



Anthoxanthum monticola (Bigelow) Veldkamp [Poaceae]: A new record for India

Manish K. Kandwal^{1,4}, Sandeep Tambe² and G. S. Rawat³

¹Botanical Survey of India, Botanic Garden of Indian Republic, Noida 201303 Uttar Pradesh, India

²Indian institute of Forest management, Bhopal 462003, Madhya Pradesh, India

³Wildlife Institute of India, Chandrabani, Dehradun, 248001, Uttarakhand, India

⁴Communicating author, e-Mail: zoysia04@gmail.com

Abstract

Anthoxanthum monticola (Bigelow) Veldkamp, (Poaceae), an alpine grass is reported here for the first time from two different localities in India. A detailed description, key to species in India, illustration, and photographs are provided for easy identification of the species.

Key words: *Anthoxanthum*, *Hierochloe*, Poaceae, Arunachal Pradesh, Sikkim, India, New record

The genus *Anthoxanthum* L. of the tribe *Aveneae* Dumort of Poaceae, characterized by coumarin scented plants, is represented by about 50 species in the world (Zu *et al.* 2006). It is distributed worldwide especially in temperate and alpine meadows, open grasslands and marshy places (Clayton & Renvoize 1986; Zu *et al.* 2006). In India the genus is represented by 8 species, *viz.*, *A. borii* Jain & Pal, *A. clarkei* (Hook.f.) Ohwi, *A. hookeri* (Griseb.) Rendle, *A. sikkimensis* (Maxim.) Ohwi and *A. odoratum* L., *A. khasianum* (C.B. Clarke) Ohwi, *A. laxum* (Hook.f.) Veldkamp, *A. flexuosum* (Hook.f.) Veldkamp. *Anthoxanthum borii* is endemic to South India while *A. odoratum* is an introduced species, also found as an escape. The other six species are distributed all along the Himalayan region (Mitra 1958; Bor 1960; Karthikeyan *et al.* 1989).

The genus *Anthoxanthum* has been separated from *Hierochloë* R.Br. by having two basal sterile, epaleate and geniculate awned lower florets. The genus *Hierochloe* is characterized by the absence of lodicules, presence of stamens in two lower florets, presence of palea and short awns or sometimes awnless. However, a number of species are intermediate in these characters (Zu *et al.* 2006) where the sex of the lower florets is variable within the species. *Hierochloe* has been treated as a separate genus by previous workers in India (Bor 1960; Karthikeyan *et al.* 1989; Shukla 1996; Clayton *et al.* 2006; Kandwal & Gupta 2009).

During the exploration of grasses in the Himalayan region, the authors came across some interesting specimens collected from two different localities in the Eastern Himalaya. Critical study of the specimens followed by scrutiny of literature (Bor 1960; Clayton & Renvoize 1986; Shukla 1996; Zu *et al.* 2006) reveals that they belong to genus *Anthoxanthum*. On further study, these specimens were identified as *Anthoxanthum monticola*. It is a dwarf species characterized by 4 – 7 mm long awn on second bifid lemma, and 3 mm long awn on first lemma. The species, is so far reported from alpine meadows of China, Japan, Korea, Mongolia, Russia, North Europe and North America (Clayton *et al.* 2006; Zu *et al.* 2006). It is not recorded from India (Hooker 1897; Bor 1940, 1960; Hara 1966, 1971; Deb 1983; Shukla 1996; Noltie 2000; Chowdhery *et al.* 2009; Kandwal & Gupta 2009). Hence it is reported here for the first time from India along with its key to species found in India, description, field photo and illustration to aid identification in the field (Figures 1 & 2).

