Distribution of weed flora in late-sown wheat

Abstract

A detailed floristic survey using random sampling was done during two years of study. Among the weed species, some were present throughout the cropping period while some appeared at later stages of crop and few showed shorter life cycle. It clearly indicates that these weeds have flourished well by weed seed bank. It provided a clue to species diversity in a community and each species that had its own range of ecological amplitude which indicate the condition of the habitat. In the first season of the study, 15 weed species (13 broadleaved weeds, 1 grass and 1 sedge) belonging to 12 families and 12 genera were identified. Among the total species the diversity of the species was found within Fabaceae (3 species), Poaceae (2 species) and the remaining families had only 1 species each. In the second year of the study, the weed population was comparatively lesser and only 10 weed species belonging to the same 9 families and 9 genera were identified. As many as 15 species of weeds were recorded in the field during both the cropping periods. Fabaceae and Poaceae had three and two species respectively while the remaining ten families had only one species each. Monocot were represented by Poaceae and Cyperaceae. *Anagallis arvensis* L. and *Chenopodium album* L. were among the broadleaved weeds, followed by annual grassy weed *Phalaris minor* L. and the perennial sedge *Cyperus rotundus* L. were the most dominant weeds which were present. The field was mainly infested with the broad-leaved weeds (78.57%), along with grasses (14.29%) and sedges (7.14%). The weed species occurring were compared and it was observed that 75.32% of weeds species were similar, conversely it may be stated that 24.68% of weeds were dis-similar compared to the previous year.

Keywords - Relative Density, Relative Frequency, Importance Value Index, Summed Dominance Ratio, Coefficient of Similarity

Introduction

Wheat (*Triticum aestivum* L.) is the most widely cultivated winter cereal crop of North-Western Plain Zone and Central Zone of India. The productivity of wheat is governed by many factors, but one of the most serious and less noticed causes of low yield is the presence of weeds. Wheat fields are infested with many monocotyledonous (grassy) and dicotyledonous (broad-leaved) weeds which may cause the yield loss of 7 to 50% based on the kind of weed flora and their intensity (Chhokar *et al.* 2012). Chemical weed control is a preferred practice due to scare and costly labour as well as lesser feasibility of mechanical or manual weeding in wheat. Late sowing of wheat is a common practice in rice-wheat, cotton-wheat, sugarcane-wheat, potato-wheat, vegetable pea- wheat cropping systems. The reasons for late sowing of wheat are late transplanting of rice, late harvest of preceding crops, use of long-duration rice varieties and heavy rains during later phase of rice. The level of weed infestation is more with largest number

of weeds in late-sown, where the crop did not form a closed canopy. The reduction of grain yield in late sown wheat was reported up to 34.3% due to mixed weed flora (Meena *et al.* 2017).

Materials and methods

A field experiment was conducted during the two successive *rabi* seasons of 2022-23 and 2023-24 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences at a height of 98 meters above mean sea level (MSL). The experimental site is situated in the agro-climatic zone IV-middle gangetic plain, at 25°24'22" N latitude and 81°50'56" E longitude. A total of 12 plots were observed and examined to check the occurrence and growth of different weed flora. The weeds were allowed to grow uninterruptedly along with the experimental crop. A recommended dose 120-60-60 kg/ha of NPK was given to accomplish the nutrient requirement of the crop. At 60 DAS, the weeds that occurred in the experimental field were counted. The sampling was done by destructive method and the weed count was done by the help of quadrats (0.5m x 0.5m) (Kim and Moody, 1983) at two places and the number was expressed in m^2 area. The weeds that came within the quadrat were uprooted and collected in the paper bag from the 12 sampling plots. Later, the collected weed samples were separated and counted on the basis of morphology, attributes and species type. The weeds were classified on the basis of morphology namely, broadleaf weeds, grassy weeds and sedges. The quantative parameters such as absolute density, relative density, absolute frequency, relative frequency, importance value index was calculated and the dominance ratio of the dominant occurring weeds was also determined.

$$\text{Absolute Density} = \frac{\text{Total No.of individuals in all quadrats}}{\text{Total No.of quadrats employed}}$$

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

$$\text{Absolute Frequency} = \frac{\text{No.of quadrats in which given species occur}}{\text{Total No. of quadrats employed}} \times 100$$

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

$$\text{Importance Value Index} = \text{Relative Density} + \text{Relative Frequency}$$

$$\text{Summed Dominance Ratio} = \frac{\text{Importance Value Index}}{2}$$

Results and Discussion

Wheat field is infested with diverse weed flora. From morphological point of view, it can be divided into broadleaf weeds, grassy weeds and sedges. When averaged over both the years of the study (2022-23 & 2023-24), the type weeds varied in their occurrence from each other in the experimental plot (Figure 1.).

