

Weed flora of various hill agro-ecosystems in Meghalaya, north-eastern India

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Summary

An account is given of the weed flora of agricultural crops in Meghalaya, north-eastern India, at different altitudes and at different seasons. A total of 194 weed species belonging to 129 genera in 51 families are reported from paddy, maize, potato and other crop lands. Habit, height, habitat and origin are given for each species.

Introduction

The State of Meghalaya consists of the three hill districts of Garo, Khasi and Jaintia which formed part of Assam until 1972. It covers an area of 22 549 km² between 25°47' and 26°10' N and 89°45' and 92°47' E. Meghalaya is bordered on the north west, north east and south east by the State of Assam and to the south west by Bangladesh (Figure 1). The altitude varies from 200 to 1950 m, with the highest peak lying in the Shillong Plateau of the Khasi Hills.

The region receives both north-east and south-west monsoons resulting in an average annual rainfall of around 205 cm; the maximum annual average of 1143 cm occurs around Cherrapunjee and Mawsynram. The average temperature varies with location from as high as 24°C in the summer to as low as 9°C in winter, with ground frost at night at higher elevations in the winter. Three seasons can be recognized: winter (November–February), spring (March–May), and summer (June–October) which includes the rainy season (Figure 2).

Agriculture is the mainstay of the people of the State, since about 85% of the population depend on it for their livelihood. Rice is the major staple food of Meghalaya, followed by maize. Potatoes and other vegetables are widely grown as cash crops. Shifting agriculture is extensively practised, and food and other crops grown to some extent by this system include paddy, maize, cassava, potato, cucurbits, bananas and chillies. These temporarily cropped areas support a large

number of weeds, many of which are utilized by tribal families to meet their various needs. Hence, these areas are often left unweeded, which results in profuse growth of both useful and useless species. The weeds are sometimes uprooted and burnt for manure, since the cultivators do not apply any artificial fertilizers.

The only existing accounts of the weeds of Meghalaya are those of Rao and Dam (1979) and Neogi and Rao (1980), which give a preliminary account of the floristics, seasonal variation and introduced weeds of paddy fields in Meghalaya. This study presents a complete account of the weed flora of the different crops, with notes on the habitat, habit, height and probable origin of each species.

Materials and methods

Extensive surveys were made of crop fields in Meghalaya at varying altitudes during different seasons. Weeds were collected for study and identification

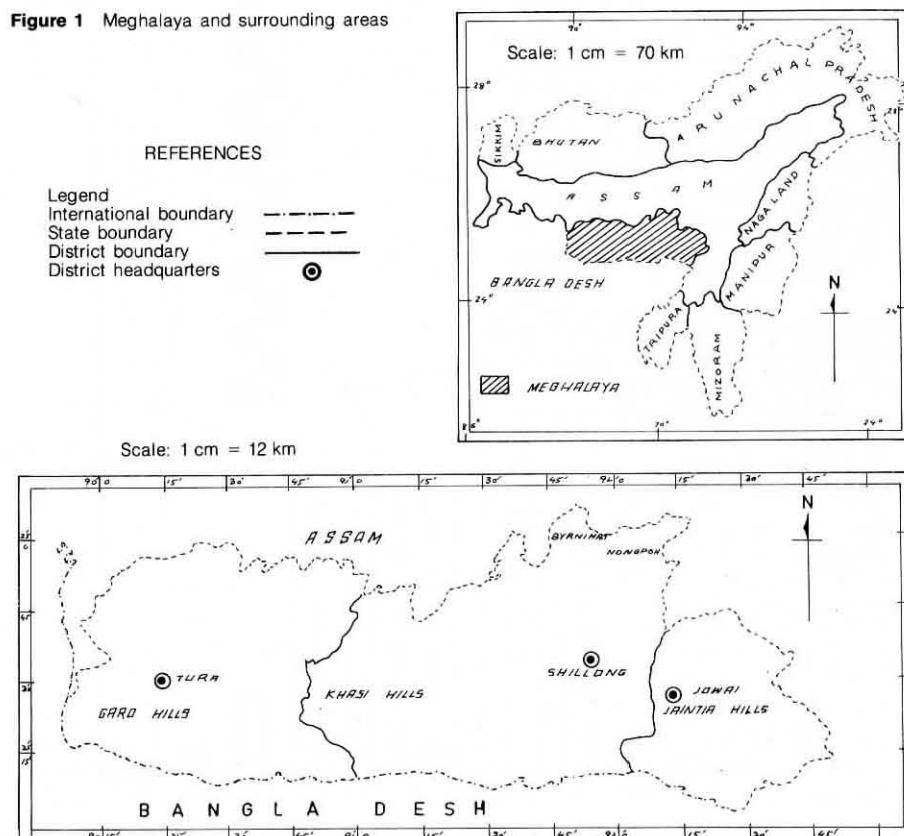
and lodged in the herbarium of North Eastern Hill University at Shillong. The weeds were identified with the help of local floras (Hooker, 1872–97; Kanjilal *et al.* 1934–40) and were determined in the herbarium of the Botanical Survey at Shillong. Notes on the habitats, habit, abundance, phenology and stage of growth of the weeds and crops were made at the time of collection.

