

Original Research Article

**Taxonomic Studies of the Genus *Eragrostis* Wolf (Poaceae: Chloridoideae) in Telangana-
with three new additions**

ABSTRACT

Eragrostis Wolf is a highly variable genus in the grass family Poaceae (subfamily Chloridoideae). A taxonomic study of twenty-five species of the genus *Eragrostis* in Telangana state is presented. The study was carried out based on fresh collections from various localities of the state and herbarium specimens housed in different herbaria. The results revealed the discovery of three previously neglected species *Eragrostis maderaspatana* Bor, *Eragrostis nigra* Nees ex Steud. and *Eragrostis zeylanica* Nees & Mey. Detailed descriptions of the species, key for identifying the investigated species based on morphological characters, phenology, habitat, local, national and global distribution, specimens examined, notes, and photographs are provided for easy identification.

Keywords: Endemic species; *Eragrostis*; new distributional records; notes; Poaceae; Telangana

1. INTRODUCTION

The genus *Eragrostis* Wolf (Poaceae: Chloridoideae) comprises approximately 423 species and is distributed in tropical, subtropical, and warm temperate regions of the world [1,2,3,4,5]. Out of 423 species, 55 species are endemic to Australia [6] followed by Mexico with 36 species and the United States and Canada with 25 species [7,8,9]. In India, the genus is represented by 48 taxa belonging to 43 species and 5 varieties and distributed from sea level to 2800 m elevations [9,10], of these 5 species and 4 varieties are endemic to the country (Vivek et al., 2021).

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In Telangana state, the genus is represented by 17 species (Pullaiah, 2015; Reddy and Reddy, 2016), recently 5 species namely, *Eragrostis barrelieri* Daveau collected from Nirmal district, Telangana and reported as an addition to the grass flora of India [11]; *E. cumingii* Steud. reported as a new distributional record for the state of Telangana, collected from Adilabad and Nizamabad districts [12,13]; *E. macilenta* (A.Rich.) Steud. collected from Manjeera Wildlife Sanctuary of Medak district and reported as an addition to the grass flora of Telangana [14]; *E. nilgiriensis* Vivek, G.V.S. Murthy & V.J. Nair collected from Tadwai Village of Kamareddy District and reported as extended distribution of endemic species [15]; *E. papposa* (Roem. & Schult.) Duf. ex Steud. collected from Manasahills, Rajendranagar, Rangareddy district, and reported as a new report from Telangana State [16].

2. STUDY AREA

Telangana, the 29th state of the Indian Union with 10 districts was carved out of the common state of Andhra Pradesh in 2014. It is the 12th largest state in India. The city of Hyderabad is the capital of Telangana. Telangana is surrounded by Maharashtra and Chhattisgarh in the North, Karnataka in the West and Andhra Pradesh in the South and East directions. The Telangana state lies on the Deccan plateau to the west of the Eastern Ghats range between 15°48' 32" to 19° 55' 46" N latitudes and 77° 09' 02" E to 81° 18' 51" longitudes with an area of 112,077 km² with an elevation range between 130 m to 900 m above sea level. The high elevation area of 800 m to 900 m is distributed in parts of Nallamalais and an average elevation of about 400 m above sea level of the state. Doli gutta is the possibly highest peak (965 m) in the present Mulugu district of the state [17,18].

3. REVIEW OF LITERATURE

A review of the literature on grasses documentation in Telangana State is presented to provide a perspective of the nature and extent of the work done within this state to date. No taxonomic/systematic work has been published on the genus *Eragrostis* (Poaceae) in Telangana except the Grasses of Adilabad (Erstwhile District) [19], Grasses of Nizamabad District [12] and Grasses of Telangana [16]. While consulting the herbarium (BSID, CAL, HY, MH, SKU, KUW, TUH (Telangana University Herbarium), etc.) and literature, the authors came across that, the collections of *Eragrostis* species were made from various parts of the state for different projects by many (33) taxonomists/botanists/plant collectors; the plant collectors names are arranged alphabetically starting from R A. Appaiah, A. B. Reddy, A.N. Henry, B. R. P. Rao, C. P. Raju, C. S. Reddy, D. A. Moulali, G. Obulesu, G.V. Subbarao, J. Swamy, K. Chandra Sekhar, K. M. Sebastine, K. Tothathri, L. Rasingam, M. H. Reedy, M. S. Gayathri, M. V. Ramana, M.. R. Prasad, M. R. Suxena, M. S. Mohammed, N. Ramarao, P. S. Annamma, P. V. Prasanna, R. Chandrasekaran, R. Gopalan, R. K. Premanath, R. Rajan, S. Nagaraju, S. R. Srinivasan, T. Pullaiah, T. Ravisankar, V. Jalander to V. S. Kumar.

