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***Psephellus gilanicus* subsp. *qazvinicus* (Asteraceae, Cardueae), a new subspecies from Qazvin province, NW Iran**

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Abstract

Psephellus, a genus of the tribe Cardueae in the family Asteraceae, comprises 114 currently accepted species. In Iran, the genus includes 14 species in eight sections, of which seven are endemic. For the taxonomic study of *Psephellus* sect. *Psephelloidei* (Boiss.) Wagenitz & Hellwig, extensive collections were conducted across its distribution area in northwestern Iran. Plant specimens were collected using conventional methods and identified based on reliable taxonomic sources. Moreover, numerous specimens deposited in different herbaria were examined. As a result, *Psephellus gilanicus* (Bomm.) Wagenitz subsp. *qazvinicus* Negaresh, a new subspecies of *P.* sect. *Psephelloidei* from Qazvin province, northwestern Iran, is described and illustrated. It resembles *P. gilanicus* subsp. *gilanicus* but differs from it in having a few-stemmed habit, the whole plant usually grayish, undivided median cauline leaves, straw-coloured or whitish-pale brown median and inner appendages, white flowers, and oblanceolate achenes ca. $7 \times 3-3.5$ mm, slightly covered with short hairs. The new taxon is notably characterized from other members of *P.* sect. *Psephelloidei* by its white flowers. In addition, the geographical distribution of the new subspecies and the closely related taxon is presented and mapped.

Keywords: Iran, new subspecies, *Psephellus gilanicus*, taxonomy.

Introduction

Taxonomic confusions associated with *Centaurea* L. are the most long-lasting problems encountered in Asteraceae as the largest family among flowering plants (Bremer, 1994; Wagenitz & Hellwig, 1996; Garcia-Jacas et al., 2001, 2006; Hellwig, 2004; Susanna & Garcia-Jacas, 2007, 2009; Ghahremaninejad et al., 2012). Subsequently, *Centaurea* s.l. was divided into four genera: *Centaurea* s. str., *Cyanus* Mill., *Rhaponticoides* Vaill. and *Psephellus* Cass. (Wagenitz & Hellwig, 2000; Hellwig, 2004; Greuter, 2003a, 2003b). The genus *Psephellus* (tribe Cardueae), comprising about 114 species (Rezaei et al., 2025), is distributed in eastern Anatolia, the Caucasus, and northwestern Iran, but only a few species occur outside this area (Wagenitz, 1986; Wagenitz & Hellwig, 2000; Greuter, 2003a; Hellwig, 2004; Greuter & von Raab-Straube, 2005; Negaresh, 2020). Members of the genus are mostly endemic with very restricted or even local distribution (Yousefi et al., 2021). The results of Wagenitz & Hellwig (2000) based on pollen morphology, micromorphology of flowers and other characters established a broader view of *Psephellus* including 12 sections: sect. *Psephelloidei* (Boiss.) Wagenitz &

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Hellwig, sect. *Psephellus*, sect. *Hyalinella* (Tzvelev) Wagenitz & Hellwig, sect. *Aetheopappus* (Cass.) Wagenitz & Hellwig, sect. *Amblyopogon* (DC.) Wagenitz & Hellwig, sect. *Heterolophus* (Cass.) Wagenitz & Hellwig, sect. *Czerniakovskya* (Czerep.) Wagenitz & Hellwig, sect. *Odontolophodei* (Tzvelev) Wagenitz & Hellwig, sect. *Odontolophus* (Cass.) Wagenitz & Hellwig, sect. *Xanthopsis* (DC.) Wagenitz & Hellwig, sect. *Uralepis* (DC.) Wagenitz & Hellwig and sect. *Sosnovskya* (Takht.) Wagenitz & Hellwig. In Iran, the genus currently includes 14 species in eight sections (Wagenitz, 1980; Ranjbar & Negaresh, 2014; Parishani et al., 2017; Rezaei et al., 2022, 2025). Seven of these fourteen species are endemic to Iran (Rezaei et al., 2025). As a result of a field trip in the Qazvin province (NW Iran), an interesting *Psephellus* species was discovered. Its morphological examination revealed that it is a member of *P.* sect. *Psephelloidei* and resembles *P. gilanicus* (Bornm.) Wagenitz, but there were several differences that justify describing a new subspecies.

