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FLORISTIC COMPOSITION AND LIFE FORM SPECTRA OF WEED FLORA IN WHEAT, MAIZE AND POTATO CROP FIELDS OF TEHSIL TOBA TEK SINGH, PUNJAB, PAKISTAN

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Abstract

The present research work was carried out in Tehsil Toba Tek Singh to evaluate the pattern of ecological prevalence of weeds of wheat, maize and potato crop fields. Sampling was conducted randomly using the quadrat method, with each quadrat measuring $1m^2$. A total of sixty quadrats were sampled for each crop, consisting of twenty quadrats from each selected site. Data collection occurred every fifteen days throughout the crop cycle. The Importance Value Index (IVI) was determined by calculating the percentage frequency, density, and percentage cover of the weed species. Total fifty one weed species belonging to 18 families were recorded. *Euphorbia helioscopia* (*Euphorbiaceae*) had the highest IVI value of 15.8% and *Chenopodium album* (*Chenopodiaceae*) had the lowest IVI of value 0.54%. Family *Poaceae* (13 species), *Asteraceae* (7 species), *Amaranthaceae* (5 species) and *Euphorbiaceae* (4 species) were the important families having maximum number of species. Family *Chenopodiaceae* and *Solanaceae* had 3 species each, *Polygonaceae*, *Cucurbitaceae* and *Cyperaceae* had 2 species each, and *Aizoaceae*, *Convolvulaceae*, *Lamiaceae*, *Primulaceae*, *Verbenaceae*, *Brassicaceae*, *Borginaceae*, *leguminosae* and *Zygophylaceae* had only 1 species each. *Amaranthus viridus*, *Conyza ambigua*, *Parthenium hysterophorus*, *Sonchus asper*, *Coronopus didymus*, *Convolvulus arvensis*, *Euphorbia prostrata*, *Cynodon dactylon* and *Saccharum spontaneum* were the only nine weed species found in all three crop fields of wheat, maize and potato with IVI values of 4.21%, 4.31%, 4.58%, 1.12%, 3.59%, 7.68%, 4.87%, 14.8% and 7.14% respectively and prominent life form classes were therophytes (68%), hemicryptophytes (30%) and Phanerophytes (2%).

Keywords: Biological Spectrum, Importance value index, Quadrate, Toba Tek Singh, Weed flora

Introduction

Weed is defined as a plant that grows in an undesired location or deviates from its natural habitat (Bakar *et al*., 2021). In their natural habitat, weeds are a component of dynamic ecosystems, but they can pose a threat to crops (Ahmad *et al*., 2016). Weeds pose more detrimental impacts on field crops compared to numerous diseases caused by bacteria, insects and fungi. They contend with crops for essential resources like water, nutrients, and light, while also demonstrating parasitism, competition and allelopathy (Mahklouf and Elhosk, 2022).

Weeds inflict significant damage to crops by raising the costs associated with various agricultural practices, reducing the efficiency of farming equipment, and degrading the quality of fertile lands. Moreover, they diminish the germination potential of crop seeds due to the presence of phytotoxins or allelochemicals (Algandaby and Salama, 2018). Only 250 species are considered significant in the context of agriculture worldwide out of a total of 8000 weed species (Ahmad *et al*., 2016). Environmental conditions mainly determine the biological spectrum

and density of weed species in different regions. Weeds in the crop fields of wheat, Maize and Potato reduce their yield depending upon their density. Identification of weed flora in the crop fields is crucial for the implementation of effective strategy for managing weed species. For this purpose, many studies have already been done in Pakistan and all over the world; some of these findings are referenced in the following lines. Javed *et al*. (2023) recorded 52 weed species in wheat, rice and sugar cane crops of Tehsil Muridke, district Sheikhupura, Pakistan which showed the dominance of family Poaceae (11 species), Asteraceae (9 species) and Fabaceae (5 species) in the study area. Iqbal *et al*. (2017) assessed the abundance and rarity of weed species and communities in relation to different environmental factors in wheat crop of District Malakand, KP (Pakistan). Riaz *et al*. (2021) recorded 41 weed species, from which 29 were present in wheat, 24 in chickpea and 25 in mustard crop fields. Similarly, Khan *et al*. (2014) conducted a floristic study of Asshab Baba graveyard in District Peshawar, noting the Poaceae family as the dominant family with 12 species. They also identified therophytes as the prominent life form class, constituting 60.60% of the recorded species.

