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RESEARCH ARTICLE

Floristic and phytosociological studies of weeds in wheat crop fields of Mungeli district of Chhattisgarh, India

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ABSTRACT

The field study was carried out to examine the floristic diversity of weeds in wheat crop fields during the Rabi season of 2018-2020 in four villages, Barela, Semarchua, Chamari, and Karhi, of Mungeli district in Chhattisgarh (India). This study recognized the floristic composition of weed species and evaluated the most dominant and common weeds at the study area. 48 weed species belonging to 19 families were recorded in all the study sites of wheat crop fields. The maximum numbers of weeds were observed in village Barela (46) followed by villages Semarchua (45), Chamari (41), and Karhi (36). The floristic composition of weed species was recorded as dicot (16%), monocot (79%), and pteridophytic (05%) groups. According to the highest importance value index (IVI value), *Alternanthera sessilis* (L.) DC was found to be the most dominant weed species in the wheat crop fields of village Barela, followed by *Anagallis arvensis* L., *Medicago polymorpha* L., and *Chenopodium album* L. in Karhi, Semarchua, and Chamari villages, respectively. This survey will provide basic information about weed flora.

Keywords: Dominant weeds, Importance value index, Weed flora, Wheat crop

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most important food crops in India and is grown extensively throughout the world. It is also cultivated by the farmers of the Mungeli district in Chhattisgarh during the rabi season. In agriculture fields, only 250 weed species were important out of the 8000 weed species in the world (Holm *et al.* 1979, Ahmad *et al.* 2016). Many factors are responsible for low wheat production, but maximum wheat yield reduction is caused by weed infestation (Rabia *et al.* 2003). There are different opinions regarding the yield loss in wheat due to weeds. According to Gill *et al.* (1979), heavy weed infestations were responsible for up to 15-50% yield loss in wheat. Qureshi (1982), reported 30% yield loss in wheat due to weeds. Due to weed infestation 34.3% loss in wheat yield was reported by Tiwari and Parihar (1993). According to Dangwal *et al.* (2010), weeds were responsible for causing up to 25-35% yield loss in wheat. Gharade *et al.* (2018) estimated 7.5 to 41% yield reduction in the wheat crop. This is quite worrying and needs attention.

The structure and composition of weeds were changed by environmental conditions such as soil type, weed management cropping system, and climate. A better design of a weed management program requires information and knowledge about the most dominant and important weed species in particular crop fields. A phytosociological survey gives overall information about weed diversity and composition in crop fields (Das 2008). So phytosociological studies of weeds are compulsory for recognizing the interconnection of wheat crops and its weed flora. This may be helpful as a device for designing a weed management strategy. The objective of the present study was to identify and determine the most common and dominant weeds in the wheat crop fields of the Mungeli district of Chhattisgarh. There are no records of ecological aspects of weeds in the study area.

MATERIALS AND METHODS

The present study was conducted to find out the common and most dominant weeds in wheat crop fields in the Mungeli district of Chhattisgarh. An extensive field- based survey was done during different months of wheat growing season of 2018-2020 in the study area. Randomly four villages in the Mungeli district were selected for the study. The observation was taken at four selected villages, which are Barela as site 1, Semarchua as site 2, Karhi as site 3, and Chamari as site 4. Five fields were surveyed in each site in 2018 to 2020. The soil in this area is black and sandy loam.

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The random quadrat method was applied for the assessment of the structure and composition of weeds. Fifty quadrates of 1 m x 1 m were laid down in the wheat crop fields of each sites. The entire weed species in quadrats were collected and identified with available authentic flora and electronic resources. An herbarium of the voucher specimens was also prepared.

Phytosociological characters such as frequency, density, abundance, relative frequency, relative density, relative dominance, and importance value index (IVI) were calculated with the help of the following methods: Curtis and McIntosh (1950) and Misra (1968). The formula for the calculation is as follows:

$$\text{Frequency (\%)} = \frac{\text{Total number of quadrats in which the species occurred}}{\text{Total number of quadrats studied}} \times 100 \quad (1)$$

$$\text{Density} = \frac{\text{Total number of individuals of a species in all quadrates}}{\text{Total number of quadrats studied}} \quad (2)$$

$$\text{Abundance} = \frac{\text{Total number of individuals of a species in all quadrates}}{\text{Total number of quadrats in which the species occurred}} \quad (3)$$

$$\text{Relative Frequency} = \frac{\text{Frequency of individuals of a species}}{\text{Total frequency of all species}} \times 100 \quad (4)$$

$$\text{Relative Density} = \frac{\text{Density of individuals of a species}}{\text{Total Density of all species}} \times 100 \quad (5)$$

$$\text{Relative Dominance} = \frac{\text{Basal area of a species}}{\text{Total Basal area of all species}} \times 100 \quad (6)$$

$$\text{Importance Value Index} = \text{Relative Frequency} + \text{Relative Density} + \text{Relative Dominance} \quad (7)$$

An importance value index is used to measure the importance and dominance of a species in a plant community. It is obtained by summing up relative frequency, relative density, and relative dominance.

RESULTS AND DISCUSSION

Floristic diversity of weed species

48 weed species belonging to 19 families were recorded in all the study sites of wheat crop fields (**Table 1-6**). Different types of weed species were present in the study site. The maximum number of weeds were observed in village Barela and Semarchua (44) followed by Chamari (42) and Karhi (36) in 2018.In the year 2019, the highest number of weeds were found in Barela(45) followed by Karhi (41), Semarchua(40), and Chamari (38). In the year 2020, the greatest number of weeds were observed in Barela (46) followed by Semarchua (45), Chamari (41), and Karhi (36). The floristic composition of weed species was recorded as dicot (79%), monocot (16%), and pteridophytic (5%) groups belonging to different weed species (**Figure 1**) Many other researchers, Moghe (2017), Singh *et al.* (2018) and Yousaf *et al.* (2022), have reported similar results in their findings.

At Barela (site1), the highest frequency (66%) of weed population was recorded for *Anagallis arvensis* L. in 2018 and 68% from 2019 to 2020 (**Table 2, 4,** and **6)**. At Semarchua (Site-2), *Alternanthera sessilis* (L.) DC, occurred with 64% in 2018, 60% with *Chenopodium album* L. and *Medicago polymorpha* L.in 2019. In the year 2020 again, *Alternanthera sessilis* (L.) DC, recorded with the highest frequency (66%). At Karhi the highest frequency of 72% was observed for *Anagallis arvensis* L.in 2018 and 2020. In the year 2019 *Rumex dentatus* L. was recorded with highest frequency (64%) at Karhi. At Chamari village (Site 4), a maximum % frequency value of 60% was associated with *Anagallis arvensis* L. and *Rumex dentatus* L. in 2018. In the year 2019, *Medicago polymorpha* L. was recorded with 64% and *Alternanthera sessilis* (L.) DC, was observed with a maximum frequency (62%).

The highest density of 1.3 was recorded for *Alternanthera sessilis* (L.) DC, at Barela. The weed species *Medicago polymorpha* L. showed the highest density (1.3) at Semarchua and Chamari, while at Karhi *Anagallis arvensis* L. exerted a maximum density of 1.36 in 2018. In the year 2019, the highest density was observed for *Medicago polymorpha* L. (1.3) in Barela and Semarchua. The weed species *Alternanthera sessilis* (L.) DC with a maximum density of 1.3 at Karhi and *Alternanthera sessilis* (L.) DC, *Medicago polymorpha* L. and *Rumex dentatus* L. were represented the highest density (1.1) at Chamari. The maximum density of 1.3 was recorded for *Alternanthera sessilis* (L.) DC, at Barela and 1.24 at Karhi. Weed species *Medicago polymorpha* L.

