

CHAPTER 25

Morphological Variations in Creeping Bluestem Grass in India

P. R. Mane,^{a, c} J. Swamy,^{b*} G. G. Potdar^c & C. B. Salunkhe^a

^a*Department of Botany, Krishna Mahavidyalaya, Rethare BK, Satara 415108, Maharashtra, India*

^b*Botanical Survey of India, Acharya Jagadish Chandra Bose Indian Botanic Garden, Howrah 711103, West Bengal, India*

^c*Department of Botany, Yashwantrao Chavan College of Science, Karad 415124, Maharashtra, India*

Corresponding author Email: swamy.2706@gmail.com

Received: 27 October 2024; Received in revised form: 18 November 2024; Accepted: 26 November 2024; Available online: 03 December 2024

Introduction

The genus *Bothriochloa* belongs to the family Poaceae (tribe Andropogoneae). It is a morphologically diverse and taxonomically complicated genus (Sanchez-Ken and Clark, 2010) and the genus is recognised by its translucent median channel on the pedicels of the spikelets and joints of the racemes, arrangement of racemes on its central axis of the inflorescence. Each raceme has above eight joints and the whole basal raceme disarticulates as a single unit with its secondary branches. The lower glumes of both i.e. sessile and pedicelled spikelets are pitted or not (Bor, 1960; Watson and Dallwitz,

This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/). This allows re-distribution and re-use of a licensed work on the condition that the author is appropriately credited and the original work is properly cited.

Interdisciplinary Research in Life Sciences: A Path Towards Sustainability (Vol. 2) - Jayvardhan V. Balkhande & Jalander Vaghmare (Eds.)

ISBN: 978-93-95369-81-7 | © 2024 Advent Publishing. All rights reserved.

<https://doi.org/10.5281/zenodo.14268141>

1992; Vega, 2000; Clayton et al., 2006; Neamsuvan et al., 2009; Mane et al., 2024).

The genus *Bothriochloa* Kuntze is a cosmopolitan. This genus represented by 38 species worldwide (POWO, 2024; Mane et al., 2022, 2024) and 13 species in India, of which 06 species are endemic: *B. compressa* (Hook.f.) Henrard, *B. ensiformis* (Hook.f.) Henrard, *B. grahamii* (Haines) Bor, *B. jainii* Deshp. & Hemadri, *B. longifolia* (Hack.) Bor and *B. woodrovii* (Hook.f.) A. Camus (Prasanna et al., 2020; Kellogg et al., 2020; Mane et al., 2022, 2024).

Material and Methods

The exploratory investigations for the present study were undertaken during the years 2019-2024. Regular field tours were undertaken to cover all the states of the country. During field studies each and every plant was collected in quadruplicate at the time of flowering and/or fruiting stages of plant growth. All the collected specimens were labelled with field numbers and herbarium was prepared (Jain and Rao, 1977). After preparation of herbarium, the detailed study of the specimens and their identification were done in the Department of Botany, Krishna Mahavidyalaya, Rethare BK and Yashwantrao Chavan College of Science, Karad, with the help of various Indian floras such as, Grasses of Burma, Ceylon, India and Pakistan (Bor, 1960), Grasses of Kerala (Sreekumar and Nair, 1991), Flora of Tamil Nadu – Grasses (Kabeer and Nair, 2009), Grasses of Maharashtra (Potdar et al., 2012) etc. Further, detailed revisions (Deshpande, 1984) and relevant taxonomic papers were consulted wherever required. After identification of the specimens, further confirmed by comparing them with the authentic specimens available at CAL, BSI, BSA, BLATT, BSID, MH, SUK, BSJO, etc.

Result and Discussion

Every specimen was carefully studied by dissecting the floral parts of the duplicate specimens under dissection and stereo microscopes and measurements have been taken for each part of the specimens. Micro photographs of each species were captured for further preparation of photo plates. Several literature including floras, revisionary studies and recently published research articles have been consulted for the identification of the dissected specimens. The variation in the habit, inflorescence and floral parts have been observed while studying the specimens from various localities of different states. The detailed description was made and the variations of the *Bothriochloa insculpta* (Hochst. ex A. Rich.) A. Camus species has discussed in conclusion based on the fresh gatherings and also information collected from the specimens deposited in country's numerous herbaria.