This study was carried out to record weed flora of wheat, Maize and Potato crop fields from Toba Tek Singh. Floristic composition, %frequency, density, %cover and IVI and life form of weed species were determined in the present research work.

Study site:

District Toba Tek Singh is located in central Punjab and occupies 3252 km^2. It comprises on three Tehsils; Kamalia, Gojra and Toba Tek Singh. Its boundaries adjoin District Faisalabad on the east and Jhang on the west and north. River Ravi is located on its south and south eastern side in which Districts of Khanewal and Sahiwal located. District Toba Tek Singh has extremities in both cold and hot climate. The land consist plains and has river Ravi which is flowing on its south eastern side (Pakistan Bureau of Statistics, 2013).

Materials and methods

This research was carried out for the floristic composition of weeds present in wheat, Maize and potato crops. Five villages of District Toba Tek Singh were selected for random sampling through quadrat method ($1\times1m^2$) after Clements (1906). The selected area of study was sampled by randomly throwing the quadrats in the fields of wheat, maize and potato. The collected weeds were pressed, dried and mounted on herbarium sheets. During the research, weed collection was done after every fifteen days approximately. Weed flora was identified by studying the literature of Ali and Qaisar (1992-2007), Ali and Nasir (1990-1992) and Nasir and Ali (1970-1989) and voucher specimens were recorded in Dr. Sultan Ahmad Herbarium of Department of Botany, GC University, Lahore. Further, Plants were categorized into life form classes of Raunkiaer's (1934) on the basis of location the perennating buds and the extent of their protection from harsh conditions. Following parameters were used for the determination of IVI

$$\%\text{Frequency: } \frac{\text{No. of quadrats in which plants are present}}{\text{Total No. of quadrats}} \times 100$$

$$\text{Relative Frequency: } \frac{\text{Frequency of individual weed species}}{\text{Total frequency of all species}} \times 100$$

$$\text{Density: } \frac{\text{Total number of weeds in a quadrat}}{\text{Total number of quadrats}}$$

$$\text{Relative Density: } \frac{\text{Density of individual weed species}}{\text{Density of all weeds species}} \times 100$$

$$\text{Relative Cover: } \frac{\text{Cover of individual weed species}}{\text{Total cover of all weed species}} \times 100$$

$$\text{IVI} = \frac{\text{Relative Frequency} + \text{Relative density} + \text{Relative cover}}{3}$$

