



## Taxonomic notes on the *Psephellus zuvandicus* group (Asteraceae) from Iran

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### Abstract

*Psephellus khalkhalensis* (Asteraceae) is described and illustrated as a new species of *Psephellus* sect. *Psephellus* from NW Iran. The section contains plants characterized by having often ascending or prostrate stems with few branches and a central rosette of leaves, lyrate to pinnatisect leaves, with arachnoid indumentum on the upper side, densely tomentose on the lower, appendages membranous, triangular to ovate, ciliate, without prominent terminal mucro or spinule, not decurrent, flowers purple or the central whitish. The new species is closely related to *P. zuvandicus* native to Iran, but differs from it by the shape of stem (decumbent or arcuate-ascending vs. ascending rarely erect), basal leaves [segments in 9–11 pairs, narrowly oblong, sometimes triangular, 2–4 mm wide vs. segments in 3–7 pairs, lanceolate or obovate, 5–12(–20) mm wide], colour of appendages (brown-blackish vs. pale brown), and also cilia (brownish vs. whitish). The value and utility of leaf indumentum was also evaluated as an additional source of information for the taxonomy of *P. zuvandicus* and *P. khalkhalensis*.

**Key words:** Ardebil, *Centaurea*, Khalkhal

### Introduction

*Centaurea* Linnaeus (1753: 909) s.l. is one of the largest genera of the family Asteraceae. It is a taxonomically difficult genus and comprises 400–700 species (Wagenitz 1975, Dittrich 1977, Bremer 1994, Wagenitz & Hellwig 1996). The taxonomic complexity of *Centaurea*, especially in the Near East has been recently discussed (Wagenitz 1983, Kaya 1986, 1987, Hellwig 1994, Kaya *et al.* 1996, Wagenitz & Hellwig 1997, Wagenitz *et al.* 1998, Türkoglu *et al.* 2003). *Centaurea* s.l. is considered as a non-monophyletic genus, and recent approaches have separated it into more natural genera, namely *Centaurea* s. str., *Cyanus* Miller (1754: 4), *Psephellus* Cassini (1826: 488) and *Rhaponticoides* Vaillant (1754: 165) (Wagenitz & Hellwig 2000, Greuter 2003a, 2003b, Hellwig 2004). *Psephellus* was first described as a genus in 1826, but it was later treated either as a section of *Centaurea* or as a genus mainly occurring in the Caucasus area and adjacent Turkey. Wagenitz & Hellwig (2000), on the basis of pollen morphology, micromorphology of flowers and other characters, established a broader view of *Psephellus* including 12 sections: *Aetheopappus* (Cassini 1827: 250) Wagenitz & Hellwig (2000: 36), *Heterolophus* (Cassini 1827: 250) Wagenitz & Hellwig (2000: 37), *Odontolophus* (Cassini 1827: 252) Wagenitz & Hellwig (2000: 39), *Amblyopogon* (Candolle 1838: 561) Wagenitz & Hellwig (2000: 37), *Uralepis* (Candolle 1838: 563) Wagenitz & Hellwig (2000: 40), *Xanthopsis* (Candolle 1838: 561) Wagenitz & Hellwig (2000: 40), *Psephelloidei* (Boissier 1875: 616) Wagenitz & Hellwig (2000: 34), *Sosnovskya* (Takhtajan 1936: 191) Wagenitz & Hellwig (2000: 41), *Czerniakovskya* (Czerepanov 1963: 609) Wagenitz & Hellwig (2000: 38), *Odontolophoidei* (Tzvelev 1963: 485) Wagenitz & Hellwig (2000: 38), *Hyalinella* (Tzvelev 1963: 426) Wagenitz & Hellwig (2000: 35), and *Psephellus*. So far ca. 90 species have been accepted in *Psephellus* s.l., which are distributed in East Anatolia, the Caucasian region and northwest Iran (Wagenitz & Hellwig 2000, Wagenitz & Kandemir 2008, Duran *et al.* 2009). In Iran the genus *Psephellus* includes 12 species in 8 sections, with about 50% of them endemic. In the Flora Iranica (Wagenitz 1980), *Psephellus* sect. *Psephellus* is represented by a single species in Iran, namely *P. zuvandicus* Sosnovsky (1948: 17). It is represented by two subspecies in Armenia (Gabrieljan 1995), subsp. *gegharkunikensis* (Gabrieljan 1994: 129) Gabrieljan (1995: 345) and subsp. *jelenevskyi* (Gabrieljan 1994: 128) Gabrieljan (1995: 344), which are entirely endemic to Armenia. Results from molecular studies on the genus *Centaurea* (*Psephellus*,

