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Classification of species of *Stipa* with awns having plumose distal segments

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Summary

Examination of species of *Stipa* having awns with plumose distal segments revealed reliable morphological characters for distinguishing infrageneric, specific and infraspecific taxa in the genus. As a result of our studies, we propose the following new combinations: *Stipa* sect. *Stipa* ser. *Syreistchikovianae* (Martinovský) F.M.Vázquez *comb. et stat nov.*; *Stipa arabica* subsp. *pamirica* (Roshev.) F.M.Vázquez *comb. et stat. nov.*; *Stipa glareosa* subsp. *pubescens* (P.A.Smirn. ex Roshev.) F.M.Vázquez *stat. nov*.; *Stipa hohenackeriana* subsp. *assyriaca* (Hand.-Mazz.) F.M.Vázquez *comb. et stat. nov.*; *Stipa iberica* var. *bolosii* (Romo, Sierra, L.Torres & Cervi) F.M.Vázquez & M.Gutiérrez *stat nov; Stipa majalis* subsp. *setulosissima* (Klokov) F.M.Vázquez & M. Gutiérrez *comb. et stat. nov.*; *Stipa oligotricha* subsp. *etrusca* (Moraldo) F.M.Vázquez *comb. et stat. nov.*; *Stipa pennata* subsp. *anomala* (P.A.Smirn.) F.M.Vázquez & M. Gutiérrez *comb. et stat. nov.*; *Stipa pennata* subsp. *eriocaulis* var. *lutetiana* (H.Scholz) F.M.Vázquez & M. Gutiérrez *stat. nov.*; *Stipa pennata* subsp. *puberula* (Podp. & Suza) F.M.Vázquez & M. Gutiérrez *comb. et stat. nov.*; *Stipa rubens* subsp. *rubentiformis* (P.A.Smirn.) F.M.Vázquez & M.Gutiérrez *comb. et stat. nov*.; *Stipa zalesskii* subsp. *glabrata* (P.A.Smirn.) F.M.Vázquez & M.Gutiérrez *comb. et stat. nov.* and *Stipa zalesskii* subsp. *maeotica* (Klokov & V.V.Osychnyuk) F.M.Vázquez & M.Gutiérrez *comb. et stat. nov*.; and the name new: ***Stipa jacobsii*** F.M.Vázquez *nom. nov.* The study also resulted in the recognition of the following new taxa: ***Stipa minuscula*** F.M.Vázquez *sp. nov*. and ***Stipa pennata*** subsp. ***slovaca*** F.M.Vázquez & M. Gutiérrez *subsp. nov.*

Introduction

The taxonomy of the Stipeae (Poaceae) has been the focus of many research groups (Caro & Sanchez 1973; Kam & Maze 1974; Freitag 1985; Barkworth & Everett 1987; Barkworth 1990, 1993; Jacobs & Everett 1996; Jacobs et al. 2000, 2006; Arriaga & Barkworth 2006; Romashchenko et al. 2007). The Stipeae Research Group is interested in the circumscription and appropriate position of its many generic and infrageneric taxa (Parodi 1944, Tzvelev 1974, Barkworth 1990, Jacobs et al. 1996, Peñailillo 1997, Torres 1997, Rojas 1998, Barkworth & Torres 2001, Arriaga & Barkworth 2006, Vazquez & Barkworth 2004, Barkworth et al. 2008).

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The genus *Stipa* L. is a complex taxon that has been the subject of many studies, as a result of which many segregate taxa have been recognised, e.g., *Achnatherum* (Beauvois 1812), *Macrochloa* (Kunth 1829), *Nassella* (Desveaux 1854), *Celtica* (Vázquez & Bartworth 2004), and *Amelichloa* (Arriaga & Barkworth 2006). Traditionally, *Stipa* was considered to be distributed in both the northern and southern hemispheres. However, recent treatments have (correctly, in our opinion) interpreted it as being restricted to the northern hemisphere (Barkworth 1990, Jacobs & Everett 1996) where it is found in Eurasia and northern Africa. Recent contributions to the taxonomy of the genus have been made by Martinovský (1966, 1967, 1976; Central Europe and Northern Africa), Tzvelev (1974, 1997; Russia and related countries), Klovov et al. (1976; Ukraine), Freitag (1985; Southwest and South Asia), Moraldo (1986; Italy) and Vázquez et al. (1996, 1997, 2002, 2007; Iberian Peninsula and Northern Africa).

The greatest problem in clarifying the infrageneric taxonomy of *Stipa* is presented by the high diversity of the genus in Asia and North Africa and the difficulty in obtaining information for the plants in these regions. For the last few years, we have been studying the species of *Stipa* that have glabrous to shortly hairy columns and plumose distal segments. In this paper we present a revised infrageneric treatment for these species, including a key to the supraspecific taxa that we recognise and a list of the species and infraspecies that we include in each.

Material and Methods

This study is based on consideration of the taxonomic and nomenclatural history of species of *Stipa* having awns with plumose distal segments (hereafter the plumose species or PS), field work in Africa, Asia and Europe, specimens in ALME, BC, BM, G, GDAC, HSS, JACA, K, MPU, MA, MAF, MGC, SEV, UNEX, VAB and Z (Thiers 2010) and study of nomenclatural types related to *Stipa* sect. *Stipa*, *Stipa* sect. *Smirnovia* Tzvelev and *Stipa* sect. *Barbatae* Junge, their incerte taxa, and synonyms (Appendix I).

We examined 34 morphological characters (Appendix II) in 150 PS taxa. As a result of this examination, we developed a revised supraspecific classification for the species involved and constructed a key to identify the supraspecific taxa that we recognise. This is presented in the next section, followed by a list of the species and infraspecies that we include in each supraspecific taxon.

Our study revealed some new taxa and the need to change the rank of some existing taxa. The new names and combinations required are presented within each list. There were some taxa that we can not place at this time because we were unable to locate the necessary specimens and descriptions. They are listed in Appendix III.

The invalid and synonymous species and infraspecific names are not included because they will need a specific treatment with the typification, distribution range and biometry and molecular studies, which are not the objectives of this work.

Results and discussion

As a result of our study, we recognise three sections: *Stipa* sects. *Stipa, Smirnovia* and *Barbatae*. In addition, we recognise seven series, five in *Stipa* sect. *Stipa* and two in *Stipa* sect. *Barbatae*). The most important morphological characters for distinguishing the sections were: lemma morphology and size (characters 23, 24, 25); callus morphology

and size (characters 21, 22); anther length (character 33); awn morphology and size (characters 26–29); and morphology of the leaf (characters 2, 4, 5, 6). Other characters with states that were frequently correlated with variation in the above characters were palea morphology and surface (characters 30, 31), lodicule shape (character 32), style number (character 34), ligule morphology and surface (characters 12, 13), and sheath surface (character 10).

Taxonomy

The supraspecific taxa we recognise are:

1. Stipa L. sect. **Stipa**

1.1 Stipa ser**. Stipa**

1.2 Stipa ser. **Atlanticae** (Martinovský) Klokov

1.3 Stipa ser. **Dasyphyllae** Martinovský

1.4 Stipa ser. **Syreistchikovianae** (Martinovský) F.M.Vázquez,

1.5 Stipa ser. **Tirsae** Martinovský

2. Stipa sect. **Smirnovia** Tzvelev

3. Stipa sect. **Barbatae** Junge

3.1 Stipa ser. **Barbatae** Junge

3.2 Stipa ser. **Lessingianae** Martinovský

Key for delimitation of *Stipa* sections and series studied

1. Lemmas up to 12(13) mm long; awns up to 20 cm long, bigeniculate, distal segments with hairs up to 3.5 mm long; glumes up to 45 mm long (sect. *Barbatae*) 2
1. Lemmas more than 14 mm long; awns (15)18–38(46) cm long, bigeniculate or unigeniculate, distal segments with hairs more than 3.5 mm long; glumes more than 35 mm 3
2. Lemmas with lines of hairs; column of awn plumose, scabrid or smooth ..... ser. ***Barbatae***
2. Lemmas uniformly pubescent; column of awn glabrous ..... ser. ***Lessingianae***
3. Awns unigeniculate ..... sect. ***Smirnovia***
3. Awns bigeniculate (sect. *Stipa*) 4
4. Column of awns scabrid to plumose ..... ser. ***Syreistchikovianae***
4. Column of awns smooth or scabrid, glabrous 5
5. Abaxial surface of the leaves smooth, glabrous ..... ser. ***Stipa***
5. Abaxial surface of the leaves scabrid or pubescent 6
6. Leaf tips setaceous; lemmas up to 15 mm long ..... ser. ***Tirsae***
6. Leaf tips obtuse or acute; lemmas more than 14 mm long 7
7. Abaxial surface of the leaves pubescent or scabrid; blades 1.5–4 mm wide ..... ser. ***Dasyphyllae***
7. Abaxial surface of the leaves scabrid; blades 0.5–2 mm wide ..... ser. ***Atlanticae***

1. *Stipa* L. sect. ***Stipa***

Basal leaf blades 0.5–5 mm wide, smooth, pubescent or scabrid on the abaxial surface, with obtuse, acute, or setaceous tips. Lemmas more than 14 mm long, with longitudinal lines of hairs, the apices frequently lobed; awns more than 15 cm long, bigeniculate, column smooth, scabrid, or pubescent, distal segments plumose with with hairs more than 3 mm long; anthers glabrous or with ciliate tips.

1.1 *Stipa* L. ser. ***Stipa***

Synonyms:

Stipa ser. *Pulcherrimae* Martinovský, *Webbia* 20: 718–719. 1965.

Stipa ser. *Pulcherrimae* subseries *Eriocaules* Martinovský, *Preslia* 39: 272. 1967.

