

## NEW SPECIES, NEW COMBINATION AND AN IDENTIFICATION KEY OF THE GENUS *ELYMUS* (POACEAE: TRITICEAE) IN IRAN

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The genus *Elymus* has been studied to prepare the draft of *Elymus* for the Flora of Iran. In this research, the plant specimens of Central Herbarium of Iran (TARI) were identified and a new key of the Iranian species of the genus *Elymus* is presented. Delimitation of the genus is discussed. Among the specimens, a new species from Zagros Mountain ranges was recognized which is described and illustrated as *E. shirazicus*. The new species is well characterized among the Iranian species of the genus by caespitose habit, having densely imbricate spikelets with none or short awns. *Elymus shirazicus* seems to be related to *E. transhyrcanus* but well distinguished by narrower spikes and much shorter rachis internodes. *Elymus dorudicus* based on *E. nodosus* subsp. *dorudicus* is introduced as a new combination. *Elymus lazicus* subsp. *iranicus* is described as a new subspecies.

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**Key words:** *Elymus*; Poaceae; new species; taxonomy; Iran

گونه‌ای جدید و ترکیبی جدید از جنس ***Elymus* (Poaceae: Triticeae)** به همراه کلید شناسایی گونه‌های این جنس در ایران  
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جنس *Elymus* که متعلق به تیره گندمیان و قبيله گندم است به منظور تهیه فلور ایران مورد بررسی آرایه‌شناسی قرار گرفته است. محدوده جنس مورد بحث قرار می‌گیرد. در این تحقیق نمونه‌های هرباریومی موجود در هرباریوم مرکزی ایران شناسایی شدند و کلید شناسایی گونه‌های ایرانی جنس تهیه گردید. در بین نمونه‌ها، گونه‌ای جدید از سلسله جبال زاگرس تشخیص داده شد که به نام *Elymus shirazicus* نامگذاری شد. این گونه به همراه تصویری از آن معرفی می‌گردد. گونه جدید در بین گونه‌های ایرانی این جنس با داشتن سیمای پشته‌ای و سنبله متراکم بدون سیخک یا با سیخک کوتاه متمایز می‌گردد و با گونه نزدیک خود به نام *Elymus transhyrcanus* با داشتن سنبله بسیار متراکم‌تر و میانگره‌های بسیار کوتاه‌تر تفاوت دارد. ترکیب جدید *Elymus dorudicus* بر اساس نام پایه *E. nodosus* subsp. *dorudicus* معرفی می‌گردد. زیرگونه *Elymus lazicus* subsp. *iranicus* به عنوان زیرگونه جدیدی معرفی می‌گردد.

### INTRODUCTION

The genus *Elymus* L. belonging to the tribe Triticeae of the family Poaceae has been a matter controversial in its delimitation among the taxonomists. The genus was described by Linnaeus (1753) containing six species. *E. sibiricus* L. has been selected as its type species. Nevski (1934) in Flora of the USSR knew it as a small genus with four species. He treated many of the species in the genera *Agropyron* Gaertn., *Roegneria* K. Koch. and *Clinelymus* (Griseb.) Nevski. Bor (1970) in Flora

Iranica included nearly all the species nowadays known as *Elymus* in the genus *Agropyron*. Tzvelev (1976) distinguished *Agropyron*, *Elytrigia* Desv. and *Elymus* as distinct genera but included *Clinelymus* and *Roegneria* in *Elymus*. Löve (1984) defined the genera of the tribe Triticeae based on genomic constitution and therefore he used the narrowest concept of the genera in the tribe Triticeae. He included the genera of *Roegneria* and *Clinelymus* in the genus *Elymus*, therefore the number of species raised much more. Löve (1984) defined the genus *Agropyron* as a rather

small genus with P genomic constitution. *Douglasdeweya* C. Yen, J. L. Yang & B. R. Baum was described as a small genus containing SP genome (Yen, C., J. L. Yang & B. R. Baum 2005). Assadi (1994a, 1994b, 1995) and Assadi and Runemark (1995) due to continuous morphological characters and close affinity of the genomic constitution S and J genome defined the genus *Elymus* with a wider concept and supposed the species containing S or J genome has to be included in the genus *Elymus*. They distinguished the genus *Agropyron* as a distinct genus but included the genera *Pseudoroegneria* (Nevski) A. Löve, *Roegneria*, *Thinopyrum* A. Löve, *Lophopyrum* A. Löve, *Trichopyrum* A. Löve in the genus *Elymus*. This concept is used in the present paper and therefore the genus *Elymus* may include about 175 species worldwide (Kellogg 2015). *Douglasdeweya* is included in the genus *Elymus*.