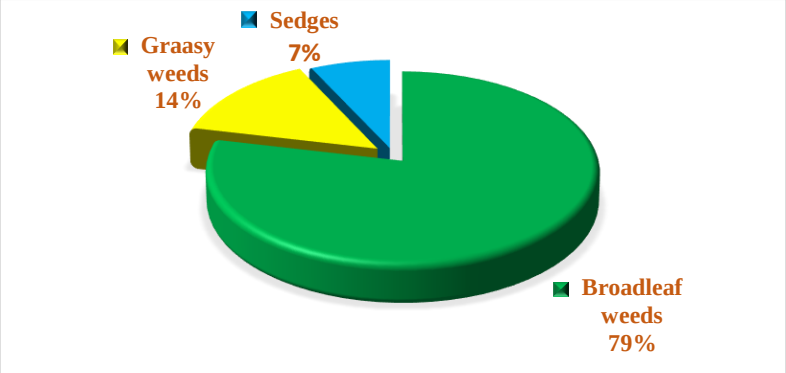

Figure 1. Morphological distribution of weed flora

Floristic analysis

In the first season of the study, 15 weed species (13 broadleaved weeds, 1 grass and 1 sedge) belonging to 12 families and 12 genera were identified. Among the total species the diversity of the species was found within Fabaceae (3 species), Poaceae (2 species) and the remaining families had only 1 species each. In the second year of the study, the weed population was comparatively lesser and only 10 weed species belonging to the same 9 families and 9 genera were identified. No species diversity was found among the total species. As many as 15 species of weeds were recorded in the field during both the cropping periods. Fabaceae and Poaceae had three and two species respectively while the remaining ten families had only one species each. Monocot were represented by Poaceae and Cyperaceae. *Anagallis arvensis* L. and *Chenopodium album* L. among the broadleaved weeds, followed by annual grassy weed *Phalaris minor* L. and the perennial sedge *Cyperus rotundus* L. were the most dominant weeds which were reported. A detailed number of weeds belonging to different families is represented in Figure 2.

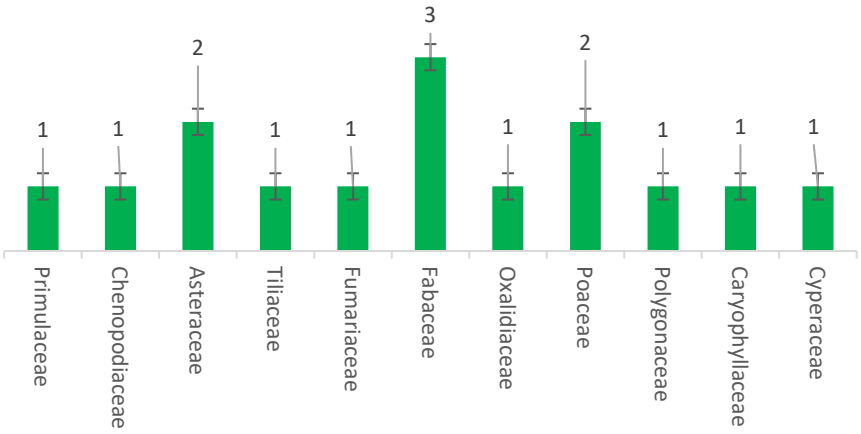

Figure 2. Number of weed species belonging to the different families occurring in the wheat field during the year 2022-23 & 2023-24

