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FLORISTIC COMPOSITION AND PHYTOSOCIOLOGICAL STUDIES OF HAZAR NAO HILLS, DISTRICT MALAKAND, KHYBER PAKHTUNKHWA, PAKISTAN

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ABSTRACT

A field study was conducted to investigate the floristic composition and phytosociology of the Hazar Nao hills, District Malakand, Khyber Pakhtunkhwa. For study purpose the whole area was divided into 5 Zones. In each Zone 25 sites were selected randomly. Data were recorded from May-September, 2014, by using 1 sq. meter quadrate. The size of Zone has a direct proportion to the distance between the quadrates as the number of quadrates is same for each Zone. Twenty four plant species belong to 13 families were identified from the study area. Seventeen plant species were identified as dicot, 6 monocot and 1 pteridophyte. Out of the 23 angiosperms 5 belong to poaceae, 4 lamiceae and asteraceae each, 2 belongs to polygonaceae as important families, distributed all over the Hazar Nao hills. The highest total weed density 119.71 plants m^{-2} was recorded in Zone-1, followed by 109.08, 98.22 91.07 and 73.34 at Zone-2, Zone-3, Zone-4 and Zone-5, respectively. The mean weed density across the Zones depicted (21.67) for Saccharum spontaneum as the dominant weed followed by Micromeria biflora (11.57). The highest relative density % (24.09) was recorded for S. spontaneum in Zone-1 followed by 21.89 at Zone-3, 21.74 at Zone-5 and 21.05 at Zone-2. The major weed communities existing in the area consisted of S. spontanium, M. biflora and Apluda mutica. The highest mean frequency % (82) was observed for S. spontaneum which was present at all Zones while lowest was recorded (20) for Chenepodium album (L). The mean highest relative frequency % (8.76) was also observed for S. spontaneum while lowest (2.21) was recorded for Conyza canadensis. The Polygala abyssinica (L), Oxalis corniculata (L) and Xanthium strumarium were having the lowest mean relative frequencies, declaring them as insignificant weeds of the area. The data shows that the highest importance value % (16.24) was recorded for S. spontaneum in Zone-5 followed by (15.79) at Zone-1. S. spontanum is the most prevalent weed at all the Zones with high (15.35%) mean importance values. Similarly the highest importance

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value constancy index (IVCI) (61.4) was found for S. spontaneum while the smallest IVCI value (5.92) was recorded for C. canadensis. Average importance value (AIV) and IVCI value confirms the predominance S. spontaneum, M. biflora, O. limbata and T. minuta form the Hazar Nao hills. The supremacy of S. spontanum is due to its stress tolerance, invasiveness, higher growth rate and high fecundity. It is concluded that the plants with grazing, feed or medicinal value are becoming rare and less frequent besides plants intrinsic characteristics of being vulnerable to environmental and anthropogenic stresses.

Key words: Floristic composition**,** Hazar Nao hills, Pakistan, phytosociology.

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INTRODUCTION

The Malakand district is located at latitude of 34° 35′ N and 71° 57′ E longitude. It is enclosed by the valley of Swat in the Northeast, Dir in the North, district Buner in the East and the irrigated plains of district Mardan and Charsadda in the South and the agencies of Mohmand and Bajaur in the West (Chagatai and Ghawas, 1976). The total protected area of district Malakand is 952 km^2. The Hazar Nao hills are important mountains of Malakand district located between Kot and Agra village having about 995m height, present a very much scenic view. The hills are thickly covered with forests and have its importance for botanical and medicinal plants studies (Zabihullah *et al.,* 2006).

The inhabitants of Malakand are mostly farmers by profession. However, due to the insufficiency and less production farming is supported by other livelihood methods like collection of medicinal plants, cattle farming, poultry farming at homes and fuel wood cutting and selling in the local market. The women folk of the area work hard to accompany their male partners in wood business by bringing the wood lots on their heads from the hills and also in harvesting and weeding their fields. The poultry and cattle management is almost totally dependent on the womenfolk in the area. Besides they are also skillful in making various handicrafts like baskets, brooms, caps, bed sheets and wooden utensils etc. The changing environmental conditions as well as the demand for more plant and forest products have severely affected the plant biodiversity of the study area. Due to

the lack of conservation strategy these valuable and non-renewable resources will not be available for the future generations (Ibrar *et al.,* 2007).