Results and discussion

Terrestrial weeds

The terrestrial weed flora in Meghalaya is very diverse, largely because of the hilly terrain and the practice of shifting agriculture which favours the establishment of new weeds. About 194 weed species belonging to 129 genera in 51 families including Pteridophytes were found to be associated in various agro-ecosystems of Meghalaya (Table 1). Of these species, 171 were recorded from paddy fields, 97 from maize fields, 102 from potato fields and 73 from shifting cultivation (Table 2). Although the monocotyledonous species were less in number, their density was much higher than that of the dicotyledonous weeds. *Ageratum conyzoides*, *Centella asiatica*, *Cyperus iria*, *Digitaria ciliaris*, *Eichhornia crassipes*, *Hydrilla verticillata* and *Polygonum hydropiper* were among the common weeds in paddy fields, whilst

Figure 1 Meghalaya and surrounding areas



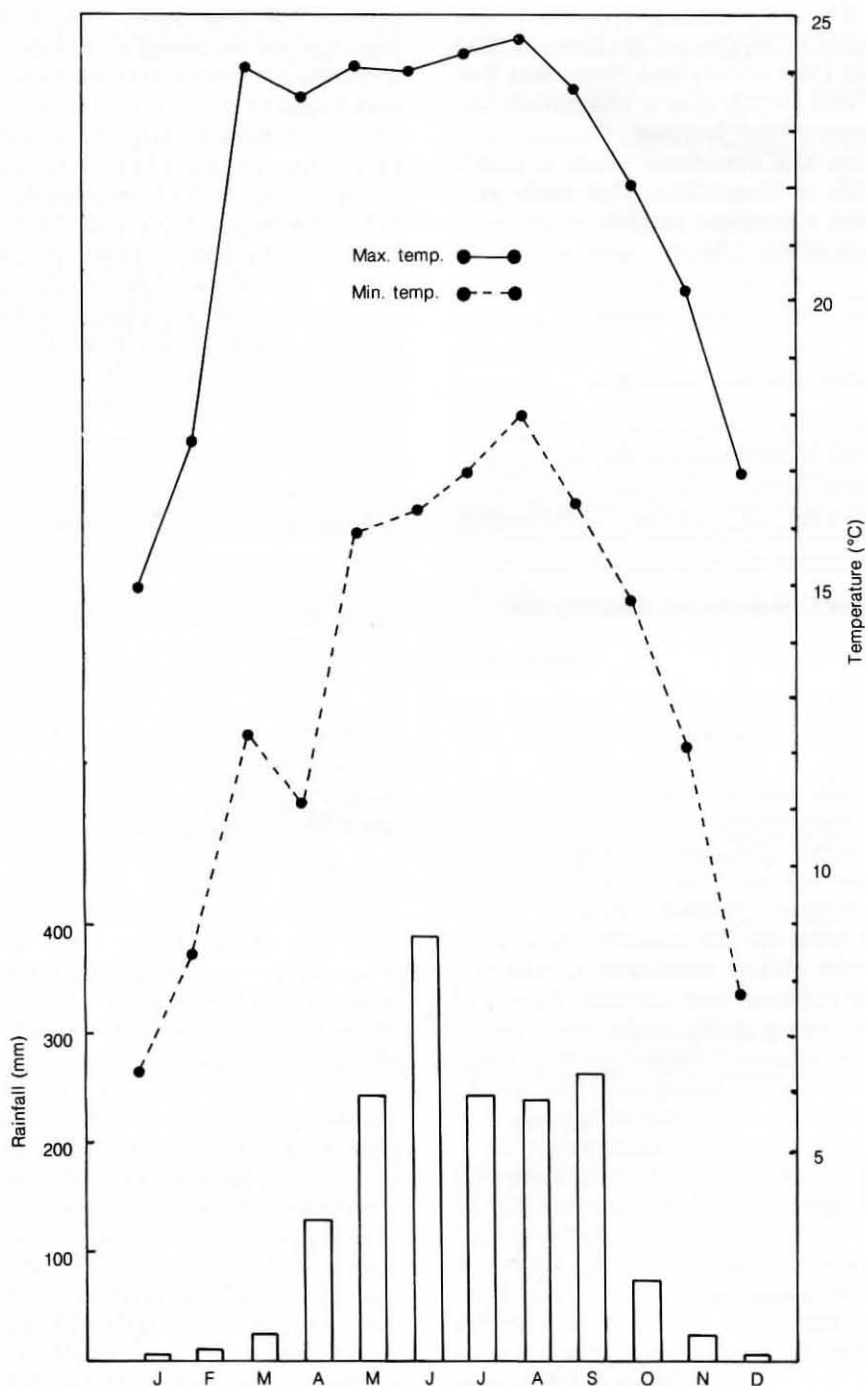
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Table 1 Statistical account of the weed flora of Meghalaya

	Dicotyledons	Monocotyledons	Ferns	Total
families	40	5	6	51
genera	101	22	6	129
species	159	29	6	194

Table 2 Number of weed species in different agro-ecosystems in Meghalaya

	Dicotyledons	Monocotyledons	Ferns	Total
paddy	140	29	2	171
maize	81	12	4	97
potato	68	33	1	102
vegetables	46	28	—	74
shifting agriculture	57	10	6	73

**Figure 2** Average shade temperatures and rainfall in Meghalaya in 1978

Achyranthes aspera, *Anemone rivularis*, *Galinsoga parviflora*, *Heliotropium indicum*, *Oxalis corniculata*, *O. corymbosa*, *Plantago major* and *Rumex nepalensis* were found in potato fields. *Conyza bonariensis*, *Elephantopus scaber*, *Galinsoga ciliata*, *G. parviflora*, *Oxalis corniculata*, *Spergula arvensis* and *Trifolium repens* were regularly collected from maize fields, and it was observed that many weed species were common to both maize and potato fields, while the weed flora of paddy fields was quite distinct (Table 3, page 12).

