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Piptatherum ferganense (تیره گندمیان)،گزارش جدید دیگری از گونه‌های آسیای میانه برای فلور ایران

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چکیده. گونه*Piptatherum ferganense* به عنوان گزارش جدیدی برای فلور گندمیان ایران از منطقه حفاظت شده قورخود و کوه‌های آلاداغ در خراسان شمالی معرفی می‌شود. دامنه پراکندگی اصلی این گونه در شرق منطقه ایران و تورانی است و با یک جدایی جغرافیایی در شمال شرق ایران یافت شده است. ویژگی‌های ریخت شناسی *P. ferganense* به تصویر کشیده شده و با نزدیکترین خویشاوند خود *P. latifolium* مقایسه شده است. این گونه با صفاتی مانند آرایش یکنواخت سنبلچه‌ها در گل‌آذین، پوشینه سرنیزه‌ای، و سیخک کوتاهتر از *P. latifolium* متمایز می‌شود. نکاتی درباره آرایه‌شناسی، اکولوژی، جغرافیای گیاهی و وضعیت حفاظتی این گونه ارایه شده است.

واژه‌های کلیدی. تنوع زیستی، جغرافیای گیاهی، حفاظت، خراسان-کپه‌داغ، گراس‌ها

Piptatherum ferganense (Poaceae), another Middle Asian species as a new record for the flora of Iran

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Abstract. *Piptatherum ferganense* is recorded as a new grass species for the flora of Iran collected from Ghorkhod Protected Area and Aladagh Mountains in North Khorassan province. The core distribution range of the species is Eastern Irano-Turanian with a disjunction in northeastern Iran. The morphological characters of *P. ferganense* are illustrated and compared with the closely related *P. latifolium*. It can be distinguished from *P. latifolium* by its evenly arranged spikelets in the panicle, lanceolate fertile lemma, and shorter lemma awns. Notes on taxonomy, ecology, phytogeography, and conservation status of the recorded species are provided.

Keywords. biodiversity, conservation, Khorassan-Kopet Dagh, grasses, phytogeography

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INTRODUCTION

The genus *Piptatherum* P.Beauv. (Poaceae: Stipeae) comprises about 30 species distributed mainly in Eurasia and growing in temperate forests, shrublands, and mountain steppes (Romaschenko et al., 2011; POWO, 2021). In several published floras, such as the Flora Iranica (Bor, 1970), the genus *Piptatherum* has been treated as a section of the genus *Oryzopsis* Michx. within the tribe Stipeae. However, *Piptatherum* differs from the mainly New World genus *Oryzopsis* by its dorsally compressed (not laterally compressed) spikelets, glabrous (not densely bearded) callus, almost flat (not deeply grooved) articulation scar, and three (not two) lodicules (Freitag, 1975). Bor (1970) recorded 25 *Piptatherum* species (under *Oryzopsis*) for the Flora Iranica and adjacent areas. In a taxonomic revision of *Piptatherum*, Freitag (1975) recorded 22 species from Southwest Asia and seven species from Iran. Termeh (1975, 1987) recorded two more species for the flora of Iran under *Oryzopsis purpurascens* Hack. ex Paulsen and *O. songarica* (Trin. & Rupr.) B.Fedtsch. Hamzeh'ee & Assadi (2015) recorded nine *Piptathrum* species for the flora of Iran and described *P. denaense* Hamzeh'ee & Assadi as the only endemic species of the genus in the country. Then, Memariani et al. (2016c) recorded several localities for *Piptatherum latifolium* (Roshev.) Nevski as a new record for the flora of Iran from the North Khorassan province, NE Iran. Based on current data, six *Piptatherum* species occur in Khorassan provinces in northeastern and eastern Iran (Freitag, 1975; Ghahremaninejad et al. 2012; Memariani et al. 2016c).

Phytogeographically, the mountainous area of northeastern Iran, and partly southern Turkmenistan, is known as the Khorassan-Kopet Dagh (KK) floristic province. The presence of a local center of endemism has made a plant biodiversity hotspot in the area (Memariani et al., 2016b). Moreover, the KK is a transitional zone connecting different phytogeographical units of the Irano-Turanian region such as Central Iranian, Afghan, Aralo-Caspian, and the Middle/Central Asian (Memariani, 2020). A comprehensive analysis of diversity and chorology of the flora of KK (Memariani et al., 2016a) and also recently recorded plant species from the area (see Memariani & Arjmandi, 2013; Behroozian et al., 2019) revealed that more than100 plant species (ca. 3.7% of the KK flora) have a range-restricted distribution mainly in the lowlands and/or mountains of the Middle/Central Asia with a disjunction in KK and some of them are connected to KK through the north of Afghanistan. This distribution pattern is known as Khorassan-Kopet Dagh/Eastern Irano-Turanian chorotype (IT^{KK-E}) and shows the important role of KK as a refuge for a considerable number of the Middle/Central Asian flora.

