

NOTES ON THE GENUS *BROMUS* L. (POACEAE) IN IRAN

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As a result of our study on the genus *Bromus*, *B. rigidus* and *B. sewerzowii* are reported as new records for the flora of Iran. *Bromus diandrus-rigidus* complex comprises a group of species ranging from tetra- to octaploid levels, which have been treated in different ways. Based on a specimen from Golestan National Park, *B. rigidus* is reported along with its illustration and a comparison with its closely related taxa. Furthermore, *B. sewerzowii* is the second record that is based on a specimen from North Khorasan (Sarakhs). In addition, a taxonomic key to two the species and their allies has been presented.

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یادداشت هایی از جنس *Bromus* L. (Poaceae) در ایران

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این مقاله شامل گزارش دو گونه جدید از جنس *Bromus* L. برای فلور ایران است. گونه *Bromus diandrus-rigidus* مجموعه‌ای پیچیده از گونه‌های تتراپلوئید تا اکتاپلوئید می‌باشد که پژوهشگران آنها را به طریق مختلف طبقه‌بندی می‌کنند. گونه‌ی *B. rigidus* با یک نمونه از منطقه جنگلی پارک ملی گلستان گزارش می‌شود و ضمن آن که با تاکسون‌های خویشاوند خود مقایسه خواهد شد تصویری از آن ارائه می‌گردد. همچنین گونه‌ی *B. sewerzowii* براساس نمونه‌ای از خراسان شمالی (سرخس) گزارش می‌شود. کلید شناسایی برای این دو گونه و گونه‌های نزدیک ارائه می‌گردد.

INTRODUCTION

Taxonomically, *Bromus* is a complicated genus containing diverse annual to perennial plants (Fortune et al. 2008, Smith 1970). The taxonomic status and infra generic relationships of *Bromus* particularly sections *Bromus* and *Genea* Dumort. were the subject of some recent studies (e.g., Sales 1991, 1993; Scholz 1998). Bor (1970) in his account of the Flora Iranica area recognized 29 species occurring in Iran. Later on, this number was increased to about 45 species by adding *B. gedrosianus* Pénzes, *B. pulchellus* Figari & De Notaris, *B. pseudojaponicus* H. Scholz (Scholz 1981a), *B. borianus* H. Scholz (Scholz 1981b), *B. adjaricus* Sommier & Levier (was accounted by Smith

(1985b) as a synonym of *B. variegatus* subsp. *villosulus* (Steud.) P. M. Smith), *B. ramosus* Hudson (Assadi 1988), *B. diandrus* Roth, *B. tigridis* Boiss. & Nöe, *B. pectinatus* Thunb. (with the synonym *B. pulchellus* Figari & De Notaris), *B. racemosus* L., *B. paulsenii* Hack. (Termeh 1987), *B. mollis* L. (Hamzeh'ee 2000; although was accounted as a synonym of *B. hordeaceus* L. by Smith 1968), *B. arvensis* L. (Noori et al. 2004), *B. secalinus* L. (Nourouzi et al. 2005) and *B. catharticus* Vahl (Hamzeh'ee et al. 2007) to this list. In addition, Ghahreman et al. (2006) and Alemi et al. (2007) reported *B. riparius* Rehmann and *B. inermis* Leyss. for the flora of Iran. As a part of comprehensive and general study of the genus *Bromus* in Iran two new

species to the flora of Iran are recorded and added to the list of *Bromus* species in this country: *B. rigidus* Roth belonging to section *Genea* Dumort. and *B. sewerzowii* Regel from section *Bromus*.

RESULTS AND DISCUSSION

Bromus rigidus Roth, Bot. Mag. (Römer & Usteri) 10: 21-23 (1790). Fig 1.

Specimen seen. Iran, Golestan province, Golestan National Park. 751 m, 25.5.2011, Naderi 17727 (Herbarium of the University of Isfahan, HUI).

