Evaluation of variability of weeds in rice fields of Gharghoda blocks of Raigarh district, Chhattisgarh

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Abstract- The most common problems encountered in the Indian farmers throughout in agriculture is control of obnoxious, undesirable, unwanted, useless, ugly and often persistent plants, injurious for crops interfere with agricultural operations increases labour and cost of production and finally reduce the crop yields. Such plants are known as weeds. Although there are losses caused by the weeds within field in terms of crop yield, crop weeds competition for space, water, light and nutrients, increases in cost of agriculture production, reduction in price of farm produce, effects livestock product quality, reduction in land value, harbors to pests and diseases, bad effect on human health and soil productivity. However, some weeds have also beneficial effect in agriculture as well as human life. They are, weeds check erosion of the soil, very good medicinal value, green manure, forages, contributions of plant nutrients, industrial importance i.e. aromatic oil/thatches/agarbatti/scent/antibiotic, improvement of saline soil, crop hybridization, beautification, environmental purification, nitrogen fixation, mulching, vegetables, fencing etc. Different fields were selected randomly under three categories viz. direct seeded fields, transplanted fields and fallow land in Gharghoda block of Raigarh district of Chattisgarh. A square quadrat of 1m x 1m of iron frame will be used for sampling. Quadrants were laid randomly in the field. Ramdomization was done approximately. For randomization each field were divided into, approximately 10 x 10m square areas. The squares were numbered and thus with the help of random number tables area for laying the quadrat was selected. Within the 10 x 10 m sq area one quadrat was sampled. In this way 4 quadrats were sampled in each of the fields. Number of weed, species wise, was recorded and three plants were uprooted for photography and the preparation of dry herbarium. Climatic data was collected from nearest meteorological for temperature, rainfall and relative humidity. The Frequency, density, abundance and their relative values and Importance value index (IVI) of individual specie were calculated. Soil samples were collected from each of the areas and were analyzed for different physio-chemical parameters. Since the economic condition of Chhattisgarh also depends on agriculture and number of crops are grown by the farmers. Out of them, paddy is a major crop cultivated in monsoon and summer season depending up on irrigation facility. The average productivity of paddy is less (21.0 q/ ha.) due to many factors and weed infestation especially early stage of crop growth is one of them. Damage caused by weeds in rice productivity ranges 15 to 85 percent depending on cultivation methods, soil and weed types, rainfall and management. Chhattisgarh farmers are not much aware on these aspects. Weed is a serious problem for state agriculture. Hence, survey, collection, identification, classification and preservation of weed are essential for effective control considering the above facts, the present investigation is therefore proposed.

Index Terms- Weeds, survey, variability, paddy, rice field, Gharghoda block, Raigarh district of Chattisgarh.

I. INTRODUCTION

Weed is remarkably adapted to a changed environment to such an extent as to be a threat to other plants. Whether a plant is considered a weed depends not only on its characteristics and habit but also on its relative position with reference to crop plants. Thus a plant of economic crop may also become a weed if it is found growing with other crops where it is not wanted. But for practical purpose weeds are undesirable, injurious, unsightly and troublesome plants which interfere with cultivated crops and affect human affairs [1]. Weeds comprise all types of plants, grasses, sedges, rushes, aquatic plants and parasitic flowering plants. Some weeds are useful as animal fodder. Indeed, weeds, as a class, have much in common with criminals. When not engaged in their nefarious activities both may have admirable qualities a thief may be an affectionate husband and father outside business hours. An aggressive weed in one environment may be charming with flowers in another modern scientific psychology has done much to illuminate the criminal mentality and a thorough knowledge of the biology of the species concerned, is equally important in the understanding of the behavior and control weeds.

