STUDIES ON THE DISTRIBUTION, PHENOLOGY AND REPRODUCTIVE POTENTIAL OF SOME CROP FIELD WEEDS OF MALDA DISTRICT, WEST BENGAL, INDIA

Thesis Submitted for the Degree of
Doctor of Philosophy (Science)
of the
University of North Bengal

1998

BY

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TO WHOM IT MAY CONCERN

This is to certify that **Abhijit Acharyya** has carried out this work under my supervision. His thesis entitled **STUDIES ON THE DISTRIBUTION, PHENOLOGY AND REPRODUCTIVE POTENTIAL OF SOME CROP FIELD WEEDS OF MALDA DISTRICT, WEST BENGAL, INDIA** is based on his original work and is being submitted for the award of Doctor of Philosophy (Science) degree in Botany in accordance with the rules and regulations of the **University of North Bengal**.

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15th June, 1998

Dedicated to the
Sacred memory
Of
My beloved Uncle

Late Sishir Kumar Acharyya

ACKNOWLEDGMENT

The life on Earth can be traced back to a history of interaction between living beings and their environments. In my work I have tried to venture in revealing the exciting world of plants (Crop-field weeds), many of which remain so close to our physical world but often without mental link with our psyche, many others remain shying away in oblivion of wilderness. My work has been possible due to the heartiest and sincerest help of many persons.

I am thankful and greatly indebted to Dr. A. P. Das, Reader, Dept. of Botany, University of North Bengal, for his valuable guidance, continuous encouragement and many others help which have not only made this work possible but also enriched my knowledge in different wings related to the work.

My heartiest and sincerest thanks are due to Dr. D. C. Deb, Head, Dept. of Zoology, N.B.U., for his early encouragement and inspiration from my student life to the end of this work.

My sincerest thanks are due to my respected teacher Dr. P. K. Sarker, Former Head and Dr. (Mrs.) U. Chakraborty, Reader, Dept. of Botany, N.B.U. for their continuous esquiry, encouragement and help during computation of the work. I am also thankful to my respected teacher Dr. B. N. Chakraborty, Head, Dept. of Botany, N.B.U. for his continuous inspiration. Thanks are also due to my respected teachers Prof. K. B. Dutta and Prof. P. K. Basu from Dept. of Botany, N.B.U. for their inspiration and various kinds of help.

My thanks are due to Dr. N. Paria, Reader, Dept. of Botany, Calcutta University for permitting me to use his personal Library and assisting me to deal with the seedling morphology of weeds. Thanks are also due to Dr. D. N. Guha Bakshi (Former Documentation Officer, BSI) for supply of many important references for my use.

I am also thankful to the Director, Botanical survey of India, for permitting me to use the Central National Herbarium and the Reference Library and to the Scientist of Botanical Survey of India for their kind help and co-operation during my work at Calcutta.

My sincere thanks are due to Mr. S. K. Banerjee, Head Master, Jote Arapur P. N. High School, for his continuous help and encouragement, without which the work would not be possible. I am also thankful to Mr. G. Murmu, Mr. T. K. Ghosh, Mr. S. K. Paul and all other colleagues of my School for their kind co-operation during my work. Special thanks are also due to Mr. S. K. Chowdhury, Teacher, Who is always a well wisher of me. My heartiest thanks are due to Sri S. Mandal and Sri D. Mandal, two of my students for their continuous help during my field work.

I am also thankful to Dr. P. K. Gayen, Former Seed Testing Officer, Mr. K. Singha and Mr. A. Bhattacharyya, Scientific Asstt. Seed Testing Laboratory, Malda, for providing me some facilities in their Laboratory.

I also extend my heartiest thanks to Dr. U. Saha, Lecturer, Malda College; Mr. S. Das, S. O. 'SB'-NIC; Mr. A. Mukherjee, D.I.O., NIC, Malda; Mr. B. N. Chowdhury, all of my friends for their various help and best wishes which have made this work possible.

Special thanks are due to two of my friends, Mr. P. Majumder who helped me to prepare the District Map and Mr. M. Das, Teacher, who helped me in various ways to complete my work.

I am also thankful to my research colleagues in the Laboratory - Mr. P. Rai, Mr. A. K. Samanta, Mr. A. F. M. Manzur Kadir for their extended helping hand during this work. I am also thankful to the students of Taxonomy, Dept. of Botany, N.B.U., Sri S. S. Mandal, Smt. S. Roy, Smt. S. Majumder and Smt. S. R. Mandal for various kinds of help during my work. I am specially thankful to Mr. N. Singha, Part time Employee of the Taxonomy Laboratory N.B.U. for his kind co-operation in the preparation of Herbarium Specimen.

I would like especially to thank my relative Mr. D. Acharyya and Mrs. S. Acharyya for their cordial hospitality and care during my work without which the work would not possible. But my sincerest thanks are due to Mrs. R.. Das for her continuous encouragement and affectionate care which always inspired me to complete my work.

I would also express my gratitude to my parents Mr. A. Acharyya and Mrs. K. Acharyya and my appreciation to my brothers Mr. A. Acharyya and Mr. S. Acharyya for their extended co-operation.

Lastly my appreciation is to my wife Sudipta, who helped me in all respects from the beginning to the end of my present work, though I failed to do my domestic duties. I am sorry to my little daughter 'Titli' as I spent very little time with her.

Abhijit Acharyya 15/6/98

(ABHIJIT ACHARYYA)

CONTENTS

CHAPTER - 1

INTRODUCTION

INTRODUCTION

Malda, a northern district in the state of West Bengal, India is situated near the center of state. The district occupies an important place in the economic map of the state for the production of raw silk yarn and huge quantity of prized varieties of Mango. The ruins of the old cities of Gour (Capital of Bengal during Pal and Sena Dynasty 8th - 12th century AD and Sultans of Bengal during 1220 - 1564 AD) Pandua and Adina also attract a large number of tourist to Malda District round the year. The District was formed out of some portions of out lying areas of Purnia, Dinajpur and Rajsahi district in the year 1813. In August 1947, during independence the district was affected by partition. Between the 12th. and 15th. of August, 1947, the fate of the district as to which side it should go, to Pakistan or to India was undecided, because the announcement of the partition award of Sir Radcliffe did not make this point clear. When the details of the Radcliffe Award were published, the district came over to West Bengal on the 17th. of August 1947.

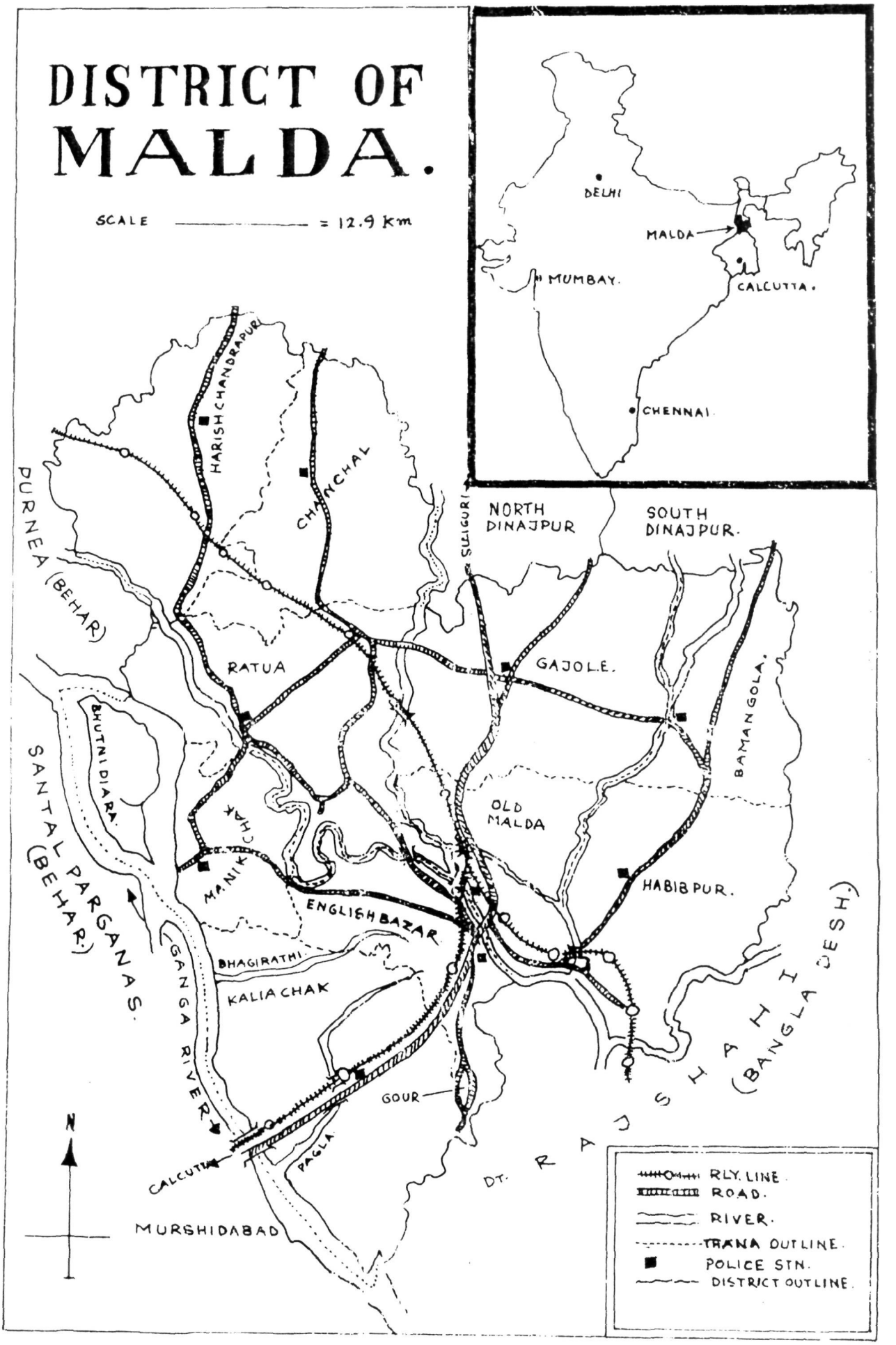
Not only silk so, Mulberry is also cultivated for leaves to rear silk warms and Mango, a large number of other crops are also grown in this district, and quite a good proportion of land is producing 2 or 3 crops every year.

1.1 LOCATION

The district of Malda is situated between the latitudes 24^0 $40'$ $20''$ and 25^0 $32'$ $08''$ in the northern hemisphere and is situated entirely to the north of Tropic of Cancer. The Easternmost extremity of the district is marked by 88^0 $28'$ $10''$ and its Westernmost extremity by 87^0 $45'$ $50''$ of longitudes. The area of the district is about 3713 sq. Km which is bounded by Uttar and Dakshin Dinajpur districts(previously known as West Dinajpur district of West Bengal) and the district of Purnia(of Bihar) on North, Dakshin Dinajpur (of West Bengal) and the district of Rajshahi (of Bangladesh) on East, the district of Murshidabad (of West Bengal) on South and the district of Santal Paraganas (of Bihar) on West.

1.2 TOPOGRAPHY

The District consist mainly of low lying plains, slowly rolling towards the south. The river Mahananda flowing north-east, divides the district into two regions - the eastern region consist mainly of Red muddy soil of old alluvial formation and relatively unfertile soil. This


DISTRICT OF
MALDA.
SCALE ——— = 12.9 km
DELHI
MALDA
MUMBAY.
CALCUTTA.
CHENNAI.
HARISHCHANDRAPUR
CHANCHAL
PURNEA (BEHAR)
SILIGURI
NORTH DINAJPUR
SOUTH DINAJPUR.
RATUA
GAJOLE.
BAMANGOLA.
BHUTNI DIARA
SANTAL PARGANAS (BEHAR)
OLD MALDA
MANIK CHAK
HABIB PUR.
ENGLISH BAZAR
BHAGIRATHI
KALIACHAK
GANGA RIVER
GOUR
PAGLA
CALCUTTA
MURSHIDABAD
DT. RAJSHAHI (BANGLADESH)
N
RLY. LINE.
ROAD.
RIVER.
THANA OUTLINE.
POLICE STN.
DISTRICT OUTLINE.

part is commonly known as 'Barind'. The Western region is further subdivided by the river 'Kalindri' into two areas. The northern areas known as 'Tal', it is low lying and vulnerable to inundation during monsoon, with mixed alluvial soil. The Southern area consisting of very fertile land commonly as 'Diara', with alluvial loam. The Ganga flows along the south - western boundary and is the friend and foe for the district. So, the main drainage system for the district was formed by the river Ganga, Kalindri and Mahananda. Ganga produced a big 'char' (island) known as 'Bhutni-diara' long ago. Bhutni-diara is still now low lying and only a small number of people have started living there for the last fifty years. Mahananda originated from Darjeeling Himalaya, a rainfed river, entered the district from north, getting released into the Rajsahi of Bangladesh and there it merge into the Ganga. Kalindri coming form Purnia of Bihar, is also rain fed and flown into Mahananda near old Malda township. These two rivers, Mahananda and Kalindri, remain nearly flowless during dry season but carry huge bodies of water during monsoon. Bhagirathi, a detached and left over part of Ganga is now with stranded water only. Tangon, Punarbhaba, Behula and Pagla are very small rivers but they are very important for irrigation and sometimes also over flown to cause wide spread flood.

The district suffer form flood, almost every year and Ganga, Mahananda and Pagla are mainly responsible for this

1.3 THE ENVIRONMENT

1.3.1 CLIMATE

Being situated at the center of the state West Bengal and on the Gangetic plain, the district of Malda experience an extremely hot and saultry summer, quite high precipitation and high relative humidity in the air.

The whole year can be divided into four distinct seasons :

SUMMER	:	March to the first week of June
MONSOON	:	Second week of June to the third week of September
AUTUMN	:	Last week of September to the middle of November
WINTER	:	Middle of November to the end of February

While the first three seasons are very distinct, the Winter of Malda is not so severe, that may be due to the clay or loam soil, thick vegetation and situated quite far away from any hilly region. However sudden fall of temperature to 4-5 ^{0}C also found to occur.
During Summer, the Nor'Westers (Kalbaisakhi) are very common, which originate form the depression in Bay of Bengal, runs over 400 Km to reach Malda, there by loosing its strength and can't do much harm to vegetation or crop.

Hailstorms comes 3-6 times every year during February to April, which is not severe and no recognisable amount of snow covering the soil but it hampers one of the main crop of Malda i.e. Mango (*Mangifera indica*).

1.3.2 TEMPERATURE

The district of Malda is situated nearer to the Tropic of Cancer and experienced extremely hot and sultry Summer, with quite high precipitation and moisture in the air throughout the year. Temperature of the district begin to rise rapidly from the beginning of March. Although the day temperature reach the maximum in April or May, night temperature continue to rise even in Monsoon. In April the mean daily maximum temperature is 35.8 ^{0}C and the mean daily minimum is 21.8 ^{0}C. Due to the high moisture in the air the heat during the summer is oppressive. In Summer again hot wave come form Bihar plateau and cause the rise of temperature to 42-47 ^{0}C. This time the district experienced the hot wave commonly known as "Loo" and this make the life unbearable in the afternoon, not only to the people but also to the different domestic animals. The hot wave also damage the small seedlings of Paddy (*Oryza sativa*) which are then in seed beds.

With the arrival of Monsoon about the first week of June the day temperature decreases by two to three degrees but the night temperature continue to rise. On account of increase in humidity and high night temperature (about 25 ^{0}C) oppressive weather is experience in between in the Monsoon particularly in between two spells of rains. Winds which are blowing moderately during summer now increases its speed and this is the only consolation to the people of the district in its oppressive condition.

In Summer months, March to May, thunderstorms occur generally in the afternoon, accompanied often with heavy rain with hailstorms on some occasions and severe squalls coming usually form the north-west. This phenomena called Nor'Westers or locally known as 'Kalbaisakhi' are often violent and cause sharp drop of temperature by 4-5 ^{0}C. Though it is sometimes violent but it always treat as a blessing to the people during the saultry summer.

With the withdrawal of south-west monsoon and wind of variable directions by about the last week of September or first week of October both day and night temperature drops steadily. Autumn is now felt after a long six or seven months humid weather.

It is the November, winds start to blow from directions between West and North-east, night temperatures drops more rapidly by 5-6 ^{0}C and day temperatures drop by 2-3 ^{0}C. The process continues till January . January is the coldest month of the year with the mean daily maximum temperature 23.8 ^{0}C and with the mean daily minimum temperature

10.3 ^{0}C. During January small amount of occational rain sometimes with hailstorms, helps to drop the temperature by 3-4 ^{0}C. In Winter in association with passing western disturbances, spells of cold weather are experienced and the minimum temperature may fall as low as 4 or 5 ^{0}C. Again from the third week of February both day and night temperature starts to rise steadily and Summer begins to appear.

During the survey period from 1992-1995 highest maximum monthly average day temperature has been observed during May '95 (36.8 ^{0}C),followed by April '92 (36.7 ^{0}C) and lowest minimum monthly average night temperature was during Jan'95 (8.3 ^{0}C) followed by Jan '92 (9.2 ^{0}C) . It has been observed that from March both day and night temperature steadily increases though during monsoon again a drop of day temperature by 2-3 ^{0}C has been taken place; but night temperature continue to rise till August . After the month of August again both day and night temperature steadily drops down till January and January is the coldest month of the year (Table 1.3.1) .

1.3.3. RAINFALL

The average annul rainfall in the district of Malda is 1453.1mm (Bachhawat 1992). Generally the major part of precipitation is received during Monsoon which contributes 78 % of the total annul rainfall. The Monsoon starts around the first week of June with the arrival of South-west monsoon and continues till the end of September. June, July and August are the months of heavy rainfall and they together contributes about 60-65 % of the total annul rainfall. During the monsoon months a number of depressions develop at the Bay of Bengal which affects the district with heavy precipitation. Rainfall during the Monsoon is often associated with thunder. During the last twenty-five years period highest annual rainfall has been observed in 1995 which was 2096.3 mm. This is about 148 % of the average annual rainfall for the district. The lowest annual rainfall has been observed during the year 1972, which was only 673.4 mm and is amounted to only 46 % of he average annual rainfall of the district. On an average there are 67 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year.

Rainfall sharply decreases after the month of September i.e. Autumn. During Autumn October is the month of highest rainfall that is due to the depression in Bay of Bengal, which often reach the district and cause widespread rain.

With the onset of Winter rainfall decreases abruptly specially from the month of December. The month of January and February receive very small amount of rain occasionally which very much helpful for Robi (winter) crops in the district.

The Summer starts from March when there is occational with a very small amount of rain but it increases with the progress of the season. Storms and depressions generally starts

from May which used to come from Bay of Bengal, which also cause wide spread heavy rain. During Summer highest amount of precipitation took place in the month of May.

During the survey period from 1992-1995, maximum rainfall 716.6 mm, for any month was recorded in September 1995 and which is recorded to be the highest during the last twenty-five years in Malda. The highest annual rainfall was also observed during the year 1995 and was amounted 2096.6 mm, which is also a record for last twenty-five years. Except for this year i.e. 1995 average annual rainfall in 1992-1994 was less than the average annual rainfall of the district . The lowest annual rainfall observed during the year 1992, which is 1221.0 mm and amounted to 84 % of the average annual rainfall for the district. Lowest monthly rainfall observed during March, November, December 1994, and December 1993, when there was no any rainfall. Rainfall increases from the month of April and continues till September . After September rainfall decreases rapidly. December, February and March receive little amount of rainfall. Heavy rainfall during monsoon sometimes cause flood which lead to the appreciable loss of production (Table 1.3.2).

Table 1.3.1 : Monthwise Mean Daily Maximum (^{0}C) and Mean Daily Minimum (^{0}C) Temperature of the District of Malda (1992 - 1995)

	Mean Daily Maximum°C				Mean Daily Minimum ° C			
Year Month	1992	1993	1994	1995	1992	1993	1994	1995
JAN	22.3	20.7	23.8	22.2	10.1	9.2	11.1	8.3
FEB	24.9	26.9	24.6	25.8	11.4	13.4	11.8	11.3
MAR	32.0	29.7	31.3	31.1	17.2	15.1	16.6	15.4
APR	36.7	33.0	34.4	36.7	20.8	19.5	20.9	20.3
MAY	33.4	32.5	36.0	36.8	22.8	22.8	24.2	25.0
JUNE	34.8	33.1	32.7	32.9	25.8	24.9	25.3	24.6
JULY	32.0	32.6	32.5	31.9	25.1	26.0	25.8	25.5
AUG	32.1	31.8	32.3	31.7	25.8	25.7	25.0	25.72
SEPT	32.1	31.3	32.1	31.5	25.0	24.7	24.1	24.7
OCT	31.1	31.4	29.8	31.2	21.9	22.3	20.7	22.5
NOV	28.5	28.8	28.1	27.7	15.7	17.0	16.3	14.6
DEC	24.0	25.6	25.1	24.5	10.8	12.3	10.3	11.6

Table 1.3.2 : Monthwise Rainfall (mm) of the District of Malda (1992 - 1995)

YEAR MONTH	1992 (mm)	1993 (mm)	1994 (mm)	1995 (mm)
JAN	1.1	49.5	29.1	3.2
FEB	10.4	0.1	28.4	7.3
MAR	1.5	24.9	0.0	3.2
APR	4.9	99.6	12.6	3.5
MAY	118.3	115.6	93.1	52.7
JUNE	113.5	157.3	415.2	300.4
JULY	493.3	197.8	181.6	359.6
AUG	226.6	228.7	181.1	551.7
SEPT	161.5	311.7	214.4	716.6
OCT	74.8	79.2	112.1	8.2
NOV	14.5	46.9	0.0	81.4
DEC	0.6	0.0	0.0	8.8
YEARLY RAINFALL	1221.0	1311.3	1267.6	2096.6

1.3.4 RELATIVE HUMIDITY

Relative humidity (RH) remains quite high in the district of Malda throughout the year. But during early part of Summer it is comparatively less being about 50-60 % in the morning and 30-40 % in the afternoons. During survey period (1992 - 1994), it was observed that morning RH never comes down below 70 % and generally found above 90 % in yearly average. Again RH in the afternoon never comes down to below 25 % and always found above 55 % in yearly average. Comparatively low maximum and minimum RH is observed during March and April . In the afternoon humidity increases steadily after the month of April and continues till September. After that it decreases by 10-20 % during winter which continues till the end of Summer. There is no sharp decrease observed in the morning RH and the decrease is only 5 - 10 % during Summer (Table 1.3.3). This is one of the causesof the prevalence of evergreen vegetation and comfortable environment in the district of Malda.

For better understanding a table (Table 1.3.4) containing the average temperature (^{0}C), rainfall (mm) and relative humidity (%), as well as Ombrothermic Diagram (Fig.1.3.1) of the district of Malda during the survey period (1992-1995) have also been given.

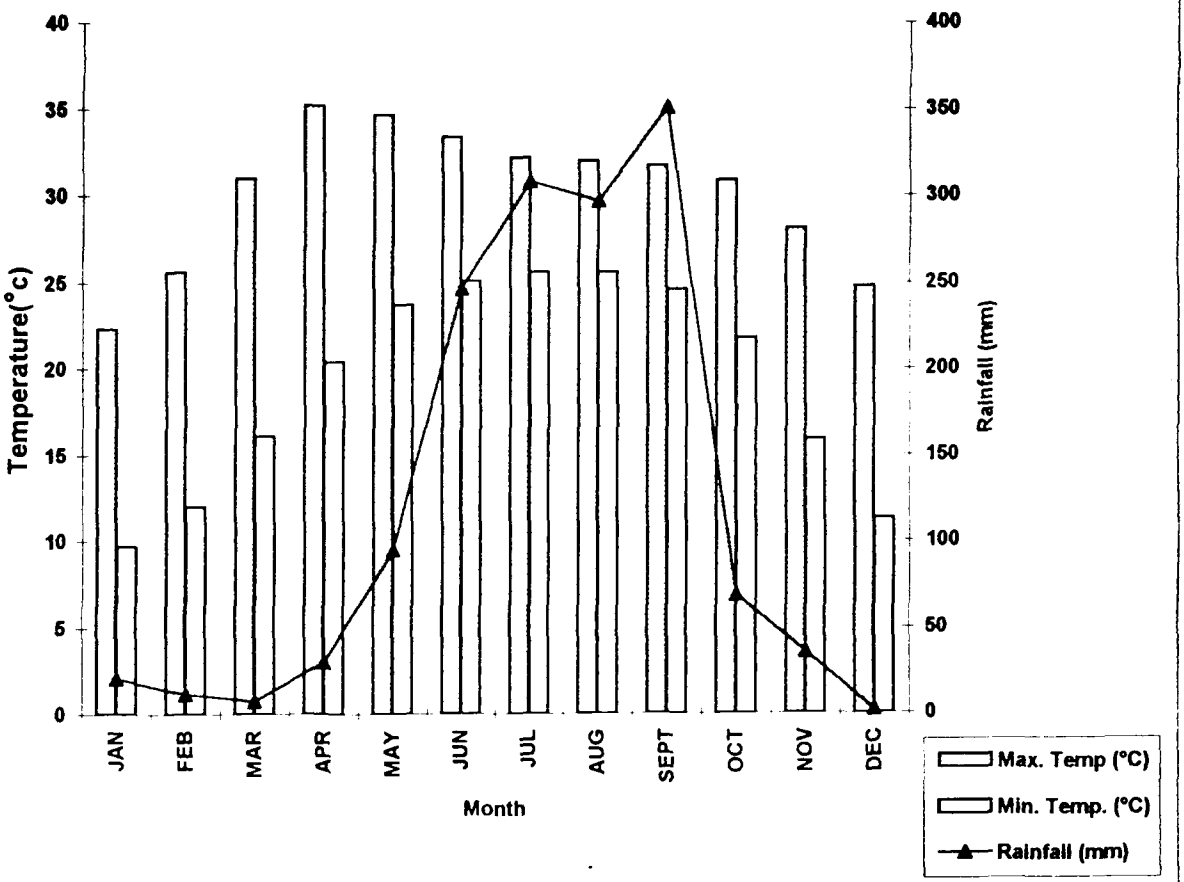
Table 1.3.3 : Relative Humidity in % in the District of Malda (1992 - 1995)

	Maximum Relative Humidity (%)				Minimum Relative Humidity (%)			
Year / Month	1992	1993	1994	1995	1992	1993	1994	1995
JAN	95	97	97	95	52	51	54	45
FEB	93	90	95	95	37	42	49	37
MAR	74	85	89	83	27	33	35	26
APR	77	86	90	75	27	43	47	28
MAY	89	89	86	86	53	58	46	41
JUNE	89	91	93	93	57	69	70	76.3
JULY	95	93	92	94	77	73	74	83
AUG	93	94	93	90	73	77	73	81.5
SEPT	94	94	94	94	68	77	68	79
OCT	95	95	95	87	62	65	61	63
NOV	94	95	93	94	47	59	53	59
DEC	98	92	91	82	52	68	45	57
Yearly Average	90.5	91.8	92.3	89.0	52.7	59.6	56.3	56.3

Table 1.3.4 : Average Temperature (^{0}C), Relative Humidity (%) And Rainfall (mm) of the District of Malda (1992 - 1995)

	TEMPERATURE (°C)		RELATIVE HUMIDITY (%)		RAINFALL (mm)
Month	Maximum	Minimum	Maximum	Minimum	Average
JAN	22.2	9.7	96.0	50.5	20.7
FEB	25.6	12.0	93.3	41.3	11.6
MAR	31.0	16.1	82.8	30.3	7.4
APR	35.2	20.4	82.0	36.3	30.2
MAY	34.7	23.7	87.5	49.5	94.9
JUNE	33.4	25.1	91.5	68.1	246.6
JULY	32.2	25.6	93.5	76.8	308.1
AUG	32.0	25.6	92.5	76.1	297.0
SEPT	31.7	24.6	94.0	73.0	351.1
OCT	30.9	21.8	93.0	62.8	68.6
NOV	28.1	15.9	94.0	54.5	35.7
DEC	24.8	11.3	90.8	55.5	2.4

Fig.1.3.1 Ombrothermic diagram for the district of Malda
(Avarage of 1992 - 1995)



1.4 VEGETATION

The flora of the district of Malda is merely a small portion of the extends from Kose to the Brahmputra basins and alteration of ditches and village shurubberies with the dried jungle of the Barind region and abundant natural vegetation excepting the sandy beds of rivers. Though there is no recognisable natural forest in this district, but old river beds, ponds, marshes etc. have a copious vegetation of various plant species. Raised lands are mostly covered by cultivation and / or plantation of different desirable species. While *Vallisnaria spiralis, Hydrilaila verticillata, Eichhornia crassipes, Monocharia vaginalis, Marsilea quadrifida* etc. are abundant in aquatic systems; species like *Hygrophila auriculata, H. polysperma, Hydrolea zeylanica, Rosa involucrata, Scirpus spp., Cyperus* spp. grow in abundance.

Some portionsof Barind area are covered which consist of thorny scrub bush (*Flacourtia indica, Cappris zeylinaca, Carissa carandas, Calms rotundus, Zizypus oenoplia, Rosa involucrata* etc.)mixed with *Ficus benghalensis, F. infectoria, F. religiosa, F. hispida, Trewia nudiflora, Bombax ceiba, Borassus flabellifer, Bumbusa tulda* etc. The thickest thorny bamboo, *Dendrocalamus strictus* are also common in Pandua area. Around the villages and on embankment of Gour area plants like *Azadirachta indica, Tamarindus indica, Artocarpus heterophyllus, Polyalthia longifolia, Anthocephalus clivensis, Zizyphus mauratiana, Dalbargia sisso* and a large number of exotic trees like *Delonix regia, Cassia siamea, C. nodosa, Lagerstroemia reginae, Acacia auriculoformis, Eucalyptus globulus* etc. are also commonly planted. Mango (*Mangifera indica*) and Mulberry (*Morus australis*)are two most common plantation crops in the district covering wide areas of which mango covers over 45,000 acres.

Sedges are observed to be the predominant weed in the crop fields during Kharif season, the genus *Cyperus* consisting of *C. compressus, C. rotundus, C. iria and C. kyllinga* forming the dominant weed community . Other members of Cyperaceae are *Fimbristylis miliacea, Scirpus* spp. along with *Eriocaulon* spp. are codominents. Among grasses *Cynodon dactylon, Eragrostis tenella, Echinochloa colona, E. crus-galli, Chloris barbata,* are present in varying density. Among dicotyledonous *Ludwigia perennis, Lindernia spp., Ammannia baccifera* etc. are dominant. Uncroped area are mainly infested by *Cynodon dactylon, Commelina benghalensis, Croton bonplandianum, Alternanthera sessiles* etc. In Rabi crops (Winter) *Anagallis arvensis , Gnaphalium purpurium , Echinochloa colona , Leucus indica, Cyperus spp., Vicia spp.* etc. are common.

Social forestry program which is now covering large areas within the villages, road sides etc. are mainly using spp. like *Eucalyptus globulus, Dalbargia sisso, Acacia auriculoformis, Tectona grandis, Swietenia mehagani, Terminalia arjuna, Lencaena lencocephala* etc.

1.5 CULTIVATION

The net area under cultivation in the District of Malda is 644092.66 acres. This amounted to 72.2 % of the total area of the district (Bachhawat, 1992). Crops under cultivation include various cereals, pulses, vegetables etc. Now a days a good proportion of these lands are used to grow different types of vegetables. Various crops of the district include :

Seasons	Cultivation
BORO	*Oryza sativa* L. (Boro paddy), *Tricoxanthes dioica* Roxb., *Momordica charantia* L., *Cucumis sativus* L., *Solanum melongena* L., *Sasamum orientale* L., *Citrullus lanatus* (Thunb.) Matsumara &Nakai, *Cucurbita maxima* Duch ex Lamk., *Saccharum officinarum* L., *Luffa acutangula* (L.)Roxb., *Abelmoschus esculentus* (L.) Monch., *Vigna sinensis* (L.) Savi ex Hassk., *Calocasia esculanta* (L.) Schott in Schott & Endl., *Basella alba* L., *Laginaria siceraeia* (Molina) Standley, *Amaranthus hybridus* L. etc.
AMAN	*Oryza sativa* L.(Aman paddy), *Corchorus capsularis* L., *C. olitorius* L., *Zea meys* L., *Pennisetum americanum* (L.) Leeke, *Cucurbita maxima* Duch ex Lamk., *Solanum melongena* L., *Luffa acuminata* (L.) Roxb., *Abelmoschus esculentus* (L.) Moench, *Cajanus cajan* (L.) Huth., *Basella alba* L., *Laginaria siceraeia* (Molina) Standley, *Amaranthus hybridus* L. etc.
RABI	*Oryza sativa* L. (Rabi paddy), *Lens culinaris* Medik., *Cicer arieinum* L., *Pisum sativum* L., *Linum usitatissimum* L., *Lathyrus sativus* L., *Brassica juncea* (L.) Czern & Coss., *B. campestris* L., *Phaseolus mungo* L., *Triticum aestivum* L., *Hordeum vulgare* L., *Solanum tuberosum* L., *Allium cepa* L., *A. sativum* L., *Spinacea oleracea* L., *Lycopersicon esculentum* Mill., *Raphanus sativus* L., *Brassica oleracea* var. *caulorapa* DC., *B. oleracea* var. *botrytis* L., *B. oleracea* var. *capitata* L., *Solanum melongena* L., *Amaranthus hybridus* L. etc.

It shows that cultivation in Malda District is a continuous process round the year, though most of the land are cultivated twice only. Aman and Rabi or Aus or Boro paddy are in the crop cycle if paddy is cultivated twice in a particular plot of land. Cultivation of paddy in Rabi season is dependent on the availability of enough water, so it is not popular in the district. Rather, Wheat is more popular cereal for Rabi. But, Pulses and mustard are more popular crop for this season. Cultivation of *Brassica oleracea* varieties are not popular and are very irregular. Only recently habit of vegetable cultivation is developing rapidly but were previously in much smaller scale.

Except sporadic fall of temperature (as in 1.3.1) the winter of this district is not so severe which favours the cultivation of numerous vegetables round the year like *Solanum melongena, Abelmoschus esculantus, Cucurbita maxima, Momordica charatia, Cucumis sativus, Amaranthus hybridus* etc.

1.6 ECONOMY

The economy of the district is basically an agrarian one and it ranks as one of the most under developed district in West Bengal . The backwardness is characterized by low per capita income, low yield per area of land, backwardness of industrialization etc. The district has no known mineral resources and agriculture remains the main stay. The main agricultural products are Paddy, Wheat, Jute and Rabi (winter) crops. Despite this backwardness, Malda occupies an important place in the map of the state for the production of raw-silk yarn. The annual estimated production is about 85% of the total output of the state. Production of Mango has another important aspect of Malda's economy. About 45000 acres of land is covered by Mango orchards which, in normal years bear fruit to the extend of 360,000 tones. The value of which in money terms comes to about Rs 55 crores (Buchhawat 1992).

1.7 ADMINISTRATIVE DIVISIONS

The district is divided into ten police station areas called 'thana', namely (1) Englishbazar (2) Kaliachak (3) Old - Malda (4) Habibpur (5) Ratua (6) Chanchal (7) Harischandrapur (8) Manikchak (9) Gazole (10) Bamongola. Among these, Gazole has highest area under cultivation and Eniglishbazar has the lowest area under cultivation [J.C. Sengupta, W.B. District Gazetteers (Malda),1969]

1.8 IMPORTANCE OF THE WORK

Importance of studding ecology of weed is felt by numerous workers including Pammel and King 1910; King 1966; Datta and Banerjee 1976; Holzner 1982 and Dutta and Chakraborty 1983. The weed flora of different crop fields and the reproductive potential of some of this weeds have also been workedout by different workers at different places (Salisbury 1942; Baker 1972; Dutta *et al* 1980; Paria and Sahoo 1981).The weed compete with the cultivated crops and are responsible for poor yield of crops (Panikar 1950; Asana 1951). Luthra 1938 calculated the loss uptothe 30 %. It is found to be extremely difficult to keep this plants away from fields. So survey of weed flora associated with different crops should be an integral part of the agricultural practice. As the frequency of weed is directly related to the ultimate crop yield, so it is necessary to know the weed flora and their frequency to make a good agricultural strategy.

Again the vulnerability of any weed depends on its reproductive potential, root development and spread as well as the allelopathic effects on cultivated plants (Evenari

1961; King 1966; Dutta and Sinha Roy 1974; Putnam and Duke 1978; Dutta and Ghosh 1987). Seed weight, seed out put, viability and germination are of profound biological significance in the dispersal and establishment of seeds (Paria and Sahoo 1981).The present work is expected to produce a bulk of knowledge about the reproductive potential, viability, germination and phenology of the common weeds in the environment of district of Malda.

The weeds are more injurious in the early stages than in the advance stages of the crop (Paul and Bhattacharyya,1959). Seedling morphology is expected to help the farmer to recognise the weeds at their juvenile stage. Seedling morphology has much taxonomic significance (Naidu and Shah 1981; Ladiges et al 1981; Hill 1982; Austin and Staples 1980; Sampatkumar 1982; Kamilya and Paria 1994).

Farmers generally use some weeding practices and most of the weeds fail to produce seeds while growing along with the crops. So seeds and propagules used to come from the same plants growing in lateral areas and also from the plants growing in the field during its resting period in between two successive crops, which sometimes longer than a month or two.

Asana (1951) remarked that in general the application of weedicides in grain crops all over the country can't be recommended in the absence of relative information. The present work is expected to help in this regard.

Weeds have both noxious and beneficial sides. Special notes on the weeds are expected to help in this respect.

So, in general the present work is expected to help the agriculturists to make their strategies, farmers to develop knowledge about weeds and taxonomists will gain information's about the distribution, phenology, germination, seedling characters etc. of some weeds of the district of Malda.

CHAPTER - 2

MATERIALS AND METHODS

MATERIALS AND METHODS

2.1 THE WEED FLORA

A detailed flora of crop field weeds of the district of Malda, West Bengal has been prepared. For this purpose crops were selected in such a manner so that their growing seasons cover the entire year. In most of the cases the sequences is as follows:

SEASONS	DURATION	CROPS
FIRST (AMAN)	JUNE /JULY - SEPT /OCT	Paddy (*Oryza sativa*)
SECOND (RABI)	OCT /NOV - JAN / FEB	Pulses(*Lens culinaris, Cicer arietinum*), Mustard *(Brassica juncea,B. campestris*), Tishi (*Linum usitatissimum*)
THIRD (BORO)	FEB / MAR - MAY / JUNE	Paddy (*Oryza sativa*)

The entire district was covered for this work and sites were selected representing all 10 of its 'Police station' (Thana) areas.The sampling of specimens were made with two methods:

A. RANDOM SAMPLING

For random sampling crop fields of the entire district of Malda was surveyed at random in different seasons of the year to get a wholistic picture of its weed flora. It was done for three consequtive years, June 1992 - May 1995.

Collected samples were recorded in the field note book and then processed for the preparation of mounted herbarium sheets.

B. QUADRATE SAMPLING

To understand the phytosociological behaviour of different weeds some randomly selected fields under each police station area were surved by Quadrate Method. As all weeds are small and herbaceous, a standard quadrate size of 1m x 1 m was used for the purpose. The total area under cultivation is much more during the first season (Aman) than two other seasons (Rabi and Boro), so a larger number of quadrate i.e. 80 were sampled in Aman crops. For two other seasons 50 quadrates for each were sampled.

It is difficult to use pegs or stakes for permanent marking of selected quadrates because that will disturb the practice of tilling for cultivation. So, Field wise position records (distance from a particular angle) were kept in field note books. As most of the weeds are

annuals or behave like annual little shift from the actual position earlier probably will not affect the result.
Quadrate sampling were made within 15-30 days after showing because a further delay effect in two ways: (I) frequency of weeds may decrease due to the first growth of crop plants and (ii) weeding practices.

Data for list, count and cover for all available species in quadrates were recorded.

2.1.1 PROCESSING OF SPECIMENS

Specimens were collected as far as possible with flowers and / or fruits by random sampling and / or quadrate sampling, tagged properly, recorded in the "Field Note Book" and temporarily preserved in polythene bags with mouth kept closed using rubber bands to prevent desiccation. Plants brought to the main camp in Malda Town (Englishbazar) in such condition and were then segregated, cleaned, properly displayed on the blotting papers and finally inserted in a Wooden Plant Press for drying. Blotting papers were changed several times. Sometimes specimens were treated with formaldehyde for better preservation.

The field records included the habit, habitat, abundance, life form, flowering period, flower colour, odour, mode of pollination etc. i.e. covering such characters which are generally available with dry herbarium specimens.

After drying specimens were poisoned by soaking in 4% solution of $HgCl_2$ in 90-95% etanol, then dried again in blotting paper. Now specimens were pasted on standard herbarium sheets (41.5-42.0 x 28.0 cm) and labeled with all relevant informations, such as i) name of the plant, ii) family, iii) local name (if available), iv) habit, v) habitat, vi)locality, vii) floral colour, viii) abundance, ix) date of collection etc. were affixed on the bottom right corner of the mounted sheets.

Tubers / rhizomes, large fruits etc. were collected and sometimes splitted apart or made into thick longitudinal or transverse sections, then preserved separately, dried in separate blotting papers, sometimes using cotton pads to maintain shape. For quick drying a hot air oven was used in case of some succulent species.

Loose flower, floral parts, small fruits and /or seeds as well as different parts were placed in paper packets or envelops which are in turn, affixed to the herbarium sheets.

2.1.2 IDENTIFICATION

Identification of collected weeds were done mostly at the Taxonomy and Environmental Biology Laboratory, Deptt. of Botany, North Bengal University and were then matched at two herbaria, CAL and NBU herbarium.

2.2 PHYTOSOCIOLOGY

As had already been mentioned, crop fields were surveyed by Quadrate method of sampling. And, from such samples data for list, count, and cover have been recorded. Using these data, different phytosociological parameters namely Relative density (RD), Relative frequency (RF), Relative dominance (RDm) and Importance Value Index (IVI) have been calculated using following formulae (Tripathi and Misra, 1971; Phillips, 1959; Malhotra, 1973):

$$\text{Relative Frequenc (RF)} = \frac{\text{No of quadrates in which the weed species occured}}{\text{No of quadrate studied}} \times 100$$

$$\text{Relative Density (RD)} = \frac{\text{Total no of plants of a given weed in all the quadrate}}{\text{Total no of plants of weed species in all the quadrates}} \times 100$$

$$\text{Relative Dominance (RDm)} = \frac{\text{Total coverage of the weed species}}{\text{Total coverage of all the species}} \times 100$$

$$\text{Importance Value Index (IVI)} = RF + RD + RDm$$

Phytographs, using all the phytosociological parameters, have also been prepared.

2.3 PHENOLOGY

Phenological studies were made on most of recorded weed species from the crop field of the district of Malda. These included both dicotyledonous and monocotyledonous plants. Following parameters were used for this study: i) germination, ii) vegetative stage, iii) flowering, iv) fruit set, v) seed dispersal, vi) death or perennation. A species was considered in a particular phenophase when it actually enters in that stage for instance, when just one or a few individuals starts flowering, plants enter in the phase / stage of flowering. Detail observations were made regularly both in natural and in laboratory conditions from 1993 to 1996 (Sundriyal, 1990). Special emphasis was given on seedling morphology, as it is the most essential feature to know the weeds of crop fields at their early stage.

For life form classification, Raunkiaer 1934, has been followed without any modification as follows:

Phanerophytes (P):	Perennating buds well above the ground.
Chamaephytes (Ch):	Herbaceous perennial or suffrutescent plants bearing perennating buds just above the ground level to 30 cm high.
Hemicryptophytes (H) :	Perennting buds hulf hidden at the ground level.
Cryptophytes (C):	Perennating organs below the ground surface.
Therophytes (T):	Annuals which perenate through seeds or spores

2.3.1 SEEDLING MORPHOLOGY

The work was done in two ways: i) observing / collecting seedling of different stages from the crop fields and ii) in laboratory condition, seeds were germinated in petriplates and in pots and stages of their life have been studied. Seedlings collected from nature were compared and identified with the help of seedling raised from the seeds of known identity. At least fifteen specimens were studied from various habitats / locations. The seedling were preserved as herbarium specimens. The seedling morphology was studied following the terminology as proposed by Burger (1972), Hicky (1973), and Vogel (1980).For method of description of seedlings Deb and Paria (1986); Paria *et. al.* (1990); Kamilya and Paria (1993, 1994) were followed. For morphological diagnosis of seedling the germination type, characters of cotyledons or paracotyledons, eophylls (first few leaves) and hypocotyle were taken into consideration.

2.4 REPRODUCTIVE POTENTIAL

Under this chapter two aspects have been covered:

A. Number of seeds per fruit and seeds per plant.

B. Seed weight.

Methods largely followed by Steven (1932, 1957); Datta and Banerjee (1976); Datta *et.al.* (1980) and Paria and Sahoo (1981) have been used to do this work. In general a plant of average size and growing under little competition, were chosen for the collection of fruits and seeds. After harvesting the fruits were air dried for three weeks, threshed and cleaned. In most cases the number of plump and well developed seeds for a single plant was recorded. In some plants where seeds can not be separated from fruits, the seed weight depicts the weight of complete fruit.

For plants in which ripening extends over a considerable period and seeds are set free as soon as mature, only a part of the total number can be procured at a single collection. In these cases daily collection was made for three months because fruit formation and seed maturity are successive to each other. For plants in which fruit formation and seed maturity are simultaneous to each other collection were made every day for a month and were bulked to calculate the total seed number.

Following Stevens (1957), remarks are made concerning abortive and immature seeds as well as number of stalks and fruits borne by the concerned plants. Abortive seeds indicate those that do not develop at all, where as immature seeds are those that do not attain the same colour, size and shape as the mature ones. In runners, where it was difficult to detach the stalks, a square area was used as the unit of measure. Branches mentioned represent the total number of branches in a particular plant. The weed families, genera and species have been arranged here alphabetically for the convenience of the uses in other fields of science.

Weight of 1000 seeds were calculated from 100, 250, 500, 1000 seeds according to the size of the seed and availability. An Electronic Digital Weigh Machine (SARTORIUS, Model No.BP-110) has been used for this purpose.

2.5 INTERCROP WEED FLORA

A different type and much more rich flora generally develop during the gap in between the harvesting of one crop and showing of the next. This flora is referred to as intercrop flora. Phenological study and flowering calendar of intercrop flora were also made following the

same procedure as described earlier. Intercrop flora have been collected at random and were processed and preserved.

2.6 WEED CALENDAR

Repeated visits to different crop fields throughout the district of Malda in various seasons were made and a comprehensive weed calendar was prepared. Weeds with crop as well as intercrop weeds were considered for this purpose. Detail observations were made over throughout a period from 1993 to 1996 (Das and Chanda, 1987; Panda *et.al.*, 1992). Following parameters were used for preparing the weed calendar: (i)time of flowering (with crop and as intercrop) (ii) mode of pollination (iii) habit (iv) habitat and (v) life form. Variation in flowering period in some species in different areas and in different years were recorded and covered within the overall recorded period of flowering.

2.7 ALLELOPATHY

Allelopathic studies were restricted to the effects of leachetes and extracts on the germination of crop seeds and early growth of seedlings only. For this work, procedures followed by Datta and Ghosh (1987)was described below. Leaves and inflorescence of different weed species were collected during 1994 to 1996 and washed thoroughly in distilled water for three times. Leachetes were made by soaking 100g of fresh material in water for 72 hours. Each type of leachetes were filtered through Whatman (No.1) filter paper and the filtrate were brought to 250 ml with the addition of distilled water. This constituted the leachetes stock solution (1: 2.5). Extracts stock solutions (1: 2.5) were made following the same procedure, only extraction was done in a Bajaj Mixture Machine. From the constituted Leachetes or Extracts stock solution (1:2.5) desired concentrations (1:5, 1:10, 1:20) were obtained by the way of dilution. Each bioassay were consisted of placing 25 seeds in a sterile petriplate of 15 cm in diameter which contained one thickness of filter paper and 15 ml test solution. Distilled water was used in control petriplates instead of leachetes or extracts solution. There were three replicates per experiment. Work was confined only to the effect of leachetes or extracts on the germination of seeds and on the growth of root and shoot of young seedlings of crop species, for the present set of experiments cultivers IET-1444, of paddy was used. Germination percentage, length of root and shoot were worked out and presented in the form of tables.

CHAPTER - 3

THE WEED FLORA

THE WEED FLORA

All together 132 species of weed have been collected from different crop fields in the district of Malda during the four years long survey for the period June 1992 - May 1996. As the present work is not purely a taxonomic work and its observations and results are supported to be used by numerous non taxonomists including agriculturist and economist, the enumeration of different taxa have been enumerated here alphabetically i.e. without following any established system of plant classification.

So, the families in this weed flora are arranged alphabetically but Pteridophytes are followed by Dicotyledonous and which in turn followed by Monocotyledonous. Genera under each family and species under each genus are also enumerated alphabetically. Each name is followed by the references by its protolog and reports in major taxonomic and floristic works (specially relevant to the flora of this region). For the recombined names, the current name is followed by basionym and which may again followed by available common synonyms. In addition local names of many of these plants have been provided where ever they are available.

The naming part of enumeration is followed by local name (if available), description , flowering and fruiting periods, references to voucher specimens, local and world distributions and ecological notes of each species and / or varieties.

Names and / or spellings of different taxa used in this work are as per International Code of Botanical Nomenclature (Tokyo Code, 1994).

In general, plants are being described briefly highlighting only important species characters to facilitate their easy identification specially under field condition

A set of vouture specimen are deposited to the NBU Herbarium at the department of Botany, North Bengal University and some interesting specimens will also be deposited at CAL, after the completion of all works related to the project.

3.1 KEY TO THE SPECIES :

The following artificial dichotomous key to all the recorded weed species have been prepared using only easily accessible character. The use of mainly exomorphic and / or easily observable characters, probably, will not create any difficulty to identify the crop field weeds of the district of Malda even by worker without much training in taxonomy.

3.1.1 PTERIDOPHYTES

1. Stem runner, rooting at nodes, all leaves digitate-quadrifolia; micro and megasporangia in specialized sporocarps borne axially; all leaves nearly similar---------- ---------- ***Marsilea quadrifida***

1. Plants erect, rosette; succulent, rooting from base only; stem very short and condensed; lower leaves sterile, simple broad, slightly lobed; upper leaves pinnately dissected; fertile one bear numerous crowded sporangia ---------- ***Ceratopteris thalictroides***

3.1.2 DICOTYLEDONS

1. Plants heterophytic with no green tissue, normal leaves absent---***Orobanche aegyptiaca***
1. Plants autophytic, green; normal leaves always present or modified into a green tendril ---------- 2
2. Leaves simple ---------- 3
2. Leaves compound---------- 85
3. Phylotaxy spiral ---------- 4
3. Phylotaxy cyclic ---------- 47
4. Flowers in capitula ---------- 5
4. Flowers not in capitula ---------- 13
5. Capitula unisexual ---------- ***Xanthium indicum***
5. Capitula bisexual ---------- 6
6. Lamina much spiny ---------- ***Cirsium arvense***
6. Lamina never spiny ---------- 7
7. Inflorescence axillary, almost sessile ---------- ***Caesulia axillaris***
7. Inflorescence terminal, generally stalked ---------- 8
8. Capitula few, never crowded, long peduncled ---------- 9
8. Capitula crowded, shortly peduncled, upright ---------- 10
9. Flowers purple, all discs ---------- ***Emilia sonchifolia***
9. Flowers yellow, all rayed ---------- ***Launaea aspleniifolia***
10. Plants aromatic, leaves large (24 x 8 cm) ---------- ***Blumea lacera***
10. Plants not aromatic, leaves small ---------- 11
11. Herbs short stemmed, leaves linear to linear spathulate, white cottony ---------- 12
11. Herbs with rigid stem, leaves ovate, serrate, dark green, capitula purple---------- ---------- ***Vernonia cinerea***
12. Capitulum yellow ---------- ***Gnaphalium luteo-album***
12. Capitula white ---------- ***Gnaphalium purpureum***
13. Leaves with distinct stipules ---------- 14
13. Leaves exstipulate ---------- 27
14. Flowers in specialised hypanthodia, branches woody, leaves large (10.5 x 4.0 cm) ----- ---------- ***Ficus heterophylla***

14. Flowers not in hypanthodia, stem herbaceous ---------- 15
15. Unisexual flowers ---------- 16
15. Bisexual flowers ---------- 22
16. Inflorescence terminal, lamina lobed ---------- 17
16. Inflorescence axillary ---------- 18
17. Fruits large (1.0 cm), lamina plicately folded in bud ---------- ***Chrozophora rottleri***
17. Fruits small (0.6 cm), lamina unlobed, never plicately folded ---------- ***Croton bonplandianum***
18. Flowers crowded at nodes ---------- 19
18. Flowers in raceme like elongated inflorescence ---------- 21
19. Dwarf shoots bear leaves and flowers ---------- 20
19. Dwarf shoots absent, branches nearly from base, simple --------- ***Phyllanthus virgatus***
20. Stem suffrutescent, herb with woody stem ---------- ***Phyllanthus amarus***
20. Stem softly herbaceous ---------- ***Phyllanthus fraturnus***
21. Bracts conspicuous, green ---------- ***Acalypha indica***
21. Bracts minute, hyaline ---------- ***Sebastiania chamaelea***
22. Flowers monochlamydeous, fruits minute, triangular nut ------- ***Polygonum plebeium***
22. Flowers dichlamydeous, fruits capsule or achene ---------- 23
23. Stamens α, corolla yellow ---------- 24
23. Stamens 5, free; corolla pinkies, lamina ovate-oblong --------- ***Melochia corchorifolia***
24. Stamens free; carpels free; fruits achene ---------- ***Ranunculus sceleratus***
24. Stamens monadelphous; capsules united; fruits capsular ---------- 25
25. Lamina orbicular, flowers crowded at tips ---------- ***Malachra capitata***
25. Lamina ovate-lanceolate, flowers axillary ---------- 26
26. Petals tip rounded; fruits terete, elongated, ribbed ---------- ***Corchorus fascicularis***
26. Petal tips lobed; fruits globose, breaks into pyrenes ---------- ***Sida rhombifolia***
27. Flowers unisexual ---------- 28
27. Flowers bisexual ---------- 33
28. Lamina peltate, stem twining ---------- ***Stephania japonica***
28. Lamina nonpeltate ---------- 29
29. Flowers dichlamydeous, Fruits α-seeded ---------- 30
29. Flowers monochlamydeous, fruits 1-seeded, plants erect ---------- ***Amaranthus viridis***
30. Plants climbing with tendrils ---------- ***Cucumis melo***
30. Plants are small, erect or rosette herbs ---------- 31
31. Corolla rotate; fruits berry ---------- 32
31. Corolla tubular; fruits capsular ---------- ***Nicotiana plumbaginifolia***
32. upper half of corolla yellow, lower half greenish; fruits develop inside balloon like calyx ---------- ***Physalis minima***
32. Entire corolla white; fruits exposed; persistent calyx much smaller than leaves ---------- ***Solanum nigrum***
33. Plants prostrate creeper ---------- 34
33. Plants twining or erect ---------- 38
34. Lamina reniform ---------- 35
34. Lamina ovate-lanceolate to sagittate ---------- 37

35. Leaf base sheathing; lamina crenate; flowers epigynous; fruit mericarps ---------- ---------- ***Centella asiatica***
35. Leaf base never sheathing; flowers hypogynous ---------- 36
36. Lamina unlobed, entire ---------- ***Evolvulus nummularius***
36. Lamina shallowly lobed; irregularly crenate or serrate ---------- ***Dichondra repens***
37. Flowers hypogynous ---------- ***Ipomoea aquatica***
37. Flowers epigynous ---------- ***Ludwigia adscendens***
38. Accessory whorls monochlamydeous ---------- 39
38. Accessory whorls dichlamydeous ---------- 41
39. Leaves and perianth succulent, entire plants white bloomy ----- ***Chenopodium album***
39. Leaves or perianth never succulent, white bloomy ---------- 40
40. Flowers in terminal, erect and compact spike; fruits pyxis, many seeded ---------- ---------- ***Celosia argentea***
40. Flowers in axillary drooping or spreading loose spike; fruits indehiscent, 1-seeded ---- ---------- ***Digera muricata***
41. Plants twining; corolla infundibuliform ---------- ***Hewittia scandens***
41. Plants erect; corolla never infundibuliform ---------- 42
42. Ovary inferior; flowers ± 1.0 cm in diameter ---------- ***Ludwigia perennis***
42. Ovary superior ---------- 43
43. Petals united, blue rarely white ---------- ***Hydrolea zeylanica***
43. Petals free, yellow or white ---------- 44
44. Lamina much spinescent only at the margins; fruits also spinescent ---------- ---------- ***Argemone mexicana***
44. Lamina or fruit never spinescent---------- 45
45. Leaves much dissected looks like decompound; petals spurred--------- ***Fumaria indica***
45. Leaves lyrate or oblong ---------- 46
46. Corolla smaller or slightly larger than calyx, limbs erect; fruits elongated, terete, spreading, lamina glabrous ---------- ***Rorippa indica***
46. Corolla much larger than calyx, limbs at right angle to claw; Fruits ovate-elongated; lamina hairy along the margin and midrib ---------- ***Cochlearia cochlearioides***
47. Flowers in capitula ---------- 48
47. Flowers not in capitula ---------- 53
48. Capitula compound; plants strictly prostrate ---------- ***Sphaeranthus indicus***
48. Capitula simple; plants either erect or prostrate with erect or semi-erect branches--- 49
49. Cypsella with no pappus; florets always ligulate ---------- ***Eclipta alba***
49. Cypsella with pappus; corolla all discs or with rays in the periphery---------- 50
50. Leaves deeply lobed to much dissected; capitulla always white; a bushy annual -------- -------- ***Parthenium hysterophorus***
50. Leaves unlobed or very shallowly lobed ---------- 51
51 Capitula white or blue, never rayed ---------- ***Spilanthes calva***
51. Capitula white or blue, never rayed ---------- ---------- 52
52. Corolla white, exerted style small, white, lamina base rounded ---------- ---------- ***Ageratum conyzoides***
52. Corolla blue, exerted style long, blue, lamina base cuspidate ---------- ---------- ***Ageratum houstonianum***

53. Inflorescence specialised cyathia ---------- 54
53. Inflorescence other than cyathia or capitula ---------- 56
54. Glands of the involucre with a petaloid lymb; lamina always over 0.5 cm long, glabrous, obscurely serrate ---------- ***Euphorbia indica***
54. Glands of the involucre wingless ---------- 55
55. Lamina ±0.5 cm long, nearly entire, nearly rounded, glabrous --- ***Euphorbia heyniana***
55. Lamina always over 0.5 cm, distantly serrate, glandular-hairy --------- ***Euphorbia hirta***
56. Leaves generally more than two at a node ---------- ***Scoparia dulcis***
56. Leaves opposite or sometimes upper ones alternate ---------- 57
57. Flowers epigynous ---------- 58
57. Flowers hypogynous ---------- 60
58. Inflorescence 1-flowerd, flowers almost sessile or pedicel very short and thick -------- ---------- ***Hedyotis diffusa***
58. Inflorescence 2-6 flowered; peduncles and pedicels distinct ---------- 59
59. Peduncle shorter than lamina, 2-6 flowered, lamina lanceolate-acute, calyx teeth not meeting at their bases ---------- ***Hedyotis pumila***
59. Peduncle equaling the lamina, generally 2-flowered; lamina elliptic-lanceolate; subacute; calyx tip meeting at their bases ---------- ***Hedyotis corymbosa***
60. Accessory whorls monochlamydeous ---------- 61
60. Accessory whorls dichlamydeous ---------- 63
61. Perianth spinescent in fruit, spike much elongate lax, terminal; plants erect ---------- ---------- ***Achyranthus aspera***
61. Perianth never spinescent, spike very short (0.5-2.0 cm), axillary, plants prostrate ----- ---------- 56
62. Inflorescence distantly stalked, globose, ±1.0 cm in diameter ---------- -------- ***Alternanthera philoxeroides***
62. Inflorescence sessile (in old ones a stalk is sometimes produced after the fall of dead flowers), never upright, oblong, less than 0.5 cm in breadth---------- ----------***Alternanthera sessilis***
63. Corolla gamopetalous ---------- 64
63. Corolla polypetalous ---------- 78
64. Lamina entire ---------- 65
64. Lamina serrated or dissected ---------- 68
65. Flowers in compact spicate ---------- 66
65. Flowers axillary ---------- 67
66. Bracts with scarious margin, spike secund ---------- ***Rungia pectinata***
66. Bracts green, without a hyaline margin, spike terete ---------- ***Hygrophila polysperma***
67. Corolla regular, blue, flowers pedicillate; fruits globular ---------- ***Anagallis arvensis***
67. Corolla irregular, pinkies; flowers sessile; fruit oblong; spinous plant ---------- ---------- ***Hygrophila auriculata***
68. Flowers in verticillester, calyx tubular, oblique, fruit compactly enclosed by calyx ----- ---------- 69
68. Flowers not in vaticillester; calyx deeply dissected, never enclosed the fruit completely ---------- 71

69. Lamina lobes narrow, flowers ebracteate or bracts very small; verticillester loose ----- ---------- 70
69. Lamina broadly lanceolate, bracts numerous, conspicuous; verticillerter large globose - ---------- ***Leucas cephalotes***
70. Corolla white, inner flowers ebracteate; plants hardly 40.0 cm tall------- ***Leucas indica***
70. Corolla pink to red; all flowers bracteate; plants tall, generally over 50.0 cm ---------- ---------- ***Leonurus japonicus***
71. Fruits deeply obcordate; lamina rugose; tips of inflorescence circinate ---------- ---------- ***Heliotropium indicum***
71. Fruits never obcordate; lamina not rugose, inflorescence various but never with circinate tip ---------- 72
72. Leaves fleshy; inflorescence axillary, compact oblong or globose spike with a narrow elongated peduncle ---------- ***Phyla nodiflora***
72. Leaves not fleshy ---------- 73
73. Seeds supported by jaculator; submerged leaves much dissected; paltate swollen, streaked ---------- ***Hygrophila difformis***
73. Seeds not supported by jaculator; submerged leaves similar to aerial ones; palate not swollen ---------- 74
74. Flowers axillary, solitary; corolla yellow, hardly larger than calyx of highly unequal sepals; plants turn black on drying ---------- ***Macardonia procumbens***
74. Flowers in terminal cymes / recemes; corolla larger than calyx of equal sepals; plants do not turn black on drying ---------- 75
75. Corolla white, inflorescence unbranched; capsule cylindric, much larger than calyx--76
75. Corolla purple-violate; inflorescence cymose, much branched; capsule globose or obovate ---------- 77
76. Lamina oblong, closely and finely serrated ---------- ***Lindernia ciliata***
76. Lamina ovate-lanceolate, distantly and obtusely serrate ---------- ***Lindernia perviflora***
77. Calyx shorter than capsule; lamina ovate-oblong ---------- ***Lindernia multiflora***
77. Calyx equaling the capsule; lamina nearly orbicular ---------- ***Lindernia crustacea***
78. Fruits circumsessile; sepals 2; plants succulent ---------- 79
78. Fruit never circumsessile; sepals 4-5; plants never succulent ---------- 80
79. Lamina flat, triangular-obovate ---------- ***Portulaca oleracea***
79. Lamina terete-oblong, very small ---------- ***Portulaca quadrifida***
80. Leaves oblong or orbicular or broadly obovate ---------- 81
80. Leaves lanceolate with cuneate base ---------- 83
81. Lamina almost glabrous; lamina cordate at base ---------- 82
81. Lamina tomentose; lamina obovate, narrowed into the petiole --------- ***Glinus lotoides***
82. Flowers crowded at nodes; lamina oblong ---------- ***Nesaea brevipes***
82. Flowers in crowded terminal spike; lamina orbicular ---------- ***Rotala indica***
83. Flowers sessile, crowded at nodes; sepals united ---------- ***Ammannia baccifera***
83. Flowers in peduncled cymes; distantly pedicillate; sepals free ---------- 84
84. Inflorescence always axillary, 2-7 flowered; petals larger, spreading in flower; buds ovate-oblong ---------- ***Glinus oppositifolius***
84. Inflorescence terminal and axillary; α flowered; petals very small; buds globose ------- ---------- ***Polycarpon prostratum***

85. Tendril climber ---------- 86
85. Tendril absent; diffuse, prostrate or erect herbs ---------- 88
86. Tendril is the modification of entire leaf with no leaflet; stipule broadly foliaceous ---- ---------- ***Lathyrus aphaca***
86. Tendrils are the modification of upper leaflets only, lower leaflets normal; stipule small and not foliaceous ---------- 87
87. Flowers solitary, very shortly stalked; pods glabrous---------- ***Vicia angustifolia***
87. Flowers 3-5, peduncled and pedicillate; pods shortly hairy---------- ***Vicia hirsuta***
88. Leaves palmately compound ---------- 89
88. Leaves pinnately compound ---------- 92
89. Leaflets 3, gynophore absent ---------- 90
89. Leaflets 5, gynophore prominent ---------- ***Cleome viscosa***
90. Corolla papilionaceous ---------- 91
90. Corolla regular; leaflets obcordate ---------- ***Oxalis corniculata***
91. Erect herbs, terminal leaflets larger ---------- ***Melilotus alba***
91. Diffuse low herbs, leaflets equal ---------- ***Medicago lupulina***
92. Leaflets sensitive to touch; small herbs with a crown of leaves; Fruits 5-chambered ---- ---------- ***Biophytum sensitivum***
92. Leaflets not sensitive; bushy herb with normal internodes; fruits 1-chambered (legume) ---------- ***Cassia sophera***

3.1.3 MONOCOTYLEDONS

1. Perianth never petaloid or absent or highly modified or its function taken over by specialized bracts (like glume) ---------- 8
1. Perianth, at least the inner whorl petaloid ---------- 2
2. Carpels free, more than three; stamens more than six; fruits 1-chambered, follicles ---- 3
2. Carpels 3, united; stamens 6 or less; fruits 3-chambered, capsular ---------- 4
3. Flowers unisexual or polygamous; carpels numerous on a globose receptacle; fruits indehiscent, 1-seeded; stamens 9-12 in bisexual flowers ---- ***Sagittaria guyanensis***
3. Flowers always bisexual, free; carpels 6-9 on flat receptacle; fruits many seeded; stamens 9 ---------- ***Butomopsis latifolia***
4. Lamina quite broad (2.0 cm or more), ovate-oblong or sagittate ------ ---------- 5
4. Lamina narrow , linear or subulate ---------- 6
5. Inflorescence axillary, enclosed in a boat shaped spathe; petals clowed; stamens 3-perfect and 3-sterile ---------- ***Commelina benghalensis***
5. Inflorescence terminal, erect spike, without a spathe; petals not clawed, stamens all perfect ---------- ***Monochoria vaginalis***
6. Flowers in terminal inflorescence, pedicillate ---------- 7
6. Flowers axillary, sessile; all stamens perfect ---------- ***Tonningia axillaris***

7. Stamens 3-perfect and 3-sterile, plants with elongated stem with internodes and subulate or oblong-subulate leaves ---------- ***Murdannia nudiflora***
7. Stamens all perfect; a rosette plant and flowers on an erect scape; leaves linear ±15.0cm ---------- ***Asphodelus tenuifolius***
8. Perianth distinct 3+3, scaly, fimbriate; flowers in compact globose head, scape terete --- ---------- ***Eriocaulon cinereum***
8. Perianth absent or represented by bristles or replaced by lodicules; flowers in spikelets, scape 3-angled or terete ---------- 9
9. Aerial stem 3-angled, always solid, leaves 3-ranked, lamina generally with 3 distinct nerves giving an opposite W- shaped in cross section; leaf sheath closed, generally with no ligule; fruit wall free from the seed inside; embryo situated inside the endosperm; peduncle erect with no internode and provided with leafy bracts at tip ---------- 27
9. Aerial stem terete, generally hollowed at internode and solid at nodes; leaves with 1/2 phyllotaxy or spiral; sheath often ligulate at tip; perianth absent or replaced by lodicules; flowers and fruits remain enclosed by lemma and palea; embryo lateral and situated at the base; pericarp and seedcoat fused ---------- 10
10. Spikelets 2-flowered, falling entire at maturity, usually with upper floret bisexual and the lower one male or sterile, spikelets sometimes dorsally compressed --------- 11
10. Spikelet 1-α flowerd, breaking up at maturity above the more or less persistent glumes or if falling entire, than not 2-flowered with the lower floret male or sterile and upper floret bisexual, usually more or less laterally compressed ---------- 20
11. Spikelets in pairs similar, joints of the raceme and the pedicel thick and swollen, one sessile and the other pedicillate; glumes as long as spikelets, hyaline ---------- ---------- ***Hemarthria compressa***
11. Spikelets in pairs, similar but joints of the raceme and pedicel neither thick nor swollen, lower glume generally small or sometimes suppressed; upper lemma generally papery ---------- 12
12. Spikelets arranged in spike like contracted (cylindric) penicle; upper lemma and palea indurated, upper glume inflated ---------- ***Sacciolepis myosuroides***
12. Spikelets arranged in one sided spikes or spike like racemes; spikes or racemes digitate or scattered , rarely solitary ---------- 13
13. Lemma of the upper floret more or less crustaceous or coriaceous usually with narrow enrolled margin exposing much of the palea ---------- 17
13. Lemma of the upper floret thinly cartilaginous, with flat hyaline margins, spikelets awnless ---------- 14
14. Hairs on spikelets always verrucose; plants perennial, decumbent at base; nodes glabrous; spikelets lanceolate-ovate ---------- ***Digitaria longiflora***
14. Hairs on spikelets if any , not verrucose ---------- 15
15. Spikelets in pairs, heteromorphous; racemes solitary or whorled; spikelets dense; culms not thickened at base and without cataphylls, racemes stout and stiff, lower lemma of sessile spikelets with prominent nerves -------- ***Digitaria bicornis***
15. Spikelets of each pair not heteromorphous, both with similar type of indumentum ----- ---------- 16

16. Fruits distinctly epiculate and protruding above the lower lemma; spikelets broad and turgid; upper glume very broad and rounded at the summit; spikelets loosely arranged on rachis ---------- ***Digitaria cruciata***
16. Fruits acute , never epiculate; spikelets narrow and lanceolate, not turgid; upper glume narrow, triangular; 5-7 nerves on lower lemma; spikelets without spreading hairs -- ---------- ***Digitaria ciliaris***
17. Lower glume, if present, turned away from the rachis of spike; spikelets abaxial ---- 18
17. Lower glume turned towards the rachis, spikelets adaxial -------- ***Brachiaria reptans***
18. Lower glume developed but small, spikelets globose, ovate ---------- 19
18. Lower glume absent ; spikelets plano-convex ---------- ***Paspalum scrobiculatum***
19. Lower lemma and upper glume equally acute, not awned; spikes distinct, 1-2 cm long ---------- ***Echinochloa colona***
19. Lower lemma and upper glume acuminate; lower lemma with a long awn; spikes upto 8.0 cm long ---------- ***Echinochloa crus-galli***
20. Inflorescence of spikes or penicles of spikes, the spikelets secund ---------- 21
20. Inflorescence of penicles; if spikes, than spikelets not secund ---------- 22
21. Spikelets with one fertile floret and one or two sterile florets; lemma of imperfect florets awned ---------- ***Chloris inflata***
21. Spikelets with one fertile floret but not accompanied with sterile florets; awns absent -- ---------- ***Cynodon dactylon***
22. Spikelets in open , contracted or spikelike penicles, rarely in solitary secund spike; awnless; lemma more or less acutely keeled, 3-nerved; grain not rugose or hollowed out on the adaxial surface ---------- 23
22. Spikelets sessile or very short pedicelled, loosely to densely imbricate in digitate or spike like racemes or spikes in racemes ---------- 26
23. Spikelets breaking from above downwards; rachis fragile ---------- 24
23. Spikelets breaking up from below upwards; rachis tough ---------- 25
24. Penicles spiceform, dense, cylindric; lemmas not ciliated on keels ---------- ---------- ***Eragrostis riparia***
24. Penicles effuse, not ciliated on keels ---------- Eragrostis tenella
25. Plants annual, eglandular; lemmas not closely imbricate with overlapping margins, 1-1.3 mm long, lateral nerves conspicuous; spikelets not flattened, crowded; paleas deciduous ---------- ***Eragrostis gangetica***
25. Plants perennials, pedicels with glandular band; lemmas at least 2.0 mm long, olive green, tinged with purple; penicles upto 25 x 8 cm; lateral nerves conspicuous, long---------- ***Eragrostis ferruginea***
26. Spikelets falling entire at maturity from the axis of straight spikes; spikes numerous and crowded into a long narrow dense penicle; glumes 1-nerved ---------- ---------- ***Desmostachya bipinnata***
26. Spikelets breaking up at maturity; spikes 1-α, crowded at or near the tip of peduncle (digittate or sub-digittate); grains oblong with a loose conspicuous pericarp -------- ---------- ***Eleusine indica***
27. Flowering glumes spirally arranged or sometimes at lowest sub-distichous ---------- 28
27. Flowering glume distichous ---------- 32
28. Style base dilated and constricted or articulated above the nut ---------- 29

28. Style base not dilated, continuous with a nut ---------- 31
29. Hypogynous bristles present, leaves absent; stem under 30.0 cm high; stigmas 3; nuts trigonous ---------- ***Eleocharis congesta***
29. Hypogynous bristles absent; leaves usually present; style base persistent, if falling not leaving a tumor on the nut ---------- 30
30. Stigmas-3, nut usually 3-gonous; spikelets numerous, ellipsoid acute, more than 0.25cm ---------- ***Fimbristylis miliacea***
30. Stigmas 2, nut narrow or biconvex; spikelets numerous; glumes glabrous, concave, 0.25 cm long ---------- ***Fimbristylis dichotoma***
31. Bristles present; stem terete; style bifid ---------- ***Scirpus juncoides***
31. Bristles absent; glumes ±0.25 cm ---------- ***Scirpus articulatus***
32. Stigmas 2; nut compressed or flattened; rachilla or spikelet deciduous; heads solitary; nut bearing glume with crest on the keel ---------- ***Cyperus kyllinga***
32. Stigmas 3; nut triquetrous ---------- 33
33. Slender or caespitose annuals ---------- 34
33. Perennials with thick root stokes or thick and slender rhizomes; spikelets distantly spikate and in short spikes ---------- 36
34. Spikelets clustered; glumes very short, as broad as long; heads dense globose, umbellate ---------- ***Cyperus difformis***
34. Spikelets spikate, elongate ---------- 35
35. Glumes truncate; spikes long not compressed ---------- ***Cyperus iria***
35. Glumes acute or mucronate; spikes short much compressed ----- ***Cyperus compressus***
36. Rays again umbellate; spicate, spikelets narrow (upto 0.09 cm broad), green to pale gray ---------- ***Cyperus tegetiformis***
36.. Rays never umbellate again, sometimes with one or two alternate branches; spicate spikelets broader (upto 0.21 cm broad), blakish brown---------- ***Cyperus rotundus***

3.2 THE ENUMERATION OF THE WEED FLORA

3.2.1 PTERIDOPHYTES

MARSILEACEAE

MARSILEA L.

Marsilea quadrifida L., Sp. Pl. 2 : 1099. 1753; Panigrahi, l.c. 265. 1964; Dixit, l.c. 85. 1984.

Perennial, creeping, aquatic to semiaquatic pteridophyte, rooting at nodes. Stem rhizomatous; rhizome stolon like with distinct nodes and internodes, branched axillary or lateral; internode 6.0-32.0 cm long. Leaves compound, ptyxis circinate; petiole ca. 5.0-14.0 cm long, with terminal leaflets; leaflets 4, ca. 1.4-2.2 x 1.1-1.8 cm, obovate, obtuse entire to serrate, base cuneate; veins dichotomous but anastomose at the apices. Sporocarp ca. 0.2-0.4 cm long, stalk ca. 0.3-0.4 cm long, oval to bean shaped, bivalved, single or in cluster, young soft, green, hairy, mature hard, brown. Sori 14-20 per sporocarp.

SPORUTING : February - April.

SPECIMEN CITED : Old Malda 11.06.1992, *Das et Acharyya* 025.

LOCAL DISTRIBUTION : Abundant with paddy, mustard, pulses and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India.

PARKERIACEAE

CERATOPTERIS Ad. Brongn.

Ceratopteris thalictroides (L.) Brongn., Bull. Soc. Philom. 186. 1821; Bedd., l.c. t. 75. 1863; l.c.123, t.83.1883; Haines, l.c.1210. 1924; Dixit, l.c. 84. 1984.

Acrostichum thalictroides L., Sp. Pl. 2 : 1070. 1753.

Annual, erect, aquatic to semiaquatic pteridophyte with small hard stem; stem with scales and roots. leaves dimorphic; sterile simple, petiole ca. 0.4-0.7 cm long; lamina ca. 8.0-13.4 x 5.1-7.2 cm, ovate to cordate, 3-5 lobed, obtuse, base auriculate to cordate; fertile ca. 15.0-32.0 cm long, erect, pinnate, clustered, sporangia on ventral side.

SPROUTING : August - November.

SPECIMEN CITED : Old Malda 25.01.1994, *Das et Acharyya* 133.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout the Tropics and Sub-tropics.

3.2.2 DICOTYLEDONS

ACANTHACEAE Juss.

HYGROPHILA R. Br.

Hygrophila auriculata (Schumach.) Heine in Kew Bull 16(2) : 172.1962; Guha Bakshi, Fl. Mur. Dist. 239.1984. [Plate 2, Fig. 8]
Barleria auriculata Schumach. in Schumach. *et.* Thonn., Beskr. Guin. Pl. 285. 1827.
B. longifolia L., Cent. Pl. 2 : 22. 1756 and Amoen. 4 : 320. 1759 (non *Hygrophila longifolia* Nees 1847).
Asteracantha longifolia (L.) Nees in Wall., Pl. As. Rar. 3 : 90. 1832; Bot. Bihar & Orissa 4 : 671. 1922.
Hygrophila spinosa T. Anders. in Thwaites. En. Pl. Zeyl. 225. 1860 & J. Linn. Soc.7 : 22. 1863; Fl. Brit. Ind. 4 : 408. 1884; Beng. Pl. 2 : 802. 1903.

Annual stout herbs with axillary spines; spines sometimes bear a node at the upper half. Petioles obscure; lamina oblong to lanceolate, ca. 8.0x1.0 cm, entire, acute to acuminate, base tapering, both surfaces hairy. Flowers in axillary whorls; bracts leafy, bractioles linear to lanceolate, with long white hairs; calyx 4-partite, unequal, margins ciliated; corolla bluish purple, widely 2-lipped; stamens didynamous, filaments of each pair united at base, glabrous. Capsule linear-oblong, 6-8 seeded.