Annual, 30-50 cm tall, erect or decumbent. Leaves 10-25 cm × 2-6 mm, covered with short hairs. Panicles 10-20 cm long, dense, stiffly erect, and slightly lax; branches never spreading or drooping. Spikelets excluding awns 30-50 mm long, glabrous or hairy; lower glumes 14-20 mm × 2 mm; the uppers 22-27.5 mm × 3.2-4 mm; lemmas 24-28 mm × 4-5 mm; awns rigid, 33-56 mm; palea 15-16.5 mm; anthers 0.5-0.6 mm.

Habitat. Roadside.

Distribution. C. & S. Europe, N. Africa, S.W. Asia.

Taxonomic status of the pair closely related species *B. diandrus* Roth (8x) and *B. rigidus* Roth (6x) from sect. *Genea* has been the matter of controversy for a long time. While some authors like Oja & Jaaska (1996) using isozyme data, Oja & Laarman (2002) relying on cytological observations, and Sales (1993, 1994) using morphological reasoning (e.g., regarding a state transformation of callus/scar shapes) considered them as a pair of closely related species, others (Smith 1980, 1985a; Liang et al. 2006; Fortune et al. 2008) argued in contrast. The latter workers applying the sequence data of the low copy nuclear gene (*Waxy*) and the multi copy one (ITS) argued that *B. rigidus* (6x) along with *B. sterilis* (2x) have taken part as the progenitors in the origin of *B. diandrus* (8x). Therefore, they split and kept the two polyploids as two distinct species; a notion followed by the authors of this study. However, it is worth of mention that Termeh (1987) reported *B. diandrus* as having partly loose, open and 25 mm width panicles with long branches and documented it by the herbarium sheet Furse 7327 (Kew) from Golestan National Park, a species that was not collected by Akhiani (2005) from the same area.

B. rigidus can be described as a plant with dense, stiffly erect and narrowly ovate with branches clearly shorter than spikelets and callus/scar shapes pointed to very pointed/narrowly ovate (Smith 1980; Sales 1993).

Bromus sewerzowii Regel, Trudy Imp. S.-Peterburgsk. Bot. Sada 7(2): 601 (1881). Fig 2.

Typus probabiliter: In montibus Karatavicis prope Nau, Sewerzow s.n. (W!).

Specimen seen. Iran, Khorasan province, Sarakhs. 250 m, 27.4.1989, Mozaffarian 67633 (TARI).

Annual, culms ca. 1 m tall, puberulent, erect or decumbent, stout. Leaf sheaths pubescent or villouse; leaf blade flat, pubescent, 20-25 cm × (4-)7-8 mm. Panicles contracted, oblong in outline, erect, up to 17 × 2-4 cm; branches very shorter than spikelets or subsessile. Spikelets including awns 3 cm long, scabrous-strigose; lower glumes 7.5 mm × 1.6-1.7 mm, 3 veined; the uppers 10.5 mm × 3.8 mm, 7 veined; lemmas 11.5 mm × 4 mm, 7 veined, apical lemma lobes bifid, acute, 0.5-1 mm; awns 8-13 mm, straight; insertion of awns 1.5-2 mm below lemma apex; anthers 1.5 mm long.

Habitat. ? Perhaps in desert grasslands.

Distribution. Afghanistan, Kazakhstan, Kyrgyzstan, Magnolia, Russia, Tajikistan, SW Asia, particularly NE of Iran.

