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Research article

Digitaria and *Setaria* species of subfamily- Panicoideae, Tribe- Paniceae (Poaceae) from Bhandara District of Maharashtra, India

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Abstract: The present paper deals with the taxonomic study of four species of *Digitaria* and three species of *Setaria* grasses. The reports species are *viz.*, *Digitaria ciliaris*, *D. stricta*, *D. radicosa*, *D. sangunalis*, *Setaria intermedia*, *S. Verticillata* and *S. pumila* collected from Bhandara district of Maharashtra State.

Keywords: Digitaria spp. - Setaria spp. - Bhandara district.

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INTRODUCTION

The genus *Digitaria* Heist., is commonly known as digit grass because of its radiating inflorescence like fingers of palm. Heister (1748) gave the name *Digitaria*. There are 218 species of genus all around the world (Vega *et al.* 2009). Veldkamp (1973) reported 27 species from Malaysia. Diego (2005) and Valdés-Reyna *et al.* (2015) have reported species diversity from Mexico and Columbia respectively. Boonsuk *et al.* (2016) carried out a taxonomic revision of the *Digitaria* in Myanmar, Peninsular Malaysia, Thailand and Vietnam. Vega *et al.* (2009) carried out studies on morphology-based cladistics analysis of the genus. In India work on *Digitaria* started when Bor (1960) reported 29 species of the genus from Burma, Ceylon, India and Pakistan. Deshpande & Singh (1986) reported 10 species. Singh & Deshpande (1978) reported *Digitaria abludens* (Roem. & Schult.) Veldkamp *D. bicornis* (Lam.) Roem and Schult., *D. ciliaris* (Retz.) Koel., *D. compacta* (Roth.) Veldkamp, *D. longiflora* (Retz.) Pers., *D. radicosa* (J.Presl.) Miq. and *D. setigera* Roth. Shukla (1978) reported 14 species of genus from Eastern India. Recently Singh & Srivastava (2016) carried out taxonomic study of six species of genus *Digitaria abludens* (Roem. & Schult.) Veldkamp, *D. ciliaris* (Retz.) Koel., *D. griffithii* (Hook.f.) Henrard., *D. longiflora* (Retz.) Pers. *D. ternate* (A.Rich.) Stapf., and *D. violascens* Link., collected from Vindhayan region of Uttar Pradesh, India. E-flora published by Botanical Survey of India have species *viz.*, *Digitaria abludens* (Roem. & Schult) Veldkamp, *D. bicornis* (Lam.) Roem & Schult., *D. ciliaris* (Retz.) Koel. *D. cruciata* (Nees ex Steud.) A.Camus., *D. griffithii* (Hook.f) Henrard, *D. longiflora* (Retz.) Pers., *D. radicosa* (J.Presl.) Miq. and *D. setigera* Roth. (eflora of India 2007)

Setaria P. Beauv., is a cosmopolitan genus of with 114 species (Webster 1987). Species of this genus are growing commonly as a weed in paddy fields and open grassland (Rominger 1962, PrasadRao *et al.* 1987, Pensiero 1999). The Old World species are concentrated largely in tropical regions of Africa, including several species endemic to Madagascar (Stapf & Hubbard 1930), whereas in the New World the center of diversity is Brazil (Rominger 1962). The genus is of economic importance because some species are cultivated for grains or perennial forage grass (Rominger 1962, PrasadaRao *et al.* 1987). *Seteria sphacelata* (Schumach.) Stapf & C.E.Hubb. is extensively collected as wild cereals in African savannas in times of scarcity (Delziel 1937) and *S. italica* (L.) P.Beauv., is known as foxtail millet, is cultivated in Asia and other regions as a cereal for humans (Naciri *et al.* 1992). In India Malik (2015) reported *S. glauca*, *S. homogyna*, *S. italica* (L.) P.Beauv., *S. verticillata* (L.) P. Beauv. *S. viridis* (L.) P.Beauv., and e-flora published by Botanical Survey of India reported *Setaria barbata* (Lam.)Kunth., *S. faberim* Herrm., *S. glauca* (L.) P.Beauv. *S. intermedia* Roem. & Schult., *S. italica* (L.) P.Beauv. *S. paliniflora* (K D Koenig) Stapf., *S.poiretiana* (Schult.) Kunth. *S. pumila* (Poir.) Roem. &

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Schult., *S. sphacelata*, (Schumach.) Stapf & C E Hubb., *S.verticillata* (L.) P.Beauv. *S. virdis* (L.) P.Beauv. (eflora of India 2007).