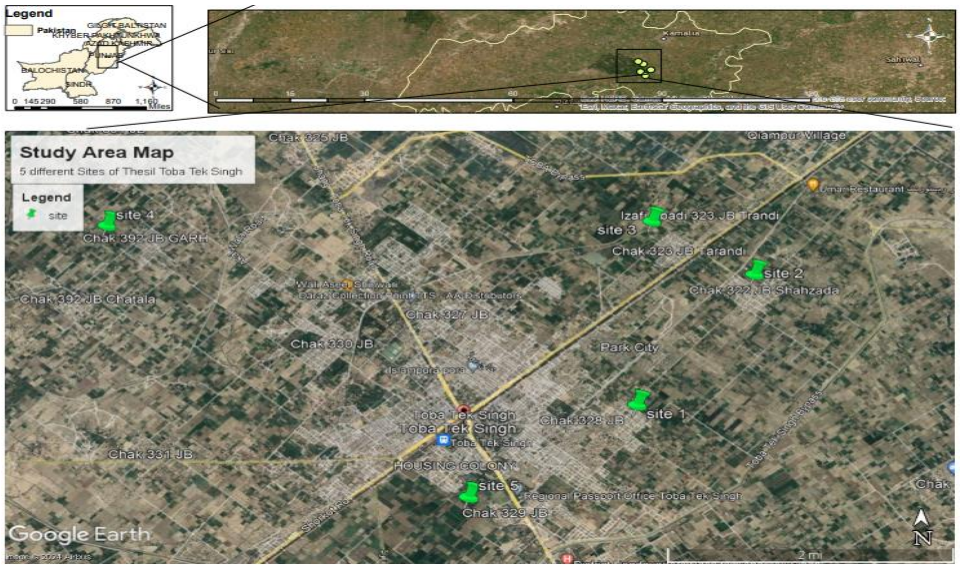


Fig.1. Map of Tehsil Toba Tek Singh

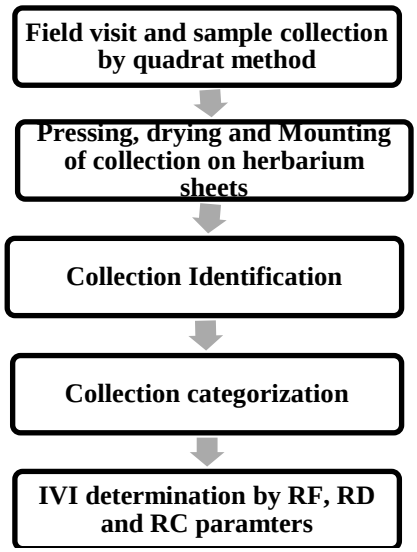


Fig. 2. Flowchart of research methodology

Results and discussion:

The total species found within a region's borders, whether they are wild or farmed, represents the region's floral diversity and is an indicator of the resources found in the surrounding vegetation. Natural disasters, overgrazing, agriculture, and human contact all have an impact on plant resources. In the current study, total of 51 weed species belonging to 18 families were recorded and identified (Table 1). Floristic analysis has shown the dominance of family Poaceae having 13 species followed by family Asteraceae (7 species), Amaranthaceae (5 species) and

Euphorbiaceae (4 species). Chenopodiaceae and Solanaceae have 3 species, Polygonaceae, Cyperaceae and Cucurbitaceae have 2 speices and remaining families has one species. Family Poaceae has total 13 species having IVI of 61.85.

The dominance of family Poaceae and Asteraceae might be due to the better seed dispersal, aggressive growth, good competitive ability and seed production. Corresponding to this study, Sher *et al*. (2011) found 40 species belonging to 31 families in the wheat crops of District Swabi. Similarly, Mahklouf and Elhosk (2022) recorded 85 weed species of 29 families in Al-Wadi Al-Shargi in Ain Zara district southwest of Tripoli- Libya and found out poaceae as the dominant weed species. Khan and Badshah (2019) identified the floral diversity of district Charsadda and Badshah *et al*. (2013) determined dominance of family poaceae in district tank.

In the present study, *Euphorbia helioscopia* of family Euphorbiaceae has the highest IVI of 15.8% and *Chenopodium album* of family Chenopodiaceae has lowest IVI of 0.54%. Highest IVI of *E. helioscopia* is due to its greater relative density of value 25.6 as compared to other species. Table 1 showed that *Amaranthus viridus*, *Conyza ambigua*, *Parthenium hysterophorus*, *Sonchus asper*, *Coronopus didymus*, *Convolvulus arvensis*, *Euphorbia prostrata*, *Cynodon dactylon* and *Saccharum spontaneum* were present in fields of wheat, Maize and Potato having IVI of 4.21%, 4.31%, 4.58%, 1.12%, 3.59%, 7.68%, 4.87%, 14.8% and 7.14% respectively. Similarly, Usman *et al*. (2020) determined the IVI of weeds of district Khanewal which showed maximum IVI of *Paspalum distichum* (6.96%) belonging to family *Poaceae*.

A bio spectrum emerges by categorizing all higher plant species into life forms and expressing their ratios in terms of numbers or percentages. This categorization based on the structural and functional similarities of plant species. The biological spectrum (Table 2, Figure 4) consisted of 68% therophytes (34 Spp.), 30% Hemicryptophytes (15 spp.) and 2% Phanerophytes (1 spp.) classified according to Raunkiaer's life form classification.

Close to these findings, Al-Robai *et al*. (2017) recorded the dominance of therophytes and Chamaephytes with 32.7% and 30.45% species respectively. Ibrahim *et al*. (2019) found the dominancy of therophytic plants (57 spp.) from rural area "Takht Bhai" District Mardan. Therophytes signify a desert climate, geophytes serve as indicators of a Mediterranean climate, and hemicryptophytes suggest a temperate zone (Khan *et al*., 2014). Change in biological spectra caused due to the biotic influences such as deforestation, grazing, climate change and agricultural practice.

