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Ecological aspects of weed flora of turmeric (*Curcuma longa* L.) fields of Visakhapatnam District, A.P., India

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Abstract

Turmeric (*Curcuma longa* L) is one of the most valuable spices all over the world and important medicinal plant. Visakhapatnam is one of the turmeric (*Curcuma longa* L) growing areas it is being grown during rainy season and is a long duration crop. Turmeric fields are severely infested with 118 (94 dicots, 24 monocots) weed species belonging to 99 genera and 36 families. *Parthenium hysterophorus* was most abundant weed followed by *Elephantopus scaber, Merremia hederacea, Merremia tridentata* and *Conyza stricta* etc . *Parthenium hysterophorus* followed by *Cyperus rotundus, Cynodon dactylon and Trianthema portulacastrum, Boerhavia diffusa* etc., were found to be most densely populated weeds. *Cyperus rotundus, Parthenium hysterophorus, Boerhavia diffusa* and, *Cynodon dactylon and Trianthema portulacastrum* etc. were high frequency species. The Important Value Index calculated for the individual weed species encountered in field revealed interesting results. *Parthenium hysterophorus* was the most important species followed by the *Cyperus rotundus, Trianthema portulacastrum, Cynodon dactylon* and *Boerhavia diffusa*. Out of 118 species: A class is represented by 56 species followed by 37 under B, 19 under C and 4 under D, 2 species under E. There is an urgent need to take necessary intervention to create awareness among the farmers for adopting integrated weed management strategies to improve and maintain the quality and yield of turmeric. Further research work is needed in the fields of weed control and weed biology.

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Introduction

Turmeric (*Curcuma longa* L.) is one of the most valuable spices all over the world and important medicinal plant. It is to prevent cancer diseases, tumours and the production of free radicals, and to improve liver and kidney functions (Hermann and Martin, 1991) found antibacterial activities of essential oils in *Curcuma longa* L. It has been used for a long time in Bangladesh, India, Myanmar, Pakistan, Sri Lanka and Thailand as a spice, cosmetic and medicine. It is cultivated mainly in India, Myanmar, Nigeria, Pakistan, Sri Lanka, Indonesia, Bangladesh, Taiwan and China. The world production of turmeric is estimated to be about 1, 60,000 tonnes, of which India accounts for 78 per cent (Anon., 1999). In India, it is grown over an area of 1, 40,000 ha with a average production of 6, 00,000 tonnes and the productivity is 4.29 tonnes per ha (Anon., 1999). It is mainly grown in the states of Andhra Pradesh (51,900 ha), Orissa (19,700 ha), Tamil Nadu (15,200 ha), Assam (10,000 ha) and Karnataka (4,100 ha) (Anon., 1999). On account of its flavour and medicinal properties, turmeric is also used in the preparation of cosmetics, soaps, ointments; face creams toothpastes *etc.* (Pujari *et al.*, 1986). The average composition of turmeric is moisture (6.0%), protein (6.5%), ash (6.0%), crude fibre (3.0%), starch (5.0%), fixed oil (3.5%), volatile oil (4.5%) and curcumin (3.1%) (Manjunath *et al.*, 1991). Weed surveys are useful for determining the occurrence and importance of weed species in crop production systems (Frick and Thomas, 1992). Documenting the kinds of weed species and its relative distribution facilitates the establishment of priorities for research and extension services (McClosky *et al.,* 1998). The presence of weeds in the fields and their impact on the crop production and environment has been well documented (Morse *et al.,* 1995; Randall, 1996; Fröhlich *et al.,* 2000; Hassan and Marwat, 2001).

Visakhapatnam is one of the turmeric (*Curcuma longa* L) growing areas it is being grown during rainy season and is a long duration crop. Hence, a large number of weeds compete for nutrients, moisture and space causing considerable yield reduction (Daulay and Singh, 1982). Weeds compete with crops for physical resources of environment, exhibit allelopathy, provide habitats for other harmful organisms cause problems during harvest, ploughing and seed purification. The farmers, therefore, control the weeds, to enhance productivity. The biology of weeds including identification and distribution, also deserve attention for effective control. The ecological information has always been pre-requisite for such efforts. Weeds of sugarcane fields (Adiseshu, 1997; Prayaga Murty, 2009) and Weed flora of crop fields (Prayaga Murty 2009)) have been reported. However, no such reference exists on the weeds of turmeric fields from Visakhapatnam district. Present study an attempt has been taken to collect information on distribution of weeds of turmeric fields from different areas of Visakhapatnam district for the first time.