The flora of an area measures and records the types of plant species, their number population size and their distribution over the area and their composition within these communities. Globally the study of flora is a continuous process due to new introductions, speciation and climate change. Due to the variable environmental conditions the number and types of plants vary in different geographical zones of the world. Floristic diversity is a reflection of environmental, physiognomy abiotic and biotic influences.

Vegetation is the collective growth of plants combine together in certain area characterized by component species or structural and functional combination of character that make their physiognomy (Dastagir *et al*.,1999). Similarly community is any collection of plant having related ecological requirements, adaptation and occupying a unit area similar with physical and atmospheric feature. A forest contains various herbs, shrubs, trees, animals, birds, insect and microorganism. In a biotic community plants and animal, microorganisms all are interrelated with each other and cannot be separated. Each vegetation type has a relative floristic composition phenological structure, shape; size and stratification have a significant species (Siddique *et al*., 2013). This is the reason; temperate forest and grassland tropical, desert and alpine meadows contrast from one another.

Phytosociology deals with plant community composition, development and their relationships among the species within different communities. Phytosociological exploration of different community based on floristic composition is aimed at finding the relationship among various ecological factors like topography, precipitation and temperature with vegetation of the area and finding correlation with the bioclimatic factors (Siddique *et al*., 2013). Regional floras are most important for recording specific information regarding plants. Studies made on the floristic composition and vegetation in northern parts of Pakistan (Champion *et al*., 1965), Harboi Kalat (Durrani *et al.*, 2006), Buner and Kirthar range (Perveen *et al.,* 2008), Swat (Hussain *et al.*, 2000), Chakwal (Chaudhry *et al.,* 2001) and Kotli (Nazir & Malik, 2006) has been done. They recorded huge degradation of flora. However, no study on the vegetation of Hazar Nao hills district Malakand has been carried out. The present study was carried out with objectives; to document list of flora with their ecological characteristics and to know the conservation status of plants on the Hazar Nao hills.

MATERIALS AND METHODS

Floristic list: Floristic composition survey was carried out during May to September, 2014. A complete checklist of the plants were prepared and arranged alphabetically along with their respective taxas. Plants were identified using flora of Pakistan (Nasir and Ali, 1971-1995; Ali and Qaiser, 1995-2009).

Vegetation data: For vegetation analysis the area was divided into 5 Zones and each site was studied regarding various floristic characteristics, vegetation structure and productivity. Moreover, plant specimens collection were also made during the study. Analysis of vegetation characteristics was done following (Hussain, 1989) methodologies.

Phytosociological study: For conducting phytosociological study the study area was divided into five Zones. From each Zones 25 sites were selected randomly using the methodology of Thomas, (1985) and Mc Cully *et al*., (1991) with slight modifications ten quadrates (1x1 m^2) were used per site. Density $m^{-2}$and frequency of species was determined from the data taken through quadrate method. Similarly the relative density (%), frequency (%), relative frequency (%), importance value (%), average importance value, constancy classes and importance value constancy index (IVCI) of the weeds species were computed from the same data. The collected plants specimens were pasted on herbarium sheets, identified, labeled and submitted to the Herbarium of Department of Weed Science, The University of Agriculture Peshawar. Farmers' perceptions regarding different plants were also noted. During the course of studies, the following parameters were recorded as adopted from (Hussain, 1989 and Hussain *et al*., 2004):

$$\text{Absolute Density } m^{-2} = \frac{\text{Total No. of individuals of a species in all quadrates}}{\text{Total No. of quadrates}}$$

$$\text{Relative Density (\%)} = \frac{\text{Mean of individual species}}{\text{Mean of total species}} \times 100$$

$$\text{Frequency (\%)} = \frac{\text{No. of quadrates in which species occurs}}{\text{Total number of quadrates}} \times 100$$

$$\text{Relative Frequency (\%)} = \frac{\text{Frequency value of single species}}{\text{Total frequency}} \times 100$$

$$\text{Importance Value (\%)} = \frac{\text{Relative density \% + Relative frequency \%}}{2}$$

$$\text{Importance Value Constancy Index} = \text{Average Importance Value} \times \text{Constancy Class}$$

RESULTS AND DISCUSSION

Absolute Density (m^{-2})