Stipa ser. *Pulcherrimae* subseries *Epilosae* Martinovský, *Preslia* 39: 272. 1967.

Stipa ser. *Pulcherrimae* Martinovský, *Preslia* 48(2): 187. 1976.

Stipa ser. *Paradoxae* Klokov, *Novosti Sist. Vyssh. Nizsh. Rast.* (Kiev), 1975: 23. 1976.

Stipa ser. *Anomalae* Klokov, *Novosti Sist. Vyssh. Nizsh. Rast.* (Kiev), 1975: 29. 1976.

Stipa ser. *Siculae* Moraldo, *Webbia* 40(2): 211. 1986.

Basal leaf blades 1.5–5 mm wide, abaxial surface smooth, tips obtuse to acute. Lemmas more than 17 mm long; awns more than 16 cm long, column smooth, distal segments with hairs more than 3.5 mm long.

Taxa included

1. *Stipa almeriensis* F.M.Vázquez, *Acta Bot. Malac.* 31: 78 (–80; figs. 2–3). 2006.
2. *Stipa apertifolia* Martinovský, *Preslia* 39: 274. 1967.
   a. *Stipa apertifolia* subsp. *apertifolia*
      α. *Stipa apertifolia* subsp. *apertifolia* var. *apertifolia*
      β. *Stipa apertifolia subsp. apertifolia* var. *nevadensis* F.M.Vázquez & Devesa, *Acta Bot. Malacitana* 21: 139. 1996.
   b. *Stipa apertifolia* subsp. *apenninicola* (Martinovský & Moraldo) F.M.Vázquez & Devesa, *Lagascalia* 18(2): 323. 1996.
   c. *Stipa apertifolia* subsp. *longiglumis* (H.Scholz) F.M.Vázquez & Devesa, *Lagascalia* 18(2): 323. 1996.
3. *Stipa crassiculmis* P.A.Smirn., *Repert. Spec. Nov. Regni Veg.* 22: 375. 1926.
   a. *Stipa crassiculmis* subsp. *crassiculmis*
   b. *Stipa crassiculmis* subsp. *heterotricha* G.Dihoru & N.Roman, *Rev. Roum. Biol., Biol. Veg.* 22(1): 24. 1977.
   c. *Stipa crassiculmis* subsp. *picentina* Martinovský, Moraldo & G.Caputo, *Delpinoa* 16–17: 186. 1976.
4. *Stipa epilosa* Martinovský, *Preslia* 39: 273. 1967.
   a. *Stipa epilosa* subsp. *epilosa*
   b. *Stipa epilosa* subsp. *montana* Moraldo, *Webbia* 40(2): 258. 1986.

5. ***Stipa jacobsii*** F.M.Vázquez, ***nom. nov.***

   Diagnosis: species Africae septentrionalis incola similis *S. apertifolia* et *S. almeriensi* sed ambabus differt lamina 0.5–0.8 mm diam. (nec 0.7–1.5 mm), lemmate cum pilis pentastichtis (nec heptastichtis); a *S. apertifolia* lemmate 17–19 mm longo (nec 13–16 mm) et a *S. almeriensis* arista 21–24(26) cm longa (nec (26)29–41(46) cm) differt. Figure 1

   Holotype: Algerie: Aures et Djurdjura, 11 Jul 1892, *D.L. Trabut* (MPU!) (Basionym: *Stipa pennata* var. *breviglumis* Maire, *Fl. Afrique N*. 2: 71. 1953; *non Stipa breviglumis* J.M. Black, *Trans. & Proc. Roy. Soc. South Australia* 65: 333 1941.)

   Etymology: species dedicated to Surrey Wilfrid Laurence Jacobs (1946–2009), friend and excellent Australian botanist.

   Culms to 95 cm tall. Leaf sheaths glabrous; ligules of cauline leaves up to 6 mm long, acute, scabrous to pubescent; blades convolute, those of the vegetative shoots to 10 cm long and 0.5–0.8 mm in diameter, abaxial surface smooth, upper surface scabrid; cauline blades to 12 cm long. Panicle to 20 cm long, lax. Glumes subequal, linear, hyaline, pale green, usually 5-veined, midvein setulose; lower glume (34–)39–50(–55) mm long, upper glume (35–)42–51(–57) mm long; anthecium 21–26(–28) mm long; callus 4.5–5.5 mm long; lemma coriaceous, 17–19 mm long, with five lines of hairs; awn 21–24(–26) cm long, bigeniculate, with hairs 3.5–4.7 mm on bristle; column twisted; palea 15–17 mm long, smooth; lodicules three; ovary with 2 styles. Plants chasmogamous, flowering from June to July.

6. *Stipa ikonnikovii* Tzvelev., *Spis. Rast. Gerb. Fl. SSSR* 21(111–114): 49. 1977.

7. *Stipa kirghisorum* P.A.Smirn., *Feddes Repert*. 21: 232. 1925.

8. *Stipa macroglossa* P.A.Smirn., *Feddes Repert*. 21: 234. 1925.

   α.' *Stipa macroglossa* f. *macroglossa*

   α." *Stipa macroglossa* f. *pubescens* P.A.Smirn., *Feddes Repert*. 21: 235. 1925.

9. *Stipa majalis* Klokov, *Novosti Sist. Vyssh. Nizsh. Rast.* (Kiev), 1975: 43. 1976.

   a. *Stipa majalis* subsp.*majalis*

   b. *Stipa majalis* subsp. *setulosissima* (Klokov) F.M.Vázquez & M. Gutiérrez ***comb. et stat. nov.*** (Basionym: *Stipa setulosissima* Klokov in *Novosti Sist. Vyssh. Nizsh. Rast.* (Kiev), 1975: 33. 1976.)

10. *Stipa mayeri* Martinovský, *Acta Bot. Croat*. 30: 145. 1971.

11. *Stipa novakii* Martinovský, *Feddes Repert*. 73: 147. 1966.

12. *Stipa oreades* Klokov, *Novosti Sist. Vyssh. Nizsh. Rast*. (Kiev), 1975: 46. 1976.

13. *Stipa paradoxa* P.A.Smirn., *Bull. Jard. Bot. Princ. URSS* 28: 525. 1929.

   a. *Stipa paradoxa* subsp. *paradoxa*

   b. *Stipa paradoxa* subsp. *glabricostata* Martinovský, *Bot. Jahrb*. 87: 389. 1967.

14. *Stipa pennata* L., *Sp. Pl.:* 78. 1753.

   a. *Stipa pennata* subsp. *pennata*

   b. *Stipa pennata* subsp. *anomala* (P.A.Smirn.) F.M.Vázquez & M. Gutiérrez, ***comb. et stat. nov.*** (Basionym: *Stipa anomala* P.A.Smirn., *Del. Sem. Hort. Bot. Univ. Mosq.,* 1930: 15. 1930.)

