BioOne COMPLETE

The genera Aristida and Stipagrostis (Poaceae) in Iran

Authors: Ghasemkhani, Maryam, Akhani, Hossein, Sahebi, Jamal, and Scholz, Hildemar

Source: Willdenowia, 38(1) : 135-148

Published By: Botanic Garden and Botanical Museum Berlin (BGBM)

URL: https://doi.org/10.3372/wi.38.38108

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Downloaded From: https://bioone.org/journals/Willdenowia on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

MARYAM GHASEMKHANI, HOSSEIN AKHANI, JAMAL SAHEBI & HILDEMAR SCHOLZ

The genera *Aristida* and *Stipagrostis (Poaceae)* in Iran

Abstract

Ghasemkhani, M., Akhani, H., Sahebi, J. & Scholz, H.: The genera *Aristida* and *Stipagrostis (Poaceae)* in Iran. – Willdenowia 38: 135-148. – ISSN 0511-9618; © 2008 BGBM Berlin-Dahlem. doi:10.3372/wi.38.38108 (available via http://dx.doi.org/)

The species of *Aristida* and *Stipagrostis (Poaceae* tribe *Aristideae)* are C_4 plants and in Iran distributed mostly in the arid and warm central and southern parts of the country. Based on examination of herbarium specimens and field studies an updated synopsis of these genera in Iran is provided, including an identification key, line drawing illustrations of floral parts and distribution maps. In Iran *Aristida* includes two species, namely *A. abnormis* and *A. adscencionis,* the latter with three subspecies, and *Stipagrostis* includes 11 species. *S. uniplumis* is newly reported for Iran from a single locality in Sistan & Baluchestan province. The specific status of two recently described species, *S. barbata* and *S. multinerva,* is confirmed and evidence is given for merging *S. paradisea* with *S. raddiana*.

Additional key words: grasses, *Aristideae, Stipagrostis uniplumis,* C_4 plants, taxonomy.

Introduction

Members of tribe *Aristideae* (subfam. *Aristidoideae,* family *Poaceae*) are widely distributed in the tropical and subtropical parts of the world. The genus *Aristida* (c. 300 species) occurs in the tropics and subtropics of both hemispheres, *Stipagrostis* (c. 50 species) is limited to the drier areas of Africa, the Middle East and Central Asia, and *Sartidia* (4 species) is distributed only in southern Africa and Madagascar (De Winter 1965; Watson & Dallwitz 1994; Henrard 1926, 1929-32). Many species of the genera *Stipagrostis* and *Aristida* are adapted to arid and semi-arid environments, such as sand dunes (Danin 1996), and are conspicuous components of some vegetation types in the southern and central parts of Iran. All known species of these genera have a C_4 photosynthetic pathway, which enables them to grow in very warm and harsh environments (Watson & Dallwitz 1994; Hattersley 1992). Three species of *Aristida* and eight species of *Stipagrostis* were reported from Iran in Flora Iranica (Bor 1970). Since then, one of the species of *Aristida* was reduced to a subspecies (Léonard 1981) and three more species of *Stipagrostis* were added for Iran (Scholz 1988; Freitag 1986; Termeh 1975; Léonard 1981). Scholz (1988) showed that the record of *S. pungens* (Desf.) De Winter in Flora Iranica is based on misidentification of *S. pennata* subsp. *scabriglumis* (Henrard) H. Scholz.

Downloaded From: https://bioone.org/journals/Willdenowia on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

Based on an extensive study of the specimens in the herbarium of the Plant Pests and Diseases Research Institute (IRAN), the herbarium of the Ferdowsi University of Mashhad (FMUH), the herbarium of the Royal Botanic Gardens, Kew (K), and the personal herbarium of and field studies by H. Akhani a revised synopsis of the two genera of *Aristideae* in Iran is provided.

Material and methods

Based on a checklist of 44 qualitative and quantitative characters, the morphological features were recorded for each specimen. These records were used for the descriptions of the species (not included in the present paper, with the exception of the newly reported *Stipagrostis uniplumis*), for the evaluation of the consistency of characters for separating the species and for the identification key. All specimen studied, or in case of very numerous specimens available, a selection of specimens are cited for each taxon. Type citations are given for species described from Iran. The floral parts were redrawn from digital pictures taken from herbarium specimens or using a stereomicroscope. The distribution maps are based on the studied herbarium material and were in a single case supplemented by literature records (open symbols); the localities were georeferenced and distribution maps generated with the computer program DMAP.

Results

Key to species of the genera *Aristida* and *Stipagrostis* in Iran

1. Awns scabrous with very short hairs less than 0.5 mm long, visible under high magnification . . . . . 2. *Aristida*
– At least one of the awns plumose with hairs more than 2 mm long . . . . 5. *Stipagrostis*
2. Awn column twisted . . . . . *A. abnormis*
– Awn column straight 3
3. Perennial, awns 18-32 mm long . . . . . *A. adscensionis* subsp. *coerulescens*
– Annual, awns 8-25 mm long 4
4. Upper glume distinctly shorter than the lemma, scabrous only along the keel; awns 10-25 mm long (plants of S Iran) . . . . . *A. adscensionis* subsp. *adscensionis*
– Upper glume slightly shorter than the lemma, hairy on the lower part of the abaxial surface; awns 8-15 mm long (plants of N Iran) . . . . . *A. adscensionis* subsp. *heymanii*
5. Lateral awns scabrous, central awn plumose 6
– Lateral and central awns plumose 13
6. Nodes with a fringe of spreading, long, whitish hairs; lemma articulated at about middle . . . . . *S. ciliata*
– Nodes glabrous; lemma articulated at its tip 7
7. Central feathery awn obtuse in outline; caespitose plant with short, rosette-like basal leaves 5-15 mm long . . . . . *S. obtusa*
– Central awn with a naked tip; growth form not as above 8
8. Central awn plumose in the upper half or 2/3, if plumose in the lower half then basal leaf sheaths covered with dense woolly hairs 9
– Central awn plumose throughout its length 11
9. Awn column distally with a distinct tuft of long, fine hairs, central awn up to 3 cm long . . . . . *S. uniplumis*
– Awn column distally glabrous, central awn 3.5-5.5 cm long 10
10. Lower glume 3-nerved; perennial, frequent in dry steppes, rarely on stabilized sand dunes . . . . . *S. plumosa*
– Lower glume 5-7-nerved; annual, known only from mobile sand dunes of Lut desert . . . . . *S. multinerva*

Downloaded From: https://bioone.org/journals/Willdenowia on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

11. Abaxial surface of the upper glume glabrous or slightly scabrous on the keel, lower glume glabrous except the villous margins; awn column glabrous 12
– Abaxial surface of glumes hirtellus; awn column distally bearded . . . . . *S. hirtigluma*
12. Lower glume shorter than upper glume, column long-bearded above and below the geniculation . . . . . *S. pogonoptila*
– Lower glume obviously longer than upper glume; awn column glabrous . . . *S. raddiana*
13. Lower glume 7(-9)-nerved; top of sheaths with spreading 2-3 mm long hairs . *S. barbata*
– Lower glume 3-5-nerved; top of sheaths with 0.5-1 mm long hairs 14
14. Awns 10-15 mm long; feathery awns obtuse to acute, hairy at the tip . . . . . *S. pennata*
– Awns 20-25(-27) mm long; feathery awns acuminate, naked at the tip . . . *S. karelinii*

Enumeration of taxa

Aristida abnormis Chiov. in Ann. Ist. Bot. Roma 8: 48. 1903. – Fig. 1A.

Specimen examined. – Hormozgan: 14 km NE of Bandar Abbas, 5.5.1961, *Pabot* (IRAN 19329).

This is a rare species previously reported only once (Bor 1970) from an unknown locality in S Iran (Persia orientalis, *Aucher 9444,* not seen).

General distribution. – NE Africa, Arabian Peninsula (Cope 2007: 101, map 163), S Iran (Fig. 2A), Pakistan.

Aristida adscensionis L., Sp. Pl.: 82. 1753. – Fig. 1B.

