NOTES ON THE TAXONOMY OF COUSINIA SECT. HAUSSKNECHTIANAE (ASTERACEAE; CARDUEAE)

I. Mehregan

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TAXONOMY OF Cousinia sect. Haussknechtianae is revised. The species belonging to this section have limited distribution in high mountainous areas of C, SW and W Iran, and NE Iraq. Due to their late flowering time and remote mountainous areas of distribution, they are poorly known. Thanks to the examination of extensive collections from Zagros mountain range in recent years, species of C. sect. Haussknechtianae are now better known.

In this paper three new species, i.e. C. komidjanensis from C Iran, C. curvibracteata from SW Iran and C. rawanduzensis from NE Iraq are described as new to science. A short diagnosis, an English description and an image of holotypes for each of these three new species are given. According to the results, C. sect. Haussknechtianae includes overall eight species endemic to Iran and N Iraq. A synopsis of all species belonging to this section, an identification key to the species and a map of distribution of species are given. In addition, C. hergtiana is here lectotypified.

Key words. Cousinia sect. Haussknechtianae, taxonomy, new species, Iran, biogeography.

INTRODUCTION

The genus Cousinia Cass. with more than 600 species worldwide, is mainly centered in SW and C Asia (Rechinger 1986; Susanna & García-Jacas 2006). Since the publication of of Flora Iranica, no. 90 (Rechinger 1972) as the first major comprehensive treatment of Cousinia in Iran, taxonomy of the genus has been changed chiefly (López-Vinyallonga et al. 2009; Mehregan & Kadereit 2009; Assadi 2009, 2011).

Thanks to the extensive collections of recent years from different parts of Iran, many new species have been published and the alpha taxonomy of the genus seems to be nearing an end.
high) subshrub or perennial plant, having rigid leathery leaves, simple or branched synflorescences with sessile, 15-60 flowered capitula, involucres with more than 80 phyllaries, smooth receptacular bristles, and rose to purple flowers (Rechinger 1972; Mehregan et al. 2003 & 2010). Mehregan et al. (2003) introduced C. gatchsaranica Mehregan, Assadi & Attar as a new species belonging to section Haussknechtianae. Recently, C. karkasensis Mehregan & Djavadi another species from the section was introduced from central Iran (Mehregan et al. 2010).

A brief look at above mentioned species revealed that those species are restricted to high mountainous regions of Iran, and usually would flower in late summer. Those species are perennials propagating directly via seeds. Direct seed dispersal in the section Haussknechtianae is in contrast to wind dispersal as tumbleweeds or by exozoochory that is common in taxa like C. sect. Cynaroideae Bunge. In the section Cynaroideae and some other taxa, capitula usually remain closed and attached to the plants after maturity, and the entire plants are dispersed by wind as tumbleweeds or by exozoochory (Mehregan & Kadereit 2008; Susanna & al. 2003). In absence of pappus in mature achens of Cousinia, propagating as tumbleweeds or by exozoochory is a very effective method explaining wide distribution of some species. In all species belonging to the section Haussknechtianae, it was observed that stems with mature capitula attached on, remain inserted to the ground until the next vegetative season. Mature capitula open on the stems and only few achenes may remain closed and attached to the plants after maturity, and the entire plants are dispersed by wind as tumbleweeds or by exozoochory (Mehregan & Kadereit 2008; Susanna & al. 2003). In absence of pappus in mature achens of Cousinia, propagating as tumbleweeds or by exozoochory is a very effective method explaining wide distribution of some species. In all species belonging to the section Haussknechtianae, it was observed that stems with mature capitula attached on, remain inserted to the ground until the next vegetative season. Mature capitula open on the stems and only few achenes may have the chance of long distance dispersal. This dispersal limitation may explain the very narrow distribution of some species belonging to C. sect. Haussknechtianae.

In this paper I will clarify an enlarged concept of C. sect. Haussknechtianae, introducing three new species, give a synopsis of all species plus an identification key to all species belonging to.

