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RESEARCH ARTICLE

PYTOSOCIOLOGICAL STUDIES ON THE WEED FLORA OF COTTON CROP IN VISAKHAPATNAM DISTRICT, ANDHRA PRADESH, INDIA

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ABSTRACT

Cotton is one of the most important commercial crops cultivated throughout India. A survey on the weeds growing in cotton crop fields in the 43 mandals, of Visakhapatnam district was carried out to identify the weed flora, species composition, density, frequency and importance value index (IVI). A total of 55 different plant species belonging to 45 genera and 21 families have been recorded in cotton fields in the study area. Among 21 families Asteraceae was the largest weed family representing 10 weed species, while Euphorbiaceae with 7 species reported as the second largest weed family followed by Poaceae (5) and Cyperaceae (4). The results of phytosociological studies revealed that *Phyllanthus debilis* (3.10) was found to be the most abundant species followed by *Chromoleana odorata* (3.0) *Celosia argentea* (2.6) *Phyllanthus amarus* (2.6) and *Cyperus iria* (2.58). The Important Value Indiex (IVI) of individual weed species encountered in the cotton crop fields revealed that *Chenopodium album* (9.44) was the most important species followed by *Euphorbia hirta* (8.94), *Phyllanthus maderaspatensis* (8.62) *Cleome viscosa* (8.03) and *Tridax procumbens* (8.03) in that order.

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INTRODUCTION

Cotton (*Gossypium herbaceum L.*) is currently the leading plant fiber crop worldwide (Smith. 1999) and is one of the most important commercial crops of the Visakhapatnam district. Bt cotton varieties MCU-5, LRA-5166, LK-861 are being cultivated by the farmers in the study area. In India weeds pose a serious problem in crop production. Infestation of large number of weeds in crop fields, in general, causing heavy yield losses to commercial crops, is a common phenomenon (Diwari, 2012). Cotton crop fields of Visakhapatnam district are no exception to it. Weeds compete with crop plants for space, water and nutrients, often even more efficiently that ultimately reflect into crop yield losses resulting in high economic loses (Muzik, 1970). The greater competing ability of weeds critically influences the optimum crop yields. Weeds deplete large quantities of mineral nutrients and moisture more efficiently than the crop plants and thrive better over the crops in drought conditions. They shade the crop seedlings and occupy space where crop plants should grow their roots. Weeds require higher contents of nutrients than crop plants; they grow faster and absorb nutrients more efficiently and thus limiting the availability of the same to crop plants.

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Besides, the weeds inflict their allelopathic effects on crop plants which are largely through their depressive root exudates. Reduction in crop yield has a direct correlation with weed competition. Inspite of using modern mechanical methods in weed management programmes for the last few decades, globally weeds still remain as a major limiting factor in agricultural farming and productivity. Of the total annual loss of agricultural produce caused by various pests, weeds have a prominent share of over 45% (Rao, 1999). Depending on the degree of Competition, weeds reduce crop yields by 10-25%. In tropical countries like India, the yield loss has been estimated to the tune of over 30%. In general, one kilogram of weed growth corresponds to a reduction in one kilogram of crop growth. One of the most important reasons attributed to the success story of weeds is their biodiversity. Biodiversity in weed population results from taxonomic diversity, as well as genetic diversity which allow them to take advantage of the variety of conditions created by any given crop production system. Successful weed management requires a thorough knowledge of weed biodiversity. Better understanding of the biological characteristics of weeds allows us in controlling and restricting of weeds whether by traditional or modern management practices. Hence, proper identification of the weed species, knowledge on phonological attributes of the same are of primary concern in weed control measures. An inventory of weeds of an area will be of immense help in controlling the loss of crop productivity.