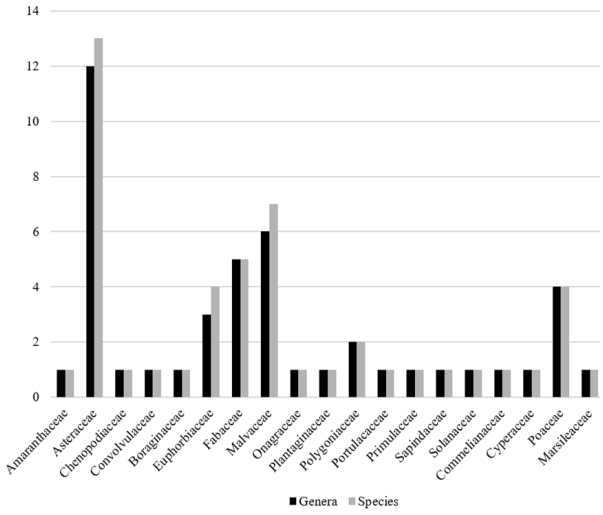

Figure 1. Graph represents no. of genera and Species distribution in different familiesFrequency, density, abundance, and important value index

showed the highest density (1.32) at Semarchua, while at Chamari *Alternanthera sessilis* (L.) DC exerted a maximum density of 1.36 in 2020. All the sites in the study area presented weed species abundance values ranging from 1 to 3. **Tables 3, 5** and **7** show the variation among the various weed species. The relative frequency value represents the less frequent and more frequent occurrences of weeds species. At the Barela village (site 1), the highest relative frequency (6.6), relative density (11.3), and relative dominance (14.6) were recorded with *Alternanthera sessilis* (L.) DC, and the IVI value was 32.5 in 2018. The maximum relative frequency (7.2), relative density (8.7), and relative dominance (15.8) were recorded with *Alternanthera sessilis* (L.) DC, and the IVI value was 32.5 in 2019. The highest

Table 1. Weed flora in wheat crop fields at the study site

S.N.	Botanical name of weed	Family	Genera	Species
Dicot				
1.	*Alternanthera sessilis* (L.) DC	Amaranthaceae	01	01
2.	*Acmella ulginosa* (Sw.) Cass. *Acmella radicans* (Jacq.) R.K. Jansen *Ageratum conyzoides* L. *Cirsium arvense* L. Scop. *Eclipta alba* (L.) Hassk *Gnaphalium lute album* L. *Grangea maderaspatana* (L.) *Parthenium hysterophorus* L. *Sonchus arvensis* L. *Sphaeranthus indicus* Kurz *Tridax procumbens* L. *Xanthium strumarium* L. *Lagascea mollis* Cav.	Asteraceae	12	13
3.	*Chenopodium album* L.	Chenopodiaceae	01	01
4.	*Ipomoea obscura* (L.)Ker Gawl.	Convolvulaceae	01	01
5.	*Heliotropium ovalifolium* L.	Boraginaceae	01	01
6.	*Chrozophora rottleri* (Geiseler) Spreng. *Euphorbia hirta* L. *Euphorbia terracina* L. *Phyllanthus niruri* L.	Euphorbiaceae	03	04
7.	*Desmodium triflorum*(L.)DC. *Cassia tora* L. *Medicago polymorpha* L. *Melilotus albus* Medik. *Rhynchosia minima* (L.)DC	Fabaceae	05	05
8.	*Abelmoschus ficulneus* (L.)Wight&Arn. *Malachra capitata* (L.)L. *Corchorus olitorius* L. *Hibiscus panduriformis* Burm.f. *Sida acuta* Burm.f. *Sida cordifolia* L. *Urena lobata* (L.)	Malvaceae	06	07
9.	*Ludwigia perennis* Burm.f.	Onagraceae	01	01
10.	*Mecardonia procumbense* (Mill) Small	Plantaginaceae	01	01
11.	*Polygonum plebeium* R.Br. *Rumex dentatus* L.	Polygoniaceae	02	02
12.	*Portulaca oleracea* L.	Portulacaceae	01	01
13.	*Anagallis arvensis* L.	Primulaceae	01	01
14.	*Cardiospermum halicacabum* L.	Sapindaceae	01	01
15.	*Physalis minima* L.	Solanaceae	01	01
Monocot				
16.	*Commelina benghalensis* L.	Commelianaceae	01	01
17.	*Cyperus difformis* L.	Cyperaceae	01	01
18.	*Cynodon dactylon* (L.) Pers. *Digitaria sanguinalis* (L.) Scop. *Echinochloa colonum* (L.) Link *Elusine indica* (L.) Gaertn.	Poaceae	04	04
Pteridophyte				
19.	*Marsilia quadrifolia* L.	Marsileaceae	01	01

relative frequency (7.56), relative density (11.33), and relative dominance (15.59) were recorded with *Alternanthera sessilis* (L.) DC, and the IVI value was 34.5 in 2020. According to IVI value, *Alternanthera sessilis* (L.) DC was found to be the most dominant weed species in 2018-2020 for site 1. At the Semarchua village (site 2), the highest relative frequency (6.8), relative density (7.1), relative dominance (18.8), and IVI value (32.7) was recorded with *Medicago polymorpha* L. in 2018.The maximum relative frequency (8.0), relative density (9.1), relative dominance (15.8), and IVI value (32.9) were observed with *Chenopodium album* L. in 2019. In the year 2020, *Medicago polymorpha* L. with relative frequency (6.78), relative density (8.39), and relative dominance (18.97) was recorded and the IVI value (34.2) was calculated. Thus, *Medicago polymorpha* L. and *Chenopodium album* L. were the most dominant weed species at the site 2. at Karhi village (site 3), the highest relative frequency (9.0), relative density (9.4), and relative dominance (13.9) were recorded with *Anagallis arvensis* L. and the IVI value was 32.3 in 2018. The maximum relative frequency (8.9), relative density (9.7), and relative dominance (19.6) were recorded with *Rumex dentatus* L. and the IVI value was 38.2 in 2019.The maximum relative frequency (9.04), relative density (9.36), relative dominance (13.91), and IVI value (32.3) were

Table 2. The frequency, density, and abundance of different weed species in the wheat crop at the study site in the year 2018 (Abbreviations: F = Frequency, D =Density, A = Abundance)

