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Floristic Composition of Weeds in Paddy Fields of Ri Bhoi District of Meghalaya

Premaradhya N.[1*], Vishram Ram[2], Santosh Korav[3] and N.J. Singh[4]

[1]Assistant Professor of Agronomy, MTTC VTC, (Arunachal Pradesh), India.
[2]Professor & In-charge, School of Natural Resource Management,
College of Post Graduate Studies in Agricultural Sciences, Umiam, (Meghalaya), India.
[3]Assistant professor Agronomy, School of Agriculture,
Lovely Professional University, Phagwara Jalandhar, (Punjab), India.
[4]Assistant Professor (SSAC), School of Natural Resource Management,
College of Post Graduate Studies in Agricultural Sciences, Umiam, (Meghalaya), India.

(Corresponding author: Premaradhya, N.)*
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ABSTRACT: The present investigation was undertaken to assess the distribution and pattern of weed flora prevailing in the rice fields of Ri-Bhoi district of Meghalaya. A random field survey was conducted in the farmers' rice field (75 sites and 3 quadrates in each site of the Ri-Bhoi district of Meghalaya during the rainy season of 2016 and 2017. The region experiences a tropical monsoon climate, in two study sites, i.e., upland which is broadcasted with no management system practiced in traditional methods of *jhum* fields and in lowland, which is submerged and transplanted system practiced in the valleys which is frequently flooded due to heavy rainfall. The genus and species of weeds were precisely identified and counted number of weeds present in the 1m^2 quadrate from all the sites of the study area using GPS coordinates and various phytosociological parameters such as Density, Frequency, Abundance and Importance Value Index (IVI) were calculated, based on the data collected in the district. The results were indicated that the total 49 weed species collected which are related to 15 families. Among the lowland families the dominance was having 06 and 05 species from *Cyperaceae* and *Poaceae,* respectively and the rest of the families represented by one or two species each. While in Uplands, *Asteraceae* was represented by 12 species followed by *Poacea*e (4) and *Rubiaceae* (3) and the family *Amaranthaceae, Commenilaceae*, and *Fabaceae,* were contained 02 weed species each. The highest IVI value of *Rotala indica and Cyperus laevigatus* was higher (20%) followed by *Fimbristylis miliacea, Echinochloa colona, Eriocaulon sieboldianum, Cyperus iria, Marsilea crenata, Monochoris vaginalis* and *Rotala rotundifolia* (ranged from 10 to 20%) were the most dominant among the observed weed community in aquatic weed species.

Keywords: *Phytosociology, Oryza sativa, Importance Value Index, Weed control strategy and weed flora.*

INTRODUCTION

India's Northeast is mostly based on an agrarian economy with more than 70 percent of the population engaged in the Agri and allied activities in the region. Rice (*Oryza sativa L.*) is among the most cultivated crop, sharing 85-90% of total food grain production. The crop is being grown under rainfed condition totally and occupying an area of about 3.5 m ha with an average productivity of 1.6 t ha^{-1} only as compared to national and world average of 2.5 t ha^{-1} and 4.0 t ha^{-1}, by deficit of 36 and 60 per cent respectively (DES, 2017). Meghalaya is an agricultural state, in which 80% of its population depends on agriculture for their livelihood. Among the crops grown, rice is the dominant one accounting for over 80% of the food requirement of the State. Covering 44% of the total agricultural land of which about 40% of rice is cultivated from the *Jhum* fields. The major land use pattern of the state is the shifting cultivation traditionally and degrading the richest natural soil resource of the state due to the cultivation in lower valleys around the undulating terrain of the hills Borthakur, (1992). Low productivity of rice under low land area of hilly ecosystem of Meghalaya is the major concern as it is being continuously affected by abiotic factors such as frequent flooding and accelerated soil erosion due to torrential rains (Saha *et al.,* 2012). As lack of motivation towards rectification of sloping gradient leads to deleterious effect on growth and productivity of rice, the resource poor tribal farmers tend their cultivation towards upland under which major biotic stress challenge prevails extensive weed infestation otherwise it is needed low input demand (Paudel *et al.,* 2017).