**MATERIAL AND METHODS**

All herbarium material deposited in herbaria W, B, P, JE, K, E, IRAN and TARI (all abbreviations according to Thiers 2008+) were screened in searching for plant material belong to or match the description of C. sect. Haussknechtianae (sensu Mehregan et al. 2003). New collections were also made from mountainous localities in Iran. In case of unknown putative material, the classical morphological examinations were also associated with a molecular analysis using ITS data that reported in a previous study (Mehregan & Kadereit 2009).

**RESULTS AND DISCUSSION**

After study of all material mentioned above, five recently known species plus material belonging to three yet unknown species regarded to be members of C. sect. Haussknechtianae. All eight species are listed below and discussions regarding their taxonomy are presented below each taxon.


Type of section: Cousinia haussknechtii C. Winkl.


Holotype: Iraq: Kurdistan, Sulaimaniya Distr., Ascent to Pir Mukurun Dagh, 1200-1400 m, 19.09.1933, Eig & Dudevani 505 (W!; isotype HUJ).

Illustration. – Fl. Iranica 90: tab. 92 (1972). Here: Fig. 1.

Distribution. – NE Iraq, W Iran (Fig. 7).

The species can be easily recognised by its discolor leaves, branched synflorescence and capitula with straight phyllaries.


Iran: Kurdestan, Marivan, Gardaneh-Taghah, 1800-1900 m, 03.08.1987, Fattahi 1557 (TARI); Nusud to Marivan, between Nusud and Gardane Tate, around Dezave and Hanigarmale, ca. 2900 m, 27.07.1995 Mozaffarian 74831 (TARI); Lorestan, Alashtar, Dartang, Kuh-e Garrin (TT3, 48° 21’ E, 33° 56’ N), 2130-2800 m, 29.06.2005, Assadi & Mehregan 88882 (TARI); Koh-i Gerra, near Nahavand, 02.08.1909, Strauss s. n. (B, JE).
Fig. 1. Holotype of *Cousinia haussknechti* (Haussknecht 569, G-BOIS)*

Lectotype (designated here): Iran, "ad Dschek-ab inter Sultanabad et Kaschan, VI. 1903", Strauss, s. n. (B100088409, B!; isotypes JE!, "In monte Latetar, VII. 1897, Strauss, s. n., B100088410", B!).

*Note.* The name was originally published based on the specimens from two different localities. A herbarium sheet in better condition (B100088409) is here selected as lectotype. The collection from the second locality in herbarium JE was selected as duplicates from both herbarium specimens from two different localities. A herbarium

**Note.** 1897, Strauss, s. n., B100088410", B!)

(B100088409, B!; isotypes JE!, "In monte Latetar, VII. 1897, Strauss, s. n., B100088410", B!).

**Distribution.** The species can be distinguished by its concolorous, glabrous and shiny leaves, branched synflorescences, and capitula with arcuate spreading phyllaries.

**Further specimens studied.** – Iran: Khuzistan, Dehdzez, Gharoun mt, from Ab-s-valess, 1000-1500 m, 17.05.1996, Mozaffarian 74497 (TARI); Kohgilouieh and Boyer Ahmad, 50 km E of Dehdasht, Nile Mt., 2400-3200 m, 21.07.1983, Assadi and Abumamzeh 46504 (TARI).


Holotype: Iran: Esfahan: Natanz, Tameh village, Mt. Karkas, 2300 m, 10.08.2003, Mehregan 96022 (TARI; isotypes IRAN!, MJG!).

**Illustration.** – Iranian J. Bot. 16: 201 (2010).

**Distribution.** – Endemic to C Iran, Karkas Mts. (Fig. 7).

The species can be distinguished by its concolorous glabrous leaves, white stems, branched synflorescence, and capitula with 130-160 arcuate-spreading phyllaries and 40-60 flowers.

**Further specimens studied.** Esfahan, Natanz, Targh, Keshe village, Karkas Mt., 33° 26' N, 51° 47' E, Pahlevani & Bahramishad 54856 (IRAN); same locality, 2900-3500 m, 26.07.2009, Pahlevani & Bahramishad 54750 (IRAN).

6. **C. komidjanensis** Mehregan, sp. nov. Fig. 4.

