Pleione 3(1): 67 - 73. 2009.

Phytosociological Study of the Winter Crop-Field Weeds of Nalbari District of Assam (India)

D. K. Bhattacharjya[2] and S. K. Sarma[1]

Department of Botany, M.C. College, Barpeta-781301, Assam, India
[1] Department of Botany, Gauhati University, Guwahati-781014, Assam, India
[2] Corresponding author: E-mail: dipkrbhatta@rediffmail.com

Abstract

Phytosociological studies for the weeds of winter crop-fields of Nalbari district (undivided) of Assam recoded the occurrence of 66 species of dicotyledonous, 23 species of monocotyledonous and 2 species of pteridophytic plants. Distribution pattern and Importance Value Index of all the recorded 91 species from ten different study sites have been determined. Out of the recorded species, *Persicaria hydropiper*, *Colocasia esculenta*, *Amaranthus spinosus*, S*onchus wightianus* and *Alternanthera sessilis* exhibit the highest IVI values and thus are recognized as the most dominant species infesting the crop-fields of the study area. Moreover, a few species are found common to all the crop-fields, while few others are restricted to certain crop-fields only.

***Key words*:** Crop-field, dominant species, phytosociology, Nalbari district, weed community

INTRODUCTION

The erstwhile Nalbari district (presently divided into two districts, *viz.* Nalbari and Baksa) of Assam lies between 26º 102 N to 26º 472 N latitude and 90º 152 E to 91º 102 E longitude which occupies an area of about 2031.76 sq km. The topography of the area is mainly plains. The river Pagladia flows down from the Bhutan Hills and runs through the district from north to south. The soil is mainly sandy loam and its p^H varies from 5.05 to 7.22. The average rainfall during the summer months is 372.18 mm and during winter months is 14.34 mm. The district is bounded in the North by the Royal province of Bhutan, in the East and South by Kamrup district and in the West by Barpeta district of Assam. According to 2001 census, the total population of the district is 11, 38,184. Several crops are cultivated during summer and winter and those occupy the fields in the district throughout the year. The major crops include rice, wheat, lentil, pea, mustard, jute, sugarcane, chilies, onion, turmeric, green vegetable yielding species etc.

Phytosociological study of the crop-field weeds reflects the distribution pattern of weed species together with the components and structure of the same. At any place, the nature of plant communities is determined by the prevalent climate, soil, biotic influence, species content and their ecological amplitude etc. The ecological amplitude of several species, indeed, overlaps over a certain range. Based on the prevalence of identical environment, the best suited species grow luxuriantly with higher ecological amplitude in association with less conspicuous ones.

The study of plant community has special significance for weed species because it represents the organizational level at which change in response to agricultural practices occurs most frequently. Further, a weed community is the most usual situation faced in agricultural use of land (Aldrich 1984). The weeds grow profusely in different crop-fields during different seasons, and thereby reduce the crop yield by offering competition with the crops for space, moisture, sunlight and important nutrients. For a successful cropping practice and effective weed management, one should realize the phytosociological behavior of the community, especially the crop-weed community (Jones 1992).

In any community, it is observed that not all the species, but only a few of them exert their major influence on the existing community thereby acting as the dominant species (Singh & Rai

2004). Same is the case in case of a weed community also, where some weed species can be designated as the dominant ones which control the nature of the entire community.

Several authors including Froud-Williams & Chancellor (1982), Cousens *et al* (1987), Bhattacharyya & Pandya (1989), Prusty *et al* (1990), Bhattacharyya *et al* (1990) , Lee & Moody (1990), Kumar & Singh (1994), Wilkenny (1995), Chikoye *et al* (1995), Dieleman *et al* (1995) and Toler *et al* (1996) contributed more towards the knowledge of phytosociological study of the weeds. Conley *et al* (2002) estimated the giant foxtail productivity and fecundity based on weed density. Acharyya (1998) and Acharyya *et al* (1999) studied the Phytosociological behavior of crop field weeds in the Malda district of West Bengal. Tripathi & Tripathi (2002) have also studied the structure of weeds infesting cereal and oil seed crops in eastern Uttar Pradesh (India).

