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Taxonomic notes on feather grasses (Poaceae: *Stipa*) from eastern Kazakhstan with typification of seven names and one new combination

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Abstract

The genus *Stipa* comprises approximately 50 taxa in Kazakhstan, of which 18 were described by Yuri A. Kotukhov from eastern Kazakhstan between 1987 and 1998. The majority of the original material of these taxa is preserved in the LE herbarium (Saint-Petersburg, Russia). Some original material of Kotukhov's species, not mentioned in the protologues, is preserved in the KUZ (Kemerovo, Russia) and KRA (Krakow, Poland) herbaria. The present paper presents a complete list of feather grasses described by Kotukhov from Kazakhstan, with indications of types and the locations where they are preserved, lectotypification of seven names (*S. akseirica*, *S. argillosa*, *S. karakabinica*, *S. kempirica*, *S. kyzylkiensis*, *S. azutavica*, *S. saikanica*), one new combination (*S. orientalis* var. *azutavica* comb. nova), synonymisation of three species (*S. akseirica* is a synonym of *S. sareptana*, *S. kyzylkiensis* is a synonym of *S. sczerbakovii*, and *S. saikanica* is a synonym of *S. lessingiana*), an identification key and taxonomic notes regarding the discussed taxa.

Keywords: Taxonomy, new combination, lectotypification, synonymisation, identification key, feather grasses, Middle Asia

Introduction

The genus *Stipa* Linnaeus (1753: 78) comprises approximately 50 taxa in Kazakhstan (Roshevitz 1934, Drobov 1941, Gamajunova 1948, 1956, Pazij 1968, Tzvelev 1976, Kotukhov 2002, Nobis 2010, 2013, 2014, Nobis *et al*. 2013). Many of them were described by the eminent Kazakh-Russian taxonomist Yury A. Kotukhov. Over a period of 12 years (1987–1998), in six papers, Kotukhov described 18 new species of *Stipa* from eastern Kazakhstan (Kotukhov 1987, 1989, 1991, 1994, 1998a, 1998b). However, in the checklist flora of Kazakhstan (Abdulina 1999) there are 39 taxa of *Stipa* recognized, including only six of the 18 species described by Kotukhov. A few years later Kotukhov (2002) provided a list of 44 species of *Stipa* that occur in eastern Kazakhstan, along with a detailed list of their locations, although the relationships and boundaries between some of the taxa presented remain unclear. Unfortunately, Kotukhov did not provide keys in any of his papers about *Stipa*, which could help in identification of these taxa. Kotukhov (2002) considered seven of the taxa he described to have originated through hybridization, namely: *S. argillosa* Kotukhov (1998a: 11) [=*S. sczerbakovii* Kotukhov (1991: 872) × *S. lessingiana* Trinius & Ruprecht (1842: 79)], *S. kamelinii* Kotukhov (1998a: 10) [=*S. orientalis* Trinius (1829: 83) × *S. zaissanica* Kotukhov (1991: 873)]; *S. kyzylkiensis* Kotukhov (1998b: 12) [=*S. capillata* Linnaeus (1762: 116) × *S. sczerbakovii*]; *S. manrakica* Kotukhov (1989: 414) [=*S. caucasica* Schmalhauzen (1892: 293) × *S. macroglossa* Smirnov (1924: 47)]; *S. pavlovii* Kotukhov (1998a: 7) [=*S. sczerbakovii* × *S. krylovii* Roshevitz (1929: 379)]; *S. tzveleviana* Kotukhov (1994: 102) [=*S. orientalis* × *S. macroglossa*] and *S. zaissanica* [=*S. orientalis* × *S. hohenackeriana* Trinius & Ruprecht (1842: 80)]. However, they were all described as legitimate species. All of these taxa are interesting and worthy of study because hybrid individuals in *Stipa* are perennial, can grow for many years and reproduce vegetatively and (rarely) generatively, and most of them have (at least partially) fertile pollen grains (Nobis *et al*. unpubl. data). Thus, the hybrids are important from the point of view of evolution of the genus *Stipa*.

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The majority of the original material (types) described by Kotukhov is preserved in the LE herbarium (Saint Petersburg, Russia). Some materials of Kotukhov's new species were (prior to their description) sent to N.N. Tzvelev (Saint-Petersburg, LE) for consultation. Tzvelev annotated this material after Kotukhov described it, which is why Tzvelev's handwritten determinations and designations of types (holotype and/or isotype or paratype) appear on some of the original labels. An even larger collection of original material of these species was preserved in Kotukhov's own collection in Ridder (Kazakhstan). However, none of these specimens were cited in the protologues of these new species. Some sheets include original descriptions and notes handwritten by Kotukhov, and in some cases his correspondence with Tzvelev regarding the new species is attached. In 2014, Kotukhov forwarded all of his *Stipa* specimens to the KUZ herbarium (Kemerovo, Russia). During our visit to this herbarium in July 2014 we annotated these specimens, and 30 specimens of this large collection were at that time transferred permanently to the KRA herbarium (Krakow, Poland).

To date, very little is known about the taxa described by Kotukhov, regarding their variation, relationships with morphologically similar taxa, distribution and places of preservation of the types. We present in this paper a complete list of feather grasses described by Kotukhov from Kazakhstan, with indication of types and the herbaria in which they are preserved, lectotypification of seven names, one new combination, synonymisation of three species, identification of five nothospecies regarded to date as legitimate species, taxonomical notes and an identification key.

Material and Methods

This study is based on the examination of the relevant literature and plant material deposited in the herbaria of (acronyms according to Thiers 2015) KRA, KUZ and LE. However, for comparison purposes, we also examined specimens of *Stipa* preserved in AA, BM, E, FRU, GAT, GOET, HAL, JE, K, KFTA, KHOR, KRAM, KUN, LECB, M, MHA, MSB, MW, NS, PE, PR, PRC, TAD, TASH, TK, W, WA, and WU.