The survey data shows that total 24 plant weed species, belonging to 13 families were collected and identified from the study area. Among the collected 24 plants, 17 plants species were dicot 6 belong to monocot, while 1 to pteridophyte (Table-1). Among plant species 5 belonged to poaceae, 4 to lamiaceae and asteraceae each, 2 to polygonaceae, 1 to asperegaceae, chenopodiaceae, buxaceae, verbenaceae, nyctaginaceae, pteridaceae, polygalaceae, ranunculaceae and oxalidaceae each. All families belong to division of spermatophyte except one which is a pteridophyte. The species in each family is further scrutinized whether they belong to same genus or various genera. So among the 5 species of poaceae all of them belong to various genera (5 genera). Similarly lamiaceae also have 4 genera for its 4 species, 2 species polygonaceae are also different generically. Poaceae, asteraceae and chenopodiaceae have emerged as the common families in the studied area. The members of poaceae and asteraceae due to their wide ecological amplitude are diverse in their habitat occurrence. Murad *et al*. (2012) conducted similar study in Hazar Nao hills and collected and identified a total number of 90 vascular plant species.

The highest weed density m^{-2} (119.71) was recorded in Zone-1, closely followed by (109.08), (98.22) and (91.07), (73.34) at Zone-2, Zone-3, Zone-4 and Zone-5 respectively in Hazar Nao hills district Malakand. The mean density m^{-2} across the Zones depicts of the *S. spontaneum* (21.67) as the dominant weed followed by *M. biflora* (11.57). The lowest value (0.43) is recorded for *O. limbata* among the species infesting the study area (Table-1). The highest infestation of *S. spontaneum* was (28.83) recorded at Zone-1, followed by (22.89), (21.50), (19.17) and (15.94) at Zone-2, Zone-3 and Zone-4 respectively. In all Zones *S. spontaneum* having the mean maximum density m^{-2} of (28.83) was followed by *M. biflora* (15.28) and *Cymbopogan jawarancusa* (11.95). These plant species show high absolute density in five Zones individually. Data recorded in Zone-1 exhibit less value of weed species *Conyza canadensis* m^{-2} (0.11) and *Oxalis corniculata* (0.78) while in Zone-5 shows (0.17) for *Otostegia limbata* and *Asparagus racemosus* (Figures-1-5).

S. spontaneum, S. filifolium, Apluda mutica and *Digiteria sanguinalis* are highly desirable turf grasses in warm temperate climates. *Boerrhavia procumbens* is a perennial herb with stout rootstock dominates the community and is present abundantly in dry soil (Shah *et al.,* 2012). *S. spontaneum* built close, continuous thickets that stop the establishment of woody species and also resistant to

weed species having deep and extensive root system (Mark *et al*., 2002).

Relative density (%)

The area was covered with vegetation and there were less bare land on the study area. However, the density of certain species was higher than other in their communities and different vegetation zones. The highest relative density % (24.09) was recorded for *S. spontaneum* in Zone-1 followed by Zone- 3 (21.89) , Zone-5 (21.74) and Zone-2 (21.05).The major weed communities existing in whole study area were comprised of *S*. *spontanium, Micromeria biflora, Apluda mutica etc.* The data revealed the dominance of *S. spontanium* weed in all 5 Zones. *S. spontanium* shows mean data in all 5 Zones with relative density % of (21.95) followed by *Clematis filifera* (21.45) and *Lantana camara s* (21.24) respectively (Table-2). However, in Zone-5, the maximum relative density % of *Otostegia limbata* and *Lantana camara* each was 100 % compared to other weeds at different Zones (figure-10). In Zone-3 *Tagetes minuta* was (100%) present in the Hazar Nao hills district Malakand (figure-8). Similarly *Otostegia limbata* and *Conyza canadensis* (0.74%) were less in Zone-3 (Table-2). In Zone-4 the relative density of *Clematis filifera* was found (100%), whereas *Asparagus racemosus*, *Otostegia limbata* is very less in number (0.30%) (Fig. 6-10). In Zone-5 *O. limbata*, *Lantana camara* is (100%), while *Asparagus racemosus* is (0.23%) was present.

