

RICE FIELD WEED FLORA OF SRI LANKA

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SUMMARY

One hundred and thirty four weed species representing 32 families were recorded from paddy fields in the three major climatic zones of Sri Lanka. In floristic composition cyperaceae and gramineae constituted the major components of weed flora. *Fimbristylis miliacea*, *Isachne globosa* and *Cyperus haspan* were the abundant weeds. Most weeds were common to both wet and dry zones of Sri Lanka.

Seven types of life forms of weeds were observed to exist in hydrophytic, hygrophytic and mesophytic habitats of paddy fields.

INTRODUCTION

Weeds constitute a major constraint in increasing rice production in most rice growing regions. The conditions favourable for rice culture are equally well suited for growth and reproduction of terrestrial, aquatic and semi-aquatic weeds. By nature weeds are prolific reproducers and are endowed with adaptiveness to changing ecological conditions (Soyza, 1930). In rice culture where land is water logged for extended periods, an ideal ecological niche prevails for establishment of weeds. Early in the growing season aquatic and semi-aquatic weeds dominate but are replaced thereafter by terrestrial forms towards the end of the cropping season when in general dry land conditions prevail (Chaudhury, 1971). These weeds compete with the rice crop for light, moisture, space and mineral nutrients (Pavlychenko and Harrington, 1934; Blackman and Templeman 1938) leading eventually to reduced rice yields (Robbins *et al* 1953). The competitive effects of weeds are most severe in early stages of the rice crop and in Sri Lanka it has been reported that failure to control weeds after planting can reduce yields by as much as 50 percent (Jayasekera and Velumurugu, 1966).

Yield losses due to weeds can vary considerably. In the United States of America yield losses of 15 percent have been reported (Smith *et al*, 1977) whereas losses in India have ranged from about 9 to 51 percent (Mani, 1968).

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In the Philippines losses have been estimated in the region of 50 percent (Vega and Paller, 1970), and in Sri Lanka losses have ranged from 20 to 40 percent (Siriwardene, unpublished).

Aside from their effect on reducing yields, weeds increase the cost of rice production by interfering with various agricultural operations. Further, many weed species function as alternate hosts for a variety of insect pests and plant pathogens (Chaudhury, 1971 and Dixit *et al*, 1968). Weeds such as *Leersia hexandra*, *Echinochloa*, spp., and *Panicum repens* act as alternate hosts of fungi and bacteria pathogenic to rice (Seneviratne, personal communication), while *Echinochloa colonum*, *E. frumentacea* and *Fimbristylis quinquangularis* are known to harbour the rice gall midge *Pachydiplosis oryzae* which subsequently infests the rice crop (Wickramasinghe, 1968).

Undoubtedly due to the damaging influence rice weeds can have on rice culture, numerous studies on paddy field weed flora have been undertaken the world over (Chakrabarty, 1957; Paul and Bhattacharya, 1959; Misra, 1946; Pandeya and Shaha, 1966). A study in Japan by Kasahara (1959) revealed the existence of 191 weed species belonging to 43 families. Thirty five species among these were widely distributed and considered to be harmful weeds in rice culture. Such studies have hitherto not been reported from Sri Lanka although there are some reports on botanical features of paddy field weeds (Amaratunga, 1972, Amaratunga, 1977), introduction and distribution of weeds (Senaratne 1940, Paul and Senaratne, 1941; Senaratne, 1943 and Senaratne, 1952) and occurrence of viruses in weeds (Kirinde, 1957).

This paper reports the results of studies on paddy field weeds carried out in Sri Lanka recently.

METHOD OF STUDY

A survey of rice field weed flora was carried out in 1975 in collaboration with the Extension Division of the Department of Agriculture. Fourteen Government Farms were surveyed in Yala 1975 and in 1975/76 Maha season 518 villages representing all the District Revenue Officer (D. R. O.) Divisions were included. Selection of villages from the D. R. O. Divisions was based on a two stage sampling design where in the first stage Village Headman (VH) Divisions were selected on a proportional basis from the D. R. O. Divisions, and in the second stage villages were selected within the VH Divisions in a manner roughly proportional to the total paddy area within each VH Division. Questionnaires were sent to the selected localities and weed specimens obtained were identified.

