



## Phyto-sociological attributes of weed flora in major crops of red and lateritic belt of West Bengal

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In agriculture, weeds compete with crop plants for various resources like water, nutrient, sunlight *etc.* Because of their high competitive ability and allelopathic interference, weeds cause an irreversible damage to plants. Crop-weed competition has been established as major deterrent for low crop productivity. The estimation of yield loss due to weeds at the farmer's field with the existing weed management practices followed by the farmers shows that nearly 12% yield loss in potato, 10.5% in wheat, 11% in mustard and 21% in *Kharif* rice in West Bengal occur due to weeds (Anonymous 2008). The red and lateritic belt of West Bengal, India comprising of three main districts, *viz.* Purulia, Bankura and Birbhum has a diverse flora of weeds severely infesting all the crops of the region. In spite of the diversity in crops and weed flora, no detailed floristic and phyto-sociological studies on the weeds in crop fields of this region have been worked out. Therefore, the present investigation on phyto-sociological studies of weed flora in crop fields of red and lateritic belt of West Bengal, India was undertaken.

Red and lateritic belt of West Bengal is situated between 22° 38' N to 24° 35' N latitude and 85° 75' E to 88° 1' E longitudes. Phyto-sociological analysis of weed flora in *Kharif* and *Rabi* season, 2009-10 was conducted in 17 blocks of Purulia and 18 blocks each of Bankura and Birbhum district out of 19, 22 and 19 total blocks present, respectively. For recording observations on the composition of weed flora, a stop was made after every 10-12 km and site for recording observation was selected 4-5 fields away from the main road. Weeds associated with the crops as well as other habitats were identified. The size of the quadrat was taken as 1x1 m. Twenty spots were considered in each village for a particular habitat. Ecological analysis of weed flora was done by traditional quantitative method on the basis of relative frequency, relative density and relative dominance

and importance value index (IVI) as per the methods used by Mishra (1968) and Raunkiaer (1934). Accordingly, there were five frequency classes, *i.e.* 'A' class with the species of frequency ranging from 1- 20%; 'B' class 21- 40%; 'C' class 41- 60%; 'D' class 61- 80% and 'E' class 81-100%. Furthermore, the weed community frequency patterns were compared with the normal frequency pattern of Raunkiaer ( $A > B > C > D < E$ ). Based on the frequency pattern of the community, the homogeneity and heterogeneity of the vegetation were determined. If the values were high with respect to 'B', 'C' and 'D', then the community is said to be heterogeneous whereas higher values of 'E' indicated the homogeneous nature. Similarity index was calculated using the formula of Sorensen (1948):

### Weed flora in rice

A total of 35 (8 grasses, 22 broad-leaved and 5 sedges), 24 (9 grasses, 10 broad-leaved and 5 sedges) and 45 (11 grasses, 28 broad-leaved and 6 sedges) weed species were observed in Purulia, Bankura and Birbhum districts, respectively (Table 1). *Ludwigia parviflora* was the most frequently distributed weed in transplanted rice field in all the districts. Similar weed flora in transplanted *Kharif* rice was also reported Kiran and Rao (2013).

### Weed flora in rapeseed-mustard and wheat

In rapeseed-mustard 16 (4 grasses, 11 broad-leaved and 1 sedge), 9 (3 grasses, 5 broad-leaved and 1 sedge) and 20 (3 grasses, 16 broad-leaved and 1 sedge) weed species were observed in Purulia, Bankura and Birbhum districts, respectively. The wheat field of Purulia and Birbhum districts was infested with 12 (3 grasses, 8 broad-leaved and 1 sedge) and 20 (3 grasses, 14 broad-leaved and 3 sedges) weeds. A total of 13 (3 grasses, 9 broad-leaved and 1 sedge) and 23 (4 grasses, 16 broad-leaved and 3 sedges) weed species were observed in potato field of Bankura and Birbhum districts, respectively. *Ludwigia parviflora* recorded the

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**Table 1. Weed flora in transplanted Kharif rice of Purulia, Bankura and Birbhum districts with their frequency (F) and importance value index (IVI)**