Fl. & Frt. : October - March.

SPECIMEN CITED: Englishbazar, 02.11.1993, *Das et Acharyya* 85.

LOCAL DISTRIBUTION: Frequent with pulse, mustered, paddy and intercrop flora; Englishbazar, Kaliachak, Gazole, Old Malda.

GENERAL DISTRIBUTION: Throughout India, Bangladesh and Sri Lanka.

Note: Young twig used as vegetable.

Hygrophila difformis (L.) Bl., Bijdr. 804. 1826; Srcem. & Bennet in BBSI 10 : 222. 1968; Bennet, Fl. Howrah 338.1979; Guha Bakshi, Fl. Mur. Dist. 240. 1984.
Ruellia difformis L. f., Suppl. 289. 1781.
Cardanthera triflora Buch. - Ham. ex Benth in Benth & Hook., Gen. 2 : 1074. 1876; Fl. Brit. India 4 : 405. 1884; Beng. Pl. 2 : 799. 1903; Bot. Bihar & Orissa 4 : 669. 1922.

Annual, decumbent herbs; rooting at nodes, about 25 cm high; stem glandular to hairy. Leaves opposite; lamina ca. 5.0-6.0 cm long, oblong to ovate, crenate, rounded, base sub-petioled, lower leaves often pinnatifid. Flowers in axillary cymes; bracts ca. 0.8cm long, obovate; sepals 5, narrow, slightly connate below, hairy; petals 5, ca. 1.5 cm long, purple, connate, 2-lipped; stamens 4, didynamous; anthers mucronate at base; carpels connate, ovary oblong. Capsule ca. 0.8 cm long, pubescent. Seeds ovoid, compressed.

Fl. & Frt. : October- March.

SPECIMEN CITED : Englishbazar, 12.11.1994, Das et Acharyya 130.

LOCAL DISTRIBUTION : Frequent with pulses, mustard, paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout Bengal, Assam, Peru, Sri Lanka and Singapore.

Hygrophila polysperma (Roxb.) T. Anders. in J. Linn. Soc. (Bot.) 9 : 456. 1867; Fl. Brit. India. 4 : 406. 1884; Beng. Pl. 2 : 801. 1903; Bot. Bihar & Orissa 4 :670. 1922.
Justicia polysperma Roxb., Fl. India. 1 : 119. 1832.
Hemiadelphis polyspermus Nees in Wall., Pl. As. Rar. 3 : 80. 1832; Guha Bakshi, Fl. Mur. Dist. 238. 1984.

Annual, small, much branched procumbent herbs. Lamina ca. 1.7x 0.7 cm, subsessile, oblong - lanceolate, entire, acute, base tapering, pubirulous. Flowers in terminal dense spike; bracts fallacious; bractioles linear, pubescent; calyx tubular, 5- toothed, villous; corolla light violate with purple strikes; fertile stamens 2, staminodes 2. Capsule narrowly oblong, very shortly apiculate, valves recurved after dehiscence. Seeds orbicular, brown; jaculaters shortly curved.

Fl. & Frt. : October - March.

SPECIMEN CITED : Englishbazar, 06.11.1992, *Das et Acharyya* 049

LOCAL DISTRIBUTION : Frequent with pulse, mustered, paddy and intercrop flora, throughout the district.

GENERAL DISTRIBUTION : India, Bangladesh, Pakistan, Afghanistan etc.

RUNGIA Nees

Rungia pectinata (L.) Nees in DC., Prodr 11 : 469. 1847; Guha Bakshi, Fl. Mur. Dist. 244. 1984.
Justicia pectinata L. in Torner, Cent. II Pl. 3. 1756.
Rungia perviflora (Retz.) Nees var. pectinata (L.) Clarke in Hook. f., Fl. Brit. India 4 : 550. 1885; Beng. Pl. 2 : 821. 1903 and in Rec. Bot. Surv. India 3 : 259. 1905; Bot. Bihar & Orissa 4 : 690. 1922.

Annual, diffuse, much branched herbs, rooting from lower nodes; stem glabrous with swollen nodes. Lamina ca. 4.0-7.0 x 1.0-2.0 cm, narrow lanceolate to elliptic, entire, tapering at ends. Flowers ca 0.4 cm long, in secund, short, clustered spikes of ca. 2.0 cm long; bracts dimorphic, the barren ones lanceolate, fertile ones orbicular, apiculate, margins scarious; calyx lobes linear - lanceolate, acuminate; corolla 2-lipped, blue, lobes imbricate; stamens 2, lower anther cells tailed. Capsule ovoid, ca. 0.25 x 0.1 cm, compressed; placenta with jaculators separating elastically; seeds 2-4 orbicular, jaculators curved.

Fl. & Frt. : November - April.

SPECIMEN CITED : Old Malda, 20.11.1993, *Das et Acharyya* 096.

LOCAL DISTRIBUTION : Abundant with pulse, mustard and with intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India, Sri Lanka, Bangladesh, Nepal, Myanmar, Thailand, Malaysia.

AMARANTHACEAE Juss.

ACHYRANTHES L.

Achyranthes aspera L., Sp. Pl. 204.1753; Wt., Ic. t. 1777. 1852; Fl. Brit. India 4 : 730. 1885; Beng. Pl. 2 : 875. 1903; Bot. Bihar & Orissa 5 : 767. 1924; Guha Bakshi, Fl. Mur. Dist. 261. 1984. [Plate 1, Fig. 1]

Annual, erect herbs, upto 60.0 cm high; stem terete, young part hairy, usually branches from base. Leaves opposite; petiole ca. 0.6-0.75 cm long, pubescent; lamina ca. 4.0-6.0 x 2.5-4.0 cm, entire, acute - obtuse, base rounded, tomentose below. Flowers greenish-

white, ca. 0.05 cm long, deflexed, sessile in a terminal and axillary spikes; mature spikes upto 32.0 cm long; bracts and bracteoles spinescent, winged at base; tepals 5, free; stamens 5, alternating with pseudostaminodes, filaments united below in a cup; Stigma capitate. Urticles obovoid, ca. 0.5 cm long, becoming spiny and pointed later.

Fl. & Frt. : October -- April.

SPECIMEN CITED : Gazole, 10.11.1992, Das et Acharyya 069.

LOCAL DISTRIBUTION : Abundant with pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India, Sri Lanka, Tropical Asia, Africa, Australia and America.

ALTERNANTHERA Forsk.

Alternanthera philoxeroides (Mart.) Griseb., Abh. Ges. Goett. Wiss. 24 : 36. 1879; Bennet, Fl. Brit. India Howrah Dist. 141. 1979; Guha Bakshi, Fl. Mur. Dist. 164.1984.
Bucholzia philoxiroides Mart., Beitr. Amar. 107. 1825.
Telanthera philoxiroides Moq. in DC., Prodr. 13,2 : 362. 1849.

Annual, semiaquatic, prostrate herbs, rooting at lower nodes. Stem ca. 45.0 cm long, rounded, hollow; internode ridged. Leaves opposite, sessile; lamina ca. 6.0-6.4 x 1.3-1.4cm, elliptic to linear-oblong, entire, acute, base sheathing forming a cup ca. 0.4 cm. Flowers in dense axillary spikes, ca. 1.2 cm; pedicel ca. 2.2 cm long; bracts sub-equal, ovate, acuminate, white; tepals 5, ca. 0.7 cm, white, lanceolate; stamens 10, anthers monothecous; stigma 1 globose. Urticles obcordate, ca. 0.2 cm, 1 seeded.

Fl. & Frt. : July - February.

SPECIMEN CITED : Chanchal, 01.07.1992, *Das et Acharyya* 027.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; major part of the district.

GENERAL DISTRIBUTION : A native of Brazil and introduced in Indonesia, Malaysia and elsewhere.

Note: Young twigs eaten as vegetable.

Alternanthera sessilis (L.) R. Br. ex DC., Cat. Hort. Monsp. 77. 1813; Wt., IC. t.727. 1843; Fl. Brit. India 4 : 731. 1885; Bot. Bihar & Orissa 5 : 768. 1924; Guha Bakshi, Fl. Mur. Dist. 264. 1984. [Plate 2, Fig. 26]
Gomphrena sessilis L., Sp. Pl. 225. 1753.
A. triandra Lamk., Enc. Meth. Bot. 1 : 95. 1783.

LOCAL NAME : Samchi

Annual, semiaquatic, prostrate, spreading herb; rooting at lower nodes. Stem obscurely 4-angled, thickened and hairy at nodes. Leaves opposite; lamina 2.0-3.0 x 1.0-1.5 cm, elliptic to linear oblong, entire, obtuse to subacute, base tapering, glabrous, dark green above, pale beneath. Flowers in dense axillary spikes; bracts and bractioles subequal, ovate, acuminate, white, purple tinged; tepals white; perfect stamens 3, anther monothicous. Utricles obcordate, ca. 0.25 cm long, compressed, deeply notched at apex, 1 seeded.

Fl. & Frt. : June - March.

SPECIMEN CITED : Old Malda, 11.06. 1992, *Das et Acharyya* 018.

LOCAL DISTRIBUTION : Very abundant with rice, pulses and mustard; throughout the district.

GENERAL DISTRIBUTION : Throughout the hotter parts of India, Sri Lanka and all warm countries of the world.

NOTE : Young twigs are taken as vegetable.

AMARANTHUS L.

Amaranthus viridis L., Sp. Pl. (ed.2) 1405. 1763; Fl. Brit. India 4 : 720. 1885; Beng. Pl. 2 : 871. 1903; Bot. Bihar & Orissa 5 : 763. 1924; Merill in Amer. J. Bot. 23 : 609. 1936; Duke in Ann. Miss. Bot. Gard. 48 : 14. 1961; Guha Bakshi, Fl. Mur. Dist. 266. 1984. [Plate 2, Fig 4]
A. gracilis Desf., Tabl. Hort. Par. 43. 1804.

Annual, errect, unarmed herbs; branches ridged, glabrous. often purplish. Leaves alternate; petiole 1.2- 1.5 cm; lamina ca. 2.0-2.5 x 1.4-1.6 cm, ovate to lanceolate, entire, emerginate, glabrous. Flowers unisexual; bracts shorter than tepals; tepals 3, ovate to oblong, membranous with a strong green keel; stamens 3, anther bithecous; stigmas 3.

Utricles ovoid, compressed, rugose, short beaked, pointed as long as tepals, 1-seeded; seeds lanticular, smooth, shining, black.

Fl. & Frt. : June - April.

SPECIMENS CITED : Englishbazar, 21. 06. 1993, *Das et Acharyya* 104.

LOCAL DISTRIBUTION : Very abundant with paddy, pulses, mustard and with intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic

Note: Young twig taken as vegetable.

CELOSIA L.

Celosia argentea L., Sp. Pl. 205. 1753; Wt., IC. t. 1767. 1852; Fl. Brit. India 4 : 714. 1885; Beng. Pl. 2 : 867. 1903; Bot. Bihar & Orissa 5 : 759. 1924; Guha Bakshi, Fl. Mur. Dist. 267. 1984. [Plate 2, Fig. 5]

LOCAL NAME : Suggi-sak.

Annual erect herbs; branches ridged. Leaves alternate; petiole short ca. 0.6 cm; lamina ca. 5.2-5.5 x 1.4-1.7 cm, linear or linear-lanceolate, acute, base tapering, glabrous. Flowers bisexual, in dense, terminal lanceolate spikes, ca 2.5-6.5 cm long; bracts and bractioles subequal, mucronate; tepals 5, light pink when young becoming white; stamens short, filaments connate into a cup; style filiform, elongate after flowering. Capsule ellipsoid tapering at apex into the style, circumsessile about the middle. Seeds 8-11, sub-reniform, black, shiny.

Fl. & Frt. : August - April.

SPECIMEN CITED : Old Malda, 11. 06. 1992; *Das et Acharyya* 005.

LOCAL DISTRIBUTION : Very abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India, Sri Lanka, Tropical Asia, Africa and America.

NOTE : Young twigs are taken as vegetable.

DIGERA Forsk.

Digera muricata (L.) Mart. Beitr. Amar. 2 : 77. 1825; Backer in FM 4 : 80. 1949; Guha Bakshi, Fl. Mur. Dist. 268. 1984.
Achyranthes muricata L., Sp. Pl. (ed.2) : 295. 1762.
Digera arvensis Forsk., Fl. Aeg. Arab. 65. 1775; Fl. Brit. India. 4 : 717. 1885; Beng. Pl. 2 : 868 1903; Bot. Bihar & Orissa 5 : 760. 1924.

LOCAL NAME : Jamaiya-sak.

Annual ascending herbs with angular branches. Leaves alternate; petioles 1.3-2.0 cm; lamina variable, ca. 6.0 x 3.6 cm, ovate or elliptic, acute, reddish tinged along margins, glabrous. Flowers in axillary peduncled spikes, 4.0-6.0 cm long, ternate, the two outer reduced to crested scales; bracts and bractioles sub-herbaceous; perianth sub-membranous, ovate to lanceolate, acute, calycine pinkies, segments 5, slightly connate below, oblong, the two outer larger, errect in fruit; stamens 5, filaments free, filiform; anthers didynamous, bithicous. carpels oblong, compressed, truncate; ovary single celled, ovule solitary; style 1, filiform; stigmas 2, recurved. Nuts subglobose, included in perianth, sides ridged. Seeds errect, subglobose.

Fl. & Frt. : July - February.

SPECIMEN CITED : Old Malda, 11.06 1992, *Das et Acharyya* 012.

LOCAL DISTRIBUTION : Vary abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Major parts of India, Sri Lanka, Pakistan and N. Africa.

NOTE : Young twigs are taken as vegetable.

APIACEAE Lindl., *nom. alt.*
(UMBELLIFERAE Juss., *nom. cons.*)

CENTELLA L.

Centella asiatica (L.) Urban. in Mart. Fl. Bras. II : 287. 1879; Mooney, Suppl. Bot. Bihar & Orissa 68. 1950; Guha Bakshi, Fl. Mur. Dist. 149. 1984. [Plate 2, Fig. 9]

Hydrocotyl asiatica L. Sp. Pl. 234. 1753; Wt. & Arn., Prodr. 366.1834; Wt.,IC.2 :565.1843; Fl. Brit. India 2 : 669. 1879; Beng. Pl. 1 : 535. 1903; Bot. Bihar & Orissa 3 : 405. 1922.

LOCAL NAME : Thankuni

Annual herbs, branches runner, radiating, upto 12.0 cm long, rooting at nodes. Leaves crowded at nodes, petiole ca. 10.0 cm long, sheathing at base; lamina ca 1.7 x 2.7 cm, reniform, crenate, base sinus large, 5 nerved from base. Flowers sessile, in axillary umbels, lateral minutely pedicellate, bractiate; ca. 0.15 cm across; calyx truncate; petals pink, ovate; stamens 5, stylopodium depressed. Creamocarps flattened, 7 ribbed, prominently reticulate.

Fl. & Frt. : June - May.

SPECIMEN CITED : Englishbazar, 11. 07. 1993, *Das et Acharyya* 100.

LOCAL DISTRIBUTION : Very abundant with paddy, pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic, ascending to temperate region (2000m in Himalayas).

NOTE : The leaf decoction is taken by the local people to combat dysentery and as liver stimulant.

ASTERACEAE Link. *nom. alt.*
(COMPOSITAE Giseke, *nom. cons.*)

AGERATUM L.

Ageratum conyzoides L., Sp. Pl. 839. 1753; Fl. Brit. India 3 :243. 1881; Beng. Pl. 1 : 591. 1903; Bot. Bihar & Orissa 4 : 462. 1922; Guha Bakshi, Fl. Mur. Dist. 160. 1984; Fl. India 12 : 348. 1995.

Annual, errect, much branched herbs; upto 55 cm high; stem terete, hairy. Leaves opposite; petioles upto 4 cm long, hairy; lamina 4.0-8.0 x 2.5-4.0 cm, ovate, crenate, acute, base cuneate, hairy, 3-nerved from base. Heads many flowered; involucral bracts, many, 2-serrate, ca. 0.35 cm long, 2-nerved, margins scarious; calyx limb annular, with

few hairs; corolla white, tubular; stamens 5; ovary slightly curved; stigma obtuse. Achenes black, 4-angled, pappus scales 5.

Fl. Frt. : October - April.

SPECIMEN CITED : Englishbazar, 12.11.1994, Das et Acharyya 131.

LOCAL DISTRIBUTION : Frequent with pulses, mustard, and paddy; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

Ageratum houstonianum Mill., Gard. Dict. ed. 8.1768; Fl. India 12 : 349. 1995.

Annual erect herbs; upto 60 cm high. Leaves opposite; petiole upto 3.8 cm long; lamina ca. 9.0 x 5.0 cm, ovate, crenate-serrate, sparsely pillose on both surfaces, 3-nerved from base. Heads many flowered, involucral bracts many, 2-serrate, ca. 0.43 cm long, 2-nerved, margins scarious, pilose on back; calyx limbs free scales, corolla narrowly funnel form, longer than owned pappus. Achenes ca. 0.1 cm long, sparsely bristle on ribs; pappus 5, free.

Fl. & Frt. : October - May.

SPECIMEN CITED : Old Malda, 05. 11. 1993, *Das et Acharyya* 118.

LOCAL DISTRIBUTION : Very abundant with pulses, mustard and intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Widely naturalised in India, Nepal, Indonesia etc. introduced as ornamentals. Native of Mexico, W. Indies, Peru, Colombia and British Honduras.

BLUMEA DC.

Blumea lacera (Burm. f.) DC. in Wight, Contrib. Bot. India 14. 1834; Fl. Brit. India 3 : 263. 1881; Beng Pl. 1 : 598. 1903; Bot. Bihar & Orissa 3 : 470. 1922; Guha Bakshi, Fl. Mur. Dist. 161. 1984. Fl. India 13 : 128. 1995.
Conyza lacera Burm. f., Fl. India 180. t. 59. fl. I. 1768.
B. subcapitata DC., Prodr. 5 : 439. 1836.
B. lacera DC. vr. cinerascens Fl. Brit. India 3 : 263. 1881.

B. lacera DC. 1881. var. glandulosa Fl. Brit. India 3 : 263. 1881.

LOCAL NAME : Kukur sunga.

Errect, branched, aromatic herbs; upto 85 cm , with many stem arising from the woody base, densely long villous, glandular. Petiole short; lamina obovate or elliptic-oblong, lyrately lobed, acute or obtuse, dentate, glandular and densely hairy on both surfaces, base narrowed to petiole. Capitula in axillary panicles, 0.5-0.7 cm in diameter; peduncle 0.5-1.5 cm long; involucral bracts slightly longer than florets, linear, acute, glandular, hairy; inner bracts scariously marginate; corolla of bisexual florets yellow, tubular, 0.6 cm long lobes 5, triangular, pubescent; corolla of female florets 0.3-0.4 cm long, lobes 2-3, glabrous. Achenes brown, oblong, angular, ca. 0.05 cm, sparsely hairy; pappus white, ca. 0.4 cm long.

Fl. & Frt. : October - May.

SPECIMEN CITED : Gazole, 07. 11. 1993, *Das et Acharyya* 119.

LOCAL DISTRIBUTION : Very abundant with pulses, mustard and intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India, Nepal, Bhutan, China, S. E. Asia, Sri Lanka, Newginea, Australia and Tropical Africa.

NOTE : Plants are given to the cattle (Cow) for early deplacentation.

CAESULIA Roxb.

Caesulia axillaris Roxb., Pl. Cor. 1 : 64. t. 93. 1798; Fl. Brit. India 3 : 291. 1881; Beng. Pl. 1 : 603. 1903; Bot. Bihar & Orissa 4 : 475. 1922. Fl. India 13 : 2. 1995. [Plate 1, Fig.17; Plate 2, Fig. 6]

LOCAL NAME : Kena ghas.

Annual, decumbent, ascending, herbs; stem glabrous, brown streaked. Leaves with semi-amplexicaul sheathing base; lamina ca. 10.0 x 0.5 cm, linear to lanceolate, distantly serrulate, acuminate, glabrous. Capitula axillary, sessile, glabrous, 3-4 connate in a compound head; florets all bisexual, pale blue; involucral bracts ovate, with a dorsal apiculus near the apex, 2-serrate; corolla lobes 5, glabrous; anthers blackish, bases sagittate. Achenes dark brown, obovoid, obcorded, ribbed, winged; pappus scales 2, ovate to lanceolate.

Fl. & Frt. : August - April.

SPECIMEN CITED : Harischandrapur, 27. 06.1992, *Das et Acharyya* 023.

LOCAL DISTRIBUTION : Abundant with paddy, pulses and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India, Bangladesh.

CIRSIUM Mill.

Cirsium arvense (L.) Scop., Fl. Carn. 2 : 126. 1772; Guha Bakshi, Fl. Mur. Dist. 164. 1984; Fl. India 12 : 155. 1995. [Plate 1, Fig. 24]
Serratula arvensis L., Sp. Pl. 820. 1753.
Cnicus arvensis (L.) Roth. Catalecta Bot. 1 : 115. 1797; Hoffm., Deutschl. Fl. 1(2) : 130. 1804; Fl. Brit. India 3 : 362. 1881; Beng. Pl. 1 : 622. 1903; Bot. Bihar & Orissa 4 :491. 1922.

LOCAL NAME : Baro-kata

Annual, erect, spiny herbs; stem ca. 70 cm high, woolly white, tomentose. Lamina ca 10-15 x 0.4-0.5 cm, oblong to lanceolate or obovate, margins and apex tipped with spines, woolly beneath, almost sessile. Capitula many, 2.5- 3.0 cm long, peduncled; involucral bracts glabrous, broad lanceolate, adpressed with short spreading spines; receptacle bristly. Flowers deep pink to pale purple; stamens arms obtuse. Fruits linear-oblong, glabrous; pappus pale brown.

Fl. & Frt. : November - May.

SPECIMEN CITED : Old Malda, 05. 11. 1992, *Das et Acharyya* 041.

LOCAL DISTRIBUTION : Abundant with pulses, mustered and intercrop flora; throughout the district.

GENERAL DISTRIBUTION : India, N. Asia and Westward to the Atlantic.

ECLIPTA L., *nom. cons.*

Eclipta alba (L.) Hassk., Pl. Jav. Rar. 528. 1848; Clarke. Comp. India. 134. 1876; Fl. Brit. India. 3 : 304. 1881; Beng. Pl. 1 ; 610. 1903; Bot. Bihar & Orissa 4 : 480. 1922; Guha Bakshi, Fl. Mur. Dist. 165. 1984. Fl. India 12 : 381. 1995.
Verbesina alba L., Sp. Pl. 902. 1753.
Eclipta prostrata (L.) L., Mart. 2 : 286. 1753, ed. 2 ; 1227. 1763; Sant., J. Bombay Nat. Hist. Soc. 54 : 475-476, 1957 & Bull. Bot. Surv. India 3 : 16. 1961; Fl. India 12 : 381. 1995.
Verbesina prostrata L., Sp. Pl. 902. 1753.

LOCAL NAME : Kesar, kesut.

Prostrate or semierect herbs; branches upto 40 cm long, often rooting at lower nodes; stem hairy. Leaves variable; petiole obscure; lamina 2.5-7.0 x 0.8-1.5 cm, linear to lanceolate, subentire, acute, base tapering, appresssed hairy on both surfaces. capitula axillary, solitary or 2-3 together, heterogamous, ca. 0.5-1.0 cm in diameter, disc florets about 20-30; involucral bracts ca. 8, ovate, hairy; corolla white. Fruits winged on margins with warty excrescences, black; pappus 0.

Fl. & Frt. : June - May.

SPECIMEN CITED : Old Malda, 11. 06. 1992, *Das et Acharyya* 004.

LOCAL DISTRIBUTION : Very abundant with paddy and intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

NOTE : Leaves decoction are used against early fall of hair and also to cool down the head.

EMILIA Cass.

Emilia sonchifolia (L.) DC. in Wt., Contrib. India Bot. 24. 1834 & in Prodr. 6 ; 302. 1838; Clarke, Comp. India 174. 1836; Fl. Brit. India 3; 336. 1881; Beng. Pl. 1 : 605. 1903; Bot. Bihar & Orissa 4 ; 489. 1922; Guha Bakshi, Fl. Mur. Dist. 166. 1984. Fl. India. 13 : 212. 1995.
Cacalia sonchifolia L., Sp. Pl. 835. 1753.
Emilia rigidula DC., Prodr. 6 : 302. 1838.

Annual rosette herbs; scape simple or much branched. Leaves much variable, lower petiolate; lamina 3.5-10.0 x 2.0-3.0 cm, lyrate to pinnatifid, upper part obovate; upper smaller, amplixicaul with large auricles, glabrous. Capitula yellow, solitary or laxly corymbose, homogamous, all florets tubular and bisexual; peduncle slender; involucral bracts 1-serrate, connate, 8-10 teethed. Fruits 5-ribbed, brown with soft white clavate hairs; pappus white, hairy equaling the bracts.

Fl. & Frt. : September - April.

SPECIMEN CITED : Englishbazar, 06. 11. 1992, *Das et Acharyya* 048

LOCAL DISTRIBUTION : Abundant with pulses, mustard and in intercrop flora; major parts of the district.

GENERAL DISTRIBUTION : Pantropic often extended to temperate regions.

GNAPHALIUM L.

Gnaphalium luteo-album L., sub sp. *affine* (D.Don) Koster in Blumea 4(3) : 484. 1941.
G. affine D. Don., Prodr. Fl. Nepal 173. 1825. Fl. India 13 : 87. 1995.
G. luteo-album L. var. *multiceps* DC., Prodr. 6 : 222. 1838; Fl. Brit. India 3 : 288. 1881; Beg. Pl. 1 : 602. 1903; Bot. Bihar & Orissa 4 : 474. 1922.

Annual woolly herbs, branched from roots; upto 40 cm high. Leaves alternate, sessile; lamina 3.0-6.0 cm long, oblong-spathulate, obtuse, base narrowed to stem, hairy above, woolly beneath. Heads in dense terminal corymbs; ray florets female, many serrate, 3-4 toothed; disc florets bisexual 5-toothed, all fertile; involucral bracts golden yellow, elliptic to lanceolate, obtuse, many serrate; calyx limbs setose; corolla female filiform, bisexual tubular. Achenes linear, smooth; pappus hairy, thickened at tip, coducous.

Fl. & Frt. : November - April.

SPECIMEN CITED : Gazole, 10.11.1992, Das et Acharyya 067.

LOCAL DISTRIBUTION : Frequent with pulses, mustard and paddy; Gazole, Old Malda, Englishbazar and Kaliachak.

GENERAL DISTRIBUTION : Plains of India, Pakistan, Nepal, Bhutan, Myanmar, Sri Lanka, China, Japan, Indonesia, Thailand, Brazil, Africa, Australia and Europe.

Gnaphalium purpureum L., Sp. Pl. 854. 1753; Fl. Brit. India 3: 289. 1881; Bot. Bihar & Orissa 4 : 474. 1922. Fl. India 13 : 92. 1995.

Annual erect herbs; upto 50 cm high; stem with thin, white cottony tomentum. Lamina 1.0-7.0 x 0.1-1.0 cm, spathulate, entire, broadly rounded and shortly mucronate at apex, narrowed at base, puberulous, white pannose below. Heads in short spicate clusters, ca. 0.2 cm across; peduncle ca. 0.1 cm long; involucral bracts 2-3 serrate, outer most brown, oblong spathulate, obtuse-acute, with white woolly tomentum; ray florets female, with filiform corolla, ca 0.1 cm long, pink at mouth; disc florets bisexual, ca. 0.2 cm long, 5-toothed. Achenes oblong, ca. 0.05 cm; pappus hairy, white, united at base.

Fl. & Frt. : November - April.

SPECIMEN CITED : Gazole, 10.11.1992, Das et Acharyya 068.

LOCAL DISTRIBUTION : Frequent with pulses, mustered and paddy; throughout the district.

GENERAL DISTRIBUTION : India, Pakistan, N. and S. America.

LAUNAEA Cass.

Launaea aspleniifolia (Willd.) Hook. f., Fl. Brit. India 3 : 415. 1881; Beng. Pl. 1 ; 630. 1903; Bot. Bihar & Orissa 4 : 497. 1922; Guha Bakshi, Fl. Mur. Dist. 169. 1984; Fl. India : 12. 306. 1995. [Plate 2, Fig. 18]
Prenanthes aspleniifolia Willd., Sp. Pl. 3 : 1540. 1803.

LOCAL NAME : Tikchana.

Herbs behaving as annual, ca. 5-30 cm high, profusely branched from base, glabrous. Leaves mostly radical; petiole short, lamina 5-10 x 2-3.5 cm, cauline few, oblanceolate to narrow obovate, sinuate lobed. Flowers in peniculate; capitula 0.8-1.5 x 0.35-0.5 cm, erect, glabrous; peduncles slender with few scattered bracts; Involucral bracts few serrate, outer ovate to obovate, ca. 0.2-0.4 x 0.1-0.15 cm, glabrous; innermost linear as long as head, glabrous; ligules yellow. Achenes pale brown, ca. 0.2 cm long, narrow, smooth, much smaller than pappus; pappus ca. 0.8cm white, silky, equal, deciduous.

Fl. & Frt. : December - May.

SPECIMEN CITED : Old Malda, 05.11.1992, *Das et Acharyya* 040.

LOCAL DISTRIBUTION : Frequent with pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India, Burma, Nepal and Pakistan.

PARTHENIUM L.

Parthenium hysterophorus L., Sp. Pl. 988.1753; Mahesh. in Curr. Sci. 37(11) : 326-327, June 5. 1968; Adams, Fl. Pl. Jamaica 751. 1972; Mathew, Mat. Fl. Tamilnadu Carnatic 244.1981 & III. Fl. Tamilnadu Carnatic t. 382. 1982- Plate 55f.; Rao in J. Bombay Nat. Hist. Soc. 54 : 218. 1956; Fl. India 12 : 403. 1995.

Profusely branched annual herbs, starts like a rosette herb, upto 1.5 m high; stem angular. Leaves alternate, sessile, bipinatifid, upto 20.0 x 10.0 cm, lobes entire, acute, upper dark-green, lower tomentose. Capitula numerous, white, peduncled, in penicles, radiate; involucral bracts green, biseriate; receptacle flat; paleaceous; outer florets 5, female, inner few male; ligule in female florate supported by 2 hyaline wings at the base. fruits dorsally compressed, narrowed below; pappus 2, lateral, awns reflexed.

Fl. & Frt. : January - December.

SPECIMEN CITED : Gazole, 10.11.1993, Das et Acharyya 110.

LOCAL DISTRIBUTION : Mainly found in intercrop flora, rarely come as weed of paddy, pulses and mustard; Old Malda, Englishbazar, Kaliachak, Gazole and Manikchak.

GENERAL DISTRIBUTION : Native of S. America; now widely distributed all over India.

NOTE : Dry plants used as fuel by the villagers.

SPHAERANTHUS L.

Sphaeranthus indicus L., Sp. Pl. 927. 1753; Clarke, Comp. India 97.1876; Fl. Brit. India 3 ; 275. 1881; Beng Pl. 1 : 601. 1903; Bot. Bihar & Orissa 4 : 473. 1922; Guha Bakshi, Fl. Mur. Dist. 174. 1984. Fl. India 13 : 160. 1995.
S. hirsuta Willd., Sp. Pl. 3 : 2394.2395. 1804; Wt. Ic. t. 1094. 1852.

LOCAL NAME : Bhui kadam.

Annual prostrate herbs, much branched, glandular, hairy. Leaves sessile, alternate; lamina 1.0-4.0 x 0.3-1.0 cm, obovate or oblanceolate, toothed, acute, base attenuate, glandular-hairy on both surfaces. Capitula compound, ca. 1.5 x 0.4 cm, compact, globose to ovoid, green turning to purple; peduncle solitary with toothed wings. Simple capitula sessile , many , densely packed on a common elongated receptacle, heterogamous; outer florets female, filiform; disc florets bisexual. Achenes stalked, oblong, smooth; pappus 0.

Fl. & Frt. : November - May.

SPECIMEN CITED : Englishbazar, 06. 11. 1992, Das et Acharyya 051.

LOCAL DISTRIBUTION : Frequent with pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : India, Bangladesh, Sri Lanka, Africa, Malaya Island and Australia.

SPILANTHES N. Jacq.

Spilanthus calva DC. in Wt., Contrib. Bot. India 19. 1834; Kitamura & Gould in Hara *et al*, Enu, Fl. Pl. Nep. 3 : 45. 1982; Fl. India 12 : 409. 1995. [Plate 2, Fig. 11]
S. acmella var. *calva* (DC.) Cl., Comp. Ind. 138.1876; Fl. Brit. India 3 : 307. 1881.
S. acmella L. : sensu, Beng. Pl. 1 : 614. 1903.
S. acmella L. var. *calva* : Bot. Bihar & Orissa 4 : 482. 1922.

Annual diffuse, much branched herbs; stem light yellow, hairy. Leaves opposite; petiole ca. 1.0 cm long; lamina 1.5-3.0 x 0.6-1.3 cm, ovate, irregularly crenate-serrate, acute, base acute. Capitula solitary, terminal, ovoid, ca. 0.8 x 0.6 cm; peduncle 1.8-2.5 cm long; involucral bracts oblong to lanceolate, acute; receptacle conical; florets yellow. Achenes slightly obovoid, compressed, glabrous; pappus 0.

Fl. & Frt. : August - May.

SPECIMEN CITED : Englishbazar, 06.11.1992, *Das et Acharyya* 055.

LOCAL DISTRIBUTION : Abundant with pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India, Sri Lanka and all Warm Countries.

VERNONIA Schreber *nom. cons.*

Vernonia cinerea (L.) Less. in Linnaea 4 : 291. 1829; Fl. Brit. India 3 : 233. 1881; Beng. Pl. 1 : 590. 1903; Bot. Bihar & Orissa 4 : 460. 1922; Guha Bakshi, Fl. Mur. Dist. 175. 1984. Fl. India 13 : 367. 1995. [Plate 2, Fig.7,13]
Conyza cinerea L., Sp. Pl. 862. 1753.

Annual or perennial, erect herbs; upto 50 cm high; stem terete, ribbed, pubescent, sometimes glandular pubescent. Leaves highly variable; petiole 0.6-1.2 cm, lamina ca. 8.0 x 3.5 cm, broadly elliptic to lanceolate, obtuse or acute, crenate or rarely entire, base narrowed, more or less pubescent on both surfaces. Capitula in terminal corymbs, ca. 0.7 cm across; peduncle slender; involucral bracts 4-serrate, awned, lanceolate with few glands, outer 0.15 cm, inner 0.4 cm. Achenes ca. 0.15 cm, terete, oblong, with appressed white hairs; pappus ca 0.3 cm, white.

Fl. & Frt. : November - February.

SPECIMEN CITED : Gazole, 07.11.1992, *Das et Acharyya* 064

LOCAL DISTRIBUTION : Frequent with pulses; Gazole, Englishbazar, Old Malda, Kaliachak, Habibpur, Bamongola.

GENERAL DISTRIBUTION : Throughout India, Tropical Asia, Africa and Australia.

XANTHIUM L.

Xanthium indicum Koen. ex Roxb., Fl. India 3 : 601. 1832; Wight, Ic. t. 1104.1846; Majumder in Bull. Bot. Surv. India 13 : 142. 1971; Guha Bakshi, Fl. Mur. Dist. 176. 1984. Fl. India 12 : 429.1995. [Plate 1, Fig.25].
Xanthium strumarium L., Sp. Pl. 987. 1753; Fl. Brit. India 3 : 303 1881; Beng. Pl. 1 : 607. 1903; Bot. Bihar & Orissa 4 : 478. 1922; Fl. India 12 : 429. 1995.

Annual, scabrous, erect herbs; upto 1.0 m high; stem stout, terete. Petiole ca 8.0 cm long; lamina broadly ovate or suborbicular, generally 3-lobed, irregularly toothed, acute to acuminate, base cuneate or cordate, palmately veined, glandular, scabrous, hairy. Capitula unisexual, monoceous, globose in axillary and terminal short racemes; male heads ciliate, 0.24-0.3 cm long; pales spathulate, hairy, 0.28 cm long ; female heads involucres ca. 0.25 cm long, hairy, beaks slightly incurved, prickles 0.4-0.45 cm long. Fruits 2, oblong-ovoid, compressed, glabrous, black; fruting involucres clothed with hooked prickles; pappus 0.

Fl. & Frt. : October - May.

SPECIMEN CITED : Old Malda, 17. 02. 1993; *Das et Acharyya* 114.

LOCAL DISTRIBUTION : Frequent with paddy, pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : India, Sri Lanka, Malaya, Indonesia, America.

BORAGINACEAE Juss.

HELIOTROPIUM L.

Heliotropium indicum L., Sp. Pl. 130. 1753; Roxb., Fl. India. 1 : 454. 1832; Fl. Brit. India 4 : 152. 1883; Beng. Pl. 2 : 716. 1903; Bot. Bihar & Orissa 4 : 578. 1922; Guha Bakshi, Fl. Mur. Dist. 204. 1984.
Tiaridium indicum Lehm., Pl. Asperif. nucif. 14. 1818; Wt., Ill. India Bot. t. 171. 1850.

LOCAL NAME : Hatisura.

Annual, erect, succulent, upto 50.0 cm high; stem hairy with few upper branches. Leaves alternate, often sub-opposite; petiole partially winged; lamina ca. 5.0 x 3.0 cm, repund to crenate- subserrate, acute to obtuse, base corded, with a few scattered hairs above, minutely pilose beneath. Inflorescence scorpiod cymes. Flowers in 2 rows; calyx bristely with a few long hairs outside, segments unequal; corolla light violate, tube hairy outside; stamens inserted below the middle of the corolla tube; anthers free. Fruits deeply 2-fid, each lobe finally divided into 1-seeded nutlets.

Fl. & Frt. : October - August.

SPECIMEN CITED : Englishbazar, 21. 06. 1993, *Das et Acharyya* 108.

LOCAL DISTRIBUTION : Abundant with pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout the warmer regions of India, Burma, East to West and South Malaysia, Tropical Africa and America.

BRASSICACEAE Burnett, nom. alt.
(*CRUCIFERAE* Juss., nom. cons.)

COCHLEARIA L.

Cochlearia cochlearioides (Roth) Santapau & Maheshwari in JBNHS 54: 804. 1957; Fl. India 2 : 191. 1993. [Plate 1, Fig.28]
Alyssum cochlearioides Roth, Nov. Pl; 322. 1821.
Cochlearia flava Roxb. ex Hook. f. and Anderson, Fl. Brit. India 1 : 145. 1872 nom. illeg.; Beng. Pl. 1 : 221. 1903; Bot. Bihar & Orissa 2 : 27. 1921.

LOCAL NAME : Bon Tishi.

Annual, erect, glabrous herbs; upto 45 cm high; stem terete, hairy. Petiole upto 5.0 cm, upper shorter; lamina upto 11.0 x 2.7 cm long, lyrate, hairs on midrib and lamina margin. Inflorescence racemes. Flowers yellow, pedicels ca. 0.06 cm; corolla lobes 4, spreading equal at the base; calyx lobes 4, shortly clawed. Pods smooth, ca. 3.0 cm, beaked, subglobose. Seeds small, rugose.

Fl. & Frt. : November - April.

SPECIMEN CITED : Gazole, 10. 11. 1993, *Das et Acharyya* 081.

LOCAL DISTRIBUTION : Frequent with pulses, mustard and tishi; Old Malda, Englishbazar, Manikchak and Gazole.

GENERAL DISTRIBUTION : Upper and lower Gangetic Vally of India, Native of North Temperate and Asiatic regions.

RORIPPA L.

Rorippa indica (L.) Hiern in Cat. Afr. Pl. Welw. Pt. 1 : 26, Addit. & Corr. 1896; Raizada in IF 92 : 322. 1966; Santapau & Wagh in BBSI 5 : 108. 1964; Babu, HFD 61. 1977; Hara, EFPN 2 ; 45. 1979; Guha Bakshi, Fl.. Mur. Dist. 52. 1984; Fl. India 2 : 129. 1993.
Sisymbrium indicum L., Mant 1 : 93. 1967.
Nasturtium indicum (L.) DC., Syst. 2 : 199. 1818; Fl. Brit. India 1 : 134. 1872 p. maj. p.; Beng. Pl. 1 : 219. 190; Bot. Bihar & Orissa 2 : 26. 1921.
N. montanum Wall. ex. Hook. F. & Thoms. In J. Linn. Soc. Bot. 5 : 139. 1861; Fl. Brit. India 1 : 134. 1872.
Nasturtium R. Br. (1812) and *Rorippa* Scop. (1760) are congeneric.

An annual, small, glabrous herbs; stems ca. 15 cm long, erect, striated, branched from base. Leaves lower petiolate, with toothed lobes; upper lyrate, frequent with small auricles. Racemes long many flowered; sepals short spreading, equal at the base; petals yellow, short, narrowed at the base; stamens 6, tetradynamous; style short; stigma bilobed. Pods sub cylindric, ca 1.25 cm long, spreading. Seeds small, turgid, 2-serrate.

Fl. & Frt. : October - June.

SPECIMEN CITED : Gazole, 08.08.1994, Das et Acharyya 129.

LOCAL DISTRIBUTION : Frequent with paddy, pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India, Malaysia, Philippines, China and Japan.

CAESALPINACEAE R. BR.

CASSIA L.

Cassia sophera L., Sp. Pl. 379. 1753; Fl. Brit. India 2 : 262. 1878; Beng. Pl. 1 : 438. 1903; Bot. Bihar & Orissa 3 : 305. 1922; Guha Bakshi, Fl. Mur. Dist. 117. 1984. [Plate 2, Fig.21]
C. purpurea Roxb., Hort. Beng. 31. 1814, *nom. nud.*
Senna exculenta Roxb., Fl. India ed. Carey 2 : 346.1832.

LOCAL NAME : Chakanda

Erect, bushy, small shrub; upto 1.0 m high. Leaves unipinnate, ca 15- 20 cm long; petiolules ca 0.15-0.2 cm long; leaflets 8-12 pairs, oblong to lanceolate, acute, base cuneate; rachies with a brown gland at base. Flowers in short axillary and terminal branches or simple corymbs; pedicels ca. 0.5 cm long; sepals obscure; petals 5, yellow; fertile stamens 7. Pods slightly curved, 6.0-9.0 x 0.6 cm, sub-terete to terete, dehiscent. Seeds ca. 0.6 x 0.4 cm, dark brown, ovoid, compressed.

Fl. & Frt. : August - April.

SPECIMEN CITED : Chanchal, 01. 07. 1993; *Das et Acharyya* 107.

LOCAL DISTRIBUTION : Frequent with paddy, pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION :Probably native of Asia but now Pantropic.

CARYOPHYLLACEAE Juss.

POLYCARPON L.

Polycarpon prostratum (Forsk.) Asch. & Schweinf. in osterr. Bot. Zeitscher. 39 : 128. 1889; Milne-Redhead in kew Bull. 3 : 451. 1948; Guha bakshi, Fl. Mur. Dist. 57. 1984; Fl. India 2 : 553. 1993.
Polycarpon loeflingii (Wt. & Arn.) Benth. & Hook. f., Gen. Pl. 1 : 153. 1862; Fl. Brit India 1 : 245. 1874; Beng. Pl. 1 : 238. 1903; Bot. Bihar & Orissa 2 : 45. 1921.

Basically a rosette herb with prostrate or decumbent branches; stem pubescent. Leaves opposite, lower ones crowded to simulate whorls of 4; lamina ca. 2.0 x 0.35 cm, spathulate, entire, subacute, base atenuate. Stipules scarious. Flowers in many flowered crowded terminal cymes; calyx lobes 5, subequal, persistent; corolla lobes 5, greenish white, shorter than calyx; stamens 5; ovary 1-celled, style 3-fid, ovules many. Capsule subglobose. Seeds pale brown, testa reticulate.

Fl. & Frt. : July - April.

SPECIMEN CITED : Ratua, 08. 07. 1993, *Das et. Acharyya* 092.

LOCAL DISTRIBUTION : Frequent with paddy, pulses and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Tropical regions of Asia and Africa.

CHENOPODIACEAE Vart.

CHENOPODIUM L.

Chenopodium album L., sp. apl. 219. 1753; Fl. Brit. India 5 : 3. 1886; Beng. Pl. 2 : 879. 1903; Bot Bihar & Orissa 4 : 769. 1924; Guha Bakshi, Fl. Mur. Dist. 270. 1984.

LOCAL NAME : Bathua

Annual erect herbs; stem often striate, white-bloomy. Leaves much variable in size and shape; petiole slender ca. 1.3 cm long; lamina ca. 2.5 x 1.0 cm, oblong, rhombic, deltoid or lanceolate, entire irregularly lobulate, hairy. Flowers greenish, in clusters forming mixed dense or lax, spicate peniculate; tepels 5, green, succulent; stamens 5, opposite to tepals; stigmas 2. Fruits depressed globose, finely papillate, 1 seeded, remain covered with slightly enlarged perianth. Seeds black, orbicular, compressed, smooth.

Fl. & Frt. : October - March.

SPECIMEN CITED : Old Malda, 05. 11. 1992, *Das et Acharyya* 046.

LOCAL DISTRIBUTION : Very abundant with pulses and mustered; throughout the district.

GENERAL DISTRIBUTION : Cosmopolitan.

NOTE : Young twigs are taken as vegetables.

CLEOMACEAE Horan.

CLEOME L.

Cleome viscosa L., Sp. Pl. 672. 1753; Fl. Brit. India 1 : 170. 1872; Beng. Pl. 1 : 225. 1903 & in Rec. Bot. Surv. India 3(2) : 173. 1905; Bot. Bihar & Orissa 2 : 29. 1921; Guha Bakshi, Fl. Mur. Dist. 55. 1984; Fl. India 2 : 317. 1993.
Polanisia viscosa (L.) DC., Prodr. 1 : 242. 1824.

Annual, erect, glandular, pubescent herbs; stem grooved, hairs simple, glandular. Leaves digitately 3-7 foliate; petiolules short, hairy; leaflets ca 2.5 x 1.7 cm, ovate to obovate, acute, base cuneate, terminal the largest. Flowers in racemes; pedicels ca. 1.0 cm long, terete, hairy; calyx lobes 4, glandular to pubescent outside; corolla lobes 4, oblong to obovate, clawed, yellow; stamens 15-20, filaments unequal. Capsules terete, cylindric, ca. 5.0-7.0 cm long, glandular, pubescent, tapering towards both ends with enlarged and persistent style. Seeds ca 0.15 cm across, brown black, subglobose, ribbed, slightly compressed.

Fl. & Frt. : July - February.

SPECIMEN CITED : Englishbazar, 15.07.1993, *Das et. Acharyya* 083.

LOCAL DISTRIBUTION : Abundant with pulses and in intercrop flora ; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

CONVOLVULACEAE Juss.

DICHONDRA Forst.

Dichondra repens Forst. Bot. Bihar & Orissa 4 : 584. 1922.

A creeping herbs, somewhat like *Hydrocotyle* with orbicular deeply corded leaves ca 2.6 cm across; stem thinly pilose. Petiole ca. 2.0 cm long, slender, thinly pilose; lamina above glabrous, beneath pilose on nerves. Flowers campanulate, ca. 0.25 cm long; petals oblong; sepals campanulate, nearly as long as the petals. Ovary very minute, villous. Nutlets 2, globose, ca. 0.2 cm across, mottled brown, far exceeding the styles which become hidden between them.

Fl. & Frt. : NR

SPECIMEN CITED : Kaliachak, 15.06.1992, Das et. Acharyya 021.

LOCAL DISTRIBUTION : Frequent with paddy; Kaliachak, Englishbazar, Old Malda, Gazole.

GENERAL DISTRIBUTION : Avery interesting little plant with a very wide distribution in both the hemispheres but not included in the Flora of India (a note states that it was found by Wallich beyond Ava).

EVOLVULUS L.

Evolvulus nummularius (L.) L., sp. Pl. (ed.2) 391. 1762; Fl. Brit. India 4 : 734. 1885; Beng. Pl. 2 : 726. 1903; Mooney, Suppl. Bot. Bihar & Orissa 91. 1950; Guha Bakshi, Fl. Mur. Dist. 208. 1984.
Convolvulus Nummularius L., Sp. Pl. 157. 1753.

Annual, prostrate, creeping herbs; rooting from nodes; stem patently hairy. Leaves alternate; petiole ca. 0.2-0.5 cm long, pilose; lamina ca. 1.0 x 1.0 cm, rounded or suborbicular, entire, rounded to retuse, base subcorded, glabrous, except hairy nerves beneath. Flowers axillary; peduncle ca. 0.3 cm long, recurved in fruit; bracts linear; calyx segment lanceolate, apiculate, ciliate; corolla white, deeply lobed, lobes oblong, hairy on the mid petaline bands; ovary glabrous, styles 2. Capsules globose. Seeds glabrous.

Fl. & Frt. : June - May.

SPECIMEN CITED : Englishbazar, 21. 06. 1993, *Das. et. Acharyya* 111.

LOCAL DISTRIBUTION : Frequent with paddy, mustard and abundant in Intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Native of W. Indies; Introduced and now widely distributed in India, T. Africa, Malagasy, America, from Mexico to North Argentina.

HEWITTIA W. & A.

Hewittia scandens (Milne), Mabberley in BHHM 84. 1980.
Convolvulus scandens Milne, Descr. Cat. 2.1773.
Hewittia bicolor W & A in Madr. J. Sci. 1(5) : 22.1837; Fl. Brit. India 4 : 216. 1883; Beng. Pl. 2 : 727. 1903; Bot. Bihar & Orissa 4 : 603. 1992.
H. sublobata (L.f.) Kuntz. Rev. Gen. Pl. 441. 1891. Ooststroom in FM 4 : 438. 1953; Guha Bakshi, Fl. Mur. Dist. 209. 1984.

Annual, twiner herbs with pubescent stems. Leaves opposite, somewhat shiny both sides; petiole 3-5 cm long; lamina ca. 6-7 x 4-5 cm, corded ovate, lobed, acuminate. Flowers axillary, solitary, pale yellow; bracts 2, ca. 1.27 cm, lanceolate, slightly below the calyx; calyx lobes 5, ca. 1.2 cm, acute, ovate, inner lanceolate, dry, enlarging in fruits; corolla shortly 5 lobed, ca. 2.5 cm, widely campanulate; stamens 5, filaments linear, dilated at base; style filiform. Capsule ca. 0.6 cm, 4 valved, 1-celled, 4 seeded. Seeds black, glabrous.

Fl. & Frt. : August - December.

SPECIMEN CITED : Old Malda, 05.11.1992, *Das et. Acharyya* 045.

LOCAL DISTRIBUTION : Frequent with paddy, pulses and mustard; Old Malda, Englishbazar, Kaliachak, Gazole, Manikchak.

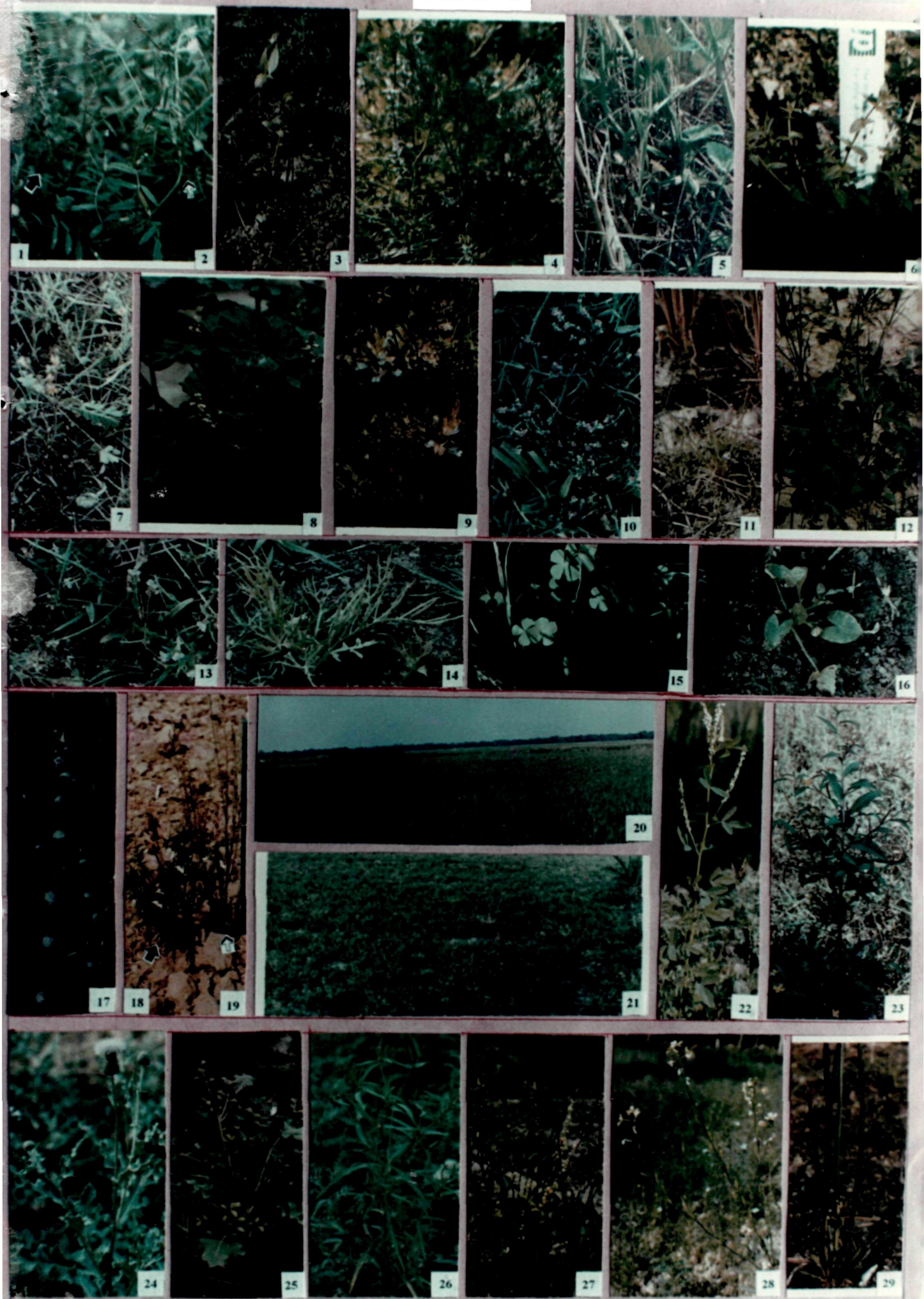
PLATE - I

(Weeds with Normal Background)

Figure

1. *Achyranthus aspera*
2. *Vicia angustifolia*
3. *Leucas cephalotes*
4. *Fumaria indica*
5. *Cucumis melo*
6. *Anagallis arvensis*
7. *Biophytum sensitivum*
8. *Chrozophora rottleri*
9. *Orobanche aegyptiaca*
10. *Polygonum plebeium*
11. *Eriocaulon cinereum*
12. *Ficus heterophylla*
13. *Murdannia nudiflora*
14. *Ceratopteris thalictroides*
15. *Marselia quadrifida*
16. *Sagittaria guyanensis*
17. *Caesulia axillaris*
18. *Leucas indica*
19. *Asphodelus tenuifolius*
20. *Oryza sativa*
    (during croping time)
21. *Leucas indica* and *Croton bonplandianum*
    (as intercrop)
22. *Melilotus alba*
23. *Ludwigia perennis*
24. *Cirsium arvense*
25. *Xanthium indicum*
26. *Sebastiania chamaelea*
27. *Croton bonplandianum*
28. *Cochlearia cochlearioides*
29. *Scirpus articulatus*

PLATE - I



GENERAL DISTRIBUTION : North and East Bengal, Malaysia, Tropical Africa.

IPOMOEA L.

Ipomoea aquatica Forsk., Fl. Aegyp.-Arab. 44. 1775; Fl. Brit. India. 4 : 210. 1883; Beng. Pl. 1 : 736. 1903; Bot. Bihar & Orissa 4 : 597. 1922; Guha Bakshi, Fl. Mur. Dist. 210. 1984. [Plate 2, Fig.1]
I. reptans pair. in Lam., Encycl. Suppl. 3 : 460. 1814 [*non. Convolvulus reptans* L. (1753)]; Fl. Brit. India 4 : 210. 1883; Beng. Pl. 2 : 736. 1903; Bot. Bihar & Orissa 4 : 597. 1922.
I. reptans acut. excl. *Convolvulus repens* L. : Roth. Nov. Pl. Sp. 110. 1821, non. *I. repens* Lam.,1791.

LOCAL NAME : Kalmi.

Annual aquatic or amphibious herbs; stem trailing on mud or floating, rooting at nodes, glabrous. Leaves alternate; petiole 5.0-12.0 cm long, glabrous; lamina ca. 5.0-10.0 x 2.0-4.5 cm, lanceolate to hastate, entire to angled, acute to acuminate, base cordate to hastate, glabrous. Flowers axillary, solitary or 2-3; pedicel ca. 2.0-4.0 cm long; bracts linear to lanceolate; calyx lobes ovate, subequal, glabrous; corolla 3.0-5.0 cm long, infundibuliform, purplish-white, lobes obscure; filaments unequal, base hairy; ovary glabrous. Capsule ovoid to globose, upto o.7 cm long; seeds 4 or less.

Fl. & Frt. : August - April.

SPECIMEN CITED : Englishbazar, 06.11.1992, *Das et. Acharyya* 050.

LOCAL DISTRIBUTION : Frequent with paddy, pulses and mustard; Chanchal, Ratua, Harischandrapur, Old Malda, Englishbazar.

GENERAL DISTRIBUTION : Tropical Asia, Australia and Africa.

NOTE : Young twigs are taken as vegetables.

CUCURBITACEA Juss.

CUCUMIS L.

Cucumis melo L., Sp. Pl. 1011. 1753; Fl. Brit. India 2 : 260. 1879; Jeffrey in KB 34 : 793. 1980. [Plate 1, Fig.5]
Cucumis callosus (Rottb.) Cogn. in Engl., Das pflanzenr 88 : 129. 1924; Chakravorty in RBSI 17 : 100. 1959.
Bryonia callosa Rottl., Neue Schriff. Ges. Nat. Fr. Ber. 4 : 210. 1803.
Cucumis trigonus Roxb., Fl. India 3 : 722. 1832; Wt. & Arn., Prodr. 342. 1834; Wt., Ic. 2 : t. 497. 1843; Fl. Brit. India 2 : 619. 1879; Beng. Pl. 1 : 522. 1903; Bot. Bihar & Orissa 3 : 392. 1922.

Annual, climbing, monoecious herbs; stem ridged, hispid, almost prickly; tendrils simple. Leaves simple; petiole ca. 3.5-5.0 cm long, hispid; lamina ca. 7.0 x 7.5 cm, triangular to ovate, shallowly or deeply 3-7 lobed, crenately dentate, base cordate, sinuses large scabrid. Male flowers axillary, solitary, sometimes 2-3 clustered; calyx lobes linear; corolla yellow. Female flowers solitary, pedicillate; ovary villose. Berry ellipsoid to globose, smooth, striped white, yellow when ripe. Seeds many, oblong, flattened, smooth.

Fl. & Frt. : June - February.

SPECIMEN CITED : Old Malda, 27. 05. 1994, *Das et Acharyya* 089.

LOCAL DISTRIBUTION : Occational with paddy and in intercrop flora; Old Malda, Englishbazar, Gazole, Kaliachak.

GENERAL DISTRIBUTION : Tropical regions of India, Pakistan, Sri Lanka, Bangladesh, Malaysia, Afghanistan, North Africa and Australia.

NOTE : Mature fruits are eaten.

EUPHORBIACEAE Juss.

ACALYPHA L.

Acalypha indica L., Sp. Pl. 1003. 1753; Wt., IC. t. 887. 1844-45; Fl. Brit. India 5 : 416. 1887; Beng. Pl. 2 : 948. 1903; Bot. Bihar & Orissa 2 : 113. 1921; Pax *et* K. Hoffm. in

Engl., Pflanzar. 85 : 33. 1924; Airy Shaw, Kew. Bull. 26 : 206. 1971; Guha Bakshi, Fl. Mur. Dist. 281. 1924.

LOCAL NAME : Muktajhury.

Erect herbs, upto 60.0 cm high; stem angular, pubescent. Leaves opposite; petiole ca. 3.5 cm long; lamina 3.0-7.0 x 2.0-4.0 cm, ovate to rhomboid-ovate, serrate, obtuse with a short acumen ca. 0.1 cm, base cuneate, arrange in mosaic. Flowers greenish, in lax, erect axillary spikes; males clustered towards the top; female solitary or paired; bract cuplike, ca. 0.5 x 0.5 cm, each enclosed the female flower; stamens 8; ovary 3-loculed. Capsule hispid, concealed by persistent bracts. Seeds ca 0.1 cm, smooth, pale brown.

Fl. & Frt. : February- January.

SPECIMEN CITED : Englishbazar, 08.08.1994, Das et Acharyya 125.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Hotter parts of India, Sri Lanka, West ward to tropical Africa and East ward to Timor and Philippines.

Note: Leaves are given to goat during stomachache.

CROTON L.

Croton bonplandianum Baill. in Adensonia 4 : 339. 1864; Croisat. In J. Bombay Nat. Hist. Soc. 41 : 573. 1940; Radcliffe Smith In Kew Bull. 30(4) : 675. 1975; Guha Bakshi, Fl. Mur. Dist. 283. 1984. [Plate 1, Fig.21, 27] .
C. sparciflorus Morung In Ann. N.Y. Acad. Sci. 7 : 221. 1893; Prain in Rec. Bot. Surv. India 3 : 276.1905; Bot. Bihar & Orissa 2 : 105. 1921.

LOCAL NAME : Dudhiya.

Annual, erect, much branched herbs, upto 50.0 cm high; stem with stellate trichomes. Leaves crowded towards the tip of branches; petiole ca. 2.0 cm; lamina 2.0-6.0 x 1.0-2.5 cm, lanceolate, serrate, acute to acuminate, base acute to obtuse, 2-glands at the base. Flowers greenish white, in terminal mixed raceme like inflorescence; male flowers towards the apex, calyx lobes 5, ovate, corolla lobes 5, ovate to oblong, stamens 15, filaments free; female flowers towards the base with 2-extra floral glands at the base of pedicel, style 3, stigma 3, each bifid. Capsules 3-angled, stellate-hairy.

Fl. & Frt. : June - May.

SPECIMEN CITED : Englishbazar, 21. 06. 1993, *Das et. Acharyya* 105.

LOCAL DISTRIBUTION : Abundant with paddy, pulses, mustard and specially in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Native of South America, now Pantropic.

CHROZOPHORA Neck. ex Juss., nom. cons.

Chrozophora rottleri (Geiseler) Juss. ex Spreng., Syst. Veg. 3 : 850. 1826; Prain, Kew Bull. 1918 : 95. 1918; Pax et. k. Hoffin. in Engl., Pflanzenr. 57 :19. 1912; Bot. Bihar & Orissa 2 : 103. 1921; Balak., Bull. Bot. Surv. India 15 : 4. 1973. [Plate 1, Fig.8]
Croton rottleri Gaiseler, Crot. Monogr. 57. 1807.
Chrozophora plicata A. Juss., Tent. Euphorb. 28. 1824; fl. Brit. India 5 : 409. 1887; Beng. Pl. 2 : 944. 1903; in Rec. Bot. Surv. India 3 : 276. 1905.
C. Plicata var. rottleri (Gaisel.) Mull.-Arg. in Dc., Prodr. 15(2) : 747. 1866.

Annual, much branched; branchlets stellate to tomentose. Leaves alternate; petiole ca. 2.5 cm long, hairy; lamina 4.0-9.0 x 2.5-5.0 cm , variable in shape and size, ovate to sub orbicular, shallowly sinuate to entire, obtuse, base acute to cordate, 3-nerved from base, lateral nerves ca. 4-pairs, biglandular at the base, both surfaces hairy; stipules deciduous. Flowers in axillary cymes; stamens 15 in two whorls; ovary 3-loculed, styles 3, each bifid. Capsule ca 1.0 cm across, with 3-valved, reddish, densely tomentose.

Fl. & Frt. : March - September.

SPECIMEN CITED : Chanchal, 01. 07. 1993, *Das et Acharyya* 106.

LOCAL DISTRIBUTION : Frequent with pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Warm regions of Asia, N. Africa, Europe and Australia.

EUPHORBIA L.

Euphorbia heyniana Sprang. in L., Syst. Veg (ed.16)3 : 791.1826; Panigrahi in Kew Bull. 29. 695. 1976; Mathew, Fl. Tamilnadu Carnatic 2 : 1433. 1983; Guha Bakshi, Fl. Mur. Dist. 285. 1984.

E. microphylla Hayne *ex.* Roth, Nov. Pl. Sp. 229. 1821, *non.* Lam., 1788; Fl. Brit. India 5 : 252. 1887; Beng. Pl. 2 : 925. 1903; Bot. Bihar & Orissa 2 : 148. 1921.
Annual, prostrate, glabrous spreading herbs; stem glabrous, internodes ribbed; stipules laciniate. Leaves opposite; petiole 0.1 cm long; lamina ca. 0.7 x 0.4 cm, ovate to oblanceolate, serrulate, subacute to obtuse, base rounded, oblique, nerves obscure. Cyathia radish, axillary; involucre bracts tubular, glands-4, appendages inconspicuous; male flowers in 4-groups, stalked; female laterally pendulous; ovary glabrous, styles 3, bifid. Capsule glabrous, obscurely keeled. Seeds 3.

Fl. & Frt. : May - April.

SPECIMEN CITED : Englishbazar, 17.09.1993, *Das et. Acharyya* 122.

LOCAL DISTRIBUTION : Abundant with paddy, pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Indomalaysia.

Euphorbia hirta L., Sp. Pl. 454. 1753; Bot. Bihar & Orissa 2 : 147. 1921; Airy Shaw in Kew Bull. 37(1) ; 18. 1982; Guha Bakshi, Fl. Mur. Dist. 286. 1984.
E. pilulifera acut. nom. L. 1853; Fl. Brit. India 5 : 250. 1887; Beng. Pl. 2 : 925. 1903 and Rec. Bot. Surv. India 3 : 272. 1905.

Annual, erect to semierect herbs; stem jointed, hairy, purplish. Leaves opposite; petiole upto 0.2 cm long; lamina 2.0-4.0 x 0.8-2.0 cm, obliquely lanceolate, rarely elliptic, serrulate, acute, base rounded or cuneate, hairy on both surfaces; stipules subulate. Flowers in terminal and axillary clustered cyathia; perianth green; stamen-1. Fruit depressed, globose, ca. 0.2 cm across, hairy; cocci trigonous.

Fl. & Frt. : June - May.

SPECIMEN CITED : Gazole, 01.03.1993, *Das et. Acharyya* 075.

LOCAL DISTRIBUTION : Vary abundant with paddy, pulses, mustered and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

Euphorbia indica Lamk., Ency. 2 : 243.1786; Raju & Rao in Indian J. Bot. 2 : 205. 1979. [[Plate 2, Fig.25]
E. hypericifolia auct. nom. L., Fl. Brit. India 5 : 249. 1887; Beng. Pl. 2 : 924. 1903; Bot. Bihar & Orissa 2 : 146. 1921; Guha Bakshi, Fl. Mur. Dist. 286. 1984.
Annual, slender, erect, ascending herbs; ca. 30.0 cm high, branched from lower nodes. Leaves opposite; lamina ca. 2.8-3.2 x 2.0-2.4 cm, oblong to obovate, obtuse, rounded, serrulate, base oblique, glabrous; stipules minute, setaceous. Flowers in small cymes; involucre bracts not distichously imbricating, 2, entire, glabrous, glands 4-5, disciform; perianth white. Fruit depressed-globose, ca. 0.3-0.35 cm across, glabrous. Seeds 3.

Fl. & Frt. : June - May.

SPECIMEN CITED : Old Malda, 11.06.1992, *Das et. Acharyya* 008.

LOCAL DISTRIBUTION : Very abundant with paddy, pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

PHYLLANTHUS L.

Phyllanthus amarus Schum. & Thonn. Jongl. Danske Vidensk. Selsk. Skr. 4 : 195. 1829; Webster in J. Arnold Arb. 37 : 13. 1956 *et.* 38 : 313. t. 19. f. I-K. 1957; Mitra & Jain, Bull. Bot. Surv. India 27(1-4) : 164. 1987.
P. nanus Fl. Brit. India 5 : 298. 1887; Bot. Bihar & Orissa 2 : 127. 1921.
P. niruri acut. non. L. (1753) : Muell.-Arg. in DC., Prodr. 15(2) : 406. 1886 '*P. niruri* [var.] *genuinus*'; Fl. Brit. India 5 ; 298. 1887; p.p.maj. quoad syn. *P. urinaria* Herb.; Beng. Pl. 2 : 936. 1903; Bot. Bihar & Orissa 2 : 126. 1921.

Annual erect herbs; stem branched, terete, smooth. Leaves alternate; petiole ca. 0.05 cm long; lamina 0.3-1.0 x 0.15-0.6 cm, elliptic oblong to obovate oblong, entire, obtuse, minutely apiculate, base obtuse, slightly oblique; stipules triangular-acuminate. Flowers in axillary unisexual and bisexual cymules on dociduous branchlets; proximal 2-3 axils with unisexual cymules of (1) 2 (3) male flowers; all succeeding axils with bisexual cymules. Male flowers : calyx lobes 5, subequal, elliptic, acute; disc segments 5; stamens 3, filaments connate into a column. Female flowers : calyx lobes 5, subequal; disc flat, deeply 5-lobed; styles 3, free, shallowly bifid. Capsule oblate, ca. 0.15 cm across. Seeds triangular, with longitudinal ribs and many minute transverse striate on back.

Fl. & Frt.: June - February.

SPECIMEN CITED : Kaliachak, 05.09.1993, *Das et Acharyya*. 087.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Probably native to South America; now Pantropic.

Phyllanthus fraternus Webster in Contr. Gray Herb. 176 : 53. 1955 and in J. Arnold Arbor. 38 : 308. 1957.
P. niruri acut. pl. non L. 1753; Fl. Brit. India 5 : 298. 1887.

Erect, annual herbs. Leaves alternate, subsessile; lamina ca. 0.4-1.0 x 0.25-0.50 cm, elliptic to oblong, obtuse, rarely subacute, base rounded. male flowers ca. 0.01 cm across, greenish yellow, axillary, solitary or 2-3; filaments united to a column. Female flowers ca 0.15 cm across, greenish yellow, axillary, solitary; styles 3, recurved. Capsules ca. 0.01 x 0.02 cm, depressed globose, obscurely 3-lobed, smooth.

Fl. & Frt. : June - February.

SPECIMEN CITED : Old Malda 11.06.1992; Das et Acharyya 006.

LOCAL DISTRIBUTION : Frequent with paddy, mustard, pulses and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Probably native to South America; now Pantropic

Phyllanthus virgatus Frost. f., Fl. Ins. Austrl. Prodr. 65. 1766. (*ut virgata*) Airy Shaw, Kew. Bull. 26: 325.1972; Guha Bakshi, Fl. Mur. Dist. 294. 1984
P. simplex Retz., Obs. Bot.5 : 29. 1789; (var: *genurinus*). Fl. Brit. India 5 : 295. 1887; Beng. Pl. 2: 936. 1903; Bot. Bihar & Orissa 2 : 125. 1921;
P. simplex var. *virgatus* (Frost.f.) Muell.-Arg., Linnaea 32: 32.1863 and in DC., Prodr. 15(2) : 391.1866.

Annual, erect or diffuse herb, upto 40.0 cm high; stem glabrous, branched from very lower node. Leaves distichous; petiole very short ca. 0.3-0.6 cm; lamina 1.0-1.8 x 0.4-0.7 cm, apiculate, base rounded, glaucous beneath; stipule sagittate, reddish brown. Flowers solitary, axillary; pedicel 0.1 cm long; perianth lobes 6; stamens free. Capsule trilobed, about 0.4 cm across, long stalked, smoth, seeds red-tubercled.

Fl. & Frt. : June - February.

SPECIMEN CITED : Old Malda 11.06.1992, *Das et. Acharyya* 007.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : India, S. Asia to Pacific Islands.

SEBASTIANIA Sprang.

Sebastiania chamaelea (L.) Muell.-Arg. in DC., Prodr. 15 (2) : 1175. 1886; Fl. Brit. India 5 : 475. 1888; Beng. Pl. 2 : 955. 1903; Bot. Bihar & Orissa 2 : 118. 1921. [Plate 1, Fig.26]
Trogia chamaelea L., Sp. Pl. 981. 1753.

Annual, branched herbs; upto 45.0 cm tall, base woody. Stipules ovate, fimbriate. Leaves simple, Petiole ca. 0.3 cm long; lamina ca. 4.0-6.0 x 0.3-0.6 cm, linear, entire, obtuse, glabrous. Inflorescence minute, bisexual, spicate. Perianth 3-pertite, narrower in male, lobes fimbricate; stamens 3; ovary 3-lobed; ovules 1 per locule; styles connate below, recurved. Capsule shortly oblong, yellow, tricoccous, each with 2 dorsal rows of short spines. Seeds ellipsoid to oblong, rounded at both ends, pale yellow.

Fl. & Frt. : November - May.

SPECIMEN CITED : Old Malda 05.11.1992, Das et Acharyya 044.

LOCAL DISTRIBUTION : Abundant with pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout the warmer parts of India, Pakistan, Sri Lanka, Bangladesh, Burma, China and Nepal.

FABACEAE Lindl., *nom.alt.*
(**PAPILIONACEAE** Giseke, *nom. cons.*)

LATHYRUS L.

Lathyrus aphaca L. Sp. Pl. 729, 1753; Roxb., Fl. Ind. 2,3: 322.1832; Fl. Brit. India 2 : 179. 1876; Beng. Pl. 1 : 368.1903; Bot. Bihar & Orissa 3 : 250. 1922. Fl. Rai. Durg & Raj. 109.1985.

LOCAL NAME : Bon-Khasari

Annual, slender, wingless much branched herbs; 40-50 cm high. Leaves completely reduced to unbranched tendrils; stipules fallacious, paired, ca. 3.0 x 1.5 cm long, hastate, entire, acute, apressed to the stem. Flowers 1-2 axillary; peduncle ca. 4.0 cm long; corolla yellow; stamens (9)+1. Pods subfalcate, ca 3.0 cm long, 4-6 seeded; seeds compressed, black.

Fl. & Frt. : November - March.

SPECIMEN CITED : Old Malda, 17.12.1994, *Das et. Acharyya* 082.

LOCAL DISTRIBUTION : Rare with pulses; Old Malda, Englishbazar, Gazole, Kaliachak.

GENERAL DISTRIBUTION : Europe, N. Africa. America, West and Central Asia, India.

NOTE : Used as fodder.

MEDICAGO L.

Medicago lupulina L., Sp. Pl. 779.1753; Fl. Brit. India 2 : 90. 1876; Beng. Pl. 1 : 414. 1903; Bot. Bihar & Orissa 3 : 235. 1922; Guha Bakshi, Fl. Mur. Dist. 108. 1984.

Annual diffuse trailing herbs; ca. 30.0 cm long; stems finely downy, hairy. Leaves pinnately 3-foliate, leaflet ca. 0.9 x 0.8 cm , hairy, obovate, faintly incisocrinate, base deltoid; stipules adnate. Flowers small, 12-22, densely capitate; peduncles ca. 2.5-3.0 cm long; bracts minute; sepals 5, connate in a campanulate tube; teeth setaceous, as long as tube; petals exerted, free form the calyx tube, subsessile; stamens 10, vaxillary filaments free, the rest connate, filiform; ovary sessile 1-ovuled; styles subulate. Pods minute, sickle shaped, unarmed, 1-seeded, faintly veined longitudinally, finally black. Seeds brown.

Fl. & Frt. : October - March.

SPECIMEN CITED : Gazole, 10.11.1993, *Das et Acharyya* 061.

LOCAL DISTRIBUTION : Abundant with pulses and mustard; throughout the district.

GENERAL DISTRIBUTION : Tropical and temperate North West India, Siberia, Europe, Abyssinia.

MELILOTUS Mill.

Melilotus alba Medik, *ex* Desr in Lamk., Encycl. Meth. Bot. 4 ;63.1796; Fl. Brit. India 2 : 89.1876; Beng. Pl. 1 : 413. 1903; Bot. Bihar & Orissa 3 : 235. 1922; Guha Bakshi, Fl. Mur. Dist. 109.1984. [Plate 1, Fig.22]

LOCAL NAME : Bon-methi.

Annual, erect herbs; upto 65 cm high; stem much branched glabrous. Leaves pinnately 3-foliate; leaflets ca. 2.5 x 1.2 cm , oblanceolate to ovate, distantly serrulate, base cuneate; stipules ca. 0.8 cm long, adnate to the petiole in their lower halves, upper halves free. Flowers on slender peduncled, axillary recemes, ca. 10-15 cm long; bracts subulate; corolla white; stamens (9)+1. Pods oblong, ca. 0.5 cm long, 2-seeded. Seeds brown.

Fl. & Frt. : November - May.

SPECIMEN CITED : Gazole, 10.11.1992, *Das et. Acharyya* 062.

LOCAL DISTRIBUTION : Abundant with pulses; throughout the district.

GENERAL DISTRIBUTION : India, China, Tibet, Without. & C. Asia, Europe, Africa, Mongolia, Siberia; Introduced into Malaysia, Australia, Except. Asia, America.

VICIA L.

Vicia angustifolia L., Amoen. Acad. 4 : 105.1759; Ohashi, FEH 165.1966.
V. sativa var. *angustifolia* (L.) Wahlenberg, Fl. Carpth. 218.1814; Fl. Brit. India 2 : 178.1876. [Plate 1, Fig.2]

LOCAL NAME : Boro-hatka papra.

Annual climbing herbs. Leaves peripinnate; rachis ending in a twisted tendril; leaflets 8-12, upper 2.0-2.5 cm long, lower shorter, broader; stipules semisagittate, stipels 0. Flowers subsessile, axillary, 1-3; calyx lobes 5, connate in a campanulate tube, subequal; corolla exerted, ovate emerginate, twice the calyx, narrowed into a wide claw, pale purple; stamens 10, the vaxillary one slightly connate with the rest; anthers uniform; ovary subsessile, many ovuled; style inflexed, pubescent. Pods linear, 4-5 cm long, glabrous, 6-9 seeded. Seeds sub-globose.

Fl. & Frt. : December - April.

SPECIMEN CITED : Old Malda 5.11.1992, *Das et. Acharyya* 043.

