Identity, relationship and distribution of the poorly known Cousinia elata (Asteraceae, Cardueae)

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Abstract


Cousinia elata has been known from only two collections, and its relationship to the major subgroups of the genus has been entirely unclear. It is shown that C. meshshedensis must be included in C. elata, that C. elata is actually widely distributed in NNE and NE Iran, and, based on chromosome number, flower and pollen morphology, that it is a member of Cousinia s.str. (C. subg. Cousinia). Within Cousinia s.str., C. elata is most closely related to species traditionally classified as C. sect. Platyacanthae, based on a Bayesian ITS sequence analysis. The name C. elata and its synonyms C. meshshedensis and C. strictissima are lectotypified and an amended description of the species and a map of its distribution are provided.

Introduction

A comparative analysis of the regional accounts of Cousinia by Rechinger (1953, 1972, 1979) and Tscherneva (1962, 1988) shows that the genus contains approximately 630 species grouped into three subgenera with c. 70 sections (Mehregan & Kadereit 2009). Cousinia thus is one of the largest genera of Compositae and among the 50 largest genera of flowering plants (Frodin 2004). However, the treatments by Rechinger and Tscherneva were prepared separately and are mainly based on material from two different geographical regions. Accordingly, the exact number of species in Cousinia is quite obscure, and a comprehensive study of the entire genus urgently needed. This is also evident from revision of C. subg. Cousinia sect. Cynaroidae (Mehregan & Kadereit 2008), where the number of species has been reduced from 110 to 31 plus eight subspecies.

Based on molecular studies, Cousinia together with Arctium L., Hypacanthium Juz., Schmalhausenia C. Winkl. and Cousinia subg. Cynaroides and subg. Hypacanthodes (2n = 2x = 36; pollen grains of the ‘Arctiastrum pollen type’; ring of sweeping hairs at the articulation of the base of the stylar apex present (except Schmalhausenia)), and (2) the cousinioid group with only Cousinia subg. Cousinia (= Cousinia s.str.; 2n = 2x = 18, 20, 22, 24, 26; pollen grains of the ‘Cousinia type’; sweeping hairs scattered on stylar branches; Duistermaat 1996; Susanna & al. 2003a, b; Ghaffari & al. 2006; López-Vinyallonga & al. 2009).

Cousinia elata was described by Boissier & Buhse (1860) from the Neka valley in the Elburz Mts in N Iran. A survey of the taxonomic treatment of C. elata in the 19th century shows that most authors placed the species in sections that today are known to be part of Cousinia s.str. (Table 1). Rechinger (1972) did not study the type collection of C. elata and did not place the species in his sectional classification of Cousinia. Tscherneva (1974, 1983), in contrast, transferred the species to Hypacanthium (arctioid group, C. sub. Cynaroides) with the new combination H. elatum (Boiss. & Buhse) Tscherneva. C. elata is only known from two collections from NNE Iran.
Fig. 1. Comparison of the illustration of *Cousinia elata* by Buhse (1899) with herbarium material – A: part of original illustration by Buhse (1899); B-C: herbarium sheet (*Buhse 1046/5, P*) with two specimens. – Scale bar: 5 cm.
Iran. Jalili & Jamzad (1999) did not specify the conservation status of the species because of the lack of data. In this paper I attempt to clarify the identity, relationship and geographical distribution of C. elata.

Material and methods

Both the literature and the available herbarium material were studied to typify the name Cousinia elata. Herbarium material matching the description of C. elata and of other species of Cousinia similar to C. elata was studied morphologically. Pollen grains were studied using light microscopy.

In order to identify the closest relatives of Cousinia elata, a Bayesian analysis of ITS sequences of 214 taxa was performed. Material and methods for this Bayesian analysis as well as the resulting cladogram are given in a separate paper (Mehregan & Kadereit 2009).

Results and discussion

The type collection of Cousinia elata was made by Buhse in NNE Iran (“Albursgebirge im Nikathal bei Radkan, Juli 1848, Buhse No. 1046/5”, Boissier & Buhse 1860). Bunge (1865) cited two collections as belonging to C. elata. These were the above type collection and material collected by Bunge himself at Shahroud (NNE Iran). Later on, these two collections were cited as the only known material of C. elata (Boissier 1875; Winkler 1892, 1897; Rechinger 1972). The specimens of the type collection in Boissier’s herbarium (G-BOIS) is suitable as the lectotype. In the Paris herbarium (P), a further specimen was found that clearly matches both the description of C. elata by Boissier & Buhse (1860) and the illustration of C. elata by Buhse (1899) (Fig. 1). I also found a specimen of Bunge’s collection in P.

Comparing this material with other material of the genus, I found that a good number of herbarium specimens, most of them collected recently, clearly match the description of Cousinia elata, and that the species is actually widely distributed in NNE and NE Iran (Fig. 3). Most of this material was identified as C. meshhedensis Bornm. & Rech. f. (in Rechinger 1940), which was first published based on material collected by Rechinger at Robat-Sefid (NE Iran). Morphological analysis of material belonging to C. meshhedensis clearly shows that this species falls within the variation of C. elata and cannot be regarded as a separate species. The same result was obtained for C. strictissima Rech. f. collected at Mt Shahvar in NNE Iran, not far from the type locality of C. elata. In fact, C. strictissima was correctly placed in synonymy with C. meshhedensis already by Rechinger (1979).

Table 1. Taxonomic history of Cousinia elata.

