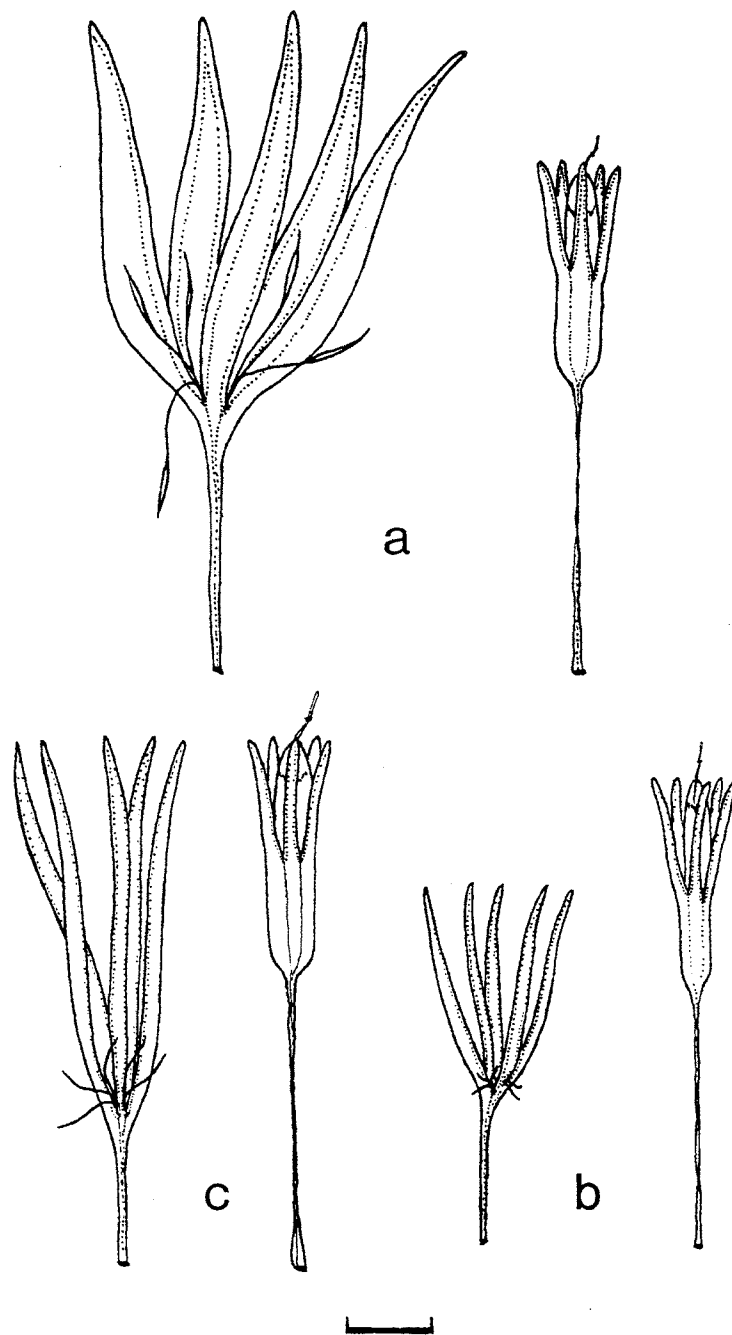


Fig. 1. Outer, sterile florets, with staminodia (left), and inner, fertile ones (right) of: a, *Centaurea fraylensis* (sect. *Vicentinae*), b, *C. africana* (sect. *Africanae*), and c, *C. ruthenica* (sect. *Centaurea*). Scale bar = 0.5 cm.

as the cypsela (Fig. 2); transversely wrinkled cypselas with a caudate hilum (DITTRICH, 1968); pollen of the "*Centaureum*" type (WAGENITZ, 1955); and a unique basic chromosome number, $x = 15$ (GUINOCHET, 1957; FERNANDES & QUEIROS, 1971; AGABABIAN & GOUKASIAN, 1994).

A number of authors have, at different times, studied representatives of our group, with varying results. CANDOLLE (1838), the last to treat it in its entirety, recognized 5 species. Regional treatments (e.g., BOISSIER, 1875; CVELEV, 1963; WAGENITZ, 1975, 1980; DOSTÁL, 1976) covered variable numbers of variously delimited taxa, including many additional ones, but no overall treatment of the group has recently been produced. The present reassessment, which concentrates on the sectional and subsectional level, is the result of a complete taxonomic revision of the subgenus by the present author, unpublished to date.

Results

On the basis of morphological criteria, *Centaurea* subg. *Centaurea* can be subdivided into three sections and seven subsections, each with a particular area. They can be characterized as follows.

Centaurea sect. *Vicentinae* M. V. Agab., sect. *nova*

Type *C. vicentina* Welw. ex Mariz [= *C. fraylensis*]. (Fig. 1a, 2a).

