



Taxonomic reassessment of *Calamagrostis garhwalensis* (Poaceae: Agrostidinae)

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Abstract

Calamagrostis garhwalensis (Poaceae: Agrostidinae) described from northwestern India has been taxonomically controversial. The distinctiveness of this enigmatic and uncommon species is assessed and its taxonomic status partly clarified. Putative relationships among *C. garhwalensis* and its close relatives from northwestern India, such as *C. emodensis*, *C. gamblei*, *C. stolizkai* and the *C. pseudophragmites* complex are characterized with a morphometric analysis. The presence of rachilla extensions has been overstated as a diagnostic characteristic for *C. garhwalensis*. Specimens other than the type previously designated as *C. garhwalensis* belong in other species. New records of *C. garhwalensis* are reported from northwestern India and southwestern China.

Key words: *Calamagrostis emodensis*, *C. pseudophragmites*, China, Garhwal, Himalaya, India, taxonomy

Introduction

Recent progress has been made in the study of species complexes within *Calamagrostis* Adanson (1763: 31) and related genera (Poaceae: Agrostidinae) (Howard *et al.* 2009, Paszko & Nobis 2010, Paszko & Ma 2011, Paszko & Pendry 2013a, Paszko & Soreng 2013, Paszko *et al.* 2013, Paszko 2014). Recently, three new related species have been discovered (Paszko 2012a, Paszko & Pendry 2013b, Paszko & Chen 2013).

The following study of the taxonomic status of *Calamagrostis garhwalensis* Hubbard & Bor in Bor (1942: 355) is part of a revision of the widespread Eurasian *C. pseudophragmites* (Haller 1797: 11) Koeler (1802: 106) complex. The study so far has brought new insights into the relationships between relatives of this complex (Paszko 2012b, 2013). Here I review the taxonomic history of *C. garhwalensis*, report new records, characterize the morphological variation among *C. garhwalensis* and its close relatives, and present a brief taxonomic synopsis of the species. A group of selected specimens of the *C. pseudophragmites* complex is used to show differences between this group and its allies, such as *C. emodensis* Grisebach (1868: 80), *C. gamblei* Paszko (2012b: 327), *C. garhwalensis*, *C. macrolepis* Litvinov (1921: 125), and *C. stolizkai* Hooker (1896: 262).

Morphometric species delimitation

Herbarium specimens of *C. emodensis*, *C. gamblei*, *C. garhwalensis*, *C. stolizkai*, and the *C. pseudophragmites* complex were examined from the following herbaria: Herb. Inst. Bot. in Třeboň (Leoš Klimeš' herb.), BM, BSD, CAL, DD, E, GOET, K, LE, M, MICH, NY, P, PE, PH, S, US and W. Studied specimens of *C. gamblei* are listed in Paszko (2012a), *C. emodensis* and *C. pseudophragmites* in Paszko (2013), and *C. garhwalensis* and *C. stolizkai* in the Appendix. Twenty qualitative characters (including six derived characters) were scored (Table 1). Usually one complete spikelet per individual was sampled from the centre of the panicle. Statistica, version 8.0 (StatSoft, Inc., Tulsa, USA) was used to conduct the principal component analysis (PCA) and prepare the figures.

The PCA analysis was conducted with data from 206 specimens, including 51 of *C. emodensis* from China, N India, and Nepal, 17 of *C. gamblei* from NW India, eight of *C. garhwalensis* from NW India and China, 54 of *C. stolizkai* from NW India and N Pakistan, and 76 of the *C. pseudophragmites* complex from China, NW India, Nepal, Pakistan and Afghanistan.

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Appendix

Selected material studied:

- Calamagrostis emodensis***:—NEPAL. [**Rasuwa distr.**]: Langtang village, 1 August 1949, *Polunin 1522* (BM!).
- Calamagrostis garhwalensis***:—INDIA. **Uttarakhand**: [Dehradun distr.], NW Himalaya, Jaunsar distr., ‘Jakolani’, 2438 m, September 1898, *Gamble 27307* (CAL!, K!); Western Himalaya, Garhwal, Nelong via Mukba across the Damdar or Hat ka Tsaura Pass to Ussilla in the Tons Valley, 26 September to 6 October 1855, *Schlagintweit 9718* (LE!). **Jammu and Kashmir**: Sonamarg, 3048 m, 23 August 1921, *Stewart 6760* (NY!).—CHINA. **Sichuan**: Dujianyan Municipality (formerly Guan Xian), Qinglongzui near the side of Longwangmiao, along the Longxi River, 1750 m, 5 September 1988, *Boufford & Bartholomew 24612* (NY!).
- Calamagrostis macrolepis***:—PAKISTAN. [**Gilgit-Baltistan**]: Kashmir, Astor distr., Guohai Valley, 22 July 1892, *Duthie 12184* (CAL!, K!).—[COUNTRY UNKNOWN]: Himalaya bor occ., Kashmir, 29 September 1848, *Thomson s.n.* (K!).
- Calamagrostis pseudophragmites* complex**:—INDIA. [**Himachal Pradesh**]: Lahul, Kyelang, 3109 m, 19 July 1941, *Bor 15480* (DD!, K!).—PAKISTAN. [**Khyber-Pakhtunkhwa Province**]: Hazara distr., W Himalaya, Nuri, Kagan, 4 August 1899, *Inayat s.n.* (CAL!); Hazara distr., Kagan Valley, *Inayat 20310* (K!).
- Calamagrostis stoliczkae***:—INDIA. **Jammu and Kashmir**. [**Dras Vy**]: Gyama Tongdze, Rurig, 25 July 1933, *Koelz 6016* (MICH!); **Indus Vy**: Domkhar—Dha, Kanuri (Phatta River Valley, Hanu area), 3530–3730 m, 10 September 2006, *Klimeš 7056* (Klimeš herb.); **Suru**: Kanji Nullah at road junction to Kanji La, to Rangdum, 4080 m, 21 August 2003, *Klimeš 3172* (Klimeš herb.); Waka Nala Valley, the lowest part, 4020–4040 m, 4 September 2004, *Klimeš 4417* (Klimeš herb.); Itchu village to Lingber village, 3540–3580 m, 8 September 2004, *Klimeš 4525* (Klimeš herb.); Zuildo to Yumtum, 3960–3980 m, 22 August 2005, *Klimeš 5950* (Klimeš herb.); Yumtum village to Gulmatungo, 3990 m, 22 August 2005, *Klimeš 5958* (Klimeš herb.); Yumtum village to Gulmatungo, 3990–3960 m, 23 August 2005, *Klimeš 5972* (Klimeš herb.); Gulmatungo to Sanmodangsa, 3960–3920 m, 23 August 2005, *Klimeš 5976* (Klimeš herb.); Tongul, valley S of the village, 4160–4300 m, 27 August 2005, *Klimeš 6119* (Klimeš herb.); Tarangox village, 3340–3360 m, 28 August 2005, *6139* (Klimeš herb.). **Zanskar**: Zanskar, on Pensi-la, 3658–4572 m, *Stoliczka s.n.* (holotype K!, isotype CAL!); Tsarap, Tanz village to Phirtse La, 4300 m, 11 September 1998, *Klimeš 383* (Klimeš herb.); Tsarap, Surichun La to Kurgiakh, 4200–4260 m, 14 August 2004, *Klimeš 4047* (Klimeš herb.); Tsarap, Niri La, above Doksa, E of the pass, 4750–4790 m, 28 August 2004, *Klimeš 5185* (Klimeš herb.); Rangdum, 3048 m, 11 September 1931, *Koelz 2888* (NY!); Rangdum, 3048 m, 11 September 1931, *Koelz 2889* (NY!); Sarle, 5182 m, 21 September 1931, *Koelz 3008c* (NY!); Tankse, Tetha, 3962 m, 15–16 July 1933, *Koelz 5595* (MICH!); Tetha, 3962 m, 15–16 July 1933, *Koelz 5632* (MICH!); Tetha, 3962 m, 15–16 July 1933, *Koelz 5634* (MICH!, S!); Mune, 3658 m, 17–18 July 1933, *Koelz 5735* (MICH!); Bok, Pensi La, 5029 m, 22 July 1933, *Koelz 5833* (MICH!, S!).—PAKISTAN. **Gilgit-Baltistan**: Karakorum Mts., Hunza- and Nagar-Gebiet, Daintar, Matten, 3200–3900 m, 1959, *Lobbichler 138* (M!); Karakorum Mts., Hunza- and Nagar-Gebiet, Daintar, Kutto Darukusch, 1959, *Lobbichler 349* (M!); Karakorum, Khunjerab Mts, Khunjerab National Park, alpine Stufe des Tals ‘Dhee Sar’, 4150–4420 m, 10 June–10 August 1988, *Ebenhöh s.n.* (M!). [**Khyber-Pakhtunkhwa Province**]: Kashmir, above Doian, Astor Valley, 3048–3353 m, 14 August 1892, *Duthie s.n.* (K!).—[COUNTRY UNKNOWN]: Karakorum, 13 June 1954, ‘*Paffen*’ 157 (M!).