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Weed Survey in Different Fields of Transplanted Rice (*Oryza sativa* L.) in North Pulinpur Area under Khowai District of Tripura

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Abstract

The present investigation was carried out during *kharif* season 2017-18 at North Pulinpur area under Khowai district, Tripura (23°52.836' N, latitude of 91°35.275' E, longitude, and 940 m above sea level). North Pulinpur is one of the drought prone areas of Khowai district, Tripura. The area falls under the subtropical hill zone, and the climate is humid. An average annual rainfall ranges from 2050-2550 mm. The soil of the experimental field was sandy loam in texture acidic in reaction with a soil pH of 4.5-5.8 and medium in fertility status with low water holding capacity. Rice field surveyed covering 435 fields of four villages (V-I, II, III and IV) the number of respective field was 102, 141, 75 and 117, respectively. Weeds indicated there were 42 species belonging to 20 families of which 22 species were broad-leaved, 10 grasses, 7 sedges and 3 aquatics. Species diversity ranking of weed community for the villages were Village-II>Village-III>Village-I>Village-IV. Based on Sorenson's Index of Similarity of the S value is 87.67-102.77 %. The highest S value of 102.77% was between Village-I and Village-III, while the lowest value of 87.67% between Village-II and Village-IV. The higher S value indicated that species composition between villages was closely similar and the lower S value indicated species compositions in both villages were diverse. Out of 42 weed species, six species namely *Oryza sativa* (Weedy rice) followed by *Echinochloa crus-galli, Leptochloa chinensis, Cynodon dactylon, Ludwigia hyssopifolia, Fimbristylis milacea* were most abundant in all villages with a greater proportion of severe infestation (score of 5:41-50 % weed cover).

1. Introduction

Weeds are unwanted and undesirable plants which interfere with utilization of land, water and other resources. Weeds are an important factor in the management of all land and water resources but losses caused by weeds exceed those by any other category of agricultural pests. Of the total annual loss in agricultural produce, weeds account for ~ 45 percent, insect 30 percent, diseases 20 percent and other pests 5 percent (Yaduraju, 2005). The different traditional methods like manual weeding, intercultural operations and herbicide spraying are practiced by the farmers separately. Integrated weed management (IWM) is the control of weeds through a long term management approach using several weed management techniques such as physical, chemical, biological and cultural control methods. Rice is a major crop in the world, it feeds one third of the world population to whom it supplies almost two third of the food requirements. From an area, 42 million hectare, India is producing about 40% of the world rice production. In rice, infestation of all types of monocot and dicot weed was observed. Like other cereal crops, rice also suffers severely from weed competition. The diverse weeds under transplanted conditions (grasses, sedges, aquatic and broad-leaved weeds) can cause yield reduction up to 76% (Singh *et al.,* 2004). In other to realize maximum benefit of applied monetary inputs, two or three hand weeding (HW) were most effective against all type of weeds in this crop (Halder and Patra, 2007). In transplanted paddy, the young plants have an advantage over germinating weeds and immediate flooding after transplanting limits the establishment of many weeds, hence yield losses due to weed competition tend to be less than those in direct seeded paddy. In, Asia yield losses due to uncontrolled weed growth in direct seeded lowland paddy has been reported 45-75 % and for transplanted lowland paddy approximately 50% (Johnson, 1996). Weeds represent a major constraint by yield loss between 5-72 % depending on season of crop sowing, weed species, and weed density, rice cultivars, growth rate and density of weed and rice (Ho, 1984;

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Kuan *et al.*, 1990). All weeds on crop field may not be harmful. At low, density, weeds do not affect yield and certain weeds can even stimulate the crop growth (Thijssen, 1991). The best way of weed management is to make use of it, to promote it to a level of wanted plants. Weed distribution is the result of the compound influence of ecological and human factors. The composition of the weed flora may differ depending on location, water supply, cultural practices, the inherent weed in the area, and the crops grown. Thus, information on the up-to-date presence, composition, abundance, importance and ranking of weed species that infest in a particular area of interest is needed to reformulate appropriate weed management strategies to produces optimum yields of rice. Site specific knowledge on the nature and extent of infestation of weed flora through weed surveys is essential in planning of their effective management strategies. Therefore, the present investigation was under taken to assess the current status of important weeds including composition, distribution, severity and structure of weed communities prevailing at the four villages in North Pulinpur area, Tripura.