Phytosociology is the study relates to all phenomena and effects regarding social life of plants (Braun-Blanquet, 1932). A plant may react with close proximity of neighbors (weed) by failure to survival with plastic development (Alam, 1991). (Saritha, 2013). Analysis of quantitative relationships among the plant species growing in an area reflects structural property of the community. Understanding the sociological structure of weeds in crop fields is a prerequisite necessary for its effective management. Ecological surveys of weed flora give us a comprehensive idea on weeds dominance (Ilorkar and khatin 2003). Knowledge on the nature and extent of infestation of weed flora in an agroecosystem through weed surveys is essential in formulating relevant weed control strategies (Frick and Thomas, 1992). Identification and quantification of weed species present in different crop cultures and cropping systems allow us to form strategies for weed control methods in important crops that can be adapted by marginal farmers. Since all the weed species are important to determine the nature of weed communities, it is desirable to know the quantitative characters like density, frequency and importance value of individual species. Documenting the diversity of weed species and their relative distribution facilitates the establishment of priorities for research and extension services (McClosky *et al*., 1998). A survey conducted in North Coastal Andhra Pradesh by Murty (2012) documented the distribution of different weed species in three major crop fields viz. Rice, Sugarcane and Groundnut. The cotton crop cultivated fields of Visakhapatnam district are reported to be heavily infested with a large number of weeds, a common phenomenon to any agro ecosystem, causing heavy losses to the cotton crop yields. With little information on the presence and distribution of weeds in the district floras published, a comprehensive study on the weed species in cotton crops of Visakhapatnam has been taken up in the present study as a first ever attempt for the Visakhapatnam district.

MATERIALS AND METHODS

During the period of two years study from 2013-2014 a detailed weed survey and phytosociological on the weeds growing in the cotton crop fields has been carried out at 100 randomly selected cotton fields in 43 mandals of Visakhapatnam district (Fig. 1). Random quadrate method was adopted for the present study to identify the weed flora, species composition, density, frequency and importance value Index (IVI). Each of all the different weeds encountered in the field sites of the cotton crop fields were carefully collected and identified. All the plant species encountered in 100 quadrates of 100 field sites in cotton crops within the district boundary were documented with phytosociological attributes in Table-2. The important quantitative analysis in phytosociological studies such as abundance, density and frequency and their relative values and importance Value Index (IVI) were calculated following the principles of Curtis and Mclntosh (1950), Misra (1968) and Muller-Dombois and Ellenberg (1974).

Frequency

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

Density

$$\text{Density} = \frac{\text{Total number of individuals of a sepcies inall quadrates}}{\text{Total number of quadrates studied}}$$

Abundance

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

Relative frequency

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

Relative density

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

Relative abundance

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

Important value index (IVI)

Important Value Index
= Relative density + Relative density
+ Relative abundance

RESULTS AND DISCUSSION

In the present study a total of 55 weeds species belonging to 45 genera and 21 families were identified as cotton crop weeds in the study area. Among the identified species 45 were dicots, 10 were monocots exclusively recorded from cotton fields. Out of 21 families 9 are monotypic, viz., representing only one species each these are Aizoaceae, Caesalpiniaceae, Chenopodiaceae, Commelinaceae, Nyctaginaceae, Rubiaceae, Sterculiaceae, Tiliaceae, Zygophyllaceae,. Asteraceae is the largest family representing with 10 species, Euphorbiaceae occupies the second position with 7 species followed by Poaceae with 5, Cleomaceae and Cyperaceae 4 species each, Fabaceae with 3 species, Amaranthacea, Boraginacceae, Convolvulaceae, Cucurbitaceae, Lamiaceae, Malvaceae and Mullogonaceae with 2 species each. Genera *Cleome* and *Cyperus* representing 4 species each followed by *Phyllanthus* 3 species each, *Euphorbia, Evolvulus* and *Sida,* representing 2 species each. The data pertaining to abundance, density, frequency and their relative values for determining the distribution pattern and Importance Value Index (IVI) of the weeds encountered in cotton crop fields are provided in Table –2. A total of 55 weed species were recorded from 100 quadrates combining 100 field sites. The most frequent weed species are *Cleome viscosa, Chenopodium album, Euphorbia hirta, Tridax procumbens* (38%). *Phyllanthus debilis* (3.10) was found to be the most abundant species followed by *Chromolaena odorata* (3.0), *Celosia argentea* (2.6), *Phyllanthus amarus* (2.6) and *Cyperus iria* (2.58) in that order.The Important Value Index (IVI) of individuals weed species encountered in the cotton crop fields revealed that *Chenopodium album* (9.44) was the most important species followed by *Euphorbia hirta* (8.94), *Phyllanthus maderaspatensis* (8.62), *Cleome viscosa* (8.03) and *Tridax procumbens* (8.03) in that order (Table-2, Fig-2). Earlier workers reported *Cyperus rotundus* was the the most important species in sugarcane crops and *Marsilea quadrifolia* was the most important weed species in rice crops of the Visakhapatnam district (Nagaraju *et al,* 2014).