Flosculi purpurei, exteriores steriles majusculi distincte radiantes, lobis lanceolatis, staminodiis fusiformibus dimidium loborum aequantibus. Pappus cypselae brevior, radiis dorso barbellatis, omnibus late linearibus apice obtusis vel rotundatis; radii pappi interioris radiis intimis pappi exterioris subconformes. Cypselae tetragono-prismaticae, totam per longitudinem transverse rugulosae.

Florets purple; the outer, sterile much enlarged, with lanceolate corolla segments and fusiform staminodes c. half as long as the segments. Pappus shorter than the cypsela, its rays barbellate on the back, all broadly linear and with blunt to rounded tips, the inner pappus not clearly differentiated from the innermost series of the outer pappus. Cypsela tetragonal-prismatic, transversely wrinkled for its whole length.

A section of two species, both endemic to S.W. Portugal: *Centaurea carrissoi* Rothm. and *C. fraylensis* Sch. Bip. ex Nym. Apart from the structural features mentioned above, they are noteworthy by their low-growing, decumbent habit and upwardly curved peduncles. The section is co-extensive with *Centaurea* subsect. *Vicentinae* M. V. Agab., subsect. *nova* (type and description as above; see GREUTER & al. 1994: Art. 34.2 and Ex. 11).

Centaurea* sect. *Africanæ* M. V. Agab., sect. *nova

Type *C. africana* Lam. (Fig. 1b, 2b).

Flosculi flavi vel purpurei, exteriores steriles interioribus breviores haud radiantes, lobis linearibus, staminodiis filiformibus lobis multoties brevioribus. Pappus cypselæ duplo vel ultra longior, radiis dorso laevibus latere bifariam scabridis, omnibus tenuiter acuminatis; radii pappi exterioris filiformes, ii pappi interioris basi multo latiores, longitudine valde inaequales nam singula seriem intimam pappi exterioris aequans reliquæ multoties breviores. Cypselæ rotundato-subglobosæ, in media parte distali transverse rugulosæ.

Florets yellow or purple; the outer, sterile smaller than the inner, with linear corolla segments and staminodes filiform, much shorter than the segments. Pappus at least twice as long as the cypselæ, its rays scabrid laterally but smooth on the back, acuminate; those of the outer pappus filiform, those of the inner pappus much wider at the base, very unequal, one of them as long as the adjacent outer pappus rays, the other much shorter. Cypselæ rounded-subglobose, transversely wrinkled in its upper half.

A section of two species, one (*Centaurea eriosiphon* EMB. & MAIRE) a little known and seldom collected, purple-flowered local endemic of the Rharb region, Morocco, the other (*C. africana* LAM.) variable and widespread, ranging from Galicia through Portugal, S. Spain and the Maghreb countries to W. Sicily (where it is but doubtfully native). The section is co-extensive with *Centaurea* subsect. *Africanæ* M. V. Agab., subsect. *nova* (type and description as above).

***Centaurea* sect. *Centaurea* (Fig. 1c, 2c).**

Flosculi flavi (raro purpurei), exteriores steriles longitudine variabiles, lobis rite linearibus, staminodiis dum adsint lobis multoties brevioribus, filiformibus vel fusiformibus. Pappus cypselæ subaequilongus, radiis dorso laevibus latere bifariam scabridis, omnibus tenuiter acuminatis; radii pappi exterioris filiformes, ii pappi interioris basi multo latiores, forma et longitudine valde variabiles. Cypselæ subcylindricæ, in media parte distali transverse rugulosæ.

Florets yellow or (rarely) purple; the outer, sterile ones variable in length, their segments usually linear; staminodes, when present, much shorter than the segments, linear or fusiform. Pappus about as long as the cypselæ, its rays scabrid laterally but smooth on the back, acuminate; those of the outer pappus filiform, those of the inner pappus much wider at the base, variable in shape and dimensions. Cypselæ cylindrical, transversely wrinkled in its upper half.

A widespread and large section, extending from S. Europe to S.W. and Middle Asia, that can be further subdivided in the following 5 subsections.

