

MICROMORPHOLOGICAL AND ANATOMICAL FEATUERS OF PUCCINELLIA DOLICHOLEPIS (POACEAE), A NEW RECORD FOR THE FLORA OF IRAN

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Puccinellia dolicholepis collected from NW. of Iran is reported as a new record from Iran and Flora Iranica area. It is also compared with its closest relative spesies *P. bulbosa* in Iran.

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Key words. *Puccinellia*, new record, Flora Iranica, Iran.

بررسی ریز ریخت‌شناسی و تشریحی گونه *Puccinellia dolicholepis* به عنوان گزارش جدید برای فلور ایران

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گونه *Puccinellia dolicholepis* (V. Krecz.) V. Krecz. که از شمال غرب ایران جمع آوری شده است، برای اولین بار از ایران و نیز محدوده فلورا ایرانیکا گزارش می‌گردد. این گونه با نزدیکترین گونه خود در ایران *P. bulbosa* (Grossh.) Grossh. مقایسه شده و نیز ویژگی‌های ریز ریخت‌شناسی و تشریحی آن توصیف می‌گردد.

INTRODUCTION

The genera *Puccinellia* Parl., *Colpodium* Trin., *Catabrosa* P. Beauv. and *Catabrosella* Tzvel. have been studied in Iran by the first author as the Ph.D thesis. The most diagnostic feature of *Puccinellia* among the other studied genera, are the number of lemma nerves, arrangement of lemma that is imbricate, number of flower in each spikelet and shape of panicle.

During our studies on this genus for preparation of the Flora of Iran (Assadi 1989), the specimens in the herbarium of Research Institute of Forests and Rangelands (TARI) were studied. *Puccinellia dolicholepis* (V. Krecz.) V. Krecz. was identified and described as a new record from Iran and Flora Iranica area. The specimens have been collected from NW of Iran in Azerbaijan province. According to Flora Iranica (Bor 1970) *Puccinellia* consists of 18 species that nine

of which occur in Iran. This new record increased the number of species of *Puccinellia* to ten in Iran.

The aim of the current paper is introducing *Puccinellia dolicholepis* as a new record from Iran and Flora Iranica area and comparing it with its closest relative *P. bulbosa* (Grossh.) Grossh. Moreover some anatomical and micromorphological characters of the species are added to the paper. A duplicate of the species is also preserved in TUH (Tehran University Herbarium).

MATERIALS AND METHODS

The herbarium specimens of the species in TARI and TUH were studied and named. The details of the species descriptions were compared with different Floras i.e. Flora Iranica (Bor 1970), Flora of the USSR (Krechetovich 1934) and Grasses of the Soviet Union (Tzvelev 1976). Tissue samples for scanning electron

Table1. Morphological comparison of *Puccinellia dolicholepis* and *P. bulbosa*.

Characters	Base of stem	Height of plant	Stem direction	Length of lemma	Lemma apex	Keels of palea
<i>P. dolicholepis</i>	Not bulbose	43 cm	Erect	3.5 mm	Acute	Hairy in upper and ciliate in lower part
<i>P. bulbosa</i>	bulbous	20-25 cm	Decumbent	2.2-3 mm	Truncate	Spinulose

microscopy (SEM) were taken from the basal leaves and lemmas of middle spikelets. Adaxial epidermis of leaf and abaxial surface of lemma first soaked in water to facilitate the separation of dust and waste materials and then brushed slowly. Tissue samples were mounted directly on stubs using double-side adhesive tape and sputter-coated with gold. Observations were made in a Vega2-Tescan SEM. For anatomical observation, the middle part of the mature basal leaf was used for sectioning. The materials were fixed in alcohol-glycerin (1:1) for two mounts. Transverse sections were prepared by hand cutting. Sections were cleared with sodium hypochlorite, dehydrated and stained with methyl blue, carmine vest and Bismark brown colors. Appropriate samples were photographed by Olympus VANOX AHBS3 light microscope. The selection of characters was based on Metcalfe (1960) and Ellis (1976).

RESULTS AND DISCUSSIONS

New record

Puccinellia dolicholepis (V. Krecz) V. Krecz (Fig. 1).

