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Taxonomic notes on the dwarf bluegrasses (*Poa* L., Poaceae) of section Stenopoa in Pan-Himalayas

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ABSTRACT: The dwarf forms of *Stenopoa* (height 5–15 cm) which are common in alpine belt of the Pan-Himalayas, represent one of the most problematic groups in the genus. Ten dwarf species of *Stenopoa* have been recorded for the area under consideration: *P. attenuata* Trin, *P.glauca* Vahl, *P. litvinoviana* Ovcz., *P. albertii* Regel, *P. koelzii* Bor, *P. lahulensis* Bor, *P. poophagorum* Bor, *P. arnoldii* Melderis, *P. mustangensis* Rajb., and *P. roemeri* Bor. At least 6 other taxa have been mentioned as synonyms of these species. Comparative examination of many specimens of this group using a morphogeographic approach supports recognition of 10 species, which belong to 3 species aggregates: aggr. *P. attenuata*, aggr. *P. glauca* and aggr. *P. albertii.* Taxa in aggr. *P. albertii* are thought to have originated from hybridization between species of aggr. *P. attenuata* and aggr. *P. glauca*. Our research leads us to recommend recognizing *P. roemeri*, *P. koelzii*, *P. mustangensis*, *P. rangkulensis* Ovcz., *P. scabriculmis* N.R. Cui, *P. tshuensis* (Serg.) Olonova and *P. indattenuata* Keng as species; three of them have been recorded from the Pan-Himalayas. *Poa koelzii* is included in aggr. *P. attenuata* because of its similarity to that species. A key for identifying the taxa is presented. One new combination, *Poa scabriculmis* subsp. *kunlunensis* (N.R. Cui) Olonova, is presented.

KEY WORDS: Grasses, *Poa*, Pan-Himalayas, Systematics.

INTRODUCTION

The aim of any systematic treatment is to understand and reveal the morphological and genetic diversity in a group of taxa and represent it in a hierarchical structure. Such work often culminates in the development of identification keys that reflect the recommended treatment. Such keys can emphasize readily discernible characters even if these were given little weight in forming the groups as, for example, when morphological keys are written to identify groups identified by molecular phylogenies. Molecular work can provide more detailed information about the genetic diversity present but, if they are to be used effectively and efficiently, they must be based on detailed morphological and geographical knowledge of the plants involved. The goal of our work was to develop such knowledge for a problematic group of species belonging to *Poa* L. sect. *Stenopoa* Dumort. in Pan-Himalaya.

The systematic treatment of *Poa* L., particularly *Poa* sect. *Stenopoa*, is known to be difficult. The difficulty arises from the fact that, because of the prevalence of hybridization (Tzvelev 1976; Probatova 2007) and apomixis (Stebbins 1941; Gustaffson 1947; Clausen 1954, 1961), we deal not so much with individual species but with hybridogenic complexes which are closely related to each other. The dwarf forms of sect. *Stenopoa* (height 5-15(25) cm), which are common and characteristic in the upper mountain and alpine belt of Asia, including the Pan-Himalaya (alpine regions of SE Tajikistan, NE Afghanistan, N Pakistan, N India, Nepal, SW China, Bhutan and N Myanmar), represent one of the most problematic of such groups. (Tzvelev 1976; Dickoré 1995). Ten dwarf species of sect. *Stenopoa* have been reported for the Pan-Himalayas: *P. albertii* Regel, *P. arnoldii* Melderis, *P. attenuata* Trin, *P. glauca* Vahl, *P.koelzii* Bor, *P. lahulensis* Bor, *P. litvinoviana*_Ovcz., *P. mustangensis* Rajbh., *P. poophagorum* Bor, and *P. roemeri* Bor (Bor 1952, 1970; Cope 1982; Ling, Liu 1987; Rajbhandari 1991; Noltie 2000; Liu 2003; Sun 2003; Kandwal *et al.*, 2003; Sekar *et al.* 2004; Zhu *et al.* 2006; Koba 2008; Brecle *et al.* 2013). At least 6 names have been mentioned as being synonyms of these species. Three of these names (*P. arnoldii*, *P. mustangensis* and *P. poophagorum*,) appear to refer to well characterized taxa with distinct distributions but the status of the remainder, particularly *P. koelzii* and *P. roemeri*, needs additional research and consideration.

