

Phytosociological Studies on Weed Species of Sugarcane Fields in Visakhapatnam District, Andhra Pradesh, India

N. Nagaraju*, Bandaru.V. Rao and M. Tarakeswara Naidu

Department of Botany, Andhra University, Visakhapatnam-530003, A.P., India.

*Corresponding Author's Email: nag.mim245@gmail.com

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ABSTRACT

Weeds inventory survey and phytosociological studies have been conducted in the sugarcane fields of Visakhapatnam district, Andhra Pradesh during the period 2012 to 2013. The survey has been carried out at 100 randomly selected sugarcane fields and well explored covering all the geographical areas of Visakhapatnam district, to identify the weed flora, species composition, density, frequency and importance values index (IVI). A total of 88 plant species, belonging to 75 genera and 33 families were identified. Among the 33 families have been recorded, out of these 16 families are representing each species. Asteraceae is the largest family representing 10 species, Poaceae occupies the second position with 8 species followed by Amaranthaceae and Euphorbiaceae having 7 species each, Malvaceae 6, Acanthaceae and Convolvulaceae having 5 species each. The results of phytosociological studies revealed that the species are *Cyperus rotundus* (42%) *Malvastrum coromandelianum* (2.4) most abundant weeds.

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Introduction:

Agricultural fields contain some small plants which are known as agrestals. Generally, weeds are perceived as unwanted intruders in agro-ecosystems that compete for resources, reduce yields, and force the use of human labor and technology to prevent crop losses(1). Weeds are plants that interfere our activities with negative value and plants that grow where they're not wanted. Weeds evolved as an interfering associate with our crops and competing with the main crops for soil, water, nutrients etc. (2, 3). Of the total annual loss of agricultural produce from various pests, weeds have a prominent share of over 45% (4). Weeds will usually have, with few exceptions, short vegetative phase, high reproductive output, and capable of limiting the crop yields (5). Sugarcane crop is a significant crop in Visakhapatnam district both in terms of acreage as well as productivity. The sugarcane cultivated fields are infested with a large number of weeds that result in heavy crop yield losses. Weed surveys are useful for determining the occurrence and importance of weed species in crop production systems (6, 7). Documenting the kinds of weed species and its relative distribution facilitates the establishment of priorities for research and extension services (8). Earlier, Murthy (9)

conducted a survey in North Coastal Andhra Pradesh to highlight the distribution of different weed species in all agricultural fields. However, no such reference exists on the weeds of sugarcane fields from Visakhapatnam district. An ecological survey of weed flora is must for a comprehensive idea of weed problem. Understanding the sociological structure of weeds in crop fields is a pre-requisite for its effective management. Identification and quantification of weed species present in different crop cultures and cropping systems is possible to provide strategies for weed control methods in important crops that can be adapted by marginal farmers. Since not all the weed species are important to determine the nature of weed communities, it will be desirable to know the quantitative characters like density, frequency and importance value of individual species. Present study has been taken up to collect the information on distribution of weeds of sugarcane fields from different areas of Visakhapatnam district for the first time.

Materials and methods:

Visakhapatnam District with an area of 11,161 lakhs ha is one of the north eastern coastal districts of Andhra Pradesh. It lies between 17⁰ – 15' and 18⁰ – 32'