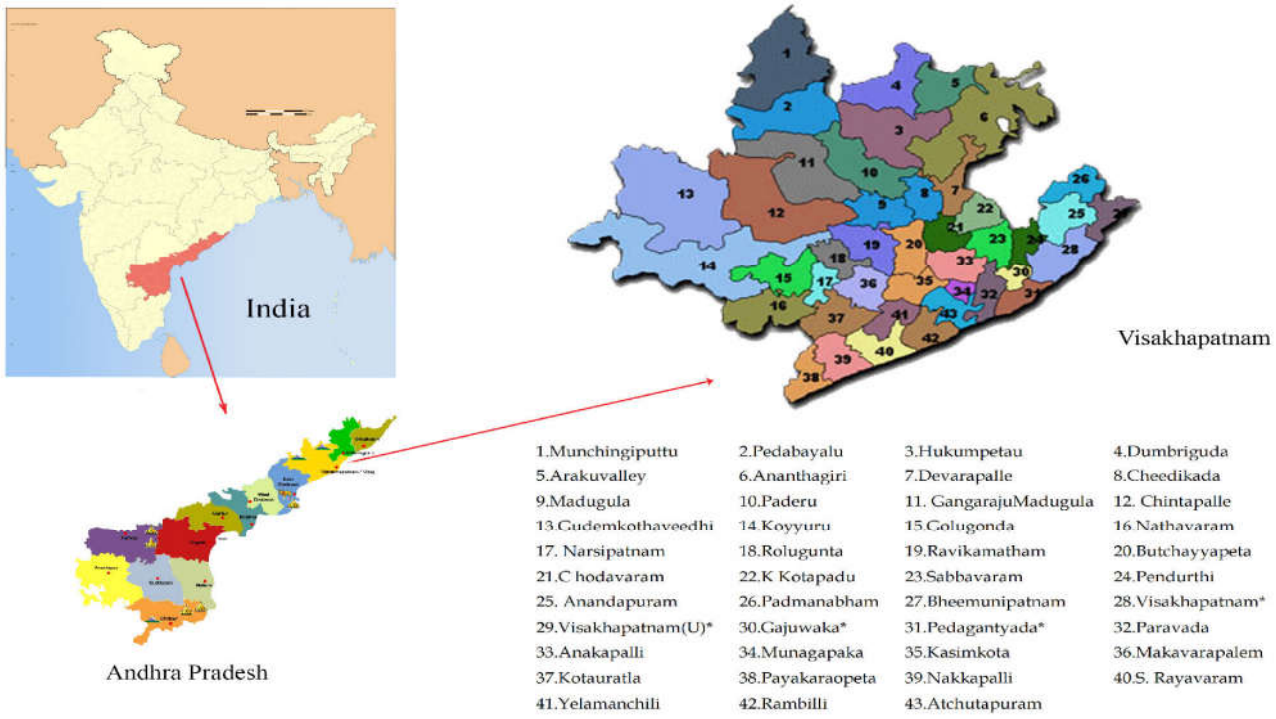

Fig. 1: Study Area

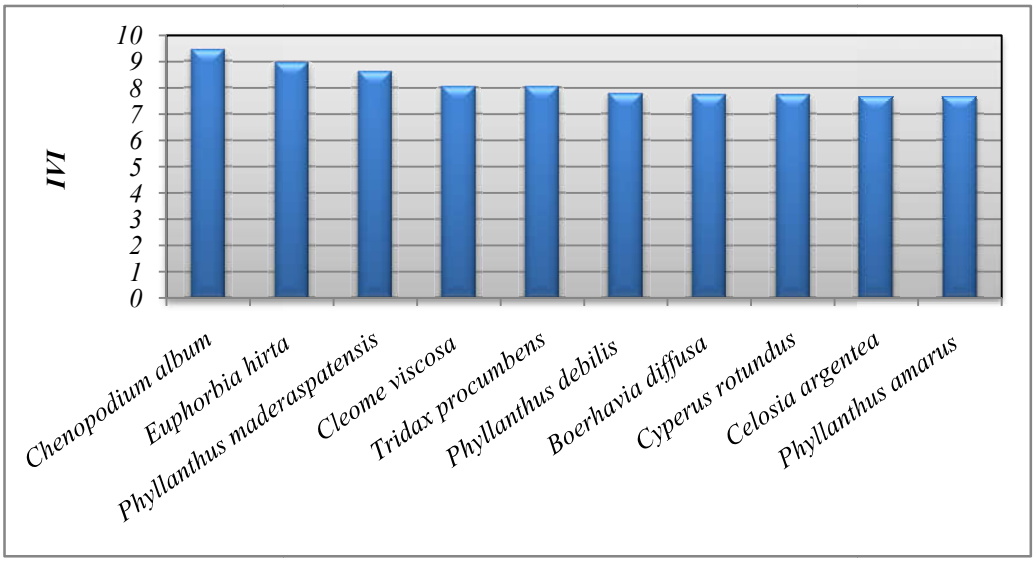

Fig. 2. Top 10 important weed species in cotton fields of Visakhapatnam district

In the present study broadleaves had higher diversity in species on the cotton crop fields but members of the Asteraceae family dominated the cotton weed community. In the terms of longevity and life forms the analysis on the life span of the weeds of cotton fields in the study area revealed that 74.54 % (41species) are annuals and 25.45 % (14 species) are biannual or perennials. Out of the 55 weed species herbs 37 (67.27%), shrubs 1 (1.81%), under shrubs 7 (12.71%), sedges 4 (7.27%), climber 1(1.81%) and grasses 5 (9.09%) recorded in the study. A critical study on the flora of Andhra Pradesh (Pullaiah and Chennaiah, 1997) has revealed the presence of 715 taxa as weeds in crop fields of the state 648 known as herbaceous weeds and 284 as grasses from different agro ecosystems from Andhra Pradesh. The available literature on Andhra Pradesh State indicates that the present quantitative analysis corroborate with previous workers findings. phytosociological study conducted by Prayaga Murthy, (2012) in two major crops, reported 56 and 78 weed species from rice and sugarcane fields respectively. *Wolffia globosa* was the most abundant and most important species in rice and *Cyperus rotundus* was the most important species in sugarcane fields of North Coastal region of Andhra Pradesh. Phytosociological studies by Kumar *et al.,* (2013) in the sugarcane crop fields of Srikakulam district indicated that *Parthenium hystophorus* was the most frequent and important weed species. In a floristic and phytosociological survey of Rayalaseema agro eco-systems (Lakshmaiah, 2006) *Echinochloa colona, Echinochloa crus-galli* were shown highest IVI values in majority of crop fields of the Rayalaseema region where *Echinochloa colona* was one of the most frequent weeds in rice fields and abundant weed in cotton fields of the Visakhapatnam district. Saritha (2013) surveyed crop fields of Chittoor district and studied phytosociological aspects of weed species especially in groundnut crop fields. Among the 21 identified weed species *Celosia argentea* has the highest density, frequency and abundance values.