The weed flora of shifting agricultural lands was different and contained a significant number of shrubby and perennial weeds including *Ageratina adenophora*, *A. riparia*, *Bridelia montana*, *Cassia occidentalis*, *Chromolaena odorata*, *Desmodium heterocarpum*, *Euphorbia hirta*, *Lantana camara*, *Lippia alba*, *Phyllanthus fraternus*, *Saccharum spontaneum*, *Scutellaria discolor*, *Solanum khasianum*, *S. sisymbriifolium* and *Stachytarpheta* spp. These weeds are utilized in a number of ways by the local people and are rarely controlled. Besides the large number of weed species, seedlings and stump regrowth of native trees and shrubs also make their appearance in these areas. The extent of sprouts and seedlings depends on the length and severity of cropping in the area.

There are marked seasonal variations in the weed flora of Meghalaya. *Alteranthera sessilis*, *Euphorbia hirta*, *Fagopyrum esculentum*, *Fimbristylis dichotoma*, *F. globulosa*, *Hypochoeris radicata*, *Mimosa pudica*, *Oxalis corniculata*, *Polygonum barbatum*, *P. nepalensis* and *Rumex nepalensis* are abundant during the monsoons, while *Achyranthes aspera*, *Amaranthus viridis* and *Pouzolzia zeylanica* appear in the winter. It is clear that temperature and altitude play an important role in the distribution of many of these weeds (Figure 3). The number of weed species is highest during spring and summer and gradually declines as the temperature falls with the approach of winter.

Aquatic weeds

Aquatic weeds pose problems in reservoirs and rice culture as severe as those caused by terrestrial weeds in the other agro-ecosystems. They have a great capacity for rapid vegetative multiplication and a devastating effect on the ecosystem. Meghalaya is a hilly state and experiences water scarcity during the dry season in spite of the heavy rainfall during the monsoon. Many of

the aquatic habitats are temporary and dry up completely in summer, when all aquatic weeds also disappear. This may be the reason for the predominance of annual aquatic weeds over perennial species.

Aquatic weeds are very common at lower elevations in paddy fields and reservoirs. Grasses and sedges are dominant in the weed communities and other monocotyledonous species are common. *Cyperus iria*, *Echinochloa colona*, *Eleocharis congesta*, *Eriocaulon*

brownianum, *Hydrilla verticillata*, *Leersia hexandra*, *Ludwigia octovalvis*, *Monocharia hastata*, *Rotala rotundifolia*, *Sacciolepis indica*, *Scirpus erectus*, *Vallisneria spiralis* and *Azolla pinnata* are all common in paddy fields and water reservoirs. *A. pinnata* completely covers the surface of water and gives it a brownish appearance. *Eichhornia crassipes* is not yet very common in Meghalaya, but is increasing in paddy fields in some areas.

There is a marked seasonal fluctua-

tion in the aquatic weed flora, particularly with weeds of temporary ponds, pools and paddy fields which dry up during the summer. True hydrophytes including *Brasenia schreberia*, *Eichhornia crassipes* and *Nymphaea nouchali* are predominant during the monsoon, while marsh species such as *Ammania multiflora*, *Cyperus* spp., *Fimbristylis* spp., *Hydrilla verticillata*, *Ludwigia octovalvis*, *Polygonum* spp., *Rotala indica*, *R. rotundifolia* and *Utricularia aurea* appear during the spring and winter.

The weeds of paddy, potatoes, maize and other crops (mainly vegetables) and shifting agriculture in Meghalaya are enumerated in Table 3. The majority are pantropical in origin whilst some are from the neotropical region. Ten species are paleotropical in origin and the rest originate in the other regions or countries.

Acknowledgements

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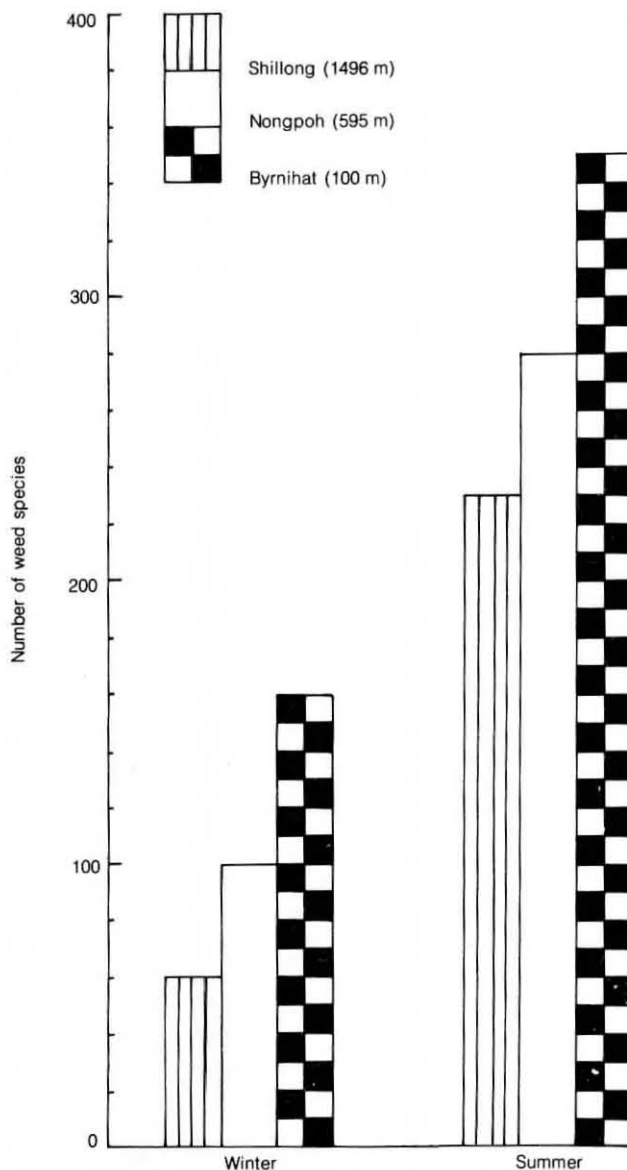


