

Crop Field Weeds in Nalbari District of Assam, India

D. K. Bhattacharjya² and S. K. Sarma¹

Department of Botany, M.C. College, Barpeta-781301, Assam, India

¹Department of Botany, Gauhati University, Guwahati-781014, Assam, India

²Address for correspondence: Forest office road, Ward No. 2, Nalbari-781335, Assam, India.

Email: dipkrbhatta@rediffmail.com

Abstract

The paper recorded the occurrence of 180 species of Angiosperms and Pteridophytes belonging to 129 genera and 49 families growing as weeds of different crops in the Nalbari district of Assam during summer and winter cropping-seasons. Plants are presented in tabular form with families arranged following Bentham and Hooker's (1862-1883) system of classification. Also the habit and method of propagation of the recorded species have been presented. Sexually reproducing annuals are found to be predominant in the crop fields.

Key words: Weed, crop field, Nalbari, Assam, propagation, habit.

INTRODUCTION

Nalbari district of Assam, occupying an area of about 20,228 sq km, is located between 26°10' to 26° 47' N latitude and 90° 15' to 91° 10' E longitude and 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 population of the district is 11,38,184 (Anonymous 2001).

A large number of crop-plants are cultivated in the Nalbari district and as per the major growing season, these plants can be grouped into summer and winter crops and are mainly cereals, vegetables, legumes and oil yielding plants.

Weeds are undoubtedly harmful to the crops as they drastically reduce the yield thereby causing economic loss. They compete with the crops for space, nutrition, moisture and sunlight. According to one estimate, 30 - 40 % yield is reduced due to the intruding weeds and the adverse effect they exert (Sharma 1993). Moreover, the crops get deprived of a share of approximately 10% of total fertilizers and manures added by the farmers (Sharma 1993). Thus, weeds should be defined as the plants unwanted in the human maintained ecosystems and therefore as far as possible should be removed from the same.

Several workers including Tiwari (1981), Holzner & Immonen (1982), Kaul (1986), Sharma (1993), Kachroo & Hakeem (1993), Ara *et al* (1995), Tamado & Milberg (2000), Kim *et al* (2003 a,b), Firehum & Tamado (2006) etc. contributed more towards the knowledge of floristic study of the weeds. But, hitherto no such works have been carried out in the Nalbari district of Assam. The present study deals with the recording of the weed species and their cropping season wise association in the various crop fields of Nalbari district of Assam.

MATERIALS AND METHODS

Extensive field tours were made, at least twice in a month, during the years 2002 – 2004 to cover the fields of almost all the major crops in summer and winter. Collected specimens were processed as per Jain & Rao (1977) and identified by matching in different Herbaria like that of Gauhati

University, North Eastern Hill University, and at ASSAM. All specimens have been deposited in the Herbarium of the Department of Botany, Gauhati University, Assam. The identified species have been presented in tabular form, family wise following the Bentham and Hooker's (1862 – 1883) system of classification. The habit and mode of propagation of the recorded weeds also have been observed and presented in tables.

For convenience, the crops have been categorized broadly into (1) Summer crops and (2) Winter crops.

1. **Summer crops** included major ones like: (i) Cereals e.g. paddy (*Oryza sativa*); and (ii) Vegetables. 2. **Winter crops** included major ones like: (i) Cereals, e.g. wheat (*Triticum aestivum*); (ii) Vegetables including potato (*Solanum tuberosum*), onion (*Allium cepa*), garlic (*A. sativum*) etc.; (iii) Legumes like lentil (*Lens culinaris*), mung (*Phaseolus aureus*), pea (*Pisum sativum*) etc.; and (iv) Oil crops like mustard (*Brassica campestris*) are common in the district and have been surveyed.

RESULTS AND DISCUSSION

A total of 180 species of weeds belonging to both Angiosperms and Pteridophytes were collected and identified. Among the angiosperms there are 126 dicotyledonous species belonging to 94 genera representing 37 families and 49 monocotyledonous species belonging to 30 genera representing 7 families. Only 5 species of pteridophytes, covering 5 genera and 5 families were found to occur in the crop fields. Among the dicotyledons, Asteraceae is represented by highest number of 20 species and is followed by Scrophulariaceae (15 spp.), Fabaceae (11 spp.) etc. Among monocotyledons, Poaceae is represented highest number of 22 species and is followed by Cyperaceae (16 spp.), Commelinaceae (5 spp.) etc. And, among the pteridophytes, all the 5 recorded families comprising of 1 species each (Tables 1 & 2).