(a) subsp. *adscensionis*

Selected examined specimens. – Fars: Jahrom to Mansoorabad, 1100 m, 13.4.1939, *Gauba 1622-E* (IRAN 19348); between Lar and Dalan, 500 m, 15.4.1939, *Gauba 1624-E* (IRAN 19349/2); Borazjan, Cheshmeh Gugerdi (spring), 4.3.1970, *Iranshahr s.n.* (IRAN 19347). – Hormozgan: Between Genu and Sarzeh, 29.4.1949, *Rechinger, Esfandiari & Aellen 3407-E* (IRAN 19356); Gheshm Island, 19.4.1949, *Behboudi 8078-E* (IRAN 19338/3); Kahurestan, 14.2.1975, *Iranshahr & Termeh* (IRAN 19339); Lavan Island, 18.-21.2.1999, *Termeh & Karavar* (IRAN 24827); Kish Island, 15.-18.2.1976, *Termeh & Mussavi* (IRAN 19342); Hengam Island, 13.2.2001, *Eskandari* (IRAN 32846); Tonbe-Bozorg Island, 8.4.1958, *Mirzaee* (IRAN 27955); Biaban, Kargushki to Kardar, 6.3.1949, *Behboudi 383-E* (IRAN 19340). – Kerman: Jiroft, 18.6.1960, *Dadashzade 10062-E* (IRAN 19352); Jebal-barez Mt., 8.-10.5.1948, *Rechinger, Esfandiari & Aellen* 3644-E (IRAN 19353); 18 km N of Jiroft to Jebal-barez, 1300 m, 28°49'12"N, 57°48'30"E , 15.6.2004, 5.6.2004, *Akhani, Caujape-Castells & Ajani 17841* (herb. Akhani). – Sistan & Baluchestan: Bahukalat to Hudar, 7.4.1974, *Iranshahr & Ershad* (IRAN 19330); Ghasr-e Ghand to Hudar, 9.3.1974, *Iranshahr & Ershad* (IRAN 19331); Tis to Chah Bahar, 27.2. 1940, *Gauba 1628* (IRAN 19333). – Yazd: Abarghu, Aliabad, 12.6.1967, *Kashkuli* (IRAN 19346).

The plants in Iran belong to either var. *ehrenbergii* Henrard characterized by a tuberculate lemma or var. *adscensionis* characterized by a scabrous lemma.

General distribution. – Throughout the tropics and subtropics.

(b) subsp. *coerulescens* (Desf.) Bourreil & Trouin ex P. Auquier & J. Duvigneaud in Bull. Soc. Échange Pl. Vasc. Eur. Occid. Bassin Médit. 16: 134. 1976 ≡ *Aristida coerulescens* Desf., Fl. Atl. 1: 109. 1798. – Fig. 1C.

Specimens examined. – Khuzestan: Near Behbahan, 15.4.1959, *Pabot 10059-E* (IRAN 19327); Pazanan, 11.4.1936, *Gauba 1621-E* (IRAN 19358).

This taxon has been reported from Lorestan and Sistan & Baluchestan in Flora Iranica (Bor 1970) and Jaz Murian by Léonard (1981). It was lectotypified by Peruzzi & Passalacqua (2004) who ac-

Downloaded From: https://bioone.org/journals/Willdenowia on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

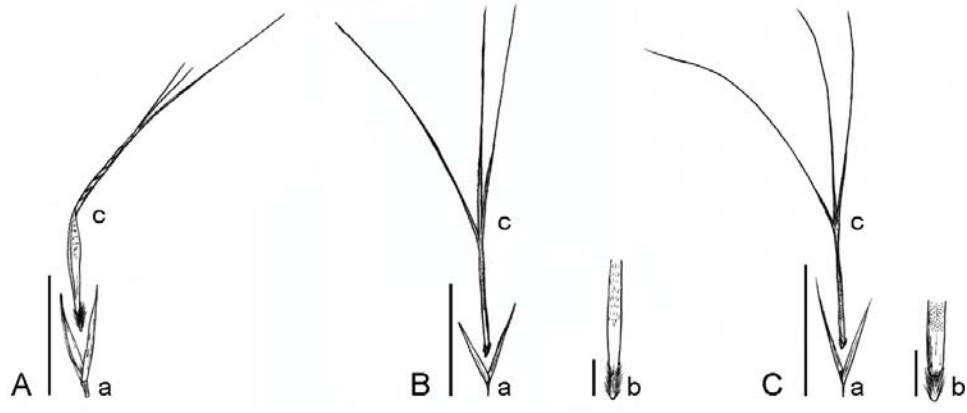


Fig 1. Flower details of *Aristida* species in Iran – A: *A. abnormis;* B: *A. adscensionis* subsp. *adscensionis;* C: *A. adscensionis* subsp. *coerulescens*. – Abbreviations: a = glumes, b = base of lemma and callus, c = lemma and awns. – Scale bars: a + c = 10 mm, b = 1 mm.

cepted it at subspecific rank (see also Léonard 1981). Beside on the Canary Islands, subsp. *adscensionis* and subsp. *coerulescens* (Fig. 2B) are sympatric also in S Iran.

General distribution. – S Europe, N Africa (Canary Islands to Egypt), Turkey, Cyprus, Palestine, Syria, Iraq, Iran to Pakistan and Himalaya.

(c) subsp. *heymannii* (Regel) Tzvelev in Novosti Sist. Vyssh. Rast. 8: 74. 1971 ≡ *Aristida heymannii* Regel in Trudy Imp. S.-Peterburgsk. Bot. Sada 7(2): 649. 1881.

General distribution. – N Africa, Iran (Fig. 2A), Himalaya, C and E Asia.

Specimens examined. – KHORASAN: Mashhad, Ferdowsi University Campus, 1050 m, 1.12.1984, *Ayatollahi s.n*. (FMUH). – W AZERBAIJAN: 35 km N Ghara-Ziaoddin towards Poldasht, 39°11'51"N, 44°58'43"E, very common along the road, 911 m, 15.9.2007, *H. Akhani s.n.* (herb. Akhani); 12 km NW of Poldasht, along Azerbaijan border, 39°22'21"N, 45°2'40"E, 812 m, 16.9.2007, *H. Akhani s.n.* (herb. Akhani).

Aristida adscencionis subsp. *heymannii* was not given for the Flora Iranica area by Bor (1970). However, its occurrence in Iran was stated in the general distribution of the taxon by Tzvelev (1976) but not substantiated by specimens.

Two recent collections from W Azerbaijan, NW Iran, close to the border with Azerbaijan are referred to subsp. *heymannii* with some hesitation. The glumes are distinctly unequal and clearly shorter than the lemma. Additionally they are only scabrous along the keel. The awn length is 8-12 mm, which matches well with subsp. *heymannii*.

Stipagrostis barbata H. Scholz in Willdenowia 17: 107. 1988.
Holotype: Iran, Khorasan, in arenosis 56-60 km N Gonabad inter Mahneh, 34°59'N, 58°51'E , et Emrani, 34°35'N, 58°40'E, 900 m, 9.5.1975, *K. H. Rechinger 51419* (W; isotype: B). – Fig. 3A.

Specimens examined. – ESFAHAN: Deh-abad to Abuzeid-abad, 1000 m, 3.6.1975, *Musavi & Tehrani* (IRAN 21707). – KHORASAN: Torbat-e Heydarieh, between Mehne and Lut-e Emrani, 850 m, 9.5.1975, *Iranshahr* (IRAN 21709/2); between Torbat-e Heydarieh and Gonabad, c. 30 km N Gonabad, sandy dune, near Dakale Omrani (Radar station), 34°37'36"N , 58°44'28E, 907. 31.8.2003, *H. Akhani & M. R. Joharchi 17257* p.p. (herb. Akhani) (locus classicus). – SEMNAN: Damghan, Hasan Abad, 25.5.2000, *Maddah* (IRAN 29233). – TEHRAN: Kavir, between Karvansaray-e Shah Abbasi and Nakhjir, 24.5.1974, *Iranshahr* (IRAN 21706).

