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A taxonomic study of grasses in Rampur district of Rohilkhand region (U.P.)

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Abstract
Grasses are the members of Poaceae family which have great diversity and abundance. A total of 37 grass species of 30 genera under 06 subfamilies and 10 tribes. Panicoideae exhibits maximum representation with 20 species followed by, Chloridoideae (7 species), Pooideae (6 species), Bambusoideae (2 species), Ehrhartoideae and Arundinoideae (1 species) respectively. *Eragrostis* and *Saccharum* showed dominance with 3 species followed by *Bambusa*, *Setaria* and *Sorghum* with 2 species. *Cynodon dactylon* (L.) Pers., *Dactyloctenium aegyptium* (L.) Willd. *Desmostachya bipinnata* (L.) Stapf, *Dichanthium annulatum* (Forssk.) Stapf, *Phalaris minor* Retz. And *Triticum aestivum* L. are found in all tehsils of Rampur district.

Keywords: grasses, taxonomic study, subfamilies, tribes, Rampur district

Introduction
Grasses are the signature of Poaceae with more than 12,000 species under 780 genera, and they are economically the most important flowering plants for their manifold use as food, fodder and for soil conservation. More than 75% of calorific value to the world population is provided by members of this family and accounts for 20% of world's vegetational cover (Ture and Bocuk, 2007) [22]. Some notable work on Indian grasses are *Grasses of Bihar, Orissa and West Bengal* (Jain *et al.*, 1975) [5], *Grasses of Madhya Pradesh* (Roy, 1984) [15], *The Grass Flora of India* (Jain, 1986) [6], *Grasses of North-Eastern India* (Shukla, 1996) [17], *Important grasses of Eastern Ghats* (Moulik, 2000) [12], *Grasses and its diversity in Gujarat state* (Parmar *et al*., 2012) [13] and *Grasses and their varieties in Indian Literature* (Sheshadri, 2013) [16]. Besides these, Srivastava (2011) [21] recorded 110 genera and 301 species under Poaceae family from Uttar Pradesh and previously Raizada & Jain (1961 & 1966), Singh (1971), Vedprakash *et al.* (1978), Uniyal *et al.* (1994), Singh (2007), Chaudhary *et al.* (2012) and Malik (2015) [14, 20, 24, 23, 18, 2, 11] did comprehensive work on grasses of Uttar Pradesh. Addition to this Kumari (2015), Kumar and Kumari (2017 & 2019) and Singh and Kumari (2018) [10, 9, 7, 19] documented grasses of Moradabad, Sambhal, Bijnor and J. P. Nagar with their utility. But no taxonomic work has been done on grasses in the study area. For the first time, we documented the grasses of Rampur district.

District Rampur is located between Longitude 79° 05' East and Latitude 28° 48' north, spread in area of 2367 Sq. Km falls in Moradabad Division of Uttar Pradesh state. It was incorporated into the state of U.P. in 1949. It is home to farms that cover long stretches of land. The average height from sea level is 180 m. The district comprises of six tehsils i.e. Rampur, Bilaspur, Milak, Shahabad, Suar and Tanda. It is surrounded by Bareilly in East, Moradabad in West, District Udham Singh Nagar in North and Badaun in South. Situated on the NH 24, the state capital is 302 km in East and national capital is 185 km in West. During summers the temperature is usually from 44.2 °C to 30 °C and during winters it is from 23 °C to 5 °C. Vegetation is highly dependent on rainfall, which is, in most cases, seasonal and erratic. The average rainfall varies between 800 to 900 mm. About 85% of the rainfall is received during June to September. The relative humidity is up to 90% in monsoon season and in drier part of the year it decreases to less than 20%.

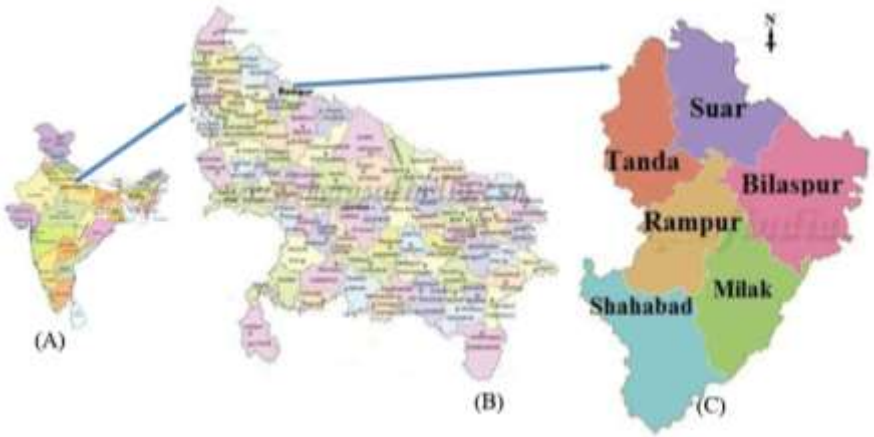

Fig 1: Map of Rampur District (C)