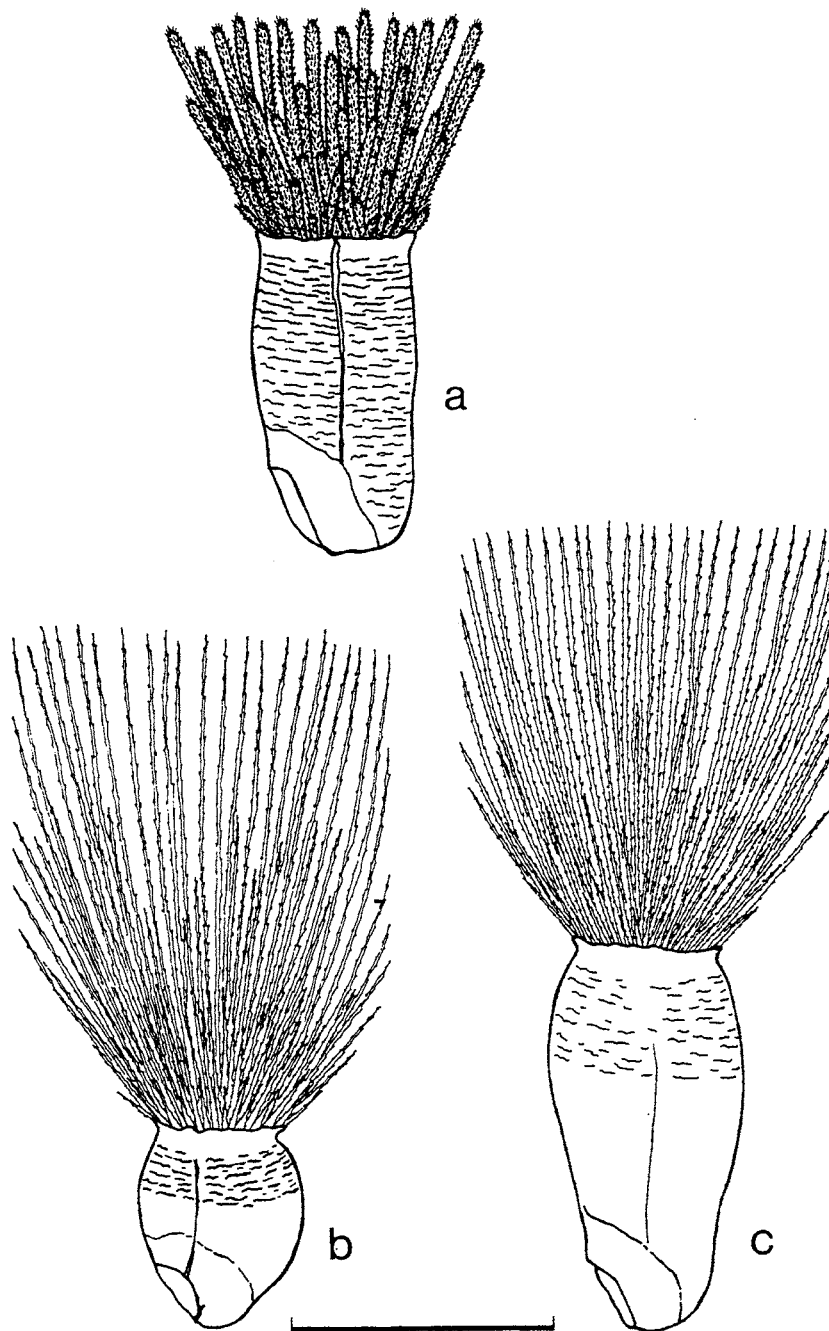


Fig. 2. Cypselas and [outer] pappus (inner pappus hidden) of: a, *Centaurea fraylensis* (sect. *Vicentinae*), b, *C. africana* (sect. *Africanae*), and c, *C. ruthenica* (sect. *Centaurea*). Scale bar = 0.5 cm.

***Centaurea* subsect. *Centaurea* (Fig. 3a, 4a).**

Heads medium-sized, ovoid. Involucral bracts appendiculate or with a narrow membranous margin. Florets purple.

A clear-cut, N.E. Mediterranean subsection of two species with a disjunct relict distribution. *Centaurea centaurium* L. is endemic to in S. Italy, whereas *C. amplifolia* Boiss. & Heldr. is known to occur in S.W. Bulgaria, the N. Peloponnisos, and N.W. Anatolia, and is doubtfully present in Albania.

***Centaurea* subsect. *Ruthenicae* M. V. Agab., subsect. nova**

Type *C. ruthenica* Lam. (Fig. 3b, 4b).

Capitula mediocria, oblongo-ovoidea. Bractea involucri margine scarioso carentes vel margine scarioso angustissimo cinctae. Flosculi flavi.

Heads medium-sized, oblong-ovoid. Involucral bracts without or with a very narrow membranous margin. Florets yellow.

This is the largest and most widespread group, comprising 14 species (*Centaurea alaica* Iljin, *C. alpina* L., *C. amasiensis* Bornm., *C. bachtiarica* Hayek & Bornm., *C. bipinnatifida* (Trautv.) Gamajun., *C. gubanovii* Kamelin, *C. iconiensis* Hub.-Mor., *C. linaresii* Lázaro Ibiza, *C. modestii* Fed., *C. mykalea* Hub.-Mor., *C. pythiae* Azn. & Bornm., *C. ruthenica* Lam., *C. taliewii* Kleopow, *C. tamanianae* M. V. Agab.; see Agababian, 1989) and ranging from N.E. Spain through S. Europe and Anatolia east to Mongolia and N.W. China.