Weed species	Barela			Semarchua			Karhi			Chamari		
	%F	D	A	%F	D	A	%F	D	A	%F	D	A
Abelmoschus ficulneus (L.) Wight&Arn.	02	0.02	1.0	02	0.02	1.0	-	-	-	02	0.02	1.0
Acmella radicans (Jacq.) R.K. Jansen	04	0.04	1.0	04	0.04	1.0	02	0.02	1.0	08	0.14	1.75
Acmella ulginosa (Sw.) Cass.	10	0.16	1.6	14	0.22	1.57	04	0.04	1.0	06	0.06	1.0
Ageratum conyzoides L.	16	0.28	1.75	12	0.24	2.0	16	0.16	1.0	06	0.06	1.0
Alternanthera sessilis (L.) DC	62	1.31	2.0	64	1.2	1.81	66	1.2	1.81	58	1.12	2.0
Ammannia baccifera L.	08	0.08	1.0	02	0.04	2.0	06	0.06	1.0	04	0.06	1.5
Anagallis arvensis L.	66	0.98	1.45	58	1.21	2.18	72	1.24	1.72	60	1.16	1.93
Cardiospermum halicacabum L.	04	0.04	1.0	02	0.02	1.0	-	-	-	-	-	-
Cassia tora L.	10	0.1	1.0	12	0.12	1.0	12	0.12	1.0	02	0.02	1.0
Chenopodium album L.	58	1.27	2.21	56	1.24	2.11	54	1.04	1.92	52	0.72	1.38
Chrozophora rottleri (Geiseler) Spreng.	14	0.22	1.57	16	0.16	1.0	12	0.28	2.2	-	-	-
Cirsium arvense L.Scop.	06	0.06	1.0	-	-	-	-	-	-	02	0.02	1.0
Commelina benghalensis L.	14	0.14	1.0	02	0.02	1.0	-	-	-	06	0.1	1.66
Corchorus olitorius L.	06	0.06	1.0	04	0.04	1.0	06	0.06	1.0	04	0.04	1.0
Cynodon dactylon (L.)Pers.	26	0.28	1.0	28	0.32	1.43	20	0.24	1.83	24	0.12	1.56
Cyperus difformis L.	02	0.02	1.0	06	0.06	1.0	-	-	-	-	-	-
Desmodium triflorum(L.)DC.	18	0.18	1.0	26	0.32	1.23	22	0.26	1.18	16	0.22	1.37
Digitaria sanguinalis (L.)Scop.	10	0.21	1.35	14	0.13	1.0	08	0.11	2.1	06	0.08	1.33
Echinochloa colonum (L.)Link	45	0.78	1.72	42	0.43	1.32	46	0.76	1.63	38	0.68	2.21
Eclipta alba (L.)Hassk	22	0.22	1.0	24	0.28	1.0	20	0.23	1.08	16	0.18	1.16
Elusine indica (L.)Gaertn.	12	0.12	1.0	16	0.18	1.23	08	0.10	1.75	06	0.1	1.66
Euphorbia hirta L.	16	0.24	1.34	20	0.3	1.35	22	0.21	1.25	18	0.22	1.16
Euphorbia terracina L.	12	0.10	1.0	14	0.17	2.2	18	0.21	1.0	10	0.14	1.23
Gnaphalium luteoalbum L.	08	0.08	2.0	20	0.28	1.4	-	-	-	-	-	-
Grangea maderaspatana (L.)	36	0.34	1.98	32	0.52	1.63	32	0.13	2.0	26	0.55	2.12
Heliotropium ovalifolium L.	12	0.11	1.0	16	0.26	1.0	16	0.16	1.0	14	0.14	1.0
Hibiscus panduriformis Burm.f.	06	0.06	1.0	04	0.04	1.0	08	0.08	1.0	04	0.04	1,0
Lagascea mollis Cav.	16	0.26	1.74	22	0.28	1.27	10	0.12	1.25	06	0.26	4.33
Ludwigia perrenis Burm.f.	10	0.1	1.0	02	0.02	1.0	-	-	-	02	0.02	1.0
Malacra capitata (L.)L.	18	0.18	1.0	12	0.14	1.16	08	1.12	1.28	06	0.06	1.0
Marsilia quadrifolia L.	-	-	-	04	0.04	1.0	-	-	-	-	-	-
Mecardonia procumbense (Mill) Small	18	0.36	2.3	04	0.04	1.0	16	0.32	2.16	22	0.54	2.45
Medicago polymorpha L.	54	1.28	2.37	60	1.32	2.2	56	1.16	2.07	52	1.34	2.21
Melilotus albus Medik.	50	1.16	2.32	54	1.12	2.07	52	0.9	1.73	46	1.21	2.0
Parthenium hysterophorus L.	12	0.12	1.0	10	0.1	1.0	06	0.06	1.0	04	0.1	2.5
Phyllanthus niruri L	14	0.14	1.0	06	0.06	1.0	10	0.1	1.0	04	0.04	1.0
Physalis minima L.	24	0.24	1.0	28	0.32	1.14	20	0.3	1.5	18	0.13	1.0
Polygonum plebeium R.Br.	28	0.52	1.85	34	0.68	2.0	24	0.56	2.33	40	0.54	1.35
Rinchosia minima (L)DC	-	-	-	-	-	-	-	-	-	04	0.04	1.0
Rumex dentatus L.	60	1.04	1.73	52	1.04	2.0	54	0.94	2.23	60	0.78	1.3
Portulaca oleracea L.	02	0.02	1.0	-	-	-	02	0.02	1.0	-	-	-
Sida acuta Burm.f.	12	0.12	1.0	08	0.08	1.0	-	-	-	04	0.04	1.0
Sida cordifolia L.	08	0.08	1.0	06	0.06	1.0	06	0.06	1.0	02	0.02	1.0
Sonchus arvensis L.	08	0.08	1.0	04	0.04	1.0	04	0.04	1.0	08	0.08	1.0
Sphaeranthus indicus Kurz	08	0.08	1.0	24	0.42	1.75	26	0.46	1.79	20	0.31	1.42
Tridax procumbens L.	04	0.04	1.0	14	0.26	1.85	10	0.1	1.0	10	0.18	150
Urena lobata (L.)	-	-	-	02	0.02	1.0	-	-	-	04	0.04	1.0
Xanthium strumarium L.	02	0.02	1.0	04	0.04	1.0	02	0.02	1.0	02	0.02	1.0

noticed with the weed species *Anagallis arvensis* L. in 2020.Thus, *Anagallis arvensis* L. and *Rumex dentatus* L. were the most dominant weeds at the site 3. At the Chamari village (site 4), the highest relative frequency (7.1), relative density (8.9), relative dominance (20.5), and IVI value (36.5) was recorded for *Chenopodium album* L. in 2018. The maximum relative frequency (9.0), relative density (8.6), relative dominance (19.7), and IVI value (37.3) was observed with *Rumex dentatus* L. in 2019. *Chenopodium album* L., with a relative frequency of 7.10, a relative density of 8.89, a relative dominance of 20.54, and an IVI value of 36.5, was recorded in Chamari (site 4) in the year 2020. Thus, *Chenopodium album* L. and *Rumex dentatus* L. were the most dominant weed species in wheat crop fields of site 4. The highest IVI values of a few weeds at all the four sites have also been depicted in **Figure 2**.

Gupta *et al.* (2008), Malik *et al.* (2013) and Khobragade and Sathawane (2014) listed *Avena*

Table 3. The relative frequency, relative density, relative dominance, and IVI of different weeds in the wheat crop at the study site in the year 2018