To determine variability of particular characters of examined species, all specimens were carefully studied. The most informative characters of vegetative and reproductive structures were also measured on each specimen. Data from these measurements are given below in taxonomical notes and in the identification key.

For the selection of lectotypes, protologues were compared with original material and the most complete and informative specimens were selected (Art. 9.3 of the ICN, McNeill *et al*. 2012). Because the information included in the protologue ("type citation") and on the type specimen sheet ("original label") were not always the same we present the information from both of them.

List of taxa

1. *Stipa akseirica* Kotukhov (1998a: 11). Type citation:—Saur-Tarbagataj, praemontia boreali-occidentalia jugi Saikan, locus Akseir, denudationes argillarum tertiarum, partitiones glareoso-argillosae, 20 VII 1993, Ju. Kotuchov (LE)

Type (original label):—Saur-Tarbagatai, sev.-zap. peredgor'ya khr. Saikan, urochishche Akseir, obnazhenya tretichnykh glin, galechno-glinistye uchastki, 20 VII 1993, *Yu. Kotukhov* (lectotype LE! designated here, isolectotypes: KRA 432648!, KRA 436049!, KUZ!, LE!)

The original material (type) of this species cited in the protologue, consisting of two sheets from a single gathering, is preserved in LE. These two sheets contain three specimens of *S. akseirica.* Three additional original specimens of this taxon, not mentioned in the protologue, are preserved in KUZ and KRA. The sheet at KUZ bears Kotukhov's original handwritten description and notes. Because a holotype was not indicated in the protologue, we designate a lectotype. Since there is more than one sheet at LE, we designate the sheet with a single specimen as the lectotype.

Stipa akseirica is very close to *S. sareptana* Becker (1882: 52). According to Kotukhov (1998a), *S. akseirica* differs from *S. sareptana* by longer spinules on the upper segment of the awn (seta) (0.2–0.3 vs. 0.1–0.2 mm long), and slightly longer and soft spinules vs. very short and hard spinules on the lower segment of the awn (column), respectively. However, after revision of over 100 specimens of *S. sareptana*, we find these characters to be highly variable, and thus we treat *S. akseirica* as conspecific with *S. sareptana*.

2. *Stipa argillosa* Kotukhov (1998a: 8). Type citation:—Altaj australis, praemontium jugi Azutau, locus Bulgartabaty, desertum praemontanum, denudatio argillarum tertiarium, in argilloso-schistosis, 22.V.1991, Ju. Kotuchov (LE)

Type (original label):—Severnoe Prizaisan'e, yugo-vostochnye peredgor'ya khr. Azutau, urochishche Bulgartabaty, peredgornaya pustynya, obnazheniya tretichnykh glin, glinisto-shchebnistye uchastki, 22 V 1991, *Yu. A. Kotukhov* (lectotype KUZ! designated here, isolectotypes KRA 436051!, KRA 436052!, KUZ! 4 sheets).

We did not locate the type of this species at LE, so we are proposing a lectotype. The lectotype was selected from Kotukhov's original collection of the species preserved in KUZ.

Stipa argillosa is close to *S. sczerbakovii*. The most conspicuous character distinguishing these two taxa is the length of ligules of vegetative leaves (up to 0.2 mm long in *S. argillosa* vs. 0.3–2.7 mm long in *S. sczerbakovii*). They do not differ by the length of hairs on the upper segment of the awns and the length of anthecium as noted by Kotukhov (1998a). *Stipa argillosa* is also close to *S. lessingiana*, but differs by having much shorter hairs on awn seta (0.9–1.3 vs. 1.8–3.5 mm long, respectively).

3. *Stipa austroaltaica* Kotukhov (1987: 1254). Type citation:—Altai Australis, jugu Azutau brachia orientalia in regione montis Mramornaja, 900–1000 m. s. m., declivitas occidentalis, prata substepposa variiherbosa, 4 IX 1984, Ju. Kotukhov (LE, isotypi—AA, LE)

Type (original label):—4.09.[197]84 g., *Stipa austroaltaica* Kotuch. sp. nova, Yuzhnyi Altai, vostochnye otrogi khrebta Azutau, v raione g. Mramornaya, srednii poyas 900–1000 m. nad ur. m., zapadnyi mikrosklon, ostepnennye raznotravnye luga, *Yu. Kotukhov* (holotype LE!, isotypes LE! 4 sheets).

In the description of *Stipa austroaltaica*, Kotukhov (1987) stated that the type of the species (in the sense of holotype) is in LE and isotypes are in LE and AA. The original material cited in the protologue consists of five sheets from a single gathering preserved in LE, of which we consider one as holotype and the remaining four as isotypes. During revision in AA, we were not able to find the isotype of the species reportedly housed there.

Stipa austroaltaica is very close to *S. capillata*. Kotukhov (1987) distinguished this taxon from *S. capillata* by its shorter anthecia (7.5–8.2 vs. 10–13 mm long), shorter awns (8.1–9.6 vs. 11–20 cm long), and by sheaths of culm leaves shorter vs. longer than internodes. After revision of all specimens of *S. austroaltaica* from the type collections at LE, we found the variability in the length of these characters to be greater than described in the protologue. For example, the anthecium is 7.8–11 mm long and the awns are 8.5–10.3 cm long. In *S. capillata*, sheaths are generally longer than or equal to internodes; in our revision we also saw some specimens of *S. capillata* with sheaths somewhat shorter than internodes. Further investigations are needed to ascertain whether *S. austroaltaica* is distinct from *S. capillata*.