Weed succession and distribution patterns in rice fields are dynamic in nature. The diversity of the weed flora may differ depending on location Petit and Boursault (2010). The competitiveness of weeds is often measured in terms of crop yield reduction per unit of weed population or biomass, and the yield reduction can vary greatly as a result of the weed species (Hassan *et al.,* 2010). In a weed management program, a thorough survey is necessary to address the current weed problems in the rice field and survey information is important to developing a sustainable long-term weed management strategy (Dinesh Sah, *et al.,* 2020). Also, such studies help in determining how a weed flora changes over time in response to selective pressures due to management of field. However, detailed information on the up-to-date presence, frequency, abundance, importance of weed species especially in paddy fields of north-east Meghalaya, in particular, is rare. The present comprehensive study was undertaken as a part of the Ph.D work to record and analyze the weed species composition in upland broadcasting and lowland transplanting paddy fields of Ri-Bhoi District of Meghalaya.

MATERIALS AND METHODS

A. Study site

The field surveys were conducted during rainy season of 2016 and 2017 at farmers' paddy fields in the Ri-Bhoi district of Meghalaya lies between 90°55' to 91°16' latitude and 25°40' to 25°21' longitude and there is an altitudinal variation of 200m to 850m amsl. The region experiences a tropical monsoon climate, in two study sites, i.e., upland which is broadcasted with no management system practiced in traditional methods of *jhum* fields and in lowland, which is submerged and transplanted system practiced in the valleys which is frequently flooded due to heavy rainfall. The soil was silty clay in texture and high in fertility with 4.2- 4.9 pH.

B. Sampling and procedure

A random field survey at active crop growth stage of rice field in different locations across (75 sites and three quadrates in each site) the district was carried out during the rainy season (2016-17) and the genus and species of weeds were precisely identified, then the number of weeds from each species was counted separately in each quadrate of each sampling point using GPS coordinates after throwing a $1m^2$ quadrate. Thus, the structure and composition of vegetation in the paddy fields have been compared in terms of frequency; density, abundance, and basal area of major species were arrived at. The following formulae were used to compute different phytosociological parameters:

Absolute frequency =

$$\frac{\text{No. of sampling units with species present}}{\text{Total number of sampling units}}$$

Relative frequency =

$$\frac{\text{Species absolute frequency}}{\text{Sum of all absolute frequencies}} \times 100$$

$$\text{Absolute density} = \frac{\text{Total no. of individuals of a species}}{\text{Total sampled area}}$$

$$\text{Relative density} = \frac{\text{Absolute density of a species}}{\text{Sum of all absolute densities}} \times 100$$

Absolute abundance =

$$\frac{\text{Total no. of individuals of a species}}{\text{Total no. of sampling units containing that species}}$$

Relative abundance =

$$\frac{\text{Absolute abundance of a species}}{\text{Sum of all absolute abundances}} \times 100$$

Importance value =

$$\frac{\text{Sum of all absolute abundances}}{\text{Relative frequency + Relative density + Relative abundance}}$$

RESULTS AND DISCUSSION

A. Weed Species and distribution

Occurrence of a total 50 weed species belonging to 18 families were recorded from both the sites (lowland and upland) in Ri-Bhoi district of the state Meghalaya during 2016-17, of which majority were from upland (29 species) and lowland had (21 Species). Among the lowland families the dominance was having 06 and 05 species from Cyperaceae and Poaceae, respectively followed by *Lythraceae* and *Onagraceae* recorded 02 species each and rest of the families *Alismataceae, Elatinaceae, Eriocaulaceae, Marsileaceae, Pontederiaceae* and Convolvulaceae represented by one species each. While in Uplands, *Asteraceae* was represented by 12 species followed by *Poaceae* (4) and *Rubiaceae* (3) and the family *Amaranthaceae, Commenilaceae,* and *Fabaceae,* were contained 02 weed species each. The remaining families i.e., *Caryophyllaceae, Melastomataceae, Oxalidaceae* and *Plantaginaceae* observed one weed species each (Table 1). The weed species namely *Rotala indica, Cyperus lavigatus, Fimbristylis miliacea, Echinochloa colona, Rotala rotundifolia, Cyperus iria, Marsilea crenata, Monochoria vaginalis, Eriocaulon sieboldianum* and *Sagittaria sagittifolia were* had maximum infestation in lowland system. In Upland, *Spermoce latifolia, Ageratum conyzoides, Ambrosia artemisiifolia, Achyranthus aspera, Bidens pilosa, Spermacoce ocymoides, Galinsoga parviflora Commelina bengalensis* and *Digitaria sangvinalis* etc. were reported frequently with maximum infestation in both years of study. These several families were also reported among the most important ones in both system of rice cultivation by Alhassan *et al.,* (2015); Silva *et al.,* (2017).