Table 1: Association of recorded angiospermic weeds with different summer and winter crops along with their habit and mode of propagation.

[Abbreviations used: A: annual, B: in both seasons, Bl: bulbil, P: Perennial, Of: offset, R: runner, Rs: root stock, Rz: rhizome, Sd: seed, Sc: Sucker, Sm: in summer, St: stem, Tb: tuber, W: in winter]

Family	Species	Crop	Habit	Propagation
DICOTYLEDONS				
Papaveraceae	<i>Argemone mexicana</i> L.	W	A	Sd
Brassicaceae	<i>Capsella bursa-pastoris</i> (L.) Medikus	W	A	Sd
	<i>Rorippa benghalensis</i> (DC.) Hara	B	A	Sd
Cleomaceae	<i>Cleome viscosa</i> L.	B	A	Sd
Caryophyllaceae	<i>Drymaria diandra</i> (Blume) Duke	B	A	Sd
	<i>Polycarpon prostratum</i> (Forsk.) Ascherson	B	A	Sd
	<i>Stellaria media</i> (L.) Villars	W	A	Sd
	<i>S. wallichiana</i> Haines	W	A	Sd
Portulacaceae	<i>Portulaca oleracea</i> L.	B	A	Sd
Hypericaceae	<i>Hypericum japonicum</i> Murray	W	A	Sd
Malvaceae	<i>Abutilon indicum</i> (L.) Sweet	B	A	Sd
	<i>Malvastrum coromandalianum</i> (L.) Garcke	B	P	Sd
	<i>Sida cordifolia</i> Wight & Arnott	B	P	Sd
	<i>Sida rhombifolia</i> L.	B	P	Sd
Tiliaceae	<i>Corchorus aestuans</i> L.	Sm	A	Sd
	<i>Grewia sapida</i> DC.	B	P	Sd
	<i>Triumfetta rhomboidea</i> Jacquin	B	P	Sd
Linaceae	<i>Linum usitatissimum</i> L.	W	A	Sd