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RESULTS AND DISCUSSION

One hundred and thirty four weed species belonging to 32 families were identified. Four species were Pteridophytes (Family Nos. 28-30), 2 were algae (Family Nos. 31 and 32) and the rest were angiosperms. The angiosperms consisted of 40 dicotyledons from 16 families and 88 monocotyledons from 11 families. The largest number of species was recorded from the gramineae and cyperaceae and together they constituted about 54% of the total weed species. Among the dicotyledons the largest number of species was recorded in the compositae and schrophularaceae (Table 1). Although 134 weed species were recorded only 25 species were widely distributed based on relative abundance while *Fimbristylis miliacea*, *Isachne globosa* and *Cyperus haspan* were the commonest weeds (Table 2). Table 2 also provides details on weeds species in the dry and wet zones. The incidence was divided into 4 categories according to intensity. It is evident that 3 weed species are important in both zones. Today *Ischaemum rugosum* is an important weed in the wet zone. It is believed to have spread from the dry zone.

Weeds have been classified by many workers using different criteria. Arai *et al* (1955) classified rice field weeds of Japan based on optimum soil moisture content required for weed emergence and growth. Three major groups classified by them were hydrophytic, hygrophytic and mesophytic weeds. Mirashi (1957) classified hydrophytic weeds into 6 life-forms on the basis of contact with soil, water and air. A classification embodying features from both these systems is presented in Table 3 to include hydrophytic, hygrophytic and mesophytic weeds. Among hydrophytes 4 different life forms were recognized viz. those that are floating, suspended, anchored-submerged, and anchored with floating leaves. Floating weeds are in contact with water and air only; suspended weeds are rootless and submerged hydrophytes; anchored-submerged weeds are entirely or for the most part in contact with soil and water only; while anchored weeds with floating leaves are in contact with soil, water and air. Hygrophytes are represented by the two life-forms, emergent-amphibious and wetland weeds. In emergent-amphibious weeds the roots, the lower part of stems and in some cases even the lower leaves are usually submerged in water. Wetland weeds are rooted in soil which is usually saturated with water at least in the early part of their life-cycle. Mesophytic weeds are represented by one life-form and are those weeds that grow under dryland conditions where water is scarce throughout the growing season.

Floating weeds generally do not constitute a major problem with the exception of *Salvinia auriculata*, which can sometimes be a troublesome weed in rice cultivation. *Azolla pinnata* though listed as a weed could be

used as a source of nitrogen for paddy. Two other species commonly encountered are *Eichornia crassipes* and *Pistia stratiotes*. These are confined mostly to ponds, lakes and slow moving waterways where they interfere with water flow.

Other hydrophytic weeds such as *Blyxa aubertii*, *Ottelia alismoides*, *Ceratophyllum demersum*, *Utricularia aurea* and *Chara* spp. are not important weeds in rice fields. The hygrophytic weeds, are those that pose serious problems in rice culture. Here the wetland life-forms represented by the cyperaceous weeds *Fimbristylis miliacea*, *Cyperus haspan* and *Cyperus iria* and the graminaceous weeds *Isachne globosa* and *Echinochloa* spp. are among the most important rice field weeds. Mesophytic types of weeds seldom cause concern in lowland rice culture although the position could be very different in upland rice culture.

CONCLUSION

This survey reveals that there are many weeds that are important in rice. Most of them are common to both wet and dry zones but the degree of their incidence varies. This implies that any control measure suited to one zone can be equally applicable in the other. However the habitat would determine to a large degree the method of weed management to be used.

The most pernicious weeds are found in upland conditions where there is enough moisture but where the soil is not water logged. The measures adopted to manage these weeds may not be of help in controlling aerial and submerged forms and therefore, special techniques are required for their control.

