Research Article

Synecological Analysis of Weeds of Wheat, Rice and Sugar Cane Crops of Tehsil Muridke, District Sheikhupura (Punjab) Pakistan

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Abstract | This study was undertaken for the synecological analysis of weeds of wheat, rice and sugarcane crops of Tehsil Muridke, District Sheikhupura, Pakistan. Sampling was done randomly with the help of a quadrat method (1m^2). For each crop, sixty quadrats were taken from each village i.e., twenty quadrats from each selected site. The data was gathered after every fifteen days during the course of crop. For the determination of Importance Value Index (IVI) percentage frequency, density and percentage cover were determined. A total of 19 families were present in all three crops. *Fumaria indica* of Family Papaveraceae had the highest IVI value of 12.14 while *Persicaria longiseta* of Family Polygonaceae had the lowest IVI value of 1.13. Poaceae was the largest family representing 11 species, Asteracea occupies the second position with 9 species followed by Fabaceae with 5, Brassicaceae and Solanacea having 4 species each, Polygonaceae with 3 species, Chenopodiacea and Cyperaceae with 2 species each, Aizoaceae, Commenlinaceae, Convolvulaceae, Euphorbiaceae, Lamiaceae, Malvaceae, Marsiliaceae, Papaveraceae, Primulariaceae, and Scorpulariaceae with 1 species each. *Brassica campestris*, *Lathyrus aphaca*, *Melilotus indicus*, *Medicago polymorpha*, *Dicanthium annulatum*, *Setaria glauca* and *Solanum nigrum* were the only 7 species found in all three crops of wheat, rice and sugarcane having IVI values of 5.86, 6.35, 4.32, 4.93, 4.36, 5.64 and 5.40 respectively. Therophytes, Hemicryptophytes and Chamaephytes were the prominent life form classes of the research area.

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Introduction

Weeds include those species of plants which are not needed and spread rapidly, grow swiftly, and reproduce in large numbers because of large quantity of their seeds. Weeds excrete allelochemicals that hinder the growth and germination of agricultural crops. The cultivated soils have millions of weed seeds in a small area (Luqman *et al*., 2021). Weeds are responsible for almost 18% of grain losses in wheat and 10-60% of losses in maize crop (Gurmani *et al*., 2020). Weeds generally exhibit a short vegetative phase and give high reproductive output (Nagarajug *et al*., 2014). They compete for water, space, CO_2,

sunlight and nutrients with the cultivated crops. The traits of different species of weeds vary from one place to another (Iqbal *et al.*, 2017). Identification and evaluation of flora is the main precondition in the determination of occurrence and significance of weed species in crop production systems for any ecological management (Frick and Thomas, 1992). So, it is important to calculate the number, distribution and identification of weed species in every area (Zeb *et al.*, 2016). Many research works have been done in this regard, which are described in the following lines.

Some scientists studied weed management in maize and blackgram of Himachal Pradesh. They stated that weeds resulted in 58.80% reduction of the yield of maize crop (Sharma and Natiyal, 1993). 401 weed species were reported in the study of weed flora of Kashmir Valley. They belonged to 251 genera and 56 angiosperm families. Among 401 weeds, 177 were reported from agricultural crops (Kaul, 1986).

Muhammad *et al.* (2009) recorded the weed distribution in wheat, potato and maize fields of Tehsil Gojra, district Toba Tek Singh, Pakistan. They found sixty-seven weed species. Wheat had 35 weed species. Maize has thirty-four while potato fields had twenty-four. 55 weeds were gathered from Visakhapatnam district, Andhra Pradesh, India by Navagana *et al.* (2017). These weeds belonged to 45 different genera and 21 families. Samreen *et al.* (2018) collected 27 species of weeds from Darazinda, Dera Ismail Khan, Pakistan which belonged to 15 different families. Muhammad *et al.* (2021) collected 56 plant species which belonged to 23 different families in wheat and potato fields of seven villages of Tehsil Sharaqpur Sharif, Punjab, Pakistan.

