ECOLOGICAL DISTRIBUTION AND BEHAVIOUR OF WEEDS IN AND OUTSIDE THE CULTIVATED LANDS

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ABSTRACT

In the present paper an attempt to study the distributional behaviour of the weed flora commonly occurring in the cultivated lands has been made. The chlorophyll content of the weeds, dry matter production per unit area have been estimated in addition to the frequency and density of the weeds distributed within the cultivated lands. The results lead us to the conclusion that where the original vegetation consists of grassland type, a few native species have persisted and spread as weeds. Certain weeds have greater density and frequency in the outer most area and are absent in the centre, while others are evenly distributed in all regions. This variation in the distribution of weeds is attributed to the variation in the adaptability of the weeds to the microclimatic conditions.

INTRODUCTION

Our country's efforts to improve the agricultural produce are confronted with several problems of which the growth of weeds in lands cultivated for different crops have been causing considerable damage to the plants, effecting the yield. The weeds vary in type and density from one region to the other in consonance with the differences in the climates or microclimates. India is a sub-continent with a wide range of variation in the environmental conditions; therefore the menance caused by weeds requires close regionwise studies for their eradication or at least for minimising the harmful effects on the crops. The present work records our studies on this aspect of ecology.

The way in which the weeds compete with the crop and garden plants for essential requirements, such as water, mineral nutrients, CO_2 of air and radiant energy, on which the manufacture of sugars by the green leaf depends, has been brought to light by SALISBURY (1942). The need for thorough ecological studies of crop-weed-association for suggesting biological control of weeds has been emphasized by PANDYA AND SOOD (1974) as eradication of weeds could not be accomplished by hand-picks or by the use of weedicides. The particulars of the species of weeds, their density of distribution both within and outside the crop land, are not given in any of the works from India to which the authors had the access. The difficulty in determining whether the weeds originated from the native flora or introduced by the various activities has been pointed out by TURRIL (1929). With the view that such a study would help in understanding of their relationship the present work has been undertaken.

MATERIAL AND METHODS

Three fields were selected for study. The area of the fields taken up for study was one hectare each. The results presented in this paper are the mean of the three fields studied. For the purpose of practical study, they were divided theoritically into four areas :

(1) Outer Area (O.A.) The area just outside the field, i.e. boundary of the field.

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(2) Border Area	(B.A.)	Upto two meters inside from the boundary.
(3) Inner Area	(I.A.)	From 2 meters to 15 meters from the boundary.
(4) Central Area	(C.A.)	The whole central area except 15 meters from boundary.

Observations were made three weeks after sowing the cotton crop in the fields as the weeds appear mostly at that stage of the crop and compete with the crop. The study of frequency and density was made by quadrats of size one sq. meter taken at random. Ten quadrats were studied at each reading. In each quadrat the density and frequency of weeds were noted. Then all the plants from the quadrats were clipped at the base and the harvest was separated specieswise. The harvest was then dried in an oven at 105°C. Thus the biomass of each species above the ground is obtained by weighing the oven dried material.

The third leaf was taken from all the weeds of the different areas and chlorophyll content has been estimated by following the method of DEXBURRY AND YENTSCH (1956). The readings of chlorophyll content presented in the paper were the mean of 5 replicates.

RESULTS AND DISCUSSION

The results given in Table 1 represent the density of the weeds in the field studied, their frequency of occurrence and biomass. The results show that the species like *Dichanthium annulatum* which is having 100% frequency in the outer area, is entirely absent in the other areas, i.e. border, inner and central areas. Same is the case with grassy species like *Thelepogon elegans*, *Panicum javanicum* and also with *Lagascea mollis*. While other species, i.e. *Euphorbia thymifolia* has 70% and 60% frequency in outer and border areas respectively, it is not occurring in the inner and central areas. The frequency of *Xanthium strumarium* is 40%, 50% and 10% in outer, border and inner areas respectively, while in the central area it is absent. Among the other weeds, *Cyperus rotundus* has almost equal frequency in all areas and *Commelina* sp., *Acalypha indica* were less frequent in its occurrence in the outer area but their frequency was almost equal in all other areas, indicating that the lesser frequency of these weeds in the outermost areas was mainly due to the interspecific ecological competition in the species occurring there. The results of density show that the maximum density was of grassy species in the outermost areas, but their absence in the field possibly suggest that the microclimatic conditions might have played an important role, to which those species could not get acclamatised. The most adapted weed *Cyperus rotundus* has equal density in all the areas of study. The case is similar with *Achyranthes alternifolia* while the other weeds like *Acalypha indica*, *Cyanotis tuberosa* and *Commelina nodiflora* have lesser density in the outermost areas, but they have almost equal density comparatively in border, inner and central areas, indicating the possible adaptation to the microclimatic conditions of the crop land, and the lesser density in outermost area was due to the interspecific competition. The importance of microclimate has been stressed by many authors (KALAMKAR, 1935; RAMDAS, 1934, 1946; RAMDAS & KATHI., 1934).