No plant is useless in nature. However, in the present study, it has been restricted to weeds infesting the crop fields of the district. As the crop fields cover the largest portion of the rural areas, so the roles played by the rural women only are taken into account. Crop field weeds, regarded undesired and neglected as the constant source of annoyance and trouble to the farmers are simply eradicated by plucking and throwing away; but in fact, they are important form the standpoint of medicinal, allelopathic and food values [2]. Some researchers have also reported medicinal industrial and allopathic uses of several obnoxious weeds [3]. Weed problem is major one in Raigarh district. According to the farmers of Raigarh district the losses in crop yields have been estimated at 10-20 percent in wheat, 15-20 percent in rice and 20-30 percent in vegetables. Therefore, the farmers are advised to restrict the weed growth at early seeding stage. Agriculture is a back bone of Indian economy most of the farmers are busy with field plantation during Rabi and Kharif

seasons. They try to avoid the growth of the weeds by sowing certified seeds [4-5]. The irrigation systems give maximum growth of the weeds. To control weed growth a very wide range of herbicides are available. Therefore, the farmers are to be trained to select the most appropriate one for weed control problem. Thus, the present study was subjected to study the variability and diverse nature of weeds in Gharghoda block associated with different fields of Raigarh district of Chattisgarh.

II. MATERIALS AND METHODS

The following strategies were adopted to fulfill the objectives of the work:

1. Survey of weeds in direct seeded rice fields of Gharghoda block.
2. Survey of weeds in lowland and transplanted rice fields Gharghoda block.
3. Survey of weeds in fallow land Gharghoda block.

In general percentage of area under direct seeding (Sowing) is more than the area under transplantation, while area under fallow land is lowest hence following no of fields was selected randomly under three categories in each of the blocks viz : Gharghoda blocks of Raigarh district of Chhattisgarh:

1. **Direct seeded fields** – 10 in each block = 24
2. **Transplanted fields** – 6 in each block = 12
3. **Fallow land** – 2 in each block = 4

Total = 40

4. Sampling

A square quadrant of 1m x 1m of iron frame was used for sampling. Quadrants were laid randomly in the field. Randomization was done approximately. For randomization each field was divided into, approximately 10 x 10m sq areas. The squares was numbered and thus with the help of random number tables area for laying the quadrant was selected. Within the 10 x 10 m sq area one quadrant was sampled. In this way 4 quadrants was sampled in each of the fields. Number of weed, species wise, was recorded and three plants was uprooted for photography and the preparation of dry herbarium [6].

5. Climatic data for the study area:

This was collected from the nearest meteorological for temperature, rainfall and relative humidity.

6. Phyto-sociology of weeds

Frequency, density, abundance and their relative values and Importance value index (IVI) of individual specie was calculated using the following formulae [7]

$$\textbf{Frequency} = \frac{\text{No. of sampling plots in which the species is present}}{\text{Total No. of plots sampled}} \times 100$$

$$\textbf{Density (Ha}^{-1}\textbf{)} = \frac{\text{No. of individuals of the species}}{\text{Total area sampled (ha)}}$$

$$\textbf{Abundance} = \frac{\text{No. of individuals of the species}}{\text{No. of sampling plots in which the species is present}}$$

$$\textbf{Relative frequency} = \frac{\text{Frequency of the species}}{\text{Frequency of all the species}} \times 100$$

$$\textbf{Relative Density} = \frac{\text{Density of the species}}{\text{Density of all the species}} \times 100$$

$$\textbf{Relative abundance} = \frac{\text{Abundance of the species}}{\text{Abundance of all the species}} \times 100$$

IVI of weeds = Relative frequency + Relative density+ Relative abundance

7. Shanon index of diversity (*H'*):

For the calculation of Shanon index IVI values of the species was made by.

Where: $H' = -\sum p_i \ln(p_i)$

H' = The Shannon Diversity Index

p_i = The relative abundance of the species

*(Or) can also be calculated as-

H'= - ∑(Ni/N) × ln (Ni/N)

Ni = Importance value of a species

N = Importance value of all the species

Simpson index of diversity was calculated using the formula:

Simpson index of diversity (D) = p_i^2

Where:

p_i = IVI of the species

8. K-dominance and rarefaction plot for weeds:

K-dominance and K-dominance and rarefaction plot for weeds will be plotted with the help of computer based software.