The aim of this paper is to describe a new species and a new subspecies, to introduce a new combination and to present an identification key to the known *Elymus* species of Iran.

## MATERIAL AND METHODS

The author has been preparing the draft of the genus *Elymus* for the Flora of Iran. The herbarium specimens were identified by using appropriate Floras and available papers, i. e. Flora Iranica (Bor 1970), Flora of the USSR (Nevski 1934), Grasses of the Soviet Union (Tsvelev 1976), Flora of Turkey (Melderis 1985) and Assadi (1996). Among the herbarium specimens of TARI, a specimen seemed to be different from all Iranian species. Comparing the specimen with different Floras and available images of type specimens and authentically named materials resulted that the specimen is a new species.

## RESULTS

*Elymus shirazicus* is described as a new species. *E. lazicus* subsp. *iranicus* is described as a new subspecies. *Elymus dorudicus* is introduced as a new combination. A key to the identification of the species occurring in Iran is presented.

### New taxa

*Elymus shirazicus* Assadi, **sp. nov.** (figs. 1 & 2).

Plant perennial, densely tufted, ca. 90 cm high. Stems many, glabrous except below the nodes, ca. 1 mm in diameter above. Leaf sheath glabrous or scabrous, smooth at margin, closed up to near the tip; leaf blades up to 20 cm long and 7 mm broad, hairy on the upper surface, scabrous or hairy on the lower surface, ca. 16 -nerved, acuminate, auriculate at base; auricles falcate, ca. 3 mm long; ligules membranous, 5

mm long, ciliate. Spike 5-9 cm long and ca. 1 cm broad, cylindrical, very dense, glabrescent or scabrous to hairy; internodes 2-5 mm long, finely hairy. Spikelets 10-16 mm long, upright or divergent in age, densely imbricate, about 3 times as long as the rachis internodes, 5-8 -flowered; the upper most flower reduced. Lower glume 6.5-8 mm long (including mucro), 5 -nerved, broadly membranous at the margin, glabrous to scabrous or ciliolate at the margin; mucro up to 1.5 mm long; upper glume similar to lower but somewhat longer. Lemma 8-16 mm long (including awn), mucronate to awned, 5 -nerved, broadly membranous at the margin, glabrous to peberulent, scabrous or ciliate on the midvein. Palea ca. 9 mm long, scabrous on the nerves, truncate to rounded at the apex. Anthers ca. 6 mm long; filaments short, ca. 1 mm long. Ovary 1.5 mm long; styles ca. 2 mm long.

*Typus.* Fars: Dashte Arjan, East slope of Kuhe Tasak from Bonrud and Zangane, 2250 - 3000 m, 11.06.1992, V. Mozaffarian 71373 (holotypus TARI); Chaharmahal Bachtari: N. slope of Kuhe Jahanbin, S of Hafshejan, 2250-2800 m, 05.07.1986, V. Mozaffarian 57486 (TARI).

The new species is well distinguished among the species of the genus *Elymus* in Iran by having tufted habit, dense spikes with well imbricate spikelets. *Elymus shirazicus* with dense spike looks like *Agropyron* species in appearance, but rather rounded glumes and lemmas with five nerves on the back put the specimen under the genus *Elymus*. The species seems to be related to *E. transhyrcanus* but differs from it by much denser spike, ca. 10 mm in diameter (not up to 5 mm), having spikelets ca. 3 times longer than the internodes (not somewhat longer). The species is also similar to *E. lazoicus* in spike form, but differs from it by having longer stems ca. 90 cm (not up to 50 cm), flat leaf blades (not involute) and lemma awn up to 8 mm long (not 20-25 mm).

The two specimens cited for this species are rather variable in the indumentum of spike and awn of lemma and glumes. In the specimen Mozaffarian 71373 spike is glabrous and glumes and lemma bear mucro or short awn up to 1 mm long but in the specimen Mozaffarian 57468 the awn is up to 6.5 mm. At present, the two specimens are regarded as the same species and not needed to make any subspecific rank for them. Unknown genomic constitution of the species is open for further studies.