Riaz *et al.* (2021) collected 41 species of weed plants from mustard, wheat and chickpea fields of Tehsil Isa Khel, District Mianwali, Punjab. These belonged to 21 different families. Abdullah *et al.* (2021) studied phytodiversity and ecological features of weed species of Sufaid Sung, Peshawar. They collected 95 weed species which belonged to 31 different families. Anwar *et al.* (2021) found 20 weed communities in the wheat crops of tehsil Razar, district Swabi, Pakistan. All of the communities were diverse because of different edaphic variables and varying growth seasons.

It is difficult to take necessary measures for weed control without accurate identification and evaluation of weed species. The objective of this study was: (1) to study the floristic composition of weeds species, (2) to study Importance Value Index (IVI) of weeds for each species and (3) to study life form of weed species.

Study area

District Sheikhupura has an area of 3,241 square kilometres. It has 5 tehsils, Muridke is one of them. District Sheikhupura is surrounded by Gujranwala district on the north, by Narowal district on the North-East, by district Nankana Sahib on the west, by Lahore district on the east and by district Kasur on the southern boundary. Wheat, sugarcane and rice are majorly grown in this region.

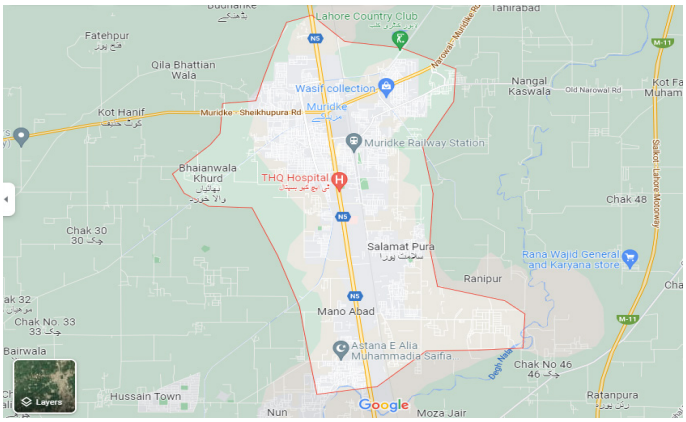

Figure 1: *Map of tehsil Muridke.*

Materials and Methods

The current research work was done to study the phytosociology of weeds of wheat, rice and sugarcane fields of tehsil Muridke of district Sheikhupura. Sampling was done randomly for this purpose through quadrat method by following Clements (1905), whose size was 1m × 1m. For each crop, sixty quadrats were taken from each village i.e., twenty quadrats from each selected site. Throughout the course of crop, the data was gathered after every fifteen days. For the determination of Importance Value Index (IVI) (Risser and Rice, 1971) percentage frequency, density and percentage cover were determined according to McIntosh (1962), Curtis and McIntosh (1950) and Daubenmire (1959), respectively. IVI was determined by adding the values of % frequency, density and % cover. Percentage frequency was calculated by determining the number the quadrate in which particular species was present. Density was determined by total number of individuals of a specific species per unit area. Percentage cover was determined by estimating the area which was covered with plants (stems, leaves and flowers). The literature of Nasir and Ali (1970-1989), Ali and Nasir, (1990-1992)

and Ali and Qaisar (1992-2007) were studied for the taxonomical identification of the weeds collected.

Results and Discussion

Weeds directly impact the quality and yield of crops as they compete with main crops for nutrients, water and disrupted the main crop of that area (Akhtar and Afzal, 2022). For the management of weeds of any area, their floristic composition and vegetation structure must be determined. This study was carried out to determine the phytosociology and floristic composition of weeds in wheat, rice and sugarcane fields of Tehsil Muridke.

In the present study, total 52 weed species belonging to 19 families were identified by floristic composition (Table 1). Poaceae is the largest family representing with 11 species, Asteracea occupies the second position with 9 species followed by Fabaceae with 5, Brassicaceae and Solanacea 4 species each, Polygonaceae with 3 species, Chenopodiaceae and Cyperaceae 2 species each, Aizoaceae, Commenlinaceae, Convolvulaceae, Euphorbiaceae, Lamiaceae, Malvaceae, Marsiliaceae, Papaveraceae, Primulariaceae, and Scorpulariaceae with 1 species each. It has been found that family Poaceae has great diversity of species in the crop fields. It has total 11 species having IVI of 57.03%. It shows that species of family Poaceae are more adapted in the region of tehsil Muridke.