Table 1: Floristic composition of weeds of wheat, maize and potato crop fields of Tehsil TOBA TEK SINGH

Family	Plant name	Wheat	Maize	Potato	RF	RD	RC	IVI	Life form
Amaranthaceae	*Amaranthus viridus* (Hook.)	✓	✓	✓	2.5	8.88	1.26	4.21	Th
	Achyranthes aspera	×	✓	×	4.14	3.86	2.83	3.61	Th

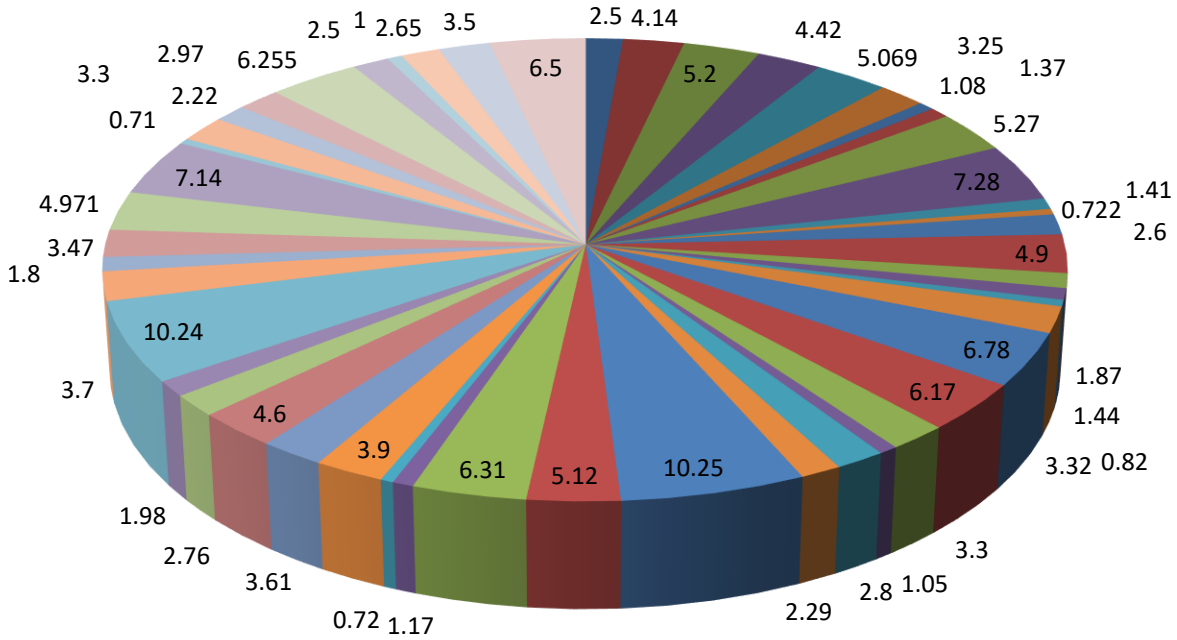
	Alternanthera sessilis (L.) R.Br.	×	✓	×	5.2	4.3	4.2	4.56	H
	Digera arvensis Forssk.	×	✓	×	4.42	1.42	1.19	2.34	Th
	Digera muricata Mart.	×	✓	✓	5.069	2.14	9.785	5.66	Th
Asteraceae	*Digera arvensis* Forssk.	✓	×	×	3.25	0.60	1.65	1.83	Th
	Cichorium intybus L.	✓	×	×	1.08	1.42	0.82	1.10	Th
	Cirsium arvense	✓	✓	×	1.37	0.995	1.8	1.39	Th
	Conyza ambigua Dc.	✓	✓	✓	5.27	3.92	3.75	4.31	Th
	Parthenium hysterophorus L.	✓	✓	✓	7.28	3.73	2.74	4.58	H
	Sonchus asper L.	✓	✓	✓	1.41	0.82	1.14	1.12	Th
	Xanthium strumarium L.	✓	×	×	0.722	0.95	4.58	2.084	Th
Aizoaceae	*Trianthema portulacastrum* Linn.	×	✓	✓	2.60	1.65	1.64	1.96	Th
Brassicaceae	*Coronopus didymus* L.	✓	✓	✓	4.9	3.771	2.10	3.59	H
Borginaceae	*Heliotropium europaeum*	✓	×	×	1.87	3.80	4.16	3.27	Th
Chenopodiaceae	*Chenopodium murale* L.	✓	×	×	1.44	1.54	0.62	1.19	H
	Chenopodium album	×	✓	×	0.82	0.26	0.53	0.54	H
	Salsola foetida (Hook.)	×	✓	✓	3.32	1.435	1.1	1.95	Th
Convolvulaceae	*Convolvulus arvensis* L.	✓	✓	✓	6.78	8.77	7.48	7.68	Th
Cucurbitaceae	*Cucumis melo* L.	×	✓	✓	6.17	4.11	10.28	6.85	H
	Cucurbita maxima D.	×	✓	×	3.3	2.5	9.0	4.93	H
Cyperaceae	*Cyperus rotundus*	×	×	✓	1.05	0.33	0.263	0.55	Th
	Cyperus iria L.	×	×	✓	2.80	2.54	3.42	2.92	Th
Euphorbiaceae	*Crozophora tinctoria* (L.) Raf.	✓	×	✓	2.29	4.44	4.67	3.8	Th
	Euphorbia helioscopia L.	✓	×	×	10.25	25.6	11.7	15.8	Th
	Euphorbia prostrata Ait.	✓	✓	✓	5.12	4.91	4.60	4.87	H
	Euphorbia hirta L.	×	×	✓	6.31	2.54	3.21	4.02	H
Lamiaceae	*Salvia plebeia* R. Brown	✓	✓	×	1.17	1.09	0.99	1.08	Th
Leguminosae	*Trizolium alexandrium* L.	✓	×	×	0.72	0.64	1.38	0.91	Th
Primulaceae	*Anagalis arvensis* L.	✓	✓	×	3.90	3.45	2.175	3.18	Th
Poaceae	*Avena sativa* L.	✓	×	×	3.61	3.39	1.93	2.98	Th
	Arnularia japonica	×	✓	×	4.6	3.7	7.3	5.2	Th