S. No.	Species	Purulia		Bankura		Birbhum	
		F (%)	IVI	F (%)	IVI	F (%)	IVI
<i>Grasses</i>							
1	<i>Cynodon dactylon</i>	15.26	7.96	13.85	6.76	32.24	16.87
2	<i>Dactyloctenium aegyptium</i>	23.42	7.20	10.00	3.57	27.66	10.29
3	<i>Echinochloa colona</i>	13.68	5.31	26.92	13.29	20.19	7.88
4	<i>E. crusgalli</i>	5.53	2.30	7.69	2.87	2.34	0.92
5	<i>E. glabrescens</i>	-	-	10.00	4.56	0.37	0.10
6	<i>Eleusine indica</i>	20.26	8.21	27.69	12.88	18.22	7.04
7	<i>Imperata cylindrica</i>	7.37	2.60	-	-	1.50	0.49
8	<i>Paspalum scorbiculatum</i>	23.16	8.11	20.00	8.05	27.38	10.59
9	<i>Oryza nivara</i>	-	-	7.69	2.63	8.50	3.11
10	<i>Sacciolepis indica</i>	0.53	0.15	10.77	2.89	5.51	1.59
11	<i>Setaria glauca</i>	-	-	-	-	1.31	0.35
<i>Broad-leaved</i>							
1	<i>Alternanthera philoxeroides</i>	7.89	3.32	-	-	18.50	7.85
2	<i>A. sessilis</i>	-	-	-	-	1.21	0.47
3	<i>Amaranthus spinosus</i>	1.84	1.24	-	-	0.37	0.12
4	<i>A. viridis</i>	2.37	1.46	-	-	0.37	0.17
5	<i>Canabis sativa</i>	1.84	0.59	-	-	0.47	0.15
6	<i>Centella asiatica</i>	12.37	4.73	28.46	12.63	5.98	2.49
7	<i>Colocasia esculenta</i>	6.05	2.57	-	-	1.03	0.39
8	<i>Commelina benghalensis</i>	36.84	18.01	49.23	24.96	40.84	18.58
9	<i>C. communis</i>	1.32	0.57	-	-	1.12	0.41
10	<i>C. nudiflora</i>	5.26	1.94	-	-	12.71	4.65
11	<i>Cyanotis axillaris</i>	-	-	-	-	0.65	0.23
12	<i>Eclipta alba</i>	55.53	44.19	28.46	16.48	28.97	23.24
13	<i>Eichhornia crassipes</i>	6.84	3.12	2.31	0.85	7.01	2.81
14	<i>Euphorbia hirta</i>	1.84	0.77	-	-	3.74	1.22
15	<i>Gomphrena celosiodes</i>	4.47	1.56	-	-	2.52	1.00
16	<i>Hydrolea zeylanica</i>	15.00	4.50	43.08	15.56	10.47	3.16
17	<i>Ipomoea aquatica</i>	3.68	1.09	3.85	1.19	5.51	1.78
18	<i>Limnocharis flava</i>	2.37	0.74	-	-	6.64	2.78
19	<i>Ludwigia parviflora</i>	77.89	55.21	83.85	61.54	66.26	52.65
20	<i>Malvastrum coromandelianum</i>	8.42	2.53	7.69	2.51	4.11	1.58
21	<i>Marsilea quadrifolia</i>	63.16	21.06	73.85	28.18	61.78	22.91
22	<i>Monochoria vaginalis</i>	-	-	-	-	12.15	3.81
23	<i>Phyllanthus niruri</i>	0.26	0.12	0.77	0.26	0.75	0.21
24	<i>Physalis minima</i>	0.79	0.45	-	-	1.31	0.44
25	<i>Polygonum hydropiper</i>	13.42	5.01	-	-	10.19	3.54
26	<i>Spilanthes acmella</i>	-	-	-	-	1.40	0.50
27	<i>Sphenoclea zeylanica</i>	-	-	-	-	1.03	0.32
28	<i>Tridax procumbens</i>	-	-	-	-	2.43	0.89
<i>Sedges</i>							
1	<i>Cyperus compressus</i>	42.63	18.80	0.77	0.50	26.36	10.60
2	<i>Cyperus difformis</i>	40.26	15.80	59.23	26.84	33.46	12.59
3	<i>Cyperus digitatus</i>	19.21	8.81	11.54	5.56	23.74	10.89
4	<i>Cyperus iria</i>	49.21	25.19	60.77	33.15	54.30	26.30
5	<i>Cyperus rotundus</i>	-	-	-	-	0.37	0.16
6	<i>Fimbristylis miliacea</i>	35.26	14.53	30.00	12.32	50.19	18.75

highest values of frequency, dominance and importance value index in rice field of all the districts which was followed by *Eclipta alba*, *Cyperus iria*, *Marsilea quadrifolia*, *C. compressus*, *Commelina benghalensis* in Purulia; *C. iria*, *M. quadrifolia*, *C.*