*Elymus lazicus* (Boiss.) Melderis, Notes Roy. Bot. Gard. Edinb. 42 (1): 79 (1984).

Syn.: *Agropyron lazicum* Boiss., Fl. Or. 5: 661 (1884). subsp. *iranicus* Assadi, **subsp. nov.**



Fig. 1. *Elymus shirazicus*. A: habit ( $\times 0.56$ ); B: ovary ( $\times 3$ ); C & E: palea ( $\times 3.4$ ); D: lemma ( $\times 3.4$ ); F: lodicules ( $\times 4.5$ ); G: ligule ( $\times 4.5$ ); H: lower glume ( $\times 3.9$ ); I: upper glume ( $\times 3.9$ ); J: spikelet ( $\times 2.8$ ); K: stamen ( $\times 3$ ).

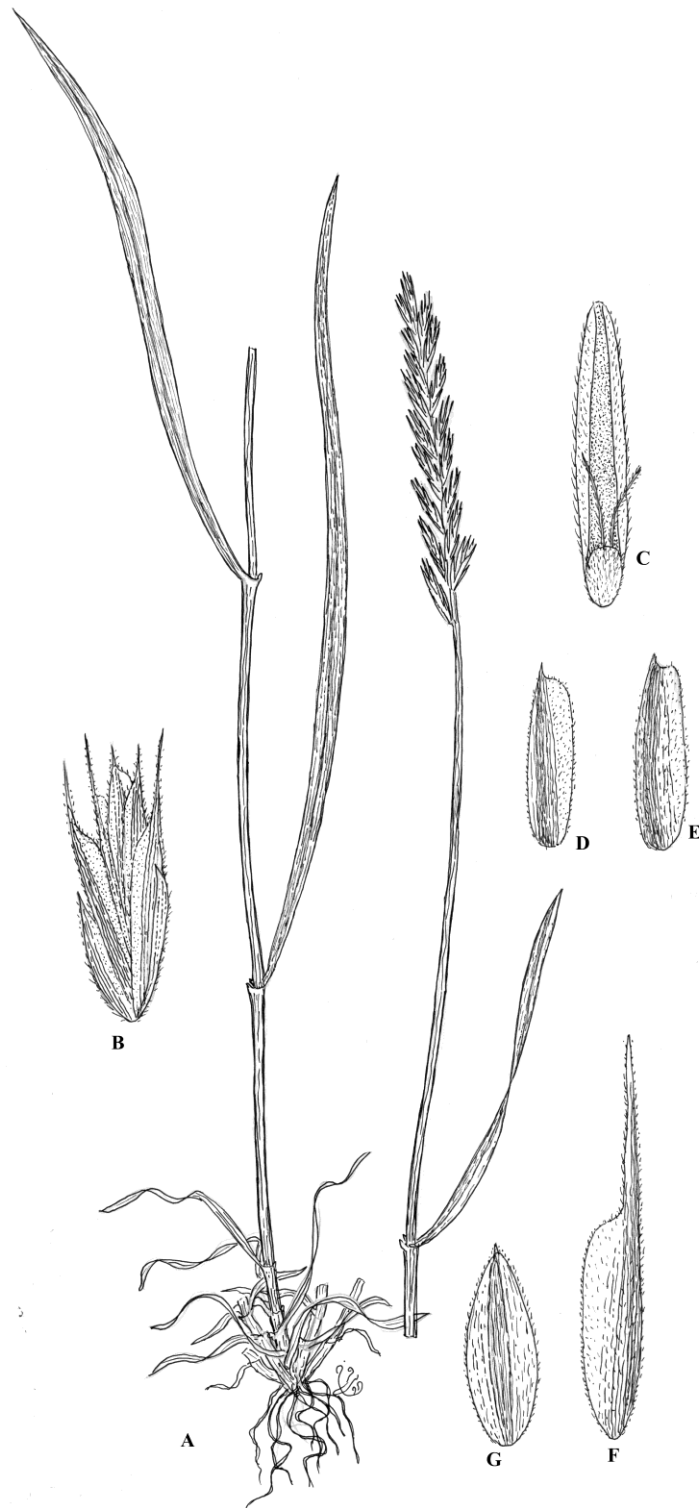


Fig. 2. *Elymus shirazicus* A: habit ( $\times 0.49$ ); B: spikelet ( $\times 1$ ); C: palea ( $\times 4.3$ ); D & E: glumes ( $\times 3$ ); F & G: lemmas ( $\times 3$ ).