Taxonomic Description

Bothriochloa insculpta (Hochst. ex A.Rich.) A.Camus in Ann. Soc. Linn. Lyon Ser. 2, 76: 165. 1931; Grasses Burma, Ceylon, India & Pakistan 107. 1960; Karthik. et al., Fl. Ind. Enum. Monocot. 189. 1989; Bhattacharya (S. Moulik), Grasses Bamboos India 1: 266. 1997; Prasanna et al., Poaceae in A. A. Mao & S. S. Dash (eds.) Fl. Pl. India Annot. Checkl. Monocot. 327. 2020. *Andropogon insculptus* Hochst. ex A. Rich., Tent. Fl. Abyss. 2: 458. 1851. *A. pertusus* (L.) Willd. var. *insculptus* (Hochst. ex A. Rich.) Hack. in A. DC. & C.DC., Monogr. Phan. 6: 482. 1889; Hook.f., Fl. Brit. India 7: 174.1896. *Amphilophis insculpta* (Hochst. ex A.Rich.) Stapf in Prain, Fl. Trop. Africa 9 (1): 176. 1917. *Dichanthium insculptum* (Hochst.

ex A. Rich.) Clayton in Kew Bull. 32 (1): 3.1977. *Bothriochloa parameswaranii* Sreek., Malathi & V.J.Nair, J. Bombay Nat. Hist. Soc. 85: 163. 1988.

Perennials. Culms tufted, erect to decumbent, (10) 25 – 80 (200) cm high, smooth; nodes bearded, whitish, at times glabrous. Leaf blade usually basal, linear-lanceolate, 3 – 12 × 0.3 – 0.5 cm, acuminate to attenuate, cartilaginous and serrulate at margins, midnerve prominent, sparsely tuberculate hairy, slightly aromatic when fresh; ligule 1 – 1.2 mm long, membranous with fimbriae hairs at the apex; leaf sheath 3 – 5 cm long, terete to keeled, sparsely tuberculate hairy towards base, mouth sparsely bearded. Inflorescence of 1 – 6 (9) digitate to sub-digitate (1) 3 – 10 cm long racemes, nodes hairy; peduncle 5 – 25 cm long, smooth. Spikelets two together, one sessile which is fertile and other pedicelled, purplish green, at times dark purple; joints and pedicels similar, 1.5 – 2.5 mm long, solid, with median translucent furrow at times appearing as a dark purple line, hairy along margins; hairs 0.8 – 1.2 mm long; entire spikelet disarticulating from joints and pedicels; callus bearded 0.8 – 1.2 mm long. Sessile spikelet oblong to ovate-lanceolate, acuminate, awned, chartaceous, yellowish green to purplish at maturity. Lower glume oblong-lanceolate, 3 – 3.5 × 0.9 – 1.2 mm, glabrous, acute to acuminate, chartaceous, 9 – 11-nerved; 2-keeled above middle and inrolled below, keel pectinate to scabrid, 1-pitted, greenish yellow to purplish. Upper glume ovate-lanceolate, 3 – 4 × 0.8 – 1 mm, acuminate, boat shaped, margins infolded and ciliate above middle, chartaceous, 3-nerved, greenish yellow. Lower lemma oblong to lanceolate, 2.8 – 3 × 0.7 – 0.8 mm, acute to obtuse, membranous, hyaline, nerveless. Upper lemma hyaline, abridged to base of awn, 1.5 – 2 × 0.2 – 0.3 mm; awn geniculate, column 6 – 8 mm long, twisted, ciliolate, rufous, bristle 3 – 8 mm long, barbellate. Lodicules 0.2 – 0.3 mm long, membranous, hyaline. Stamens 3; anthers 1.5 – 2.2 mm long, brownish; filaments 0.3 – 0.6 mm long, hyaline to brownish. Ovary oblong, 0.8 – 1 mm long, acute, brown; style 1.3 – 1.5 mm long, brown; stigma plumose, 1.5 – 2 mm long, brownish. Caryopsis oblong-elliptic to oblanceolate, 2 – 2.5 × 0.5 – 0.7 mm, acute, brownish. Pedicelled spikelet ovate-lanceolate, 3.5 – 4 mm long, acuminate, unawned, 2 (3)-pitted, greenish, at times purplish; pedicel, 0.4 – 6 mm long. Lower glume oblong to elliptic-lanceolate, 3.5 – 4 × 0.8 – 1 mm, acute to acuminate, chartaceous, greenish, prominently many (13) nerved, 2-keeled; keels serrate, narrowly winged, 2 (3)-pitted; pits not clearly visible when young. Upper glume ovate to oblong-lanceolate, 3.7 – 4 × 0.6 – 0.8 mm, acuminate, chartaceous, 3-nerved, greenish, margins infolded and ciliate. Lower lemma oblong to lanceolate, 2.5 – 3 × 0.6 – 0.8 mm, acute to obtuse, membranous, hyaline, nerveless. Stamens 3, at times absent; anthers 1.3 – 2 mm long, brownish.