***Centaurea* subsect. *Aralocaspicae* M. V. Agab., subsect. nova**

Type *C. kasakorum* Iljin (Fig. 3c, 4c).

Capitula parva, oblongo-ovoidea. Bractea involucri margine scarioso amplo lacerato cinctae. Flosculi flavi.

Heads small, oblong-ovoid. Involucral bracts with a wide, lacerate membranous margin. Florets yellow.

A Central Asian subsection centred on Kazakhstan and neighbouring areas, with 5 species: *Centaurea kasakorum* Iljin, *C. kultiassovii* Iljin, *C. lasiopoda* Popov & Kult., *C. phyllopoda* Iljin, and *C. razdorskyi* Karjagin.

***Centaurea* subsect. *Turkestanicae* M. V. Agab., subsect. nova**

Type *C. turkestanica* Franch. (Fig. 3d, 4d).

Capitula mediocria, sphaerico-ovoidea. Bractea involucri triangulares, acutae, margine scarioso integro cinctae. Flosculi flavi.

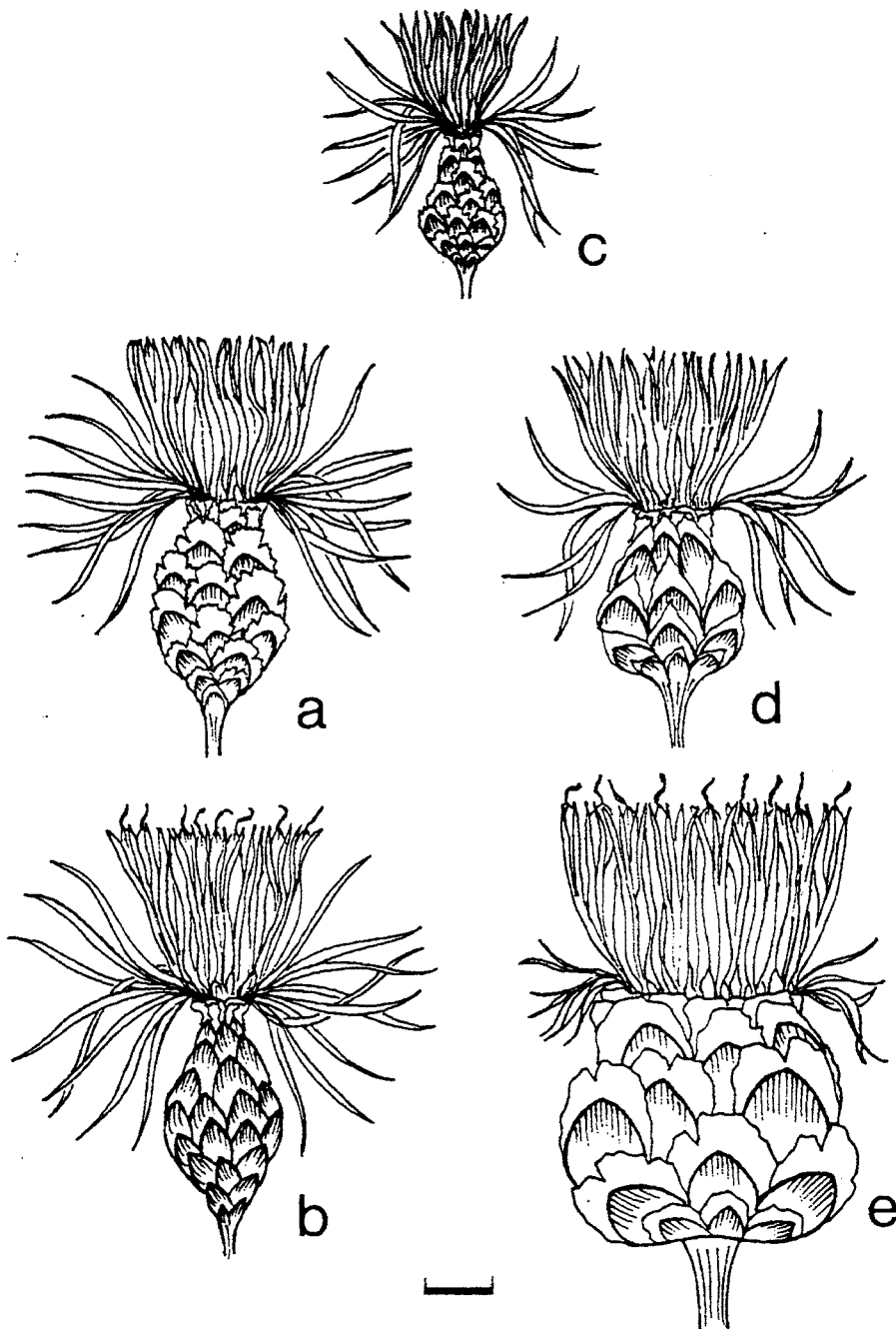


Fig. 3. Flowering capitula, in side view, of: a, *Centaurea amplifolia* (subsect. *Centaurea*), b, *C. ruthenica* (subsect. *Ruthenicae*), c, *C. kultiassovii* (subsect. *Aralocaspicae*), d, *C. turkestanica* (subsect. *Turkestanicae*), and e, *C. lachnopus* (subsect. *Iranicae*). Scale bar = 1 cm.

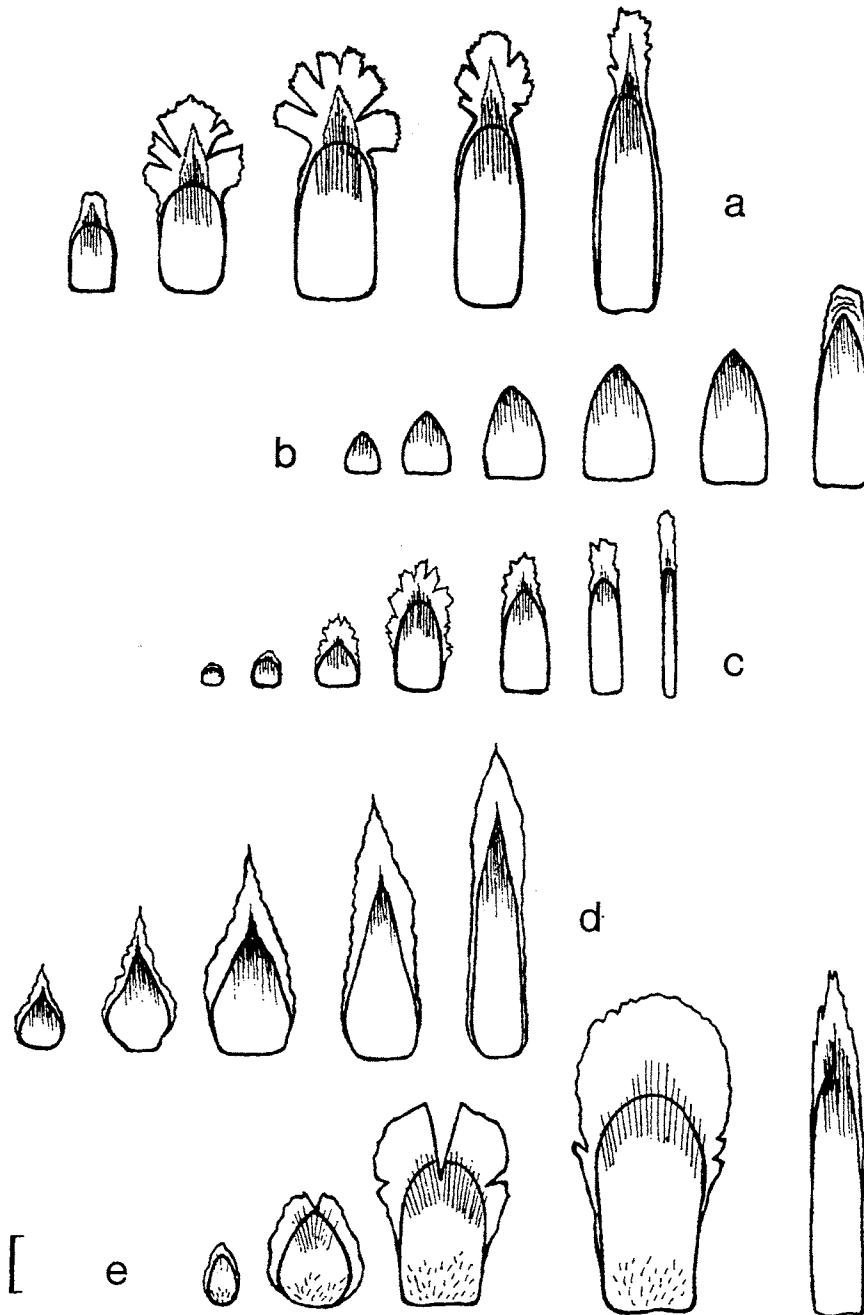


Fig. 4. Series of involucre bracts, from outer (left) to inner (right), of: a, *Centaurea amplifolia* (subsect. *Centaurea*), b, *C. ruthenica* (subsect. *Ruthenicae*), c, *C. kultiassovii* (subsect. *Aralocaspicae*), d, *C. turkestanica* (subsect. *Turkestanicae*), and e, *C. lachnopus* (subsect. *Iranicae*). Scale bar = 0.5 cm.