9. Photographic herbarium and dry herbarium of weeds:

a) Photographic herbarium

Photographs of the weeds were taken in their natural habitat as well as by spreading the collected weed plant at some suitable place to get a good photograph of the species.

b) Dry Herbarium

Dry herbarium was prepared as follows:

Collection of weed as far as possible in flowering and fruiting condition

i) Place the plant tween sheets of blotting paper/news paper
ii) Press the plant in a herbarium press
iii) Change the blotting paper/news paper frequently till complete dryness of the plant
iv) Paste the plant on a herbarium sheet

v) Spray the plant with 1% solution of $HgCl_2$
vi) Label the plant
vii) Store the herbarium sheet at a dry place

10. Economic importance of weeds:

Information on the economic Importance of the weeds was gathered from the published literature and personal interview from the local people. Medicinal property of the plant was determined through questionnaire. The questionnaire was filled from local healers and knowledgeable persons from the villages.

11. Soil analysis:

Soil samples were taken from the selected area for analysis. Sample from 0-5 and 15-20 cm depth was collected by "Soil auger" after clearing the surface. Such samples were taken from 3 places from each field of vegetation. Composite samples were prepared depth wise for each field. Sample was laled properly for date, place and depth of collection. Soil samples were dried in air at room temperature. While drying, each of the sample was covered with paper to prevent falling dust or dirt on it. After proper and sufficient drying each composite soil sample was stored in clean polythene bags. Soil analysis was done as per standard methods [8].

(a) Colour

(b) pH - The analysis of pH (1 : 2.5 soil : water) was done by Glass electrode pH meter.

(c) Available N - The analysis of available N (kg ha^{-1}) was done by Alkaline permanganate method [8].

(d) Available P - The analysis of available P (kg ha^{-1}) was done by Olsen method.

(e) Available K - The analysis of available K (kg ha^{-1}) was done by Flame photometer method.

(f) Electrical conductivity (E.C.) - The analysis of Electrical conductivity (dSm^{-1} at 25°C) was done by Solubridge method.

III. RESULTS

Environmental pollution has imposed serious threat globally mainly due to the growing utilization of agrochemicals including pesticides. With global perspective of environmental protection and food security, indigenous wisdom is getting worldwide importance for sustainable eco-friendly agriculture production system. To combat the challenges of today's food production, healthcare and nutritional security, biological pesticides including plant-based pesticides can play a greater role. Insect pests, diseases and weeds inflict enormous loss to the potential agriculture production. Anecdotal evidences also indicate rise in the loss, despite increasing use of chemical pesticides. At the same time, there is a rising public concerns about the potential adverse effects of chemical pesticides on the human health, environment and bio-diversity. These negative externalities, though, cannot be eliminated altogether but their intensity can be minimized through development, dissemination and promotion of alternative technologies such as plant-based pesticides. India has vast flora and fauna that have potential for developing in to commercial technologies. The results are shown in **Tables 1 -4** and **Figure 1**.

