Taxonomic revision and population status of *Psephellus marschallianus* (*Centaureinae, Asteraceae*) in Bulgaria

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Abstract. *Psephellus marschallianus* (≡*Centaurea marschalliana*) is a rare species in the Bulgarian flora, attached to a specific habitat of subcontinental peripannonain shrub communities, and distributed in two floristic regions: Northeast Bulgaria and the Black Sea Coast (*Northern*). This study offers comments on the taxonomy of genus *Psephellus*, as well as on the taxonomy, morphology, karyology, ecology, population and conservation status of the species.

Key words: *Asteraceae*, *Centaurea*, *Centaureinae*, *Psephellus*, taxonomy, threatened plants

Introduction

Centaureinae (Cass.) Dumort. is a major group in the tribe *Cardueae* Cass. (*Asteraceae*), with characteristically complex taxonomy and not very distinct delimitation between the taxa in it. The generic concepts vary within a wide range. Hoffmann (1894) distinguished nine genera within the subtribe *Centaureinae*; Dostál (1973) set apart 51; Bremer (1994) determined 31, etc. The latest taxonomic studies have been aimed at determining to what an extent the taxa in the group are monophyletic. In recent years, combining the morphological with the molecular studies has resulted in splitting the genus *Centaurea* L. and has led to further changes in the number and volume of genera in *Centaureinae* (Wagenitz & Hellwig 1996, 2000; Greuter & al. 2001; Greuter 2003; Hellwig 2004). *Psephellus* Cass. has been subjected to these changes. According to the taxonomic schemes in *Flora Europaea* (Dostál 1976) and in many regional floras, including Peev (1992), *Psephellus* is considered within the limits of genus *Centaurea.* Differentiation of *Psephellus* into an independent genus is based on the pollen morphology (a very conspicous pollen type named "*Centaurea dealbata* type" – Wagenitz 1955), basic chomosome number $x = 15$, and molecular data. According to Wagenitz & Hellwig (2000), the phylogenetic analyses using molecular markers (Susanna & al. 1995, nrITS; Wagenitz & Hellwig 1996, nrITS + RFLP of chloroplast DNA) have proven that *Psephellus* is a monophyletic group.

In the Bulgarian flora, the genus is represented by one species: *P. marschallianus* (Spreng.) K. Koch (≡*Centaurea marschalliana* Spreng.) distributed in Northeast Bulgaria and the Black Sea Coast (*Northern*), at altitudes up to 500 m. The populations of the species have been researched in line with the preparation of *Red Lists of the Plants and Fungi in Bulgaria* and the latest edition of the *Plants* volume of the *Red Data Book of Bulgaria* in the period 2003–2006. According to IUCN criteria (2001), *P. marschallianus* is determined as Endangered species [EN B1ab(iii)+2ab(iii)].

The aim of the present study is to enhance the information on the taxonomy, biology, ecology, and the population status of *P. marschallianus* in Bulgaria.

Material and methods

The morphological description is based on the description of *C. marschalliana* Spreng. (Dostál 1976) and a study of the herbarium specimens stored in Bulgarian Herbaria: Herbarium of the Sofia University (SO), collections of the Agrarian University of Plovdiv (SOA and Training collection) and Herbarium of the Institute of Botany, Bulgarian Academy of Sciences (SOM).

The karyotype was studied on mitotic metaphase plates obtained from root tips of four wild-collected plants, pretreated with 8-Oxyhinoline for 30 min, than fixed in acetic alcohol (1:3) for 24 h at 4 °C, hydrolysed in 1N HCl for 15 min at 60 °C, stained with Haematoxylin after Gomori (Melander & Wingstrand 1953) for 30 min at 60 °C, and then squashed in 45 % acetic acid.

Results and discussion

Genus *Psephellus* Cass. in Cuvier, Dict. Sci. Nat. 43: 488. 1826

Type: *Centaurea dealbata* Willd. ≡ *Psephellus dealbatus* (Willd.) K. Koch

This genus is represented by about 80 species, with distribution centres in Caucasia, Transcaucasia, E Anatolia, and NW Iran. Pollen morphology is one of the most important distinguishing features of the genus. Wagenitz's "*Centaurea dealbata* pollen type" (Wagenitz 1955) is characterised by a spheroid to subprolate shape, a well-developed inner row of bacula, a scarcely visible outer row of bacula, and a minutely scabrate surface. Mention deserves the absence of annuals and biennials, and of spines or spinules on the phyllaries. Wagenitz & Hellwig (2000) subdivide the genus into 12 sections. The Bulgarian representative *P. marschallianus* belongs to section *Heterolophus* (Cass.) Wagenitz & Hellwig, which, according to Klokov (1963), includes six species distributed from Bulgaria, the Ukraine and S Russia to W Siberia and Central Asia.

Psephellus marschallianus (Spreng.) K. Koch, Linnaea 24: 438. 1851; (Figs 1, 2)

Basionym: *Centaurea marschalliana* Spreng., Syst. Veg. 3: 398. 1826.

Synonym: *Heterolophus marschallianus* (Spreng.) Soják, in Čas. Nár. Muz., Odd. Přír. 140: 133. 1972.

Description. Perennial plant. Stems 10–20(–30) cm high, ascending, curved pipe-like. Basal leaves 6–12 mm long, petiolate, pinnatisect, with grey hairs; upper and lower cauline leaves undivided, the middle lyrate. Capitula 3–4 cm in diameter. Involucre 10–15 mm in diameter, ovate. Bracts triangular. Appendages of the middle bracts elongated, brown, with 3–4 short fimbriae (up to 1 mm) on each side. Florets pink. Achenes *ca*. 4 mm long; pappus *ca*. 1,5 mm long.