During plant collections and vegetation surveys in western KK, we recorded some unknown *Piptatherum* specimens in the phytosociological releves. They were determined as *Piptatherum ferganense*, a Middle Asian species which is new for the flora of Iran. In this paper, we aim to document the new species record, provide a revised description of the species based on newly collected specimens and observed ones in several herbaria, with additional notes on taxonomy, ecology, and biogeography.

MATERIALS AND METHODS

The plant specimens were collected from Ghorkhod Protected Area and western Aladagh Mountains in North Khorassan province. All living and herbarium specimens were examined using identification keys and species descriptions in relevant Floras and monographs (Bor, 1970; Freitag, 1975; Tzvelev, 1976; Usupbaev, 2018). We consulted several representative specimens of newly recorded species and their close relatives in FUMH, LE, and W herbaria in order to confirm their identity (herbarium codes based on Thiers, 2021). The plant specimens are preserved in the Herbarium of Ferdowsi University of Mashhad (FUMH). The threat status of the species was determined based on the IUCN Red List categories and criteria (IUCN, 2019). We produced a distribution map for the newly recorded species using collection data of the herbarium specimens and phytosociological releves in DIVA-GIS 7.5 (Hijmans et al., 2001).

RESULTS AND DISCUSSION

New record

Piptatherum ferganense (Litv.) Roshev., Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 14: 115 (1951). (Fig. 1-2)

Syn.: *Oryzopsis ferganensis* Litv., Fl. URSS 2: 116, 742 (1934).

Type: Asia Media, Fergana, in montibus prope Arslanbob ad trajectum Kenkol, 30.V.1899, Litvinov (LE holo, K).

Perennial, caespitose, loosely tufted; culms erect, 40-80 cm; leaf blades 5-10 mm wide, scabrous, acuminate, ligule an ecilliate membrane, 5-7 mm long, obtuse; panicle lanceolate, 6-12 cm long, primary panicle branches 2-3-nate; spikelets solitary, fertile spikelets pedicelled with one fertile floret, without rachilla extension, ovate, dorsally compressed, 6-7 mm long; floret callus curved, glabrous, disarticulating transversely, with an

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elliptic scar; glumes persistent, similar, exceeding apex of florets, thinner than fertile lemma; lanceolate, membranous, acuminate, without keels; lower glume 7-veined; upper glume 5-veined; fertile lemma lanceolate, dorsally compressed, 5-5.5 mm long, coriaceous, without keel, lemma surface pubescent, hairy all along, at margins involute, exposing palea, 1-awned; lemma awn straight or curved, 6.5-9.5 mm long, deciduous; palea coriaceous, 2-veined, without keels; lodicules 3; anthers 3; caryopsis with adherent pericarp, hilum linear.

Specimens seen: Iran. North Khorassan Province: W Bojnord, Ghorkhod Protected Area, 20 km E Badbor towards Kastan, Suleh-Qabakh valley, 37°28′41″N, 56°20′39″E, 1355 m, 25.05.2010, Memariani & Arjmandi 43809A (FUMH); W Bojnord, W Aladagh Mountains, Darkesh area, Kashigorbeh, 37°25′29.0″N, 56°45′34.8″E, 1358 m, 27.05.2019, Arjmandi 46790 (FUMH).

General distribution: Middle Asia, mainly in Kazakhstan, Uzbekistan, Kirgizstan, Tadzhikistan, and also in NE Iran (in the present paper).

Taxonomy: Based on the infrageneric classification, *Piptatherum ferganense* belongs to sect. *Piptatherum* subsect. *Holciformia* Freitag. The species in the large section *Piptatherum* are distributed from Macaronesia in NW Africa to China; however, the species of subsect. *Holciformia* are adapted to the cooler environments, so they are mostly found in the montane and alpine areas of the Irano-Turanian region and Himalayas (Freitag, 1975). *P. ferganense* belongs to species-group 'Lanceolata' with lanceolate lemmas (usually 1.0-1.3 mm wide) (Fig. 2C-D) and it is easily distinguished from the species-group 'Ovata' with ovate to broad-ovate lemmas (1.4-2.2 mm wide) such as *P. latifolium*, *P. holciforme* (M.Bieb.) Roem. & Schult., and *P. songoricum* (Trin.) Roshev. *P. ferganense* resemble *P. latifolium*, another Middle Asian species recently recorded as new to the Iranian flora (Memariani et al. 2016c), by having broad leaf blades; however, it differs by its spikelets evenly crowded on panicle branches (Fig. 1, 2B)(not clustered towards branch tips) and several other morphological characters (Table 1). The other species of 'Lanceolata' group, i.e., *P. aequiglume* (Hook.f.) Roshev. and *P. munroi* (Hook.f.) Mez differ from *P. ferganense* by contracted (not lax) panicles and longer lemmas, respectively.