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4. MATERIALS AND METHODS

The present study based on the regular floristic investigations were undertaken during the years 2014-2022 and investigation of the specimens housed in various regional and national herbaria (BSID, CAL, HY, MH, SKU, KUW, TUH, etc.). The collected specimens were processed as per the standard herbarium protocol described by Jain and Rao [20]. Every specimen was carefully studied by dissecting the floral parts of the duplicate specimens under dissection and compound microscopes. Detailed study of the dried specimens and their identification were carried out in the Botanical Survey of India, Deccan Regional Centre, Hyderabad and Department of Botany, Telangana University, Nizamabad district and with the

help of various Indian floras such as Grasses of Burma, Ceylon, India and Pakistan [21], Flora of Tamil Nadu – Grasses [22], Grasses of Maharashtra [23], Flora of Telangana [17,18], Grasses of Adilabad (Erstwhile District) [19] and Grasses of Nizamabad District [12]. Further, detailed recent revision by Vivek et al. [10]. The identified specimens were further confirmed by comparing them with the authentic specimens available at BSID, CAL, and MH and deposited in BSID and TUH. Detailed description with colour photographs is provided to facilitate easy identification. Voucher specimens are deposited at the Botanical Survey of India, Deccan Regional Centre (BSID), Hyderabad, and Department of Botany, Telangana University Herbarium (TUH), Dichpally, Nizamabad, Telangana.

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5. RESULTS AND DISCUSSION

Twenty-five species have been documented in present taxonomic studies on the genus *Eragrostis* in Telangana. During the study three previously neglected species namely *Eragrostis maderaspatana* Bor, *E. nigra* Nees ex Steud. and *E. zeylanica* Nees & Mey have reported as an addition to the flora of Telangana (Figs. 3-5). Five other species namely, *Eragrostis barrelieri* Daveau [11], *E. cumingii* Steud. [12,13], *E. macilenta* (A.Rich.) Steud. [14], *E. nilgiriensis* Vivek, G.V.S. Murthy & V.J. Nair [15], *E. papposa* (Roem. & Schult.) Duf. ex Steud. [16] added to the flora of Telangana by various authors in last three years. The detailed studies of the species are discussed in taxonomic treatment.

5.1. Taxonomic treatment

Eragrostis Wolf, Gen. Pl.: 23. 1776. Type: *Eragrostis minor* Host. Lectotype designated by Pfeiffer, Nomencl. Bot. 1(2): 1226. 1874-1875.

Annuals or perennials. Culms erect or decumbent, geniculate. Leaf blades linear to lanceolate with raised glands on margins or eglandular, surfaces hairy or glabrous; ligules usually ciliate or membranous; leaf sheaths often with tufts of hairs at the mouth. Inflorescence is open to contracted or spiciform panicle, branches alternate or sub-whorled, glandular or eglandular, glabrous or hairy on axils. Spikelets ovate, oblong, linear to lanceolate, laterally compressed, green to grey, greenish to yellowish, purplish to greenish black (Fig. 1). Glumes deciduous, linear to lanceolate or ovate, acute or acuminate at apex, glabrous or ciliate on margins, nerved or nerveless, keeled or not keeled. Florets up to 72, disarticulate from below upwards or from above downwards; rachilla more or less zigzag. Lemmas ovate, lanceolate, oblong or elliptic, acute to acuminate or obtuse at apex, glabrous or ciliate on margins, 3-nerved, 1-keeled. Paleas persistent or caducous, acute, acuminate or obtuse at apex, flap margins entire or ciliate, 2-nerved, 2-keeled, keels scaberulous, ciliate or eciliate. Lodicules 2. Stamens 2 or 3. Ovary ovoid, obovoid, or ellipsoid; stigmas plumose. Caryopses variously shaped, truncate, obtuse or acute, brownish to yellowish or deep brown (Fig. 2).

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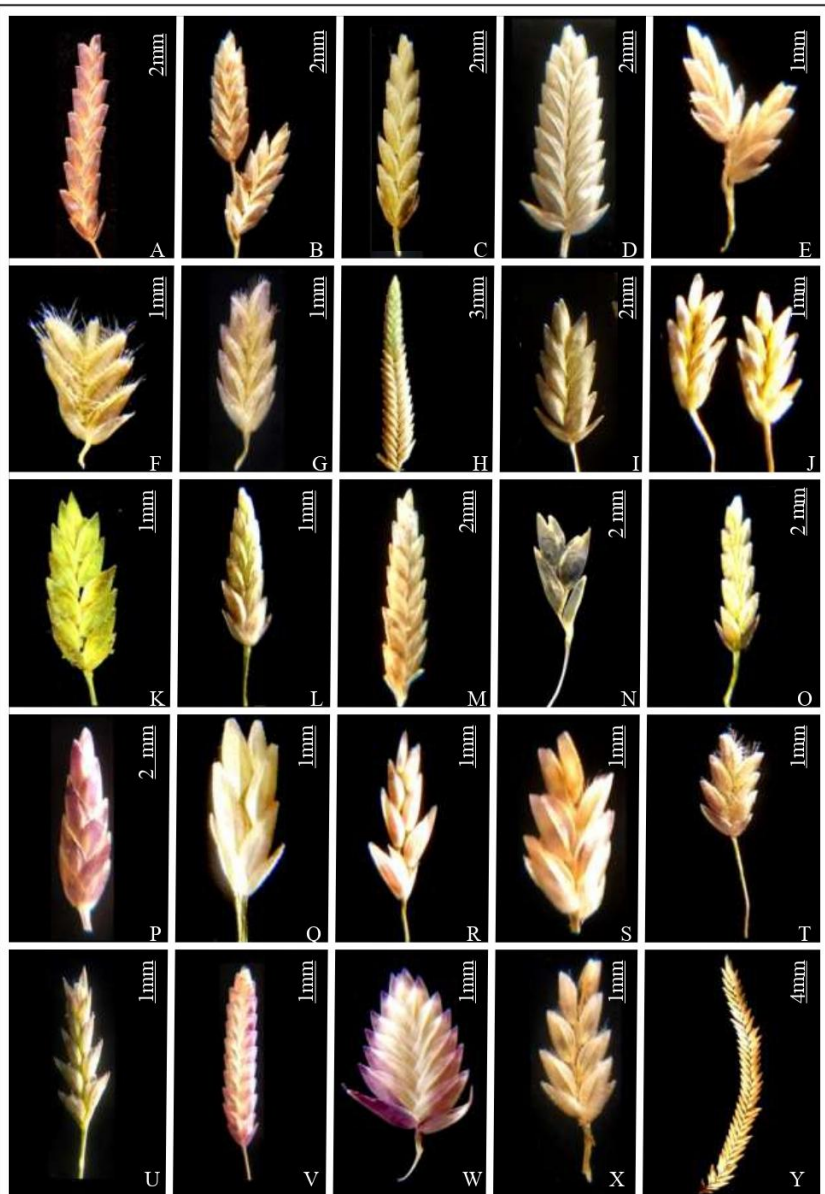