In Maharashta State there are 415 species belonging to 125 genera of grasses (Potdar *et al.* 2012). The history of botanical exploration in the Bhandara district and its adjoining regions reveals that Witt (1911) published a list of fodder grasses found in Central Province and Berar regions. He draw beautiful quarto-atlas depicting the habit sketches of 39 grasses and compiled a list of 80 grass species which he collected from adjoining districts of Bhandara. Later on Graham (1913) enumerated 48 grasses in his descriptive list from adjoining districts *viz.*, Wardha, Naour and Chandrapur. The pioneer work on the grasses in the adjoining Nagpur district was started by Ugemuge (1985). He reported 133 species belonging to 66 genera of grasses. Purekar (1985) in his thesis work reported six species of *Digitaria* and four species of *Setaria* and 197 species distributed among 81 genera of grasses. Later on Tiwari (2013) reported the biodiversity of nine species of *Eragrostis* from the Bhandara district. Tiwari & Deshmukh (2019) four species of *Sporobolus* and 27 species of *Andropogonae* and 56 species of *Paniceae* from Bhandara district. There still exist a number of areas in Bhandara district which are yet to be explored for the study of grasses and hence the present investigation have been undertaken.

MATERIALS AND METHOD

Area under study

Latitude and Longitude - Bhandara district	21º 38′ and 79º 27′
Total Area	3717 km^2
Cultivated Area	1718.63 km^2
Forest Area	1343 km^2
Total major and minor lakes in the district	1254
Maximum Temperature	45ºC
Minimum Temperature	06ºC
Grassland Area	20.370 km^2
Non Agriculture Land	430 km^2
Barren Land	390 km^2
Average Rainfall	1250–1500 mm per annum
Average Elevation	357 meters
Rivers	Wainganga, Chulband, Sur, Godra, Bawanthadi
Adjoining Districts	Nagpur, Chandrapur, Gadchiroli, Balaghat, Gondia

Method adopted

Several field visits were conducted during the year 2018–2019 in various localities for the collection of grasses. 2 or 3 specimens of material is collected for the preparation of herbarium sheets. The morphological study of specimen was carried out with the help of dissecting microscope of Olympus Magnus MSZ – TR Model with binocular eye pieces of SWF10X/22 magnification. Field data was noted in the field book. The plant specimens were pressed, dried, preserved and mounted on standard size of herbarium sheets. The herbarium sheets are deposited in herbarium of J M Patel College, Bhandara. The botanical identification was confirmed by using floras and monographs. The Nikon Cool Pix L810; 26X Zoom 16.1 Mp Camera is used for photography. The taxonomic key is prepared based on easily observable morphological characters in the field.

RESULTS

Enumeration of species

1. *Digitaria ciliaris* (Retz.) Koeler., Descr. Gram. 27. 1802. Bor in Towns., Guest & Al- Rawi, Fl. Iraq 9: 478. 1968; Blake in Proc. R. Soc. Queensland 81: 10. 1969; Bor in Rech.F., Fl. Iran.70: 490.1970; Tzvelev, Poaceae URSS 671. 1976; Calyton in Tutinet. al., Fl. Eur. 5: 262. 1980. **[Fig. 1A]**

Clums erect and decumbent, 30–100 cm. Nodes and pubescent. Leaf shape is linear-lanceolate, upper surface pilose. Ligule present. Inflorescence is raceme, digitate, 5–17 cm, branches 3–10. Spikelet elliptic-acute, 2.50–3.45 mm. Rachis triquetlous. Upper glume ovate, 7 veined. Lower glume triangular. Lower lemma 7 nerved. Stamen 3, Lodicules absent. Caryopsis ellipsoid, light brown.

Flowering and Fruiting: August to December

Habitat: growing as a weed in open grassland.

Locality: Wakeshwar

Collectors Name and Herbarium Sheet Number: VJT- 1751

Figure 1. A, *Digitaria ciliaris* (Retz.) Koeler.; **B**, *Digitaria sanguinalis* (L.) Scopoli; **C**, *Digitaria stricta* Roth ex Roemer & Schultes.; **D**, *Digitaria radicosa* (J. Presl) Miquel.

2. *Digitaria sanguinalis* (L.) Scopoli, Fl. Carinol., ed. 2. 1: 52. 1771. **[Fig. 1B]**

Panicum sanguniale Linnaeus, Sp. Pl. 1: 57. 1753; *Paspalum sanguinale* (L.) Lamarck.