Weed species	Barela				Semarchua				Karhi				Chamari			
	RF	RD	RDom	IVI	RF	RD	RDom	IVI	RF	RD	RDom	IVI	RF	RD	RDom	IVI
Abelmoschus ficulneus (L.)Wight&Arn.	0.5	0.3	0.0	0.8	0.2	0.1	0.0	0.3	-	-	-	-	0.7	0.4	0.0	1.1
Acmella radicans (Jacq.) R.K.Jansen	0.2	0.2	0.0	0.4	0.9	0.5	0.2	1.6	0.8	0.5	0.0	1.3	1.9	1.6	0.6	4.1
Acmella ulginosa (Sw.) Cass.	1.2	1.3	0.3	2.8	1.8	1.9	0.4	4.1	0.8	0.8	0.1	1.7	1.7	1.4	0.4	3.5
Ageratum conyzoides L.	1.9	2.5	0.8	5.2	1.6	1.5	0.4	3.5	2.5	3.4	2.4	8.3	1.9	1.9	1.0	4.8
Alternanthera sessilis (L.) DC	6.6	11.3	14.6	32.5	7.5	7.6	5.3	20.4	8.0	9.1	11.6	28.7	7.3	9.3	13.8	30.4
Ammannia baccifera L.	0.7	0.5	0.0	1.2	0.2	0.3	0.0	0.5	0.8	0.5	0.0	1.2	-	-	-	-
Anagallis arvensis L.	8.0	8.8	9.4	26.2	6.3	7.5	3.8	17.6	9.0	9.4	13.9	32.3	7.1	7.9	10.0	25.0
Cardiospermum halicacabum L.	0.5	0.3	0.0	0.8	0.5	0.2	0.0	0.7	-	-	-	-	-	-	-	-
Cassia tora L.	0.9	0.7	0.0	1.6	1.4	0.8	0.3	2.5	1.5	0.9	0.2	2.6	1.2	0.7	0.1	2.0
Chenopodium album L.	6.6	8.0	12.6	27.2	6.3	7.9	6.2	20.4	6.8	7.9	14.6	29.3	7.1	8.9	20.5	36.5
Chrozophora rottleri (Geiseler) Spreng.	1.9	1.7	0.4	4.0	2.9	2.3	0.9	6.1	1.5	1.8	0.6	3.9	1.7	1.5	0.4	3.6
Cirsium arvense L.Scop.	0.7	0.5	0.0	1.2	-	-	-	-	0.5	0.3	0.0	0.8	0.2	1.4	0.0	1.6
Commelina benghalensis L.	1.9	1.3	0.4	3.6	0.2	0.1	0.0	0.3	-	-	-	-	-	-	-	-
Corchorus olitorius L.	0.9	0.7	0.0	1.6	1.1	0.6	0.0	1.7	0.5	0.3	0.0	0.8	0.7	0.4	0.0	1.1
Cynodon dactylon (L.)Pers.	2.4	3.8	0.9	7.1	3.4	3.0	0.6	7.0	2.8	3.5	1.2	7.5	3.8	3.8	1.2	8.8
Cyperus difformis L.	0.5	0.3	0.0	0.8	0.7	0.4	0.1	1.1	-	-	-	-	-	-	-	-
Desmodium triflorum(L.)DC.	2.1	2.2	0.1	4.4	3.0	2.0	1.2	6.2	2.8	3.5	1.2	7.5	2.8	2.7	0.3	5.8
Digitaria sanguinalis (L.)Scop.	0.9	0.8	0.1	1.8	1.8	1.0	0.2	3.0	0.8	1.0	0.1	1.9	1.4	1.1	0.1	2.6
Echinochloa colonum (L.)Link	5.2	6.0	5.9	17.1	4.5	3.1	2.7	10.3	5.3	4.2	4.6	14.1	5.5	4.4	4.6	14.5
Eclipta alba (L.)Hassk	2.8	2.0	0.4	5.2	2.9	1.7	0.7	5.3	3.0	2.0	0.4	5.4	3.6	2.2	0.6	6.4
Elusine indica (L.)Gaertn.	1.4	1.0	0.3	2.7	1.6	1.0	0.5	3.1	1.3	1.4	0.5	3.2	-	-	-	-
Euphorbia hirta L.	2.1	1.5	0.4	4.0	1.8	1.3	0.7	3.8	3.3	2.6	1.4	7.3	3.6	2.2	1.0	6.8
Euphorbia terracina L.	1.9	1.3	0.3	3.6	1.4	1.7	1.2	4.3	3.0	1.8	0.9	5.7	2.6	1.5	0.5	4.6
Gnaphalium luteoalbum L.	0.9	0.7	0.4	2.0	2.3	1.8	1.6	5.7	-	-	-	-	-	-	-	-
Grangea maderaspatana (L.)	3.8	2.7	6.2	12.6	4.1	4.2	7.2	15.5	3.8	5.3	7.2	16.3	3.1	5.2	5.9	14.2
Heliotropium ovalifolium	1.7	1.2	0.2	3.1	1.6	0.9	0.3	2.8	2.0	1.2	0.3	3.5	1.4	0.8	0.1	2.3
Hibiscus panduriformis Burm.f.	0.7	0.5	0.0	1.2	0.5	0.3	0.0	0.8	1.0	0.6	0.1	1.7	0.5	0.3	0.0	0.8
Ipomoea obscura (L.)Ker Gawl.	0.2	0.2	0.0	0.4	-	-	-	-	-	-	-	-	-	-	-	-
Lagascea mollis Cav.	1.7	2.0	0.7	4.4	2.5	1.8	1.4	5.7	2.0	1.5	0.5	4.0	1.4	1.5	0.5	3.4
Ludwigia perrenis Burm.f.	1.2	0.8	0.1	2.1	0.2	0.1	0.0	0.3	-	-	-	-	0.5	0.3	0.0	0.8
Malacra capitata (L.)L.	1.4	1.0	0.2	2.6	1.4	0.9	0.4	2.7	1.0	0.8	0.1	1.9	1.7	1.1	0.3	3.1
Marsilia quadrifolia L.	-	-	-	-	0.5	0.3	0.0	0.8	-	-	-	-	0.7	0.4	0.0	1.1
Mecardonia procumbense (Mill) Small	1.7	2.7	0.2	4.6	0.5	0.3	0.0	0.8	2.0	2.6	0.2	4.8	0.7	1.5	0.0	2.28
Medicago polymorpha L.	6.4	10.7	13.7	30.8	6.8	7.1	18.8	32.7	7.0	8.8	9.6	25.4	6.2	8.5	10.2	24.9
Melilotus albus Medik.	5.9	9.7	12.6	28.2	6.1	7.1	15.3	28.5	6.5	6.8	6.5	19.8	5.2	7.3	9.3	21.8
Parthenium hysterophorus L.	1.4	1.0	0.1	2.5	1.1	0.6	0.1	1.8	0.8	0.5	0.0	1.2	1.4	0.8	0.0	2.2
Phyllanthus niruri L	1.7	1.2	0.2	3.1	0.7	0.4	0.0	1.1	0.5	0.3	0.0	0.8	0.5	0.3	0.0	0.8
Physalis minima L.	2.8	2.0	0.5	5.3	3.2	2.0	1.4	6.6	2.5	2.3	0.9	5.7	3.6	2.1	0.7	6.4
Polygonum plebeium R.Br.	3.3	4.3	0.4	8.0	3.8	4.3	4.5	12.6	3.0	4.2	2.0	9.2	3.8	4.1	2.1	10.0
Rinchosia minima (L)DC	-	-	-	-	-	-	-	-	-	-	-	-	0.6	0.3	0.0	0.9
Rumex dentatus L.	7.1	8.6	16.1	31.8	5.9	6.6	21.6	34.1	6.8	7.1	16.6	30.5	6.4	7.4	13.0	26.8
Portulaca oleracea L.	0.2	0.2	0.0	0.4	-	-	-	-	0.3	0.2	0.0	0.5	-	-	-	-
Sida acuta Burm.f.	1.4	1.0	0.0	2.4	0.9	0.5	0.0	1.4	-	-	-	-	0.7	0.4	0.0	1.1
Sida cordifolia L.	0.9	0.7	0.0	1.6	0.7	0.4	0.0	1.1	0.8	0.5	0.0	1.2	0.5	0.3	0.0	0.8
Sonchus arvensis L.	0.9	0.7	0.1	1.7	0.5	0.3	0.0	0.8	0.5	0.3	0.0	0.8	0.9	0.5	0.1	1.5
Sphaeranthus indicus Kurz	0.9	0.7	0.0	1.6	2.7	2.7	2.5	7.9	3.3	3.5	2.9	9.7	3.1	3.6	2.0	8.7
Tridax procumbens L.	0.5	0.3	0.0	0.8	1.6	1.7	0.6	3.9	1.3	0.8	0.0	2.1	1.9	1.1	0.1	3.1
Urena lobata (L.)	-	-	-	-	0.2	0.1	0.0	0.3	-	-	-	-	0.2	0.1	0.0	0.3
Xanthium strumarium L.	0.2	0.2	0.0	0.4	0.5	0.3	0.0	0.8	-	-	-	-	0.Abre8	0.3	1.2	2.3

(Abbreviations: RF= Relative frequency, RD= Relative density, RDom = Relative dominance and IVI = Importance value index)

sativa, Anagallis arvensis, Coronopus didymus, Chenopodium album, Cynodon dactylon, Fumaria indica, Melilotus indica, Medicago polymorpha, Phalaris minor, Polypogon monspeliensis, Polygonum plebeium, Parthenium hysterophorus, Poa annua, Rumex dentatus, Stellaria media, and Veronica persica as dominant weed species in wheat crop fields based on the highest important values index. Moghe (2017), found the highest importance value index for *Melilotus indica* L. (71.58%), *Echinochloa colonum* L. (45.58%), and *Avena fatua* L. (16.66%) in wheat crop fields in Sakri Bilaspur district of Chhattisgarh. According to Khanal *et al.* (2018), a higher IVI value was seen on *Anagallis arvensis, Vicia sativa,* and *Chenopodium album* in the wheat-mustard ecosystem at Paklihawa, Rupandehi, Nepal. Kumar *et al*. (2020), and Kumar and Shivani, (2020), observed the highest importance value for *Phalaris minor, Chenopodium album, Cynodon dactylon* L., and *Parthenium hysterophorus* L. in wheat crop fields. *Cyperus rotundas* and *Echinochloa colona* registered the highest IVI (Kumar *et al.*2023).

Conclusion

The environmental factors such as soil type, agricultural practices, weed control methods, cropping system and other cultivation practices affect the diversity, distribution and composition of

Table 4. The frequency, density, and abundance of different weed species in the wheat crop at the study site in the year 2019