*difformis*, *C. benghalensis* in Bankura, and *C. iria*, *E. alba*, *M. quadrifolia*, *Fimbristylis miliacea* and *C. Benghalensis* in Birbhum district, respectively. Whereas, the dominant weed species in rapeseed-mustard, wheat and potato fields was *Cynodon*

**Table 2. Weed flora in potato of Bankura and Birbhum districts with their frequency and importance value index**

S. No	Species	Bankura		Birbhum	
		F (%)	IVI	F(%)	IVI
<i>Grasses</i>					
1	<i>Cynodon dactylon</i>	29.65	15.86	76.67	42.07
2	<i>D. aegyptium</i>	13.37	8.43	8.75	3.02
3	<i>D. sanguinalis</i>	-	-	32.92	15.95
4	<i>E. colona</i>	5.09	3.07	2.08	0.99
<i>Broad-leaved</i>					
1	<i>Amaranthus viridis</i>	10.12	6.48	15.00	6.90
2	<i>Amaranthus spinosus</i>	2.06	1.70	-	-
3	<i>Argemone mexicana</i>	3.12	2.44	-	-
4	<i>Asteracantha longifolia</i>	1.23	0.73	4.17	2.04
5	<i>Anagallis arvensis</i>	-	-	21.25	9.89
6	<i>Blumea lacera</i>	44.02	54.33	10.00	6.93
7	<i>C. album</i>	61.01	56.67	86.67	70.06
8	<i>C. bonplandianum</i>	-	-	22.50	11.68
9	<i>Euphorbia hirta</i>	32.00	18.24	12.08	4.48
10	<i>Fumaria parviflora</i>	-	-	2.50	1.17
11	<i>G. indicum</i>	-	-	34.58	14.59
12	<i>G. celosiodes</i>	4.12	3.10	8.33	3.36
13	<i>Phyllanthus niruri</i>	-	-	4.58	1.62
14	<i>P. hysterothorus</i>	-	-	2.50	1.14
15	<i>Solanum nigrum</i>	80.02	103.3	7.50	3.08
16	<i>Sonchus arvensis</i>	-	-	2.08	0.70
17	<i>Polygonum plebeium</i>	-	-	63.75	37.88
18	<i>Spilanthes acmella</i>	-	-	14.58	5.92
<i>Sedges</i>					
1	<i>Cyperus difformis</i>	-	-	1.67	0.62
2	<i>Cyperus iria</i>	-	-	4.58	1.90
3	<i>Cyperus rotundus</i>	44.02	25.69	82.08	53.27

*dactylon* followed by *Echinochloa colona* and *Digitaria sanguinalis* among grasses, and *Cyperus rotundus* among sedges. Among the broad-leaved, the most predominant species was *Chenopodium album* in all the *Rabi* crops of Birbhum, *Anagallis arvensis* in rapeseed-mustard and wheat of Purulia and Bankura, and *Solanum nigrum* in potato field of Bankura district. Other predominant weeds in *Rabi* crops were *Polygonum plebeium*, *Croton bonplandianum*, *Blumea lacera*, *Asteracantha longifolia* and *Euphorbia hirta*.

### Weed flora in potato

In potato field, a total of 13 (3 grasses, 9 broad-leaved and 1 sedge) and 23 (4 grasses, 16 broad-leaved and 3 sedges) weed species were observed in Bankura and Birbhum districts, respectively (Table 2). *S. nigrum* in Bankura and *C. Album* in Birbhum district recorded the highest value of density, frequency and dominance, respectively. Similar weed flora in potato was also reported by Pramanick *et al.* (2012).