Fig. 1. Spikelets of *Eragrostis* species: A. *Eragrostis aspera*, B. *E. atrovirens*, C. *E. barrelieri*, D. *E. cilianensis*, E. *E. ciliaris*, F. *E. ciliata*, G. *E. coarctata*, H. *E. cumingii*, I. *E. gangetica*, J. *E. japonica*, K. *E. macilentata*, L. *E. maderaspatana*, M. *E. minor*, N. *E. nigra*, O. *E. nilgiriensis*, P. *E. mutans*, Q. *E. papposa*, R. *E. pilosa*, S. *E. riparia*, T. *E. tenella*, U. *E. tenifolia*, V. *E. tremula*, W. *E. unioloides*, X. *E. viscosa*, Y. *E. zylanica*.

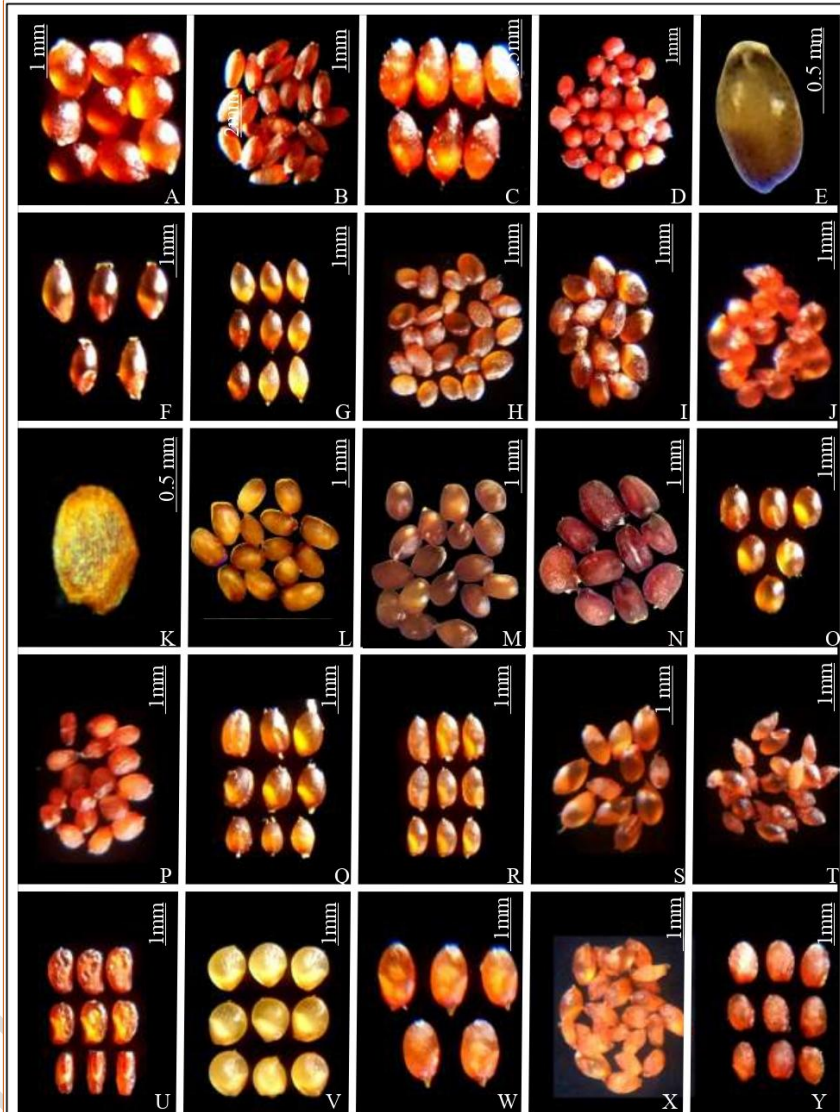


Fig. 2. Spikelets of Eragrostis species: A. *Eragrostis aspera*, B. *E. atrovirens*, C. *E. barrelieri*, D. *E. cilianensis*, E. *E. ciliaris*, F. *E. ciliata*, G. *E. coarctata*, H. *E. cumingii*, I. *E. gangetica*, J. *E. japonica*, K. *E. macilentata*, L. *E. maderaspatana*, M. *E. minor*, N. *E. nigra*, O. *E. nilgiriensis*, P. *E. nutans*, Q. *E. papposa*, R. *E. pilosa*, S. *E. riparia*, T. *E. tenella*, U. *E. tenifolia*, V. *E. tremula*, W. *E. uniolooides*, X. *E. viscosa*, Y. *E. zylanica*.

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5.2. Key to the species in Telangana

1. Florets disarticulating from above downward.....2
 Florets disarticulating from below upward.....9
2. Lemmas ciliate on the margins.....3
 Lemmas not ciliate on the margins.....4
3. Lemmas acuminate or mucronate; stamens 2 **E. ciliata**
 Lemmas obtuse to acute; stamens 3..... **E. coarctata**
4. Palea keels more or less ciliate.....5
 Palea keels scabrid or smooth, not ciliate.....8
5. Panicle spiciform or compact6
 Panicle effuse.....7
6. Annuals; lemma ciliate on the keels at least at the base; stamens 2..... **E. ciliaris**
 Perennials; lemma not ciliate on the keels; stamens 3..... **E. riparia**
7. Culms and leaves more or less viscous..... **E. viscosa**
 Culms and leaves not viscous..... **E. tenella**
8. Panicles thyriform; lemmas truncate at apex; palea rounded at apex..... **E. aspera**