Weed species	Barela			Semarchua			Karhi			Chamari		
	%F	D	A	%F	D	A	%F	D	A	%F	D	A
Abelmoschus ficulneus (L.)Wight&Arn.	04	0.0	1.0	02	0.0	1.0	-	-	-	02	0.0	1.0
Acmella radicans (Jacq.) R.K.Jansen	16	0.2	1.5	06	0.1	1.0	08	0.2	3.0	08	0.1	1.0
Acmella ulginosa (Sw.) Cass.	16	0.3	1.9	06	0.1	1.0	10	0.7	1.6	08	0.1	1.0
Ageratum conyzoides L.	14	0.2	1.1	20	0.2	1.2	14	0.3	1.9	06	0.1	1.7
Alternanthera sessilis (L.) DC	50	1.0	2.1	56	1.1	2.0	50	1.3	2.5	44	1.1	2.5
Ammannia baccifera L.	04	0.0	1.0	-	-	-	02	0.0	1.0	04	0.0	1.0
Anagallis arvensis L.	68	1.0	1.6	40	0.9	2.3	60	1.2	1.9	46	1.0	2.3
Cardiospermum halicacabum L.	-	-	-	-	-	-	02	0.0	1.0	-	-	-
Cassia tora L.	10	0.1	1.0	02	0.0	1.0	08	0.1	1.3	02	0.0	1.0
Chenopodium album L.	42	0.7	1.7	60	1.1	1.9	58	1.2	1.9	60	1.0	1.6
Chrozophora rottleri (Geiseler) Spreng.	08	0.2	3.0	12	0.2	2.0	16	0.3	0.8	-	-	-
Cirsium arvense L.Scop.	-	-	-	02	0.0	1.0	-	-	-	02	0.0	1.0
Commelina benghalensis L.	14	0.2	1.4	-	-	-	06	0.1	1.7	12	0.2	1.3
Corchorus olitorius L.	12	0.2	1.3	04	0.0	1.0	04	0.0	1.0	04	0.0	1.0
Cynodon dactylon (L.)Pers.	36	0.8	2.2	34	0.8	2.2	32	0.4	1.3	32	0.6	2.0
Cyperus difformis L.	02	0.0	1.0	-	-	-	-	-	-	-	-	-
Desmodium triflorum(L.)DC.	24	0.5	2.2	22	0.3	1.9	24	0.4	1.7	26	0.6	2.3
Digitaria sanguinalis (L.)Scop.	20	0.2	1.2	04	0.0	1.0	04	0.0	1.0	04	0.0	1.0
Echinochloa colonum (L.)Link	48	0.8	1.8	54	0.9	1.7	38	0.6	1.6	62	0.9	1.5
Eclipta alba (L.)Hassk	12	0.1	1.0	16	0.2	1.1	12	0.2	1.6	12	0.1	1.0
Elusine indica (L.)Gaertn.	04	0.0	1.0	12	0.1	1.0	08	0.1	1.3	-	-	-
Euphorbia hirta L.	08	0.1	1.8	14	0.2	1.3	16	0.3	1.3	20	0.2	1.2
Euphorbia terracina L.	14	0.3	2.3	12	0.3	2.2	16	0.2	1.0	-	-	-
Gnaphalium luteoalbum L.	08	0.1	2.0	12	0.1	1.0	-	-	-	-	-	-
Grangea maderaspatana (L.)	14	0.3	2.3	40	0.9	2.1	30	0.3	1.1	24	0.4	1.7
Heliotropium ovalifolium L.	12	0.1	1.0	14	0.1	1.0	16	0.2	1.0	10	0.2	2.2
Hibiscus panduriformis Burm.f.	02	0.0	1.0	04	0.0	1.0	02	0.0	1.0	04	0.0	1.0
Lagascea mollis Cav.	14	0.2	1.7	16	0.2	1.3	12	0.2	1.8	06	0.1	1.7
Ludwigia perrenis Burm.f.	10	0.1	1.0	-	-	-	02	0.0	1.0	04	0.0	1.0
Malacra capitata (L.)L.	04	0.0	1.0	08	0.1	1.0	12	0.2	1.3	10	0.1	1.2
Marsilia quadrifolia L.	-	-	-	04	0.0	1.0	-	-	-	-	-	-
Mecardonia procumbense (Mill) Small	24	0.6	2.3	14	0.1	1.0	08	0.1	1.5	16	0.3	2.0
Medicago polymorpha L.	62	1.3	2.2	60	1.3	2.1	40	0.9	2.4	64	1.1	1.8
Melilotus albus Medik.	46	0.6	1.4	58	0.9	1.4	46	0.8	1.7	60	1.0	1.7
Parthenium hysterophorus L.	20	0.2	1.0	12	0.1	1.0	10	0.1	1.2	08	0.1	1.0
Phyllanthus niruri L	16	0.2	1.5	06	0.1	1.0	06	0.1	1.0	08	0.1	1.3
Physalis minima L.	24	0.3	1.3	20	0.2	1.1	10	0.2	1.2	12	0.1	1.0
Polygonum plebeium R.Br.	12	0.2	1.8	32	0.6	1.9	30	0.7	2.0	32	0.7	2.1
Rinchosia minima (L)DC	08	0.1	1.0	-	-	-	04	0.0	1.0	02	0.0	1.0
Rumex dentatus L.	56	1.2	2.1	52	1.1	2.2	64	1.2	1.9	66	1.1	1.6
Portulaca oleracea L.	02	0.0	1.0	-	-	-	-	-	-	-	-	-
Sida acuta Burm.f.	12	0.1	1.0	06	0.1	1.0	04	0.0	1.0	04	0.0	1.0
Sida cordifolia L.	04	0.0	1.0	02	0.0	1.0	02	0.0	1.0	04	0.0	1.0
Sonchus arvensis L.	14	0.1	1.0	04	0.1	1.5	06	0.1	1.3	06	0.1	1.0
Sphaeranthus indicus Kurz	12	0.2	1.8	24	0.3	1.3	10	0.2	1.2	30	0.4	1.4
Tridax procumbens L.	04	0.0	1.0	06	0.1	1.3	10	0.1	1.0	10	0.1	1.0
Urena lobata (L.)	02	0.0	1.0	-	-	-	02	0.0	1.0	-	-	-
Xanthium strumarium L.	02	0.0	1.0	04	0.0	1.0	-	-	-	-	-	-

weed flora. The presence of dominant weeds shows their strong adaptability with environment. Some weeds clearly indicate that they have grown in special condition. *Alternanthera sessilis* (L.) DC, *Anagallis arvensis* L., *Medicago polymorpha* L.and *Rumex dentatus* L. were found as the most dominant weeds in all the study site of the study area. This survey provides basic and important information to design for the better weed management management strategies at the four study sites in Mungeli district of Chhatisgarh.

Table 5. The relative frequency, relative density, relative dominance, and IVI of different weeds in the wheat crop at the study site in the year 2019

