Eco. Env. & Cons. 28 (November Suppl. Issue) : 2022; pp. (S454-S458)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2022.v28i07s.075

A Phytosociological Survey on weed Flora and Diversity in Rice Fields of Chidambaram Block, T.N., India

M. Vikram Sai*[1], G. Murugan[2], M. Saravana Perumal[2] and C. Kathiravelu[3]

[1,2]Department of Agronomy, Faculty of Agriculture, Annamalai University, Chidambaram, Cuddalore, Tamil Nadu, India
[3]Department of Agricultural Entomology, Faculty of Agriculture, Annamalai University, Chidambaram, Cuddalore, Tamil Nadu, India

(Received 20 May, 2022; Accepted 7 July, 2022)

ABSTRACT

A phytosociological survey was carried out to assess the varied weed flora and diversity in rice fields of Chidambaram block, Tamil Nadu, India. Chidambaram lies in low land habitat and the climate is subtropical. An average annual rainfall varies between 1200 to 1500 mm. The study has been done during 2020, Navarai season to determine the weed flora, species composition, density, frequency and important value index (IVI). To project the types of weed sps that are mainly affected the low land rice ecosystems. A total of 4 sedges, 3 grasses, 8 broad leaved weeds and 1 aquatic weed were detected. Sedges are most prominent weed flora found in the rice fields of Chidambaram block. The findings indicated that *Cyperus difformis*, *Echinochloa colonum* are the most abundant weeds in rice field followed by *Cyperus rotundus*, *Echinochloa crusgalli*, *Leptonchloa chinensis*, *Eclipta alba* and *Sphenoclea zelyancia*.

Key words : *Weed flora, Sedges, Diversity, rice*

Introduction

Rice is the major staple food crop in India. 60% population depends on rice for their daily consumption. As per the 2nd Advance estimates of Agriculture crops 2021-22, rice production accounts for 127.93 million tonnes in India (Anonymous, 2022). Weed is an undesired plant out of place. Weed is the major problem in the rice fields compared to other crops.

There are 30,000 species of weeds worldwide, of which about 18,000 causes losses to the crops. The losses will depend on the intensity of infestation, time of occurrence and types of weeds; plant requires nutrients and water for their growth and establishment. Weeds cause severe competition for these growth factors, injure the crop and make the plants famish. Weeds also extrude chemicals from their roots and leaves that are harmful to plant crops, interfering with normal crop growth and resulting in a drop in yield and quality. The competitive effect of a particular density of weeds on the crop is determined by the length of time they are present in the field. The relationship between the duration of competition and crop yield reduction is approximately sigmoidal (Kamble *et al.,* 2005). Weed occurrence at growth stages causes a drastic reduction in the yield of crops. Weed infestation is one of the factors responsible for low productivity (Singh *et al.,* 2015). It acts as an alternate host for insects and pests. Usually, rice yield losses vary between 15 and

([1]Ph.D. Scholar, [2] Assistant Prof., [3]Associate Prof.)

20%, but in severe conditions, yield losses might exceed 50%, depending on the type and strength of the weeds (BRRI, 2006).

Damage caused by weeds cannot be identified in early stage as compared to insect damage, so that weeds act as hidden war on crop plants (Murugan and Kathiresan, 2010). Some weeds contain noxious substances that can suppress the growth of crop plants. Competition of rice against weeds reduces the yield. The potential loss in rice production in India due to weed infestation is estimated at 15 million tonnes per annum. Indirectly weeds reduce production by serving an alternate host for disease and insect pests. *Echinochloa* sp is an alternate host for the rice stem borer. To evaluate different weeds present, the current survey was carried out in the low land rice fields of Chidambaram block of Tamil Nadu.