### Frequency classes of weed species

The frequency classes of weed species recorded in the selected crops are presented (Table 3). In rice

out of 35, 24 and 45 weed species in Purulia, Bankura and Birbhum, 25, 13 and 33 species were under 'A' category, 5, 5 and 7 species under 'B', 3 each under 'C' and 2 each under 'D' category, respectively for three districts while only one species was found under 'E' category in Bankura district. In rapeseed-mustard 11, 5 and 11 species were under 'A' class frequency, 3, 2 and 3 species under 'B' class, 2 each under 'C' class in Purulia, Bankura and Birbhum districts, respectively.

From the frequency classes and frequency formulae, (Table 4) it is clearly established that most of the weed species encountered in the four crop fields fall under 'A', 'B', 'C' and 'D' frequency classes in rice indicating heterogeneous weed vegetation. Among the *Rabi* crops, wheat of Purulia district showed the homogenous weed vegetation.

*Rabi* crops in all the districts under study showed higher values of similarity index (Table 5) indicating similar weed flora. However, higher similarity was between rapeseed-mustard and wheat as compared to others.

The knowledge and information regarding phyto-sociological attributes of the weeds of red and lateritic belt of West Bengal may be considered for effective weed management and better crop yield.

**Table 3. Frequency classes of weeds in different crops**

Frequency classes	Rice			Rapeseed-mustard			Wheat		Potato	
	Purulia	Bankura	Birbhum district	Purulia	Bankura	Birbhum district	Purulia	Birbhum district	Bankura	Birbhum district
A (01-20 %)	25	13	33	11	5	11	3	10	7	15
B (21-40 %)	5	5	7	3	2	3	6	5	2	4
C (41-60 %)	3	3	3	2	2	2	1	2	2	-
D (61-80 %)	2	2	2	-	-	3	2	1	2	2
E (81-100 %)	-	1	-	-	-	1	-	2	-	2
Total	35	24	45	16	9	20	12	20	13	23

**Table 4. Frequency formulae**

Districts	Rice	Rapeseed-mustard	Wheat	Potato
Purulia	A>B>C>D	A>B>C	A<B>C<D	-
Bankura	A>B>C>D>E	A>B=C	-	A>B=C=D
Birbhum	A>B>C>D	A>B>C<D>E	A>B>C<D>E	A>B>D=E

**Table 5. Similarity and dissimilarity Index of weeds under different Rabi crops**

Districts	Between crops	Similarity index	Dissimilarity index
Purulia	Rapeseed-mustard v/s wheat	0.815	0.185
Bankura	Rapeseed-mustard v/s potato	0.522	0.478
Birbhum	Rapeseed-mustard v/s wheat	0.80	0.20
	Rapeseed-mustard v/s potato	0.727	0.273
	Wheat v/s potato	0.773	0.227

### SUMMARY

Phyto-sociological analysis of weed flora in Kharif and Rabi season of 2009-2010 conducted in Purulia, Bankura and Birbhum districts of West Bengal, India revealed that rice field was infested with 35 (8 grasses, 22 broad-leaved and 5 sedges), 24 (9 grasses, 10 broad-leaved and 5 sedges) and 45 (11 grasses, 28 broad-leaved and 6 sedges) weed species in Purulia, Bankura and Birbhum districts, respectively. In rapeseed-mustard 16 (4 grasses, 11 broad-leaved and 1 sedges), 9 (3 grasses, 5 broad-leaved and 1 sedges) and 20 (3 grasses, 16 broad-leaved and 1 sedge) weed species were observed in Purulia, Bankura and Birbhum districts, respectively. The wheat field of Purulia and Birbhum districts was infested with 12 (3 grasses, 8 broad-leaved and 1 sedges) and 20 (3 grasses, 14 broad-leaved and 3 sedges) weeds. A total of 13 (3 grasses, 9 broad-leaved and 1 sedge) and 23 (4 grasses, 16 broad-leaved and 3 sedges) weed species were observed in potato field of Bankura and Birbhum districts, respectively. *Ludwigia parviflora* recorded the highest values of frequency, dominance and importance value index in rice field of all the districts

Whereas, the dominant weed species in rapeseed-mustard, wheat and potato fields was *Cynodon dactylon* followed by *Echinochloa colona* and *Digitaria sanguinalis* among grasses, and *Cyperus rotundus* among sedges.

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