Ecology and biogeography: *Piptatherum ferganense* is distributed in Middle Asia on rocky mountain slopes in the meadows and shrublands. Based on newly recorded localities from Iran, it grows in moist habitats including rocky slopes of *Carpinus orientalis* Mill. communities (Ghorkhod P. A.) and in *Acer monspessulanum* L. subsp. *turcomanicum* (Pojark.) Rech.f. scrubs (western Aladagh Mountains) which is composed of several shrubby species such as *Fraxinus rotundifolia* Mill., *Lonicera nummulariifolia* Jaub. & Spach, *Cornus meyeri* (Pojark.) Pilip., *Prunus microcarpa* C.A.Mey., and *Berberis integerrima* Bunge. Based on our current data, the closely related *P. latifolium* inhabits in relatively drier conditions in open *Paliurus spina-christi* Mill. scrubs and mountain slopes (Memariani et al., 2016c).

The core distribution range of *Piptatherum ferganense* is the Eastern Irano-Turanian region in the Middle Asian Mountains. The new records of *P. ferganense* extend its distribution range more south-westward to NE Iran (Fig. 3). It has a very limited distribution range in NE Iran with insufficient information on its area of occupancy in shrublands and scrub forests of the area. Based on criterion D2 of the IUCN Red List categories and criteria which deals with very small or restricted populations for some taxa with few numbers of known locations (IUCN, 2019), *P. ferganense* is provisionally evaluated as a vulnerable (VU) species in Iran.

Table 1. Morphological and comparison of *Piptatherum ferganense* and *P. latifolium*.

Character	***Piptatherum ferganense***	***Piptatherum latifolium***
Culms	erect, 40-80 cm long	decumbent, 85-130 cm long
Leaf blades	5-10 mm wide	6-15 mm wide
Panicle	lanceolate, 6-12 cm long	ovate, 15-30 cm long
Spikelets	evenly furnished	clustered towards branch tips
Glumes	lanceolate, acuminate	ovate, acute
Upper glume	5-veined	7-9-veined
Fertile lemma	lanceolate	ovate
Lemma awn	6.5-9.5 mm long	12-15 mm long

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Figure 1. Herbarium specimen of *Piptatherum ferganense* (Arjmandi 46790-FUMH)**.**

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Figure 2. A-D: Some details of morphological characters in *Piptatherum ferganense* (Arjmandi 46790-FUMH); **A.** the leaf sheaths showing the long ligule (ca. 7 mm), culm node, and the wide leaf blade (ca. 10 mm); **B.** the lanceolate panicle with evenly furnished spikelets; **C.** the acuminate glumes and the anthecium with hairy lanceolate lemma and a slightly curved awn; **D.** a ventral view of the anthecium.

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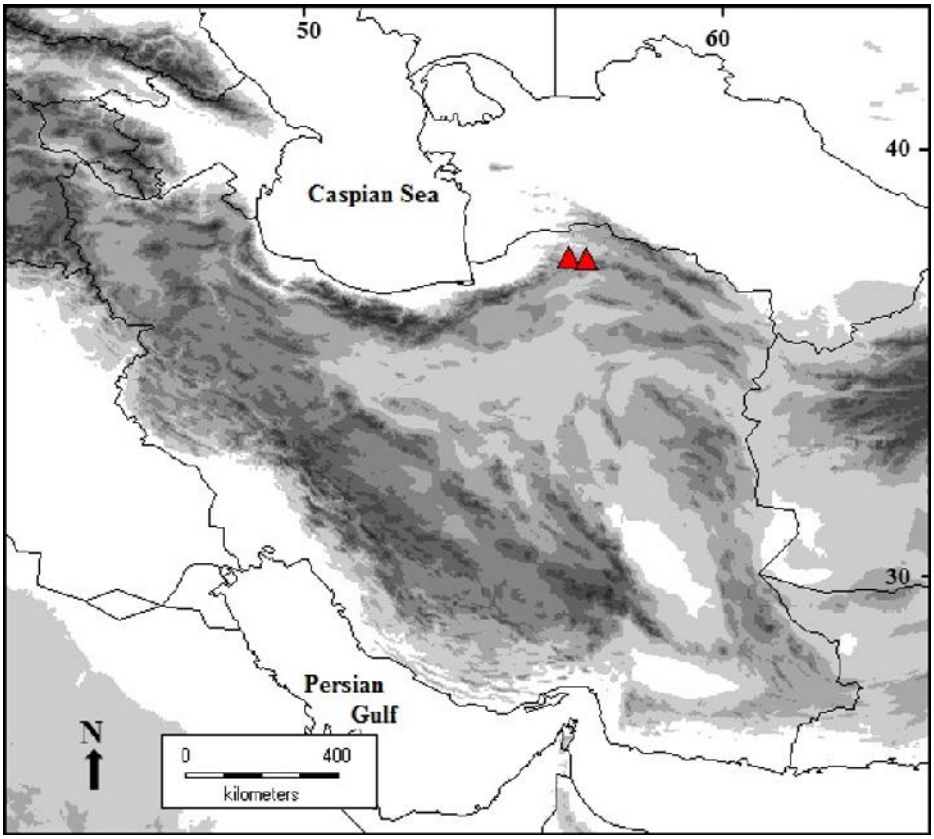

Figure 3. Distribution map of *Piptatherum ferganense* in Iran.

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