Table 1. Analysis of cotton weed species of the study areas

Traditional plant group	Species
Dicotyledons:	
Polypetalae	17
Gamopetalae	17
Monochlamydae	11
Monocotyledons	10
Total species	55

Table 2. Identified weed species and their Phytosociological attributes in cotton fields of Visakhapatnam district

S.No	Name of the weed	TOI	TNI	F	D	A	R.F	R.D	R.A	IVI
1.	*Alysicarpus monilifer*	21	35	21	0.35	1.67	1.91	1.61	1.54	5.06
2.	*Boerhaavia diffusa*	31	65	31	0.65	2.10	2.82	2.99	1.93	7.75
3.	*Cassia absus*	10	19	10	0.19	1.90	0.91	0.87	1.75	3.54
4.	*Celosia argentea*	25	65	25	0.65	2.60	2.28	2.99	2.40	7.67
5.	*Chenopodium album*	38	85	38	0.85	2.24	3.46	3.91	2.06	9.44
6.	*Chromolaena odorata*	12	36	12	0.36	3.00	1.09	1.66	2.77	5.52
7.	*Citrullus colocynthis*	18	25	18	0.25	1.39	1.64	1.15	1.28	4.07
8.	*Cleome aspera*	12	21	12	0.21	1.75	1.09	0.97	1.61	3.67
9.	*Cleome gynandra*	18	31	18	0.31	1.72	1.64	1.43	1.59	4.65
10.	*Cleome monophylla*	9	15	9	0.15	1.67	0.82	0.69	1.54	3.05
11.	*Cleome viscosa*	38	65	38	0.65	1.71	3.46	2.99	1.58	8.03
12.	*Coldenia procumbens*	27	57	27	0.57	2.11	2.46	2.62	1.95	7.03
13.	*Commelina benghalensis*	21	45	21	0.45	2.14	1.91	2.07	1.98	5.96
14.	*Croton bonplandianum*	24	48	24	0.48	2.00	2.19	2.21	1.84	6.24
15.	*Cucumis sativus*	14	21	14	0.21	1.50	1.28	0.97	1.38	3.62
16.	*Cynodon dactylon*	21	52	21	0.52	2.48	1.91	2.39	2.28	6.59
17.	*Cyperus difformis*	18	35	18	0.35	1.94	1.64	1.61	1.79	5.04
18.	*Cyperus diffusus*	15	28	15	0.28	1.87	1.37	1.29	1.72	4.38
19.	*Cyperus iria*	12	31	12	0.31	2.58	1.09	1.43	2.38	4.90
20.	*Cyperus rotundus*	30	65	30	0.65	2.17	2.73	2.99	2.00	7.72
21.	*Dactyloctenium aegyptium*	19	31	19	0.31	1.63	1.73	1.43	1.50	4.66
22.	*Digera muricata*	15	35	15	0.35	2.33	1.37	1.61	2.15	5.13
23.	*Echinochloa colona*	10	25	10	0.25	2.50	0.91	1.15	2.31	4.37
24.	*Eclipta prostrata*	17	35	17	0.35	2.06	1.55	1.61	1.90	5.06
25.	*Emilia sonchifolia*	20	42	20	0.42	2.10	1.82	1.93	1.94	5.69
26.	*Euphorbia hirta*	38	78	38	0.78	2.05	3.46	3.59	1.89	8.94
27.	*Euphorbia indica*	24	51	24	0.51	2.13	2.19	2.35	1.96	6.49
28.	*Evolvulus alsinoides*	28	49	28	0.49	1.75	2.55	2.25	1.61	6.42
29.	*Evolvulus nummularius*	19	31	19	0.31	1.63	1.73	1.43	1.50	4.66
30.	*Grangea maderaspatana*	23	42	23	0.42	1.83	2.09	1.93	1.68	5.71
31.	*Hedyotis gracilis*	25	45	25	0.45	1.80	2.28	2.07	1.66	6.01
32.	*Indigofera hirsuta*	10	24	10	0.24	2.4	0.91	1.10	2.21	4.23
33.	*Lagascea mollis*	12	25	12	0.25	2.08	1.09	1.15	1.92	4.16
34.	*Leucas cephalotes*	24	38	24	0.38	1.58	2.19	1.75	1.46	5.39