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Table 1 : Floristic Composition of Paddy Field Weeds

1. **CARYOPHYLLACEAE**
Drymaria diandra Bl. Kukulupala (S)*
2. **STERCULIACEAE**
Melochia corchorifolia L. Gal-kura (S)
3. **GERANIACEAE**
Hydrocera angustifolia Bl. Diya-kudalu (S)
Hydrocera triflora W. and A.
4. **LEGUMINOSAE**
Aeschynomene americana L.
Aeschynomene aspera L.
Aeschynomene indica L. Diya-siyambala (S)
Phaseolus lathyroides L.
5. **LYTHRACEAE**
Ammannia baccifera L.
Rotala indica (Willd) Kochne
6. **ONAGRACEAE**
Ludwigia perennis L.
Jussiaea repens L.
Jussiaea tenella Burm f.
7. **RUBIACEAE**
Hedyotis diffusa Willd.
8. **COMPOSITAE**
Eclipta alba Hassk. Kikirindi (S) Karippan (T)
Emilia sonchifolia Dc. Kadupahara (S)
Epaltes divaricata (L) Cass Hinmuda-mahana (S)
Grangea spp. Adans.
Sphaeranthus indicus L. Muda-mahana (S)
Spilanthes calva Dc. Akmella (S)
9. **SPHENOCLEACEAE**
Sphenoclea zeylanica Gaertn. Maha-muda mahana (S)
10. **HYDROPHYLLACEAE**
Hydrolea zeylanica (L) Vahl. Diya-kirilla (S)
11. **SCROPHULARIACEAE**
Bacopa monnieri (L) Wettst. Lunu-wila (S)
Dopatrium nudicaule (Willd.) Buch—Han ex Benth. Bim Sewan (S)
Dopatrium lobeloides (Retz) Beauv.

* Local name—S in Sinhala and T in Tamil.

- Limnophila aquatica* (Retz) Alst.
Limnophila chinensis Merr.
Limnophila heterophylla (Roxb) Benth Amba-Wila (S) Kapura (T)
Lindernia antipoda Alst.
Lindernia cordifolia Alst.
Lindernia hirta pennell
Lindernia hyssopioides (L) Haines
Lindernia rotundifolia Alst.
Microcarpaea minima (Koen ex, Retz) Merr.
12. LENTIBULARIACEAE
Utricularia aurea Lour. (*U. flexuosa* Vahl.) Diya Pasi (S)
Utricularia reticulata Smith Nil-Monaressa (S)
13. ACANTHACEAE
Asteracantha longifolia (L) Nees Katu-ikiri (S) Nirmulli (T)
14. VERBENACEAE
Phyla nodiflora (L) Greene Herimenakola (S) Podutalai (T)
15. AMARANTHACEAE
Celosia argentea L. Kiri Henda (S)
16. CERATOPHYLLACEAE
Ceratophyllum demersum L.
17. HYDROCHARITACEAE
Blyxa aubertii Rich Diya-Hawari (S) Pil-sewel (S)
Ottelia alismoides Pers.
Vallisneria spp.
18. PONTEDERIACEAE
Monochoria vaginalis (Burm f.) Presl ex kunth Diya-Habarala (S) Jabara (S)
Eichornia crassipes (Marti) Solms Japan Jabara (S)
19. BUTOMACEAE
Limnocharis flava (L) Buchen Diya Gowa (S)
20. XYRIDACEAE
Xyris indica L. Ran-Motu (S)
21. COMMELINACEAE
Commelina diffusa Burm f. Gira-pala (S) Amalaipul (T)
Aneilema spiratum (L) R. Br.
22. JUNCACEAE
Juncus prismatocarpus R. Br.
23. TYPHACEAE
Typha angustifolia L. Hamba-pan (S)
24. ARACEAE
Pistia stratiotes L. Diya-Paranala (S)

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25. ERIOCAULONACEAE

- Eriocaulon quinquangulare* L. Hin-kokmota (S)
- Eriocaulon truncatum* Ham
- Eriocaulon cinereum* R. Br.
- Eriocaulon sexangulare* L. Kokmota (S)