Materials and methods

Plants were collected from different regions within the natural geographical distribution of *Psephellus* sect. *Psephelloidei* during several excursions in Iran, both during the flowering and fruiting phases, between 2011 and 2024. In addition, the collections of the herbaria B, BASU, BM, E, FUMH, G, HUI, JE, K, KHAU, LE, P, TMRC, US, Z and W (all herbarium codes according to Thiers 2026+) were examined. Digitized specimens were received upon request from the relevant herbaria and viewed via online herbarium catalogues or through JSTOR (2026). Morphological characters related to habit such as the life form, ramification and shape of stems, indumentum of all parts, shape, length and dissection of leaves, number of capitula, shape and size of involucre, shape, size, texture and indumentum of phyllaries, shape, size, color, status and concealing of appendages, number, length and shape of cilia, color of flowers, length of florets, size, shape and color of achenes, and length and color of pappus were studied in every taxon (Wagenitz, 1980; Wagenitz & Hellwig, 2000; Ranjbar & Negaresh, 2014; Parishani et al., 2017; Yousefi et al., 2021; Rezaei et al., 2022). The taxonomic applicability of these characters was evaluated among all the material studied. All vegetative and floral parts were measured in a dry state and some parts were observed and measured under a stereo microscope.

Results and Discussion

Psephellus gilanicus (Bornm.) Wagenitz subsp. *qazvinicus* Negaresh, *subsp. nov.* Figures 1, 2 and 3A.

Type: Iran. Qazvin province: road Avaj, bifurcate Tobe Abad village toward Asalak village, 35° 29' 29.04" N, 49° 31' 14.3" E, 2220-2250 m, 26 May 2016, Negaresh 988 (holotype: KHAU!, isotype: KHAU!).

Etymology: The specific epithet refers to Qazvin province, where the new subspecies was found.



Figure 1. Holotype of *Psephellus gilanicus* subsp. *qazvinicus*. Scale bar: 5 cm.