Northern latitude and 18° – 54' and 80° – 30' in Eastern longitude. It is bounded on the North by the Orissa state and by Vizianagaram district, on the South by East Godavari district, on the West by Orissa state and on the East by Bay of Bengal. Sugarcane is the second largest crop after the rice crop cultivating in this area, varieties Viswamitra (87 A 298) mid late variety crop duration 11-12 months, Sarada (93 A 145) early variety crop duration 10 months, Kanakamahalakshmi (2001 A 63) early variety crop duration 10 months and Uttara (99 A 163) early variety crop duration 10 months are cultivating by the farmers of Visakhapatnam district. The sugarcane crops with these varieties were selected for the weeds inventory survey and phytosociological investigations in selected field sites. The studies were conducted before weeding during period 2012-2013 Kharif seasons (June-October). Field surveys at 100 random sugarcane fields have been well explored covering all the geographical areas of Visakhapatnam district for weed survey and phytosociological studies. The weeds encountered in the field sites of the above crop fields were carefully collected and identified. Random quadrat method was adopted for weed survey and studying phytosociological attributes of weeds. All the weeds from each quadrat were collected separately in polythene bags. After completing the weed collection from the sugarcane crop fields, the specimens were identified by comparing with the authentic certified specimens at the Andhra University herbarium, Department of Botany and Central National Herbarium (CAL) Howrah (for some grasses). Later, these identifications were checked again at the regional herbarium or in the laboratory with the help of floras, monographs and other relevant literature and consequently the correct name were provided to each plant. Abundance, density and frequency and their relative values and importance value index (IVI) were calculated by applying the following principles of Curtis and McIntosh (10), Misra (11) and Muller-Dombois and Ellenberg (12).

Frequency

$$= \frac{\text{Total number of quadrates in which the species occur}}{\text{Total number of quadrates studied}} \times 100$$

Density

$$= \frac{\text{Total number of individuals of a species in all quadrates}}{\text{Total number of quadrates studied}}$$

Abundance

$$= \frac{\text{Total number of individuals of a species in all quadrates}}{\text{Total number of quadrates in which the species occurred}}$$

Relative frequency

$$= \frac{\text{Frequency of individuals of a species}}{\text{Total frequency of all species}} \times 100$$

Relative density

$$= \frac{\text{Density of individuals of a species}}{\text{Total density of all species}} \times 100$$

Relative abundance

$$= \frac{\text{Abundance of individuals of a species}}{\text{Total abundance of all species}} \times 100$$

Important Value Index

$$= \text{Relative density} + \text{Relative frequency} + \text{Relative abundance}$$

Results and discussion

During the period of study, a total of 88 weeds belonging to 75 genera and 33 families were identified as sugarcane crop weeds in the study area (Table 1). Among the identified species 72 were dicots, 16 were monocots recorded exclusively from the sugarcane fields. Out of 33 families, 16 are monotypic, viz., representing only one species each, these are Apiaceae, Boraginaceae, Caesalpiniaceae, Lamiaceae, Mimosaceae, Molluginaceae, Oxalidaceae, Papaveraceae, Pedaliaceae, Rubiaceae, Sapindaceae, Solanaceae, Tiliaceae, Verbenaceae, Violaceae, and Zygophyllaceae.

Asteraceae is the largest family representing with 10 species, Poaceae occupies the second position with 8 species, whereas in Sugarcane fields of Srikakulam district Poaceae and Asteraceae were the dominant families (13). Amaranthaceae and Euphorbiaceae 7 species each, Malvaceae 6, Acanthaceae and Convolvulaceae 5 species each Fabaceae 4, Commelinaceae and Cyperaceae 3 each and Aizoaceae, Cleomaceae, Cucurbitaceae, Lamiaceae, Nyctaginaceae, Scrophulariaceae and Sterculiaceae 2 species each. Five weed families are represented with more or equal to 5 genera. Asteraceae is the largest with 10 genera followed by Poaceae (8), Amaranthaceae (6), Euphorbiaceae and Acanthaceae each with 5 genera. The largest genus is *Phyllanthus* with 3 species.