Syn.: *Atropis dolicholepis* V. Krecz

Azerbaijan: North of Maco, near to Chechme Grik and Doman, Iran and Turkey frontier, 11.07.1991, Mozaffarian 70022 (TARI).

Plant perennial, herbaceous, erect, 43 cm high. Stem leaves linear, flat or convolute, acute, on upper (inner) surface smooth, up to 12 cm long and ½ mm broad; ligule triangular, acute, 2 mm long. Panicle slightly lax, oblong, 15 cm long, 1 cm wide with scabrous branches. Spikelet linear or narrowed toward the apex, 7-8 mm long, 4-5 flowered. Lower glume lanceolate, 2 mm long; upper glume oblong, acute, 3 mm long. Lemma elliptic-oblong, triangular at the apex, fairly densely pilose at the base, 3/5 mm long. Palea scabrous in upper part, pilose below along the keels. Anthers 2 mm long.

This species is distributed in central and southern Asia (Bor 1970, Tzvelev 1976). It had not been reported within the borders of Flora Iranica but as it occurred in neighbouring areas such as Caucasus and Kazakhstan, It was predicted by Bor (1970) that it can be found in the Flora Iranica area. Now its distribution extends to Iran. No type material of the species was seen, but the specimen was compared with the

description of the species in Flora Iranica (Bor 1970), Flora of the USSR (Krechetovich 1934) and Grasses of the Soviet Union (Tzvelev 1976).

Morphological studies

According to the some Floras, *Puccinellia dolicholepis* is closely related to *P. tenuissima* and *P. bulbosa*. *P. tenuissima* has not been reported from Iran yet, whereas *P. bulbosa* is currently distributed in N.W Iran and differs from *P. dolicholepis* in the following characters (see table 1).

Micromorphological observations

The leaf blades are usually divided into longitudinal zones with the costal zones lying opposite the veins and the intercostal zones present between the veins (Metcalfe 1960).

Intercostal zone

Intercostal zone in adaxial and abaxial surfaces in two species includes oblique papillae with thickened endings on the long cells, there usually being one papilla towards one end of each long cell.

Costal zone

Costal zone in two surfaces in *P. dolicholepis* with prickles can be separated from *P. bulbosa* by chains of oblique globose papillae overlying the veins in abaxial surface (Fig. 2).

Anatomical studies

In general, basal leaf blades of *P. dolicholepis* show similar structure to the closest species *P. bulbosa*. The outline of the transverse sections of the two species are U-shaped; vascular bundle of keel is single and orbicular and second and third orders of vascular bundles are situated in same level of lamina. Both species show two -layer bundle sheaths and these are not always distinguishable in third order vascular bundles; inner layer is complete and the cells are smaller than outer layer, tangential and radial walls of the cells are heavily thickened, the outer sheath consists of parenchyma, well differentiated from chlorenchyma, adaxial and abaxial outer sheaths of midrib in two species is incomplete due to interrupted of sclerenchyma girder. Xylem and phloem are