4. *Stipa* ×*czerepanovii* Kotukhov (1998b: 13) *pro sp.* Type citation:—Depressio Zaissanica denudatinies argillarum tertiariarum Akseir (maryo orientalis) jugi parve declivitas australi-occidentalis glareoso-argillosa, 17 VII 1993, Ju. Kotuchov (LE)

Type (original label):—Zaisanskaya kotlovina, obnazheniya tretichnykh glin Akseir (vostochnaya okraina), yugo-zapadnyi galechno-glinistyi sklon gryady, 17 VII 1993, *Yu. Kotukhov* (lectotype LE!, designated by Nobis & Gudkova 2011: 199, isolectotypes KRA 436047! KRA 436048!, KUZ! 9 sheets, LE!).

We consider *Stipa* ×*czerepanovii* to be a hybrid, originating from hybridization between *S. richteriana* Karelin & Kirilov (1841: 862) and *S. orientalis*. *Stipa* ×*czerepanovii* is known from two locations, the Akseir Mts (Kotukhov 1998b) and the southwestern part of Balkhash Lake (Nobis *et al*. 2015a). At the locality near Balkhash Lake, it was found growing together with *S. orientalis* and *S. richteriana* (Nobis *et al*. 2015a). Length of ligules of vegetative shoots, pilosity of leaves, length of callus, length of anthecium, and length of hairs on the awn of *S.* ×*czerepanovii* are intermediate in comparison with the parental species.

Stipa ×*czerepanovii* is morphologically most similar to *S. sczerbakovii*. They differ mainly in the length of the callus (1.2–1.6 mm long in *S.* ×*czerepanovii* vs. 1.5–2.6 mm long in *S. sczerbakovii*), length of hairs on awn column (0.3–0.7 mm long in *S.* ×*czerepanovii* vs. less than 0.3 mm long in *S. sczerbakovii*), and seta with hairs 1–1.5 mm long in *S.* ×*czerepanovii* vs. 0.6–1.3 mm long in *S. sczerbakovii* (Nobis *et al*. 2015a).

5. *Stipa* ×*kamelinii* Kotukhov (1998a: 10) *pro sp*. Type citation:—Saur-Tarbagataj, praemontium boreali-occidentale juge Sajkan, in denudationibus tertiariis Akseir, jugi parvi declivitas aqua erosa australi-occidentalis, in glareoso-argillosis, 09.VI.1992, Ju. Kotuchov (LE)

Type (original label):—*Stipa kamelinii Kotuch. 1998 (Turczaninowia 1 vyp. 1), [det.] N. Tzvelev*, No. 2, 9 VI 1992, Stipa *sp. nova! kamelinii*, !Tip, Vostochnyi Kazakhstan, sev.-zap. predgor'e khr. Saikan, gliny Akseir, yugo-vost. sklon, galechno-glinistye uchastki, *Yu. Kotukhov* (holotype LE!; isotypes KRA 436045!, KRA 436046!, KUZ! 9 sheets).

At LE there are three sheets with specimens determined by Tzvelev (not by Kotukhov) as *Stipa kamelinii*. However, only one sheet includes specimens and a label similar to the one cited in the protologue and matches the description of the species; we treat it as holotype. The first of the two remaining sheets contains specimens of *S. saikanica* Kotukhov (1998b: 10), whereas the second, with a label dated 20 July 1993, contains specimens of *S. sareptana*.

We consider *Stipa* ×*kamelinii* to be a hybrid, originating from hybridization between *S. orientalis* and *S. lessingiana*. The length of ligules of vegetative shoots, pilosity of leaves, length of callus, length and character of anthecium, and length and pilosity on the awn of *S.* ×*kamellini* are intermediate in comparison with the parental species. The taxon has been found at the localities where both of its parental species grow together.

In morphology, *Stipa* ×*kamelinii* is close to *S.* ×*zaissanica*; however, they differ in the length of ligules of the vegetative shoots, which are 0.3–1.0(–1.3) vs. (0.5–)3–6.5(–7.5) mm long, respectively. Kotukhov (1998a) distinguished these two taxa by the length of callus (1.4 vs. 1.5–2.0 mm), anthers (4–5 vs. 3.5–4 mm) and hairs of awn seta (3.5–4 vs. 2–2.5 mm). In our revision of all original specimens of *S.* ×*kamelinii* and *S.* ×*zaissanica*, we found that the ranges in length of all the above-mentioned characters distinctly overlap in these two taxa: callus 1.5–2.2 vs. 1.3–1.8 mm, anthers 3.5–4.6 vs. 3.2–4.4 mm, hairs on seta 3.3–4.0 vs. 2.3–3.6 mm, respectively. Kotukhov (1991, 1998a) supposed that *S. kamelinii* is a result of the hybridisation of *S. orientalis* × *S. zaissanica* whereas *S. zaissanica* is a hybrid of *S. orientalis* × *S. hohenackeriana*. In our opinion it seems unlikely that *S.* ×*kamelinii* originated from a backcrossing of *S.* ×*zaissanica* and its putative parent, *S. orientalis*, since its ligules on the vegetative shoots are much shorter than in both putative parental species (in *S. orientalis*, ligules of the vegetative shoots are 1–3.5 mm long).

6. *Stipa karakabinica* Kotukhov (1994: 105). Type citation:—Altaj Australis, jugum Tarbagatai, depressio Karakabinica, 1800 m s. m., moraenae clausae, declivitas substepposa cum *Sibiraea altaiensis*, 18 VIII 1986, Ju. Kotuchov (LE)

Type (original label):—Stipa karakabinica Kotuch., (Sect. Leiostipa Dumort.), Yuzhnyi Altai, khr. Tarbagatai, Karakabinskaya vpadina, 1800 m. nad ur. m., zakrytye moreny, yugo-vost. ostepnennye sklony c *Sibiraea altaiensis,* 18 VIII 1986, *Yu. Kotukhov* (lectotype KRA 451780! designated here, isolectotypes KRA 436020!, KRA 436022!, KRA 436024!, KRA 436027!, KUZ! 4 sheets).