Materials and methods

Study area

Visakhapatnam district, with an area of 13,460 Sq. Km accredited as the largest district in the Northern Andhra Pradesh. It lies between 17° 12' to 83° 33' N latitudes and 82°18' to 83°22' E longitudes. In the Northern side it borders with Srikakulam district, in the North West side Orissa, Bay of Bengal in the East and South and East Godavari District in the South West. The soils are red ferruginous loams mixed with quartzite in the hill slopes and sandy to clay in the lower slopes and villages. In valleys the soil is fertile and characterized by the presence of humus on top. Calcareous and lateritic soils are met with in the more open and badly eroded terrain. In the densely wooded parts the ground is covered with a thick layer of humus. District shows variation in climatic conditions from plain regions to hilly areas. Near coast, the air is moist and relaxing, but gets warmer towards the interior and cools down in the hilly areas because of elevation and vegetation. The temperature is low and cool climate is seen in the hilly regions compared to the plains. The mean maximum

temperature is 33.6ºC and the mean minimum temperature is 21.0ºC. In some hill areas like Anantagiri, Araku, Paderu and Chintapalli the temperature touches to 10ºC or even low during the months of December and January. The rainfall varies from plain to hill regions, hilly areas receive more rainfall than the plain regions. The annual rainfall in the hill regions is 1000-2000 mm while that of the plain regions is 800-1000mm.Out of total rainfall South – West monsoon accounts for 60-65% while North – East monsoon contributes 30-35% and the rest is shared by summer and winter showers.

All the weeds encountered in the field sites (G. Madugula, Chintapalli, Tajangi, Lambasingi, Mondigadda, G.K. Veedi, Vanjangi, Kilchari, R.V. Nagar, Killam kota, Maddigaruvu,, Sobhakota, Kommulamamidi, Minumuluru, Sompi, Kothavalasa and Madagada etc.) of the turmeric crop fields were carefully collected and identified. Random quadrate method was adopted for studying phytosociological attributes of weeds. Quadrates of 1x1m were laid down and hence a sum of 60 quadrates for turmeric crop. All the weeds from each quadrate were collected separately in polythene bags. All the plant species encountered in 60 quadrates were listed.

The phytosociological attributes: abundance, density and frequency and their relative values and Importance Value Index (IVI) were calculated the following principles of Curtis and Mclntosh (1950), Misra (1968) and Mueller-Dombois and Ellenberg (1974).

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

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

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

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

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

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

Importance Value Index = Relative density + Relative frequency + Relative abundance

Based on Raunkiaer (1934), the frequency classes of weed species were determined. Accordingly there are 5 frequency classes, i.e. 'A' class with the species of frequency ranging from 1-20%; 'B' class 21-40%; 'C' class 41-60%; 'D' class 61-80% and 'E' class 81-100%. Further the weed community frequency patterns were compared with the normal frequency pattern of Raunkiaer (A>B>C>=D<E). Based on the frequency pattern of the community, the homogeneity and heterogeneity of the vegetation. If the values are high with respect to B, C and D, then the community is said to be heterogeneous where as higher values of E indicates the homogeneous nature.

Results

Turmeric fields are severely infested with 118 weed species belonging to 99 genera and 36 families. Of these Asteraceae and Poaceae stood first and second with 20 and 19 species respectively followed by Amarantaceae (7); Euphorbiaceae and Rubiaceae with 6 species respectively; Convolvulaceae (5); Cyperaceae, Fabaceae and Malvaceae with 4 species each; Acantaceae, Lamiacae, Scrophulaceae and Verbinaceae with 3 species each; Aristolociaceae, Boraginaceae, Caryophyllaceae, Commelinaceae, Oxalidaceae, Portulacaeae and Solanaceae with 2 species; Aizoaceae, Brassicaceae, Chenopodiaceae, Cuscutaceae, Elatinaceae, Gentianaceae, Hypoxidaceae, Fumariaceae, Liliaceae, Mimosaceae, Nyctaginaceae, Pedaliaceae, Sapindaceae, Tiliaceae and Violacecae represents single species only (Table 1).