Balsaminaceae	<i>Impatiens glandulifera</i> Arnott	B	A	Sd	
Oxalidaceae	<i>Oxalis corniculata</i> L.	B	A	Sd, R	
	<i>O. debilis</i> H.B.K. ssp. <i>corymbosa</i> (DC.) O. de Bolòs & J. Vigo	B	A	Sd, Bl	
Sapindaceae	<i>Cardiospermum halicacabum</i> L.	B	A	Sd	
Mimosaceae	<i>Mimosa pudica</i> L.	B	A	Sd	
Caesalpiniaceae	<i>Cassia sophora</i> L.	B	A	Sd	
	<i>C. tora</i> L.	B	A	Sd	
Fabaceae	<i>Aeschynomene indica</i> L.	W	A	Sd	
	<i>Crotalaria juncea</i> L.	B	P	Sd	
	<i>Desmodium gangeticum</i> DC.	B	A	Sd	
	<i>D. laxiflorum</i> DC.	B	A	Sd	
	<i>D. triflorum</i> DC.	Sm	A	Sd	
	<i>D. triquetrum</i> (L.) DC. ssp. <i>pseudotriquetrum</i> (DC.) Prain	Sm	A	Sd	
	<i>Lathyrus aphaca</i> L.	W	A	Sd	
	<i>Tephrosia purpurea</i> (L.) Persoon	B	P	Sd	
Rosaceae	<i>Duchesnea indica</i> (Andrews) Focke	W	A	Sd, R	
Haloragaceae	<i>Callitriche stagnalis</i> Scopoli	Sm	A	Sd	
Lythraceae	<i>Ammannia baccifera</i> L.	Sm	A	Sd	
	<i>A. multiflora</i> Roxb.	Sm	A	Sd	
	<i>Rotala indica</i> (Willd.) Coehne	Sm	A	Sd	
Onagraceae	<i>Ludwigia adscendens</i> (L.) Hara	Sm	A	Sd, Of	
	<i>L. octovalvis</i> (Jacq.) Raven	Sm	A	Sd	
Aizoaceae	<i>Glinus lotoides</i> L.	W	A	Sd	
	<i>Mollugo pentaphylla</i> L.	Sm	A	Sd	
Apiaceae	<i>Centella asiatica</i> (L.) Urban	B	A	Sd, R	
	<i>Hydrocotyle nepalensis</i> Hook.f.	B	A	Sd, R	
	<i>H. sibthorpioides</i> Lamarck	B	A	Sd, R	
	<i>Oenanthe javanica</i> (Blume) DC.	B	A	Sd	
Rubiaceae	<i>Dentella repens</i> J. & G. Forster	B	A	Sd	
	<i>Oldenlandia diffusa</i> (Willd.) Roxburgh	Sm	A	Sd, R	
	<i>Richardia scabra</i> L.	B	A	Sd, R	
Asteraceae	<i>Ageratum conyzoides</i> L.	B	A	Sd	
	<i>Blumea densiflora</i> DC.	B	A	Sd	
	<i>B. lacera</i> (Burm. f.) DC.	B	A	Sd	
	<i>Cosmos sulfureus</i> Cavan	B	A	Sd	
	<i>Cotula hemisphaerica</i> (Roxb.) Bentham & Hook.f.	W	A	Sd	
	<i>Dichrocephala integrifolia</i> (L.f.) O. Kuntze	B	A	Sd	
	<i>Eclipta prostrata</i> (L.) L.	B	A	Sd	
	<i>Chromolaena odorata</i> (L.) King & Robinson	B	A	Sd	
	<i>Gnaphalium luteo-album</i> L.	W	A	Sd	
	<i>G. pensylvanicum</i> Willdenow	W	A	Sd	
	<i>G. polycaulon</i> Persoon	W	A	Sd	
	<i>Grangea maderaspatana</i> (L.) Poiret	W	A	Sd	
	<i>Mikania micrantha</i> Kunth	B	A	Sd, R	
	<i>Sonchus wightianus</i> DC.	B	A	Sd	
	<i>Sphaeranthus indicus</i> L.	W	A	Sd	
	<i>Spilanthes acmella</i> var. <i>paniculata</i> (DC.) Hook.f.	B	A	Sd, Sc	
	<i>Taraxacum officinale</i> Wiggers	B	A	Sd	
	<i>Vernonia cinerea</i> (L.) Lessing	W	A	Sd	
	<i>Xanthium indicum</i> Koenig ex Roxburgh	W	A	Sd	
	<i>Youngia japonica</i> (L.) DC.	W	A	Sd	
	Campanulaceae	<i>Lobelia zeylanica</i> L.	W	A	Sd
		<i>Wahlenbergia marginata</i> (Thunb.) A. DC.	B	A	Sd
	Hydrophyllaceae	<i>Hydrolea zeylanica</i> (L.) Vahl	Sm	A	Sd