	Cenchrus ciliaris L.	✓	×	×	2.76	2.55	2.76	2.69	H
	Colonum spp.	×	✓	✓	1.98	0.561	0.319	0.95	Th
	Cynodon dactylon L.	✓	✓	✓	10.24	18.63	15.72	14.8	H
	Cyperus rotundus (L.)	×	✓	×	3.7	6.8	7.9	6.13	Th
	Dicanthium annulatum (Frossk) Stapf.	✓	×	×	1.80	2.38	2.86	2.35	H
	Dactyloctenium aegyptium (L.)Willd.	×	✓	✓	3.47	4.815	4.87	4.38	Th
	Digitaria sanguanalis (L.) Scop.	×	×	✓	4.971	10.216	13.79	9.66	Th
	Saccharum spontaneum L.	✓	✓	✓	7.14	8.52	5.75	7.14	H
	Sorghum halepense (L.)	✓	×	✓	0.71	0.517	2.612	1.28	H
	Setaria glauca L.	×	×	✓	3.3	3.4	2.52	3.07	Th
	Polypogon monspeliensis (L.) Desf.	×	✓	✓	2.22	0.359	1.085	1.22	Th
Polygonaceae	*Rumex dentatus* L.	✓	×	✓	2.97	2.352	5.12	3.48	Th
	Polygonum plebeium R. Br.	✓	×	✓	6.255	4.855	5.63	5.58	Th
Solanaceae	*Solanum xanthocarpum* L.	×	×	✓	2.5	2.01	2.33	2.28	Th
	Solanum sp. L.	×	×	✓	1.0	0.73	0.91	0.88	Th
	Wilthania somnifera L.	✓	×	×	2.65	3.52	8.17	4.78	Ph
Verbenaceae	*Phyla nodiflora* (L.)	✓	✓	×	3.50	8.57	2.805	4.96	Th
Zygophylaceae	*Tribulus terristris* (Linn.)	×	✓	✓	6.5	18.403	4.03	9.64	H

H, Hemicryptophytes; IVI, Importance Value Index; Ph,Phanerophytes; RC, Relative cover; RD, Relative density; RF, Relative Frequency; TH, therophytes

Table 2: Life form distribution of weeds

Life forms	No. of Species	% of Species
Hemicryptophytes	15	30
Therophytes	34	68
Phanerophytes	1	2



Amaranthus viridus Hook. *Achyranthes aspera* *Alternanthera sessilis (L.) R.Br.*