In this part of the country, although phytosociological works relating to the weed community are relatively few, yet, a few workers contributed towards our knowledge in the subject. Sarma (1987) reported the grazing stress on the growth and production of *Borreria articularis* – a crop-field weed. Sarma (1990) analyzed the floristic composition and phytosociological attributes of herbaceous community at Dibrugarh. Saikia & Sarma (1992) investigated the phytosociological characters of rice field weeds at Moranhat of Assam. Likewise, the same authors (1993) conducted the similar survey at Dibrugarh of Assam. Bhattacharjya & Sarma (2006) surveyed the phytosociological attributes of some summer crop-field weeds of Nalbari district of Assam. Bhattacharjya & Sarma (2008) also made a round the year detailed survey of crop field weeds in this district.

The present study aims at gaining a firsthand knowledge concerning different phytosociological parameters of winter crop-field weeds of the district so as to determine the dominant species among all the weed species occupying the habitat.

MATERIALS AND METHODS

Ten study sites were selected to cover almost all the major crop-fields during the winter season in the Nalbari district of Assam (Table 1). Field survey was conducted for two consecutive years, 2003 and 2004, to record the basic phytosociological characters of the crop field weeds using quadrate method (Misra 1966). Twenty quadrates of 50 cm^2 were laid down at each study site to record the list-count data. Such information, thus obtained was analyzed quantitatively following the method of Curtis (1959) and Phillips (1959) to determine Relative Frequency, Relative Density and Relative Dominance for the recorded species. The Importance Value Index (IVI) was assessed against each species by adding the values of above three parameters (Table.2).

Table 1. Crop-fields of Nalbari district covered under different Study Sites.

Study Area	Areas of Nalbari District
Study Site – I	Malikuchi, Poila and Digheli
Study Site – II	Sandha and Guakuchi
Study Site – III	Japarkuchi, Teresia and Mugkuchi
Study Site – IV	Balikaria, Dhekiabari and Balijar
Study Site – V	Sariahtoli and Kasimpur
Study Site – VI	Balitara and Dhamdhama
Study Site – VII	Arikuchi, Morowa and Banhjani
Study Site – VIII	Bangaon, Jagara and Belsor
Study Site – IX	Akhra, Suradi and Tihu
Study Site – X	Tamulpur and Kumarikata

Species have been arranged in descending order against their IVI values in Study Site-I followed by their values in other Study sites, *i.e.* Study Site-II to X.

RESULTS

A total of 91 Angiospermic and Pteridophytic species were recorded from the survey. There are 66 species of dicotyledons and 23 species of monocotyledons and only 2 species of pteridophytes in the list. *Persicaria hydropiper*, *Cassia tora*, *Colocasia esculenta*, *Amaranthus spinosus* were recorded with their highest IVI values in study site-I to X respectively and were followed by *Portulaca oleracea*, S*onchus wightianus*, *Setaria glauca* and *Heliotropium indicum*, *Mikania micrantha*, *Colocasia esculenta*, *Alternanthera sessilis* and *Hydrocotyle sibthorpioides* for the second and third positions (Table 2). Out of these, *Persicaria hydropiper*, *Colocasia esculenta*, *Amaranthus spinosus*, S*onchus wightianus* and *Alternanthera sessilis* from study site-I, -III, -IV, -V and -X respectively were recorded with significantly increased IVI values (Table 3). Moreover, 9 species, *viz. Persicaria hydropiper, Cynodon dactylon, Centella asiatica*, *Cyperus brevifolius, Oxalis corniculata, Hydrocotyle sibthorpioides*, *Ageratum conyzoides*, *Gnaphalium polycaulon* and *Polygonum plebium* were found to occur in all the study sites, and 7 species *viz. Alternanthera sessilis, Commelina benghalensis, Stellaria media, Colocasia esculenta, Eclipta prostrata*., *Polycarpon prostratum* and *Alternanthera philoxeroides* were found to occur in 9 study sites. Out of the recorded 91 species, 19 species were found to be of selective of their habitats in the study area, *i.e.* each of the 19 species was found to appear only in a few study sites. As an instance, *Eichhornia crassipes* was recorded only in study site-II, *Commelina diffusa* in study site-III, *Cannabis sativa* in study site-V etc. (Table 2). Majority of the species with rare occurrence, *viz. Eichhornia crassipes, Cannabis sativa, Rorippa benghalensis, Launaea asplenifolia, Eupatorium odoratum, Rotala indica, Blumea densiflora, Diplazium esculentum, Sphaeranthus indicus* and *Vernonia cinerea* were recorded mainly in the field margins and not in intermingled condition with the crops in the respective study sites, which otherwise, are found available in un-cropped areas, fallow land and other habitats also with greater density.