Materials and Methods

The Chidambaram block comes under Veeranam command area of Tamil Nadu. In which the climate is subtropical with a average rainfall varies from 1200-1500 mm. The current study was carried out on "Phytosociological Survey on Weed Flora and Diversity in Low land Rice Fields of Chidambaram, India". The study was carried out during Navarai season during 2020-21. To project the types of weed species that are mainly affected the low land rice ecosystems. The survey was conducted in selected rice fields of Chidambaram block, Veeranam command area. A quadrate of 1.0 x 1.0 m^2 is used for surveying with thehelp of 'Handbook on Weed Identification' (Naidu, 2012) and Weed seed Atlas (Naidu and Varshiney, 2007). Survey was conducted in the rice fields were weed managements is not practiced. To determine the abundance various ecological characters like Relative dominance, Relative density, Relative frequency and Important Value Index (IVI) were calculated by using formula given by Curtis (1959)

$$\text{Relative dominance R. Do.}(\%): \frac{\text{Dominance of Particular Species}}{\text{Sum total of the dominance of all species}} \times 100$$

$$\text{Relative density R. De. }(\%) = \frac{\text{Density of particular species}}{\text{Sum total of the density of all species}} \times 100$$

$$\text{Relative frequency R. F }(\%) = \frac{\text{Frequency of particular species}}{\text{Sum total of the frequency of all species}} \times 100$$

Importance value index (IVI) = R.Do + R.De + R.F.

Species diversity index (Shannon weiner index, 1963)

Shannon weiner index (H) = Pi log Pi

Where, Pi = ni/N; and ni=abundance of each species, N=total abundance of all species

Evenness index (Pielou, 1977)

Evenness (E) =H / Log S

Where, H = Shannon weaver index; S= Number of species

Species richness (Pielou, 1977)

Species richness is another mode of expression of the diversity and based on the total number of species and total number of individuals in a sample or habitat.

Richness Index D = S/√N

Where, 'D' is the index value, 'S' total number of species and 'N' total number of individuals of all species.

Results

Plant/weed phytosociological investigations, which give information on the dynamics and relative significance of a species in a single Phyto society or across Phyto societies, have sufficient value in the agricultural weed environment. It assesses species based on quantitative characteristics, allowing for better weed control decisions. According to the findings mentioned above, the total number of individual weeds varies between species. The variable rate of frequency class distribution of weed flora of paddy fields under the Chidambaram block describes the typical biological pattern that suggests the most dominant species arose in the particular location due to available resources and competitive interaction.

The data in Fig. 1 reflects the density of the observed weed species in the Chidambaram block of Veeranam command area. The density values varied from 0.05 to 10.03. *Cyperus difformis* and *Cynontis axillaries* had the highest and lowest density values. The majority of plant species have lower density values, indicating that a single species dominates the community composition of the weed flora of the Chidambaram area's paddy fields.

The data in Fig. 2 represents the frequency of the weed species occurred in the Chidambaram block. The frequency values varied from 6.67 to 100. Among the weed species observed the frequency