Some populations of dwarf *Stenopoa* taxa have been recognized as species although there is little information about their variability, the heritability of their distinguishing features, or even their relationship

and identity of their parental species. There are no karyological data, no molecular data, and no information about how the species would compare if grown under controlled conditions. In other words, the available data on Asiatic alpine bluegrasses not only precludes conducting systematic research at the γ level, which uses all available biological information, including the molecular data for revealing the evolutionary rates and trends, but often also at the β level, which attempts to place the species into a natural system. It is difficult to argue for the recognition of species based solely on morphological differences, often very slight differences although the frequent lack of any other kind of data makes this, by necessity, a common practice. Nevertheless, in the absence of any other kind of information, it is also difficult to support placing them in synonymy even if the differences are slight. Bluegrasses, like other grasses, have few prominent markers of their evolutionary branches. The dwarf members of sect. *Stenopa* differ from each other primarily by the distribution of their lemma indumentum and the presence or absence of a tuft of hairs on the callus. These features are not reliable markers of relationship because they may have arisen independently or been acquired through hybridization. On the other hand, minor morphological differences among geographically isolated populations can hide deep genetic differences. Failure to recognize them because their differences, in the absence of additional supporting information, are deemed too slight and can lead to lack of concern for their conservation and even loss. Undoubtedly errors will be made but, in the absence of evidence to support a contrary treatment, we prefer to recognize as species taxa that exhibit slight but consistent morphological differences and distinct geographic distributions. This paper reflects the acquisition of new data on the rare and little studied dwarf species of sect. *Stenopoa* from the eastern Himalayas.

The "Flora of China" project was an important stage in the study of the Asian flora. In it, a polytypic species concept was accepted. Groups of morphologically similar but ecologically or geographically isolated populations were treated as subspecies; those without such isolation were treated as forms. This created a problem for the treatment of hybrid taxa. If the characters of one putative parental species dominated in a population, the population was treated as a subspecies of that parent. If the morphological characteristics of both parents were present in approximately equal proportions, all taxa thought to have arisen from the same parental species were treated as subspecies of the member of the complex that had been first named as a species as required by the International Code of Nomenclature for algae, fungi and plants (McNeill *et al.*, 2012). In other words, hybrid complexes were treated as polytypic species.

Preparation of a treatment for the new, large scale project, "Flora of the Pan-Himalaya," demands that a new treatment is to be prepared, one that reflects data acquired since completion of the treatment in the "Flora of China" so that it can provide a scientific basis for conservation of local biodiversity throughout this larger and poorly known region. We find it useful, in this situation, to adopt a narrower species concept but identifying as species aggregates, (aggr.), not formal taxa, groups of species that have similar characteristics. Using the informal designation "aggregate" helps highlight areas that that merit further research. It would be possible to present these as formal taxa, possibly superspecies, to reflect new interpretations of the affinities of the taxa involved but it seems unwise to add more names to the many that already exist until more information is available.

MATERIALS AND METHODS

This paper is based on observations made during fieldwork, conducted over several seasons, in Siberia (Altai, W Sayan), Tajikistan (Gissaro-Darvaz, Alay and Pamir), China (Xinjiang and Sichuan) and examination of specimens from BM, BRY, C, E, HAL, K, KUN, L, LE, MW, NS, NSK, PE, SZ, TAD, TK, US, UTC, XJA, XJBI, XJNU. The field work led to the collection of 2,500 specimens that have already been deposited in TK and additional samples, collected in Sichuan, that will also be deposited in KUN, PE, SZ. Equally importantly, it enabled us to observe the plants in their native habitats Nomenclatural information developed from our work has been shared with Dr. R.J. Soreng who has made it available via TROPICOS (2016).

RESULTS AND DISCUSSION

As a result of our studies, we favor recognition of more taxa at the species level than in the Flora of China but group them in three species aggregates, those named for *P. attenuata*, *P. glauca*, and *P. albertii*. The plants involved are all cryophytic and xerophytic members of *Stenopoa* that grow in the upper mountain and alpine belts of non-tropical Asia, including the Pan-Himalayas. They are small plants, 5–15(25) cm tall, usually with more or less rigid, folded leaf blades that are 1–1.5 mm wide when folded. They differ primarily in the shape of the panicle and the indumentum of the lemma and callus. Members of aggr. *P. albertii* are thought to be derived from hybrids between members of the first two aggregates. As a whole, the polytypic species accepted in the "Flora of China" are treated here as aggregates but our research requires making some additional changes, primarily with respect to *P. koelzii* which combines the morphological features of

Table 1. Morphological difference between species, close to ***Poa roemeri*** Bor.