Figure 3 Weed flora at different altitudes in different seasons

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Table 3 Weed flora in different croplands in Meghalaya

Family and species	Croplands					Habit	Height (cm)	Habitat	Origin
	R	P	M	O	S				
Acanthaceae									
<i>Adhatoda zeylanica</i> Medic.	+	+	-	+	-	E	5-20	T	Indo-Mal.
<i>Andrographis laxiflora</i> (Bl.) Lindau.	+	+	-	+	-	E	20-40	T	S. India
<i>Barteria cristata</i> L.	+	-	+	-	+	E	20-40	T	S. India
<i>Dicliptera roxburghiana</i> Nees	+	-	+	+	-	E	20-40	T	S. India
<i>Hygrophila phlomoides</i> Nees	+	-	+	-	+	E	20-40	T	India
<i>Justicia khasiana</i> C.B. Clarke	+	+	-	+	+	E	40-60	T	S. India
<i>J. procumbens</i> L.	+	+	-	+	+	E	40-60	T	S.W. India
<i>Rungia pectinata</i> (L.) Nees	-	+	-	+	+	P	60-80	T	India, Sri Lanka
Adiantaceae									
<i>Adiantum venustum</i> D. Don	-	+	+	-	-	B	20-30	T	Eur.
Aizoaceae									
<i>Mollugo pentaphylla</i> L.	+	-	-	-	-	D-A	5-20	T	Paleotrop.
Amaranthaceae									
<i>Achyranthes aspera</i> L.	+	+	-	+	-	E	60-80	T	Trop. Amer.
<i>Alternanthera philoxeroides</i> (Mart.) Griseb.	+	+	-	+	+	P	20-40	M	Amer.
<i>A. sessilis</i> (L.) DC.	+	+	-	+	-	P	5-20	M	Trop. Amer.
<i>Amaranthus viridis</i> L.	+	+	-	+	+	D-B	20-40	T	Amer.
<i>A. spinosus</i> L.	+	+	+		+	E-D	20-40	T	Trop. Amer.
Anthrydiaceae									
<i>Diplazium esculentum</i> (Retz.) W.	-	-	+	-	+	D	20-40	T	?
Apiaceae									
<i>Centella asiatica</i> (L.) Urb.	+	+	-	+	-	P	5-20	T	Trop.
<i>Oenanthe javanica</i> (Bl.) DC.	+	+	-	+	-	E	20-40	M	S.W. India
Asteraceae									
<i>Adenostemma lavenia</i> (L.) Ktze.	+	+	-	-	-	E	20-40	T	Trop. Amer.
<i>Ageratina adenophora</i> (Spreng.) King. & Rob.	+	-	+	+	-	E	40-60	T	Trop. Amer.
<i>A. riparia</i> (Regel) King. & Rob.	+	+	-	+	-	E	40-60	T	Trop. Amer.
<i>Ageratum conyzoides</i> L.	+	+	+	+	+	E	20-40	T	S. Amer.
<i>Ambrosia artemisiifolia</i> L.	+	+	+	-	+	E	20-40	T	N. Amer.
<i>Bidens biternata</i> (Lour.) Merr. et Sherff.	+	-	+	+	+	E	20-40	T	Amer.
<i>B. pilosa</i> L.	+	-	+	+	+	E	20-40	T	Amer.
<i>Blainvillea acmella</i> (L.) Phillip	+	-	+	+	-	E	60-80	T	S. Amer.