Table 2. Weed species and their IVI values in different study sites during the winter months
[*Study site-I: Malikuchi, Poila and Digheli, Study site-II: Sandha and Guakuchi, Study site-III: Japarkuchi, Teresia and Mugkuchi, Study site-IV: Balikaria, Dhekiabari and Balijar, Study site-V: Sariahtoli and Kasimpur, Study site-VI: Balitara and Dhamdhama, Study site-VII: Arikuchi, Morowa and Banhjani, Study site-VIII: Bangaon, Jagara and Belsor, Study site-IX: Akhra, Suradi and Tihu, Study site-X: Tamulpur and Kumarikata*]

Species	IVI Values in Study Site									
	I	II	III	IV	V	VI	VII	VIII	IX	X
Persicaria hydropiper L.	54.39	14.51	34.77	1.74	3.19	15.99	12.71	4.79	5.53	21.23
Nicotiana plumbaginifolia Viviani	45.62								12.43	
Cynodon dactylon (L.) Persoon	22.90	8.92	15.59	25.93	17.87	18.70	7.91	16.68	23.57	13.94
Mimosa pudica L.	18.58			2.50	6.20				1.77	
Pogostemon fraternus Miquel	18.58				0.84					
Centella asiatica (L.) Urban	14.28	9.89	13.80	4.51	5.75	5.41	5.72	4.91	7.35	3.18
Xanthium indicum Koenig	13.01	3.67			3.31	3.05				11.24
Solanum nigrum L.	12.33			1.12	9.58		8.96	5.56	2.97	1.32
Cyperus brevifolius (Rottb.)Hasskarl	10.57	3.90	8.41	16.29	11.25	3.57	4.96	9.05	17.75	3.87
Oxalis corniculata L.	9.79	8.80	4.57	4.41	29.68	7.12	3.69	5.08	2.08	7.59
Hydrocotyle sibthorpioides Lamarck	8.72	7.23	14.16	4.31	12.42	17.51	18.05	9.08	4.96	24.32