Species	Distribution	Surface of stem under the panicle	Ligule length (mm)	Spikelets length (mm)	Surface lemma callus	Surface between lemma veins
P.koelzii	Jammu and Kashmir, N Xizang	Smooth	To 3	4.5–6	With tuft of hairs or glabrous	Ciliate
P. roemeri	Wakhan, Afghanistan	Almost smooth	2.5–3	4.5	With tuft of hairs or glabrous	Ciliate
P. scabriculmis	Xinjiang, China; alpine zone	Densely scabrous	3–4	4	Glabrous	Ciliate
P.indattenuata	Western China	Almost smooth	1.5–2	4	With tuft of hairs or glabrous[1]	Glabrous
P. festucoides *subsp.* ***kunlunensis***	Xinjiang, China; alpine zone	Scabrous	2.5–3.5	3–4	Glabrous	Ciliate
P. tshuensis	Altai, Central and Eastern Asia	Moderately scabous	1.5–2.5	3–4.5	With tuft of hairs	Ciliate
P. rangkulensis	Pamir, Central Asia	Moderately scabrous	1–3	3.5–4	Glabrous	Ciliate

[1]Type has glabrous callus

I took out endemic because it does not mean much when used for any area from a province to the western portion of a region.

P. attenuata and *P. glauca*. It is treated in the "Flora of China" as a subspecies of the polytypic species *P. albertii*, together with *P. indattenuata* Keng, *P. rangkulensis* Ovcz. et Czuk., *P. roemeri*, *P. scabriculmis* N.R. Cui, and *P. festucoides* N.R. Cui *subsp. kunlunensis* N.R. Cui, all which are quite similar morphologically. Because only *P. festucoides subsp. kunlunensis* had been named at the rank of subspecies, all these taxa were treated as *P. albertii subsp. kunlunensis* in accordance with the Code (McNeill *et al.*, 2012).

We propose recognizing all but *P. festucoides subsp. kunlunensis* as poorly differentiated species (table 1). With this interpretation, the geographic range of *P koelzii* and *P. roemeri* is much narrower than previously thought, being restricted to the Pan-Himalayas. Because *P. albertii subsp. kunlunensis* is morphologically similar to *P. scabriculmis* and has a similar distribution, it is treated here as ***Poa scabriculmis* subsp. *kunlunensis* (N.R. Cui) Olonova** (comb. nov.; basionym: *Poa festucoides* N. R. Cui subsp. *kunlunensis* N. R. Cui, Acta Bot. Boreal.-Occid. Sin. 7(2): 97. 1987).

Taxonomic Synopsis

Aggr. *P. attenuata* (1, 2)

This aggregate includes two species, *P. attenuata* and *P. koelzii*

1. *Poa attenuata* Trin.**,** 1835, Mem. Acad. Imp. Sci. St.-Petersb. Sav. Etrang. 2: 527.

Typus*:* "Altai, 1833, Bunge." (LE!). – Dry grasslands, rocky and stepped slopes of alpine mountain belt. *Distribution:* Wakhan, N Pakistan, Jammu and Kashmir, W Nepal, Sikkim, Upper Yarlung Zangbo, Bhutan, Tangut [China, Central Asia, Siberia, Mongolia].

This species consists of densely tufted, stiff plants that are usually grayish-yellow-green, and have dense, ovoid or spiciform panicles and lemmas that are moderately pubescent on the veins, often purple striped, and with a more or less pronounced tuft of hairs on the callus. *Poa attenuata* is widely distributed among cold and dry highlands of Siberia, Central and Middle Asia. This species has been recorded in many areas covered by the Pan-Himalayan Flora but, because of the region's climate, it is much rarer there than in Siberia and Central Asia. In Pan-Himalaya they seem to be replaced by more mesomorphic race. The presence or absence of the tuft of hairs on the lemma callus is a variable character in section *Stenopoa,* sometimes varying within a population (Olonova 2005), but in Tibet and the Pan-Himalayan region the glabrous callus is constant and dominant (Olonova *et al.*, 2014). In Eastern Siberia, individuals morphologically similar to *P. attenuata*, but with a glabrous callus were described as *P. dahurica* Trin. (1836, Mem Acad Sci Petersb, ser 6, 4, 2:64; Lectotypus: In apricis Dahuriae, 1832, Turczaninow). Griseb. (1852) treated them as *P. attenuata* var. *dahurica* (Trin.) Griseb. and his treatment was followed in the Flora of China (Zhu *et al.*, 2006). Our studies suggest that, in the Pan-Himalayan region, plants with a glabrous callus belong to a different taxon which is more mesomorphic than *P. dahurica*. They are treated here as *P. attenuata* pending further study.