IV. DISCUSSION AND CONCLUSION

Raigarh is the important district of Chhattisgarh. The soil of entire district is less fertile on account of low percentage of organic matter. The irrigation facility is negligible because the net work of Sardar Sarovar Project is not completed. Only few villages are irrigated by tube wells, tanks and wells. On account of poor fertile soils, less organic materials of the soil, low irrigation potential, some of the areas are converted into industrial zones. The chemical industries are well developed in these zones, which cause air and water pollution the also effect on soil composition. As a result the growth of weeds is seen in every crop, weeds are intermixed with cereals, legumes. Fibre, sugarcane, vegetables and fodder crops. Therefore the climatic, edaphic and biotic factors are constantly acted upon all the crops at every stage and they try to reduce the farm yield. Environmental factors such as low and high temperatures, wind velocity and rainfall are playing major role on agriculture practices. The annual rain fall is reduced constantly. Therefore, weed crop competition for moisture usually occurs along with other elements of competition. It becomes increasingly critical with increasing soil moisture stress as occurring in the dry farming areas of semi arid and arid regions of Raigarh district. Therefore, in dry land agriculture the actual evaporation from the weedy crop fields is much more than the evaporation from a weed free crop field weeds remove the soil moisture hence the yield in non irrigated fields is very less than the irrigated fields.
Weed competition for moisture, nutrients are plentiful and weeds have an edge over crop plants. Crop likes Cotton, Maize, vegetables and sugarcane are prone to heavy weed growths at their seedling stage and consequently suffer badly at the fruiting stage. Animals both- domestic and wild as well as human activities are the key biotic factors. Rapid industrialization and urbanization of Raigarh district have direct impact on agriculture practice. Short supply of field workers is directly affected on weed control. Most of the farmers, erroneously assume that removing weeds any time during the growing season was good enough for obtaining full benefits of weeding in terms of increased crop-yield but contrary to it sub substantial scientific evidences are available that time of weeding a crop is as important as the weeding itself. The weeds that germinate either before or along the crop offer stronger competition to it then the later germinating ones. It has been observed that these early weeds accumulate dry matter faster than the crop seeding. In Maize, Sorghum and Bajara weeding is done 1/3 or 1/4 growing periods of crops which gives optimum yield. The hottest month during the last eight years is April. The average minimum temperature is 10.43°C and average maximum temperature is 42.76°C during last eight years. The mean of the maximum temperature of the month of May in last eight years is 44° C and the mean of minimum temperature is 21° C. The coldest month during the last eight years is February. The average temperature of the month February during last eight years is 10.94°C. The mean of the maximum temperature of the month of February in last eight years is 38° C and the mean of the minimum temperature is 10° C.

The rainfall during monsoon is highly erratic, both in intensity and intervals between two successive rains. The average total rainfall in last eight years is 850 mm. The maximum rainfall recorded was 1015.8 mm in year 2001 and lowest rainfall

recorded was 663.1 mm in 2005. The average rainy days during the 2000-2007 is 44 days. The average of maximum relative humidity of the month of November 89.90 % and the average of minimum relative humidity of the month of November is 87.90 %. Other months which shows high average of relative humidity is September (88.58 %), October (88.51%), December (88.41%), April (82.18%). Weed competition is most serve when the competing weeds are having similar vegetative habits and demand upon available resources. Weed competition depends upon the type of weeds, duration of weeds, soil moisture, climatic condition and severity of infection [9-12].

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Table 1: Weeds species in Gharghoda ropa field

	GHARGHODA ROPA FIELD																			
A	**B**	**C**										**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**
S.No	**NAME OF PLANT SPECIES**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**TOTAL NO OF INDIVIDUALS**	**TOTAL NO OF QUADRAT STUDIES**	**TOTAL NO OF QUADRAT IN WHICH THE SPECIES OCCURE**	**FREQUENCY**	**DENSITY**	**ABUDANCE**	**RF**	**RD**	**RA**	**IVI**
1	**Cynodon Dactylon**	13	10	22	16	6	12	0	2	12	9	102	10	9	90	10.2	11.33	18.75	20.6	11.12	50.47
2	**Merremia Emarginata**	0	0	2	0	13	0	6	0	0	0	21	10	3	30	2.1	7	6.25	4.24	6.87	17.36
3	**Melochia Corchorifolia**	0	0	0	0	2	0	0	0	0	0	2	10	1	10	0.2	2	2.08	0.4	1.96	4.44
4	**Medicagn Polymorpha**	0	0	9	0	0	0	0	0	0	0	9	10	1	10	0.9	9	2.08	1.81	8.83	12.72
5	**Amaranthus Viridis**	0	0	0	0	4	18	0	0	10	3	35	10	4	40	3.5	8.75	8.33	7.07	8.59	23.99