The weeds like *Cyperus rotundus* and *Parthenium hysterophorus* show maximum infestation. *Merremia hederacea*, *Acalypha lanceolata* were the most abundant weeds in sugarcane fields of north coastal Andhra Pradesh (14). However some of the weeds reported from the study area having positive aspects i.e., *Abutilon indicum*, *Aerva lanata*, *Ageratum conyzoides*, *Amaranthus spinosus*, *Cardiospermum halicacabum*, *Centella asiatica*, *Cleome viscosa*, *Eclipta prostrata*, *Evolvulus alsinoides*, *Heliotropium indicum*, *Hybanthus ennaespermus*, *Jjusticia procumbens*, *Leucas aspera*, *Mimosa pudica*, *Scoparia dulcis*, *Xanthium strumarium* etc. are of medicinal importance, used in traditional medicines by local people to treat their health problems. The weeds like *Acalypha indica*, *Amaranthus viridis*, *Boerhaavia*

diffusa, *Cardiospermum halicacabum*, *Cassia occidentalis*, *Centella asiatica*, *Coccinia grandis*, *Trianthema portulacastrum*, *Zaleya decandra* etc. are used in some cooking recopies of the study area.

The data pertaining to abundance, density, frequency of weeds are presented in table Table-1. The most frequent species is *Cyperus rotundus* (42%) followed by *Parthenium hysterophorus* (41%) *Digera muricata* (40%) *Ageratum conyzoides* (37%) *Acalypha indica*, *Cynodon dactylon*, *Euphorbia hirta*, *Physalis*

minima and *Sphaeranthus indicus* (35%), *Malvastrum coromandelianum* (2.4) is most abundant weed in sugarcane field followed by *Merremia hederacea* (2.33), *Cynodon dactylon* (2.31), *Boerhaavia erecta* (2.28) and *Mimosa pudica* (2.25). The Important Value Index (IVI) of individuals weed species encountered in the sugarcane crop fields identified *Cyperus rotundus* (6.10) is most important species followed by *Cynodon dactylon* (5.77), *Parthenium hysterophorus* (5.63), *Digera muricata* (5.6) and *Sphaeranthus indicus* (5.49).