Heads medium-sized, spheroidal-ovoid. Involucral bracts triangular, acute, with an entire membranous margin. Florets yellow.

Monotypic and confined to S.E. Kazakhstan and N.E. Afghanistan.

Centaurea* subsect. *Iranicae* M. V. Agab., subsect. *nova

Type *C. lachnopus* Rech. f. (Fig. 3e, 4e).

Capitula majuscula, depresso-ovoidea. Bracteae involucri margine scarioso amplo lacerato cinctae. Flosculi flavi.

Heads large, depressed-ovoid. Involucral bracts with a wide, lacerate membranous margin. Florets yellow.

This group of 6 species (*Centaurea androssovii* Iljin, *C. gerhardii* M. V. Agab.*, *C. gontscharovii* Iljin, *C. hajastana* Tzvelev, *C. lachnopus* Rech. f., *C. schmidii* Wagenitz) is found in the S.E. portion of the sectional range, occurring throughout the northern half of the *Flora iranica* area and just extending westward into the Caucasus.

Discussion

Centaurea subg. *Centaurea* is confined to the Holarctic floristic kingdom, more exactly to three of its floristic regions: the Eurasian-Circumboreal, the Mediterranean and the Irano-Turanian regions (TAKHTAJAN, 1986). In the Eurasian part of the Circumboreal Region, the subgenus is rather poorly represented, by three species only (*Centaurea ruthenica*, *C. taliewii*, and *C. modestii*), all of which have wide if partly discontinuous areas. In the two other regions species diversity is higher, with 11 species in the Mediterranean and 15 in the Irano-Turanian region.

Only three species bridge the divide between the Mediterranean and Irano-Turanian plus Circumboreal regions: *Centaurea ruthenica*, *C. taliewii*, and *C. modestii*, the two latter occurring in the very border area, whereas *C. ruthenica* is the only species that is widespread in both regions. The Mediterranean representatives are relatively few, taxonomically well defined and little variable, whereas the non-Mediterranean group includes a great number of either polymorphic or very local species often connected by intermediate forms.

Analysing the areas (Fig. 5) and species contents of the various sections and subsections, the rates of endemism, and the phylogenetic links inferred from their inherent

* *Centaurea gerhardii* M. V. Agab., sp. nova (Type: "Afghanistan, Kokcha valley, north of Kesem", 1440 m, 30 May 1971, Gibbons, K). Ab affinibus *C. gontscharovii* et *C. schmidii* differt foliorum segmento terminali laterales aequante nec superante, anguste lanceolato nec elliptico vel triangulari-ovato, imprimis autem radiis pappi interioris pappo exteriori partim aequilongis partim longioribus (nec omnibus brevioribus). Speciem hanc clarissimo Gerardo Wagenitz, qui eam in schedulis distinctam habuit sed nunquam juris publici fecit, reverenti animo dicare volui.