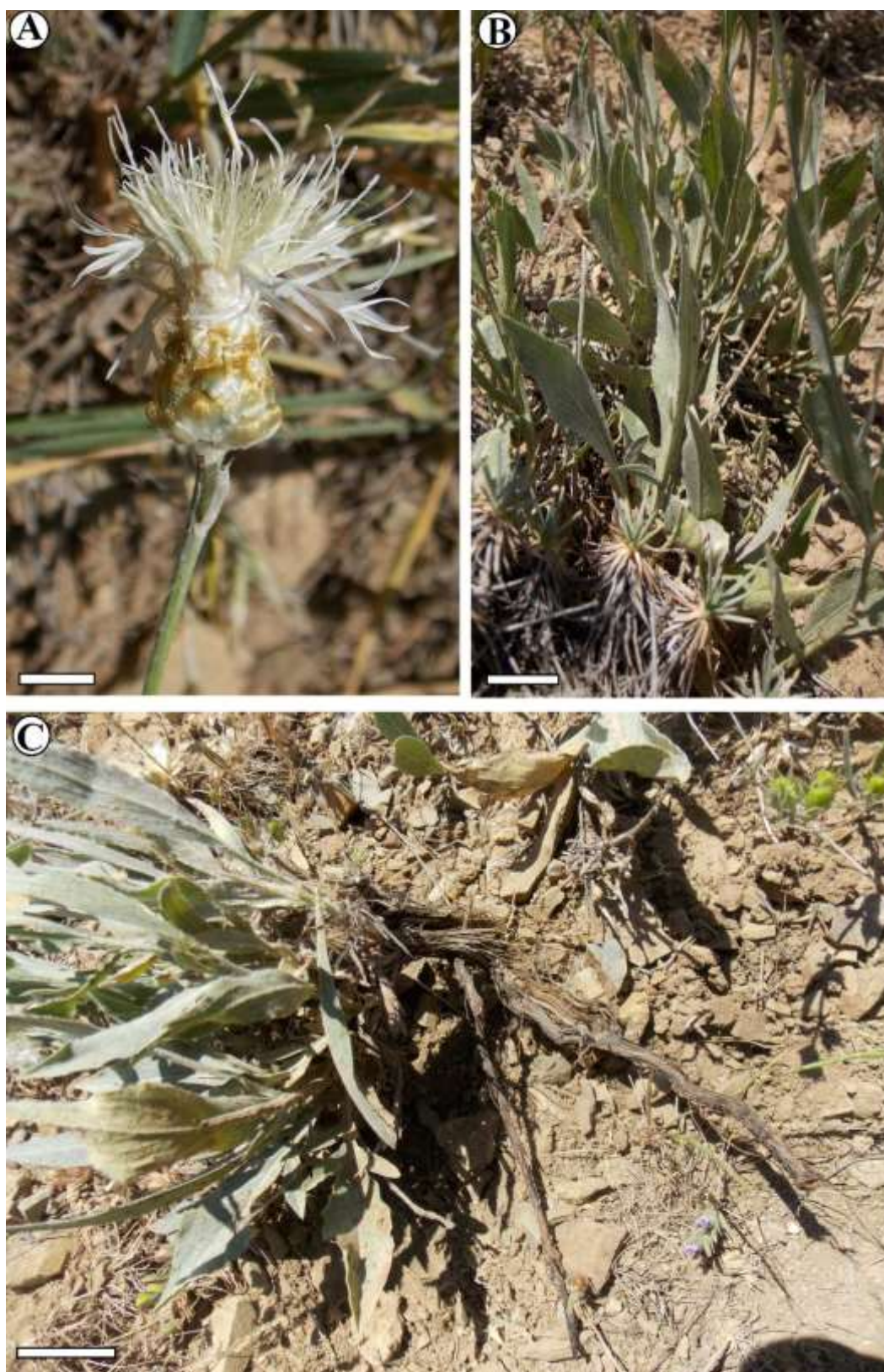


Figure 2. *Psephellus gilanicus* subsp. *qazvinicus* (holotype material). A: close-up of capitulum; B: lower and median cauline leaves; C: string-like root and basal leaves. Scale bars: A = 1 cm, B and C = 3 cm.



Figure 3. Close-ups of achenes with pappus. A: *Psephellus gilanicus* subsp. *qazvinicus* (Negaresh 988); B: *P. gilanicus* subsp. *gilanicus* (Negaresh & Pakzad 248). Scale bars: 2 mm.

Diagnosis: *Psephellus gilanicus* subsp. *qazvinicus* is related to *P. gilanicus* subsp. *gilanicus*, from which it differs mainly in having a few-stemmed habit, the whole plant usually grayish (vs. many-stemmed, whole plant usually green), median cauline leaves undivided (vs. pinnatilobed), median and inner appendages straw-coloured or whitish-pale brown (vs. brown or pale brown), flowers white (vs. pink-purple), anthers white (vs. pink), achenes oblanceolate, ca. $7 \times 3\text{--}3.5$ mm, slightly covered with short hairs (vs. oblong, $6\text{--}6.5 \times 2.5\text{--}3.0$ mm, glabrous).