<i>Chromolaena odorata</i> (L.) King. & Rob.	+	+	-	+	-	E	40-60	T	C. & S. Amer.
<i>Chrysanthemum cinerariaefolium</i> (Trev.) Vis.	+	-	+	-	+	E	60-80	T	Eur.
<i>Conyza bonariensis</i> (L.) Cronq.	+	-	+	-	+	E	60-80	T	Amer.
<i>C. canadensis</i> (L.) Cronq.	+	-	+	+	-	E	40-60	T	Trop. Amer.
<i>Coreopsis lanceolata</i> L.	+	+	-	+	+	E	20-40	T	N. Amer.
<i>Crassocephalum crepidioides</i> (Benth.) S. Moore	+	+	+	-	+	E	20-40	T	Trop. Amer.
<i>Elephantopus scaber</i> L.	+	+	+	-	+	E	60-80	T	Amer.
<i>Erigeron karvinskianus</i> DC.	+	-	-	+	+	E	40-60	T	Trop. Amer.
<i>Galinsoga ciliata</i> (Rafn.) Balak	+	+	+	+	-	E	20-40	T	Trop. Amer.
<i>G. parviflora</i> Cav.	+	-	+	+	+	E	30-40	T	Trop. Amer.
<i>Hypochaeris radicata</i> L.	+	+	-	-	+	E	20-40	T	S. Eur.
<i>Matricaria matricarioides</i> (Less.) Porter	+	+	-	+	+	E	20-40	T	N. Amer.
<i>Sonchus arvensis</i> L.	+	+	+	-	+	E	40-60	T	Eur.
<i>S. oleraceus</i> L.	+	-	+	+	-	E	40-60	T	Eur.
<i>Tagetes erecta</i> L.	+	+	-	-	+	E	60-80	T	Mexico
<i>T. minuta</i> L.	+	-	+	+	-	E	60-80	T	Trop. Amer.
<i>T. patula</i> L.	+	+	-	+	+	E	20-40	T	Mexico
<i>Taraxacum officinale</i> Wiggers	-	-	+	+	-	E	20-40	T	Eur.
<i>Tithonia tagetiflora</i> DC.	-	-	+	-	+	E	40-60	T	C. Amer.
<i>Xanthium strumarium</i> L.	+	+	+	-	+	E	20-40	T	Amer.
Azollaceae									
<i>Azolla pinnata</i> L.	+	-	-	+	-	P	10-15	A	Trop. Amer.
Balsaminaceae									
<i>Impatiens angustiflora</i> Hook.f.	+	+	-	+	-	E	5-20	T	India
<i>I. chinensis</i> L.	+	+	-	+	-	E	5-20	T	China, India
<i>I. fimbriata</i> Hook.	+	+	-	+	-	E	5-20	M	India
<i>I. racemosa</i> DC.	+	+	+	-	-	E	20-40	T	W. India
<i>I. radiata</i> Hook.f.	+	+	+	-	+	E	20-40	T	W. India
<i>I. salicifolia</i> Hook.f. & Thoms.	+	+	-	+	-	E	5-20	M	India
Boraginaceae									
<i>Cynoglossum glochidiatum</i> DC.	+	+	+	-	+	E	40-60	T	S. India, Sri Lanka
<i>Heliotropium indicum</i> L.	+	-	+	+	+	E	20-40	T	Pantrop.
Brassicaceae									
<i>Rorippa indica</i> (L.) Hiern.	+	-	+	-	+	E-B	5-20	T	Amer.
<i>R. nasturtium-aquaticum</i> (L.) Hayek.	+	-	-	-	-	P	5-20	A	Amer.
Caesalpinnaceae									
<i>Cassia hirsuta</i> L.	+	-	+	-	+	B	5-20	T	Trop. Amer.