Abundance, Density, Frequency and their relative values for determining the distribution pattern and Importance Value Index (IVI) of the weeds encountered in turmeric crop fields was provided in Table -1**.** A total of 118 weed species (94 dicots, 24 monocots) was recorded from 60 quadrates. *Parthenium hysterophorus* (3.71) was most abundant weed followed by *Elephantopus scaber*(3.17), *Merremia hederacea, Merremia tridentata* (3.00) and *Conyza stricta* (2.67) etc . *Parthenium hysterophorus* (3.03) followed by

Cyperus rotundus(2.10) *Cynodon dactylon and Trianthema portulacastrum (* 1.27) *Boerhavia diffusa (*1.07) etc., were found to be most densely populated weeds. *Cyperus rotundus (*96.67) *Parthenium hysterophorus (*81.67) *Boerhavia diffusa (*71.67) and, *Cynodon dactylon and Trianthema portulacastrum (*68.33) etc. were high frequency species (Table-1). The Important Value Index calculated for the individual weed species encountered in field revealed interesting results. *Parthenium hysterophorus (*11.34) was the most important species followed by the *Cyperus rotundus (*8.93), *Trianthema portulacastrum, Cynodon dactylon* (6.02) and *Boerhavia diffusa (*Table-1). The frequency classes of the weed species encountered in the study was analyzed and frequency formula for each class also determined. It is revealed interesting results. Out of 118 species: A class is represented by 56 species followed by 37 under B, 19 under C and 4 under D, 2 species under E. (Table 2)

Table 1. Phytosociological attributes of weeds.

S.No	Name of the Species	Family	TOI	TNI	A	D	F	FC	RA	RD	RF	IVI
1	*Abutilon crispum*	Malvaceae	4	4	1.00	0.07	6.67	A	0.57	0.14	0.22	0.93
2	*Abutilon indicum*	Malvaceae	3	4	1.33	0.07	5.00	A	0.76	0.14	0.16	1.06
3	*Acanthospermum hispidum*	Asteraceae	21	28	1.33	0.47	35.00	B	0.76	1.01	1.14	2.91
4	*Aerva lanata*	Amaranthaceae	32	34	1.06	0.57	53.33	C	0.60	1.23	1.74	3.57
5	*Ageratum conyzoides*	Asteraceae	31	33	1.06	0.55	51.67	C	0.60	1.19	1.69	3.48
6	*Allmania nodiflora*	Amaranthaceae	33	48	1.45	0.80	55.00	C	0.83	1.73	1.79	4.35
7	*Alloteropsis cimicina*	Poaceae	4	4	1.00	0.07	6.67	A	0.57	0.14	0.22	0.93
8	*Alpuda mutica*	Poaceae	8	12	1.50	0.20	13.33	B	0.85	0.43	0.44	1.72
9	*Alternanthera sessilis*	Amaranthaceae	36	46	1.28	0.77	60.00	C	0.73	1.66	1.96	4.34
10	*Amaranthus spinosus*	Amaranthaceae	18	31	1.72	0.52	30.00	B	0.98	1.12	0.98	3.08
11	*Amaranthus viridis*	Amaranthaceae	19	24	1.26	0.40	31.67	B	0.72	0.87	1.03	2.62
12	*Aristolochia bracteolata*	Aristolochiaceae	6	6	1.00	0.10	10.00	A	0.57	0.22	0.33	1.11
13	*Aristolochia indica*	Aristolochiaceae	4	4	1.00	0.07	6.67	A	0.57	0.14	0.22	0.93
14	*Arundinella ciliaata*	Poaceae	16	23	1.44	0.38	26.67	B	0.82	0.83	0.87	2.52
15	*Arundinella pumila*	Poaceae	13	18	1.38	0.30	21.67	B	0.79	0.65	0.71	2.14
16	*Bergia ammannioides*	Elatinaceae	4	6	1.50	0.10	6.67	A	0.85	0.22	0.22	1.29
17	*Bidens pilosa*	Asteraceae	29	41	1.41	0.68	48.33	C	0.80	1.48	1.58	3.86
18	*Blumeopsis flava*	Asteraceae	11	19	1.73	0.32	18.33	A	0.98	0.69	0.60	2.26
19	*Boerhavia diffusa*	Nyctaginaceae	43	64	1.49	1.07	71.67	D	0.85	2.31	2.34	5.49
20	*Brachiaria ramosa*	Poaceae	9	18	2.00	0.30	15.00	A	1.14	0.65	0.49	2.27
21	*Byttneria herbacea*	Sterculiaceae	15	17	1.13	0.28	25.00	A	0.64	0.61	0.82	2.07
22	*Canscora diffusa*	Gentianaceae	7	16	2.29	0.27	11.67	A	1.30	0.58	0.38	2.26
23	*Cardiospermum halicacabum*	Sapindaceae	21	23	1.10	0.38	35.00	B	0.62	0.83	1.14	2.59
24	*Celosia argentea*	Amaranthaceae	11	19	1.73	0.32	18.33	A	0.98	0.69	0.60	2.26
25	*Chenopodium album*	Chenopodiaceae	13	18	1.38	0.30	21.67	B	0.79	0.65	0.71	2.14
26	*Chloris barbata*	Poaceae	40	44	1.10	0.73	66.67	D	0.62	1.59	2.18	4.39
27	*Chromolaena odorata*	Asteraceae	5	6	1.20	0.10	8.33	A	0.68	0.22	0.27	1.17
28	*Chrozophora rottleri*	Euphorbiaceae	4	7	1.75	0.12	6.67	A	0.99	0.25	0.22	1.46
29	*Commelina benghalensis*	Commelinaceae	16	31	1.94	0.52	26.67	B	1.10	1.12	0.87	3.09
30	*Conyza stricta*	Asteraceae	3	8	2.67	0.13	5.00	A	1.51	0.29	0.16	1.97

