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

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

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. meshhedensis* 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. Platycanthes*, based on a Bayesian ITS sequence analysis. The name *C. elata* and its synonyms *C. meshhedensis* and *C. strictissima* are lectotypified and an amended description of the species and a map of its distribution are provided.

Additional key words: Compositae, Cousinia subg. Cousinia, Cousinia sect. Platycanthes, taxonomy, Iran

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. *Cynaroideae* (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
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>Odontocarpace C. Winkl.</td>
<td>Winkler 1892, 1897; Buhse 1899</td>
</tr>
<tr>
<td>Cousinia elata</td>
<td>–</td>
<td>–</td>
<td>Rechinger 1972</td>
</tr>
<tr>
<td>Hypacanthium elatum</td>
<td>Cynaroides</td>
<td>–</td>
<td>Tscherneva 1974</td>
</tr>
<tr>
<td>Cousinia elata</td>
<td>Cousinia</td>
<td>Platyacanthae Rech. f.</td>
<td>present study</td>
</tr>
</tbody>
</table>
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 & Kadereit 2009). This clearly shows that the transfer of C. elata into Hypacanthium, a genus of the arctioid group, by Tcherneva (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 & Kadereit 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 suffruti- cose-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 synonymy, 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 attenuate 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 corollary 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-wined; asymmetrically 4-ridged or 4-wined; 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 Mehmansoust), 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,

Fig. 3. Geographical distribution of Cousinia elata. The type localities of C. elata, C. meshhedensis and C. strictissima are marked by larger circles.
Mojen, 7 km from Shahkuh to Mojen, 11.8.1988, 2450 m, Moussavi & al. 9099 (IRAN); in declivibus australibus montium versus casas pastorales Dihí, 24.7.1948, 2200-2400 m, Rechinger 5950 (B, M, K, W); NE, prov. Khorassan. 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 Heydarieh, in tractu boreali montium inter Robat-Safid & Turbat-e Mashhad, Iran); Mashhad to Torbat-e Heydarieh, in declivibus australibus montium Shahvar supra Nokarman (Nigar - Bunge A. von 1865: Übersichtliche Zusammenstellung listes Moscou 90. – Russische Auslandsdienst (DAAD; Ph.D. grant to Iraj Mehregan). I acknowledge the staff of the herbaria B, G, IRAN, P and W for access to their collections or the loan of material. I am also grateful to J. W. Kadereit (Mainz) for help in preparing this manuscript, and N. Kilian, M. Mirtadzadini and G. Wagenitz for their helpful comments on a previous version of this paper.

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