Downloaded From: https://bioone.org/journals/Willdenowia on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

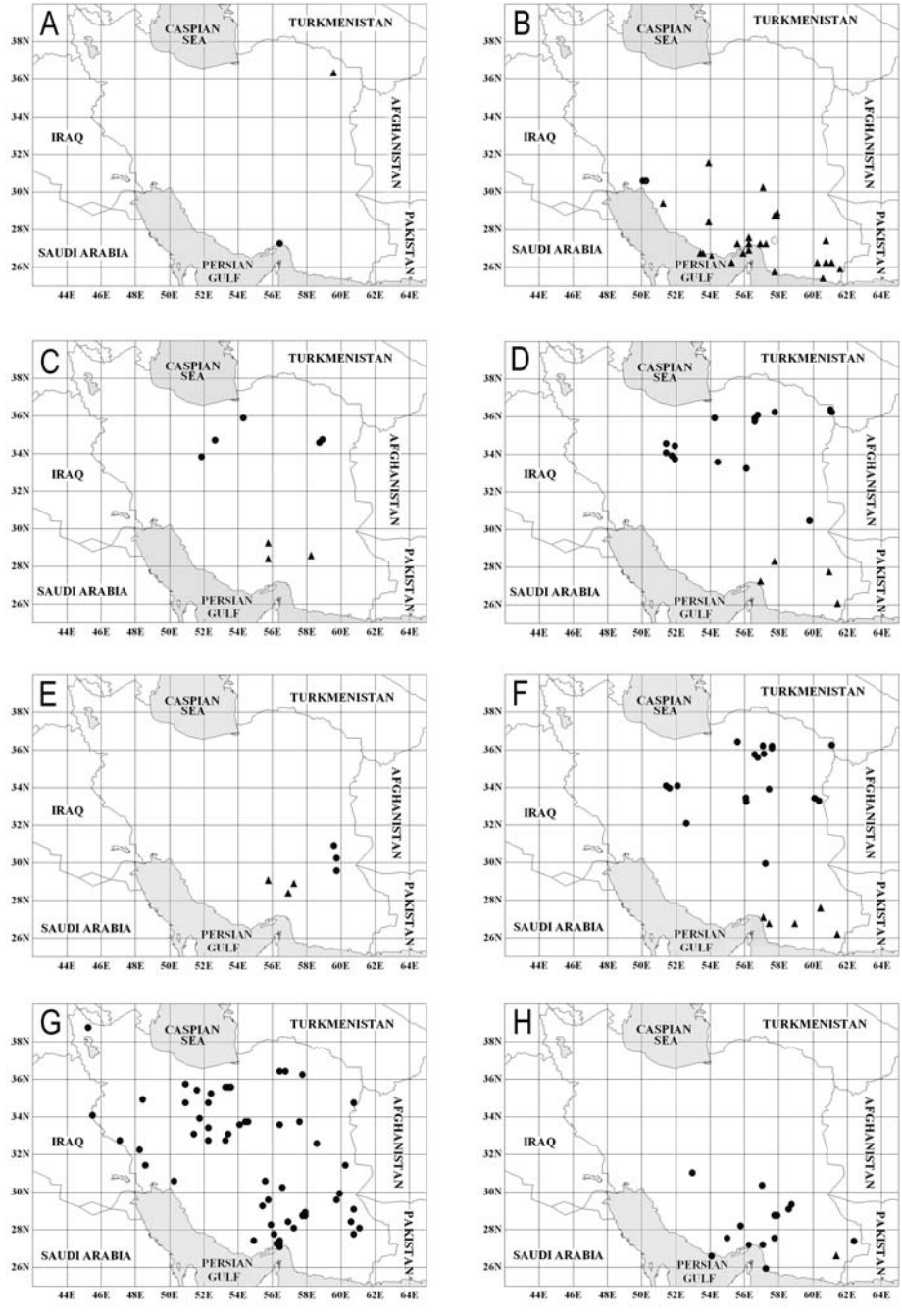


Fig. 2. Distribution of the species of *Aristida* and *Stipagrostis* in Iran – A: *Aristida abnormis* (●), *A. adscensionis* subsp. *heymannii* (▲); B: *A. adscensionis* subsp. *adscensionis* (▲), *A. adscensionis* subsp. *coerulescens* (●, ○ = literature record); C: *Stipagrostis barbata* (●), *S. ciliata* (▲); D: *S. hirtigluma* (▲), *S. karelinii* (●); E: *S. multinerva* (●), *S. obtusa* (▲); F: *S. pennata* (●), *S. pogonoptila* (▲); G: *S. plumosa* (●); H: *S. raddiana* (●), *S. uniplumis* (▲).

Downloaded From: https://bioone.org/journals/Willdenowia on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

The species is very similar to *Stipagrostis pennata* and both species occur sympatrically in N central and E Iran (Fig. 2C + F) but both are clearly specifically distinct. The most important diagnostic characters separating *S. barbata* from *S. pennata* are the up to 3 mm long hairs of the ligules, the 7(-9)-nerved lower glume and the 3(-5)-nerved upper glume. Furthermore, the leaves of *S. barbata* are vertically arranged on the stem instead of pointing obliquely upwards as in *S. pennata.* At the type locality both species were found; *S. pennata,* however, occurs on low dunes, whereas *S. barbata* grows on higher dunes.

General distribution. – Endemic to Iran (Fig. 2C) and Afghanistan.

Stipagrostis ciliata (Desf.) De Winter in Kirkia 3: 133. 1963
≡ *Aristida ciliata* Desf. in Neues J. Bot. (Schrader) 3: 255. 1809. – Fig. 3D.

Specimens examined. – KERMAN: 12 km S of Sirjan, 6.5.1961, *Pabot 12057-E* (IRAN 21697/1); Jebal-barez Mt., Dehbid (Deh Bakri) to Jiroft, 8.-10.5.1948, *Rechinger, Esfandiari & Aellen 3798-E* (IRAN 21696); between Chah Choghok and Tarom, 1400 m, *Rechinger 7462* (IRAN).

A characteristic species with long-spreading hairs on the nodes. *Stipagrostis ciliata* is a very rare plant in Iran, represented in IRAN only by three old collections of over half a century ago (Fig. 2C). The attempts of H. Akhani to recollect the species in Jebel-Barez near Deh Bakri were in vain.

General distribution. – Canary Islands, N and tropical Africa, Arabian Peninsula (Cope 2007: 90, map 144), S Iran (Fig. 2C), Pakistan, India.

Stipagrostis hirtigluma (Steud.) De Winter in Kirkia 3: 134. 1963 ≡ *Aristida hirtigluma* Steud., Nomencl. Bot., ed. 2, 131. 1841. – Fig. 3E.

Specimens examined. – HORMOZGAN: Minab to Rudan, 23 km to Minab, 15.2.1973, *Iranshahr & Mussavi* (IRAN 21694). – SISTAN & BALUCHESTAN: Between Khash and Iranshahr, Karvander Mt., 1500-1600 m, 16.5.1948, *Rechinger, Esfandiari & Aellen 3990* p.p. (IRAN 21695; K); Houdar, 7.3.1974, *Iranshahr & Ershad* (IRAN 21692). – KERMAN: NO du Jaz Murian piste entre Djiroft et Kahanuj, 28°18'N, 57°47'E, 500 m, 20.4.1972, *Léonard 5676* (K).

A very rare species in Iran, which is known from the southernmost and southeasternmost parts of the country (Fig. 2D), only based on the above cited specimens.

General distribution. – Tropical and N Africa through SW Asia to India.

Stipagrostis karelinii (Trin. & Rupr.) H. Scholz in Willdenowia 6: 161. 1970
≡ *Aristida pennata* var. *karelinii* Trin. & Rupr., Sp. Gram. Stipac.: 177. 1842 ≡ *Aristida karelinii* (Trin. & Rupr.) Roshev. in Komarov, Fl. SSSR 2: 67, 740. 1934. – Fig. 3B.