Frequency (%)

S. spontaneum, Apluda mutica, Cymbopogon jwarancus occurred most frequently in the whole study area of Hazar Nao hills of district Malakand (Table-3). In the study area the members of Poaceae were widely distributed with the highest mean frequency % (82) of *S. spontaneum* in all five Zones. In Zone-4 and 5 *S. spontaneum* was 100% present,while less frequent(60%) in Zone-2. While *Micromeria biflora* had mean frequency (78%) in all 5 Zones. *Chenopodium album* was present at the lowest frequency (20%). Following *S. spontaneum* weed in all study locations, *Oxalis corniculata* and *Otostegia limbata* prevail in large stands with frequencies % of (24.6) and (39.4), respectively. Similarly Zone-1 showed high frequency of *Apluda mutica* and *Isodon rugosus* both as shown in (Figures-11-15). *S. spontaneum* being best competitor with other weeds for water, nutrients and light; resulted in reduced growth of neighboring plants species in plant community. The *Saccharum* weed species with high frequency and better competitive ability often reduce growth and yield of associated weeds. Weeds have specific adoptive characteristics that help their survival in stress, competition and changed environmental conditions. The one stronger in such characteristics will be the winner in the race while the weaker ones will be the losers. These characteristics may be

in the form of deep root system of as in *S. spontaneum*, plant physiology like C3 vs C4, underground food storage and vegetative propgules, a lot of seed production, allelopathy and resistance to grazing and trampling etc. These competitive characteristics enable them to consume large amount of habitat resources and deprive the other weeds.

Relative frequency (%)

The relative frequency of weeds is a good indicator showing the distribution of species in a given area. The relative frequency % of the Hazar Nao hills district Malakand is presented in (Table-4). The data showed the dominance of *S. spontaneum* weed at all five Zones studied. The mean highest relative frequency % (10.75) was recorded for *S. spontaneum* weeds and lowest (2.21) was recorded for *Conyza canadensis*. The data further manifest that *S. spontaneum* weed distribution was almost uniform at all Zones. However minimum relative frequency (7.50%) was recorded at Zone-1 (figure-17). The *Chenopodium album, Otostegia limbata* and *Xanthium strumarium had* the lowest relative frequencies at most of the locations studied declaring them as insignificant among the weed flora of the study area. In Zone-1-5 *Apluda mutica, Micromeria biflora* (7.55) and (8.16), respectively is observed with mean relative frequency % (figures-17, 18, 19, 20, 21). In *S. spontanum,* Zone-4 and Zone-5 has highly relatively frequency % (9.80), (10.75) (Figures- 16-20).

Importance Value (IV) %

The IV of species shows various weeds and its distribution in a specific area. The data shows that the highest IV 16.24% was recorded for *S. spontaneum* in Zone-5 closely followed by 15.79% at Zone-1. It stand at the top and the most prevalent weed at all Zones giving high (15.35%) mean IV. The highest importance value constancy index (IVCI) (61.4) was observed for *S. spontaneum* weed species in all five Zones, while the smallest value of IVCI (5.92) was recorded for *Conyza canadensis*. The results of Ahmad *et al.* (2009) are in line with our data who analyzed the IV and floristic composition of various vegetation zones.

The perusal of data exhibits that *S. spontaneum, Micromeria biflora, Otostegia limbata,* and *Tagetes minuta* community dominated all 5 Zones. The data exhibited that *S. spontanum* is spreading in all Zones and competing with *Otostegia limbata* and other less competitive weed species (figure-21). Average importance value (AIV) and IVCI also confirmed the predominance *S. spontaneum, M. biflora, O. limbata,* and *T. minuta* form the Hazar Nao hills. However our results are in line with that of Dastagir *et al*., (1999) who reported that the same results.

CONCLUSION

All the recorded plants of the study area belongs to angiosperm family except a single pteridophyte the *Adiantum philippense* (L). Out of 24 weeds species, majority 17 were dicot species. Among all monocots (5 families), the majority plants species belong to Poaceae family. Among all Zones the highest weed density (119.7 m^2) and relative density (24.09 %) was recorded for *S. spontaneum* in Zone-1. The highest mean frequency (82%) of *S. spontaneum* was present in all Zones. The mean highest relative frequency (10.75%) was observed for *S. spontaneum* and lowest (2.21%) was recorded for *Conyza canadensis*. In Zone-5 the relative frequency of *Otostegia limbata* and *Lantana camra* was found 100%. While in Zone-4 the relative frequency of *Clematis filifera* was found 100%. The highest IV of *S. spontanum* (16.24%) was recorded in Zone-5. *C. canadensis, O. corniculata* and *Polygala abyssinica* having the smallest relative frequency % at all locations. The major weed communities existing in study area were comprised of *S. spontanium, M. biflora* and *Apluda mutica.* The supremacy of *S. spontanum* weed is due to its invasiveness, higher growth rate, rapid flowering and higher productivity.The study area is under biotic pressure in the form of overgrazing and deforestation.The area has a high potential for medicinal plants, wildlife and rangeland. However, ecological management including various conservation strategies are required so that we can safeguard these resources for our future generations.