Differs from all other subspecies including subsp. *lazicus*, subsp. *divaricatus* (Boiss. & Bal.) Melderis, subsp. *lomatolepis* Melderis and subsp. *attenuatiglumis* (Nevski) Melderis (syn.: *Agropyron attenuatiglume* Nevski) by having dense and long hairs on the upper surface of leaves (not shortly pubescent) and glume awn with 7.5-8 mm long (not 2.5-6).

*Typus.* Iran, Azerbaijan, road of Khalkhal to Asalem, West elevations of Talish, Agh Bolagh village, 2700 m, 13.07.2001, rocky and limestone slopes, M. Yousofi & M. Esmail Sharif 4102 (holotypus TARI). Uosofi (2002) based on above mentioned specimen recorded and illustrated *E. lazicus* subsp. *attenuatiglumis* from Iran. Further studies showed that the specimen is in fact a new subspecies. *E. lazicus* subsp. *attenuatiglumis* is not known from Iran at present.

**New combination**

*Elymus dorudicus* (Assadi) Assadi, **comb. et stat. nov.**

Syn.: *E. nodosus* (Nevski) Melderis subsp. *dorudicus* Assadi, Willdenowia 26: 258 (1996).

Based on the same type.

Plant perennial, tufted, without long stolons. Stems 75-90 cm high, thin, ca. 1-2 mm in diameter, hairy in lower part or all along. Leaf sheath glabrous, pubescent or hairy, ciliate or partly ciliate; leaf lamina up to 20 cm long and 2-3 mm broad, involute, glabrous or pubescent in lower surface, hairy above. Spike 6-15 cm long, erect. Spikelets 10-14 mm long, lanceolate, 4-8 -flowered. Glumes unequal, oblong, rounded at the apex, 5-7 -nerved, membranous at the margin, glabrous; lower glume 6-8 mm long; upper glume 7-10 mm long. Lemma 7-10 mm long, glabrous, weakly 5 -nerved, obtuse or mucronate. Palea equaling the lemma or somewhat shorter, ciliate on the keels.

*Distribution.* Endemic in Iran.

*Selected specimens.* Lorestan: Doroud, Oshtorankuh, 2400-2700 m, Assadi 70752 and 70753 (TARI), 58 km from Aligoudarz to Shulabad, N. slope of Ghalikuh, 2900 m., Runemark and Lazari 26195 (TARI). -Bakhtiari, Shahrekord, Noghan, Kase-Kase mt., 2350-2950 m, Mozaffarian 54870 (TARI).

Melderis (1985) made the new combination *Elymus nodosus* (Nevski) Melderis based on *Agropyron nodosum* Nevski and recognized some subspecies for it. Among the subspecies *E. nodosus* subsp. *caespitosus* (K. Koch) Melderis has been based on *Agropyron caespitosum* K. Koch (1848), a combination obviously has the priority comparing to *E. nodosus*, therefore the combination *E. nodosus* is not apparently the correct name. However, *E.*

*dorudicus* is related to *Elymus nodosus* subsp. *caespitosus* (K. Koch) Melderis but differs from it by having leaf blades hairy on upper surface (not scabrous), 4-8 flowers in spikelets (not 3 or rarely 5) and glumes with 5-7 nerves (not 5 nerves).

*Agropyron cognatum* Hack. was recorded by Bor (1970) in Flora Iranica from a locality between Doroud and Azna. This species has a distribution in Kashmir and NE. Afghanistan and far distant from western Iran. Image of the type specimen of this species was studied. It differs from *E. dorudicus* by having flat leaves and also shape of spike and spikelets. However, the specimen cited in Flora Iranica was not observed, but it may belong to *E. dorudicus*.