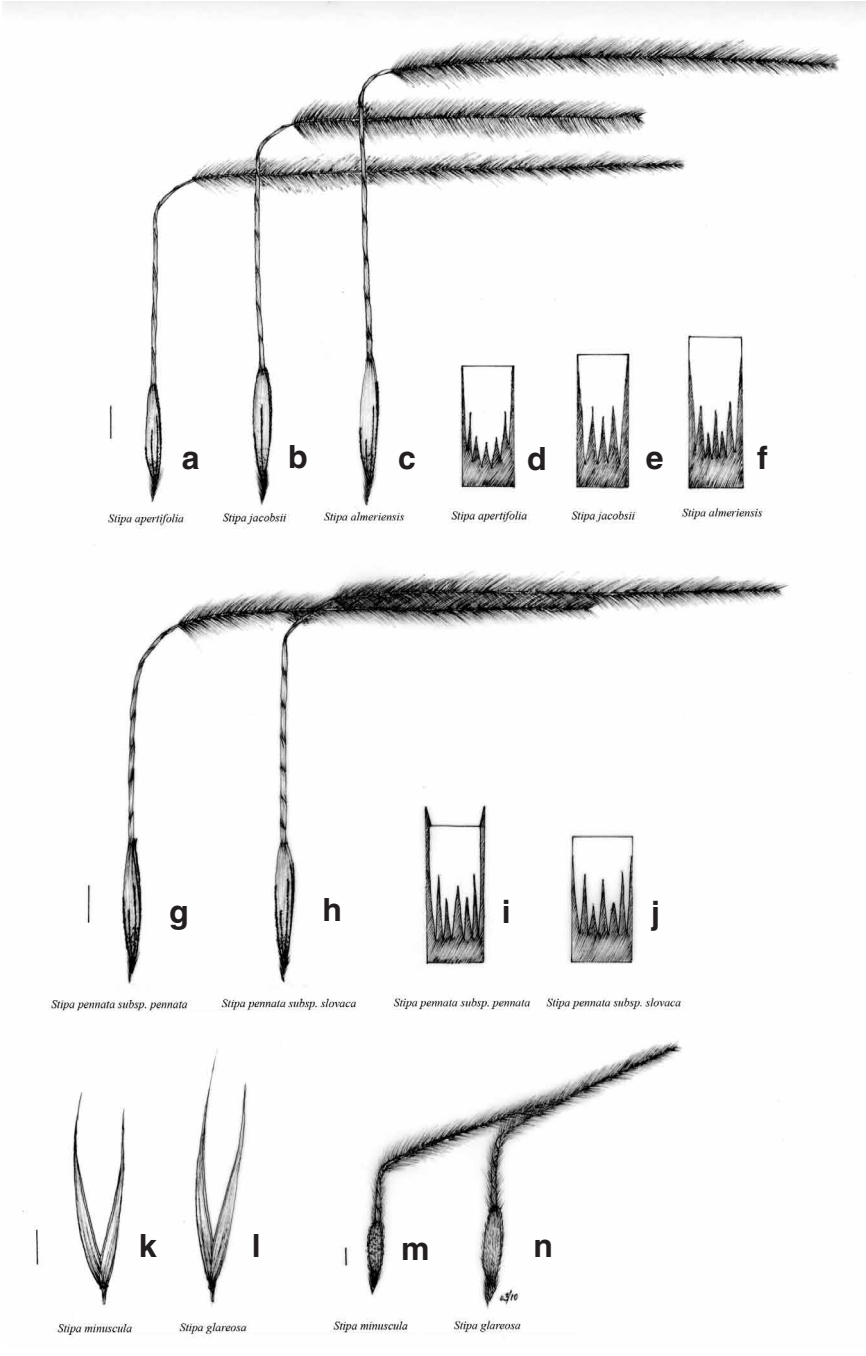

Fig. 1. Critical features of the newly described taxa in *Stipa*. *S. apertifolia*: **a,** flower; **d,** lemma hairs distribution (UNEX14479); *S. jacobsii*: **b,** flower; **e,** lemma hairs distribution (MPU; holotype); *S. almeriensis*: **c,** flower; **f,** lemma hairs distribution (GDAC26148); *S. pennata* subsp. *pennata*: **g,** flower; **i,** lemma hairs distribution (*M. Hrlulp*, Z); *S. pennata* subsp. *slovaca*: **h,** flower; **j,** lemma hairs distribution (BM; holotype); *S. minuscula*: **k,** glumes, **m,** flower (BM; holotype); *S. glareosa*: **l,** glumes; **n,** flower (*G. Fenzel*, Z). Scale bars: a–j = 5mm, k–n = 1 mm.

c. *Stipa pennata* subsp. *austriaca* (G.Beck) Martinovský & Skalický, *Preslia* 41: 331. 1969.

d. *Stipa pennata* subsp. *dvorakii* Martinovský & Moraldo, *Preslia* 52(1): 17. 1980.

e. S*tipa pennata* subsp. *eriocaulis* (Borbás) Martinovský & Skalický, *Preslia* 41: 331. 1969.

α. *Stipa pennata* subsp. *eriocaulis* var. *eriocaulis*

β. *Stipa pennata* subsp. *eriocaulis* var. *lutetiana* (H.Scholz) F.M.Vázquez & M. Gutiérrez, ***stat. nov*** (Basionym: *Stipa eriocaulis* subsp. *lutetiana* H.Scholz, *Willdenowia* 4: 299. 1968.)

f. *Stipa pennata* subsp. *lejophylla* (P.A.Smirn.) Tzvelev, *Novosti Sist. Vyssh. Rast*. 11: 18. 1974.

g. *Stipa pennata* subsp. *lithophila* (P.A.Smirn.) Martinovský, *Preslia* 44(1): 18. 1972.

h. ***Stipa pennata*** subsp. ***slovaca*** F.M.Vázquez & M. Gutiérrez, ***subsp. nov.***
Diagnosis: Species Europeae centrali incola *S. pennatae* subsp. *pennatae* similis sed differt lemmate sine auriculis et apice sine pilis, versus lemmate cum auriculis et apice piloso. Figure 1.

Holotype: Flora du Jura de Gremien,Verbois a Tajomas, 30 May 1924, *J. Briquet 3149* (BM).

Culms 45 cm tall. Leaf sheaths glabrous; ligules of cauline leaves to 7.3 mm long, acute, scabrous to pubescent; blades convolute, those of the vegetative shoots to 51 cm long, 0.6–0.7 mm in diameter, abaxial surface smooth, adaxial surface scabrid; cauline leaves to 9 cm long. Panicle up to 20 cm long, lax. Glumes subequal, linear, hyaline, pale green, usually 5-veined, midvein setulose; lower glume 45–50(–55) mm long; upper glume (45–)48–55(–60) mm long; anthecium 15–18(–20) mm long; callus 3.5–4.5 mm long; lemma 12–14(–15) mm long, coriaceous, with 5 lines of hairs extending to midlenth; awn 20–26(–28) cm long, bigeniculate, column twisted smooth, distal segments with hairs up 5–6.8 mm long; palea 12–13 mm long, smooth; lodicules 3; ovary with 2 styles. Plants chasmogamous, flowering from May to July.

i. *Stipa pennata* subsp. *okensis* (P.A.Smirn.) F.M.Vázquez & M. Gutiérrez, ***comb. et stat. nov***. (Basionym: *Stipa joannis* f. *okensis* P.A. Smirn., *Rab. Biol. Stancii* I, III nº 2, 3.1925.)

j. *Stipa pennata* subsp. *puberula* (Podp. & Suza) F.M.Vázquez & M. Gutiérrez, ***comb. et stat. nov.*** (Basionym: *Stipa joannis* var. *puberula* Podp. & Suza, *Sp. Prirod. Fak. Masar. Univ. Brno* 12: 7. 1922.)

15. *Stipa pulcherrima* C.Koch, *Linnaea* 21: 440. 1848.

a. *Stipa pulcherrima* subsp. *pulcherrima*

α. *Stipa pulcherrima* subsp. *pulcherrima* var. *pulcherrima*

α.' *Stipa pulcherrima* subsp. *pulcherrima* var. *pulcherrima* f. *pulcherrima*

α.'' *Stipa pulcherrima* subsp. *pulcherrima* var. *pulcherrima* f. *nudicostata* Martinovský, *Preslia* 48: 187. 1976.

β. *Stipa pulcherrima* subsp. *pulcherrima* var. *alagezica* Tzvelev, *Konspekt Fl. Kavkaza* 2: 353. 2006

γ. *Stipa pulcherrima* subsp. *pulcherrima* var. *karadagensis* Tzvelev, *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* 91(1): 121. 1986.

b. *Stipa pulcherrima* subsp. *bavarica* (Martinovský & Scholz) Conert in G. Hegi, *Illustr. Fl. Mitteleur*., ed. 3, 1(3: Lief. 6): 425. 1992.

c. *Stipa pulcherrima* subsp. *glabrinoda* (Klokov) Tzvelev, *Bot. Zhurn.* (Moscow & Leningrad) 78(10): 94. 1993.

d. *Stipa pulcherrima* subsp. *palatina* H.Scholz & Korneck, *Kochia* 2: 2 (1–7; fig. 1). 2007.

16. *Stipa rechingeri* Martinovský, *Preslia* 44:10. 1972.

17. *Stipa rigida* Martinovský, *Preslia* 39: 273–274. 1967.

18. *Stipa sabulosa* (Pacz.) Sljussarenko, *Tr. Nauc. Issled. Inst. Biol. Fakult. Charkov. Gosud Univ*. 37: 26. 1963.

a. *Stipa sabulosa* subsp. *sabulosa*

b. *Stipa sabulosa* subsp. *germanica* (Endtmann) Martinovský & Rauschert in Martinovský, *Preslia* 48: 187. 1976.

19. *Stipa sicula* Moraldo, V.La Valva, M.Ricciardi & G.Caputo, *Delpinoa* n.s. 23–24: 139. 1985.

20. *Stipa turcica* Martinovský, *Preslia* 39: 273. 1967.

21. *Stipa veneta* Moraldo, *Webbia* 40(2): 238. 1986.

1.2 *Stipa* ser. *Atlanticae* (Martinovský) Klokov, *Novosti Sist. Vyssh. Nizsh. Rast.* (Kiev), 1975: 32–33. 1976.

Basionym:

Stipa ser. *Pulcherrimae* subseries *Atlanticae* Martinovský, *Preslia* 39: 272. 1967.

Basal leaves 0.5–2 mm wide, abaxial surface scabrid, tip obtuse to acute. Lemma more than 15 mm long, with longitudinal lines of hairs, without apical lobes. Awn more than 16 cm, long bigeniculate, column smooth, distal segments with hairs more than 3.5 mm long. Anthers glabrous.

Taxa included

1. *Stipa asperella* Klokov & V.V.Osychnyuk, *Novosti Sist. Vyssh. Nizsh. Rast*. (Kiev), 1975: 35. 1976.

2. *Stipa atlantica* P.A.Smirn., *Feddes Repert*. 26: 270. 1929.

3. *Stipa austroitalica* Martinovský, *Webbia* 20: 723. 1965.

a. *Stipa austroitalica* subsp. *austroitalica*

b. *Stipa austroitalica* subsp. *appendiculata* (Celak.) Moraldo, *Webbia* 40(2): 254. 1986.

c. *Stipa austroitalica* subsp. *theresiae* Martinovský & Moraldo, *Preslia* 52: 18. 1980.

4. *Stipa endotricha* Martinosvký, *Preslia* 44: 12. 1972.

5. *Stipa iberica* Martinovský, *Feddes Repert*. 73: 150. 1966.

α. *Stipa iberica* var. *iberica*

β. *Stipa iberica* var. *austro-iberica* (H.Scholz) F.M.Vázquez & Devesa, *Acta Bot.*

Malacitana 21: 142. 1996.

γ. *Stipa iberica* var. *bolosii* (Romo, Sierra, L.Torres & Cervi) F.M.Vázquez & M.Gutiérrez ***stat. nov.*** (Basionym: *Stipa iberica* subsp. *bolosii* Romo, Sierra, L.Torres & Cervi, *Act. Bot. Barcin*. 45: 214. 1998.)

δ. *Stipa iberica* var. *pseudodasyphylla* (Martinovský) F.M.Vázquez & Devesa, *Acta Bot. Malacitana* 21: 141. 1996.

ε. *Stipa iberica* var. *pygmaea* Martinovský, *Anal. Inst. Bot. Cavanilles* 27: 74. 1970.