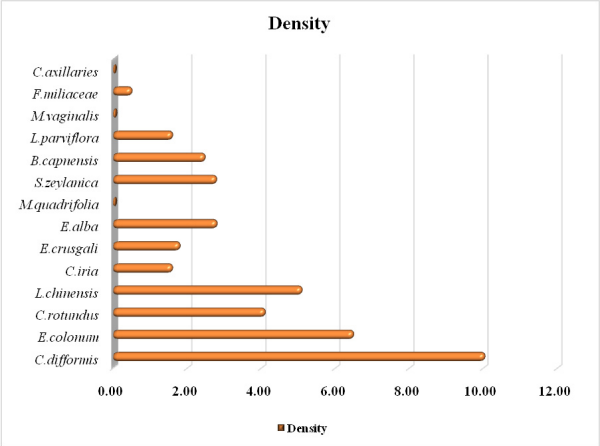


Fig. 1. Density of weed flora in chidamabaram block

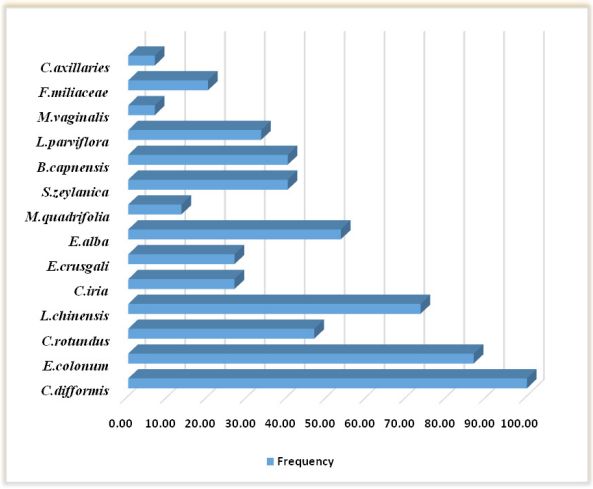
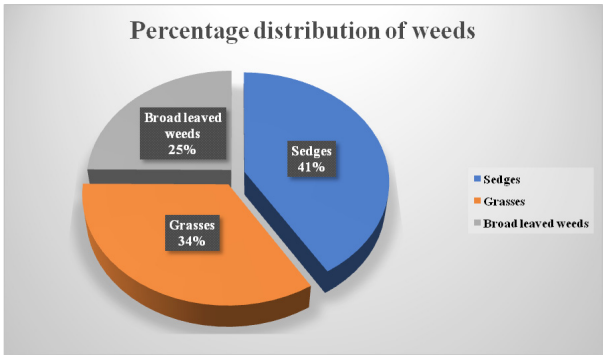


Fig. 2. Frequency of weed flora of Chidambaram block

distribution of the *Cyperus. difformis* recorded highest i.e., 100 and lowest frequency was obsereved by *Cynontis axillaries*

The survey revealed that there is a presence of 14 weed species, belonging to 10 families 12 genera were found in the rice fields. Out of these, 2 families consisting of 4 genera's and 8 species were monocotyledons and 8 families consisting of 8 genera's, 8 species were dicotyledons. According to the survey done, among sedges *Cyperus difformis, Cyperus rotundus, Cyperus iria, Fimbristylis milieceae* in grasses *viz., Echinochloa colonum, Echinochloa crusgali, Leptochloa chinensis* and in Broad leaved weeds *Eclipta alba, Bergia capensis, Marsilea quadrifolia, Ludwigia parviflora, Sphenoclea zeylancia, Monochoria vaginalis* and *Cyanotis axillaries* were weeds found in the surveyed plots. Highest relative dominance, frequency, density and IVI were recorded by *C. Difform is* followed by *E. colonum* (Table 1 & 2) in Navarai season of 2020.

Among the several categories of weeds, sedges were predominant (41%), grasses and broadleaf weeds accounts for 34 and 25%. Among several weeds *C. difformis, E. colonum, C.rotundus, L. chinensis, C. iria, E. crusgali, E.alba* and *S. zelayancia* were present in the block.



Relative dominance, density and frequency

The relative dominance, density and frequency of various weed species under the prevailing environmental setup was presented in Table 1. In Chidambaram block, *C. difformis* showed highest relative dominance (16.61), density (18.18) and frequency (15.29) followed by *E. colonum* (16.35), (18.08), (14.12). Lowest relative dominance, density and frequency was reported in *M. vaginalis* i.e., (0.18), (0.13), (1.18). Most of the weed species reflecting lower relative dominance, density and frequency values indicating single plant dominated community structure of the weed flora. So, this is likely to be as result of difference in cultural and weed management practices.

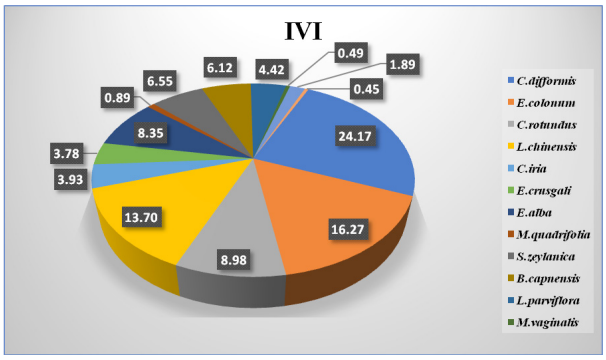


Fig. 3. Importance value index of various weed flora in Chidamabaram block

Important value index

The highest IVI value of *C. difformis, E. colonum* and *L. Chinensis* was most prevalent among the studied weed community. *M. vaginalis* has the lowest IVI values, indicating that they are the rarest species in the weed community of Chidambaram block. As a result, *C.difformis* is the dominating weed species in the block. The IVI value ranged from 1.492 to 50.09. The density-based cluster analysis of the Chidambaram block weed flora revealed that many clusters among distinct species, indicating tighter density values, significant associations between different weed species, and homogeneous distribution of species in their natural environment.