2. *Poa koelzii* Bor, 1948, Kew Bull. (1): 139.

Typus: "Tzakhum Tso, Ladak, Kashmir, in dry sand plain, alt. 15,000 ft. № 2385. July 20, 1931. Walter Koelz" (K!). – Dry gravel slopes, rocky and stepped slopes, grassy places *Distribution:* Jammu and Kashmir, N Xizang (Tibet)[endemic].

Poa koelzii was described by Bor (1948) from the Himalayas who mentioned that it resembled *P. litvinoviana* in having a glabrous callus (*lana nulla*). This is evident on the type specimen. Initially *P. koelzii* was regarded as endemic to Jammu and Kashmir (Bor 1960) but it was subsequently found in Pakistan (Bor 1970; Cope 1982), and Xizang (Liu 2003). Over time, it

has also been accepted that *P. koelzii* sometimes has hairs (wool) on the callus (Bor 1960, 1970). Later, Tzvelev (1968) relegated *P. rangkulensis* Ovcz., which was described in 1956 (Ovchinnikov and Chukavina 1956) from the alpine belt of the Pamirs, to a synonym of *P. koelzii* thereby further expanding the range of *P. koelzii*.

Further investigation has revealed additional dwarf taxa of sect. *Stenopoa* in Asian Highlands, similar to *P. koelzii*. Sergievskaja (1975), in revising *Poa* from the Altai, found the dwarfish samples with lemmas that were pubescent between the veins. In this they resemble *P. argunensis* Rosh., which is common in low mountain belts of East Siberia. Since the alpine plants differed from *P. argunensis* only in stem height, Sergivskaja treated them as *P. argunensis var. tshuensis* Serg. Tzvelev (1976) considered them more similar to the alpine *P. attenuata* and made the combination *P. attenuata var. tshuensis* (Serg.) Tzvelev to reflect this. Later Namzalov (1990), based on the observation of vegetative shoots in the tufts, included them in Pamirian species *P. rangkulensis*. In the "Flora of China" (Zhu *et al*., 2006), as it was mentioned above, it treated in the frame of *P. albertii*.

Olonova (2016), accepted the species in narrow sense, and treated it as a species, *P. tshuensis*, within aggr. *P. albertii*, because it combines the features of *P. attenuata* and *P. glauca* in roughly equal proportions. It does not extend into the Pan-Himalayas.

Further study of *P. koelzii* has shown that its type is morphologically closer to *P. attenuata* than *P. albertii*, hence its inclusion in aggr. *P. attenuata* rather than in aggr. *P. albertii.*

Aggr. *P. glauca* (3 – 5)

This aggregate includes 3 species. They resemble each other in habit but differ in the presence or absence of hairs on the callus and between lemma veins and some characters of lemma and vegetative parts as well as in their distribution.

3. *Poa glauca* Vahl, 1790, Fl. Dan. Fasc. 17: 3.

Typus: Legi in Alpibus Norvegica Valders verser Vang (C!). – Dry gravel slopes, rocky and stepped slopes, grassy places on the river banks in alpine mountain belt. *Distribution:* Wakhan, N Pakistan, Jammu and Kashmir, W Nepal, Sikkim, M Yarlung Zangbo, Bhutan, Tangut [China, Central Asia, Siberia, Mongolia, Korea, Japan, Europe, N. America].

This species is very variable within its huge range. Nevertheless, it seems to be less common in the western Himalaya than it might be expected, being replaced by taxa that seem to have arisen from hybridization of *P.glauca* and *P.attenuata*, all of which are treated here as aggr. *P. albertii*.

4. *Poa litwinoviana* Ovcz., 1933, Izv. Taj. Bazy Akad. Nauk SSSR 1(1):22.

Typus: (Tzvelev,1976: 476): "Inter rupibus in montibus Zeravcshanicis prope glaciem Zeravcshanicum, 16 VII 1927, № 354, V. Drobov" (LE!). – Alpine grassy places, rocky slopoes. *Distribution:* all districts [China, Central Asia, Siberia, Mongolia].