We were not able to find the type of this species at LE, thus we designate a lectotype selected from the original specimens from Kotukhov's collection preserved in KRA.

Having awns 7–10 cm long, anthecia 9–11 mm long and internodes longer than culm sheaths (Kotukhov 1994), *Stipa karakabinica* is very close to *S. austroaltaica* and *S. capillata* (see notes under *S. austroaltaica*). This group of taxa requires taxonomic revision.

7. *Stipa kempirica* Kotukhov (1994: 101). Type citation:—Saur-Tarbagatai, brachia australi-occidentalia jugi Manrak, 600 m s. m., locus Kempirbulak, clivulus lapidosus orientalis, 11 VII 1992, Ju. Kotuchov (LE)

Type (original label):—*Stipa kempirica Kotuch. 1994, Bot. Zhurn. t. 79, n 7, Typus!, [det.] N. Tzvelev*, 11 VII 1992, Stipa rupestris Kotuch. (Sect. Stipa), Saur=Tarbagatai, yugo-zap. otrogi khr. Manrak, 600 m. nad ur. m., urochishche Kempirbulak, vost. kamenistyi mikrosklon, *Typus!*, *Yu. Kotukhov* (lectotype LE! designated here, isolectotypes KRA 436044!, KUZ!, LE!).

The original material (type) of this species cited in the protologue consists of two sheets from a single gathering preserved in LE. Each sheet contains one specimen provisionally named by Kotukhov as *S. rupestris*, but described as *S. kempirica* [the name *S. rupestris* Philippi (1891: 81) is reserved for a South American feather grass]. Another sheet of this taxon was collected from the same location and probably at the same time [although the date on the label is 11 June (not July) 1992]. The specimen on this sheet is in the same stage of development as the two mentioned above, which would be unlikely if it had been collected from the same location one month earlier. Two additional original specimens of this taxon (named *S. rupestris*) not mentioned in the description are preserved in KUZ and KRA.

They contain original handwritten descriptions and Kotukhov's notes. Because the holotype was not indicated in the protologue, we here designate a lectotype. Since there is more than one sheet at LE, we designate the sheet with the word 'Typus' written by N. Tzvelev on the label as the lectotype.

Stipa kempirica is similar to *S. macroglossa* subsp. *kazachstanica* (Kotukhov 1994: 104) Nobis (2013: 1352) and *S. kirghisorum* Smirnov (1925: 223). It differs from these taxa by having shorter hairs on the awn seta (2.3–3.2 mm long in *S. kempirica* vs. 3.8–6.7 mm long in *S. macroglossa* subsp. *kazachstanica* and 3.5–6.5 mm long in *S. kirghisorum*) and somewhat thinner vegetative leaves.

8. *Stipa kotuchovii* Nobis (2011a: 494)

=*S. monticola* Kotukhov (1998a: 11) hom. illeg., non *S. monticola* H. Scholz (1993: 117). Type citation:—Saur-Tarbagataj, brachia austro-occidentalia jugi Saur, in viciniis hibernaculi Kyzylkija, 1700 m s.m., declivitas australi-orientalis, 18.VIII.1992, Ju. Kotuchov (LE).

Type (original label):—No. 19, 18 VIII 1992, Stipa *sp. nova! (blizok k S. sczerbakovii) [det. N. Tzvelev]*, Vostochnyi Kazakhstan, khr. Saur, v raione zimovki Kyzyl-Kiya, yugo-vost. shchebnistyi sklon, 1700 m. n. ur. m., *Yu. A. Kotukhov* (holotype LE!, isotypes KRA 436032!, KRA 435918!, KRA 436039!, KRA 436040!, KUZ! 2 sheets).

We found only one sheet in LE with a label and specimens matching the protologue of the species, and consider this to be the holotype. Because *S. monticola* is an illegitimate homonym of the species published by Scholz (1993), a new name for Kotukhov's taxon, *S. kotuchovii*, was published by Nobis (2011a).

Stipa kotuchovii is morphologically very close to *S. sczerbakovii*. This group of taxa requires taxonomic revision (see notes under *S. sczerbakovii*).

9. *Stipa kyzylkiensis* Kotukhov (1998b: 12). Type citation:—Saur-Tarbagataj, jugum Saur, in regione hibernaculi Kyzylkija, declivitas australi-orientalis lapidosa, 17 VII 1993, Ju. Kotuchov (LE)

Type (original label):—Stipa kyzylkiensis Kotuch. sp. nov., Tip: Saur-Tarbagatai, khr. Saur, v raione zimovki Kyzylkiya, yugo-vostochnyi kamenistyi sklon, 17 VII 1993, *Yu. Kotukhov* (lectotype LE! designated here, isolectotypes KRA 436041!, KRA 436042!, KUZ! 6 sheets, LE! 2 sheets).

The original material (type) of this species at LE consists of three specimens from a single gathering mounted on three sheets. Eight additional original specimens of this taxon, not mentioned in the description, are preserved in KUZ and KRA. Because a holotype was not indicated in the protologue, we designate a lectotype. Since there is more than one sheet at LE, we designate the sheet with a specimen having five culms and numerous vegetative shoots as the lectotype.

Kotukhov (1998b) distinguished *Stipa kyzylkiensis* from *S. sczerbakovii* by having shorter hairs on awn seta (0.1–0.2 vs. 0.5–0.8 mm long), longer anthecia (9–10 vs. 8–9 mm long) and longer anthers (ca. 5 vs. 3.5–4 mm long). Based on study of all original material of *S. kyzylkiensis*, we found the variability of several characters to be somewhat greater than described in the protologue: glumes 21–26 mm long (not 21–22 mm as described), anthecium 9.0–11.5 mm long (not 9–10 mm), hairs on seta 0.6–1.3 mm long (not 0.1–0.2 mm), anthers 4.1–5.3 mm long. The variability of these characters in *S. sczerbakovii* is also somewhat greater (see notes under *S. sczerbakovii*). All of the specimens from the type material at LE as well as other original specimens at KUZ and KRA have distinctly longer hairs on the seta than was indicated in the description of the species (0.8–1.3 mm not 0.1–0.2 mm). Taking into account the overlapping variation in these two taxa, we treat *S. kyzylkiensis* as conspecific with *S. sczerbakovii*.