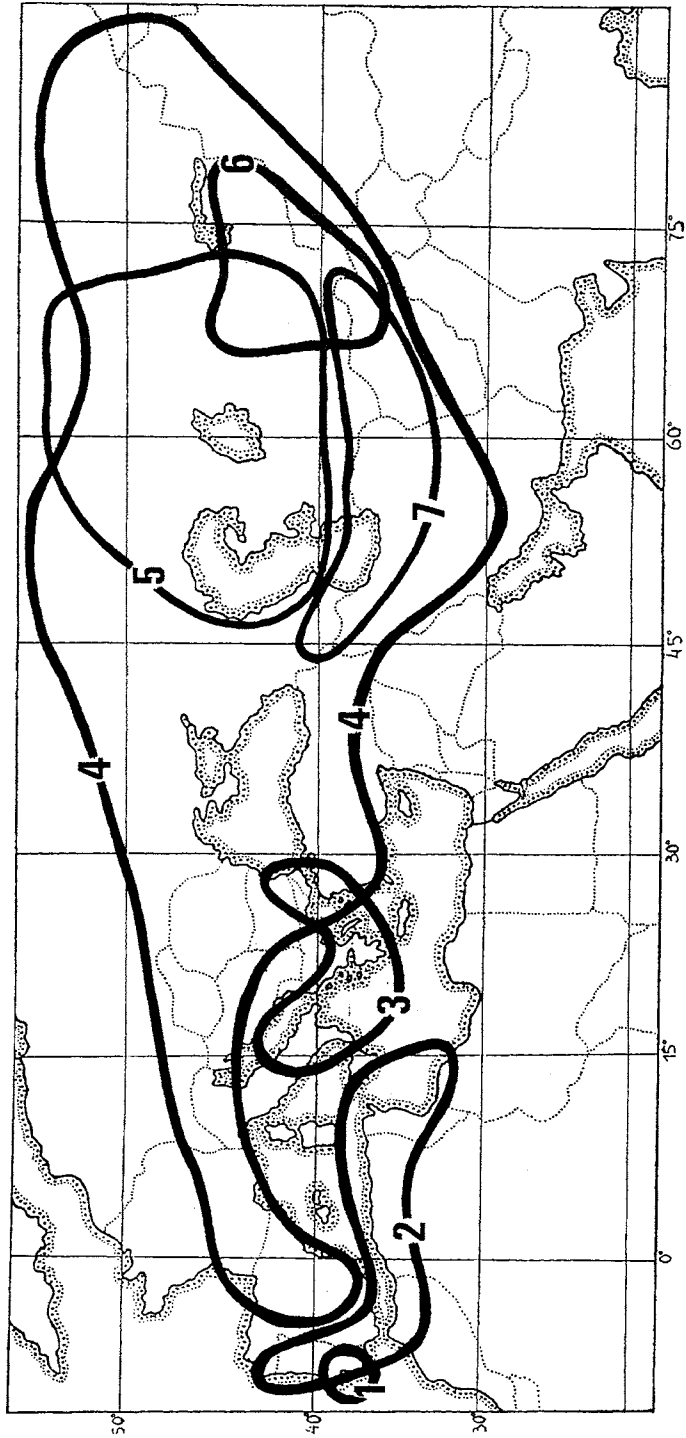


Fig. 5. Sectional and subsectional areas in *Centaurea* subg. *Centaurea*: 1, *C. sect. Vicentinae*; 2, *C. sect. Africanae*; 3, *C. subsect. Centaurea*; 4, *C. subsect. Ruthenicae*; 5, *C. subsect. Aralocaspicae*; 6, *C. subsect. Turkestanicae*; 7, *C. subsect. Iranicae*.