Poa litvinoviana consists of rigid and rough grayish-green plants with large spikelets, frequently tinged with purple. It is a widespread polymorphic species that differs from *P. glauca* in having a glabrous callus but is otherwise similar to that species in shape of spikelets and proportions between lemma and glumes. That is why we include them in aggr. *P. glauca*.

5. *Poa poophagorum* Bor, 1948, Kew Bull.3(1): 143.

Typus: "Sikkim: Temu La, 16000 ft., Rohmoo Lepcha 374" (K!). – Alpine screes, grassy places. *Distribution*: Nepal, Sikkim, M Yarlung Zangbo, Bhutan, Tangut, S Hengduan.

This species differs from the others in usually having a completely glabrous lemma, including its callus. Very rarely some short hairs may present on the base of keel or marginal veins.

Aggr. *P. albertii* (6 – 10)

This aggregate comprises 5 species that combine the features of *Poa attenuata* and *P. glauca* and are, for that reason, thought to be derived from hybrids between members of those two complexes. In the "*Flora of China"* (Zhu *et al.* 2016), these species were included in *P. albertii.* We consider the consistent differences among them, although slight, to indicate that they represent different lineages that merit recognition at the species level.

6. *Poa albertii* Regel, 1881, Acta Horti Petrop. 7: 611.

Lectotypus Tzvelev 1976: 474): Dschungarischer Alatau, 7000-8000 f., Aug 1878, A. Regel (LE!). – Alpine rocky and gravel slopes and steppes. *Distribution:* Wakhan, N. Pakistan, Jammu and Kashmir, W Nepal, Sikkim, Upper Yarlung Zangbo, Bhutan, Tangut [China, Central Asia, Siberia, Mongolia].

Moderately tufted plants with mostly extravaginal branching. Spikelets 3-4.5(5.5) mm, lemma glabrous between veins and with glabrous callus.

7. *Poa roemeri* Bor, 1979, Fl. Iranica 70:39.

Typus: "Afganistan, Wakhan-Distr., Mandaras-Tal, 4300 m, Feinsandige Stellen zwischen Moränan blöken Juli 1964 leg. H. Roemer. Nr. 222." Alpine grasslands and screes. *Distribution:* Wakhan [endemic].

Poa roemeri differs from other species in aggr. *P. albertii* by the characters shown in table 1 and in having thinner, more flexible leaves leaves and panicle branches, and narrower, sharper glumes. This is the only species in the complex that grows in the Pan

Table 2. Morphological difference between ***Poa arnoldii*** Melderis and ***P. mustangensis*** *Rajb.* according to protologs and K. Rajbhandari (1991)

N	Character	***P. arnoldii***	***P. mustangensis***
1	Culm	18–21 cm, smooth	7-16 cm., antrorsely scabrid
2	Leaf blades	5–6 cm x 1–1.8 mm, plate	3.5–4 cm x 0.5–1.2 mm
3	Ligule	2.2–3 mm	2.5–3.5 mm
4	Panicle	Oblong to ovate, 3.6–6.5 x 1–2.5 cm	2–4 x 0.4–1 cm
5	Branches	Spread	Ascending
6	Spikelets	4–7 mm, 2–3 florets	3.5–5 mm, 2–4 florets
7	Rachilla	Smooth	Hairy

Himalayas and it has a much narrower distribution than stated in the Flora of China (Zhu *et al*., 2006).

8. *P. arnoldii* Melderis 1978, in: Hara *et al.*, Enum. Fl. Pl. 1: 142.

Typus: "Nepal, west, 5 mi NE of Saipal, scree, 5600 m, 25 Aug 1954, Arnold 226." (BM!) – Alpine grasslands and screes. *Distribution:* W Nepal, M Yarlung Zangbo, Tangut, India (Uttarpradesh), China.

In the Flora of China (Zhu *et al.*, 2006) *P. mustangensis* was treated as a synonym of *P. arnoldii* because of their close similarity including the fact that both are viviparous. According to the protologues, *P. arnoldii* and *P. mustangensis* differ from each other mainly with shape of panicle (Table 2), a feature that often varies greatly within a plant during the course of one season. Field work in the summer of 2015 allowed us to observe multiple populations of viviparous bluegrasses that matched the description of *P. mustangensis.* The panicles of the plants in these populations were narrow and consistent at all stages of development. In addition, these plants were as robust and rigid as *P. glauca*, whereas *P. arnoldii* s.s. is more slender and flexible, even resembling species in other sections. For these reasons, and because the differences appear to be genetically fixed, we recognize *P. arnoldii* and *P. mustangensis* as distinct species that differ primarily in the shape of their panicles (see key).