Clums decumbent, 20–70 cm, nodes glabrous. Leaf shape linear lanceolate.Leaf surface pilose. Keel present in leaf sheath, Ligule membranous. Inflorescence receme, digitate, 5–18 cm, branches 4–12, rachis winged. Spikelets are lanceolate –ovate, 3.0–3.5 mm. Upper glumes lanceolate, pubescent and 3–5 nerved. Lower glume is triangular and veinless. Lower lemma is leathery, 7-nerved. Lodicules present. Anthers-3. Caryopsis light green.

Fruiting: October to November

Habitat: Growing on roadsides

Locality: Kesalwada

Collectors Name and Herbarium Sheet Number: VJT- 1762

3. *Digitaria stricta* Roth ex Roemer & Schultes. **[Fig. 1C]**

Agrostis pilosa Retzius; *Digitaria puberula* Link; *D. royleana* (Nees ex J. D. Hooker) Prain; *Paspalum royleanum* Nees ex J. D. Hooker; *Setaria stricta* (Roth ex Roemer & Schultes) Kunth.

Clums ascending, 20–40 cm. Nodes and glabrous. Leaves are linear-lanceolate. Leaf surface hirsute, apex acuminate. Leaf-sheath keel present. Leaf-sheath keel present. Ligule membrances. Inflorescence raceme, digitate, 4–147 cm, 3–6. Rachis winged. Spikelet elliptic-oblong. Sterile florets are basal. Spikelets are 1.2–1.4 mm, pedicillate, three florets in cluster. Upper glume elliptic, glabrous, 3 veined, apex acute. Lower glume isobscure. Lemma of sterile florets, 3–5 nerved, hairy lines between the veins. Lemma of fertile floret is elliptic,

3 nerved, apex is apiculate, cartilaginous. Stamens 3. Lodicules absent. Caryopsis is light brown.

Flowering and Fruiting: July to December

Habitat: growing on open grasslands and roadsides on dry sandy soil.

Locality: Mujbhi

Collectors Name and Herbarium Sheet Number: VJT- 1755

4. *Digitaria radicosa* (J. Presl) Miquel, Fl. Ned. Ind. 3:437. 1837. [**Fig. 1D]**

Panicum radicosum J. Presl, Reliq. Haenk.1: 297. 1830; *Digitaria chinensis* Hornemann var. *hirusta* (Honda) Ohwi; *D. formosana* Rendle; *D. formosana* var. *hirsute* (Honda) Henrard*; D. radicosa* var. *hirsute* (Honda) C.C. Hsu; *D. tenuispica* Rendle; *D. timorensis* (Kunth) Balansa; *Panicum formosanum* (Rendle) Makino &Nemoto: *P. timorense* Kunth; *Syntherisma formosana* (Rendle) Honda; *S. formosana* var. *hirsute* Hond.

Clums trailing, 30–50 cm. Nodes glabrous leaves linear lanceolate. Ligule present. Raceme digitate, branches 2–4, 4–10 cm. Rachis triquetrous. Spikelet with fertile and sterile floret. Sterile floret on lower side. Sterile floret on lower side. Spikelet 2.8–3.0 mm, pedicillate, 2 florets in pair. Upper glume ovate 1–3 veined. Lower glume triangular, apex obtuse. Lower lemma 5–7 veined. Upper lemma is yellow. Palea is cartilaginous. Stames 3. Lodicules absent. Caryopsis yellow.

Habitat: Growing as a weed in wasteland

Locality: Bhilewada

Collectors Name and Herbarium Sheet Number: VJT- 1772

5. *Setaria pumila* (Poiret) Roemer & Schultes, Syst. Veg, 2: 891 1817. **[Fig. 2A]**

Panicum pumilum Poir.; Encycl (suppl.) 4:273, 1816 *Setaria pallidefusca* (Schumach.) Stapf & C.E. HUbb., Bull. Misc. Inform. 1939, 259, 1930; C.Fischer, Fl. Madras 3:1789 (1239) 1934; Bor Grass India 363; 1960; Matthew Mat Fl. Tamilnadu Carnatic 400 1982. *Panicum pallidefuscum* Schum. Beskr Giun. Pl. 58, 1827. Steriaglauca Brot.3:135, 1884, non P. Beauv. 1812: Hooker. F. Fl. Brit India 7, 78, 1896. Rangachari and Tadulingam Handb.5 S. Indian Grasses 110, f, 109, 1921.