6	**F**	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
7	**G**	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
8	**Sida Acuta**	0	0	0	0	3	0	0	0	0	0	3	10	1	10	0.3	3	2.08	0.6	2.94	5.62
9	**I**	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
10	**J**	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
11	**Sphaeranthus Indicus**	36	22	3	11	0	0	22	5	13	12	124	10	8	80	12.4	15.5	16.66	25.05	15.22	56.93
12	**L**	0	0	2	0	0	0	0	0	0	5	7	10	2	20	0.7	3.5	4.16	1.41	3.43	9
13	**M**	21	33	5	12	8	11	9	22	10	8	139	10	10	10	13.9	13.9	20.83	28.08	13.65	62.56
14	**Euphorbia Micriphylly**	0	0	0	8	0	0	0	5	0	6	19	10	3	30	1.9	6.33	6.25	3.83	6.21	16.29
15	**Coldenia Procumbens**	0	0	0	0	0	0	0	4	0	10	14	10	2	20	1.4	7	4.16	2.82	6.87	13.85
16	**Solanum Xanthocarpum**	0	3	0	0	0	0	0	0	0	0	3	10	**1**	**10**	**0.3**	**3**	2.08	0.6	2.94	5.62
17	**Q**	0	0	6	0	0	0	0	0	0	0	6	10	1	10	0.6	6	2.08	1.21	5.89	9.18

18	**Hiptis Suaveolens**	0	0	5	0	0	6	0	0	0	0	11	10	2	20	1.1	5.5	4.16	2.22	5.4	11.78
													TOTAL		**480**	**49.5**	**101.81**				

Table 2: Weeds species in Gharghoda spray field

	GHARGHODA SPRARY FIELD																			
A	**B**	**C**										**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**
S.No	**NAME OF PLANT SPECIES**	**NO OF QUADRAT**										**TOTAL NO OF INDIVIDUALS**	**TOTAL NO OF QUADRAT STUDIES**	**TOTAL NO OF QUADRAT IN WHICH THE SPECIES OCCURE**	**FREQUENCY**	**DENSITY**	**ABUDANCE**	**RF**	**RD**	**RA**	**IVI**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**										
1	**Cynodon Dactylon**	15	10	12	20	5	0	8	0	11	3	84	10	8	80	8.4	10.5	22.22	27.36	13.07	62.65
2	**Merremiaemarginata**	6	20	15	6	0	0	11	0	15	0	73	10	6	60	7.3	12.16	16.66	23.77	15.13	55.56
3	**Melochia Corcholifolia**	0	0	1	0	0	0	0	0	0	0	1	10	1	10	0.1	1	2.77	0.32	1.24	4.33
4	**Medicagn Polymorpha**	0	0	3	0	0	0	0	7	6	0	16	10	3	30	1.6	5.33	8.33	5.21	6.63	20.17
5	**Amaranthus Viridis**	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
6	**F**	0	0	5	0	18	0	0	0	0	0	23	10	12	20	2.3	11.5	5.55	7.49	14.31	27.35
7	**G**	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
8	**Sida Acuta**	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
9	**I**	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
10	**J**	0	5	0	4	0	0	0	3	0	0	12	10	3	30	1.2	4	8.33	3.9	4.98	17.21

11	**Sphaeranthus Indicus**	0	0	0	0	8	0	0	0	0	12	20	10	2	20	2	10	5.55	6.51	12.45	24.51
12	**L**	4	2	0	0	0	25	0	0	0	12	31	10	3	30	1.2	4	8.33	3.9	4.98	17.21
13	**M**	0	0	0	0	0	6	8	14	0	6	34	10	4	40	3.4	8.5	11.11	11.07	10.58	32.76
14	**Euphirbia Microphylly**	0	0	0	0	0	3	1	5	0	0	9	10	3	30	0.9	3	8.33	2.93	3.73	14.99
15	**Coldenia Procumbens**	0	0	0	0	0	0	4	0	0	0	4	10	1	10	0.4	4	2.77	1.3	4.98	9.05
														TOTAL	**360**	**30.7**	**80.32**				