10. *Stipa macroglossa* subsp. *kazachstanica* (Kotukhov 1994: 104) Nobis (2013: 1055)

≡*S. kazachstanica* Kotukhov (1994: 104). Type citation:—Saur-Tarbagatai, praemontia australi-occidentalia jugi Manrak, locus Sarybulak, clivulus schistosus australi-orientalis, 12 VI 1992, Ju. Kotuchov (LE).

Type (original label):—12 VI 1992, Stipa kazachstanica Kotuch. (sect. Stipa), Tip: Saur=Tarbagatai, yugo-zap. predgor'e khr. Manrak, urochishche Sarybulak, yugo-vost. shchebnistyi mikrosklon, *Yu. Kotukhov* (holotype LE!, isotypes KRA436018!, KUZ! 2 sheets).

We found only one sheet in LE with a label and specimens matching the protologue of the species, and consider this to be the holotype.

The taxon is similar to *Stipa macroglossa*, but differs in spikelet characters and structures of the vegetative shoots. It has recently been recognized as a subspecies, *S. macroglossa* subsp. *kazachstanica* (Nobis 2013). *Stipa macroglossa* subsp. *macroglossa* differs from *S. macroglossa* subsp. *kazachstanica* in having somewhat longer anthecium, seta, and adaxial surface of blades of the vegetative shoots, which are covered by a mixture of short and long hairs, rather than covered by very short spinules (Nobis 2013, Nobis *et al*. 2014a, 2014b, Nobis *et al*. 2016).

11. *Stipa* ×*manrakica* Kotukhov (1989: 414). Type citation:—Kazachstania Orientalis, jugi Manrak pars centralis, locus Sagyndyk Major, in regione montana media, 1100 m supra mare, jugi parvi declivitas occidentalis schistosa, 27 VI 1998, J. Kotuchov (LE)

Type (original label):—27 VI 1986, Stipa manrakica Kotuch. sp. nov. (sect. Smirnovia Tzvel.), Tip: Vostochnyi Kazakhstan, tsentral'naya chast' khr. Manrak, uroch. Bol'shoi Sagyndyk, srednii poyas, 1100 m, yugo-zap. shchebnistyi sklon gryady, *Yu. Kotukhov* (lectotype LE! designated by Nobis 2010: 737, isolectotypes KUZ! 2 sheets, LE! 2 sheets).

=*Stipa saurica* Kotukhov (1994: 102).

This is a hybrid taxon that originated from hybridization of *Stipa caucasica* and *S. macroglossa* subsp. *kazachstanica* (Nobis 2010, Nobis 2013). Recently, *S.* ×*manrakica* was found in Kyrgyzstan, where it grows among populations of the parental species (Nobis *et al*. 2015b).

12. *Stipa orientalis* var. *azutavica* (Kotukhov 1998b: 9) M. Nobis & P. Gudkova, *comb. et stat. nov.*

Basionym: *Stipa azutavica* Kotukhov (1998b: 9). Type citation:—Altaj australis, praemontia australi-orientalia jugi Azutau, mons Bulgartabaty, desertum lapidosum, 22 V 1991, Ju. Kotuchov (LE).

Type (original label):—Stipa azutavica Kotuch. sp. nov., Tip: Yuzhnyi Altai, yugo-vost. predgor'ya khr. Azutau, gory Bulgartabaty, kamenistaya pustynya, 22 V 1991, *Yu. Kotukhov* (lectotype LE! designated here, isolectotypes KRA 436050!, KUZ!, LE!).

Original material (type) of *Stipa azutavica* preserved in LE consists of nine specimens from a single gathering mounted on two sheets. Two additional sheets with seven original specimens, not mentioned in protologue of this taxon, are preserved in KUZ and KRA. Because the holotype was not indicated by the author, we designate a sheet containing four individuals as the lectotype.

Stipa azutavica is very close to *S. orientalis*. Kotukhov (1998b) distinguished this taxon from *S. orientalis* by having somewhat shorter awns (4–5 vs. 5–7 cm long, respectively), ligules of the vegetative shoots covered by longer hairs, and slightly scabrous to almost glabrous leaves.

As a result of revision of *Stipa orientalis* from its entire range, we found that the ranges of the main characters of this taxon are much wider than presented by Kotukhov (1998b). One example is the length of awn, which varies from 3.9 to 9.0 cm; thus, there is no difference between *S. orientalis* and *S. azutavica* in this character. The only differences between these taxa are: leaves slightly scabrous to almost glabrous in *S. azutavica* vs. leaves more or less distinctly scabrous in *S. orientalis*; and hairs on ligules 0.7–1.5(–2) mm long in *S. azutavica* vs. hairs on ligules up to 1 mm long in *S. orientalis*. The plants of *S. azutavica* are generally smaller than those of *S. orientalis*. For all these reasons, we propose to reduce *S. azutavica* to the rank of variety within *S. orientalis*.

13. *Stipa pavlovii* Kotukhov (1998a: 7). Type citation:—Saur-Tarbagataj, jugi Saurici brachia australi-occidentalia, 1800 m s.m., in regione hibernaculi Kyzylkija, declivitas austro-orientalis saxosa, 04 July 1991, Ju. Kotukhov (LE)

Type:—not found.

Paratypes:—Saur-Tarbagatai, khr. Manrak, v raione pos. Mauldy, yugo-zap. shchebnistyi sklon, 21.VII.1993, Yu. Kotukhov (LE—not found); Saur-Tarbagatai, khr. Manrak, v raione per. Saikan, 1300 m nad ur. m., yugo-vost. shchebnistyi sklon, 16.VII.1993, Yu. Kotukhov (LE—not found).