Materials and Methods

Field trips were made in the villages of Rampur district during 2017-19 to collect grass specimens and available literature by Clifford and Watson (1977), Jain (1986), Gould and Shaw (1988), Uniyal *et al.* (1994), Anonymous (2007) and Singh (2007) [3, 6, 4, 23, 1, 18] have been consulted for identification of species and matched with herbarium of FRI, Dehradun and BSI, Allahabad. Online database such as- The International Plant Name Index (www.ipni.org) and the plant list (www.theplantlist.org) were referred for author citation and correct nomenclature.

Grasses specimens were dried, preserved, and deposited in the Herbarium, Department of Botany, Hindu College, Moradabad (U.P.) for future use.

Key to the Genera

1a. Spikelets 1-many flowered, braking up when mature, if falling entire, then not 2-flowered, of laterally compressed or terete:
2a. Shrubs or tree like, leaves articulate with the sheaths, stamens-6, lodicules generally-3:
3a. Spikelets dense, globose, congested heads, pericarp fleshy and free from the seeds:
3b. Spikelets not as above, pericarp thin, fused with the seeds … 3. *Bambusa*
2b. Herbs or shrub like, leaves not articulate with the sheaths, stamens 1-3, lodicules 2 or absent:
4a. Male and female spikelets born in separate inflorescence…30. *Zea*
4b. all type of spikelets mixed in the same inflorescence:
5a. Spikelets in open or contracted spike-like panicles:
6a. Rachilla joints and lemmas glabrous, if hairy then not enveloping lemmas with a geniculate awn:
7a. lowest florets usually larger than the glumes, upper florets distinctly exerted:
8a. Lemmas 5-13 nerved.23. *Poa*
8b. Lemmas generally 1-3 nerved:
9a. Inflorescence a panicle, if raceme or spike, the spikelets not second:
10a. Spikelets arranged in open, contracted spike like panicle …16. *Eragrostis*
10b. Spikelets arranged in racemosely or digitate spikes or spike like racemes:
11a. the axis of the spike terminate in sharp point…11. *Dactyloctenium*
11b. Branches and main axis of inflorescence terminate in spikelet:
12a. Spikelet falling wholly from spikes, crowded in long, narrow, dense panicle…12. *Desmostachya*
12b. Spikelet braking up when mature, spikes few to several:
9b. Inflorescence of a panicle of racemes or racemes, spikelets secund:
13a. Spikelets awned, secund, Spikes digitate more than three…7. *Chloris*
13b. Spikes not so above:
14a. Spikelets awnless imperfect flowers absent…10. *Cynodon*
14b. Spikelets not so above:
7b. Lowest florets usually shorter or equaling the glumes, upper florets as long as the spikelets…2. *Avena*
6b. Rachilla joints and lemmas long hairy, enveloping the lemmas:
15a. Rachilla long hairy, lemmas glabrous:
15b. Rachilla glabrous, lemmas hairy all over on the back…1. *Arundo*
5b. Spikelets in contracted or rarely open spike like panicles:
16a. Fertile lemma and palea similar, glumes reduced minute:
17a. Leaves linear, acuminate, cultivated…19. *Oryza*
17b. Leaves not as above:
16b. fertile lemma and palea dissimilar, glumes well developed:
18a. Spikelets with 3-florets, lower-2 florets reduced to lemmas, often minute or absent…22. *Phalaris*
18b. Spikelets with 1 or 2 florets:
19a. Inflorescence a spreading, lobulate panicle, involucral glumes awned…24. *Polypogon*
19b. Involucral glumes otherwise:
20a. Spikelets in threes, 1- flowered at each node of the spike axis…17. *Hordeum*
20b. Spikelets solitary, 2 or more flowered at each node of the spike axis…28. *Triticum*
1b. Spikelets generally 2- flowered, falling entire at maturity, often with upper florets bisexual and lower male or barren more or less dorsally compressed:
21a. Inflorescence bearing bisexual spikelets or male or barren or bisexual spikelets at the same time, if unisexual then the fertile florets indurated:
22a. Spikelets paired (one sessile and one pedicelled) similar or dissimilar. Glumes rigid equaling the spikelets and enclosing the florets, lemma hyaline or membranous, upper lemma often awned:
23a. Spikelets all in similar pairs, hermaphrodite:
23b. Spikelets 3.5 - 5 mm long…25. *Saccharum*
24a. Spikelets 2 - 3 mm long…18. *Imperata*
24b. Spikelets dissimilar, in each pair, sessile bisexual. Pedicelled male or barren or absent:
25a.Spikelets dorsally compressed with lower glume flat…27. *Sorghum*
25b. Spikelets terete or laterally compressed with usually concave lower glume not flat:
26a. Joints and pedicels with a translucent longitudinal furrow…4. *Bothriochloa*
26b. Joints and pedicels not as above:
27a. Upper lemma of the sessile spikelets reduced to the translucent base of an awn. Plants not aromatic…13. *Dichanthium*
27b. Upper lemma of the sessile spikelets 2-cleft or lobed, awned from the sinus. Plants aromatic…9. *Cymbopogon*
22b. Spikelets solitary or paired, generally similar, glumes shorter or equaling the spikelets, membranous, upper lemma often awnless:
28a. Spikelets subtended by a solitary bristle or with an involucre of bristles, often not falling singly:
29a. Bristles persistent, upper lemma transversely rugose…26. *Setaria*
29b. Bristles persistent, upper lemma smooth:
30a. Lower glumes nerveless, upper absent…21. *Pennisetum*
30b. Both glumes present subequal…6. *Cenchrus*
28b. Spikelets not subtended by bristles, often falling singly:
31a. Lemmas of the upper floret often crustaceous or with in rolled margins exposing much of the palea:
32a. Spikelets adaxial (i.e. lower glume turned towards the rachis, the back of the upper lemma turned away from it…5. *Brachiaria*