Boraginaceae	<i>Heliotropium indicum</i> L.	W	A	Sd
Convolvulaceae	<i>Evolvulus nummularis</i> L.	B	A	Sd, R
	<i>Ipomoea aquatica</i> Forsskal	Sm	A	Sd
	<i>I. carnea</i> Jacquin	Sm	P	Sd, St
Solanaceae	<i>Nicotiana plumbaginifolia</i> Viviani	W	A	Sd
	<i>Solanum nigrum</i> L.	B	A	Sd
	<i>S. torvum</i> Swartz.	B	A	Sd
Scrophulariaceae	<i>Bacopa monnieri</i> (L.) Wettstein	W	A	Sd, R
	<i>Limnophila hirsuta</i> (Benth.) Bentham	B	A	Sd
	<i>Lindernia anagallis</i> (Burm.f.) Pennell	W	A	Sd
	<i>L. antipoda</i> (L.) Alston	W	A	Sd
	<i>L. ciliata</i> (Colsm.) Pennell	W	A	Sd
	<i>L. cordifolia</i> (Colsm.) Merrill	W	A	Sd
	<i>L. crustacea</i> (L.) Mueller	W	A	Sd
	<i>L. parviflora</i> (Roxb.) Haines	B	A	Sd
	<i>L. ruellioides</i> (Colsm.) Pennell	B	A	Sd
	<i>L. tenuifolia</i> (Colsm.) Alston	Sm	A	Sd
	<i>L. viscosa</i> (Hornem) Boldingh	W	A	Sd
	<i>Mazus pumilus</i> (Burm.f.) van Steenis	W	A	Sd
	<i>Pagesia dianthera</i> (Swartz) Pennell	W	A	Sd
	<i>Scoparia dulcis</i> L.	W	A	Sd
	<i>Torenia diffusa</i> D. Don	B	A	Sd
Lentibulariaceae	<i>Utricularia aurea</i> Loureiro	Sm	A	Sd, Of
Acanthaceae	<i>Lepidagthis incurva</i> D. Don	B	A	Sd
	<i>Rostellularia japonica</i> (Thunb.) Ellis	W	A	Sd
	<i>Rungia pectinata</i> (L.) Nees	B	A	Sd
Verbenaceae	<i>Clerodendrum viscosum</i> Ventenat	B	P	Sd
	<i>Phyla nodiflora</i> (L.) Greene	W	A	Sd
Lamiaceae	<i>Leonurus japonicus</i> fa. <i>niveus</i> (Baranov et Skvortz) Hara	B	A	Sd
	<i>Leucas plukenetii</i> (Roth.) Sprengel	W	A	Sd
Amaranthaceae	<i>Ocimum basilicum</i> L.	W	P	Sd
	<i>Pogostemon fraternus</i> Miquel	Sm	A	Sd
	<i>P. strigosus</i> Bentham	Sm	A	Sd
	<i>Achyranthes aspera</i> L.	W	A	Sd
	<i>Alternanthera philoxeroides</i> (Mart.) Grisebach	Sm	A	Sd
	<i>A. sessilis</i> (L.) DC.	W	A	Sd, R
	<i>Amaranthus hybridus</i> L.	Sm	A	Sd
	<i>A. spinosus</i> L.	W	A	Sd
	<i>A. viridis</i> L.	W	A	Sd
	<i>Celosia argentea</i> L.	W	A	Sd
Chenopodiaceae	<i>Chenopodium album</i> L.	W	A	Sd
Polygonaceae	<i>Persicaria chinensis</i> (L.) H. Gross	B	A	Sd
	<i>Persicaria hydropiper</i> (L.) Spach	B	A	Sd
	<i>Persicaria orientalis</i> (L.) Spach	B	A	Sd
	<i>Persicaria strigosa</i> (R. Br.) Nakai	W	A	Sd
	<i>Polygonum plebeium</i> R. Brown	B	A	Sd
	<i>Rumex nepalensis</i> Sprengel	B	A	Sd
Euphorbiaceae	<i>Acalypha indica</i> L.	W	A	Sd
	<i>Croton bonplondianus</i> Baillon	B	A	Sd
	<i>Euphorbia gaudichaudii</i> Boissier	B	A	Sd, R
	<i>E. thymifolia</i> L.	B	A	Sd
	<i>Phyllanthus fraternus</i> Webster	W	A	Sd
Urticaceae	<i>Pouzolzia zeylanica</i> (L.) Bennett & Brown	B	A	Sd
Cannabinaceae	<i>Cannabis sativa</i> L.	W	A	Sd
MONOCOTYLEDONS				
Pontederiaceae	<i>Eichhornia crassipes</i> (Mart.) Solms	Sm	A	Of
	<i>Monochoria hastata</i> (L.) Solms	Sm	A	Tb