9. *P. mustangensis* Rajb., 1988, Acta Phytotax. Geobot. 39: 61.

Typus: "Nepal, Mustang Distr., 4900 m, in open place, 25 Jul 1983, Rajbhandari 8352". - Alpine grasslands and screes.

Distribution: C Nepal, Sikkim, Bhutan [endemic].

See the discussion above for *P. arnoldii.*

10. *Poa lahulensis* Bor, 1948, Kew Bull. 1: 138.

Typus: "Lingti, Lahul, 12000 ft, 29 Jun 1941, N.L. Bor 15024. (K!) – Alpine grasslands and screes. *Distribution:* N Pakistan, Jammu and Kashmir, U Ganges and Indus, W Nepal, M Yarlung Zangbo, Tangut [endemic].

Poa lahulensis differs from the other species in aggr. *P. albertii* in the shape of the panicle and spikelets as well as in not being viviparous. It resembles some species of aggr. *P. versicolor* that are dwarfish when growing in the alpine zone. More material is needed before detailed research on its relationships can be conducted.

Key for identification of the dwarf bluegrasses of section *Stenopoa* in Pan-Himalayas

1a Panicles with viviparous spikelets ……..…. 2
1b Panicles without viviparous spikelets ……..…. 3
2a Panicle quite open, pyramidal, with 15 (20) spikelets …… ……..…… 8. ***P. arnoldii***
2b Panicle dense, spiciform, with more than (15) 20 spikelets …….. …….. 9. ***P. mustangensis***
3a Lemmas usually completely glabrous, occasionally with a few short hairs on the base of keel and marginal veins …… …….. 5 ***P. poophagorum***
3b Lemma distinctly pubescent on keel and marginal veins ……..… 4
4a Panicles contracted, densely ovoid to spiciform, branches up to 1 (–1.5) cm long, with crowded spikelets 3–4(–5) mm long; uppermost internode not more than 1 mm in diameter; blades firm in age, narrow, folded or enrolled. Plants pale or grayish-yellow; glumes and lemmas sometimes with purplish bands. …..…….. 5
4b Panicles sometimes quite open, branches up to 2 cm long, with moderately crowded sparse spikelets; spikelets (3.8) 4–5.5 (6) mm; uppermost internode sometimes 0.5–2 mm in diameter; blades withering folded or flat; plants green or glaucous, glumes and lemmas and vegetative parts strongly purplish …… 7
5a. Plants densely tufted; branching mostly intravaginal; leaf blades inrolled, 0.5–1 mm wide when flattened ……..……. 1 ***P. attenuata***
5b Plants moderately tufted; branching mostly extravaginal; leaf blades folded, 1—1.5 mm wide when flattened. ……..…… 6
6a Lemma glabrous between veins …….. 6 ***P. albertii***
6b Lemma pubescent between veins ……..……... 2. ***P. koelzii***
7a Callus webbed ……..……. 3 ***P. glauca***
7b Callus usually glabrous, occasionally with a few short hairs. ….. 8
8a Lemma glabrous between veins ……..…….. 4. ***P. litwinoviana***
8b Lemma pubescent between veins. …… 9
9a Spikelets 4–5 mm, purplish …….. 7. ***P. roemeri***
9b Spikelets 5–7.2 mm, green ……..……. 10. ***P. lahulensis***

CONCLUSIONS

Most of species dwarf species of Poa sect. *Stenopoa* considered in this paper are poorly represented in herbaria. Based on extensive work in the field and herbaria for the Flora of the Pan-Himalayas, we recommend recognition of 10 species. We divide these 10 species among 3 species aggregates, those named for *P. attenuata*, *P. glauca*, and *P. albertii*. On the basis of their morphology we hypothesize that members of aggr. *P. albertii* are derived from hybridization between members of the first two aggregates. One new combination – *Poa scabriculmis subsp. kunlunensis* (N.R. Cui) Olonova – is presented because it is

pertinent to the discussion. It is not included in the treatment because neither it, nor any other subspecies of *P. scabriculmis*, grow in the Pan-Himalayas. Further study is recommended, including additional examination of naturally occurring populations and cytological and molecular studies based on carefully identified specimens.

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