B. sewerzowii Regel (a wrong spelled name as "*B. severtzovii* Regel" in Bor, 1970) of section *Bromus* was reported with no specific locality or herbarium sheet within a general distribution by Tzvelev (1976) and Liang et al. (2006) from Afghanistan, Kazakhstan, Kyrgyzstan, Magnolia, Russia, Tajikistan and SW Asia (NE Iran). This species was discovered and reported here from Khorasan, Sarakhs based on the herbarium sheet Mozaffarian 67633 (TARI). *B. sewerzowii* resembles *B. hordeaceus* L. and *B. scoparius* L. in having dense panicles in which branches and pedicels are being shorter than spikelets. The two last species morphologically are similar, differing in lemmas/caryopsis width and shape which have been cited in many floras such as Smith (1980, 1985a) and Liang et al. (2006). Hamzeh'ee (2000) also reported *B. mollis* L. based on a depauperate material and no identifiable herbarium sheet "Azimi 80076 (TARI)" for the flora of Iran. This species has been generally known as a synonym of *B. hordeaceus* L. subsp. *hordeaceus* (Smith 1968). Thus, the presence authenticity of *B. hordeaceus* for the flora of Iran will be unresolved.

Key to the species

A key to the taxa belonging to the sections concerned including sect. *Genea* Dumort. and *Bromus* are provided and presented here.

1. Spikelets cuneate, with wide apex (sect. *Genea* Dumort.) 2
- Spikelets ovate to ovate-lanceolate, terete to slightly compressed (sect. *Bromus*) 4
2. Lower glume 6-10 mm long; the upper 10-16 mm long. Lemma less than 20 mm long *B. sterilis* L.
- Lower glume 15-23 mm long; the upper 20-32 mm long. Lemma at least 20 mm long 3
3. Panicle dense, stiffly erect, narrowly ovate; branches