Digera arvensis Forssk. *Digera muricata Mart.* *Digera arvensis Forssk.*

Cichorium intybus L. *Cirsium arvense* *Conyza ambigua Dc.*

Parthenium hysterophorus L. *Sonchus asper L.* *Xanthium strumarium L.*

Trianthema portulacastrum Linn. *Coronopus didymus L.* *Heliotropium europaeum*

Chenopodium murale L. *Chenopodium album* *Salsola foetida Hook.*

Convolvulus arvensis L. *Cucumis melo L.* *Cucurbita maxima D.*

Cyperus rotundus *Cyperus iria L.* *Crozophora tinctoria (L.) Raf.*

Euphorbia helioscopia L. *Euphorbia prostrata Ait.* *Euphorbia hirta L.*

Salvia plebeia R. Brown *Trizolium alexandrium L.* *Anagalis arvensis L.*

Avena sativa L. *Arnularia japonica* *Cenchrus ciliaris L.*

Colonum spp. (L.) *Cynodon dactylon L.* *Cyperus rotundus (L.)*

Dicanthium annulatum (Frossk) stapf. *Dactyloctenium aegyptium (L.) Willd.* *Digitaria sanguanalis (L.) Scop.*

Saccharum spontaneum L. *Sorghum helepense (L.)* *Setaria glauca L.*

Polypogon monspeliensis (L.) Desf. *Rumex dentatus L.* *Polygonum plebeium R. Br.*

Solanum xanthocarpum L. *Solanum sp. L.* *Wilthania somnifera L.*

Phyla nodiflora (L.) *Tribulus terristris (Linn.)*

Fig.3: IVI distribution of weed species

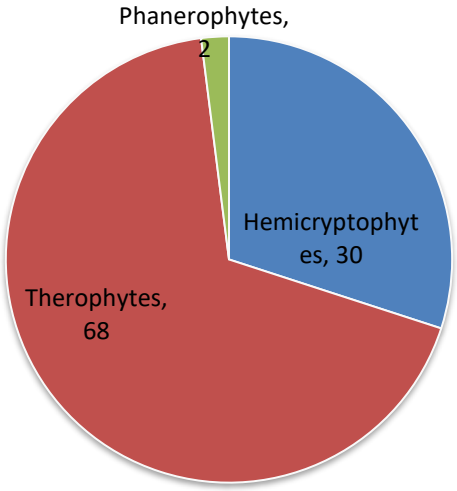


Fig.4: Biological Spectrum of Life form of weeds

Conclusion

This study revealed that *Poaceae* was the dominant family with 11 species. *Euphorbia helioscopia* of family *Euphorbiaceae* had highest importance value index of 15.8%. *Chenopodium album* of family Chenopodiaceae had lowest IVI of 0.54%. Therophytes (68%) were the dominant life form class. The documentation of weed flora found in the maize, wheat and potato crops became significantly helpful in making a comprehensive plan for managing weeds over the long run. This study clearly indicates that crops in Tehsil Toba Tek Singh are extensively infested with weeds, resulting in significant crop losses. It is recommended that all relevant quarters address this issue to control the proliferation of weeds by implementing suitable measures, such as cultural, mechanical, biological, and chemical methods. It would greatly enhance crop yields and help ensure food security for the nation's population.

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Conflicts of interest:

There is no conflict of interest related to this article.

Author's Contribution

MM: Field work, write-up; TK: Write-up, results; MZ: Map; SM, AA, ZK: Supervision and concept.

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References

Ahmad, Z., S.M. Khan, E.F. Abd_Allah, A.A. Alqarawi and A. Hashem. 2016. Weed species composition and distribution pattern in the maize crop under the influence of edaphic factors and farming practices: A case

study from Mardan, Pakistan. *Saudi journal of biological sciences*, 23(6): 741-748.

Ahmad, Z., S.M. Khan, S. Ali, I.U. Rahman, H. Ara, I. Noreen and A. Khan. 2016. Indicator species analyses of weed communities of maize crop in district Mardan, Pakistan. *Pak. J. Weed Sci. Res*., 22(2): 227-238.

Algandaby, M.M. and M. Salama. 2018. Management of the noxious weed; *Medicagopolymorpha* L. via allelopathy of some medicinal plants from Taif region, Saudi Arabia. *Saudi Journal of Biological Sciences*, 25(7): 1339-1347.

Ali, S.I. and M. Qaiser. 1992-2007. *Flora of Pakistan*. Nos. 194-208. Department of Botany, University of Karachi and National Herbarium, PARC, Islamabad.

Ali, S.I. and Y.J. Nasir. 1990-92. *Flora of Pakistan*. Nos. 191-193. Department of Botany, University of Karachi and National Herbarium, PARC, Islamabad.