Table 3 Weed flora in different croplands in Meghalaya (*continued*)

Family and species	Croplands					Habit	Height (cm)	Habitat	Origin
	R	P	M	O	S				
<i>C. occidentalis</i> L. Caryophyllaceae	+	-	+	-	+	E	5-20	T	S. Amer.
<i>Drymaria cordata</i> (L.) Willd. ex Roem & Schutt.	+	+	-	+	-	P-B	5-20	T	Trop. & Subtrop.
<i>Spergula arvensis</i> L.	-	+	-	+	-	D	5-20	T	Paleotrop.
<i>Stellaria longissima</i> Wall ex Edgw. Chenopodiaceae	+	-	-	+	-	E	5-20	T	Eur.
<i>Chenopodium album</i> L.	+	+	-	+	-	E	60-80	T	S. Amer.
<i>C. ambrosioides</i> L. Cleomaceae	+	+	-	+	-	B	40-60	T	Paleotrop.
<i>Cleome viscosa</i> L. Convolvulaceae	-	-	-	+	-	S	20-40	T	Indo-Mal.
<i>Evovulus alsinoides</i> (L.) L.	+	+	-	+	-	P	5-20	T	Subtrop.
<i>Ipomoea aquatica</i> Forsk. Cyperaceae	+	-	-	-	-	P	20-40	A	Trop.
<i>Cyperus iria</i> L.	+	+	-	+	-	E	20-40	M	Paleotrop.
<i>C. rotundus</i> L.	+	+	-	+	-	E	20-40	M	Pantrop.
<i>Eleocharis congesta</i> D. Don	+	-	-	+	-	E	20-40	M	Pantrop.
<i>Fimbristylis dichotoma</i> (L.) Vahl	+	+	-	+	-	E	10-35	M	Tropics & Subtrop.
<i>F. globulosa</i> (Retz.) Kunth.	+	-	+	+	-	E	10-30	T-M	Pantrop.
<i>F. littoralis</i> Gaud.	+	+	-	+	+	E	20-40	M	Pantrop.
<i>Scirpus erectus</i> L. Euphorbiaceae	+	-	-	+	-	E	20-60	M	Madagascar, Indo-Japan
<i>Bridelia montana</i> (Roxb.) Willd.	+	-	-	-	+	E	5-20	T	S.W. India
<i>Croton bonplandianus</i> Baill.	+	-	+	-	+	E	20-40	T	S. Amer.
<i>Euphorbia hirta</i> L.	+	+	+	+	+	E-T	5-20	T	Pantrop.
<i>E. prostrata</i> Ait.	+	+	+	+	+	P	5-20	T	W. Indies
<i>Phyllanthus fraternus</i> Webst. Fabaceae	+	+	+	-	+	E	20-40	T	Trop. except Austr.
<i>Crotalaria bialata</i> Schrank.	+	-	-	-	+	E	40-60	T	Indo-Mal.
<i>C. mysorensis</i> Roth.	+	-	+	-	+	E	40-60	T	Indo-Mal.
<i>C. pallida</i> Ait.	+	-	+	-	+	E	5-20	T	Trop.
<i>Desmodium heterocarpum</i> (L.) DC.	+	-	-	-	+	E	40-60	T	Paleotrop.
<i>D. khasianum</i> Prain.	+	-	-	-	+	E	40-60	T	India
<i>D. triflorum</i> (L.) DC.	+	-	-	-	+	E(T)	20-40	T	Trop.
<i>D. triquetrum</i> (L.) DC.	+	-	-	-	+	B	20-40	T	Pantrop.
<i>D. velutinum</i> (Willd.) DC.	+	-	-	-	+	B	20-40	T	Trop.
<i>Trifolium repens</i> L. Gentianaceae	+	+	-	+	-	P	5-20	T	Eur.
<i>Crawfordia speciosa</i> Wall.	+	-	+	-	+	T	20-40	T	S.W. India
<i>Swertia cordata</i> Wall. Geraniaceae	+	-	+	-	+	B	20-40	T	S.W. India
<i>Geranium nepalense</i> Sweet Gesneriaceae	+	+	+	+	+	E	5-20	T	Mexico
<i>Rhynochoglossum obliquum</i> Bl. Hydrocharitaceae	-	+	-	+	+	E	20-40	T	Indo-Mal.
<i>Hydrilla verticillata</i> (L.f.) Royle	+	-	-	-	+	C	5-20	M-A	Temp. & Trop. Old World
<i>Ottelia alismoides</i> (L.) Pers.	+	-	-	-	-	C	5-20	M-A	Austro-Asia
<i>Vallisneria spiralis</i> L. Hypericaceae	+	-	-	+	-	S	5-20	A	S. Asia-Mal.
<i>Hypericum japonicum</i> Thunb.	+	-	+	+	+	E	20-40	T	Indo-Mal.
<i>H. patulum</i> Thunb. Lamiaceae	+	-	+	-	+	E	40-60	T	Indo-Mal.
<i>Dysophylla auricularia</i> Bl.	+	+	-	+	-	E	40-60	T	S. India
<i>Eusteralis stellata</i> (Lour.) Balak	+	+	-	+	-	E	40-60	T	India
<i>Leucas ciliata</i> Benth.	+	+	-	+	+	E	40-60	T	India
<i>L. lavandulaefolia</i> J. E. Sm.	+	+	-	+	+	E	20-40	T	Indo-Mal.
<i>Ocimum basilicum</i> L.	+	+	-	-	+	E	20-40	T	C. India
<i>Plectranthus hispidus</i> Benth.	-	-	+	-	+	E	40-60	T	India
<i>P. japonicus</i> (Bum.f.) Koidz	+	-	+	-	+	E	40-60	T	India
<i>P. striatus</i> Benth.	-	-	+	-	+	E	40-60	T	C. & S. India
<i>P. ternifolius</i> D. Don	-	-	+	-	+	E	40-60	T	India
<i>Pogostemon brachystachya</i> Benth.	-	-	+	-	+	E	40-60	T	India
<i>Prunella vulgaris</i> L.	+	+	-	+	-	E	20-40	T	Eur.
<i>Scutellaria discolor</i> Benth.	-	-	+	-	+	E	20-40	T	Asia

Croplands R = rice; P = potato; M = maize; O = other vegetables; S = shifting agriculture

Habit S = stoloniferous; E = erect; D = decumbent; P = prostrate; B = branched; A = ascending; T = trailing; C = climbing; F = floating

Habitat A = aquatic; T = terrestrial; M = marsh

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Table 3 Weed flora in different croplands in Meghalaya (continued)