31	*Corchorus aestuans*	Tiliaceae	4	6	1.50	0.10	6.67	A	0.85	0.22	0.22	1.29
32	*Crotalaria medicaginea*	Fabaceae	5	11	2.20	0.18	8.33	A	1.25	0.40	0.27	1.92
33	*Curculigo orchioides*	Hypoxidacea	6	9	1.50	0.15	10.00	A	0.85	0.32	0.33	1.50
34	*Cuscuta reflexa*	Cuscutaceae	8	8	1.00	0.13	13.33	A	0.57	0.29	0.44	1.29
35	*Cyanotis cristata*	Commelinaceae	16	23	1.44	0.38	26.67	B	0.82	0.83	0.87	2.52
36	*Cynodon dactylon*	Poaceae	41	76	1.85	1.27	68.33	D	1.05	2.74	2.23	6.02
37	*Cyperus difformis*	Cyperaceae	34	63	1.85	1.05	56.67	C	1.05	2.27	1.85	5.17
38	*Cyperus rotundus*	Cyperaceae	58	126	2.17	2.10	96.67	E	1.23	4.55	3.15	8.93
39	*Dichanthium annulatum*	Poaceae	3	5	1.67	0.08	5.00	A	0.95	0.18	0.16	1.29
40	*Dichrocephala integrifolia*	Asteraceae	2	3	1.50	0.05	3.33	A	0.85	0.11	0.11	1.07
41	*Digera muricata*	Amaranthaceae	34	62	1.82	1.03	56.67	C	1.04	2.24	1.85	5.12
42	*Digitaria ciliaris*	Poaceae	9	17	1.89	0.28	15.00	A	1.07	0.61	0.49	2.18
43	*Dinebra retroflexa*	Poaceae	11	13	1.18	0.22	18.33	A	0.67	0.47	0.60	1.74
44	*Drymaria cordata*	Caryophyllaceae	4	6	1.50	0.10	6.67	A	0.85	0.22	0.22	1.29
45	*Echinochloa colona*	Poaceae	24	38	1.58	0.63	40.00	B	0.90	1.37	1.31	3.58
46	*Echinochloa crusgalli*	Poaceae	23	36	1.57	0.60	38.33	B	0.89	1.30	1.25	3.44
47	*Elephantopus scaber*	Asteraceae	6	19	3.17	0.32	10.00	A	1.80	0.69	0.33	2.81
48	*Eleusine indica*	Poaceae	7	11	1.57	0.18	11.67	A	0.89	0.40	0.38	1.67
49	*Emilia sonchifolia*	Asteraceae	28	36	1.29	0.60	46.67	C	0.73	1.30	1.52	3.55
50	*Eragrostis ciliata*	Poaceae	21	26	1.24	0.43	35.00	B	0.70	0.94	1.14	2.78
51	*Euphorbia hirta*	Euphorbiaceae	18	28	1.56	0.47	30.00	B	0.88	1.01	0.98	2.87
52	*Evolvulus alsinoides*	Convolvulaceae	4	6	1.50	0.10	6.67	A	0.85	0.22	0.22	1.29
53	*Evolvulus nummularius*	Convolvulaceae	6	8	1.33	0.13	10.00	A	0.76	0.29	0.33	1.37
54	*Fumaria indica*	Fumariaceae	1	1	1.00	0.02	1.67	A	0.57	0.04	0.05	0.66
55	*Galinsoga parviflora*	Asteraceae	1	1	1.00	0.02	1.67	A	0.57	0.04	0.05	0.66
56	*Galium asperifolium*	Rubiaceae	2	3	1.50	0.05	3.33	A	0.85	0.11	0.11	1.07
57	*Goniogyna hirta*	Fabaceae	21	26	1.24	0.43	35.00	B	0.70	0.94	1.14	2.78
58	*Grangea maderaspatana*	Asteraceae	26	34	1.31	0.57	43.33	C	0.74	1.23	1.41	3.38
59	*Heliotropium indicum*	Boraginaceae	10	13	1.30	0.22	16.67	A	0.74	0.47	0.54	1.75
60	*Hybanthus enneaspermus*	Violaceae	17	19	1.12	0.32	28.33	B	0.63	0.69	0.92	2.24
61	*Justicia glauca*	Acanthaceae	2	4	2.00	0.07	3.33	A	1.14	0.14	0.11	1.39
62	*Kyllinga nemoralis*	Cyperaceae	33	61	1.85	1.02	55.00	C	1.05	2.20	1.79	5.05
63	*Lagascea mollis*	Asteraceae	18	26	1.44	0.43	30.00	B	0.82	0.94	0.98	2.74
64	*Lantana indica*	Verbenaceae	7	13	1.86	0.22	11.67	A	1.05	0.47	0.38	1.90
65	*Leucas biflora*	Lamiaceae	18	21	1.17	0.35	30.00	B	0.66	0.76	0.98	2.40
66	*Leucas stricta*	Lamiaceae	7	11	1.57	0.18	11.67	A	0.89	0.40	0.38	1.67
67	*Lindernia parviflora*	Scrophulariaceae	2	3	1.50	0.05	3.33	A	0.85	0.11	0.11	1.07
68	*Lindernia ciliata*	Scrophulariaceae	13	19	1.46	0.32	21.67	B	0.83	0.69	0.71	2.22
69	*Malvastrum coromandelianum*	Malvaceae	16	24	1.50	0.40	26.67	B	0.85	0.87	0.87	2.59
70	*Melochia corchorifolia*	Sterculiaceae	17	26	1.53	0.43	28.33	B	0.87	0.94	0.92	2.73
71	*Merremia gangetica*	Convolvulaceae	2	4	2.00	0.07	3.33	A	1.14	0.14	0.11	1.39
772	*Merremia hederacea*	Convolvulaceae	2	6	3.00	0.10	3.33	A	1.70	0.22	0.11	2.03
73	*Merremia tridentata*	Convolvulaceae	6	18	3.00	0.30	10.00	A	1.70	0.65	0.33	2.68