Specimens examined. – KHORASAN: 30 km N of Ahmad-abad, 51 km S of Kalat-e Mazinan, Reza-abad, 900 m, 13.6.1990, *Akhani 6441* (herb. Akhani); 26 km S of Sarakhs, 5 km S of Dolat-abad, 350 m, 16.6.1990, *Akhani 6494* (herb. Akhani); ibid. Joharchi 19197a (FMUH); Sabzevar, sand dunes, 880 m, 16.5.1966, *Pabot 10052-E* (IRAN 21687, K); Sabzevar, Sabri, 16.8.1956, *Sabeti* (IRAN 21701). – ESFAHAN: Kashan, Deh-abad to Abuzeidabad, 1000 m, 3.6.1975, *Mussavi & Tehrani 30694-E* (IRAN 21684); Abuzeidabad to Fakhre, 200-1000 m, 4.6.1975, *Mussavi & Tehrani* (IRAN 21686); Abuzeidabad, 28.10.1956, *unknown collector* (IRAN 21699); Aliabad, Abuzeidabad, 28.9.1956, *Sabeti* (IRAN 21688), Aran, 29.10.1956, *Sabeti* (IRAN 21689); ibid. 10 km N Kashan, 940 m, 13.11.1948, *Aellen 1823* (K); Kashan, Kavir Pireh, 18.11.1948, *Aellen & Sharif 8083-E* (IRAN 1698) (K); ibid. 18.11.1948, *Iranshahr & Mussavi* (IRAN 21700); SE of Darya-yi Namak, 15 km E of Maranjab, 860 m, 21.11.1948, *Sharif & Aellen 1826* (K). – SEMNAN: Turan, sand dunes in 4 km E of Ahmad-abad, 35°47'N, 56°39'E, c. 1000 m, 5.10.2001, *Akhani & Ghobadnejhad 15839-b* (herb. Akhani); Touran Protected Area, c. 60 km SE of Ahmad-abad, 31.10.1987, *Akhani 4182* (herb. Akhani); Damghan, Hasan-abad, 25.5.2000, *Maddah* (IRAN

Downloaded From: https://bioone.org/journals/Willdenowia on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

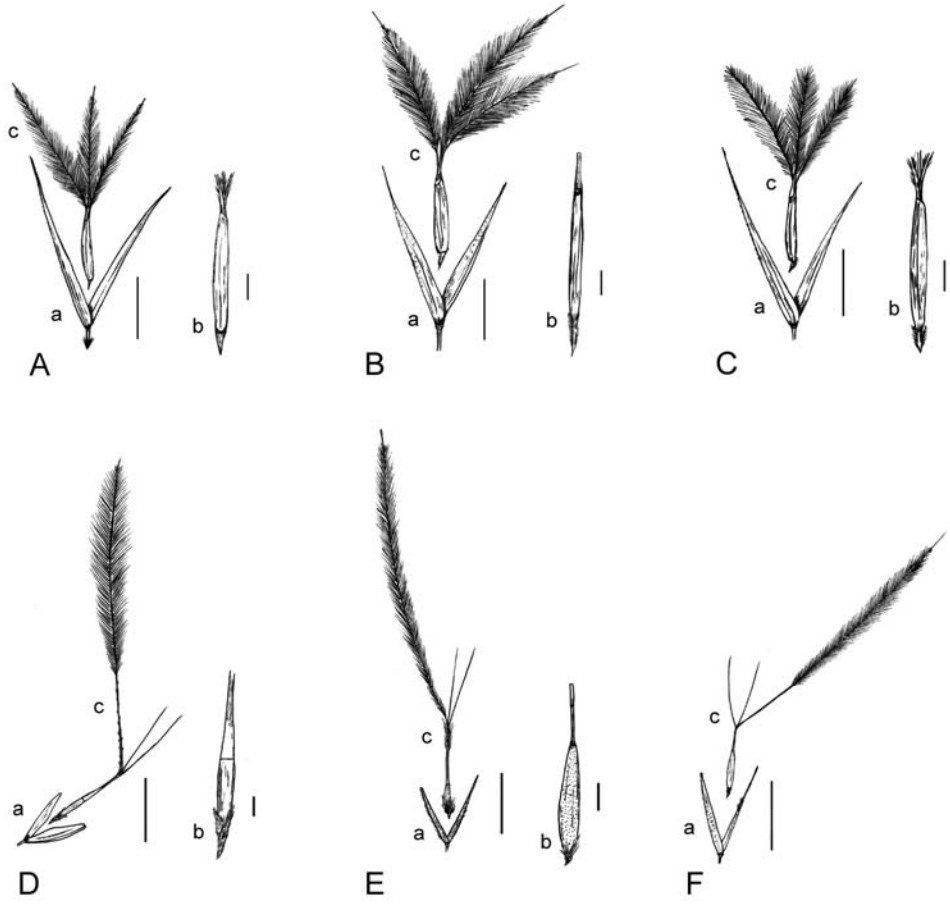


Fig. 3. Flower details of *Stipagrostis* species in Iran – A: *S. barbata;* B: *S. karelinii*; C: *S. pennata;* D: *S. ciliata;* E: *S. hirtigluma;* F: *S. multinerva.* – Abbreviations: a = glumes, b = base of lemma and callus, c = lemma and awns. – Scale bars: a + c = 10 mm, b = 1 mm.

29233). – SISTAN & BALUCHESTAN/KERMAN: Est du Dasht-e Lut, lst des grandes dunes, 30°22'N, 59°48'E, 1130 m, 10.5.1972, *Léonard 6103* (K). – YAZD: 6 km SW of Robat-e-Khan, sand dunes, 1000 m, 14.5.1975, *Iranshahr* (IRAN 21685); 37 km from Chah-Malek to Chupanan, 840 m, 16.5.1975, *Iranshahr* (IRAN 21691).

Stipagrostis karelinii was not given for Iran by Bor (1970). Its occurrence in Iran was first reported by Freitag (1986) from Turan Protected Area. *S. karelinii* (Fig. 2D) is sympatric with *S. pennata* (Fig. 2F) and occurs almost in similar habitats on both fixed or mobile sand dunes. Both species are extreme xerophytes, which survive with their long rhizomes even long periods of drought. They are usually associated with other psammophytes such as *Haloxylon persicum* Bunge ex Boiss., *Xylosalsola richteri* (Moq.) Akhani & E. H. Roalson (= *Salsola richteri* (Moq.) Karel. ex Litw., Akhani & al. 2007), *Heliotropium arguzioides* Kar. & Kir., *Smirnowia turkestana* Bunge, *Calligonum* spp., *Heliotropium dasycarpum* subsp. *transoxanum* (Bunge) Akhani & Förther, *Horaninowia ulicina* Fisch. & C. A. Mey., *Agriophyllum latifolium* Fisch. & C. A. Mey. ex Fenzl and *A. minus* Fisch. & C. A. Mey.

General distribution. – Aralo-Caspian lowlands, Iran (Fig. 3D), Afghanistan.

Downloaded From: https://bioone.org/journals/Willdenowia on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