32b. Spikelets abaxial (i.e. lower glume, if present, turned away from the rachis, the back of the upper lemma facing it):
33a. Upper lemma acute or mucronate, glumes awnless…29. *Urochloa*
33b. Upper lemma not so but, glumes awned …15. *Echinochloa*
31b. Lemmas of the upper florets thinly cartilaginous and often with flat, hyaline margin:
34a. Spikelets in open or contracted panicles …20. *Panicum*
34b. Spikelets usually in whorled racemes or 2-9 digitate…14. *Digitaria*
21b. Inflorescence bearing unisexual male and female spikelets in different parts or in the same, lemmas membranous…8. *Coix*

Result & Discussion

The present study documented 37 grass species under six subfamilies namely Panicoideae (20 species), Chloridoideae (7 species), Pooideae (6 species), Bambusoideae (2 species), Ehrhartoideae and Arundinoideae (1 species) respectively (Table-2). Panicoideae was the most dominant with 20 species growing in all six tehsils. Grass species, subfamilies tribes, phenology and their occurrence in six tehsils of Rampur district is given in (Table-1). Genus *Eragrostis* and *Saccharum* showed maximum representation with 3 species followed by *Bambusa*, *Setaria* and *Sorghum* with 2 species.

Table 1: List of grasses growing in six tehsils of Rampur district

Sr. No.	Grass species	Subfamilies	Tribes	Phenology	Tehsils of Rampur district					
					Bl	Mk	Rm	Sh	Su	Td
1.	*Arundo donax* L.	Arundinoideae	Arundineae	Sept – Apr	+	-	+	-	+	+
2.	*Avena sativa* L.	Pooideae	Poeae	Jan – May	+	+	+	+	-	+
3.	*Bambusa bambos* (L.) Voss	Bambusoideae	Bambuseae	Not seen	+	-	+	-	-	+
4.	*Bambusa vulgaris* Schrad.	Bambusoideae	Bambuseae	Not seen	+	-	-	-	+	-
5.	*Bothriochloa pertusa* (L.) A.Camus	Panicoideae	Andropogoneae	July – Nov	-	+	+	-	+	-
6.	*Brachiaria ramosa* (L.) Stapf	Panicoideae	Paniceae	June – Sept	+	-	-	-	+	+
7.	*Cenchrus ciliaris* L.	Panicoideae	Paniceae	Most parts of the year	+	-	+	+	-	+
8.	*Chloris barbata* Sw.	Chloridoideae	Cynodonteae	July – Oct	+	+	-	+	+	-
9.	*Coix lacryma-jobi* L.	Panicoideae	Andropogoneae	Aug – Nov	-	+	-	+	+	-
10.	*Cymbopogon citratus* (DC.) Stapf	Panicoideae	Andropogoneae	Feb– Apr	-	-	+	-	-	+
11.	*Cynodon dactylon* (L.) Pers.	Chloridoideae	Cynodonteae	Most parts of the year	+	+	+	+	+	+
12.	*Dactyloctenium aegyptium* (L) Willd.	Chloridoideae	Cynodonteae	July – Oct	+	+	+	+	+	+
13.	*Desmostachya bipinnata* (L.) Stapf	Chloridoideae	Chlorideae	June – Sept	+	+	+	+	+	+