Table 1. Weed vegetation analysis

Weed Species	Absolute Density (No./m^2)	Relative Density (%)	Absolute Frequency (%)	Relative Frequency (%)	Importance Value Index (%)	Summed Dominance Ratio (%)
			2022-23			
Anagallis arvensis L.	362.8	26.8	100.0	8.5	35.3	17.7
Chenopodium album L.	281.5	20.8	100.0	8.5	29.3	14.7
Cirsium arvense L.	30.1	2.2	83.3	7.1	9.3	4.7
Coronopus didymus L.	36.5	2.7	83.3	7.1	9.8	4.9
Fumaria parviflora L.	15.2	1.1	66.7	5.7	6.8	3.4
Melilotus indica	27.0	2.0	91.7	7.8	9.8	4.9
Oxalis corniculata L.	35.9	2.7	100.0	8.5	11.2	5.6
Parthenium hysterophorus L.	24.4	1.8	75.0	6.4	8.2	4.1
Polypogon monspeliensis	20.3	1.5	58.3	5.0	6.5	3.2
Rumex dentatus L.	29.6	2.2	83.3	7.1	9.3	4.6
Spergula arvensis L.	34.2	2.5	58.3	5.0	7.5	3.7
Vicia sativa L.	16.7	1.2	33.3	2.8	4.1	2.0
Vicia hirusta L.	43.7	3.2	66.7	5.7	8.9	4.5
Phalaris minor L.	168.7	12.5	75.0	6.4	18.8	9.4
Cyperus rotundus L.	227.0	16.8	100.0	8.5	25.3	12.6
			2023-24			
Anagallis arvensis L.	313.3	29.4	100.0	15.0	44.4	22.2
Chenopodium album L.	243.3	22.8	100.0	15.0	37.8	18.9
Cirsium arvense L.	13.1	1.2	41.7	6.3	7.5	3.7
Coronopus didymus	33.1	3.1	58.3	8.8	11.9	5.9
Fumaria parviflora L.	79.8	7.5	83.3	12.5	20.0	10.0
Melilotus indica	38.3	3.6	58.3	8.8	12.3	6.2
Oxalis corniculata L.	5.5	0.5	16.7	2.5	3.0	1.5
Parthenium hysterophorus L.	0	0	0	0	0	0
Polypogon monspeliensis	0	0	0	0	0	0
Rumex dentatus L.	0	0	0	0	0	0
Spergula arvensis L.	0	0	0	0	0	0
Vicia sativa L.	0	0	0	0	0	0
Vicia hirusta L.	0	0	0	0	0	0
Phalaris minor L.	25.0	2.3	58.3	8.8	11.1	5.5
Cyperus rotundus L.	291.3	27.3	100	15.0	42.3	21.2

Absolute Density

It represents the number of individuals weeds of a particular weed species per unit area. In the first season (2022-23), the highest values were recorded of *Anagallis arvensis* L. (362.8%) followed by *Chenopodium album* L. (281.5%) while the lowest values were recorded by *Fumaria parviflora* L. (15.2%) and *Vicia sativa* L. (16.7%). In the second season (2023-24), *Anagallis arvensis* L. (313.3%) followed by *Cyperus rotundus* L. (291.3%) while a number of species showed zero occurrence when compared with the first season.

On the basis of absolute density, the coefficient of similarity showed 75.32% similarity of the weeds with the first season crop. Conversely, we can say there was 24.68% dissimilarity.

Relative Density

It is the evaluation of a species numerical strength in proportion to the total number of individuals of all the species. In the first season, the highest value of relative density was

recorded by *Anagallis arvensis* L. (26.8%) followed by *Chenopodium album* L. (20.8%) while the lowest values were recorded by *Fumaria parviflora* L. (1.1%) and *Vicia sativa* L. (1.2%). In the second season, *Anagallis arvensis* L. (29.4%) followed by *Cyperus rotundus L.* (27.6%) showed higher values while *Oxalis corniculata* L. (0.5%) showed lowest value along with few species having zero relative density.

Absolute Frequency

It indicates the number of quadrats in which the particular species occur to the total number of quadrats employed. In the first season, *Anagallis arvensis* L. (100%) followed by *Chenopodium album* L. (100%) *Oxalis corniculata* L. (100%) and *Cyperus rotundus* L. (100%) showed maximum occurrence in the sampling plots whereas *Vicia sativa* L. (33.3%), *Polypogon monspeliensis* (58.3%) and *Spergula arvensis* L. (58.3%) showed minimum occurrence. In the second season, *Anagallis arvensis* L. (100%), *Chenopodium album* L. (100%) and *Cyperus rotundus* L. (100%) showed maximum occurrence whereas *Oxalis corniculata* L. (16.7%) showed minimum occurrence.

Relative Frequency

It can be calculated from the absolute frequency as it shows the ratio between absolute frequency of individual species to the frequency total of all species. During the first season, *Anagallis arvensis* L. (8.5%), *Chenopodium album* L. (8.5%) and *Cyperus rotundus* L. (8.5%) showed highest relative frequency while *Vicia sativa* L. (2.8%) being at lowest. In the second season, similar results were obtained.