Quantitative analysis of weeds shows that *Fumaria indica* of family papaveraceae has highest importance value index of 12.14% and *Persicaria longiseta* of family Polygonaceae has lowest IVI value of 1.13%. Highest IVI of *Fumaria indica* is due to its greater value of relative frequency 29.4 as compared to others.

Brassica campestris, Lathyrus aphaca, Melilotuss indicus, Medicago polymorpha, Dicanthium annulatum, Setaria glauca and *Solanum nigrum* were the only 7 species found in all three crops of wheat, rice and sugarcane having IVI values of 5.86, 6.35, 4.32, 4.93, 4.36, 5.64 and 5.40, respectively. *Blumea membranacea* and *Polypogon monspeliensis* were found in both wheat and rice fields having IVI values of 5.81 and 2.81, respectively. *Conyza ambigua*, *Brassica rapa, Chenopodium album, Chenopodium murale, Cyperus difformis, Euphorbia prostrata, Marsilia minuta, Cynodon dactylon, Papsulum distichum* and *Setaria pumila* were found in both wheat and sugarcane fields having IVI values of 4.81, 2.95, 3.78, 3.60, 4.93, 4.165, 2.36, 3.84, 10.12 and 3.59, respectively. *Parthenium hysterophorus, Sonchus asper, Ageratum conyzoides, Polygonum plebeium* and *Anagalis arvensis* were found in both rice and sugar cane fields having IVI values of 4.71, 2.76, 4.94, 5.32 and 3.7, respectively.

Trianthema portulacastrum, Amaranthus viridus, Carthamus oxycantha, Salvia plebeian, Arachne racemose, Arunlaria japonica, Persicarialongiseta, Rumex dendatus, Nicotiana plumbaginifloia, Solanum surattense, Cyperus rotundus and *Mazus pumils* were only found in wheat fields and had IVI values of 3.30, 2.64, 3.24, 3.31, 2.08, 2.94, 1.13, 1.48, 1.84, 3.26, 5.62 and 4.54, respectively.

*Digeria arvensis, Coronopus didymis, Chenopodium album, Commelina albescens, Convolvus arvensis, Trifolium resupinatum, Trifolium alexandrium, Malva parviflora, Fumaria indica, Rumex dendatus, Avena sativa, Conchrus ciliaris*and *Solanum xanthocarpum* were found only in rice fields having IVI values of 11.62, 9.01, 7.92, 3.77, 4.84, 9.23, 2.28, 8.29, 12.14, 7.77, 8.49, 5.39 and 12.9 respectively. *Gnaphalium, Cirsium arevense* and *Conyza canadensis* were found only in sugarcane fields and had IVI values of 4.01, 3.91 and 2.19, respectively.

Close to the current finding, Touseef *et al.* (2012) found the importance value index of weeds in cotton crop fields. He found that *Cyprus rotundus* and *Echinochloa colona* have highest IVI of 20.9% and 17.3% respectively. Similarly, Pala in 2020 found 71 weeds species of 20 families in wheat crop. He detected that *Avena sterilia* has highest importance value index of 22.3%. Species of high IVI value are the dominant species of the particular area. Hence, *Fumaria indica* is the dominant species of the study area.

Besides importance value index, biological spectrum using Raunkiaer's life form (1934) showed the therophytes (42 species, 80.76%) as dominant life form class (Table 2, Figure 2). It was followed by Chamaephytes (1 species, 1.92%) and Hemicryptophytes (9 species, 17.30%). This research in terms of life form is in the line with Ali *et al.* (2022) who documented therophytes (83 species, 34.87%) as dominant life form. Similarly, Ka *et al.* (2017) analyzed that therophytes (78.9%) were the dominant life form of Senegal region. The dominance of therophytes showed that the area of research was under severe anthropogenic activities and biotic pressure (Manan *et al.*, 2022).