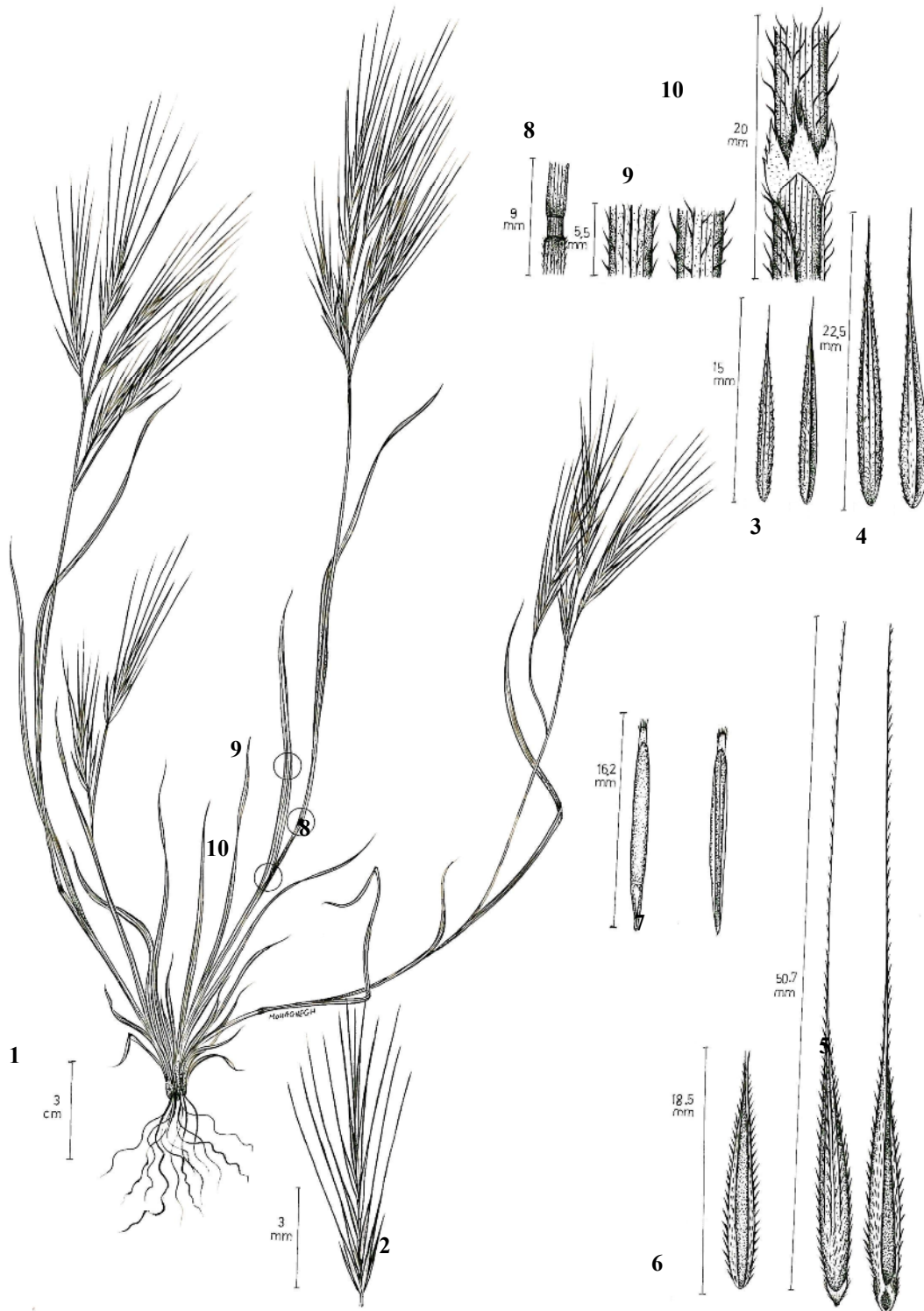


Fig. 1. *Bromus rigidus*. 1, habit; 2, spikelet; 3, lower glume; 4, upper glume; 5, lemma including awn; 6, lemma excluding awn; 7, caryopsis; 8, node; 9, leaf; 10, ligule – Naderi 17727 (HUI).



Fig. 2. *Bromus sewerzowii*, Mozaffarian 67633 (TARI).

mainly shorter than the spikelets *B. rigidus* Roth
 3. Panicle lax, spreading, broadly ovate; branches
 mainly longer than the spikelets *B. diandrus* Roth
 4. Panicle 10-17 cm long. Lower glume 7-7.5 mm long;
 upper glume 10.5 mm long *B. sewerzowii* Regel
 - Panicle less than 7 cm long. Lower glume up to 6.5
 mm long; upper glume up to 7 mm long 5
 5. Lemma with margin conspicuously angled about 2/3
 up. Grains oblanceolate *B. hordeaceus* L.
 - Lemmas with margin rounded or very obscurely
 angled. Grains narrowly elliptical *B. scoparius* L.