LOCAL DISTRIBUTION : Very abundant with pulses; throughout the district.

GENERAL DISTRIBUTION : Plains of North West India, Europe.

NODE : Used as fodder.

Vicia hirsuta Koch Synops. 191; Boiss. fl. Orient.2.595;Fl. Brit. India 2: 177.1876; Beng. Pl. 1 : 367.1903; Bot. Bihar & Orissa 3 : 248. 1922.
Ervum hirsutum L.; W&A. Prodr. 235; Roxb. Fl. India. 3 : 323.
E. filiforme Roxb. in Wall. Cat. 5955.

LOCAL NAME : Choto-hatkapapra.

Annual climbing herbs. Leaves peripinnate; rachis ending in a twisted branched tendril; leaflets opposite, 6-12, ca. 1.5 x 0.2 cm long, linear to linear oblong; stipules semisagittate, stepels 0. Flowers several in a peduncled raceme, ca. 0.4 cm long; calyx lobes 5, connate in a campanulate tube, subequal; corolla scarcely exerted, pale purple; stamens 10; anthers uniform; style influxed, pubescent. pods shortly hairy, 2-seeded. Seeds globose, compressed.

Fl. & Frt.: December - March.

SPECIMEN CITED : Old Malda, 5. 11.1992, *Das et. Acharyya* 039.

LOCAL DISTRIBUTION : Very abundant with pulses; throughout the district.

GENERAL DISTRIBUTION : Plains of North-West India, Europe, Orient & C.

NOTE: Used as fodder.

FUMARIACEAE J.L.Ellis & N.P.Balakrishnan

FUMARIA L.

Fumaria indica (Haussk.) Pugslay in J. Linn. Soc., Bot. 44: 313.1919; Whitemore, 2 : 36.1979; Guha Bakshi, Fl. Mur. Dist. 53. 1984. Fl. India 2 : 84. 1993. [Plate 1, Fig.4; Plate 2, Fig.15]
F. vaillantii var. indica Hussak. in Flora 56: 443. 1873.
F. perviflora acut. nom. Lam. 1788; Wt. & Arn., Prodr. 18. 1834; Beng. Pl. 1: 217. 1903 Rec. Bot. Surv. India 3(2) : 171. 1905.
F. perviflora subsp. *vaillantii* Fl. Brit. India 1 : 128. 1872.

LOCAL NAME : Bandhania

Annual, spreading, branched, glaucous herbs, with watery sap; 30-50 cm long; stems grooved. Leaves decompound, segments flat, ca. 0.5x0.1 cm, narrow linear, acute, mucronate. Flowers in racemes, ca. 0.6 x 0.2 cm; bracts lanceolate, acuminate; pedicels ca. 0.215 cm long; calyx lobes-2;, ca. 0.1 mm long, lanceolate, caducous; corolla lobes 4, pinkies red , spurred at base, upper emerginate; stamens deciduous; anthers 1-celled; carpels 2, connate; ovary 1-celled, styles filiform; stigma straightly lobed. Nutlets 1, globose, pale brown

Fl. & Frt. : November - May.

SPECIMEN CITED : Old Malda , 5.11.1992, *Das et. Acharyya* 047.

LOCAL DISTRIBUTION : Abundant with pulses and mustard; throughout the district.

GENERAL DISTRIBUTION : Without Asia, India, N. Africa, Europe and Central Asia.

Note : The decoction of plant is locally used to purify blood in skin diseases; used as vegetable

HYDROPHYLLACEAE R. Br. ex Edwards

HYDROLEA L., nom. cons.

Hydrolea zeylanica (L.) Vahl. Symb. Bot. 2 : 46.1791; Wt. Ic. t. 601.1843; Brit. India 4 : 133. 1883; Beng. Pl. 2 : 711. 1903; Bot. Bihar & Orissa 4 : 571. 1922; Guha Bakshi, Fl. Mur. Dist. 202.1984. [Plate 2, Fig.12]

Nama zeylanica L., Sp. Pl. 226.1753.

Annual, suberect, aquatic or semiaquatic herbs; upto 40.0 cm high; stem succulent, rooting at lower nodes; branches numerous. Leaves opposite; petiole ca. 0.5 cm long; lamina ca. 2.3-6.0x0.5-1.5 cm, lanceolate, membranous, entire, acute, base tapering, glabrous, becoming smaller and passing into bracts upwards. Flowers in much branched raceme, blue; bracts folier; pedicel upto 0.7 cm long, glandular, hairy; calyx glandular, pubescent. Capsules ca. 0.5x0.3 cm, ellipsoid, enclosed in calyx. Seeds many, brown, oblong.

Fl. & Frt. : August - January.

SPECIMEN CITED : Gazole 21.08.1994, *Das et. Acharyya* 084.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout the warmer parts of India, S. E. Asia, Malaya, Australia, Tropical Africa and America.

LAMIACEAE Lindl., *nom. alt.*
(*LABIATAE* Juss., *nom. cons.*)

LEUCAS R.Br.

Leucas cephalotes (Roth) Spreng., Syst. 2 : 743.1825; Fl. Brit. India 4 : 689.1885; Beng. Pl. 2 : 856.1903; Bot. Bihar & Orissa 5 : 750. 1922; Guha Bakshi, Fl. Mur.Dist. 255.1984. [Plate 1, Fig.3]
Phlomis cephalotus Roth, Nov. Sp. 262.1821.

Annual erect herbs; upto 35.0 cm high; stem 4-angled, hairy. Leaves opposite; petiole 0.5-0.6 cm long, hairy; lamina 3.0-3.5x 1.0-1.2 cm, lanceolate, serrate, acute, base acute, hairy, punctate glands beneath. Flowers in dense, globose, terminal, verticillaster, 2.5-3,5 cm across; bracts many, folier, lanceolate, prominantely nerved, acute; calyx 10 teethed, mouth oblique; corolla white, two lipped; stamens didynamous; style bifid. Nutlets ca. 0.4 cm, oblong, 3-gonous, dark brown, smooth.

Fl. & Frt. : November - February.

SPECIMEN CITED : Gazole, 10.11.1992, *Das et. Acharyya* 066.

LOCAL DISTRIBUTION : Frequent with pulses, mustered; throughout the district.

GENERAL DISTRIBUTION : Throughout India, Bangladesh, Pakistan and Afghanistan.

Note : Leaf sap is applied on forehead for headache and for stomach troubles.

Leucas indica (L.) R. Br. ex vatke in Oesterr. Bot. Zeits. 25 : 95. 1875; Press in Hara *et al*, Enu. Fl. & Frt. : Pl. Nep. 3 : 157.1982. [Plate 1, Fig.18; Plate 2, Fig.3,17]
Leonurus indicus L., Syst. ed. 10 : 1101.1760.
Leucas lavandulifolia Smith in Rees cycl. 20, n. 2. 1812; Mukherjee in Rec. Bot. Surv. India 14(1) : 167.1940; Keng in Gard. Bull. Straits Settlem. 24 : 103. 1969.
L. linifolia (Roth) Sprang., Syst. 2 : 743. 1825; Fl. Brit. India 4 :690.1885; Beng. Pl. 2 : 856. 1903; Bot. Bihar & Orissa 4 : 751. 1922.

LOCAL NAME : Dulphi.

Annual erect much branched herbs; stem 4-gonous. Leaves opposite; petiole ca. 0.5 cm long; lamina ca. 4.0x 0.7 cm, linear-lanceolate, entire or remotely serrate, membranous, obtuse, base narrowed. Flowers in verticillasters, upto 1.5 cm across, many flowered; calyx pubescent outside, teeth 8-10, the posterior one longest, tube erect, mouth oblique, throat glabrous; corolla white, 2-lipped, upper lip shorter; stamens didynamous, anterior pair longer, anther cells divergent, confluent; style bifid. Nutlets ca. 0.25 cm long, oblong, 3-gonous, dark brown, smooth, rounded at apex.

Fl. & Frt. : October - September.

SPECIMEN CITED : Old Malda 05.11.1992, *Das et. Acharyya* 063.

LOCAL DISTRIBUTION : Very abundant with pulses, mustard and paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout the plains of India, Bangladesh, Sri Lanka, Malaya, China.

Note : Leaves are used in bronchitis, dyspepsia.

LEONURUS L.

Leonurus japonicus fa. *niveus* (Baranov et. Skvortz.) Hara in JJB 51: 227.1976. [Plate 2, Fig.23]
L. sibiricus var. *albiflorus* Migo in J. Shanghai Sci. Inst. 3,3 : 7.1985; Fl. Brit India 4 : 678. 1885; Beng. Pl. 2 : 845. 1903; Bot. Bihar & Orissa 4 : 746. 1922.
L. sibiricus fa *nivea* Baranov et. Skvortz in Acta Soc. Harbin investig. Nat. 12 : 35. 1954.
L. heterophyllus fa. *leucanthus* Wu & Li in Acta Phyf. Sin. 10 : 163. 1965.

Annual erect stout leafy herbs, ca. 60.0 cm high; stem 4-angled, hairy. Leaves opposite, sessile, ca. 8.0-10.0 cm long, pinnately compound; segments linear lanceolate. Flowers small, in dense-flowered, distant auxiliary folds; calyx lobes-5, connate in 5-nerved, turbinate calyx, teeth spreading, spinescent; corolla lobes-5, connate in a 2-lipped corolla , upper lip entire, lower 3-fid, midlobe obcordate, light pink with violet tinged; stamens-4, didynamous, lower pair longer; filaments ascending; anthers connivent; carpels connate in 4-pertite ovary; style bifid, lobes equal. Fruits of 4-nutlets; nutlets ca. 0.2 cm long, 3-gonous, dark brown, smooth, rounded at apex.

Fl. & Frt. : August - May.

SPECIMEN CITED : Englishbazar 08.08.1994, *Das et. Acharyya* 123.

LOCAL DISTRIBUTION : Frequent with paddy, pulses and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Plains of India, Tropical Asia, Africa and America.

LYTHRACEAE Jaume. St. Hil.

AMMANNIA L.

Ammannia baccifera L., Sp. Pl. 120. 1753; Fl. Brit India 2 : 569. 1879; Beng. Pl. 1 : 500. 1903; Bot. Bihar & Orissa 3 : 379. 1922; Guha Bakshi, Fl. Mur.Dist. 131.1984. [Plate 2, Fig.2]
A. baccifera L. var. *aeguptiaca* Koehne in Pflanzenr. 17.4. 216 : 53. 1903.
A. vasicatoria Roxb., Fl. India 1 : 427. 1820; DC. Prodr. 3 : 78. 1828; Wt. & Arn., Prodr. 305. 1834.
A. salicifolia Hiern in Oliv. Fl. Trop. Africa 2 : 478. 1871.

Annual erect herbs; upto 30.0 cm high; stem 4-angled. Leaves opposite, sessile; Lamina ca. 6.0x1.3 cm, linear to elliptic, entire, obtuse, base tapering, glabrous. Flowers green with reddish tinged, in dense axillary clusters of 10 forming whorls, ca. 0.7 cm across; bracts filiform; calyx lobes-4, broadly ovate, glabrous; corolla 0; stamens-4, episepalous; ovary-4 loculed, glabrous; stigma capitate. Capsule depressed-globose, red, many seeded. Seeds minute.

Fl. & Frt. : July - May.

SPECIMEN CITED : Old Malda 17.02.1993, *Das et. Acharyya* 071.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

NESAEA Comm. ex Juss.

Nesaea brevipes Koehne in Bot. Jahrb. 3 : 326. 1882 and Pfreich Ht. 17 : 226.1903; Blatter and Hallberg in JBNHS : 26. 216.1918.
Ammania cordata W. & A., Prodr. 1 : 304. 1834, non *Nesaea cordata* Hiern 1871; Fl. Brit. India 2 : 570. 1889.

Annual, glabrous, erect, herbs; ca. 35.0 cm high. Leaves opposite, oblong-cordate, sub amplexicaul. Flowers 2-5 very shortly pedicelled but not congested; calyx lobes-4, campanulate, green; teeth-4, triangular, connivent over capsule; accessory teeth as 4 small prominent horns. Capsule globose. Seeds sub hemispheric.

Fl. & Frt. : September - January.

SPECIMEN CITED : Englishbazar, 17.09.1993, *Das et. Acharyya* 120.

LOCAL DISTRIBUTION : Occational with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Bengal, Decan Penninsula, Sri Lanka.

ROTALA L.

Rotala indica (Willd.) Koehne in Bot. Jahrb. 1 : 172. 1880; Bot. Bihar & Orissa 3 : 377.1922; Guha Bakshi, Fl. Mur.Dist. 134.1984.
Peplis indica Willd., Sp. Pl. 2 : 244.1799.
Ameletia indica DC., Prodr. 3 : 76. 1828; Wt., Ic. t. 257A. 1840.
Ammania peploides Sprang., Syst. 1 : 444. 1835; Fl. Brit India 2 : 566. 1879; Beng. Pl. 1 : 500. 1903.

Decumbent herbs with rooting base; stem 4-angled. Leaves opposite decussate, sessile; lamina 1.1-1.3x0.5-0.6 cm, elliptic-lanceolate, entire, subacute, base cuneate, 4-6 nerved. Flowers axillary, spicate; bractiole 2, linear; calyx lobes-4, campanulate, acuminate; Corolla lobes-4, pink; stamens-4, inserted. Capsule ellipsoid, 2-valved, many seeded.

Fl. & Frt. : June - February.

SPECIMEN CITED : Ratua 10.07.1993, *Das et. Acharyya* 076.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Major parts of India, Malaya to Philippines, Kabul and Parsia.

MALVACEAE (Maxwell T. Masters, F.R.S.)

MALACHRA L.

Malachra capitata (L.)L., Syst. Ed. 12.2 : 458. 1767; Fl. Brit India 1: 329.1874; Beng. Pl. 1 : 262. 1903; Bot. Bihar & Orissa 2 : 62. 1921; Guha Bakshi, Fl. Mur.Dist. 65. 1984. Fl. India 3 : 367. 1993.

Annual herbs, coarsely hairy. Leaves opposite; Petiole ca. 4.0 cm long; lamina 10-12 cm wide, suborbicular, often angled, crenate-dentate, base truncate-cordate; stipules ca. 1.0 cm long, linear. Flowers in axiallary or terminal heads; calyx-5, forming a cup like tube below the middle; corolla lobes-5, yellow, coherent below, connate at the base with the tube of stamens; staminal tube truncate, filaments numerous; carpels-5, 1-ovuled; styles 10. Fruit 1-seeded. Seeds reniform, ascending.

Fl. & Frt. : August - December.

SPECIMEN CITED : Englishbzar 05.08.1992, *Das et Acharyya* 033.

LOCAL DISTRIBUTION : Occational with paddy; throughout the district.

GENERAL DISTRIBUTION : Throughout the hotter parts of India; West tropical Africa, Tropical America.

SIDA L.

Sida rhombifolia L., Sp. Pl. 684. 1753; Fl. Brit India 1 : 327. 1874; Beng. Pl. 1 : 259. 1903; Bot. Bihar & Orissa 2 : 61. 1921; Borss. in Blumea 14 : 193.1966; Guha Bakshi, Fl. Mur.Dist. 67.1984.
ssp. *rhombifolia* var. *rhombifolia* : Paul & Nayer; Fase. Fl. India 19 : 214. 1988
S. alba cav., Diss. 1 : 22, t. 3. f. 3. 1785, nom. L.., Beng. Pl. 1 : 258.1903.
S. rhomboidia Roxb. ex. Flaming in As. Res. 6 : 178. 1810; Fl. Brit. India 3 : 176. 1832.
S. rhombifolia var. *rhomboidica (* Roxb. *ex* Flaming) ; Fl. Brit India 1 : 324. 1874; Beng. Pl. 1 : 259. 1903.
S. obovata Wall., Cat. No. 1864. 1828 nom. nud.
S. rhombifolia var. *obovata* Wall. *ex* Mast. In Hook. f. ,Fl. Brit India 1 : 324. 1874; Beng. Pl. 1: 259. 1903.

Profusely branched under shrub, upto 1.0 m high; stellate hairy, branches erect. Leaves variable; petiole upto 1.5 cm long; lamina ca. 0.5-0.8x0.3-0.5 cm, ovate-oblong, obtuse-rounded, base obtuse-rounded; stipule linear similar to each other. Flowers axillary, solitary; pedicel upto 3.5 cm long, longer than the petiole, jointed above the middle; corolla 1.0-1.8 cm, yellow; anthers stalked; stylar branches 5-10. Schizocarp rugulose; mericarps 5-10; awns-2, very small.

Fl. & Frt. : August - July.

SPECIMEN CITED : Habibpur, 23. 06. 1993, *Das et. Acharyya* 080.

LOCAL DISTRIBUTION : Abundant with paddy, pulses and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

MENISPERMACEAE Juss.

STEPHANIA Lour.

Stephania japonica (Thunb.) Miers in Ann. Mag. Nat. Hist. Ser. 3,18 : 14. 1866; Fl.pres. Madr. 29(21). 1915; Forman in Kew. Bull. 11 :49. 1956; Saldanha, Fl. Brit. India Karnataka 1 : 100. 1984; Guha Bakshi, Fl. Mur.Dist. 48.1984. Fl. India 1 : 335. 1993.
Minispermum japonicum Thunb. Fl. Jap. 193. 1784.
Stephania hernandifolia (Willd.); Rep. 1 : 96. 1842; Fl. Brit India 1 : 103. 1872; Beng. Pl. 1: 208. 1903; Bot. Bihar & Orissa 2 : 17. 1921.
Cissampelos Hernandifolia Willd., Sp. Pl. 4 : 861. 1806.

A slender climber, branched glabrous, striate. Leaves peltate; petiole ca. 6.0 cm long; lamina ca. 6.5-7.0x5.8-6.5 cm, ovate, entire, acuminate, base rounded, glabrous. Flowers in umbels of 3-6 heads; peduncle upto 2.0 cm long, unisexual; Calyx lobes- male 6, female 4; corolla lobes-4, greenish yellow anthers-6; carpels solitary. Drupes ca. 0.5 cm long, turns yellow to red on ripening.

Fl. & Frt. : July - December.

SPECIMEN CITED : Bamongola 23. 06. 1993, *Das et. Acharyya* 116.

LOCAL DISTRIBUTION : Rare as pulse weed; Bamongola, Habibpur, Old Malda.

GENERAL DISTRIBUTION : Tropical to temperate places of Asia and Africa.

MOLLUGINACEAE Wight

GLINUS L.

Glinus lotoides L., Sp. Pl. 463. 1753; DC., Prodr. 3 : 455. 1882; Wt. & Arn., Prodr. 362. 1834; Guha Bakshi, Fl. Mur.Dist. 148.1984.
Mollugo lotoides (L.) O. Ktze., Rev. Gen. Pl. 264. 1891; Bot. Bihar & Orissa 2 : 48. 1921.
M. hirta Thunb, Pl. Cop. 24. 1794; Fl. Brit India 2 : 662. 1879; Beng. Pl. 1 : 553. 1903.

Prostrate spreading herbs; stem tomentose with stellate and simple hairs. Leaves facicled; shortly petiolate; lamina ca. 2.0 x 1.7 cm, obovate, entire, epiculate, densely tomentose.

Flowers axillary, solitary or cluster of 6; inner tepals white, ovate, acute hairy; stamens 10; staminods linear; ovary globose 5-locular; styles 5; stigma persistent. Capsules oblong. Seeds several, black, faintly tuberculate, strophiolate with a filiform appendages.

Fl. & Frt. : June - May.

SPECIMEN CITED : Englishbazar, 21. 06. 1993, *Das et. Acharyya* 098.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

Glinus oppositifolius (L.) A. DC., Bull. Harb. Baiss. 2,1 : 552.1991; Baker in FM 4(3) : 270. 1951; Guha Bakshi, Fl. Mur.Dist. 148. 1984.
Mollugo oppositifolia L., Sp. Pl. 89. 1753; Monney, Suppl. Bot. Bihar & Orissa 25. 1950.
M. spergula L., Syst. ed. 10 : 881. 1759; Wt. Arn., Prodr. 44. 1834; Fl. Brit India 2 : 662. 1879; Beng. Pl. 1 : 553. 1903; Bot. Bihar & Orissa 2 : 48. 1921.

LOCAL NAME : Gimasak.

Annual prostrate or ascending herbs; Stem slender, glabrascent. Leaves facicled at nodes; petiole 0.2 cm long; lamina 0.5-2.5x 0.2-1.5 cm, oblanceolate or elliptic-obovate, entire, acute, base cuneate, apiculate, glabrous or sparsely hairy beneath. Flowers in axillary fasicles of 2-7; pedicel ca. 0.5-1.2 cm long; tepals 5, white, oblong-lanceolate, glabrous; stamens-5; staminodes 2-fid; ovary 3-locular; styles 3. Capsule oblong, 3-4 valved, ca. 0.3 cm long. Seeds radish, sub reniform.

Fl. & Frt. : June - May.

SPECIMEN CITED : Englishbazar, 11. 07. 1993, *Das et. Acharyya* 101.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

Note : Used as vegetable.

MORACEAE Link.

FICUS L.

Ficus heterophylla L. f., Suppl. Pl. 442. 1781; Wt., IC. t. 659. 1853; King. Ahn. Roy. Bot. Gard. (Calcutta) 1 : 75, t. 94. 1887-88; Fl. Brit India 5 . 499. 1888; Beng. Pl. 2 : 981. 1903; Bot. Bihar & Orissa 5 : 335. 1924; Guha Bakshi, Fl. Mur.Dist. 301. 1984. [Plate 1, Fig.12]

Scandent shrub. Leaves polymorphous; petiole 1.0 cm long; lamina ca. 10.5x4.1 cm, lanceolate, sub entire or denticulate, juveniles 3-7 lobed, acute to acuminate, base rounded-cordate, scabrid on both surfaces; stipules ovate-lanceolate, caducous. Figs solitary, axillary, globose, 1.0-2.2x0.8-1.7 cm, scabrid, dark orange when ripe; peduncle ca. 0.5 cm long; basal bracts 3, ovate.

Fl. & Frt. : NR

SPECIMEN CITED : Old Malda, 03. 07. 1993, *Das et. Acharyya* 117.

LOCAL DISTRIBUTION : Rare with paddy and pulses; Old Malda, Englishbazar, Kaliachak.

GENERAL DISTRIBUTION : India, Sri Lanka, S. China, Malay Islands.

ONAGRACEAE Juss.

LUDWIGIA L.

Ludwigia adscendens (L.) Hara in J. Jap. Bot. 28 : 290. 1953; Raven in Steenis, Fl. Brit. India Males. I, 8(2) : 104. 1977; Guha Bakshi, Fl. Mur.Dist. 135. 1984. [Plate 2, Fig.20]
Jussiaca repens L., Sp. Pl. 1 : 388. 1753, non L. repens Forst. 1771; Fl. Brit India 2 : 587. 1879; Beng. Pl. 1 : 507. 1903; Bot. Bihar & Orissa 3 : 381. 1922.

Aquatic annual herbs; stem rooting at nodes; with spongy white aerophores. Leaves alternate; petiole ca. 1.5 cm long, sparsely pubescent; lamina ca. 6.5x2.3 cm, elliptic-oblong, entire, obtuse, base narrowed, glabrous. Flowers solitary, axillary, 5-merous; bracts deltoid; calyx lobes-5, deltoid-acuminate; corolla lobes-5, white, obovate. Capsule

ca. 1.2-2.5x0.3-0.4 cm, terete, 10-ribbed, sparsely pubescent or glabrous, thick walled, irregularly dehiscent.

Fl. & Frt. : October - June.

SPECIMEN CITED : Kaliachak, 17. 06. 1992, *Das et. Acharyya* 016.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

Ludwigia perennis L., Sp. Pl. 1 : 119. 1753; Ravan in Reinwardtia 6 : 367. 1963 et. in Steenis; Fl. Males. Sur. 1, 8(2) : 103. 1977; Guha Bakshi, Fl. Mur.Dist. 136. 1984. [Plate 1, Fig.23]
L. perviflora Roxt., Fl. India 1 : 440. 1820; DC. Prodr. 3 : 59. 1828; Wt. & Arn., Prodr. 336. 1834; Fl. Brit India 2 : 588. 1879; Beng. Pl. 1 : 507. 1903; Bot. Bihar & Orissa 3 : 382. 1922.

Erect herbs, upto 60.0 cm high; young stem puberulous. Leaves opposite; petiole winged, 0.2-1.4 cm long; lamina 1.0-7.0x0.3-2.3 cm, elliptic-lanceolate; entire, acute, base narrowed to petiole, glabrous, nerves 6-12 pairs. Flowers solitary or paired, axillary, upto 1.0 cm across, shortly pedicillate; calyx lobes-4, persistent; corolla lobes-4, yellow, deciduous; stamens-4, disc glabrous. Capsule oblong 4-angled, glabrous, pale brown.

Fl. & Frt. : July - May.

SPECIMEN CITED : Kaliachak 15. 06. 1992, *Das et. Acharyya* 015.

LOCAL DISTRIBUTION : Abundant with paddy, pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : India, Sri Lanka, Madagascar, Continental S. E. Asia and Malaysia to tropical Africa, Australia and New Caledonia.

OROBANCHACEAE Hook.

OROBANCHE L.

Orobanche aegyptiaca Pers. Sy. 2 : 181.1806; FUGP 2 : 37. 1960. [Plate 1, Fig.9]
O. indica Buch.- Ham. *ex* Roxb. Fl. India 3 : 27. 1832; Fl. Brit. India 4 : 326. 1883.

Local name : Benabou.

Annual, erect, scapigeous, brownish root parasite; scapes or stem ca. 15-17 cm high, simple or sometimes branched; scales lanceolate, acute, pubescent. Flowers in lax spikes; bracts ca. 0.4 cm long, ovate, acuminate; bractioles-2, subulate, filiform; calyx lobes 4, unequal, connate, 2-pertite; corolla lobes 5, connate in a 2-liped corolla, tube curved, lateral above, circunsessile below; upper lip 2-fid, lower 3-lobed; stamens 4, didynamous, included; anther cells equal, parallel; carpels connate in a 1-celled ovary; style simple; stigma funnel shaped. Capsule ca. 0.7 cm long, 2-valved. Seeds many, minute, glabrous, dark brown.

Fl. & Frt. : November - April.

SPECIMENS CITED : Gazole, 10. 11. 1992, *Das et Acharyya* 060

LOCAL DISTRIBUTION : Frequent with pulses, mustard; Old Malda, Englishbazar, Gazole, Kaliachak, Manikchak.

GENERAL DISTRIBUTION : Throughout the greater part of India and Sri Lanka, also found in S. E. Asia.

OXALIDACEAE R.Br.

BIOPHYTUM DC.

Biophytum sensitivum (L.) DC., Prodr, 1 : 690. 1824; Wt. & Arn., Prodr. 162. 1834; Fl. Brit India 1 : 436. 1874; Beng. Pl. 1 : 295. 1903 & in Rec. Bot. Surv. India 3 : 183. 1905; Bot. Bihar & Orissa 2 : 156. 1921; Guha Bakshi, Fl. Mur.Dist. 77. 1984. [Plate 1, Fig.7]
Oxalis sensitivum L., Sp. Pl. 434. 1753.

Annual erect herbs, upto 12.0 cm high. Leaves several crowded at the apex, sensitive, ca. 7.0 cm long; rachis hairy; leaflets ca. 10 jugate, ca. 0.9x0.4 cm, subsessile, oblong to oblong-obovate, entire, apex rounded, base slightly unequal, ciliate; bracts and bractioles ovate-acuminate. Flowers in terminal umbels, shortly pedicillate; petals clawed, bright yellow. Capsule ovoid, shorter than persistent calyx, apiculate. Seeds many, spirally grooved.

Fl. & Frt. : July - January.

SPECIMEN CITED : Old Malda, 13. 06. 1992, *Das et. Acharyya* 020.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Tropical parts of Asia, Africa and America.

OXALIS L.

Oxalis corniculata L., Sp. Pl. 435. 1753; DC., Prodr. 1 : 700. 1824; Fl. Brit India 1 : 436. 1874; Beng. Pl. 1: 294. 1903 & In Rec. Bot. Surv. India 3 : 183. 1905; Bot. Bihar & Orissa 2 : 157. 1921; Eiten in Taxon 4 : 99. 1955; Guha Bakshi, Fl. Mur.Dist. 78. 1984.

LOCAL NAME : Amruli, Amrul.

Small procumbent herbs; a runner; rooting at nodes, pubescent. Leaves palmately 3-foliate, ca. 2.2x 2.7 cm; stipules lanceolate, adhering to petiole; petiole hispid; leaflets subsessile, ca. 1.2 x 1.3 cm, obovate, entire, deeply obcordate, base cuneate, sparsely hispid. Flowers in axillary umbels; calyx lobes-5; corolla yellow; stamens 10. Capsule ca. 2.0 cm long, sub cylindric, 5-angled, beaked, puberulous, abruptly tapering above, many seeded.

Fl. & Frt. : June - April.

SPECIMEN CITED : Ratua 08. 07. 1993, *Das et. Acharyya* 099.

LOCAL DISTRIBUTION : Abundant with paddy, pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Cosmopolitan.

NOTE : Leaves are used to cure dysentery; to improve appetite, also taken as a sauce after cooking.

PAPAVERACEAE Juss.

ARGEMONE L.

Argemone maxicana L., Sp. Pl. 505. 1753; Fl. Brit India 1 : 117. 1872; Beng. Pl. 1 : 216. 1903; Bot. Bihar & Orissa 2 : 23. 1921; Guha Bakshi, Fl. Mur.Dist. 51. 1984. Fl. India 2 : 2. 1993. [Plate 2, Fig.16,24]

LOCAL NAME : Sialkanta.

Erect annual herbs, upto 60.0 cm high, with yellowish sap. Leaves upper sessile, clasping at base; lamina ca. 15-20 x 6-8 cm, deeply sinuate to pinnatifid, spinulose, few prickles on veins only on both surfaces. Bracts leafy. Flowers terminal, solitary on short crowded branches, ca. 4.0 cm across, shortly pedicelled; calyx lobes-3, oblong, apex horned, back prickly; corolla recaceous with 3+3 petals, yellow; stamens numerous; stigma subsessile,3-6 lobed, red. Capsule oblong-ellipsoid, 3-6 valved, spiny, many seeded. Seeds brown black, globose.

Fl. & Frt. : November - May.

SPECIMEN CITED : Old Malda, 05.11. 1992, *Das et. Acharyya* 054.

LOCAL DISTRIBUTION : Vary abundant with pulses, mustard; throughout the district.

GENERAL DISTRIBUTION : Native of America, naturalizes throughout India, now Pantropic.

NOTE : Seeds used as adulterants to mustard seed and latex is sometimes used as substitute to opium by local people.

POLYGONACEAE Juss.

POLYGONUM L.

Polygonum plebeium R. Br., Prodr. 420. 1810 (‘*plebejum*’); Fl. Brit India 5 : 27. 1886; Beng. Pl. 2 : 855. 1903; Bot. Bihar & Orissa 5 : 755. 1926; Guha Bakshi, Fl. Mur.Dist. 274. 1984. [Plate 1, Fig.10]

Annual, diffuse, prostrate herbs; stem slender. Leaves sub-sessile; lamina ca. 1.0x0.25 cm linear-lanceolate to spathulate, entire, acute, base narrowed, glabrous, lateral nerves obscure, ochrea small. Bracts membranous. Flowers axillary, solitary or 2-3 together; perianth lobes-5; unequal, pink; stamens-5, included; style-3 persistent. Nutlets-3 gonous, shining, black.

Fl. & Frt. : December - July.

SPECIMEN CITED : Gazole, 07.11.1992, *Das et. Acharyya* 057.

LOCAL DISTRIBUTION : Abundant with pulses and paddy; throughout the district.

GENERAL DISTRIBUTION : Throughout the warmer regions of India; widely distributed in the tropical regions of Old World.

PORTULACACEAE Juss.

PORTULACA L.

Portulaca oleracea L., Sp. Pl. 445. 1753; Fl. Brit India 1 : 246. 1874; Beng. Pl. 1 : 240. 1903 & in Rec. Bot. Surv. India 3(2) : 175. 1905; Bot. Bihar & Orissa 2 : 47. 1921; Geesink in Blumea 17 : 292. 1969; Guha Bakshi, Fl. Mur.Dist. 58. 1984. Fl. India 3 : 4. 1993.

Annual prostrate, succulent herbs; branches radiating; stem swollen at nodes, glabrous, pink. Leaves succulent, whorled above; petiole ca. 0.2 cm; lamina ca. 1.7x0.8 cm, triangular-obovate to spathulate, retuse, base cuneate; stipular hairs scarious, minute. Flowers sessile, in clusters of 3-5; sepals-2, enveloping fruit, unequal, boat shaped, obtuse; petals-5, yellow; stamens-8-12, filaments pubescent; ovary ovoid, 1-locular; style 3-5 branched. Capsules ovoid, curcumsessile below the middle. Seeds many, black, glabrous.

Fl. & Frt. : June - May.

SPECIMEN CITED : Englishbazar, 21.06.1993, *Das et. Acharyya* 103.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

Portulaca quadrifida L., Mant. 1 : 73. 1767; Fl. Brit India 1 : 247. 1874; Beng. Pl. 1 : 240. 1903; Bot. Bihar & Orissa 2 : 47, 1921; Guha Bakshi, Fl. Mur.Dist. 59. 1984. Fl. India 3 : 6. 1993.

Annual, much branched succulent herbs; upto 25.0 cm long; stem rooting at nodes. Leaves opposite, sub-sessile; lamina ca. 0.8x0.25 cm, succulent; stipules of a ring of silvery hairs. Flowers small, terminal, solitary; involucral bracts 4-leaved, surrounded by copious white hairs; calyx hyaline, united at the base; corolla lobes-4, yellow, oblong-ovate; stamens 8-12; filaments hairy at base. Capsule conical, circumsessile. Seeds many, black, glabrous.

Fl. & Frt. : June - May.

SPECIMEN CITED : Chanchal, 01.07. 1993, *Das et. Acharyya* 109.

LOCAL DISTRIBUTION : Rare with paddy and in intercrop flora; Englishbazar, Old Malda, Chanchal.

GENERAL DISTRIBUTION : Tropical Asia and Africa to Malaya, Mariana and Caroline Islands.

PRIMULACEAE J. D. Hooker

ANAGALLIS Tournef.

Anagallis arvensis L. var *caerulea* (L.) Gouan, Fl. Monspel. 29. 1765; Kollmann & Feinburn in NRBGE 28 : 176. 1968; Burtt. in NRBGE 28 : 185. 1968. [Plate 1, Fig.6]
A. caerulea L., Amoen. Acad. 4 : 479. 1959.
A. arvensis sensu Fl. Brit India 3 : 506. 1882; Beng. Pl. 1 : 639. 1903; Guha Bakshi, Fl. Mur.Dist. 179. 1984.

Annual diffuse herbs; stem branched from the base, branches quadrangular. Leaves opposite, sessile; lamina 1.2-1.6x0.5-0.7 cm, ovate, entire, acute, base cordate. Flowers axillary, solitary; peduncle ca. 1.5-2.0 cm; calyx lobes-5; corolla lobes-5, rotate, blue; stamens adnate to corolla tube; filaments villous. Capsules connate in a globose ovary; styles filiform; ovules many, amphitropous. Capsule globose, circumsessile. Seeds peltate, planoconvex, 3-gonous.

Fl. & Frt. : November - March.

SPECIMEN CITED : Old Malda, 05. 11. 1992; *Das et. Acharyya* 056.

LOCAL DISTRIBUTION : Vary abundant with pulses and mustard; throughout the district.

GENERAL DISTRIBUTION : Europe, West Asia, North West India.

RANUNCULACEAE Juss.

RANUNCULUS L.

Ranunculus sceleratus L., Sp. Pl. 551. 1753; Fl. Brit India 1 : 19. 1872; Beng. Pl. 1 : 193. 1903 & in Rec. Bot. Surv. India 3(2) : 168. 1905; Bot. Bihar & Orissa 2 : 6. 1921; Guha Bakshi, Fl. Mur.Dist. 43. 1984. Fl. India 1 : 128. 1993.

Annual, erect, much branched herbs; upto 40.0 cm high; stem fistular, ribbed, glabrous. Leaves in basal rosette, 3-pertite, segments cuneate and again lobed, glabrous, upper sessile, uppermost entire, linear-lanceolate. Flower numerous, small in terminal lax cymose-penicle; sepals spreading and reflexed, pubescent out side; corolla lobes-5, dull yellow; stamens many free; carpels many, free. Achenes many, obliquely obovate, glabrous, on an oblong hairy receptacle.

Fl. & Frt. : January - April.

SPECIMEN CITED : Bamongola, 18. 02. 1993; *Das et. Acharyya* 115.

LOCAL DISTRIBUTION : Frequent with pulses and mustard; throughout the district.

GENERAL DISTRIBUTION : Asia in general; Europe, North Africa and temperate America.

RUBIACEAE Juss.

HEDYOTIS L.

Hedyotis corymbosa (L.) Lamk., Tab. Encl. 1 : 272. 1791; Manilal and Sivarajan, Fl. Calicut 143. 1982.

Oldenlandia corymbosa L., Sp. Pl. 119. 1753; Fl. Brit India 3 : 64. 1880; Beng. Pl. 1 : 559.1903; Bot. Bihar & Orissa 4 : 446.1992; Guha Bakshi, Fl. Mur.Dist. 154. 1984.

Annual herbs, branches erect to prostrate; stem terete, ca. 30.0 cm long, glabrous. Leaves sessile; lamina ca. 3.0x0.4 cm, linear to linear-lanceolate, margin recurved, acute, base obtuse, glabrous; stipules membranous, almost truncate. Flowers 2-4 in axillary fascicles; peduncles ca. 0.7 cm long; calyx lobes-4, ovate; corolla lobes-4, white, acute. Capsule globose, glabrous. Seeds angular.

Fl. & Frt. : June - May.

SPECIMEN CITED : Old Malda, 25. 01. 1994, *Das et Acharyya* 132.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

Hedyotis diffusa Willd., Sp. Pl. 1 : 566. 1797.
Oldenlandia diffusa (Willd.) Roxb., H. Beng. 2. 1814 & Fl. India 1 : 444. 1820; Fl. Brit India 3 : 65. 1880; Beng. Pl. 1 : 559. 1903; Bot. Bihar & Orissa 3 : 447. 1922; Guha Bakshi, Fl. Mur.Dist. 157. 1984.
O. brachypoda DC., Prodr. 4 : 424. 1830.

Annual diffuse glabrous herbs; branches ca. 25.0 cm. Leaves decussate; lamina ca. 2.0-4.0x0.2-0.4 cm , linear, acute, revolute, base decurrent. Flowers solitary or axillary pairs, short-pedicelled; calyx lobes-4, acute, glabrous, shorter than the corolla tube; corolla lobes-4, white; stamens-4; stigma 2-fid, hairy. Capsule loculicidal with persistent calyx lobes.

Fl. & Frt. : June - May.

SPECIMEN CITED : Englishbazar, 21.06.1993, *Das et. Acharyya* 097.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Tropical and sub tropical Eastern Asia, India, S. china, Japan, Malaysia, Borneo and Philippines.

Hedyotis pumila L. f. Suppl. 119. 1781; Rao & Hemadri in IF 99 : 377. 1973.
Oldanlandia pumila (L. f.)DC.; Prodr 4 : 425. 1830; Santapau & Merchant in BBSI 3 : 109. 1962; Guha Bakshi, Fl. Mur.Dist. 157. 1984.
O. crystallina Roxb. Fl. India 1 : 443. 1820; Fl. Brit India 3 : 65.1880; Bot. Bihar & Orissa 3 : 447. 1922; Beng. Pl. 1 : 559. 1903.

Annual, small, diffuse, flaccid, glabrous, herbs; branches upto 15.0 cm long. Leaves decussate, sub sessile; lamina ca. 0.8-1.0x0.2-0.4 cm, lanceolate, acute, entire, minutely dotted, base decurrent; stipules with few bristles. Flowers solitary, axillary, shorter than the leaves; calyx lobes-4, ca. 0.18 cm, acute, glabrous, which nearly touch even in fruit; corolla lobes-4, ca. 0.22 cm, white, ovate; stamens-4; stigma 2-fid; Capsules ca. 0.25 cm long, ovoid, locucidal with persistent corolla lobes. Seeds rounded, oblong, minutely pitted.

Fl. & Frt. : June - May.

SPECIMEN CITED : Ratua 08.07.1994, *Das et Acharyya* 126.

LOCAL DISTRIBUTION : Rare with paddy; Englishbazar, Old Malda, Gazole, Chanchal.

GENERAL DISTRIBUTION : Java, Decan, Central and Eastern Bengal.

SCORPHULARIACEAE Juss.

LINDERNIA All.

Lindernia ciliata (Colsm.) Pennel, Brittonia 2 : 182. 1936 & in J. Arnold Arbor. 24 : 253. 1943 & In Acad. Nat. Sci. Philad. Mon. 5 : 32. 1943; Moony, Suppl. Bot. Bihar & Orissa 99. 1950; Mukherjee, Bull. Bot. Soc. Bengal 9 : 145. 1955; Philcox, Kew Bull. 22 : 51. 1968; Guha Bakshi, Fl. Mur.Dist. 227. 1984.
Gratiola ciliata Colsm.; Prodr. Desc. Gart. 14. 1793.
Bonnaya brachiata Link. *et* Otto. IC. Pl. Select. 25 : t.11.1820; Benth., Scroph, India 52. 1835; Fl. Brit India 4 : 284. 1884; Beng. Pl. 2 : 770.1903.
Illysanthes serrata (Roxb.) Urb., Ber. Deutsch. Bot. Ges. 2 : 436. 1884; Gambel, Fl. Pres. Madr. 962. 1923.
Gratiola serrata Roxb., Fl. IndiA. 140. 1820.
Vendellia brachiata Bot. Bihar & Orissa 4 : 632. 1922.

Erect herbs, upto 15.0 cm high; branches sometimes deccumbent; stem 4-angled. Leaves all opposite, sessile; lamina ca. 3.0x1.0 cm, broadly oblong, sharply aristate-serrate, sub-acute or obtuse, base rounded, glabrous. Flowers in lax terminal racemes, opposite decussate; corolla pinkies white, bilabiate, upper lobe exterior in bud; stamens-2; staminodes-2. Capsules, ca. 1.0 cm long, linear-oblong, glabrous. Seeds minute, dark-brown.

Fl. & Frt. : July - April.

SPECIMEN CITED : Chanchal, 01. 07. 1993 *Das et. Acharyya* 112.

LOCAL DISTRIBUTION : Frequent with paddy; throughout the district.

GENERAL DISTRIBUTION : Tropical Asia.

Lindernia crustacea (L.) Fl. Brit India. Muell., Syst. Cens. Austral. Pl. 97. 1882; Pernell, Acad. Nat. Sci. Philad. mon. 5 : 29. 1943; Mukherjee, J. Indian Bot. Soc. 24 : 130. 1945; Chatterjee *et.* Bharadwaja, Bull. Bot. Soc. Bengal 9: 142. 1945; Moony, Suppl. Bot. Bihar & Orissa 100. 1984; Guha Bakshi, Fl. Mur. Dist. 227. 1984
Capraria crustacea L., Mant. 87. 1767.
Torinia varians Roxb., Fl. India 96. 1832.
Vendellia crustacea (L.) Benth., Scroph. India 95. 1835; Wt., IC. t. 863. 1844-45; Fl. Brit India 4 : 279. 1884; Beng. Pl. 2 : 278. 1903; Bot. Bihar & Orissa 4 : 631. 1922.
V. alba Benth., Scroph. India 35. 1835.

Annual prostrate herbs; branches upto 10.0 cm long, rooting at nodes; stem 4-angled, glabrous. Leaves all opposite; petiole ca. 0.2 cm long; lamina 0.7-1.0x0.4-0.55 cm, suborbicular to ovate, serrate, obtuse, base rounded, thinly pubescent. Flowers in terminal cymes; pedicel ca. 1.2 cm long; calyx ca. 0.3 cm, shallowly lobes; corolla violet, bilabiate, upper lip exterior in bud; stamens 4, anterior filaments appendiculate. Carpels ca. 0.4 cm, oblong ovate. Seeds minute, pale brown.

Fl. & Frt. : July - May.

SPECIMEN CITED : Englishbazar, 08. 08. 1994, *Das et Acharyya* 128.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

Lindernia multiflora (Roxb.) Mukherjee in JIBS 24 : 131. 1945; Philcox in KB 22 : 44.1968.
Torinia multiflora Roxb., Fl. India 3 : 96. 1832.
Vendellia multiflora (Roxb.) G. Don, Gen. Syst. 4 : 549. 1838; Fl. Brit India 4 : 280. 1884; Beng. Pl. 2 : 768. 1903; Bot. Bihar & Orissa 4 : 632. 1922.

Annual, small. erect, succulent, glabrous herbs; stem trichotomously branched, ca. 16.0 cm long. Leaves narrowed into a short petiole; lamina ca. 5.0 cm long, ovate, oblong, entire, base obtuse. Flowers in racemes; pedicel exceeding the calyx; bracts minute; calyx segment partite to the base, lanceolate, ca. 0.25 cm, shorter than the capsule. Capsule Orbicular, apex acute.

Fl. & Frt. : June - April.

SPECIMEN CITED : Old Malda, 17.02.1993, Das et. Acharyya 070.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : India, Tropical Asia.

Lindernia parviflora (Roxb.), Bot. Bihar & Orissa 4 : 635. 1922; Pennel, Acad. Nat. Sci. Philad. Mon. 5 : 29. 1943; Mukherjee in JIBS 24 : 132. 1945; Chatterjee et Bharadwaja , Bull. Bot. Soc. Bengal 9 : 144. 1955.
Gratiola perviflora Roxb., Pl. Corim. 3 : 3, t. 203. 1819 & in Fl. India 140. 1820.
Illysanthus perviflora Benth. in DC., Prodr. 10 : 419. 1846; Fl. Brit India 4 : 283. 1884; Beng. Pl. 2 : 769. 1903.
Bannya hyssopoides Wt., IC. t. 857. 1844-45 (non Benth. 1835)

Annual erect herbs, upto 15.0 cm high; stem 4-angled, glabrous. Leaves all opposite, sessile or sub sessile; lamina ca. 0.6-1.8 x 0.5-1.2 cm, ovate-lanceolate or lower ones elliptic, entire, acute, base attenuate; palmately 3-5 nerved. Flowers in axillary or terminal racemes; pedicel ca. 1.5 cm long; corolla white, bilabiate, upper lip exterior in bud; stamens-2; staminodes-2. Capsules cylindric to elliptic, ca. 2.7 cm long, longer than calyx.

Fl. & Frt. : August - May.

SPECIMEN CITED : Old Malda, 18.02.1993, *Das et. Acharyya* 072.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Tropical regions of Asia and Africa.

MACARDONIA Ruiz & Pav.

Macardonia procumbens (Miller) Small, Fl. Southeast U.S. 1065 : 1838. 1903; D' Arey in Ann. Miss. Bot. Gard. 66 : 240. 1979; Guha Bakshi, Fl. Mur.Dist. 229. 1984. [Plate 2, Fig.10]
Herpestis chamaedroides H.B.K., NOV. Gen. Sp. 2 : 369. 1818; Beng. Pl. 2 : 765. 1903 (non L.)
Macardonia dianthera (Swartz) Mill. Sp., Field Mus. Nat. Hist. Bot.. Ser. 2 : 98. 1900; Pennell in Proc. Acad. Nat. Sci. Philad. 98 : 87. 1946; Mooney, Suppl. Bot. Bot. Bihar & Orissa 95, 256. 1950.
Bacopa procumbens (Miller) Greenm., Publ. Field Columbian Mus., Bot. Surv. 2 : 261. 1907; Edwin, Publ. Field Mus. Nat. Hist. Bot. Surv. 13 (513) : 481. 1971.

Annual prostrate herbs. Leaves decussate, sub sessile; lamina ovate-lanceolate, ca. 1.6x0.7 cm, crenate-serrate, acute, base decurrent into short petiole. Flowers axillary solitary; peduncle ca. 1.3 cm long; bracts-2, ca. 0.5 cm long; calyx deeply 5-pertite, segments unequal, inner calyx lobes much narrower; corolla yellow, obscurely 2-liped, upper lip exterior in bud; stamens-4, didynamous, all fertile; anthers divaricate. Capsule equaling calyx, septicidal. Seeds reticulate.

Fl. & Frt. : February - January.

SPECIMEN CITED : Ratua 08.07.1993, *Das et. Acharyya* 095.

LOCAL DISTRIBUTION : Rare with paddy and in intercrop flora; Chanchal, Manikchak, Harischandrapur.

GENERAL DISTRIBUTION : Naturalized throughout India, Native of America; all warm countries.

SCOPARIA L.

Scoparia dulcis L., Sp. Pl. 116. 1753; Fl. Brit India 4 : 289. 1884; Beng. Pl. 2 : 772. 1903; Bot. Bihar & Orissa 4 : 637. 1922; Penell, Acad. Nat. Sci. Philad. mon. 5 : 22. 1943; Chatterjee *et* Bharadwaja, Bull. Bot. Soc. Bengal 9 : 132. 1955; Guha Bakshi, Fl. Mur.Dist. 229. 1984.

Erect much branched herbs; ca. 55.0 cm high; stem 4-6 angled, glabrous. Leaves opposite, petiole ca. 0.8-1.1 cm long; lamina ca. 2.3-4.2x1.0-2.0 cm, elliptic or elliptic-obovate, serrate, sub acute, base attenuate, glandular-punctate on lower surfaces. Flowers solitary or in short axillary racemes; calyx deeply 4-pertite; corolla 4-lobed, white, almost actinomorphic, throat bearded; stamens-4, equal, exerted. Capsule sub globose, ca. 0.2 cm across, sepcidal, 2-valved.

Fl. & Frt. : June - May.

SPECIMEN CITED : Englishbazar, 05. 07. 1993, *Das et. Acharyya* 113.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Tropical & sub tropical regions of Asia, Africa and America.

Note : Leaf decoction used in Diabetes and Toothache.

SOLANACEAE Juss.

NICOTIANA L.

Nicotiana plumbaginifolia Viv., Elench. Pl. Hort. Dinegro 26. t. 5. 1802; Fl. Brit India 4: 246. 1883; Beng. Pl. 2 : 752. 1903; Bot. Bihar & Orissa 4 : 616. 1922; Hara *et al* Enu. Fl. Brit. India Pl. Nepal 3 : 110. 1982; Guha Bakshi, Fl. Mur.Dist. 218. 1984.

LOCAL NAME : Ban-tamaku.

Annual, erect, viscid herbs; ca. 60.0 cm high; stem glandular-hairy. Basal leaves in a rosette, larger; upper ones sessile; lamina ca. 15.0 x 6.0 cm, elliptic-obovate, acute-obtuse, base semi amplexicaul, uppermost ones smallest, passing into bracts, all undulate, glandular white dotted beneath. Flowers in terminal penicles; pedicel ca.. 0.9 cm long; calyx 10-ribbed, glandular, hairy, lobes unequal; corolla salver shaped, tube linear, lobes-5, white or pale pink; stamens-5, attached near the throat at different levels, dehiscence longitudinal. Capsule ca. 0.9x0.6 cm, ovoid, irregularly dehiscing above. Seeds minute, dark brown.

Fl. & Frt. : June - May.

SPECIMEN CITED : Old Malda, 18.02.1993, *Das et. Acharyya* 086.

LOCAL DISTRIBUTION : Abundant with paddy, pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Native of Tropical America; a common weed throughout India, Nepal etc.

PHYSALIS L.

Physalis minima L., Sp. Pl. 183. 1753; Fl. Brit India 4 : 238. 1883; Beng. Pl. 2 : 750. 1903; Bot. Bihar & Orissa 4 : 607. 1922; Guha Bakshi, Fl. Mur.Dist. 219. 1984. [Plate 2, Fig.27]
Physalis pubescen Wt., IC. t. 166. 1838.

Annual, erect, succulent herbs; ca. 30.0 cm high; stem hispid, striated. Leaves alternate; petile ca. 5.5 cm long; lamina ca. 1.3-6.3x0.7-3.7 cm, ovate or narrowly elliptic, entire or distantly and shallowly serrate, acute, base obtuse, glabrous. Flowers solitary, axillary; pedicel ca. 1.4 cm long; corolla light yellow. Berries ca. 1.0 cm across, enclosed in a inflated bladder like calyx. Seeds reniform, muricate.

Fl. & Frt. : October - May.

SPECIMEN CITED : Old Malda, 07. 12. 1994, *Das et. Acharyya* 094.

LOCAL DISTRIBUTION : Frequent with paddy, pulses and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

Note: Ash of calyx with fruit used in skin diseases for children.

SOLANUM L.

Solanum nigrum L., sp. Pl. 186. 1753; Fl. Brit India 4 : 229. 1883; Beng. Pl. 2 : 745. 1903; Bot. Bihar & Orissa 4 : 610. 1922; Guha Bakshi, Fl. Mur.Dist. 221. 1984.
S. rubrum Miller, Gard. Dist. ed. 8, n. 4. 1768, *non* L.,1767; Wight, IC. t. 344. 1840.

Erect herbs; stem glabrous or sparsely pubescent. Leaves alternate; petiole ca. 1.5 cm long; lamina ca. 4.5-7.2x3.7-5.3 cm, ovate, almost entire or lobed or sinuate, acute, base rounded. Flowers in dropping, sub umbellate, extra axillary cymes; corolla white; anthers dehiscing by terminal pores. Berries ca. 0.8 cm across, black sometimes orange, globose, smooth, shining. seeds yellow, flat, discoid.

Fl. & Frt. : November - October.

SPECIMEN CITED : Gazole, 07.11.1992, *Das et. Acharyya* 058.

LOCAL DISTRIBUTION : Abundant with pulses and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Cosmopolitan.

STERCULARIACEAE Vent.

MELOCHIA L.

Melochia corchorifolia L., Sp. Pl. 675. 1753; Fl. Brit India 1 : 374. 1874; Beng. Pl. 1 : 277. 1903 & in Rec. Bot. Surv. India 3 : 181. 1905; Bot. Bihar & Orissa 2 : 82. 1921; Guha Bakshi, Fl. Mur.Dist. 71. 1984. Fl. India 3 : 441. 1993.
Riedleia corchorifolia (L.) DC., Prodr. 1 : 66. 1824; Wt. & Arn., Prodr. 1 : 66. 1834.

A much branched herbs; stem pubescent. Leaves variable; petiole ca. 0.5-0.8 cm long; lamina ca. 5.0x2.0 cm, oblong-obovate, crenate-serrate, acuminate, base cordate, stellate-hairy; stipules lanceolate. Flowers in dense heads; bracts ciliate; bractioles 4-5, linear; calyx tubular, truncate, 5-toothed; corolla lobes-5, spathulate, marsescent, pink, stamens-5, filaments connate below. Capsule depressed globose, loculicidal, pubescent, 5-valved; Seeds 1-2 per locule, angular, brownish-black.

Fl. & Frt. : June - January.

SPECIMEN CITED : Kaliachak, 05. 09. 1993; *Das et. Acharyya* 102.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

NOTE : The stem yields a good fiber; sometimes leaves are eaten as vegetable.

TILIACEAE P.Daniel and M. Chandrobose.

CORCHORUS L.

Corchorus fascicularis Lamk., Fl. Brit India 1 : 398. 1874; Beng. Pl. 1 : 286. 1903; Bot. Bihar & Orissa 2 : 87. 1921. Fl. India 3 : 486. 1993.

LOCAL NAME : Jangli-pat

Annual, suberect herbs; ca. 50.0 cm high; stems woody. Leaves simple; petiole 0.5-0.7 cm long, upper hispid; lamina 4.0-7.5x1.0-2.0 cm, elliptic-oblong, obtuse serrate, glabrous 3-nerved; stipules subulate. Flowers in cymes; calyx lobes-5, linear oblong, apiculate; corolla lobes-5, oblong-obovate; stamens 5-10; carpels-3, style short, stigma capitate. Capsules 1.0-1.5 cm long, triangular, pubescent, shortly beaked, 3 loculed, locules septate between seeds. Seeds ca. 0.1-0.15 cm long, wedge shaped, black.

Fl. & Frt. : September - March.

SPECIMEN CITED : Kaliachak, 05.09.1993, Das et. Acharyya 088.

LOCAL DISTRIBUTION : Frequent with paddy, pulses, mustard and intercrop flora; throughout the district.

GENERAL DISTRIBUTION : India, Sri Lanka, Africa and America.

VERBINACEAE Jaume St.-Hilaire

PHYLA Lour.

Phyla nodiflora (L.) Greene, Pittonia 4 : 46. 1899; Meeuse in Blumea 5 ; 69. 1942; Guha Bakshi, Fl. Mur.Dist. 250. 1984.
Verbina nodiflora L., Sp. Pl. 20. 1753.
Lippia nodiflora (L.) Michaux, Fl. Bor. Aman. 2 : 15. 1803; Wt., IC. T. 1849; Fl. Brit India 4 : 563. 1885; Beng. Pl. 2 : 825. 1903; Bot. Bihar & Orissa 4 : 706. 1922.

Slender diffuse, prostrate herbs; often rooting at nodes. Leaves simple opposite; petiole ca. 0.25 cm long; lamina ca. 1.4x0.5 cm, obovate, serrate towards apex, entire towards base, obtuse, base cuneate, glabrous. Flowers numerous in compact spikes; spikes cylindric, axillary from each node, ca. 1.0-2.0 cm long; peduncle ca. 3.0 cm long; calyx lobes-2, finely hairy; corolla lobes-5, bilabiate, white, tinged with purple; stamens-4, didynamous; carpels-2, ovary-2 chambered. Drupes globose, enclosed by calyx, splitting into cocci.

Fl. & Frt. : July - June.

SPECIMEN CITED : Old Malda 18. 02. 1993, *Das et. Acharyya* 074.

LOCAL DISTRIBUTION : Abundant with paddy, pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

PLATE - II

(Weeds with artificial background)

Figure

1. *Ipomoea aquatica*
2. *Ammannia baccifera*
3. *Leucas indica*
4. *Amaranthus viridis*
5. *Celosia argentea*
6. *Caesulia axillaris*
7. *Vernonia cineria*
8. *Hygrophila auriculata*
9. *Centella asiatica*
10. *Macardonia procumbens*
11. *Spilanthes calva*
12. *Hydrolea zeylanica*

Fig. 13 - 19 are association of *Orobanche aegyptiaca*

13. *Vernonnia cinerea*
14. *Cicer ariatinum*
15. *Fumaria indica*
16. *Argemone mexicana*
17. *Leucas indica*
18. *Launea aspleniifolia*
19. *Brassica oleracea*
20. *Ludwigia adscendens*
21. *Cassia sophera*
22. *Cyperus rotundus*
23. *Leonurus japonicus*
24. *Argemone mexicana*
25. *Euphorbia indica*
26. *Alternanthera sessilis*
27. *Physalis minima*
28. *Cyperus difformis*
29. *Echinochloa colona*

PLATE - II

3.2.3 MONOCOTYLEDONS

ALISMATACEAE Vent.

BUTOMOPSIS Kunth

Butomopsis latifolia (D.Don) Kunth, Enum Pl. 3 : 165, 1841; Hara et al EFPN 1 : 94. 1978.
Butomus latifolius D. Don, Prodr. 22. 1825.
Butomopsis lanceolata (Roxb.) Kunth. Enum. Pl. 3 : 165. 1841; Fl. Brit. India 6 : 562. 1893; Beng. Pl. 2 : 1120. 1903; Bot. Bihar & Orissa 6 : 845. 1924.
Tenagocharis latifolia (D.Don) Dechenau in Abh. Nat. Ver. Bremen 2 : 6. 1868.

Annual, erect, scapigeous, palustrine herbs, with milky juice. Leaves radial, elliptic, acute. Flowers bisexual, umbelled on a scape, longer than the leaves, whorls solitary or superposed, bracteate; sepals 3, herbaceous, persistent; petals 3, membranous, deciduous, white, larger than the sepals; stamens 8-12, hypogynous; filaments filiform; anthers oblong; carpels 6-9, sessile, shortly connate below. Follicles 6-7, erect, membranous. Seeds minute, smooth.

Fl. & Frt. : December - February.

SPECIMEN CITED : Old Malda, 25.01.1994, *Das et Acharyya* 091.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Plains of India, Tropics of Old World.

SAGITTARIA L.

Sagittaria guyanensis H.B.K. ssp. *lappula* (D.Don) Bogin, Mem. N. Y. Bot. Gard. 9 : 192. f. 5. 1955; Hartog in Van Steenis, Fl. Males 5 : 328. 1957; Guha Bakshi, Fl. Mur.Dist. 343. 1984. [Plate 1, Fig.16]
S. lappula D. Don, Prodr. 22. 1825.
S. guyanensis sensu, Fl. Brit. India 6 : 561. 1893; Beng. Pl. 2 : 1120. 1903; Bot. Bihar & Orissa 4 ; 845. 1924.

A fibrous-rooted, aquatic or semiaquatic herbs. Leaves floating; petiole ca. 30.0 cm long, hairy; lamina ca. 4.5-10.0 x 3.5-8.5 cm, broadly ovate, entire, membranous, obtuse-rounded, base deep corded, obscurely nerved. Flowers polygamous, in few, close whorls, pedicillate on an erect scape; petals white; stamens 6-10 in male flowers. Achenes many, flat, wing toothed.

Fl. & Frt. : August - May.

SPECIMEN CITED : Harischandrapur, 27.06.1992, Das et *Acharyya* 024.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : In the aquatic and marshy habitats of India, Bangladesh, Burma, Nepal, Malaya, China to Tropical Australia.

COMMELINACEAE R.Br.

Commelina benghalensis L., Sp. Pl. 41. 1753; Wt., Ic. t. 2065. 1853; Fl. Brit. India 6 : 370. 1892; Beng. Pl. 1 : 199. 1903; Bot. Bihar & Orissa 6 : 1077. 1924; Guha Bakshi, Fl. Mur.Dist. 326. 1984.

Annuals, subscandent herbs with naked underground stem, with white fertile clistogasmous flowers. Lamina ca. 2.1-5.6 x 1.5-3.1 cm, ovate, entire, acute, base often asymmetric, sheath ca. 1.0 cm long, rugose, hairy at mouth. Scapes 1-3 in the axils, ca. 1.2 cm long, pubescent, turbinate. Clistigasmous flowers blue. Capsule ca. 0.5 cm long, pyriform, 5-seeded; seeds oblong, rugose.

Fl. & Frt. : July - march.

SPECIMEN CITED : Kaliachak, 15.06.1992, *Das et Acharyya* 038.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India and tropics of Old World.

MURDANNIA Royle *nom. cons.*.

Murdannia nudiflora (L.) Brenan, Kew Bull. 7 : 189. 1952; Gandhi in Saldanha & Nicolson, Fl. Hassain Dist. 648. 1976; Mathew, Fl. Pl. Murs. 119. 1981; Guha Bakshi, Fl. Mur. Dist. 329. 1984. [Plate 1, Fig.13]
Commelina nudiflora L., Sp. Pl.. 41. 1753, *protyp. parate.*
Tradescantia malabarica L., Sp. Pl. ed. 2: 412. 1762.
Aneilema nudiflorum (L.) R. Br., Prodr. 271. 1810; Fl. Brit. India 6 : 378. 1892; Beng. Pl. 2 : 1084. 1903; Bot. Bihar & Orissa 6 : 1080. 1924.
Phaeneilema malabaricum (L.) Naray. *ex* Biswas in India. For. Rec. n. s. Bot. 3 : 55. 1941.

Annual, diffuse, slender herbs; ca. 18.0 cm high, rooting at nodes. Leaves glabrous alternate, ca. 5.0-6.0 x 0.5-0.7 cm, linear-lanceolate, acute-acuminate, flat, base narrowed into the sheath; sheath ca. 1.0 cm long, bearded. Penicle terminal; rachis with obscurely raised scars; petals purplish; stamens 3, fertile; filaments bearded, staminodes 3. Capsule globose. Seeds 2 per locule, brown, rugose, pitted.

Fl. & Frt. : July - March.

SPECIMEN CITED : Old Malda, 11.06.1992, *Das et Acharyya* 001.

LOCAL DISTRIBUTION : Very abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

TONNINGIA Neck.

Tonningia axillaris (L.) Kuntz, Rev. Gen. 2 : 721. 1891.
Commelina axillaris L., Sp. Pl. 42. 1753.
Cyanotis axillaris (L.) J. a. & J. H. Schultes, Syst. Veg. 7(2) : 1154. 1830; Fl. Brit. India 6 : 388. 1892; Beng. Pl. 2 : 1085. 1903; Bot. Bihar & Orissa 6 : 1081. 1924.
Amischophacelus axillaris (L.) Rao. & Kamm. in J. Linn. Soc. Bot. 59 : 396. 1966.

Annual, glabrous, sub-succulent, creeping and rooting herbs; stem 15.0-30.0 cm high, elongated, sparsely hairy. Leaves opposite, sessile; lamina ca. 5-15x1.0-1.5 cm, linear - lanceolate, acuminate, flat; sheath inflated, ciliated. Flowers in cymes, reduced to axillary fascicles; clustered in short inflated sheath; petals long clawed, light blue; filaments

bearded; ovary glabrous; style ovoid below the tip. Capsule ca. 0.5 cm long, acute or oblong-elliptic, glabrous except at the beak, valves bifid. Seeds sub cylindric, punctate.

Fl. & Frt. : July - October.

SPECIMEN CITED : Kaliachak, 15.06.1992, *Das et. Acharyya* 014.

LOCAL DISTRIBUTION : Abundant with paddy; throughout the district.

GENERAL DISTRIBUTION : Lower Gangetic plains of India, Ceylon, East Asia, Tropical Africa.

CYPERACEAE Juss.

CYPERUS L.

Cyperus compressus L., Sp. Pl. 46. 1953; Fl. India 1 : 198. 1820; Fl. Brit. India 6 : 605. 1893; Beng. Pl. 2 : 1143. 1903; Bot. Bihar & Orissa 6 : 896. 1924; Enu. Fl. Pl. Nepal 1 : 107. 1978; Rao. et. Verma, Cyp. N. E. India 15. 1982; Guha Bakshi, Fl. Mur.Dist. 352. 1984.

Tufted, erect, glabrous annual, upto 20.0 cm high; root fibrous; stem 3-gonous. Leaves shorter, sometimes longer than the stem, ca. 0.2 cm broad, acuminate. Bracts 3-7 leafy. Spikelets digitately clustered, much compressed; glumes ca. 0.4 cm long, ovate-lanceolate closely imbricate; keels ca. 0.1 cm long, laterally compressed. Nuts ca. 0.16 cm, dark-brown or brown or brownish-black, shortly stipitate, obovoid, triquetrous, apiculate.

Fl. & Frt. : July - December.

SPECIMEN CITED : Ratua, 08. 07. 1992, *Das et. Acharyya* 030.

LOCAL DISTRIBUTION : Rare with paddy; Kaliachak, Englishbazar, Ratua.

GENERAL DISTRIBUTION : Pantropic.

Cyperus difformis L. Cent. pl. 2 : 6. 1756; Rao *et.* Verma, Cyp. N. E. India 12. 1982; Fl. Brit. India 6 : 599. 1893;; Beng. Pl. 2 : 1142. 1903; Bot. Bihar & Orissa 6 : 893. 1924; Guha Bakshi, Fl. Mur.Dist. 353. 1984. [Plate 2, Fig.28]

Annual tufted herbs, upto 50.0 cm high; stem flaccid, compressed, triquetrous. Leaves 1-3, ca. 0.15-0.45 cm broad, shorter than the stem, abruptly acuminate. Anthella simple, evolute; bracts 2-3 foliaceous, erect or spreading, lowest 5-22 cm long; rays 1-7 spreading, lowest 0.5-4.5 cm long. Spikelets numerous, 0.5-0.15 cm broad; heads subglobose, ca. 0.3-0.6x0.1 mm, 12-35 flowered; glumes ca. 0.6-0.8 mm long, membranous, ovate-orbicular, 3-nerved, mucronate, caducous; stamens 1-2; styles 0.15 mm long; stigmas-3, ca. 0.2 mm. Nuts sessile, obovoid, trigonous, yellowish-brown, minutely apiculate.

Fl. & Frt. : June - October.

SPECIMEN CITED : Englishbazar, 21.06.1992, *Das et. Acharyya* 022.

LOCAL DISTRIBUTION : Frequent with paddy; throughout the district.

GENERAL DISTRIBUTION : Tropics of Old World, introduced in Mexico.

Cyperus iria L., Sp. Pl. 45. 1753; Clarke, J. L. Soc. Lond. 21 : 137. 1884; Fl. Brit. India 6 : 606. 1893; Beng. Pl. 2 : 1143. 1903; Bot. Bihar & Orissa 6 : 895. 1924; Kern, Reinwardtia 6 : 35. 1961; Enu. Fl. Pl. Nepal 1 : 107. 1978; Rao *et.* Verma, Cyp. N. E. India 15. 1982; Guha Bakshi, Fl. Mur.Dist. 356. 1984.

Tufted annual, upto 60.0 cm high; stem erect triquetrous. Leaves few, ca. 0.3 cm broad, acuminate at apex, with papery sheath. Inflorescence a decompound umbell; bracts leafy, exceeding rays; spikelets ca. 0.5-0.75x0.1-0.15 cm, 6-10 flowered, compressed, erectopetent, golden yellow; glumes ca. 0.15x0.1 cm, obovate, keeled, spreading, with nerveless sides , upper edge membranous. Nuts obovate-elliptic, exceeding glume when mature, with concave smooth sides.

Fl. & Frt. : July - February.

SPECIMEN CITED : Old Malda, 11.06.1992, *Das et. Acharyya* 010.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Cosmopolitan.

Cyperus kyllinga Endl., Cat. Hort. Vindob. 1 : 94. 1842; Kuk. in Engl., Pflanzenr. 101 : 606. 1936; Kern, Reinwardtia 6 : 67. 1961 & in Fl. Males 7(3) : 659-660. 1974; Matthew, Fl. Pl. Kurs. 123. 1981.
Kyllinga monocephala Rottb., Descr. *et.* Ic. 13, t. 4, f. 4. 1773, Nom. illegit; Nees in Wt., Contrib. India Bot. 91. 1834; Fl. Brit. India 6 : 588. 1893 & in J. L. Soc. Lond. 36 : 224. 1903; Bot. Bihar & Orissa 6 : 907. 1924.

Rhizome slender, flexuose, creeping; stem leafy ca. 7.0-10.0 cm high, erect, compressed, triangular. Leaves longer than stem; bracts long and leafy. head oblong, compact, white; glume with a broad opaque, ciliate wing and short acute tip. Nuts brown.

Fl. & Frt. : July - April.

SPECIMEN CITED : Old Malda, 11.06.1992, *Das et. Acharyya* 037.
LOCAL DISTRIBUTION : Abundant with paddy, pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic, extending to subtropical regions.

Cyperus rotundus L., Sp. Pl. 45. 1753; Roxb., Fl. India 1 : 201. 1830; Fl. Brit. India 6 : 614. 1893; Beng. Pl. 2 : 1145. 1903; Bot. Bihar & Orissa 6 : 903. 1924; Rao in Indian Forester 93 : 57. 1967; Enu. Fl. Pl. Nepal 1 : 108. 1978; Guha Bakshi, Fl. Mur.Dist. 358. 1984. [Plate 2, Fig.22]

Perennials, upto 40.0 cm high; stolen slender, with intermittent ellipsoid aromatic tubers; stem compressed 3-gonous, base tuberous. Leaves flat, 1-nerved, narrow linear, acuminate; lamina 0.3-0.5 cm broad. Anthela simple or compound; bracts 2-4, foliaceous, spreading; spikelets 3-10 together, linear-lanceolate, brown, often curved; rachilla winged; glumes ovate, ca. 0.3 cm long; stamens-3, anthers crest-red; style long exerted. Nuts obovate-ellipsoid, ca. 0.15 cm long, blakish.

Fl. & Frt. : July - April.

SPECIMEN CITED : Old Malda, 11.06.1992, *Das et. Acharyya* 009.

LOCAL DISTRIBUTION : Abundant with paddy, pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Cosmopolitan

Cyperus tigitiformis Roxb. Hart. Ben. 6 and Ic. ined. t. 1321; Fl. Brit. India 6 : 612. 1893; Beng. Pl. 2 : 1144. 1903; Bot. Bihar & Orissa 6 : 899. 1924.

A tall, glabrous, annual herbs, ca. 50.0 cm high; stem trigonous at top. Leaves hardly any; bracts short, lowest green with margins recurved in dried specimens, ca. 11.0 cm long; Spikelets in short corymb, 9, linear, compressed, ca. 2.6 cm long; glumes closely imbricate, ca. 0.25 cm long, back with 6-7 nerved keel, ovate-oblong. Rachilla with linear hyaline wings embracing the ovary; anthers linear, minutely apiculate; style ca. 0.8 cm; stigma ca. 0.1 cm long. Seeds ca. 0.1 cm, 3-gonous, black.

Fl. & Frt. : July - March.

SPECIMEN CITED : Gazole 08.08.1994, *Das et. Acharyya* 079.

LOCAL DISTRIBUTION : Rare with paddy; Englishbazar, Old Malda, Gazole.

GENERAL DISTRIBUTION : Major parts of India, Sri Lanka, Burma, West Africa, North Australia, West Indies, Tropical South America.

ELEOCHARIS R.Br.

Eleocharis congesta D.Don, Prodr. Fl. Nepal 41. 1825; Fl. Brit. India 6 : 630. 1893; Beng. Pl. 2 : 1149. 1903; Bot. Bihar & Orissa 5 : 913. 1924. Kern in Backer & Bakh. f., Fl. Java 3 : 461. 1968.
E. afflata Steud., Syn. Pl. Glum. 2 : 76. 1855; Fl. Brit. India 6 : 629. 1893.

Annual herbs; stem upto 35.0 cm long, 3-angular, ridged; sheath apex truncate, apiculate. Spikelets oblong, 0.5-0.85x0.25-0.4 cm, terete, subacute, purplish often proliferous; glumes loosely imbricate, oblong, ca. 0.15 cm long; stigmas-3. Nuts 0.15 cm long, yellowish green. Bristles-7, white or brown.

Fl. & Frt. : July - December.

SPECIMEN CITED : Kaliachak, 17.06.1992; *Das et. Acharyya* 034.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India, Sri Lanka, Nepal, Japan, Malaysia.

FIMBRISTYLIS Vahl, *nom.cons.*

Fimbristylis dichotoma (L.) Vahl. Enum. Pl.. 2 : 287. 1806; Burkill in Rec. Bot. Surv. India 4 : 136. 1910; Kern in Steenis, Fl. Males. 7 : 575. 1974; Guha Bakshi, Fl. Mur.Dist. 363. 1984.
Scirpus dichotomus L., Sp. PL. 50. 1753.
S. diphyllus Retz., Obs. Bot. 5 : 15. 1788.
Fimbristylis diphylla (Retz.) Vahl. Enum. 2 : 289. 1806; Fl. Brit. India 6 : 636. 1893; Beng. Pl. 2 : 1153. 1903; Bot. Bihar & Orissa 5 : 920. 1924.
Scorpus brevifolius Roxb., Fl. India 229. 1820; non. Rottb.

Annual herbs, shortly rhizomatous; stem ca. 50.0 cm high, tufted, erect, compressed. Leaves flat, 0.15-0.45 cm broad, margin scabirulous, apex obtuse-acute; sheath short, coriaceous, glabrous. Anthella simple or sub-compound; spikelets ca. 0.6 cm long, ovate, acute, terete; rachilla pitted; glumes ca. 0.2 cm long, broadly ovate, acute, apiculate; stamens-3. Nuts obovate-elliptic, ca. o.1 cm long, trabeculate with 5-10 longitudinal ribs on either face, whitish to stramineus.

Fl. & Frt. : May - October.

SPECIMEN CITED : Englishbazar, 21.06.1992, *Das et. Acharyya* 019.

LOCAL DISTRIBUTION : Abundant with paddy; throughout the district.

GENERAL DISTRIBUTION : Tropical to temperate zone of all the World.

Fimbristylis miliacea (L.) Vahl. Enum. 2 : 287. 1806; Fl. Brit. India 6 : 644. 1893; Enu. Fl. Pl. Nepal 1 : 111. 1978; Guha Bakshi, Fl. Mur.Dist. 364. 1984.
Scirpus miliaceous L., Syst. Nat. ed. 10 ; 868. 1759.

Fimbristylis quinquangularia Kunth, Enum. 2 : 229. 1837; Fl. Brit. India 6 : 644. 1893; Beng. Pl. 2 : 1154. 1903; Bot. Bihar & Orissa 5 : 915. 1924.

Annual herbs. Leaves shorter than to equaling the stem., 0.2-0.3 cm broad. Anthela lax, compound or decompound; bracts setaceous, foliaceous. Spikelets solitary, oblong-ovoid, 0.16-0.52x0.1-0.21 cm; glumes spiral, ovate, 0.1-0.2 cm long, mucronate; stamens 1-2; stigmas-3. Nuts broadly ellipsoid to sub globose, 0.04-0.08x0.03-0.05 cm, densely verruculose, stramineous to pale brown.

Fl. & Frt. : July - December.

SPECIMEN CITED : Ratua, 08.07.1992; *Das et. Acharyya* 032.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

SCIRPUS L.

Scirpus articulatus L., Sp. Pl. 47. 1753; Roxb., Fl. India 1 : 217. 1818; Fl. Brit. India 6 : 656. 1893; Beng. Pl. 2 : 1160. 1903; Bot. Bihar & Orissa 5 : 926. 1924; Kern, Reindardtia 6: 34. 1961 & in Fl. Males 7(3) : 513-514. 1974. [Plate 1, Fig.29]
Schoenoplectus articulatus (L.) Palla in Bot. Jahrb. 10 : 229. 1889; Guha Bakshi, Fl. Mur.Dist. 373. 1984.

Annual herbs; upto 30.0 cm high; stem terete, spongy, transversely septet, green; Leaves 0 or the sheath with a membranous acute tip. Inflorescence pseudolateral , capitate, of many sessile spikelets; bracts ca. 0.45 cm long, solitary, erect, transversely septet, glabrous; bristles 0; stamens-3; stigma-3. Nuts 3-gonous, obovoid, brown, triquetrous, apiculate, transversely striolate.

Fl. & Frt. : November - May.

SPECIMEN CITED : Old Malda, 18.02.1994, *Das et. Acharyya* 090.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Tropical region of Asia, Africa and Australia.