6. *Stipa oligotricha* Moraldo, *Webbia* 40(2): 248. 1986.

a. *Stipa oligotricha* subsp. *oligotricha*

b. *Stipa oligotricha* subsp. *etrusca* (Moraldo) F.M.Vázquez ***comb. et stat. nov*** (Basionym: *Stipa etrusca* Moraldo, *Webbia* 40(2): 236. 1986.)

c. *Stipa oligotricha* subsp. *kiemii* (Martinovský) Moraldo, *Webbia* 40(2) 250. 1986.

7. *Stipa pauneroana* (Martinovský) F.M.Vázquez & Devesa, *Acta Bot. Malacitana* 21: 143. 1996.

8. *Stipa styriaca* Martinovský, *Oesterr. Bot. Z*. 118: 179. 1970.

α.' *Stipa styriaca* f. *styriaca*

α." *Stipa styriaca* f. *melzeri* Martinovský, *Oesterr. Bot. Z.* 118: 179. 1970.

1.3 *Stipa* ser. *Dasyphyllae* Martinovský, *Preslia* 47(3): 260. 1975; *Preslia* 48(2): 186. 1976.

Synonyms:

Stipa ser. *Rubentes* Klokov, *Novosti Sist. Vyssh. Nizsh. Rast*. (Kiev), 1975: 64. 1976.

Stipa ser. *Poeticae* Klokov, *Novosti Sist. Vyssh. Nizsh. Rast*. (Kiev), 1975: 56. 1976.

Basal leaves 1.5–4 mm wide, abaxial segment pubescent or scabrid, tip obtuse or acute. Lemma more than 16 mm long, with lines of hairs, apex not lobed. Awn more than 17 cm long, bigeniculate, column smooth to scabrid, distal segments with hairs more than 4 mm long. Anthers glabrous.

Taxa included

1. *Stipa araxensis* Grossh., *Beih. Bot. Centralbl.* 44(2): 200. 1927.

2. *Stipa bavarica* Martinovský & H.Scholz, *Willdenowia* 4: 322. 1968.

3. *Stipa canescens* P.A.Smirn. ex Roshev., *Fl. URSS* 2: 101, 741. 1934.

4. *Stipa dasyphylla* (Czern. ex Lindem.) Trautv., *Trudy Imp. S.-Peterburgsk. Bot. Sada* 9: 350. 1884.

α. *Stipa dasyphylla* var. *dasyphylla*

β. *Stipa dasyphylla* var. *eriosoma* (Borbás) Soó, *Acta Bot. Acad. Sci. Hung*. 17(1–2): 123. 1972.

5. *Stipa fallacina* Klokov & V.V.Osychnyuk, *Novosti Sist. Vyssh. Nizsh. Rast*. (Kiev), 1975: 62. 1976.

6. *Stipa graniticola* Klokov., *Novosti Sist. Vyssh. Nizsh. Rast*. (Kiev), 1975: 68. 1976.
7. *Stipa kempirica* Kotukhov, *Bot. Zhurn*. (Moscow & Leningrad) 79(7): 101. 1994.
8. *Stipa krascheninnikowii* Roshev., *Mat. Commiss. Exped. Invest. Acad. Sci. Kazakh.* Ser. 5: 253. 1928.
9. *Stipa poetica* Klokov, *Novosti Sist. Vyssh. Nizsh. Rast.* (Kiev), 1975: 57. 1976.
10. *Stipa pontica* P.A.Smirn., *Feddes Repert*. 26: 268. 1929.
11. *Stipa rubens* P.A.Smirn., *Feddes Repert*. 21: 231. 1925.
    a. *Stipa rubens* subsp. *rubens*
    b. *Stipa rubens* subsp. *rubentiformis* (P.A.Smirn.) F.M.Vázquez & M.Gutiérrez ***comb. et stat. nov***. (Basionym: *Stipa rubentiformis* P.A.Smirn., *Acta Acad. Sci. Imp. Petrop.* 40: 115, *in obs.* 1928.)
    c. *Stipa rubens* subsp. *sublevis* Martinovský, *Preslia* 44(1): 21. 1972.
12. *Stipa smirnovii* Martinovský, *Preslia* 47: 260. 1975.
13. *Stipa turkestanica* Hack., *Trudy Imp. S.-Peterburgsk. Bot. Sada* 26: 59. 1906.
    a. *Stipa turkestanica* subsp. *turkestanica*
    b. *Stipa turkestanica* subsp. *trichoides* (P.A.Smirn.) Tzvelev, *Novosti Sist. Vyssh. Rast.* 11: 17. 1974.
14. *Stipa ucrainica* P.A.Smirn., *Feddes Repert*. 22: 374. 1926.
15. *Stipa zalesskii* Wilensky, *Dnevn. Vseross. S''ezda Russk. Bot.* 1: 41. 1921.
    a. *Stipa zalesskii* subsp. *zalesskii*
    b. *Stipa zalesskii* subsp. *glabrata* (P.A.Smirn.) F.M.Vázquez & M.Gutiérrez ***comb. et stat. nov.*** (Basionym: *Stipa dasyphylla* var. *glabrata* P.A.Smirn., *Mittheil. Zentr. Biol. St.* 41. 1921.)
    c. *Stipa zalesskii* subsp. *maeotica* (Klokov & V.V.Osychnyuk) F.M.Vázquez & M.Gutiérrez ***comb. et stat. nov.*** (Basionym: *Stipa maeotica* Klokov & V.V.Osychnyuk, *Novosti Sist. Vyssh. Nizsh. Rast*. (Kiev), 1975: 60. 1976.)
    d. *Stipa zalesskii* subsp. *turcomanica* (P.A.Smirn.) Tzvelev, *Novosti Sist. Vyssh. Rast*. 11: 18. 1974.

1.4 *Stipa* ser. *Syreistchikovianae* (Martinovský) F.M.Vázquez *comb. et stat nov.*

Basionym:

Stipa ser. *Pulcherrimae* subseries *Syreistchikovianae* Martinovský, *Preslia* 49(2): 100. 1977.

Basal leaves 0.5–2.5 mm wide, abaxial surface smooth or scabrid, tip obtuse. Lemma more than 14 mm long, with lines of hairs, apex not lobed. Awn more than 14 cm long, bigeniculate, column pubescent, distal segments with hairs more than 3 mm long. Anthers glabrous.

Taxa included

1. *Stipa brachyptera* Klokov, *Novosti Sist. Vyssh. Nizsh. Rast*. (Kiev), 1975: 26. 1976.
2. *Stipa danubialis* Dihoru & Roman, *Rev. Roumaine Biol., Ser. Bot.,* 24: 26. 1969.
3. *Stipa iljinii* Roshev., *Bull. Jard. Bot. Acad. Sc. URSS*, 30: 294. 1932.
4. *Stipa martinovskyi* Moraldo, *Webbia* 37(1): 25. 1983.
5. *Stipa syreistschikovii* P.A.Smirn., *Del. Sem. Hort. Bot. Univ. Mosq*. 1948: 36. 1948.
6. *Stipa transcarpatica* Klokov, *Novosti Sist. Vyssh. Nizsh. Rast*. (Kiev), 1975: 54. 1976.
7. *Stipa transcaspica* Roshev. ex Czerniak., *Bull. Jard. Bot. Princ*. URSS, 26: 257. 1927.

1.5 *Stipa* ser. *Tirsae* Martinovský, *Preslia* 48(2): 186 (1976)

Synonym:

Stipa ser. *Stenophyllae* Klokov, *Novosti Sist. Vyssh. Nizsh. Rast*. (Kiev), 1975: 81. 1976.

Basal leaves 0.5–2 mm wide, abaxial surface scabrous, tip. Lemma more than 14 mm long, with lines of hairs, apex frequently lobed. Awn more than 16 cm long, bigeniculate, column smooth, distal segments with hairs more than 3 mm long. Anthers glabrous.

Taxa included

1. *Stipa cretacea* P.A.Smirn., *Bull. Soc. Nat. Moscou*, Sér. 2, 49(1): 90. 1940.
2. *Stipa longifolia* Borbás, *Magy. Növ. Lapok*. 10: 117. 1886.
3. *Stipa stenophylla* (Czern ex Lindem.) Trautv., *Acta Horti Petrop*. 9: 351. 1884.
4. *Stipa tirsa* Steven, *Bull. Soc. Nat. Moscou* 30(2): 115. 1857.
   a. *Stipa tirsa* subsp. *tirsa*
   b. *Stipa tirsa* subsp. *albanica* Martinovský, *Preslia* 44: 22. 1972.

2. *Stipa* sect. *Smirnovia* Tzvelev, *Novosti Sist. Vyssh. Rast.* 11: 20. 1974.

Synonym:

Stipa sect. *Subsmirnovia* Tzvelev, *Bot. Zhurn*. (Moscow & Leningrad) 78(10): 94. 1993.

Basal 1–5 mm wide, abaxial surface smooth or scabrid, tip obtuse or acute. Lemma more than 14 mm long, seriated, apex unlobed. Awn more than 12 cm long, unigeniculate, column smooth, or scabrid, distal segments with hairs more than 3.5 mm long. Anthers glabrous.