26. CYPERACEAE

- Cyperus alopecuroides* Rottb
- Cyperus brevifolius* Hassk
- Cyperus compressus* L.
- Cyperus corymbosus* Rottb. Gal-ehi (S)
- Cyperus cyporinus* Suringar
- Cyperus dehiscens* Nees Hewan pan (S)
- Cyperus difformis* L.
- Cyperus exaltatus* Retz.
- Cyperus flavidus* Retz.
- Cyperus globosus* All
- Cyperus haspan* L. Hal pan (S)
- Cyperus iria* L. Wel-hiri (S)
- Cyperus killingia* Endl. chudalu (S)
- Cyperus melanospermus* Nees
- Cyperus pilosus* Vahl.
- Cyperus platystylis* R. Br.
- Cyperus polystachyos* Rottb.
- Cyperus procerus* Rottb.
- Cyperus punctulatus* Vahl.
- Cyperus rotundus* L. Kalanduru (S) Korai (T)
- Cyperus sanguinolentus* Vahl.
- Cyperus tenuiculmis* Boeckeler
- Cyperus tenuispica* Steud.
- Eleocharis dulcis* (Berm f.) Trin ex Henschel
- Eleocharis congesta* D. Don
- Fimbristylis acuminata* Vahl.
- Fimbristylis falcata* Kunth
- Fimbristylis ferruginea* Vahl.
- Fimbristylis miliacea* (L) Vahl Mudu-halpan (S)
- Fimbristylis quinquangularis* Kunth
- Fimbristylis schoenoides* Vahl.
- Fimbristylis tetragona* R. Br.
- Fuirena ciliaris* (L) Roxb.
- Fuirena umbellata* Rottb.
- Fuirena uncinata* Kunth
- Lipocarpha chinensis* Kern
- Mariscus dregeanus* Kunth
- Phycreus punctulatus* Nees

Rhynchospora spp. Vahl.
 Scirpus juncooides Roxb.
 Scirpus grossus L. f.
 Scirpus oryzetorum Steud.

27. GRAMINEAE

Brachiaria distachya A. Camus
 Chloris barbata SW.
 Coelechne simpliciuscula Munro Ex. Benth
 Coix gigantea koen ex Roxb
 Cynodon dactylon Pers. Durra (S) Heen-Etora (S) Arugam pul (T)
 Digitaria adscendens Henr. Arisi pul (T)
 Echinochloa colonum (L) Link Giri-Tana (S) Heen maratu (S) Adi-pul (T)
 Echinochloa crus-galli (L) Beauv Wel-marukku (S)
 Echinochloa frumentacea Link Raja maratu (S)
 Echinochloa stagnina (Retz) Beauv Wel-maratu (S)
 Eleusine indica Gaertn Bela-Tana (S) Tippa-Ragi (T)
 Elytrophorus spicatus A. Camus Uhasu (S) Eeti (T)
 Eragrostis uniolooides Nees
 Eragrostis willdenoviane Nees
 Hemarthria compressa R. Br.
 Hygrorhiza aristata Nees Go-jabba (S)
 Isachne globosa O. Ktze Bata-del (S)
 Ischaemum rugosum saligb Kudu-kedu (S)
 Leersia hexandra SW Layu (S)
 Leptochloa chinensis (L) Nees
 Oryza perennis Meench Uru Vi (S) Pandinel (T)
 Oryza rufipogon Criff
 Panicum repens L Etora (S), Inji-pul (T)
 Paspalum vaginatum SW
 Paspalum commersonii Lam, (P, merizii steud)
 Sacciolepis interrupta (Willd.) stapf
 Sacciolepis myosuroides A Camus
 Setaria glauca Beauv
 Setaria lutescens (Weigel) Hubbard
 Sporobolus indicus R. Br.

28. SALVINIACEAE

Azolla pinnata Lam
 Salvinia auriculata Aublet

29. MARSILEACEAE

Marsilea quadrifolia L. Diya-embul Embiliya (S) Ara-kiri (T)

30. PARKERIACEAE

Ceratopteris thalictroides Brongn

31. ZYGNEMATACEAE

Spirogyra Spp.