Table 1. Relative dominance, relative density and relative frequency of weeds in low land rice fields of Chidambaram block

Weed Sps	Relative dominance	Relative density	Relative frequency
C.difformis	16.61	18.18	15.29
E.colonum	16.35	18.08	14.12
C.rotundus	8.29	11.45	9.41
L.chinensis	16.26	14.19	11.76
C.iria	4.13	4.43	5.88
E.crusgali	4.60	4.99	4.71
E.alba	9.65	7.79	10.59
M.quadrifolia	1.42	0.17	3.53
S.zeylanica	7.71	7.75	7.06
B.capnensis	7.23	6.89	5.88
L.parviflora	4.45	4.42	4.71
M.vaginalis	0.18	0.13	1.18
F.miliaceae	2.00	1.37	3.53
C.axillaries	1.12	0.16	2.35

Diversity indices

Shannon's H index of weed flora diversity was found to be higher in the rice fields of Chidambaram block (2.06). Thus, *C. difformis* is the most dominant species of the study area. The evenness index (1.93) is very high it indicates that species are uniformly disributor in the cluster clumped together within their habitat and therefore not evenly spaced.

Table 3. Diversity indices values of weed flora in Chidambaram block of Veeranam command

Shannon_H	2.32
Evenness index	1.93
Species richness index	2.69

Discussion

The data reported above clearly show that *C. difformis* and *E. colonum* were the most commonly distributed weed species in all research sites investigated. These two species were also discovered to be the most abundant species in terms of density. Almost the same image may be observed with plenty. Furthermore, this data demonstrates that density, frequency, and abundance do not change much between cropping seasons and research sites. The existence of a colossal weed seed bank in the soil, which must have been deposited in prior years, might explain the high number of weeds discovered in this study.

C. difformis produces large quantity of seeds and can complete lifecycle in about 30 days. A dominant weed in the direct seeded rice when it occurs high

Table 2. Importance value Index (IVI) of weeds in low land rice fields of Chidambaram

Weed Sps	Common name	Family	Group	Lifecycle	IVI
C.difformis	Umbrella sedge	Cyperaceae	Monocot	Perennial	50.09
E.colonum	Jungle rice	Gramineae	Monocot	Annual	48.55
C.rotundus	Nut grass	Cyperaceae	Monocot	Perennial	29.15
L.chinensis	-	Gramineae	Monocot	-	42.21
C.iria	Flat sedge	Cyperaceae	Monocot	Perennial	14.44
E.crusgali	Barnyard grass	Gramineae	Monocot	Annual	14.30
E.alba	Eclipta	Compositae	Dicot	Annual	28.03
M.quadrifolia	Pepper wort	Marsileaceae	Dicot	-	5.12
S.zeylanica	-	Companulaceae	Dicot	-	22.52
B.capnensis	-	Elatinaceae	Dicot	-	20.00
L.parviflora	-	Onagraceae	Dicot	-	13.57
M.vaginalis	Pond weed	Pontederiaceae	Dicot	Annual/Perennial	1.49
F.miliaceae	Globe fringerush	Cyperaceae	Monocot	Perennial	6.90
C.axillaries	-	Commelinaceae	Dicot	-	3.63

plant densities; forms dense mats of vegetation in the young crop and can cause rice yield losses upto 12 to 50% and it is an alternate host for *Xanthomonas campestris* (Rice Knowledge bank). The dominance of *C. difformis* was reported by Raghavendra *et al.*, 2015; Parthipan, 2016 and Satapathy *et al.*, 2020). Jungle rice is considered as a noxious weed in several crops and particularly in rice fields as it closely mimics rice in its vegetative growth stage (Catindig *et al.*, 2011). *Echinochloa* in the rice culture indicated that dark respiration rate of *Echinochloa* sp was considerably lower than that of rice such weeds appeared to be superior to rice in efficiently utilizing the environment and producing higher biomass due to their pathway of photosynthesis (Rabbani *et al.*, 2011).