Holotype: Iran, NWY Arak, Komijan towards Vafs, Mt. Ghalanjeh, 2500 m, 31.07.2002, Mehregan 96021 (TARI; isotypes MJG!, JAUI!, B!).

**Perenniss.** Caulis 100 usque ultra 150 cm altus, crassus, erectus, eburneus, tenuiter sulcato-striatus, in daubus tertissis partibus inferiore foliis; synflorescentia simplicia. Folia omnia rigida, coriacea, discoloria, superne glabra, subitus tomentosa. Capitula singulaira, ca. 50-flora. Involucrum ovato-campanulatum; phylla 100-120; phylla exteriora et intermedia lineari-subulata, erecta. Receptaculi setae leaves. Corolla rosea, 16-18 mm longa. Antherarum tubus purpureus, glaber.

**Description.** Perenniss. With glabrous, ivory white, erect, upright, thick, slightly furrowed, leafy, and unbranched stems, 100-150 cm or more high. Leaves leathery, discolored, green above and white-tomentose beneath, deeply spiny-lobed at margins, with white prominent pinnate veins; basal and lower stem leaves up to 20x5 cm, linear-lanceolate, sessile, with spreading lobes, ending to tough, up to 12 mm long spines; middle and upper stem leaves similar to basal ones, but gradually decreasing upwards, sessile, lanceolate to ovate-lanceolate, with large lobes; upper
Fig. 2. Image of *Cousinia hergtiana* (Assadi 75073, TARI).
Fig. 3. Isotype of *Cousinia raphiocephala* (Edmondson 806, E).
Fig. 4. Holotype of *Cousinia komidjanensis* (Mehregan 96021, TARI).
leaves very reduced, usually ovate-acuminate. Capitula singular, arranged in form of a spike, slightly arachnoid, ca. 10 mm in diameter without phyllaries, ca. 25 mm with phyllaries, ovate-campanulate, ca. 20 mm long, with 100–120 yellowish brown phyllaries, with ca. 50 flowers; outer and middle phyllaries linear-subulate, 1-1.5 mm width, straight, ending to a spine; inner phyllaries linear, membranaceous and acuminate at apex. Receptacular bristles smooth. Flowers purple, 16-18 mm long, with tube slightly shorter than limb; anthers purple. Achenes ca. 5 mm long, ca. 2 mm wide, compressed, narrowly ovate, brown, irregularly darkly spotted, longitudinally obscurely striated.

Further specimens studied. Iran: Arak, Komijan, Vafs, Mt. Ghalanjeh, 2600 m, Moussavi, Eskandari 31763 (IRAN, MJG).

Etymology. The specific epithet refers to the city of Komijan, NNW of Arak where the type material of new species was collected.

Distribution and ecology. – Cousinia komidjanensis is an endemic species to central Iran, known only from Mt Ghalanjeh N of Komijan (province Markazi, Fig. 7). It was found on stony slopes.

Relationship and delimitation. Cousinia komidjanensis is characterized by having unbranched, thick ivory white stems, discolorous leaves, and heads with straight linear-subulate phyllaries. As the most prominent character, only one of species belonging to C. sect. Haussknechtianae, i.e. C. raphiocephala has unbranched stems. C. komidjanensis can be distinguished from it by its lanceolate concolorous (not narrow lanceolate and discolorous) leaves, capitula with 100-120 (not 160-200) phyllaries, and ca. 50 (not 25-30) flowers.

7. C. curvibracteata Mehregan, sp. nov. Fig. 5.

Holotype: Bakhitari, Derarh Bazoft, Kuh-e Keynou close to Leb, 2150-2400 m, 12.08.1986, Mozauffarian 58019 (TARI!; isotype TARI!).