<table>
<thead>
<tr>
<th>Binomial</th>
<th>Subgenus (present concept)</th>
<th>Section</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cousinia elata</td>
<td>–</td>
<td>Sphaerocephalae Bunge</td>
<td>Boissier &amp; Buhse 1860</td>
</tr>
<tr>
<td>Cousinia elata</td>
<td>Cousinia</td>
<td>Alpinae Bunge</td>
<td>Bunge 1865</td>
</tr>
<tr>
<td>Cousinia elata</td>
<td>Cousinia</td>
<td>Odontocarpae C. Winkl.</td>
<td>Buhse 1897</td>
</tr>
<tr>
<td>Cousinia elata</td>
<td>–</td>
<td>–</td>
<td>Boissier 1875</td>
</tr>
<tr>
<td>Hypacanthium elatum</td>
<td>–</td>
<td>–</td>
<td>Rechinger 1972</td>
</tr>
<tr>
<td>Cousinia elata</td>
<td>Cousinia</td>
<td>Platyacanthae Rech. f.</td>
<td>Tscherneva 1974</td>
</tr>
</tbody>
</table>

Fig. 2. Achene and flower morphology of Cousinia elata – A-B: ridged and winged achenes; C: style with hairs scattered on stylar branches; D: flower. – Scale bar: 5 mm.
**Cousinia elata** clearly has all major diagnostic characters of the cousinioid group. Pollen grains are oblong and smooth (*Cousinia* type of *C. subg. Cousinia*), its chromosome number is $2n = 2x = 26$ (Ghaffari & al. 2006 for *C. meshhedensis*), and sweeping hairs are scattered on the stylar branches (Fig. 2).

The results of our molecular analysis support these morphological and karyological findings. The species clearly falls into the “cousinioid clade” in our Bayesian analysis of ITS sequences of 214 taxa (Mehregan & Rechinger 2009). This clearly shows that the transfer of *C. elata* into *Hypacanthium*, a genus of the arctioid group, by Tschernova (1974), is incorrect. The molecular analysis also shows that *C. elata* together with *C. eriophylla* and *C. rechingerorum* (both of *C. sect. Platyacanthae*) form a monophyletic clade with a posterior probability of 1.00 (Mehregan & Kade- reit 2009: 41, fig. 3, right column). *C. sect. Platyacanthae* is a small section endemic to NE Iran and has synapomorphies also found in *C. elata*: plants are suffrutescent-caespitose and lateral capitula overtop the capitulum of the main axis (Rechinger 1972). Therefore, I place *C. elata* in *C. sect. Platyacanthae* (Table 1). It should be clear, however, that, following the molecular analysis of the ‘Arctium-Cousinia complex’ by López-Vinyallonga & al. (2009), the present sectional classification of *Cousinia* s.str. is highly artificial. A synonomy, an amended description of the species as well as a map of its geographical distribution are given:


Plants suffrutescent, caespitose, up to 60 cm high. Leaves rigid and leathery, araneose-tomentose on both sides; basal leaves rosulate, up to 30 × 5 cm, lanceolate, coarsely pinnately lobed to pinnatisect, gradually attenuated into petiole; cauline leaves smaller and less divided towards the apex. Stems branched above to form a corymbose synflorescence. Capitula with 20-50 flowers, 2.5-5.5 cm broad including phyllaries. Phyllaries 30-45, middle ones ± spreading, their free part often ± constricted at base and expanded above into a corotate, ovate to lanceolate appendage of 10-30 × 5-9 mm, attenuate into a long spine at apex. Receptacular bristles smooth. Corolla purple, 15-20 mm long; anthers concolorous or pale. Achenes 5-6.5 mm long, asymmetrically 4-ridged or 4-win- ged. Chromosome number: 2$n = 2x = 26$. Flowering June to August. – Fig. 1-2.

Additional specimens seen. — *IRAN*: Shahpasand to Bojnourd, N of Robat-e Qareh-Bil to Almeh, 7.6.1975, 1200-1300 m, *Termé* 32234 = 34040-E (IRAN); prov. Semnan, Damghan towards Shahrud, Tazreh (30 km N of Mehmandoust), 28.7.1975, *Moussavi & Karavar* 9095 = 33820-E (IRAN); 60 km N of Damghan on way to Kalateh, 24.6.1973, 1900 m, *Andersen & Jensen* 7232 (E); Shahrud, Tash, 30.7.1975, 2400-2600 m, *Moussavi & Karavar* 9098 = 33807-E (IRAN); near Shahrud, 5.1858, *Bunge & Bienert* s.n. (P); Shahrud to Bastam,
Mojen, 7 km from Shahkuh to Mojen, 11.8.1988, 2450 m, Moussavi & al. 9099 (IRAN); in declivibus australibus montium Shahvar supra Nakarman (Nigarman) versus casas pastora
ners Dihí, 24.7.1948, 2200-2400 m, Rechinger 5950 (B, M, K, W); NE, prov. Khorrassan, Esferaien, N slopes of Shah-Djahan mnts., after Noshirevan, supra Denj, 11.6.2002, 1470-1630 m, Mehregan 46 (herb. Faculty of Farmacy, Mashhad, Iran); inter Khargh and Ghouchan, Birak, 11.6. 2002, 1740-1975 m, Mehregan 45 (herb. Faculty of Farmacy, Mashhad, Iran); Mashhad to Torbat-e Heydari, in declivibus australibus montium Shahvar supra Nokarman (Nigar - Mehr) März 2003. – Acta Arct. 27: 101-118. [CrossRef]

Acknowledgements
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