blackish (vs. pale brown), cilia brownish (vs. whitish), and also lobes of peripheral florets lanceolate to broadly lanceolate (vs. lanceolate-linear).

**Additional specimen seen (paratype):**—IRAN. Prov. Ardebil: 43 km to Khalkhal, 1900 m, 25 June 1977, Zargari *s.n.* (FUMH!).

**Suggested conservation status:**—We observed a very low frequency of the new species in field. Therefore, it was decided to classify it as VU (Vulnerable), a category that includes taxa with small populations that could be at risk, according to IUCN criteria (IUCN 2001). Our interpretation is based on a single known population.

### Leaf trichome morphology

Micromorphological characters especially those related to trichomes, could be considered as useful taxonomic features for the *P. zuvadicus* group. Results from our studies of leaf trichome morphology in this group showed that the leaves are covered with glandular, semicrispy and multicellular trichomes (Fig. 3 A–F). Glandular trichomes are sessile or subsessile and consist of two or four cells (Fig. 3 A–D), and multicellular trichomes originated from two epidermal cells (Fig. 3E).

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### References

- Bremer, K. (1994) *Asteraceae: Cladistics and Classification*. Timber Press, Portland, Oregon. 752 pp.
- Boissier, E. (1875) *Flora Orientalis* 3. H. Georg, Geneva & Basilea [Basel], 1033 pp.
- Cassini, H. de (1826) Ptérophe, *Pterolophus*. In: Cuvier, G. (ed.) *Dictionnaire des sciences naturelles* 44. Le Normant, Paris, pp. 34–40.
- Cassini, H. (1827) *Notobase*. In: Cuvier, G. (ed.), *Dictionnaire des sciences naturelles* 50. Le Normant, Paris, pp. 250–252.
- Czerepanov, S.K. (1963) *Centaurea* L. subgen. *Czerniakovskya* Czer., *Sosnovskya* (Takht.) Czer. In: Bobrov, E.G. & Czerepanov, S.K. (eds.) *Flora of the USSR* 28. Publishing House of the Academy of Sciences of the USSR, Moscow & Leningrad, pp. 418–420, 477–481 [in Russian].
- Candolle, A.P. de (1838) *Prodromus systematis naturalis regni vegetabilis* 6. Treuttel & Würtz, Paris, pp. 1–687. <http://dx.doi.org/10.5962/bhl.title.286>
- Dittrich, M. (1977) Cynareae—systematic review. In: Heywood, V.H., Harborne, J.B. & Turner, B.L. (eds.) *The Biology and Chemistry of Compositae* 2. Academic Press, London, New York & San Francisco, pp. 999–1015.
- Duran, A., Östürk, M. & Doğan, B. (2009) A new species of the genus *Psephellus* Cass. (Asteraceae) from North-East Anatolia, Turkey. *Ozean Journal of Applied Sciences* 2(1): 103–111.
- Fahn, A. (1990) *Plant anatomy*, 4th ed. Pergamon Press, New York, 588 pp.
- Font, M., Garnatje, T., Garcia-Jacas, N. & Susanna, A. (2002) Delineation and phylogeny of *Centaurea* sect. *Acrocentron* (Cass.) DC. based on DNA sequences: a restoration of the genus *Crocodylium* and indirect evidence of introgression. *Plant Systematics and Evolution* 234: 15–26.
- Gabrieljan, E. (1994) New taxa of the subgenus *Psephellus* of the genus *Centaurea* (Asteraceae) from Armenia and Iran. *Botanicheskii zhurnal S S S R*. 79: 120–129.
- Gabrieljan, E. (1995) *Psephellus* Cass. In: Takhtajan, A.L. (ed.) *Flora Armenii* 9. Koeltz Scientific Books, Königstein, pp. 336–352.
- Greuter, W. (2003a) The Euro+Med treatment of Cardueae (Compositae)—generic concepts and required new names. *Willdenowia* 33: 49–61.
- Greuter, W. (2003b) The Euro+Med treatment of Senecioneae and the minor Compositae tribes—generic concepts and required new names, with an addendum to Cardueae. *Willdenowia* 33: 245–250.
- Hellwig, F.H. (1994) Chromosomenzahlen aus der tribu Cardueae (Compositae). *Willdenowia* 24: 219–248.
- Hellwig, F.H. (1996) *Untersuchungen zur Phylogenie der Cardueae-Centaureinae (Compositae) unter Verwendung molekularer und morphologisch-anatomischer Merkmale*. Habilitations-Schrift, Universität Göttingen, Göttingen, 133 pp.