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REFERENCES

- Akhani, H. 2005: The Illustrated Flora of Golestan National Park, Iran, vol. 1. –Tehran University Press, Tehran.
- Alemi, M., Attar, F. & Hamzeh'ee, B. 2007: Micromorphological studies of indumentum in *Bromus* L. (Poaceae) as taxonomical evidence. –Iran. J. Bot. 13 (2): 129–137.
- Assadi, M. 1988: Plants of Arasbaran Protected Area, NW. Iran (Part II). –Iran. J. Bot. 4 (1): 1–59.
- Bor, N. L. 1970: Bromaeae in Rechinger, K. H. (ed.), *Flora Iranica* 70: 105–141. –Akademische Druck- u. Verlagsanstalt, Graz-Austria.
- Fortune, P. M., Pourtau, N., Viron, N. & Ainouche, M. L. 2008: Molecular phylogeny and reticulate origins of the polyploidy *Bromus* species from section *Genea* (Poaceae). –*Amer. J. Bot.* 95 (4): 456–464.
- Ghahreman, A., Alemi, M., Attar, F., Hamzeh'ee, B. & Columbus, J. T. 2006: Anatomical studies in some species of *Bromus* L. (Poaceae) in Iran. –Iran. J. Bot. 12(1): 1–14.
- Hamzeh'ee, B., Alemi, M., Attar, F. & Ghahreman, A. 2007: *Bromus catharticus* and *Bromus danthoniae* var. *uniaristatus* (Poaceae), two new records from Iran. –Iran. J. Bot. 13(1), 33–36.
- Hamzeh'ee, B. 2000: Some new and noteworthy plant records from Iran. –Iran. J. Bot. 8 (2): 271–277.
- Liang, L., Guanghua, Z. & Ammann, K. H. 2006: *Bromus* L. in Zhengyi, W. & Raven, P. H. (eds.), *Flora of China* 22: 371–386. –Science Press, Beijing & Missouri Botanical Garden Press, St. Louis.
- Noori, A., Nourozi, M., Azizian, D., Sheidai, M. & Termeh, F. 2004: *Bromus arvensis* (Poaceae), a new record for the flora of Iran. –Iran. J. Bot. 10(2): 173–175.
- Nourouzi, M., Sheydaei, M., Nouri, A. & Assadi, M. 2005: *Bromus secalinus* L. (Poaceae), a new record for flora of Iran. –Iran. J. Bot. 11(1): 71–73.
- Oja, T. & Jaaska, V. 1996: Isoenzyme data on the genetic divergence and allopolyploidy in the section *Genea* of the grass genus *Bromus* (Poaceae). –*Hereditas* 125: 249–255.
- Oja, T. & Laarmann, H. 2002: Comparative study of the ploidy series *Bromus sterilis*, *B. diandrus* and *B. rigidus* (Poaceae) based on chromosome numbers, morphology and isozymes. –*Plant Biol.* 4: 484–491.
- Sales, F. 1991: A re-assessment of *Bromus tectorum*, a computer analysis, synaptospermy and chorispory. –*Fl. Veg. Mundi* 9: 29–41.
- Sales, F. 1993: Taxonomy and nomenclature of *Bromus* sect. *Genea*. –*Edinb. J. Bot.* 50: 1–31.
- Sales, F. 1994: Evolutionary tendencies in some annual species of *Bromus* (*Bromus* L. sect. *Genea* Dum. (Poaceae)). –*Bot. J. Linn. Soc.* 115: 197–210.
- Scholz, H. 1981a: Der *Bromus-pectinatus*-Komplex (Gramineae) im Nahen und Mittleren Osten. –*Bot. Jahrb. Syst.* 102: 471–495.
- Scholz, H. 1981b: Drei neue Gramineen aus Iran und Libyen. –*Willdenowia* 11: 95–100.
- Scholz, H. 1998: Notes on *Bromus danthoniae* and relatives (Gramineae). –*Willdenowia* 28: 143–150.
- Smith, P. M. 1968: The *Bromus mollis* aggregate in Britain. –*Watsonia* 6 (6), 327–344.
- Smith, P. M. 1970: Taxonomy and nomenclature of the brome-grasses (*Bromus* L. s.l.). –*Notes Roy. Bot. Gard. Edinburgh* 30: 361–375.
- Smith, P. M. 1980: *Bromus* L. in Tutin, T. G., Heywood, V. H., Burges, N. A., Moore, D. M., Valentine, D. H., Walters, S. M., & Webb, D. A. (eds.), *Flora Europaea* 5: 182–189. –Cambridge University Press, Cambridge, UK.
- Smith, P. M. 1985a: *Bromus* L. in Davis P. H. (ed.), *Flora of Turkey and the East Aegean Islands* 9: 272–301. –University Press, Edinburgh.
- Smith, P. M. 1985b: Observations on Turkish brome-grasses. I. Some new taxa, new combinations and notes on typification. –*Notes Roy. Bot. Gard. Edinb.* 42 (3): 491–501.
- Termeh, F. 1987: Contribution à l'étude de quelques Graminées nouvelles pour la Flore de l'Iran. Fasc. 2: pp. 10-13. –Ministry of Agriculture, Plant Pests & Diseases Research Institute, Tehran (in Persian).
- Tzvelev, N. N. 1976: Grasses of the Soviet Union. Part 1. p. 337 –Nauka Publisher, Leningrad, Soviet Union.