Family and species	Croplands					Habit	Height (cm)	Habitat	Origin
	R	P	M	O	S				
<i>Teucrium quadrifarium</i> Ham. Lentibulariaceae	-	-	+	-	+	E	40-60	T	
<i>Utricularia aurea</i> Lour. Lycopodiaceae	+	-	+	-	+	E	40-60	T	Indo-Mal.
<i>Lycopodium cernuum</i> L. Lythraceae	+	+	+	+	-	B	20-60	T	Pluriregional
<i>Ammania multiflora</i> Roxb.	+	-	-	+	-	E	5-20	M	Paleotrop.
<i>Rotala indica</i> (Willd.) Koehne	+	+	-	+	-	E	5-20	M	Indo-Mal.
<i>R. rotundifolia</i> Koehne Malvaceae	+	+	-	+	-	S	5-20	M	
<i>Hibiscus surattensis</i> L.	+	-	-	+	+	C	60-80	T	Pantrop.
<i>Sida rhombifolia</i> L.	+	+	-	+	-	E	20-40	T	Pantrop.
<i>Urena lobata</i> L. Melastomaceae	+	-	+	-	-	B	40-60	T	Pantrop.
<i>Melastoma malabathricum</i> L.	+	+	+	+	+	E	80+	T	E. Asia
<i>Osbeckia crinita</i> Benth.	+	+	+	+	+	E	80+	T	S.W. India
<i>O. glauca</i> Naud.	+	-	+	-	-	E	40-60	T	S.W. India
<i>O. nepalensis</i> Hook.f.	+	-	+	-	+	E	20-40	T	S. India
<i>O. rostrata</i> D. Don Mimosaceae	+	-	+	-	+	E	20-40	T	India
<i>Acacia pennata</i> (L.) Willd.	+	+	-	+	-	C	5-20	T	Austr.
<i>Mimosa pudica</i> L. Nymphaeaceae	+	+	-	+	+	P	20-40	T	?
<i>Brasenia schreberi</i> Gmel.	+	-	-	-	-	S	40-60	A	E. Amer.
<i>Nymphaea nouchalii</i> Burm.f. Onagraceae	+	-	-	-	-	S	60-80	A	Trop. Amer.
<i>Ludwigia octovalvis</i> (Jacq.) Raven.	+	+	-	+	+	P	5-20	M	Pantrop.
<i>Oenothera rosea</i> Sol. Oxalidaceae	+	+	-	-	-	E	40-60	T	E. Asia
<i>Oxalis corniculata</i> L.	+	+	-	+	-	P	5-20	T	Pantrop.
<i>O. corymbosa</i> DC.	+	+	-	+	+	E	20-40	T	Pantrop.
<i>O. latifolia</i> H.B.K. Papaveraceae	+	+	-	+	-	E	5-20	T	Mexico
<i>Argemone mexicana</i> L. Plantaginaceae	+	-	+	+	-	E	40-60	T	Eurasia
<i>Plantago major</i> L. Poaceae	+	+	-	+	-	E	5-20	T	Eur.
<i>Bromus catharticus</i> Vahl.	-	+	+	+	+	E	40-60	T	Amer.
<i>Dicanthelium clandestinum</i> (L.) Gould.	+	-	+	-	+	E	80+	T	Trop. Amer.
<i>Digitaria ciliaris</i> (Retz.) Koeh	+	+	+	+	-	E	40-60	T	Pantrop.
<i>D. ischaemum</i> (Schreb.) Schreb.	+	+	+	+	+	E	40-60	T	Eur.
<i>Echinochloa colona</i> (L.) Link.	+	-	-	+	-	E	20-30	T	Paleotrop.
<i>E. crus-galli</i> (L.) Beauv.	+	+	+	+	+	E	60-80	T	Eur.
<i>Leersia hexandra</i> Sw.	+	-	-	-	+	E	20-25	M-A	Pantrop.
<i>Panicum maximum</i> Jacq.	+	+	+	+	+	E	40-60	T	Trop. Africa
<i>Paspalum conjugatum</i> Berg.	+	+	+	-	+	E	20-40	T	Africa
<i>P. dilatatum</i> Poir.	+	+	+	+	+	E	20-40	T	Trop. Amer.
<i>Poa annua</i> L.	-	-	+	-	+	E	5-20	T	Amer.
<i>Saccharum spontaneum</i> L.	-	-	+	-	+	E	80+	T	S. Amer.
<i>Sacciolepis indica</i> (L.) A. Chase	+	+	-	+	-	E	10-30	T	Indo-Mal.
<i>Setaria glauca</i> (L.) Beauv.	+	+	+	-	+	E	40-60	T	Eurasia
<i>S. viridis</i> (L.) Beauv. Polygalaceae	+	+	+	-	+	E	40-60	T	Europe
<i>Polygala glomerata</i> Lour. Polygonaceae	+	-	+	-	+	B	20-40	T	Indo-Mal.
<i>Fagopyrum esculentum</i> Moench.	+	+	-	-	-	B	60-80	M	C. Eur.
<i>Polygonum alatum</i> D. Don	+	+	-	+	-	P	40-60	M	Paleotrop.
<i>P. barbatum</i> L.	+	+	-	+	-	S	20-40	M	Paleotrop.
<i>P. chinense</i> L.	+	-	-	+	-	C	20-40	T	China, Japan
<i>P. hydropiper</i> L.	+	-	-	+	-	S	40-60	M	W. Eur.
<i>P. nepalense</i> Meissn.	+	-	-	+	-	E-D	20-40	M	Trop. Amer.
<i>P. orientale</i> L.	+	-	-	+	-	S	60-80	M	Trop. Amer.
<i>P. stagninum</i> Ham. ex Meissn.	+	-	-	-	+	C	20-40	T	India, Burma
<i>Rumex nepalensis</i> Spreng. Pontederiaceae	+	+	-	+	-	E	40-60	T	Asia
<i>Eichhornia crassipes</i> (Mart.) Solms.	+	-	-	-	-	F	20-40	A	S. Amer.
<i>Monochoria hastata</i> (L.) Solms. Pteridaceae	+	-	-	+	-	P	20-30	A	Paleotrop.
<i>Pteridium aquilinum</i> (L.) Kuhn.	-	+	+	+	+	S	20-40	T	Trop. & Temp.