Taxa included

1. *Stipa alaica* Pazij, *Opred. Rast. Sred. Azii* 1: 76, 200. 1968.
2. *Stipa bella* Drobow, *Repert. Spec. Nov. Regni Veg*. 21: 37. 1925.
3. *Stipa caucasica* Schmalh., *Ber. Deutsch. Bot. Ges*. 10: 293. 1892.
   a. *Stipa caucasica* subsp. *caucasica*
   b. *Stipa caucasica* subsp. *desertorum* (Roshev.) Tzvelev, *Novosti Sist. Vyssh. Rast*. 11: 20. 1974.
   c. *Stipa caucasica* subsp. *drobovii* Tzvelev, *Novosti Sist. Vyssh. Rast*. 11: 20. 1974.
   d. *Stipa caucasica* subsp. *iskanderkulica* Tzvelev, *Novosti Sist. Vyssh. Rast*. 11: 20. 1974.
4. *Stipa gaubae* Bor, *Fl. Iranica* [Rechinger] 70: 388. 1970.
5. *Stipa glareosa* P.A.Smirn., *Repert. Spec. Nov. Regni Veg*. 26: 266. 1929; *Bull. Soc. Nat. Mosc., Sect. Biol.*, n.s. 38: 12. 1929.
   a. *Stipa glareosa* subsp. *glareosa*
      α. *Stipa glareosa* subsp. *glareosa* var. *glareosa*
      β. *Stipa glareosa* subsp. *glareosa* var. *langshanica* Y.Z.Zhao, *Acta Sci. Nat. Univ. Intramongolicae*, 23(4): 546. 1992.
   b. *Stipa glareosa* subsp. *pubescens* (P.A.Smirn. ex Roshev.) F.M.Vázquez ***stat. nov***. (Basionym: *Stipa glareosa* f. *pubescens* P.A.Smirn. ex Roshev., *Fl. URSS* 2: 90. 1934.)
6. *Stipa gobica* Roshev., *Not. Syst. Herb. Hort. Petrop*. 5: 13. 1924.
7. *Stipa karataviensis* Roshev., *B. Fedtsch. Fl. Asiat. Ross*. 12:159. 1916.
8. *Stipa klemenzii* Roshev., *Not. Syst. Herb. Hort. Petrop*. 5: 12. 1924.
9. *Stipa kopetdaghensis* Czopanov, *Novit. Syst. Pl. Vasc., Acad. Sci. URSS*, 6: 22. 1970.
10. *Stipa lingua* Junge, *Bull. Jard. Bot. Petersb*. 10: 129. 1910.
11. *Stipa lipskyi* Roshev., *B. Fedtsch. Fl. Asiat. Ross*. 12: 153. 1916.
12. *Stipa longiplumosa* Roshev. ex Komarov & Roshev., *Trudy Bot. Inst. Akad. Nauk S.S.S.R*., Ser. 1, *Fl. Sist. Vyssh. Rast*. 2: 91. 1936.
13. *Stipa magnifica* Junge, *Bull. Jard. Bot. Petersb*. 10: 128. 1910.
14. *Stipa manrakica* Kotukhov, *Bot. Zhurn*. (Moscow & Leningrad) 74(3): 414. 1989.
15. ***Stipa minuscula*** F.M.Vázquez, ***sp. nov***.

    Diagnosis: species Asiae centralis incola *S. glareosae* similis a qua differt glumis 14–18(20)mmlongis(nec20–30mm);lemmatibus3.5–4.5mmlongis(nec8–9mm)etaristis 4–5.5 cm longis (nec 5.5–7 cm). Figure 1.

    Holotype: Tibet: Plants of the North-Eastern part of the Qinghai-Xizang (Tsinghai-Tibet) Plateau, *C.G. 81-0362 8* (collector not identified) (BM, left hand specimen).

    Culms to 19 cm tall. Leaf sheaths glabrescent or pilose; ligules of the cauline blades up to 1.5 mm long, acute, scabrous; blades convolute, those of the vegetative shoots up to 5 cm long, 0.5–0.7 mm in diameter, abaxial surface smooth, adaxial surface scabrid; cauline

blades up to 3 cm long. Panicle to 14 cm long, lax. Glumes subequal, linear, hyaline, pale green, usually 3-veined, the midvein setulose; lower glumes 14–17 mm long; upper glumes 15–18(–20) mm long; anthecium 4–6 mm long; callus 1–1,5 mm long; lemma 3.5–4.5 mm long, coriaceous, uniformly pubescent; awn 4–5.5 cm long, unigeniculate, column twisted, distal segment plumose with hairs 2.7–3.8 mm long; palea 3–4.2 mm long, smooth; lodicules three; ovary with 2 style branches. Plants chasmogamous, flowering in July.

16. *Stipa mongolorum* Tzvelev, *Akad. Nauk SSSR Bot. Inst. Komarova, Rast. Tsentral. Azii* Fasc. 4: 57. 1968.
17. *Stipa nachiczevanica* Musajev & Sadychov, *Novosti Sist. Vyssh. Rast*. 14: 4. 1977.
18. *Stipa ovczinnikovii* Roshev. ex Komarov & Roshev., *Trudy Bot. Inst. Akad. Nauk S.S.S.R.*, Ser. 1, *Fl. Sist. Vyssh. Rast*. 2: 92. 1936.
19. *Stipa platypoda* Bor, *K. Danske Vid. Selsk., Biol. Skrift.* 24(4)(Synb. Afghan. VI.): 81. 1965.
20. *Stipa talassica* Pazij, *Not. Syst. Herb. Inst. Bot. & Zool. Acad. Sci. Uzbekistan* 10: 21. 1948.
21. *Stipa tianschanica* Roshev., *B. Fedtsch. Fl. Asiat. Ross.* 12: 149. 1916.
22. *Stipa wulateica* (Y.Z.Zhao) Y.Z.Zhao, *Acta Sci. Nat. Univ. Neimonggol* 27(2): 211. 1996.
23. *Stipa* × *gegarkunii* P.A.Smirn., *Byull. Moskovsk. Obshch. Isp. Prir. Otd. Biol. n. s., Biol.* 75(4): 114. 1970. *pro spec.*

3. *Stipa* sect. *Barbatae* Junge, *Bull. Jard. Bot. Pétersb.* 10: 130. 1910.

Basal leaves 0.3–3 mm wide, abaxial surface smooth, pubescent, or scabrous, tip obtuse or acute. Lemma up to 13 mm long, with lines of hairs or uniformly pubescent, apex unlobed. Awn up to 20 cm long, bigeniculate, column scabrid to pubescent, distal segments with hairs up to 3.5 mm long. Anthers glabrous or ciliate.

3.1. *Stipa* sect. *Barbatae* ser. *Barbatae* Junge

Synonyms:

Stipa ser. *Barbatae* Moraldo, *Webbia* 40(2): 211. 1986.

Stipa sect. *Subbarbatae* Tzvelev, *Bot. Zhurn*. (Moscow & Leningrad) 78(10): 94. 1993.

Basal leaves 0.3–3 mm wide, abaxial surface smooth, pubescent, or scabrid, tip obtuse or acute. Lemma up to 13 mm long, with lines of hairs, apex unlobed. Awn up to 18 cm long, bigeniculate, column scabrid to pubescent, distal segments with hairs up to 3 mm long. Anther glabrous or ciliate.

Taxa included

1. *Stipa aktauensis* Roshev., *Bull. Jard. Bot. Acad. Sc. URSS* 30: 302. 1932.
2. *Stipa alba* F.M.Vázquez & S.Ramos, *Bot. J. Linn. Soc*. 153(4): 443 (fig. 2). 2007.
3. *Stipa arabica* Trin. & Rupr., *Mém. Acad. Imp. Sci. Saint-Pétersbourg,* Sér. 6, *Sci. Math., Seconde Pt. Sci. Nat*. 5: 77. 1842.

a. *Stipa arabica* subsp. *arabica*

α. *Stipa arabica* subsp. *arabica* var. *arabica*

β. *Stipa arabica* subsp. *arabica* var. *turgaica* (Roshev.) Tzvelev, *Zlaki SSSR:* 584. 1976.

b. *Stipa arabica* subsp. *caspia* (K.Koch) Tzvelev, *Novosti Sist. Vyssh. Rast.* 11: 16. 1974.

c. *Stipa arabica* subsp. *koenigii* (Woronow) Tzvelev, *Bot. Zhurn.* (Moscow & Leningrad) 78(10): 93. 1993.

d. *Stipa arabica* subsp. *pamirica* (Roshev.) F.M.Vázquez, ***comb. et stat. nov.*** (Basionym: *Stipa pamirica* Roshev., *Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R.* 11: 20. 1949.)

e. *Stipa arabica* subsp. *prilipkoana* (Grossh.) Tzvelev, *Novosti Sist. Vyssh. Rast.* 11: 16. 1974.

4. *Stipa barbata* Desf., *Fl. Atlant.* 1: 97, t. 27. 1798.

a. *Stipa barbata* subsp. *barbata*

b. *Stipa barbata* subsp. *brevipila* (Coss. & Durieu) F.M.Vázquez & Devesa, *Bot. J. Linn. Soc.* 124(2): 202. 1997.

5. *Stipa cacuminis* H.Scholz & Parolly, *Willdenowia* 34(1): 151; fig. 3. 2004.

6. *Stipa gnezdilloi* Pazij, *Opred. Rast. Sred. Azii* 1: 77, 201. 1968.

7. *Stipa hohenackeriana* Trin. & Rupr., *Sp. Gram. Stip.* 80. 1842.

a. *Stipa hohenackeriana* subsp. *hohenackeriana*

b. *Stipa hohenackeriana* subsp. *assyriaca* (Hand.-Mazz.) F.M.Vázquez, ***comb. et stat. nov.*** (Basionym: *Stipa assyriaca* Hand.-Mazz., *Ann. Nat. Hofmus. Wien* 28: 26. 1914.)

8. *Stipa orientalis* Trin. ex Ledeb., *Fl. Altaic.* [Ledebour] 1: 83. 1829.

9. *Stipa subbarbata* Keller, *Bot. Geogr. Invest., Zaisan Country Semip. Reg.* 2: 53. 1912.