Weed species	Barela				Semarchua				Karhi				Chamari			
	RF	RD	RDom	IVI	RF	RD	RDom	IVI	RF	RD	RDom	IVI	RF	RD	RDom	IVI
Abelmoschus ficulneus (L.)Wight&Arn.	0.5	0.3	0.0	0.8	0.3	0.2	0.0	0.5	-	-	-	-	0.3	0.7	0.0	1.0
Acmella radicans (Jacq.) R.K.Jansen	2.0	1.8	0.0	3.8	0.8	0.5	0.1	1.4	1.1	1.9	0.1	3.1	1.1	0.7	0.0	1.8
Acmella ulginosa (Sw.) Cass.	2.0	2.2	0.7	4.9	0.8	0.5	0.1	1.4	1.4	1.3	0.1	2.8	1.1	0.7	0.0	1.8
Ageratum conyzoides L.	1.7	1.1	0.9	3.7	2.6	1.8	0.3	4.7	1.9	2.0	0.3	4.2	0.8	0.8	0.2	1.8
Alternanthera sessilis (L.) DC	7.2	8.7	15.8	31.7	7.2	8.6	11.9	27.7	6.9	9.9	9.6	26.4	6.0	8.8	11.6	26.4
Ammannia baccifera L.	0.5	0.3	0.0	0.8	-	-	-	-	0.3	0.2	0.1	0.6	0.5	0.3	0.0	0.8
Anagallis arvensis L.	8.4	7.8	8.9	25.1	5.2	6.9	9.8	21.9	8.3	9.1	12.6	30.0	6.3	8.5	10.7	25.5
Cardiospermum halicacabum L.	-	-	-	-	-	-	-	-	0.3	0.2	0.0	0.5	-	-	-	-
Cassia tora L.	1.2	0.7	0.0	1.9	0.3	0.2	0.0	0.5	1.1	0.8	0.0	1.9	0.3	0.2	0.0	0.5
Chenopodium album L.	5.2	5.3	10.3	20.8	7.7	8.8	15.7	32.2	8.0	9.1	15.8	32.9	8.2	8.1	15.5	31.8
Chrozophora rottleri (Geiseler) Spreng.	1.0	1.8	0.5	3.3	1.5	1.8	0.6	3.9	2.2	2.1	1.0	5.3	-	-	-	-
Cirsium arvense L.Scop.	-	--	-	-	0.3	0.2	0.0	0.5	-	-	-	-	0.3	0.2	0.0	0.5
Commelina benghalensis L.	1.7	1.5	0.4	3.6	-	-	-	-	0.8	0.8	5.3	6.9	1.6	1.3	5.3	8.2
Corchorus olitorius L.	1.5	1.2	0.0	2.7	0.5	0.3	0.0	0.5	0.6	0.3	0.0	0.9	0.5	0.3	0.0	0.8
Cynodon dactylon (L.)Pers.	4.4	5.9	1.6	11.9	4.4	5.9	2.2	12.5	4.4	3.3	2.0	9.7	4.4	5.2	2.1	11.7
Cyperus difformis L.	0.2	0.1	0.0	0.3	-	-	-	-	-	-	-	-	-	-	-	-
Desmodium triflorum(L.)DC.	3.0	3.8	0.3	7.1	2.8	2.0	0.3	5.1	3.3	3.1	0.9	7.3	3.5	4.9	0.7	9.1
Digitaria sanguinalis (L.)Scop.	2.5	1.8	0.2	4.5	0.5	0.3	0.0	0.8	0.6	0.3	0.0	0.9	0.5	0.3	0.0	0.8
Echinochloa colonum (L.)Link	6.0	6.2	5.8	18.0	7.0	7.1	21.6	35.7	5.3	4.4	21.7	31.4	8.4	7.5	21.9	37.8
Eclipta alba (L.)Hassk	1.5	0.9	0.5	2.9	2.1	1.4	0.1	3.6	1.7	1.3	0.1	3.1	1.6	1.0	0.1	2.7
Elusine indica (L.)Gaertn.	0.5	0.3	0.0	0.8	1.5	0.9	0.0	2.4	1.1	0.8	0.2	2.1	-	-	-	-
Euphorbia hirta L.	1.0	1.0	0.4	2.4	1.8	1.4	0.6	3.8	3.3	2.4	0.1	5.8	2.7	2.0	0.8	5.5
Euphorbia terracina L.	1.7	2.3	0.3	4.3	1.5	2.0	0.2	3.7	2.2	1.7	0.3	4.2	-	-	-	-
Gnaphalium luteoalbum L.	1.0	0.6	0.0	1.6	1.5	0.9	0.0	2.4	-	-	-	-	-	-	-	-
Grangea maderaspatana (L.)	1.7	2.3	0.3	4.3	5.2	6.5	6.2	17.9	4.2	2.7	3.1	10.0	3.3	3.3	3.1	9.7
Heliotropium ovalifolium	1.5	0.9	0.2	2.6	1.8	1.1	0.5	3.4	2.2	1.3	0.9	4.4	1.4	1.8	0.8	4.0
Hibiscus panduriformis Burm.f.	0.2	0.1	0.0	0.3	0.5	0.3	0.0	0.8	0.3	0.2	0.0	0.5	0.5	0.3	0.0	0.8
Ipomoea obscura (L.)Ker Gawl.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lagascea mollis Cav.	1.7	1.8	0.8	4.3	2.1	1.5	0.3	3.9	1.7	1.7	0.1	3.5	0.8	0.8	0.1	1.7
Ludwigia perrenis Burm.f.	1.2	0.7	0.1	2.0	-	-	-	-	0.3	0.2	0.0	0.5	0.5	0.3	0.0	0.8
Malacra capitata (L.)L.	0.5	0.3	0.7	1.5	1.0	0.6	0.2	1.8	1.7	1.3	0.2	3.2	1.4	1.0	0.2	2.6
Marsilia quadrifolia L.	-	-	-	-	0.6	0.3	0.0	0.9	-	-	-	-	-	-	-	-
Mecardonia procumbense (Mill) Small	3.0	4.1	0.7	7.8	1.8	1.1	0.1	3.0	1.1	0.9	0.1	2.1	2.2	2.6	0.2	5.0
Medicago polymorpha L.	7.7	10.0	12.2	29.9	7.7	9.7	12.8	30.2	5.6	7.5	8.3	21.4	8.7	9.1	12.5	30.3
Melilotus albus Medik.	5.7	4.7	11.6	22.0	7.5	6.5	10.3	24.3	6.4	6.3	9.3	22.0	8.2	8.3	12.6	29.1
Parthenium hysterophorus L.	2.5	1.5	0.3	4.3	1.5	0.9	0.1	2.5	1.4	0.9	0.1	2.4	1.1	0.7	0.1	1.9
Phyllanthus niruri L	2.0	1.8	0.1	3.9	0.8	0.5	0.0	1.3	0.8	0.5	0.0	1.3	1.1	0.8	0.0	1.9
Physalis minima L.	3.0	2.2	0.6	5.8	2.6	1.7	0.3	4.6	1.4	1.9	0.1	3.4	1.6	1.0	0.1	2.7
Polygonum plebeium R.Br.	1.5	1.6	0.1	3.2	4.1	4.6	3.7	12.4	4.2	5.7	2.6	12.5	4.4	5.4	3.9	13.7
Rinchosia minima (L)DC	1.0	0.6	0.0	1.6	-	-	-	-	0.6	0.3	0.0	0.9	0.3	0.2	0.0	0.5
Rumex dentatus L.	7.0	8.5	15.2	30.7	5.7	7.6	17.3	30.6	8.9	9.7	19.6	38.2	9.0	8.6	19.7	37.3
Portulaca oleracea L.	0.2	0.1	0.0	0.3	-	-	-	-	-	-	-	-	-	-	-	-
Sida acuta Burm.f.	1.5	0.9	0.2	2.6	0.8	0.5	0.0	1.3	0.6	0.3	0.0	0.9	0.5	0.3	0.0	0.8
Sida cordifolia L.	0.5	0.3	0.1	0.9	0.3	0.2	0.0	0.5	0.3	0.2	0.0	0.5	0.5	0.3	0.0	0.8
Sonchus arvensis L.	1.7	1.0	0.2	2.9	0.5	0.5	0.1	1.1	0.8	0.6	0.1	1.5	0.8	0.5	0.1	1.4
Sphaeranthus indicus Kurz	1.5	1.6	0.3	3.4	3.1	2.5	1.7	7.3	1.4	1.9	1.5	4.8	4.1	3.4	1.9	9.4
Tridax procumbens L.	0.5	0.3	0.4	1.2	0.8	0.6	0.0	1.4	1.4	0.8	0.1	2.3	1.4	0.8	0.1	2.3
Urena lobata (L.)	0.2	0.1	0.0	0.3	-	-	-	-	0.3	0.2	0.0	0.5	-	-	-	-
Xanthium strumarium L.	0.2	0.1	0.0	0.3	0.5	0.3	0.0	0.8	-	-	-	-	-	-	-	-

Table 6. The frequency, density, and abundance of different weed species in the wheat crop at the study site in the year 2020