Scirpus juncoides Roxb., Fl. India 1 : 218. 1820.
S. erectus acut. non. poir. 1805; Fl. Brit. India 6 : 656. 1893; Beng. Pl. 2 : 1160. 1903; Bot. Bihar & Orissa 6 : 1258. 1924.
Schoenoplectus juncoides (Roxb.) Palla in Bot. Jahrb. 10 : 299. 1888.

Annual herbs; upto 60.0 cm high; stem terete, finely striate; sheaths with an oblique mouth. Inflorescence capitate; spikelets usually 2-4, ovoid-oblong, 0.7-1.0x0.3-0.5 cm, many fid; glumes broadly ovate to suborbicular, 0.1-0.2 cm long, mucronate, broadly scarious margined; perianth bristles-5 , unequal; stamens 2-3; styles usually 2-fid. Nuts sessile, ca. 0.15 cm long, broadly obovate, faintly transversely wavy-wrinkled, ashy-gray to nearly black.

Fl. & Frt. : November - May.

SPECIMEN CITED : Old Malda, 18.02.1993, *Das et. Acharyya 073.*

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India, China, Japan, Malaysia, Australia.

ERIOCAULACEAE Desv.

ERIOCAULON L.

Eriocaulon cinereum R. Br. , Prodr. 254. 1810; Babu, Herb. Fl. Brit. India Dehradun 547. 1977. [Plate 1, Fig.11]
E. sieboldianum Sieb. & Zucc. *ex* Steud., Syn. Pl. Glum. 2 : 272. 1855; Fl. Brit. India 6 : 577. 1893; Beng. Pl. 2 : 1127. 1903; Bot. Bihar & Orissa 6 : 1068. 1924.

Small, glabrous annual herbs. Leaves narrow, linear, ca. 6.0 cm long. Heads ca. 0.3 cm across, globose; bracts pale glabrous. Male florets : corolla lobes with an apical glands; stamens-6, free, biserriate. Female florets : sepals hyaline, petals linear, eglandular; stigmas-3, filiform. Seeds minute, globose, blakish brown.

Fl. & Frt. : August - March.

SPECIMEN CITED : Ratua, 11.07.1992; *Das et. Acharyya* 031.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India and tropical countries of Old World.

LILIACEAE Juss.

ASPHODELUS L.

Asphodelus tenuifolius Cav., Anal. Cienc. Nat. 3 : 46t. 27. 1801; Fl. Brit. India 6 : 332. 1892; Guha Bakshi, Fl. Mur.Dist. 322. 1984. [Plate 1, Fig.19]
A. clavatus Roxb. Fl. India 2 ; 148. 1832.

Annual herbs with slender and flashy root fibers. Lamina ca. 15.0-25.0 cm long, radical, linear, terete, fistular. Flowers small, racemose on the simple or sparingly branched leafless scape; pedicels jointed, solitary in the axils of the small, scarious bracts; perianth petaloid, marcescent; segments 6, free or shortly connate below; stamens-6, hypogynous, shorter than perianth lobes, erect; filaments wide based, enclosing the ovary, flattened above; anthers oblong or almost linear, versatile, the filament inserted in a pit on the back of the connective; carpels-3, connate in 3-celled ovary; ovules-2, collateral in each cell; style filiform; stigma somewhat 3-lobed. Fruit a glabrous, 3-quetrous, locucidal capsule, with rugose partitions. Seeds usually solitary in each cell of capsule, ca. 0.25 cm long, black, sharply trigonous.

Fl. & Frt. : November - May.

SPECIMEN CITED : Gazole, 10.11.1992, *Das et. Acharyya* 059.

LOCAL DISTRIBUTION : Occational with pulses and mustard; Gazole, Old Malda.

GENERAL DISTRIBUTION : West ward to the Canary Island, Plains of India.

POACEAE Branhart, *nom. alt.*
(*GRAMINEAE* Juss., *nom. cons.*)

BRACHIARIA Griseb.

Brachiaria reptans (L.) Gardn. & Hubb. in Hook., Ic. Pl. Sub. t. 3363. 1938; Mooney, Suppl. Bot. Bihar & Orissa 177. 1950; Bor, Grass, Bur. Cey. India. Pak. 445. 1985; Guha Bakshi, Fl. Mur. Dist. 378. 1984.
Penicum reptans L., Syst. Nat. ed. 10. 870. 1759.
P. prostratum Lam., Tab. Encycl. meth. Bot. 1 : 171. 1791; Fl. Brit. India 7 : 33. 1896; Beng. Pl. 2 : 1177. 1903.
Urochloa reptans Stapf. : sensu Bot. Bihar & Orissa 6 : 1003. 1924.

Annual, culms slender, decumbent, upto 30.0 cm tall, nodes pubescent. Leaves glabrous; lamina ca. 2.5-6.5 x 0.8-1.0 cm, linear-lanceolate, base cordate; ligule hairy. Flowers with 5-8 alternate racemes, ca. 3.0 cm long; spikelets in pairs, secund, ca. 0.2 cm long; pedicel with balbous basal bristles; lower florets male or neuter, upper floret bisexual; lemma indulate, apiculate; palea clasped by lemma; stamens 3. Caryopsis ca. 0.1 cm long, ovoid, flattened.

Fl. & Frt. : April - November.

SPECIMEN CITED : Englishbazar, 21.06.1992, *Das et. Acharyya* 011.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

CHLORIS Sw.

Chloris inflata Link, Enu. Pl. 1 : 105. 1821; Fosberg in Taxon 25 : 178. 1976; Bor, Grass, Bur. Cey. India. Pak. 465. 1960.
Andropogon barbatum sensu L., Mantissa 2 : 302, 1771 non. L. 1759.
Chloris barbata sensu Sw., Prodr. 1 : 200. 1797 nom (L.) Sw. 1797. Fl. Brit. India 7 : 292. 1897; Beng. Pl. 2 : 1228. 1903; Bot. Bihar & Orissa 5 : 969. 1924; Guha Bakshi, Fl. Mur. Dist. 379. 1984.

Annual herbs, ca. 40.0 cm long, nodes with large tufts of leaves with compressed sheaths Leaves ca. 5.0-25.0 x 0.2-0.4 cm, acuminate, flat, mouth of sheath ciliate. Inflorescence of 5-12 digitately arranged spikes; spikes ca. 4-5 cm long, suberect; spikelets ca. 0.35 cm, green 1-flowered, 2-serrate, unilateral, the rachila produced beyond the flowering glumes, 1-3 empty glumes beyond the flowers; awns-2, ca. 0.5 cm long; stamens-3, anthers small; styles free; stigmas laterally exerted. Grains narrow, free.

Fl. & Frt. : May - November.

SPECIMEN CITED : Ratua, 10.07.1992, *Das et. Acharyya* 029.

LOCAL DISTRIBUTION : Frequent with paddy; throughout the district.

GENERAL DISTRIBUTION : Throughout the plains of India, Burma, Sri Lanka and other tropical countries.

CYNODON Rich. *ex.* Pers., *nom. cons.*

Cynodon dactylon (L.) Pers., Syn. Pl. 1 ; 85. 1805; Fl. Brit. India 7 : 228. 1896; Beng. Pl. 2 ; 1227. 1903; Bot. Bihar & Orissa 5 : 966. 1924; Bor, Grass, Bur. Cey. India. Pak. 469. t. 52. 1960; Enu. Fl. Pl. Nep. 1 : 128. 1978; Guha Bakshi, Fl. Mur. Dist. 381. 1984.
Panicum dactylon L., Sp. Pl. 58. 1753.

LOCAL NAME : Dubba-ghasa.

Perennial herbs, culms decumbent-ascending, much branched runners can cover large area, rooting at nodes. Lamina linear, scabrid on the upper surface and margins; sheath compressed, keeled, glabrous except the hairy throat; ligule a scarious, ciliated rim. Spikes 2-6, linear, digitate or umbellate; Spikelets conduplicate, acute, 1-flowered, ca. 0.1-0.5 cm long; glumes as long as or shorter than lemmas; stamens-3. Caryopsis oblong ca. 0.15 cm long, brown.

Fl. & Frt. : June - May.

SPECIMEN CITED : Old MALDA, 11.06.1992, *Das et. Acharyya* 002.

LOCAL DISTRIBUTION : Abundant with paddy, pulses, mustered and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Cosmopolitan.

DESMOSTACHYA Stapf

Desmostachya bipinnata (L.) Stapf in Dyer, Fl. Cap. 7: 632. 1900; Bor, Grass, Bur. Cey. India. Pak. 491. 1960.
Uniola bipinnata L., Sp. Pl. 2 : 104.1762
Poa cynosuroides Retz., Obs. Bot. 4 : 20. 1786; Fl. Brit. India 7 : 325. 1897; Beng. Pl. 2 : 1123. 1903.
Eragrostis cynosuroides (Retz.) P. Beauv., Ess. Agrost. 162. 1812; Bot. Bihar & Orissa 5 : 954. 1924.

An annual herbs, branched from base; stem ca. 60.0 cm tall, tufted, smooth, erect, stout. Leaves many, basal fascicled, very long, rigid, long acuminate, tips filiform, mouth of sheath with hairs; ligule 0. Penicle ca. 40.0 cm long, erect narrowly pyramidal. Spikelets sessile, unilateral, biseriate, crowded, pale brown, shining; internodes or rachilla very short, hairy; glumes obtuse; lemma glabrous, keeled, scabrid; stamens-3. Seeds very minute, laterally compressed.

Fl. & Frt. : March - May.

SPECIMEN CITED : Old Malda, 04. 03. 1993, *Das et. Acharyya* 077.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India, Arab, North Africa to Tropical Africa.

DIGITARIA Haller.

Digitaria bicornis (Lamk.) Roem. & Schult., Syst. 2 . 470. 1817; Bor, Grass, Bur. Cey. India. Pak. 299. 1960; Guha Bakshi, Fl. Mur. Dist. 384. 1984.
Paspalum bicorne Lamk., Encyl. 1 : 176. 1791.
Panicum bicorne Kunth, Rev. Gram. 1 : 33. 1829.
Digitaria biformis Willd., Enum. Pl. Hort. Berol. 1 : 92. 1809; Bor, Grass, Bur. Cey. India. Pak., 299. 1960.
Paspalum sanguinale Lamk.. var. *commutatum* Fl. Brit. India 7 : 15. 1896.
Digitaria sanguinalis Scop. f. *commutata*, Beng. Pl. 2 : 1181. 1903; Bot. Bihar & Orissa 5 : 1007. 1924.

Annual herbs; culms ca. 50.0 cm tall, decumbent. Lamina linear, scabrid, sparsely short pilose; ligule truncate. Inflorescence of 2-5 racemes; rachis winged, serrate; Spikelets

binate, lanceolate, glabrous to slight hairy; sterile lemma equal to spikelet; sessile spikelet slightly pubescent and pectinate; stamens-3. Caryopsis ca. 0.25 cm long.

Fl. & Frt. : July - December.

SPECIMEN CITED : Ratua, 08.07.1992, *Das et. Acharyya* 028.

LOCAL DISTRIBUTION : Occational with paddy; Ratua, Chanchal, Manikchak.

GENERAL DISTRIBUTION : Tropical and sub tropical regions of Asia and Africa.

Digitaria ciliaris (Retz.) Koel., Deser. Gram. 27. 1802; Guha Bakshi, Fl. Mur. Dist. 385. 1984.
Penicum ciliare Retz., Obs. Bot. 4 : 16. 1786.
P. adscendens H. B. & K., Nov. Gen. Sp. 1 : 97. 1816.
Paspalum sanguinale Lamk. var. *ciliare*, Fl. Brit. India 7 : 15. 1896.
P. sanguinalis Lamk. var. *commutatum sensu*, Fl. Brit. India 7 : 15. 1896.
Digitaria sanguinalis Scop. fa. *ciliaris* (Retz.), Beng. Pl. 2 : 1181. 1903; Bot. Bihar & Orissa 6 : 1008. 1924.
Digitaria sanguinalis Scop. fa. *commutata sensu*, Bot. Bihar & Orissa 6 : 1007. 1924.
D. adscendens (H.B.K.) Henr. in Blumea 1 : 92. 1934; Bor, Grass, Bur. Cey. India. Pak. 298. 1960.

Erect or decumbent annual herbs; culms ca. 55.0 cm tall. Lamina linear to linear lanceolate, acuminate, glabrous, except bulbous based, base hairy; ligule truncate. Racemes 2-9, subdigitate; rachis scabrid.; spikelets in pairs, oblong acute, awnless, upper involucral glume ciliate; floral glume densely bearded with soft, spreading hairs; stamens 3. Caryopsis ca. 0.2 cm long, brownish.

Fl. & Frt. : July - April.

SPECIMEN CITED : Gazole, 10. 11. 1992, *Das et. Acharyya* 065.

LOCAL DISTRIBUTION : Abundant with paddy, pulses, mustard and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

Digitaria cruciata (Nees) A. Camus in Lecomte, Fl. Gen. del' IndoChina 7 : 399. 1922; Bor, Grass, Bur. Cey. India. Pak. 300. 1960; Bot. Bihar & Orissa 6 : 1008. 1924.
Penicum cruciatum nees ex Steud., Syn. Pl. Glum. 1 : 39. 1854.
Paspalum sanguinale Lamk. var. *cruciatum*, Fl. Brit. India 7 : 14. 1896; Beng. Pl. 2 : 1181. 1903.

A small annual herbs, branched from the base; stem ca. 4.5 cm long, erect. Leaves linear-lanceolate, acute, mouth of sheath hairy. Spikes ca. 1.5 cm, horizontal; rachis slender; spikelets hairy, ovate-oblong, acute, binate, loosely imbricate, purple; glume II half as long as III, ovate-oblong, obtuse, 3-nerved; glume III ovoid. Fruit distantly apiculate and protruding above the lower lemma.

Fl. & Frt. : July - December.

SPECIMEN CITED : Gazole, 07.11.1992, *Das et. Acharyya* 053.

LOCAL DISTRIBUTION : Occational with paddy; Gazole, Old Malda, Englishbazar.

GENERAL DISTRIBUTION : Throughout India in dry and moist situation and all Warm Countries.

Digitaria longiflora (Retz.) Pers., Syn. Plan. 1 : 85. 1805; Bor, Grass, Bur. Cey. India. Pak. 302. 1960; Bot. Bihar & Orissa 6 : 1008. 1924; Guha Bakshi, Fl. Mur. Dist. 385. 1984.
Paspalum longiflorum Retz., Obs. Bot. 4 : 15. 1786; Fl. Brit. India 7 : 17. 1896; Beng. Pl. 2 : 1182. 1903.
Penicum longiflorum Gmel. in L., Syst. Nat. 13 (2) : 158. 1791.

An annual herbs; stem ca. 35.0 cm tall, procumbent, tufted, branched. Leaves ca. 15.0 cm long, linear, sheath hairy; nodes glabrous; ligule short, truncate, membranous. Spikes ca. 7.0 cm long, silvery white; spikelets ca. 0.2 cm, subsessile, pale green, elliptic-oblong, silky with slender crisped hairs; pedicels glabrous; glume I & II subequal; II 5-nerved; III ovate, acuminate. Fruits protruding beyond lower lemma.

Fl. & Frt. : July - October.

SPECIMEN CITED : Ratua, 08.07.1994, *Das et Acharyya* 127

LOCAL DISTRIBUTION : Frequent with paddy; throughout the district.

GENERAL DISTRIBUTION : Throughout India, Tropical & Sub-tropical regions of the Old-World.

ECHINOCHLOA P. Beauv., *nom. cons.*

Echinochloa colona (L.) Link, Enum. Hort. Brol. 2 : 209. 1833; Bot. Bihar & Orissa 5 : 997. 1924; Bor, Grass, Bur. Cey. India. Pak. 308. 1960; Guha Bakshi, Fl. Mur. Dist. 387. 1984. [Plate 2, Fig.29]
Penicum colonum L., Syst. Nat. ed. 10(2) : 870. 1759; Fl. Brit. India 7 : 32. 1896; Beng. Pl. 2 : 1177. 1903;

LOCAL NAME : Shyma-ghasa.

Tufted annual, ca. 60.0 cm tall; culms slender, erect or decumbent. lamina linear, 5.0-17.0 x 0.2-0.5 cm, tapering to an acute point, glabrous or sparsely hairy; sheath compressed, glabrous; logule 0. Spikelets globose, greenish on erect penicles; florets 2, the lower male, upper bisexual; lower glume 5-nerved; upper glume 7-nerved; stamens 3; anthers yellow. Caryopsis ovoid, ca. 0.15 cm long.

Fl. & Frt. : July - March.

SPECIMEN CITED : Old Malda, 11.06.1992, *Das et. Acharyya* 003.

LOCAL DISTRIBUTION : Very abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : All Warmer Countries of the World.

Echinochloa crus-galli (L.) P. Beauv., Ess. Agrost. 53 : 161. 1812. var. *crusgalli*; Bor, Grass, Bur. Cey. India. Pak. 310. 1960; Bot. Bihar & Orissa 5 : 998. 1924; Guha Bakshi, Fl. Mur. Dist. 387. 1984.
Penicum crus-galli L., Sp. Pl. ed. 1 : 56. 1753; Fl. Brit. India 7 : 30. 1896; Beng. Pl. 2 : 1177. 1903.
Penicum grossum Salisb., Prodr. Strip. 18.1796.
Penicum hispidulum Retz., Obs. Bot. 5 : 18. 1789.
Echinochloa hispidula (Retz.) Nees ex. Royal, Ill. Bot. Himal. 416. 426. 1840.

Erect annual herbs; stem 50.0 cm tall, slender, branched. Leaves ca. 10.0-20.0 x 0.6-0.8 cm, flat, glabrous; sheath somewhat loose; ligule 0. Racemes ca. 18.0 cm long, inclined; spikes subsessile, upper gradually shorter, erect, erecto-patent, ca. 8.0 cm long; rachis setulose; spikelets ca. 0.35 cm long, subglobose, hispid; glume I acute, 3-5 nerved, II & III mucronate; lower lemma moderately long-owned; palea coriaceous, shining white. Caryopsis ca. 0.17 x 0.12 cm, ovoid, brown.

FL. & FRT. : July - March.

SPECIMEN CITED : Ratua, 08.07.1994, *Das et. Acharyya* 124.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Pantropic.

ELEUSINE Gaertn.

Elusine indica (L.) Gaertn., Fruct. 1 : 8. 1788; Fl. Brit. India 7 : 293. 1896; Beng. Pl. 2 : 1229. 1903; Bot. Bihar & Orissa 5 : 970. 1924; Bor, Grass, Bur. Cey. India. Pak. 493. 1960.
Cynosurus indicus L., Sp. Pl. 72. 1753.

Erect annual herbs, ca. 50.0 cm high; culms loosely tufted, soft, glabrous. Lamina ca. 6.0-27.0 x 0.2-0.5 cm, linear, flaccid, deep green; sheath compressed, glabrous; ligule membranous. Spikelets 2-serrate, elliptic, whitish, in 3-5 terminal sub-digitate spikes; lower glume 1-nerved, upper 1-3 nerved, keeled and folded; stamens 3. Caryopsis oblong, 3-gonous, narrowed at both ends, laterally compressed, dark brown.

Fl. & Frt. : June - May.

SPECIMEN CITED : Englishbazar, 17.09.1993 *Das et. Acharyya* 121.

LOCAL DISTRIBUTION : Very abundant with paddy, pulses, mustered and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Tropical and Sub tropical regions of the world.

ERAGROSTIS Wolf.

Eragrostis ferruginea (Thunb.) P. Beauv., Ess. Agrost. 71 : 1812; Bor, Grass, Bur. Cey. India. Pak. 508. 1960; Fl. Brit. India 7 ; 324. 1897.
Poa ferruginea Thnub., Fl. Brit. India Jap. 50. 1784.

Annual erect herbs, ca. 17.0 cm high. Leaves ca. 10.0 cm long, narrow; basal sheaths broad, compressed, keeled, naked at the mouth. Penicles oblong, branches solitary, ca. 12.0 cm long, with stouter branches; pedicels longer than the spikelets, with glandular band; spikelets ca. 0.6 cm long, linear- ovate, 5-10 flowered; glumes minute ca. 0.2 cm long; empty glumes unequal, acute 1-nerved; rachilla tough; lemmas rounded back , tip firmly compressed, olive green tinged with purple, ca. 2.5 cm long, 1.2 cm broad, oblong-obtuse; lateral nerves conspicuous; stamens 3. Seeds obovoid, truncate.

Fl. & Frt. : July - May.

SPECIMEN CITED : Englishbazar, 20.06.1992, *Das et. Acharyya* 036.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Sikkim, Tibet, North China, Japan.

Eragrostis gangetica (Roxb.) Steud., Syn. Pl. Glum. 1 : 266. 1854; Bor, Grass, Bur. Cey. India. Pak. 508. 1960; Bot. Bihar & Orissa 5 : 958. 1924; Guha Bakshi, Fl. Mur. Dist. 389. 1984.
Poa gangetica Roxb., Fl. India 1 : 341. 1820.
Eragrostis stenophylla Hoechst. ex. Miq. in Verh. Konink.-Nederl. Inst. 3(4) : 39. 1851 in part; Fl. Brit. India 7 : 318. 1896; Beng. Pl. 2 ; 1222. 1903.

An annual herbs; stem erect many, densely tufted, ca. 42.0 cm tall, geniculately ascending. Leaves ca. 4.0 x 0.2 cm, smooth, linear-lanceolate, acuminate, strict, convolute; Sheaths smooth. Penicle oblong, inclined; branches distant, alternate, obliquely spreading when ripe; Spikelets ca. 0.5 cm long, crowded on penicle, linear, slate-gray, 30-40 flowered, breaking up from below -upwards; rachilla zigzag; empty glumes subequal, subacute, 1-nerved; lemmas ovate, acute, not closely imbricate with over lapping margins, 1-1.2 mm long, side nerves conspicuous; paleas deciduous, stamens 3. Caryopsis ca. 0.6 cm long, oblong, brown.

Fl. & Frt. : September - April.

SPECIMEN CITED : Kaliachak, 05.09.1993, *Das et Acharyya* 093.

LOCAL DISTRIBUTION : Abundant with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India, Burma, Sri Lanka, Tropical Asia and Africa.

Eragrostis riparia (Willd.) Nees, Agrost. Bras. 512. 1829; Bor, Grass, Bur. Cey. India. Pak. 513. 1960.
Poa amboinica Retz., Obs. Bot. 4 ; 20. 1786 non L.1771.
P. riparia Willd. in Ges. atur. Freunde Barlin, Neue Schrift 4 : 185. 1803.
Eragrostis tenella (L.) P. Beauv. var *riparia*, Fl. Brit. India 7 : 315. 1896; Bot. Bihar & Orissa 5 : 956. 1924; Beng. Pl. 2 ; 1222. 1903.

Annual erect herbs, ca. 20.0 cm high, branched from base; stem glabrous. Leaves ca. 18.0 cm long; linear-lanceolate, acuminate; sheaths ribbed. Penicle compact, dense, ca. 20.0 cm long; rachies glabrous; spikelets ca. 0.12 cm long, pedicelled, 4-9 flowered; empty glumes unequal; lemmas ca. 1.25 mm long, rounded at the apex, not ciliated on the keels. Seeds minute, ovoid.

Fl. & Frt. : September - April.

SPECIMEN CITED : Old Malda, 05. 11. 1992, *Das et Acharyya* 042.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Bengal, Sri Lanka, Tropical Asia and Africa.

Eragrostis tenella (L.) Beauv. ex Roem et Schullt., Syst. Veg. 2 : 576. 1817; Bor, Grass, Bur. Cey. India. Pak. 513. 1960; Guha Bakshi, Fl. Mur. Dist. 392. 1984.
Poa tenella L., Sp. Pl. 69. 1753.
Eragrostis plumes Link, Enum. Hort. Berol. 1 : 192. 1827.
Eragrostis tenella var. *plumosa* (Retz.) Stapf. Fl. Brit. India 7 : 315. 1896; Beng. Pl. 2 : 1221. 1903; Bot. Bihar & Orissa 5 : 957. 1924.

Loosely tufted , erect , annual herbs; ca. 50.0 cm high; culms slender. Lamina ca. 3.0-7.0 x 0.1-0.3 cm, narrowly linear, acute, glabrous; sheaths glabrous, throat with long hairs; ligule ciliated. Spikelets ca. 2.0-3.5 cm long, greenish on loosely branched terminal penicles; lemma ca. 0.1 x 0.05 cm , seaberalous on the keel; palea ciliated; stamens 3. anthers light to dark pink. Caryopsis ca. 0.05 cm long, oblong, pale to light brown.

Fl. & Frt. : August - January.

SPECIMEN CITED : Englishbazar, 20. 06. 1992, *Das et Acharyya* 035.

LOCAL DISTRIBUTION : Frequent with paddy, pulses and mustard; throughout the district.

GENERAL DISTRIBUTION : Tropics of the Old World, introduced into America.

HEMARTHRIA R.Br.

Hemarthria compressa (L. f.) R. Br. Prodr. 207. 1810; Bor, Grass. Bur. Cey. India. Pak. 161. 1960; Guha Bakshi, Fl. Mur. Dist. 394. 1984.
Rottboellia compressa L. f. Suppl. 114. 1781; Fl. Brit. India 7 : 153. 1897; Beng. Pl. 2 ; 1192. 1903; Bot. Bihar & Orissa 6 : 1061. 1924.
R. glabra Roxb., Fl. India 1 : 353. 1820.
Hemarthria coromandelina Steud., Sys. Pl. Glum. 1 : 358. 1854.

Annual; stem usually creeping. Leaves 8.0-10.0 cm long, very weak, linear-lanceolate, acute, glabrous, upper dotted; sheath smooth. Inflorescence racemes, 6-10 cm long; Spikelets similar, pressed to the rachis which is often hollowed, very tough, two types - sessile and pedicillate; sessile spikelets 0.4-0.45 cm long, lowest glume 7-9 nerved, upper 3-5 nerved; lowers florets reduced to lemma , upper bisexual, acute; lower glume of the sessile spikelet constricted suddenly at the apex into a very blunt bifid point, 4-5 cm long.

Fl. & Frt. : June - October.

SPECIMEN CITED : Englishbazar, 21. 06. 1992, *Das et Acharyya* 013.

LOCAL DISTRIBUTION : Occational with paddy; Englishbazar, Gazole, Kaliachak.

GENERAL DISTRIBUTION : Throughout the hotter parts of India, Sri Lanka, Burma and Malaysia.

PASPALUM L.

Paspalum scrobiculatum L., Mant. 1 : 29. 1767; Fl. Brit. India 7 : 10. 1896; Beng. Pl. 2 : 1182. 1903; Bot. Bihar & Orissa 5 : 1000. 1924; Bor, Grass. Bur. Cey. India Pak. 340. 1960; Guha Bakshi, Fl. Mur.Dist. 403. 1984.
P. orbiculata G. Forster, Fl. Brit. India Insul. Austr. Prodr. 7. 1786; Bor, Grass. Bur. Cey. India Pak. 340. 1960.
P. commersonii Lamk., Tab. Ency. Meth. Bot. 1 : 175. 1791; Bor, Grass. Bur. Cey. India Pak. 335. 1960.
P. longifolium Roxb., Fl. India 1 : 283. 1820; Bor, Grass. Bur. Cey. India Pak. 339. 1960.

LOCAL NAME : Dal-ghasa.

Annual, tufted, erect or ascending herbs. Lamina linear, acuminate, glabrous, margins papillate; sheath compressed, glabrous. Inflorescence of 2-6 spikes, closely placed together; rachis flattened; spikelets in two rows, elliptic to ovate; lower glume 0; upper glume 3-5 nerved; lower lemma membranous; upper floret bisexual, lemma nearly rounded, edges slightly inflexed, shining; stamens 3. Caryopsis ovoid or globose, biconvex, ca. 0.2 cm long.

FL. & FRT. : July - March.

SPECIMEN CITED : Kaliachak, 17.06.1992, *Das et Acharyya* 017.

LOCAL DISTRIBUTION : Abundant with paddy, pulses, mustered and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : South East Asia to Polynesia and Australia.

SACCIOLEPIS Nash.

Sacciolepis myosuroides (R.Br.) A. Camus in lecomte, Fl. Brit. India Gen. de l Indo-China 7 : 460. 1922; Bot. Bihar & Orissa 5 : 990. 1924; Bor, Grass. Bur. Cey. India Pak. 357. 1960; Enu. Fl. Pl. Nep. 1 : 145. 1978.
Penicum myosuroides R.Br. Prodr. 189. 1810; Fl. Brit. India 7 : 41. 1896; Beng. Pl. 2 : 1179. 1903.

Annual herbs, culms terete, upto 60.0 cm tall, simple or branched. Lamina narrow, linear, usually glabrous, margin scabrous; sheath compressed, striate; ligule very short,

membranous. Inflorescence a narrow cylindric penicle, ca. 12.0 cm long, dense; rachis scabrous; spikelets elliptic, ca. 0.2 cm long; lower glume ovate, 3-nerved, upper glume elliptic, 5-9 nerved; lower lemma empty, upper lemma white, shining; stamens 3. Caryopsis elliptic-oblong, ca. 0.3 cm long.

Fl. & Frt. : August - February.

SPECIMEN CITED : Old Malda, 09.08.1993, *Das et Acharyya* 078.

LOCAL DISTRIBUTION : Occational with paddy and in intercrop flora; Old Malda, Englishbazar, Kaliachak, Gazole.

GENERAL DISTRIBUTION : Tropics of Asia and Australia.

PONTEDERIACEAE Kunth.

MONOCHORIA Presl.

Monochoria vaginalis (N. Burn.) Presl., Reliq. Haenk. 1 : 128. 1827; Fl. Brit. India 6 : 363. 1892; Beng. Pl. 2 : 1079. 1903; Bot. Bihar & Orissa 6 : 1101. 1924; Ramam. in Saldanha & Nocolson, Fl. Brit. India Hassan Dist. 791. 1976.
Pontederia vaginalis N. Burn. Fl. India 80. 1768.
P. plantaginea Roxb., Fl. India 2 : 123. 1832.
P. vaginalis var. *plantaginea* (Roxb.) Solms in A. & C. DC., Monogr. Phan. 4 : 524. 1883; Fl. Brit. India 6 : 363. 1892.

LOCAL NAME : Kachu.

An aquatic herbs; root stock short, suberect. Lamina ca. 5.0-8.0 x 2.0-4.5 cm, lanceolate-ovate, entire, 5-nerved; petiole ca. 20.0 cm long. Tepals 6, petaloid, blue; stamens 6, one larger than the rest, anthers basifixed; ovary 3-locular; ovules many. Capsule oblong.

Fl. & Frt. : July - January.

SPECIMEN CITED : Chanchal, 01.07.1992, *Das et Acharyya* 026.

LOCAL DISTRIBUTION : Frequent with paddy and in intercrop flora; throughout the district.

GENERAL DISTRIBUTION : Throughout India, Bangladesh, Sri Lanka, Malay Islands, China, Japan and Tropical Africa.

3.3 RESULT AND DISCUSSION

A wholistic picture of the weed flora for the district of Malda, situated at the central part of the state of West Bengal, has been emerged from the present four years long Survey of different types of crop fields in the district during the period 1992 to 1996. The survey included crops like paddy, mustard, linseed and pulses (musur and gram) - the total period of cultivation which covers all months of the year. Weeds with crops and from the intercrop fields were collected at random for the preparation of weed flora and by quadrate sampling for the determination of different phytosociological characters of its floristic elements.

3.3.1 RICHNESS OF THE FLORA

The survey has recorded 132 species of weeds which included 2 pteridophytes, 93 species of dicotyledons (under 74 genera and 37 families) and 37 species of monocotyledons (under 23 genera of 7 families). A previous survey of weeds in this district, as a part of the survey in the entire state of West Bengal, from the department of Agricultural Engineering, Indian Institute of Technology, Kharagpur (Hara and Tripathi, 1985), has recorded only 40 species of plants. So, the present survey (Acharyya *et al*,1997) has recorded more than three times of the previous record. The number of weeds may increase to some extent, if fields of all other crops in the district are also surveyed. But, the present survey has covered a large area and have studied the fields of major crops in the district and in all major seasons of the year.

Majumder (1962) has recorded 344 species of weeds from the district of 24-paraganas (North and South) in the southernmost part of West Bengal. This rich weed flora is probably due to the extreme variation in habitat structure in different parts of the district, method of cultivation, less weeding practices, more and wide range of precipitation, much larger area etc. This survey has also recorded weeds from road side areas and from the fields left uncroped for a long time. Another factor is also very important, the fields are mostly used for single crop in a year i.e. weeds are getting much wide period for the migration into the crop-field.

On the other hand, vast fields of Chinsurah Rice Research Station in the Hoogly District (adjacent to 24-paraganas) of West Bengal hosts only 57 species (Paul and Bhattacharyya, 1959). Though the survey also included road side areas, fallow lands but the fields remain engaged throughout the year. The total area, much less variation in habitat structure, round the year engagement of fields and weeding practices might be the reasons for the occurrence of such less weeds. Earlier Chakraborty (1957) surveyed the paddy fields of Chinsurah, Bakura and Suri State Agricultural Farms (in West Bengal) during 1938-40

and recorded 87 weed species. Long back in 1905 Prain surveyed the flora of Hoogly district and listed about 30 species occurring as weeds in paddy-fields.

So, the record of 132 species of crop field weeds from the district of Malda is quite significant though the total area is much less, most of the fields are cultivated round the year, climate is quite dry with low and narrowly distributed precipitation, regular practice of weeding, etc. Another factor is also very important, the first growth of crop plants thickly cover the entire soil surface which also restrict the growth of weed species.

3.3.2 TAXONOMIC DISTRIBUTION OF WEEDS

The recorded 132 species of weeds (excluding 2 pteridophytes) comes under 97 genera and 44 families of angoisperms (Table 5.1). Dicotyledonous plants are represented by 93 species (covering 74 genera and 37 families) and Monocotyledonous with 37 species (covering 23 genera and 7 families). Dicotyledonae is much bulky taxon than Monocotyledonae and the occurrence of more representative of the bulky taxon is very natural. But further analysis (Table 5.1) shows that Poaceae (18 species) is the best represented family in the present flora with Cyperaceae (11 species) occupying the third position. Again, like Poaceae, Asteraceae is also a very advanced family, dominated by herbaceous plants and generally very prominent in all floras. Here too, Asteraceae occupied the second position with its 15 species of weeds.

Analysis of some other weed floras (Table 3.1) also substantiate this observation. Chakravarty (1957) recorded the dominance of these three families in a slight different sequence: Cyperaceae(15 species), Poaceae (13 species) and Asteraceae (9 species). In Majumdar's (1962) weed flora of 24-paraganas this same set occupying the first three with a slight shift in their position : Poaceae and Cyperaceae both are represented by 54 species and Asteraceae is with 28 species.

Sharma (1978, 1981, 1983) prepared the weed flora of the state of Punjab in the Northern Part of India. Here too, Poaceae occupied the first position with 28 species but the second position is occupied by Papilionaceae (24 species) and Asteraceae (14 species) is in the third position. Cyperaceae with its 6 species has been shifted to the fifth position.

Neogi and Rao (1979) prepared the weed flora of Khasi Hills, Meghalaya (Eastern part of India). They also observed the dominance of Poaceae, Asteraceae and Cyperaceae in a similar sequence with the present work. Poaceae occupied the top position with 39 species followed by Asteraceae with 17 species and Cyperaceae with 8 species.

Table 3.3.1 : Five most successful families in different Weed floras.

Position	Present Work	24-paraganas (Majumder 1962)	Chinsurah, Suri & Bakura (Chakrabarty 1957)	Khasi Hills (Neogi & Rao 1979)	Punjab (Sharma 1978, '81,'83)
1	Poaceae	Cyperaceae & Poaceae	Cyperaceae	Poaceae	Poaceae
2	Asteraceae	Asteraceae	Poaceae	Asteraceae	Papilionaceae
3	Cyperaceae	Fabaceae	Asteraceae	Cyperaceae	Asteraceae
4	Euphorbiaceae	Scorphulariaceae	Leguminoceae	Lamiaceae	Euphorbiaceae
5	Scorphulariaceae & Amaranthaceae	Euphorbiaceae	Scorphulariaceae	Polygonaceae	Cyperaceae

So, the adaptation of the members of Poaceae as weeds is most effective. Grasses are successful almost in all the floras (Table 3.3.1) and their success in propagation is well understood. Broadness in ecological amplitude, methods of propagation,, development of apomictic embryo etc. are some reasons for their success.

The success of two other top families Asteraceae and Cyperaceae as contributors to weed flora of a region also are almost parallel to Poaceae. Both the families are cosmopolitan in distribution, produce easily dispersible small seeds, show wide ecological amplitude, production of numerous vegetative propagules, etc. are behind their success. Presence of awn and other spiny or hairy structures with the fruit (provided on special covering formed by bracts or glumes) and various types of pappi and the cypsella of Asteraceae help either to get themselves attached to the body of the migratory animals or help them for wind dispersal. The dry glume also help them for aquatic dispersal and can provide mechanical and physiological support for their protection. The wide flowering and fruiting period of many of these weeds, probably, are also helping them to be successful weed.

However other successful weed families include Scorphulariaceae, Euphorbiaceae, Acanthaceae, Amarathaceae, Eriocaulonaceae etc. When weedy members of Scorphulariaceae and Eriocaulonaceae prefer mainly moist or aquatic habitat, members of Fabaceae and Acanthaceae contribute both terrestrial and aquatic weeds, but families like Euphorbiaceae, Amaranthaceae etc. contribute mostly terrestrial weeds.

Analysing weeds at the generic level shows that in the weed flora of Malda *Cyperus* contributed the highest number of six species (*C. compressus, C. difformis, C. iria, C. kyllinga, C. rotundus and C. tegetiformis*) followed by *Lindernia, Digitaria and Eragrostis* each with four species. The fifth position is occupied by four genera *Hygrophila, Euphorbia, Phyllanthus* and *Hedyotis* with three species each. So, out of the first four genera, except *Lindernia*, three belong to Glumiflorae (Poan and Cyperean). This observation also repeats the observation of the family level. Recorded weed genera of Asteraceae are represented by one or two species only. So, this family is represented not by many species for a few successful genera but few species for many successful genera.

This indicates that their is a higher genetic diversity among the members of Asteraceae in the weed flora of Malda.

A look into the distribution of different species recorded under the first four dominant genera i.e. *Cyperus, Lindernia, Digitaria* and *Eragrostis* shows that all are widely distributed. Majority of them either cosmopolitan or pantropic in distribution and other are of very wide regional distribution. Their is not a single species with restricted distribution or an introduced element. The distribution of most of the other recorded weeds are also very wide (chapter 3). Many of them are cosmopolitan or pantropic weeds and numerous are with wide distribution at least in tropical areas.

As it has already been discussed, weedy species are generally with quite wide in their distribution but there are some elements which are rare plants though basically with wide distribution. *Cochleria cochlearioides* (Brassicaceae), *Dichondra repens* (Convolvulaceae) and *Asphodelus temifolius* (Liliaceae) recorded as weed in the crop fields of Malda District are very sparsely distributed in different floras. Probably the seeds of *C. cochleroides* remain mixed with the seeds of mastered and linseed, so the species is found only with these two crops and never out side the cultivated area. On the other hand *A. temifolius* and *D. repens* grow like naturally occurring plants but are very rare.

Orobanche aegyptiaca (Orobanchaceae), a total root parasite is quite frequent in Rabi season. This species was known to grow on some crops like tobacco, mustard and other cultivated species of *Brassica*, Tomato, Brinjal and some other related crops. During the present survey the parasite was found in association with a new crop i.e. *Cicer arietinum*. In addition another eight new hosts for the parasite have also been recorded from the district of Malda which are *Argemone maxicana* (Papaveraceae), *Digitaria ciliaris* (Poaceae), *Fumaria indica* (Fumariaceae), *Launea asplenifolia* (Asteraceae), *Leucas indica* (Lamiaceae), *Oxalis corniculata* (Oxalidaceae), *Polygonum plebeium* (Polygonaceae) and *Vernonia cinerea* (Asteraceae). This is for the first time so many wild hosts for the species have been recorded and among these hosts *Digitaria ciliaris* deserves special mention because it is the only monocotyledonous hosts recorded so far for the species. This species may be treated as a difficult weed because it parasitises on a large number Rabi crops and the species is not visible before the emergence of scape when the crop plants are quite mature and dense, and its manual eradication is almost impossible. At the time of harvesting the parasite has almost completed its out of seed dispersal. It Produces innumerable seeds in each fruit and the seeds are minute like dust particles (ca. 0.01 cm in diameter).

3.3.3 EXOTIC WEEDS

Now a days exotic elements are very common almost in all floras in the world and this is due to the migration of man to different corners of the world. During migration and to

satisfy their various types of desire man generally introduce a large number of weeds to a region. Many of these plants used to get escape, naturalize subsequently and behave like natural elements of the local flora.

Voigt (1845) was the first botanist to recorded exotic weeds in India. Subsequently many other recorded exotics along with local species of weeds in Bengal which include Prain 1903a, 1903b, 1905; Bruhl, 1908; Datta and Biswas, 1973; Dutta and Mitra, 1961; Maity and Hore, 1978; Mukherjee, 1969; Das and Chanda, 1987; Guha Bakshi,1974; Mukherjee, 1965.

The present flora is no exception. As much as 20 species of plants (15.2%) have been recognised as naturalised exotics from the weed flora of Malda District which are *Argemone mexicana, Alternanthera philoxeroides, Ageratum houstonianum, Croton bonplandianum, Phyllanthus amarus, Malachra capitata, Nicotiana plumbaginifolia, Scoparia dulcis, Gnaphalium purpureum, Parthanium hysterophorus, Macardonia procumbens, Lathyrus aphaca, Medicago lupulina, Vicia angustifolia, Anagallis arvensis, Celosia argentea, Fimbristylis miliacea, Digitaria longiflora, D. ciliaris, Desmostachya bipinnata.* Out of these 20 species, there are 11 species (8.3%) American (Central and South), 4 species (3.0%) South East Asiatic, 4 species (3.0%) Eurasian and 1 species (0.8%) African in origin. Some of these weeds are quite dominating and species like *Alternanthera philoxeroides, Vicia angustifolia, Argemone mexicana, Nicotiana plumbaginifolia, Celosia argentea* etc. are found almost every where in the district. Again most of these exotic weeds grow mainly during Rabi and Boro seasons though there are some plants which grow either during warm seasons or round the year. *Scoparia dulcis* is a perennial rigid and short height herb.

CHAPTER - 4

PHYTOSOCIOLOGY

PHYTOSOCIOLOGY

Generally a number of species grow together in a vegetation and in a balanced vegetation they maintain a beautiful association or in other words they live in a harmonious society But, if one or more members of the society try to dominate, that will be, certainly, in expense of the interest of other members of the society. Fortunately or unfortunately most of the associations or societies found in nature are of the second type where some species dominate over others. The consequence of domination leads to many other developments e.g.(i) siphoning of major parts of available nutrition by the dominants(ii) they also receive more sunlight by covering or shadowing other species (iii) species feeling uncomfortable will disappear from the vegetation (iv) some new shade lover species(sciophytes)may enter in the vegetation (v) in general it leads to the decrease of number of species in the vegetation etc. The process will continue to produce a vegetation with one or few dominant species and some other associated plants in its different strata.

The situation is of completely different nature in cultivated fields where the structure of the original vegetation of the area have been intentionally eliminated by man (a third force) in his own interest. For the cultivation of a particular species the soil of the area have been modified and the growth of naturally occurring species were suppressed forcefully. These unwanted plants were termed as weeds. But, for the benefits of cultivation weeds are killed or cleaned by different method. Again, like a natural vegetation, there should have competition not only between the crop plant and the weeds but also between different species of weed growing in a field.

It is now important to know the distribution pattern of different species of weeds within the total weeds population. Any scientific method of weeding program can be formulated or decided only after knowing the basic information about the density, frequency and dominance of different members of a weed flora.

Different kinds of such information can be collected through phytosociological studies. Phytosociology or plant sociology can be defined as 'the science of plant communities or the knowledge of vegetation in the widest sense, includes all phenomena which touch upon the life of plants in social unites'.

But, it depends on the interest or need that the criteria are to be incorporated in such studies. In the present work, with a view to determine the important species of weeds. Relative Dominance, Relative Frequency, and Relative Density have been worked out, which together will produce the importance value index.

The methodology following for this work has been described under the chapter 2.2 using 180 random quadrates each for three years during the survey period of 1992 to 1995. Sampling was done at random and all the quadrates were of 1m x 1 m in size. This size is

generally used as a standard for survey of ground covering vegetation (Misra 1966; Neogi and Rao 1980; Malhotra 1973; Das and Lahiri 1997).

4.1 RESULT AND DISCUSSION

The phytosociological survey of crop field weeds in the district of Malda during June 1992 to May 1995 have recorded 61 species of higher plants from a total of 180 quadrates each for three years. Data from different quadrates of each 'Police Station' or Thana' studied during different seasons in each year, have been presented in tables (4.1-4.9). The Relative Density (RD), Relative Frequency(RF), Relative Dominance (RDm) and Importance Value Index (IVI) of those species have been worked out and were presented in tables (4.10-4.18). The number of weed species vary in different seasons and also in different 'Thanas'.

The survey recorded 28 species in Aman crop (Paddy),35 species in Rabi crop (Pulses, Mustard and Tishi) and 18 species in Boro crop (Paddy), throughout the district. Quadrate study reveal very little variation in respect of number of species (Table 4.1-4.9).

4.1.1 WEEDS IN AMAN

A total of 28 species of weeds have been recorded from the fields of Aman Paddy. Of which, the highest number of species have been recorded in 'Kaliachak' (56.6%) followed by 'Old Malda' and 'Habibpur' (55.4% each), and on the other hand 'Gazole' recorded the lowest (33.7%).The highest number of individuals have been recorded is 4047 during 1992 and the largest area of 68736 cm^2 have been covered by weeds during 1993 (Table 4.10 - 4.12). *Ludwigia perennis* appeared to be the most frequently available species with RF value 78.33% and is followed by *Cyperus rotundus* (62.08%), *Echinochloa colona* (61.67%), *Tonningia axillaris* (58.75%), *Cynodon dactylon* (53.75%) etc. *Mudannia nudiflora* has been recorded with highest number of individual i.e. RD values (10.44%) and the followers were *Ludwigia perennis* (8.86%), *Marsilea quadrifida* (7.74%) *Cyperus difformis* (7.48%), *Fimbristylis miliacea* (6.97%)etc. The pteridophytic plant *Marsilea quadrifida* has been recorded with highest area covered i.e. RDm value (10.84%), followed by *Murdannia nudiflora* (9.92%), *Fimbristylis dichotoma* (9.20%),*Ludwigia perennis* (8.82%), *Echinochloa colona* (8.29%)etc. The determined IVI value revealed that *Ludwigia perennis* is the most important weed of Aman with IVI (96.01), followed by *Cyperus rotundus* (75.42),*Echinochloa colona* (74.57),*Marsilea quadrifida* (67.75),*Tonningia axillaris* (67.39), *Cynodon dactylon* (62.54), *Fimbristylis dichotoma* (62.42),*Murdannia nudiflora* (59.11),*Alternanthera sessilis* (57.84),*Cyperus*

Table 4.1: Phytosociological characters of Weeds of the district of Malda (Thana wise) during Aman season 1992

[for data in other Thanas this table is continued laterally in 4.1.A]

THANA ⇒	Gazole			Kaliachak			Habibpur			Harischandrapur			Chanchal		
WEEDS ⇓	NQ	NI	AC (cm^2)	NQ	NI	AC (cm^2)	NQ	NI	AC (cm^2)	NQ	NI	AC (cm^2)	NQ	NI	AC (cm^2)
1. *Alternanthera philoxeroides*	-	-	-	-	-	-	4	5	63	-	-	-	-	-	-
2. *A. sessilis*	-	-	-	6	57	570	9	29	324	-	-	-	-	-	-
3. *Biophytum sensitivum*	-	-	-	5	50	648	-	-	-	-	-	-	-	-	-
4. *Brachiaria reptans*	-	-	-	4	29	689	-	-	-	-	-	-	-	-	-
5. *Caesulia axillaris*	-	-	-	-	-	-	-	-	-	8	85	431	8	56	403
6. *Celosia argentea*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7. *Cynodon dactylon*	9	65	298	6	9	157	-	-	-	3	5	23	6	14	84
8. *Cyperus difformis*	-	-	-	-	-	-	7	22	495	6	184	2277	5	29	451
9. *C. iria*	-	-	-	-	-	-	5	5	200	-	-	-	5	6	266
10. *C. rotundus*	6	11	517	7	11	155	-	-	-	5	8	294	5	8	294
11. *Dichondra repens*	-	-	-	4	9	356	-	-	-	-	-	-	-	-	-
12. *Digera muricata*	-	-	-	5	14	375	-	-	-	-	-	-	-	-	-
13. *Echinochloa colona*	-	-	-	6	18	682	7	11	785	2	2	110	5	8	253
14. *Eclipta alba*	-	-	-	-	-	-	-	-	-	2	2	52	3	3	32
15. *Euphorbia indica*	-	-	-	-	-	-	-	-	-	2	2	10	2	2	13
16. *Fimbristylis dichotoma*	-	-	-	6	11	1406	8	11	566	6	121	1538	7	75	981
17. *Hemarthria compressa*	9	68	1081	-	-	-	-	-	-	-	-	-	-	-	-
18. *Ludwigia adscendens*	9	149	937	-	-	-	4	11	112	8	152	454	5	32	107
19. *L. perennis*	9	45	1237	-	-	-	7	13	748	8	65	867	7	38	304
20. *Marsilea quadrifida*	-	-	-	5	52	278	7	90	5693	7	72	301	8	74	341
21. *Monochoria vaginalis*	-	-	-	-	-	-	6	7	569	-	-	-	-	-	-
22. *Murdannia nudiflora*	-	-	-	5	38	695	6	40	647	-	-	-	-	-	-
23. *Paspalum scrobiculatum*	8	45	877	6	20	481	9	63	1080	-	-	-	-	-	-
24. *Phyllanthus fraternus*	-	-	-	4	76	1007	-	-	-	-	-	-	-	-	-
25. *P. virgatus*	-	-	-	5	40	320	-	-	-	-	-	-	-	-	-
26. *Sagittaria guyanensis*	-	-	-	-	-	-	5	5	153	3	3	93	2	2	66
27. *Tonningia axillaris*	9	34	1097	5	13	521	4	11	440	-	-	-	-	-	-

Contd. to Table 4.1.A

Table 4.1.A : [lateral continuation of the Table 4.1]

	Ratua			Manikchak			Old Malda			Englishbazar			Bamongola			TOTAL		
Sl. No.	NQ	NI	AC (cm^2)	NQ	NI	AC (cm^2)	NQ	NI	AC (cm^2)	NQ	NI	AC (cm^2)	NQ	NI	AC (cm^2)	NQ	NI	AC (cm^2)
1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	16	5	6	79
2	5	42	318	5	11	196	-	-	-	6	14	109	6	18	206	37	171	1723
3	-	-	-	-	-	-	5	6	87	-	-	-	-	-	-	10	56	735
4	-	-	-	-	-	-	4	40	440	-	-	-	-	-	-	8	69	1129
5	6	27	311	8	73	549	-	-	-	-	-	-	-	-	-	30	241	1694
6	-	-	-	-	-	-	6	55	1156	2	2	53	-	-	-	8	57	1209
7	2	18	64	-	-	-	7	27	189	7	106	676	-	-	-	40	244	1491
8	3	18	591	6	35	531	-	-	-	-	-	-	6	10	230	33	298	4575
9	-	-	-	5	5	225	-	-	-	-	-	-	3	4	136	18	20	827
10	-	-	-	7	16	635	6	75	1337	7	122	840	4	6	284	47	257	4356
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	9	356
12	-	-	-	-	-	-	6	14	400	-	-	-	-	-	-	11	28	775
13	5	14	1009	8	41	1228	7	77	704	-	-	-	5	10	611	45	181	5382
14	-	-	-	8	67	601	5	10	279	-	-	-	-	-	-	18	82	964
15	-	-	-	-	-	-	4	6	122	4	8	153	-	-	-	12	18	298
16	6	56	1416	-	-	-	-	-	-	-	-	-	3	4	227	36	278	6134
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	68	1081
18	2	14	57	-	-	-	-	-	-	-	-	-	-	-	-	28	358	1667
19	6	24	706	6	17	119	4	6	62	7	119	1068	6	11	544	60	338	5655
20	6	38	505	-	-	-	-	-	-	-	-	-	6	45	210	39	371	7328
21	-	-	-	-	-	-	-	-	-	-	-	-	1	1	131	7	8	700
22	-	-	-	-	-	-	7	288	4608	7	15	84	5	29	489	30	410	6523
23	6	13	371	-	-	-	-	-	-	-	-	-	5	10	613	34	151	3422
24	-	-	-	8	10	183	6	31	796	6	11	424	-	-	-	24	128	2410
25	-	-	-	-	-	-	4	18	177	-	-	-	-	-	-	9	58	497
26	-	-	-	-	-	-	-	-	-	7	20	506	1	1	43	18	31	861
27	7	21	663	8	18	544	3	4	177	-	-	-	5	10	121	41	111	3563
																	4047	65434

Table 4.2 : Phytosociological characters of Weeds of the district of Malda (Thana wise) during Aman season 1993

[for data in other thanas this table is continued laterally in 4.2.A]

THANA ⇒	Gazole			Kaliachak			Habibpur			Harischandrapur			Chanchal		
WEEDS ⇓	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)
1. *A. philoxeroides*	-	-	-	-	-	-	3	4	55	-	-	-	-	-	-
2. *Alternanthera sessilis*	3	7	91	8	54	582	8	22	265	-	-	-	-	-	-
3. *Biophytum sensitivum*	-	-	-	7	57	741	-	-	-	-	-	-	-	-	-
4. *Brachiaria reptans*	-	-	-	4	28	644	-	-	-	-	-	-	-	-	-
5. *Caesulia axillaris*	-	-	-	-	-	-	-	-	-	8	84	547	8	51	476
6. *Celosia argentea*	-	-	-	1	3	75	-	-	-	-	-	-	-	-	-
7. *Cynodon dactylon*	9	63	315	7	10	170	-	-	-	4	9	95	6	17	171
8. *Cyperus difformis*	-	-	-	-	-	-	8	27	453	5	163	2354	6	34	547
9. *C. iria*	-	-	-	-	-	-	5	7	205	-	-	-	5	5	262
10. *C. rotundus*	7	15	648	7	12	219	2	2	37	5	10	312	6	9	318
11. *Dichondra repens*	-	-	-	4	5	311	-	-	-	-	-	-	-	-	-
12. *Digera muricata*	-	-	-	5	17	476	-	-	-	-	-	-	-	-	-
13. *Echinochloa colona*	3	5	69	6	18	676	7	14	826	3	5	158	6	11	264
14. *Eclipta alba*	-	-	-	-	-	-	-	-	-	4	5	79	4	5	85
15. *Euphorbia hirta*	2	3	52	-	-	-	4	9	126	2	3	36	-	-	-
16. *E. indica*	-	-	-	-	-	-	-	-	-	3	4	55	3	3	39
17. *Fimbristylis dichotoma*	-	-	-	5	12	1428	9	11	569	6	127	1541	7	69	993
18. *Hemarthria compressa*	9	64	1054	-	-	-	-	-	-	-	-	-	-	-	-
19. *Ludwigia adscendens*	7	102	647	-	-	-	2	3	21	6	49	693	5	23	81
20. *L. perennis*	9	52	1289	-	-	-	8	15	784	8	74	987	8	53	453
21. *Marsilea quadrifida*	2	3	36	6	38	308	6	71	5476	7	41	281	7	57	287
22. *Monochoria vaginalis*	-	-	-	-	-	-	6	8	571	-	-	-	-	-	-
23. *Murdannia nudiflora*	-	-	-	6	41	734	6	43	684	-	-	-	-	-	-
24. *Paspalum scrobiculatum*	8	46	864	6	23	460	8	57	832	-	-	-	-	-	-
25. *Phyllanthus fraternus*	-	-	-	5	72	978	-	-	-	-	-	-	-	-	-
26. *P. virgatus*	-	-	-	5	43	387	-	-	-	-	-	-	-	-	-
27. *Sagittaria guyanensis*	-	-	-	-	-	-	4	5	147	3	4	114	2	2	67
28. *Tonningia axillaris*	9	38	1183	6	14	573	6	14	448	-	-	-	-	-	-

Continued to Table 4.2.A

Table 4.2.A : [lateral continuation of the Table 4.2]

	Ratua			Manikchak			Old Malda			Englishbazar			Bamongola			TOTAL		
Sl. No.	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	4	55
2	6	51	462	6	14	199	-	-	-	6	17	179	7	22	227	44	187	2005
3	-	-	-	-	-	-	6	10	112	3	6	62	-	-	-	16	73	915
4	-	-	-	-	-	-	5	35	408	-	-	-	-	-	-	9	63	1052
5	6	21	235	8	69	521	-	-	-	-	-	-	-	-	-	30	225	1779
6	-	-	-	-	-	-	7	59	1193	3	4	93	-	-	-	11	66	1361
7	4	15	87	3	5	83	7	26	226	7	105	819	-	-	-	47	250	1966
8	2	17	434	6	31	507	3	8	134	-	-	-	6	13	224	36	293	4653
9	-	-	-	4	5	232	-	-	-	-	-	-	2	3	121	16	20	820
10	-	-	-	7	18	649	7	73	1343	7	127	883	5	7	297	53	273	4706
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	5	311
12	-	-	-	-	-	-	6	13	426	-	-	-	-	-	-	11	30	902
13	6	13	1029	8	37	1273	7	63	821	1	2	48	6	15	636	53	183	5800
14	-	-	-	8	63	734	5	9	277	1	1	41	-	-	-	22	83	1216
15	5	7	120	-	-	-	3	4	72	2	4	76	3	4	95	21	34	577
16	-	-	-	-	-	-	5	7	139	5	9	180	-	-	-	16	23	413
17	7	58	1433	-	-	-	-	-	-	-	-	-	4	5	239	38	282	6203
18	-	-	-	-	-	-	-	-	-	-	-	-	1	1	31	10	65	1085
19	2	7	31	-	-	-	-	-	-	-	-	-	-	-	-	22	184	1473
20	7	27	746	5	17	137	5	5	80	7	116	1057	7	13	562	64	372	6095
21	6	32	513	-	-	-	-	-	-	1	1	28	6	30	228	41	273	7157
22	-	-	-	-	-	-	-	-	-	-	-	-	1	2	152	7	10	723
23	-	-	-	-	-	-	7	283	4591	6	21	254	7	33	483	32	421	6746
24	6	11	398	-	-	-	-	-	-	-	-	-	4	10	562	32	147	3116
25	-	-	-	8	13	213	6	34	763	5	9	402	-	-	-	24	128	2356
26	-	-	-	-	-	-	5	15	178	-	-	-	-	-	-	10	58	565
27	-	-	-	-	-	-	-	-	-	7	18	485	-	-	-	16	29	813
28	8	27	678	7	18	540	4	7	229	6	8	104	5	9	118	51	135	3873
																	3916	68736

Table 4.3 : Phytosociological characters of Weeds of the district of Malda (Thana wise) during Aman season 1994

[for data in other Thanas this table continued laterally in 4.3.A]

THANA ⇒	Gazole			Kaliachak			Habibpur			Harischandrapur			Chanchal		
WEEDS ⇓	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)
1. *Alternanthera philoxeroides*	-	-	-	-	-	-	3	5	60	-	-	-	-	-	-
2. *A. sessilis*	2	5	50	6	58	584	9	32	347	-	-	-	-	-	-
3. *Biophytum sensitivum*	-	-	-	7	61	792	-	-	-	-	-	-	-	-	-
4. *Brachiaria reptans*	-	-	-	5	32	693	-	-	-	-	-	-	-	-	-
5. *Caesulia axillaris*	-	-	-	-	-	-	-	-	-	8	87	636	7	55	401
6. *Celosia argentea*	-	-	-	1	3	64	-	-	-	-	-	-	-	-	-
7. *Cynodon dactylon*	9	59	312	6	10	156	-	-	-	3	6	128	5	16	107
8. *Cyperus difformis*	-	-	-	-	-	-	6	21	321	6	178	2423	6	36	551
9. *C. iria*	-	-	-	-	-	-	5	6	217	-	-	-	5	7	284
10. *C. rotundus*	7	13	536	7	8	149	1	2	25	4	7	287	6	8	304
11. *Dichondra repens*	-	-	-	4	8	352	-	-	-	-	-	-	-	-	-
12. *Digera muricata*	-	-	-	4	12	339	-	-	-	-	-	-	-	-	-
13. *Echinochloa colona*	2	2	31	7	16	592	7	13	785	3	4	129	5	8	248
14. *Eclipta alba*	-	-	-	-	-	-	-	-	-	2	3	47	4	4	61
15. *Euphorbia hirta*	2	4	68	-	-	-	3	7	98	1	1	19	-	-	-
16. *E. indica*	-	-	-	-	-	-	-	-	-	2	2	32	3	4	56
17. *Fimbristylis dichotoma*	-	-	-	5	12	1327	8	10	540	7	129	1546	7	61	1074
18. *Hemarthria compressa*	8	62	994	-	-	-	-	-	-	-	-	-	-	-	-
19. *Ludwigia adscendens*	5	92	515	-	-	-	1	3	18	8	131	413	4	27	90
20. *L. perennis*	9	50	1284	-	-	-	7	14	802	8	67	916	8	39	357
21. *Marsilea quadrifida*	-	-	-	5	36	295	7	77	5584	7	54	337	8	65	319
22. *Monochoria vaginalis*	-	-	-	-	-	-	6	6	543	-	-	-	-	-	-
23. *Murdannia nudiflora*	-	-	-	6	42	724	6	38	652	-	-	-	-	-	-
24. *Paspalum scrobiculatum*	7	40	856	6	39	718	8	52	818	-	-	-	-	-	-
25. *Phyllanthus fraternus*	-	-	-	4	73	976	-	-	-	-	-	-	-	-	-
26. *P. virgatus*	-	-	-	5	42	331	-	-	-	-	-	-	-	-	-
27. *Sagittaria guyanensis*	-	-	-	-	-	-	5	7	167	3	4	103	2	2	72
28. *Tonningia axillaris*	9	35	1123	5	11	495	5	13	460	-	-	-	-	-	-

Contd. to Table 4.3.A

Table 4.3.A : [lateral continuation of Table 4.3]

	Ratua			Manikchak			Old Malda			Englishbazar			Bamongola			TOTAL		
Sl. No.	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	5	60
2	5	44	449	5	9	158	-	-	-	6	15	176	7	23	235	40	186	1999
3	-	-	-	-	-	-	5	8	105	2	5	56	-	-	-	14	74	953
4	-	-	-	-	-	-	4	39	458	-	-	-	-	-	-	9	71	1151
5	6	29	214	7	68	497	-	-	-	-	-	-	-	-	-	28	239	1748
6	-	-	-	-	-	-	6	54	1161	3	4	89	-	-	-	10	61	1314
7	4	13	53	1	2	29	7	30	205	7	101	866	-	-	-	42	237	1856
8	2	14	257	6	37	570	1	2	31	-	-	-	5	10	174	32	298	4327
9	-	-	-	4	6	240	-	-	-	-	-	-	3	3	133	17	22	874
10	-	-	-	6	18	619	7	73	1351	7	125	872	4	5	280	49	259	4423
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	8	352
12	-	-	-	-	-	-	7	14	418	-	-	-	-	-	-	11	26	757
13	5	13	1026	8	42	1269	7	73	803	1	1	31	5	12	594	50	184	5508
14	-	-	-	6	68	799	5	11	253	1	2	28	-	-	-	20	88	1188
15	5	6	102	-	-	-	2	2	31	1	2	37	1	1	30	15	23	385
16	-	-	-	-	-	-	4	5	117	3	9	174	-	-	-	12	20	379
17	5	51	1439	-	-	-	-	-	-	-	-	-	5	5	245	37	268	6171
18	-	-	-	-	-	-	-	-	-	-	-	-	1	2	38	9	64	1032
19	2	8	33	-	-	-	-	-	-	-	-	-	-	-	-	20	261	1069
20	7	25	739	6	15	103	5	6	82	7	111	1027	7	15	685	64	342	5995
21	6	24	526	-	-	-	-	-	-	1	1	25	4	21	223	38	278	7309
22	-	-	-	-	-	-	-	-	-	-	-	-	2	2	186	8	8	729
23	-	-	-	-	-	-	7	279	4615	7	24	287	5	26	409	31	401	6687
24	5	13	425	-	-	-	-	-	-	-	-	-	4	11	594	30	155	3411
25	-	-	-	8	11	207	6	28	724	5	12	483	-	-	-	23	124	2390
26	-	-	-	-	-	-	3	14	152	-	-	-	-	-	-	8	56	483
27	-	-	-	-	-	-	-	-	-	6	18	481	-	-	-	16	31	823
28	8	23	676	8	19	527	4	4	171	6	12	132	4	7	93	49	124	3677
																	3921	67050

Table 4.10 : Phytosociological characters of Weeds of the district of Malda during Aman Season 1992.

NAME OF WEED	PRESENCE			PHYTOSOCIOLOGICAL CHARACTERS			
	NQ	No. Indv.	Area covered (cm^2)	RF	RD	RDm	IVI
Alternanthera philoxeroides	5	6	79	06.25	0.15	0.12	06.52
Alternanthera sessilis	37	171	1723	46.25	4.23	2.63	53.11
Biophytum sensitivum	10	56	735	12.50	1.38	1.12	15.00
Brachiaria reptans	8	69	1129	10.00	1.70	1.73	13.43
Caesulia axillaris	30	241	1694	37.50	5.96	2.59	46.05
Celosia argentea	8	57	1209	10.00	1.41	1.85	13.26
Cynodon dactylon	40	244	1491	50.00	6.03	2.28	58.31
Cyperus difformis	33	298	4575	41.25	7.36	6.99	55.60
Cyperus iria	18	20	827	22.50	0.49	1.26	24.25
Cyperus rotundus	47	257	4356	58.75	6.35	6.66	71.76
Dichondra repens	4	9	356	05.00	0.22	0.54	5.76
Digera arvensis	11	28	775	13.75	0.69	1.18	15.62
Echinochloa colona	45	181	5382	56.25	4.47	8.23	68.95
Eclipta alba	18	82	964	22.50	2.03	1.47	26.00
Euphorbia indica	12	18	298	15.00	0.44	0.46	15.90
Fimbristylis dichotoma	36	278	6134	45.00	6.87	9.37	61.24
Hemarthria compressa	9	68	1081	11.25	1.68	1.65	14.58
Ludwigia adscendens	28	358	1667	35.00	8.85	2.55	46.40
Ludwigia perennis	60	338	5655	75.00	8.35	8.64	91.99
Marsilea quadrifida	39	371	7328	48.75	9.17	11.20	69.12
Monochoria vaginalis	7	8	700	08.75	0.20	1.07	10.02
Murdannia nudiflora	30	410	6523	37.50	10.13	9.97	57.60
Paspalum scrobiculatum	34	151	3422	42.50	3.73	5.23	51.46
Phyllanthus fraternus	24	128	2410	30.00	3.16	3.68	36.84
Phyllanthus virgatus	9	58	497	11.25	1.43	0.76	13.44
Sagittaria guyanensis	18	31	861	22.50	0.77	1.32	24.59
Tonningia axillaris	41	111	3563	51.25	2.74	5.45	59.44

* Total no of individual - 4047 ; Total area covered - 65434 cm^2;
Total number of quadrate - 80

Table 4.11 : Phytosociological characters of Weeds of the district of Malda during Aman Season 1993.

NAME OF WEED	PRESENCE			PHYTOSOCIOLOGICAL CHARACTERS			
	NQ	No. Indv.	Area covered (cm^2)	RF	RD	RDm	IVI
Alternanthera philoxeroides	3	4	55	3.75	0.10	0.08	3.93
Alternanthera sessilis	44	187	2005	55.00	4.78	2.92	62.70
Biophytum sensitivum	16	73	915	20.00	1.86	1.33	23.19
Brachiaria reptans	9	63	1052	11.25	1.61	1.53	14.39
Caesulia axillaris	30	225	1779	37.50	5.75	2.59	45.84
Celosia argentea	11	66	1361	13.75	1.69	1.98	17.42
Cynodon dactylon	47	250	1966	58.75	6.38	2.86	67.99
Cyperus difformis	36	293	4653	45.00	7.48	6.77	59.25
Cyperus iria	16	20	820	20.00	0.51	1.19	21.70
Cyperus rotundus	53	273	4706	66.25	6.97	6.85	80.07
Dichondra repens	4	5	311	5.00	0.13	0.45	5.58
Digera muricata	11	30	902	13.75	0.77	1.31	15.83
Echinochloa colona	53	183	5800	66.25	4.67	8.44	79.36
Eclipta alba	22	83	1216	27.50	2.12	1.77	31.39
Euphorbia hirta	21	34	577	26.25	0.87	0.84	27.96
Euphorbia indica	16	23	413	20.00	0.59	0.60	21.19
Fimbristylis dichotoma	38	282	6203	47.50	7.20	9.02	63.72
Hemarthria compressa	10	65	1085	12.50	1.66	1.58	15.74
Ludwigia adscendens	22	184	1473	27.50	4.70	2.14	34.34
Ludwigia perennis	64	372	6095	80.00	9.50	8.87	98.37
Marsilea quadrifida	41	273	7157	51.25	6.97	10.41	68.63
Monochoria vaginalis	7	10	723	08.75	0.26	1.05	10.06
Murdannia nodiflora	32	421	6746	40.00	10.75	9.81	60.56
Paspalum scrobiculatum	32	147	3116	40.00	3.75	4.53	48.28
Phyllanthus fratermus	24	128	2356	30.00	3.27	3.43	36.70
Phyllanthus virgatus	10	58	565	12.50	1.48	0.82	14.80
Sagitaria guyanensis	16	29	813	20.00	0.74	1.18	21.92
Tonningia axillaris	51	135	3873	63.75	3.45	5.63	72.83

* Total no of individual - 3916 ; Total area covered - 68736 cm^2;
Total number of quadrate - 80

Table 4.12 : Phytosociological characters of Weeds of the district of Malda during Aman Season 1994.

NAME OF WEED	PRESENCE			PHYTOSOCIOLOGICAL CHARACTERS			
	NQ	NO. Indv.	Area covered (cm^2)	RF	RD	RDm	IVI
Alternanthera philoxeroides	3	5	60	3.75	0.13	0.09	3.97
A. sessilis	40	186	1999	50	4.74	2.98	57.72
Biophytum sensitivum	14	74	953	17.50	1.89	1.42	20.81
Brachiaria reptans	9	71	1151	11.25	1.81	1.72	14.78
Caesulia axillaris	28	239	1748	35.00	6.10	2.61	43.71
Celosia argentea	10	61	1314	12.50	1.56	1.96	16.02
Cynodon dactylon	42	237	1856	52.50	6.04	2.77	61.31
Cyperus difformis	32	298	4327	40.00	7.60	6.45	54.05
Cyperus iria	17	22	874	21.25	0.56	1.30	23.11
Cyperus rotundus	49	259	4423	61.25	6.60	6.60	74.45
Dichondra repens	4	8	352	5.00	0.20	0.52	5.72
Digera muricata	11	26	757	13.75	0.66	1.13	15.54
Echinochloa colona	50	184	5508	62.50	4.69	8.21	75.40
Eclipta alba	20	88	1188	25.00	2.24	1.77	29.01
Euphorbia hirta	15	23	385	18.75	0.59	0.57	19.91
Euphorbia indica	12	20	379	15.00	0.51	0.57	16.08
Fimbristylis dichotoma	37	268	6171	46.25	6.83	9.20	62.28
Hemarthria compressa	9	64	1032	11.25	1.63	1.54	14.42
Ludwigia adscendens	20	261	1069	25.00	6.66	1.59	33.25
Ludwigia perennis	64	342	5995	80.00	8.72	8.94	97.66
Marsilea quadrifida	38	278	7309	47.50	7.09	10.90	65.49
Monochoria vaginalis	8	8	729	10.00	0.20	1.09	11.29
Murdannia nudiflora	31	409	6687	38.75	10.43	9.97	59.15
Paspalum scrobiculatum	30	155	3411	37.50	3.95	5.09	46.54
Phyllanthus fraturnus	23	124	2390	28.75	3.16	3.56	35.47
Phyllanthus virgatus	8	56	483	10.00	1.43	0.72	12.15
Sagittaria guyanensis	16	31	823	20.00	0.79	1.23	22.02
Tonningia axillaris	49	124	3677	61.25	3.16	5.48	69.89

* Total no of Individual-3921 ; Total area covered - 67050 cm^2;
Total number of quadrate - 80

Table 4.19 : Phytosociological characters of Weeds of the district of Malda (average for three years 1992 - 1994) during Aman season.

NAME OF WEEDS	RF	RD	RDm	IVI
Alternanthera philoxeroides	04.58	0.13	0.10	4.81
Alternanthera sessilis	50.42	4.58	2.84	57.84
Biophytum sensitivum	16.67	1.71	1.29	19.67
Brachiaria reptans	10.83	1.71	1.66	14.20
Caesulia axillaris	36.67	5.94	2.60	45.21
Celosia argentea	12.08	1.55	1.93	15.56
Cynodon dactylon	53.75	6.15	2.64	62.54
Cyperus difformis	42.08	7.48	6.74	56.30
C. iria	21.25	0.52	1.25	23.02
C. rotundus	62.08	6.64	6.70	75.42
Dichondra repens	05.00	0.18	0.50	05.68
Digera muricata	13.75	0.71	1.21	15.67
Echinochloa colona	61.67	4.61	8.29	74.57
Eclipta alba	25.00	2.13	1.67	28.81
Euphorbia hirta	22.50	0.73	0.71	23.94
E. indica	16.67	0.51	0.54	17.72
Fimbristylis dichotoma	46.25	6.97	9.20	62.42
Hemarthria compressa	11.67	1.66	1.59	14.92
Ludwigia adscendens	29.17	6.74	2.09	38.00
L. perennis	78.33	8.86	8.82	96.01
Marsilea quadrifida	49.17	7.74	10.84	67.75
Monochoria vaginalis	09.17	0.22	1.07	10.46
Murdannia nudiflora	38.75	10.44	9.92	59.11
Paspalum scrobiculatum	40.00	03.81	4.95	48.76
Phyllanthus fraternus	29.59	3.20	3.56	36.35
P. virgatus	11.25	1.45	0.77	13.47
Sagitaria guyanensis	20.83	0.77	1.24	22.84
Tonningia axillaris	58.75	3.12	5.52	67.39

difformis (56.30) etc.(Table 4.19). While *Echinochloa colona* has been recorded in all the 'Police Station' or 'Thana' areas and *Cyperus difformis, Cyperus rotundus, Fimbristylis dichotoma, Ludwigia perennis* have been recorded in majority of them. The most weeded 'Thana' has been recorded as Habibpur followed by Old Malda and Kaliachak (Table 4.1 - 4.3).Out of the ten most important weed species, though *Ludwigia perennis* occupied the top position, there are seven monocotyledonous again five of which are either grass or sedges.

4.1.2 WEEDS IN RABI

A total of 35 species have been recorded from the fields of mustard and pulses in Rabi season in the district of MALDA. The highest number of species have been recorded in Englishbazar (55.4%) followed by 'Old Malda' (48.5%).Harischandrapur (42.6%) and Gazole recorded the lowest (29.7%).The highest number of individual recorded and total area covered (Table 4.13 - 4.15) is during the year 1992-'93 (1932 and 40299 cm^2). *Leucas indica* appeared to be the most frequently available weed with RF value (80.67) followed by *Vicia angustifolia* (75.33), *Vicia hirsuta* (73.33), *Chenopodium album* (58.67), *Cyperus rotundus* (30.00)etc. *Leucas indica* also recorded with highest RD value (19.40) followed by *Launea aspleniifolia* (8.88), *Anagallis arvensis* (8.20) *Vicia hirsuta* (7.60), *Fumaria indica*(7.50) etc. Highest RDm value again possessed by *Leucas indica* (17.80), followed by *Launea aspleniifolia* (11.03),*Vicia angustifolia* (10.42), *Vicia hirsuta* (8.35%), *Sebastiania chamaelea* (6.76). *Leucas indica* with highest RF, RD and RDm values, naturally stands for highest IVI value (117.87) for the 'Rabi' season, followed by *Vicia angustifolia* (93.19), *Vicia hirsuta* (89.28), *Chenopodium album* (69.72), *Launea aspleniifolia* (44.58), *Sebastiania chamaelea* (39.20), *Fumaria indica* (36.09), *Cyperus rotundus* (35.93), *Cynodon dactylon* (31.62), *Solanum nigrum* (27.38) etc.(Table 4.20). While *Leucas indica, Vicia angustifolia, Vicia hirsuta, Chenopodium album* have been recorded in all 'Thanas' in the district, and *Cynodon dactylon, Cyperus rotundus, Alternanthera sessilis, Euphorbia hirta* and E. *indica, Sebastiania chamaelea, Solanum nigrum* from 50% or more 'Thanas' of district. The most weeded 'Thana' has been recorded as Gazole, followed by Old Malda, Kaliachak, and Englishbazar (Table 4.4 - 4.6). A number of crops are cultivated in this season which include mustard, pulses (Gram, Musur), linseed, vegetable etc. The present survey was made in the fields of mustard and pulses, but in numerous cases pulses are mixed with rows of linseed or mustard and /or mixed cropping (pulses, mustard, linseed) were recorded.

It is the common sight that in the field of pulses *Leucas indica* is growing in so abundance to give the idea that this is the cultivated species. A total root parasite *Orobanche aegyptiaca* Pers. is also frequently found as a weed with all these crop plants, though it is not uniformly distributed. During the present survey nine new angiospermic hosts have been recorded for this parasite.