10. *Stipa subsareptana* B.Keller, *Vegetationsbilder* 28(Heft 4): 4. 1927, in obs.

11. *Stipa zaissanica* Kotukhov, *Bot. Zhurn.* (Moscow & Leningrad) 76(6): 873. 1991.

3.2. *Stipa* sect. *Barbatae* ser. *Lessingianae* Martinovský, *Preslia* 48(2): 186. 1976.

Basal leaves 0.5–3 mm wide, abaxial surface smooth or scabrid, tip obtuse or acute. Lemma up to 14 mm long, uniformly pubescent, apex unlobed. Awn up to 20 cm long, bigeniculate, column scabrid to pubescent, distal segments with hairs up to 3.5 mm long. Anthers smooth or ciliate.

Taxa included

1. *Stipa armeniaca* P.A.Smirn. *ex* Roshev., *Fl. URSS* 2: 92, Add. 740. 1934.

2. *Stipa himalaica* Roshev., *Not. Syst. Herb. Hort. Petrop.* 5: 11. 1924.

3. *Stipa isoldeae* H.Scholz, *Willdenowia* 19(1): 127. 1989.

4. *Stipa lessingiana* Trin. & Rupr., *Sp. Gram. Stip*. 79. 1842.

a. *Stipa lessingiana* subsp. *lessingiana*

α. *Stipa lessingiana* subsp. *lessingiana* var. *lessingiana*

β. *Stipa lessingiana* subsp. *lessingiana* var. *zederbaueri* Hackel, *Ann. Nat. Hofmus. Wien* 20: 429. 1905.

b. *Stipa lessingiana* subsp. *brauneri* Pacz., *Zap. Krymsk. Obsc. Estestv*. 5: 151. 1916.

5. *Stipa purpurea* Griseb., *Nachr. Ges. Wiss. Gottingen.* 1868: 82. 1868.

6. *Stipa roborowskyi* Roshev., *Bot. Mater. Gerb. glavn. bot. Sada.* 1(6): 1. 1920.

7. *Stipa saikanica* Kotukhov, *Turczaninowia* 1(2): 10. 1998.

8. *Stipa saurica* Kotukhov, *Bot. Zhurn*. (Moscow & Leningrad) 79(7): 103. 1994.

Discussion and conclusions

As a result of our study, we recognise 55 species and 42 non-autonymic infraspecies in *Stipa* sect. *Stipa*, 23 species and 5 infraspecies in *Stipa* sect. *Smirnovia*, and 19 species and 9 infraspecies in sect. *Barbatae.* The taxa differ principally in the characteristics of their leaves, awns, and lemmas. Of the species in *Stipa* sect. *Stipa, S. pennata* was the most diverse, with 10 different subspecies, followed by *S. zalesskii* and *S. pulcherrima* with four subspecies. In sect. *Barbatae*, the most variable species is *S. arabica* with five subspecies.

The sections differ in their distribution as well as their morphology. *Stipa* sect. *Stipa* is found through Eurasia; *Stipa* sect. *Barbatae* has a similar distribution but grows at lower elevations. *Stipa sect. Smirnovia* differs in being restricted to Asia.

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References

Arriaga MO & Barkworth, ME (2000) A comparison of the leaf anatomy of *Nassella* with that of other South American stipoid grasses. *American Journal Botany* 87 (suppl.): 33.

Arriaga MO & Barkworth ME (2006) *Amelichloa*: a new genus in the. *Stipeae* (Poaceae). *Sida* 22: 145–149.

Barkworth ME. (1990) *Nassella* (Gramineae, Stipeae): revised interpretation and nomenclatural changes. *Taxon* 33(4): 597–614.

Barkworth ME (1993) North American Stipeae (Gramineae): taxonomic changes and other comments. *Phytologia* 74: 1–25.

Barkworth ME & Everett J (1987) *Evolution in the Stipeae: Identification and relationships of its monophyletic taxa*. Pp. 231–264 in Soderstrom et al. (eds) Grass systematics and evolution. (Smithsonian Institution Press, Washington, D.C.)

Barkworth ME & Torres MA (2001) Distribution and diagnostic characters of *Nassella* (*Poaceae*: *Stipeae*). *Taxon* 50:439–468.

Barkworth ME Arriaga MO Smith JF Jacobs SWL Valdés-Reyna J & Bushman BS (2008) Molecules and morphology in South American Stipeae (Poaceae). *Systematic Botany* 33: 719–731.

Beauvois AMFJ. Palisot de (1812) *Essai d´une nouvelle Agrostographie ou nouveaux genres de Graminées.* (Paris)

Caro JA & Sanchez E (1973) Las especies de *Stipa* (*Graminae*) del subgenero *Jarava*. *Kurtziana* 7: 61–116.

Desvaux E (1854) Gramineas. Pp. 23–551 in Gay C (ed.) *Historia Física y Política de Chile,* vol. 6. (Paris)

Freitag H (1985) The genus *Stipa* (Gramineae) in southwest and south Asia. *Notes from the Royal Botanic Garden, Edinburgh* 42: 355–489.

Jacobs SWL & Everett J (1996) *Austrostipa*, a new genus, and new names for Australasian species formerly included in *Stipa* (Gramineae). *Telopea* 6(4): 579–595.

Jacobs SWL, Everett J, Barkworth ME, & Hsiao C (2000) Relationships within the Stipoid grasses (Gramineae). Pp. 75–82 in Jacobs SWL and Everett J (eds) *Proceedings of the Third International Symposium on Grass Systematics and Evolution.* (CSIRO, Canberra)

Jacobs SWL, Bayer R, Everett J, Arriaga MO, Barkworth ME, Sabin-Badereau A, Torres MA, Vázquez FM, & Bagnall N (2007) Systematics of the tribe Stipeae using molecular data. *Aliso* 23: 349–361.

Kam YK & Maze J (1974) Studies on the relationships and evolution of supraspecific taxa utilizing developmental data. II. Relationships of *Oryzopsis hymenoides, O. virescens*, *O. kingii*, *O. micrantha*, and *O. asperifolia*. *Botanical Gazette* 135: 227–247.

Klokov M. & Ossycznjuk (1976) *Stipae Ucrainicae. Novosti Sistematiki Vysshikh i Nizshikh Rastenii* (Kiev), 1975: 7–92.

Kunth CS (1829) *Revision des Graminées publiées dans les Nova Genera et Species Plantarum de Humboldt et Bonpland*. (Gide Fils, Paris)

Maire R (1953) *Stipa* L. Pp 2: 61–81 in Maire R, Guinochet M & Faurel L (eds) *Flore de l'Àfrique du Nord* 2. (Editions Lechavalier, Paris)

Martinovský JO (1966) Zwei neue suderuropäische Federgrassippen IX. Beitrag zur Kenntnis der europäischen *Stipa*-Sippen. *Feddes Repertorium* 73: 141–152.

Martinovský JO (1967) Neue submediterrane *Stipa*-Arten und die taxonomische Einteilung der Federgrassippen der Serie Pulcherrimae Martinovský. *Preslia* 39(2): 260–275.

Martinovský JO (1976) Neue *Stipa*-Sippen und einige Ergänzungen der früher beschriebenen *Stipa*-Taxa. *Preslia* 48(1): 186–188.

Moraldo B (1986: Il genere *Stipa* L. (Gramineae) in Italia. *Webbia* 40(2): 203–278.

Parodi LR (1944) Revisión de las gramíneas australes americanas del género *Piptochaetium*. *Revista del Museo de la Plata. Sección Botanica.* 6: 208–310.

Peñailillo B (1996) *Anatherostipa*, un nuevo genero de Poaceae (Stipeae). *Gayana: Instituto Central de Biologia. Botanica.* 53: 277–284.

Rojas PF (1998) Nuevas especies y nuevas combinacioines para la tribu *Stipeae* (Poaceae) en Bolivia. *Gayana: Instituto Central de Biologia. Botanica.* 54: 163–182.

Romashchenko KP Peterson M, Garcia-Jacas N, Soreng RJ & Susanna A (2007) A phylogeny of Stipeae (Poaceae) based on nuclear DNA (ITS) sequence data. (American Society of Taxonomists, Chicago, USA)

Thiers B (2010). [continuously updated]. *Index Herbariorum: A global directory of public herbaria and associated staff*. New York Botanical Garden's Virtual Herbarium. http://sweetgum.nybg.org/ih/ (accessed 12 March 2010)

Torres MA (1997) *Nicoraella* (Graminae) un nuevo género para América del Sur. *Monografías, comisioon investigaciones cientificas de la provincia de Buenos Aires. La Plata* 13: 69–76.

Trinius CB (1820) *Fundamenta agrostografica.* (Vienna)
Trinius CB. & Ruprecht FJ (1842) *Gramina Agrostidea*, III. *Callus obconicus (Stipaceae)*. *Mémoires de l' Académie Impériale des Sciences de St. Pétersbourg.* Sér. 6, *Sciences Mathématiques, physiques et naturelles*. *Seconde partie: Sciences Naturelles* 5: 1–189.
Tutin TG (1980) *Gramineae*. Pp. 118–267 in Tutin TG et al. *Flora Europaea,* vol. 5. (Cambridge University Press, Cambridge)
Tzvelev NN (1974) Notulae de Tribu *Stipeae* Dumort. (Fam. Poaceae) in URSS. *Novosti Sistematiki Vysshikh Rastenii* 11: 4–21.
Tzvelev NN (1997) The origin and evolution of feathergrasses (*Stipa* L.). Pp. 139–150 in Lebedev DV and Karamyscheva ZV (eds) *Problemy Ekologii, Geobranikii, Botnicheskoi Geografii i Floristiki. (*Nauka, Leningrad)
Vázquez FM & Devesa JA (1997) Two new species and combinations in *Stipa* (Gramineae) from northwest Africa. *Botanical journal of the Linnean Society* 124: 201–209.
Vázquez FM & Devesa JA (2002) *Stipa* L. Pp 836–840 in Valdés B, Rejdali M, Achhal El Kadmiri A, Jury JL & Montserrat JM *Catalogue des plantes vasculaires du nord du Maroc, incluant des clés d'identification*. (Universidad de Sevilla, Madrid)
Vázquez FM & Ramos S (2007) Two new taxa and a new combination for *Stipa* (Gramineae: Stipeae) in Tunisia. *Botanical journal of the Linnean Society* 153: 439–444.
Vázquez FM & Devesa JA (1996) Revisión del género *Stipa* L. y *Nasella* Desv. (Poaceae) en la Península Ibérica e Islas Baleares. *Acta Botanica Malacitana* 21: 125–189.
Vázquez FM & Barkworth ME (2004) Resurrection and emendation of *Macrochloa* (Gramineae: Stipeae). *Botanical journal of the Linnean Society* 144: 483–495.