Key to the species in India (including *Hierochloe*):

- 1a. Lower floret both sterile, epaleate (*Anthoxanthum*)..... 2
 1b. Lower floret staminate, paleate (*Hierochloe*) 6
 2a. Perennial; upper glume mucronate; anthers 3..... ***A. sikkimense***
 2b. Annual; upper glume not mucronate; anthers 2 (3 in *A. borii*)..... 3
 3a. Leaves non aromatic; lower glume elliptic ***A. hookeri***
 3b. Leaves aromatic; lower glumes lanceolate or oblong 4
 4a. Rhizome absent; awns of the spikelets projecting 2 mm or less beyond the tip of the spikelets
 ***A. odoratum***
 4b. Rhizome elongated; awn projection much more than 2 mm beyond the tip of the spikelet ...5
 5a. Inflorescence contracted, lanceolate to oblong; leaves linear lanceolate, up to 10mm broad,
 spikelet 6.5 mm long, on short hairy pedicels; second lemma awned from the back, 5 mm long;
 third lemma 3 mm long ***A. borii***
 5b. Inflorescence spiciform; leaves linear, up to 5 mm broad; spikelet 5.5 mm long, on glabrous
 pedicels; second lemma 5.5 mm long; third lemma 3.5 mm long ***A. clarkie***
 6a. Spikelet 3 -3.5 mm long; basal floret barren without significant palea ***A. khasianum***
 6b. Spikelet 4 -7 mm long; basal floret male with palea 7
 7a. Inflorescence contracted; leaves less than 2 mm wide; basal floret dissimilar ***A. monticola***
 7b. Inflorescence lax; leaves more than 2 mm wide 8
 8a. Rhizome present, elongate; leaves aromatic, glumes gaping ***A. laxum***
 8b. Rhizome absent, leaves non aromatic, glumes parallel ***A. flexuosum***

Anthoxanthum monticola (Bigelow) Veldkamp, Blumea 30: 347. 1985; Zu et al, in Fl. China, Poaceae. 22: 338. 2006. *Holcus monticola* Bigelow, New Engl. J. Med. & Surg. 5: 334.1896; *Hierochloe alpina* (Sw. ex Willd.) Roem. & Schult., Syst. Veg. 2: 515. 1817. *Holcus alpinus* Sw. ex Willd., Sp. Pl., ed.4 [Willdenow] 4(2): 937. 1806.

Rhizomatous perennials, rhizomes short. Culms solitary or few, erect, 20–40 cm tall. Leaf-sheaths glabrous on surface, striate, longer than or equal to internodes. Ligules aciliate and membranous, 1 – 2 mm long. Leaf blades flat, 10 – 25 cm long, 1 – 4 mm wide, aromatic. Lamina glabrous or minutely scabrous. Inflorescence a contracted panicle, oblong or ovate in outline, 3 – 6 cm long, 1 – 2 cm wide with short branches, sometimes nodding. Spikelets 3-flowered, solitary, pedicelate, oblong, laterally compressed, 5 – 6 mm long; 2 basal florets sterile, 1 upper floret fertile, rhachilla not produced. Glumes 5 – 6 mm long, subequal, as long as spikelet, thinner than fertile lemma. Lower glumes ovate, 5 – 6 mm long, membranous, 3-nerved, 1-keeled, apex acute. Upper glume ovate, 5 – 6 mm long, membranous, 3-nerved, 1-keeled, apex acute. Basal sterile florets dissimilar; male florets paleate. Lower lemma elliptic, 5 mm long, chartaceous, 1-keeled, 5-nerved, pubescent, dentate, 2-fid, awned, margins and keel hairy; awn 1 – 3 mm long. Palea, linear, ca 4 mm long, 2-nerved, 2-fid, 2-keeled, keels hairy on upper half. Second lemma oblong, equal to lower lemma in size, chartaceous, pubescent, 2-lobed, obtuse, margins and keels hairy, awned. Awn weakly geniculate, scabrid, 5 – 7 mm long. Palea similar to palea of lower lemma. Fertile (upper) lemma ovate, ca 4 mm long, cartilaginous, without keel. Surface densely hairy above, margins convolute, apex acute. Palea elliptic, 1–nerved, without keels. Anthers 2, or 3, 1.5 – 2 mm long. Ovary glabrous.

Flowering & Fruiting: June – August.