Description. Perennial, subshrub. Root collars with remains of petioles of fallen leaves. Stems up to 100 cm high, glandular, becoming glabrous, yellowish white, erect, upright, slightly furrowed, leafy, racemecorymbsely branched at upper half. Leaves leathery, discolorous, green and usually glabrous above, white-tomentose beneath, shallow spreading spiny-lobed at margins, with white prominent pinnate-reticulate veins; basal leaves up to 25x4.5 cm, linear-lanceolate, attenuating at base into up to 4 cm long petioles, with spreading lobes, ending to tough, up to 6 mm spines; lower and middle stem leaves similar to basal ones, but decreasing upwards, sessile, lanceolate to ovate-lanceolate, cordate at base; upper leaves very reduced, usually ovate-acuminate. Synflorescence simple below, branched above. Capitula singular, arachnoid, glandular, becoming glabrous, 7-9 mm in diameter without phyllaries, 16-18 mm with phyllaries, ovate to oblong, 14-16 mm long, with 80-95 yellowish brown phyllaries, with 15-25 flowers; outer and middle phyllaries linear-subulate, 1-1.5 mm wide, spreading-arcuate to recurved, ending to a spine; inner phyllaries linear-lanceolate, membranaceous, very finely serrate and acute at apex. Receptacular bristles smooth. Corolla purple, 13-15.5 mm long, with tube slightly shorter than limb; anthers purple. Achenes 5-6 mm long, 2.5-3 mm wide, compressed, narrowly obovate, round or truncate at apex, attenuate below, grey-brown, irregularly darkly spotted, longitudinally obscurely striated.

Further specimens studied. – Iran: Luristan, Aligoudarz towards Boznawid, Darreh Absefid, 2030-2400 m, 16.09.1996, Mozauffarian 77168 (TARI).

Etymology. The specific epithet refers to the curved form of phyllaries.

Distribution and ecology. – Cousinia curvibracteata is an endemic species to SW Iran, grows on the stony slopes of Zagros Mts. (Fig. 7).

8. C. rawanduzensis Mehregan, sp. nov. Fig. 6.


Note. Herbarium material belonging to the new species were formerly misidentified by Rechinger (1972) sub C. leptolepis, a narrow endemic from C Elburz in N Iran (for more details see below).

Holotype: Iraq: Erbil (Kurdistan), Mons Helgurd ad confines Persiae, ca. 36° 40' N, 44° 50' E, in valle supra pagum Nowanda, ca. 2000-2600 m, 10.-14.08.1957, Rechinger 11347 (11347 –I, W!; isotypes E!, K!, 11347-II (basal leaves only), W!).
Fig. 5. Holotype of *Cousinia curvibracteata* (Mozaffarian 58019, TARI).
Fig. 6. Holotype of *Cousinia rawanduzensis* (Rechinger 11347-I, W).
Perennis, collo residuis petiolorum comos. Caulis erectus, usque 100 cm altus, pallidus, glabrescens. Folia basalia petiolo usque ad 5 cm longa suffulta, usque 35 × 10 cm, ambitu lanceolata vel ob lanceolata, irregulariter spinoso-sinuato-lobata, cocoloria, supra et subitus glabra. Synflorescentia stricte ramosa. Capitula omnisellia, spinis inclusis 17-22 mm diametro, 30-50-flora; involucrum absque spinis 15-24 × 14-17 mm, oblongum vel ovatum. Phylla 90-100, extima et media 50-flora; involucrum absque spinis 15-24 × 14-17 mm, omnino sessilia, spinis inclusis 17-22 mm diametro, 30-22 mm glabros, 14-17 mm in diametro, 15-24 mm longo, with 90-100 yellowish brown, usually purple glabrous ones, but gradually decreasing upwards, sessile, attenuate at base, lanceolate to lanceolato-lanceolate, membranaceous and acuminate at apex. Capitula singular, arachnoid, glandular, becoming glabrous, 14-17 mm in diameter without phyllaries, 17-22 mm with phyllaries, ovate to oblong, 15-24 mm long, with 90-100 yellowish brown, usually purple tinged phyllaries, with 30-50 flowers; outer and middle petiolar leaves similar to basal ones, but gradually decreasing upwards, sessile, attenuate at base, lanceolate to lanceolato-lanceolate, cordate or up to 3 cm decurrent at base; upper leaves reduced, usually ovate-acuminate to triangular. Petiolar bristles smooth. Corolla purple or pink, 15-20 mm long, with tube shorter than limb; anthers purple or pink. Achenes ca. 6 mm long, 2.5-3 mm wide, compressed, narrowly obovate, round or truncate at apex, attenuate below, brown, irregularly darkly spotted, longitudinaly obscurely striate.