2. Materials and Methods

The present investigation was carried out during *kharif* season 2017-18 at North Pulinpur area under Khowai district, Tripura (23°52.836' N, latitude of 91°35.275' E, longitude, and 940 m above sea level). North Pulinpur is one of the drought prone areas of Khowai district, Tripura. The area falls under the subtropical hill zone, and the climate is humid. Prevailing temperature ranges from 16-37 °C. An average annual rainfall ranges from 2050-2550 mm. The soils are classified as hilly red loamy to plain sandy loamy soil. Agriculture is the mainstay of the people, about 80 percent of them engage in agriculture and allied activities. The soil of the experimental field was sandy loam in texture acidic in reaction with a soil P^H of 4.5-5.8 and medium in fertility status with low water holding capacity. In rice crop grown under irrigated condition weed infestations were assessed at heading stage. Rice fields surveyed covering of four villages with 435 fields. For Village-I (Bidhya Hazari Para), Village-II (Laxminarayan Para), Village-III (Magrai Sardar Para) and Village-IV (Sarat Chandra Para) the number of respective fields was 102, 141, 75 and 117, respectively (Table 4). All fields along the route were assessed irrespective of size. The percentage cover of weeds prevailing above the rice canopy was based on the whole fields, whereas the percentage covers of weeds below the crop canopy was taken from four randomly selected quadrant of 1 m^2 dimension of the rice field. This method was adopted both to reduce the time taken to survey a field and to prevent possible damage to the crop (Chancellor and Froud-Williams, 1982 & 1984; Elazegui *et al.,* 1990). The percentage weeds cover prevailing above and below the rice canopy was assessed on a whole field basis. All weed species present were recorded and scored for distribution and frequently. A rating scale of 1 to 10 was used to denote weed cover (Pablico and Moody, 1985), where the lowest score of 1 = 1-10 % weed cover, while the maximum score of 10 = 91-100 %. Species with a few scattered plants were coded as Tr. (Trace amounts).

Comparison of species affiliation among weed communities between villages was made using the "Sorenson's Index Similarity" (Goldsmith *et al.*, 1986) computation of the S value is a follows:

$$S = \frac{2J}{A + B} \times 100$$

Where,

S = Comparison of species association between Village A and B

J = Number of species common to both A and B.

A = Number of species present at Village A.

B = Number of species present at Village B.

Higher S value indicates close similarity in species composition between villages. Conversely, lower S values reflect divergence in species composition in the two villages.

3. Results and Discussion

3.1 Weed Species Distribution

According to Azmi (1990) weed are categorizes into broadleaf weeds, grasses, sedges and submerged weeds. Occurrence of 42 weed species belonging to 20 families were recorded in transplanted rice Variety Gomatidhan at North Pulinpur area, of which 22 were broadleaved, 10 grasses, 7 sedges, and 3

Table 1: Distribution of weed species based on family affiliation and weed type in four villages of North Pulinpur area under Khowai district, Tripura

Family	Species	Weed Occurrence			
		V-I	V-II	V-III	V-IV
Aquatic (Submerged)					
Gentiaceae	*Nymphoides indica (L.)*	x	x	x	-
Zygnemataceae	*Spirogyra spp.*	x	x	x	x
Marsileaceae	*Marsilea quadrifolia*	x	x	x	x
Broad-leaved weeds					
Alismataceae	*Sagittaria guayanensis*	x	x	x	x
Onagraceae	*Ludwigia hyssopifolia (G.Don) Exell*	x	x	x	x
	Ludwigia adscendes (L.) Hara	x	x	x	-
	Ludwigia perennis	x	x	x	x
	Ludwigia parviflora	x	x	x	x

Table 1: Continue...