Species	IVI Values in Study Site									
	I	II	III	IV	V	VI	VII	VIII	IX	X
Ageratum conyzoides L.	6.30	13.24	7.93	8.16	20.96	4.88	6.09	8.71	6.90	9.40
Duchesnea indica (Andr.) Focks.	5.81	2.81			1.72					
Leucas plukenetii (Roth.) Sprengel	5.11			1.68	11.87	2.19	16.38	3.52	2.64	1.96
Alternanthera sessilis (L.) R.Br. ex DC.	4.78	5.95	8.22	7.33	3.60		5.32	13.48	31.27	2.82
Gnaphalium polycaulon Persoon	4.56	17.82	4.63	2.13	2.24	3.37	17.93	5.49	5.01	8.33
Heliotropium indicum L.	4.09				1.20	18.93		1.29	0.82	3.99
Polygonum plebeium R. Br.	3.66	16.50	13.07	11.37	10.64	16.87	16.91	14.77	5.83	14.98
Commelina benghalensis L.	3.50	1.14	6.69	5.8	1.99	0.88	2.59	5.09	0.74	
Pouzolzia zeylanica (L.) Bennette	3.50	6.35	7.47	3.77	2.42		1.88	2.97		
Hypericum japonicum Thunberg ex Murray	3.17		2.02	3.21					0.93	1.56
Phyllanthus fraternus Webster	3.17			1.37		5.39		3.50	1.68	1.32
Stellaria media (L.) Villars	3.09	24.61	15.31	2.55	4.21	5.20	10.28	19.74	2.65	
Oenanthe javanica (Blume) DC.	2.64	1.28					4.65			
Colacasia esculenta (L.) Schott	2.54	9.02	61.40	1.10	1.37	10.62	9.02	26.77	3.50	
Pagesia dianthera (Swartz) Pennell	2.25		6.70		1.12	5.71	2.27	1.42		3.06
Eclipta prostrata (L.) L.	2.02	3.48		2.73	2.29	1.32	5.29	2.79	2.01	2.27
Polycarpon prostratum (Forskal) Aschers. & Schwein f.	2.02	1.56	4.29	5.10	1.69		3.52	0.86	4.29	2.04
Mikania micrantha Kunth	1.88	5.23		3.30	1.20		23.33	1.68	4.00	
Alternanthera philoxeroides (Martius) Grisebach	1.86	2.24		3.21	2.04	4.94	6.95	3.88	4.31	3.31
Rostellularia japonica (Thunb.) Ellis	1.67	2.18						1.43		
Dentella repens (L.) J.R. &G..Forster	1.53	3.83		3.16	0.83		0.85	3.36	7.21	3.37
Cassia tora L.	1.50	26.47			3.73					
Chenopodium album L.		17.58	4.63	9.61	14.29	2.18	15.47	14.23	5.49	7.84
Grangea maderaspatana (L.) Poiret		12.05	6.50			2.61	4.60	8.85	5.16	
Eichhornia crassipes (Martius) Solms		9.10								
Cardiospermum helicacabum L.		7.61		6.62	3.84	6.29		4.04	6.06	4.62
Amaranthus spinosus L.		7.04		40.51						
Monochoria hastata (L.) Solms		6.29					4.34			16.68
Rumex nepalensis Sprengel		5.64	9.99	1.68		3.05	2.23	2.55	30.91	
Persicaria orientale L.		5.59	11.95	3.97	2.59	2.18	4.30	3.51	3.25	
Youngia japonica (L.) DC.		4.2			3.35	2.15	2.68	0.83		9.66
Spilanthes paniculata Wallich ex DC.		3.97	7.60	3.81	7.07	2.24	5.00	5.84	2.32	3.51
Sonchus wightianus DC.		3.45			46.10					
Lathyrus aphaca L.		3.29	5.03		1.78	6.04	3.14	4.15		11.43
Echinochloa colonum Link		3.15		8.07	0.64	4.36	3.69	2.99	7.95	7.08
Gnaphalium pensylvanicum Willdenow		3.07	6.59	2.39	3.96	2.1	1.00			2.08
Ludwigia octavalvis (Jacquin) Raven		3.05	3.53	15.12		1.97	3.07	1.54	8.24	4.46
Mazas pumilus (Burman f.) van Steenis		2.65	6.08	1.55		1.77	3.85		1.59	4.75
Paspalum conjugatum Berg		2.65	3.11	2.19	0.64	2.57	0.91		1.94	9.01
Lindernia crustacea (L.) Mueller		2.35		3.25			3.47		1.91	
Amaranthus viridis L.		1.79		3.44	3.94	2.61	6.76	5.11	4.35	13.46
Cotula hemisphaerica Wallich		1.23				2.23	1.68	4.56		
Cosmos sulfureus Cavan			5.81			4.95				3.32