The significant degree of persistence of the most significant weed species as progenitors in all phytosociological qualities could not be disconnected from their families' morphology and developmental attributes. Most of the weed species with the highest density, frequency, and abundance belonged to the Cyperaceae and Poaceae families. These weeds have the highest productivity, generating hundreds of thousands of seeds in a single growing season, reproduce by vegetative propagules, and seeds exhibit ecological similarity with crops in addition to extended seed dormancy. Perennial weeds provide the most significant difficulties in paddy fields because the largest seed bank remains in the soil, bringing forth the following generation in the next cropping cycle. It should be stressed that main weeds should be handled at the appropriate time to prevent the decline in paddy yield, and they should be eliminated before blooming and fruiting to minimise seed production and regulate seed bank in the soil for the following years.

Acknowledgement

I am thankful to all the faculty members of the Department of Agronomy for their encouragement and support. I express my gratitude to my Advisor Dr. G. Murugan, Assistant Professor, Department of Agronomy and Dr. V. Imayavaramban, Professor and Head, Department of Agronomy, Faculty of Agriculture, Annamalai University for constant support and guidance to carry out my research work.

References

Anonymous, 2022. 2nd advance estimates Ministry of Agriculture and Farmer's welfare.Government of India.

Catindig, J.L.A., Lubigan, R.T. and Johnson, D. 2011. *Echinochloacolona*. Factsheets about rice weeds: the dirty dozen. International Rice Research Institute.

Curtis, J.T. 1959. *The Vegetation of Wisconsin: An Ordination of Plant Community*. University of Winconsin press, Madison.

Kamble, T.C., Kakade, S.U., Nemade, S.U., Pawar, R.V and Apotikar, V.A. 2005. Integrated weed management in hybrid maize. *Crop Research*. 29 (2): 396-400.

Murugan, G. and Kathiresan, R.M. 2010. A survey of weed flora in rice fields of Cuddalore district of Tamil Nadu, India. *Plant Achives*. 10 (2): 647-649.

Naidu, V.S.G.R and Jay G. Varshney. 2007. *Weed Seed Atlas*. National Research Centre for Weed Science, Jabalpur.

Naidu, V.S.G.R. 2012. *Hand Book on Weed Identification*. Directorate of weed science research, Jabalpur, India. Pp.354.

Parthipan, T. 2016. Strategies for weed management in drum seeded rice under puddle condition (*Oryza sativa* L.). *International Journal of Forestry and Crop Improvement.* 7(1): 14–18.

Pielou, E.C. 1977. *Mathematical Ecology*. A Wiley interscience publication, New York. Pp.364-75.

Rabbani, N., Bajwa, R. and Javaid, A. 2011. Interference of five problematic weed species with rice growth and yield. *African Journal of Biotechnology*. 10 (10): 1854-1862.

Raghavendra, B.M., Susheela, R., Praveen Rao, V. and Madhavi, M. 2015. Efficacy of different weed management practiceson growth and yield of direct wet seeded rice sown throughdrum seeder. *The Bioscan.* 10(1): 97–101.

Satapathy, B.S., Duary, B., Saha, S., Munda, S., Singh, T. and Chatterjee, D. 2020. Yield and economics of drum-seeded rice (*Oryza sativa*) as influenced by broad-spectrum herbicides and herbicide mixtures. *Indian Journal of Agronomy*. 65(1): 41–46.

Shannon, C.E. and Wiener, W. 1963. *The Mathematical Theory of Communication*. University of Juionis Press, Urbana. 117.

Singh, P., Singh, P., Singh, L., Qayoom, S., Lone, B.A., Kanth, H., Singh, G., Gania, M.A. and Singh, K.N. 2015. A Phytosociological association of weeds in Summer-Kharif crops of Kashmir Valley under different eco-situations. *Journal of Agri Search.* 2 (3) : 183-188.

IRRI (International Rice Research Institute), 2006. Bringing hope, improving lives: strategic plan 2007 – 15. Manilla, Philippines. p.61.

http://www.knowledgebank.irri.org/training/factsheets/item/cyperus-difformis.