Importance Value Index

It gives the overall picture of ecological importance of a species in relation to community structure combining measures of density and frequency. It determines species overall impact and contribution to the ecosystem. In the first season, *Anagallis arvensis* L. (35.3%) ranked the highest while *Vicia sativa* L. (4.1%) was found to be at the lowest. In the second season, *Anagallis arvensis* L. (44.4%) obtained highest values while *Oxalis corniculata* L. (3.0%) was found to be at the lowest.

Summed Dominance Ratio

It indicates the degree of dominance of a species over the other species in a given sample plot (Chul and Moody, 1983). The major 5 species that occurred during the first year of study were namely, *Anagallis arvensis* L., *Chenopodium album* L., *Cyperus rotundus* L., *Phalaris minor* and *Vicia hirusta* while in the second year, *Anagallis arvensis* L., *Cyperus rotundus* *Chenopodium album* L., *Fumaria parviflora* L. and *Melilotous indica* showed maximum dominance over other species.

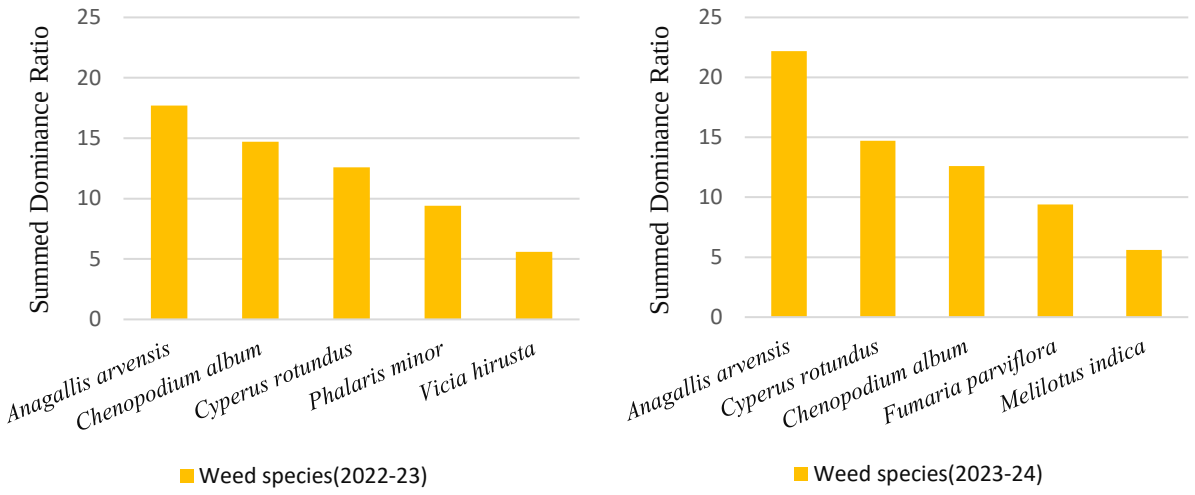

Figure 3. Summed Dominance Ratio of major weeds found in weedy plots during 2022-23 & 2023-24

Simpson's Index

It is a measure of the concentration of dominance of species which maybe used to determine the degree of diversity in given community type (Whittaker, 1965 and Raju, 1997). This index is used to quantify the biodiversity. A higher value indicates lower biodiversity while a lower value indicates higher biodiversity. The values of different weed species are mentioned in Table 2.

Table 2. Simpson's Index of weed species occurring during two seasons.

Weed species	2022-23	2023-24
Anagallis arvensis L.	6.23	10.36
Chenopodium album L.	4.29	7.51
Cirsium arvense L.	0.43	0.30
Cornopus didymus L.	0.48	0.74
Fumaria parviflora L.	0.23	2.10
Melilotus indica	0.48	0.80
Oxalis corniculata L.	0.63	0.05
Parthenium hysterophorus L.	0.34	0.00
Polygonum monspeliensis L.	20.3	0.00
Rumex dentatus L.	29.6	0.00
Spergula arvensis L.	34.2	0.00
Vicia sativa L.	16.7	0.00
Vicia hirsuta L.	43.7	0.00
Phalaris minor L.	168.7	0.65
Cyperus rotundus L.	227.0	9.40

Conclusion

From the above study, it was can be summed that the experimental field was highly infested by *Anagallis arvensis* L., *Chenopodium album* L. and *Cyperus rotundus* L. while rest of the species were found in lesser number. The composition of weed flora was 78.57% broadleaved weeds, 14.29% grasses and 7.14% sedges. When compared to the first year of study 75.32% weeds were similar.

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