 Panicles oblong or linear; lemmas acute to acuminate at apex; palea three lobed at apex.....
 **E. japonica**
9. Plants prominently glandular at least on culms/leaves/peduncle/panicle branches/pedicels/
 nerves of glumes and lemmas.....10
 Plants eglandular.....18
10. Primary panicle branches capillary, filiform; spikelets less than 1 mm wide..... **E. pilosa**
 Primary panicle branches more or less stiff; spikelets more than 1 mm wide.....11

11. Leaf margins glandular (at times absent in <i>E. maderaspatana</i>).....	12
Leaf margins eglandular.....	14
12. Caryopses oblong, truncate at both ends.....	E. maderaspatana
Caryopses elliptic-globose to orbicular.....	13
13. Spikelets oblong, 1.3-2.5 mm wide; lemmas 1.5-2 mm long.....	E. minor
Spikelets broadly oblong to ovate-lanceolate, 2-4 mm wide; lemmas 2-2.2 mm long.....	E. cilianensis
14. Perennials, glumes nerved/nerveless or nerves obscure	15
Annuals or short-lived perennials, glumes distinctly one nerved.....	16
15. Spikelets serrate in appearance, ellipsoid to oblongoid.....	E. tenuifolia
Spikelets do not serrate in appearance, oblong to ellipsoid.....	E. papposa
16. Annuals or short-lived perennials; spikelets 1-1.25 mm wide; lemma 1.8-2 mm; caryopsis laterally compressed.....	E. barrelieri
Annuals; spikelets 1.3-1.8 mm wide; lemma 1.2-1.8 mm; caryopsis ventrally compressed...17	
17. Lemmas 1.2-1.5 mm long; caryopsis ellipsoid or narrowly oblong or ovoid to sub-globose, sometimes ventrally flattened, not grooved.....	E. nilgiriensis
Lemmas 1.5-1.8 mm long; caryopsis oblong, truncate at both ends, ventrally flattened to slightly grooved.....	E. maderaspatana
18. Palea not persistent on rachilla nodes (at times sub-persistent in <i>E. gangetica</i>).....	19
Palea persistent on rachilla nodes	21
19. Rachilla slender and clearly visible between florets; spikelets less than 1.5 mm wide; lemmas less than 1 mm long.....	E. gangetica
Rachilla more or less stiff and not visible between florets; spikelets more than 1.5 mm wide;	