Table 1: Weed flora observed in paddy fields of Ri Bhoi District, Meghalaya during study.

Sr. No.	Scientific Name	Common Name	Family	Ecosystem
1.	*Sagittaria sagittifolia*	Arrow head	Alismataceae	wetland
2.	*Cyperus laevigatus*	smooth flatsedge	Cyperaceae	wetland
3.	*Cyperus compactus*	Boeckele	Cyperaceae	wetland
4.	*Cyperus difformis*	Flatsedge	Cyperaceae	wetland
5.	*Cyperus iria*	Yellow nut sedge	Cyperaceae	wetland
6.	*Cyperus rotundus*	Purple nut sedge	Cyperaceae	wetland
7.	*Fimbristylis miliacea*	hoorahgrass	Cyperaceae	wetland
8.	*Bergia aquatica*	Waterwort	Elatinaceae	wetland
9.	*Eriocaulon sieboldianum*	Pipeworts	Eriocaulaceae	wetland
10.	*Rotala indica*	Rotala	Lythraceae	wetland
11.	*Rotala rotundifolia*	dwarf rotala	Lythraceae	wetland
12.	*Marsilea crenata*	Water clover	Marsileaceae	wetland
13.	*Dactyloctenium aegyptium*	Crow foot grass	Poaceae	wetland
14.	*Echinochloa crus-galli*	Barnyard grass	Poaceae	wetland
15.	*Echinochloa colona*	Swanki	Poaceae	wetland
16.	*Monochoria vaginalis*	pickerelweed	Pontederiaceae	wetland
17.	*Ludwigia octovalvis*	Mexican primrose-willow	Onagraceae	wetland
18.	*Ludwigia adscendens*	water primrose	Onagraceae	wetland
19.	*Leptochloa chinensis*	red sprangletop	Poaceae	wetland
20.	*Ischaemum rugosum*	Murainagrass	Poaceae	wetland
21.	*Ipomaea aquatica*	morning-glory	Convolvulaceae	wetland
22.	*Alternanthera sessilis*	dwarf copperleaf	Amaranthaceae	upland
23.	*Achyranthus aspera*	chaff-flower	Amaranthaceae	upland
24.	*Ageratum conyzoides*	Nilam (Goat weed)	Asteraceae	upland
25.	*Ageratum houstonianum*	Goat weed	Asteraceae	upland
26.	*Ambrosia artemisiifolia*	Stick weed	Asteraceae	upland
27.	*Bidens pilosa*	Spanish needle	Asteraceae	upland
28.	*Galinsoga parviflora*	Potato weed	Asteraceae	upland
29.	*Chromolaena odorata*	Siam weed	Asteraceae	upland
30.	*Acmella uliginosa*	marsh para cress	Asteraceae	upland
31.	*Eclipta prostrata*	false daisy	Asteraceae	upland
32.	*Crassocephalum crepidioides*	Fireweed	Asteraceae	upland
33.	*Conyza sumatrensis*	white horseweed	Asteraceae	upland
34.	*Drymaria cordata*	Sticky weed	Caryophyllaceae	upland
35.	*Commelina bengalensis*	Benghal dayflower	Commenilaceae	upland
36.	*Commelina diffusa*	spreading dayflower	Commelinaceae	upland
37.	*Sesbania exaltata*	bigpod sesbania	Fabaceae	upland
38.	*Mimosa pudica*	touch me not	Fabaceae	upland
39.	*Osbeckia nepalensis*	-	Melastomataceae	upland
40.	*Oxalis corniculata*	Creeping wood sorrel	Oxalidaceae	upland
41.	*Scoparia dulcis*	sweet-broom	Plantaginaceae	upland
42.	*Digitaria sangvinalis*	Crabgrass	Poaceae	upland
43.	*Cynodon dactylon*	Bermuda grass	Poaceae	upland
44.	*Eragrostis tenella*	Senegal	Poaceae	upland
45.	*Digitaria ciliaris*	southern crabgrass	Poaceae	upland
46.	*Spermoce latifolia*	False button weed	Rubiaceae	upland
47.	*Borreria hispida*	Thaarthaval	Rubiaceae	upland
48.	*Spermoce ocymoides*	false button weed	Rubiaceae	upland

