

## New species of Bhutanese *Yushania*

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**Abstract.** The species of the spreading temperate pachymorph-rhizomed genus *Yushania* from Bhutan are revised to describe a new species used for making arrows, to exclude a species that is no longer considered to occur in the country, to record the extended distribution of another species, and to provide names for two previously described species that were recorded under misapplied names.

**Keywords:** Bamboo, Himalayas

### INTRODUCTION

*Yushania* Keng f. is a large and widely distributed genus of temperate pachymorph-rhizomed bamboos, characterised by ebracteate, open, paniculate inflorescences with pulvinate branches, and relatively long rhizomes having a lengthy proximal section of extended internodes with rootless nodes, known as a long neck. This leads to a spreading habit with culms that can arise in a well-separated fashion or in small interconnected clumps and thickets. It was described (Keng 1957) specifically as a running genus, distinguished from other spreading genera by its pachymorph rather than leptomorph rhizomes.

Molecular phylogenetic studies (Wang et al. 2017, Ye et al. 2019) have resolved *Yushania* as a monophyletic group with 90 or more species (Zhang & Xia 2021), all having long-necked rhizomes. They occupy temperate montane habitats, either as a dense forest understorey or along watercourses in drier areas. After deforestation they may be browsed and grazed down to form extensive swards of stunted miniature plants, particularly well developed in the Pele La area of Central Bhutan, where *Y. microphylla* (Munro) R.B. Majumdar is the predominant species.

In the first enumeration of the bamboos of Bhutan (Stapleton 1994a), four species were included. Two well-known smaller species, *Yushania maling* (Gamble) R.B. Majumdar, and *Y. microphylla* had been described before, from Darjeeling in West Bengal and from Trashigang District in eastern Bhutan respectively. Two further, larger species, from western and eastern Bhutan were also included and later described (Stapleton 1994b; 2000). They had strong similarities to two poorly known bamboos, from the West Bengal/Sikkim/Bhutan tripoint on the Rechi La (now Rachel) and from Meghalaya, *Y. pantlingii* (Gamble) R.B. Majumdar and *Y. hirsuta* (Munro) R.B. Majumdar, respectively, and those names were tentatively applied, subject to further investigation.

A further species, *Y. yadongensis* T.P. Yi, similar to *Y. microphylla*, had recently been described from the Chumbi Valley in Tibet, and it was added later as a new record for Bhutan (Stapleton 1999), so that five species were included in the account for the Flora of Bhutan (Stapleton 2000).

### MATERIALS & METHODS

Further information on the *Yushania* species in Bhutan and India has since become available. Fieldwork across Bhutan on several different occasions has allowed better documentation of their characteristics. Information has also been obtained and shared online through both institutional websites and social media, allowing better national and international data sharing and collaboration.

It was widely known in Bhutan that a particular kind of bamboo made the best arrows for traditional archery, and that this bamboo was only found in a certain area of Central Bhutan (Gyelmo 2017). Therefore an in-depth investigation of the bamboos in that locality was undertaken. Consequently a new *Yushania* species was discovered. It is cultivated by local farmers specifically for use in arrow-making, having a very limited natural distribution, and is described below.

In addition, more information has become available outside Bhutan with regard to the characteristics and distribution of the two species from W. Bengal, Sikkim and Meghalaya—*Y. pantlingii* and *Y. hirsuta*. This has allowed a better comparison with the two Bhutanese bamboos that were previously described under those names, and better information on their own characteristics has also been obtained. They are consequently now considered to represent different species instead, and names are provided for them. *Y. pantlingii* itself has also now been located well within Bhutan, in Haa district. It was previously only recorded from the Rachel pass area, on the western border.

## NOMENCLATURE

***Yushania sagittifera*** S. Dorjee, sp. nov. Fig. 1. TYPE: Bhutan, Wangdue Phodrang, Jalla Tanka-Tsho, 27°22'9.96"N, 89°56'57.71"E, 2700m alt., 3 xi 2019, Sangay S02 (holotype THIM).

Similar to *Yushania maling*, but with smoother culm internodes.

Rhizome pachymorph; necks long, solid, without buds or roots; neck internodes solid, 0.5–2cm long. Culms very erect; length 6.3–7m, diam. 1.6–2cm, wall c. 0.5cm thick; nodes smooth with single nodal line; internodes 31–35cm long. Culm sheaths 30.5–35.5cm long, longer than internode, without blotches, with dense brownish spines, caducous, blade long, narrow, horizontal, ca. 6.6–8cm long, inner ligule short, oral setae erect, 1–1.2cm long. Branches 8–13 with dominant central, intravaginal, produced just above the nodal line, angled upward. Buds pointed, ca. 3cm long. Leaves 5–8 in number, 13.5–15cm long; hairs present underneath the leaf towards the base, with tessellate veins. Inflorescence unknown.

Etymology: *sagittifera* from the use of the culms for making arrows.