Commelinaceae	<i>Commelina benghalensis</i> L.	B	A	Sd, R	
	<i>C. diffusa</i> Burman	B	A	Sd, R	
	<i>Cyanotis axillaris</i> (L.) Don	W	A	Sd, R	
	<i>Floscopa scandens</i> Loureiro	Sm	A	Sd, R	
	<i>Murdania nudiflora</i> (L.) Brenan	Sm	A	Sd	
Araceae	<i>Colacasia esculenta</i> (L.) Schott	B	P	Sd	
Alismataceae	<i>Sagittaria guayanensis</i> H.B.&K.	Sm	A	Tb	
Eriocaulaceae	<i>Eriocaulon viride</i> Koern.	Sm	A	Sd, Tb	
Cyperaceae	<i>Cyperus brevifolius</i> (Rottb.) Hasskarl	B	A	Sd, Tb	
	<i>C. difformis</i> L.	Sm	A	Sd, Tb	
	<i>C. halpan</i> L.	Sm	A	Sd, Tb	
	<i>C. iria</i> L.	Sm	A	Sd, Tb	
	<i>C. pilosus</i> Vahl	Sm	A	Sd, Tb	
	<i>C. pumilus</i> L.	Sm	A	Sd, Tb	
	<i>C. rotundus</i> L.	Sm	A	Sd, Tb	
	<i>C. sanguinolentus</i> Vahl	Sm	A	Sd, Tb	
	<i>C. tenuispica</i> Steudel	Sm	A	Sd, Tb	
	<i>Fimbristylis aestivalis</i> (Retz.) Vahl	Sm	A	Sd, Tb	
	<i>F. dichotoma</i> (L.) Vahl	Sm	A	Sd, Tb	
	<i>F. littoralis</i> Gaudichaud	B	A	Sd, Tb	
	<i>F. miliacea</i> (L.) Vahl	B	A	Sd, Tb	
	<i>F. tomentosa</i> Vahl	Sm	A	Sd, Tb	
	<i>Scirpus articulatus</i> L.	Sm	A	Sd, Tb	
	<i>S. juncooides</i> Roxb.	Sm	A	Sd, Tb	
	Poaceae	<i>Andropogon ascinoidis</i> C.B. Clarke	Sm	A	Sd
		<i>Axonopus compressus</i> (Swartz) P. Beauverd	B	A	Sd, R
		<i>Brachiaria distachya</i> (L.) Stapf	Sm	A	Sd
		<i>Cynodon dactylon</i> (L.) Persoon	B	A	Sd, R
<i>Dactyloctenium aegyptium</i> (L.) P. Beauverd		B	A	Sd, Tb	
<i>Digitaria ciliaris</i> (Retz.) Koeler		Sm	A	Sd	
<i>D. sanguinalis</i> Scopoli		B	A	Sd	
<i>Echinochloa colonum</i> Link		Sm	A	Sd	
<i>Eleusine indica</i> (L.) Gaertner		B	A	Sd, Rs	
<i>Eragrostis coarctata</i> Stapf		B	A	Sd	
<i>E. tenella</i> (L.) P. Beauverd		B	A	Sd, Tb	
<i>E. unioloides</i> (Retz.) Nees ex Steudel		Sm	A	Sd, Tb	
<i>E. viscosa</i> Trinius		Sm		Sd	
<i>Eriochloa procera</i> (Retz.) C.E. Hubb.		Sm	A	Sd, Rz	
<i>Hemarthria protensa</i> Steudel		Sm	A	Sd, R	
<i>Hymenachne acutigluma</i> (Steud.) Gilliland		Sm	A	Sd, Tb	
<i>Imperata cylindrica</i> (L.) P. Beauverd		W	A	Sd, Rz	
<i>Leptochloa chinensis</i> (L.) Nees		Sm	A	Sd, Rz	
<i>Oplismenus burmannii</i> (Retzius) P. Beauverd		B	A	Sd, R	
<i>Panicum paludosum</i> Roxburgh		B	A	Sd, Rz	
<i>Paspalum conjugatum</i> O. Berg		B	A	Sd, R	
<i>P. scrobiculatum</i> L.		Sm	A	Sd, R	
<i>Setaria glauca</i> (L.) P. Beauverd		Sm	A	Sd	

Majority of the weeds, 78 species, are common for both summer and winter crops. While, 53 species were found to occur only during the summer, a slightly lesser number of 49 species grows during winter (Table 3).

Considering the habit, mainly life span, there is predominance of annuals in the weed flora as out of the recorded 180 species, 168 are annuals and only 12 species are perennials (Table 3). This is at par with the ecoclimatic conditions of crop fields prevalent during both the cropping seasons.

Table 2: Pteridophytic weeds, their association with the summer and winter crops along with their habit and method of propagation

[Abbreviation: A: annual, B: in both seasons, P: perennial, Sm: in summer, Sp: spore; Rs: rootstock, R: runner, W: in winter]

Family	Species	Crop Season	Habit	Propa- gation
Selaginellaceae	<i>Selaginella descipiens</i> Warb.	B	A	Sp
Equisetaceae	<i>Equisetum ramosissimum</i> Desf. ssp. <i>debile</i> Hauke.	W	A	Sp, Rs
Dryopteridaceae	<i>Diplazium esculentum</i> (Retzius) Swartz	B	P	Sp, Rs
Marsiliaceae	<i>Marsilea minuta</i> L.	Sm	A	Sp, R
Azollaceae	<i>Azolla pinnata</i> R. Br.	Sm	A	Sp

As the weed flora is dominated by annuals or therophytes, so most of these plants perenates and propagate through seeds. However, some of the therophytes also propagate vegetatively, exhibiting dual method of propagation. Only a few species propagate through vegetative organs like runner, offset, tuber etc. Among the recorded plants, 120 species were found to propagate only by seeds/spores, 57 species by both seeds and vegetative propagules and 3 species only by vegetative methods (Table 3).