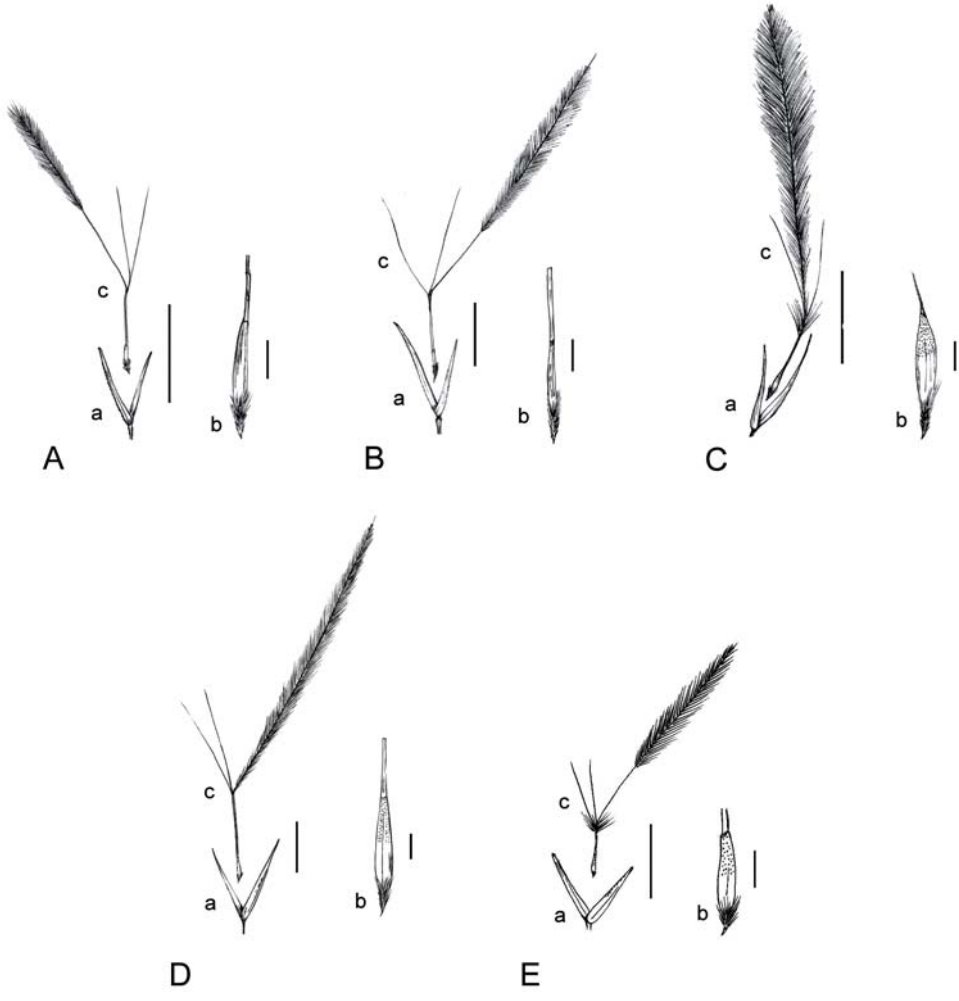


Fig. 4. Flower details of *Stipagrostis* species in Iran – A: *S. obtusa;* B: *S. plumosa;* C: *S. pogonoptila;* D: *S. raddiana;* E: *S. uniplumis.* – Abbreviations: a = glumes, b = base of lemma and callus, c = lemma and awns. – Scale bars: a + c = 10 mm, b = 1 mm.

Stipagrostis multinerva H. Scholz in Oesterr. Bot. Z. 117: 289. 1969. – Fig. 3F.

Specimens examined. – SISTAN & BALUCHESTAN: 38 km S of Nosrat-abad in the road from Nosrat-abad to Bam, 29°35'26"N, 59°45'21"E, 696 m, 15.6.2004, *Akhani, Caujape-Castells & Ajani 17869* (herb. Akhani); est du Dasht-e Lut à l'étude des grandes dunes 30°10'N, 59°45'E, 10.5.1972, 930 m, *J. Léonard 6094* (K); ibid., 30°55'N, 59°39'E, 14.5.1972, 1100 m, *J. Léonard 6191* (K).

The recent above cited collection of this plant by Akhani & al. was made in an extremely dry area on sandy soils beside the road not far from two previously known localities (Fig. 2E) cited by Scholz (1979) and Léonard (1981). The species is superficially very similar to the widespread *Stipagrostis plumosa* (which occurs frequently in nearby localities) but is distinguishable by its smaller size, annual life form and the 5-7-nerved lower glume.

Downloaded From: https://bioone.org/journals/Willdenowia on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

General distribution. – N Africa (Algeria, Libya), Sinai, Arabian Peninsula (Cope 2007: 94, map 152) and S central Iran (Fig. 2E and see Scholz 1979: 213, fig. 1).

Stipagrostis obtusa (Delile) Nees in Linnaea 7: 293. 1832
≡ *Aristida obtusa* Delile, Fl. Egypt. Expl. Pl.: 13, t. 13, fig. 3. 1813. – Fig. 4A.

Specimens examined. – KERMAN: Haji-abad to Sirjan, Aliabad, 6.5.1961, Pabot *10060-E* (IRAN 21703); Jiroft to Esfandagheh, 1900 m, 20.3.1971, *Iranshahr & Termeh* (IRAN 21702); between Orzuiyeh and Faryab, 16 km E of Sorkhan, 1589 m, 28°20'8"N, 56°58'2"E, 14.6.2004, *Akhani, Caujape-Castells & Ajani 17819* (herb. Akhani). – SISTAN & BALUCHESTAN: E slope of Kuh-e Bazman, 28°2'N, 60°6'E, c. 1700 m, 11.5.1975, *B. S. Parris 175.455* (K).

Stipagrostis obtusa was first reported for Iran by Termeh (1975). Distributed in S Iran (Fig. 2E), its habitats are rocky deserts with a thin layer of sand and gravel. The species is densely caespitose characterized by its small rosette-like leaves crowded on the tufted base.

General distribution. – Almost overall Africa, Arabian Peninsula (Cope 2007: 99, map 160), Iraq, Iran (Fig. 2E), Pakistan.

Stipagrostis pennata (Trin.) De Winter in Kirkia 3: 135. 1963
≡ *Aristida pennata* Trin. in Mém. Acad. Imp. Sci. St. Pétersbourg Hist. Acad. 6: 488, t. 10. 1815.
= *Stipagrostis pennata* var. *scabriglumis* (Hausskn. & Bornm. ex Henrard) H. Scholz in Willdenowia 17: 108. 1988 ≡ *Aristida pennata* var. *scabriglumis* Hausskn. & Bornm. ex Henrard in Meded. Rijks-Herb. Leiden 54: 437. 1926. – Fig. 3C.

Specimens examined. – ESFAHAN: 120 km E of Esfahan, Hasan-abad sand dune Stabilization Station, Jarghuye, 1700 m, 31.10.2003, *Sahebi s.n.* (herb. Akhani); Kashan, Kavir, Kuhe-Yakhab, 21.5.1970, *Iranshahr* (IRAN 21713); Aran, 940 m, 29.10.1956, *Saleh 10252-E* (IRAN 21714); Abuzeidabad versus Fakhreh, 900-1000 m, 4.6.1975, *Musavi & Tehrani 30722 E* (IRAN 21712). – KERMAN: In arenosis montis Kuh-i-Dschupar, 2000 m, 9.5.1892, *J. Bornmüler 4833* (K). – KHORASAN: 26 km S Sarakhs, 5 km S Doulatabad, 350 m, 16.9.1990, *Akhani 6452* (herb. Akhani); 6 km NE Zamanabad, sand dunes, 1100 m, 13.6.1990, *H. Akhani 6457* (herb. Akhani); S. Sabzevar, Haresabad, desert park, 800 m, 31.5.1991, *Joharchi & Zanguei 20548* (FMUH); Ghaen, SE of Hemmat-abad, 980 m, 28.5.1955, *Rafeie & Zanguei 25661* (FMUH); Ghaen Mt., 20 km from Hajiabad to Mohammad abad, 1000 m, 7.6.1993, *Joharchi & Zanguei 23274* (FMUH); SW of Sabzevar, 10 km from Parvand to Parvand Mountains, 800 m, 17.5.1999, *Faghihnia & Zanguei 32457* (FMUH); in arenosis mobilibus 25 km SE Boshruyeh, 33°54'N, 57°29'E, 900 m, 11.5.1975, *Rechinger 51669* (K); Sabzevar, 880 m, 16.5.1966, *Pabot 10055 E* (IRAN 21711); Sabzevar, 10 km to Sabzevar, Hares-abad, 4.3.1968, (IRAN 29231); Rud-e Shur, 5 km to S of Sabzevar, 36°9'32"N, 57°38'22"E, 925 m, 20.7.2001, *Akhani & Salimian 15424* (herb. Akhani). – SEMNAN: Touran Protected Area, Sand dunes E of Ahmad-abad, 35°47'N, 56°39'E, c. 1000 m, 5.10.2001, *Akhani & Ghobadnejhad 15839b* (herb. Akhani); in desertis arenosis inter Damghan and Sabzevar, prope Maimei, *Rechinger 1291* (K). – YAZD: 6 km SW of Robat-e Khan, 1000 m, 14.5.1975, *Iranshahr* (IRAN 21710); ibid. 33°21'N, 56°3'E, *Rechinger 51805* (K).

Stipagrostis pennata s.l. is a complex centred in the Aralo-Caspian area, Iran and Afghanistan. So far, *S. karelinii* (see notes under that species) and *S. barbata* were separated from this complex. *S. pungens* (Desf.) De Winter was reported by Bor (1970) based on four specimens from Iran, Afghanistan and Turkmenistan. The specimen cited from Iran *(Bornmüller 4833),* however, is the type of *S. pennata* var. *scabriglumis.* We agree with Scholz (1988) that *S. pungens* does not occur in the Flora Iranica area and it is also not confirmed for the Arabian Peninsula (Cope 2007: 92). It is actually restricted to N Africa and differs from *S. pennata* by the straight articulation between lemma column and arista. Furthermore the basal parts and the leaves of *S. pungens* are

Downloaded From: https://bioone.org/journals/Willdenowia on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

sturdy, which has not been seen in any population in Iran. Scabrid glumes are found in many specimens of *S. pennata* in Iran, differing only on the density, without any correlation with other characters.