**Key to the species**

1. Spike very dense. Spikelets ca. 3 times longer than the rachis internodes. Plant caespitose..... *E. shirazicus* Assadi  
- Spike not dense or if dense then plant not caespitose .....
2. Spikelets not awned or with an awn up to 5 mm long..... 3  
- Spikelets awned; awn much longer ..... 15
- 3- Stems often higher than 1 m, 3 mm in diameter in lower part. Spikelets laterally well compressed, 7-9 -flowered. Leaf lamina leathery and thick, more than 3 mm wide, with 7 prominent nerves on the upper surface ..... *E. elongatus* (Host.) Runemark  
..... subsp. *ponticus* (Podp.) Melderis  
- Stems less than 1 m high, less than 2 mm in diameter in lower part. Spikelets up to 7 -flowered. Leaf lamina thin, if broader than 3 mm then 15 -nerved on the upper surface .....
4. Plants caespitose, without stolons. Stems narrow, ca. 1.5 mm broad. Leaf blades usually convolute and less than 3 mm broad; leaf sheath not ciliate or with few cilia at the margin. Spikelets less than 4 mm broad..... 5  
- Plants not caespitose, with long stolons. Leaf blades flat and more than 3 mm broad; leaf sheath sometimes ciliate. Spike broader than 4 mm .....
5. Glumes soft, lanceolate, narrowly triangular or ovate lanceolate, acute, acuminate or shortly mucronate at the apex..... 6  
- Glumes coriaceous, oblong, truncate, rounded or obtuse .....
6. Glumes and lemma ciliate at the margin ..... 8  
..... *E. zagricus* Assadi  
- Glumes and lemma not ciliate at the margin .....
7. Glumes lanceolate, narrow triangular, gradually narrowed toward the apex, acute or acuminate,

narrowly membranous at the margin, with equal nerves on the back.....*E. libanoticus* (Hackel) Melderis - Glumes ovate-lanceolate, abruptly narrowed at the apex and often shortly mucronate, broadly membranous at the margin; midvein more prominent than the others, changing to a short mucro at the apex ..  
.....*E. pertenuis* (C. A. Mey.) Assadi  
8. Glumes coriaceous, rounded and membranous at the apex. Stems densely hairy or only hairy in lower part  
.....*Elymus tauri* (Boiss. & Bal.) Melderis  
..... var. *kosaninii* (Nab.) Assadi  
- Glumes wooden coriaceous, truncate, emarginate or rarely obtuse, green at the apex. Stems glabrous or sometimes hairy in lower part.....9  
9- Leaf blade 2 or rarely up to 3 mm broad, involute at the margin. Spikelets distant or sometimes shortly imbricate. Middle rachis internodes longer than 10 mm. Glumes narrowly membranous at the margin. Lemma sometimes shortly mucronate .....  
.....*E. doridicus* (Assadi) Assadi  
- Leaf blade 3-6 mm broad, flat or sometimes involute at the margin. Spikelets often imbricate. Rachis internodes less than 10 mm long. Glumes broadly membranous, often auriculate at the apex. Lemma mucronate or shortly awned.....10  
10. Glumes and lemma glabrous.....  
.....*E. gentryi* (Melderis) Melderis var. *gentryi*  
- Glumes and lemma ciliate at the margin .....  
.....*E. gentryi* var. *ciliatiglumis* Assadi  
11. Glumes obtuse or rounded, rarely shortly awned at the apex, glabrous, hairy or only ciliate at the margin. Leaf sheath ciliate at the margin. Plant dark green or greyish, rather weakly stoloniferous .....12  
- Glumes acute or acuminate or shortly awned, glabrous. Leaf sheath rarely weakly ciliate at the margin. Plant light green or yellowish, strongly stoloniferous .....14  
12. Glumes and lemma glabrous  
.....*E. hispidus* Opiz (Melderis) var. *hispidus*  
- Glumes and lemma hairy on the back or ciliate at the margin .....13  
13. Glumes and lemma ciliate at the margin.....  
.....*E. hispidus* var. *podperae* (Nab.) Assadi  
- Glumes and lemma hairy on the back.....  
.....*E. hispidus* var. *villosus* (Hackel) Assadi  
14. Spikes dense, greyish turning to violet. Rachis internodes 4-6 mm long. Spikelets densely imbricate, 2-3 times longer than the rachis internodes. Lemma acuminate or awned. Leaf sheath never ciliate at the margin .....*E. repens* (L.) Gould  
- Spike not dense, greenish or turning to yellow. Rachis internodes 6-8 mm long. Spikelets up to two times longer than the internodes. Lemma not awned. Leaf sheath weakly ciliate at the margin.....