74	*Mimosa pudica*	Mimosaceae	12	19	1.58	0.32	20.00	A	0.90	0.69	0.65	2.24
75	*Orthosiphon rubicudus*	Lamiaceae	8	17	2.13	0.28	13.33	A	1.21	0.61	0.44	2.26
76	*Oxalis corniculata*	Oxalidaceae	11	21	1.91	0.35	18.33	A	1.08	0.76	0.60	2.44
77	*Oxalis latifolia*	Oxalidaceae	8	17	2.13	0.28	13.33	A	1.21	0.61	0.44	2.26
78	*Parthenium hysterophorus*	Asteraceae	49	182	3.71	3.03	81.67	E	2.11	6.57	2.66	11.34
79	*Pedalium murex*	Pedaliaceae	13	23	1.77	0.38	21.67	B	1.00	0.83	0.71	2.54
80	*Pennisetum polystachyon*	Poaceae	2	3	1.50	0.05	3.33	A	0.85	0.11	0.11	1.07
81	*Pentanema indicum*	Asteraceae	1	1	1.00	0.02	1.67	A	0.57	0.04	0.05	0.66
82	*Perotis indica*	Poaceae	36	38	1.06	0.63	60.00	C	0.60	1.37	1.96	3.93
83	*Phyla nodiflora*	Verbenaceae	30	41	1.37	0.68	50.00	C	0.78	1.48	1.63	3.89
84	*Phyllanthus amarus*	Euphorbiaceae	34	63	1.85	1.05	56.67	C	1.05	2.27	1.85	5.17
85	*Phyllanthus debilis*	Euphorbiaceae	26	32	1.23	0.53	43.33	C	0.70	1.15	1.41	3.27
86	*Phyllanthus maderaspatensis*	Euphorbiaceae	27	36	1.33	0.60	45.00	C	0.76	1.30	1.47	3.52
87	*Physalis minima*	Solanaceae	8	12	1.50	0.20	13.33	A	0.85	0.43	0.44	1.72
88	*Polycarpaea corymbosa*	Caryophyllaceae	7	16	2.29	0.27	11.67	A	1.30	0.58	0.38	2.26
89	*Portulaca oleracea*	Portulacaceae	16	28	1.75	0.47	26.67	B	0.99	1.01	0.87	2.87
90	*Portulaca quadrifida*	Portulacaceae	13	19	1.46	0.32	21.67	B	0.83	0.69	0.71	2.22
91	*Pycreus flavidus*	Cyperaceae	11	11	1.00	0.18	18.33	A	0.57	0.40	0.60	1.56
92	*Rorippa indica*	Brassicaceae	23	23	1.00	0.38	38.33	B	0.57	0.83	1.25	2.65
93	*Rostellularia procumbens*	Acanthaceae	19	26	1.37	0.43	31.67	B	0.78	0.94	1.03	2.75
94	*Rubia cordifolia*	Rubiaceae	17	24	1.41	0.40	28.33	B	0.80	0.87	0.92	2.59