Weed species	Barela			Semarchua			Karhi			Chamari		
	%F	D	A	%F	D	A	%F	D	A	%F	D	A
Abelmoschus ficulneus (L.) Wight&Arn.	04	0.04	1.0	02	0.02	1.0	-	-	-	06	0.06	1.0
Acmella radicans (Jacq.) R.K.Jansen	02	0.02	1.0	08	0.08	1.0	06	0.06	1.0	16	0.24	1.5
Acmella ulginosa (Sw.) Cass.	10	0.16	1.6	16	0.3	1.87	06	0.1	1.66	14	0.2	1.42
Ageratum conyzoides L.	16	0.3	1.5	14	0.24	1.71	20	0.42	2.1	16	0.28	1.75
Alternanthera sessilis (L.) DC	64	1.36	2.12	66	1.2	1.81	64	1.2	1.87	62	1.36	2.19
Ammannia baccifera L.	06	0.06	1.0	02	0.04	2.0	06	0.06	1.0	-	-	-
Anagallis arvensis L.	68	1.06	1.55	56	1.18	2.10	72	1.24	1.72	60	1.16	1.93
Cardiospermum halicacabum L.	04	0.04	1.0	04	0.04	1.0	-	-	-	-	-	-
Cassia tora L.	08	0.08	1.0	12	0.12	1.0	12	0.12	1.0	10	0.1	1.0
Chenopodium album L.	56	0.96	1.71	56	1.24	2.21	54	1.04	1.92	60	1.3	2.16
Chrozophora rottleri (Geiseler) Spreng.	16	0.2	1.25	26	0.36	1.38	12	0.24	2.0	14	0.22	1.57
Cirsium arvense L.Scop.	06	0.06	1.0	-	-	-	-	-	-	02	0.02	1.0
Commelina benghalensis L.	16	0.16	1.0	02	0.02	1.0	-	-	-	-	-	-
Corchorus olitorius L.	08	0.08	1.0	10	0.1	1.0	04	0.04	1.0	06	0.06	1.0
Cynodon dactylon (L.)Pers.	20	0.46	2.3	30	0.46	1.53	22	0.46	2.09	32	0.56	1.75
Cyperus difformis L.	04	0.04	1.0	06	0.06	1.0	-	-	-	-	-	-
Desmodium triflorum(L.)DC.	18	0.26	1.44	26	0.32	1.23	22	0.26	1.18	24	0.4	1.66
Digitaria sanguinalis (L.)Scop.	08	0.1	1.25	16	0.16	1.0	06	0.14	2.33	12	0.16	1.33
Echinochloa colonum (L.)Link	44	0.72	1.63	40	0.48	1.2	42	0.56	1.33	46	0.64	1.39
Eclipta alba (L.)Hassk	24	0.24	1.0	26	0.26	1.0	24	0.26	1.08	30	0.32	1.06
Elusine indica (L.)Gaertn.	12	0.12	1.0	14	0.16	1.14	10	0.18	1.8	-	-	-
Euphorbia hirta L.	18	0.18	1.0	16	0.2	1.25	26	0.34	1.30	30	0.32	1.06
Euphorbia terracina L.	16	0.16	1.0	12	0.26	2.16	24	0.24	1.0	22	0.22	1.0
Gnaphalium luteoalbum L.	08	0.08	2.0	20	0.28	1.4	-	-	-	-	-	-
Grangea maderaspatana (L.)	32	0.32	1.93	36	0.66	1.83	30	0.7	2.33	26	0.76	2.92
Heliotropium ovalifolium L.	14	0.14	1.0	14	0.14	1.0	16	0.16	1.0	12	0.12	1.0
Hibiscus panduriformis Burm.f.	06	0.06	1.0	04	0.04	1.0	08	0.08	1.0	04	0.04	1,0
Ipomoea obscura (L.)Ker Gawl.	02	0.02	1.0	-	-	-	-	-	-	-	-	-
Lagascea mollis Cav.	14	0.24	1.71	22	0.28	1.27	16	0.2	1.25	12	0.22	1.83
Ludwigia perrenis Burm.f.	10	0.1	1.0	02	0.02	1.0	-	-	-	04	0.04	1.0
Malacra capitata (L.)L.	12	0.12	1.0	12	0.14	1.16	08	0.1	1.25	14	0.16	1.14
Marsilia quadrifolia L.	-	-	-	04	0.04	1.0	-	-	-	06	0.06	1.0
Mecardonia procumbense (Mill) Small	14	0.32	2.28	04	0.04	1.0	16	0.34	2.12	06	0.22	3.6
Medicago polymorpha L.	54	1.28	2.37	60	1.32	2.2	56	1.16	2.07	52	1.24	2.38
Melilotus albus Medik.	50	1.16	2.32	54	1.12	2.07	52	0.9	1.73	44	1.06	2.40
Parthenium hysterophorus L.	12	0.12	1.0	10	0.1	1.0	06	0.06	1.0	12	0.12	1.0
Phyllanthus niruri L	14	0.14	1.0	06	0.06	1.0	10	0.1	1.0	04	0.04	1.0
Physalis minima L.	24	0.24	1.0	28	0.32	1.14	20	0.3	1.5	30	0.3	1.0
Polygonum plebeium R.Br.	28	0.52	1.85	34	0.68	2.0	24	0.56	2.33	32	0.6	1.87
Rinchosia minima (L)DC	-	-	-	-	-	-	-	-	-	04	0.04	1.0
Rumex dentatus L.	60	1.04	1.73	52	1.04	2.0	54	0.94	2.23	54	1.08	2.0
Portulaca oleracea L.	02	0.02	1.0	-	-	-	02	0.02	1.0	-	-	-
Sida acuta Burm.f.	12	0.12	1.0	08	0.08	1.0	-	-	-	06	0.06	1.0
Sida cordifolia L.	08	0.08	1.0	06	0.06	1.0	06	0.06	1.0	04	0.04	1.0
Sonchus arvensis L.	08	0.08	1.0	04	0.04	1.0	04	0.04	1.0	08	0.08	1.0
Sphaeranthus indicus Kurz	08	0.08	1.0	24	0.42	1.75	26	0.46	1.79	26	0.52	2.0
Tridax procumbens L.	04	0.04	1.0	14	0.26	1.85	10	0.1	1.0	16	0.16	1.0
Urena lobata (L.)	-	-	-	02	0.02	1.0	-	-	-	02	0.02	1.0
Xanthium strumarium L.	02	0.02	1.0	04	0.04	1.0	-	-	-	04	0.04	1.0

Table 7. The relative frequency, relative density, relative dominance, and IVI of different weeds in the wheat crop at the study site in the year 2020