Phenology. Flowering April–May, fruiting May–June.

Chromosome number. A constant chromosome number of $2n = 2x = 30$ (Fig. 3) was found in all seven studied cells. The chromosomes are generally small, 1–1.5 mμ, and their morphology is difficult to determine. However, the metacentric and submetacentric type prevails in the complement. Kuzmanov & Georgieva (1983, 1990) reported $2n = 20$ for the species from the same locality (Kabiyushka Mogila, Shoumen district), whereas Tonian (1980)

Fig. 1. *Psephellus marschallianus* in its natural habitat.

Fig. 2. *Psephellus marschallianus*: capitula.

published $2n=18$ from Armenia. Wagenitz & Hellwig (2000) expressed doubts about reliability of these data and recommended another study of the chromosome number, which was carried out in this article. Thus, data on the chromosome number and karyoptype of the species are reported for the first time here.

Habitat and population status. The species participates in the composition of subcontinetal peripannonian shrub communities included in Supplement 1 to the *EC Council Directive 92/43/ EEC* on the protection of natural habitats and wild fauna and flora. The populations are in a good state, with about 100–200 individuals each, but strongly fragmented owing to their attachment to a specific habitat.

Fig. 3. Microphotograph of the metaphase plate of *Psephellus marschallianus*, $2n = 30$.

The plants are outcrossers. They reproduce mainly by seeds with not very good migration abilities. This explains the mosaic distribution of the individuals within the population.

Distribution in Bulgaria. Northeast Bulgaria and the Black Sea Coast (*Northern*), up to 500 m a.s.l.

General distribution. Bulgaria, Moldova, Romania, Russia, the Ukraine.

Conservation status. According to the *IUCN Criteria* (IUCN 2001), the species was evaluated by the author as Endangered **[EN B1ab(iii)+2ab(iii)]**. It is included in Supplement 3 to the *Biological Diversity Act* (2007). For its effective protection, it is recommended to include part of its populations in the *NATURA 2000* ecological network.

Specimina visa (for morphological studies). **Northeast Bulgaria**: in herbosis intra Kabiyuska Mogila Reserve, distr. urb. Shoumen, 23.05.1978, leg. & det. *M. Markova*, *Z. Cherneva* & *P. Gerginov* (SOM 139272; SO 89609, 40895); Kabiyuska Mogila, distr. urb. Shoumen, 01.05.1926, leg. & det. *D. Jordanov* (SOA 12338; SO 78273, 78274, 84295; SOM 161911); Venchanski Dyuz loc. near Venchan vill., Varna distr. 08.05.2005, leg. & det. *A.S. Petrova* (SOM 161913); near Nevsha vill., Varna distr., 08.05.2005, leg. & det. *A.S. Petrova* (SOM 161912); Taushan Tepe loc. near Nevsha vill., Varna distr., 08.05.2005, leg. & det. *A.S. Petrova* (SOM 161914); ad Nevsha, 04.04.1900, leg. *B. Davidov*, det. *N. Stoyanov* & *B. Achtarov* (SOM 84750, 84760); ad Nevsha, 18.05.1902, leg. *A. Javashev*, det. *N. Stoyanov* & *B. Achtarov* (SOM 84760); between Venchan and Nevsha vill., Varna distict, Probitiya Kamuk loc., 02.04.2004, leg. et det. *S. Stoyanov* (SOM 160274); Kabiyuk, Shoumen distr., 26.05.1904, leg. *A. Javashev*, det. *N. Stoyanov* & *B. Achtarov* (SOM 84759); Kabiyuska Mogila loc., near Makak vill., Shoumen distr. 18.05.1990, leg. & det. H. Kovachev (SOM 152510); Kabiyuk, 06.06.1902, leg. & det. *A. Yavashev* (SOM 84761); ad pagum Voivoda ca. Novi Pazar, 09.04.1905, leg. & det. *B. Achtarov* & *N. Stoyanov* (SOM 84751); north of Tsarev Brod vill., Shoumen distr. (SOM 152514); Patleina loc., Shoumen distr., 22.05.1969, leg. & det. *H. Kochev* (SOM 152317); inter pagum Harman Kaya et Markovo, 11.04.1902, leg. *A. Javashev*, det. *N. Stoyanov* & *B. Achtarov* (SOM 84754, 84753, 84756); supra pagum Reka-Devne, 28. 05.1901, leg. *B. Davidov*, det. *N. Stoyanov* & *B. Achtarov* (SOM 84758); **Black Sea Coast** (*Northern*): cape Kaliakra, 07.05.1992, leg. et det. *M. Filipova* &

D. Stoyanov (SO 97347); Beloslav vill., Varna distr., 12.04.1957, leg. et det. *D. Jordanov* (SO 78272); between Bulgarevo vill. and cape Kaliakra, 29.04.1986, leg. et det. *V. Velchev* (SOM 154588); ad pagum Russlar, *ca*. Varnam, 13.04.1901, leg. *B. Davidov*, det. *N. Stoyanov* & *B. Achtarov* (SOM 84755).

Origin of the karyological studied materials. Kabiyushka Mogila loc., near Shoumen town, *ca*. 300 m, 25.04.2003, leg et det. *S. Bancheva* (SC 03112).

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