The original material of *Stipa pavlovii* (types and paratypes) cited by Kotukhov (1998a) was not found at LE and KUZ. We also did not find any other specimens match the description of the species. We are therefore not able to designate a lectotype or a neotype for the species. Based on the description, *S. pavlovii* is very close to *S. sczerbakovii*. This group of taxa requires taxonomic revision.

14. *Stipa saikanica* Kotukhov (1998b: 10). Type citation:—Saur-Tarbagataj, praemontia boreali-occidentalia jugi Saikan, locus Akseir, denudationes argillarum tertiariarum (in gypsaceis), partitiones glareoso-argillosae, 9 VI 1992, Ju. Kotuchov (LE)

Type (original label):—Stipa saikanica Kotuch sp. nov., Tip: Saur-Tarbagatai, sev.-zap. predgor'ya khr. Saikan, urochishche Akseir, obnazheniya tretichnyh glin (pestrotsvety), galechno-glinistye uchastki, 9 VI 1992, *Yu. Kotukhov* (lectotype LE! designated here, isolectotypes KRA 436036!, KUZ! 2 sheets, LE! 2 sheets).

Original material (type) of this species at LE consists of five specimens from a single gathering mounted on two sheets. A third sheet of the taxon with the same label was determined by N. Tzvelev as *S. kamelinii*. Additionally, three sheets with original specimens of this taxon (not mentioned in the description) are preserved at KUZ and KRA. Because the holotype was not indicated by the author, we designate a sheet containing three specimens as the lectotype.

Kotukhov (1998b) distinguished *Stipa saikanica* from *S. lessingiana* by a shorter anthecium (7–8 vs. 9–11 mm long), and shorter awn (12–14 vs. 20–26 cm long). However, specimens from the type collection have a longer anthecium (up to 9 mm long) and somewhat longer awns (12–15 cm long). In our opinion, specimens of *S. saikanica* look like young (not fully developed) *S. lessingiana*. Moreover, as a widely distributed species, *S. lessingiana* is characterized by greater variability in the length of anthecia (8.5–11.5 mm long) and awns ((14–)17–22(–26) cm long) than was stated by Kotukhov (1998b). Thus, we treat *S. saikanica* as conspecific with *S. lessingiana*.

15. *Stipa saurica* Kotukhov (1994: 102). Type citation:—Saur-Tarbagatai, brachia boreali-occidentalia jugi Saur, in viciniis hibernaculi Kesek, clivulus saxosus australi-occidentalis, in schistosis, 14 VII 1992, Ju. Kotuchov (LE)

Type (original label):—14 VII 1992, Stipa saurica Kotuch. (sect. Smirnovia Tzvel.), Tip: Saur=Tarbagatai, sev.-zap. otrogi khr. Saur, v okr. zimovki Kesek, yugo-zap. skalistyi mikrosklon, shchebnistye uchastki, *Yu. Kotukhov* (lectotype LE! designated by Gonzalo *et al*. 2011: 433, isolectotype KUZ!).

This taxon is conspecific with *S.* ×*manrakica* (Nobis 2010, 2013).

16. *Stipa sczerbakovii* Kotukhov (1991: 872). Type citation:—Altai Australis, brachia austro-orientalia jugi Azutau, montes Bulgartabaty, 600 m s. m., locus Sargalym, steppa fruticeto-graminosa lapidosa, 16 VI 1988, J. Kotuchov (LE)

Type (original label):—16. 06. [197]88 g., Stipa ~~sp. nov~~. *zaissanica Kotuch. 1991, Bot. Zhurn. 76,6: 873 [determ.] N. Tzvelev*, Yuzhnyi Altai, khr. Azutau, Uroch. Bylgar-tabaty, yugo-vostochnyi kamenistyi sklon, sredi kustarnika, *Isotypus!*, *Kotukhov Yu. A*. (holotype LE!, isotypes KRA 136031!, KUZ! 13 sheets).

=*Stipa kyzylkiensis* Kotukhov (1998: 12) *syn. nov.*

In the course of revision in LE herbarium we found only one sheet with a specimen of *Stipa sczerbakovii* collected by Kotukhov on 16 June 1988 and matching the description of this species. Thus, we treat it as the holotype of the taxon. However, Tzvelev incorrectly annotated this specimen as *S. zaissanica* and designated it as an isotype of that taxon. These two taxa differ distinctly in the length of ligules of the vegetative shoots and in the length of hairs on the awn (Kotukhov 1991).

Stipa sczerbakovii is the most abundant species represented in Kotukhov's collection. More than 40 sheets with specimens identified by Kotukhov as *S. sczerbakovii* are preserved in KUZ, KRA and LE. The variability of morphological characteristics in this taxon is somewhat greater than that presented in the protologue of the taxon: e.g., ligules of vegetative shoots (0.1–)0.3–2.7 mm (not 0.3–2 mm as in the protologue), anthecium 8–10.5(–11) mm (not 8.5–9 mm), awns 8.5–11.7 cm (not 9–10 cm), hairs on seta 0.4–1.3 mm (not 0.5–0.8 mm), anthers 3.2–4.3 mm (not 3.5–4 mm). Taking into account that Kotukhov described three species that are very close to *S. sczerbakovii*, namely *S. pavlovii*, *S. kyzylkensis* and *S. kotuchovii* (=*S. monticola*), revision of this group of taxa is needed.