Table: 1. Phytosociological attributes of Sugarcane weeds

| Name of the weed | TOI | TNI | F | D | A | R.F | R.D | R.A | IVI |
|----------------------------------|-----|-----|----|-----|-----|-----|-----|-----|-----|
| <i>Abutilon indicum</i> | 14 | 29 | 14 | 0.3 | 2.1 | 0.8 | 0.9 | 1.3 | 2.9 |
| <i>Acalypha indica</i> | 35 | 72 | 35 | 0.7 | 2.1 | 1.9 | 2.1 | 1.3 | 5.3 |
| <i>Achyranthes aspera</i> | 24 | 41 | 24 | 0.4 | 1.7 | 1.3 | 1.2 | 1.1 | 3.6 |
| <i>Aerva lanata</i> | 26 | 49 | 26 | 0.5 | 1.9 | 1.4 | 1.4 | 1.2 | 4.1 |
| <i>Ageratum conyzoides</i> | 37 | 57 | 37 | 0.6 | 1.5 | 2.1 | 1.7 | 1.0 | 4.7 |
| <i>Allmania nodiflora</i> | 21 | 35 | 21 | 0.4 | 1.7 | 1.2 | 1.0 | 1.0 | 3.2 |
| <i>Alternanthera sessilis</i> | 24 | 45 | 24 | 0.5 | 1.9 | 1.3 | 1.3 | 1.2 | 3.8 |
| <i>Amaranthus spinosus</i> | 14 | 30 | 14 | 0.3 | 2.1 | 0.8 | 0.9 | 1.3 | 3.0 |
| <i>Amaranthus viridis</i> | 21 | 42 | 21 | 0.4 | 2.0 | 1.2 | 1.2 | 1.2 | 3.6 |
| <i>Argemone mexicana</i> | 12 | 21 | 12 | 0.2 | 1.8 | 0.7 | 0.6 | 1.1 | 2.4 |
| <i>Barleria prianoitis</i> | 12 | 25 | 12 | 0.3 | 2.1 | 0.7 | 0.7 | 1.3 | 2.7 |
| <i>Biophytum sensitivum</i> | 15 | 29 | 15 | 0.3 | 1.9 | 0.8 | 0.9 | 1.2 | 2.9 |
| <i>Boerhaavia erecta</i> | 14 | 32 | 14 | 0.3 | 2.3 | 0.8 | 0.9 | 1.4 | 3.1 |
| <i>Boerhavia diffusa</i> | 24 | 45 | 24 | 0.5 | 1.9 | 1.3 | 1.3 | 1.2 | 3.8 |
| <i>Cardiospermum halicacabum</i> | 28 | 56 | 28 | 0.6 | 2.0 | 1.6 | 1.7 | 1.2 | 4.5 |
| <i>Cassia occidentalis</i> | 12 | 25 | 12 | 0.3 | 2.1 | 0.7 | 0.7 | 1.3 | 2.7 |
| <i>Centella asiatica</i> | 13 | 25 | 13 | 0.3 | 1.9 | 0.7 | 0.7 | 1.2 | 2.7 |
| <i>Chromolaena odorata</i> | 25 | 56 | 25 | 0.6 | 2.2 | 1.4 | 1.7 | 1.4 | 4.4 |
| <i>Citrullus colocynthis</i> | 19 | 29 | 19 | 0.3 | 1.5 | 1.1 | 0.9 | 0.9 | 2.9 |
| <i>Cleome gynandra</i> | 13 | 26 | 13 | 0.3 | 2.0 | 0.7 | 0.8 | 1.2 | 2.7 |
| <i>Cleome viscosa</i> | 15 | 31 | 15 | 0.3 | 2.1 | 0.8 | 0.9 | 1.3 | 3.0 |
| <i>Clitoria ternatea</i> | 12 | 21 | 12 | 0.2 | 1.8 | 0.7 | 0.6 | 1.1 | 2.4 |
| <i>Coccinia grandis</i> | 20 | 32 | 20 | 0.3 | 1.6 | 1.1 | 0.9 | 1.0 | 3.0 |
| <i>Commelina benghalensis</i> | 24 | 41 | 24 | 0.4 | 1.7 | 1.3 | 1.2 | 1.1 | 3.6 |
| <i>Corchorus acutangularis</i> | 32 | 65 | 32 | 0.7 | 2 | 1.8 | 1.9 | 1.3 | 5.0 |
| <i>Crotalaria verrucosa</i> | 18 | 29 | 18 | 0.3 | 1.6 | 1.0 | 0.9 | 1.0 | 2.9 |
| <i>Croton banplandianum</i> | 21 | 40 | 21 | 0.4 | 1.9 | 1.2 | 1.2 | 1.2 | 3.5 |
| <i>Cyanotis arachnoidea</i> | 18 | 31 | 18 | 0.3 | 1.7 | 1 | 0.9 | 1.1 | 3.0 |
| <i>Cyanotis cristata</i> | 15 | 25 | 15 | 0.3 | 1.7 | 0.8 | 0.7 | 1.0 | 2.6 |
| <i>Cymbopogon coloratus</i> | 7 | 9 | 7 | 0.1 | 1.3 | 0.4 | 0.3 | 0.8 | 1.4 |
| <i>Cynodo ndactylon</i> | 35 | 81 | 35 | 0.8 | 2.3 | 1.9 | 2.4 | 1.4 | 5.8 |
| <i>Cyperus rotundus</i> | 42 | 85 | 42 | 0.9 | 2.0 | 2.3 | 2.5 | 1.2 | 6.1 |
| <i>Dactyloctenium aegyptium</i> | 19 | 29 | 19 | 0.3 | 1.5 | 1.1 | 0.9 | 0.9 | 2.9 |