The above cited specimens could be divided into two groups. The first groups *(Akhani & Salimian 15424, Akhani & Ghobadnejhad 15839b, Rechinger 1291)* are smaller, mostly less than 50 cm tall, have shorter inflorescences usually 10-13 cm long, distinctly inrolled leaves, which are spiny and rigid at apex, a shorter lower glume 11-13 mm long and a shorter 9-10 mm long central awn. The second group (the remaining cited specimens) are characterized by taller growth mostly up to 1 m or more, longer inflorescences (10-25 cm), leaves frequently flat at least at the lower part, and not clearly spiny at the tip, the lower glume 12-18 mm long and the longer central awn 12-15 mm long. The two morphs are not geographically correlated. It is likely that these differences reflect ecotypes. The smaller plants have been collected in shallow sandy soils where the soil is saline below the sands. Therefore we hesitate proposing a formal rank before further studies in a broader context including var. *litwinowii* from Turkmenistan and var. *rigida* Roshev. from Songaria (Henrard 1929, sub *Aristida*) have been done.

General distribution. – Aralo-Caspian area, S Russia, Caucasus, W Siberia, Iran (Fig. 2F), Afghanistan.

Stipagrostis plumosa (L.) Munro ex T. Anderson in J. Linn. Soc. London, Bot., 5, Suppl. 1: 40. 1860 ≡ *Aristida plumosa* L., Sp. Pl., ed. 2, 2: 1666. 1763. – Fig. 4B.

Selected specimen examined. – AZERBAIJAN: In locis arenosis salsas prov. Adzbaidschan [Azerbaijan] inter Khoi et Seid Chuschi., *Szovitz* (K, type of *Aristida plumosa* var. *szovitsiana*). – ESFAHAN: 50 km E of Esfahan to Naeen, 85 km W of Naeen, 1636 m, 32°42'20"N, 52°14'53"E, 10.6.2004, *Akhani & al. 17721* (herb. Akhani); 21 km SE of Naeen to Ardakan, 1438 m, 32°4'31"N, 53°14'45"E, 10.6.2004, *Akhani & al. 17726* (herb. Akhani). – FARS: Inter Hormud-e Bagh et Dalun, 550 m, 15.4.1939, *Gauba 1630* (IRAN 21753), Neiriz to Sirjan, Tolombe-Darvish to Gol-Gohar, 60-100 km to Ghotruyeh, 26.5.1975, *Musavi & Termeh* (IRAN 21717). – GILAN: Manjil to Zanjan, 30 km to Manjil, 30.5.1971, *Iranshahr* (IRAN 21749). – HORMOZGAN: Haji-abad, beginning of the road from Haji-abad to Orzuiyeh, 955 m, 28°19'1"N, 55°56'4"E, 14.6.2004, *Akhani & al. 17810* (herb. Akhani); Hormoz Island, 10-11.2.1976, *Termeh & Musavi* (IRAN 21726). – KERMAN: Jebel-Barez Mountain, 8.-10.5.1948, *Rechinger, Esfandiari & Aellen 3706* (IRAN 21737); c. 7 km N of Faryab, sand dunes near Hur-e-olia village, 674 m, 28°9'18"N, 57°16'3"E, 14.6.2004, *Akhani & al. 17825* (herb. Akhani). – ILAM: 23 km NE Dehloran, 8 km after Meime in the road to Barzieh, c. 200 m, 5.8.1989, *Akhani 5599* (herb. Akhani). – KHORASAN: Tabas, 20 km SW of Robat-e-Gur to Robat-e-Khan, 1000 m, 14.5.1975, *Iranshahr* (IRAN 21719); 7 km N of Taibad to Torbat-e-Jam, 780 m, 15.6.1990, *Akhani 6528* (herb. Akhani). – KHUZESTAN: Near Ahvaz, 12.4.1959, *Pabot 10054 E* (IRAN 21761); c. 40 km SE of Andimeshk, c. 10 km N of Chanane, 150 m, 4.8.1989, *Akhani 5478* (herb. Akhani). – SEMNAN: Momen-abad, 1100-1150 m, 16.6.1992, *Termeh, Musavi & Tehrani* (IRAN 29227); Semnan, 24.5.2000, *Madah* (IRAN 29232). – SISTAN & BALUCHESTAN: 5 km W of Nosrat-abad to Bam, near Nosrat-abad Police station, 1257 m, 29°50'32"N, 59°54'19"E, 15.6.2004, *Akhani & al. 17871* (herb. Akhani); Saravan, 14.4.1980, *Salavatian* (IRAN 21734); 60 km N of Sefidabe, 23.5.1948, *Rechinger, Esfandiari & Aellen 4126* (IRAN 21746); Zahedan to Khash, 1300-1600 m, 15.5.48, *Rechinger, Esfandiari & Aellen 4275* (IRAN 21764); Dasht-kuh, Jandagh to Khur, 30-50 km SE of Jandagh, 920 m, 30.10.1974, *Termeh & Musavi* (IRAN 21765); Goharshahr, 14.5.1974, *Hakimi* (IRAN 21766). – TEHRAN: Tehran, W of Pardisan Nature Park, 35°44'44"N, 51°21'37"E, 1400 m, 17.10.1998, *H. Akhani 13265* (herb. Akhani); 25 km S Behesht-e Zahra towards Hasanabad, *Artemisia* steppe, southern slopes of Aradeh Mountains, 35°23'52"N, 51°18'36"E, 1072 m, 3.5.2001, *H. Akhani 15041* (herb. Akhani); 39 km after Mamazan to Eyvanaki, 100 m, 11.6.1990, *Akhani 6349* (herb. Akhani); Qom to Tehran, 34°41'36"N, 50°52'56"E, 21.6.2002, *Akhani 16403* (herb. Akhani); Kavir-e Siah-Kuh, 23.5.74, *Iranshahr* (IRAN 21723); Hable rud, Bon-Kuh,

Downloaded From: https://bioone.org/journals/Willdenowia on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

31.8.1948, *Aellen & Manuchehri 8079E* (IRAN 21732); Alborz, Mountains S of Firuz-kuh, 5000 m, 22.6.1960, *Furse & Singeh* (IRAN 21733); Karadj, 4.8.1934, *Gauba 1631* (IRAN 21754). – YAZD: 15 km W of Chupanan to Chah-Malek, 880 m, 16.5.1975, *Iranshahr* (IRAN 21721); between Anar and Rafsanjan, 23.4.1948, *Rechinger, Aellen & Esfandiari 2931* (IRAN 21730); Anarak to Naeen, 30.10.1986, *Salari 10253* (IRAN 21741).

A widely distributed (Fig. 2G) and most variable species in Iran; *Stipagrostis plumosa* is one of the components of dry steppes dominated by *Artemisia sieberi*. It occurs also on very dry habitats and on gypsum hills along the Iran-Iraq border as based on field observation and documented by *Akhani 5599*. Sometimes it colonizes very dry steppes as a dominant species in the provinces of Esfahan, Semnan and Yazd. It occurs also in slightly saline soils together with *Kaviria tomentosa* (Moq.) Akhani (= *Salsola tomentosa* (Moq.) Spach, see Akhani & al. 2007).

Henrard (1926) provided a list of varieties of *Stipagrostis plumosa* (under *Aristida plumosa*). Two of these varieties, namely var. *haussknechtii* Boiss. (not yet validated in *Stipagrostis*) and *S. plumosa* var. *szovitsiana* (Trin. & Rupr.) Tzvelev, have been known from type localities in Iran. We did not see the type of var. *haussknechtii* Boiss. collected from Khuzestan province, between Seytun and Bebehan [Behbahan] and characterized by the upper glume having long, white hairs. The type of var. *szovitsiana* from Azerbaijan (*Szovitz,* K) is characterized by the median awn having hairs near the base (*Akhani 13265, 15041, Termeh & al. s.n.* IRAN 29227; IRAN 29230; *Termeh s.n.* IRAN 21736/2). Except for the type locality from Azerbaijan, all other collections are from Tehran and surrounding areas. According to the examined specimens, var. *brachypoda* (Tausch) Bor does not occur in Iran. This taxon is accepted as a separate species by Scholz (1972), who stated its distribution to be limited to NE Egypt.