B. Relative frequency, density and dominance

The relative frequency distribution values represented in the Table 2 reflects significant level of variation among the different observed weed species. The relative frequency distribution of aquatic weeds namely, *Rotala indica, Monochoria vaginalis, Sagittaria sagittifolia, Cyperus laevigatus, Cyperus iria, Echinochloa colona, Fimbristylis miliacea* were reflects higher values among 21 species in lowlands and *Spermoce latifolia, Ageratum conyzoides, Ambrosia artemisiifolia, Mimosa pudica, Bidens pilosa, Acmella uligosa* and *Digitaria sangvinalis* were observed among 29 species in Uplands in both years of study, respectively. Further, it also indicates that the relative proportion of occurrence of these species to each other is very high compared to other weed species it might be due to microclimatic preference for the appearance of these species made to fit well with the environment of low altitude or valley region, also greater reproductive potential exist in these species may be the possible reasons for this fact Sridevi *et al.,* (2013); Begum (2006). Similarly, the same trend has followed in relative density of which *Rotala indica, Cyperus lavigatus* and *Fimbristylis miliacea* in lowland rice and *Spermoce latifolia and Ageratum conyzoides* in uplands was found highest in both years of study, which clearly

reflects that only few species had dominating feature among the weed community of the paddy fields of Ri-Bhoi district. Relative dominance of lowland weed species was found highest in *Rotala indica*, *Cyperus laevigatus*, *Eriocaulon sieboldianum*, *Fimbristylis miliacea* and Marsilea crenata. While in upland *Spermoce latifolia and Ageratum conyzoides* were reflected higher values which therefore indicate their relative population strength among the diverse weed community.

Table 2: Phyto-sociological studies of weed flora observed in paddy fields of Ri Bhoi District, Meghalaya observed during study.