Description: Perennial herb with a woody base and very long string-like roots (up to 15 cm), whole plant usually grayish, few-stemmed, with remains of stems and leaf bases of the previous year. Stems simple, rarely branched in the basal part, erect, 30–35 cm tall, densely leafy in lower part, ca. 1.5 mm in diam. at base, cylindrical, with thin whitish striations, $\pm$ densely covered with gray-floccose-tomentose hairs. Leaves coriaceous, densely covered with gray-floccose-tomentose hairs and sessile glands. Basal and lower cauline leaves petiolate, 8–12 cm long, lyrate, sometimes simple; terminal segment larger, lanceolate or lanceolate-elliptic, $3\text{--}4.5 \times 1.5\text{--}2$ cm, smooth or denticulate at margins, acuminate at apex; lateral segments smaller, in 1–3 pairs, narrowly lanceolate or linear. Median cauline leaves sessile, undivided, lanceolate, $5\text{--}10 \times 0.8\text{--}1.2$ cm long, smooth at margins, acuminate at apex. Upper cauline leaves increasingly smaller, sessile, undivided, narrowly lanceolate to linear, $3\text{--}7 \times 0.2\text{--}1$ cm, mucronate at apex. Capitula solitary on long peduncles (7–10(–12) cm long). Involucres subglobose to ovoid, truncate at base, $14\text{--}20 \times 14\text{--}18$ mm. Phyllaries multiseriate, coriaceous, imbricate, green, glabrous. Appendages medium-sized, membranous, totally concealing the phyllaries, suborbicular, narrowly decurrent, never with a spine; outer appendages fimbriate or lacerate at margin, whitish or straw-coloured; median appendages ciliate, straw-coloured or whitish-pale brown, ca. 5–6 mm wide (excluding cilia), with 8–10 cilia on each side, 1–1.5 mm long; inner appendages smaller, shortly

fimbriate, straw-coloured. Flowers white in vivo, yellowish in sicco; central florets hermaphrodite, numerous, ca. 20 mm long, corolla 10-12 mm long, 5-lobed, with lobes 6-7 mm long, stigma exerted from corolla up to 4 mm, and appendages of anthers obtuse; peripheral florets slightly longer than central ones, slightly radiant, with staminodes, 5-lobed, with limb lobes narrowly lanceolate, 6-9 mm long. Achenes oblanceolate, ca. $7 \times 3-3.5$ mm, smooth, yellowish, rounded at apex, slightly covered with short hairs; hilum lateral, large, ca. 1 mm long. Pappus multiseriate, brownish, persistent, scabrous, slightly shorter than achenes, 6-7 mm long; bristles of inner rows much shorter than outer ones, 2-3 mm long.

Distribution, habitat and ecology: *Psephellus gilanicus* subsp. *qazvinicus* is a rare endemic taxon found in Qazvin province, NW Iran (Figure 4). It is an Irano-Turanian element (Ghahremaninejad et al., 2025), and grows on clay slopes, roadsides and mid-montane zones, at 2200-2300 m a.s.l. (Figure 1). In addition, other plant species associated with the new taxon include: *Chardinia orientalis* (L.) O. Kuntze, *Centaurea kotschy* (Boiss. & Heldr.) Hayek subsp. *persica* (Boiss.) Greuter, *Cyanus depressus* (M.Bieb.) Soják, *Echinops ritrodes* Bunge, *Tanacetum polycephalum* Schultz-Bip. subsp. *polycephalum*, *Euphorbia cheiradenia* Boiss. & Hohen. ex Boiss., *Phlomis aucheri* Boiss., *Aegilops cylindrica* Host, *Bromus tectorum* L., *Myosotis stricta* Link, *Paracaryum rugulosum* (DC.) Boiss., *Alyssum minus* (L.) Rothm., *Scabiosa persica* Boiss., *Convolvulus arvensis* L., and *Astragalus* sp.



Figure 4. Distribution of *Psephellus gilanicus* subsp. *qazvinicus* (circle) and *P. gilanicus* subsp. *gilanicus* (squares).