General distribution. – Tropical and N Africa, Mediterranean region, Middle East, Central Asia, NW India and W Tibet.

Stipagrostis pogonoptila (Jaub. & Spach) De Winter in Kirkia 3: 135. 1963
≡ *Aristida pogonoptila* (Jaub. & Spach) Boiss., Fl. Orient. 5: 496. 1884 ≡ *Arthratherum pogonoptilum* Jaub. & Spach, Ill. Pl. Orient. 4: 56, t. 337. 1851. – Fig. 4C.

Specimens examined. – HORMOZGAN: Minab, 2.5.1955, *Alexandrov 8089-E* (IRAN 21771, K); Bashagard, Senderk to Dar-Pahn, 4.3.1973, *Iranshahr & Musavi* (IRAN 21775). – KERMAN: Jiroft, Rameshk to Fotuj, 6 km E of Rameshk, 700-1000 m, 15.3.1978, *Musavi & Tehrani* (IRAN 21774). – SISTAN & BALUCHESTAN: Hodar, 9.3.1974, *Iranshahr & Ershad* (IRAN 21773); Iranshahr to Bazman, 3.3.1949, *Sharif 8084 E* (IRAN 21776).

General distribution. – Iran (Fig. 2F), Afghanistan, Pakistan, Arabian Peninsula (Cope 2007: 96, considered conspecific with *S. uniplumis*) and NW India.

Stipagrostis raddiana (Savi) De Winter in Kirkia 3: 135. 1963
≡ *Aristida raddiana* Savi in Mem. Mat. Fis. Soc. Ital. Sci. Modena, Pt. Mem. Fis. 21: 198. 1837.
= *Stipagrostis paradisea* (Edgew.) De Winter in Kirkia 3: 135. 1963, **syn. nov.** ≡ *Aristida paradisea* Edgew. in J. Asiat. Soc. Bengal 16: 1219. 1847. – Fig. 4D.

Specimens examined. – FARS: Between Borazjan and Hendijan, 8.4.1936, *Gauba 1620* (IRAN 21782). – HORMOZGAN: In arenosis ad Bandare Abbas, 12.3.1893, *J. Bornmüler 737* (K); Kish Island, 15.-18.2.1976, *Termeh & Musavi* (IRAN 21780); Kish Island, 31.6.1977, *Termeh & Musavi* (IRAN 21779); Bandar-Abbas, Minab, Sar, 26.4.1977, *Riedl & Ershad* (IRAN 21781); Biaban, Bonji Meski to Gatan, 4.3.1949, *Behboudi 409 E* (IRAN 21778); Steppe Harmid, Dature, 15.4.1939, 550 m, *Gauba 597* (not *Parsa*) (K). – KERMAN: 12 km N of Jiroft, 980-1000 m, 28°47'51"N, 57°46'29"E, 15.6.2004, *Akhani & al. 17833* (herb. Akhani); betwen Jiroft and Jebalbarez, 10 km S of Jebal-barez, 1601 m, 28°48'56"N, 57°58'33"E, 15.6.2004, *Akhani & al. 17843* (herb. Akhani); Haji-abad to Tarom, 900 m, *Rechinger 3267* (IRAN 21705); Sud du Dasht-e Lut,

Downloaded From: https://bioone.org/journals/Willdenowia on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

17 km au sud de Bam, 28°50'N, 58°23'E, 1200 m, 24.5.1972, *J. Léonard 6284* (K) (named as *S. paradisea* but clearly with hairy lower internodes); Bordure montagneuse ouest de la depression du Jas Murian, 27°24'N, 57°45'E, 27.4.1972, 520 m, *Léonard* 5863 (K); In monte Kuh-Seidin ditionis Kerman, c. 2000 m, 11.5.1892, *J. Bornmüler 4840* (K). – YAZD: 25 km W of Abarkuh, Surmagh, 1758-1847 m, 31°2'4"N, 52°58'14"E, 11.6.2004, *Akhani, Caujape-Castells & Ajani 17767* (herb. Akhani). – SISTAN & BALUCHESTAN: Between Bam and Iranshar, 21.5.1955, *Alexandrov* (IRAN 21777); Saravan, 30.4.1950, *Salavatian 8080E* (IRAN 21704).

General distribution. – N Africa, Somalia, Arabian Peninsula (Cope 2007: 93, map 151 and 97, map 158 sub *S. paradisea*), S Iran (Fig. 2H), Pakistan and Afghanistan.

Stipagrostis raddiana is restricted to southern Iran with warm and hot climates. The record in Flora Iranica (Bor 1970) from Azerbaijan, "in jugo 30 km NW Khoy, 1800 m, *Rechinger 32706*" (n.v.), is more likely due to misidentification of the common *S. plumosa.* This locality is close to the type locality of *Aristida plumosa* var. *szovitsiana* Trin. & Rupr. (see picture in Henrard 1926: 456), which is characterized by the median awn having hairs nearly to the base. The record of *S. raddiana* from Esfahan province (between Esfahan and Meibod, *Bunge* K) is based on misidentified *Stipa* material. The area has been searched for this species but only *S. plumosa* was found.

Stipagrostis raddiana and *S. paradisea* have been separated by several authors only based on the pubescent or lanate lower internodes in the former and glabrous lower internodes in the latter species (Bor 1970). Henrard (1933) kept these species separate because of the absence of intermediate forms. The type specimen of *S. paradisea* from Yemen (Aden, 1847, *Edgeworth*, K) and several specimens from Yemen are glabrous at the base. However, many intermediates in Iran and across the range of this complex indicate that this character cannot be considered as a reliable feature to separate species. For example, *Salavatian 8080-E* identified by Bor as *S. paradisea* is slightly hairy at the lower internodes; *Behboudi 409-E* has both glabrous and slightly pubescent stems. Similar specimens are known from Saudi Arabia (c. 20 km W of Riyadh, *Hedberg 92014,* K), Yemen (Hadramout, *Thulin & al. 8387,* K) and Oman (Dhofar, *Cope 638,* K). In Kew there is an old specimen from Arabia Petraea, *Donald* 1849, with woolly lowermost internodes and identified by Edgeworth as *S. paradisea*. Another specimen collected from Egypt with glabrous lower internodes annotated by Edgeworth as *S. paradisea* (im nördlichsten Teile der östlichen Wüste von Aegypten, 24.4.1880, *G. Schweinfurth 444,* K), clearly indicates that Edgeworth correctly recognized the species and its variation. For these reasons we consider these species as conspecific.

Stipagrostis uniplumis (Licht.) De Winter in Kirkia 3: 136
≡ *Aristida uniplumis* Licht. in Roemer & Schultes, Syst. Veg. 2: 401. 1817.
= *Stipagrostis papposa* (Trin. & Rupr.) De Winter in Kirkia 3: 135. 1963 ≡ *Aristida papposa* Trin. & Rupr., Sp. Gram. Stipac.: 173. 1842. – Fig. 4E.

Specimen examined. – SISTAN & BALUCHESTAN: 90 km from Iranshahr towards Rask, c. 500-600 m, 21.11.1990. *H. Akhani 6790* (B; herb. Akhani).

Stipagrostis uniplumis is a new report for Iran (Fig. 2H).