.....*E. elongatiformis* (Drobov) Assadi  
15. Spikelets with awns up to 25 mm long; awns straight.....16  
- Spikelets with awns of 20-90 mm long; awns curved and divergent.....20  
16- Lemma awns up to 6 mm long, shorter than the lemma .....17  
- Lemma awns longer than 6 mm, longer than the lemma .....18  
17. Stems, rachis internode, glumes and lemma glabrous or glabrescent.....*E. transhyrcanus* (Nevski)  
.....Tzvelev var. *transhyrcanus*  
- Stems glabrescent; rachis internode, glumes and lemma hairy .....*E. transhyrcanus* var.  
.....*lorestanicus* Assadi  
18. Glumes 7-9 -nerved, 13-20 mm long. Lower glume longer than the lower lemma .....  
.....*E. panormitanus* (Parl.) Tzvelev  
- Glumes 3-5 -nerved, 8-11 mm long. Lower glume shorter than the lower lemma .....19  
19- Leaves 3-10 mm broad, flat, long hairy on the upper surface. Spikelets 3 -flowered. Glumes 3 -nerved, with 3 mm awn .....*E. caninus* (L.) L.  
- Leaves up to 3 mm broad, involute or involute at the margin. Spikelets 6-8 -flowered. Glumes 5-7 -nerved, acute .....*E. brachyphyllus* (Boiss. & Hausskn.)  
.....A. Löve  
20. Spike dense. Spikelets 2 times longer than the spike internodes, up to 1.5 cm long. Lemma awn up to 2 cm long .....*E. lazicus* (Boiss.) Melderis  
.....subsp. *iranicus* Assadi  
- Spike not dense. Spikelets shorter, equal or somewhat longer than the rachis internodes, longer than 1.5 cm. Lemma awn longer than 2.5 cm.....21  
21. Lemma awn 2.5-3.5 cm, flat at base. Leaves flat, ca. 8 mm broad. In *Fagus* forests  
.....*E. caucasicus* (K. Koch) Tzvelev  
- Lemma awn 4-9 cm long, canaliculate at the base. Leaves often involute, 2-4 mm broad. In non-forest areas or at the margin of forests.....  
.....*E. longearistatus* (Boiss.) Tzvelev

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## REFERENCES

- Assadi, M. 1994a: Crossing experiments in *Elymus transhyrcanus* group, a new subspecies and a new species. – Iran. J. Bot. 6: 185–195.  
Assadi, M. 1994b: Experimental hybridization and genome analysis in *Elymus* L. sect. *Caespitosae* and sect. *Elytrigia* (Poaceae: Triticeae). – Pp. 22–

- 28 in: Proceedings of the 2nd International Triticeae Symposium, Logan, Utah, USA. – Logan.
- Assadi, M. 1995: Meiotic configuration and chromosome number in some Iranian species of *Elymus* L. and *Agropyron* Gaertner (Poaceae: Triticeae). –Botanical Journal of the Linnean Society 117: 159–168.
- Assadi, M. 1996: A taxonomic revision of *Elymus* sect. *Caespitosae* and sect. *Elytrigia* (Poaceae, Triticeae) in Iran. Willdenowia 26: 251-271.
- Assadi, M. & Runemark 1995: Hybridisation, genomic constitution and generic delimitation in *Elymus* s.l. (Poaceae: Triticeae). – Plant Systematics and Evolution 194: 189–205.
- Bor, N. L. 1970: Gramineae in K. H. Rechinger Flora Iranica, no. 70. -Graz.
- Kellog, E. A. 2015: Poaceae in K. Kubitzki the Families and Genera of Vascular Plants XIII. – Springer Cham Heidelberg New York Dordrecht London.
- Linnaeus, C. 1753: Species Plantarum 1. –Holmiae.
- Löve, A. 1984: Conceptus of the Triticeae. –Feddes Repertorium 95 (7-8): 425-521).
- Melderis, A. 1985: *Elymus* L. in P. H. Davis Flora of Turkey and the East Aegean Islands vol. 9: 206-227.
- Nevski, S. A. 1934: *Elymus* in V. L. Komarov Flora of the USSR vol 2: 694-697. –Moskva & Leningrad.
- Tsvelev, N. N. 1976: Grasses of the Soviet Union, translated by B. R. Sharma in 1983. –Oxonian Press, New Delhi.
- Usofi, M. 2002: *Elymus lazicus* subsp. *attenuatiglumis*, a new record for Iran. –Iranian Journal of Botany 9 (2): 249-251.
- Yen, C., J. L. Yang & B. R. Baum 2005: *Douglasdeweya*, a new genus, with a new species and a new combination (Triticeae: Poaceae). – Canadian Journal of Botany, vol. 83, no. 4: 413-419.