Species	IVI Values in Study Site									
	I	II	III	IV	V	VI	VII	VIII	IX	X
Commelina diffusa Burman			5.77							
Portulaca olaracea L.				40.51	2.17	2.47	3.11	1.42	11.92	
Fimbristylis miliacea (L.) Vahl				7.47		2.98			5.05	
Gnaphalium affine D. Don				4.95					1.91	4.62
Setaria glauca (L.) P. Beauvois				3.94	1.21	18.93			1.51	9.66
Persicaria strigosa (R. Br.) Nakai				3.88	4.45	5.73	1.68	5.18	2.77	
Impatiens glandulifera Royle				3.66				13.18		
Corchorus aestuans L.				2.26	1.22	4.12		1.42		5.68
Eragrostis viscosa (Retzius) Trinius				1.79		1.81			9.49	3.24
Scoparia dulcis L.				1.56	4.80		2.52		5.58	
Cannabis sativa L.					11.86					
Digitaria sanguinalis Scopoli					1.95	7.36	8.85	2.35		6.02
Rorippa benghalensis (DC.) Hara					1.76					
Sida rhombifolia L.					0.81				11.98	
Cyperus halpan L.						7.25				
Launaea asplenifolia (Willdenow) Hook.f.						5.16				
Eupatorium odoratum L.						4.97				
Eleusine indica (L.) Gaertner						3.59		2.68		
Stellaria wallichiana Haines						2.47	2.49			
Fimbristylis littoralis Gaudichaud						2.38				
Torenia diffusa D. Don						2.09				3.70
Cyperus difformis L.						1.89				1.85
Ammannia multiflora Roxburgh						1.65	3.07			
Murdania nudiflora (L.) Brenan						1.65		1.42		1.32
Rotala indica L.						1.29				
Cyperus iria L.						1.23				
Scirpus articulatus L.							3.11			
Marsilea minuta L.							0.79		0.77	
Blumea densiflora DC.								6.17		
Paspalum scrobiculatum L.								4.68		
Oplismenus burmannii (Retzius) P. Beauvois								4.33	4.45	
Rungia pectinata (L.) Nees								2.52		
Mollugo pentaphylla L.								1.42		
Diplazium esculentum (Retzius) Swartz								1.77		
Sphaeranthus indicus L.										10.83
Vernonia cinerea (L.) Lessing										4.65
Eriocaulon viride Koern.										1.65

Table 3. Five most dominant weed species in Study Sites along with their IVI score.

Species	IVI score in Study Sites				
	I	III	IV	V	X
Persicaria hydropiper	54.39				
Colacasia esculenta		61.40			
Amaranthus spinosus			61.40		
Sonchus wightianus				46.10	
Alternanthera sessilis					31.27

DISCUSSION

Study reveals that crop-field conditions mostly favor the growth of angiospermic weeds rather than the pteridophytic ones. Presence of large number of dicotyledonous species in comparison to the monocotyledons attributes their capability of survival in relatively dry winter condition. Most of the monocotyledonous species overcome the dry winter season in the area with their semi-dorment or dorment vegetative propagules. Species with highest IVI values are the most dominant species indicating their major influence and ecological success in the concerned communities. Species which grow and develop in a given set of environment determine the nature of the community. Dominance of species which can be recognized on the basis of their IVI values shows that in different study sites different species dominate. This can be due to the change in microenvironment and also associated crop species which influence the growth of weeds. Due to micro-environmental differences, species composition may vary from site to site (Mishra *et al* 1997). In the present study sites, difference in the species composition might be due to the changed physico-chemical characteristics of the soil as a result of agricultural practice (Bhattacharjya & Sarma, 2006; Bhattacharjya, 2006). Species were found to have wide distribution in the study area which indicates their high ecological amplitude. Species with rare occurrence which are available in the un-cropped areas attribute their preference to grow in relatively undisturbed conditions.

Acknowledgement

Authors are grateful to Dr. (Mrs.) S.J. Phukan, BSI, Shillong (India) for her kind help in identification of the specimens.

LITERATURE CITED

Acharyya, A. 1998. *Studies on the distribution, phenology and reproductive potential of some crop field weeds of Malda district of West Bengal (India).* Ph.D. thesis, North Bengal University, India.

Acharyya, A.; Das, M. & Das, A.P. 1999. On the Crop Field Weeds in the District of Malda in West Bengal, India**.** *Sci. & Cult.* 65(5 - 6): 167 - 168.

Aldrich, R.J. 1984. *Weed-Crop Ecology*. Breton Publishers. INC. North Scituate. Massachusetts.

Bhattacharjya, D.K. & Sarma, S.K. 2006. Phytosociological study of some summer crop-field weeds of Nalbari district of Assam. *Procd. Nat. Sem. Biodiv. Consv. Future Concern,* NEBA, Guwahati, India.

Bhattacharjya, D.K. 2006. *Eco-taxonomical studies of vegetation infesting summer and winter crop-fields of Nalbari district of Assam*. Ph.D. thesis, Gauhati University, India.