Distribution. The only natural locality known is in the Yangphu area of Wangdue Phodrang District, near Tanka-Tsho, above Jalla village, in evergreen broad-leaved forest at 2700m, where it is interspersed with the other 2 species described below. This natural population was scarce and declining, but cultivated plants were well established on the land of the majority of households in Jalla.

Uses. Cultivated and managed for smaller culms, to make traditional Bhutanese arrows of the highest quality. It is considered sacred because of a long association with arrow-making and the historic importance of archery in the defence of the country, but also because of the use of *changdha* and *tshedha* arrows for religious purposes.

Local name (Dz.): མདའ་མོ་གཡང་ཀམ་དེ་ལུ། (*damo-yangka dew*)

***Yushania punatsangensis*** Stapleton, sp. nov. Fig. 2. *Yushania hirsuta* sensu Stapleton non (Munro) R.B. Majumdar, in Stapleton 1994b: 52; 2000: 19. TYPE: Bhutan, Thimphu, Yosipang, 27°27'44"N 89°42'32"E, 2675m, 19 ix 1989, Stapleton 858 (holotype THIM).

Similar to *Yushania hirsuta* (Munro) R.B. Majumdar in its large auricles on the culm sheath and leaf sheath, with widely spreading oral setae, and to *Y. pantlingii* in its mainly glabrous culm sheaths, with a thick ring of short soft hairs at the base.

Rhizome pachymorph, necks long and solid. Culms to 8m tall; internodes to 40cm long and 3cm in diam, minutely

scabrous, with no wax, nodes slightly raised. Culm sheaths shorter than internode, very tough, apically broad, tinged red without blotches, proximally and distally glabrous, but centrally sparsely pilose at first, and bearing a broad, densely puberulous to sericeous basal band of short brown hairs around the node; margin long-ciliate to base; auricles large, spreading, falcate; oral setae c. 15 each side, to 12mm long, spreading; ligule short, pubescent; blade long, narrow, deflexed. Leaf sheaths glabrous or initially sparsely pilose; auricles large, falcate, spreading, dark; oral setae c. 10, to 6mm long, spreading, persistent; margin apically ciliate; ligule long, pubescent; exterior ligule shortly ciliate, blade linear-lanceolate, basally cuneate, to 12 x 1.5cm, adaxially glabrous, abaxially shortly pilose at first, margins sparsely setose, pseudopetiole abaxial densely short-pilose. Mid-culm branches initially 5-7. Inflorescence unknown.

Etymology: *punatsangensis* from Puna Tsang, a region of central Bhutan.

Distribution. Endemic to Bhutan, centred on the Punatsangchhu basin. Thimphu, Gasa, Punakha, and Wangdue Phodrang Districts, on damp sites in conifer and broad-leaved forest, 1800–2800m.

Additional specimens: Thimphu, Yosipang, 27°27'44"N 89°42'32"E, 2675m 8 ix 1985, Stapleton 401; Gasa, Bale La, 3000m, 13 xi 1988, Stapleton 806.

*Yushania punatsangensis* was conservatively included in *Y. hirsuta* in the initial enumeration (Stapleton 1994a), because they both have prominent falcate auricles with spreading oral setae. Inspection of *Y. hirsuta* at Elephant Falls in Meghalaya in 2000, and publication of improved illustrations and description from the same locality (Kumari & Singh 2010) confirmed that they are different species, and that *Y. hirsuta* has not been found in Bhutan. *Y. punatsangensis* now appears to be closer to *Y. pantlingii* (Gamble) R.B. Majumdar as described from Rachel, but it has larger, more prominent auricles and oral setae, deflexed culm sheath blades, and no ring of white wax below the culm nodes.

Local name (Dz.): ཧིམ། (*hima*)

***Yushania fimbriata*** Stapleton, sp. nov. Fig. 3. *Yushania pantlingii* sensu Stapleton non (Gamble) R.B. Majumdar, in Stapleton 1994b: 55; 2000: 20. TYPE: Bhutan, Trashigang, Rongthang, 1600m, 8 i 1987, Stapleton 431b (holotype THIM).

Similar to *Yushania pantlingii* (Gamble) R.B. Majumdar in having a ring of hairs at the base of the culm sheath, but with those hairs longer and often projecting downwards in a fimbriate ring, with sparse hairs on the rest of the culm sheath, fimbriate culm sheath margins, and with dark setaceous bristles on the culm internodes.

Rhizome pachymorph, necks long and solid. Culms to 8m; internodes densely scabrous to shortly white-setose, distally



**Figure 1.** *Yushania sagittifera*. **a.** Culm sheath, long and centrally hirsute. **b.** Mid-culm node with glabrous internode and upright hairs around culm sheath base. **c.** Culm sheath apex, narrow with few long erect oral setae and deflexed blade. **d.** Culm sheath apex interior view with short fimbriate ligule. **e.** Leaf sheath apex with few long erect oral setae. **f.** Leaf blade abaxial pilose around midrib base. Photos by Sangay Dorjee.