Sr.No.	Scientific Name	Relative frequency		R Uniformity		R Mean Density		Relative Abundance	
		2016	2017	2016	2017	2016	2017	2016	2017
1.	*Sagittaria sagittifolia*	6.47	6.96	5.59	6.77	2.54	3.80	14.60	17.53
2.	*Cyperus laevigatus*	6.26	5.87	6.96	6.16	10.23	9.93	23.45	21.95
3.	*Cyperus compactus*	1.67	1.30	1.61	1.35	0.90	1.34	4.19	4.00
4.	*Cyperus difformis*	3.97	4.13	3.85	3.94	2.44	3.18	10.26	11.25
5.	*Cyperus iria*	5.01	5.00	5.22	5.30	3.96	5.73	14.19	16.02
6.	*Cyperus rotundus*	1.04	0.65	1.12	0.62	0.60	0.49	2.76	1.75
7.	*Fimbristylis miliacea*	3.34	3.48	3.73	3.57	5.91	4.39	12.98	11.44
8.	*Bergia aquatica*	1.88	2.83	1.37	2.46	0.89	1.87	4.14	7.16
9.	*Eriocaulon sieboldianum*	1.04	1.74	1.12	1.85	2.68	3.18	4.85	6.77
10.	*Rotala indica*	6.89	7.17	7.95	7.14	12.27	7.89	27.11	22.21
11.	*Rotala rotundifolia*	1.46	1.30	1.61	1.48	3.49	1.59	6.57	4.37
12.	*Marsilea crenata*	2.92	3.26	3.35	3.20	4.13	2.90	10.41	9.36
13.	*Dactyloctenium aegyptium*	1.04	1.09	0.99	0.99	1.28	0.99	3.31	3.06
14.	*Echinochloa crus-galli*	0.84	0.65	0.75	0.62	0.57	0.80	2.15	2.06
15.	*Echinochloa colona*	3.97	3.26	4.35	3.45	4.86	5.96	13.18	12.67
16.	*Monochoria vaginalis*	6.26	6.74	5.96	6.65	2.90	4.77	15.12	18.16
17.	*Ludwigia octovalvis*	1.46	1.52	1.37	1.60	0.82	1.33	3.65	4.45
18.	*Ludwigia adscendens*	1.25	0.87	0.87	0.74	0.69	0.31	2.81	1.92
19.	*Leptochloa chinensis*	1.46	1.30	1.12	1.23	1.02	0.99	3.60	3.52
20.	*Ischaemum rugosum*	1.04	1.30	1.24	0.99	0.93	0.96	3.22	3.25
21.	*Ipomaea aquatica*	2.51	2.39	2.36	2.34	0.80	1.34	5.66	6.07
22.	*Alternanthera sessilis*	0.21	0.43	0.12	0.49	0.09	0.19	0.43	1.12
23.	*Achyranthus aspera*	1.25	1.74	1.49	1.97	1.50	1.90	4.24	5.61
24.	*Ageratum conyzoides*	3.97	3.48	4.60	3.45	9.56	4.80	18.13	11.73
25.	*Ageratum houstonianum*	0.42	0.22	0.37	0.25	0.23	0.19	1.02	0.66
26.	*Ambrosia artemisiifolia*	2.30	2.17	2.36	2.34	1.98	2.27	6.64	6.78
27.	*Bidens pilosa*	1.88	2.61	1.99	2.59	1.49	2.42	5.35	7.61
28.	*Galinsoga parviflora*	1.67	1.74	1.49	1.72	1.09	2.06	4.25	5.53
29.	*Chromolaena odorata*	0.42	0.43	0.37	0.49	0.13	0.32	0.92	1.25
30.	*Acmella uliginosa*	2.09	1.96	1.74	2.09	0.67	2.14	4.50	6.19
31.	*Eclipta prostrata*	0.84	0.43	0.75	0.49	0.25	0.25	1.83	1.18
32.	*Crassocephalum crepidioides*	0.63	0.65	0.62	0.49	0.16	0.18	1.41	1.32
33.	*Conyza sumatrensis*	2.09	2.83	2.48	3.20	1.45	1.77	6.02	7.80
34.	*Drymaria cordata*	1.04	0.87	0.87	0.86	0.35	0.87	2.26	2.60
35.	*Commelina bengalensis*	2.30	1.52	1.99	1.35	1.10	1.15	5.39	4.03
36.	*Commelina diffusa*	1.46	1.52	1.12	0.99	0.40	0.53	2.98	3.04
37.	*Sesbania exaltata*	0.63	0.43	0.37	0.37	0.09	0.15	1.09	0.95
38.	*Mimosa pudica*	2.71	2.39	1.99	1.97	0.80	1.03	5.50	5.39
39.	*Osbeckia nepalensis*	1.04	0.65	0.87	0.49	0.39	0.19	2.30	1.34
40.	*Oxalis corniculata*	0.63	0.65	0.50	0.62	0.25	0.37	1.38	1.64
41.	*Scoparia dulcis*	0.21	0.22	0.12	0.25	0.11	0.28	0.44	0.74
42.	*Digitaria sangvinalis*	1.88	1.74	1.86	1.85	1.05	2.02	4.79	5.60
43.	*Cynodon dactylon*	0.84	0.43	0.87	0.49	0.53	0.68	2.24	1.60
44.	*Eragrostis tenella*	0.63	0.43	0.50	0.37	0.21	0.32	1.34	1.13
45.	*Digitaria ciliaris*	1.25	1.96	1.49	2.22	0.77	0.77	3.51	4.94
46.	*Spermoce latifolia*	4.59	4.35	5.34	4.80	10.33	7.72	20.27	16.87
47.	*Borreria hispida*	0.42	0.43	0.37	0.37	0.19	0.12	0.98	0.92
48.	*Spermoce ocymoides*	0.84	0.87	0.87	0.99	0.92	1.61	2.62	3.46