Table 4.4 : Phytosociological characters of Weeds of the district of Malda (Thana wise) during Rabi season 1992 - '93

[for data in other thanas this table is continued laterally in 4.4.A]

THANA ⇒	GAZOLE			KALIACHAK			HABIBPUR			HARISCHANDRAPUR			CHANCHAL		
WEEDS ⇓	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)
1. *Alternanthera sessilis*	3	9	243	-	-	-	3	8	217	-	-	-	-	-	-
2. *Anagallis arvensis*	-	-	-	-	-	-	-	-	-	3	153	344	-	-	-
3. *Argemone mexicana*	3	13	223	-	-	-	-	-	-	-	-	-	-	-	
4. *Asphodelus tenuifolius*	2	5	528	-	-	-	-	-	-	-	-	-	-	-	-
5. *Caesulia axillaris*	-	-	-	-	-	-	-	-	-	2	3	205	2	4	168
6. *Chenopodium album*	3	13	211	-	-	-	3	17	198	2	33	143	4	17	109
7. *Cirsium arvense*	1	1	431	4	14	709	-	-	-	-	-	-	-	-	-
8. *Cynodon dactylon*	1	2	10	-	-	-	3	6	128	-	-	-	-	-	-
9. *Cyperus rotundus*	-	-	-	-	-	-	1	1	13	3	27	451	3	17	272
10. *Digitaria longiflora*	-	-	-	-	-	-	-	-	-	2	2	30	2	2	26
11. *Emilia sonchifolia*	-	-	-	-	-	-	-	-	-	-	-	-	2	5	180
12. *Eragrostis riparia*	-	-	-	1	1	66	-	-	-	-	-	-	-	-	-
13. *Euphorbia hirta*	-	-	-	-	-	-	2	3	198	-	-	-	-	-	-
14. *Euphorbia indica*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15. *Fumaria indica*	-	-	-	-	-	-	-	-	-	-	-	-	3	31	343
16. *Hewittia scandens*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17. *Hygrophila polysperma*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18. *Ipomoea aquatica*	-	-	-	-	-	-	-	-	-	-	-	-	2	3	193
19. *Launaea aspleniifolia*	-	-	-	4	89	3774	-	-	-	2	37	1131	-	-	-
20. *Leucas indica*	5	107	2944	5	18	588	4	25	624	3	37	245	3	45	417
21. *Ludwigia perennis*	-	-	-	-	-	-	2	3	83	-	-	-	-	-	-
22. *Marsilea quadrifida*	-	-	-	-	-	-	-	-	-	1	2	17	1	1	12
23. *Medicago lupulina*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24. *Melilotus alba*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25. *Orobanche aegyptiaca*	3	9	66	-	-	-	-	-	-	-	-	-	-	-	-
26. *Paspalum scrobiculatum*	-	-	-	4	4	369	-	-	-	-	-	-	-	-	-
27. *Polygonum plebeium*	-	-	-	-	-	-	-	-	-	2	57	295	-	-	-
28. *Sebastiania chamaelia*	2	7	367	3	10	208	-	-	-	-	-	-	-	-	-
29. *Solanum nigrum*	3	8	166	-	-	-	2	3	80	1	1	35	-	-	-
30. *Sphaeranthus indicus*	-	-	-	-	-	-	-	-	-	1	1	16	-	-	-
31. *Spilanthes calva*	-	-	-	-	-	-	-	-	-	2	47	974	2	26	539
32. *Vicia angustifolia*	2	63	1811	4	7	137	5	8	178	1	2	37	5	7	137
33. *V. hirsuta*	5	34	844	1	5	144	4	5	121	2	4	62	5	12	177

Contd. to Table 4.4.A

Table 4.4.A : [longitudinal continuation of the Table 4.4]

	RATUA			MANIKCHAK			OLD MALDA			ENGLISHBAZAR			BAMONGOLA			TOTAL		
Sl. No.	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)
1	-	-	-	-	-	-	-	-	-	-	-	-	3	9	242	9	26	702
2	-	-	-	1	1	46	-	-	-	-	-	-	-	-	-	4	154	380
3	1	1	30	1	1	22	-	-	-	-	-	-	-	-	-	5	15	275
4	-	-	-	-	-	-	1	1	46	-	-	-	-	-	-	3	6	574
5	-	-	-	1	3	97	-	-	-	-	-	-	-	-	-	5	10	470
6	3	6	93	1	9	117	1	2	16	3	9	145	5	18	161	25	124	1193
7	2	3	35	1	1	169	-	-	-	1	2	23	-	-	-	9	21	1367
8	3	12	296	3	13	569	-	-	-	2	2	40	3	7	126	15	42	1169
9	3	8	108	-	-	-	-	-	-	4	6	83	1	1	19	15	60	946
10	1	1	10	-	-	-	2	30	291	1	1	12	1	1	18	9	37	387
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	5	180
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	66
13	-	-	-	-	-	-	-	-	-	2	2	271	-	-	-	4	5	469
14	-	-	-	-	-	-	-	-	-	2	2	117	-	-	-	2	2	117
15	5	110	1027	-	-	-	1	1	26	3	5	78	-	-	-	12	147	1474
16	-	-	-	-	-	-	5	59	2045	-	-	-	-	-	-	5	59	2045
17	-	-	-	-	-	-	1	1	31	-	-	-	-	-	-	1	1	31
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	3	193
19	-	-	-	2	6	121	4	79	1035	2	4	122	-	-	-	14	215	6183
20	3	49	468	4	7	182	3	45	220	5	9	382	5	27	658	40	369	6728
21	-	-	-	-	-	-	-	-	-	-	-	-	2	3	92	4	6	175
22	1	1	15	2	26	1242	-	-	-	-	-	-	1	1	15	6	31	1301
23	-	-	-	-	-	-	-	-	-	5	41	420	-	-	-	5	41	420
24	-	-	-	-	-	-	-	-	-	3	42	965	-	-	-	3	42	965
25	-	-	-	-	-	-	-	-	-	5	12	102	-	-	-	8	21	168
26	-	-	-	-	-	-	-	-	-	2	4	360	-	-	-	6	8	729
27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	57	295
28	-	-	-	2	7	184	3	15	323	3	12	1122	-	-	-	13	51	2204
29	-	-	-	2	2	63	-	-	-	-	-	-	3	6	156	11	20	500
30	1	1	12	-	-	-	-	-	-	-	-	-	1	1	13	3	3	41
31	-	-	-	-	-	-	-	-	-	-	-	-	2	6	129	6	79	1642
32	5	9	119	3	7	660	5	21	352	2	8	332	4	6	132	36	138	3895
33	4	14	413	2	5	173	4	39	585	3	5	220	5	10	276	35	133	3015
																	1932	40299

Table 4. 5 : Phytosociological characters of Weeds of the district of Malda (Thana wise) during Rabi season 1993 - '94

[for data in other thanas this table is continued laterally in 4.5.A]

THANA ⇒	Gazole			Kaliachak			Habibpur			Harischandrapur			Chanchal		
WEEDS ⇓	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)
1. *Alternanthera sessilis*	3	10	257	-	-	-	4	7	186	-	-	-	-	-	-
2. *Anagallis arvensis*	-	-	-	-	-	-	-	-	-	4	137	285	-	-	-
3. *Argemone mexicana*	4	12	221	2	3	78	-	-	-	1	1	20	-	-	-
4. *Asphodelus tenuifolius*	3	5	519	-	-	-	-	-	-	-	-	-	-	-	-
5. *Caesulia axillaris*	-	-	-	-	-	-	-	-	-	2	3	182	3	3	145
6. *Chenopodium album*	4	16	254	2	10	166	4	20	224	3	27	151	4	13	132
7. *Cirsium arvense*	1	1	392	4	11	708	-	-	-	-	-	-	-	-	-
8. *Cynodon dactylon*	2	5	28	-	-	-	3	4	132	-	-	-	-	-	-
9. *Cyperus rotundus*	1	1	13	-	-	-	1	2	31	3	23	392	3	19	311
10. *Digitaria ciliaris*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11. *D. longiflora*	-	-	-	1	1	23	-	-	-	1	2	34	2	2	27
12. *Emilia sonchifolia*	-	-	-	-	-	-	-	-	-	-	-	-	2	3	86
13. *Eragrostis riparia*	-	-	-	1	1	71	-	-	-	-	-	-	-	-	-
14. *Euphorbia hirta*	-	-	-	1	2	69	3	3	185	-	-	-	-	-	-
15. *E. indica*	-	-	-	-	-	-	-	-	-	-	-	-	1	1	43
16. *Fumaria indica*	-	-	-	-	-	-	-	-	-	-	-	-	2	20	208
17. *Hewittia scandens*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18. *Hygrophila polysperma*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19. *Launaea aspleniifolia*	-	-	-	4	43	1265	-	-	-	2	29	1127	-	-	-
20. *Leucas cephalotes*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21. *L. indica*	5	102	2835	4	10	423	3	19	507	4	32	276	3	46	434
22. *Ludwigia perennis*	1	1	18	-	-	-	3	3	84	-	-	-	-	-	-
23. *Marsilea quadrifida*	-	-	-	-	-	-	-	-	-	2	3	23	1	2	16
24. *Medicago lupulina*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25. *Melilotus alba*	-	-	-	1	2	41	-	-	-	-	-	-	1	1	28
26. *Orobanche aegyptiaca*	2	8	56	-	-	-	-	-	-	-	-	-	-	-	-
27. *Paspalum scrobiculatum*	-	-	-	2	3	271	-	-	-	-	-	-	-	-	-
28. *Polygonum plebeium*	-	-	-	-	-	-	-	-	-	2	49	263	-	-	-
29. *Sebastiania chamaelea*	3	12	551	4	11	219	-	-	-	-	-	-	-	-	-
30. *Solanum nigrum*	3	6	120	-	-	-	3	4	143	1	2	108	-	-	-
31. *Sphaeranthus indicus*	-	-	-	-	-	-	-	-	-	1	2	35	-	-	-
32. *Spilanthes calva*	-	-	-	-	-	-	-	-	-	3	45	971	2	27	547
33. *Vicia angustifolia*	3	45	1357	4	15	405	5	10	242	2	2	41	5	5	137
34. *V. hirsuta*	5	39	943	2	6	213	4	4	108	1	3	85	4	12	160

Contd. to Table 4.5.A.

Table 4.5.A : [lateral continuation of Table 4.5]

	Ratua			Manikchak			Old Malda			Englishbazar			Bamongola			TOTAL		
Sl. No.	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)
1	-	-	-	2	2	41	-	-	-	-	-	-	3	6	183	12	25	667
2	-	-	-	2	3	42	-	-	-	3	10	56	-	-	-	9	150	383
3	1	1	26	2	2	46	-	-	-	-	-	-	-	-	-	10	19	391
4	-	-	-	-	-	-	2	3	279	1	1	58	-	-	-	6	9	856
5	-	-	-	1	2	90	-	-	-	-	-	-	-	-	-	6	8	417
6	2	3	35	1	7	82	2	5	57	3	12	142	4	20	196	29	133	1439
7	2	4	74	1	1	35	2	3	73	-	-	-	-	-	-	10	20	1282
8	3	10	292	3	16	635	-	-	-	2	3	71	3	4	119	16	42	1277
9	4	7	103	-	-	-	1	1	15	3	7	98	1	1	17	17	61	980
10	-	-	-	-	-	-	1	1	92	1	1	73	-	-	-	2	2	165
11	1	2	26	-	-	-	-	-	-	1	1	15	1	1	14	7	9	139
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	3	86
13	1	1	51	-	-	-	-	-	-	-	-	-	-	-	-	2	2	122
14	-	-	-	-	-	-	2	2	122	1	1	129	-	-	-	7	8	495
15	-	-	-	-	-	-	1	1	66	3	3	144	-	-	-	5	5	253
16	5	102	1037	-	-	-	2	5	101	3	5	97	-	-	-	12	132	1443
17	-	-	-	-	-	-	3	29	1024	-	-	-	-	-	-	3	29	1024
18	-	-	-	-	-	-	1	1	22	-	-	-	-	-	-	1	1	22
19	-	-	-	2	7	123	4	71	916	1	3	92	-	-	-	13	153	3523
20	-	-	-	-	-	-	-	-	-	2	9	49	-	-	-	2	9	49
21	4	52	818	4	10	200	3	33	285	5	15	314	5	31	682	40	350	6774
22	-	-	-	-	-	-	-	-	-	-	-	-	2	4	101	6	8	203
23	1	1	10	2	18	424	-	-	-	-	-	-	-	-	-	6	24	473
24	-	-	-	-	-	-	3	5	53	4	29	329	-	-	-	7	34	382
25	-	-	-	2	3	69	1	1	40	3	37	918	-	-	-	8	44	1096
26	-	-	-	-	-	-	2	5	51	4	10	88	-	-	-	8	23	195
27	-	-	-	-	-	-	2	5	388	-	-	-	-	-	-	4	8	659
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	49	263
29	-	-	-	1	6	138	4	18	948	3	14	931	-	-	-	15	61	2787
30	1	1	32	2	2	49	-	-	-	-	-	-	3	6	164	13	21	616
31	1	1	10	-	-	-	-	-	-	-	-	-	1	1	22	3	4	67
32	-	-	-	-	-	-	-	-	-	-	-	-	2	8	155	7	80	1673
33	4	10	174	3	5	427	5	19	411	3	6	403	14	7	129	48	124	3726
34	5	13	414	3	5	175	5	42	714	3	7	284	5	11	272	37	142	3368
																1792		37295

Table 4. 6 : Phytosociological characters of Weeds of the district of Malda (Thana wise) during Rabi season 1994 - '95

[for data in other Thanas this table is continued to 4.6.A]

THANA ⇒	Gazole			Kaliachak			Habibpur			Harischandrapur			Chanchal		
WEEDS ⇓	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)
1. *Alternanthera sessilis*	4	8	219	-	-	-	3	5	186	-	-	-	-	-	-
2. *Anagallis arvensis*	-	-	-	-	-	-	-	-	-	3	130	275	-	-	-
3. *Argemone mexicana*	4	10	215	3	4	88	-	-	-	-	-	-	-	-	-
4. *Asphodelus tenuifolius*	1	4	408	-	-	-	-	-	-	-	-	-	-	-	-
5. *Caesulia axillaris*	-	-	-	-	-	-	-	-	-	2	2	148	2	3	182
6. *Chenopodium album*	4	14	149	2	11	141	5	22	238	3	19	171	4	8	110
7. *Cirsium arvense*	1	1	375	4	12	624	-	-	-	-	-	-	-	-	-
8. *Cynodon dactylon*	2	2	104	2	3	56	1	1	42	-	-	-	-	-	-
9. *Cyperus rotundus*	-	-	-	-	-	-	2	2	39	3	28	472	2	15	223
10. *Digitaria ciliaris*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11. *D. longiflora*	-	-	-	-	-	-	-	-	-	2	2	31	1	1	19
12. *Emilia sonchifolia*	-	-	-	-	-	-	-	-	-	-	-	-	2	5	163
13. *Eragrostis riparia*	-	-	-	2	2	94	-	-	-	-	-	-	-	-	-
14. *Euphorbia hirta*	1	1	16	2	3	67	3	4	145	-	-	-	-	-	-
15. *E. indica*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16. *Fumaria indica*	-	-	-	-	-	-	-		-	-	-	-	2	21	244
17. *Hewittia scandens*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18. *Hygrophila polysperma*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19. *Launaea asplenifolia*	-	-	-	3	38	1189	-	-	-	2	28	869	-	-	-
20. *Leucas cephalotes*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21. *L. indica*	5	85	2637	4	15	275	3	22	421	5	29	281	3	38	402
22. *Ludwigia perennis*	2	3	43	-	-	-	3	3	64	-	-	-	-	-	-
23. *Marsilea quadrifida*	-	-	-	-	-	-	-	-	-	2	4	45	-	-	-
24. *Medicago lupulina*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25. *Melilotus alba*	-	-	-	2	2	56	-	-	-	-	-	-	1	2	38
26. *Orobanche aegyptiaca*	3	7	52	-	-	-	-	-	-	-	-	-	-	-	-
27. *Paspalum scrobiculatum*	1	1	71	3	3	286	-	-	-	-	-	-	-	-	-
28. *Polygonum plebeium*	-	-	-	-	-	-	-	-	-	2	51	264	-	-	-
29. *Sebastiania chamaelia*	4	8	505	4	12	236	-	-	-	-	-	-	-	-	-
30. *Solanum nigrum*	3	6	129	-	-	-	3	2	118	1	3	97	-	-	-
31. *Sphaeranthus indicus*	-	-	-	-	-	-	-	-	-	1	1	24	-	-	-
32. *Spilanthes calva*	-	-	-	-	-	-	-	-	-	4	37	913	2	23	522
33. *Vicia angustifolia*	3	59	1613	4	11	145	5	5	206	2	5	188	5	8	271
34. *V. hirsuta*	5	32	826	2	4	163	4	7	137	1	3	64	5	11	182

Contd. to Table 4.6.A

Table 4.6.A : [lateral continuation of Table 4.6]

Ratua				Manikchak			Old Malda			Englishbazar			Bamongola			TOTAL		
Sl. No.	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)
1	-	-	-	3	4	137	-	-	-	-	-	-	3	9	224	13	26	766
2	-	-	-	-	-	-	-	-	-	3	5	39	-	-	-	6	135	314
3	2	3	61	1	2	53	-	-	-	-	-	-	-	-	-	10	19	417
4	-	-	-	-	-	-	1	2	87	1	1	43	-	-	-	3	7	538
5	-	-	-	1	2	81	-	-	-	-	-	-	-	-	-	5	7	411
6	3	12	109	2	9	98	3	5	73	3	13	164	5	21	189	34	134	1442
7	2	2	122	1	1	83	1	1	24	1	1	35	-	-	-	10	18	1263
8	1	1	19	-	-	-	1	2	107	1	1	24	2	3	62	10	13	414
9	2	4	92	-	-	-	-	-	-	2	5	81	2	3	46	13	57	953
10	-	-	-	-	-	-	1	1	76	-	-	-	-	-	-	1	1	76
11	2	2	37	-	-	-	1	1	21	1	2	40	1	2	29	8	10	177
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	5	163
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	94
14	-	-	-	-	-	-	2	3	82	2	3	198	-	-	-	10	14	508
15	-	-	-	-	-	-	1	2	69	2	3	82	-	-	-	3	5	151
16	5	95	1006	-	-	-	3	4	77	3	3	105	-	-	-	13	123	1432
17	-	-	-	-	-	-	3	32	1124	-	-	-	-	-	-	3	32	1124
18	-	-	-	-	-	-	1	1	25	-	-	-	-	-	-	1	1	25
19	-	-	-	1	4	84	3	42	608	1	2	52	-	-	-	10	114	2802
20	-	-	-	-	-	-	-	-	-	3	8	51	-	-	-	3	8	51
21	4	44	805	3	12	240	4	32	302	5	10	256	5	33	634	41	320	6253
22	-	-	-	-	-	-	-	-	-	-	-	-	3	3	85	8	9	192
23	2	2	29	3	18	214	-	-	-	-	-	-	-	-	-	7	24	288
24	-	-	-	-	-	-	3	6	76	5	20	313	-	-	-	8	26	389
25	-	-	-	-	-	-	1	1	27	4	38	910	-	-	-	8	43	1031
26	-	-	-	-	-	-	2	2	23	3	11	89	-	-	-	8	20	164
27	-	-	-	-	-	-	-	-	-	3	3	277	-	-	-	7	7	634
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	51	264
29	-	-	-	1	2	47	4	20	949	3	12	744	-	-	-	16	54	2481
30	1	2	54	2	2	82	-	-	-	-	-	-	3	5	135	13	20	615
31	1	2	45	-	-	-	-	-	-	-	-	-	1	1	26	3	4	95
32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	60	1435
33	4	10	172	4	4	284	5	21	509	3	7	421	4	5	103	39	135	3912
34	5	14	405	3	5	191	5	40	460	3	5	204	5	10	247	38	131	2879
																	1635	33753

Table 4.13 : Phytosociological characters of Weeds of the district of Malda during Rabi Season 1992 - '93.

NAME OF WEED	PRESENCE			PHYTOSOCIOLOGICAL CHARACTERS			
	N.Q.	No. Indv.	Area covered (cm^2)	RF	RD	RDm	I.V.I.
Alternanthara sessilis	9	26	702	18	1.35	1.74	21.09
Anagallis arvense	4	154	380	8	7.97	0.94	16.91`
Argemone mexicana	5	15	275	10	0.78	0.68	11.46
Asphodelus tenuifolius	3	6	574	6	0.31	1.42	7.73
Caesulia axillaris	5	10	470	10	0.52	1.17	11.69
Chenopodium album	25	124	1193	50	6.42	2.96	59.38
Cirsium arvense	9	21	1367	18	1.09	3.39	22.48
Cynodon dactylon	15	42	1169	30	2.17	2.90	35.07
Cyperus rotundus	15	60	946	30	3.11	2.35	35.46
Digitaria longiflora	9	37	387	18	1.92	0.96	20.88
Emilia sonchifolia	2	5	180	4	0.26	0.45	4.71
Eragrostis riparia	1	1	66	2	0.05	0.16	2.21`
Euphorbia hirta	4	5	469	8	0.26	1.16	9.42
Euphorbia indica	2	2	117	4	0.10	0.29	4.39
Fumaria indica	12	147	1474	24	7.61	3.66	35.27
Hewittia scandens	5	59	2045	10	3.05	5.07	18.12
Hygrophila polysperma	1	1	31	2	0.05	0.08	2.13
Ipomoea aquatica	2	3	193	4	0.16	0.48	4.64
Launaea aspleniifolia	14	215	6183	28	11.13	15.34	54.47
Leucas indica	40	369	6728	80	19.10	16.70	115.80
Ludwigia perennis	4	6	175	8	0.31	0.43	8.74
Marsilea quadrifida	6	31	1301	12	1.60	3.23	16.83
Medicago lupulina	5	41	420	10	2.12	1.04	13.16
Melilotus alba	3	42	965	6	2.17	2.39	10.56
Orobanche aegyptiaca	8	21	168	16	1.09	0.42	17.51
Paspalum scrobiculatum	6	8	729	12	0.41	1.81	14.22
Polygonum plebeium	2	57	295	4	2.95	0.73	7.68
Sebastiania chamaelea	13	51	2204	26	2.64	5.47	34.11
Solanum nigrum	11	20	500	22	1.04	1.24	24.28
Sphaeranthus indicus	3	3	41	6	0.16	0.10	6.26
Spilanthes calva	6	79	1642	12	4.09	4.07	20.16
Vicia angustifolia	36	138	3895	72	7.14	9.67	88.81
Vicia hirsuta	35	133	3015	70	6.88	7.48	84.36

Total no of indivigual - 1932 ; Total area covered - 40299 cm^2;
Total number of quadrate - 50

Table 4.14 : Phytosociological characters of Weeds of the district of Malda during Rabi Season 1993 - '94.

	PRESENCE			PHYTOSOCIOLOGICAL CHARACTERS			
NAME OF WEED	**NQ**	**No. Indv.**	**Area Covered (cm^2)**	**RF**	**RD**	**RDm**	**IVI**
Alternanthera sessilis	12	25	667	24	1.40	1.79	27.19
Anagallis arvensis	9	150	383	18	8.37	1.03	27.40
Argemone mexicana	10	19	391	20	1.06	1.05	22.11
Asphodelus tenuifolius	6	9	856	12	0.50	2.30	14.80
Caesulia axillaris	6	8	417	12	0.45	1.12	13.57
Chenopodium album	29	133	1439	58	7.42	3.86	69.28
Cirsium arvense	10	20	1282	20	1.12	3.44	24.56
Cynodon dactylon	16	42	1277	32	2.34	3.42	37.76
Cyperus rotundus	17	61	980	34	3.40	2.63	40.03
Digitaria ciliaris	2	2	165	4	0.11	0.44	4.55
Digitaria longiflora	7	9	139	14	0.50	0.37	14.87
Emilia sonchifolia	2	3	86	4	0.17	0.23	4.40
Eragrostis riparia	2	2	122	4	0.11	0.33	4.44
Euphorbia hirta	7	8	495	14	0.45	1.33	15.78
Euphorbia indica	5	5	253	10	0.28	0.68	10.96
Fumaria indica	12	132	1443	24	7.37	3.87	35.24
Hewittia scandens	3	29	1024	6	1.62	2.75	10.37
Hygrophila polysperma	1	1	22	2	0.06	0.06	2.12
Launaea aspleniifolia	13	153	3523	26	8.54	9.45	43.99
Leucas cephalotes	2	9	49	4	0.50	0.13	4.63
Leucas indica	40	350	6774	80	19.53	18.16	117.69
Ludwigia perennis	6	8	203	12	0.45	0.54	12.99
Marsilea quadrifida	6	24	473	12	1.34	1.27	14.61
Medicago lupulina	7	34	382	14	1.90	1.02	16.92
Melilotus alba	8	44	1096	16	2.46	2.94	21.40
Orobanche aegyptiaca	8	23	195	16	1.28	0.52	17.80
Paspalum scrobiculatum	4	8	659	8	0.45	1.77	10.22
Polygonum plebeium	2	49	263	4	2.73	0.71	7.44
Sebastiania chamaelea	15	61	2787	30	3.40	7.47	40.87
Solanum nigrum	13	21	616	26	1.17	1.65	28.82
Sphaeranthus indicus	3	4	67	6	0.22	0.18	6.40
Spilanthes calva	7	80	1673	14	4.46	4.49	22.95
Vicia angustifolia	38	124	3726	76	6.92	9.99	92.91
Vicia hirsuta	37	142	3368	74	7.92	9.03	90.95

Total no. of individual -1792; Total area covered -37295 cm^2; Total no. of quadrate- 50

Total number of quadrate - 50

Table 4.15 : Phytosociological characters of Weeds of the district of Malda during Rabi Season 1994 - '95.

NAME OF WEED	PRESENCE			PHYTOSOCIOLOGICAL CHARACTERS			
	NQ	No. Indv.	Area Covered (cm^2)	RF	RD	RDm	IVI
Alternanthera sessilis	13	26	766	26	1.59	2.27	29.86
Anagallis arvensis	6	135	314	12	8.26	0.93	21.19
Argemone mexicana	10	19	417	20	1.16	1.24	22.40
Asphodelus tenuifolius	3	7	538	6	0.43	1.59	8.02
Caesulia axillaris	5	7	411	10	0.43	1.22	11.65
Chenopodium album	34	134	1442	68	8.20	4.27	80.47
Cirsium arvense	10	18	1263	20	1.10	3.74	24.84
Cynodon dactylon	10	13	414	20	0.80	1.23	22.03
Cyperus rotundus	13	57	953	26	3.49	2.82	32.31
Digitaria ciliaris	1	1	76	2	0.06	0.23	2.29
Digitaria longiflora	8	10	177	16	0.61	0.52	17.13
Emilia sonchifolia	2	5	163	4	0.31	0.48	4.79
Eragrostis riparia	2	2	94	4	0.12	0.28	4.40
Euphorbia hirta	10	14	508	20	0.86	1.51	22.37
Euphorbia indica	3	5	151	6	0.31	0.45	6.76
Fumaria indica	13	123	1432	26	7.52	4.24	37.76
Hewittia scandens	3	32	1124	6	1.96	3.33	11.29
Hygrophila polysperma	1	1	25	2	0.06	0.07	2.13
Launaea aspleniifolia	10	114	2802	20	6.97	8.30	35.27
Leucas cephalotes	3	8	51	6	0.49	0.15	6.64
Leucas indica	41	320	6253	82	19.57	18.53	120.10
Ludwigia perennis	8	9	192	16	0.55	0.57	17.12
Marsilea quadrifida	7	24	288	14	1.47	0.85	16.32
Medicago lupulina	8	26	389	16	1.59	1.15	18.74
Melilotus alba	8	43	1031	16	2.63	3.05	21.68
Orobanche aegyptiaca	8	20	164	16	1.22	0.49	17.71
Paspalum scrobiculatum	7	7	634	14	0.43	1.88	16.31
Polygonum plebeium	2	51	264	4	3.12	0.78	7.90
Sebastiania chamaelea	16	54	2481	32	3.30	7.35	42.65
Solanum nigrum	13	20	615	26	1.22	1.82	29.10
Sphaeranthus indicus	3	4	95	6	0.24	0.28	6.52
Spilanthes calva	6	60	435	12	3.67	4.25	17.00
Vicia angustifolia	39	135	3912	78	8.26	11.59	97.85
Vicia hirsuta	38	131	2879	76	8.01	8.53	92.54

Total no. of individual -1635; Total area covered - 33753cm^2;
Total number of quadrate - 50

Table 4.20 : Phytosociological characters of Weeds of the district of Malda (average for three years 1992-'93 to 1994- '95) during Rabi season.

NAME OF WEED	RF	RD	RDm	IVI
Alternanthera sessilis	22.67	1.45	1.93	26.05
Anagallis arvense	12.67	8.20	0.97	21.84
Argemone mexicana	16.67	1.00	0.99	18.66
Asphodelus tenuifolius	8.00	0.41	1.77	10.18
Caesulia axillaris	10.67	0.47	1.17	12.31
Chenopodium album	58.67	7.35	3.70	69.72
Cirsium arvense	19.33	1.10	3.52	23.95
Cynodon dactylon	27.33	1.77	2.52	31.62
Cyperus rotundus	30.00	3.33	2.60	35.93
Digitaria ciliaris	3.00	0.09	0.34	3.43
D. longiflora	16.00	1.01	0.62	17.63
Emilia sonchifolia	4.00	0.25	0.39	4.64
Eragrostis riparia	3.33	0.09	0.26	3.68
Euphorbia hirta	14.00	0.52	1.33	15.85
E. indica	6.67	0.23	0.47	7.37
Fumaria indica	24.67	7.50	3.92	36.09
Hewittia scandens	7.33	2.21	3.72	13.26
Hygrophila polysperma	2.00	0.06	0.07	2.13
Ipomoea aquatica	4.00	0.16	0.48	4.64
Launaea aspleniifolia	24.67	8.88	11.03	44.58
Leucus cephalotes	5.00	0.50	0.14	5.64
L. indica	80.67	19.40	17.80	117.87
Ludwigia perennis	12.00	0.44	0.51	12.95
Marsilea quadrifida	12.67	1.47	1.78	15.92
Medicago lupulina	13.33	1.87	1.07	16.27
Melilotus alba	12.67	2.42	2.79	17.88
Orobanche aegyptiaca	16.00	1.20	0.48	17.68
Paspalum scrobiculatum	11.33	0.43	1.82	13.58
Polygonum plebeium	4.00	2.93	0.74	7.67
Sebastiania chamaelea	29.33	3.11	6.76	39.20
Solanum nigrum	24.67	1.14	1.57	27.38
Sphaeranthus indicus	6.00	0.21	0.19	6.40
Spilanthes calva	12.67	4.07	4.27	21.01
Vicia angustifolia	75.33	7.44	10.42	93.19
V. hirsuta	73.33	7.60	8.35	89.28

4.1.3 WEEDS IN BORO

Only 18 species of weed have been collected in this season and the highest number of species has been recorded in 'Englishbazar' (77.4 %) 'Thana' followed by 'Chanchal' (73.6 %), 'Old Malda' (71.7 %), and 'Bamongola' has recorded the lowest (50.9%) number of species. The highest total of individuals recorded and area covered (Table 4.16 - 4.18) were during 1994 and 1993 respectively (1632 and 19315 cm^2).The highest RF value has been recorded for *Alternanthera sessilis* (93.33) followed by *Cyperus rotundus* (92.0), *Eclipta alba* (74.0), *Cynodon dactylon* (72.0), *Leucas indica* (50.0) etc. Highest Relative Density possessed by *Cyperus rotundus* (29.17) followed by *Alternanthera sessilis* (22.38), *Eclipta alba* (13.53), *Cynodon dactylon* (4.96), *Scirpus juncoides* (4.69) etc. Highest RDm value has been recorded as *Cyperus rotundus* (22.48), followed by *Alternanthera sessilis* (16.76), *Eclipta alba* (13.65), *Marsilea quadrifida* (10.79), *Cynodon dactylon* (8.22) etc. For the IVI value, *Cyperus rotundus* came as most important (143.68) and *Alternanthera sessilis* (132.47), *Eclipta alba* (101.18), *Cynodon dactylon* (85.18), *Marsilea quadrifida* (57.78), *Leucas indica* (56.44), *Caesulia auxillaris* (46.38), *Lindernia perviflora* (44.21), *Ammannia baccifera* (29.89), *Gnaphalium purpurium* (28.36) were the followers (Table 4.21). Though the number of species is very less during this season but *Cynodon dactylon, Cyperus rotundus, Alternanthera sessilis, Eclipta alba, Marsilea quadrifida, Leucas indica* have been recorded in all 'Police Stations' or 'Thanas' of the district. The Manikchak has been recorded as the most weeded thana, followed by 'Gazole', 'Englishbazar' etc. (Table 4.7 - 4.9). From the middle of February day temperature starts rising and one can expect the growth of new set of weeds for these plants. But, among the ten most important species such a picture is not available. Species like *Caesulia auxillaris, Lindernia perviflora* and *Gnaphalium purpurium* were in the field in winter, they have now started flowering and became prominent probably due to the decrease of some other weeds.

4.1.4 THE ANNUAL PICTURE

To understand the reason and nature dominance and ecological success of a species, determination of 'Importance Value Index' is well accepted (Phillips, 1959; Misra, 1966; Malhotra, 1973). The result of sampling of the consecutive years in the crop fields of Malda District has revealed that the sampled species are not restricted for a particular season only. So the wholistic picture of the year is very much necessary to understand the ecological behavior of these species. Annual phytosociological calculation has been presented in Table 4.22. The highest RF value has been recorded for *Cyperus rotundus* (61.48)and were followed by *Alternanthera sessilis* (54.63), *Cynodon dactylon* (51.48), *Ludwigia perennis* (41.67), *Marsilea quadrifida* (37.41), *Leucas indica* (36.30), *Eclipta alba* (31.67), *Echinochloa colona* (30.0), *Caesulia axillaris* (30.0), *Tonningia axillaris* (26.11) etc. Highest RD value has been recorded for *Cyperus rotundus* (10.60), again, and was followed by *Alternanthera sessilis* (7.58), *Murdannia nudiflora* (5.67), *Leucas indica* (5.45), *Marsilea quadrifida* (5.35), *Ludwigia perennis* (5.05), *Cynodon dactylon* (4.83),

Table 4.7 : Phytosociological characters of Weeds of the district of Malda (Thana wise) during Boro season 1993

[for data in other thanas this table is continued laterally in 4.7.A]

THANA ⇒	Gazole			Kaliachak			Habibpur			Harischandrapur			Chanchal		
WEEDS ⇓	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)
1. *Alternanthera sessilis*	5	34	230	5	51	335	3	27	202	5	19	225	5	22	227
2. *Ammannia baccifera*	-	-	-	-	-	-	-	-	-	2	3	51	1	1	21
3. *Caesulia axillaris*	-	-	-	2	2	60	-	-	-	3	10	98	3	4	82
4. *Cynodon dactylon*	2	3	71	4	10	161	3	7	198	4	7	176	3	6	146
5. *Cyperus rotundus*	5	41	346	4	18	242	5	39	498	5	101	674	5	69	537
6. *Echinochloa colona*	2	3	56	1	1	27	-	-	-	-	-	-	-	-	-
7. *Eclipta alba*	5	28	308	3	17	243	3	8	115	5	29	381	4	32	310
8. *Eriocaulon cinereum*	-	-	-	2	2	42	-	-	-	-	-	-	2	3	65
9. *Gnaphalium purpurium*	1	2	47	1	1	31	2	2	40	1	1	31	1	2	43
10. *Hemarthria compressa*	-	-	-	2	3	64	1	1	31	-	-	-	1	1	24
11. *Lindernia multiflora*	4	30	134	-	-	-	-	-	-	3	19	199	-	-	-
12. *L. perviflora*	2	6	52	2	6	60	-	-	-	2	7	64	4	22	163
13. *Leucas indica*	-	-	-	3	4	69	3	8	74	2	3	23	2	4	35
14. *Ludwigia perennis*	-	-	-	-	-	-	-	-	-	2	4	55	2	3	49
15. *Marsilea quadrifida*	2	8	204	2	4	104	2	4	80	1	5	87	2	6	120
16. *Phyla nudiflora*	-	-	-	1	2	42	2	3	58	-	-	-	-	-	-
17. *Sagittaria guyanensis*	1	2	39	-	-	-	-	-	-	-	-	-	-	-	-
18. *Scirpus juncoides*	5	79	930	-	-	-	-	-	-	-	-	-	-	-	-

Contd to Table 4.7.A

Table 4.7.A : [lateral continuation of table 4.7]

	Ratua			Manikchak			Old Malda			Englishbazar			Bamongola			TOTAL		
Sl. No.	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)
1	4	16	149	5	17	153	5	74	736	5	62	567	4	39	346	46	361	3170
2	1	1	18	-	-	-	1	21	243	3	22	311	-	-	-	8	48	644
3	3	8	132	5	32	369	1	1	29	2	2	76	-	-	-	19	59	846
4	2	8	145	5	13	288	4	5	67	3	5	121	5	12	298	35	76	1671
5	5	47	396	4	76	916	3	13	233	4	15	245	5	49	396	45	468	4483
6	-	-	-	1	1	23	-	-	-	-	-	-	-	-	-	4	5	106
7	4	23	199	3	68	590	4	9	212	3	8	160	2	3	166	36	225	2634
8	-	-	-	-	-	-	1	1	26	1	1	21	-	-	-	6	7	154
9	-	-	-	-	-	-	1	2	43	1	1	27	3	4	92	11	15	354
10	1	2	37	1	1	27	1	2	61	1	2	42	1	1	27	9	13	313
11	1	2	37	1	9	63	1	2	42	2	3	67	-	-	-	12	65	542
12	3	8	108	-	-	-	1	2	15	1	3	53	-	-	-	15	54	515
13	2	8	83	1	2	38	3	4	61	4	5	89	3	8	75	23	46	547
14	-	-	-	1	1	12	1	1	9	1	2	27	1	1	27	8	12	179
15	1	3	64	2	12	581	1	8	315	2	11	394	1	2	41	16	63	1990
16	-	-	-	2	3	55	-	-	-	1	2	43	-	-	-	6	10	198
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	39
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	79	930
																	1608	19315

Table 4.8 : Phytosociological characters of weeds of the district of Malda (Thana wise) during Boro season 1994

[for data in other thanas this table continued laterally in 4.8.A]

THANA ⇒	Gazole			Kaliachak			Habibpur			Harischandrapur			Chanchal		
WEEDS ⇓	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)
1. *Alternanthera sessilis*	4	31	192	5	47	338	4	34	246	5	23	241	5	24	239
2. *Ammannia baccifera*	-	-	-	-	-	-	2	5	56	2	2	50	1	2	37
3. *Caesulia axillaris*	-	-	-	3	4	77	-	-	-	3	11	84	4	5	93
4. *Cynodon dactylon*	3	5	78	4	9	124	3	9	186	5	6	187	2	3	102
5. *Cyperus rotundus*	5	37	326	4	23	267	5	30	324	5	63	489	5	89	572
6. *Echinochloa colona*	3	5	83	1	2	31	-	-	-	-	-	-	-	-	-
7. *Eclipta alba*	5	31	327	3	14	228	4	8	104	5	37	427	4	25	246
8. *Eriocaulon cinereum*	-	-	-	3	4	69	-	-	-	-	-	-	2	2	46
9. *Gnaphalium purpurium*	-	-	-	-	-	-	3	3	53	-	-	-	2	3	52
10. *Hemarthria compressa*	-	-	-	3	3	56	2	2	45	-	-	-	1	1	23
11. *Lindernia multiflora*	3	17	79	-	-	-	-	-	-	3	16	187	2	5	48
12. *L. perviflora*	3	12	92	3	8	88	-	-	-	3	11	84	3	11	66
13. *Leucas indica*	-	-	-	3	5	62	4	9	93	2	5	71	2	3	37
14. *Ludwigia perennis*	-	-	-	-	-	-	-	-	-	1	3	46	-	-	-
15. *Marsilea quadrifida*	2	4	193	1	3	61	4	5	139	1	3	73	3	7	154
16. *Phyla nudiflora*	-	-	-	1	1	33	3	7	85	-	-	-	-	-	-
17. *Sagittaria guyanensis*	1	1	27	-	-	-	-	-	-	1	1	23	-	-	-
18. *Scirpus juncoides*	5	66	924	-	-	-	-	-	-	-	-	-	-	-	-

Contd. to Table 4.8.A

Table 4.8.A : [lateral continuation of Table 4.8]

	Ratua			Manikchak			Old Malda			Englishbazar			Bamongola			TOTAL		
Sl. No.	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)
1	5	26	218	5	18	145	5	76	723	5	53	517	5	45	368	48	377	3227
2	2	3	56	-	-	-	3	23	218	4	29	344	-	-	-	14	64	761
3	3	5	104	5	29	376	1	1	18	2	3	79	-	-	-	21	58	831
4	3	4	77	5	17	315	4	6	81	2	3	96	5	13	322	36	75	1568
5	5	73	474	4	78	919	4	21	258	5	31	341	4	40	327	46	485	4297
6	-	-	-	1	1	21	-	-	-	-	-	-	-	-	-	5	8	135
7	2	15	133	4	63	593	2	5	120	3	12	181	3	5	136	35	215	2495
8	-	-	-	-	-	-	1	2	38	1	1	23	-	-	-	7	9	176
9	2	3	64	-	-	-	3	4	69	1	1	16	3	3	83	14	17	337
10	1	1	20	-	-	-	-	-	-	-	-	-	1	2	47	8	9	191
11	-	-	-	1	3	34	-	-	-	1	2	24	-	-	-	10	43	372
12	4	17	136	-	-	-	2	7	87	2	5	59	-	-	-	20	71	612
13	2	5	69	3	9	54	3	5	67	5	7	113	2	7	61	26	55	627
14	-	-	-	-	-	-	1	2	20	-	-	-	2	3	42	4	8	108
15	3	4	78	2	7	511	3	9	426	3	10	408	2	3	53	24	55	2096
16	-	-	-	2	4	62	-	-	-	2	3	68	-	-	-	8	15	248
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	50
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	66	924
																	1632	19055

Table 4.9 : Phytosociological characters of Weeds of the district of Malda (Thana wise) during Boro season 1995

[for data in other Thanas this table is continued laterally in 4.9.A]

THANA ⇒	Gazole			Kaliachak			Habibpur			Harischandrapur			Chanchal		
WEEDS ⇓	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)	NQ	NI	AC (cm2)
1. *Alternanthera sessilis*	4	27	176	5	43	312	4	22	137	5	18	196	4	19	192
2. *Ammannia baccifera*	-	-	-	-	-	-	2	3	42	1	3	58	1	1	23
3. *Caesulia axillaris*	-	-	-	3	5	62	-	-	-	4	7	87	2	3	56
4. *Cynodon dactylon*	3	4	63	5	8	137	2	6	94	4	9	131	3	4	67
5. *Cyperus rotundus*	5	43	369	5	19	246	5	37	413	5	73	427	5	70	479
6. *Echinochloa colona*	2	3	48	2	2	34	-	-	-	-	-	-	-	-	-
7. *Eclipta alba*	5	23	302	3	13	223	4	5	91	5	32	373	4	21	237
8. *Eriocaulon cinereum*	-	-	-	2	3	51	-	-	-	-	-	-	2	2	43
9. *Gnaphalium purpurium*	1	1	21	-	-	-	2	3	46	1	1	21	1	3	51
10. *Hemarthria compressa*	-	-	-	2	2	49	2	2	47	-	-	-	1	2	34
11. *Lindernia multiflora*	4	25	109	-	-	-	-	-	-	2	12	134	1	2	24
12. *L. perviflora*	3	14	84	3	5	46	-	-	-	2	8	56	3	7	41
13. *Leucas indica*	-	-	-	2	3	32	3	7	54	3	7	42	3	4	45
14. *Ludwigia perennis*	-	-	-	-	-	-	-	-	-	2	3	49	-	-	-
15. *Marsilea quadrifida*	3	5	183	2	5	98	2	6	126	2	3	53	2	4	138
16. *Phyla nudiflora*	-	-	-	1	1	27	3	4	53	-	-	-	-	-	-
17. *Scirpus juncoides*	5	71	892	-	-	-	-	-	-	-	-	-	-	-	-

Contd. to Table 4.9.A

Table 4.9. A : [lateral continuation of Table 4.9]

	Ratua			Manikchak			Old Malda			Englishbazar			Bamongola			TOTAL		
Sl. No.	NQ	NI	AC (cm^2)	NQ	NI	AC (cm^2)	NQ	NI	AC (cm^2)	NQ	NI	AC (cm^2)	NQ	NI	AC (cm^2)	NQ	NI	AC (cm^2)
1	5	21	210	4	13	127	5	57	597	5	42	463	5	37	363	46	299	2773
2	2	2	41	-	-	-	3	14	176	3	24	317	-	-	-	12	47	657
3	3	5	118	5	22	306	-	-	-	1	1	39	-	-	-	18	43	668
4	2	5	59	5	15	247	5	7	102	3	5	89	5	14	287	37	77	1276
5	4	42	378	5	42	532	4	17	216	5	23	207	4	31	285	47	397	3552
6	-	-	-	1	2	39	-	-	-	-	-	-	-	-	-	5	7	121
7	4	17	152	5	51	512	3	6	149	4	11	166	3	7	125	40	186	2330
8	-	-	-	-	-	-	1	1	23	1	2	33	-	-	-	6	8	150
9	2	2	47	-	-	-	2	2	52	1	2	33	3	4	91	13	18	362
10	-	-	-	-	-	-	-	-	-	-	-	-	2	2	34	7	8	164
11	-	-	-	2	3	36	1	1	14	1	1	19	-	-	-	11	44	336
12	4	11	103	-	-	-	4	5	79	2	7	73	-	-	-	21	57	482
13	3	5	61	3	12	77	2	2	51	4	5	92	3	7	71	26	52	525
14	-	-	-	2	4	24	1	1	19	-	-	-	2	2	43	7	10	135
15	1	4	56	3	7	345	2	5	306	5	9	434	3	3	73	25	51	1812
16	-	-	-	1	2	38	-	-	-	2	2	36	-	-	-	7	9	154
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	71	892
																	1384	16389

Table 4.16 : Phytosociological characters of Weeds of the district of Malda during Boro Season 1993.

	PRESENCE			PHYTOSOCIOLOGICAL CHARACTERS			
NAME OF WEED	**NQ**	**No. Indv.**	**Area covered (cm^2)**	**RF**	**RD**	**RDm**	**IVI**
Alternanthera sessilis	46	361	3170	92	22.45	16.41	130.86
Ammannia baccifera	8	48	644	16	2.99	3.33	22.32
Caesulia axillaris	19	59	846	38	3.67	4.38	46.05
Cynodon dactylon	35	76	1671	70	4.73	8.65	83.38
Cyperus rotundus	45	468	4483	90	29.10	23.21	142.31
Echinochloa colona	4	5	106	8	0.31	0.55	8.86
Eclipta alba	36	225	2634	72	13.99	13.64	99.63
Eriocaulon cinereum	6	7	154	12	0.44	0.80	13.24
Gnaphalium purpurium	11	15	354	22	0.93	1.83	24.76
Hemarthria compressa	9	13	313	18	0.81	1.62	20.43
Lindernia multiflora	12	65	542	24	4.04	2.81	30.85
Lindernia perviflora	15	54	515	30	3.36	2.67	36.03
Leucas indica	23	46	547	46	2.86	2.83	51.69
Ludwigia perennis	8	12	179	16	0.75	0.93	17.68
Marsilea quadrifida	16	63	1990	32	3.92	10.30	46.22
Phyla nodiflora	6	10	198	12	0.62	1.03	13.65
Sagittaria guyanensis	1	2	39	2	0.12	0.20	2.32
Scirpus juncoides	5	79	930	10	4.91	4.81	19.72

Total number of individual -1608; Total area covered - 19315 cm^2;
Total number of quadrate - 50

Table 4.17 : Phytosociological characters of Weeds of the district of Malda during Boro Season 1994.

	PRESENCE			PHYTOSOCIOLOGICAL CHARACTERS			
NAME OF WEED	**N.Q.**	**No. Indv.**	**Area covered (cm2)**	**RF**	**RD**	**RDm**	**IVI**
Alternanthera sessilis	48	377	3227	96	23.10	16.94	136.04
Ammanniabaccifera	14	64	761	28	3.92	3.99	35.91
Caesulia axillaris	21	58	831	42	3.55	4.36	49.91
Cynodon dactylon	36	75	1568	72	4.60	8.23	84.83
Cyperus rotundus	46	485	4297	92	29.72	22.55	144.27
Echinochloa colona	5	8	135	10	0.49	0.71	11.20
Eclipta alba	35	215	2495	70	13.17	13.09	96.26
Eriocaulon cinereum	7	9	176	14	0.55	0.92	25.47
Gnaphalium purpureum	14	17	337	28	1.04	1.77	30.81
Hemarthria compressa	8	9	191	16	0.55	1.00	17.55
Lindernia multiflora	10	43	372	20	2.63	1.95	24.58
Lindernia perviflora	20	71	612	40	4.35	3.21	47.56
Leucas indica	26	55	627	52	3.37	3.29	58.66
Ludwigia perennis	4	8	108	8	0.49	0.57	9.06
Marsilea quadrifida	24	55	2096	48	3.37	11.00	62.37
Phyla nodiflora	8	15	248	16	0.92	1.30	18.22
Sagittaria guyanensis	2	2	50	4	0.12	0.26	4.38
Scirpus juncoides	5	66	924	10	4.04	4.85	18.89

Total no of individual 1632 ; Total area covered 19055 cm^2;
Total number of quadrate - 50

Table 4.18 : Phytosociological characters of Weeds of the district of Malda during Boro Season 1995.

NAME OF WEED	PRESENCE			PHYTOSOCIOLOGICAL CHARACTERS			
	NQ	No. Indv.	Area covered (cm^2)	RF	RD	RDm	IVI
Alternanthera sessilis	46	299	2773	92	21.60	16.92	130.52
Ammannia baccifera	12	47	657	24	3.40	4.01	31.41
Caesulia axillaris	18	43	668	36	3.11	4.08	43.19
Cynodon dactylon	37	77	1276	74	5.56	7.79	87.35
Cyperus rotundus	47	397	3552	94	28.68	21.67	144.35
Echinochloa colona	5	7	121	10	0.51	0.74	11.25
Eclipta alba	40	186	2330	80	13.44	14.22	107.66
Eriocaulon cinereum	6	8	150	12	0.58	0.92	13.50
Gnaphalium purpureum	13	18	362	26	1.30	2.21	29.51
Hemarthria compressa	7	8	164	14	0.58	1.00	15.58
Lindernia multiflora	11	44	336	22	3.18	2.05	27.23
Lindernia perviflora	21	57	482	42	4.12	2.94	49.06
Leucas indica	26	52	525	52	3.76	3.20	58.96
Ludwigia perennis	7	10	135	14	0.72	0.82	15.54
Marsilea quadrifida	25	51	1812	50	3.68	11.06	64.74
Phyla nodiflora	7	9	154	14	0.65	0.94	15.59
Scirpus juncoides	5	71	892	10	5.13	5.44	20.57

Total no of individual - 1384 ; Total area covered -16389 cm^2;
Total number of quadrate - 50

Table 4.21: Phytosociological characters of Weeds of the district of Malda (average for three years 1993 - 1995) during Boro season.

NAME OF WEED	RF	RD	RDm	IVI
Alternanthera sessilis	93.33	22.38	16.76	132.47
Ammannia baccifera	22.67	3.44	3.78	29.89
Caesulia axillaris	38.67	3.44	4.27	46.38
Cynodon dactylon	72.00	4.96	8.22	85.18
Cyperus rotundus	92.00	29.17	22.48	143.68
Echinochloa colona	9.33	0.44	0.67	10.44
Eclipta alba	74.00	13.53	13.65	101.18
Eriocaulon cinereum	12.67	0.52	0.88	14.07
Gnaphalium purpurium	25.33	1.09	1.94	28.36
Hemarthria compressa	16.00	0.65	1.21	17.86
Lindernia multiflora	22.00	3.28	2.27	27.55
L. perviflora	37.33	3.94	2.94	44.21
Leucas indica	50.00	3.33	3.11	56.44
Ludwigia perennis	12.67	0.65	0.77	14.09
Marsilea quadrifida	43.33	3.66	10.79	57.78
Phyla nudiflora	14.00	0.73	1.09	15.82
Sagittaria guyanensis	3.00	0.12	0.23	3.35
Scirpus juncoides	10.00	4.69	5.03	19.72

Caesulia axillaris (4.07), *Cyperus difformis* (4.07), *Eclipta alba* (4.02) etc. For RDm highest value recorded by *Marsilea quadrifida* (8.10) followed by *Cyperus rotundus* (7.81), *Leucas indica* (5.84), *Murdannia nudiflora* (5.43), *Ludwigia perennis* (5.10), *Fimbristylis dichotoma* (5.04), *Echinochloa colona* (4.64), *Cyperus difformis* (3.69), *Cynodon dactylon* (3.45), *Launaea asplenifolia* (3.41) etc. So the most dominant species i.e. with highest IVI value has been recorded as *Cyperus rotundus*(79.89), followed by *Alternanthera sessilis* (66.85), *Cynodon dactylon* (59.76), *Ludwigia perennis* (51.82), *Marsilea quadrifida* (50.86), *Leucas indica* (47.59), *Eclipta alba* (38.64), *Echinochloa colona* (37.22), *Caesulia axillaris* (36.48), *Tonningia axillaris* (30.83) etc. While *Cyperus rotundus, Cynodon dactylon, Marsilea quadrifida, Alternanthera sessilis, Caesulia axillaris, Ludwigia perennis* have been recorded growing throughout the year but with varying degree of abundance and may be in different stages of life cycle. This is due to (i) their sufficient long life span, (ii) long flowering and fruiting period and (iii) a broad range of germination period i.e. their seed can germinate in different seasons of the year. However out of the ten plants with highest recorded IVI value three are perennials and can propagate by seeds and propasgules.

In the picture of annual assessment of weeds dicotyledonous (40 species) have been out numbered monocotyledonous (20 species) and with only one pteridophytic plant (*Marsilea quadrifida*). The seasons wise picture was also substantiating this observation. For Aman, Rabi and Boro respectively there are 14, 27 and 10 dicotyledonous plants and 13, 7 and 7 monocotyledonous plants.

But the picture of highest IVI is interesting while dicotyledonous plants are dominating in annual, Rabi and Boro seasons (5, 8 and 7 respectively out of top ten) But the picture is entirely reverse for Aman crop when out of top ten there are only 2 dicotyledonous and 7 monocotyledonous plants (Table 4.23).

The fields of Aman paddy do not remain covered by water for a long time and for many cases the crop just grow in an water saturated soil which generally favoured the growth of many sedges like *Cyperus rotundus, Fimbristylis dichotoma* and *Cyperus difformis*. Gregarious monsoon grass *Echinochloa colona* grows well both in marshy and aquatic condition. *Cynodon dactylon* also found growing luxuriously in water saturated paddy fields. So the dominance of monocotyledonous plants in Aman is probably due to the favourable climatic conditions for this major groups of plants. On the other hand the dry fields of Rabi crop and nearly dry fields of Boro crop certainly have favourable growth of dicotyledonous weeds. Less frequent weeding operation during Aman might be another reason for the dominance of monocotyledonous weeds.

Phytographs of ten important species for Aman, Rabi and Boro seasons, as well as for annuals have been presented in Fig. 4.1 - 4.8.

Table 4.22 : Overall Phytosociological Characters of crop-field Weeds of the District of Malda (average for three years June 1992 - May 1995)

NAME OF WEED	RF	RD	RDm	IVI
Alternanthera philoxeroides	2.04	0.07	0.05	2.16
A. sessilis	54.63	7.58	4.64	66.85
Ammannia baccifera	6.30	0.73	0.56	7.59
Anagallis arvensis	3.52	2.01	0.29	5.82
Argemone mexicana	4.63	0.20	0.31	5.14
Asphodelus tenuifolius	2.22	0.12	0.54	2.88
Biophytum sensitivum	7.41	0.93	0.71	9.05
Brachiaria reptans	4.81	0.93	0.91	6.65
Caesulia axillaris	30.00	4.07	2.41	36.48
Celosia argentea	5.37	0.84	1.11	7.32
Chenopodium album	16.30	1.79	1.11	19.20
Cirsium arvense	5.37	0.27	1.06	6.70
Cynodon dactylon	51.48	4.83	3.45	59.76
Cyperus difformis	18.70	4.07	3.69	26.46
C. iria	9.44	0.28	0.69	10.41
C. rotundus	61.48	10.60	7.81	79.89
Dichondra repens	2.22	0.10	0.28	2.60
Digera muricata	6.11	0.38	0.66	7.15
Digitaria ciliaris	0.56	0.01	0.07	0.64
D. longiflora	4.44	0.26	0.19	4.89
Echinochloa colona	30.00	2.58	4.64	37.22
Eclipta alba	31.67	4.02	2.95	38.64
Emilia sonchifolia	1.11	0.06	0.12	1.29
Eragrostis riparia	0.93	0.02	0.09	1.04
Eriocaulon cinereum	3.52	0.11	0.13	3.76
Euphorbia hirta	10.56	0.38	0.66	11.60
E. indica	9.26	0.33	0.44	10.03
Fimbristylis dichotoma	20.56	3.79	5.04	29.39
Fumaria indica	6.85	1.84	1.18	9.87
Gnaphalium purpurium	7.03	0.40	0.42	7.85
Hemarthria compressa	9.63	1.04	1.05	10.72
Hewittia scandens	2.04	0.55	1.14	3.73
Hygrophila polysperma	0.56	0.01	0.02	0.59
Ipomoea aquatica	0.37	0.01	0.05	0.43
Launaea asplenifolia	6.85	2.20	3.41	12.46
Lindernia multiflora	6.11	0.70	0.34	7.15
L. perviflora	10.37	0.83	0.44	11.64
Leucas cephalotes	0.93	0.08	0.03	1.04
L. indica	36.30	5.45	5.84	47.59

continuation of table 4.22				
Name of weed	**RF**	**RD**	**RDm**	**IVI**
Ludwigia adscendens	12.96	3.67	1.15	17.78
L. prennis	41.67	5.05	5.10	51.82
Marsilea quadrifida	37.41	5.35	8.10	50.86
Medicago lupulina	3.70	0.42	0.32	4.44
Melilotus alba	3.52	0.59	0.84	4.95
Monochoria vaginalis	4.07	0.12	0.59	4.78
Murdannia nudiflora	17.22	5.67	5.43	28.32
Orobanche aegyptiaca	4.44	0.29	0.14	4.87
Paspalum scrobiculatum	20.93	2.18	3.26	26.37
Phyla nodiflora	3.89	0.16	0.16	4.21
Phyllanthus fraturnus	13.15	1.74	1.95	16.84
P. virgatus	5.00	0.79	0.42	6.21
Polygonum plebeium	1.11	0.72	0.22	2.05
Sagittaria guyanensis	9.81	0.43	0.70	10.94
Scirpus juncoides	2.78	0.99	0.75	4.52
Sebastiania chamaelea	8.15	0.76	2.03	10.94
Solanum nigrum	6.85	0.28	0.47	7.60
Sphaeranthus indicus	1.67	0.50	0.06	2.23
Spilanthes calva	3.52	0.77	1.29	5.58
Tonningia axillaris	26.11	1.69	3.03	30.83
Vicia angustifolia	20.93	1.90	3.14	25.97
V. hirsuta	20.37	1.86	2.52	24.75

Table 4.23: 10 Dominant Weed species (seasonwise and annual) with highest IVI values

Name of weed(Aman)	IVI	Name of weed (Rabi)	IVI	Name of weed (Boro)	IVI	Name of weed (Annual)	IVI
Ludwigia perennis	96.01	*Leucas indica*	117.87	*Cyperus rotundus*	143.68	*Cyperus rotundus*	79.89
Cyperus rotundus	75.42	*Vicia angustifolia*	93.19	*Alternanthera sessilis*	132.47	*Alternanthera sessilis*	66.85
Echinochloa colona	74.57	*V. hirsuta*	89.28	*Eclipta alba*	101.18	*Cynodon dactylon*	59.76
Marsilea quadrifida	67.75	*Chenopodium album*	69.72	*Cynodon dactylon*	85.18	*Ludwigia perennis*	51.82
Tonningia axillaris	67.39	*Launaea aspleniifolia*	44.58	*Marsilea quadrifida*	57.78	*Marsilea quadrifida*	50.86
Cynodon dactylon	62.54	*Sebastiania chamaelea*	39.20	*Leucas indica*	56.44	*Leucas indica*	47.59
Fimbristylis dichotoma	62.42	*Fumaria indica*	36.09	*Caesulia axillaris*	46.38	*Eclipta alba*	38.64
Murdannia nudiflora	59.11	*Cyperus rotundus*	35.93	*Lindernia perviflora*	44.21	*Echinochloa colona*	37.22
Alternanthera sessilis	57.84	*Cynodon dactylon*	31.62	*Ammannia baccifera*	29.89	*Caesulia axillaris*	36.48
Cyperus difformis	56.30	*Solanum nigrum*	27.38	*Gnaphalium purpureum*	28.36	*Tonningia axillaris*	30.83