95	*Saccharum spontaneum*	Poaceae	4	4	1.00	0.07	6.67	A	0.57	0.14	0.22	0.93
96	*Scoparia dulcis*	Scrophulariaceae	21	23	1.10	0.38	35.00	B	0.62	0.83	1.14	2.59
97	*Sebastiania chamaelea*	Euphorbiaceae	18	24	1.33	0.40	30.00	B	0.76	0.87	0.98	2.60
98	*Setaria pumila*	Poaceae	6	6	1.00	0.10	10.00	A	0.57	0.22	0.33	1.11
99	*Solanum nigrum*	Solanaceae	16	18	1.13	0.30	26.67	B	0.64	0.65	0.87	2.16
100	*Sonchus oleraceus*	Asteraceae	21	24	1.14	0.40	35.00	B	0.65	0.87	1.14	2.66
101	*Spermacoce hispida*	Rubiaceae	19	26	1.37	0.43	31.67	B	0.78	0.94	1.03	2.75
102	*Spermacoce articularis*	Rubiaceae	17	19	1.12	0.32	28.33	B	0.63	0.69	0.92	2.24
103	*Sphaeranthus indicus*	Asteraceae	36	43	1.19	0.72	60.00	C	0.68	1.55	1.96	4.19
104	*Spilanthes calva*	Asteraceae	24	28	1.17	0.47	40.00	B	0.66	1.01	1.31	2.98
105	*Stachytarpheta jamaicensis*	Verbenaceae	13	16	1.23	0.27	21.67	B	0.70	0.58	0.71	1.98
106	*Thecagonum biflorum*	Rubiaceae	3	3	1.00	0.05	5.00	A	0.57	0.11	0.16	0.84
107	*Thecagonum ovalifolium*	Rubiaceae	4	4	1.00	0.07	6.67	A	0.57	0.14	0.22	0.93
108	*Themeda tremula*	Poaceae	7	7	1.00	0.12	11.67	A	0.57	0.25	0.38	1.20
109	*Thunbergia fragrans*	Acanthaceae	4	4	1.00	0.07	6.67	A	0.57	0.14	0.22	0.93
110	*Trianthema portulacastrum*	Aizoaceae	41	76	1.85	1.27	68.33	D	1.05	2.74	2.23	6.02
111	*Trichodesma indicum*	Boraginaceae	23	28	1.22	0.47	38.33	B	0.69	1.01	1.25	2.95
112	*Tridax procumbens*	Asteraceae	27	29	1.07	0.48	45.00	C	0.61	1.05	1.47	3.12
113	*Urena lobata*	Malvaceae	16	18	1.13	0.30	26.67	B	0.64	0.65	0.87	2.16
114	*Urginea indica*	Liliaceae	25	27	1.08	0.45	41.67	C	0.61	0.97	1.36	2.95
115	*Vernonia albicans*	Asteraceae	11	13	1.18	0.22	18.33	A	0.67	0.47	0.60	1.74
116	*Vernonia cinerea*	Asteraceae	31	42	1.35	0.70	51.67	C	0.77	1.52	1.69	3.97