17. *Stipa* ×*tzveleviana* Kotukhov (1994: 102) *pro sp.* Type citation:—Saur-Tarbagatai, brachia australi-occidentalia jugi Manrak, 600 m s. m., locus Kempirbulak, clivulus saxosus boreali-occidentalis, 11 VII 1992, Ju. Kotuchov (LE)

Type (original label):—11 VI 1992, Stipa tzveleviana Kotuch. (sect. Barbatae), Tip: Saur=Tarbagatai, yugo-zap. otrogi khr. Manrak, 600 m nad ur. m., urochishche Kempirbulak, sev.-zap. skalistyi mikrosklon, *Typus!*, *Yu. Kotukhov* (holotype LE!, isotypes LE! 3 sheets).

Stipa ×*tzveleviana* has recently been treated as synonymous with *S. turkestanica* Hackel (1906: 59) subsp. *turkestanica* by Gonzalo *et al*. (2013). However, our detailed examination of specimens of *S.* ×*tzveleviana* reveals that the taxon differs from *S. turkestanica* subsp. *turkestanica* in shorter ligules of vegetative shoots (2–5 vs. 2.6–11.5 mm long, respectively), a poorly developed ring of hairs present at the top of anthecium vs. top of anthecium glabrous, and in the scabrous column, which is covered by spinules or hairs (0.05–)0.1–0.3 mm long on the lower segment and 0.2–0.5(–0.7) mm long on the upper segment vs. the lower and the upper segment of the column scabrous to glabrous (Nobis *et al*. 2016).

We consider *Stipa* ×*tzveleviana* to be a hybrid, arising from hybridization of *S. orientalis* and *S. macroglossa* subsp. *kazachstanica*. As a hybrid, *Stipa* ×*tzveleviana* need not be phenotypically intermediate in reference to its parental species, and may have intermediate and extreme characters, as is generally typical for taxa of such origin (Rieseberg 1995, Paszko & Nobis 2010, Nobis 2011b, 2013). For this reason, some specimens have a more or less poorly developed ring of hairs at the top of anthecium, while the same character is absent in others.

18. *Stipa* × *zaissanica* Kotukhov (1991: 873) *pro sp*. Type citation:—Altai Australis, brachia australi-orientalia jugi Azutau, montes Bulgartabaty, 600 m s. m., declivitas lapidosa austro-orientalis, 16 VI 1988, J. Kotuchov (LE)

Type (original label):—16. 06. [197]88 g., Stipa ~~sp. nov~~. *zaissanica Kotuch. 1991, Bot. Zhurn. 76,6: 873 [determ.] N. Tzvelev*, Yuzhnyi Altai, khr. Azutau, Uroch. Bylgar-Tabaty, yugo-vostochnyi kamenistyi sklon, shchebnistye uchastki, *Typus!*, *Kotukhov Yu. A.* (holotype LE!, isotypes KRA 436028!, KRA 436029!, KUZ! 2 sheets).

In LE we found only one sheet of *Stipa* ×*zaissanica* matching the description of that species. It was determined by N. Tzvelev as *S.* ×*zaissanica* and is the holotype.

We consider *Stipa* ×*zaissanica* to be a hybrid, arising from hybridization of *S. orientalis* and *S. hohenackeriana*. Specimens of this taxon have morphological characters that are intermediate between the two parental species. The hybrid origin of *S.* ×*zaissanica* was also hypothesized by Kotukhov (1991); however, he published the taxon with the rank of a legitimate species. Original material of *Stipa* ×*zaissanica* is characterized by somewhat greater variability of main morphological characters than was presented in the protologue of the taxon. Ranges of important characters are: glumes 20–30 mm (not 20–25 mm as in the protologue) long, anthecium 9–11 mm (not 9–10 mm) long, awns 9–12 cm (not 9–11 cm) long, and hairs of awn seta 2.3–3.5 mm (not 2–2.5 mm long; see also the note under *S. kamelinii*).

Conclusion

Original material of species described by Kotukhov between 1987 and 1998 is preserved in LE, KUZ and KRA. It consist of 119 sheets, and includes: 7 sheets containing holotypes, 10 lectotypes, 45 isotypes and 57 isolectotypes. As a result of our studies, we lectotypified seven names: *S. akseirica*, *S. argillosa*, *S. karakabinica*, *S. kempirica*, *S. kyzylkiensis*, *S. azutavica* and *S. saikanica*. No original material of *S. pavlovii* or any other specimens matching the description of this species was found during our studies.

Of the 18 taxa described by Kotukhov from eastern Kazakhstan, we consider 12 as species, one as a subspecies (*Stipa macroglossa* subsp. *kazachstanica*) and one as a variety (*S. orientalis* var. *azutavica*). We treat four of the species described by Kotukhov as conspecific with earlier described taxa: *S. akseirica* is conspecific with *S. sareptana*, *S. kyzylkiensis* is conspecific with *S. sczerbakovii*, *S. saikanica* is conspecific with *S. lessingiana* and *S. saurica* is conspecific with *S.* ×*manrakica*. Among the studied taxa we distinguished two complexes comprising very closely related species; the first includes *S. kyzylkiensis* and *S. austroaltaica*, which are very similar to each other as well as to *S. capillata*, and the second includes *S. pavlovii* and *S. kotuchovii*, which are very similar to *S. sczerbakovii*. Both of these complexes requires taxonomic revision.

As a result of revision of Kotukhov's collection, supported by our observations in the field, we consider *Stipa* ×*czerepanovii*, *S.* ×*kamelinii*, *S.* ×*manrakica*, *S.* ×*tzveleviana* and *S.* ×*zaissanica* as nothospecies. *Stipa argillosa*, *S. kempirica* and *S. sczerbakovii* also probably arose through hybridization, but clarification of their origins require further studies.

Identification key

In this key we include only these species from Kazakhstan which have awns bigeniculate, scabrous or pilose throughout, or pilose in the upper part and scabrous in the lower. Most of species described by Kotukhov belong to this artificial group. The key contains also *Stipa lessingiana* (a species having glabrous lower segment of the awn) because it is one of the parental species of some hybrid taxa discussed in this paper.