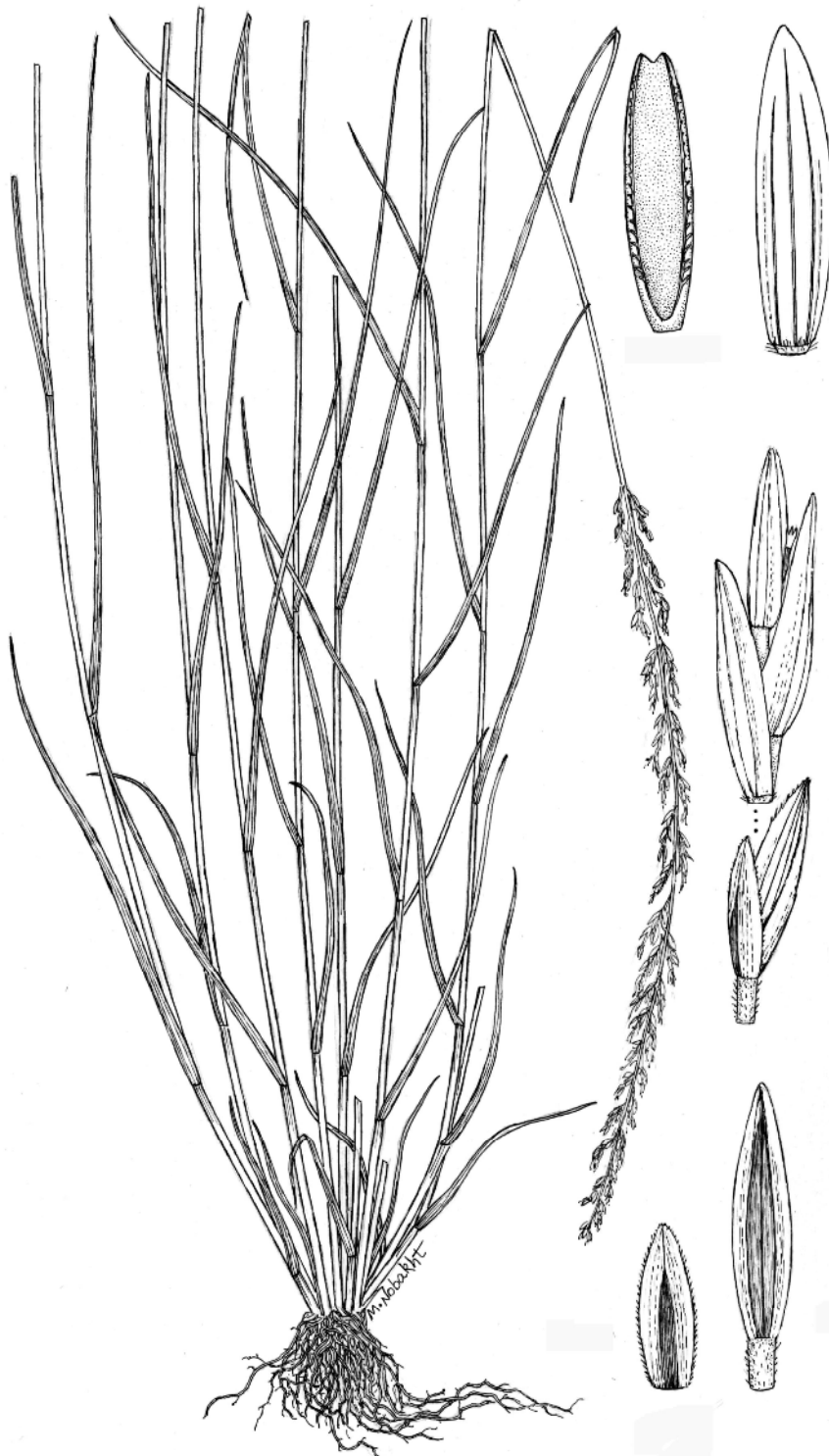


Fig. 1. *Puccinellia dolicholepis* ($\times 0.66$); lower (left) and upper (right) glumes, below ($\times 11$); separated spikelet, middle ($\times 10$); lemma (right) and palea (left), above ($\times 11$).