However some of the weeds reported from the study area i.e., *Achyranthes aspera, Eclipta alba, Commelina benghalensis, Cynodon dactylon, Euphorbia hirta, Euphorbia prostrata* etc. are of medicinal importance, used as traditional medicines by the tribes of the district Vijay and Ashok (2018). The weeds like *Amaranthus viridis, Boerhaavia diffusa, Trianthema portulacastrum, Portulaca oleracea, Oxalis corniculata etc.* are used in some cooking racepies of the study area (Mallick and Raha, 2015).

C. Importance value index

The highest IVI value of *Rotala indica and Cyperus laevigatus* was higher (20%) followed by *Fimbristylis miliacea,* Echinochloa colona, *Eriocaulon sieboldianum, Cyperus iria Marsilea crenata, Monochoris vaginalis* and *Rotala rotundifolia* (ranged from 10 to 20%) were the most dominant among the observed weed community in aquatic weed species against the lowest IVI values represented by *Cyperus rotundus, Cyperus compactus, Ipomaea aquatica* and *Ludwigia* sp. reflects that they are less common aquatic species in the weed community. This indicates the higher concentration of these species in limited area which in turn may be influenced by dispersal mechanism of the respective species. Further, the presence of higher ecological importance (IVI) for these species in the study area showed that they are having well adaptive mechanism against the disturbance. Our findings were similar and confirmatory with the earlier findings of Sinha, (2017); Kaur *et al.,* (2020).

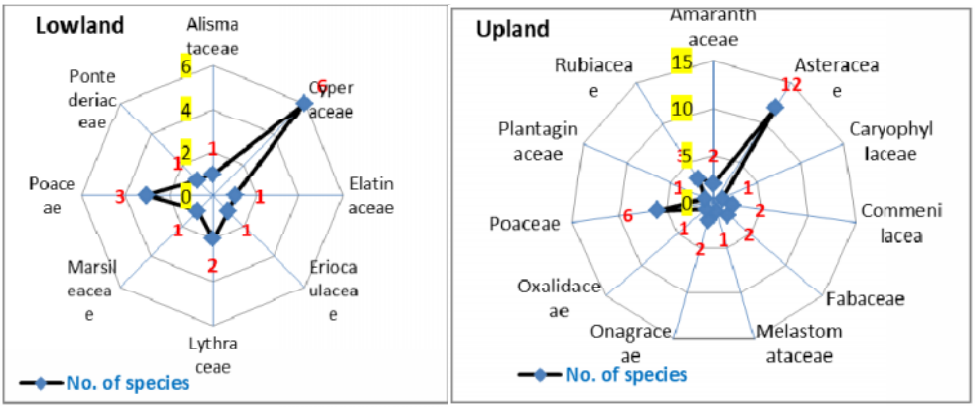

Fig. 1. Family wise classification weed species found in the paddy fields of Ri Bhoi District, Meghalaya.

CONCLUSIONS

The present study was conducted as a first ever attempt from the study area to explore and identify the weeds of paddy crop. Study was able to establish that the most important weeds that were associated and the diversity pattern with the paddy crop in the study area are of grass and sedge family in lowlands and broadleaves and sedges in uplands. The present analysis would be useful in developing future crop management and devising methods to control those specific areas through long-term monitoring of weed diversity in this region in the context of precision agriculture.

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Conflict of interest. Nil.

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