Table 1: *Importance value index (IVI) of weeds of wheat, rice and sugarcane crop fields of tehsil Muridke (Sheikhupura).*

Family	Plant name	Wheat	Rice	Sugar cane	*RF	**RD	***RC	IVI	Life form
Aizoaceae	*Trianthema portulacastrum* Linn	✓	×	×	4.18	1.96	3.15	3.30	TH
Amaranthaceae	*Amaranthus viridus* Hook.	✓	×	×	3.02	2.39	2.52	2.64	TH
	Digera arvensis Forssk.	×	✓	×	24.8	3.59	6.47	11.62	TH
Asteracea	*Carthamus oxyacantha* L.	✓	×	×	2.62	1.41	5.71	3.24	TH
	Blumea membranacea L.	✓	✓	×	11.3	3.69	2.46	5.81	TH
	Conyza ambigua Dc.	✓	×	✓	4.23	2.17	8,02	4.81	TH
	Parthenium hysterophorus L.	×	✓	✓	9.185	2.60	2.35	4.71	TH
	Sonchus asper L.	×	✓	✓	4.11	1.56	2.64	2.76	TH
	Ageratum conyzoides L.	×	✓	✓	7.89	3.27	3.66	4.94	TH
	Gnaphalium sp.	×	×	✓	5.32	3.56	3.15	4.01	TH
	Cirsium arevense L.	×	×	✓	1.08	5.08	3.86	3.91	TH
	Conyza canadensis L.	×	×	✓	2.03	2.15	2.39	2.19	TH
Brassicaceae	*Brassica rapa* L.	✓	×	✓	3.60	2.71	2.56	2.95	TH
	Brassica campestris L.	✓	✓	✓	10.65	4.39	2.55	5.86	TH
	Coronopus didymis L.	×	✓	×	18.9	4.28	3.87	9.01	TH
	Raphanus sativus L.	×	✓	×	14.4	4.62	4.74	7.92	TH
Chenopodiaceae	*Chenopodium album* L.	✓	×	✓	5.05	3.78	2.54	3.78	TH
	Chenopodium murale L.	✓	×	✓	3.75	3.47	3.57	3.60	H
Commelinacea	*Commelina albescens* L.	×	✓	×	7.41	2.00	1.90	3.77	TH
Convolvulaceae	*Convolvus arvensis* L.	×	✓	×	11.05	2.41	1.07	4.84	TH
Cyperaceae	*Cyperus rotundus* L.	✓	×	×	4.06	8.39	4.41	5.62	TH
	Cyperus difformis L.	✓	×	✓	4.24	4.76	5.81	4.93	H
Euphorbiaceae	*Euphorbia prostrata* Ait.	✓	×	✓	3.08	2.25	7.16	4.165	H
Fabaceae	*Lathyrus aphaca* L.	✓	✓	✓	11.01	4.03	4.09	6.35	TH
	Melilotus indicus L.	✓	✓	✓	5.22	4.67	3.08	4.32	TH
	Medicago polymorpha L.	✓	✓	✓	8.14	2.78	3.88	4.93	TH
	Trifolium resupinatum L.	×	✓	×	21.2	3.66	2.84	9.23	TH
	Trifolium alexamdrium L.	×	✓	×	4.19	1.31	1.36	2.28	TH
Lamiaceae	*Salvia plebeian* R. Brown	✓	×	×	2.74	3.98	3.23	3.31	TH
Malvaceae	*Malva parviflora* L.	×	✓	×	15.7	4.07	5.10	8.29	TH
Marsiliaceae	*Marsilia minuta* L.	✓	×	✓	2.82	2.27	2.01	2.36	TH
Papaveraceae	*Fumaria indica* (Husskn.) Pugsley	×	✓	×	29.4	4.00	3.02	12.14	TH
Poaceae	*Arachne rcemosa* L.	✓	×	×	2.51	2.26	1.49	2.08	TH
	Cynodondactylon L.	✓	×	✓	5.94	3.40	2.19	3.84	H
	Dicanthium annulatum (Forssk) Stapf	✓	✓	✓	6.51	3.55	3.02	4.36	H
	Paspulum distichum L.	✓	×	✓	5.05	16.57	8.88	10.12	H
	Polypogon monspeliensis L.	✓	✓	×	4.06	2.19	2.19	2.81	H
	Setaria glauca L.	✓	✓	✓	9.07	3.63	4.22	5.64	TH
	Setaria pumila L.	✓	×	✓	3.61	3.47	3.70	3.59	TH
	Arunlaria japonica Benth and Hook	✓	×	×	3.24	3.00	2.58	2.94	TH
	Rumex dentatus L.	×	✓	×	14.8	4.35	4.18	7.77	CH
	Avena sativa L.	×	✓	×	15.5	3.52	6.47	8.49	TH
	Conchrus ciliaris	×	✓	×	10.07	3.31	2.79	5.39	H
Polygonaceae	*Persicarialongiseta* L.	✓	×	×	0.86	0.98	1.57	1.13	TH
	Rumex dendatus L.	✓	×	×	2.44	1.34	0.67	1.48	TH
	Polygonum plebeium R.Br.	×	✓	✓	7,51	419	4.28	5.32	TH
Primulariaceae	*Anagalis arvensis* L.	×	✓	✓	5.88	1.78	3.43	3.7	TH
Solanaceae	*Nicotiana plumbaginifloia* L.	✓	×	×	1.67	1.41	2.37	1.84	TH
	Solanum nigrum L.	✓	✓	✓	9.98	2.38	3.86	5.40	TH
	Solanum surattense L.	✓	×	×	1.55	1.71	6.53	3.26	TH
	Solanum xanthocarpum Schard & Wend	×	✓	×	28.6	5.38	4.95	12.9	H
Scorpulariaceae	*Mazus pumilus* Horn.	✓	×	×	4.55	4.53	4.64	4.54	TH