- Hellwig, F.H. (2004) Centaureinae (Asteraceae) in the Mediterranean—history of ecogeographical radiation. *Plant Systematics and Evolution* 246: 137–162.  
<http://dx.doi.org/10.1007/s00606-004-0150-2>
- IUCN (2001) *IUCN red list categories, version 3.1*. IUCN Species Survival Commission, Gland and Cambridge, pp. 1–30. Available on-line: <http://www.iucn.org> [accessed 25 Feb. 2012].
- Kaya, Z. (1986) Exterior and interior morphological studies on the Turkish endemic *Centaurea derderiifolia* Wagenitz and *Centaurea saligna* (C. Koch) Wagenitz.1. *Journal of Pharmacy of University of Marmara* 2(2): 145–156.
- Kaya, Z. (1987) Exterior and interior morphological studies on the Turkish endemic *Centaurea derderiifolia* Wagenitz and *Centaurea saligna* (C. Koch) Wagenitz 2. *Journal of Pharmacy of University of Marmara* 3(1): 1–17.
- Kaya, Z., Sezer, N., Kuş, S. & Tutel, B. (1996) Systematic and palynological research on some endemic species of *Centaurea* L. in Turkey. In: Öztürk, M.A., Seçmen, Ö. & Görk, G. *Plant life in Southwest and Central Asia* 2. University Press İzmir, Türkiye, pp. 850–870.
- Koch, C. (1851) Beiträge zur Flora des Orients (Fortsetzung). *Linnaea* 24: 305–438.
- Linnaeus C. (1753) *Species plantarum*. Laurentius Salvius, Stockholm, 1200 pp.
- Miller, P. (1754) *The gardeners dictionary, ed. 4*. Privately published, London, 520 pp..
- Sosnovsky, D.I. (1948) Obzor predstavitelej roda *Psephellus* (Cass.) D. Sosn. [Specierum caucasicarum generis *Psephelli* (Cass.) D. Sosn. emend. revisio]. *Zametki po Sistematike i Geografii Rastenii* 14: 5–22 [In Russian].
- Sosnovsky, D.I. (1963) *Centaurea* L. subgen. *Psephellus* (Cass.) Schmalh. In: Bobrov, E.G. & Czerepanov, S.K. (eds.) *Flora of the USSR* 28. Publishing House of the Academy of Sciences of the USSR, Moscow & Leningrad, pp. 420–440 [In Russian].
- Susanna, A., Garcia Jacas, N., Soltis, D.E. & Soltis, P.S. (1995) Phylogenetic relationships in tribe Cardueae (Asteraceae) based on ITS sequences. *American Journal of Botany* 82: 1056–1068.  
<http://dx.doi.org/10.2307/2446236>
- Takhtajan, A.L. (1936) *Sosnovyka*, genus *Compositarum novum caucasicum*. *Repertorium specierum novarum regni vegetabilis* 41: 191.
- Trautvetter, E.R. (1866) Plantarum novarum in Caucaso a Dr. G. Radde lectarum decadem proposuit E.R. a Trautvetter. *Bulletin de l'Académie Impériale des Sciences de Saint-Pétersbourg* 10: 393–398.