Family	Species	Weed Occurrence			
		V-I	V-II	V-III	V-IV
Pontederiaceae	*Monochoria vaginalis (Burm.f.)*	x	x	x	x
	Monochoria hastate (L.) Solms	-	-	x	-
Rubiaceae	*Hedyotis corymbosa (L.) Lamk.*	x	x	x	x
Salviniaceae	*Salvinia molesta*	-	x	-	-
Scrophulariaceae	*Bacoba rotundifolia*	x	x	-	-
Spenocleaceae	*Sphenoclea zeylanica Gaertn.*	-	x	-	-
Amaranthaceae	*Amarnthus spinosus*	x	x	x	x
	Amarnthus viridis Hook. F.	-	x	x	-
Asteraceae	*Ageratum coxyzoides*	x	x	x	x
	Eclipta prostrata	x	x	x	-
	Chromolaena odorata	x	-	x	x
Commelinaceae	*Commelina benghalensis*	x	x	x	x
Potulacaceae	*Portulaca oleracea L.*	x	x	x	x
Aizoaceae	*Trianthema portulacastrum*	-	x	x	x
Lythraceae	*Ammania baccifera*	-	x	-	-
Apiaceae	*Centella asiatica*	x	x	x	x
Fabaceae	*Mimosa pudica L.*	x	x	x	x
Grasses					
Gramineae	*Echinochloa crus-galli (L.) Beauv.*	x	x	x	x
	Echinochloa colonum (L.) Link	x	x	x	x
	Ishchaemum rugosum Salisb.	x	x	x	x
	Leptochloa chinensis (L.) Nees	x	x	x	x
	Oryza sativa complex (weedy rice)	x	x	x	x
	Paspalum vaginatum Sw.	x	x	x	x
	Cynodon dactylon	x	x	x	x
	Axonopus compressus (SW.) Beauv.	x	x	x	x
	Digitaria sanguinalis L.	x	x	x	x
	Eleusine indica L.	x	x	x	x
Sedges					
Cyperaceae	*Cyperus difformis L.*	x	x	x	x
	Cyperus haspan L.	x	x	x	x
	Cyperus iria L.	x	x	x	x
	Cyperus rotundus L.	x	x	x	x
	Scirpus grossus L.f	x	x	x	x
	Scirpus juncoides Roxb.	-	x	-	x
	Fimbristylis dichotoma	x	x	x	x
Total	*42*	35	40	37	33

Weed arranged in alphabetical order of Family; x = present; - = absent; V=Village

Aquatic weeds, respectively (Table 1). In the present study, the highest number of species (10) belongs to Gramineae family followed by Cyperaceae (7), Onagraceae (4), Asteracea (3), Pontederiaceae (2) and Amaranthaceae (2). Remaining of the 14 families was represented by one species each. The number of species recorded in four villages ranged from 33 to 40 (Table 2) Village-II appeared to be most diversified with 40 species under 20 families, Village-III had 37 species under 16 families, Village-I registered 35 species under 16 families; while Village-IV registered 33 species grouped under 15 families (Table 2). In this study, species diversity ranking for the villages were as follows, Village-II>Village-III>Village-I>Village-IV (Table 2). Seven weed species, *viz*. *Oryza sativa* (Weedy rice), *Echinochloa crus-galli, Leptochloa chinensis, Cynodon dactylon, Ludwigia hyssopifolia, Fimbristylis milacea, Monochoria vaginalis* were the most frequent rice fields (more than 30% field infested) in Village-I (Table 2). In Village-II and Village-IV eight weed species were the most frequent (more than 30% field infested) namely- *Oryza sativa* (Weedy rice), *Echinochloa crus-galli, Leptochloa chinensis, Ludwigia*

Table 2: Occurrence of weed species in four villages of North Pulinpur area (% of fields infested)

Weed species	Village-I	Village-II	Village-III	Village-IV
Oryza sativa (Weedy rice)	100	100	98.66	95.72
Echinochloa crusgalli	97.05	93.61	66.66	74.35
Leptochloa chinensis	82.35	77.30	82.66	87.17
Cynodon dactylon	78.04	23.40	33.33	29.91
Ludwigia hyssopifolia	50.00	83.68	61.33	75.21
Fimbristylis milacea	42.15	50.35	56.00	51.28
Scirpus grossus	28.43	42.55	48.00	39.31
Monochoria vaginalis	40.19	36.87	18.66	19.65
Ischaemum rugosum	24.50	34.04	37.33	40.17
Cyperus iria	21.56	29.07	30.66	44.44
Nymphoides indica L.	14.70	14.18	13.33	-
Spirogyra spp.	9.80	5.88	8.00	11.11
Masilea quadriformis	16.66	9.21	13.13	12.82
Sagittaria guayanesis	17.64	10.63	16.00	11.96
Ludwia perenis	10.78	11.34	12.00	13.67
Ludwigia parviflora	18.62	19.85	17.33	18.80
Hedyotic corymbosa	5.88	5.67	6.66	12.82
Bacoba rotundifolia	11.76	10.63	-	-
Amaranthus spinosus	9.80	6.38	8.00	4.27
Agaratum coxyzoides	4.90	4.96	5.33	2.55
Eclipta prostrata	2.94	1.41	1.33	-
Chromolaena odorata	4.90	-	2.66	5.12
Centella asiatica	11.76	7.09	14.66	11.11
Portulaca oleracea	6.86	3.54	9.33	11.96
Mimosa Pudica L.	16.66	14.18	2.00	9.33
Echinochloa colonum	9.80	7.09	9.33	9.40
Paspalum vaginatum	7.84	3.54	1.33	2.56
Axonopus compressus	7.84	4.96	6.66	7.69
Digitaria sanguinalis	11.76	6.38	5.33	7.69
Eleusine indica L.	10.78	10.63	8.00	9.40
Cyperus difformis	5.88	4.96	6.66	6.83