Flowering and Fruiting: October-January.

Habitat: Occasional in meadows, along the field bunds, road sides, on rock surfaces and on the slopes of foot hills up to 2200 m.

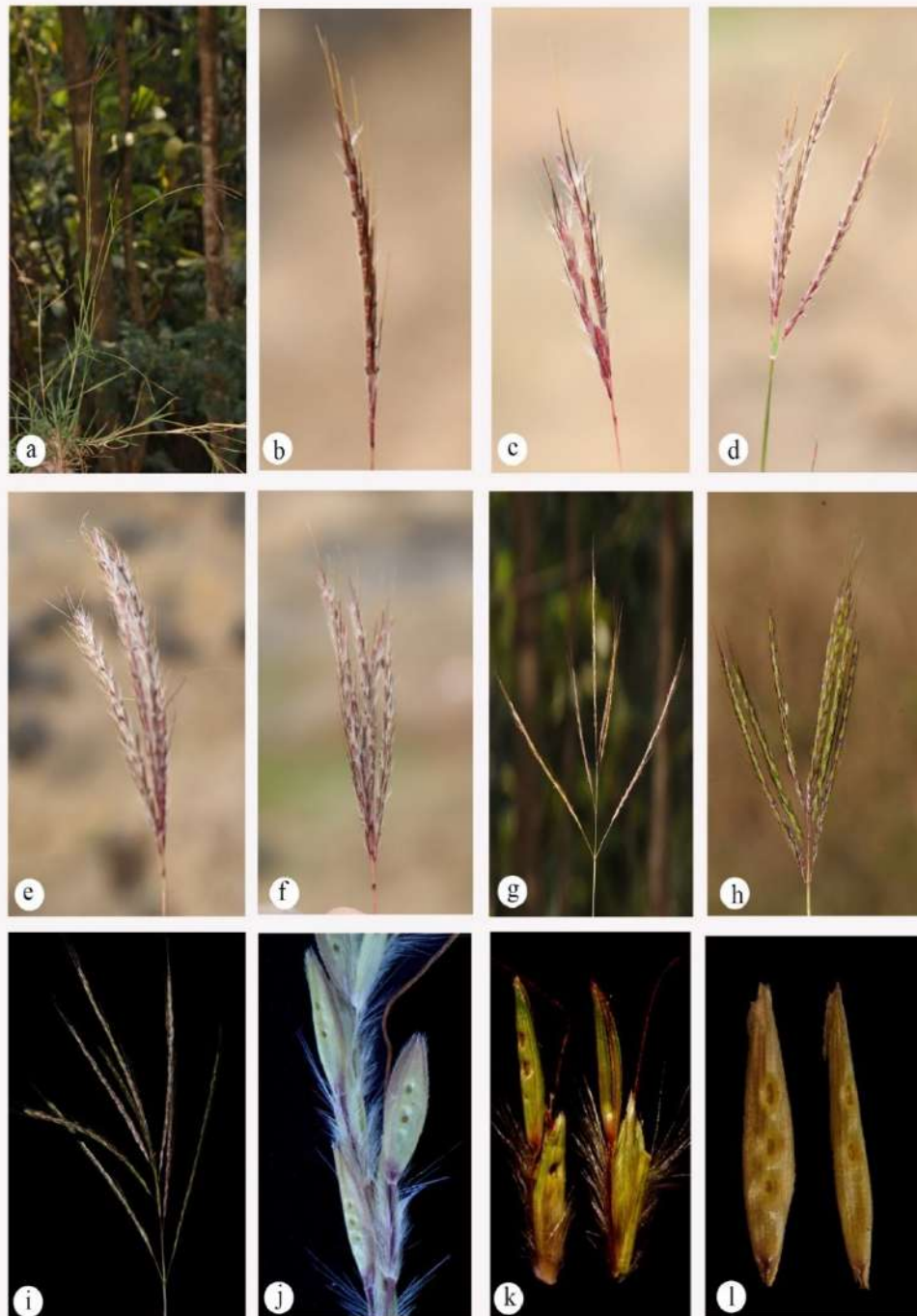


Fig. 1. *Bothriochloa insculpta* (Hochst. ex A.Rich.) A.Camus : a. Habit; b-i. Variation in inflorescence; j. Portion of raceme depicting the pits on the spikelets; k. Pair of spikelets; l. Two and three pits on the pedicelled spikelets.

Chromosome number: n=30 (de Wet, 1954).

Distribution: Bihar, Jharkhand, Karnataka, Kerala, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Telangana and Uttarakhand (Prasanna *et al.*, 2020; Swamy *et al.*, 2021).

Conclusion

Bothriochloa insculpta (Hochst. ex A.Rich.) A.Camus is allied and often confused with *Bothriochloa pertusa* (L.) A.Camus by its habit and also fairly similar to *Bothriochloa kuntzeana* (Hack.) Henrard but it can be easily recognised from former species by its 2 – 3 pitted or glandular depressions on pedicelled spikelets and the from the later species, it can be easily distinguished by its 3-8 number of racemes (vs 9 – 15 number of racemes) and 2 – 3 pitted pedicelled spikelets (vs slit like pitted or not pedicelled spikelets). *Bothriochloa parameswaranii* Sreek., Malathi & V.J.Nair was collected from Eravikulam National Park, Idukki district of Kerala by P.V. Sreekumar in 1981 and later it was compared with *Bothriochloa kuntzeana* (Hack.) Henrard and published by Sreekumar and his associates in 1988. During the filed exploration to the type locality and the consultation of type specimens at CAL and MH revealed that the species is conspecific to *Bothriochloa insculpta* (Hochst. ex A.Rich.) A.Camus, hence it is treated under the synonym of *Bothriochloa insculpta*.