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|-----------------------------------|----|----|----|-----|-----|-----|-----|-----|-----|
| <i>Desmodium triflorum</i> | 12 | 20 | 12 | 0.2 | 1.7 | 0.7 | 0.6 | 1.0 | 2.3 |
| <i>Digera muricata</i> | 40 | 75 | 40 | 0.8 | 1.9 | 2.2 | 2.2 | 1.2 | 5.6 |
| <i>Echinochloa colona</i> | 21 | 41 | 21 | 0.4 | 2.0 | 1.2 | 1.2 | 1.2 | 3.6 |
| <i>Echinochloa crus-galli</i> | 25 | 49 | 25 | 0.5 | 2.0 | 1.4 | 1.4 | 1.2 | 4.1 |
| <i>Eclipta prostrata</i> | 25 | 45 | 25 | 0.5 | 1.8 | 1.4 | 1.3 | 1.1 | 3.8 |
| <i>Emilia sonchifolia</i> | 20 | 41 | 20 | 0.4 | 2.1 | 1.1 | 1.2 | 1.3 | 3.6 |
| <i>Eragrostis riperia</i> | 19 | 31 | 19 | 0.3 | 1.6 | 1.1 | 0.9 | 1.0 | 3.0 |
| <i>Euphorbia hirta</i> | 35 | 69 | 35 | 0.7 | 2.0 | 1.9 | 2.0 | 1.2 | 5.2 |
| <i>Euphorbia indica</i> | 29 | 45 | 29 | 0.5 | 1.6 | 1.6 | 1.3 | 1.0 | 3.9 |
| <i>Evolvulus alsinoides</i> | 32 | 65 | 32 | 0.7 | 2.0 | 1.8 | 1.9 | 1.3 | 5.0 |
| <i>Evolvulus nummularius</i> | 29 | 61 | 29 | 0.6 | 2.1 | 1.6 | 1.8 | 1.3 | 4.7 |
| <i>Heliotropium indicum</i> | 17 | 28 | 17 | 0.3 | 1.6 | 0.9 | 0.8 | 1.0 | 2.8 |
| <i>Hybanthus ennaespermus</i> | 19 | 31 | 19 | 0.3 | 1.6 | 1.1 | 0.9 | 1.0 | 3.0 |
| <i>Hygrophila auriculata</i> | 20 | 35 | 20 | 0.4 | 1.8 | 1.1 | 1.0 | 1.1 | 3.2 |
| <i>Indoneesiella echioides</i> | 7 | 10 | 7 | 0.1 | 1.4 | 0.4 | 0.3 | 0.9 | 1.6 |
| <i>Jatropha gossypifolia</i> | 5 | 7 | 5 | 0.1 | 1.4 | 0.3 | 0.2 | 0.9 | 1.3 |
| <i>Justicia glauca</i> | 15 | 25 | 15 | 0.3 | 1.7 | 0.8 | 0.7 | 1.0 | 2.6 |
| <i>Justicia procumbens</i> | 25 | 45 | 25 | 0.5 | 1.8 | 1.4 | 1.3 | 1.1 | 3.8 |
| <i>Lantana camara</i> | 21 | 41 | 21 | 0.4 | 2.0 | 1.2 | 1.2 | 1.2 | 3.6 |
| <i>Lemna gibba</i> | 10 | 15 | 10 | 0.2 | 1.5 | 0.6 | 0.4 | 0.9 | 1.9 |
| <i>Leptochloa chinensis</i> | 18 | 28 | 18 | 0.3 | 1.6 | 1.0 | 0.8 | 1.0 | 2.8 |
| <i>Leucas aspera</i> | 12 | 21 | 12 | 0.2 | 1.8 | 0.7 | 0.6 | 1.1 | 2.4 |
| <i>Macardonia procumbens</i> | 15 | 25 | 15 | 0.3 | 1.7 | 0.8 | 0.7 | 1.0 | 2.6 |
| <i>Malvastrum coromandelianum</i> | 10 | 24 | 10 | 0.2 | 2.4 | 0.6 | 0.7 | 1.5 | 2.7 |
| <i>Martynia annua</i> | 8 | 10 | 8 | 0.1 | 1.3 | 0.4 | 0.3 | 0.8 | 1.5 |
| <i>Melochia corchorifolia</i> | 18 | 35 | 18 | 0.4 | 1.9 | 1.0 | 1.0 | 1.2 | 3.2 |
| <i>Merremia gangetica</i> | 25 | 56 | 25 | 0.6 | 2.2 | 1.4 | 1.7 | 1.4 | 4.4 |
| <i>Merremia hederacea</i> | 15 | 35 | 15 | 0.4 | 2.3 | 0.8 | 1.0 | 1.4 | 3.3 |
| <i>Merremia tridentata</i> | 24 | 51 | 24 | 0.5 | 2.1 | 1.3 | 1.5 | 1.3 | 4.2 |
| <i>Mimosa pudica</i> | 32 | 72 | 32 | 0.7 | 2.3 | 1.8 | 2.1 | 1.4 | 5.3 |
| <i>Mollugo disticha</i> | 15 | 25 | 15 | 0.3 | 1.7 | 0.8 | 0.7 | 1.0 | 2.6 |
| <i>Ocimum basilicum</i> | 9 | 12 | 9 | 0.1 | 1.3 | 0.5 | 0.4 | 0.8 | 1.7 |
| <i>Oplismenus burmani</i> | 24 | 49 | 24 | 0.5 | 2.0 | 1.3 | 1.4 | 1.3 | 4.0 |
| <i>Panicum maximum</i> | 12 | 20 | 12 | 0.2 | 1.7 | 0.7 | 0.6 | 1.0 | 2.3 |
| <i>Parthenium hysterophorus</i> | 41 | 75 | 41 | 0.8 | 1.8 | 2.3 | 2.2 | 1.1 | 5.6 |
| <i>Pavonia zeylanica</i> | 21 | 41 | 21 | 0.4 | 2.0 | 1.2 | 1.2 | 1.2 | 3.6 |
| <i>Phyllanthus amarus</i> | 28 | 45 | 28 | 0.5 | 1.6 | 1.6 | 1.3 | 1.0 | 3.9 |
| <i>Phyllanthus virgatus</i> | 18 | 28 | 18 | 0.3 | 1.6 | 1.0 | 0.8 | 1.0 | 2.8 |
| <i>Physalis minima</i> | 35 | 68 | 35 | 0.7 | 1.9 | 1.9 | 2.0 | 1.2 | 5.2 |
| <i>Schoenoplectus articulatus</i> | 6 | 8 | 6 | 0.1 | 1.3 | 0.3 | 0.2 | 0.8 | 1.4 |
| <i>Scleria lithosperma</i> | 8 | 10 | 8 | 0.1 | 1.3 | 0.4 | 0.3 | 0.8 | 1.5 |
| <i>Scoparia dulcis</i> | 25 | 45 | 25 | 0.5 | 1.8 | 1.4 | 1.3 | 1.1 | 3.8 |
| <i>Sida cordata</i> | 18 | 32 | 18 | 0.3 | 1.8 | 1.0 | 0.9 | 1.1 | 3.0 |