1. Awn 1.5–3 cm long 2
- Awn over 3 cm long 3
2. Awn column with hairs up to 1 mm long ..... *S. regeliana* Hackel (1884: 130)
- Awn column with hairs 2–3 mm long ..... *S. subsessiliflora* (Ruprecht 1869: 35) Roshevitz (1916: 128)
3. Upper part of awn (seta) scabrous, covered with spinules not longer than 0.3 mm 4
- Upper part of awn (seta) pilose, covered with hairs longer than 0.3 mm 8
4. Apex of lemma without a ring of hairs, rarely with a few short spinules near the margin of lemma 5
- Apex of lemma with a well developed ring of hairs 6
5. Anthecium (10–)11–13(–14) mm long, awn 12–22 cm long ..... *S. capillata*
- Anthecium 7.5–11mm long, awn 7–11 cm long ..... *S. austroaltaica* (including *S. karakabinica*)
6. Abaxial surface of leaves distinctly scabrous due to hard bristles or spinules ..... *S. sareptana* (=*S. akseirica* syn. nov.)
- Abaxial surface of leaves glabrous or only slightly scabrous due to pointed tubercles 7
7. Anthecium 9–12(–13) mm long, awn column 2–3.5(–4) mm long, adaxial surface of leaves densely covered by very short hairs up to 0.1 mm long ..... *S. krylovii*
- Anthecium 13–14 mm long, awn column 3.5–5 cm long, adaxial surface of leaves covered by a mixture of short and long hairs ..... *S. baicalensis* Roshevitz (1929: 380)
8. Awn uni- or indistinctly bigeniculate 9
- Awn distinctly bigeniculate 10
9. Hairs on seta 0.4–0.8 mm long ..... *S. consanguinea* Trinius & Ruprecht (1842: 78)
- Hairs on seta over 4 mm long ..... *S. ×manrakica*
10. Awn column glabrous and smooth, rarely with few single short hairs 11
- Awn column scabrous or pilose 12
11. Hairs on seta up to 1.3 mm long, awn column glabrous rarely with a few single short hairs ..... *S. argillosa*
- Hairs on seta over 1.8 mm long, awn column glabrous and smooth ..... S. *lessingiana* (=*S. saicanica* syn. nov.)
12. Ligules of the vegetative shoots up to 0.4 mm long 13
- Ligules of the vegetative shoots over 0.5 mm long 15
13. Seta straight or arquate, up to 5 cm long, callus up to 1.2 mm long ..... *S. richteriana*
- Seta flexuous, over 5 cm long, callus over 1.2 mm long 14
14. Hairs on seta up to 0.6 mm long ..... *S. korshinskyi* Roshevitz (1916: 163)
- Hairs on seta 0.9–1.5 mm length ..... *S. heptapotamica* Goloskokov (1959: 46)
15. Awn column scabrous due to short prickles 16
- Awn column pilose 21
16. Awn up to 8 cm long, anthecium up to 7 mm long ..... *S. gracilis* Roshevitz (1916: 151)
- Awn and anthecium longer 17
17. Hairs on seta up to 0.8 mm long 18
- Hairs on seta over 1.5 mm long 19
18. Awn 8–13 cm long, indistinctly bigeniculate ..... *S. consanguinea*
- Awn 15–20 cm long, bigeniculate ..... *S. pseudocapillata* Roshevitz (1916: 172)
19. Hairs on seta (1.5–)2–3 mm long, awn column 0.2–0.3 mm wide ..... *S. hohenackeriana*
- Hairs on seta 4.5–6 mm long, awn column 0.3–0.5 mm wide 20
20. Ligules of the vegetative shoots up to 1.5 mm long, awn indistinctly bigeniculate ..... *S. ×manrakica*
- Ligules of the vegetative shoots over 1.5 mm long, awn distinctly bigeniculate ..... *S. ×tzveleviana*
21. Awn 18–24 cm long, glumes 5–6 mm long ..... *S. kungeica* Goloskokov (1954: 39)
- Awn 3.9–18 cm long, glumes 1.5–3.5 mm long 22
22. Hairs on seta up to 1.3 mm long 23
- Hairs on seta over 1.5 mm long 24
23. Callus 1.2–1.6 mm long, awn 5.5–8 cm long, hairs on awn column 0.3–0.7 mm long, seta with hairs 1–1.5 mm long ..... *S. ×czerepanovii*
- Callus 1.5–2.6 mm long, awn 8.5–12 cm long, hairs on awn column not longer than 0.3 mm, seta with hairs 0.4–1.3 mm long ..... *S. sczerbakovii* complex (=*S. kyzylkiensis* syn. nov.)
24. Panicle lax, glumes purple ..... *S. purpurea* Grisebach (1868: 82)
- Panicle compressed, glumes green to straw colored, rarely slightly purple 25
25. Ligules of the vegetative shoots 0.3–1(–1.3) mm long ..... *S. ×kamelinii*
- Ligules of the vegetative shoots (0.5–)1–8(–10) mm long 26
26. Anthecium 9–13 mm long, awn (8–)9–18 mm long, hairs on seta 1.5–3.5 mm long 27
- Anthecium up to 7–9 mm long, awn (3.9–)4.5–8(–9.5) mm long, hairs on seta (3.5–)4–5(–5.5) ..... *S. orientalis*
    a. Ligules of the vegetative shoots with hairs 0.3–1 mm long ..... *S. orientalis* var. *orientalis*
    - Ligules of the vegetative shoots with hairs 0.7–2 mm long ..... *S. orientalis* var. *azutavica*

27. Hairs on column 0.2–0.4 mm long, hairs on seta 2.3–3.5 mm long ..... *S.* ×*zaissanica*
- Hairs on column 0.5–1.5 mm long, hairs on seta 1.5–2.5(–2.9) mm long..... *S. arabica* Trinius & Ruprecht (1842: 77) complex

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