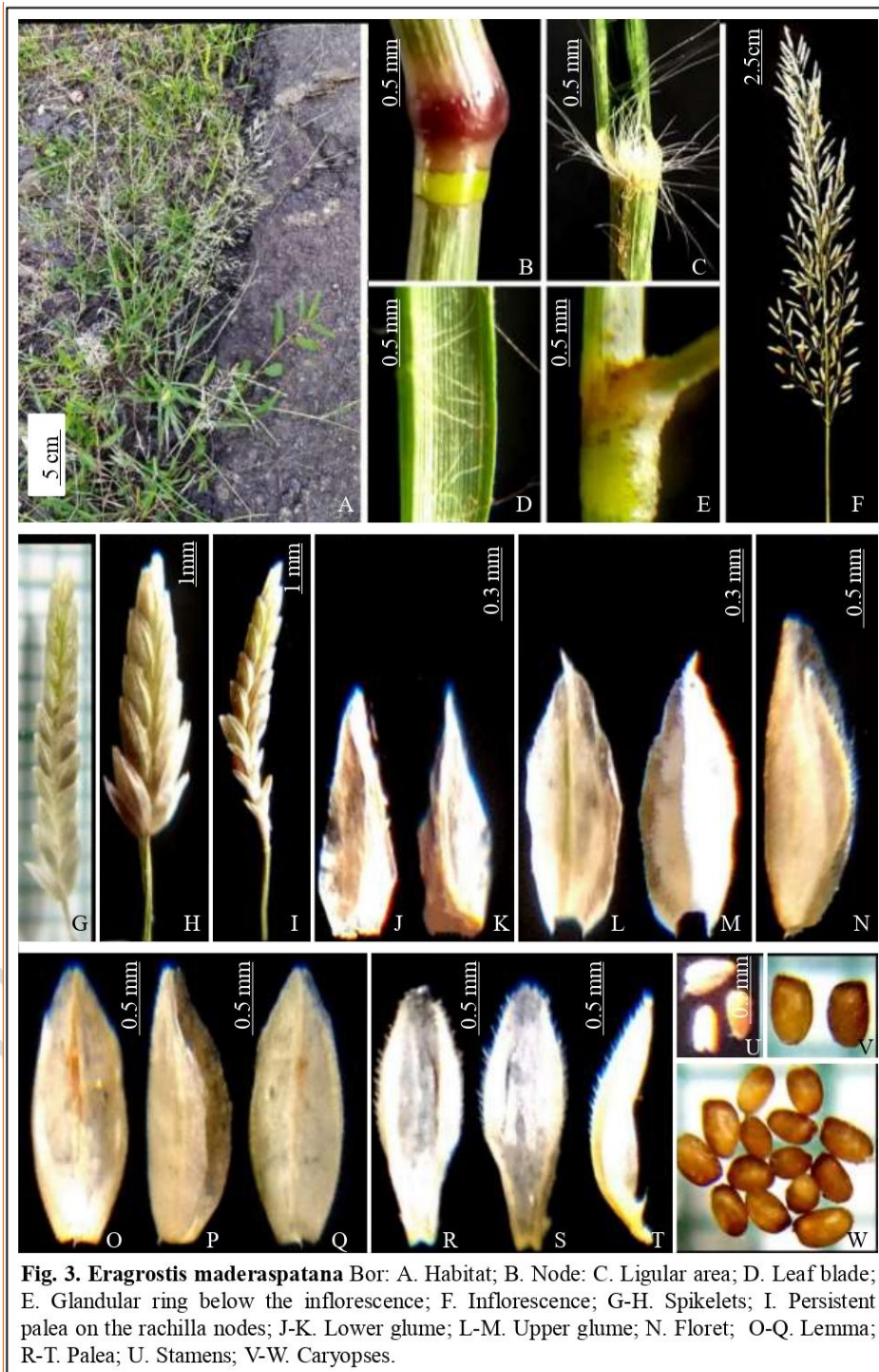
lemmas more than 1 mm long.....	20
20. Paleas narrowly winged; stamens 2; anthers less than 0.5 mm long.....	E. unioloides
Paleas not winged; stamens 3; anthers more than 0.5 mm long.....	E. atrovirens
21. Spikelets in fascicles.....	22
Spikelets not in fascicles.....	23
22. Spikelets up to 66-flowered; lemmas up to 2.2 mm long; paleas up to 1.5 mm long.....	
.....	E. zeylanica
Spikelets up to 40-flowered; lemmas less than 1.8 mm long; paleas less than 1.25 mm long...	
.....	E. cumingii
23. Perennials.....	24
Annuals.....	25
24. Panicles more or less contracted; lemmas 1.2-1.5 mm long, purplish towards the apex.....	
.....	E. nutans
Panicles effused; lemmas 2-2.2 mm long, black or greenish black.....	E. nigra
25. Spikelets 10-30 mm long, 10 -72 flowered.....	E. tremula
Spikelets 3-6 mm long, up to 14-flowered.....	26
26. Lowermost branches whorled; long white hairs usually in the axils of the panicle branches; spikelets less than 1 mm wide.....	E. pilosa
Lowermost branches sub-whorled; no long white hairs in the axils of the panicle branches; spikelets more than 1 mm wide.....	E. macilenta

5.3. Enumeration

Eragrostis maderaspatana Bor, Grasses Burma, Ceylon, India Pakistan: 509. 1960; S.Moulik, Grass. Bamb. India 2: 604. 1997; Vivek et al. in Nelumbo 60 (1): 63. 2021. *Eragrostis willdenowiana* Nees [in Wight, Cat. Ind. Pl.: n. 1779] ex Stapf in Hook.f., Fl. Brit. India 7: 322. 1896, non Nees ex Hook. & Arn., Bot. Beechey Voy.: 252. 1832 & in Nov. Act. Nat. Cur. 19: Suppl. 1. 205. 1843. (Fig. 3)