Weed species	Barela				Semarchua				Karhi				Chamari			
	RF	RD	RDom	IVI	RF	RD	RDom	IVI	RF	RD	RDom	IVI	RF	RD	RDom	IVI
Abelmoschus ficulneus (L.)Wight&Arn.	0.5	0.3	0.0	0.8	0.2	0.1	0.0	0.3	-	-	-	-	0.7	0.4	0.0	1.1
Acmella radicans (Jacq.) R.K.Jansen	0.2	0.2	0.0	0.4	0.9	0.5	0.2	1.6	0.8	0.5	0.0	1.3	1.9	1.6	0.6	4.1
Acmella ulginosa (Sw.) Cass.	1.2	1.3	0.3	2.8	1.8	1.9	0.4	4.1	0.8	0.8	0.1	1.7	1.7	1.4	0.4	3.5
Ageratum conyzoides L.	1.9	2.5	0.8	5.2	1.6	1.5	0.4	3.5	2.5	3.4	2.4	8.3	1.9	1.9	1.0	4.8
Alternanthera sessilis (L.) DC	7.6	11.3	15.6	34.5	7.5	7.6	5.3	20.4	8.0	9.1	11.6	28.7	7.3	9.3	13.8	30.4
Ammannia baccifera L.	0.7	0.5	0.0	1.2	0.2	0.3	0.0	0.5	0.8	0.5	0.0	1.2	-	-	-	-
Anagallis arvensis L.	8.0	8.8	9.4	26.2	6.3	7.5	3.8	17.6	9.0	9.4	13.9	32.3	7.1	7.9	10.0	25.0
Cardiospermum halicacabum L.	0.5	0.3	0.0	0.8	0.5	0.2	0.0	0.7	-	-	-	-	-	-	-	-
Cassia tora L.	0.9	0.7	0.0	1.6	1.4	0.8	0.3	2.5	1.5	0.9	0.2	2.6	1.2	0.7	0.1	2.0
Chenopodium album L.	6.6	8.0	12.6	27.2	6.3	7.9	6.2	20.4	6.8	7.9	14.6	29.3	7.1	8.9	20.5	36.5
Chrozophora rottleri (Geiseler) Spreng.	1.9	1.7	0.4	4.0	2.9	2.3	0.9	6.1	1.5	1.8	0.6	3.9	1.7	1.5	0.4	3.6
Cirsium arvense L.Scop.	0.7	0.5	0.0	1.2	-	-	-	-	0.5	0.3	0.0	0.8	0.2	1.4	0.0	1.6
Commelina benghalensis L.	1.9	1.3	0.4	3.6	0.2	0.1	0.0	0.3	-	-	-	-	-	-	-	-
Corchorus olitorius L.	0.9	0.7	0.0	1.6	1.1	0.6	0.0	1.7	0.5	0.3	0.0	0.8	0.7	0.4	0.0	1.1
Cynodon dactylon (L.)Pers.	2.4	3.8	0.9	7.1	3.4	3.0	0.6	7.0	2.8	3.5	1.2	7.5	3.8	3.8	1.2	8.8
Cyperus difformis L.	0.5	0.3	0.0	0.8	0.7	0.4	0.1	1.1	-	-	-	-	-	-	-	-
Desmodium triflorum(L.)DC.	2.1	2.2	0.1	4.4	3.0	2.0	1.2	6.2	2.8	3.5	1.2	7.5	2.8	2.7	0.3	5.8
Digitaria sanguinalis (L.)Scop.	0.9	0.8	0.1	1.8	1.8	1.0	0.2	3.0	0.8	1.0	0.1	1.9	1.4	1.1	0.1	2.6
Echinochloa colonum (L.)Link	5.2	6.0	5.9	17.1	4.5	3.1	2.7	10.3	5.3	4.2	4.6	14.1	5.5	4.4	4.6	14.5
Eclipta alba (L.)Hassk	2.8	2.0	0.4	5.2	2.9	1.7	0.7	5.3	3.0	2.0	0.4	5.4	3.6	2.2	0.6	6.4
Elusine indica (L.)Gaertn.	1.4	1.0	0.3	2.7	1.6	1.0	0.5	3.1	1.3	1.4	0.5	3.2	-	-	-	-
Euphorbia hirta L.	2.1	1.5	0.4	4.0	1.8	1.3	0.7	3.8	3.3	2.6	1.4	7.3	3.6	2.2	1.0	6.8
Euphorbia terracina L.	1.9	1.3	0.3	3.6	1.4	1.7	1.2	4.3	3.0	1.8	0.9	5.7	2.6	1.5	0.5	4.6
Gnaphalium luteoalbum L.	0.9	0.7	0.4	2.0	2.3	1.8	1.6	5.7	-	-	-	-	-	-	-	-
Grangea maderaspatana (L.)	3.8	2.7	6.2	12.6	4.1	4.2	7.2	15.5	3.8	5.3	7.2	16.3	3.1	5.2	5.9	14.2
Heliotropium ovalifolium	1.7	1.2	0.2	3.1	1.6	0.9	0.3	2.8	2.0	1.2	0.3	3.5	1.4	0.8	0.1	2.3
Hibiscus panduriformis Burm.f.	0.7	0.5	0.0	1.2	0.5	0.3	0.0	0.8	1.0	0.6	0.1	1.7	0.5	0.3	0.0	0.8
Ipomoea obscura (L.)Ker Gawl.	0.2	0.2	0.0	0.4	-	-	-	-	-	-	-	-	-	-	-	-
Lagascea mollis Cav.	1.7	2.0	0.7	4.4	2.5	1.8	1.4	5.7	2.0	1.5	0.5	4.0	1.4	1.5	0.5	3.4
Ludwigia perrenis Burm.f.	1.2	0.8	0.1	2.1	0.2	0.1	0.0	0.3	-	-	-	-	0.5	0.3	0.0	0.8
Malacra capitata (L.)	1.4	1.0	0.2	2.6	1.4	0.9	0.4	2.7	1.0	0.8	0.1	1.9	1.7	1.1	0.3	3.1
Marsilia quadrifolia L.	-	-	-	-	0.5	0.3	0.0	0.8	-	-	-	-	0.7	0.4	0.0	1.1
Mecardonia procumbense (Mill) Small	1.7	2.7	0.2	4.6	0.5	0.3	0.0	0.8	2.0	2.6	0.2	4.8	0.7	1.5	0.0	2.28
Medicago polymorpha L.	6.4	10.7	13.7	30.8	6.8	8.4	19.0	34.2	7.0	8.8	9.6	25.4	6.2	8.5	10.2	24.9
Melilotus albus Medik.	5.9	9.7	12.6	28.2	6.1	7.1	15.3	28.5	6.5	6.8	6.5	19.8	5.2	7.3	9.3	21.8
Parthenium hysterophorus L.	1.4	1.0	0.1	2.5	1.1	0.6	0.1	1.8	0.8	0.5	0.0	1.2	1.4	0.8	0.0	2.2
Phyllanthus niruri L	1.7	1.2	0.2	3.1	0.7	0.4	0.0	1.1	0.5	0.3	0.0	0.8	0.5	0.3	0.0	0.8
Physalis minima L.	2.8	2.0	0.5	5.3	3.2	2.0	1.4	6.6	2.5	2.3	0.9	5.7	3.6	2.1	0.7	6.4
Polygonum plebeium R.Br.	3.3	4.3	0.4	8.0	3.8	4.3	4.5	12.6	3.0	4.2	2.0	9.2	3.8	4.1	2.1	10.0
Rinchosia minima (L)DC	-	-	-	-	-	-	-	-	-	-	-	-	0.6	0.3	0.0	0.9
Rumex dentatus L.	7.1	8.6	16.1	31.8	5.9	6.6	21.6	34.1	6.8	7.1	16.6	30.5	6.4	7.4	13.0	26.8
Portulaca oleracea L.	0.2	0.2	0.0	0.4	-	-	-	-	0.3	0.2	0.0	0.5	-	-	-	-
Sida acuta Burm.f.	1.4	1.0	0.0	2.4	0.9	0.5	0.0	1.4	-	-	-	-	0.7	0.4	0.0	1.1
Sida cordifolia L.	0.9	0.7	0.0	1.6	0.7	0.4	0.0	1.1	0.8	0.5	0.0	1.2	0.5	0.3	0.0	0.8
Sonchus arvensis L.	0.9	0.7	0.1	1.7	0.5	0.3	0.0	0.8	0.5	0.3	0.0	0.8	0.9	0.5	0.1	1.5
Sphaeranthus indicus Kurz	0.9	0.7	0.0	1.6	2.7	2.7	2.5	7.9	3.3	3.5	2.9	9.7	3.1	3.6	2.0	8.7
Tridax procumbens L.	0.5	0.3	0.0	0.8	1.6	1.7	0.6	3.9	1.3	0.8	0.0	2.1	1.9	1.1	0.1	3.1
Urena lobata (L.)	-	-	-	-	0.2	0.1	0.0	0.3	-	-	-	-	0.2	0.1	0.0	0.3
Xanthium strumarium L.	0.2	0.2	0.0	0.4	0.5	0.3	0.0	0.8	-	-	-	-	0.8	0.3	1.2	2.3

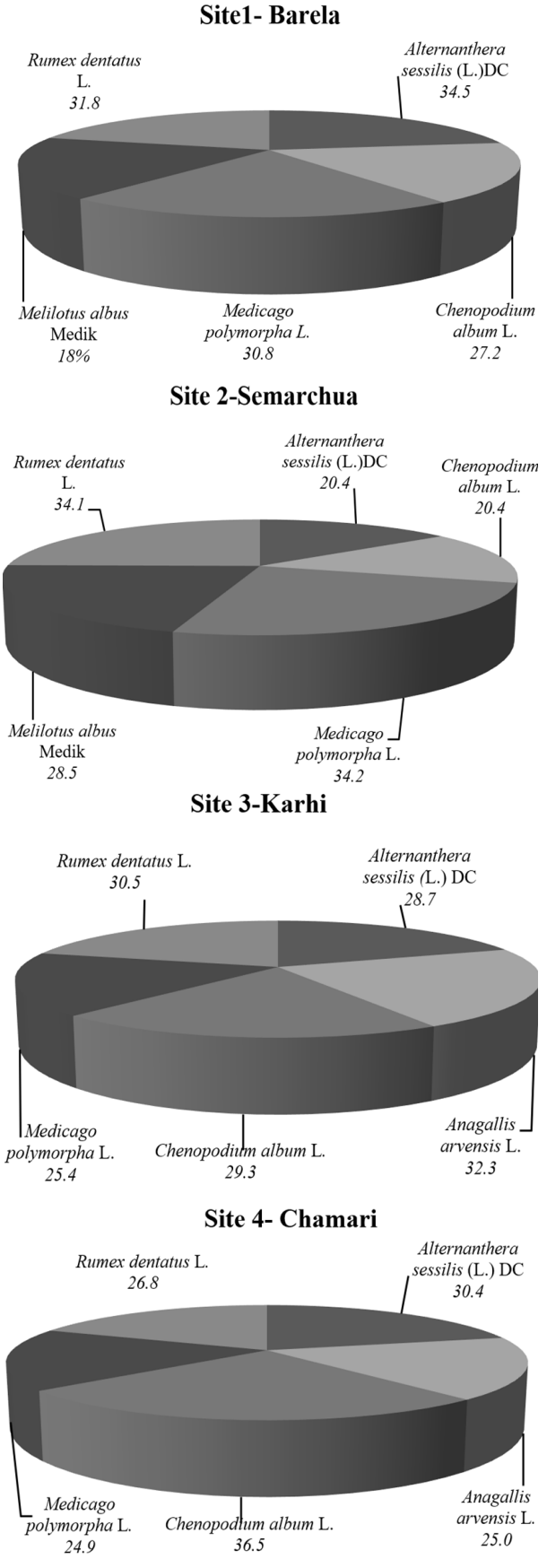

Figure 2. The graph represents the five highest IVI value of weeds at the selected study site in 2020

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