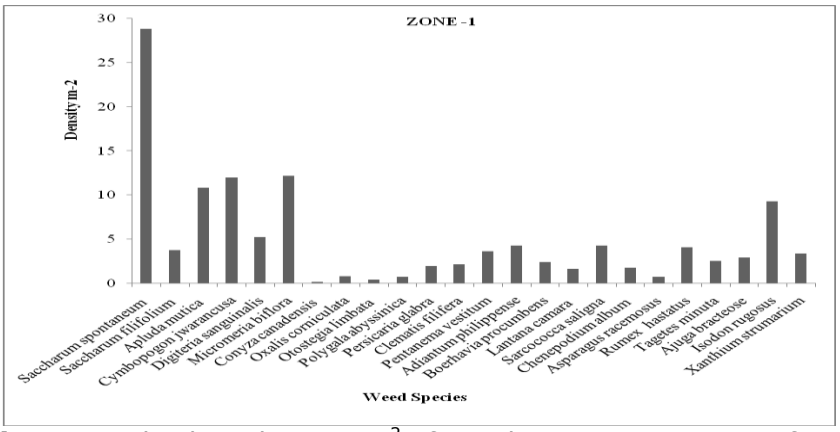

Figure 1. Absolute density m^{-2} of weed species in Zone-1 of Hazar Nao hills District Malakand

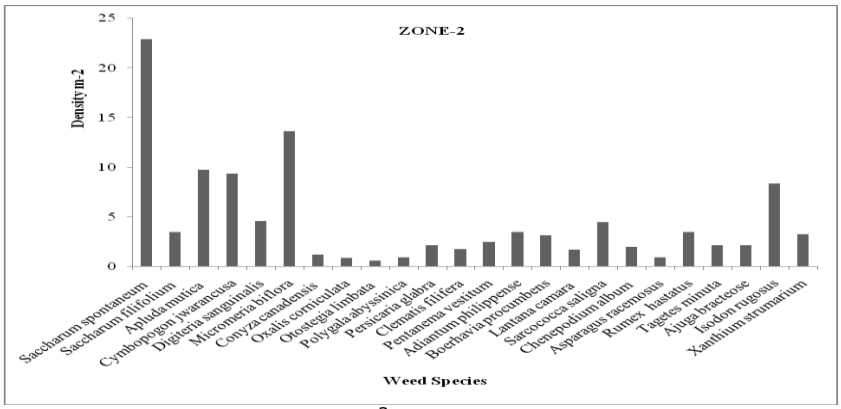

Figure 2. Absolute density m^{-2} of weed species in Zone-2 of Hazar Nao hills District Malakand

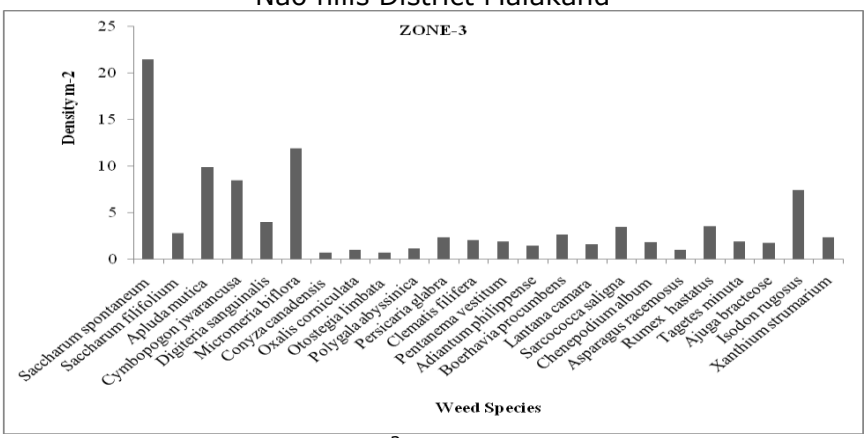

Figure 3. Absolute density m^{-2} of weed species in Zone-3 of Hazar Nao hills District Malakand