| | | | | | | | | | |
|----------------------------------|----|----|----|-----|-----|-----|-----|-----|-----|
| <i>Sida cordifolia</i> | 25 | 48 | 25 | 0.5 | 1.9 | 1.4 | 1.4 | 1.2 | 4.0 |
| <i>Spermacoce hispida</i> | 21 | 47 | 21 | 0.5 | 2.2 | 1.2 | 1.4 | 1.4 | 3.9 |
| <i>Sphaeranthus indicus</i> | 35 | 75 | 35 | 0.8 | 2.1 | 1.9 | 2.2 | 1.3 | 5.5 |
| <i>Spilanthus acmella</i> | 21 | 45 | 21 | 0.5 | 2.1 | 1.2 | 1.3 | 1.3 | 3.8 |
| <i>Tephrosia purpurea</i> | 15 | 21 | 15 | 0.2 | 1.4 | 0.8 | 0.6 | 0.9 | 2.3 |
| <i>Trianthema portulacastrum</i> | 24 | 54 | 24 | 0.5 | 2.3 | 1.3 | 1.6 | 1.4 | 4.3 |
| <i>Tribulus terrestris</i> | 15 | 32 | 15 | 0.3 | 2.1 | 0.8 | 0.9 | 1.3 | 3.1 |
| <i>Tridax procumbens</i> | 25 | 48 | 25 | 0.5 | 1.9 | 1.4 | 1.4 | 1.2 | 4.0 |
| <i>Vernonia cinerea</i> | 25 | 42 | 25 | 0.4 | 1.7 | 1.4 | 1.2 | 1.0 | 3.7 |
| <i>Waltheria indica</i> | 12 | 21 | 12 | 0.2 | 1.8 | 0.7 | 0.6 | 1.1 | 2.4 |
| <i>Xanthium strumarium</i> | 21 | 45 | 21 | 0.5 | 2.1 | 1.2 | 1.3 | 1.3 | 3.8 |
| <i>Zaleya decandra</i> | 12 | 21 | 12 | 0.2 | 1.8 | 0.7 | 0.6 | 1.1 | 2.4 |