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Tufted annuals. Culms geniculate, 20-50 cm high, more or less ribbed, with a glandular ring-like patch just below the node. Leaf blades linear to lanceolate, 2-12 × ca. 0.3 cm, acuminate, flat to inrolled, margins rarely with sparse tuberculate glands, finely scabrellate; ligule membranous fringe of cilia; leaf sheath more or less ribbed, sparsely ciliate along on margin, mouth bearded. Panicle 6-20 × 3-5 cm, racemes alternately arranged on the central axis; peduncle 7-17 cm long, with a glandular ring-like patch just below the panicle, pedicels straight, 1-5 mm long, with or without glandular patches, scabrous on margins. Spikelets narrowly ovate-lanceolate, 5.5-11 × 1.5-1.8 mm, acute, olive green to grey with or without a purplish tinge; rachilla zigzag; florets closely arranged on rachilla. Glumes unequal; lower glume ovate-lanceolate, 1-1.2 × ca. 0.3 mm, acute, chartaceous, purplish, prominently 1-nerved; upper glume ovate, 1.2-1.4 × ca. 0.5 mm, acute, chartaceous, purplish, prominently 1-nerved. Florets 9-22, closely imbricate on zigzag rachilla; disarticulating from below upwards. Lemma broadly elliptic, 1.5-1.8 × 0.6-0.7 mm, subacute, chartaceous, olive green to purplish, prominently 3-nerved, 1-keeled, scabrid along the keel. Palea elliptic to oblanceolate, 1.4-1.6 × 0.25-0.3 mm, obtuse, membranous, 2, truncate at apex, membranous, hyaline. Stamens 3; anthers 0.3-0.5 mm long, brownish yellow. Ovary ovate to oblong-ellipsoid, ca. 0.4 mm long, acute, greenish; style



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ca. 0.3 mm long, hyaline; stigma plumose, 0.4-0.6 mm long. Caryopses 0.5-0.8 mm long, oblong to ellipsoid, truncate at both ends, ventrally flattened to slightly grooved, yellowish brown.

Flowering and fruiting: August-October.

Habitat: Common along the roadsides and wastelands.

Distribution: INDIA: Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, and now from Telangana, Endemic.

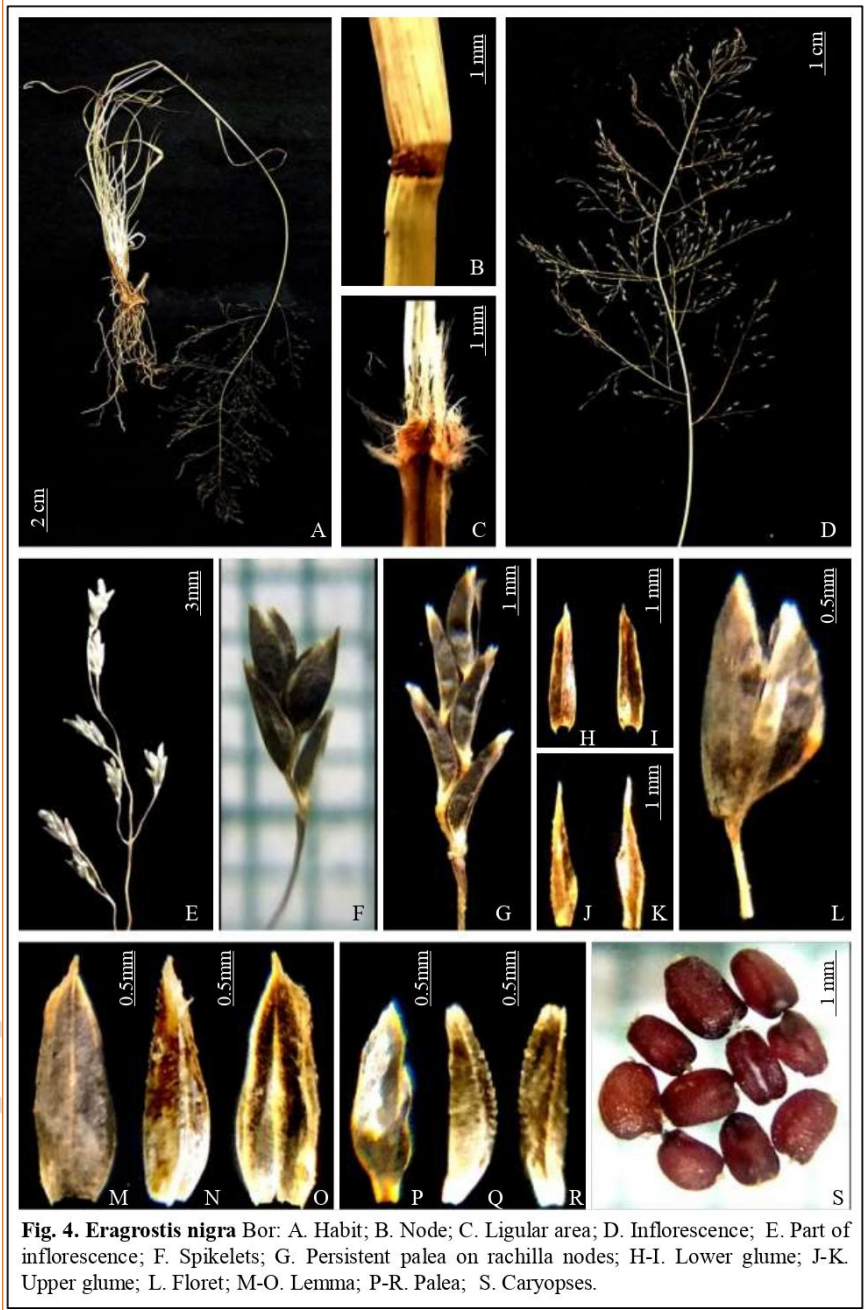
Specimens examined: India, Telangana, Adilabad District: Echoda Mandal, near Gubba Village, *V. Jalander* 494 (TUH); Nizamabad District: Dichpally (Mandal), *V. Jalander* 885 (TUH).