Bhattacharyya, G. & Pandya, S.M. 1989. Ecological studies of crop-weed association of gram (*Cicer arietinum* L.) crop-fields at Rajkot. *Ad. Plant Sc*. 2: 10 – 18.

Chikoye, D.; Weise, S.F. & Swanton, C.J. 1995. Influence of common ragweed (*Ambrosia artemisiifolia*) time of emergence and density on white bean (*Phaseolus vulgaris*). *Weed Sci.* 43: 375 – 380.

Conley, S.P.; Binning, L.K.; Stoltenberg, D.E. & Boerboom C.M. 2002. Estimating giant foxtail cohort productivity and fecundity in soybean based on weed density, leaf area, or volume. *Weed Sci.* 50: 72 – 78.

Cousens, R.D.; Brain, P.; O'Donovan, J.T. & O'Sullivan, P.A. 1987. The use of biologically realistic equations to describe the effects of weed density and relative time of weed emergence on crop yield. *Weed Sci.* 35: 720 – 725.

Curtis, J.T. 1959. *The vegetation of Wisconsin*. An ordination of plant community. University of Wisconsin Press. Madison.

Dieleman, A.; Hamill, A.S.; Weisse, S.F. & Wanton, C.J. 1995. Empirical models of pigweed (*Amaranthus* spp.) interference in soybean (*Glycine max*). *Weed Sci.* 43: 612 – 618.

Froud-Williams, R.J. & Chancellor, R.J. 1982. A survey of grass weeds in cereals in central southern England. *Weed Res.* 22 (3): 163 – 171.

Jones, G. 1992. Weed phytosociology and crop husbandry: identifying a contrast between ancient and modern practice. *Rev. Palaeobot. Palynol.* 73 (1-4): 133 – 143.

Kumar, S. & Singh, V. 1994. Phytosociological studies on the weeds of gram fields. *World Weeds* 1: 47 – 52.

Lee, H.K. & Moody, K. 1990. Growth and yield of upland rice under different densities and competition periods of *Eclipta prostrata* (L.) L. Research Report of the Rural Development Administration. *Crop Protection*. 32(3): 32 – 38.

Mishra, D.; Mishra, T.K. & Banerjee, S.K. 1997. Comparative phytosociological and soil physicochemical aspects between managed and unmanaged lateretic land. *Ann. For.* 5(1): 16 – 25.

Misra, R. 1966. *Ecology Workbook*. Oxford & I.B.H. Pub. Calcutta.

Phillips, E.A. 1959. *Methods of Vegetation Study*. Hensy Holt and Co. Inc.

Saikia, L.R. & Sarma, S.K. 1992. Phytosociological investigation of the rice field weeds of Maranhat (Assam). *J. Assam Sci.* Soc. 34(3): 13 – 18.

Saikia, L.R. & Sarma, S.K. 1993. Phytosociological investigation of the rice field weeds of Dibrugarh (Assam). *Indian J. Ecol*. 20(2): 173 – 175.

Sarma, S.K. 1987. Grazing stress on the growth and production of Borreria articularis, an obnoxious weed of crop-fields. *J. Assam Sc. Soc*. 29(4): 1 – 5.

Sarma, S.K. 1990. Floristic composition and Phytosociological studies of a herbaceous community at Dibrugarh. *Indian J. For.* 13: 273 – 280.

Singh, S.K. & Rai, J.P.N. 2004. Vegetation pattern related to grazing pressure in alpine meadows of Nanda Devi Biosphere Reserve. *J. Environ. Biol*. 25(3): 299 – 306.

Toler, J.E.; Guice, J.B. & Murdock, E.B. 1996. Interference between johnsongrass (*Sorghum halepense*), smooth pigweed (*Amaranthus hybridus*) and soybean (*Glycine max*). Weed Sci. 44: 331 – 338.

Tripathi, J.S. & Tripathi, R. 2002. Structure of weeds in rabi cereal and oil seed crops in eastern U.P. *Indian J. Ecol*. 29(1): 83 – 85.

Wilkenny, Z.A. 1995. *Emergence and Growth of Varied Annual Weeds under Varied Levels of Shade*. M.S. thesis, University of Wisconsin, Madison, Wl. Pp.92.