Table 3 Weed flora in different croplands in Meghalaya (*continued*)

Family and species	Croplands					Habit	Height (cm)	Habitat	Origin
	R	P	M	O	S				
Ranunculaceae									
<i>Anemone rivularis</i> Ham.	+	+	+	+	+	E	40-60	T	Trop. & N. Temp.
Rosaceae									
<i>Agrimonia pilosa</i> Ledeb. var. <i>nepalensis</i> (D. Don) Nakai	+	+	+	+	+	E	40-60	T	India
<i>Potentilla monniana</i> Wt.	+	+	+	+	-	P	40-60	T	India
<i>Rubus ellipticus</i> J.E. Sm.	-	+	+	+	+	C	5-20	T	Sri Lanka
<i>R. moluccanus</i> L.	+	+	-	+	-	C	5-20	T	Sri Lanka to Burma
Rubiaceae									
<i>Hedyotis auricularia</i> (L.) F. Muell.	+	-	+	-	+	C	5-20	T	Pantrop.
Schizaeaceae									
<i>Lygodium flexuosum</i> (L.) Sw.	+	-	+	+	+	C	10-40	T	New Guinea
Scrophulariaceae									
<i>Limnophila chinensis</i> (Osbeck) Merr.	+	-	-	+	-	E	20-40	T	Indo-Mal.
<i>Lindernia anagallis</i> (Burm.f.) Pannel.	+	-	-	+	-	E	20-40	T	Indo-Mal.
<i>L. crustacea</i> (L.) F. Muell.	+	-	+	-	+	P	20-40	T	Paleotrop.
<i>L. hookeri</i> (C.B. Clarke) Wt.	+	-	+	+	+	E	20-40	T	India
<i>L. procumbens</i> (Krock.) Philcox	+	-	-	+	-	E	5-20	T	Paleotrop.
<i>L. rualloides</i> (Colsm.) Pennell	+	-	+	-	+	P	20-40	T	Indo-Mal.
<i>Scoparia dulcis</i> L.	-	+	-	-	+	D	5-20	T	Neotrop.
<i>Sopubia trifida</i> D. Don	-	+	-	+	-	E	20-40	T	Indo-Mal.
<i>Tarenia diffusa</i> D. Don	-	+	-	+	-	E	5-20	T	S. India
<i>T. parviflora</i> Ham. ex Hook.f.	-	+	+	-	+	E	5-20	T	S.W. India
<i>T. peduncularis</i> Benth.	-	+	+	-	+	E	5-20	T	S.W. India
Selaginaceae									
<i>Selaginella decipiens</i> Warb.	+	+	+	+	+	E	20-30	T	Pluriregional
Solanaceae									
<i>Nicandra physaloides</i> (L.) Gaertn.	+	+	-	+	-	E	20-40	M	Peru
<i>Solanum khasianum</i> C.B. Clarke	+	+	+	+	+	E	20-40	T	India
<i>S. nigrum</i> L.	+	+	-	+	-	E	20-40	T	Temp. & Trop.
<i>S. sisymbriifolium</i> Lam.	+	+	+	+	+	E-D	40-60	T	Indo-Mal.
<i>S. torvum</i> Sw.	+	-	+	-	+	E	20-40	T	Trop. Amer.
Tiliaceae									
<i>Triumfetta rhomboidea</i> Jacq.	-	-	-	-	+	E	40-60	T	C. & S. India
Urticaceae									
<i>Pouzolzia bennettiana</i> Wight	+	+	+	-	+	E	20-40	T	Old World
<i>P. zeylanica</i> (L.) Benn.									
Verbenaceae									
<i>Lantana camara</i> L.	+	-	+	+	+	C	40-60	T	S. India
<i>Lippia alba</i> N.E. Br. ex Brit.	+	-	+	-	+	E	40-60	T	Trop. Amer.
<i>Stachytarpheta dichotoma</i> Vahl.	+	-	+	-	+	E	20-40	T	Trop. Amer.
<i>S. jamaicensis</i> (L.) Vahl.	-	-	+	-	+	C	20-40	T	Trop. Amer.

Croplands R = rice; P = potato; M = maize; O = other vegetables; S = shifting agriculture

Habit S = stoloniferous; E = erect; D = decumbent; P = prostrate; B = branched; A = ascending; T = trailing; C = climbing; F = floating

Habitat A = aquatic; T = terrestrial; M = marsh

Glossary of terms

Air Blast Sprayer — A machine which can deliver high and low volumes of spray by means of an air blast; used for spraying orchards, shade trees, vegetables, and fly control.

Analysis — The process of determining the composition of substances. The figures and results obtained about the composition of a substance.

Annual — A plant that grows from a seed, produces flowers, fruit or seed the same year, and then dies.

Antagonism — The loss of activity (or decrease in effectiveness) which is a result

of two or more chemicals being exposed to each other or mixed together.

Opposing action of different chemicals such that the action of one is impaired or the total effect is less than that of either component used separately.

Counteraction between chemicals, organisms or groups of organisms.

Antagonist — The agent which opposes (blocks or counteracts) the action of another agent, such that the total effect is less than that obtained with either agent alone.

Anticholinesterase Poisons — Poisons which interfere with the production of cholinesterase thus causing muscles to move constantly. Examples of these

poisons are organophosphate and carbamate insecticides.

Antidote — Any agent administered to prevent or counteract, or reduce, the action of a poison (e.g. Ipecac Syrup, atropine).

Anti-siphoning Device — A small piece of equipment attached to the filling hose to prevent fill water from draining back into the water source. Example: check valve.

Applicator — A person or piece of equipment which applies pesticides.

Apply Uniformly — To spread, spray, put, place or distribute a pesticide evenly.