CH, Chamaephytes; H, Hemicryptophytes; IVI, Importance Value Index; TH, therophytes; RF, Relative Frequency; RD, Relative density; RC, Relative cover.

Table 2: *Biological spectrum of weeds.*

Life forms	No. of species	% of species
Therophytes	42	80.76
Hemicryptophytes	9	17.30
Chamaephytes	1	1.92

Most problematic weeds of collection area were *Fumaria indica*, *Solanum xanthicarpum*, *Digera arvensis* and *Paspulum distichum* which had importance value index of 12.14, 12.9, 11.62 and 10.12, respectively. Akhtar and Afzal (2022) investigated that *Polygonum plebium* (108.44%), *Chenopodium album* (1330.15%), *Galium aparine* (158.5%) and *Fumaria indica* (144.39%) were most problematic weeds of Tehsil Paharpur.

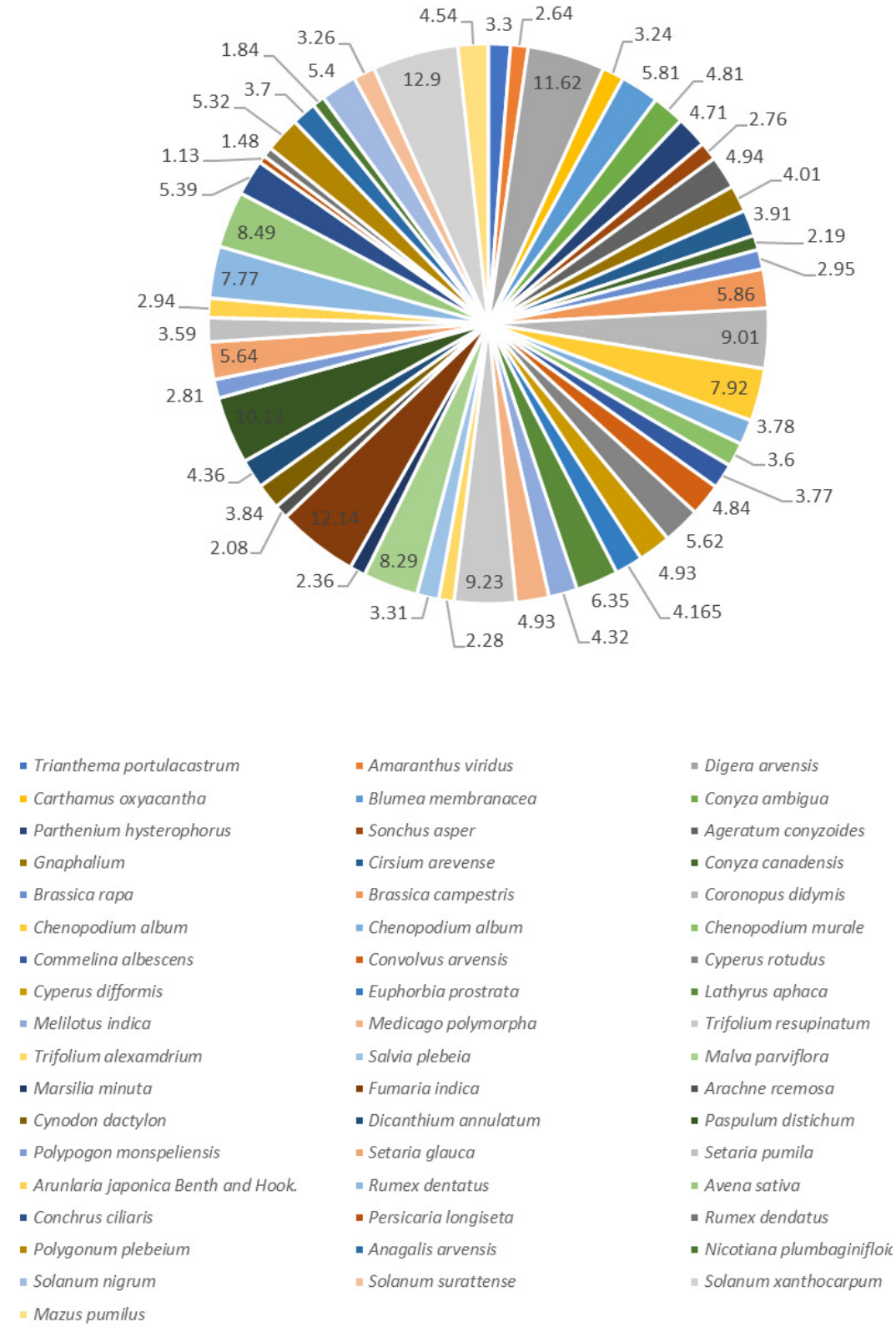

Figure 1: *IVI distribution of weed species.*

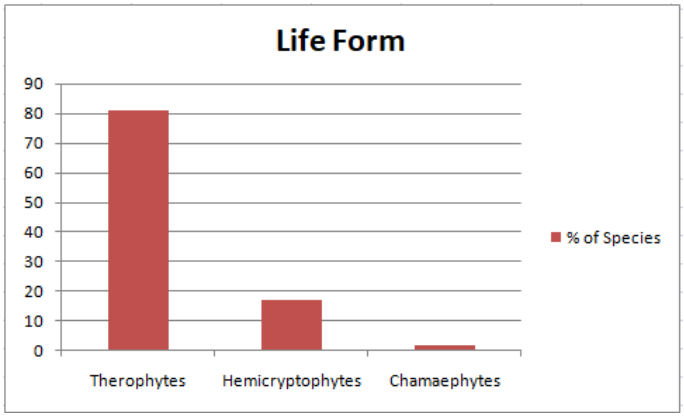

Figure 2: *Life form classes.*

Conclusions and Recommendations

It is concluded that Poaceae is the dominant family with 11 species. Fumaria indica of family papavareacea has highest IVI of 12.14%. Dominant life form class is therophytes with 80.76%. It shows that research area is under serious biodiversity threat due to anthropogenic activities and biotic pressure as well. Weeds have negative impact on crop but there are some species which have medicinal importance. Out of 52 species, some species have important ethno-medicinal uses like *Cynodon dactylon*, *Chenopodium album* and *Cyprus rotundus*. Farmers' economic situation would be substantially improved by knowledge of proper weed species exploitation and utilization through propagation and scientific conservation (Nagaraju Navagana *et al*. 2017). The results of the current study will help in developing weed management plans.

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Novelty Statement

This topic deals with distribution pattern of weeds in cash crops of wheat, rice and sugarcane, if the distribution pattern is determined and their taxonomical identification can be found out, it would help to manage the weeds in these crops through better weed management strategies.

Author's Contribution

Komal Javed: Field work, Sohaib Muhammad: Conceptualization and Review, Zarghaam Khan: Field work and write up, Sehar Fatima: Editorial work, Hassan Nawaz: Analyzation of data, Mahrukh: Preparation of manuscript, Tahira Khalid: Final preparation of manuscript, Shariat Ullah: Review and proof reading

Conflict of interest

The authors have declared no conflict of interest.

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