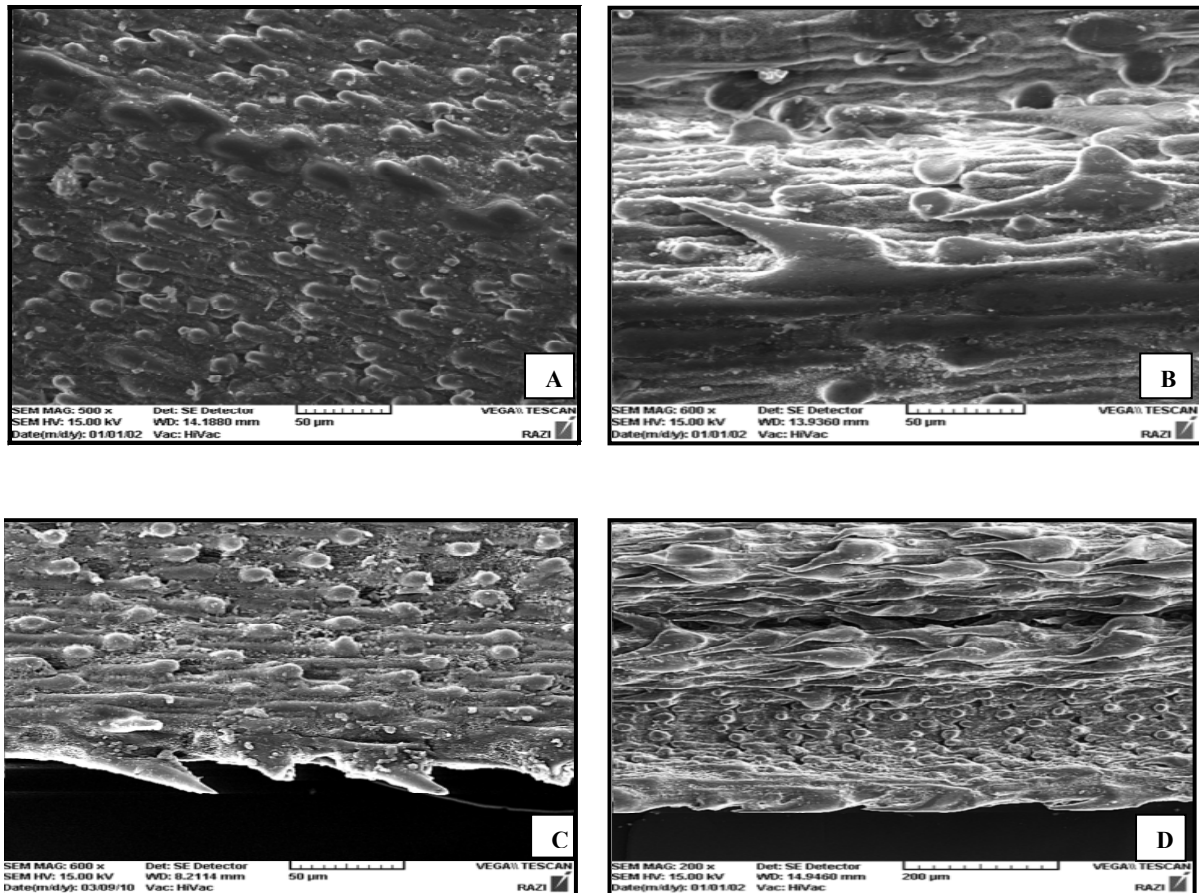


Fig. 2. A & C, Scanning electron micrographs of leaf in *Puccinellia bulbosa*; A, abaxial surface ($\times 500$); C, adaxial surface ($\times 600$). B & D, Scanning electron micrographs of leaf in *P. dolicholepis*; B, abaxial surface ($\times 600$); D, adaxial surface ($\times 200$).