Conservation status: *Psephellus gilanicus* subsp. *qazvinicus* is known only from the type locality. After detailed field investigations, no other population was found in the surrounding area. The only known population covers an area of ca. 1000 m² and consists of ca. 100 individuals. Possible threats include deterioration of habitats (erosion), the location near a human settlement and restricted distribution. According to the IUCN Red List Categories and Criteria (IUCN, 2024), *Psephellus gilanicus* subsp. *qazvinicus* should be considered ‘Critically Endangered’ (CR) (the assessment is based on the online IUCN database).

Taxonomic remarks: *Psephellus gilanicus* subsp. *qazvinicus* belongs to *P.* sect. *Psephelloidei*, which includes taxa with lyrate to pinnatipartite leaves, medium-sized capitula, with usually large, semitransparent to brown appendages that are orbicular to ovate and are usually denticulate or regularly ciliate or lacerate, never with spines, pink or purple flowers, and persistent pappus (Rezaei et al., 2022). It is distinguished from *P. gilanicus* subsp. *gilanicus*, which is endemic to Iran (Figures 3B, 4, and 5), by having undivided median cauline leaves, longer peduncle, straw-coloured or whitish-pale brown appendages, white flowers and larger achenes (also see Table 1). Our field observations showed that there is a clear geographical delimitation between these two taxa and they were not found together in the field. Moreover, these taxa also differ in terms of bioecological conditions; whereas *P. gilanicus* subsp. *qazvinicus* grows mostly along roadsides and in clay slopes, while the *P. gilanicus* subsp. *gilanicus* grows mostly in green hills and meadows. The new taxon is notably characterized from other members of the *P.* sect. *Psephelloidei* by its white flowers. Various studies on the genus *Psephellus* have shown that flower color is one of the important traits in separating taxa (Wagenitz, 1980; Wagenitz & Hellwig, 2000; Ranjbar & Negaresh, 2014; Parishani et al., 2017; Yousefi et al., 2021; Rezaei et al., 2022). *Psephellus gilanicus* subsp. *qazvinicus* can be related to *P. vanensis* A. Duran, Behçet & B. Doğan, which is endemic to E Turkey, in the indumentum of plant and shape and color of appendages. However, it differs from *P. vanensis* by its height being 30-35 cm (vs. 13-20 cm), basal and lower cauline leaves lyrate (vs. usually undivided), median cauline leaves 5-10 cm (vs. 1-2.5 cm) long, involucre 14-20 × 14-18 mm (vs. 11-17 × 11-14 mm), flowers white (vs. pink-violet), achenes ca. 7 mm (vs. 4-5 mm) long, and pappus 6-7 mm long, inner rows 2-3 mm long (vs. 4-5 mm long, inner rows 1-2 mm long). In addition, *P. gilanicus* subsp. *qazvinicus* shares some characters such as stem and leaves indumentum floccose-tomentose, basal and lower cauline leaves lyrate and median appendages straw-coloured with *P. sennikovianus* Negaresh, which is endemic to NW Iran, but differs from it by its stems erect, densely leafy in lower part (vs. arcuate-ascending, leafy throughout), involucre subglobose to ovoid, 14-20 × 14-18 mm (vs. cylindrical, 12-15 × 8-10 mm), appendages fimbriate, lacerate or ciliate, 5-6 mm wide (excluding cilia) (vs. ciliate, 2.5-3 mm wide (excluding cilia)), flowers white (vs. pale pink), central florets ca. 20 mm (vs. 15-17 mm) long, peripheral florets slightly longer than central ones, slightly radiant (vs. equal to central ones, not radiant), and achenes ca. 7 mm (vs. 5-5.8 mm) long.