The presence of all weeds in the outermost area (ie. O.A.) and the absence of a few species like *Xanthium strumarium*, *Euphorbia thymifolia* in central and inner areas and central area respectively show that the weeds had entered into the cropfield from the outermost area which is of grassland type of vegetation. Some species like *Cyperus rotundus*, *Achyranthes alternifolia*, *Commelina nodiflora*, *Cyanotis tuberosa*, *Acalypha indica* get adapted to the microclimatic conditions of the cropfield and hence occur in all the areas of the field, while other species like *Euphorbia thymifolia* and *Xanthium strumarium* were able to invade upto border and inner areas of the field respectively. Thus, the results lead to the conclusion that the

Table 1—Density, frequency (%) and biomass (gms/m²) of weeds inside and outside the cultivated land

Name of species	Outer Area O.A.			Border Area B.A.			Inner Area I.A.			Central Area C.A.		
	Density	Frequency	Biomass	Density	Frequency	Biomass	Density	Frequency	Biomass	Density	Frequency	Biomass
Dichanthium annulatum	159	100	46.7	..	..	..	..	..	..	..	..	..
Thelepogon elegans	140	100	38.6	..	..	..	..	..	..	..	..	..
Panicum javanicnm	162	100	47.8	..	..	..	..	..	..	..	..	..
Cyperus rotundus	16	60	9.76	28	70	17.08	24	70	14.4	28	70	21.6
Lagascea mollis	80	100	23	..	..	..	..	..	..	..	..	..
Achyranthes altenifolia	28	50	7.3	32	50	6.3	30	40	9.8	28	30	7.4
Commelina nodiflora	4	20	16.4	56	50	28.0	84	60	4.3	44	60	18.2
Cyanotis tuberosa	62	30	18.6	168	100	42.6	180	100	47.3	173	100	43.7
Euphorbia thymifolia	26	70	4.94	21	60	4.62	..	..	..	..	..	..
Xanthium strumarium	4	40	4.8	6	50	4.24	2	10	2.13	..	..	..
Acalypha indica	9	20	.36	118	100	10.62	86	100	7.74	93	100	6·5

Table 2—Chlorophyll-a, chlorophyll-b and total chlorophyll content of the weeds of in and outside (mg/gm fresh wt.) the cultivted land

Name of species	Chlorophyll-a				Chlorophyll-b				Total Chlorophyll			
	O.A.	B.A.	I.A.	C.A.	O.A.	B.A.	I.A.	C.A.	O.A.	B.A.	I.A.	C.A.
Acalypha indica	0.9300	1.2592	1.7096	0.8028	0.2872	0.1320	0.6112	0.3566	1.2172	1.3912	2.3188	1.1594
Cyperus rotundus	3.5596	1.5425	1.5382	2.1753	0.2952	0.3024	0.3748	0.0620	1.8548	1.8449	1.9130	2.2373
Commelina nodiflora	0.6539	1.3265	1.2993	1.0307	0.0996	0.4457	0.3817	0.3026	1.7535	1.7722	1.6810	1.3333
Achyranthes alternifolia	0.8288	0.9411	1.2004	1.3032	0.3306	0.3922	0.3289	0.3158	1.1594	1.3333	1.5293	1.6190
Cyanotis tuberosa	0.4836	0.4408	0.5089	0.4733	0.0472	0.0466	0.0784	0.0483	0.5308	0.4874	0.5873	0.5216
Xanthium strumarium	2.0657	1.6848	1.5865	..	0.6008	0.5236	0.5003	..	2.6665	2.2084	2.0868	..
Euphorbia thymifolia	1.2930	1.4700	..	..	0.4460	0.6168	..	..	1.7390	2.0868	..	..
Crop:												
Gossyium herbaceum	..	1.3028	1.3449	1.6406	..	0.5214	0.5680	0.5622	..	1.8242	1.9129	2.2028

O.A.—Outer area; B.A.—Border area; I.A.—Inner area; and C.A.—Central area.

original vegetation consisted of grassland type; few native species have persisted and spread as weeds.

Chlorophyll content can also be used to estimate the productivity potential of producers of the ecosystem (Misra *et al.*, 1970). Same view was expressed earlier by Yusho and Monsi (1963). Hence the chlorophyll content was estimated for seven weeds which were occurring within the cropland and the results are given in Table 2. If we take the total chlorophyll content into consideration, *Cyperus rotundus* which has equal frequency and density in almost all areas has 1.8548, 1.8449, 1.9130, 2.2373 mg/gm fresh wt total chlorophyll in outer area, border area, inner area and central area respectively. Thus it is well adapted for all regions of the cropfield. In fact, the data of chlorophyll content can give a clue of the adaptive mechanism of the species from the local flora which tend to turn weed of cultivated lands. The gradual enrichment in the chlorophyll in *Cyperus rotundus* and some other species in areas from outer towards centre shows adaptation of weeds in field and is a proof of photosynthetic adaptations in weak light conditions, i.e. due to shade. *Cyanotis tuberosa* and *Achyranthes alternifolia* have also, almost equal chlorophyll content at all regions. *Acalypha indica* was much adapted well upto middle area of the field, as there is gradual increase in chlorophyll content from 1.2172 mg/gm fresh wt of the outer area to 2.3188 mg/gm fresh wt in the inner area. But the plants of the central area have lesser chlorophyll content than the plants of the other areas which indicates weakness for adaptation in the central area. The higher chlorophyll content in *Xanthium strumarium* in the outer area decreases gradually in the plants of internal areas, indicating its adaptability in the former area better than those of the latter. Similar is the case with *Euphorbia thymifolia*, but higher concentration of chlorophyll, i.e. indirectly productivity potential in the plants of border area, indicates that in future *Euphorbia thymifolia* may enter into the inner and central areas of the field.

The soil of the border area has been tested for seed population. The study shows that seeds of grass species were present but the plants were not established (detailed study is under progress). This shows that those on the border areas are not well adapted to the prevailing microclimatic conditions existing in the fields.

From the observations and results of the study it has been found that the microclimatic conditions such as soil, light, temperature, play a vital role in the prevalence of weeds, acclimatising themselves to the new habitat.

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