Clums tall and erect, 20–90 cm. Leaf blade linear, ligulate. Inflorescence panicle, cylindrical, 3–17 cm, Spikelets ovate, 2.5–3.5mm, bristles 5–10. Upper glume ovate, 5-veined. Lower glume acute 3 veined. Upper lemma ovate, rugose. Lower palea hyaline, keels winged.

Flowering and Fruiting: July to December

Habitat: growing as a weed in paddy field

Locality: Kardha

Collectors Name and Herbarium Sheet Number: VJT- 1750

6. *Setaria verticillata* (L.) P. Beauvois, Ess, Agrostogr. 51. 1812. **[Fig. 2B]**

Panicum verticillatum Linnaeus, Sp. Pl., ed. 2, 1: 82. 1762; *Chaetochloa brevispica* Scribner & Merrill; *C. vertici-llata* (L.) Scribner; *Chamaraphis italic* (L.) Kuntze var. *verticillata* (L.) Kuntze; *C. verticillata* (L.) Porter; *Panicum asperum* Lamarck; *Pennisetum verti-cillatum* (L.) R. Brown; *Setaria brevispica* (Scribner & Merrill) K. Schumann.

Clums tufted, 30–100 cm. Leaves are linear lanceolate. Leaf sheath puberulous, margin ciliate.Leaf blade linear lanceolate.Ligulate. Inflorescence panicled, dense 4–15 cm. Bristles 1–4. Spikelets elliptic, 1.5–2.5mm.Upper glume boat shape, 7-veined.Lower glume obtuse. Upper lemma compressed, rugose.

Flowering and Fruiting: August to October

Habitat: on dry sandy soil roadsides

Locality: Mohadi

Collectors Name and Herbarium Sheet Number: VJT- 1752

7. *Setaria intermedia* Roemer & Schultes, Syst. Veg. 2:489.1817. **[Fig. 2C]**

Panicum tomentosum Roxb.; *Setaria tomentosa* (Roxb.) Kunth.

Clum descubent, 40–60 cm. Leaves are linear lanceolate, liguate as line of hairs. Inflorescence panicle, contracted, narrow lanceolate 3–12 cm. Spikelets elliptic-ovate, acute, 1.5–2.0 mm. Glume elliptic, obtuse.

Lower glume 1-nerved. Upper glume elliptic, obtuse, 5-veined. Palea ovate, second lemma ovate, coracious. Palea faintly rugose.

Flowering and Fruiting: August to December

Habitat: growing as a weed in paddy field

Locality: Tavepar

Collectors Name and Herbarium Sheet Number: VJT- 1749

Figure 2. A, *Setaria pumila* (Poiret) Roemer & Schultes; **B**, *Setaria verticillata* (L.) P. Beauvois; **C**, *Setaria intermedia* Roemer & Schultes.

Taxonomic keys

Digitaria

(1a) Nodes pubescent, upper glume 7 nerved, caryopsis light yellow ……..…….. *D. ciliaris*

(1b) Nodes glabrous, upper glume 3–5 nerved, caryopsis light green/light green ….…….….. (2)

(2a) Lodicules present ……..…….. *D. sangunalis*

(2b) Lodicules absent ……..……..…….. (3)

(3a) Raceme 3–6, single spikelet consists of cluster of 3florets ……..…….... *D. stricta*

(3b) Raceme 2–4, single spikelet in pairs of 2 florets ……..……...……. *D. radicosa*

Setaria

(1a) Spikelet ovate 2.5 mm to 3.5 mm ……..…….. *S. pumila*

(1b) Spikelet elliptic 1.5 mm to 2.5 mm ……..……..…… (2)

(2a) Upper glume boat shaped, 7 veined ……..…….. *S. verticillata*

(2b) Upper glume elliptic, obtuse shaped, 5 veined ……..……..... *S. intermedia*

DISCUSSION AND CONCLUSION

Digitaria is extremely variable in inflorescence structure relative length of spikelet scales, and spikelets appressed pubescence, glassy bristles and marginal cilia possible within the same species or even between the two members of a spikelet pair. The morphological study of *Setaria* indicates that species can be differentiated based on node, lead blade, ligule, inflorescence, spikelets and seeds. The authors have pointed out morphological similarities and dissimilarities while dissecting the florets under the microscope to identify these species, The present study plays a significant role in the preparation of taxonomic keys of species of both the genera.

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