Usually, the range of culms height are 25-80 cm but 10 cm and 200 cm height of culms with inflorescence was observed at district of Pune, Maharashtra and Amrabad Tiger Reserve of Telangana, respectively. Nodes commonly consist of hairs in young stage, becoming glabrescent at maturity but on the fresh collections made from the Ooty area of Tamil Nadu revealed that they are devoid of hairs on nodes. Inflorescence composed of greenish racemes but dark purple racemes were observed from Eravikulam National Park, Idukki district of Kerala and Nilgiri Biosphere Reserve of Tamil Nadu. Single raceme (Fig. 1 b) per inflorescence was observed from Kinnerasani Wildlife Sanctuary of Telangana and one and five racemes (Fig. 1 b-f) per inflorescence observed from Pune districts of Maharashtra and nine racemes (Fig. 1 i) per inflorescence was observed at Nagarkurnool district, Telangana state. The specimens examined at CAL, MH, BSID, BSI, BSA, BSJO, BLATT, SUK, etc. revealed that 3-8 racemes (Fig. 3d-h) per the inflorescence were observed from the collections made in various parts of India. Lower glume of pedicelled spikelet is usually 2-pitted (Fig. 1 j-k) but 3-4 pitted (Fig. 3i) pedicelled spikelets were observed from the collections made from Harithavanam of Adilabad district, Telangana and Nilgiri Biosphere Reserve and Palani hills of Tamil Nadu during our field tours.

Acknowledgements

The authors are grateful to the Director, Botanical Survey of India (BSI), Kolkata and the Scientist in-charge of Acharya Jagadish Chandra Bose Indian Botanic Garden, as well as the curators/heads of various herbaria including CAL, MH, BLAT, BSI, BSID, BSA, BSJO and SUK, for their invaluable support, resources and facilities.