14.	*Dichanthium annulatum* (Forssk.) Stapf	Panicoideae	Andropogoneae	July – Nov	+	+	+	+	+	+
15.	*Digitaria setigera* Roth	Panicoideae	Paniceae	Aug – Oct	+	-	+	+	+	-
16.	*Echinochloa colona* (L.) Link	Panicoideae	Paniceae	July – Nov	+	-	-	+	+	-
17.	*Eragrostis ciliaris* (L.) R.Br.	Chloridoideae	Eragrostideae	May – Dec	+	+	+	+	-	+
18.	*Eragrostis pilosa* (L.) P.Beauv.	Chloridoideae	Eragrostideae	Apr – July	+	-	+	+	+	+
19.	*Eragrostis tremula* Hochst. ex Steud.	Chloridoideae	Eragrostideae	June – Sept	+	+	-	-	+	-
20.	*Hordeum vulgare* L.	Pooideae	Triticeae	Feb – Apr	+	+	+	+	-	+
21.	*Imperata cylindrica* (L.) Raeusch.	Panicoideae	Andropogoneae	July – Nov	-	+	-	+	+	+
22.	*Oryza sativa* L.	Ehrhartoideae	Oryzeae	Aug – Nov	+	-	-	+	+	+
23.	*Panicum antidotale* Retz.	Panicoideae	Paniceae	June – Dec	+	-	-	-	+	+
24.	*Pennisetum glaucum* (L.) R.Br.	Panicoideae	Paniceae	Aug – Nov	+	-	-	+	+	+
25.	*Phalaris minor* Retz.	Pooideae	Poeae	Feb – May	+	+	+	+	+	+
26.	*Poa annua* L.	Pooideae	Poeae	Jan – Apr	+	+	-	+	+	+
27.	*Polypogon monspeliensis* (L.) Desf.	Pooideae	Poeae	Feb – May	+	-	-	+	+	-
28.	*Saccharum bengalense* Retz.	Panicoideae	Andropogoneae	Sept – Mar	+	+	+	-	+	+
29.	*Saccharum officinarum* L.	Panicoideae	Andropogoneae	Nov – Apr	+	+	-	+	+	+
30.	*Saccharum spontaneum* L.	Panicoideae	Andropogoneae	Oct – Jan	+	-	-	-	+	+
31.	*Setaria glauca* (L.) P.Beauv.	Panicoideae	Paniceae	May – Nov	+	+	-	+	-	+
32.	*Setaria verticillata* (L.) P.Beauv.	Panicoideae	Paniceae	Sept – Dec	+	-	+	+	-	-
33.	*Sorghum bicolor* (L.) Moench	Panicoideae	Andropogoneae	July – Oct	+	+	-	+	+	-
34.	*Sorghum halepense* (L.) Pers.	Panicoideae	Andropogoneae	Aug – Nov	+	+	+	-	+	-
35.	*Triticum aestivum* L.	Pooideae	Triticeae	Feb – May	+	+	+	+	+	+
36.	*Urochloa panicoides* P. Beauv.	Panicoideae	Paniceae	Sept – Dec	+	-	+	-	+	-
37	*Zea mays* L.	Panicoideae	Andropogoneae	Aug – Nov	+	+	-	+	+	-

Name of Tehsils: Bl = Bilaspur, Mk = Milak, Rm = Rampur, Sh = Shahabad, Su = Suar and Td = Tanda

Table 2: Numerical data analysis according to subfamilies

Sr. No.	Subfamilies	No. of Tribe	No. of Genera	No. of Species
1.	Arundinoideae	1	1	1
2.	Bambusoideae	1	1	2
3.	Chloridoideae	3	5	7
4.	Ehrhartoideae	1	1	1
5.	Panicoideae	2	16	20
6.	Pooideae	2	6	6
Total	06	10	30	37

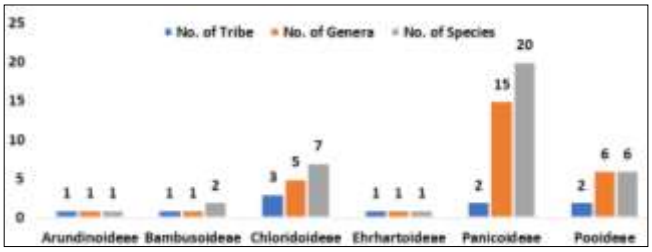

Fig 2: Occurrence of grass species according to subfamilies

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