- Turkoğlu, İ., Akan, H. & Civelek, Ş. (2003) A new species of *Centaurea* L. (Asteraceae: sect. *Psephelloideae*) from Turkey. *Botanical Journal of the Linnean Society* 143: 207–212.  
<http://dx.doi.org/10.1046/j.1095-8339.2003.00205.x>
- Tzvelev, N.N. (1963) *Centaurea* L. subgen. *Amblyopogon* (DC.) Tzvel., *Xanthopsis* (DC.) Tzvel., *Odontolophus* (Cass.) Hayek, *Odontolophopsis* Tzvel., *Pseudohyalea* (Tzvel.) Tzvel., *Hyalinella* (Tzvel.) Tzvel. In: Bobrov, E.G. & Czerepanov, S.K. (eds.) *Flora of the USSR* 28. Publishing House of the Academy of Sciences of the USSR, Moscow & Leningrad, pp. 472–477, 481–493 [In Russian].
- Vaillant, S. (1754) Neue Kennzeichen dreier Classen von Pflanzen mit zusammengesetzten Blumen, nämlich: der Cynarocephalarum, derer mit Artischockenhäuptern. Corymbiferarum, die zusammengesetzte, scheibenförmige Blumen tragen. *Der Königl[ichen] Akademie der Wissenschaften in Paris Anatomische, Chymische und Botanische Abhandlungen* 5: 143–194, 333–377.
- Wagenitz, G. (1975) *Centaurea* L. In: Davis, P.H. (ed.) *Flora of Turkey and the East Aegean Islands* 5. Edinburgh University Press, Edinburgh, pp. 524–528.
- Wagenitz, G. (1980) *Centaurea* L. In: Rechinger, K.H. (ed.) *Flora Iranica* 139b. Akademische Druck-und Verlagsanstalt, Graz, pp. 356–362.
- Wagenitz, G. (1983) *Centaurea* L. and Index Kewensis. *Taxon* 32: 107–109.  
<http://dx.doi.org/10.2307/1219861>
- Wagenitz, G. & Hellwig, F.H. (1996) Evolution of characters and phylogeny of the Centaureinae. In: Hind, D.J.N. & Beentje, H.J. (eds.) *Compositae: Systematics*. Proceedings of the International Compositae Conference, Kew, 1994. Royal Botanic Gardens, Kew, pp. 491–510.
- Wagenitz, G., Ertuğrul, K. & Dural, H. (1998) A new species of *Centaurea* sect. *Psephelloideae* (Boiss.) Sosn. (Compositae) from SW Turkey. *Willdenowia* 28: 157–161.
- Wagenitz, G. & Hellwig, F.H. (1997) Eine neue und eine verschollene *Centaurea* L.-Art aus der Türkei und eine neue *Volutaria*-Art (Compositae-Cardueae). *Annalen des Naturhistorischen Museums in Wien* 98B (Supplement.): 175–181.
- Wagenitz, G. & Hellwig, F.H. (2000) The genus *Psephellus* Cass. (Compositae, Cardueae) revisited with a broadened concept. *Willdenowia* 30: 29–44.
- Wagenitz, G. & Kandemir, A. (2008) Two new species of the genus *Psephellus* Cass. (Compositae, Cardueae) from eastern Turkey. *Willdenowia* 38: 521–526.  
<http://dx.doi.org/10.3372/wi.38.38211>
- Willdenow, C.L. (1803) *Species Plantarum ed. 4*, 3(3). G.C. Nauk, Berlin, pp. 1477–2409.