Table 2: Continue...

Weed species	Village-I	Village-II	Village-III	Village-IV
Cyperus haspan	8.82	4.96	4.00	4.27
Cyperus rotundus	2.94	2.12	5.33	3.41
Scirpus juncoides	-	3.54	-	5.98
Trianthema portulacastrum	-	4.90	7.09	6.83
Ammania baccifera	-	3.92	-	-
Commelina benghalensis	14.70	13.47	14.66	12.82
Amarathus viridis	-	9.21	22.66	-
Sphenoclea zeylanica	-	4.96	-	-
Salvinia molesta	-	3.54	-	-
Monochoria hastate	-	-	6.66	-
Ludwigia adscendes	4.90	5.67	4.00	-

hyssopifolia, Fimbristylis milacea, Scripus grossus, Monochoria vaginalis, Ischaemum rogusum, Cyperus iria, while Village-III nine weed species were the most frequent (more than 30% field infested) namely- *Oryza sativa* (Weedy rice), *Echinochloa crus-galli, Leptochloa chinensis, Cynodon dactylon, Ludwigia hyssopifolia, Fimbristylis milacea , Scripus grossus, Ischaemum rogusum, Cyperus iria. Scirpus juncoides, Trianthema portalacastrum, Ammania baccifera, Amaranthus viridis, Sphenoclea zeylanica, Salvinia molesta, Monochoria* hastate were not found in Village-I, *Chromolaena odorata, Monochoria hastate* were not found in Village-II, *Bacoba rotundifolia, Scirpus juncoides, Ammania baccifera, Sphenoclea zeylanica, Salvania molesta* were absent in Village–III, while *Nymphoides indica L., Bacoba rotundifolia, Eclipta prostrata, Ammanica baccifera, Amarantus viridis, Sphenoclea Zeylanica, Salvania molesta, Monochoria hastate, Ludwigia adscendes* were absent in Village-IV.

High value of Sorenson's index (87.67-102.77 %) indicates close similarity in weed species in all villages (Table 3). The highest similarity value of 102.77% was between Village-I and Village-III, while the lowest value of Sorenson's index was 87.67% between Village-II and Village-IV followed by Village-I and Village-IV (91.17%), Village-I and Village-II (90.66%), Village-II and Village-III (90.90%), Village-III and Village-IV (91.42%), this indicated that the difference of number of occurring weeds species between these villages was lower and higher, respectively. Grasses were the dominant species followed by sedges, broad-leaved weeds and aquatic weeds in all villages. The different in distribution of different weed groups between these villages could reflect the difference in agronomic practices, especially water management.

Table 3: Sorenson's Index of Similarity in weed species among the four villages in North Pulinpur area

Village	Village-I	Village-II	Village-III	Village-IV
Village-I	-	90.66	102.77	91.17
Village-II	90.66	-	90.90	87.67
Village-III	102.77	90.90	-	91.42
Village-IV	91.17	87.67	91.42	-

3.2 Severity of Weed Infestation

Oryza sativa (Weedy rice), *Echinochloa crus-galli, Leptochloa chinensis, Cynodon dactylon, Ludwigia hysssopifolia* and *Fimbrystylis milacea* infested wide-spread species in all villages. They were most abundant in all villages with a greater proportion of severe infestation (score of 5 = 41-50 % weed cover). *Scripus grossus* was the most frequent and abundant species in Village-II, III and IV having the severity score of 3 to 4 = 31-40 % weed coverage, and in Village-I the rating score for weed coverage was 20%. *Ischaemum rugosum, Cyperus iria* species were the severity score of (3 = 21-30 %) of Village-I, II, III weed coverage and Village-IV was 4 = 31-40 % weed coverage. Other frequent species having the rating score of (2 = 11-20 %) weed coverage were *Nymphoides indica L*. (Village-I, II, III), *Marsilea quadriformis* (Village-I, II, IV), *Sagitaria guayanensis* (Village-I, III, IV), *Ludwigia perenis* (Village-II, III, IV), *Ludwigia parviflora* (Village-I, II, III, IV), *Centella asiatica* (Village-I, III, IV) and *Commelina bengalensis* (Village- I, II, III, IV) (Table 4).