Fig. 4.1 : Phytograph of Weeds in Aman Season

A. *Ludwigia perennis* B. *Cyperus rotundus* C. *Echinochloa colona*
D. *Marsilea quadrifida* E. *Tonningia axillaris*

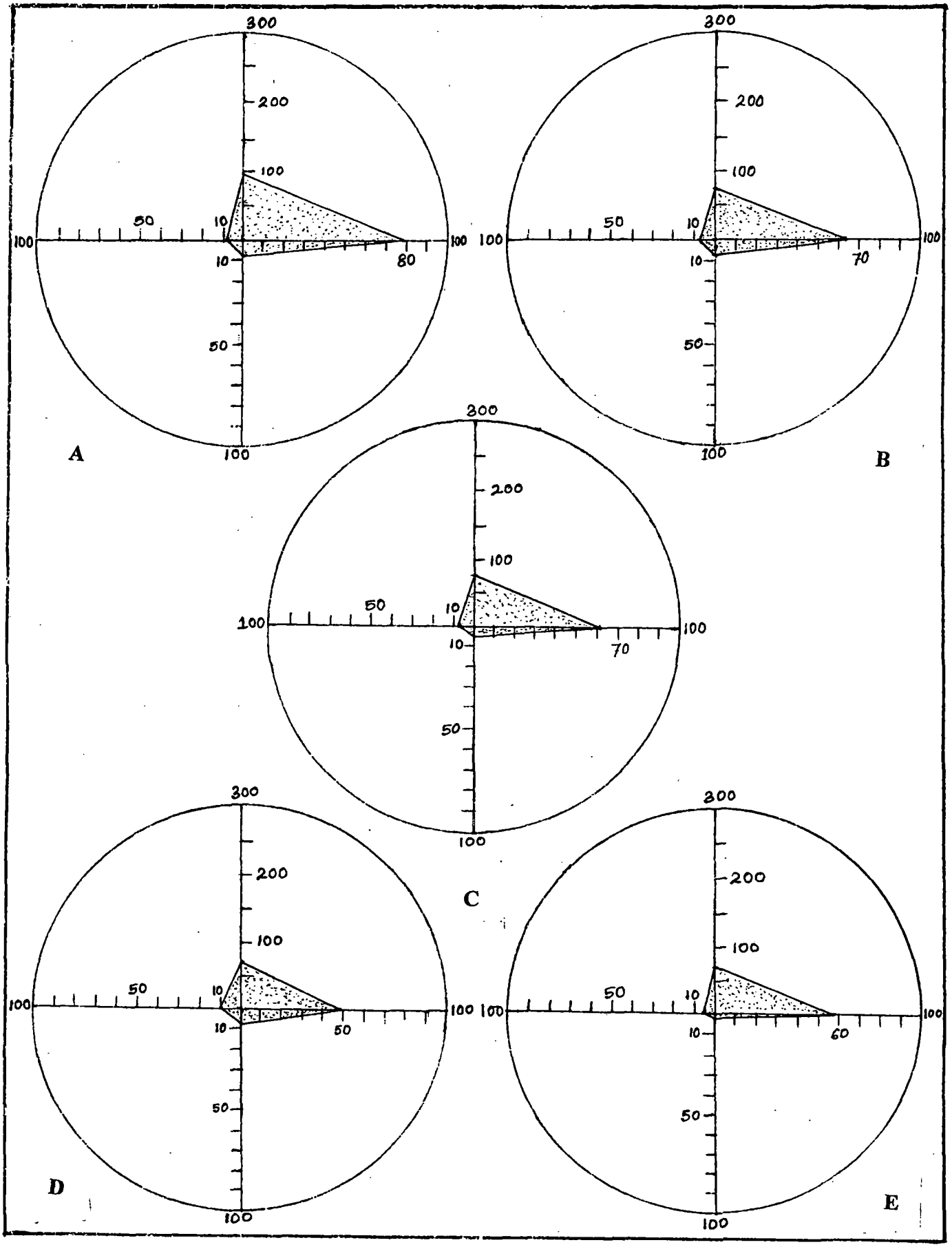


Fig. 4.2 : Phytograph of Weeds in Aman Season

A.. *Cynodon dactylon* B. *Fimbristylis dichotoma* C. *Murdannia nudiflora*

D. *Alternanthera sessilis* E. *Cyperus difformis*

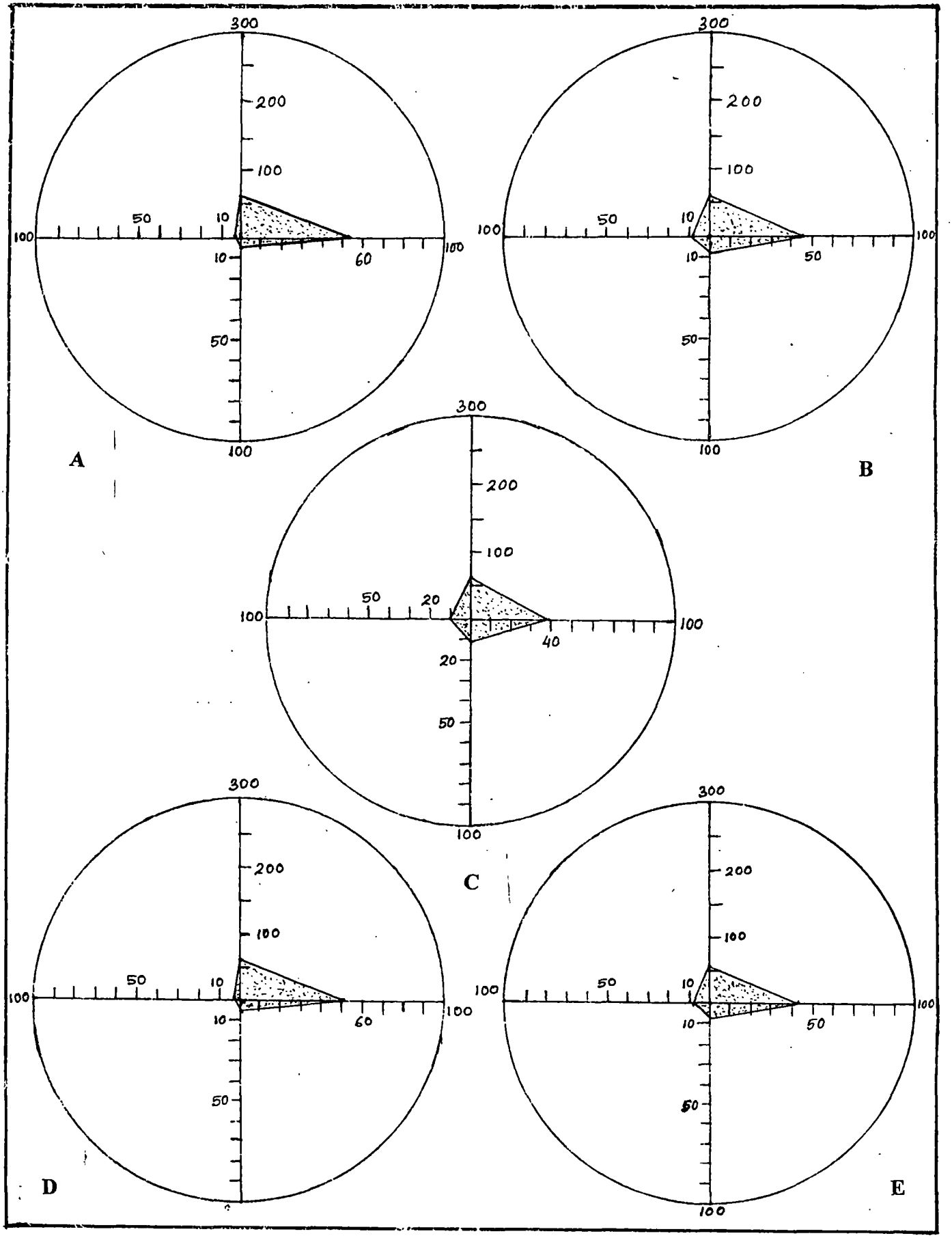


Fig. 4.3 : Phytographs of Weeds in Rabi Season

A. *Leucas indica* B. *Vicia angustifolia* C. *V. hirsuta*

D. *Chenopodium album* E. *Launea aspleniifolia*

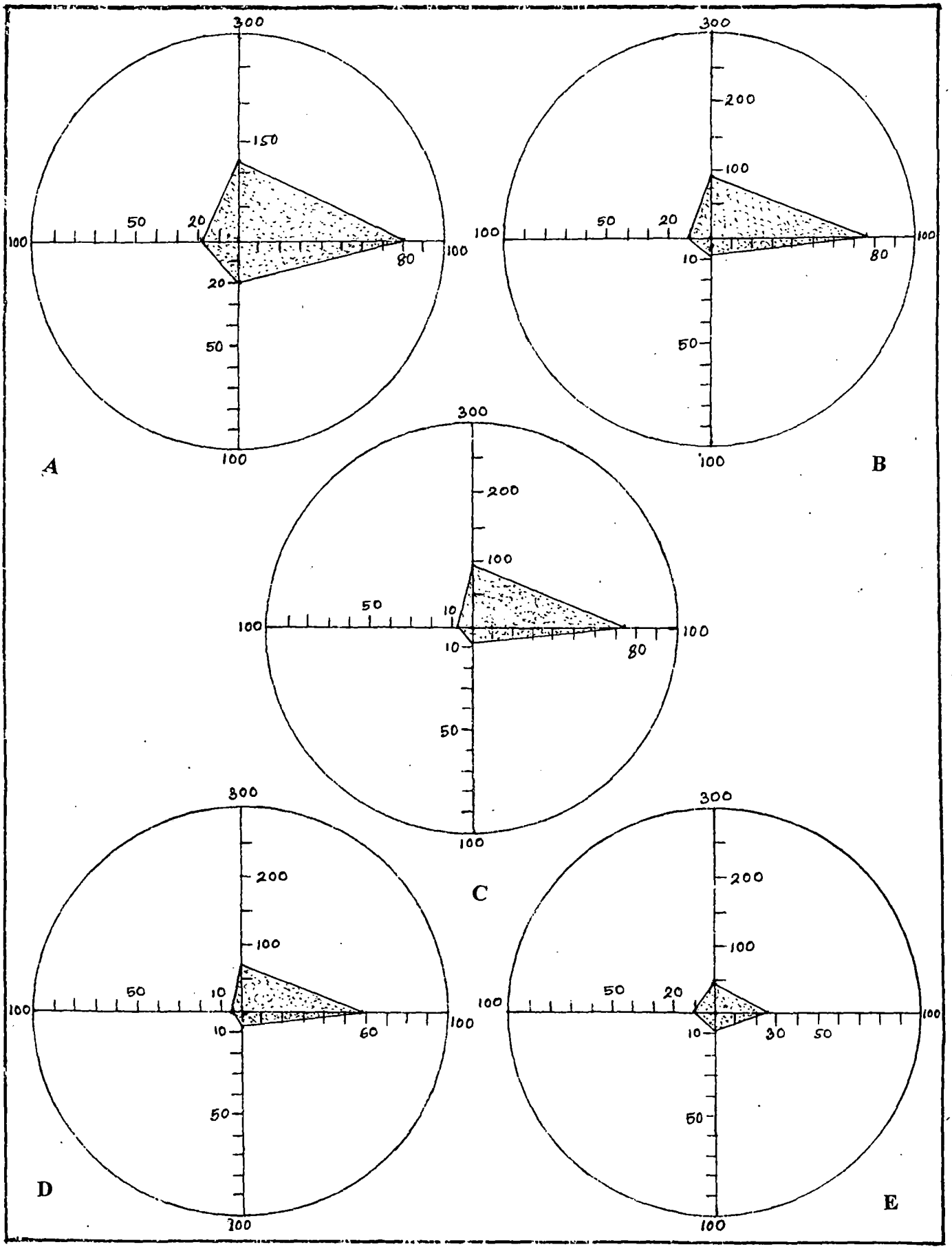


Fig. 4.4 : Phytographs of Weeds in Rabi Season

A. *Sebastiania chamaelea* B. *Fumaria indica* C. *Cyperus rotundus*

D. *Cynodon dactylon* E. *Solanum nigrum*

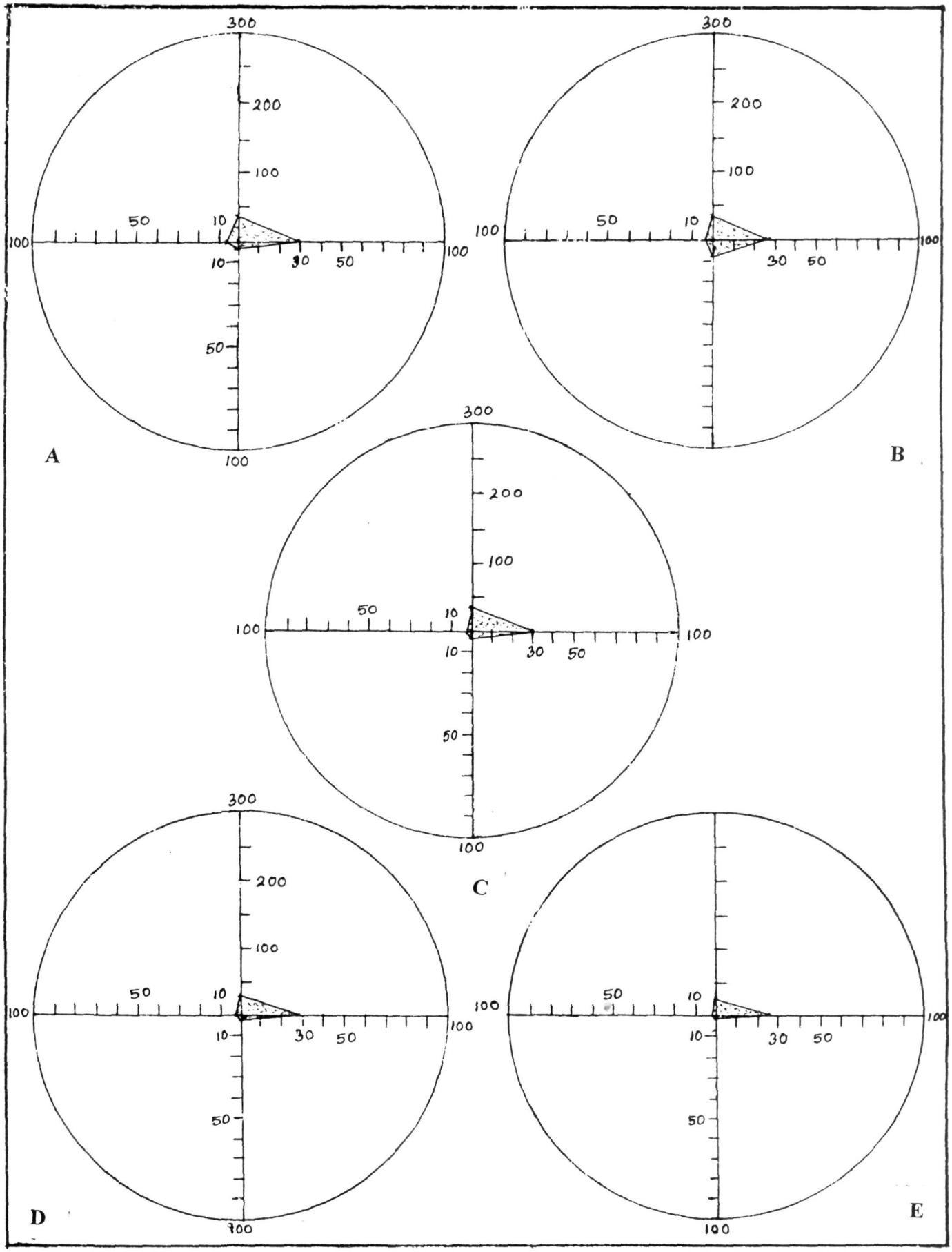


Fig. 4.5 : Phytographs of Weeds in Boro Season

A. Cyperus rotundus B. *Alternanthera sessilis* C. *Eclipta alba*

D. *Cynodon dactylon* E. *Marsilea quadrifida*

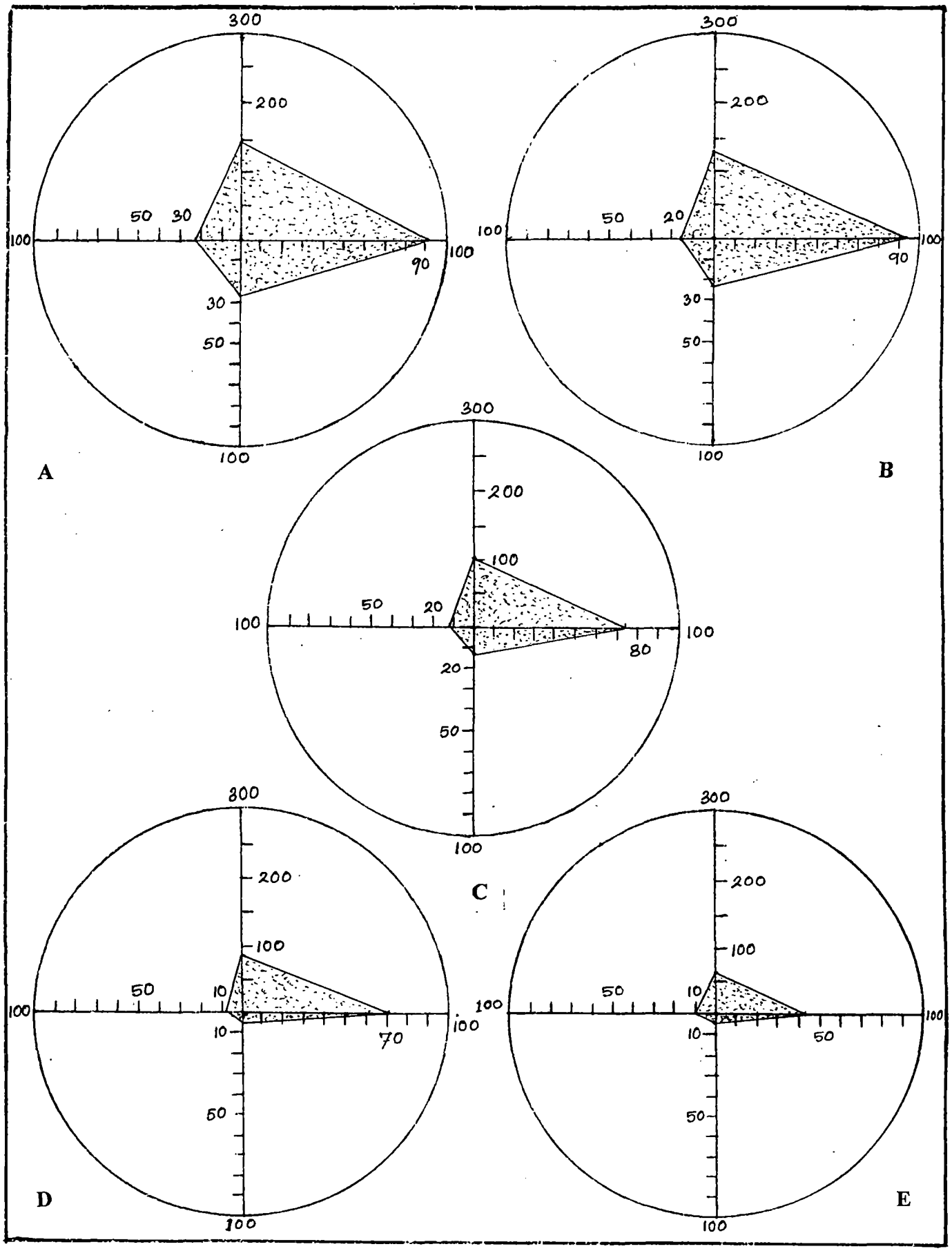


Fig. 4.6 : Phytographs of Weeds in Boro Season

A. *Leucas indica* B. *Caesulia axillaris* C. *Lindernia perviflora*

D. Ammannia baccifera E. *Gnaphalium purpureum*

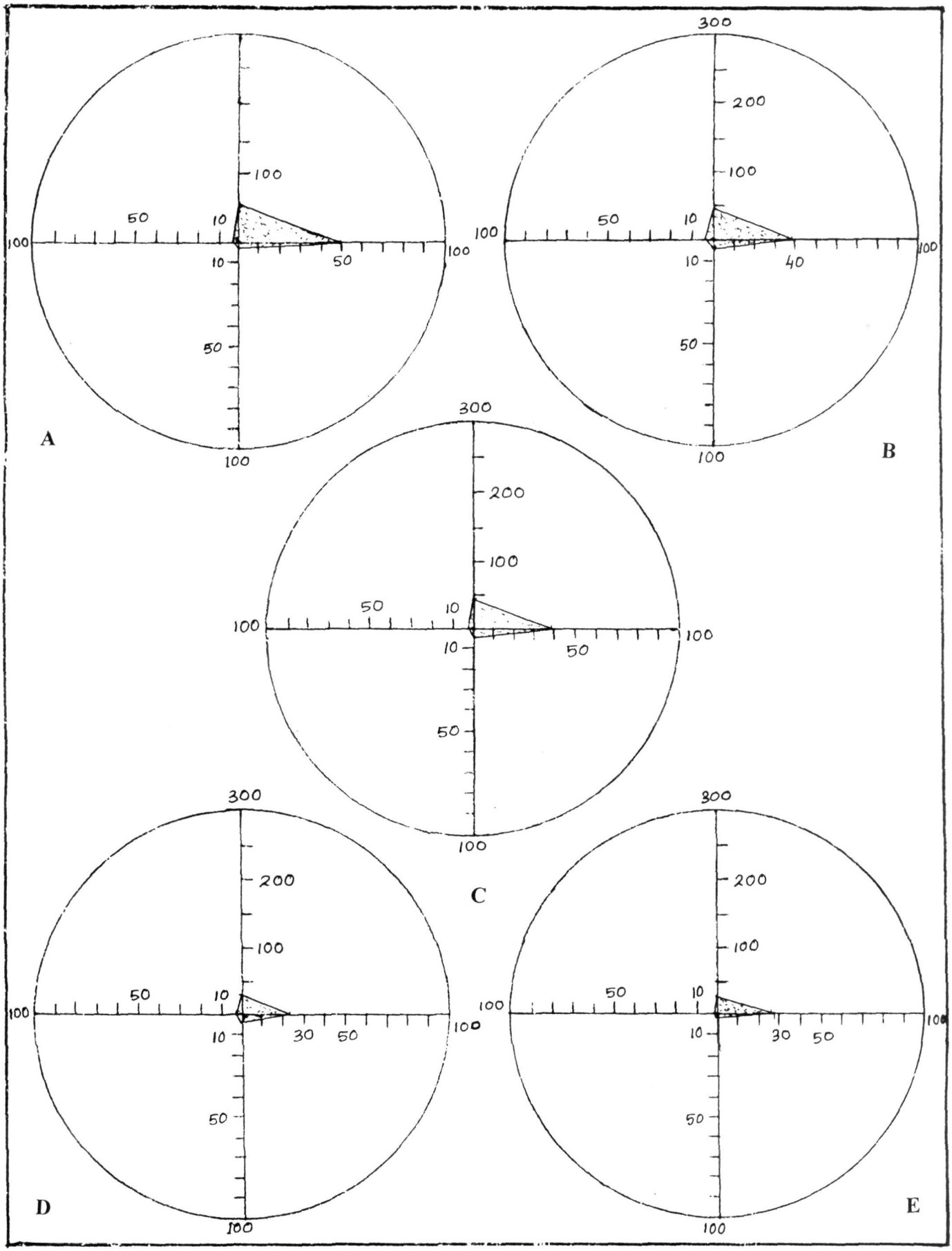


Fig. 4.7 : Annual Phytograph of Weeds

A. *Cyperus rotundus* B. *Alternanthera sessilis* C. *Cynodon dactylon*
D. *Ludwigia perennis* E. *Marsilea quadrifida*

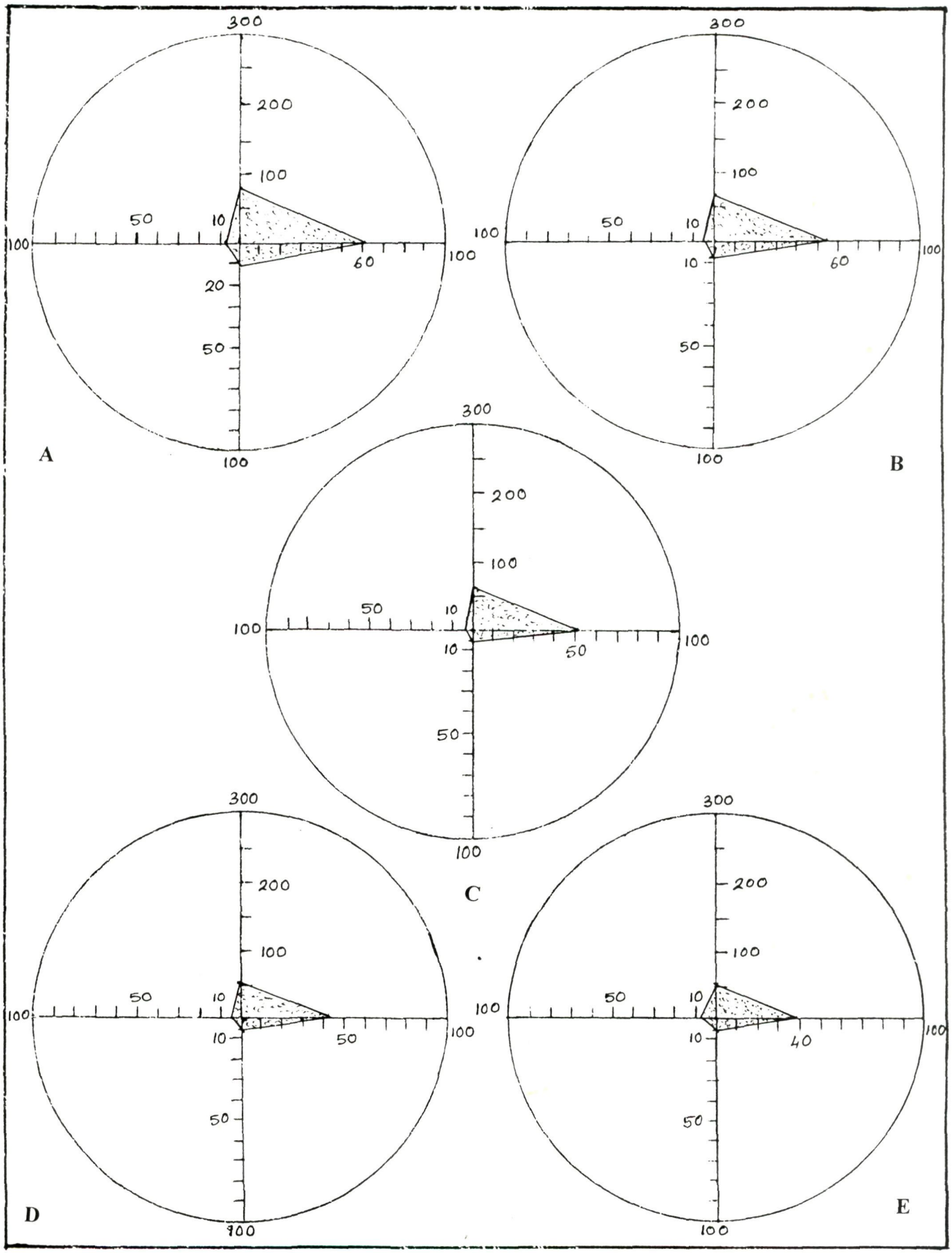
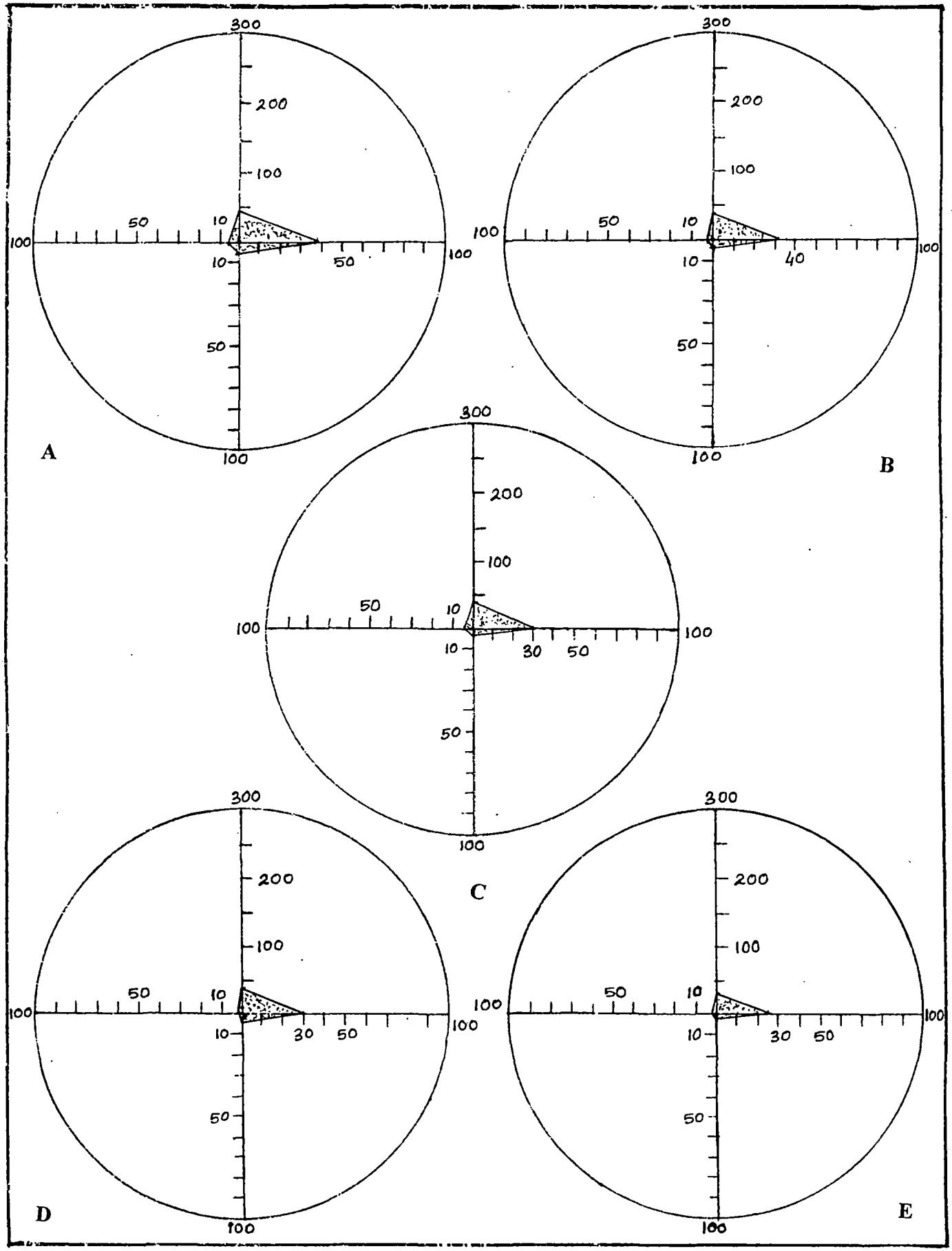


Fig. 4.8 : Annual Phytograph of Weeds

A. *Leucas indica* B. *Eclipta alba* C. *Ehinochloa colona*

D. *Caesulia axillaris* E. *Tonningia axillaris*



CHAPTER - 5

PHENOLOGY

PHENOLOGY

The study of organism in relation to climate has been termed "Phenology" (King, 1966). It embraces all studies of the relationship between climatic factors and periodic phenomena in organisms (Sundriyal, 1990).In more simpler way, it is the study of germination to death of a plant in relation to months or seasons of a year or more. There are numerous reports on the floristic composition and weed flora of agriculture fields (Paul and Bhattacharyya 1959; Chakroborty 1957; Majumder 1962; Datta and Maity 1964; Tripathy 1964; Mahapatra et al 1965; Bandopadhya 1972; Datta and Biswas 1972; Datta and Roy 1972; Tripathy and Misra 1971; Sharma 1978, 1981, 1983); there are also many reports on general phenological pattern of tropical tree species (Harper 1906; Koelmeyer 1959; Janzen 1978; Leith 1970; Leith and Redford 1971; Medway 1972; Daubenmire 1972; Frankie et al 1974; Croat 1969, '78; Croat 1975; Putz 1979) but in India such studies have been restricted to some restricted areas of Himalayas and in the Eastern Ghats (Booj and Ramkrishnan 1981; Sukla and Ramkrishnan 1981; Ralhan et al 1985; Kaul and Raina 1980; Sivaraj and Krishnamurthy 1989; Sundriyal 1990). They mainly dealt with flowering phenology of trees. As, it is already proved that airborne pollen grains cause the respiratory trouble and with the object of identifying the allergic potentiality of plants; many workers prepare flowering calendar or flowering calendar in relation to aerobiology (Chanda 1973; Mandal et al 1977; Mandal and Chanda 1979, 1980, 1981; Mandal and Yonzone 1983, 1987, 1988; DE et al 1988; Mandal et al 1989; Bhattacharyya et al 1984; Das 1986; Das and Chanda 1987; Panda 1990; Panda et al 1992).There present little report on the flowering calendar of cropfield weeds (Chakroborty 1957; Sharma 1983). The study dealing with phenological events of weeds of agricultural fields are rather scanty (Neogi and Rao 1980). In the present plan of work an attempt has been made to record the broad phenological phenomena of weeds of crop fields starting from germination and ending with their death, consecutively for 4-years i.e. June 1992 to May 1996.

5.1.PHENOPHASES

The phenological parameters include (i) germination or sprouting (ii) vegetative stage (iii) flowering (iv) fruiting (v) seed dispersal and (vi) death. Also, the mode of pollination and biological spectrum of those weeds have been studied for better understanding of their life cycle. Special emphasis has been given to Seedling Morphology of some common dicotyledonous weeds so that they can be recognised at the very early stage in the crop fields.

5.1.1 GERMINATION

Seeds of different weeds were collected from the field and were put into the germination during their normal season of germination. Seeds were shown both on moist filter paper in petridishes and also on soil in earth plots. The mode of germination was recorded from this study. In general, quite a large number of seeds germinate in field condition but only a small part of them survive to attain the maturity. Sprouting of perennating structure of perennial weeds were considered equivalent with the stage of germination in annuals for the purpose of present phenological studies.

5.1.2 VEGETATIVE STAGE

In the present study, the length of vegetative stage is calculated starting from the emergence of first leaf till the initiation of flowering i.e. the blooming of flower . However in many weeds the vegetative growth continues along with fruiting.

5.1.3 FLOWERING PERIOD

This phenophase starts with the initiation of flowering and in the present study, it continues so long a species goes on producing flowers. Naturally, this phase overlaps with the fruiting period of a species.

5.1.4 FRUITING PERIOD

Similarly to the flowering period, this phenophase also starts with the initiation of fruit-set in a species. As all the flowers on a plant do not bloom at a time, both flowers and fruits will be available on a plant at the same time.

5.1.5 SEED DISPERSAL

Except those plants which disperse seeds only after their death, other plants generally disperse their seeds after the proper ripening of their seeds. But the mechanism of release of seeds from fruits and the mechanism of dispersal varies in different plants. Considering both the mechanisms, following modes of dispersal have been recognised among the recorded species of weeds :

a) Dispersal by animals including man.
b) Dispersal by wind.
c) Dispersal by water and
d) Mechanical dispersal (i.e. explosion of fruits).

5.2 RESULT AND DISCUSSION

Phenology of crop field weeds of the district of Malda have been studied consecutively for 4-years. Except 8 weed species viz. *Dichondra repens, Ficus heterophylla, Orobanche aegyptiaca, Malachra capitata, Stephania japonica, Desmostachya bipinnata, Digitaria longiflora and Hemarthria compressa,* total phenological events of all other weed species recorded from the crop fields of Malda district have been studied.

5.2.1 GERMINATION

It has been observed that majority of the dicotyledonous species either in laboratory or in fields or in both conditions, germinate between May and October and monocotyledonous species between May and July, with peak during the month of June in both the cases. When 42 species of dicots (46.7%) and 31 species of monocots (86.1%) have been observed to germinate; it is followed by July with 36 species of docot (40.0%) and 23 species of monocot (63.9%) and May with 34 species of dicot (37.8%) and 15 species of monocot (41.7%). In case of dicots germination continues till October where 23 species (25.6%) have been found germinating but in case of monocots there have been a sharp decline in rate of germination (2.7%) after July and does not increase further till April. The length of germination period of majority of the weed species is more than one month.

5.2.2 VEGETATIVE GROWTH

Vegetative growth for majority of the dicot and monocot species have been observed between June and October; with a peak for both during June and July, when 36 species of dicot (38.7%) and 26 species of monocot (72.2%) grow vegetatively. This is followed by the month of October with 31 species of dicot (33.3%) and August with 10 species of monocot (27.8%). Vegetative growth starts to decline from the month of November in case of dicotyledonous and from the month of September in case of monocotyledonous species of weeds.

5.2.3 FLOWERING

Vegetative growth is soon followed by the flowering period. Different weed species flowered in different times of the year. But majority of the dicot species flowered during winter; with a peak in December with 88 species (96.7%) followed by November (85 species i.e. 93.4%) and January (84 species i.e. 92.3%). After the month of January flowering of dicotyledonous species starts to decline and this trend continues till the month of May. From the month of June again it starts to increase. On the other hand majority of the monocotyledonous species flowered during September (32 species or 86.5%) followed by October (31 species or 83.8%), August and November (30 species or 81.1%). So,

monocots flowered 2 or 3 months earlier than the dicots though in the month of May only a few plants have been observed in flowering condition. There are at least 32 species of weed which flowered more or less round the year, though the rate of flowering is not same in different months (e.g. *Amaranthus viridis, Eclipta alba, Parthenium hysterophorus, Leucas indica, Euphorbia sp., Glinus sp., Hedyotis sp., Lindernia sp., Portulaca sp., Solanum nigram, Cyperus rotundus, Elusine indica, Cynodon dactylon, Eragrostis ferruginea etc.).*However majority of weeds of pulses and a few monocotyledonous are with very short flowering period e.g. *Anagallis arvensis, Fumaria indica, Leucas cephalotes, Asphodelus tenuifolius, Butomopsis latifolia, Cyperus compressus, C. difformis* etc.

5.2.4 FRUITING

Unlike many general plants, in case of weed species flowering and fruiting are a simultaneous process, as the majority of the weed species has a short life-span. In majority of the species fruit set occurs simultaneously with the ripening of fruits. So, in a plant there are fruits of all the stages, newly set to dehiscing or dispersing ones. December and January with 87 species (95.6 %) show the peak of fruiting in case of dicotyledonous weed followed by February with 82 species (90.1%) and November with 76 species (83.5%). September shows the peak for monocotyledons weeds with 32 species (86.5%), followed by October with 31 species (83.8%) and August and November with 28 species (75.7%). For both monocot and dicot species the month of June shows the lowest fruiting condition and it starts to increase from July which is very much at per with the observation of initiation of flowering period.

5.2.5 DEATH

It is very hard to understand the particular death phase of weeds of crop fields because of (i)the prevailing weeding practices (ii)as soon as the harvesting of one crop is being completed the field after a very short interval is generally prepared for next crop. So, the intercrop weed flora gave a clear picture about this phenophase. Except for the perennials both monocotyledonous and dicotyledonous weed species have a particular death phase. Dicotyledonous and monocotyledonous weeds show a peak during the month of April with 40 species (44.9%) and 17 species (50.0%) respectively, followed by May 38 species (42.7%) and March with 20 species (22.5%) for dicotyledonous; and March with 16 species (43.1%) and December with 7 species (20.6%) for monocotyledonous weeds. It has been observed that between June and September there is no death of monocotyledonous weed and for dicotyledonous weed it is for the month of October and November.

But *Parthenium hysterophorus* and *Leucas indica* show two distinct germination and death phase. For *Parthenium hysterophorus* June - July and October - November are periods for germination, April-May and August-September are the periods for death, for

Leucas indica May and October for germination and January - March and June - August for death. Some plants complete their life cycle within a year i.e. annual where as others live for years i.e. perennials but in each case all the phenophase is governed by the climatic factors like photoperiod, temperature, precipitation etc. All the phenophase in relation with weed species have been represented in table 5.1. Flowering and fruiting of weed species (%) in different months of the year in relation to temperature and precipitation have been represented graphically in fig. 5.1.

5.2.6 LIFEFORM

The weed flora is dominated by Therophytes (122 species or 92.42%) but Chamaephytes, Nanophenarophytes, Geophytes are less than 4%. While annuals are dominating (122 species or 92.42%), Perennials herbs, shrubs and root parasite are poorly represented (below 5%). While 103 species (78.0%) of weeds are mesophytes, other types include helophytes (18.9%) and hydrophytes (3.0%) respectively. Distribution of these habit and habitat groups are at per with the field conditions. Because, most of the time there is no water cover in the field but during monsoon, the soil remain water saturated at least for 4-months. During tilling most of the weed species dies, so it is difficult for perennials to survive in such fields. So, the change of the season, tilling, weeding and cover of crop plants are mainly responsible for the selection of annuals or therophytes in the crop fields of Malda District. Weeds are largely entomophilous (71 species or 54.6%) but there are quite a few anemophilous (35.4%) and amphiphilous (9.2%) plants. Seeds of 116 weed species (89.9%) have been observed to disperse by water, followed by 39 species (30.2%) dispersed by animals (including man) and 16 species (12.4%) by wind. Weeds belonging to the family Acanthaceae like *Hygrophila auriculata, H. difformis, H. polysperma, Rungia pectinata* and some other plants like *Cochleria cochleroides* of Brassicaceae; *Cleome viscosa* of Cleomaceae; *Chrozophora rottleri* of Euphorbiaceae; *Lathyrus aphaca , Vicia angustifolia, V. hirsuta* of Fabaceae; *Biophytum sensitivum, Oxalis corniculata* of Oxalidaceae disperse their seeds by explosion to a great distance. But most of the weeds disperse their seeds by two methods. By explosion seeds can move from a few centimeter to a few feet (upto 10 ft) only and for further movement the water current is probably the best carrier.

Most of the dicotyledonous weeds produce fruit during November to February and monocotyledonous weeds during August to November. So, weeding has to be done before that period, otherwise the produced seeds of the weeds would be dispersed and buried in the soil and will germinate with the onset of favorable conditions.

Table 5.1 : Phenology of Weed flora of the district of Malda

(**Abbreviation used** : **G** = Germination, **V** = Vegetative, **F** = Flowering, **R** = Fruiting, **D** = Death)

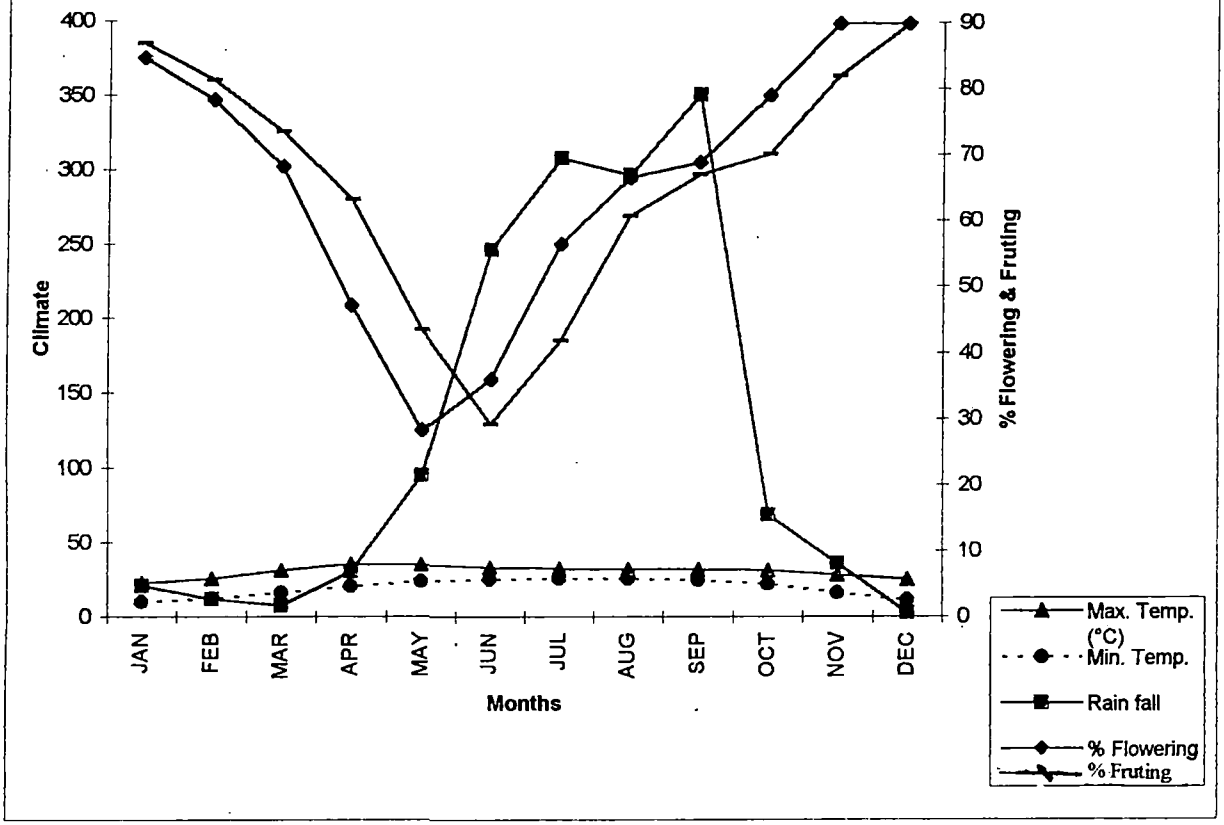
Name of Weed	Family	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Hygrophila auriculata	Acanthaceae	FR	FR	FR	RD	D	-	-	-	GV	VF	FR	FR
H.difformis	-do-	FR	FR	FR	D	-	-	-	GV	GV	VF	FR	FR
H. polysperma	-do-	FR	FR	FR	D	-	-	-	GV	GV	VF	FR	FR
Rungia pectinata	-do-	FR	FR	FR	FR	RD	D	-	-	GV	GV	FR	FR
Achyranthes aspera	Amaranthaceae	FR	FR	FR	RD	-	-	-	GV	GV	FR	FR	FR
Alternanthera philoxeroides	-do-	F	F	D	-	GV	V	VF	F	F	F	F	F
A. sessilès	-do-	FR	FR	RD	DG	GV	VF	FR	FR	FR	FR	FR	FR
Amaranthus viridès	-do-	FR	FR	FR	FRD	DGV	GVF	GVFR	FR	FR	FR	FR	FR
Celosia argentea	-do-	FR	FR	FR	RD	D	GV	GV	GVF	FR	FR	FR	FR
Digera muricata	-do-	FR	FRD	D	-	G	GV	VF	FR	FR	FR	FR	FR
Centella asiatica	Apiaceae	FR	FR	FR	FR	FDG	GVF	GVF	FR	FR	FR	FR	FR
Ageratum conyzoides	Asteraceae	FR	FR	FR	FRD	RD	GV	GV	V	V	VF	FR	FR
A. houstonianum	-do-	FR	FR	FR	FR	RD	GV	GV	V	V	VF	FR	FR
Blumea lacera	-do-	FR	FR	FR	FRD	RD	GV	GV	V	V	VF	FR	FR
Caesulia axillaris	-do-	FR	FR	FR	RD	-	G	GV	FR	FR	FR	FR	FR
Cirsium arvense	-do-	FR	FR	FR	FR	RD	-	-	GV	GV	V	F	FR
Eclipta alba	-do-	FR	FR	FR	FRG	FRDG	GVF	FR	FR	FR	FR	FR	FR
Emilia sonchifolia	-do-	FR	FR	FR	RD	-	-	GV	GV	F	FR	FR	FR
Gnaphalium luteo-album	-do-	FR	FR	FR	FR	D	-	-	-	GV	GV	F	FR
G. purpureum	-do-	FR	FR	FR	FR	D	-	-	-	GV	GV	F	FR
Launaea asplenifolia	-do-	FR	FR	FR	FR	FRD	D	-	-	-	GV	GV	F
Parthenium hysterophorus	-do-	FR	FR	FR	FRD	FRD	FRGV	FRGV	FRD	FRD	FRGV	FRGV	FR
Sphaeranthus indicus	-do-	FR	FR	FR	FR	RD	-	-	-	G	GV	F	FR
Spilanthes calva	-do-	FR	FR	FR	FR	RD	-	-	FR	FR	FR	FR	FR
Vernonia cinerea	-do-	FR	FR	-	-	-	-	-	-	-	-	FR	FR
Xanthium indicum	-do-	FR	FR	FR	FR	RD	D	GV	GV	V	V	FR	FR
Heliotropium indicum	Boraginaceae	FR	FR	FR	FR	FR	FR	FR	FRDG	GV	VF	FR	FR
Cochleria cochlearioides	Brassicaceae	FR	FR	FR	RD	-	-	-	-	GV	GV	FR	FR
Rorippa indica	-do-	FR	FR	FR	FR	FRD	RD	GV	GV	GV	GVF	FR	FR
Cassia sophera	Caesalpinaceae	FR	FR	FR	RD	GV	GV	V	F	FR	FR	FR	FR
Polycarpon prostratum	Caryophyllaceae	FR	FR	FR	RD	-	G	GVF	FR	FR	FR	FR	FR
Chenopodium album	Chenopodiaceae	FR	FR	RD	-	-	-	-	-	GV	VF	FR	FR

Name of Weed	Family	J	F	M	A	M	J	J	A	S	O	N	D
Cleome viscosa	Cleomaceae	FR	FRD	D	-	G	GV	GVFR	FR	FR	FR	FR	FR
Dichondra repens	Convolvulaceae	-	-	-	-	-	V	V	V	V	V	V	-
Evolvulus nummularius	-do-	FR	FR	FR	FR	GVFR	GVFR	FR	FR	FR	FR	FR	FR
Hewittia scandens	-do-	-	-	-	-	GV	GV	V	FR	FR	FR	FR	FR
Ipomoea aquatica	-do-	FR	FR	FRD	RD	GV	GV	V	FR	FR	FR	FR	FR
Cucumis melo	-do-	FR	RD	-	GV	GV	FR	FR	FR	FR	FR	FR	FR
Acalypha indica	Euphorbiacee	FR	FR	FR	FR	FR	GVFR	GVFR	FR	FR	FR	FR	FR
Croton bonplandianum	-do-	FR	FR	FR	FR	FRD	GVFR	GVFR	FR	RR	FR	FR	FR
Chrozophora-rottleri	-do-	GV	V	VF	FR	FR	FR	FR	FR	RD	-	-	GV
Euphorbia heyniana	-do-	FR	FR	FR	FRG	FRG	DGFR	FR	FR	FR	FR	FR	FR
E. hirta	-do-	FR	FR	FR	FR	FRG	DGFR	FR	FR	FR	FR	FR	FR
E. indica	-do-	FR	FR	FR	FR	FRG	DGFR	FR	FR	FR	FR	FR	FR
Phyllanthus amarus	-do-	FR	RD	-	-	GV	GVFR	FR	FR	FR	FR	FR	FR
P. fraturnus	-do-	FR	RD	-	-	GV	VFR	FR	FR	FR	FR	FR	FR
P. virgatus	-do-	FR	RD	-	-	GV	VFR	FR	FR	FR	FR	FR	FR
Sebastiania chamaelea	-do-	FR	FR	FR	FR	RD	-	-	-	-	G	GVF	FR
Lathyrus aphaca	Fabaceae	FR	FR	RD	-	-	-	-	-	G	GV	VFR	FR
Medicago lupulina	-do-	FR	FR	FRD	D	-	-	-	-	G	GVF	FR	FR
Melilotus alba	-do-	FR	FR	FR	FR	RD	-	-	-	G	GV	VFR	FR
Vicia angustifolia	-do-	FR	FR	FRD	RD	-	-	-	-	-	G	GV	FR
V. hirsuta	-do-	FR	FR	FRD	D	-	-	-	-	-	G	GV	FR
Fumaria indica	Fumariaceae	FR	FR	FR	FRD	RD	-	-	-	-	GV	GVF	FR
Hydrolea zeylanica	Hydrophyllaceae	RD	-	-	-	-	-	GV	GVF	FR	FR	FR	FR
Leucas cephalotes	Lamiaceae	FR	FR	D	-	-	-	-	-	-	G	GF	FR
L. indica	-do-	FRD	FRD	FRD	FR	RGF	VFR	FRD	FRD	FR	FRGV	FR	FR
Leonurus japonicus	-do-	FR	FR	FR	FRD	RD	-	GV	GVF	FR	FR	FR	FR
Ammannia baccifera	Lythraceae	FR	FR	FRD	FRD	RD	G	GVF	FR	FR	FR	FR	FR
Nesaea brevipes	-do-	FRD	D	-	-	-	-	G	GV	FR	FR	FR	FR
Rotala indica	-do-	FR	FR	D	-	-	GVF	GVFR	FR	FR	FR	FR	FR
Malachra capitata	Malvaceae	-	-	-	-	-	G	GV	F	F	FR	FR	FR
Sida rhombifolia	-do-	FR	FR	FR	FRD	FR	FRGV	FRGV	FR	FR	FR	FR	FR
Stephania japonica	Menispermaceae	V	V	V	V	GV	GVF	FR	FR	FR	FR	FR	R
Glinus lotoides	Molluginaceae	FR	FR	FR	FRG	FRDG	FR	FR	FR	FR	FR	FR	FR
G. oppositifolius	-do-	FR	FR	FR	FRG		FR	FR	FR	FR	FR	FR	FR
Ficus heterophyla	Moraceae	V	V	V	V	V	V	V	V	V	V	V	V

Name of Weed	Family	J	F	M	A	M	J	J	A	S	O	N	D
Ludwigia adscendens	Onagraceae	VFR	VFR	VFR	VFR	FRD	FRD	GV	GV	V	VFR	VFR	VFR
L. perennis	-do-	FR	FR	FR	FR	RD	GV	GVF	FR	FR	FR	FR	FR
Orobanche aegyptiaca	Orobanchaceae	FR	FR	FR	RD	-	-	-	-	-	-	F	FR
Biophytum sensitivum	Oxalidaceae	RD	-	-	-	GV	GV	FR	FR	FR	FR	FR	FRD
Oxalis corniculata	-do-	FR	FR	FR	FRD	DGV	GVF	GVFR	GVFR	GVFR	GVFR	FR	FR
Argemone mexicana	Papaveraceae	FR	FR	FR	FRD	RD	G	GV	GV	GV	V	FR	FR
Polygonum plebeium	Polygonaceae	FR	FR	FR	FR	FR	FR	FRD	-	-	GV	GV	VFR
Portulaca oleracea	Portulacaceae	FR	FR	FR	FRDG	FRDG	GVFR	GVFR	GVFR	GVFR	VFR	VFR	VFR
P. quadrifida	-do-	FR	FR	FR	FRDG	FRDG	GVFR	GVFR	GVFR	GVFR	VFR	VFR	VFR
Anagallis arvensis	Primulaceae	FR	FR	FRD	D	-	-	-	-	GV	GV	VFR	FR
Ranunculus sceleratus	Ranunculaceae	GVFR	FR	FRD	RD	-	-	-	-	-	-	G	GV
Hedyotis corymbosa	Rubiaceae	FR	FR	FRD	GFRD	GFR	GFR	GFR	GFR	GFR	GFR	FR	FR
H. diffusa	-do-	FR	FR	FRD	GFRD	GFR	FR	FR	FR	FR	FR	FR	FR
H. pumila	-do-	FR	FR	FR	GFRD	GFR	FR	FR	FR	FR	FR	FR	FR
Lindernia ciliata	Scorphulariaceae	FR	FR	FRD	RD	-	GV	GVFR	FR	FR	FR	FR	FR
L. crustacea	-do-	FR	FR	FR	FRD	RD	GV	GVFR	FR	FR	FR	FR	FR
L. multiflora	-do-	FR	FR	FR	RD	D	GVFR	GVFR	FR	FR	FR	FR	FR
L. perviflora	-do-	FR	FR	FR	FRD	RD	G	GV	GFR	GFR	FR	FR	FR
Macardonia procumbens	-do-	FR	FR	FR	FR	GVFR	GVFR	GVFR	FR	FR	FR	FR	FR
Scoparia dulcis	-do-	FR	FR	FR	FRD	GVFR	GFR	GFR	FR	FR	FR	FR	FR
Physalis minima	Solanaceae	FR	FR	FR	FR	RD	D	-	G	GV	FR	FR	FR
Solanum niagrum	-do-	FR	FR	FR	FR	GFR	GFR	GFR	GFR	GFR	GFR	GFR	FR
Nicotiana plumbaginifolia	-do-	FR	FR	FR	FR	FR	FR	FR	GFRD	GFRD	GFR	GFR	GFR
Melochia corchorifolia	Stercullariaceae	RD	-	-	G	GV	FR	FR	FR	FR	FR	FR	FRD
Corchorus fascicularis	Tiliaceae	FR	FRD	RD	-	-	-	-	GV	GVFR	FR	FR	FR
Phyla nodiflora	Verbinaceae	FR	FR	FR	FRD	GVFRD	GVFR	FR	FR	FR	FR	FR	FR
Butomopsis latifolia	Alismataceae	FR	FRD	D	-	-	-	-	GV	GV	V	V	F
Sagitaria guyanensis	-do-	FR	FR	FR	FRD	FRD	GV	GV	FR	FR	FR	FR	FR
Commelina benghalensis	Commelinaceae	FR	FR	FRD	D	-	GV	GVF	FR	FR	FR	FR	FR
Murdannia nudiflora	-do-	FR	FR	RD	D	-	G	GVFR	FR	FR	FR	FR	FR
Tonningia axillaris	-do-	-	-	-	-	-	G	GVF	FR	FR	FRD	D	-
Cyperus compressus	Cyperaceae	D	-	-	-	GV	GV	GVF	VFR	FR	FR	FR	FRD
C. difformis	-do-	-	-	-	-	GV	GVF	FR	FR	FR	RD	D	-
C. iria	-do-	FR	FRD	D	-	-	GV	GVF	FR	FR	FR	FR	FR

Name of Weed	Family	J	F	M	A	M	J	J	A	S	O	N	D
C. kyllinga	Cyperaceae	FR	FR	FR	RD	D	GV	GVFR	FR	FR	FR	FR	FR
C. rotundus	-do-	FR	FR	FR	FRD	G	GV	VFR	FR	FR	GFR	GFR	FR
C. tegetiformis	-do-	FR	FR	FRD	D	-	GV	VF	FR	FR	FR	FR	FR
Eleocharis congesta	-do-	D	-	-	-	-	GV	GVFR	FR	FR	FR	FR	FRD
Fimbristylis dichotoma	-do-	-	-	-	GV	GVF	FR	FR	FR	FR	FRD	D	-
F. miliacea	-do-	D	-	-	-	-	GV	GVF	VFR	FR	FR	FR	FRD
Scirpus articulatus	-do-	F	FR	FRD	FRD	RD	G	GV	V	V	V	F	F
S. juncoides	-do-	FR	FR	FRD	FRD	RD	G	G	V	V	V	F	F
Eriocaulon cinereum	Eriocaulaceae	FR	FR	FRD	D	G	GV	GV	FR	FR	FR	FR	FR
Asphodelus tenuifolius	Liliaceae	FR	FR	FRD	RD	RD	-	-	-	-	GV	GVF	FR
Brachiaria reptans	Poaceae	-	-	GV	GVF	GVFR	GFR	GFR	FR	FR	FR	FRD	D
Chloris inflata	-do-	-	-	-	GV	GVF	FR	FR	FR	FR	FRD	RD	-
Cynodon dactylon	-do-	VFR	VFR	VFR	VFR	VFR	VFR	VFR	VFR	VFR	VFR	VFR	VFR
Desmostachya bipinnata	-do-	NR	NR	FR	FR	FR	NR	-	-	-	-	-	-
Digitaria bicornis	-do-	-	-	-	-	-	GV	GVF	FR	FR	FR	FRD	RD
D. ciliaris	-do-	FR	FR	FRD	RD	-	GV	GVF	FR	FR	FR	FR	FR
D. cruciata	-do-	D	-	-	-	-	GV	GVF	FR	FR	FR	FR	RD
D. longiflora	-do-	-	-	-	-	GV	GVF	GVFR	FR	FR	FR	NR	-
Echinochloa colona	-do-	FR	FR	RD	D	G	GV	GVF	FR	FR	FR	FR	FR
E. crus-galli	-do-	FR	FR	RD	D	G	GV	GVF	FR	FR	FR	FR	FR
Elusine indica	-do-	FR	FR	FR	FR	GVFR	GVFR	FR	FR	FR	FR	FR	FR
Eragrostis ferruginea	-do-	FR	FR	FR	FRD	GVRD	GV	FR	FR	FR	FR	FR	FR
E. gangetica	-do-	FR	FR	FRD	RD	-	G	GV	V	FR	FR	FR	FR
E. riparia	-do-	FR	FR	FRD	RD	G	GV	V	V	FR	FR	FR	FR
E. tenella	-do-g	FRD	D	-	-	-	GV	GV	VF	FR	FR	FR	FR
Hemarthria compressa	-do-	-	-	-	-	GV	GVF	FR	FR	FR	FR	NR	-
Paspalum scrobiculatum	-do-	FR	FR	RD	D	-	GV	GVF	FR	FR	FR	FR	FR
Sacciolepis myosuroides	-do-	FR	RD	D	-	-	GV	GV	VF	FR	FR	FR	FR
Monochoria vaginalis	Pontederiaceae	FRD	D	-	-	GV	GV	VF	FR	FR	FR	FR	FR
Ceratopteris thalictroides	Parkeriaceae	-	-	-	-	-	GV	GV	S	S	S	S	D
Marsilea quadrifida	Marsileaceae	V	S	S	S	V	V	V	V	V	V	V	V

Fig. 5.1 : Flowering and Fruiting of Crop-field Weeds of the district of Malda in relation to Temperature and Rainfall



CHAPTER - 6

SEEDLING MORPHOLOGY

SEEDLING MORPHOLOGY

Seedling is the juvenile stage of the plant and is produced from the seeds, in distinction to a plant propagated artificially, or a young plant so produced (Jackson, 1928). Early in botanical history, little attention was paid to seedling morphology (Caesalpinus, 1583). In 20th century occasional works has been done in this field but on temperate seedlings only. Some forest botanist made some works on tropical tree seedlings (Duke, 1965,1969; Burger, 1972). Many other workers (Naidu and Shah, 1981; Lodiges et al. 1981, 1984; Sampatkumar, 1982; Canne, 1983; Nemato and Ohashi, 1993; Kumilya and Paria, 1993, 1994) attempted to study the seedlings from the taxonomic view point. But no attempt has been made so far to study the seedling morphology of crop field weeds, to identify the weeds at their juvenile stage. Though Tiwari (1953-54) in Bihar observed that the weeds are more injurious in their early stage than the advance stages of the crop. So, in the present work attempt has been made to characterize and to identify the seedlings at their juvenile stage.

In the present work seedlings of 45 common dicotyledonous crop field weeds belonging to 20 families have been morphologically diagnosed on the basis of cotyledons or paracotyledons, eophylls (first few leaves) and hypocotyl characters.

6.1 KEY TO THE IDENTIFICATION OF SEEDLINGS

An artificial Key has been prepared for easy identification of the weed species at their juvenile stage.

1. First leaf compound ---------- 2
1. First leaf simple---------- 6
2. Leaflets obcordate---------- ***Oxalis corniculata***
2. Leaflets never obcordate ---------- 3
3. Paracotyledons narrowly lanceolate; leaflets deeply dissected --------- ***Fumaria indica***
3. Paracotyledons oblong or rounded; leaflets entire ---------- 4
4. Terminal leaflet absent ---------- 5
4. Terminal leaflet rhomboid ---------- ***Cleome viscosa***
5. Leaflets sessile; rachis tip extended ---------- ***Biophytum sensitivum***
5. Leaflets petiolate; rachis tip not extended ---------- ***Cassia sophera***
6. First two leaves reduced into minute prophyll ---------- 7
6. First leaf not reduced but simple ---------- 8
7. Third to sixth leaves with two leaflets and increase in subsequent leaves ---------- ---------- ***Vicia angustifolia***
7. Third and forth leaf with four leaflets and increase in subsequent leaves ---------- ---------- ***Vicia hirsuta***
8. Second and subsequent leaves compound ---------- 9
8. Second and subsequent leaves simple ---------- 10
9. Terminal leaflets of second leaf obcordate with few obscure serrations or almost entire ---------- ***Medicago lupulina***
9. Terminal leaflet of second leaf rounded at tip, distantly crenate --------- ***Melilotus alba***
10. Internode between cotyledonary node and next leaf suppressed ---------- 11
10. Internode between cotyledonary node and the first leaf never suppressed ---------- 19
11. Cotyledons obcordate (upto 1/3 part deep) ---------- ***Hewittia scandens***
11. Cotyledons not obcordate ---------- 12
12. Lamina of first four to six leaves reniform to slightly oblong-reniform ---------- 13
12. lamina of first few leaves or of mature leaves never reniform ---------- 14
13. Petiole of cotyledon 0.6-0.8 cm long; base of basal leaf lamina slightly cordate --------- ---------- ***Leonurus japonicus***
13. Petiole of cotyledon 0.1 cm long; base of all lamina deeply cordate -- ***Centella asiatica***
14. Leaves exstipulate ---------- 15
14. Leaves stipulate ---------- 17
15. Margins of lamina, except cotyledons, deeply sinuate and spinous and with pinnate venation ----------***Argemone mexicana***
15. Margin of lamina never spinous ---------- 16
16. Cotyledons distinctly petiolate; lamina of first few leaf ovate to orbicular, entire and with pinnate veins ---------- ***Rorippa indica***

16. Cotyledons almost sessile, lamina of first leaf broader than long; irregularly serrate and with palmate veins ---------- ***Cucumis melo***
17. Seedling always produce two or more branches after the production of first leaf; second pair of leaf upto 0.45 cm long ---------- ***Euphorbia heyniana***
17. Seedling do not branch after the first leaf; normal stem with distinct internodes continues after the first leaf ---------- 18
18. Stem densely woolly, serrations distant, broadest area for the lower half of lamina 1/3 part away from base ---------- ***Euphorbia hirta***
18. Stem shortly and sparsely woolly; serrations quite close set; broadest area for the lower half of lamina near the base ---------- ***Euphorbia indica***
19. Leaves except cotyledons alternate ---------- 20
19. *Leaves (in addition to paracotyledons), at least the first pair opposite* ---------- 35
20. Lamina deeply dissected ---------- ***Parthenium hysterophorus***
20. Lamina never dissected but entire/slightly lobed or variously serrate/dentate -------- 21
21. Veins three from base (palmate) ---------- ***Chrozophora rottleri***
21. Single vein from base ---------- 22
22. Cotyledons shorter than the lamina of second leaf ---------- 23
22. Cotyledons longer than lamina of second leaf, entire, narrowly lanceolate, lamina of other leaves entire, obtuse ---------- ---------- ***Digera muricata***
23. Leaves stipulate, sometimes stipules replaced by glands ---------- 24
23. Leaves ex-stipulate ---------- 27
24. Cotyledons and lamina of first few leaves obovate-oblong ---------- 25
24. Cotyledons and lamina of the leaves never obovate; dwarf shoot never produced ------ ---------- 26
25. Dwarf shoot develop after second leaf ---------- ***Phyllanthus fraturnus***
25. Dwarf shoot develop after 4-6 leaves ---------- ***Phyllanthus amarus***
26. Stem with no scales or stellate hairs ---------- ***Phyllanthus virgatus***
26. Stem scaly and with stellate hairs ---------- ***Croton bonplandianum***
27. Lamina entire at least of first few leaves ---------- 28
27. Lamina dentate or sinuate or serrate ---------- 31
28. Petiole absent; lamina linear lanceolate ---------- ***Sebastiania chamaelea***
28. Petiole always present ---------- 29
29. Stem zigzag; lamina slightly obovate with rounded tip ------ ***Evolvulus nummularius***
29. Stem erect ---------- 30
30. Lamina ovate with notched tip ---------- ***Amaranthus viridis***
30. Lamina lanceolate with acute tip ---------- ***Celosia argentea***
31. Cotyledons minute, triangular ovate, lamina (of cotyledon) 0.12 cm long ---------- ---------- ***Scoparia dulcis***
31. Cotyledons more than 0.2 cm long, ovate or rounded ---------- 32
32. Lamina of leaves of second and onwards broadly ovate ---------- ***Blumea lacera***
32. Lamina of leaves (except cotyledons) not obovate ---------- 33
33. Paracotyledon narrowly lanceolate; leaves fleshy, ovate-lanceolate ---------- ---------- ***Chenopodium album***
33. Paracotyledons ovate ---------- 34
34. Base of lamina slightly cordate or rounded ---------- ***Physalis minima***

34. Base of lamina narrowed to petiole, never cordate ---------- ***Solanum nigrum***
35. Margins of lamina not entire ---------- 36
35. Margins of lamina entire or slightly and irregularly undulating ---------- 41
36. Paracotyledons always more than 2.0 cm long; slightly ovate-lanceolate; lamina with cordate base ---------- ***Xanthium indicum***
36. Paracotyledons always less than 1.0 cm long, generally ovate or ovate-rounded; lamina never with a cordate base ---------- 37
37. Lamina pinnately veined ---------- 38
37. Lamina 3-veined from base ---------- 39
38. Paracotyledons 0.07 cm long including petiole; lamina fleshy ---------- ***Phyla nodiflora***
38. Paracotyledons 1.2 cm long including petiole; lamina not fleshy --------- ***Leucas indica***
39. Hypocotyl over 2.0 cm long; lamina obscurely serrate ---------- ***Acalypha indica***
39. Hypocotyl less than 1.5 cm long; lamina distinctly dentate-serrate ---------- 40
40. Base of lamina cuneate ---------- ***Ageratum conyzoides***
40. Base of lamina truncate ---------- ***Ageratum houstonianum***
41. Leaves sessile ---------- ***Anagallis arvensis***
41. Leaves petiolate ---------- 42
42. Lamina rugose above ---------- ***Heliotropium indicum***
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43. Paracotyledons unequal, over 1.0 cm long; lamina gradually narrowed to petiole ---------- ***Alternanthera sessilis***
43. Paracotyledons equal, less than 1.0 cm long; lamina base otherwise ---------- 44
44. Lamina strigose hairy above ---------- ***Eclipta alba***
44. Lamina glabrous ---------- ***Ludwigia perennis***

6.2 ENUMERATION

Enumeration of the seedling morphology has been made with families, genera and species of the weed flora arranged alphabetically.

Alternanthera sessilis

Germination epigeal, phanerocotylar.

Taproot 3.8-4.3 cm long, moderately thick, creamy white, lateral roots scarcely branched.

Hypocotyle straight, terete, 2.5-2.9 cm long, reddish.

Paracotyledons 2, unequal, opposite, persistent upto 8-10 leafed stage, exstipulate, petiolate; for smaller one petiole upto 0.7 cm, blade 0.8 x 0.55 cm, wide oblong, entire, base narrowed to petiole; for second one-blade ca. 0.9 x 0.7 cm entire, suborbicular, acute, base narrowed to petiole, reddish below; primary vein-1, secondary veins indistinct.

Internode straight, reddish, terete, 1st and 2nd internode 2.2 and 2.8 cm respectively.

First two leaves opposite, simple, exstipulate, petiolate; petiole 0.6-0.7 cm, blade ca. 1.7 x 0.95 cm, wide oblong, entire, obtuse, base narrowed to petiole, primary vein 1, secondary veins alternate.

Subsequent leaves opposite, petiole gradually shorter and other characters are same as that of first two leaves, branching also arises from the cotyledonary nodes.

Amaranthus viridis

Germination epigeal, phanerocotylar.

Taproot 3.4-4.0 cm long, thin, grayish, lateral roots profusely branched.

Hypocotyl straight, whitish green, terete, 0.9-1.1 cm long.

Paracotyledons two, opposite, fleshy, persistent upto 7-10 leaved stage, exstipulate, petiolate; petiole 0.4-0.6 cm, blade 0.7-0.8 x 0.2 cm, narrow elliptic, entire, obtuse, primary vein 1, secondary veins alternate.

Internode straight, terete, greenish-gray, Ist and 2nd internode 0.3-0.4 cm and 0.3-0.5 cm long respectively
First two leaves alternate, simple, exstipulate, petiolate; petiole 0.5-0.6 cm and 0.55-0.62 cm and blade 0.8-0.85 x 0.4-0.55 cm and 0.8-0.9 x 0.5-0.6 cm respectively, ovate, entire, emerginate, base obtuse; primary vein 1, secondary veins alternate.

Subsequent leaves alternate, exstipulate, petiolate and other characters are same as that of first two leaves except in size. [Plate 4, Fig.12]

Celosia argentea

Germination epigeal, phanerocotylar.

Taproot 8.4-10.2 cm long, moderately thick, white, lateral roots profusely branched.

Hypocotyl straight, terete, 1.2-1.4 cm long, violate, enveloped by petiolar sheath of paracotyledons.

Paracotyledons 2, opposite, entire, exstipulate, petiolate, persistent upto 10-12 leafed stage, sometimes found attached with mature plant; petiole 0.5 cm, blade 1.1 x 0.45 cm, fleshy, entire, lanceolate, acute, lower violate; primary vein 1, secondary veins indistinct.

Internode straight, light violate, 1st and 2nd internode 0.2 x 0.3 cm, respectively.

First two leaves semialternate, simple, green, dorsal violate near the midrib, fleshy, petiolate; petiole 0.9 and 1.4 cm, blade 1.8 x 0.9 cm and 2.9 x 1.4 cm respectively, entire, lanceolate, acute, base acute to acuminate; primary veins 1, secondary veins alternate.

Subsequent leaves alternate and other characters are same as that of first two leaves.

Digera muricata

Germination epigeal, phanerocotylar.

Taproot 7.4-7.6 cm long, white, lateral roots profusely branched.

Hypocotyle straight, 1.5-1.9 cm, lower reddish, upper green, enveloped by petiolar sheath of paracotyledons.

Paracotyledons 2, persistent upto 8-10 leafed stage, sometimes till branching, petiolate; petiole 1 cm, blade 3.8 x 0.4 cm, entire, linear, acute, base acute, primary veins 1, secondary veins indistinct.

Internode straight, 1st and 2nd internode 0.5 and 0.3 cm respectively.

First two leaves alternate, simple, exstipulate, petiolate; petiole 1.5 and 1.1 cm, blade 2.4 x 1.0 cm and 2.5 x 1.5 cm respectively, entire, ovate, acute, base acute; primary vein 1, secondary veins alternate.

Subsequent leaves alternate and others characters are same as that of first two leaves, branching also arises from the cotyladonary node. [Plate 3, Fig.4,18]

Centella asiatica

Germination epigeal, phanerocotylar.

Taproot 5.5-6.5 cm long, thin, creamy white, lateral roots profusely branched.

Hypocotyl straight, fleshy, 0.6-0.8 cm long, greenish.

Paracotyledons two, opposite, fleshy, persistent upto 8-12 leafed stage, exstipulate, petiolate; petiole ca. 0.1 cm, blade 0.5-0.6 x 0.45-0.5 cm, very wide ovate, entire, obcorded, base rounded, fleshy, primary vein 1, secondary veins indistinct.

Internode suppressed, leaves crowded at nodes.

First two leaves simple, fleshy, exstipulate, petiolate; petiole of first leave 1.0-1.2 cm long, blade 0.7-0.9 cm; petiole of second one 1.5-1.7 cm, blade 0.9-1.0 x 1.6-1.7 cm, both blades reniform, crenate, lobed, primary veins 5 nerved from base.

Subsequent leaves crowded at nodes and other characters are same as that of first two leaves except in size. [Plate 3, Fig.1]

Ageratum conyzoides

Germination epigeal, phanerocotylar.
Taproot 3.0-3.8 cm long, thin, creamy white, lateral roots profusely branched.

Hypocotyl straight, 0.8-1.2 cm long, light reddish to green.

Paracotyledons 2, opposite, persistent upto 8-12 leafed stage, exstipulate, petiolate; petiole 0.15-0.18 cm long, blade ca. 0.25 x 0.22 cm, wide-ovate, entire, rounded, base rounded, primary vein 3 from base, secondary veins alternate.

Internode straight, terete, hairy, 1st and 2nd internode 1.1-1.9 cm and 1.7-2.8 cm long respectively.

First two leaves opposite, simple, exstipulate, petiolate; petiole 0.4-0.45 cm long, hairy, blade 0.7-0.8 x 0.5-0.55 cm, hairy, ovate, distantly serrate, acute, base cuneate, primary veins 3 from base, secondary veins alternate.

Subsequent leaves opposite, simple, exstipulate, petiolate, serrate and other characters are same as that of first two leaves except in size.

Ageratum houstonianum

Germination epigeal, phanerocotylar.

Taproot 4.0-5.0 cm long, thin white, lateral roots profusely branched.

Hypocotyle straight, terete, 0.4-0.6 cm long, reddish.

Paracotyledons 2, opposite, persistent upto 8-12 leafed stage, exstipulate, petiolate; petiole 0.1-0.16 cm long, blade 0.21 x 0.28 cm, oblate to very wide ovate, entire, rounded, base rounded, primary vein 3 from base, secondary veins alternate.

Internode straight, reddish, hairy, 1st and 2nd internode 0.7-1.3 cm and 0.5-0.9 cm long respectively.

First two leaves opposite, simple, exstipulate, petiolate; petiole 0.3-0.35 cm long, hairy, blade 0.6-0.7 x 0.5-0.55 cm, wide ovate, distantly serrate, acute, base truncate, hairy; primary veins 3 from base, secondary veins alternate.

Subsequent leaves opposite; simple, exstipulate, petiolate, serrate, base truncate and other characters are same as that of first two leaves except in size.

Blumea lacera

Germination epigeal, phanerocotylar.

Taproot 2.0-2.4 cm, thin, light brown, lateral roots profusely branched.

Hypocotyle straight, 0.25-0.4 cm, whitish green.

Paracotyledons 2, opposite, persistent upto 5-8 leafed stage, exstipulate, petiolate; petiole ca. 0.1 cm, blade 0.3 x 0.3 cm, wide ovate to orbiculate, entire, rounded, base rounded; primary and secondary vein indistinct.

Internode straight, green, hairy, 1st and 2nd internode 0.2 cm and 0.05-0.1 cm respectively.

First two leaves opposite, exstipulate, petiolate; petiole 0.1-0.2 cm, blade 0.6 x 0.5 cm and 0.7 x 0.5 cm respectively, wide ovate to suborbiculate, entire to dentate, obtuse, base obtuse; primary vein 1, secondary veins alternate.

Subsequent leaves form a rosette, sessile to sub sessile, exstipulate and other characters are same as that of first two leaves expect in size. [Plate 4 , Fig.4]

Eclipta alba

Germination epigeal, phanerocotylar.

Taproot 1.8-2.1 cm long, thin, brown, lateral roots are moderately branched.

Hypocotyle straightly curved, terete, greenish brown, 1.0-1.2 cm long.

Paracotyledons two, persistent upto 8-12 leafed stage, exstipulate, petiolate; petiole 0.2, blade ca 0.4 x 0.2 cm, narrow ovate, obtuse, entire, base obtuse rounded; primary vein one and secondary veins are indistinct.

Internode straight, terete, hairy, greenish brown, 1st and 2nd internode 0.5-0.6 cm and 0.5-0.1 cm respectively.

First two leaves are opposite, simple, exstipulate, petiolate; petiole ca. 0.1 cm, blade ca. 0.8 x 0.5 cm, ovate, obtuse, entire, base obtuse, primary vein one, secondary veins alternate.
Subsequent leaves are opposite decussate and other characters are same as that of first two leaves except in size. [Plate 3, Fig.15]

Parthenium hysterophorus

Germination epigeal, phanerocotylar.

Taproot 2.5-3.0 cm long, greenish, lateral roots profusely branched.

Hypocotyle straight, 1.1-1.3 cm, greenish gray, fleshy.

Paracotyledons two , opposite, persistent upto 6-11 leafed stage, fleshy, exstipulate, petiolate; petiole 0.2-0.3 cm, blade 0.4-0.45 x 0.3-0.35 cm, wide obovate, entire, rounded, base narrowed to petiole; primary vein 1, secondary vein indistinct.

Internode straight, hairy greenish-gray, fleshy, 1st and 2nd internode 0.25-0.3 cm and ca. 0.1 cm respectively.

First two leaves alternate, exstipulate, petiolate; petiole hairy, 0.6-0.7 cm and 1.0-1.3 cm respectively, 1st blade 0.7-0.75 x 0.35-0.4 cm, narrow ovate, entire, obtuse, base acute, primary vein 1, secondary veins indistinct, and 2nd one 0.9-1.1 x 0.4-0.45 cm, lanceolate above, pinnately lobed downwards, obtuse, base rounded, primary vein 3 nerved from base, secondary veins alternate.

Subsequent leaves alternate, exstipulate, petiolate, lanceolate above and pinnately lobed downwards, and other characters are same as that of second leaf except in size. [Plate 4, Fig.7]

Xanthium indicum

Germination epigeal, phanerocotylar.
Taproot 10.0-10.5 cm long, thick, creamy-white, lateral roots profusely branched.

Hypocotyle straight, terete, 4.8-5.5 cm, lower white upper reddish.

Paracotyledons two, persistent upto 6-8 leafed stage, opposite, exstipulate, petiolate; petiole ca.0.8 cm, blade 2.7-2.9 x 0.8-0.85 cm, fleshy, entire, lanceolate, acute, yellowish-white, base narrowed to petiole, Primary veins 3 from base, secondary veins alternate.

Internode straight, terete, reddish, rough with short hairs, 1st and 2nd internode 1.2-1.4 cm and 0.4-0.45 cm respectively.

First two leaves opposite, simple, petiolate; petiole 2.2-2.4 cm, reddish, hairy, blade 4.2-4.4 x 3.4-3.6 cm, ovate to wide ovate, acute, rough with appressed hair on both sides, irregularly inciso-serrate, base asymmetrical, lobed; primary veins 3 from base, secondary veins alternate.

Subsequent leaves are opposite, and other characters are same as that of first two leaves. [Plate 4, Fig.16]

Heliotropium indicum

Germination epigeal, phanerocotylar.

Taproot 2.9-3.2 cm, whitish-brown, moderately thick, lateral roots profusely branched.

Hypocotyl straight, terete, light green, 1.5-2.4 cm long, hairy.

Paracotyledons two, opposite, persistent upto 6-8 leafed stage, exstipulate, petiolate; petiole 0.4-0.5 cm, hairy, blade ca. 0.65 x 0.35 cm, ovate, entire, obtuse, base atenuate; primary vein 1, secondary veins indistinct.

Internode straight, terete, light green, hairy, 1st and 2nd internode 1.1-1.3 cm, and 0.3-0.5 cm respectively.

First two leaves opposite, simple, exstipulate, petiolate; petiole 0.7-0.85 cm, hairy, blade ca. 2.15 x 1.5 cm, narrow-ovate, entire, acute, base obtuse; primary vein 1, hairy from base to some extent, secondary veins alternate.

Subsequent leaves are opposite and other characters are same as that of first two leaves expect in size. [Plate 3, Fig.27]

Rorippa indica

Germination epigeal, phanerocotylar.

Taproot 2.0-2.2 cm long, light brown, slender, lateral roots profusely branched.

Hypocotyl straight, ca. 0.2 cm long, fleshy, whitish-green.

Paracotyledons two, opposite, persistent upto 4-6 leafed stage, fleshy, exstipulate, petiolate; petiole 0.2-0.25 cm; blade 0.2-0.25 x 0.15 cm, wide-oblong, entire, rounded, base rounded; primary vein 1, secondary veins indistinct.

Internodes suppressed to form a basal rosette of leaves.

First two leaves also arise from the cotyledonary node, exstipulate, petiolate; petiole ca. 0.5 cm and 1.0 cm respectively; blade ca. 0.5 x 0.4 cm and 0.5 x 0.45 cm respectively, suborbiculate to orbiculate, entire to dentate, obtuse, base rounded; primary vein 1, secondary veins opposite.

Subsequent leaves alternate but in rosette, exstipulate, petiolate and other characters are same as that of first two leaves except in size. [Plate 4, Fig.19]

Cassia sophera

Germination epigeal, phanerocotylar.

Taproot 4.5-5.5 cm long, moderately thick, dark brown, lateral roots profusely branched.

Hypocotyl straight, terete, 6.0-6.5 cm, lower reddish upper green.

Paracotyledons two, opposite, persistent upto 6-10 leafed stage, exstipulate, petiolate; petiole about 0.1 cm, blade 1.2-1.3 x 1.0-1.1 cm, very wide oblong, entire, rounded, base cordate; Primary vein 5 nerved from base, secondary veins opposite.

Internode straight, terete, greenish gray, !1st and internode ca. 0.4 cm and ca. 0.2 cm respectively.

First two leaves alternate, pinnately compound, exstipulate, with a solitary dark gland near the base, petiolate; petiole 0.9-1.1 cm and 1.4-1.5 cm respectively; leaflets 4, petiolules ca. 0.1 cm, blade 1.1-1.3 x 0.6-0.7 cm, narrow obovate, entire, obtuse to rounded, base asymmetric.

Subsequent leaves alternate, leaflets became 3-5 pairs after 2-3 leafed stage, oblanceolate to narrow obovate, acute and other characters are same as that of first two leaves except in size. [Plate 3, Fig.16; Plate 4, Fig.10]

Chenopodium album

Germination epigeal, phanerocotylar.

Taproot 5.3 - 6.1 cm long , thin, grayish white.

Hypocotyle straight, terete, 2.8 - 3.0 cm long, reddish.

Paracotyledons 2 opposite, persistent upto 10-12 leafed stage, sometime till branching, exstipulate, petiolate; petiole 0.2-0.5 cm, blade 0.8-1.0 x 0.15-2.0 cm, linear to lanceolate, entire, fleshy, obtuse, base acute, veins are not distinct.

Internode straight terete, reddish, 1st and 2nd internode 0.5 and 0.7 cm respectively.

First two leaves opposite, simple fleshy, petiolate, petiole 0.45-0.7 cm, blade 1.0-1.2 x 0.25-0.45 cm, lanceolate-ovate, entire, obtuse, base obtuse; primary vein 1, secondary veins alternate.

Subsequent leaves are alternate, entire and other characters are same as that of first two leaves. [Plate 4, Fig.2]

Cleome viscosa

Germination epigeal, phanerocotylar.

Taproot 3.0-3.5 cm long, slender, light brown, lateral roots moderately branched.

Hypocotyl straight, 1.5-1.7 cm long, grayish green.

Paracotyledons two, opposite, persistent upto 8-12 leafed stage, exstipulate, petiolate; petiole 0.3-0.4 cm, blade 0.45-0.5 x 0.25-0.3 cm, elliptic to oblong, entire, rounded, base rounded; primary vein 1, secondary veins indistinct.

Internode straight, light green, 1st and 2nd internode 0.7-0.8 cm and 0.4-0.5 cm respectively.

First two leaves opposite, exstipulate, trifoliate, petiolate; petiole 0.9-1.0 cm, hairy; leaflets ovate to lanceolate, entire, obtuse, base cuneate, middle one largest, 0.8-0.9 x 0.5-0.6 cm, lateral two 0.65-0.7 x 0.3-0.35 cm; primary vein 1, secondary veins opposite.

Subsequent leaves opposite, trifoliate upto 8 leafed stage, exstipulate, petiolate and other characters are same as that of first two leaves expect in size. [Plate 4, Fig.9]

Evolvulus nummularius

Germination epigeal, phanerocotylar.

Taproot 3.0-3.5 cm long, moderately thick, whitish brown, lateral roots profusely branched.

Hypocotyl straight, terete, 1.0-1.2 cm, light green.

Paracotyledons two, opposite, persistent upto 6-10 leafed stage, exstipulate, petiolate; petiole 0.3-0.35 cm, blade 0.7-0.75 x 0.45-0.5 cm, wide oblong, entire, retuse, base obtuse; primary vein 1, secondary veins alternate.

Internode straight to slightly zigzag, light green, hairy, 1st and 2nd internode 0.4-0.5 cm, and 0.35-0.4 cm respectively.

First two leaves simple, alternate, exstipulate, petiolate; petiole hairy, 0.1-0.15 cm and ca. 0.15 cm respectively; blade 0.55-0.65 cm and 0.9-1.0 x 0.5-0.55 cm respectively, oblong, entire, retuse, base subcordate; primary vein 1, secondary veins alternate.

Subsequent leaves alternate, simple, exstipulate, petiolate and other characters are same as that of first two leaves except in size. [Plate 4, Fig.15]

PLATE - III
(SEEDLINGS)

Figure

1. *Centella asiatica*
2. *Phyllanthus fraturnus*
3. *Scoparia dulcis*
4. *Digera muricate*
5. *Leucas indica*
6. *Anagallis arvensis*
7. *Vicia hirsuta*
8. *V. angustifolia*
9. *Hewittia scandens*
10. *Medicago lupulina*
11. *Physalis minima*
12. *Argemone mexicana*
13. *Leonurus japonicus*

Fig. 14-19 Seedlings on seedbed and tub

14. *Vicia hirsuta*
15. *Eclipta alba*
16. *Cassia sophera*
17. *Physalis minima*
18. *Digera muricata*
19. *Euphorbia hirta*
20. *Fumaria indica*
21. *Oxalis corniculata*
22. *Euphorbia indica*
23. *Biophytum sensitivum*
24. *Phyllanthus amarus*
25. *Croton bonplandianum*
26. *Sebastiania chamaelea*
27. *Heliotropium indicum*

PLATE III


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Hewittia scandens

Germination epigeal, phanerocotylar.

Taproot 8.3-9.7 cm long, moderately thick, creamy white, lateral roots are profusely branched.

Hypocotyl straight to straightly-curved, terete, 2.6-2.9 cm long, lower white upper reddish.

Paracotyledons two, opposite, fleshy, persistent upto 10-14 leafed stage, exstipulate, petiolate; petiole 1.0-1.1 cm, blade 1.1-1.2 x 1.3-1.4 cm, cuneate to obcorded, entire, lobed, base obtuse to rounded; primary veins 3 nerved from base, secondary veins alternate.

Internode straight, 1st ca. 0.1 cm and 2nd suppressed.

First two leaves alternate, simple, exstipulate, petiolate; petiole 2.0-2.2 cm and 1.9-2.0 cm respectively; blade 2.2-2.3 x 1.5-1.6 cm and 2.3-2.4 x 1.5-1.6 cm respectively, ovate, acute to acuminate, cordate to lobed; primary vein 1, secondary veins alternate.

Subsequent leaves alternate, petiolate and other characters are same as that of first two leaves but sometimes variablity in shape and other characters are also observed. [Plate 3, Fig.9]

Cucumis melo

Germination epigeal, phanerocotylar.

Taproot 5.0-5.8 cm long, moderately thick, creamy white, lateral roots profusely branched.

Hypocotyl straight, terete, light green, hairy, 2.8-3.6 cm long.

Paracotyledons 2, opposite, persistent upto 6-9 leafed stage, exstipulate, petiolate; petiole 0.2-0.25 cm long, blade 0.95-1.15 x 0.5-0.55 cm, elliptic, entire, retuse, base rounded, upper surface densely scabrous, margin hairy, primary vein 1, secondary vein alternate, midrib hairy.

Internode straight, ridged, prickly, 1st one very much reduced, 2nd one 0.2-0.25 cm long.

First two leaves alternate, simple, exstipulate, petiolate; petiole 2.2-2.4 cm and 3.0-3.2 cm long respectively, hairy, blade 1.7-1.8 x 1.9-2.1 cm and 2.3-2.5 x 2.5-2.6 cm respectively, very wide ovate, crenately dentate, acute, base lobed, surface hairy, primary 3-5 from base, secondary veins alternate.

Subsequent leaves alternate, exstipulate, petiolate and other characters are same as that of first two leaves except in size. [Plate 4, Fig.6]

Acalypha indica

Germination epigeal, phanerocotylar.

Taproot 4.5-5.0 cm, thin, grayish, lateral roots moderately branched.

Hypocotyle straight to straightly curved, terete, greenish-gray, 2.4-2.6 cm.

Paracotyledons 2, opposite, persistent upto 6-10 leafed stage, exstipulate, petiolate; petiole 0.2-0.25 cm, blade 0.55-0.6 x 0.35-0.4 cm, wide oblong, entire, rounded, base rounded, primary veins 3 nerved originated from base, secondary veins opposite.

Internode straight, greenish gray, 1st and 2nd internode 0.5-0.55 cm and 0.1-0.15 cm respectively.

First two leaves opposite, simple, exstipulate, petiolate; petiole 0.45-0.5 cm, blade 1.05-1.1 x 0.7-0.8 cm, wide obovate, shallowly serrate, acute, base obtuse, primary veins 3-nerved from base, secondary veins alternate.

Subsequent leaves alternate, petiolate, exstipulate and other characters are same as that of first two leaves except in size. [Plate 4, Fig.5]

Chrozophora rottleri

Germination epigeal, phanerocotylar.

Taproot 8.2-9.0 cm long, thin, white, lateral roots are profusely branched.

Hypocotyle straight, terete, lower creamy upper radish, 5.5-5.8 cm long.

Paracotyledons 2, opposite, entire, exstipulate, petiolate; petiole 0.7-0.8 cm, persistent upto 7-9 leafed stage, blade 1.2-1.3 x 0.5 cm, entire, elliptic to narrow elliptic, obtuse, base acute, primary vein 3 from base, secondary veins alternate.

Internode straight, terete, hairy, first internode ca. 0.4 cm, 2nd very much suppressed.

First two leaves alternate, simple, entire, hairy, petiolate; petiole of first leave 2.0 cm, blade ca. 4.0 x 1.5 cm; petiole of 2nd leaf 1.7 cm, blade ca. 4.3 x 1.9 cm, lanceolate, acute, base obtuse, hairy on both sides, shallowly sinuate, primary veins 3 from base, secondary veins alternate.

Subsequent leaves alternate, ovate to wide ovate, obtuse, base obtuse and other characters are same as that of first two leaves except in size. [Plate 4, Fig.18]

Croton bonplandianum

Germination epigeal, phanerocotylar.

Taproot 8.0-9.0 cm long, moderately thick, creamy white, lateral roots profusely branched.

Hypocotyle straightly curved, 2.8-3.6 cm long, brown, upper greenish.

Paracotyledons 2, persistent upto 5-8 leafed stage, opposite, exstipulate, petiolar; petiole with hairs, 0.6 cm long, blade fleshy, 1.5 x 0.55 cm, entire, linear-oblong, obtuse, base acute, primary veins 3 of which middle one thick extended, secondary veins inconspicuous.

Internode straight, green, hard, with dotted hairs, terete, 1st and 2nd internode are 1.0 cm and 1.1 cm respectively.

First two leaves alternate, simple, exstipulate, petiolar; petiole 1.2 cm, blade 2.0 x 1.5 and 2.0 x 1.9 cm respectively, serrate, ovate, acute, entire, dotted hairs on ventral side, yellowish green; primary vein 3-nerved from base, secondary veins alternate.

Subsequent leaves alternate, simple, exstipulate and other characters are same as that of first two leaves expect in size. [Plate 3, Fig.25]

Euphorbia heyniana

Germination epigeal, phanerocotylar.

Taproot 2.1-2.7 cm long, thin, brownish, lateral roots profusely branched.

Hypocotyle straight to straightly curved, 0.5-0.7 cm, reddish.

Paracotyledons 2, opposite, persistent till branching, exstipulate; petiole ca. 0.1 cm, blade 0.2-0.25 x 0.1 cm, narrow ovate, lanceolate, entire, rounded, base rounded; primary and secondary veins are not distinct.

Internode 1st suppressed, 2nd 0.45-0.6 cm, terete, light reddish.

First two leaves opposite, simple, symmetric, stipulate, petiolate; stipule minute, setaceous; petiole ca. 0.1 cm, blade ca. 0.25 x 0.15 cm, narrow obovate, entire, rounded, base rounded, primary vein 1, secondary veins indistinct, first two leaves arranged at right angle with the paracotyledons; 2nd pair of leaves opposite, stipules indistinct, petiolate; petiole ca. 0.1 cm, blade ca. 0.35 x 0.2 cm, oblong, serrulate, round, base asymmetric, primary vein 1, secondary veins indistinct.

Subsequent leaves opposite, petiolate and other characters are same as that of 2nd pair of leaves except in size; branches arise from the cotyledonary node. [Plate 4, Fig.8]

Euphorbia hirta

Germination epigeal, phanerocotylar.