35.	*Melochia corchorifolia*	28	59	28	0.59	2.11	2.55	2.72	1.94	7.21
36.	*Mollugo cerviana*	9	12	9	0.12	1.33	0.82	0.55	1.23	2.60
37.	*Ocimum gratissimum*	5	7	5	0.07	1.40	0.46	0.32	1.29	2.07
38.	*Oplismenus burmannii*	12	28	12	0.28	2.33	1.09	1.29	2.15	4.53
39.	*Parthenium hysterophorus*	19	45	19	0.45	2.37	1.73	2.07	2.18	5.99
40.	*Phyllanthus amarus*	25	65	25	0.65	2.60	2.28	2.99	2.40	7.67
41.	*Phyllanthus debilis*	21	65	21	0.65	3.10	1.91	2.99	2.85	7.76
42.	*Phyllanthus maderaspatensis*	35	75	35	0.75	2.14	3.19	3.45	1.98	8.62
43.	*Sebastiania chamaelea*	9	14	9	0.14	1.56	0.82	0.64	1.43	2.90
44.	*Sida acuta*	12	19	12	0.19	1.58	1.09	0.87	1.46	3.43
45.	*Sida cordata*	15	24	15	0.24	1.60	1.37	1.10	1.48	3.95
46.	*Sorghum halepense*	8	15	8	0.15	1.88	0.73	0.69	1.73	3.15
47.	*Synedrella nodiflora*	15	35	15	0.35	2.33	1.37	1.61	2.15	5.13
48.	*Tephrosia purpurea*	18	32	18	0.32	1.78	1.64	1.47	1.64	4.75
49.	*Trianthema portulacastrum*	28	48	28	0.48	1.71	2.55	2.21	1.58	6.34
50.	*Tribulus terristris*	27	35	27	0.35	1.30	2.46	1.61	1.20	5.27
51.	*Trichodesma indicum*	26	45	26	0.45	1.73	2.37	2.07	1.60	6.04
52.	*Tridax procumbens*	38	65	38	0.65	1.71	3.46	2.99	1.58	8.03
53.	*Triumfetta pentandra*	17	21	17	0.21	1.24	1.55	0.97	1.14	3.65
54.	*Vernonia cinerea*	18	34	18	0.34	1.89	1.64	1.56	1.74	4.95
55.	*Xanthium strumarium*	15	35	15	0.35	2.33	1.37	1.61	2.15	5.13

Despite the negative impacts of weeds, some weed species actually proved to be beneficial in terms of their medicinal value. Visakhapatnam district, being one of the hot spots for floristic diversity, offers immense scope for medicinal plant research. Out of 55 weed species collected in the present study about 14 weed species *Cassia absus, Celosia argentea, Chenopodium album, Cleome aspera, Coldenia procumbens, Cynodon dactylon, Cyperus rotundus, Eclipta prostrata, Ephorbia hirta, Evolvulus alsinoides, Phyllanthus amarus, Tribulus terristris, Tridax procumbens* and *Xanthium strumarium* infesting the cotton crop fields of the study area have been reported to have the potential medicinal values regularly used as essential ingredients for preparing herbal medicines by native people.

Similar studies carried out by Padal *et al.* (2013) on Chinthapalli mandal, Visakhapatnam district revealed 35 dominant weeds with ethno-medicinal uses. Knowledge on proper exploitation and utilization of the weed species by propagation, scientific conservation would greatly enhance the economic status of farmers.

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