Table 3: Weeds species in Gharghoda barren land

	GHARGHODA BARREN LAND																				
A	**B**	**C**										**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**
S. NO.	**NAME OF PLANT SPECIES**	**NO OF QUADRATS**										**TOTAL NO OF INDIVUDUALS**	**TOTAL NO OF QUATRATS STUDIES**	**TOTAL NO OF IN WHICH THE SPECIS OCCURE**	**FREQUENCY**	**DENSITY**	**ABUNDANCE**	**RF**	**RD**	**RA**	**IVI**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**										
1	**Cynodon Dactylon**	44	31	25	16	11	15	6	40	50	30	268	10	10	100	26.8	26.8	1.92	49.3	29.7	80.92
2	**Merremia Emarginata**	3	10	22	8	6	2	3	3	2	6	65	10	10	100	6.5	6.5	1.92	11.97	7.2	21.09
3	**Melochia Corchorifolia**	2	12	8	0	25	8	0	3	4	3	65	10	8	80	6.5	8.12	15.38	11.97	9	36.35
4	**Madicagn Polymorpha**	5	3	6	4	3	0	25	6	3	0	55	10	8	80	5.5	6.8	15.38	10.12	7.53	33.03
5	**Amaranthus Viridis**	2	0	0	4	0	12	0	0	0	0	18	10	3	30	1.8	6	5.76	3.31	6.65	15.72

6	**F**	3	4	5	5	7	6	0	0	0	0	30	10	6	60	3	5	11.53	5.52	5.54	22.59
7	**G**	0	0	0	0	3	0	0	0	0	0	3	10	1	10	0.3	3	1.92	0.55	3.32	5.79
8	**Sida Acuta**	0	0	0	0	0	5	4	0	0	0	9	10	1	10	0.3	3	1.92	0.55	3.32	5.79
9	**I**	0	0	0	0	0	0	5	0	8	0	13	10	2	20	1.3	6.5	3.84	1.65	4.98	10.47
10	**J**	0	0	0	0	0	0	0	2	0	0	2	10	1	10	0.2	2	1.92	0.36	2.21	4.49
11	**Sphaeranthus Indicus**	0	0	0	0	0	0	0	0	0	15	15	10	1	10	1.5	15	1.92	2.76	16.62	21.3
												TOTAL			**520**	**543**	**90.22**				

Table 4 (a): Parameters analyzed in soil samples of different fields of Gharghoda block of Raigarh district

S.No.	Name of fields	Village	Soil type	pH	EC	OC %	Available N kg/ha	Available P kg/ha	Available K kg/ha	Available micronutrients			
										Fe ppm	Mn ppm	Cu ppm	Zn ppm
1	Ropa Field	Gharghoda	Entisol	6.07	0.08	0.21	163	6.96	219	19.44	14.30	0.92	0.18
2	Spray field	Gharghoda	Inceptisol	5.27	0.09	0.66	260	5.30	276	47.20	12.56	2.52	0.34
3	Banjar field	Gharghoda	Inceptisol	5.36	0.12	0.55	260	8.96	288	10.54	20.98	0.50	0.98

Table 4 (b): Levels of parameters analyzed in soil samples of different fields of Gharghoda block of Raigarh district

S.No.	Name of fields	Village	Soil type	pH	OC %	Availabe N kg/ha	Available P kg/ha	Available K kg/ha	Available micronutrients			
									Fe ppm	Mn ppm	Cu ppm	Zn ppm
1	Ropa Field	Gharghoda	Entisol	Slightly acidic	Low	Low	Low	Medium	High	High	Sufficient	Sufficient
2	Spray field	Gharghoda	Inceptisol	Acidic	Medium	Low	Low	Medium	High	High	Sufficient	Sufficient
3	Banjar field	Gharghoda	Inceptisol	Acidic	Medium	Low	Low	Medium	Sufficient	High	Sufficient	Sufficient

Figure 1: Different weed species reported in different areas of study