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Appendix I

Selection of material studied; type specimens and significant collections.

Stipa aktauensis Roshev. Russia: Desertum Kysylkum, *K. Muravlpansky*, 3 Jun 1932, G.

Stipa alba F.M.Vázquez & S.Ramos. Tunez: Beni M'Hira, near Tataouïne, *M. Visser*, Apr 1996, HSS 11867.

Stipa almeriensis F.M.Vázquez. Spain: Almeria: Minas Almagrera, *J. Guirado*, 19 Jun 1984, ALME 17433. Granada: Sierra de Baza, without collector, 17 Jul 1984 GDAC 26148.

Stipa apertifolia Martinovský. Spain: Albacete: Sierra Alcaráz, *P.F. Cannon et al.*, 24 Jun 1979, SEV 52227. Granada: Granada, Dornajo, *S. García et al.*, 24 Aug 1989, UNEX 14479. Málaga: Sierra Almijara, *M. Laza*, 7 Jul 1935, MAF 29011.

Stipa apertifolia subsp. *apenninicola* (Martinovský & Moraldo) F.M.Vázquez & Devesa. Italy: M. Alburini, *B. Moraldo et al.*, without dates, G283486.

Stipa apertifolia var. *nevadensis* F.M.Vázquez & Devesa. Spain: Granada: Sierra de Baza, *J. Torres et al.*, 10 Jul 1984, GDAC 26143.

Stipa arabica subsp. *koenigii* (Woronow) Tzvelev. Armenia: Eviran, *B. Schischiv*, 5 Jun 1915, BM. Russia: Diza, *A. Grosheim*, 4 Jun 1947, BM.

Stipa arabica Trin. & Rupr. Israel: Negev, *J. Angelis & A. Grizi*, 27 Mar 1952, Z. Sinai, *W. Schimper*, 15 May 1835, Z. Russia: Tiflis, *A. Grossheim*, 20 May 1820, Z.

Stipa araxensis Grossh. Armeria: Seva, *P. Smirnow*, 23 Aug 1929, G.

Stipa atlantica P.A.Smirn. Morocco: Alhucemas, *M. Gandoger*, Jul 1908, G 6932-1.

Stipa austroitalica Martinovský. Italy: Verona, *Pedicina*, without dates, Z; Lecceta, *B. Moraldo et al.*, 21 May 1978, G 283488.

Stipa austroitalica subsp. *appendiculata* (Celak.) Moraldo. Italy: Sicily: Termini, *M. Parlatore*, 1844, G 5998-97.

Stipa barbata Desf. Spain: Albacete, Almansa, *P. Font Quer*, 31 Jun 1919, BC 90043. Granada, Cuellar, *F.M. Vázquez*, 27 Apr 1990.UNEX 14512. Madrid, Aranjuez, *A. Rodriguez*, 12 Jun 1962, SEV 6667.

Stipa barbata subsp. *brevipila* (Coss. & Durieu) F.M.Vázquez & Devesa. Morocco: Itzer, *C. Blanche et al.*, 3 Jun 1985, MA 340534; Ksar-es-Souk: Col de Tizi, *J. Molero et al.*, 14 Jun 1988, MA 537928.

Stipa bavarica Martinovský & H.Scholz. Austria: Moravia, *H. Suza*, Jun 1911, G 452882(1).

Stipa bella Drobow. Russia: Kazakh, *J.A. Kotokhov*, 8 Jun 1984, K.

Stipa canescens P.A.Smirn. ex Roshev. Armeria: Seram, *O. Polianska*, 19 Feb 1930, K .

Stipa caucasica Schmalh. Iran: Abadeh, *H.S.L. Gertry 14983*, 8 Jun 1955, K. Mongolia: Ikhengung, *F. Muhlenweg*, 17 Jun 1931, BM. Russia, Podkumk *A. Gordjagin*, 1912, BM.

Stipa caucasica subsp. *desertorum* (Roshev.) Tzvelev. Russia: Prshewalsk, *R.J. Roshevitz 574*, 1908, K.

Stipa cretacea P.A.Smirn. Russia: Sirotinskaja, *P. Smirnow*, 8 Jun 1938, G 18734.

Stipa dasyphylla (Czern. ex Lindem.) Trautv. Austria: Moravia, *H. Suza*, Jun 1911, Z. Hungary: Budapest, *Z. Karpati*, 26 May 1935, Z; Buda-Ujlak, *Simonkai*, without dates, Z.

Stipa endotricha Martinosvký. France: Montpellier, *Handoy*, 21 May 1893, BM. Switzerland: Wallis, *F.O. Wolf*, May 1900, MA 291399.

Stipa epilosa Martinovský. Turkey: Ankara, *F. Mankgraf*, 15 Jun 1958, Z.

Stipa glareosa P.A.Smirn. Afghanistan: Ghazni, *K.H. Rechinger*, 6 Jul 1962, Z. Kansu, *G. Fenzel*, 25 Jul 1935, Z. Russia: Mohrom, *Hocomob*, 23 Aug 1944, K.

Stipa glareosa subsp. *pubescens* (P.A.Smirn. ex Roshev.) F.M.Vázquez. Afghanistan: Ghazbi, *K.H. Rechinger*, 6 Jul 1962, G 46172.

Stipa gobica Roshev. Mongolia: Wang, in "Gobi", *J. Eriksson*, 19 Jun 1934, BM.

Stipa himalaica Roshev. China:Tibet: Tsumgals, *Schlagintweit*, 9 Jul 1856, BM. Pakistan: Baltistan, *H. Hartmann*, 19 Jun 1962, Z; Bezirk Shigar, *E. Reiser*, 13 Jun 1962, Z.

Stipa hohenackeriana Trin. & Rupr. Afghanistan: *J.E.T. Aitchison*, 1884–85, BM. Iran: Kaserem, *O. Staf*, 1885, BM; Halkedar, *K.H. Rechinger*, 15 Jun 1937, BM.

Stipa iberica Martinovský. Spain: Albacete: Alpera, *E. Villanueva et al.*, 27 May 1987, MA 428056. Guadalajara: Alcolea Del Pinar, *S. Garcia et al.*, 16 Jun 1990, UNEX 14434. Segovia: Garbayosa, *S. García et al.*, 16 Jun 1990, UNEX 14450.

Stipa iberica var. *austro-iberica* (H. Scholz) F.M.Vázquez & Devesa . Spain: Albacete: Peñascosa, without collector, 25 Jun 1984, MA 330621. Jaen: Sierra de Mágina, *H. Ern*, 8 Jul 1979, B.

Stipa iberica var. *pseudodasyphylla* (Martinovský) F.M.Vázquez & Devesa. Spain: Lérida: Rocallaura, *P. Font Quer*, 2 Jun 1932, BC 90020.

Stipa ikonnikovii Tzvelev. Russia: Badachsham, *S. Ikonnikov*, 5 Aug 1957, K.

Stipa jacobsii F.M.Vázquez. Algerie: Aures et Djurdjura, *D.L. Trabut*, 11 Jul 1892, MPU (Holotype).

Stipa kirghisorum P.A.Smirn. Pakistan: Gilgit, *G.M. Giles*, 23 Jul 1885, K. Russia: Attei, *Resniezenko*, 20 Jun 1900, K.

Stipa klemenzii Roshev. Russia: Monrones, *H. Ucarenow et al.*, 29 Jul 1971, K.

Stipa lessingiana Trin. & Rupr. Russia: Arhaba, *D. Litwinov*, 1898, BM. Turkey: Kars, *David & Hedge*, 5 Jul 1957, K. Iran: Mazandeon, *P. Wendelobt*, 6 Jul 1959, K.

Stipa lingua Junge. Iran: Khorasan, *K.H. Rechinger*, 4 Jul 1937, BM. Afghanistan: Lake Shiva, *H. Leach*, 4 Jul 1971, BM; Suluku, *Haikel*, 13 Jul 1900, BM.

Stipa lipskyi Roshev. Uzbekistan: Samarkanda, *V.N. Lipsky*, 27 May 1897, K. Russia: Montes Karatan, *G. Mickeschin*, 23 May 1936, G.

Stipa longiplumosa Roshev. ex Komarov & Roshev. Russia: Tadjikistan, *Gontscharow et al. 227*, 7 Jun 1932, K; Djuschambe, *N. Gontscharow*, 11 Aug 1931, G.

Stipa macroglossa P.A.Smirn. Turkey: Ispiriz, *Davis et al.*, 31 Jul 1954, K. Russia: Seemireezii, *A. Midelson 929*, 10 Jun 1910, K.

Stipa martinovskyi Moraldo. Italy: Arischia, *B. Moraldo*, 6 Jul 1982, G 283484.