Habitat: Alpine moist meadows, 3000 – 4500 m.

Distribution: India (Eastern Himalaya); NE China, Japan, Korea, Mongolia, Russia, North Europe, North America.



Figure 1. *Anthoxanthum monticola* (Bigelow) Veldkamp : A. Habit; B. Close-up of inflorescence

Specimens examined: India: Arunachal Pradesh, Tawang District, PT Tso lake, 9 July 2012, *M. K. Kandwal* 37148 (ARUN); Sangester Lake, 3000 m, 9 July 2012, *M. K. Kandwal* 37147 (ARUN). Sikkim, Khangchendzonga National Park, Arralongchak area, 4150 m, 26.07. 2005, *Sandeep Tambe* 32483 (WII).

Acknowledgements

Senior author (MKK) is grateful to the Director, Botanical Survey of India, Kolkata for providing necessary facilities during the present work and to the Indian Army, Indian Tibet border police and district authorities of Tawang district, Arunachal Pradesh for providing logistic support during the exploration work in the state.

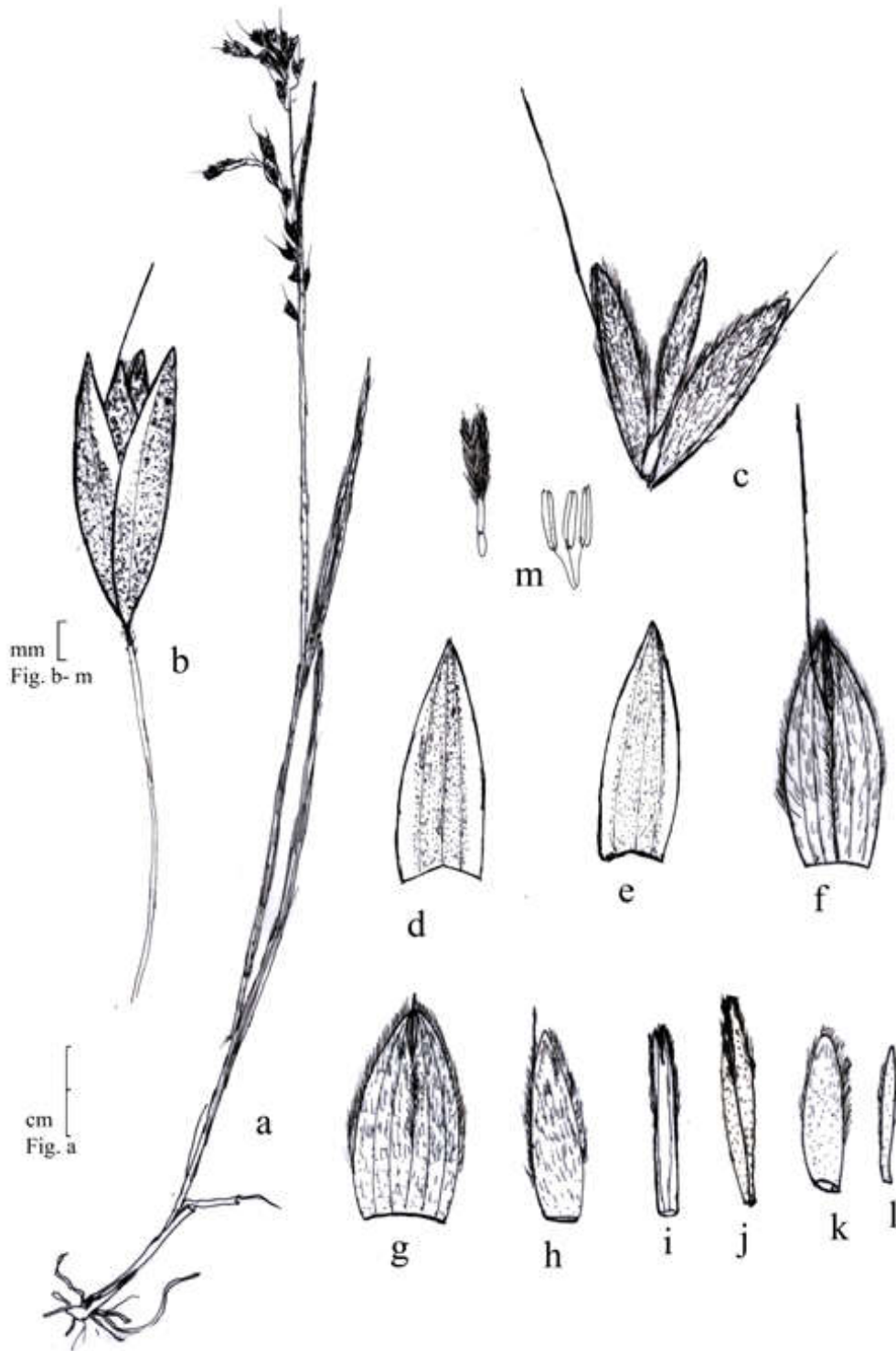


Figure 2. *Anthoxanthum monticola* (Bigelow) Veldkamp: a. Habit; b. Spikelets; c. Floret; d. Lower glume; e. Upper glume; f. Second lemma; g. - h. Second lemma (Dorsal and sideview); i - j. Palea of first lemma; k. Third lemma; l. Palea of third lemma; m. Stamens and pistil.

LITERATURE CITED

- Bor, N.L. 1940. *Flora of Assam*, Vol. V. Gramineae. Calcutta.
- Bor, N.L. 1960. *The Grasses of Burma, Ceylon, India and Pakistan*. Pergamon Press, London.
- Chowdhery, H.J.; Giri, G.S.; Pal, G.D.; Pramanik, A. & Das, S.K. 2009. *Materials for the flora of Arunachal Pradesh (Hydrocharitaceae - Poaceae)*, Vol. 3. Botanical Survey of India, Kolkata.