Note: It is reported here as an addition to the flora of Telangana. It is similar to *E. minor* in having glandular bodies but it differs from *E. minor* by the ventrally flattened and truncate caryopses.

Eragrostis nigra Nees ex Steud., Syn. Pl. Glumac. 1: 267. 1854; Mao & Dash, Fl. Pl. India Annot. Checkl. Monocot. 3: 367. 2020; Vivek et al. in Nelumbo 60 (1): 66. 2021. *Eragrostis atropurpurea* Hochst. ex Steud., Syn. Pl. Glumac. 1: 267. 1854. (Fig. 4)

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Perennials. Culms erect to geniculate, 5 to 80 cm high; nodes brownish. Leaf blades linear-lanceolate, 5-40 × 0.2-0.5 cm; ligulae fringe of cilia. Panicle 10-22 × 5-12 cm, ovate, lax to effuse; branches 1-9 cm long, alternate to sub-whorled; axils glabrous or ciliate. Spikelets ovate to lanceolate, 2.5-4 × 1-2 mm, black or greenish black. Glumes divergent at maturity sub-equal. Lower glume ovate-lanceolate, 1.5-2 mm long, acute-acuminate, chartaceous, 1-nerved, 1-keeled. Upper glume 1.5-2.2 mm long, similar to lower glume. Florets up to 8, closely arranged on rachilla; disarticulating from below upwards. Lemma ovate, 2-2.3 × 0.8-1.2 mm, acuminate, chartaceous, 3-nerved, 1-keeled. Palea elliptic-oblongate, 1.8-2 × 0.5-0.7 mm, sub-persistent,



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acute at apex, 2-nerved, 2-keeled, scabrid. Stamens 3; anthers 0.2 mm long, purplish. Caryopsis 0.4-0.6 mm long, oblong, ventrally flattened to grooved, dark reddish.

Flowering and fruiting: January–November.

Distribution: INDIA: Almost throughout and now from Telangana (Bhadradri Kothagudem District); WORLD: China, Indonesia, Sri Lanka.

Habitat: Occasionally on roadsides and stream banks

Specimen examined: India, Telangana, Bhadradri Kothagudem District, Allapally Mandal, Ananthogu Village, *J. Swamy & V. Jalander* 446 (TUW).