Stipa mayeri Martinovský. Serbia: Mirusa, *E. Mayer*, 30 May 1968, BM (Isotype).

Stipa minuscula F.M.Vázquez. China: Tibet: Qinghai-Xizang (Tsinghai-Tibet). Plateau/ Presented 1982, C.G. 81-0362 8 (collector not identified, and collector number), BM (Holotype).

Stipa novakii Martinovský. Greece: Macedonia, *E.K. Ball*, 2 Jul 1937, K.; Epirus, *W. Greuter*, 17 Aug 1976, G 166670.

Stipa oligotricha Moraldo. Italy: Puglia: Gargano, *B. Moraldo et al.*, 21 May 1978, G (Isotype); Trieste, *L. Poldini*, 19 May 1972, MA 357330.

Stipa oligotricha subsp. *etrusca* (Moraldo) F.M.Vázquez. Italy: Alto Valle Tiberina, *B. Moraldo* et al., 20 Jun 1984, G283485.

Stipa orientalis Trin. ex Ledeb. China: Tibet: Tsanskav, *Schlaginwent*, 27 Jun 1856, BM. Russia: Altai, *P. Krylov*, 21 Jun 1901, BM.

Stipa pauneroana (Martinovský) F.M.Vázquez & Devesa. Spain: Cuenca: Beteta, *A. Caballero*, 13 Jul 1932, MA 4970; Toledo: Dos Barrios, *S. García et al.*, 13 May 1990, UNEX 14471; Valencia: Requena, *E. Sanchis et al.*, 20 Jun 1985, VAB 890294.

Stipa pennata L. Switzerland: Cristalis, *W. Junger*, without dates, Z; Wallis, Bergall, *H. Seitter*, 2 Jul 1970, Z. Germany: Jena, *M. Hrlulp*, Jun 1888, Z. Rumania: Pest in Ungarn, *A. Degen*, 6 Jun 1900, Z.

Stipa pennata subsp. *austriaca* (G.Beck) Martinovský & Skalický. Switzerland: Sta. Galen: Walensee, *E. Sulger*, 3 Jul 1971, Z; Wallis: Bransora, *A. Thellung*, 22 May 1915, Z; Ms. Salvatore, *H. Stanfler*, 8 Jun 1946, Z.

Stipa pennata subsp. *dvorakii* Martinovský & Moraldo. Switzerland: Tessin : Val Sambuco, *W. Michel*, Jul 1946, Z. Germany: Wrietzen, *Schäde*, 28 May 1865, Z. Hungary: Fulophaza, *W. Huber*, 4 Jun 1986, Z.

Stipa pennata subsp. *eriocaulis* (Borbás) Martinovský & Skalický. Russia: Krasnodar, *D. Litvinot*, 25 May 1907, BM. Spain: Huesca: Ibon de Armeña, *G. Montserrat*, 21 Aug 1983, JACA 219483; Plan de Cotiella, *G. Montserrat*, 3 Jul 1980, JACA 1693.

Stipa pennata subsp. *slovaca* F.M.Vázquez & M. Gutiérrez. France: Col de l'Abisso, *J. Vetter*, 2 Aug 1879, Z. Switzerland: Wallis, *W. Koch*, 27 May 1947, Z; Flora du Jura de Gremien/Verbois a Tajomas, *J. Briquet 3149*, 30 May 1924, BM (Holotype).

Stipa pontica P.A.Smirn. Russia: Tiflis, *A. Grosshein*, 20 May 1920, BM. Turkey: Dagh, *E.K. Ball*, 1934, BM; Kayseri, *Davis*, 18 Jun 1954, BM; Anatolia, *J. Bormuller*, 20 Jun 1890, K 2577.

Stipa pulcherrima C.Koch. Armenia: Tapu, *B. Manakan*, 26 Jun 1970, BM. Russia: Stavropol, *D. Litvinot*, Jun 1906, BM.

Stipa rechingeri Martinovský. Greece: Macedonia, *K.H. Rechinger 18469*, Aug 1956, MA 497221. Italy: Palermo, *Lojacono*, May 1879, G 5998.

Stipa rubens P.A.Smirn. Turkey: Kayseri, *Davis*, 18 Jun 1954, K; *A. Tschikchef*, without date, K. Russia: Caucaso, *Marenoconr*, 12 Oct 1926, K.

Stipa styriaca Martinovský. Poland: Torum, Bielany, *W. Gugnacka-Fieder*, 31 May 1975, Z. Russia: without lócus, *Mahbweb*, 8 Jun 1907, Z.

Stipa tianschanica Roshev. Russia: Kazakh, Altai, *J.A. Kotukhov*, without dates, K; Margelan, *N. Dessiatgff*, 1913, K.

Stipa tirsa Steven. Russia: Sarykamysk, *D. Litnonov*, 5 Jul 1914, BM.

Stipa turkestanica subsp. *trichoides* (P.A.Smirn.) Tzvelev. Afghanisthan: Waldzone, *H.F. Nenbaouer*, 28 Jun 1951, K; Kurun *J.E.T. Aitchison*, 29 May 1879 H1179/71, K; Gardez, *K.H. Rechinger 30005/32005*, 7 Jul 1965, , K. Russia: Ashabat, *D. Litwinow 2222*, 9 Aug 1898, K.

Stipa turkestanica Hack. Russia: Parkour, Julidah, *H. Hartmann*, 30 Aug 1976, G 152538.

Stipa ucrainica P.A.Smirn. Russia: Kazaklastam, Kotukhov, 2 Jun 1976, *K. Saratov, & Varos*, 5 Jul 1993, K.

Stipa zalesskii subsp. *turcomanica* (P.A.Smirn.) Tzvelev. Russia: Junga Kopet, *V. Kipsky 3342*, 8 May 1902, K.

Stipa zalesskii Wilensky. Iran: Mazanderam, *P. Wendelb*o, 24 Jun 1959, K. Russia: Iter semipalatense, *A. Prozoransky et al.*, 19 Jun 1928, K; Braschkiria, *V.V. Gractner*, 10 Jun 1928, K.

Appendix II

Characters examined

1. Culm length (cm)
2. Basal leaves long (cm)
3. Culm leaves long (cm)
4. Basal leaves section (mm)
5. Leaf abaxial surface pubescence
6. Leaf adaxial surface pubescence
7. Number of cauline nodes
8. Lower node hairiness
9. Prophyll length
10. Sheath pubescence
11. Ligule length (mm)
12. Ligule shape
13. Ligule hairiness of abaxial surface
14. Panicle length (cm)
15. Lower glume length (mm)
16. Lower glume vein number
17. Upper glume length (mm)
18. Lower glumes vein number
19. Glume apex
20. Anthecium length (mm)
21. Callus length (mm)
22. Callus tip shape
23. Lemma length (mm)
24. Lemma hair distribution
25. Lemma apical lobes
26. Awn length (mm)
27. Awn geniculations
28. Column surface
29. Awn distal segments hair length (mm)
30. Palea length (mm)
31. Palea hairiness
32. Lodicule shape
33. Anther length (mm)
34. Style number

Appendix III

Species incertae sedis

We were unable to determine the appropriate placement of the following taxa because we were unable to examine the relevant type specimens and/or locate adequate descriptions.

Stipa anisotricha P.A.Smirn., *Byull. Moskovsk. Obshch. Isp. Prir. Otd. Biol.* n. s., *Biol.*, 45(4): 115. 1970.

Stipa cerariorum Panc., *Fl. Knezev. Srbije:* 738. 1874.

Stipa czekanovskii Petrov, *Fl. Iakut. Fasc.* I: 136. 1930.

Stipa intermedia Trin. & Rupr., *Mém. Acad. Imp. Sci. Saint-Pétersbourg*, Sér. 6, *Sci. Math., Seconde Pt. Sci. Nat*. 5: 26. 1842.

Stipa kitagawai Honda, *Rep. Exped. Manchoukuo Sect*. IV, Pt. 4, *Index Fl. Jeholensis*: 104. 1936.

Stipa kokonorica K.Hao, *Bot. Jahrb. Syst*. 68: 583. 1938.

Stipa kuhitangi Drobow, *Fl. Uzbekist.*, ed. Schreder, 1: 183, 537. 1941.

Stipa redowskii Trin., Spreng., *Neue Entdeck*. 2: 53. 1821.

Stipa schmidtii Woronow ex Grossh., *Fl. Kavkaza*, 1: 68. 1928.

Stipa semenowii Krassn., *Script. Hort. Univ. Petrop*. II(I): 22. 1887–88.

Stipa sinomongholica Ohwi, *J. Jap. Bot*. 19: 168. 1943.

Stipa spiridonovii Roshev., *Bull. Jard. Bot. Acad. Sc. URSS*, 1931, 30: 302. 1932.

Stipa stapfii Roshev., *Not. Syst. Herb. Hort. Petrop*. 5: 11. 1924.

Stipa tenerrima Bornm. & Gauba, *Repert. Spec. Nov. Regni Veg*. 47: 129. 1939.

Stipa transcaucasica Grossh., *Trud. Bot. Inst., Akad. Nauk SSSR, Azerb. Fil., Baku*, 2: 245. 1936.

Stipa turgaica Roshev., *Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk* 11: 21. 1949.

Stipa tzveleviana Kotukhov, *Bot. Zhurn.* (Moscow & Leningrad) 79(7): 102. 1994.

Stipa tzvelevii Ikonn., *Opred. Vyssh. Rast. Badakhshana:* 84. 1979.

Stipa villifolia Simk., *Term. tud. Közl. Pótf*. 32: 46. 1895.

Stipa woroninii Krassn., *Script. Hort. Univ. Petrop*. II(I): 22. 1887–88.