- Clayton, W.D. & Renvoize, S.A. 1986. *Genera Graminum*. HMSO Publications, London.
- Clayton, W.D.; Vorontsova, M.S.; Harman, K.T. & Willioamson, H. (2006 onwards) Grass base – The online world Grass Flora [Http://www.Kew.org/data/grasses](http://www.Kew.org/data/grasses).
- Deb, D.B. 1983. *The Flora of Tripura State Vol II (Buddlejaceae- Gramineae)*. Today and Tomorrow Printers and Publishers. New Delhi.
- Hara, H. 1966. *The Flora of Eastern Himalaya*, First Report. The University of Tokyo Press, Japan.
- Hara, H. 1971. *The Flora of Eastern Himalaya*, Second Report. The University of Tokyo Press, Japan.
- Hooker, J.D. 1897. *Flora of British India*, Vol.7. L. Reeve & Co., London.
- Kandwal, M. K. & Gupta, B.K. 2009. An update to grass flora of Uttarakhand. *Ind. Jour. For.* 32: 657 – 668.
- Karthikeyan, S.; Jain, S.K.; Nayar, M.P. & M. Sanjappa. 1989. *Fl. Ind., Enum. - Monocot.* Botanical Survey of India, Calcutta, India. .
- Mitra, J.N. 1958. *Flowering plants of Eastern India*. Vol. I. *Monocotyledons*, World press Pvt. Ltd., Calcutta.
- Noltie, H.J. 2000. *The Grasses of Bhutan* In *Flora of Bhutan* Vol. 3(2). Royal Botanic Garden Edinburg & Royal Government of Bhutan.
- Shukla, U. 1996. *Grasses of North-Eastern India*. Scientific Publishers, Jodhpur.
- Zu Y.M.; Zhenlan, W.; Shenglian, L.; Shou-liang, C.; Wenli C. & Phillips S.M. 2006. Tribe Aveneae. In: W. Zhengyi, P.H. Raven, H. Deyuan (eds.), *Flora of China – Poaceae*. Vol. 22. Science Press and Missouri Botanical Garden, Beijing and St. Louis.