References

- Bor, N.L. (1960). *The Grasses of Burma, Ceylon, India and Pakistan (excluding Bambuseae)*. Pergamon Press, London.
- Clayton, W.D., Vorontsova, M.S., Harman, K.T. and Williamson, H. (2006 onwards). GrassBase - The Online World Grass Flora. <http://www.kew.org/data/grasses-db.html>.
- de Wet, J. M. J. (1954). Chromosome numbers of a few South African grasses. *Cytologia* 19: 97–103.
- Deshpande, U. R. (1984). Poaceae: Tribe Andropogoneae. *Fascicle Flora. India* 15: 1-30. Botanical Survey of India, Calcutta.
- Jain, S. K. and Rao, R. R. (1977). *Hand Book of Field and Herbarium Methods*. New Delhi.
- Kabeer, K.A.A. and V.J. Nair (2009). *Flora of Tamil Nadu – Grasses*. Botanical Survey of India, Kolkata.
- Kellogg, E.A., J. R. Abbott, B. K. S. Kamaljit, K. N. Gandhi, B. R. Kailash, K. N. Ganeshaiyah, U. B. Shrestha and P. Raven (2020). Checklist of the grasses of India. *Phytokeys* 163: 1–560.
- Mane, P. R., J. Swamy, C.B. Salunkhe, and G.G. Potdar (2022). *Bothriochloa ischaemum* (Poaceae: Andropogoneae): An addition to the flora of eastern ghats, India. *Journal of Indian Botanical Society*. 102 (1): 87-90. <https://doi.org/10.5958/2455-7218.2022.00014.6>
- Mane, P.R., J. Swamy, S.P. Panda, P.K. Kamila, V.K. Mastakar, G.G. Potdar and C.B. Salunkhe (2024). The genus *Bothriochloa* (Poaceae: Andropogoneae) in Odisha: with an addition of species *Bothriochloa kuntzeana* (Hack.) Henrard. *Vegetos* <https://doi.org/10.1007/s42535-024-00913-4>
- Neamsuvan, O., Seelanan, T. and Veldkamp, J.F. (2009) A revision of the genus *Bothriochloa* (Poaceae) in Thailand. *The Gardens' Bulletin Singapore* 61: 129-143.
- Potdar, G.G., C.B. Salunkhe and S.R. Yadav (2012). *Grasses of Maharashtra*. Shivaji University Press, Kolhapur.
- POWO (2024). *Plants of the World Online*. Facilitated by the Royal Botanic Gardens, Kew. Available at: <http://www.plantsoftheworldonline.org/> (Accessed on 10.09.2024).
- Prasanna, P.V., Chowdhury, S.D., Arumugam, S., Vivek, C.P., Chorgha, A., Sutrishna, K. and Prasad. K., 2020. Poaceae (Gramineae). A.A. Mao and S.S. Dash (eds.), *Flowering Plants of India- An Annotated Checklist (Monocotyledons)*. Botanical Survey of India, Kolkata.
- Sánchez-Ken, J.G. and Clark, L.G. (2010) Phylogeny and a new tribal classification of the Panicoideae s.l. (Poaceae) based on plastid and nuclear sequence data and structural data. *American Journal of Botany* 97: 1732–1748.
- Sreekumar, P. V. And V. J. Nair (1991). *Flora of Kerala – Grasses*. Botanical Survey of India, Calcutta.
- Sreekumar, P.V., C.P. Malathi and V.J. Nair (1988). *Bothriochloa parameswaranii*-A new species of Poaceae from Kerala, India. *Journal of the Bombay Natural History Society* 85 (1): 163–165.

- Swamy, J., P. R. Mane, T.J. Shaikh, S.S. Yashvardhan and L. Rasingam (2021). Endemic Grass Species *Bothriochloa woodrovii* (Andropogoneae: Poaceae): Addition to the Flora of Eastern Ghats. *Indian Forester* 147 (12): 1234-1235.
- Swamy, J., S. Nagaraju, P.R., Mane and T.J. Shaikh (2021). *Bothriochloa insculpta* (Hochst. ex. A. Rich.) A. Camus (Poaceae): A new record for the flora of Telangana, India. *Indian Forester* 147 (1): 89-90.
- Vega, A.S. 2000. Revision taxonomica de las especies americanas del genero *Bothriochloa* (Poaceae: Panicoideae: Andropogoneae). *Darwiniana* 38: 127-1 86.
- Watson, L. and Dallwitz, M. J. (1992). *The Grass Genera of the World*. (Revised ed.). CAB International, U. K. Pergamon Press, London.