Table 3: Quantitative distribution of different groups of the weeds for their seasonal occurrence, habit and propagation. [Abbreviations used: Ann = Annual, Prn = Perennial, Sum = Summer, Vegt = Vegetative, Wint = Winter]

Groups	Associated with crops in			Life span		Mode of propagation		
	Sum & Wint	Sum	Wint	Ann	Pern	Seed/ spore	Vegt	Dual
Dicots	60	21	46	116	10	109	0	17
Monocots	16	30	2	48	1	9	3	37
Pteridophytes	2	2	1	4	1	2	0	3
Total	78	53	49	168	12	120	3	57
		180			180		180	

Among the dicotyledonous families the highest representation of Asteraceae is due to their convenient methods of dispersal of very large number of seeds they produce. Among the monocotyledons, Poaceae is the highest represented family as many of its members opt for dual methods for propagation. In addition, the crop-field habitat facilitates the grasses to grow easily. The occurrence of a few weed species to a particular season indicates their similar specific requirements of water present in soil as well as the atmospheric humidity, photoperiod and temperature. The predominance of annual habit of weeds attribute to their corresponding life spans with the associated crops. It also signifies the production of viable seeds by such weed species as their seeds mature simultaneously with the crops. The dual method of propagation possessed by a few weed species provides the species extra vigor and adaptiveness to survive in the disturbed ecosystem like crop fields.

Now it is concluded that the crop fields provide a rich floristic diversity comprising the dicotyledons, monocotyledons and pteridophytes in varying proportion. The field condition favors

largely the growth of seed producing annual, majority of which are long-term annuals infesting both summer and winter crop fields.

Acknowledgement

Authors are thankful to Dr. (Mrs.) Sandhya Jyoti Phukan, Deputy Director, BSI, Eastern Circle, Shillong for her precious advice in identification of plants.

LITERATURE CITED

- Anonymous 2001-2004. *Statistical Hand Book of Assam*. Directorate of Economics and Statistics. Govt. of Assam.
- Ara, S.; Naqshi, A.R. & Dar, G.M. 1995. Weed flora of cultivated fields of Guraish Valley, Kashmir. *J. Econ. Tax. Bot.* 19 (2): 293 – 302.
- Firehum, Y. & Tamado, T. 2006. Weed flora in the Rift Valley sugarcane plantations of Ethiopia as influenced by soil types and agronomic practices. *Weed Biology and Management*. 6 (3): 139.
- Holzner, W. & Immonen, R. 1982. Europe: an overview of weed flora and vegetation. *Geobotany*. 2: 203 – 226.
- Kachroo, P. & Hakeem, M.A. 1993. Weeds of Tehsil Handwara (dist. Kupwara, Kashmir). *J. Econ. Tax. Bot.* 17 (2): 251 – 259.
- Kaul, M.K. 1986. *Weed flora of Kashmir valley*. Scientific Publishers, Jodhpur, India.
- Kirn, H.S.; Kapahi, B.K. & Srivastava, T.N. 2003a. Weed flora associated with rabi crops of Jammu and Kashmir state, India. *J. Non-Timb. Forest Products*. 10 (1/2): 83 – 89.
- Kirn, H.S.; Kapahi, B.K. & Srivastava, T.N. 2003b. Weed flora associated with kharif crops in Jammu and Kashmir state. *J. Non-Timb. Forest Products*. 10 (1/2): 71 – 75.
- Sharma, N.K. 1993. Studies on the weed flora of Jhalawar district (S.E. Rajasthan). *J. Econ. Tax. Bot.* 17(2): 357 – 361.
- Tamado, T. & Milberg, P. 2000. Weed flora in arable fields of eastern Ethiopia with emphasis on the occurrence of *Parthenium hysterophorus*. *Weed Research*. 40 (6): 507.
- Tiwari, J.P. 1981. The major winter weeds in Sagar Division of Madhya Pradesh. *Indian J. Weed Sci.* 14(1): 37 – 42.