The present study shows that *Oryza sativa* (Weedy rice) and *Echinochloa crus-galli* dominance weed species followed by *Leptochloa chnensis, Cynodon dactylon, Ludwigia hyssopifolia, Fimbritylis milacea, Scirpus grossus, Monochoria vaginalis* and other trace amount weed species also dominance and equally important weed in North Pulinpur area. Based on Sorenson's Index of Similarity of the S value is 87.67-102.77 %, the higher S value indicated that species composition between villages was closely similar and the lower S value indicated species compositions in both villages were diverse. Klingman *et al.,* (1975) stated that weed seed, rhizomes and stolen are easy to be transported by farm machinery during land preparation and during harvesting by using combine harvester from one place to place. Furthermore water one of factor that play a main role as dispersal agent that can disperse weed seed via surface running off through stream, irrigation, rivers and drainage

Table 4: The occurrence at six level of frequency of most abundant weed species in transplanted rice fields in the four villages of North Pulinpur Area

Weed Species	Weed Infestation (% cover)						Total no. of fields infested
	Tr.	1	2	3	4	5	
Village –I (Total fields surveyed 102)							
Oryza sativa	30	26	22	13	5	6	102
Echinochloa crus-galli	47	24	15	7	2	4	99
Leptochloa chinensis	38	20	15	9	2	-	84
Cynodon dactylon	42	26	8	4	-	-	80
Ludwigia hyssopifolia	32	12	7	-	-	-	51
Fimbristylis milacea	35	5	3	-	-	-	43
Monochoria vaginalis	30	6	3	2			41
Scirpus grossus	22	5	2	-	-	-	29
Ischaemum rugosum	15	7	2	1	-	-	25
Cyperus iria	17	5	-	-	-	-	22
Village –II (Total fields surveyed 141)							
Oryza sativa	52	40	25	10	9	5	141
Echinochloa crus-galli	88	26	15	3	-	-	132
Ludwigia hyssopifolia	105	10	3	-	-	-	118
Leptochloa chinensis	97	5	3	2	1	1	109
Fimbristylis milacea	57	10	2	2	-	-	71
Scirpus grossus	42	6	2	-	-	-	71
Monochoria vaginalis	35	9	5	3			52
Ischaemum rugosum	37	9	1	1	-	-	48
Cyperus iria	38	2	1	-	-	-	41
Cynodon dactylon	34	2	-	-	-	-	33
Village –III(Total fields surveyed 75)							
Oryza sativa	24	29	10	5	3	3	74
Leptochloa chinensis	36	16	7	3	-	-	62
Echinochloa crus-galli	30	14	4	2	-	-	50
Ludwigia hyssopifolia	32	10	4	-	-	-	46
Fimbristylis milacea	35	5	2	-	-	-	42
Scirpus grossus	27	3	1	-	-	-	31
Ischaemum rugosum	22	4	2	-	-	-	28
Cynodon dactylon	23	1	1	-	-	-	25
Cyperus iria	20	2	1	-	-	-	23
Village –IV (Total fields surveyed 117)							
Oryza sativa	40	28	19	15	10	-	112
Leptochloa chinensis	52	29	14	5	2	-	102
Echinochloa crus-galli	56	31	9	7	-	-	97

canals (Wilson, 1980). However, based on Drost and Moody (1982), the composition of weed flora and dominance patterns of weed group in rice areas are affected by soil moisture or condition after harvesting period.

4. Conclusion

The grassy weed species were the dominated species in North Pulinpur area with more than 50% lowland rice fields infested and a rating score of 3 = 21-30 % to 5 = 41-50 % weed cover in all villages. The dominant grassy species were *Oryza sativa* (Weedy rice), *Echinochloa crusgalli, Leptochloa chinensis, Cynodon dactylon, Ischaemum rugosum* in all villages. Village-I had the widest spread and abundant infestation with grassy weeds followed by Village-II, Village-IV and Village-III.

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