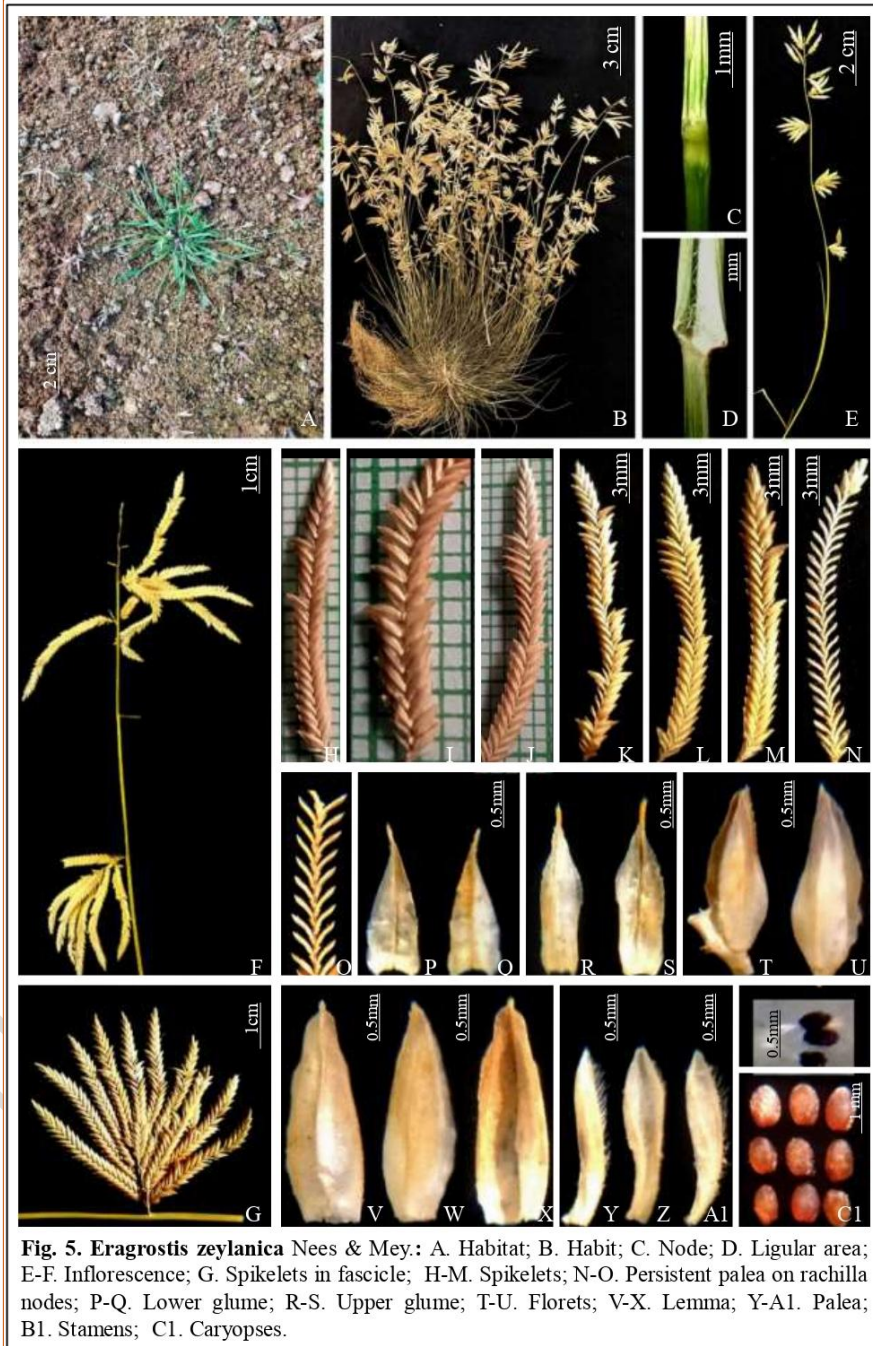
Note: It is reported here as an addition to the flora of Telangana.

Eragrostis zeylanica Nees & Mey., Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 19(Suppl. 1): 204. 1843; Mao & Dash, Fl. Pl. India Annot. Checkl. Monocot. 3: 368. 2020; Vivek et al. in Nelumbo 60 (1): 95. 2021. *Eragrostis elongata* sensu Stapf in Hook.f., Fl. Brit. India. 7: 319. 1896, non Jacq., 1813.

(Fig. 3)

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Annual or short-lived perennial. Culms 15-45 cm high, erect or decumbent, geniculate; nodes brownish. Leaf sheaths 0.5-2 cm long, ciliate at along margin, mouth bearded. Ligule a fringe of hairs. Leaves linear to lanceolate; blades 3-14 cm long. Panicles 3-18 × 1.5-3.5 cm, open, with spikelets fascicled and grouped in branches; primary branches 1-2.5 cm long; axils slightly ciliate. Spikelets 2.5-27 × 1.5-3 mm, 5-65-flowered, lanceolate to oblong, sharply acute at apex; florets firmly arranged on rachilla, rachilla narrowly zigzag, disarticulating from below upwards. Glumes linear to lanceolate, chartaceous or sub-coriaceous, 1-nerved, 1-keeled, scabrid along keel, apex acute to acuminate; lower glume 1-1.5 × 0.3-0.5 mm; upper glume, 1.5-2 × 0.5-0.7 mm. Lemmas 1.5-2.2 × 1-1.8 mm, ovate to lanceolate, subcoriaceous, 3-nerved, 1-keeled, scabrous along the keel, apex acute. Paleas 1.3-1.5 × 0.3-1 mm, persistent, elliptic slightly



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curved, 2-nerved, 2-keeled, ciliolate along keels above middle, apex acute to obtuse. Anthers 3, 0.25-0.3 mm long, purplish. Caryopses 0.5-0.6 × 0.3-0.4 mm, ovate to sub-globose or orbicular, laterally compressed, light brownish.

Flowering and fruiting: August-October

Habitat: Occasional on road sides banks of streams and backwaters.

Distribution: INDIA: Assam, Kerala, Madhya Pradesh, Sikkim, Uttar Pradesh, West Bengal and now from Telangana (Nizamabad District); WORLD: Bangladesh, Myanmar and Sri Lanka.

Specimens examined: India, Telangana, Nizamabad District, Near CMC, Dichpally Mandal and Village, *V. Jalander* 454 (TUH).

6. CONCLUSION

The taxonomic studies on the genus led to the discovery of seven new distributional records for Telangana state and India. Many species in the genus *Eragrostis* exhibit a high range of variations due to the occurrence of polyploids. Precipitation and other environmental factors are the primary causes of polyploidization. Due to climate change, most of the areas in tropical countries are converting into arid and also witnessed the expansion of desertification. Many *Eragrostis* species have a high potential to adapt to specific environmental changes, especially in drylands. The ancestors of the existing *Eragrostis* species originated in dry areas. Hence, selected species can be used in semi-arid and arid regions to control soil erosion and development of grasslands.

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