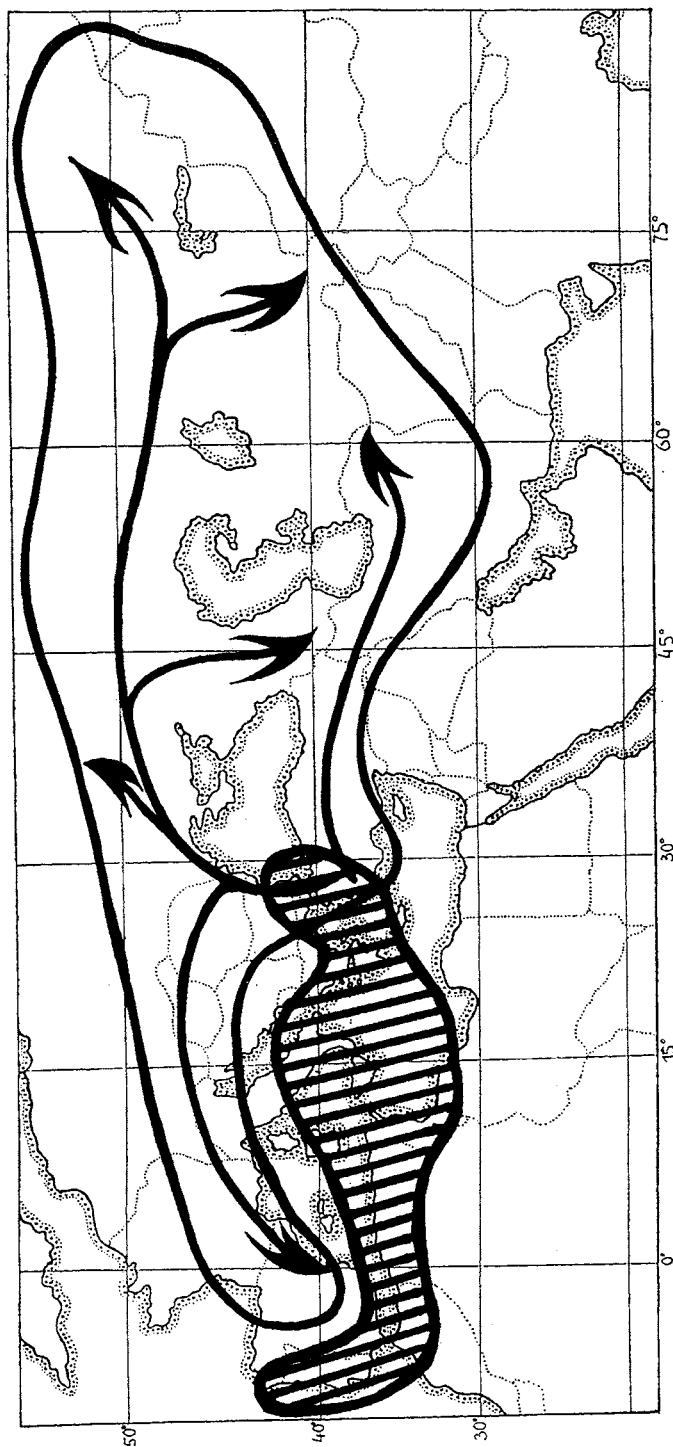


Fig. 6. Map illustrating the presumed evolution in *Centaurea* subg. *Centaurea*. Hatched area: supposedly ancient westerly, mesophilous groups (*C. sect. Vicenitinae*, sect. *Africanae*, subsect. *Centaurea*); unhatched area: younger, steppicolous subsections of *C. sect. Centaurea*, showing their supposed spread from a nucleus of old, broad-leaved W. Anatolian taxa.

morphological features, one finds that *Centaurea* subg. *Centaurea* consists of two main geographical groups of very unequal size and nature. The Ibero-Maghrebine area in the S.W. Mediterranean houses four very distinctive relict species or, rather, two clearly defined and only distantly related species pairs, each of which we treat as an independent section; whereas in the remainder of the total range, from southern Europe to S.W. and Middle Asia, five rather weakly differentiated natural groups of (sometimes widespread and variable) species occur that are best treated as subsections of a third, polymorphic section.

In terms of habitat preferences, the representatives of *Centaurea* subg. *Centaurea* are mainly elements of the steppes and steppe-like biocoenoses, being limited to the steppic domain across much of the Eurasian continent. Only a small group of westerly species (*C.* sect. *Vicentinae*, sect. *Africanae*, subsect. *Centaurea*), supposedly the most ancient by origin, are of a more mesophilous type, growing in broad-leaved (mainly oak) and coniferous (fir or pine) forests. The subsequent evolution of the group may have had its roots in some broad-leaved species of *C.* subsect. *Ruthenicae* (*C. pythiae*, *C. mykalea*) now confined to the Mediterranean strip of W. Anatolia, and probably took place in the realm of primary steppes that covered vast land surfaces of southern Eurasia in the geological past (Fig. 6).

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References

- AGABABIAN, M. V. (1989). Novi vid *Centaurea tamaniana* (Asteraceae) iz Armenii. *Biol. Zurn. Armenii* **42**: 186-190.
- & A. V. GOUKASIAN (1994). On the karyology of Armenian representatives of the *Centaurea* subgenus *Centaurea* (Asteraceae). *Thaiszia* **4**: 171-173.
- BOISSIER, E. (1875). *Flora orientalis* 3. Genève, Basel & Lyon.
- CANDOLLE, A. P. DE (1838). *Prodromus systematis naturalis regni vegetabilis* 6. Paris, Strasbourg & London.
- CVELEV, N. N. (1963). *Centaurea* L. In: V. L. KOMAROV (ed.), *Flora SSSR* **28**: 377-387. Leningrad.
- DITTRICH, M. (1968). Morphologische Untersuchungen an Früchten der Subtribus Cardueae-

- Centaureinae (Compositae). *Willdenowia* 5: 67-107.
- DOSTÁL, J. (1976). *Centaurea* L. In T. G. TUTIN, V. H. HEYWOOD, N. A. BURGESS, D. M. MOORE, D. H. VALENTINE, S. M. WALTERS & D. A. WEBB (ed.), *Flora europaea* 4: 254-301. Cambridge.
- FERNANDES, A. & M. QUEIROS (1971). Contribution à la connaissance cytotaxonomique des Spermatophyta du Portugal. II. Compositae. *Bol. Soc. Brot., ser. 2*, 45: 5-122.
- GREUTER, W., F. R. BARRIE, H. M. BURDET, W. G. CHALONER, V. DEMOULIN, D. L. HAWKSWORTH, P. M. JØRGENSEN, D. H. NICOLSON, P. C. SILVA, P. TREHANE & J. MCNEILL (1994). International code of botanical nomenclature (Tokyo Code). *Regnum Veg.* 131.
- GUINOCHET, M. (1957). Contribution à l'étude caryologique du genre *Centaurea* L. sens. lat. *Bull. Soc. Hist. Nat. Afr. Nord* 48: 282-300.
- TAKHTAJAN, A. L. (1986). *Floristic regions of the world*. Berkeley.
- WAGENITZ, G. (1955). Pollenmorphologie und Systematik in der Gattung *Centaurea* L. *Flora* 142: 213-279.
- (1975). *Centaurea* L. In: P. H. DAVIS (ed.), *Flora of Turkey and the East Aegean Islands* 5: 465-585. Edinburgh.
- (1980). *Centaurea*. In: K. H. RECHINGER (ed.), *Flora iranica* 139: 313-420. Graz.

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