Taproot 2.8-3.4 cm long, thin, grayish, lateral roots profusely branched.

Hypocotyle straight, terete, 0.6-0.7 cm, reddish.

Paracotyledons 2, opposite, persistent upto 10-14 leafed stage, exstipulate; petiolate; petiole ca. 0.05 cm, blade about 0.15 x 0.1 cm, wide elliptic, entire, obtuse, base obtuse to rounded, primary vein 1, secondary veins indistinct.

Internode straight, terete, gray, hairy; 1st internode suppressed, 2nd 1.6-1.7 cm long.

First two leaves opposite, simple, symmetric, arranged at right angle with the paracotyledons, stipulate, petiolate; stipule minute, subulate; petiole ca. 0.12 cm, blade ca.

0.3 x0.22 cm, wide obovate, entire, rounded, primary vein 1, secondary veins indistinct; 2nd pair of leaves opposite, simple, exstipulate, petiolate, petiole about 0.1 cm, blade ca. 0.6 x 0.3 cm, elliptic oblong, serrate, acute, base asymmetric, hairy, primary vein 1, secondary veins indistinct.

Subsequent leaves opposite, oblong to narrow oblong, hairy and other characters are same as that of 2nd pair of leaves except in size. [Plate 3, Fig.19; Plate 4, Fig.1]

Euphorbia indica

Germination epigeal, phanerocotylar.

Taproot 3.5-4.1 cm long, moderately thick, grayish, lateral roots profusely branched.

Hypocotyle straight, terete, 0.6-0.8 cm, reddish-brown.

Paracotyledons 2, opposite, persistent upto 6-10 leafed stage, sometimes till maturity and flowering, stipulate; stipule minute, subulate; petiolate; petiole 0.05 cm, blade ca. 0.45 x 0.22 cm, symmetric, elliptic, entire, apex and base obtuse, primary vein 1, secondary veins indistinct.

Internode straight, terete, greenish gray , first internode suppressed, first two leaves arranged at right angle with the paracotyledons, second internode 1.4-1.8 cm.

First two leaves opposite, simple, stipulate, petiolate; stipule minute, subulate; petiole ca. 0.05 cm, blade ca. 0.6 x 0.35 cm, narrow obovate, entire, obtuse, base cuneate, primary vein 1, secondary veins opposite. 2nd pair of leaves opposite, simple, exstipulate, petiolate; petiole ca. 0.1 cm, blade ca. 0.9 x 0.4 cm, narrow oblong, serrate, acute, base asymmetric, primary vein 1, secondary veins alternate.

Subsequent leaves opposite and other characters are same as that of 2nd pair of leaves except in size. [Plate 3, Fig.22]

Phyllanthus amarus

Germination epigeal, phanerocotylar.

Taproot 3.5-4.0 cm long, whitish gray. lateral roots are profusely branched.
Hypocotyle straight to straightly curved, 1.0-1.3 cm long, lower violate, upper grayish green.

Paracotyledons 2, opposite, persistent till branching, exstipulate, petiolate; petiole ca. 0.05 cm, blade ca. 0.45-0.15 cm, Lanceolate, obtuse, entire, base obtuse to rounded, lower violate, primary vein 1, secondary veins indistinct.

Internode straight, terete, 1st and 2nd internode 0.15 cm and 0.1 cm respectively.

First two leaves alternate, simple, stipulate, petiolate; stipule triangular - acuminate, ca. 0.01 cm long; petiole <0.05 cm both, blade ca. 0.5 x 0.2 cm and ca. 0.6 x 0.3 cm respectively, oblanceolate to narrow obovate, rounded, entire, base cuneate, primary vein 1, secondary veins opposite but not very distinct.

Subsequent leaves alternate, simple, exstipulate, petiolate, acuminate in branched leaves and other characters are same as that of first two leaves expect in size; suppressed internode form a 5-6 leafed rosette like structure and branching arises after that stage. [Plate 3, Fig.24]

Phyllanthus fraturnus

Germination epigeal, phanerocotylar.
Taproot ca 3.1-3.5 cm long, grayish white, lateral roots profusely branched.

Hypocotyle straight, 2.7-3.0 cm, greenish white.

Paracotyledons 2, opposite, persistent till branching, exstipulate, petiolate; petiole ca. 0.1 cm, blade 0.35 x 0.2 cm, ovate, obtuse, entire, base obtuse to rounded, primary vein 1, secondary veins alternate.
Internode straight, green, 1st and 2nd internode 1 cm and 0.25 cm respectively.

First two leaves alternate, simple, stipulate, petiolate; stipule minute, acuminate, petiole 0.1 cm both; blade 0.4 -0.45 x 1.5 cm and 0.6 x 0.3 cm respectively, oblanceolate to narrow obovate, rounded, entire, base cuneate, primary vein 1, secondary veins alternate

Subsequent leaves alternate, simple, exstipulate, petiolate and other characters are same as that of first two leaves expect in size; branching arises from 2-3 leafed stage. [Plate 3, Fig.2]

Phyllanthus virgatus

Germination epigeal, phanerocotylar.

Taproot 7.5-8.7 cm long, brown, lateral roots profusely branched.

Hypocotyle straight, terete, 1.7-1.9 cm long, reddish green.

Paracotyledons 2, opposite, persistent upto 11-15 leafed stage, exstipulate, petiolate; petiole ca. 0.05 cm, blade ca. 0.7 x 0.15 cm, narrow oblong, entire, obtuse, base rounded, primary vein 1, secondary veins indistinct.

Internode straight, terete, reddish green, 1st and 2nd internode 5.0 cm and 2.0 cm respectively.

First two leaves alternate, simple, stipulate; stipule sagittate, reddish brown; petiolate; petiole 0.1 cm both, blade ca. 0.7 x 0.2 cm and 1.0 x 0.2 cm respectively, narrow oblong, acute, entire, base rounded, primary vein 1, secondary veins indistinct.

Subsequent leaves alternate, simple, exstipulate and other characters are same as that of first two leaves expect in size. [Plate 4, Fig.17]

Sebastiania chamaelea

Germination epigeal, phanerocotylar.

Taproot 5.2-8.3 cm long, whitish, moderately thick, lateral roots are scarcely branched.

Hypocotyle straight, terete, 4.5-6.5 cm long, greenish white.

Paracotyledons 2, persistent upto 10-14 leafed stage, sometimes till branching, exstipulate, sessile, blade 1.0-1.4 x 0.2-0.25 cm, lorate, entire, acute, base attached to the node, primary vein 1, secondary veins indistinct.

Internode straight, terete, 1st and 2nd internode 0.6-0.8 cm and 0.05-0.1 cm respectively.

First two leaves semialternate, simple, exstipulate, sessile, blade ca. 1.6-1.8 x 0.15-0.2 cm both, linear, entire, acute, base narrowed to the stem, primary vein 1, secondary veins indistinct.

Subsequent leaves are semialternate, sessile, simple and other characters are same as that of first two leaves expect in size. [Plate 3, Fig.26]

Medicago lupulina

Germination epigeal, phanerocotylar.

Taproot 4.8-5.3 cm long, thin, creamy white, lateral roots are profusely branched.

Hypocotyle straight, terete, 0.5-0.7 cm long, reddish.

Paracotyledons 2, opposite, persistent, upto 6-11 leafed stage, exstipulate, petiolate; petiole ca. 0.1 cm, blade 0.4-0.5 x 0.25- 0.28 cm, wide oblong, entire, obtuse, base obtuse; primary vein 1, secondary veins indistinct

Internode straight, terete, hairy, 1st and 2nd internode 0.2-0.3 cm and 0.1-0.15 cm long respectively.

First two leaves alternate, simple, stipulate, petiolate; stipule adnate, ca. 0.25 cm long; petiole 1.7-2.1 cm, hairy, blade 0.4-0.5 x 0.6-0.7 cm, lunate, dentate, mucronate, base obtuse to rounded, primary vein 1, secondary veins indistinct; 2nd leaf pinnately trifoliate, petiolate; petiole 2.5-2.7 cm long, hairy, stipule adnate, leaflets obovate, faintly incise-crenate, mucronate, base rounded, middle one 0.5-0.7 x 0.5-0.6 cm, lateral two 0.4-0.5 x 0.4-0.45 cm.

Subsequent leaves alternate and other characters are same as that of 2nd leaf except in size. [Plate 3, Fig.10]

Melilotus alba

Germination epigeal, phanerocotylar.

Taproot 8.0-11.3 cm long, brown, moderately thick, lateral roots are profusely branched.

Hypocotyle straight, terete, 2.0-2.4 cm long, lower white upper reddish.

Paracotyledons 2, persistent upto 6-8 leafed stage, exstipulate, petiolate; petiole 0.2-0.25 cm, blade 0.6-0.65 x 0.3 cm, narrow obovate, entire, obtuse, base obtuse to cuneate, flashy, veins indistinct.

Internode straight, terete, greenish, 1st and 2nd internode 1.7-2.1 cm and 1.6-1.7 cm respectively.

First two leaves alternate, stipulate; stipule adnate, ca. 0.2 cm long; 1st one simple, petiolate; petiole 1.2-1.4 cm, blade 0.9-1.0 x 1.1-1.4 cm, reniform, dentate, base rounded primary vein 1, secondary veins opposite; 2nd one pinnately trifoliate, petiolate; petiole 1.3-1.4 cm; leaflet 0.6-0.7 x 0.5-0.6 cm, rounded, dentate, acuminate, base obtuse to rounded; petiolules 0.1-0.3 cm.

Subsequent leaves alternate, trifoliate, petiolate, stipule adnate and other characters are same as that of 2nd leaf expect in size. [Plate 4, Fig.14]

Vicia angustifolia

Germination hypogeal, cryptocotylar.

Taproot 8.0-14.0 cm long, creamy white, lateral roots profusely branched.

Cotyledons 2, opposite, hard, dark brown, 0.4 x 0.35 cm.

Epicotyl straight to straightly curved, 0.8-1.2 cm long, light green.

Internode straight, green, first two nodes beard prophyll, 1st and 2nd internode 1.0-1.2 cm and 1.2-2.0 cm respectively; first two normal leaf bearing internodes 1.2-1.5 cm and 0.8-1.3 cm long respectively.
Prophyll 0.2-0.3 cm long, sessile, sobulate, entire, acuminate, green.

First two normal leaves alternate, peripinnate, rachis ending in a twisted tendril, stipulate, petiolate; stipule semi-sagittate, petiole 0.8-0.9 cm long in both; leaflets 2, subsessile, blade 2.0-2.15 x 0.2 cm, linear, entire, acute, base rounded, primary vein 1, secondary veins alternate.

Subsequent normal leaves alternate, leaflets 4-6 above and other characters are same as that of first two normal leaves except in size. [Plate 3, Fig.8]

Vicia hirsuta

Germination hypogeal, cryptocotylar.

Taproot 6.0-10.0 cm long, thin creamy white, lateral roots profusely branched.

Cotyledons 2, opposite, hard, dark brown, 0.3 x 0.25 cm.

Epicotyle straight to straightly curved, 1.8-2.0 cm long, reddish.

Internode straight, reddish, first two nodes beard prophyll, 1st and 2nd internode 1.8-2.0 cm and 1.6-1.8 cm respectively; first two normal leaf bearing internodes 0.7-1.0 cm and 0.8-0.9 cm respectively.

Prophyll 0.15-0.2 cm long, sobulate, entire, acute, sessile, green.

First two normal leaves alternate, peripinnate, rachis ending in a twisted tendril, stipulate, petiolate; stipule semi-sagittate, petiole 0.6-0.7 cm long in both; leaflets 4, petiolulate; petiolule 0.04 cm long, blade lower 0.85 x 0.15 cm and upper 0.7 x 0.1 cm, linear, entire, mucronate, base obtuse-rounded, primary vein 1, secondary veins alternate.

Subsequent normal leaves alternate, leaflets 4-8 above and other characters are same as that of first two normal leaves except in size. [Plate 3, Fig.7,14]

Fumaria indica

Germination epigeal, phanerocotylar.

Taproot 6.0-7.3 cm long, creamy white, lateral roots are moderately branched.
Hypocotyle straight, terete, 3.4-4.1 cm long, reddish.

Paracotyledons 2, opposite, persistent upto 8-10 leafed stage, exstipulate, sessile, blade 2.8-3.5 x 0.18-0.2 cm, linear, entire, acute, base sheathing, primary vein 1, secondary veins 2, parallel to the primary one.

Internode straight with sheathing leaf bases, whitish green, 1st and 2nd internode 0.25-0.3 cm and ca. 0.1 cm long respectively.

PLATE - IV
(Seedling)

Figure

1. *Euphorbia hirta*
2. *Chenopodium album*
3. *Phyla nudiflora*
4. *Blumea lacera*
5. *Acalypha indica*
6. *Cucumis melo*
7. *Parthenium histerophorus*
8. *Euphorbia heyniana*
9. *Cleome viscosa*
10. *Cassia sophera*
11. *Ludwigia perennis*
12. *Amaranthus viridis*
13. *Solanum nigrum*
14. *Melilotus alba*
15. *Evolvulus nummularius*
16. *Xanthium indicum*
17. *Phyllanthus virgatus*
18. *Chrozophora rottleri*
19. *Rorippa indica*

PLATE - IV

First two leaves alternate, compound with narrow segments, exstipulate, petiolate; petiole 2.1-2.5 cm and 2.6-3.0 cm long respectively, leaf base sheathing, leaflets narrow, entire, acute, glabrous, reticulate, unicostate.

Subsequent leaves opposite and other characters are same as that of first two leaves expect in size. [Plate 3, Fig.20]

Leonurus japonicus

Germination epigeal, phanerocotylar.

Taproot 4.2-5.0 cm long, thin, creamy white, lateral roots profusely branched.

Hypocotyle straight to straightly curved, terete, 1.0-1.25 cm long, reddish.

Paracotyledons 2, opposite, persistent upto 6-10 leafed stage, exstipulate, petiolate; petiole 0.65-0.8 cm long, hairy, blade 0.5-0.55 x 0.5-0.52 cm, orbiculate, entire, rounded, base lobed, primary vein 1, secondary veins alternate.

Internode straight reddish, hairy, 1st one 0.15-0.18 cm long, 2nd one suppressed.

First two leaves opposite, simple, exstipulate, petiolate; petiole 1.6-1.8 cm long, hairy, blade 1.6-1.7 x 1.4-1.5 cm, wide-ovate, serrate, rounded, base lobed, margin hairy, primary vein 1, secondary veins alternate.

Subsequent leaves opposite but suppressed internodes forms a rosette and other characters are same as that of first two leaves except in size. [Plate 3, Fig.13]

Leucas indica

Germination epigeal, phanerocotylar.

Taproot 3.8-4.3 cm long, thin, whitish brown, lateral roots are profusely branched.

Hypocotyle straight, terete, 2.7-3.0 cm long, greenish brown, hairy.

Paracotyledons 2, persistent upto 6-10 leafed stage, exstipulate, petiolate; petiole 0.4-0.5 cm long, blade 0.7-0.9 x 0.45-0.55 cm, wide elliptic, obtuse to emerginate, entire, base obtuse, primary vein 1, secondary veins indistinct.

Internode straight, terete, hairy, brownish green, 1st and 2nd internode 0.5-0.6 cm and 0.2-0.3 cm respectively.

First two leaves opposite, simple, exstipulate, petiolate; petiole ca. 0.3 cm, blade 1.5-1.6 x 0.5-0.6 cm, narrow elliptic, serrate, acute, base cuneate, primary vein 1, secondary veins alternate.

Subsequent leaves opposite, and other characters are same as that of first two leaves except in size. [Plate 3, Fig.5]

Ludwigia perennis

Germination epigeal, phanerocotylar.

Taproot 3.0-4.0 cm long, thin, white, lateral roots numerous and profusely branched.

Hypocotyle straight, fleshy, 0.7-1.0 cm long, light pink.

Paracotyledons two opposite, persistent upto 6-10 leafed stage, exstipulate, petiolate; petiole 0.25-0.3 cm; blade ca. 0.35 x 0.25 cm, sub orbiculate, entire, obtuse, base narrowed to petiole; primary vein 1, secondary veins indistinct.

First two leaves opposite, simple, exstipulate, petiolate; petiole 0.45-0.5 cm; blade 1.0-1.1 x 0.5-0.6 cm, glabrous, elliptic, entire, acute, base narrowed to petiole; primary vein 1, secondary veins alternate.

Subsequent leaves opposite, entire, petiolate and other characters are same as that of first two leaves expect in size. [Plate 4, Fig.11]

Biophytum sensitivum

Germination epigeal, phanerocotylar.

Taproot 1.3-1.5 cm long, brown, thin, lateral roots profusely branched.

Hypocotyle straight, terete, hairy, 0.9-1.4 cm long.

Paracotyledons 2, opposite, persistent upto 8-10 leafed stage, sometimes till maturity, exstipulate, petiolate; petiole ca. 0.1 cm; blade 0.25 x 0.15 cm, entire wide elliptic, obtuse, base rounded, primary veins 3, secondary veins indistinct.

Internode straight, verymuch reduced, ca. 0.1 cm hairy.

First two leaves opposite, compound, bifoliate, exstipulate, petiolate; petiole 0.15 -0.2 cm; leaflet rounded, 0.3 x 0.2 cm, bean shaped, rachis continued, primary vein 1, secondary alternate.

Subsequent leaves alternate on very suppressed internode, first 3 -4 leaves bifoliate, others compound peripinnate, number of leaflet 4 or more. [Plate 3, Fig.23]

Oxalis corniculata

Germination epigeal, phanerocotylar.

Taproot 2.7-3.0 cm long, thin, brown, lateral roots profusely branched.

Hypocotyle straight, terete, greenish brown, hairy, 0.6-0.8 cm long.

Paracotyledons 2, opposite, persistent upto 8-12 leafed stage, exstipulate, petiolate; petiolate ca. 1.0 cm; blade 0.35 x 0.25 cm, wide elliptic, obtuse, entire, base obtuse; primary vein 1, secondary veins alternate.

Internode straight, very much reduced, <0.1 cm, greenish brown, hairy.

First two leaves opposite, compound, trifoliate, exstipulate, petiolate; petiole 0.8-0.85 cm, hairy; leaflet ca. 0.3 x 0.4 cm, emerginate, margins hairy, base acute; primary veins 3, secondary veins 2-4 not very distinct.

Subsequent leaves opposite and other characters are same as that of first two leaves except in size. [Plate 3, Fig.21]

Argemone mexicana

Germination epigeal, phanerocotylar.

Taproot 4.8-5.5 cm long, thin brown, lateral roots scarcely branched.

Hypocotyle straightly curved, 2.0-2.5 cm long, greenish white

Paracotyledons 2, opposite, persistent upto 6-8 leafed stage, exstipulate, sessile, blade 2.6 x 0.15 cm, entire, linear, attenuate, base sheathing the hypocotyle, primary veins indistinct.

Internode straight, 1st and 2nd internode much reduced ca. 0.1 cm

First two leaves alternate, simple, sessile, exstipulate, blade 2.0 x 0.55 cm and 2.0 x 0.5 cm respectively, oblanceolate, spiny, acute, base sheathing the internode; primary vein 1, secondary veins alternate.

Subsequent leaves alternate and other characters are same as that of first two leaves except in size. [Plate 3, Fig.12]

Anagallis arvensis

Germination epigeal, phanerocotylar.

Taproot 5.0-5.7 cm long, thin, creamy white, lateral roots are profusely branched.

Hypocotyle straight, terete, 1.4-1.7 cm long, lower white, upper light green.

Paracotyledons 2, opposite, persistent upto 8-14 leafed stage, sometimes till flowering, exstipulate, petiolate; petiole ca. 0.15 cm; blade 0.5-0.55 x 0.2-0.25 cm, elliptic, entire, acute, base narrowed to petiole; primary vein 1, secondary veins indistinct.

Internode straight, 1st and 2nd internode 0.7-0.8 cm and 1.0-1.1 cm long respectively.

First two leaves opposite, simple, sessile, exstipulate, blade 0.8-0.9 x 0.5 cm, narrow ovate, entire, obtuse, base cordate; primary vein 1, secondary veins indistinct.

Subsequent leaves opposite and other characters are same as that of first two leaves except in size. [Plate 3, Fig.6]

Scoparia dulcis

Germination epigeal, phanerocotylar.

Taproot 1.1-1.5 cm long, thin, creamy white, lateral roots profusely branched.
Paracotyledons 2, opposite, persistent upto 6-8 leafed stage, exstipulate, petiolate; petiole 0.06-0.08 cm long, blade 0.12-0.14 x 0.1 cm, wide ovate, entire, acute, rounded, primary vein 1, secondary veins indistinct.

Internode straight, 4-angled, reddish, 1st and 2nd internode 0.15-0.2 cm and 0.1 cm respectively.

First two leaves opposite, simple, exstipulate, petiolate; petiole 0.12-0.14 cm long, blade 0.18-0.2 x 0.12-0.14 cm, ovate, entire, distantly serrate, base attenuate, primary vein 1, secondary veins alternate.

Subsequent leaves opposite, exstipulate, ovate, distantly serrate to serrate and other characters are same as that of first two leaves except in size. [Plate 3, Fig.3]

Physalis minima

Germination epigeal, phanerocotylar.

Taproot 4.0-4.5 cm long, thin, creamy white, lateral roots profusely branched.

Hypocotyle straight, terete, 2.2-2.4 cm long, whitish green, hairy.

Paracotyledons 2, opposite, persistent upto 8-10 leafed stage, exstipulate, petiolate; petiole 0.4-0.45 cm long, hairy, blade 0.7-0.75 x 0.38-0.42 cm , narrow ovate, entire, acute, base rounded, hairy on midrib and lamina margin, primary vein 1, secondary veins opposite.

Internode straight, hairy, 1st and 2nd internode 0.2-0.25 cm and 0.3-0.35 cm long respectively.

First two leaves alternate, simple, exstipulate, petiolate; petiole 0.6-0.7 cm and 0.8-0.9 cm respectively, hairy, blade 0.9-1.1 x 0.75-0.8 cm , wide ovate, entire, obtuse, base obtuse to rounded, glabrous, margin hairy, primary vein 1, secondary veins lower opposite, upper alternate.

Subsequent leaves alternate, exstipulate, petiolate, ovate - narrow elliptic, distantly and shallowly serrate, acute, secondary veins alternate and other characters are same as that of first two leaves except in size. [Plate 3, Fig.11,17]

Solanum nigrum

Germination epigeal, phanerocotylar.

Taproot 8.5-9.3 cm long, creamy white, moderately thick, lateral roots are profusely branched.

Hypocotyle straight, hairy, terete, 1.8-2.0 cm long, whitish green.

Paracotyledons 2, opposite, fleshy, persistent upto 5-9 leafed stage, exstipulate, petiolate; petiole 0.4-0.5 cm; blade 0.8-0.85 x 0.4 cm, narrow ovate, entire, acute, base narrowed to petiole, Primary vein 1, secondary veins indistinct.

Internode straight, 1st and 2nd internode ca. 0.5 cm and 0.25 cm respectively.

First two leaves alternate, simple, glabrous, exstipulate, petiolate; petiole 0.7-0.8 cm; blade 1.0-1.2 x 0.7-0.8 cm and 1.55-1.6 x 1.2-1.3 cm respectively, ovate, entire, acute, base rounded; primary vein 1, secondary veins alternate.

Subsequent leaves alternate, petiolate and other characters are same as that of first two leaves except in size. [Plate 4, Fig.13]

Phyla nodiflora

Germination epigeal, phanerocotylar.

Taproot 3.0-3.4 cm long, thin, brown, lateral roots moderately branched.

Hypocotyle straight, terete, 0.5-0.6 cm long, greenish.

Paracotyledons 2, opposite, persistent upto 6-8 leafed stage, exstipulate, petiolate; petiole 0.05 cm; blade ca. 0.2 x 0.15 cm, suborbiculate, obtuse, entire, base obtuse; primary vein 1, secondary veins indistinct.
Internode straight, terete, greenish, 1st and 2nd internode 0.5-0.6 cm and 0.7-0.8 cm respectively.

First two leaves opposite, simple, exstipulate, petiolate; petiole 0.25 cm; blade 0.45 x 0.25 cm, elliptic, acute, entire to serrate, base decurrent; primary vein 1, secondary veins indistinct.

Subsequent leaves opposite, serrate, narrow obovate and other characters are same as that of first two leaves except in size. [Plate 4, Fig.3]

6.3 RESULT AND DISCUSSION

It is evident from the key to the seedlings of these plants that they may be divided into two groups on the basis of first leaf character i.e. compound or reduced to prophyll or simple. The compound leaves are borne by 5 species viz. *Oxalis corniculata, Fumaria indica, Biophytum sensitivum, Cassia sophera and Cleome viscosa.* Again they are divided on the basis of leaflet characters. So, *Oxalis corniculata* can be identified by obcorded leaves; other seedlings with compound leaves again divided on the basis of paracotyledons and leaflet characters. *Fumaria indica* bears narrowly lanceolate paracotyledons and deeply dissected leaflets; opposite group is again divided on the basis of presence and absence of terminal leaflet. *Biophytum sensitivum* and *Cassia sophera* can be distinguished on the presence or absence of extended rachis, remaining one is *Cleome viscosa*, where there is a terminal rhomboid leaflet. Prophylls borne by *Vicia angustifolia* and *V. hirsuta* can be distinguished on the basis of leaflet number in subsequent leaves.

Another important group created in the key, where the first leaf simple but second and subsequent leaves are compounded as found in *Medicago lupulina* and *Melilotus alba* but they can be distinguished easily by the character of terminal leaflet.

In the third important group in the key, second and subsequent leaves are simple, and the group has been divided on the basis of internode characters. Internode between cotyledonary node and first leaf is suppressed found in 9 species. Among them only *Hewittia scandens* bears obcorded cotyledons. *Leonurus japonicus* and *Centella asiatica* bear reniform eophylls but can be distinguished on the basis of lamina base characters. Where eophylls are not reniform, different species can be distinguished by the presence or absence of stipule. Among 3 exstipulate species, *Argemone maxicana* is distinct with its spinous leaf margin where as *Rorippa indica* and *Cucumis melo* can be distinguished on the basis of venation pattern of first leaf. Among the stipulate species *Euphorbia heyniana* produces two or more branches after first leaf. Where as *Euphorbia hirta* and *E. indica* can be distinguished on the basis of woolly nature of stem, serration of leaf and position of the broadest part of the leaf-lamina.

Another major group of seedlings with simple leaves produce normal internode between cotyledonary node and the first leaf and can be further divided on the basis of phylotaxy of leaves (except cotyledons). Among 16 species with alternate leaf, lamina of *Parthenium hysterophorus* is deeply dissected. The other group (lamina not dissected) can be divided again on the basis of number of veins from the base of lamina. *Chrozophora rottleri* is borne 3 veins from base and other species can be subdivided on the basis of cotyledon and lamina characters. Cotyledons longer than the lamina of second leaf presents in *Digera muricata* where as opposite character bearing plants can be divided on the basis of cotyledon and lamina characters.

Phyllanthus fraturnus and *P. amarus* though borne obovate-oblong cotyledon and lamina but development dwarf shoot took place after the production of first few leaves. The opposite characters is borne by *Phyllanthus virgatus* and *Croton bonplandianum* and they can be distinguished by the presence or absence of stellate hairs. The group with entire lamina of first few leaves is again divided on the basis of sessile or petiolate leaves. Leaves in *Sebastiania chamaelea* are sessile. Petiole bearing *Evolvulus numularius* bears zigzag stem where as erect stem bearing *Amaranthus viridis* possessed lamina with notched tips and *Celosia argentea* with acute tip. On the other hand lamina with serrate, dentate etc. bearing plant species can be catagoriesed on the basis of minute cotyledons (in *Scoparia dulcis)* and cotyledons more than 0.2 cm long. The group with large cotyledon, again, shows variation in their lamina and paracotyledon characters. *Blumea lacera* bears broadly ovate lamina, where as seedlings with lamina other than ovate in shape can be subdivided on the basis of paracotyledons and the structure of the base of lamina. *Chenopodium album* produces narrowly lanceolate paracotyledons where as ovate paracotyledons are borne by *Physalis minima* and *Solanum nigrum.* While the former produces slightly cordate or rounded lamina base, the leaves of *Solanum nigrum* never produces a cordate lamina base.

The ten species which produce a pair of leaves (i.e. opposite phylotaxy) immediately after the cotyledons again have 6 species, where the margin of lamina is not entire. *Xanthium strumarium* bears more than 2.0 cm long lamina but others produce much smaller. Pinnately veined lamina bearing *Phyla nodiflora* has only 0.07 cm long paracotyledons. Paracotyledons in *Leucas indica* are 1.2 cm long and are pinnately veined. Seedlings with lamina 3-nerved from base can be divided on the basis of the length of hypocotyl. While *Acalypha indica* has hypocotyl over 2.0 cm long, *Ageratum conyzoides* and *A. houstonianum* has less than 1.5 cm long hypocotyl. While *A. conyzoides* has cuniate lamina, *A. houstonianum* has lamina with truncate base. On the other hand 5 species with entire or slightly irregularly undulating lamina are again divided on the basis of presence or absence of petiole. Leaves of *Anagallis arvensis* are sessile and among petiolate ones *Heliotropium indicum* have rugose lamina surface. Among the last three species *Alternanthera sessilis* has unequal paracotyledons but *Eclipta prostrata* and *Ludwigia perennis* have equal paracotyledons. Though they bear equal paracotyledons but the leaves in *Eclipta prostrata* are strigose above, but the leaves in *Ludwigia perennis* are glabrous.

So, we find, there is tremendous variation within the weed population of the district of Malda. And, this set of knowledge will be helpful in recognition of seedlings at their juvenile stage. It will also help the farmers to eradicate the weeds at their early stage when they are more dangerous.

CHAPTER - 7

REPRODUCTIVE POTENTIAL

REPRODUCTIVE POTENTIAL

The crop field weeds adapted to grow in a habitat with frequent disturbances in the soil mainly due to the different agronomic practices. Annuals are, therefore, the prevailing life forms among the weeds. So, these are mainly therophytes, i.e. they reproduced by seeds. It is therefore very important to understand the reproductive potentiality of these weeds which basically include, mainly, the health and number of seeds. The reproductive capacity, which are certainly genetically controlled, are very much species specific and is of considerable ecological interest. Reproductive capacity also has bearing on the dispersal of seeds.

In angiosperms, the adaptive significance of seeds is associated with the reproductive efficiency and successful establishment of seedlings in nature (Stebbeins, 1971). Due to the above fact, the resources available to a plant during development are divided between seed production and other ends so that the allocation of seeds is itself partitioned between numbers and size (Harper, 1970). The high seed number and small seed size confers an increased chance for dispersal. Accordingly, some seeds will land in a spot that is favorable foe seed germination and seedling establishment. Larger seed numbers enhances the chances that some seeds will find a "safe site" (Harper, 1965). So, it is necessary to gather some knowledge about the number of seeds produced by a plant and also the seed weight, to understand its reproductive potential. Though many of these seeds are consumed, destroyed or wasted in nature in various ways, but both seed weight and seed number contribute to the establishment of a weed species.

Weed related literature contains many references to seed production, seed weight, seed size, seed morphology, seed shape etc. Stone (1914) listed the weed seed contents of crop seed samples. Korsmo (1930) provided considerable information on the weight and numbers of seed per plant. Stevens (1932, 1957) presented valuable data on the seed production of common weeds and economic plants with special reference to the selection of specimens and clearing of seed material according to a definite plan. Salisbury (1942) commented on the paucity of data on weight and number of seeds per plant. Black (1956, 1959) pointed out the influence and variation in seed size. Baker (1972) presented the seed weight in relation to environmental conditions. Harper (1970) presented the valuable informations on the shapes and size of seeds. Holm et al (1977) also counted the seed of weed species. In India, Tadulingam and Venkatnarayana (1932) described the seed morphology of several South Indian weeds, Datta et al (1970) and Ghosh and Datta (1975) described the seed morphology of some species of *Corchorus*, Maity and Banerjee (1976) described the exomorphic seed structure but they did not give any information of seed out put per plant. But, Datta and Banerjee (1976) recorded the seed weight of 1000 seeds and total seed number for 140 weeds prevailing in rice fields of West Bengal. They also compare the seed production of three common species with those published by Pammel and King (1910), Ottawa Laboratory (1929), Korsmo (1930) and Stevens (1932,

1957). Datta et al (1980) recorded the weight of 1000 seeds as well as total number of seeds produced by a plant of 66 Indian weeds. Paria and Sahoo (1981) reported the reproductive capacity of certain weed species growing in the vicinity of Calcutta.

So in the present plan of work, an attempt has been made to record the seed number and seed weight of recorded weeds of crop fields in the district of Malda during the survey period between June 1992 and May 1996.

7.1 RESULT AND DISCUSSION

During the study of "Reproductive Potential" three aspects of angiospermic crop-field weeds of the district of Malda has been taken into consideration. These are - A. number of seeds per fruit B. number of seeds per plant C. weight of 1000 seeds.

A total of 114 species out of the recorded 130 species of angiospermic weeds have been worked out for this purpose (Table 7.1). The reason behind the deletion of 16 species include low frequency of species, weeding practices, failure in fruit development,, not availability of adequate number of mature seeds etc.

7.1.1 SEEDS PRE FRUIT

Within the studied dicotyledonous weed species highest number of seeds per fruit has been observed in *Orobanche aegyptiaca* (Orobanchaceae) which produce 1400-1500 seeds, which is a total root parasite. It is then followed by *Hydrolea zeylanica* (520-600), Nicotiana plumbaginifolia (482-500), *Argemone mexicana* (454-480), *Lindernia multiflora* (340-386), *Ludwigia perennis* (320-382), *Macardonia procumbens* (367-378), *Cleome viscosa* (171-193), *Glinus lotoides* (162-178) and *Lindernia perviflora* (146-158). Among the first ten dicotyledonous weed species with higher number of seeds per fruit, three species belong to Scorphulariaceae and one each of Orobanchaceae, Molluginaceae, Cleomaceae, Hygrophyllaceae, Onagraceae, Papaveraceae and Solanaceae. There have been 71.8% (61 species) weeds which contain more than 1 seed per fruit and 28.2% (24 species) weeds contain only 1 seed per fruit. Except *Xanthium indicum* all other recorded members of Asteraceae and except *Celosia argentia* all other recorded members of Amaranthaceae bear 1 seed per fruit. On the other hand only 5 species (17.2%) of monocotyledons weed produce more than 1 seed per fruit and the rest 24 species (82.8%)produce only 1 seed per fruit. Highest number of seeds per fruit among monocotyledons has been observed in *Monochoria vaginalis* (125-140)followed by *Butomopsis latifolia* (35-58), *Murdannia nudiflora* (6), *Asphodelus tenuifolius* (5-6) and *Commelina benghalensis* (4).

7.1.2 SEEDS PER PLANT

Highest number of seed per plant, in case of dicotyledonous weeds, has been observed in *Ludwigia perennis* (218287), followed by *Orobanche aegyptiaca* (42050), *Blumea lacera* (28875), *Hydrolea zeylanica* (27000), *Argemone mexicana* (23368), *Rotala indica* (21100), *Celosia argentea* (18750), *Leucas indica* (18000), *Glinus oppositifolius* (14140), *G. lotoides* (12410) etc. Lowest number of seed produced per plant has been observed in *Centella asiatica* (56) and other plant which contain less than 200 seeds per plant include *Leucas cephalotes* (111), *Hewittia scandens* (136), *Evolvulus nummularius* (144) and *Lathyrus aphaca* (153). In monocotyledonous weeds highest number of seed per plant has been observed in *Scirpus articulatus* (12688) followed by *Eragrostis riparia* (10250), *Cyperus difformis* (9870), *Eriocaulon cinereum* (9405), *Desmostachya bipinnata* (5400), *Elusine indica* (4494), *Eragrostis tenella* (2485), *Cyperus iria* (2300), *C. tegetiformis* (2050), *Fimbristylis dichotoma* (1172). Among these top ten monocotyledonous weeds with high capacity of seed production, Cyperaceae contain 5 species, Poaceae 4 species and only 1 species by Eroicaulaceae. Lowest seed per plant, in monocotyledonous weed, has been observed in *Butomopsis latifolia* (208) and other weed species which contain less than 450 seeds per plant are *Paspalum scrobiculatum* (288), *Sacciolepis myosuroides* (296), *Murdannia nudiflora* (378) and *Digitaria ciliaris* (410).

7.1.3 SEED WEIGHT

Seeds of dicotyledonous weeds with higher seed weight than the monocotyledons weeds. Highest seed weight has been observed among dicotyledons weeds in *Ipomoea aquatica* (42.980g)which is followed by *Xanthium indicum* (30.800g),*Vicia angustifolia* (15.500g), *Hewittia scandens* (14.280g), *Cassia sophera* (14.100g), *Chrozophora rottleri* (14.100g), *Vicia hirsuta* (11.600g), *Lathyrus aphaca* (11.400g), *Croton bonplandianum* (9.738g), *Cucumis melo* (6.120g). Among these top ten species with high seed weight, 3 are of Fabaceae, 2 each of Euphorbiaceae and Convolvulaceae, 1 each of Asteraceae, Caesalpinaceae and Cucurbitaceae. Among dicotyledons *Hydrolea zeylanica* bears lightest seeds weighting 0.001g only. Other dicotyledonous weeds which have seed weight equal or less than 0.020g are *Lindernia ciliata* (0.002g), *Rotala indica* (0.004g), *Lindernia multiflora* (0.006g), *Hygrophila difformis* (0.006g), *Lindernia perviflora* (0.010g), *Macardonia procumbens* (0.010g), *Hedyotis corymbosa* (0.010g), *Gnaphalium purpureum* (0.011g), *Orobanche aegyptiaca* (0.013g), *Ammannia baccifera* (0.016g), *Gnaphalium luteo-album* (0.019g), *Ludwigia perennis* (0.020g), *Hedyotis diffusa* (0.020g) and *Nicotiana plumbaginifolia* (0.020g). Among monocotyledonous weeds highest seed weight has been observed in *Commelina benghalensis* (2.500g) and is followed by *Tonningia axillaris* (1.910g), *Echinochloa crus-galli* (1.620g), *Asphodelus tenuifolius* (1.550g), *Sacciolepis myosuroides* (1.488g), *Paspalum scrobiculatum* (1.425g), *Brachiaria reptans* (1.324g), *Echinochloa colona* (1.300g) and *Hemarthria compressa* (1.300g). Except the above weeds, all other monocotyledonous weeds bear seed weight less than 1.000g per 1000 seeds. Lowest seed weight among monocotyledonous weeds has been observed in *Monochoria vaginalis* (0.002g) and other

weeds which have seed weight less than 0.050g are *Eragrostis riparia* (0.012g), E. tenella (0.013g) and *Eriocaulon cinereum* (0.014g), *Butomopsis latifolia* (0.045g).

7.1.4 REPRODUCTIVE POTENTIAL OF SUCCESS FUL FAMILIES

In the present weed flora five most successful families are Poaceae, Asteraceae, Cyperaceae, Euphorbiaceae, Scorphulariaceae and Amaranthaceae (the last two families occupy the 5th position jointly, Table 3.3.1). In Poaceae , seed per plant ranges from 1026-10250, except 5 species viz. *Cynodon dactylon, Brachiaria reptans, Digitaria ciliaris, Sacciolepis myosuroides* and *Paspalum scrobiculatum*; which bear 208 - 546 seeds per plant. Considering the seed weight, 6 species viz. *Brachiaria reptans, Echinochloa colona, E. crus-galli, Hemarthria compressa, Paspalum scrobiculatum* and *Sacciolepis myosuroides* show more than 1.000g for 1000 seeds and ranges between 1.300g and 1.620g and for other members it is less than 1.000g. In Asteraceae, except *Xanthium indicum* (485 seeds per plant), *Launea aspleniifolia* (358 seeds per plant) and *Cirsium arvense* (256 seeds per plant) all other recorded species bear seeds numbering between 1580 and 28875 per plant. But for seed weight except *Xanthium indicum* (30.800g / 1000 seeds) and *Cirsium arvense* (1.700g / 1000 seeds), 1000 seed weight in all other recorded species lies between 0.11g and 0.600g. In Cyperaceae, except *Scirpus juncoides* (544 seeds / plant), the number of seeds produced per plant ranges between 1156 and 12688; where as incase of seed weight, it ranges between 0.092g and 0.210g per 1000 seeds, except *Scirpus articulatus* (0.700g) and *S. juncoides* (0.817g). In Euphorbiaceae seeds per ranges between 1238 and 5297 except *Croton bonplandianum* (949), *Phyllanthus amarus* (892), *P. fraturnus* (756), *Sebastiania chamaelea* (825). In 1000 seed weight, except *Chrozophora rottleri* (14.100g), *Croton bonplandianum* (9.738g) and *Sebastiania chamaelea* (4.0g), it ranges between 0.072g and 0.550g. In Scorphulariaceae, interestingly no species has been observed to bear less than 1000 seeds per plant and the ranges of seed per plant has been observed between 1679 and 11010 seeds. For the weight of 1000 seeds, it is very low lies between 0.002g and 0.040g in this family. In the family Amaranthaceae seed number ranges between 1535 and 18750 per plant and as per seed weight is concerned it ranges between 0.333g and 0.550g except for *Achyranthus aspera* which produced 630 seeds per plant and shows 2.330g as 1000 seed weight and *Digera muricata* which also shows 3.600g as 1000 seed weight.

So among the recorded weeds of five most successful families 71.4% (i.e. 40 species) species bear more than 1000 seeds per plant and on the other hand 76.8% (i.e. 43 species) species shows seed weight less than 1.0g per 1000 seeds. Though some extent of differences in seed number as well as seed weight exists within the species of different families still there is much uniformity, either in seed number or in seed weight present in the members of a particular family. There is positive correlation between seed weight and seed number generally exists within different members in a particular family. This finding is get its support from Dutta and Banerjee (1976). The successful families of the present flora viz. Poaceae and Cyperaceae also support Salisbury's (1956) view who states that some of the most successful species are those which exhibit a large seed out put and

possesses also a means of vegetative propagation. This latter method provide the equivalent of a large food supply in the seed - but over a much longer period and thus permits tolerance of greater and more prolonged competition by the vegetatively produced off-springs. *Cyperus rotundus* usually has a very restricted seed production (Tripathy, 1969; Thullen and Keeley, 1979), but it can multiply, spread and survive most of the unfavorable conditions of soil management very effectively by means of its small underground tubers / rhizomes; this system also reserves food and buds concentrated to swellings distributed between slender rhizome parts may be an efficient, substance-economic system for spread and persistent (Horowitz, 1972b; Holm et al, 1977). In the present work no mature seed has been observed in this species, so the only mode of reproduction observed its vegetative reproduction by underground tubers. *Cynodon dactylon* is another weed with a very variable and wide spread distribution in different seasons. A very low rate of seed production (Horowitz, 1972a, 1972c; Moriera 1977; Holm et al, 1977) has been recorded for the species (546) in the present too. It reproduces mainly vegetatively by underground and / or half-aerial stems i.e. by stolons and runners. The ability to propagate both by seeds as well as vegetatively is an advantage to the plant and that must be one of the reasons behind the success of the species as an weed. Other grasses and sedges also have the capacity to produce large number of seeds as well as they propagate vegetatively and that is why they generally dominate the weed floras. Though majority of the species of Asteraceae does not reproduce vegetatively but they have some other specials features to become successful weeds, which include -
(a) majority are anemochore species i.e. send their seeds away from the mother plant by air
(b)seeds are furnished with special devices such as pappus which increase the ability to disperse by air to a new habits (c) the ratio of the pappus size per seed weight is high in case of weedy Compositae (e.g. *Cirsium arvense*) which is not favorable for long distance dispersal therefore decrease the chance of seed loss (Sheldon, 1974) (d) rosette growth to occupy a certain amount of space (e.g. *Cirsium arvense, Blumea lacera* etc.)
(e) exotic like *Parthanium hysterophorus* is dispersed by man with his traffic and transport systems to a new habitat etc.

Other families including Euphorbiaceae, Scorphulariaceae and Amaranthaceae also have production of large number of small seeds and consist mainly of clitochore species i.e. the species shed their seeds around the mother plant and relay on dispersal in time rather than in space. They do not have any sophisticated dispersed devices because man himself is by far the most important agent for dispersal of crop-field weed seeds with his livestock, transport devices, agriculture machinery, irrigation systems and so on or sometimes they are able to disperse their seeds by any special means to a few meters. So, the seedlings are threatened by intraspecific competition. But the weeds overcome this situation by (a) prolong germination time and (b) only a small portion of seed germinate at a time and even this portion does not germinate at the very same time. These weeds also have the ability to continuous seed production for as long as the growing condition permit and wide amplitude of modificational plasticity and adaptability (Ehrendorfer, 1965) enabling the population to survive and produce seeds in a wide range of ecological conditions e.g. in very late germinated plant of *Chenopodium album* has been observed to produce seeds

when only 10-15 leaves are borne by the plant. On the other hand the weed species which bear small number of large seeds also get good opportunity of establishment because large seeds carry much food for the seedling and make it as independent as possible from the supply of nutrients and light from the environment and also enhance the seedling growth during the time of establishment.

7.1.5 COMPARISION WITH OTHER FLORAS

It is interest to compare the seed production and seed weight in this study with those published by Datta and Banerjee (1976), Dutta et al (1980), Paria and Sahoo (1981). There are seven species common to most of these lists (Table7.2) namely *Scirpus articulatus, Alternanthera sessilis, Amaranthus viridis, Argemone mexicana, Sida rhombifolia, Evolvulus nummularius* and *Cassia sophera*. In the present work except for *Alternanthera sessilis,* all common species contain less seed number in comparison to the other investigators. Other investigators found almost double or more seeds for the remaining six common species which is interesting. In this context Holzner and Numata (1982) commented that one must be aware that due to the high plasticity of weeds, seed number may vary from none to some hundreds of thousands or even millions per plant within one species. In the context of seed-weight, there also exists some variations and it is ranging between 100 mg and 1.100g. *Scirpus articulatus* and *Amaranthus viridis* of present work contain greater seed weight (per 1000 seeds) in comparison to the prevailing reported works. Stevens (1932) pointed out that the differences are due to the selection and cleaning of seeds. However, the paucity of data on seed number and seed weight may be due to the following facts - (a) selection of the plant (b) competition during growth (c) nature of collection (i.e. either from the crop field or outside) (d) cleaning of seeds (e) proper drying etc.

Table7.2 : Weight (g) of 1000 seeds and number of seeds per plant recorded by four group of workers

	Present Work		**Datta & Banerjee (1976)**		**Datta, Paria & Sahoo (1980)**		**Paria and Sahoo (1981)**	
Name of weed	Seed weight (g)	No. of seeds	Seed weight (g)	No. of seeds	Seed weight (g)	No. of seeds	Seed weight (g)	No. of seeds
Alternanthera sessilis	0.550	7994	0.936	4356	-	-	0.904	4500
Amaranthus viridis	0.380	1724	-	-	0.195	3217	0.195	3217
Argemone mexicana	1.300	23368	2.360	36685	-	-	2.400	35841
Cassia sophera	14.100	4860	-	-	15.245	10076	15.245	10076
Evolvulus nummularius	1.830	144	2.410	333	-	-	2.217	351
Scirpus articulatus	0.700	12688	0.608	32585	-	-	0.600	32142

TABLE 7.1 : Reproductive Potential of Crop Field Weeds of the district of Malda

(Abbreviation : **Pl** = Plant, **brs** = branches, ***imm*** = immature, **abr** = abortive, **sts** = stalks, **gls** = glumes, **sps** =spikes, **till** = tillers)

Name of Weed (a)	Family (b)	Weight 1000 seeds (g) (c)	Seed /fruit (d)	Total no /unit of measure (e)	Unit of meas -ure (f)	Remarks (g)
Hygrophila auriculata	Acanthaceae	1.300	6-8	6800	1Pl.	5 brs
H.difformis	-do-	0.006	40-60	6044	1Pl.	11brs
H. polysperma	-do-	0.045	24-32	2108	1Pl.	10brs
Rungia pectinata	-do-	0.158	2-4	7542	1Pl.	9brs
Achyranthes aspera	Amaranthaceae	2.330	1	630	1Pl.	7brs
Alternanthera philoxeroides	-do-	-	-	-	-	-
A. sessiles	-do-	0.500	1	7994	1Pl.	10brs
Amaranthus viridis	-do-	0.380	1	1724	1Pl.	3brs
Celosia argentea	-do-	0.333	8-11	18750	1Pl.	5brs
Digera muricata	-do-	3.600	1	1535	1Pl.	8brs 3% immature
Centella asiatica	Apiaceae	0.500	2	56	1Pl.	2brs
Ageratum conyzoides	Asteraceae	0.054	1	4324	1Pl.	8brs
A. houstonianum	-do-	0.067	1	3180	1Pl.	5sts
Blumea lacera	-do-	0.030	1	28875	1Pl.	15brs
Caesulia axillaris	-do-	0.600	1	1580	1Pl.	1brs 6% immature
Cirsium arvense	-do-	1.700	1	256	1Pl.	3brs 73% abr
Eclipta alba	-do-	0.380	1	3744	1Pl.	15brs 11% imm
Emilia sonchifolia	-do-	-	-	-	-	-
Gnaphalium luteo-album	-do-	0.019	1	2116	1Pl.	2brs
G. purpureum	-do-	0.011	1	2451	1Pl.	2brs
Launaea asplenifolia	-do-	0.058	1	358	1Pl.	2brs
Parthenium hysterophorus	-do-	0.360	1	12335	1Pl.	11brs
Sphaeranthus indicus	-do-	0.036	1	12000	1Pl.	3brs 10% imm
Spilanthes calva	-do-	0.125	1	3250	1Pl.	7brs 5% imm
Vernonia cinerea	-do-	0.171	1	2432	1Pl.	6brs 7% imm
Xanthium indicum	-do-	30.800	2	485	1Pl.	5brs 2% abr
Heliotropium indicum	Boraginaceae	1.640	1	3920	1Pl.	3brs
Cochleria cochlearioides	Brassicaceae	3.100	14-19	1658	1Pl.	6brs
Rorippa indica	-do-	0.090	38-46	1892	1Pl.	4brs 8% imm
Cassia sophera	Caesalpinaceae	14.100	52-58	4860	1Pl.	5brs
Polycarpon prostratum	Caryophyllaceae	0.043	9-12	2407	1Pl.	5brs 8% imm
Chenopodium album	Chenopodiaceae	0.450	1	8521	1Pl.	15brs 3%I imm

(a)	(b)	(c)	(d)	(e)	(f)	(g)
Cleome viscosa	Cleomaceae	1.000	171-193	11895	1Pl.	9brs 8% imm
Dichondra repens	Convolvulaceae	-	-	-	-	-
Evolvulus nummularius	-do-	1.830	3	144	1Pl.	3brs
Hewittia scandens	-do-	14.280	3-4	136	1Pl.	4brs 6% abr
Ipomoea aquatica	-do-	42.980	3-4	549	1Pl.	4% abr
Cucumis melo	-do-	6.120	62-70	786	1Pl.	4brs
Acalypha indica	Euphorbiacee	0.500	3	3510	1Pl.	2brs 2% abr
Croton bonplandianum	-do-	9.738	3	949	1Pl.	5brs few abr and insect infested
Chrozophora rottleri	-do-	14.100	3	1532	1Pl.	5brs 3% abr
Euphorbia heyniana	-do-	0.072	3	2782	1Pl.	12brs
E. hirta	-do-	0.153	3	5297	1Pl.	6brs
E. indica	-do-	0.400	3	1500	1Pl.	5brs
Phyllanthus amarus	-do-	0.498	6	892	1Pl.	9brs 7% immature
P. fraturnus	-do-	0.510	6	756	1Pl.	6brs 7% immature
P. virgatus	-do-	0.360	6	1238	1Pl.	8brs 11% immature
Sebastiania chamaelea	-do-	4.000	3	825	1Pl.	5brs few abr and insect infested
Lathyrus aphaca	Fabaceae	11.400	4-7	153	1Pl.	4brs
Medicago lupulina	-do-	1.400	1	1376	1Pl.	6brs
Melilotus alba	-do-	2.200	1	3069	1Pl.	14brs
Vicia angustifolia	-do-	15.500	6-9	288	1Pl.	10brs
V. hirsuta	-do-	11.600	2	285	1Pl.	7brs
Fumaria indica	Fumariaceae	2.482	1	1592	1Pl.	6brs
Hydrolea zeylanica	Hydrophyllaceae	0.001	520-600	27000	1Pl.	1brs
Leucas cephalotes	Lamiaceae	2.020	3-4	111	1Pl.	1brs 11% imm 2% abr
L. indica	-do-	0.850	4	18000	1Pl.	6brs
Leonurus japonicus	-do-	0.460	4	6216	1Pl.	2sts
Ammannia baccifera	Lythraceae	0.016	86-94	2760	1Pl.	3brs
Nesaea brevipes	-do-	-	-	-	-	-
Rotala indica	-do-	0.004	54-70	21100	1Pl.	2brs
Malachra capitata	Malvaceae	-	-	-	-	-
Sida rhombifolia	-do-	1.680	4-6	1840	1Pl.	10brs
Stephania japonica	Menispermaceae	-	-	-	-	-
Glinus lotoides	Molluginaceae	0.050	162-178	12410	1Pl.	5brs
G. oppositifolius	-do-	0.040	136-152	14140	1Pl.	4brs

(a)	(b)	(c)	(d)	(e)	(f)	(g)
Ficus heterophyla	Moraceae	-	-	-	-	-
Ludwigia adscendens	Onagraceae	0.148	38-52	2362	1Pl.	3brs 4% immature
L. perennis		0.020	320-382	218287	1Pl.	15brs
Orobanche aegyptiaca	Orobanchaceae	0.013	1400-1500	42050	1Pl.	3brs 29% imm
Biophytum sensitivum	oxalidaceae	0.205	19-23	3059	1Pl. 1Pl.	19sts
Oxalis corniculata	-do-	0.400	58-70	640	1Pl.	2brs 29% imm
Argemone mexicana	Papaveraceae	1.300	454-480	23368	1Pl.	5brs 3% immature
Polygonum plebeium	Polygonaceae	0.762	1	1405	1Pl.	10brs
Portulaca oleracea	Portulacaceae	0.070	25-42	1520	1Pl.	7brs
P. quadrifida	-do-	0.200	22-32	958	1Pl.	5brs
Anagallis arvensis	Primulaceae	0.460	17-27	1647	1Pl.	4brs
Ranunculus sceleratus	Ranunculaceae	0.080	1	4680	1Pl.	6brs
Hedyotis corymbosa	Rubiaceae	0.010	28-37	3977	1Pl.	5brs
H. diffusa	-do-	0.020	76-94	6278	1Pl.	3brs
H. pumila	-do-	-	-	-	-	-
Lindernia ciliata	Scorphulariacear	0.002	127-140	1679	1Pl.	3brs
L. crustacea	-do-	0.022	108-123	6243	1Pl.	5brs
L. multiflora	-do-	0.006	340-386	5264	1Pl.	2brs 7% imm
L. perviflora	-do-	0.010	146-158	3230	1Pl.	2brs
Macardonia procumbens	-do-	0.010	367-378	11010	1Pl.	5brs
Scoparia dulcis	-d0-	0.040	120-150	10030	1Pl.	6brs
Physalis minima	Solanaceae	0.560	32-44	525	1Pl.	4brs
Solanum nigrum	-do-	0.800	48-57	6272	1Pl.	4brs
Nicotiana plumbaginifolia	-do-	0.020	482-500	4986	1Pl.	2brs
Melochia corchorifolia	Stercullariaceae	4.216	14-22	822	1Pl.	4brs
Corchorus fascicularis	Tiliaceae	0.540	20-24	5340	1Pl.	3brs
Phyla nodiflora	Verbinaceae	0.437	2	3239	1Pl.	5brs
Butomopsis latifolia	Alismataceae	0.045	35-58	208	1Pl.	2sts
Sagitaria guyanensis	-do-	0.660	1	878	1Pl.	8 heads 3% immature
Commelina benghalensis	Commelinaceae	2.500	4	984	1Pl.	6brs 3% abr
Murdannia nudiflora	-do-	0.950	6	378	1Pl.	3brs
Tonningia axillaris	-do-	1.910	1	541	1Pl.	4brs
Cyperus compressus	Cyperaceae	-	-	-	-	-
C. difformis	-do-	0.092	1	9870	1Pl.	with gls

(a)	(b)	(c)	(d)	(e)	(f)	(g)
C. iria	-do-	0.138	1	2300	1Pl.	6sps with gls
C. kyllinga	Cyperaceae	0.140	1	1156	1Pl.	10 tills without gls
C. rotundus	-do-				1Pl.	
C. tegetiformis	-do-	0.210	1	2050	1Pl.	without gls
Eleocharis congesta	-do-	-	-	-	-	-
Fimbristylis dichotoma	-do-	0.170	1	1172	1Pl.	3 tills
F. miliacea	-do-	-	-	-	-	-
Scirpus articulatus	-do-	0.700	1	12688	1Pl.	15tills without gls 14% imm
S. juncoides	-do-	0.817	1	544	1Pl.	11tills without gls
Eriocaulon cinereum	Eriocaulaceae	0.014	1	9405	1Pl.	38 heads
Asphodelus tenuifolius	Liliaceae	1.550	5-6	672	1Pl.	2sts
Brachiaria reptans	Poaceae	1.324	1	456	1Pl.	5brs with gls
Chloris inflata	-do-	0.210	1	4082	1Pl.	without gls
Cynodon dactylon	-do-	0.204	1	546	1Pl.	70% abr
Desmostachya bipinnata	-do-	0.008	1	5400	1Pl.	with gls
Digitaria bicornis	-do-	-	-	-	-	-
D. ciliaris	-do-	0.724	1	410	1Pl.	16% imm
D. longiflora	-do-	-	-	-	-	-
Echinochloa colona	-do-	1.300	1	1120	1Pl.	without gls
E. crus-galli	-do-	1.620	1	1094	1Pl.	without gls
Elusine indica	-do-	0.310	1	4494	1Pl.	3sts without gls
Eragrostis ferruginea	-do-	-	-	-	-	-
E. gangetica	-do-	0.078	1	5500	1Pl.	3brs without gls
E. riparia	-do-	0.012	1	10250	1Pl.	5brs with gls
E. tenella	-do-	0.013	1	2485	1Pl.	without gls
Hemarthria compressa	-do-	1.300	1	1026	1Pl.	5tills without gls
Paspalum scrobiculatum	-do-	1.425	1	288	1Pl.	3tills
Sacciolepis myosuroides	-do-	1.488	1	296	1Pl.	1sls
Monochoria vaginalis	Pontederiaceae	0.002	125-140	810	1Pl.	1br

CHAPTER - 8

WEED CALENDAR

WEED CALENDAR

Weeds are the integral part of the crop fields. Their seeds and propagules generally perennate in the soil of the field and also they migrate from the surrounding vegetation. Different weed species disperse their seeds in different time which, in turn, also germinate in different time. Existence of this basis vegetation like differential flowering, fruiting and germination periods brought about a change in the weed flora in the field in different parts of the year. When these are recorded monthwise, a calendar is thus produced.

This calendar is the excerpt of some basic date from the data recorded for the phenology of these weedy species. It is expected that, this calendar will be helpful in formulating the strategies for the control or eradication of weeds in the field.

Weed calendar for the district of Malda included monthwise record of occurrence of different weeds growing in the field. As, in a particular month not all the species are passing with the same stage, so, the knowledge from the appearance of a weed to its different stages, that is, vegetative, flowering fruiting, and death is very much required and which was discussed in Chapter-5. As the majority of the weeds are annual, so, the comprehensive weed calendar was prepared to indicate appearance of each and every recorded weed species, period of their presence and disappearance in the crop fields of the district of Malda. There are many reports on flowering calendar of trees or for the entire vegetation (Booj and Ramkrishnan 1981; Das and Chanda 1987; Panda *et al* 1992; Sukla and Ramkrishnan 1982; Ralhan *et al* 1985; Kaul and Raina 1980; Sivaraj and Krishnamurthy 1989; Sundriyal, 1990)from different parts of the country. But existence of any weed calendar is not known to me.

8.1 RESULT AND DISCUSSION

Weed calendar of the district of Malda contains 132 species, of which 93 are dicotyledonous, 37 are monocotyledonous and only two species of pteridophytes. Different species passing through different stages of their life cycle in different months of a calendar year Table 5.1 and at the sametime not all the species present in all the months of the year (Table 8.1). Again, as discussed under the phenology of the weeds, different stages of the life cycle generally intermingle with each other because in nature it is observed that not the all members of a species passing with the same stage at a given time. But generally, each stage of life cycle has a particular duration except for perennials.

8.1.1 MONTHWISE PICTURE

At the starting of the calendar year (Fig. 8.1-8.2), that is, during the month of January, 118 species of angiosperm have been observed in the crop field of the district of Malda. Out of 118 species of angiosperm, there are 90 dicotyledonous species and 28 species of monocotyledons. While, only 2 species have been observed to germinate in January, 5 dicotyledonous and 6 monocotyledonous species terminate their life cycle in this month. In the month of February, totals 111 species of angiospermic weeds have been observed in the crop-field, out of these weeds dicotyledons and monocotyledons contain 87 species and 24 species respectively. No angiospermic has been observed to germinate, while 9 dicotyledonous and 5 monocotyledonous species terminate their life cycle in this month.

In the month of March, 105 species of angiosperm have been observed in the crop-field, out of these weeds, dicotyledons and monocotyledons contain 81 species and 24 species respectively. While, only 1 species has been observed to germinate in March, 20 dicotyledons and 17 monocotyledons terminate their life cycle in this month.

In the month of April, 98 species of angiosperm have been observed in the crop field, out of these weeds dicotyledons and monocotyledons contain 75 species and 23 species respectively. While, 15 species have been observed to germinate in April, 40 dicotyledonous and 17 monocotyledonous species terminate their life cycle in this month.

During the month of May, 91 species of angiosperm have been observed in the crop-field, out of these weeds dicotyledons and monocotyledons contain 69 species and 22 species respectively. While, 49 species have been observed to germinate in May, 37 dicotyledons and 6 monocotyledons terminate their life cycle in this month.

During the month of June, 99 species of angiosperm have been observed in the crop-field, out of these weeds dicotyledons and monocotyledons contain 65 species and 34 species respectively. While, 72 species have been observed to germinate in June and only 9 dicotyledons terminate their life cycle in this month.

During the month of July 100 species of angiosperm have been observed in the crop-field, out of these weeds dicotyledons and monocotyledons contain 66 species and 34 species respectively. While, 59 species have been observed to germinate in July and only 2 dicotyledonous species terminate their life cycle in this month.

In the month of August, 107 species of angiosperm have been observed in the crop field, out of these weeds dicotyledons and monocotyledons contain 72 species and 35 species respectively. While, 24 species have been observed to germinate in August and only 3 dicotyledonous species terminate their life cycle in this month.

In the month of September, 118 species of angiosperm have been observed in the crop-field, out of these weeds dicotyledons and monocotyledons contain 83 species and 35

Fig. 8.1 : Presence of dicotyledonous weeds in different months of the year in the district of Malda

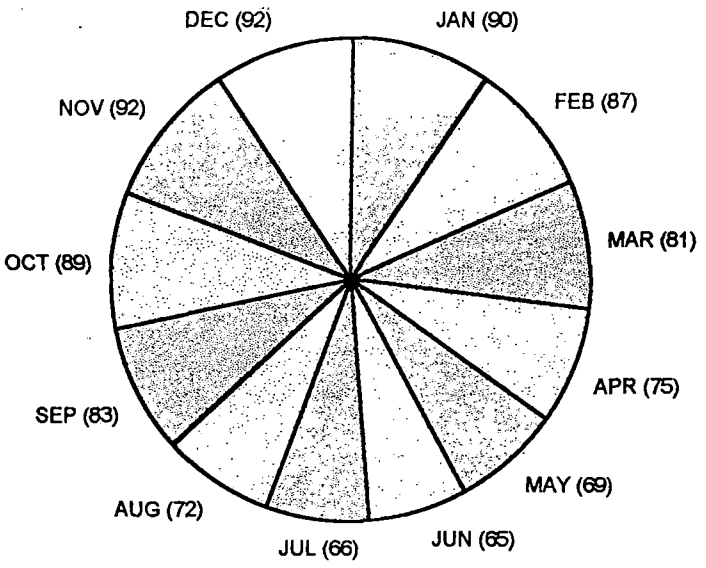
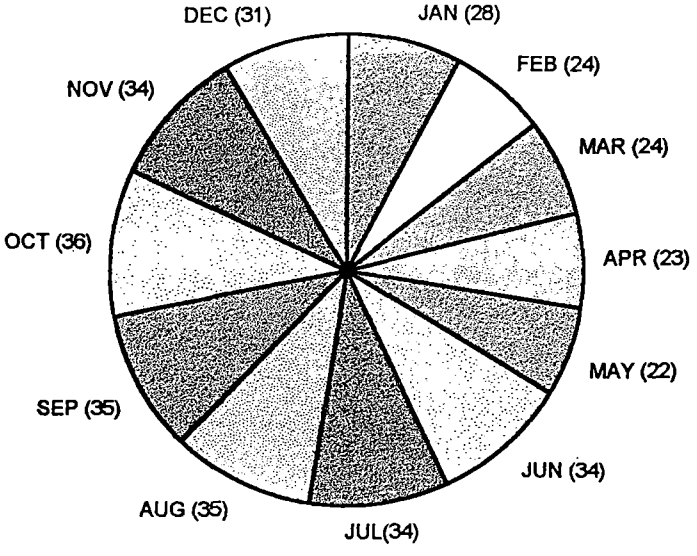


Fig. 8.2 : Presence of monocotyledonous weeds in different months of the year in the district of Malda



species respectively. While 28 species have been observed to germinate in September and only 3 species of dicotyledons terminate their life cycle in this month.

In the month of October, 125 species of angiosperm have been observed in crop-field, out of these weeds, dicotyledons and monocotyledons contain 89 species and 36 species and 36 species respectively. While, 25 species have been observed to germinate in October and 4 species of monocotyledons terminate their life cycle in this month.

In the month of November, 126 species of angiosperm have been observed in the crop-field, out of these weeds, dicotyledons and monocotyledons contain 92 species and 34 species respectively. While, 13 species have been observed to germinate in November and 6 species of monocotyledons terminate their life cycle in this month.

In the month of December, 123 species of angiosperm have been observed in the crop-field, out of these weeds, dicotyledons and monocotyledons contain 92 species and 31 species respectively. While, 3 species have been observed to germinate in December, 2 dicotyledonous and 6 monocotyledonous species terminate their life-cycle in this month.

8.1.2 OVERALL PICTURE

The overall picture emerging out of the above discussion is that the period November to April is unfavourable for the germination for dicotyledonous weed and it is August to April for monocotyledonous weed. The month of June is most favourable for germination for both dicotyledonous and monocotyledonous weed. Vegetative growth of dicotyledonous weeds have been observed mainly in May to October and for monocotyledonous weeds it is mainly in May to August. Flowering condition of dicotyledonous weeds (Fig. 5.1) has been observed to increase from June and continues till December; after that the number of flowering species starts to decline slowly upto the month of March and then rapidly till the month of May. As majority of the crop field weeds are annual and flowering and fruiting have been observed as a simultaneous process, so the whole picture of flowering just sifted to one month forward in case of fruiting in dicotyledonous weeds. But in monocotyledonous weeds, it has been observed that number of flowering species starts to increase suddenly from July but continues only till September, after that the number starts to decline steadily till the month of June. The similar picture has been observed also in case of number of fruiting species of monocotyledonous weeds. No species have been observed in dying stage during the month of October and November in case of dicotyledonous weeds and June to September in case of monocotyledonous weeds. Majority of dicotyledonous species have been observed to complete their life cycle during the period of March to May and majority of the monocotyledons during March and April.

8.1.3 THROUGHOUT PRESENCE

66 species of angiospermic weeds have been observed in different stages of their life cycle in the crop fields of the district of Malda throughout the year. Among those there are 44 species of dicotyledons (under 22 families) and 12 species of monocotyledons (under 4 families). The dicotyledonous species that have been observed throughout the year include *Alternanthera sessilis, Eclipta alba, Euphorbia hirta* etc., and monocotyledonous weeds include *Cyperus rotundus, Cynodon dactylon, Elusine indica* etc.

8.1.4 PTERIDOPHYTES

Among two pteredophytic species, *Marsilea quadrifida* has been observed in different stages of its life cycle throughout the year. Sporocarp formation has been observed during February to April only and in the remaining part of the year it is found in vegetative condition. The other pteridophytic weeds *Ceratopteris thalictroides*, an annual, has been observed in germinating and vegetative stages during the month of June and July. During August to November it has been observed in sprouting stage and it generally dies during the dry winter months.

Table 8.1: Weed calendar of the district of Malda

(❊ = Presence; ◉ = Germination; ✦ = Death)

Name of Weed	Family	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Hygrophila auriculata	Acanthaceae	❊	❊	❊	❊	✦	-	-	-	◉	❊	❊	❊
H.difformis	-do-	❊	❊	❊	✦	-	-	-	◉	❊	❊	❊	❊
H. polysperma	-do-	❊	❊	❊	✦	-	-	-	◉	❊	❊	❊	❊
Rungia pectinata	-do-	❊	❊	❊	❊	❊	✦	-	-	◉	❊	❊	❊
Achyranthes aspera	Amaranthaceae	❊	❊	❊	✦	-	-	-	◉	❊	❊	❊	❊
Alternanthera philoxeroides	-do-	❊	❊	✦	-	◉	❊	❊	❊	❊	❊	❊	❊
A. sessiles	-do-	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊	❊	❊
Amaranthus virides	-do-	❊	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊	❊
Celosia argentea	-do-	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊
Digera muricata	-do-	❊	❊	✦	-	◉	❊	❊	❊	❊	❊	❊	❊
Centella asiatica	Apiaceae	❊	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊	❊
Ageratum conyzoides	Asteraceae	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊
A. houstonianum	-do-	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊
Blumea lacera	-do-	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊
Caesulia axillaris	-do-	❊	❊	❊	✦	-	◉	❊	❊	❊	❊	❊	❊
Cirsium arvense	-do-	❊	❊	❊	❊	✦	-	-	◉	❊	❊	❊	❊
Eclipta alba	-do-	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊	❊	❊
Emilia sonchifolia	-do-	❊	❊	❊	✦	-	-	◉	❊	❊	❊	❊	❊
Gnaphalium luteo-album	-do-	❊	❊	❊	❊	✦	-	-	-	◉	❊	❊	❊
G. purpureum	-do-	❊	❊	❊	❊	✦	-	-	-	◉	❊	❊	❊
Launaea asplenifolia	-do-	❊	❊	❊	❊	❊	✦	-	-	-	◉	❊	❊
Parthenium hysterophorus	-do-	❊	❊	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊
Sphaeranthus indicus	-do-	❊	❊	❊	❊	✦	-	-	-	◉	❊	❊	❊
Spilanthes calva	-do-	❊	❊	❊	❊	✦	-	-	❊	❊	❊	❊	❊
Vernonia cinerea	-do-	❊	❊	-	-	-	-	-	-	-	-	❊	❊
Xanthium indicum	-do-	❊	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊
Heliotropium indicum	Boraginaceae	❊	❊	❊	❊	❊	❊	❊	◉	❊	❊	❊	❊
Cochleria cochlearioides	Brassicaceae	❊	❊	❊	✦	-	-	-	-	◉	❊	❊	❊

Name of Weed	Family	J	F	M	A	M	J	J	A	S	O	N	D
Rorippa indica	-do-	❊	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊
Cassia sophera	Caesalpinaceae	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊	❊
Polycarpon prostratum	Caryophyllaceae	❊	❊	❊	✦	-	◉	❊	❊	❊	❊	❊	❊
Chenopodium album	Chenopodiaceae	❊	❊	✦	-	-	-	-	-	◉	❊	❊	❊
Cleome viscosa	Cleomaceae	❊	❊	✦	-	◉	❊	❊	❊	❊	❊	❊	❊
Dichondra repens	Convolvulaceae	-	-	-	-	-	❊	❊	❊	❊	❊	❊	-
Evolvulus nummularius	-do-	❊	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊	❊
Hewittia scandens	-do-	-	-	-	-	◉	❊	❊	❊	❊	❊	❊	❊
Ipomoea aquatica	-do-	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊	❊
Cucumis melo	-do-	❊	✦	-	❊	❊	❊	❊	❊	❊	❊	❊	❊
Acalypha indica	Euphorbiacee	❊	❊	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊
Croton bonplandianum	-do-	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊
Chrozophora rottleri	-do-	❊	❊	❊	❊	❊	❊	❊	❊	✦	-	-	◉
Euphorbia heyniana	-do-	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊	❊	❊
E. hirta	-do-	❊	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊	❊
E. indica	-do-	❊	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊	❊
Phyllanthus amarus	-do-	❊	✦	-	-	◉	❊	❊	❊	❊	❊	❊	❊
P. fraturnus	-do-	❊	✦	-	-	◉	❊	❊	❊	❊	❊	❊	❊
P. virgatus	-do-	❊	✦	-	-	◉	❊	❊	❊	❊	❊	❊	❊
Sebastiania chamaelea	-do-	❊	❊	❊	❊	✦	-	-	-	-	◉	❊	❊
Lathyrus aphaca	Fabaceae	❊	❊	✦	-	-	-	-	-	◉	❊	❊	❊
Medicago lupulina	-do-	❊	❊	❊	✦	-	-	-	-	◉	❊	❊	❊
Melilotus alba	-do-	❊	❊	❊	❊	✦	-	-	-	◉	❊	❊	❊
Vicia angustifolia	-do-	❊	❊	❊	✦	-	-	-	-	-	◉	❊	❊
V. hirsuta	-do-	❊	❊	❊	✦	-	-	-	-	-	◉	❊	❊
Fumaria indica	Fumariaceae	❊	❊	❊	❊	✦	-	-	-	-	◉	❊	❊
Hydrolea zeylanica	Hydrophyllaceae	✦	-	-	-	-	-	◉	❊	❊	❊	❊	❊
Leucas cephalotes	Lamiaceae	❊	❊	✦	-	-	-	-	-	-	◉	❊	❊
L. indica	-do-	❊	❊	❊	❊	◉	❊	❊	❊	❊	◉	❊	❊
Leonurus japonicus	-do-	❊	❊	❊	❊	✦	-	◉	❊	❊	❊	❊	❊
Ammannia baccifera	Lythraceae	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊
Nesaea brevipes	-do-	❊	✦	-	-	-	-	◉	❊	❊	❊	❊	❊
Rotala indica	-do-	❊	❊	✦	-	-	◉	❊	❊	❊	❊	❊	❊
Malachra capitata	Malvaceae	-	-	-	-	-	◉	❊	❊	❊	❊	❊	❊

Name of Weed	Family	J	F	M	A	M	J	J	A	S	O	N	D
Sida rhombifolia	-do-	❊	❊	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊
Stephania japonica	Menispermaceae	❊	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊	❊
Glinus lotoides	Molluginaceae	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊
G. oppositifolius	-do-	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊
Ficus heterophyla	Moraceae	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊
Ludwigia adscendens	Onagraceae	❊	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊
L. perennis	-do-	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊
Orobanche aegyptiaca	Orobanchaceae	❊	❊	❊	✦	-	-	-	-	-	-	❊	❊
Biophytum sensitivum	oxalidaceae	✦	-	-	-	◉	❊	❊	❊	❊	❊	❊	❊
Oxalis corniculata	-do-	❊	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊	❊
Argemone mexicana	Papaveraceae	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊
Polygonum plebeium	Polygonaceae	❊	❊	❊	❊	❊	❊	✦	-	-	◉	❊	❊
Portulaca oleracea	Portulacaceae	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊
P. quadrifida	-do-	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊
Anagallis arvensis	Primulaceae	❊	❊	❊	✦	-	-	-	-	◉	❊	❊	❊
Ranunculus sceleratus	Ranunculaceae	❊	❊	❊	✦	-	-	-	-	-	-	◉	❊
Hedyotis corymbosa	Rubiaceae	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊
H. diffusa	-do-	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊
H. pumila	-do-	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊
Lindernia ciliata	Scorphulariaceae	❊	❊	❊	✦	-	◉	❊	❊	❊	❊	❊	❊
L. crustacea	-do-	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊
L. multiflora	-do-	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊
L. perviflora	-do-	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊
Macardonia procumbens	-do-	❊	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊	❊
Scoparia dulcis	-do-	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊
Physalis minima	Solanaceae	❊	❊	❊	❊	❊	✦	-	◉	❊	❊	❊	❊
Solanum nigrum	-do-	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊
Nicotiana plumbaginifolia	-do-	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊
Melochia corchorifolia	Stercullariaceae	✦	-	-	◉	❊	❊	❊	❊	❊	❊	❊	❊
Corchorus fascicularis	Tiliaceae	❊	❊	✦	-	-	-	-	◉	❊	❊	❊	❊
Phyla nodiflora	Verbinaceae	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊
Butomopsis latifolia	Alismataceae	❊	❊	✦	-	-	-	-	◉	❊	❊	❊	❊
Sagittaria guyanensis	-do-	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊
Commelina benghalensis	Commelinaceae	❊	❊	❊	✦	-	◉	❊	❊	❊	❊	❊	❊

Name of Weed	Family	J	F	M	A	M	J	J	A	S	O	N	D
Murdannia nudiflora	-do-	❊	❊	❊	✦	-	◉	❊	❊	❊	❊	❊	❊
Tonningia axillaris	-do-	-	-	-	-	-	◉	❊	❊	❊	❊	✦	-
Cyperus compressus	Cyperaceae	✦	-	-	-	◉	❊	❊	❊	❊	❊	❊	❊
C. difformis	-do-	-	-	-	-	◉	❊	❊	❊	❊	❊	✦	-
C. iria	-do-	❊	❊	✦	-	-	◉	❊	❊	❊	❊	❊	❊
C. kyllinga	-do-	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊
C. rotundus	-do-	❊	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊	❊
C. tegetiformis	Cyperaceae	❊	❊	❊	✦	-	◉	❊	❊	❊	❊	❊	❊
Eleocharis congesta	-do-	✦	-	-	-	-	◉	❊	❊	❊	❊	❊	❊
Fimbristylis dichotoma	-do-	-	-	-	◉	❊	❊	❊	❊	❊	❊	✦	-
F. miliacea	-do-	✦	-	-	-	-	◉	❊	❊	❊	❊	❊	❊
Scirpus articulatus	-do-	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊
S. juncoides	-do-	❊	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊
Eriocaulon cinereum	Eriocaulaceae	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊	❊
Asphodelus tenuifolius	Liliaceae	❊	❊	❊	❊	✦	-	-	-	-	◉	❊	❊
Brachiaria reptans	Poaceae	-	-	◉	❊	❊	❊	❊	❊	❊	❊	❊	✦
Chloris inflata	-do-	-	-	-	◉	❊	❊	❊	❊	❊	❊	✦	-
Cynodon dactylon	-do-	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊
Desmostachya bipinnata	-do-	-	-	❊	❊	❊	-	-	-	-	-	-	-
Digitaria bicornis	-do-	-	-	-	-	-	◉	❊	❊	❊	❊	❊	✦
D. ciliaris	-do-	❊	❊	❊	✦	-	◉	❊	❊	❊	❊	❊	❊
D. cruciata	-do-	✦	-	-	-	-	◉	❊	❊	❊	❊	❊	❊
D. longiflora	-do-	-	-	-	-	◉	❊	❊	❊	❊	❊	-	-
Echinochloa colona	-do-	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊	❊
E. crus-galli	-do-	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊	❊
Elusine indica	-do-	❊	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊	❊
Eragrostis ferruginea	-do-	❊	❊	❊	❊	◉	❊	❊	❊	❊	❊	❊	❊
E. gangetica	-do-	❊	❊	❊	✦	-	◉	❊	❊	❊	❊	❊	❊
E. riparia	-do-	❊	❊	❊	✦	◉	❊	❊	❊	❊	❊	❊	❊
E. tenella	-do-	❊	✦	-	-	-	◉	❊	❊	❊	❊	❊	❊
Hemarthria compressa	-do-	-	-	-	-	◉	❊	❊	❊	❊	❊	-	-
Paspalum scrobiculatum	-do-	❊	❊	❊	✦	-	◉	❊	❊	❊	❊	❊	❊
Sacciolepis myosuroides	-do-	❊	❊	✦	-	-	◉	❊	❊	❊	❊	❊	❊
Monochoria vaginalis	Pontederiaceae	❊	✦	-	-	◉	❊	❊	❊	❊	❊	❊	❊

Name of Weed	Family	J	F	M	A	M	J	J	A	S	O	N	D
Marsilea quadrifida	Marsileaceae	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊	❊
Ceratopteris thalictroides	Parkeriaceae	-	-	-	-	-	✺	❊	❊	❊	❊	❊	✦

CHAPTER - 9

ALLELOPATHY

ALLELOPATHY

The term "Allelopathy" was first coined by Molisch (1937), who referred it as a biochemical interactions between all types of plants including microorganisms. Both beneficial and harmful reciprocal biochemical interactions were thought by him to be covered by the term. However, the elimination of beneficial effects from the definition was considered to be very artificial by Rice (1979). Khailov (1974) stated that the effect of any given compound may be 'inhibitory' or 'stimulatory' which, intern, depends on the concentration of the compound in the surrounding medium. Molisch's original definition of the term has been consistently followed by many investigators in Asia and Europe. Rice (1984) stated that many of us are concerned with detrimental effects of added chemicals, extremely significant roles of allelopathy may have been overlooked. Some biologists regard allelopathy to be a component of competition or are completely unaware of the phenomenon of allelopathy. Muller (1969) suggests that the term 'interference' should be employed to the overall deletorious effects, thus encompassing both competition and allelopathy. Salisbury (1957) indicates the presence of allelopathy by saying that anything which prevents a seed from sprouting and discourages a species from thriving, must have a powerful influence on the composition of the plant community. Del Moral and Cates (1971)defined allelopathy as the inhibitor of germination, growth and metabolism of one plant due to the release of organic chemicals by another. According to Putnam and Duke (1978), allelopathy may be a habitat factor in enhancing dominance by certain weeds in a variety of agro-ecosystems. Harper (1977) proposed a blanket term 'interference', comprising all chances in the environment, brought about by the proximity of the individuals and also include 'the production of toxins'.