Description. – *Perennial,* densely caespitose, up to 90 cm, glabrous. *Leaf blades* convolute, up to 20 cm long, 1-2 mm diameter (in convolute state), glabrous beneath, scabrous above; ligules with a dense fringe of short (± 0.5 mm long) hairs inside and long (3.5-7 mm long) hairs at the sides. *Panicle* 10-18 cm long, effuse. *Spikelets* pallid; glumes unequal, *lower glume* 8-9 mm long, sparsely pilose on the back, glabrescent at the upper one-third, acuminate at apex; *upper glume* 10-11 mm long, glabrous, minutely scabrid at median nerves, linear, strongly acuminate, appearing as an awn from above the middle; *lemma* 2 mm long, finely tuberculate in the upper half, abruptly passing into the awn; stamens 3.75 mm long, callus 0.5-1 mm long, acute, bearded, the hairs gradually increasing in length upwards; awn column 5 mm long, glabrous except for a dense tuft of up to 2.5 mm long hairs at the distal end; median awn 28-32 mm long, plumose with

Downloaded From: https://bioone.org/journals/Willdenowia on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

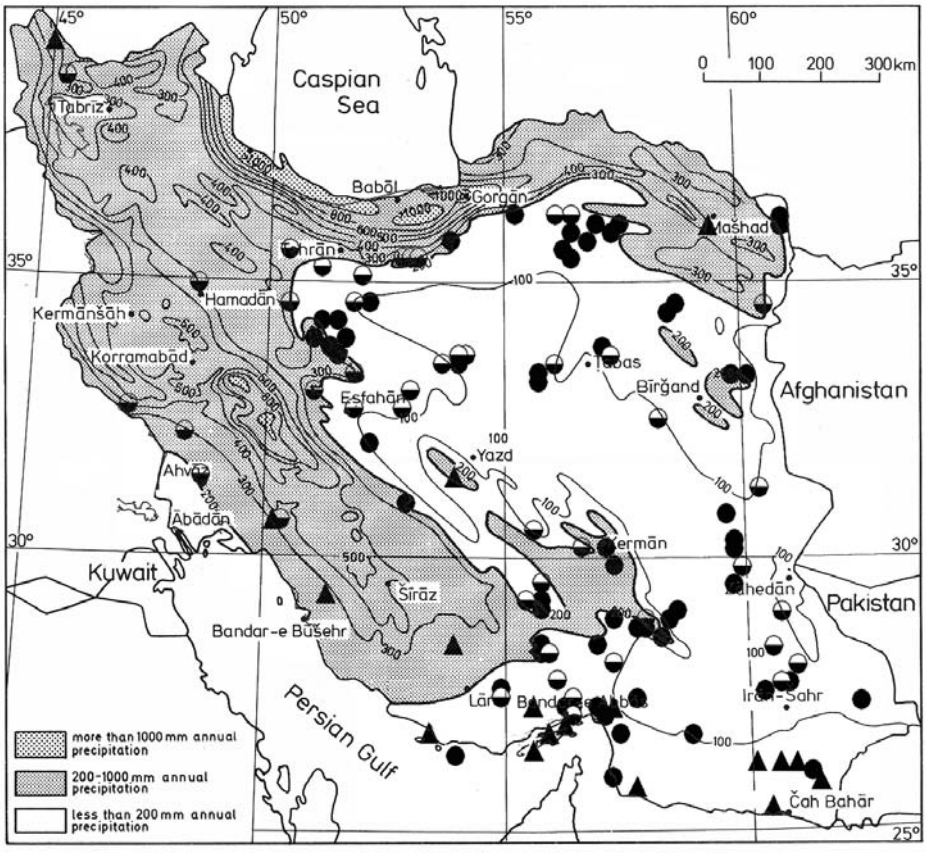


Fig. 5. Average precipitation (after Frey & Probst 1986) and the total distribution of all species of *Aristida* (triangle) and *Stipagrostis* (dot) in Iran. Semi-filled dots show the range of *S. plumosa*.

long hairs up to 3.5 mm long in the upper two-thirds, scabrid in the lower one-third; lateral awns glabrous, 8-10 mm long.

General distribution. – Somalia, south to Tanzania and west to Senegal, S Africa extending northward to Rhodesia and Angola, Arabian Peninsula (Cope 2007: 96, map 16, including *S. pogonoptila*), Iran (Fig. 2G) and Pakistan.

Concluding remarks

The species of the two *Aristida* and *Stipagrostis* in Iran are C_4 plants, which prefer dry and warm conditions. The range of all species in Iran is restricted to semi-arid and arid to very arid parts of Iran (Fig. 2). Comparing the total range of all species with the precipitation map of Iran (Fig. 5) indicates that most of the species occur in areas receiving less than 200 mm annual precipitation. Except *S. plumose* which is widely distributed in Iran, the other species are mostly restricted to the southern and central parts of Iran.

The geographical distribution of the studied species show that only three related species, *Stipagrostis barbata*, *S. karelini* and *S. pennata,* are Irano-Turanian elements, growing on sand dunes of Aralo-Caspian area, Afghanistan and Iran. The other species have a wide distribution range in Africa and/or Pakistan and India.

Downloaded From: https://bioone.org/journals/Willdenowia on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

Acknowledgements

This paper is the result of the research project Geobotanical Studies in Different Parts of Iran III supported by the Research Council, University of Tehran. We acknowledge the support by the staff and curators of the mentioned herbaria during our visits, in particular Dr M. Abbasi, Ms. Bakhsheshi (IRAN) and Mr M. R. Joharchi (FMUH). The support of a visit to the Royal Botanic Gardens, Kew, for H. Akhani during the summer 2006 by the Royal Society (UK) is gratefully acknowledged.

References

Akhani, H., Edwards, G. & Roalson, E. H. 2007: Diversification of the Old World *Salsoleae* s.l. *(Chenopodiaceae):* Molecular phylogenetic analysis of nuclear and chloroplast data sets and a revised classification. – Int. J. Pl. Sci. **168:** 931-956. [CrossRef]

Bor, N. L. 1970: *Aristideae.* – Pp. 363-376 in: Rechinger, K. H. (ed.), Flora iranica **70.** – Graz.

Cope, T. 2007: Flora of the Arabian Peninsula and Socotra **5(1).** – Edinburgh.

Danin, A. 1996: Adaptation of *Stipagrostis* species to desert dunes. – J. Arid Environm. **34:** 297-311. [CrossRef]

De Winter, B. 1965: The South African *Stipeae* and *Aristideae (Gramineae).* An anatomical, cytological and taxonomic study. – Bothalia **8(3):** 199-404.

Freitag, H. 1986: Notes on the distribution, climate and flora of sand deserts of Iran and Afghanistan. – Proc. Roy. Soc. Edinburgh. **89B:** 135-146.

Frey, W. & Probst, W. 1986: A synopsis of the vegetation of Iran. – Pp. 9-24 in: Kürschner, H. (ed.), Contribution to the vegetation of Southwest Asia. – Beih. Tübinger Atlas Vorderen Orients, Reihe A Naturwiss. **24.**

Hattersley, P. W. 1992: C_4 photosynthetic pathway variation in grasses *(Poaceae):* its significane for arid and semi-arid lands. – In: Chapman, G. P. (ed.), Desertified grasslands, their biology and management. – Linnean Society Symposium Series **13:** 181-212.

Henrard, J. T. 1926: A critical revision of the genus *Aristida.* – Meded. Rijks-Herb. Leiden **54.**

— 1929-32: A monograph of the genus *Aristida* I-II. – Meded. Rijks-Herb. Leiden **58.**

Léonard, J. 1981: Contribution à l'étude de la flore et de la végétation des deserts d'Iran **1.** – Meise.

Peruzzi, L. & Passalacqua, N. G. 2004: On the lectotypification of the names of four species described by Desfontaines for Calabria (S Italy). – Taxon **53:** 543-547. [CrossRef]

Scholz, H. 1972: Der *Stipagrostis plumosa*-Komplex *(Gramineae)* in Nord-Afrika. – Willdenowia **6:** 519-552.

— 1979: Quanten-Artbildung auch bei *Stipagrostis (Gramineae)?* – Willdenowia **9:** 209-214.

— 1988: Eine neue *Stipagrostis (Gramineae)* aus den Sand-Wüsten Irans und Afghanistan. – Willdenowia **17:** 107-109.

Termeh, F. 1975: Contribution à l'étude de quelques graminées nouvelles pour la flore de l'Iran. – Publ. Dep. Bot. Pl. Pest Diseases Res. Inst. **5.**

Tzvelev, N. N. 1976: Zlaki SSSR [Grasses of the Soviet Union]. – Leningrad.

Watson, L. & Dallwitz, M. J. 1994: The grass genera of the world. – Wallingford.

Addresses of the authors:

Dr H. Akhani (corresponding author) & M. Ghasemkhani, Department of Plant Sciences, School of Biology, College of Science, University of Tehran, P.O. Box 14155-6455, Tehran, Iran; e-mail: akhani@khayam.ut.ac.ir

Dr J. Sahebi, Department of Biology, Faculty of Science, University of Isfahan, Iran.

Prof. Dr H. Scholz, Botanischer Garten und Botanisches Museum Berlin-Dahlem, Freie Universität Berlin, Königin-Luise-Str. 6-8, D-14195 Berlin, Germany; e-mail: hischo@zedat. fu-berlin.de

Downloaded From: https://bioone.org/journals/Willdenowia on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use