Badshah, L., F. Hussain and Z. Sher. 2013. Floristic inventory, ecological characteristics and biological spectrum of rangeland, District Tank, Pakistan. *Pak. J. Bot*., 45(4): 1159-1168.

Bakar, S., L. Al Faria, R. Rani and M. Rahman. 2021. Diversity of vascular weeds species in six selected farms of Chuadanga district, Bangladesh. *Species*, 22(69): 36 – 42.

Clements, F.E., 1906. *Research methods in Ecology*. University Publishers Company, *Lincola*. pp. 334.

Ibrahim, M., M.N. Khan, S. Ali, A. Razzaq, A. Zaman, M. Iqbal and F. Jan. 2019. Floristic composition and species diversity of plant resources of rural area "Takht Bhai" district Mardan, Khyber Pakhtunkhwa, Pakistan. *Medicinal and aromatic Plants (Los Angeles)*, 8(338): 2167-0412.

Iqbal, M., S.M. Khan, M.A. Khan, Z. Ahmad, Z. Abbas, S.M. Khan and M.S. Khan. 2017. Distribution pattern and species richness of natural weeds of wheat in varying habitat conditions of district Malakand, Pakistan. *Pak. J. Bot.*, 49(6): 2371-2382.

Javed, K., S. Muhammad, Z. Khan, S. Fatima, H. Nawaz, T. Khalid, Mahrukh and Shariat Ullah. 2023. Synecological analysis of weeds of wheat, rice and sugar cane crops of tehsil Muridke, district Sheikhupura (Punjab) Pakistan. *Pakistan Journal of Weed Science Research*, 29(2): 107-114.

Khan, H., K.B. Marwat, G. Hassan, M.A. Khan and S. Hashim. 2014. Distribution of parthenium weed in Peshawar valley, Khyber Pakhtunkhwa-Pakistan. *Pak. J. Bot.*, 46(1): 81-90.

Khan, M., F. Hussain and S. Musharaf. 2014. Floristic composition and biological characteristics of the vegetation of Sheikh Maltoon Town District Mardan, Pakistan. *Annual Research & Review in Biology*, 3(1): 31-41.

Khan, M.N. and L. Badshah. 2019. Floristic diversity and utility of flora of district Charsadda, Khyber Pakhtunkhwa. *Acta Ecologica Sinica*, *39*(4): 306-320.

Mahklouf, M.H. and M.A. Elhosk. 2022. Weed flora of selected farms in Al-Wadi Al-Shargi in Ain Zara District Southwest of Tripoli-Libya. *Magna Scientia Advanced Research and Reviews*, 05(01): 036–04.

Nasir, E. and S.I. Ali. 1970-89. Flora of Pakistan. Nos. 1-190. National Herbarium, PARC, Islamabad and Department of Botany, University of Karachi, Pakistan.

Statistics Bureau of Pakistan. 2013. Pre investment Study District Toba Tek Singh. Directorate of industries Punjab, Lahore. Pp.2.

Raunkier, S.C. 1934. The life forms of the plants and statistical plant geography. Clarendon Press, Oxford. pp. 362.

Riaz, G., M.U.F. Awan, A.A. Sardar, M. Tayyab, S.S. Malik and S. Muhammad. 2021. Multivariate analysis of weeds of chickpea, mustard and wheat crop fields of tehsil Isakhel, District Mianwali (Punjab), Pakistan. *Pakistan Journal of Weed Science Research*, 27(2): 153.

Sher, Z., F. Hussain, L. Badshah and M. Wahab. 2011. Floristic composition, communities and ecological characteristics of weeds of wheat fields of Lahore, District Swabi, Pakistan. *Pak. J. Bot.*, 43(6): 2817-2820.

Usman, M., G. Murtaza, A. Ditta, T. Bakht, M. Asif, M. Nadir and S. Nawaz. 2020. Distribution pattern of weeds in wheat crop grown in District Khanewal, Punjab, Pakistan. *Pakistan Journal of Weed Science Research*, 26(1): 47.

Al-Robai, S.A., H.A. Mohamed, S.M. Howladar and A.A. Ahmed. 2017. Vegetation structure and species diversity of Wadi Turbah Zahran, Albaha area, southwestern Saudi Arabia. *Annals of Agricultural Sciences*, 62(1): 61-69.