117	*Vigna trilobata*	Fabaceae	3	4	1.33	0.07	5.00	A	0.76	0.14	0.16	1.06
118	*Zornia diphylla*	Fabaceae	6	8	1.33	0.13	10.00	A	0.76	0.29	0.33	1.37

Table 2. Frequency classes of weed species.

S. No	Frequency classes	Turmeric field
1	A: 01-20	56
2	B:21-40	37
3	C:41-60	19
4	D:61-80	4
5	E:81-100	2
6	Total	118

Frequency formulae A>B>C>D>E. From the obtained results it is clearly established that most of the weed species encountered in the turmeric crop field fall under A, B,C, D and E frequency classes and hence the weed vegetation is relatively heterogeneous.

Discussion

The frequently occurring species viz *Cyperus rotundus, Parthenium hysterophorus, Boerhaavia diffusa, Cynodon dactylon, Trianthema portulacastrum, Chloris barbata, Perotis indica, Sphaeranthus indicus, Alternanthera sessilis, Phyllanthus amarus, Cyperus difformis and Digera muricata* are also found in other crops where they are known to cause heavy yield losses due to competition for nutrients, water, and space and sometimes through the release of allelochemicals (Rabbani and Bajwa,2001). Out of 118, majority of species reported in different crop fields of North Coastal Andhra Pradesh by Prayaga Murty (2009); 78 weed species reported by Adiseshu (1997) from sugarcane field of Anakapalli, most of the species are similar to the present study. *Cyperus rotundus* is one of the prominent weed of the present study. This weed is the native of India but has become cosmopolitan, spread over most of the tropic countries, and is treated as the world's worst weed. (Holm *et al.* 1977). It is one of the weeds that appear immediately after sowing and may compete heavily with the crop plants for nutrients and water. Majority of the weed species which are noted in this work are found place among the agrestals recorded as weeds in North Coastal Andhra Pradesh, Andhra Pradesh and in India in general (Tadulingam and Venkata narayana 1932; Chandrasingh and Narayana Rao 1973; Sen 1981; Rao 1986; Prayaga Murty, 2009). Some of the weeds reported from the study area i.e. *Abutilon crispum, Abutilon indicum, Aristolochia bracteolate, Aristolochia indica, Boerhavia diffusa, Commelina benghalensis, Cynodon dactylon, Cyperus rotundus, Heliotropium indicum, Hybanthus enneaspermus, Mimosa pudica, Pedalium murex, Phyla nodiflora, Trianthema portulacastrum, Tridax procumbens* etc., are of medicinal importance used in pharmaceutical industries . The weeds like *Alternanthera sessilis, Amaranthus spinosus, Amaranthus viridis, Commelina benghalensis, Digera muricata, Eleusine indica, Oxalis corniculata, Oxalis latifolia, Portulaca oleracea, Portulaca quadrifida, Solanum nigrum, Trianthema portulacastrum etc.* are used as leafy vegetables. *Solanum nigrum, Portulaca oleracea ,Trianthe portulacastrum* etc. are used for certain cooking recipes in the study area. These finding are in great analogy of Gupta *etal.,* (2008) and Dangwal *etal.,* (2010). The present study may be helpful in identification of weeds of turmeric field. It may be useful for taxonomists, agriculturists and scientists involved in the management of weeds. There is an urgent need to take necessary intervention to create awareness among the farmers for adopting integrated weed management strategies to improve and maintain the quality and yield of turmeric. Further research work is needed in the fields of weed control and weed biology.