Since the turn of the century, allelopathic study has been mainly restricted to the cultivated crop plants only. In agricultural ecosystems there are many agrestals of which allelopathic influences have been proved in the laboratory (Griimmer and Beyer, 1960; Martin and Rademacher, 1960; Welbank, 1960; Grodzinskiy, 1965). Muller (1966, 1970,1974) showed the significance of allelopathy in relation to the environmental complex and threw light on the allelopathic mechanism for a dominant vegetation. There are four general ways by means of which toxic metabolites get out of plants, these are weathering, leaching, exudation and volatilization (Tukey, 1969; Datta and Sinha Roy, 1974; Datta and Chatterjee, 1980a). At present there is considerable information on the role of allelopathy in manipulated and natural ecosystems (Muller et al, 1968; Muller, 1970; Rice, 1979). Rice (1984) mentioned the effects of weed interference of crop yields, effect of crop plants on other crop plants and effect of crop plants on weeds. In the field of forestry the importance of the studies of an allelopathic effect of woody seed plants or herbaceous angiosperms, ferns, as well as micorrhizae and other microorganisms can be realised. Allelopathy has also been implicated in case of plant pathology. In the last three decades, allelopathic research has been mainly carried out in the United States in general

and California and Oklahoma in particular. Both these states belong to the semi-arid climatic zone, there being very little or no information from the humid or sub-humid region, though the latter areas are covered with luxuriant vegetation and offered an excellent aspect for plant ecologists to do their work (Chou, 1977). In India Datta and Sinha Roy (1973,1974,1975,1983), Datta and Chakroborty (1975, 1978, 1982a, 1982b), Datta and Chatterjee (1980a, 1980b, 1980c), Datta and Bandyopadhyay (1981, 1989), Datta and Ghosh (1982, 1987, 1988), Datta and Dasmahapatra (1984, 1988) worked on allelopathy of weeds of natural and cultivated vegetation in West Bengal.

In agriculture, weeds always offer competition as well as they produce some chemicals which may have some allelopathic effects on crops. Taking all the above aspects in mind, the present work is restricted only on the effects of leachetes of leaves and inflorescence and extraction of leaves of some common weed species upon the certified variety of Paddy (IET-1444). During the work, the effect of derived concentration (1:2.5, 1:5, 1:10, 1:20) of leachetes or extracts has been observed upon germination, length of root and shoot in comparison with control, where distilled water has been used against leachetes or extracts. For each desired concentration of leachetes or extracts and for control (i.e. with distilled water) three replicates (in petriplates) each with 25 seeds (Paddy) and 15 ml of solution has been used. Effects of leachetes or extracts on germination of seeds and on the growth of root and shoot of young seedlings of used crop species have been observed. Measurement of length of root and shoot has been taken and percentage of deviation in respect of control has been worked out. For the determination of % of deviation , the following formula has been used :

$$\% \text{ of Deviation} = \frac{\text{Length in control - Length in desired solution}}{\text{Length in Control}} \times 100$$

Germination percentile has also been calculated for better understanding of allelopathic effect.

9.1 RESULT AND DISCUSSION

In the present work six weed species have been examined for their allelopathic effect. Among these, five belong to dicotyledons viz. *Digera muricata, Chenopodium album, Leucas indica, Eclipta alba, Celosia argentea* and only one, *Murdannia nudiflora,* belongs to monocotyledons. All these six species is very common in crop-fields in the district of Malda. Effects of leachetes of leaves and inflorescence of these species have

Table 9.1 : Effect of leachetes of inflorescence of *Digera muricata* on the germination and early growth of seedling in Paddy.

Concentration	1: 0	1: 2.5	1: 5	1: 10	1: 20
Viable	96	78.67	85.33	88	94.67
Nonviable	4	21.33	14.67	12	5.33
Root length (cm)	8.15	5.98	7.08	7.18	7.54
Shoot length (cm)	3.79	2.50	3.42	3.56	3.74
% Deviation Root	0	26.63	13.13	11.90	7.48
% Deviation Shoot	0	30.04	9.76	6.07	1.32
Percentile of viability	100	81.95	88.89	91.67	98.61

Table 9. 2 : Effect of leachetes of leaf of *Digera muricata* on the germination and early growth of seedling in Paddy.

Concentration	1: 0	1: 2.5	1: 5	1: 10	1: 20
Viable	96	61.33	81.33	90.67	90.67
Nonviable	4	38.67	18.67	9.33	9.33
Root length (cm)	8.15	1.32	7.08	7.24	7.32
Shoot length (cm)	3.79	1.98	3.02	3.68	3.76
% Deviation Root	0	83.80	13.13	11.17	10.18
% Deviation Shoot	0	47.76	20.32	2.90	0.79
Percentile of viability	100	63.89	84.72	94.45	94.45

Table 9.3 : Effect of leachetes of inflorescence of *Chenopodium album* on the germination and early growth of seedling in Paddy.

Concentration	1: 0	1: 2.5	1: 5	1: 10	1: 20
Viable	96	40	86.67	86.67	90.67
Nonviable	4	60	13.33	13.33	9.33
Root length (cm)	9.78	0.38	5.42	8.14	9.72
Shoot length (cm)	3.98	1.66	2.66	3.40	3.56
% Deviation Root	0	96.11	44.58	16.67	0.61
% Deviation Shoot	0	58.29	33.17	14.57	10.55
Percentile of viability	100	41.67	90.28	90.28	94.45

Table 9.4 : Effect of leachetes of leaf of *Chenopodium album* on the germination and early growth of seedling in Paddy.

Concentration	1: 0	1: 2.5	1: 5	1: 10	1: 20
Viable	93.33	72.00	74.67	86.67	93.33
Nonviable	6.67	18.00	25.33	13.33	6.67
Root length (cm)	10.52	0.96	6.02	10.02	10.18
Shoot length (cm)	4.50	1.60	3.60	4.42	4.49
% Deviation Root	0	90.87	42.78	4.75	3.23
% Deviation Shoot	0	64.44	20.00	1.78	0.22
Percentile of viability	100	77.15	80.01	92.86	100

Table 9.5 : Effect of leachetes of inflorescence of *Leucus indica* on the germination and early growth of seedling in Paddy.

Concentration	1: 0	1: 2.5	1: 5	1: 10	1: 20
Viable	93.33	88	89.44	92.00	93.33
Nonviable	6.67	12	10.66	8.00	6.67
Root length (cm)	9.60	8.62	8.80	9.14	9.54
Shoot length (cm)	6.50	5.58	5.88	6.06	6.48
% Deviation Root	0	10.21	8.33	4.79	0.63
% Deviation Shoot	0	14.15	9.54	6.77	0.31
Percentile of viability	100	94.29	95.83	98.57	100

Table 9.6 : Effect of leachetes of leaf of *Leucus indica* on the germination and early growth of seedling in Paddy.

Concentration	1: 0	1: 2.5	1: 5	1: 10	1: 20
Viable	96.00	88.00	92.00	92.00	93.33
Nonviable	4.00	12.00	8.00	8.00	6.67
Root length (cm)	10.72	4.66	9.76	9.94	10.56
Shoot length (cm)	7.68	6.90	7.08	7.14	7.52
% Deviation Root	0	56.33	8.96	7.28	1.49
% Deviation Shoot	0	10.16	7.81	7.03	2.08
Percentile of viability	100	91.67	95.83	95.83	97.22

Table 9.7 : Effect of leachetes of inflorescence of *Eclipta alba* on the germination and early growth of seedling in Paddy.

Concentration	1: 0	1: 2.5	1: 5	1: 10	1: 20
Viable	89.33	86.67	86.67	86.67	89.33
Nonviable	10.67	13.33	13.33	13.33	10.67
Root length (cm)	9.88	6.02	7.52	9.80	9.82
Shoot length (cm)	7.32	6.48	7.00	7.04	7.22
% Deviation Root	0	39.07	23.89	0.81	0.61
% Deviation Shoot	0	11.48	4.37	3.83	1.37
Percentile of viability	100	97.02	97.02	97.02	100

Table 9.8 : Effect of leachetes of leaf of *Eclipta alba* on the germination and early growth of seedling in Paddy.

Concentration	1: 0	1: 2.5	1: 5	1: 10	1: 20
Viable	90.67	76.00	85.33	89.33	90.67
Nonviable	9.33	14.00	14.67	10.67	9.33
Root length (cm)	9.68	4.94	7.44	8.28	8.40
Shoot length (cm)	7.12	5.66	6.86	6.94	7.10
% Deviation Root	0	48.97	23.14	14.46	13.22
% Deviation Shoot	0	20.51	3.65	2.53	0.28
Percentile of viability	100	83.82	94.11	98.52	100

Table 9.9 : Effect of leachetes of inflorescence of *Celosia argentea* on the germination and early growth of seedling in Paddy.

Concentration	1: 0	1: 2.5	1: 5	1: 10	1: 20
Viable	93.33	89.33	92.00	92.00	93.33
Nonviable	6.67	10.67	8.00	8.00	6.67
Root length (cm)	8.24	4.42	4.88	6.42	6.52
Shoot length (cm)	3.46	2.68	3.16	3.19	3.28
% Deviation Root	0	46.36	40.78	22.09	20.87
% Deviation Shoot	0	22.54	8.67	7.80	5.20
Percentile of viability	100	95.71	98.57	98.57	100

Table 9.10 : Effect of leachetes of leaf of *Celosia argentea* on the germination and early growth of seedling in Paddy.

Concentration	1: 0	1: 2.5	1: 5	1: 10	1: 20
Viable	90.67	78.67	85.33	85.33	86.67
Nonviable	9.33	21.33	14.67	14.67	13.33
Root length (cm)	8.35	3.06	4.96	6.25	6.72
Shoot length (cm)	3.52	2.38	2.68	3.08	3.26
% Deviation Root	0	63.35	40.60	25.15	19.52
% Deviation Shoot	0	32.39	23.86	12.50	7.39
Percentile of viability	100	86.77	94.11	94.11	95.59

Table 9.11 : Effect of leachetes of inflorescence of *Murdannia nudiflora* on the germination and early growth of seedling in Paddy.

Concentration	1: 0	1: 2.5	1: 5	1: 10	1: 20
Viable	94.67	88.00	92.00	93.33	93.33
Nonviable	5.33	12.00	8.00	6.67	6.67
Root length (cm)	9.32	7.00	7.86	8.90	9.28
Shoot length (cm)	5.90	5.60	5.68	5.71	5.72
% Deviation Root	0	24.89	15.67	4.51	0.43
% Deviation Shoot	0	5.08	3.73	3.22	3.05
Percentile of viability	100	92.95	97.18	98.58	98.58

Table 9.12 : Effect of leachetes of leaf of *Murdannia nudiflora* on the germination and early growth of seedling in Paddy.

Concentration	1: 0	1: 2.5	1: 5	1: 10	1: 20
Viable	94.67	92.00	92.00	94.67	94.67
Nonviable	5.33	8.00	8.00	5.33	5.33
Root length (cm)	9.28	5.90	6.98	7.94	8.88
Shoot length (cm)	5.80	5.00	5.20	5.62	5.78
% Deviation Root	0	36.42	24.78	14.44	4.31
% Deviation Shoot	0	13.79	10.34	3.10	0.34
Percentile of viability	100	97.18	97.18	100	100

Table 9.13 : Effect of extracts of leaf of Digera muricata on the germination and early growth of seedling in Paddy.

Concentration	1: 0	1: 2.5	1: 5	1: 10	1: 20
Viable	96.00	80.00	88.00	89.33	89.33
Nonviable	4.00	20.00	12.00	10.67	10.67
Root length (cm)	8.54	7.7	7.82	8.08	8.24
Shoot length (cm)	3.92	3.24	3.44	3.72	3.86
% Deviation Root	0.00	9.84	8.43	5.39	3.51
% Deviation Shoot	0.00	17.35	12.24	5.10	1.53
Percentile of viability	100	83.33	91.67	93.05	93.05

Table 9.14 : Effect of extracts of leaf of *Celosia argentea* on the germination and early growth of seedling in Paddy.

Concentration	1: 0	1: 2.5	1: 5	1: 10	1: 20
Viable	96.00	29.33	76.67	86.67	90.67
Nonviable	4.00	70.67	23.33	13.33	9.33
Root length (cm)	8.54	0.34	6.54	8.12	8.22
Shoot length (cm)	3.92	2.46	3.26	3.66	3.88
% Deviation Root	0.00	96.02	23.42	4.92	3.75
% Deviation Shoot	0.00	37.24	16.84	6.63	1.02
Percentile of viability	100	30.55	79.86	90.28	94.45

Table 9.15 : Effect of extracts of leaf of *Chenopodium album* on the germination and early growth of seedling in Paddy.

Concentration	1: 0	1: 2.5	1: 5	1: 10	1: 20
Viable	92.00	1.33	64.00	85.33	92.00
Nonviable	8.00	98.67	36.00	14.67	8.00
Root length (cm)	10.34	0.00	6.60	9.00	10.22
Shoot length (cm)	4.26	0.04	3.16	4.14	4.22
% Deviation Root	0.00	100	36.17	12.96	1.16
% Deviation Shoot	0.00	99.06	25.82	2.82	0.94
Percentile of viability	100.00	1.45	69.57	92.75	100.00

been observed upon certified variety of Paddy (IET-1444). Leaf extracts of *Digera muricata, Celosia argentea* and *Chenopodium album* have also been used for the study.

9.1.1 TOXICITY

In all these cases the present study clearly demonstrated the inhibitory effect (Table 9.1-9.15). It has also been observed that in all cases major toxicity has been caused by 1:2.5 concentration of the inhibitory solution and other diluted solution showed decrease in toxicity to a great extent. Toxicity showed a clear effect on germination as well as growth of root and shoot of young seedlings of Paddy.

9.1.2 EFFECT ON GERMINATION

It has been observed from the calculated germination percentile value that the 1:2.5 concentration of leachetes from inflorescence and leaves or leaf extracts show the highest degree of inhibitory capacity on germination and with the subsequent diluted solution, the degree of inhibition decreases gradually. Inflorescence leachete from *Chenopodium album* shows the lowest germination percentile (GP) value 41.67 or it has the highest inhibitory capacity on germination at 1:2.5 dilution. It is followed by *Digera muricata* (GP-81.95), *Murdannia nudiflora* (GP-92.95), *Leucas indica* (GP-94.29), *Celosia argentea* (GP-95.71) and *Eclipta alba* (GP-97.02). Though in subsequent diluted concentration GP value increases to some extent still there exists some inhibitory effect except in 1:20 dilution of *Leucas indica* (GP-100), *Eclipta alba* (GP-100) and *Celosia argentea* (GP-100). In case of leaf leachetes, *Digera muricata* shows the highest inhibitory capacity (GP-63.89) at 1:2.5 concentration which is followed by *Chenopodium album* (GP-77.15), *Eclipta alba* (GP-83.82), *Celosia argentea* (GP-86.77), *Leucas indica* (GP-91.67) and *Murdannia nudiflora* (GP-97.18). Except 1:20 concentration of *Chenopodium album* (GP-100), *Eclipta alba* (GP-100), *Murdannia nudiflora* (GP100) and 1:10 concentration of *Murdannia nudiflora* (GP-100), all other concentration of the studied material showed some inhibitory effect on germination. Highest inhibitory effect of leaf extracts has been observed in case of *Chenopodium album* (GP-1.45) at 1:2.5 concentration and is followed by *Celosia argentea* (GP-30.55) and *Digera muricata* (GP-83.33); other diluted concentration of leaf extracts also showed some inhibitory effect except 1:20 concentration of *Chenopodium album* (GP-100).

9.1.3 EFFECT ON ROOT AND SHOOT

Leachetes of inflorescence also showed inhibitory effect on root and shoot development of Paddy at different concentration but highest effect was observed at 1:2.5 concentration. At this concentration of inflorescence of leachetes of *Chenopodium album* showed the highest degree of deviation (96.11%) of root development which is followed by *Celosia argentea* (46.36%), *Eclipta alba* (39.07%), *Digera muricata* (23.63%),

Murdannia nudiflora (24.89%) and *Leucas indica* (10.21%). In all other concentration of inflorescence leachetes there was a sharp decline in the degree of deviation. Leaf leachetes of *Chenopodium album* at 1:2.5 concentration also showed the highest degree of deviation of shoot development (58.29%) followed by *Digera muricata* (30.04%) and *Celosia argentea* (22.54%). In all other species the degree of deviation lies below 15%.

Leaf leachetes of studied weed species also showed much inhibitory effect in higher concentration (1:2.5) than the further diluted ones. Highest degree of deviation of root development has been observed with *Chenopodium album* (90.87%) which is followed by *Digera muricata* (83.80%), *Celosia argentea* (63.35%), *Leucas indica* (56.53%), *Eclipta alba* (48.97%) and *Murdannia nudiflora* (36.42%). Highest degree of deviation of shoot development has also been observed with *Chenopodium album* (64.44%) which is followed by *Digera muricata* (47.76%) and *Celosia argentea* (32.39%). With all other weed species the deviation lies below 21%.

9.1.4 EFFECT OF EXTRACTS

Among the leaf extracts of three species (*Chenopodium album, Celosia argentea* and *Digera muricata*), highest degree of deviation of root and shoot development has been observed with *Chenopodium album* which is followed by *Celosia argentea* and *Digera muricata* at 1:2.5 concentration. In *Chenopodium album* the degree of deviation of root and shoot development are 100% and 99.06% respectively, which clearly indicate its very high capacity of inhibition. *Celosia argentea* with 96.02% deviation of root development also shows its much inhibitory effect but in other cases deviation lies below 40%. On the other hand *Digera muricata* showed less inhibitory effect for both root and shoot development.

So, in general, among the six species of weeds studied for the allelopathic effect *Chenopodium album* showed its highest toxicity against germination as well as for root and shoot development. *Digera muricata* and *Celosia argentea* ranked second and third in this respect. Also extracts have more toxicity than leachetes. Among leachetes, leaf leachetes showed more toxicity than the inflorescence leachetes. Over all, it has been observed that leachetes of inflorescence, leaves and leaf extracts have a tendency to resist the root development than the shoot development of the young seedlings of Paddy, which ultimately adversely affect the establishment of a plant. For better understanding the result of experiments is also represented graphically (Fig 9.1 to 9.15).

PLATE - IV
(Allelopathy)

Figure

1. Effect of Leachetes of leaf of *Digera muricata* on the germination and the early growth of seedlings in Paddy.
2. Effect of Leachetes of inflorescence of *Chenopodium album* on the germination and the early growth of seedlings in Paddy.
3. Effect of Leachetes of leaf of *Chenopodium album* on the germination and the early growth of seedlings in Paddy.
4. Effect of Leachetes of inflorence of *Leucas indica* on the germination and the early growth of seedlings in Paddy.
5. Effect of Leachetes of leaf of *Leucas indica* on the germination and the early growth of seedlings in Paddy.
6. Effect of Leachetes of inflorescence of *Eclipta alba* on the germination and the early growth of seedlings in Paddy.
7. Effect of Leachetes of leaf of *Eclipta alba* on the germination and the early growth of seedlings in Paddy.
8. Effect of Leachetes of leaf of *Celosia argentea* on the germination and the early growth of seedlings in Paddy.
9. Effect of Leachetes of inflorescence of *Murdannia nudiflora* on the germination and the early growth of seedlings in Paddy.
10. Effect of Leachetes of leaf of *Murdannia nudiflora* on the germination and the early growth of seedlings in Paddy.
11. Effect of Extracts of leaf of *Celosia argentea* on the germination and the early growth of seedlings in Paddy.
12. Effect of Extracts of leaf of *Chenopodium album* on the germination and the early growth of seedlings in Paddy.

PLATE V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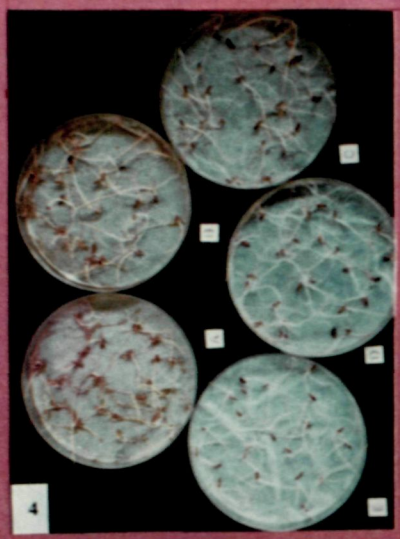
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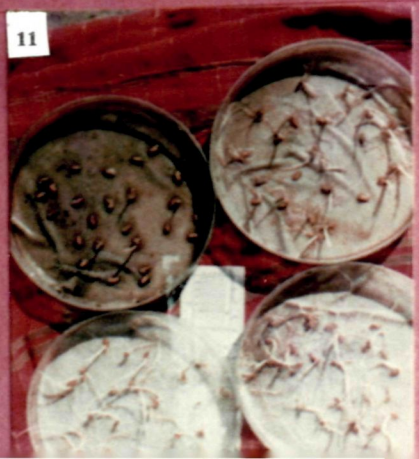
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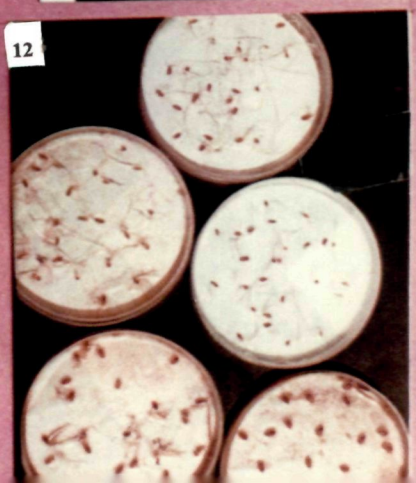
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Fig.9.1 Effect of leachetes of inflorescence of *Digera muricata* on the germination and early growth of seedling in Paddy

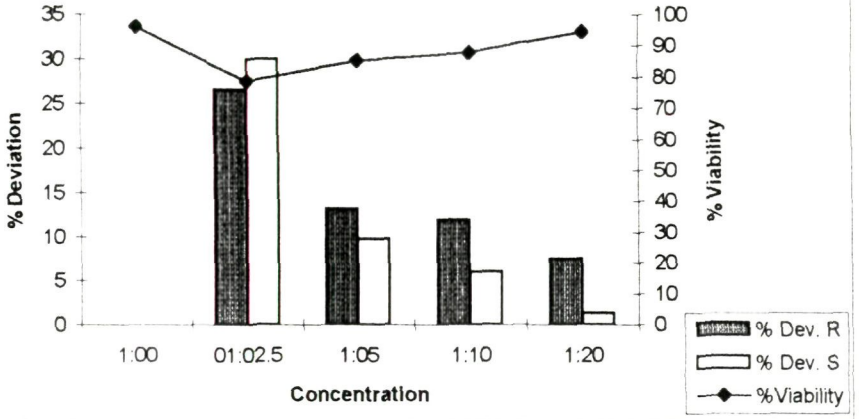


Fig.9.2 Effect of leachetes of leaf of *Digera muricata* on the germination and early growth of seedling in Paddy

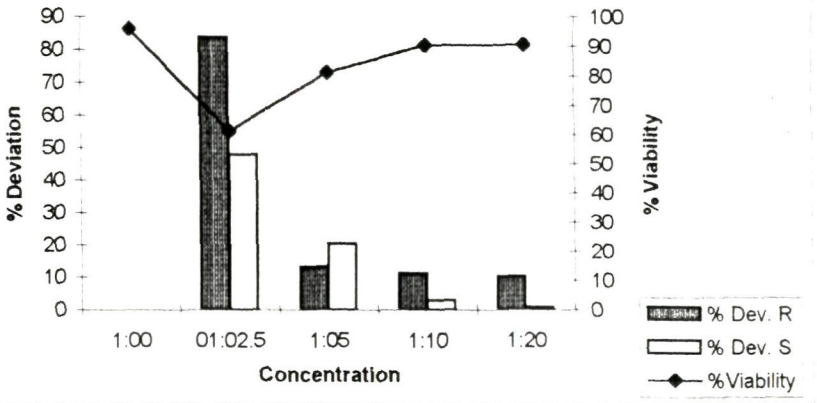


Fig.9.3 Effect of leachetes of inflorescence of *Chenopodium album* on the germination and early growth of seedling in paddy

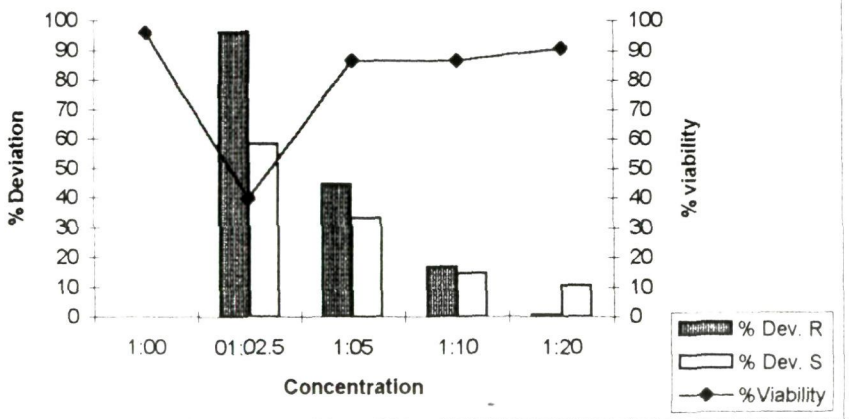


Fig.9.4 Effect of leachetes of leaf of *Chenopodium album* on the germination of early growth of seedling in paddy

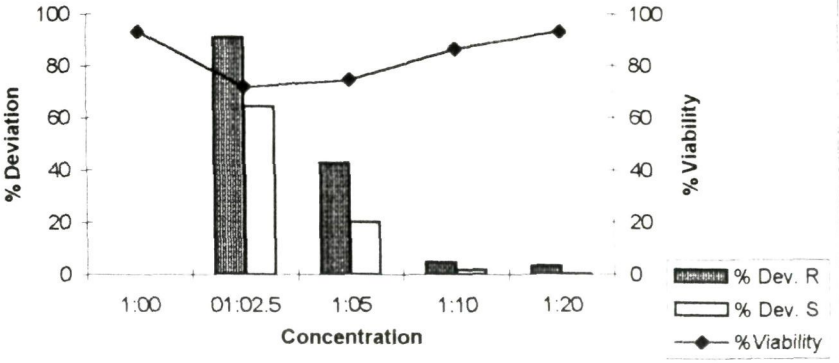


Fig.9.5 Effect of leachetes of inflorescence of *Leucas indica* on the germination and early growth of seedling in Paddy

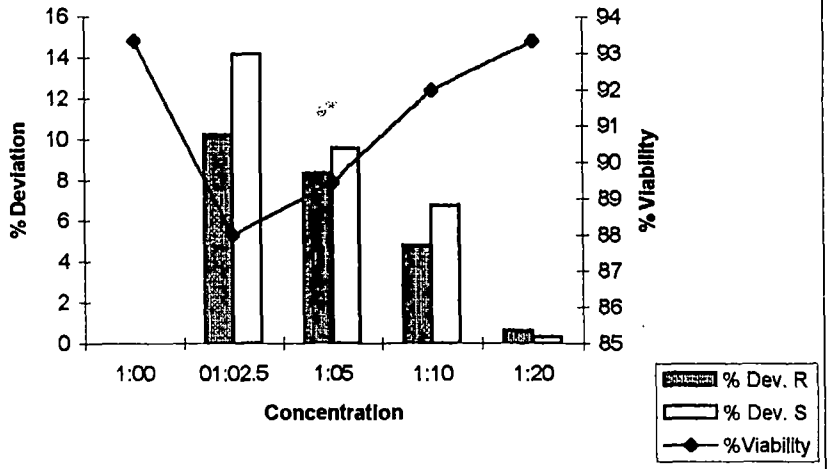


Fig.9.6 Effect of leachetes of leaf of *Leucas indica* on the germination and early growth of seedling in Paddy

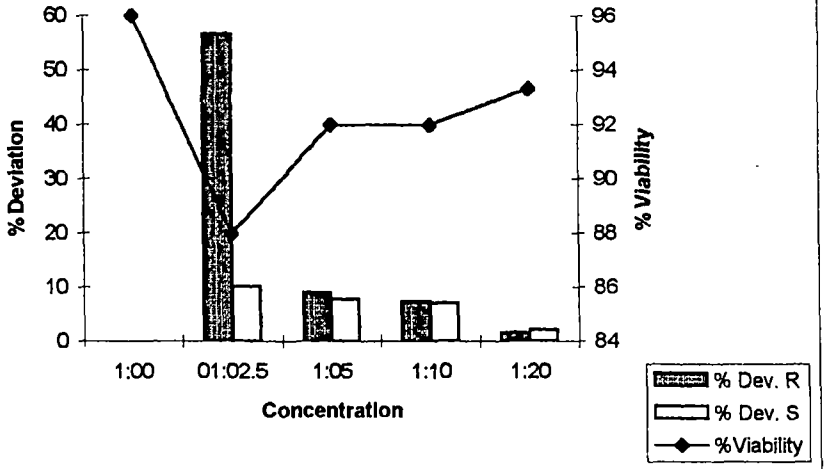


Fig.9.7 Effect of leachetes of inflorescence of *Eclipta alba* on the germination and early growth of seedling in Paddy

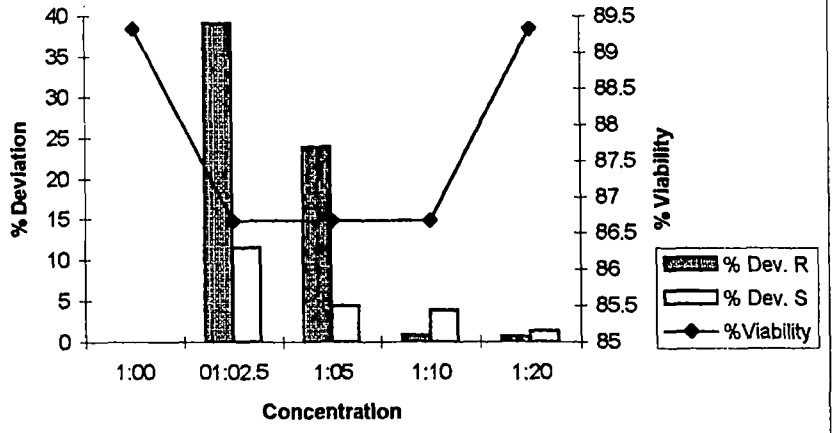


Fig.9.8 Effect of leachetes of leaf of *Eclipta alba* onthe germination and early growth of seedling in Paddy

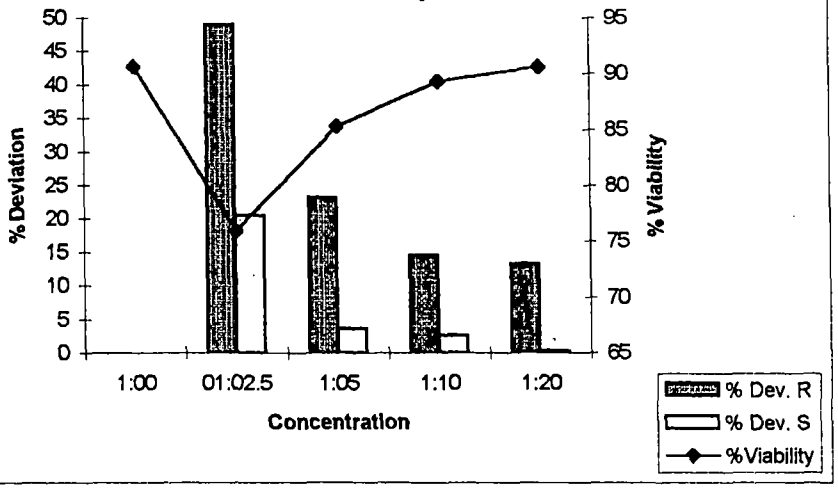


Fig.9.9 Effect of leachetes of inflorescence of *Celosia argentea* on the germination and early growth in seedling of Paddy

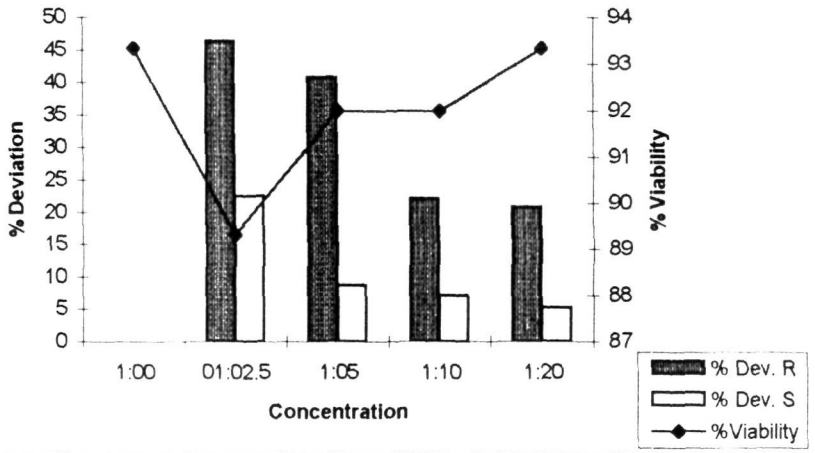


Fig.9.10 Effect of leachetes of leaf of *Celosia argentea* on the germination and early growth of seedling in Paddy

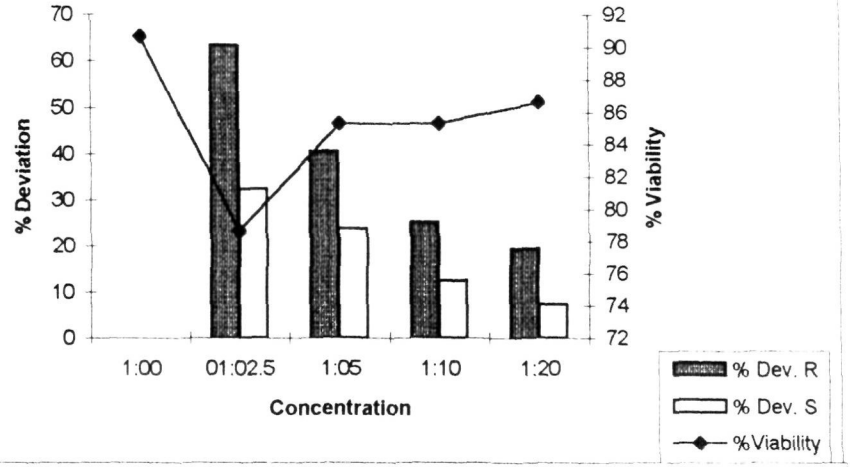


Fig.9.11 Effect of leachetes of inflorescence of *Murdannia nudiflora* on the germination and early growth in seedling of Paddy

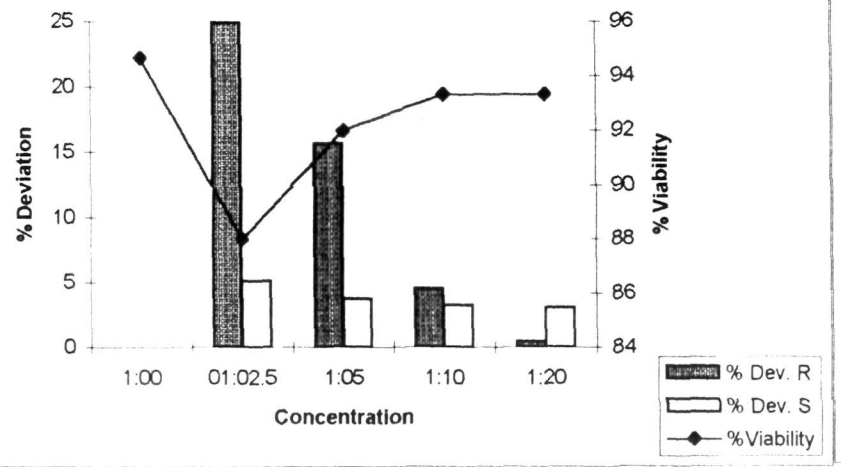


Fig.9.12 Effect of leachetes of leaf of *Murdannia nudiflora* on the germination and early growth of seedling in Paddy

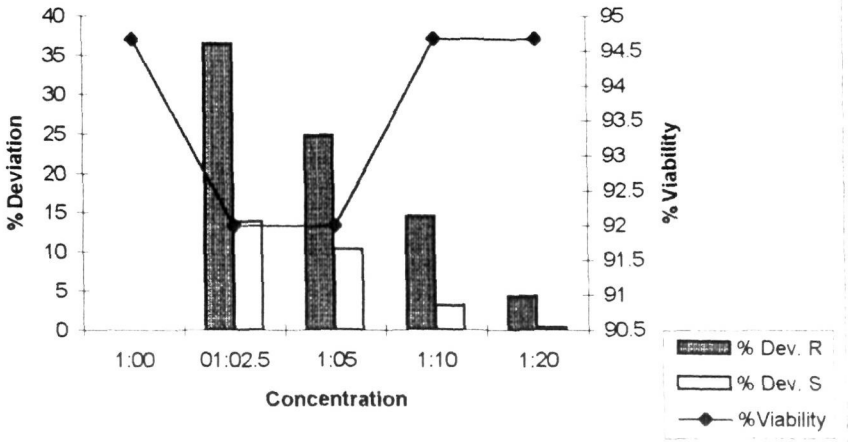


Fig.9.13 Effect of extracts of leaf of *Digera muricata* on the germination and early growth in Paddy

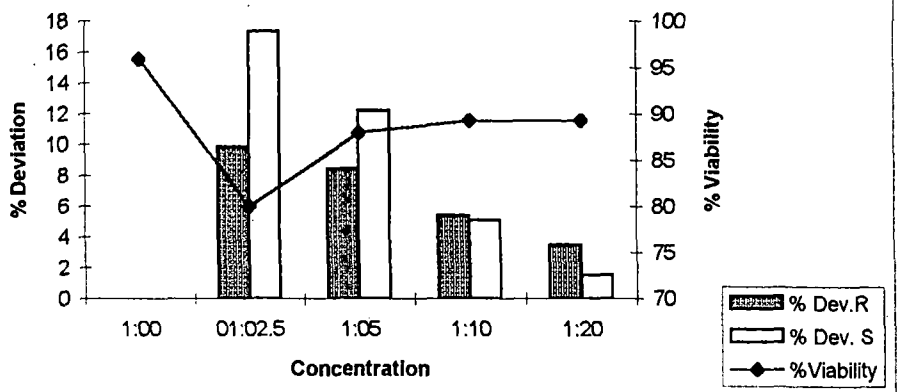


Fig.9.14 Effect of extracts of leaf of Celosia argentea on the germination and early growth in Paddy

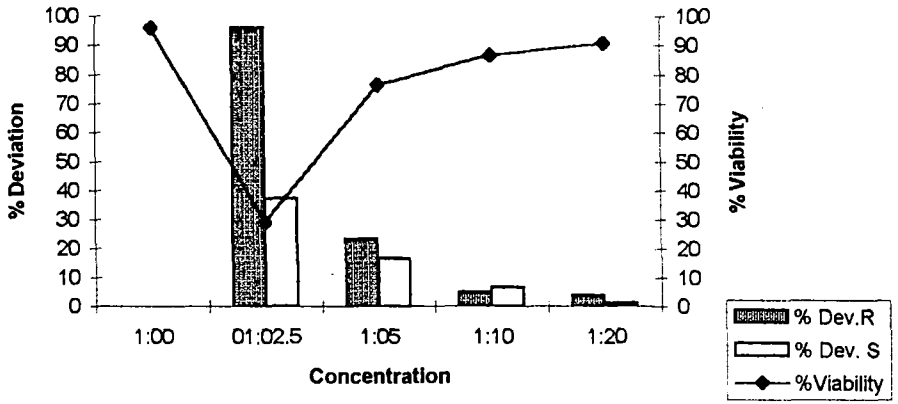
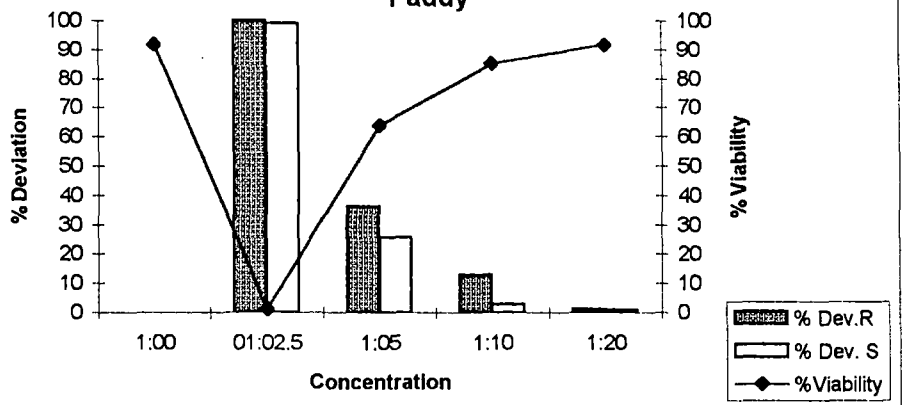


Fig.9.15 Effect of extracts of leaf of Chenopodium album on the germination and early growth of seedling in Paddy



CHAPTER - 10

USES OF WEEDS

USES OF WEEDS

Weeds though are unwanted plants of crop-fields, have immense potential to be used as medicines, vegetables, fodder and organic mater recycling in the field. In this respect King (1966) stated that the situation is anomalous because if a plant has a reputed use, Strictly by definition it should ceased to be classed as weed. Of course, it is also true, that a weed in one region where it has few or no use, may, when growing in another region, possess some very valuable uses or sometimes few of them may actually be cultivated. Prehistoric man was dependent upon herbaceous plants for his elemental needs and later learnt to use those for various purposes. Takhtajian (1959) stated that if it had not been for the seed plants, man might not have evolved and spreaded so widely over the earth. Ames (1939) has also appraised the important role of seed plants in man's history and evolution.

Weed related literature contains numerous references about the various uses of weeds. Fukai (1940), Brewer and Blinn (1924) examined the nutritive value of weeds, whereas Fox (1942) and Palmer (1949)studied the general uses of weeds as a source of food for man. Even specific Weeds e.g. *Chenopodium, Typha* etc. has been studied by different workers. Weed related literature also contains many references about the utilization of weed as food for animals (Martin *et al*, 1951; McAtee, 1939; Costello, 1942 etc.). There are also works about the medical uses of weeds (Henkel, 1904; Welch, 1961). Some workers (Train *et al*, 1941; Davis and Ross, 1955; DE Laszlo and Henshaw, 1954) also indicate the medicinal value of weeds against Human Fertility and Cancer.

The flora of India is very rich and numerous of its herbaceous elements, which grow in our crop-fields, are now treated as weeds. The use of herbs in India is not new. The Worlds oldest repository of Knowledge, the Vedas, specially the Ayurveda (a part of Atharba Veda) described the use of numerous plants for different types of uses. The medical application of plants as devised in Ayerveda is still in practice specially in India and its neighboring countries. In recent past numerous literatures have been published on Indian Medicinal plants like Kirtikar and Basu (1935), Biswas and Chopra (rep. 1982), Jain *et al* (1991), Gaur et al 1983, Lal and Yadav (1983), Pal (1985), Puri (1983), Nautiyal (1980), Aminuddin *et al* (1994), Paul (1997), Verma and Panday (1991), Ghosh *et al* (1996) etc.

On basic consultation of these literature will reveal that hundreds of so called weeds are in use in traditional medicines and in many other aspects of everyday use.

Besides of the above, weeds also have general uses like soil binding, nitrogen fixation, ornamentation, ceremonial and religious uses etc. The recent trend of ethnobotanical studies specially among the tribals gaining momentum in different corners of the World (Gill and Opera, 1988; Gill et al, 1977; Posey and Overal, 1990; Berg, 1984, Born *et al*, 1996; Davis and Yost, 1983; Duke, 1994; Jain *et al*, 1995; Schultes and Raffauf, 1990 etc.) including India (Singh and Singh 1985, '88; Das *et al*, 1983; Sharma and Das 1984;

Jain and De, 1966; Maheshwari *et al*, 1980; Raghupati and Mahadevan, 1991; Shah and Joshi, 1971; Sinha, 1986; Tarafder, 1986; Ghosh and Sensharma, 1997; Rajendran et al, 1997; Singh *et al*, 1997; Upadhye *et al*, 1997; Viswanathan, 1997; Jamir, 1997; Lalramnghinglova and Jha, 1997 etc.)

In present work an attempt has been made to gather informations about the uses of Crop-field Weeds by the local people of Malda District. With freshly collected weeds in hand, numerous farmers and their family members are asked to know if any one or more of those are useful to them. Any information, collected from places out-side this district has not been incorporated in the present work.

Uses of these plants have been recorded (Table 9.1) under any one or more of the following categories :

10.1 WEEDS USED AS FOOD FOR MAN

People of the district not only take different weed as vegetable but weeds constitute a source of income to them, who collect and include these in the local market. Young twigs and leaves of the following weeds, namely, *Alternanthera philoxeroides, A. sessilis Amaranthus viridis, Celosia argentea, Digera muricata, Centella asiatica, Chenopodium album, Ipomoea aquatica, Lathyrus aphaca, Glinus oppositifolius, Fumaria indica, Oxalis corniculata, Portulaca oleracea, Melilotus alba and Polycarpon prostratum* are used as vegetables. Fruits of *Cucumis melo*, Seeds of *Paspalum scrobiculatum* (locally named Dal-ghasa), Rhizome of *Cyperus rotundus* are also used as food. But the most interesting one is *Argemone mexicana*, the young shoot of which also used by the villagers as vegetable.

10.2 WEEDS USED AS FOOD FOR DOMESTIC ANIMALS

This category include majority of the monocotyledonous and some dicotyledonous weed, namely, *Cynodon dactylon, Cyperus rotundus, C. kyllinga, C. iria, Paspalum scrobiculatum, Echinochloa colona, E. crus-galli, Elusine indica, Brachiaria reptans, Eragrostis sp. Digitaria sp. Alternanthera philoxeroides, Amaranthus viridis, Vicia angustifolia, V. hirsuta,* and *Lathyrus aphaca.* Generally *Cynodon dactylon, Echinochloa colona, E. crus-galli* are given to lactating cattles to increase milk production. Though at the time of weeding the shorted weeds at a lot are used as food for animals.

10.3 WEEDS USED AS MEDICINE

Many crop field weeds are used as medicine by the local people of the district of Malda, namely, *Hygrophila auriculata, Centella asiatica, Fumaria indica, Leucas cephalotes, L. indica, Oxalis corniculata, Scoparia dulcis, Eclipta alba, Croton bonplandianum,*

Physalis minima and *Cynodon dactylon*. Again *Blumea lacera* and *Acalypha indica* are used as medicine for cattles.

10.4 WEEDS USED AS FUEL

Some weeds are in dry condition used as fuel by the local people, namely, *Parthenium hysterophorus, Xanthium indicum, Leucas indica, Hygrophila auriculata and Argemone mexicana.*

10.5 MISCELLANEOUS USES OF WEEDS

Cynodon dactylon is used in worshipping and ceremonial purposes by the Hindus. Again *Cynodon dactylon* and *Elusine indica* are used as soil binder in road sides, banks of tanks and rivers etc.

However, matching with different available literatures (Kirtikar and Basu, 1935; Biswas and Chopra, 1982; Sharma and Das, 1984; Singh and Singh, 1985, '88; Jain and De 1966; Chopra et al, 1956,1965; Chopra and Chopra, 1955; Sinha, 1986; Jain, 1991; Bhattacharyya, --- etc.),it is found that quite a few other recorded weeds of crop fields of Malda District are of medicinal value. which include:
Achyranthes aspera, Alternanthera sessilis, Amaranthus viridis, Celosia argentea, Digera muricata, Ageratum conyzoides, Cirsium arvense, Eclipta alba, Emilia sonchifolia, Gnaphalium luteo-album, Launea aspleniifolia, Sphaeranthus indicus, Spilanthes calva, Vernonia cinerea, Xanthium indicum, Heliotropium indicum, Cochleria cochlearioides, Cassia sophera, Polycarpon prostratum, Chenopodium album, Cleome viscosa, Ipomoea aquatica, Cucumis melo, Euphorbia hirta, E. heyniana, Phyllanthus fraturmus, Sebastiana chamaelea, Lathyrus aphaca, Medicago lupulina, Melilotus alba, Vicia angustifolia, V. hirsuta, Hydrolea zeylanica, Leonurus japonicus, Ammannia baccifera, Malachra capitata, Sida rhombifolia, Glinus lotoides, G. oppositifolius, Ficus heterophyla, Ludwigia perennis, Orobanche aegyptiaca, Biophytum sensitivum, Oxalis corniculata, Argemone mexicana, Polygonum plebeium, Portulaca oleracea, p. quadrifida, Anagallis arvensis, Ranunculus sceleratus, Hedyotis corymbosa, H. diffusa, Lindernia crustacea, Solanum nigrum, Melochia corchorifolia, Corchorus fascicularis, Phyla nudiflora, Sagittaria guyanensis, Commelina benghalensis, Cyperus iria, C. rotundus, Scirpus articulatus, Asphodelus temuifolius, Desmostachya bipinnata, Echinochloa crus-galli, Elusine indica, Paspalum scrobiculatum, Monochoria vaginalis, Ceratopteris thalictroides.

Table 9.1 : Uses of Crop-field Weeds of the district of Malda

Weed (1)	Parts used (2)	Uses (3)
Acalypha indica	Leaf	For stomachache of Goat.
Alternanthera philoxeroides	Young twigs; entire plant	Vegetables; food for domestic animals
Alternanthera sessilis	Young twigs	Vegetables
Amaranthus viridis	Young twigs; entire plant	Vegetables; food for domestic animals
Argemone mexicana	Young stem; dry plant	Vegetables; fuel
Blumea lacera	Leaf	For early deplacentation of Cow.
Brachiaria reptans	Entire plant	Food for domestic animals
Celosia argentea	Leaf	Vegetables
Centella asiatica	Leaf	Vegetables; decoction of leaf used in dysentery and as liver stimulant.
Chenopodium album	Young twigs	Vegetables
Croton bonplandianum	Latex	Used as antihammoragic
Cucumis melo	Young and ripe fruit	Vegetables
Cynodon dactylon	Entire plant; twigs	food for domestic animals; soil binder; crushed leaf used as anti-hammoragic; ceremonial and worshipping
C. iria	Entire plant	Food for domestic animals
Cyperus kyllinga	Entire plant	Food for domestic animals
Cyperus rotundus	Rhizome; entire plant	Vegetables; food for domestic animals
Digera muricata	Young twigs	Vegetables
Digitaria sp.	Entire plant	Food for domestic animals
Echinochloa colona	Entire plant	Food for domestic animals
E. crus-galli	Entire plant	Food for domestic animals
Eclipta alba	Leaf	Decoction of leaf for checking early fall of hairs and cool down the head.
Elusine indica	Entire plant	Food for domestic animals; soil binder
Eragrostis sp.	Entire plant	Food for domestic animals
Fumaria indica	Twigs	Vegetables; Decoction of plant is locally used to purify blood in skin diseases.
Glinus oppositifolius	Leaf	Vegetables
Hygrophila auriculata	Leaf; dry plant	Decoction of leaf used in anemia; fuel.

(1)	(2)	(3)
Ipomoea aquatica	Leaf and young stem	Vegetables
Leucas cephalotes	Leaf	Leaf sap used in headache and stomachache
L. indica	Leaf; dry plant	Decoction of leaf in bronchitis and dyspepsia; fuel.
Lathyrus aphaca	Young twigs and entire plant	Vegetables; food for domestic animals
Melilotus alba	Leaf	Vegetables
Oxalis corniculata	Leaf and young twigs	Vegetables; decoction of leaf used to cure dysentery and as appetite.
Parthenium hysterophorus	Dry Plant	Fuel
Paspalum scrobiculatum	Seed; entire plant	Used as supplement of rice; food for domestic animals
Physalis minima	Calyx with fruit	Ash used in skin diseases for children.
Polycarpon prostratum	Young twigs	Vegetables
Portulaca oleracea	Young twigs	Vegetables
Scoparia dulcis	Leaf	Decoction of leaf in diabetes and toothache.
Vicia angustifolia	Entire plant	Food for domestic animals
V. hirsuta	Entire plant	Food for domestic animals
Xanthium indicum	Dry Plant	Fuel

CHAPTER – III

GENERAL DISCUSSION

GENERAL DISCUSSION

11.1 CROPS AND WEEDS

Malda, the southernmost district of North Bengal, is situated near the center of the state of the state of West Bengal (India). The district is famous for its prized variety of Mango and for the production of raw silk yarn (about 80 % of state out put). The landscape of the district is almost a plain land, mainly consists of alluvial loam and red muddy soil. The district is drained by three rivers, namely, the Ganga, the Mahananda and the Kalindri. Wide variety of crop plants are cultivated in the district throughout the year, which can be divided into three cropping seasons, namely, Boro, Aman and Rabi. Apart from large acreage of mango orchards, most of the cultivated lands produce two crops in a year.

As the district is an agrarian one and weed flora associated with crop is very much responsible for the ultimate production, so, in the present work attempt has been made to explore such plants in the district of Malda. For this purpose crops were selected in such a way (chapter 2) so that three seasons (*viz.* Boro, Aman and Rabi) of cultivation practice of an year of the district can be covered. Random sampling during the four years long survey has recorded 132 species of weeds. Compared with the available weed floras from other districts, the number is quite significant (Majumder 1962, Paul and Bhattacharyya 1959, Chakroborty 1957, Prain 1905, Neogi and Rao 1980) because -

(I) It is a very small district (3713 sq. km)

(ii) Most of the fields are cultivated round the year

(iii) Climate is quite dry with low and narrowly distributed precipitation

(iv) Regular practice of weeding

(v) The fast growth of crop plants which offers the highest degree of competition to weeds.

11.2 NATURE OF WEEDS

The recorded 132 weed species comes under 97 genera and 44 families of angiosperms and 2 genera and 2 species of pteridophytes. Dicotyledons are represented by 93 species, 74 genera and 37 families and monocotyledons are represented by 37 species, 23 genera and 7 families. More representative of bulky taxon dicotyledons is quite natural. But among the first three most successful families there are two monocotyledonous families with Poaceae at the top which is followed by Asteraceae and Cyperaceae respectively. This observation is nearly *at per* with other such floras. The exceptionally broad ecological

amplitude of the members of Poaceae rendered them as most successful weed in all floras. Their modes of propagation, development of apomictic embryo, high rate of vegetative propagation by runners, sobols, tillers, etc. are behind their success. Contribution of weeds of other two families Asteraceae and Cyperaceae are almost two parallel to Poaceae. Both the families are cosmopolitan in distribution, produce easily dispersible small seeds and have wide ecological amplitude. Further more members of Cyperaceae can produce numerous vegetative propagules, whereas members of Asteraceae have the special structure with their fruits. All these characters probably help the members of Cyperaceae and Asteraceae to be successful weed of crop fields. However success of other families like Scorphulariaceae, Euphorbiaceae, Acanthaceae, Amaranthaceae, Eriocaulonaceae etc. are due to their wide ecological amplitude, large number of small seeds, wide flowering and fruiting period etc. Analysis at the generic level shows that *Cyperus* contributed the highest number of six species, followed by *Lindernia, Digitaria,* and *Eragrostis* (each with 4 species) and all are widely distributed. Majority of them are either cosmopolitan or pantropic in distribution and others are very wide in regional distribution. There are also present some rare plants viz. *Cochleria cochlearioides, Dichondra repens,* and *Asphodelus tenuifolius.* These are basically with wide distribution but the frequency of occurrence is very low. *Orobanche aegyptiaca* (Orobanchaceae) a total root parasite has been recorded with a new crop *Cicer arietinum* and other eight new hosts for the parasite have also been recorded from the district of Malda during Rabi season. These newly recorded hosts are *Argemone mexicana, Fumaria indica, Launaea aspleniifolia, Leucas indica, Oxalis corniculata, Polygonum plebeium, Vernonia cinerea and Digitaria ciliaris.* This is for the first time so many wild hosts for *Orobanche aegyptiaca* have been recorded and among these hosts *Digitaria ciliaris* deserves special mention because it is the only monocotyledonous hosts recorded so far for the species. As this parasite has a large number of host-crops and the parasite is not visible before the emergence of scape when the crop plants are quite mature. So, special attention should be given to *Orobanche aegyptiaca* during the management practices. The weed flora of the district of Malda also contain 20 species (15.2 %) of natuarilised exotics which are known to be the elements of the floras of America, South East Asia, Eurasia and Africa. These exotic weeds grow mainly during Rabi and Boro seasons. Among the two pteridophytic species *Marsilea quadrifida* grows throughout the year in varying densities Where as *Ceratopteris thalictroides* grows mainly during Aman season.

11.3 PATTERN OF DISTRIBUTION OF WEEDS

Basic informations about density, frequency and dominance of different members of a weed flora are the prerequisites to frame a strategy to combat them. Data collected from 180 quadrates (1m x 1m) have been analysed for the determination of Relative Density (RD), Relative Frequency (RF), Relative Dominance (RDm) and Importance Value Index (IVI). 61 species of higher plants have been recorded with the following seasonwise distribution: Aman 28 species, Rabi 35 species and Boro 18 species (Table 4.10 to 4.18)

of which many species have been observed to occur in more than one season. A total 28 species have been recorded from the fields of Aman Paddy. Among the 'Thanas' highest and lowest number of species have been recorded from Kaliachak (56.6 %) and Gazole (33.7 %) respectively. Within the survey period, highest number of individuals (4047) have been recorded during 1992 and largest area (68736 cm^2) covered by weeds have been recorded during 1993. *Ludwigia perennis* has been recorded as most frequent weed (RF 78.33 %) during Aman and among the top ten frequent weeds, monocots occupied seven positions, dicot two positions and *Marsilea quadrifida*, a pteridophyte also has a position (7th) within first ten. *Murdannia nudiflora* (RD 10.43 %) has been recorded with highest Relative Density and among such first ten weeds, monocots occupied five positions, and dicots four positions. *Marsilea quadrifolia* has been recorded as most dominant weed (RDm 10.83 %). The determined IVI value revealed that *Ludwigia perennis* (IVI 96.00) is the most important weed of Aman. Among the top ten dominant and important weeds, monocots occupied seven positions (*Cyperus rotundus, C. difformis, Echinochloa colona, Tonningia axillaris, Cynodon dactylon, Fimbristylis miliacea* and *Murdannia nudiflora*) dicots two positions (*Ludwigia perennis, Alternanthera sessilis*) and pteridophytes one position (*Marsilea quadrifida*). So, over all in Aman season of the district monocotyledonous weed recorded as frequent, dense, dominant and important than dicotyledonous weed though *Ludwigia perennis* came out as most important weed during this season. Out of ten most important weed species, there are seven monocotyledons, again five of which are either grasses and sedges. Within the 'Thanas', 'Habibpur' has been recorded as most weeded one.

A total of 35 species have been recorded from the fields of mustard and pulses in the district of Malda during Rabi season. Among the 'Thanas', highest and lowest number of species have been recorded from Englishbazar (55.4 %) and Gazole (29.7 %) respectively. Within the survey period, highest number of individuals (1932) and largest area (40299 cm^2) covered by weeds have been observed during the year 1992. During this season *Leucas indica* has been recorded as most frequent (RF 80.67), most dense (RD 19.39) most dominant (RDm 17.74) and most important (IVI 117.87) weed. For phytosociological characters of top ten weed species it has been observed that dicotyledonous weeds occupied 80 % - 100 % positions. Still, two monocotyledonous species *Cyperus rotundus* (8th) and *Cynodon dactylon* (9th) managed to enter within top ten important weeds probably due to their broad ecological amplitude, methods of propagation etc. Probably, dry soil, low temperature and low precipitation are the causes of dominance of dicotyledonous weeds during Rabi season in this district. It is common sight that in the field of pulses *Leucas indica* is growing in so abundance to give the idea that this is also cultivated species. The total root parasite *Orobanche aegyptiaca* is also observed in association with crops and weeds during this season. Among the 'Thanas', the most weeded one has been recorded as 'Gazole'.

During Boro season lowest number (18) of weeds has been recorded for the district. Again among 'Thanas', 'Englishbazar' has been recorded with highest number of species (77.4 %) and 'Bamongola' with lowest number of species (50.9 %). Within the survey

period highest number of individuals (1632) and largest area covered (19315 cm^2) have been recorded during 1994 and 1993 respectively. During this season *Alternanthera sessilis* (RF 93.33) has been recorded as most frequent weed, whereas, *Cyperus rotundus* is with highest Relative Density (29. 17 %), highest Relative Dominance (22.48 %) and most important (IVI 143.68) weed. In this season, for phytosociological characters of top ten weed species, it has been observed that dicotyledonous weeds occupied 70 % positions. Still *Cyperus rotundus* with high degree of ecological amplitude and by their methods of propagation occupied the rank of most important weed. *Cynodon dactylon* for the similar reason occupied the forth position. From the middle of February day temperature starts rising and growth of a new set of weeds is now expected in the field. But, among the ten most important species such a picture is not available. Species like *Caesulia axillaris, Lindernia perviflora* and *Gnaphalium purpurium* were in the field in Winter now became prominent probably due to the decrease of some other weeds. But, increase in day temperature, some amount of precipitation and cultivation practice increase the number of monocotyledonous weeds (38.9 %) in comparison with Rabi season (20.0 %). Among the 'Thanas', the most weeded one has been recorded as 'Manikchak'. The result of sampling of consecutive years in the crop fields of Malda District has revealed that the growth period of sampled species are not restricted to a particular season only (Table 4.22). Specially the plants preferring the warmer climate has gained long life-span. From annual calculation, *Cyperus rotundus* came out as most frequent (RF 61.48 %), most dense (RD 10.60 %) and most important (IVI 79.89) weed. But the pteridophytic species *Marsilea quadrifida* has been appeared as most dominant weed. For phytosociological characters of top ten weeds except for dominance, dicotyledonous weed occupied 5 position, monocotyledonous weed 4 position and 1 position by the pteridophytic *Marsilea quadrifida.* For dominance the ratio between dicot and monocot has been observed as 2:1. The most important ten weed species with respect to IVI value, of the district of Malda are *Cyperus rotundus* (79.89), *Alternanthara sessilis* (66.85), *Cynodon dactylon* (59.86), *Ludwigia perennis* (51.82), *Marsilea quadrifida* (50.86), *Leucas indica* (47.59), *Eclipta alba* (38.64), *Echinochloa colona* (37.22), *Caesulia axillaris* (36.48) and *Tonningia axillaris* (30.83). Of these six species (*Cyperus rotundus, Cynodon dactylon, Alternanthera sessilis, Caesulia axillaris, Ludwigia perennis* and *Marsilea quadrifida*) grow throughout the year but with varying degree of abundance. This is due to (I) their broad ecological amplitude, (ii) long life span, (iii) long flowering and fruiting period and (iv) a broad range of germination period. However out of ten plants with highest recorded IVI value there are perennials and can propagate by seeds and propagules.

In the picture of annual and seasonwise assessment of weeds, dicotyledonous plants have been out numbered the monocotyledonous ones and with only one pteridophyte. But in Aman the number of dicot and monocot species are in close contact, 14 and 13 respectively. This is due to high temperature, humidity, precipitation and water saturated soil condition of the paddy field which helped the growth of helophytic plants dominated by sedges. But on the other hand moist soil, low temperature and low precipitation favour the growth of broad leaf weeds.

11.4 LIFE STYLE OF WEEDS

Phenology embraces all studies of the relationship between climatic factors and periodic phenomena in organisms (Sundriyal 1990). Phytosociological studies generate knowledge on distributional aspects of weeds, but it is not enough for weed management unless phenological data are supplied to support it. Phenological data, taking side by side phenology of the concerned crop plants, can help us to decide the time and method of weed eradication.

11.4.1. GERMINATION

It has been observed that majority of dicotyledonous species germinate between May and October with a peak during June and majority of monocotyledonous species geminate between May and July with a peak during June. Little rain during April - May and high rain fall between June and September moisten the soil and increase the rate of germination of dicots. On the other hand in case of monocotyledonous, too, little to high rainfall between May and July, stagnant water of the cropfields helps to increase the rate of germination. For both dicot and monocot high temperature (above 30^0) and high relative humidity (above 90 %) also favour the rate of germination. Majority of dicotyledonous weeds of Rabi crops germinate during October and onwards, when precipitation, temperature and relative humidity starts to decline. The length of germination period of majority of the weed species is more than one month, whereas, *Leucas indica* and *Parthenium hysterophorus* shows two distinct germination seasons.

11.4.2 VEGETATIVE GROWTH

Germination is followed by vegetative growth, which continues till the initiation flowering. It has been observed that after germination next one or two months are favourable for vegetative growth. As majority of weeds are annual and to compete with vigorous crop plants for their growth, they became adapted to early flowering for the production and dispersal of seeds in a quite short time. So, vegetative growth does not continue very long. In case of late germinated seeds, it has been observed that vegetative growth becomes restricted even to the one or two leafed condition only.

11.4.3 FLOWERING AND FRUITING

Majority of the dicot species flowered during November to January with a peak in December (96.7 %) and majority of the monocot species during August to November with a peak in September(86.5 %). So, in case of dicot flowering is favoured by the decreasing precipitation, temperature, humidity and the initiation of short photoperiod, whereas in monocotyledonous weeds it is favoured by high precipitation, high temperature, high humidity and long photoperiod. There are 32 species of weeds (both monocot and dicot) which flowered more or less round the year, though the rate of flowering is not same in different months. However, majority of weeds in Rabi season (mustard and pulses) including a few monocot are with very short flowering period e.g. *Anagallis arvensis, Leucas cephalotes, Butomopsis latifolia, Cyperus compressus, Asphodelus tenuifolius* etc.

As the majority of the weed-species are with short life span, so, flowering and fruiting are simultaneous process in them. So, in a plant fruits of all the stages of maturity are generally available at a time. Incase of dicotyledonous weed December and January are the peak fruiting period which is again matching with their flowering period. In case of monocotyledonous weeds it happens in the month of September.

Determination of the death phase of crop field weeds is very hard because of (i) weeding practice and (ii) harvesting of one crop is immediately followed by the preparation of the next crop. However the recorded dicotyledonous and monocotyledonous weeds show maximum death during the month of April. This is due to the dry condition of the soil, developed due to almost no precipition during the previous months, low humidity etc. But there are also several months during which no death of the recorded species have been observed.

11.4.4 LIFE FORM

Weed flora of this district is dominated by Therophytes (92.42 %) which in *at per* with the field conditions. Change in season, tilling, weeding and cover of crop plants are mainly responsible for the selection of annuals or therophytes. Weeds are largely entomophilous (54.6 %) and majority of the weeds (89.9 %) have been observed to disperse their seeds by water.

11.4.5 DISPERSAL AND THE SELECTION OF WEEDING PERIOD

As most of the dicotyledonous weeds produce fruit during November - February and monocotyledonous weeds during August to November, so, weeding has to be done before

that period, otherwise the produced seeds of the weeds would be dispersed and buried under the soil and will produce a further generation with the onset of favourable conditions.

11.5 RECOGNITION OF SEEDLINGS

Weeds are more injurious in the early stages of the crop (Tiwari 1953 - '54), So, it is much necessary to recognise them as early as possible. Seedlings of 45 common dicotyledonous weed belonging to 20 families have been morphologically diagnosed for this purpose. As, weed seeds are very small, low in germination rate, low in survival rate and majority have a very short life-span, so, the initial growth rate of the weeds of crop-field is higher than the crop. Because of that, at the initial stage, they utilize more nutrients from the soil, dominate over crop seedlings and become very injurious. So, eradication of the weeds at their early stage would be helpful to attain a good crop yield. In the present work an attempt has been made to identify the weeds at their early stage by means of morphological characters and the key prepared for the purpose will be helpful. The tremendous variation in morphology within the population of different weeds, use of seedling morphological characters are much dependable for their early recognition which is very much essential to decide over the eradication procedure. However seedling morphological characters are also useful in taxonomic studies (Kamilya and Paria, 1993,'94).

11.6 REPRODUCTIVE CAPACITY AND SEEDLING ESTABLISHMENT

In angiosperms adaptive significance of seeds is associated with the reproductive efficiency and successful establishment of seedlings in nature (Stebbins 1970). The out put in a particular habitat may be an important factor in determining the occurrence as well as frequency or abundance of a species in natural conditions (Salisbury 1942). Again,, the magnitude of the reproductive capacity is also related to the frequency and abundance. Reproductive capacity of a species is as much a characteristics as any other specific features and of considerable ecological interest. It also has an importance in dispersal of seeds and establishment of seedlings. In the present work Reproductive Potential of 114 species of crop field weeds of the district of Malda has been worked out. During this work three aspects have been taken into consideration - (i) number of seeds per fruit (ii) number of seeds per plant (iii) weight of 1000 seeds. *Orobanche aegyptiaca* (Orobanchaceae), a total root parasite, has been observed to produce highest number of seeds per fruit (1400-1500) among dicotyledonous and *Monochoria vaginalis* with 140-150 seeds per plant ranked 1st in monocotyledonous weeds. Among dicotyledonous weeds 71.8 % weeds bear more than 1 seed per fruit but among the monocotyledons only 17.2 % weeds bear more than 1 seed per fruit. In species level among dicotyledonous

weeds, *Ludwigia perennis* and *Centella asiatica* have been observed to produce highest number (218287) and lowest number (56) of seeds per plant respectively. In monocotyledonous weeds, highest and lowest number of seeds per plant have been observed to produce by *Scirpus articulatus* (12688) and *Butomopsis latifolia* (208) respectively. Concerning the weight of 1000 seeds, highest and lowest among dicotyledonous weeds have been observed in *Ipomoea aquatica* (42.980g) and *Hydrolea zeylanica* (0.001g) respectively. Among monocotyledonous weeds highest and lowest seed which have been observed in *Commelina benghalensis* (2.500g) and *Monochoria vaginalis* (0.002g) respectively. In the present weed flora the most successful families are Poaceae, Asteraceae, Cyperaceae, Euphorbiaceae, Scorphulariaceae and Amaranthaceae. Among the recorded weeds of these families, 71.4 % species bear more than 1000 seeds per plant and 76.8 % species shows seed weight less than 1.0g per 1000 seeds. While, Poaceae and Cyperaceae have a special mode of vegetative propagation, Asteraceae has some special devices of dispersal like pappus, hooks etc. Euphorbiaceae, Scorphulariaceae, Amaranthaceae mainly consist of clitochore species and they rely on dispersal in time rather than space, they also have the ability to continue seed production for as long as the growing conditions permit. So, high seed number with small seed size, special mode of dispersal and other related characters enable the plants of these families to establish them as most successful weeds of the crop-field in the district of Malda. Comparative study of the seed number and seed weight of some weeds common with other floras indicate the high plasticity of weeds, due to which seed numbers vary from hundred to some thousands and difference in weight is due to selection, competition, collection, cleaning and proper drying of seeds.

11.7 WEED CALENDAR

Weed calendar is the excerpt of some basic data recorded for the phenology of the crop field weeds of the district of Malda. Weed calendar was prepared to indicate appearance, presence and disappearance of each and every weed species in the crop fields of the district of Malda. Presence of highest number of dicotyledonous weed species has been observed during November and December (92 species each) after that their number go on decreasing till June (65 species) but from July again it starts to increase. While, highest number of monocotyledonous weeds has been observed during October (36 species). Their number decreases after that and trend continues till May (22 species) and then from June new weeds starts appearing. Highest number of dicotyledonous and monocotyledonous weeds have been observed to appear during the month of June (41 species and 31 species respectively). While no species of dicotyledons has been observed to appear during February and March, and in case of monocotyledons , no species has been observed to appear during December, January and February. Very low temperature and precipitation are probably the main causes behind this. Regarding disappearance, it is the month of April when highest number of dicotyledonous weed (40 species) and during March - April, when highest number of monocotyledonous weeds (17 species) have been

observed to complete their life cycle. Among two species of pteridophyte, *Marsilea quadrifida* has been observed to present in different stages of their life cycle throughout the year. The other recorded pteridophyte *Ceratopteris thalictroides*, an annual, has been observed to appear during June, stays upto November and disappear during December. With this calendar in hand, protective measures may be taken against the appearance or spread of different weeds in advance

11.8 NEED OF ALLELOPATHIC SURVEY

In agriculture , weeds always offer competition to the normal growth of crop plants by various means which also include the production of some chemicals which leached into soil causing allelopathic effect. As has already been discussed in chapter 8, such effects of numerous weeds is well known to the scientist. However, six common weeds of Malda have tested which showed that all are active in allelopathic effect at least at certain concentration. As Salisbury (1957) indicated that the major allelopathic effect is to restrict the germination of seeds of other plants. It also affects the growth and metabolism of other plants (Del Morel and Cates, 1971).

So, When we find a large number of weeds growing round the year in the crop fields of Malda District and also many other weeds growing on boundary walls and fallow lands, these plants are cetainly releasing a considerable amount of leachetes, specially during rainy seasons, which contain germination and growth reterdants.

Controll measures against such allelopathic effects can be formulated only after knowing such effects of various weeds growing in a region. That is why it is essential to take up allelopathic studies of various weeds on different crop plants of Malda District.

11.9 IMPORTANCE OF WEEDS

Weeds though have many harmful effects upon crops but also have their many fold uses. In our present survey work informations were gathered from the local people about the uses of crop-field weeds. There have been recorded five types of uses of the weed species by the local people (i) weeds used as food for man (ii) weeds used for food for animals (iii) weeds used as medicine (iv) weeds used as fuel (v) miscellaneous uses (as soil binder and ceremonial). So, weeds are not useless plants. many of them even need to be cultivated to meet up our demand or there are possibilities of more exploration. However, some other phenomena like (I) atmospheric nitrogen fixation by leguminous weeds (ii) bringing up nitrogen compounds from lower strata to upper strata of soil, in part, by the growth and decay of weed species (Campbell 1924) i.e. to make it easily available for crop

plants, (iii) conservation nitrogen by early, late and winter annuals at times when no cultivated plants are present on land etc. are all beneficial aspects of weeds.

11.10 CONCLUSION

Through the full set up of the present work informations from different angles on the very rich flora of crop field weeds of Malda district have been accumulated which might be helpful in drawing strategies to improve the yield of various crop plants.

The weed flora, phenology of most of these plants (including the calendar) their distribution pattern - regionwise and seasonwise, mode of propagation, early identification through seedling morphological characters etc. are important and can be used in the programs of weed management.

The weedy plants of this district also include a few rare and interesting plants like *Dichondra repens, Asphodelus tenuifolius, Cochlearia cochlearioides* etc. The usefulness of weedy plants has been discussed and it is found that many weeds offer food to the man and often sold in the market. In addition there are also a large number of medicinal plants, many of which are also used by the local inhabitants. The role of weeds in drawing deeply located nitrates to the upper strata of soil has also been remembered.

Weeds are not useless plants. They constitute a very important part of the Country's fabulous biodiversity and in future many of these weeds might be treated as important cultivable plants when their proper method of utilisation will be discovered.

CHAPTER - 12

REFERENCES

12 REFERENCES

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