Further specimens studied. – Iraq: Erbil: Hisar-i Rost (NE Rawanduz, near Persian territory), 200-2400 m, 17.05.1956, Guest & Husham 15814 (K); Chiya-i Manau, near Walza, 6000-7000 ft., 19.09.1932, Guest 2735 (K); Road track from Bardana to Qandil range, 2500 m, 29.08.1957, Rawi & Serhang 24620 (K); Serin Mt., on the road to Qandil, 1820-2380 m, 30.07.1957, Rawi & Serhang 24010 (K); "ArGird" Algard Dagh, 1900-2500 m, 23.08.1948, Gillett 12470 (K); Montes Qandil ad confluens Persiae, ca. 36° 30' N, 45° E, in decliv. arid. supra Push stahan, ca. 1800-2200 m, 28.07.-01.08.1957, Rechinger 11109 (W).

Key to the species of the Cousinia sect. Haussknechtianae

1. Leaves concolorous; green and glabrous on both surfaces
   - Leaves discolorous; green above and white-tomentose beneath

2. Capitula limited in number (4-7). Involucrum 15-20 mm in diameter without phyllaries, with 150-200 phyllaries and ca. 50 flowers
   - Plant without above combination of characters
   - Middle involucral bracts straight
   - Middle involucral bracts arcuate or recurved
   - Stems shinny ivory white, glabrous

Cousinia sect. Haussknechtianae

C. raphiocephala - Stems straw colored, glandulose

6. Capitula with more than 130 phyllaries and more than 40 flowers
   - Capitula with less than 115 phyllaries and less than 25 flowers

C. karkasensis - Capsulata arenosa

C. rawanduzensis - Stems straw colored, glandulose

C. hergtiana - Leaves discolorous; green above and white-tomentose beneath

C. leptolepis – Plant without above combination of characters

Distribution and ecology. – Cousinia rawanduzensis is an endemic species to NE Iraq, in mountains near the border with Iran (Fig. 7). It grows in high rocky mountain slopes in the thorn-cushion zone.

Relationship and delimitation. – Specimens belonging to this species were mistakenly identified as C. leptolepis (C. sect. Sphaerocephalae Bunge), an endemic to central Elburz in N Iran. Apart from the morphological differences, two species can be separated by their habit and biogeography. Species of the section Sphaerocephalae are mainly monoparic, though C. sect. Haussknechtianae consists of mainly perennial species. All species of C. sect. Sphaerocephalae are restricted to Elburz mountain ranges in N Iran while C. rawanduzensis is restricted to a limited area in NE Iraq (Fig. 7).

In addition, a sample from the holotype of the new species (sub “C. sp. 11347”) was analyzed along with the material of C. leptolepis (collected from Tehran, Karadj, Kuh Dashteh, S slopes, 2200 m, 09.2003, Mehregan 111, deposited at MJG & TARI) in a previous molecular study (Mehregan & Kadereit 2009). Though all species belonging to the section Sphaerocephalae formed a monophyletic group with high posterior probability of 1.00, the new species showed no close relationship with them.

The new species is related to C. haussknechtii, but differs from it mainly by its concolorous (not discolorous) leaves.

Etymology. The specific epithet refers to the city of Rawanduz in NE Iraq, where the type material was collected.

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Fig. 7. Map of distribution, and schematic habit of species belonging to *Cousinia* sect. *Haussknechtianae*.
6. Stem unbranched. Capitula with ca. 50 flowers
   \textit{C. komidjanensis}

- Stem branched above. Capitula with 30 flowers or less

7. Involucrum 7-9 mm in diameter without phyllaries; phyllaries arcuate or recurved
   \textit{C. curvibracteata}

- Involucrum 15-20 mm in diameter without phyllaries; phyllaries straight
   \textit{C. haussknechtii}

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