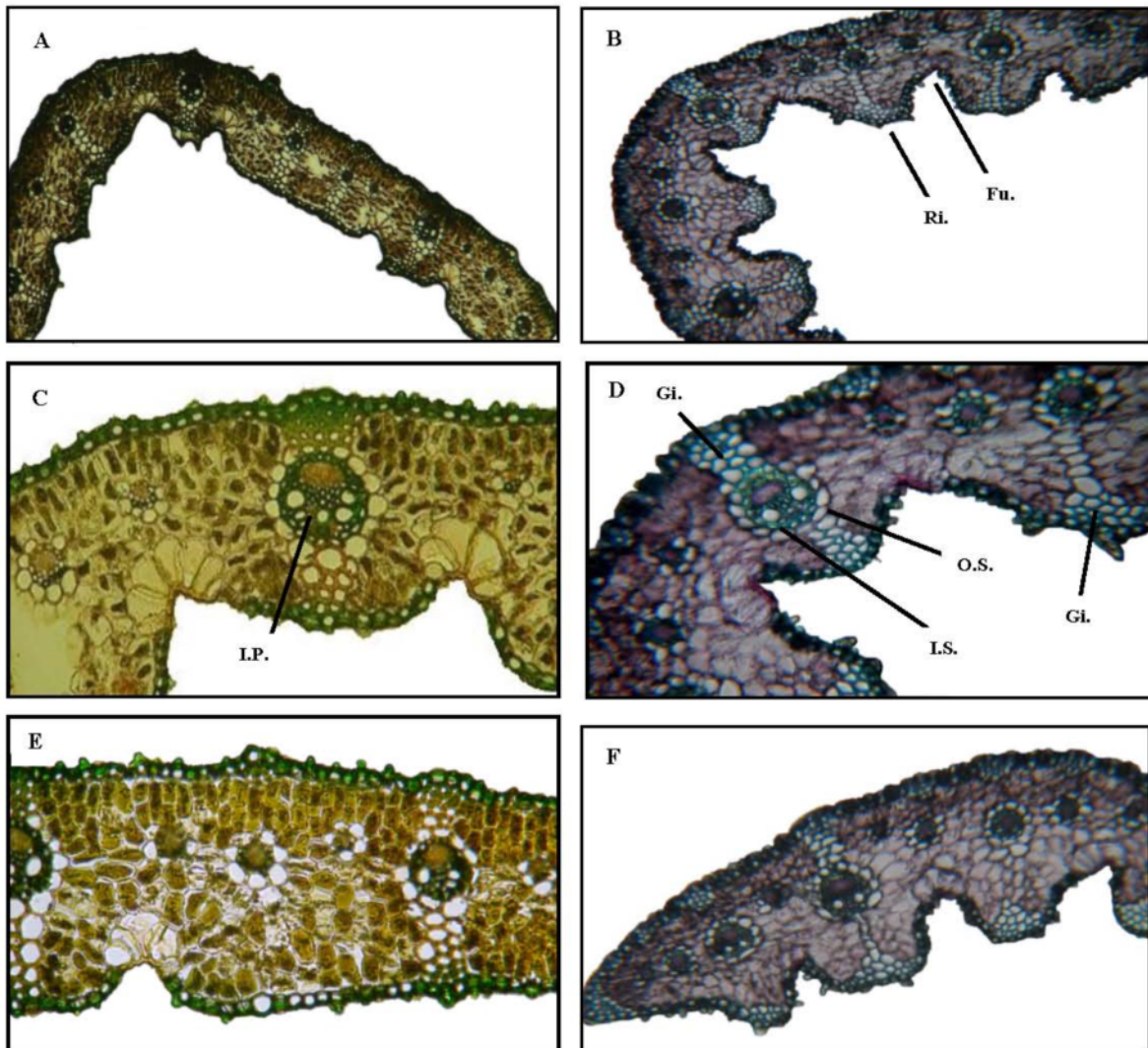


Fig. 3: A, C & E, Leaf of *Puccinellia bulbosa* in TS: A, general aspect ($\times 4$); C, keel structure and midrib ($\times 20$); E, lamina ($\times 20$); B, D & F, leaf of *P. dolicholepis* in TS: B, general aspect ($\times 4$); D, keel structure and midrib ($\times 10$); F, lamina ($\times 10$). -Abbreviations, I.S: inner sheath; O.S: outer sheath; I.F: inner phloem; Gi: girder; Fu.: furrow; Ri.: rib.

Table 2. Anatomical comparison of *Puccinellia dolicholepis* and *P. bulbosa*.

Species	<i>P. dolicholepis</i>	<i>P. bulbosa</i>
Characters		
Thickness of lamina	0.180 mm	0.105 mm
Adaxial side of keel	Rounded	Flattened
Ribs	Rounded	Rounded and truncate
Shape of furrows	Narrow deep	Open shallow and narrow
Presence of furrows	Between all vascular bundles	Between some vascular bundles
Shape of adaxial sclerenchymatous or fiber cells of the keel	Developed girders as long as wide in adaxial and abaxial surfaces	Triangular girder narrowing toward epidermis in adaxial and column like fiber cells in abaxial surface
Inner phloem	Present	Absent
Type of mesophyll of abaxial surface	Spongy parenchyma	Pseudo palisade parenchyma
Thickness of bulliform cells	Occupy less than ¼ of the leaf thickness	Occupy ¼ of the leaf thickness

surrounded by sclerenchymatous cells. Sclerenchyma is present over first and second order vascular bundles and shape of sclerenchyma in leaf margin in two species is pointed cap. Bulliform cells are fan-shaped and fill the furrows on the adaxial surface, the cells uniformly have very thin walls and are conspicuously large and gradually larger than the rest of the epidermal cells. Outer wall of each epidermal cell thickened individually. Adaxial epidermis comprises papilla and prickles. Abaxial surface only has papilla (Fig. 3).

Regarding to anatomical features, *P. dolicholepis* can be separated from *P. bulbosa* in the characters presented in table 2.

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