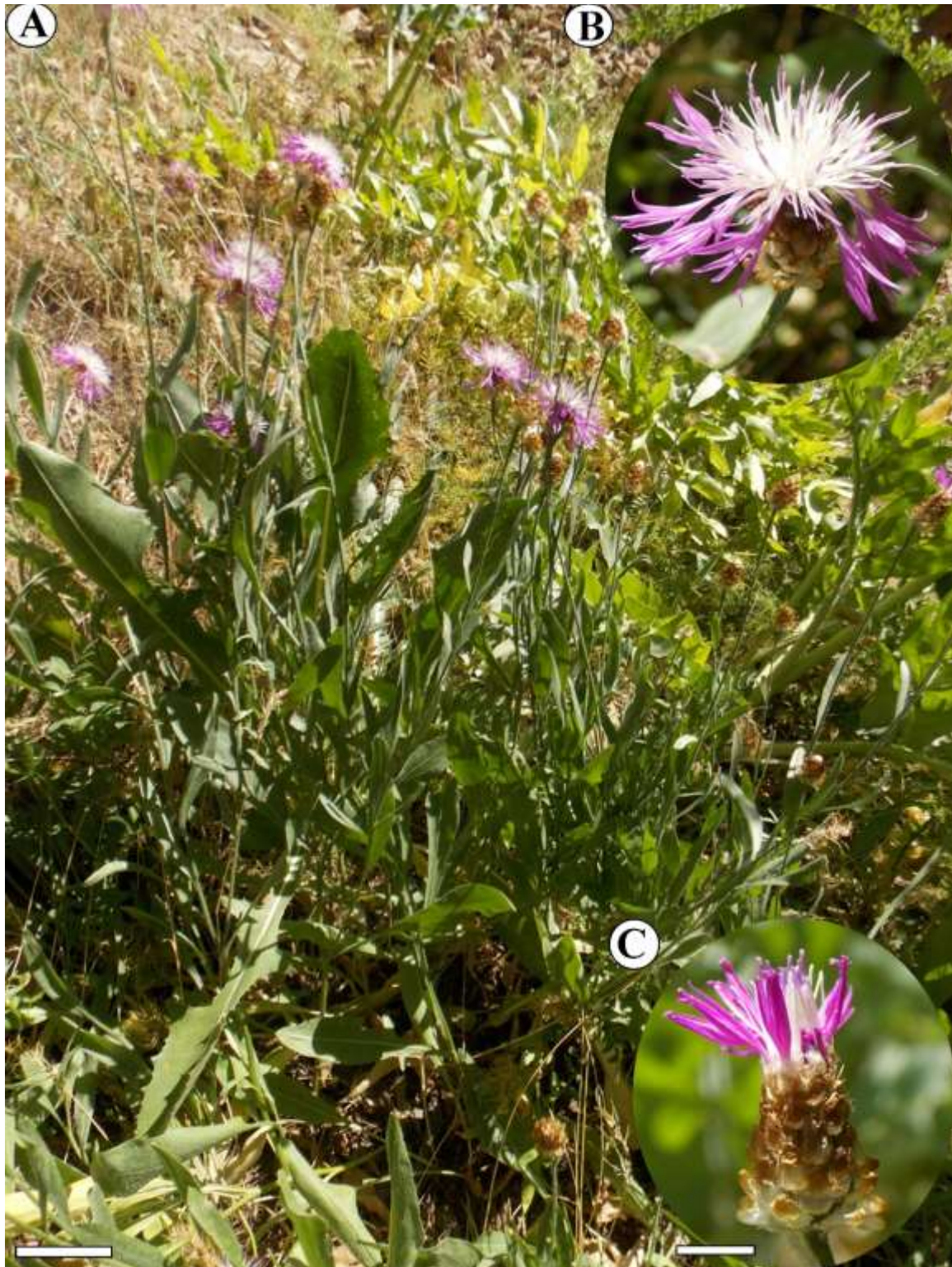


Figure 5. *Psephellus gilanicus* subsp. *gilanicus* (Negaresht & Pakzad 248). A: habit and habitat; B: capitulum (focused on florets); C: close-up of capitulum. Scale bars: A = 6 cm, C = 1 cm

Table 1. Diagnostic morphological characters of *Psephellus gilanicus* subsp. *qazvinicus* and *P. gilanicus* subsp. *gilanicus*.