32. CHAROPHYCEAE

Chara spp.

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Table 2. Relative Abundance and Distribution of common Paddy Field Weeds in two Major Agroclimatic Regions.

<i>Weed species</i>	<i>Relative Abundance</i>	<i>Distribution</i>	
		<i>Wet Zone</i>	<i>Dry Zone</i>
Cyperus haspan		****	****
Fimbristylis miliacea	<70%	****	****
Isachne globosa		****	****
Cyperus iria	50%-70%	***	**
Echinochloa colonum		***	***
Cyperus difformis		**	*
Cyperus pilosus		**	*
Ischaemum rugosum	25%-50%	**	**
Jussiaea tenella		**	*
Ludwigia perennis		**	*
Monochoria vaginalis		**	*
Aeschynomene spp.		*	*
Aneilema spiratum		*	*
Commelina diffusa		*	*
Echinochloa crusgalli		*	*
Echinochloa frumentacea		*	*
Eclipta alba		*	*
Eriocaulon spp.		*	*
Fimbristylis quinqueangularis		*	*
Limnocharis flava	10%-25%	*	*
Lindernia spp.		*	*
Marsilea quadrifolia		*	*
Panicum repens		*	*
Scripus spp.		*	*
Others	>10%	*	*

* Scanty, ** Fairly moderate, *** Moderate, **** Extensive.

Table 3: Classification of Paddy Field Weeds based on Habitat.

HYDROPHYTIC WEEDS

(Weeds grow well in state of submergence)

1. **Floating Weeds:** These are in contact with water and air only.

- eg. *a. Azolla pinnata*
b. Eichornia crassipes
c. Pistia stratiotes
d. Salvinia auriculata

2. **Suspended Weeds:** Rootless submerged hydrophytes.

- eg. *a. Ceratophyllum demersum*
b. Spirogyra
c. Utricularia—Their vegetative organs
suspended in water, but their inflorescences are aerial.

3. **Anchored submerged weeds:** They are entirely or for the most part in contact with soil and water only.

- eg. *a. Blyxa aubertii*
b. Chara
c. Hygrorhiza aristata
d. Microcarpaea minima
e. Vallisneria

4. **Anchored weeds with floating leaves:** These are in contact with soil and with water as well as air.

- eg. *Ottelia alismoides*

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HYDROPHYTIC WEEDS

(Weeds grow well under water saturated condition)

5. Emergent amphibious weeds: The root, the lower part of the stem and in some cases even the lower leaves are usually submerged under water.

- eg. a. *Ammannia baccifera*
b. *Asteracantha longifolia*
c. *Bacopa monnieri*
d. *Ceratopteris thalictroides*
e. *Eleocharis*
f. *Eriocaulon*
g. *Hydrolea zeylanica*
h. *Hydrocera angustifolia*
i. *Limnocharis flava*
j. *Marsilea quadrifolia*
k. *Monochoria vaginalis*
l. *Oryza*
m. *Rotala indica*
n. *Typha*

6. Wet land weeds: These are rooted in the soil that is usually saturated with water at least in the early part of their life.

- eg. a. *Commelina diffusa*
b. *Cyperus*
c. *Dopatrium*
d. *Echinochloa*
e. *Fimbristylis*
f. *Fuirena*
g. *Isachne globosa*
h. *Jussiaea tenella*
i. *Lindernia*
j. *Ludwigia perennis*
k. *Sacciolepis*
l. *Scirpus*

MESOPHYTIC WEEDS
(Weeds grow under dryland conditions)

7. Dry Land Weeds: Grow in soil where water is scarce throughout the year.

- cg. a. *Ageratum conyzoides*
- b. *Cynodon dactylon*
- c. *Cyperus rotundus*
- d. *Eleusine indica*
- e. *Leptochloa chinensis*
- f. *Panicum repens*
- g. *Paspalum vaginatum*
- h. *Setaria glauca*
- i. *Sphaeranthus indicus*
- j. *Spilanthes paniculata*