TOI = Total Occurrence of individuals, TNI = Total Number of Individuals, F = Frequency, D = Density, A = Abundance, RA= Relative Abundance, RF= Relative Frequency, RD= Relative density, IVI= Importance Value Index

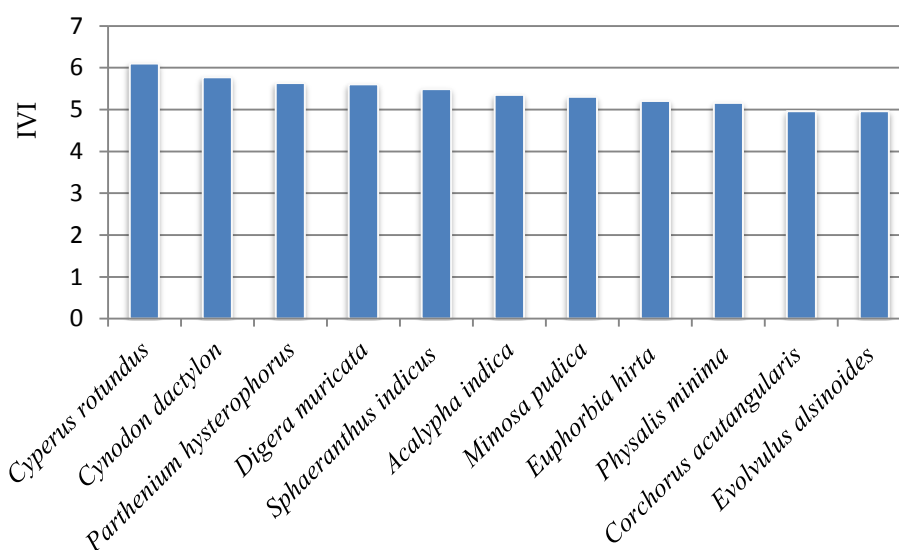


Fig. 1. Top 10 important weed species in Sugarcane fields of Visakhapatnam district.

Conclusion:

The present study was conducted to explore and identify the weeds of sugarcane fields. This study will help the farmers and agriculturists of the study area to identify the weeds and thus help in planning a suitable strategy for their control as these weeds compete with sugarcane crop for resources and hence reduce its yield. They also affect the quality of the crop and cause enormous loss to the farmers. A detailed study on the weeds of sugarcane crop fields in Visakhapatnam district was undertaken for the first time and the results obtained (regarding the taxonomy of weeds) sugarcane field weeds have clearly established the fact that the weed diversity in this region is high and significant. Diversity of weeds in the region perhaps attributed to

the availability of wide range of ecological conditions. The knowledge and information regarding the taxonomy and phytosociological attributes of the weeds of sugarcane crop lands in Visakhapatnam district will be communicated to the concerned governmental and non-governmental organizations and farmers for effective weed management and for better crop yielding. It is also helpful in designing suitable weed control technology for this area.

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