Characters	<i>P. gilanicus</i> subsp. <i>qazvinicus</i>	<i>P. gilanicus</i> subsp. <i>gilanicus</i>
Habit	few-stemmed, whole plant usually grayish	many-stemmed, whole plant usually green
Stem	densely leafy in lower part	densely leafy throughout
Median cauline leaves dissection	undivided	pinnatilobed
Peduncle length (cm)	7-10(-12)	up to 3(-5)
Median and inner appendages color	straw-coloured or whitish-pale brown	brown or pale brown
Flowers color	white	pink-purple
Anthers color	white	pink
Peripheral florets	slightly longer than central florets	much longer than central florets
Achenes	ob lanceolate, ca. 7 × 3-3.5 mm, slightly covered with short hairs	oblong, 6-6.5 × 2.5-3.0 mm, glabrous
Pappus length (mm)	6-7	7-9

Selected specimens examined: *Psephellus gilanicus* subsp. *gilanicus*. Iran. Azerbaijan province: 41 km NE Mianeh, 1400 m, *Pabot 3806* (G!); Sofian toward Marand, 8 km to Jolfa-Marand trifurcate, 38° 20' 11.1" N, 45° 51' 25.9" E, 1715-1730 m, 25 June 2015, *Negaresh & Pakzad 248* (KHAU!); *Negaresh & Pakzad 249* (KHAU!). Ardabil province: Mianeh toward Khalkhal, around of Zarj Abad village, 37° 37' 47.5" N, 48° 4' 30.31" E, 1850-1900 m, 23 June 2015, *Negaresh & Pakzad 246* (KHAU!); *Negaresh & Pakzad 247* (KHAU!). Qazvin province: 66 km W Karaj, 2060 m, 26 June 1972, *Forughian & Hariri 3773* (W!); Alamout, 60 km to Moallem Kolieh, 36° 21' 55.27" N, 50° 11' 54.13" E, 1980-2000 m, 19 June 2015, *Negaresh & Asadbegy 244* (KHAU!); Alamout, 58 km to Moallem Kolieh, 36° 22' 21.86" N, 50° 12' 12.23" E, 2080-2200 m, 19 June 2015, *Negaresh & Asadbegy 245* (KHAU!). Zanzan province: Kuh-e Anguran, in declivibus borealibus jugi Tarom inter Manjil et Zanzan, 2000 m, 31 May 1971, *Lamond & Iranhshahr in Rechinger 41093* (W!); Kuh-e Anguran, 35-42 km SW Tashvir inter Manjil et Zanzan, 1900-2200 m, *Lamond & Iranhshahr in Rechinger 40907* (W!); Kuh-e Anguran, in jugo Tarom, 18 km SW Tashvir inter Manjil et Zanzan, 1300 m, *Lamond & Iranhshahr in Rechinger 41073* (W!); Manjil to Zanzan, north side of Tarom Pass, 1800-2000 m, 31 May 1971, *Lamond & Iranhshahr 3539* (E!); Terom pass, ca. 33 km Tabriz, 2100 m, 2 June 1971, *Lamond & Iranhshahr 3607* (E!); north side of Tarom pass, ca. 18 km from Tashvir, 1300 m, 31 May 1971, *Lamond & Iranhshahr 3513* (E!). Kurdistan province: Kuh-e Hamze-Arab, 2100-2550 m, 7 July 1968, *Iranhshahr 13182E* (W!). Hamedan province: 100 km NE Hamedan, 2300 m, 30 June 1968, *Petrovitz 21* (W!); Kabudar-Ahang to Damagh, Baba-Nazar village, 12 km N of village, Chaman-Ali-Khan area, 2168 m, 3 June 2011, *Moazzeni & Pirani 4922* (TMRC!; two sheets); montes Karagan prope Hamedan, July 1899, *Strauss s.n.* (JE!, Z!). Tehran province: prope Shekerabad ad basin septentr. M. Tchal, 2200 m, *Bornmüller 7266* (B!, JE!, P!, W!).

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