**Figure 2.** *Yushania punatsangensis*. **a.** Culm sheath short, mainly glabrous, with ciliate margins. **b.** Culm node with ring of short silky light hairs, internode and culm sheath base glabrous. **c.** Culm sheath apex with falcate auricles, many spreading oral setae, short puberulous ligule; internode with no wax. **d.** Older culm sheath with persistent auricles and reflexed blade. **e.** Leaf sheath apex with falcate auricles, many spreading oral setae. **f.** Older culm sheath, oral setae fallen, leaf blade abaxial initially lightly pilose. Photos by Chris Stapleton.



**Figure 3.** *Yushania fimbriata*. **a.** Culm sheath short, hirsute, with fimbriate margins. **b.** Culm node with fimbriate ring of long retrorse dark hairs, internode and culm sheath base setaceous. **c.** Culm sheath apex with reflexed blade, few oral setae, prominent marginal fringe. **d.** Shoot apex. **e.** Culm sheath apex with small auricles, tall ligule; internodes scabrous to setose. **f.** Leaf sheaths with erect oral setae, leaf blade abaxial initially lightly pilose. Photos by Chris Stapleton.

brown-setose, apically lightly waxy below node. Culm sheaths shorter than internode, quite tough, distally finely purple-spotted, margins long-ciliate, initially lightly appressed brown-setose, with prominent persistent basal fringe of long reflexed and deflexed red-brown hairs around the node; auricles small, rounded or triangular, scabrous; oral setae 3–6, to 2cm long, spreading or erect; ligule tall, c. 3mm, rounded, shortly pubescent, shortly fimbriate. Leaf sheath glabrous, tough, one margin initially long-ciliate; ligule short, truncate; auricles small, rounded; oral setae 6–12mm long, erect, basally scabrous; exterior ligule long-ciliate on one side or shortly ciliate on both sides; blade lanceolate, to 12 x 1.2cm, adaxially glabrous, abaxial sparsely pilose at first, pseudopetiole adaxially waxy, abaxially sparsely pilose. Mid-culm branches initially 5–7. Inflorescence unknown.

Etymology: *fimbriata* from the fringed culm sheath base and margins.

Distribution. Trongsa, Bumthang, Mongar and Trashigang Districts. Common in coniferous and broad-leaved forest, 1700–2600m. Possibly endemic to Bhutan, but it is not known whether distribution extends to Arunachal Pradesh.

Additional specimens: Trongsa, Chendebji, 2500m 4 i 1987, Stapleton 427.

Local name (Keng.): རྩོམ་ལོ་ (zing)

*Yushania fimbriata* was conservatively included in *Y. pantlingii* in the initial enumeration (Stapleton 1994a), as

they share a prominent ring of hairs at the culm sheath base and lack falcate auricles, but discovery of a distinct species of *Yushania* in SW Haa district, with characters seen in the type specimen of *Y. pantlingii* and in images from Rachel, but absent in *Y. fimbriata*, has confirmed that they are different species.

## DISCUSSION

This brings the total number of *Yushania* species for Bhutan to seven, keyed out below. *Y. sagittifera* and *Y. punatsangensis* are most likely to be endemic to Bhutan, while *Y. fimbriata* is possibly also endemic. These species are most easily distinguished by the distinctive characteristics of their culm nodal area and culm sheath bases, which are compared and contrasted for all seven species in Fig. 4.

High quality traditional bamboo arrows are increasingly valued on international markets as well as within Bhutan, and there is potential for expansion of growth and arrow production. *Yushania* species all have horticultural potential, several species already being in cultivation in the west. Their moderate size and reduced spreading ability in cooler and drier summer conditions, along with dense, lush foliage make them good choices for screening and specimen planting.

### Key 1: *Yushania* species recorded in Bhutan

- 1. Rhizome neck hollow ..... 2
  - + Rhizome neck solid ..... 3
- 2. Leaf sheath auricles small; oral setae spreading ..... *Y. microphylla*
  - + Leaf sheath auricles absent; oral setae erect ..... *Y. yadongensis*
- 3. Base of new culm sheath glabrous, or with sparse or deciduous hairs ..... 4
  - + Base of new culm sheath with prominent, persistent hairs ..... 5
- 4. Culm internodes rough with scabrid points ..... *Y. maling*
  - + Culm internodes smooth with no scabrid points ..... *Y. sagittifera*
- 5. Culm sheath with basal ring of fringed hairs, rest of culm sheath partially hairy ..... *Y. fimbriata*
  - + Culm sheath with basal band of short soft hairs, rest of culm sheath glabrous ..... 6
- 6. Auricles large; oral setae spreading widely, no wax below nodes ..... *Y. punatsangensis*
  - + Auricles small or variable, oral setae variable, white wax below nodes ..... *Y. pantlingii*



**Figure 4.** Culm sheaths and nodes of Bhutanese *Yushania* species. **a.** *Yushania maling*. **b.** *Yushania sagittifera*. **c.** *Yushania microphylla*. **d.** *Yushania yadongensis*. **e.** *Yushania pantlingii*. **f.** *Yushania punatsangensis*. **g.** *Yushania fimbriata*. Photos a, c, d, f & g by Chris Stapleton, b & e by Sangay Dorjee.

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