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References

Adiseshu G. 1997. Ecological aspects of weed flora of Sugarcane fields at Anakapalle Ph.D. Thesis submitted to the Andhra University, Visakhapatnam.

Anonymous 1999. *Production Year Book,* Food and Agriculture Organization of UnitedNation, Rome.

Chandra Singh DJ, Narayana Rao K. 1973. Weed flora of Andhra Pradesh. PANS **19(2),** 223-229.

Curtis JT, Mclntosh RP. 1950. The interrelationships of certain analytic and synthetic Phytosocioogical characters. Ecology **31,** 434-455.

Dangal RL, Singh AD, Singh T, Sharma A, Sharma C. 2010. Common weeds of Rabi(winter) crops of Tehsil Nowshera district rajouri (J7K), India. Pak. J. Weed Sci.Res. **16(1),** 39-45.

Daulay HS, Singh KC. 1982. Chemical weed control in greengram and clusterbean. Indian J. Agric. Sci. **52(11),** 758-763.

Frick B, Thomas AG. 1992. Weed surveys in different tillage systems in south-western Ontario field crops. Can. J. Plant Sci. **72,** 1337-1347.

Frick B, Thomas AG. 1992. Weed surveys in different tillage systems in south-western Ontario field crops. Can. J. Plant Sci. **72,** 1337-1347.

Gupta A, Joshi SP, Manahas RK. 2008. Multivariate analysis of diversity and composition of weeds communities of wheat fields in Doon valley india, trop. Ecol. **49,** 103 112.

Hermann PTA, Martin AW. 1991. Pharmacology of *Curcuma longa*. Planta Med. **57,** 1-7.

Holm LG, Plucknett DL, Pancho JV, Herberger JP. 1977. The World's Worst Weeds. University Press of Hawai, Hawai.

McClosky WB, Baker PB, Sherman W. 1998. Survey of cotton weeds and weed control practices in Arizona upland cotton fields. Publication AZ1006 cotton: College of Agric., Univ. Of Arizona.

Misra R. 1968. Ecology workbook. Oxford and IBH publishing company Ltd., New Delhi.

Morse LE, Kartesz JT, Kutner LS. 1995 Native vascular plants. Our Living Resources: A Report to the Nation on the Distribution, Abundance, and Health of U.S. Plants, Animals and Ecosystems. U.S. Department of the Interior, National Biological Service, Washington, DC, p. 205-209.

Muller-Dombois Ellenberg H. 1974. Aims and Methods of Vegetation Ecology. John Wiley and Sons, New York.

Prayaga Murty P. 2009. Studies on Weed Flora of Crop Fields of North Coastal Andhra Pradesh, India Ph.D Thesis, Andhra University, Visakhapatnam.

Randall JM. 1996. Weed control for the preservation of biologicaldiversity. Weed Tech. **10,** 370-381.

Fröhlich J, Fowler SV, Gianotti A, HillR, Kilgore E, Morin L, Sugiyama L,Winks C. 2000. Biological control of mist flower (*Ageratina riparia*, Asteraceae) in New Zealand. Proc., Xth International Symp. on Biological Control of Weeds, 4-14 July1999, Bozeman, Montana USA, p. 51-57.

Hassan G, Marwat KB. 2001. Integrated weed management inagricultural crops.National Workshop on Technologies for Sustainable.

Manjunath MN, Sattigeri VV, Nagaraj KV. 1991. Curcumin in turmeric. Spice India **4(3),** 7-9.

Pujari PD, Patil RB, Sakpal RT. 1986. "Krishna" – A high yielding variety of turmeric. *Indian Cocoa,* Arecanut and Spices J. **14,** 65-66.

Rabbani N, Bajwa R. 2001. Weeds distribution in rice fields offive districts of the Punjab. Pak. J. Bot. **33 (special issue),** 541-549.

Rao VS. 1986. Principles of Weed Science. Oxford and I.B.H.Pub.Co., New Delhi.

Raunkiaer C. 1934. The Life forms of Plants and Statistical Plant Geography. Clarendon Press, Oxford.

Sen DN. 1981. Ecological Approaches to Indian weeds. Geobios International, Jodhpur.

Tadulingam C, Narayana GV. 1932. A Hand Book of some South Indian weeds. Govt Press, Madras.