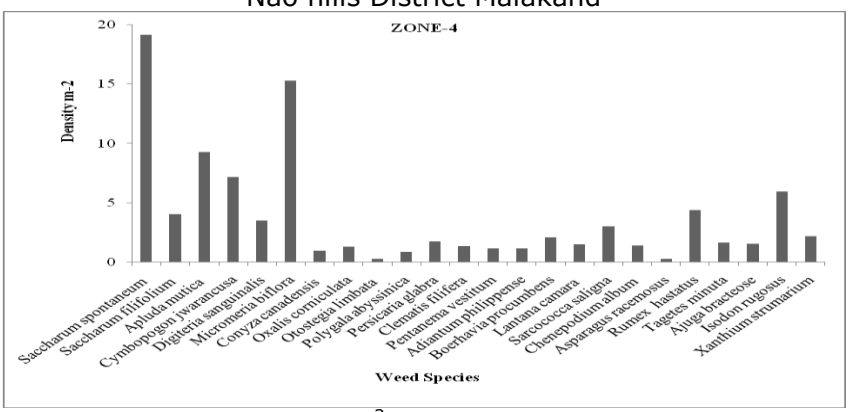

Figure 4. Absolute density m^{-2} of weed species in Zones-4 of Hazar Nao hills District Malakand

Figure 5. Absolute density m^{-2} of weed species in Zones-5 of Hazar Nao hills District Malakand

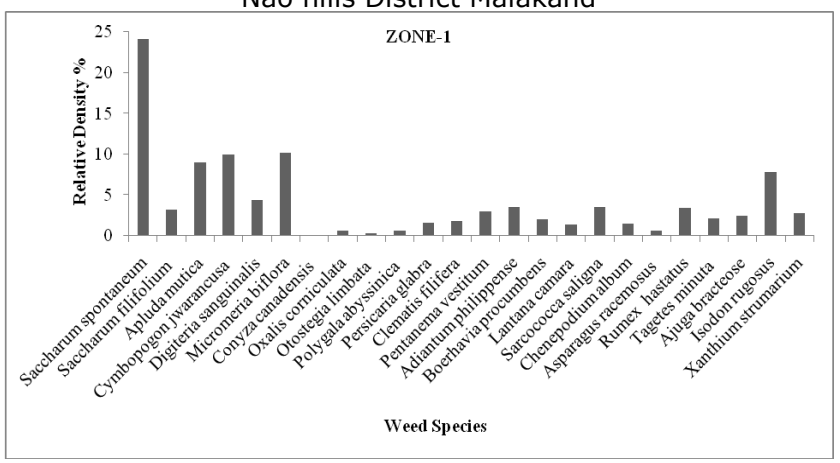

Figure 6. Relative density % of weed species in Zone-1 of Hazar Nao hills District Malakand

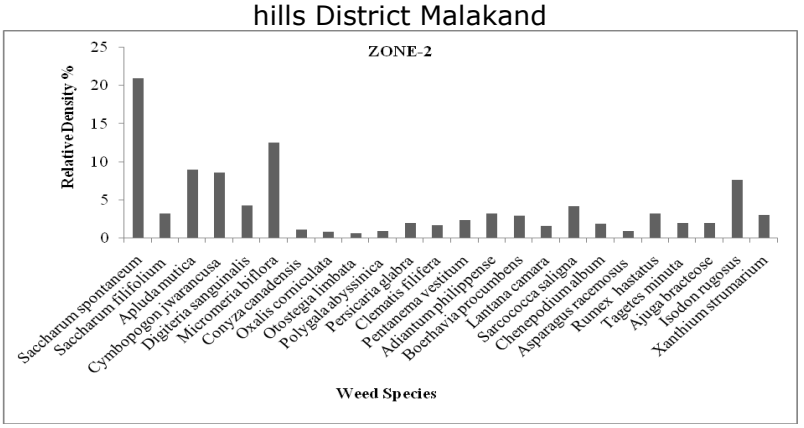

Figure 7. Relative density % of weed species in Zone-2 of Hazar Nao hills District Malakand

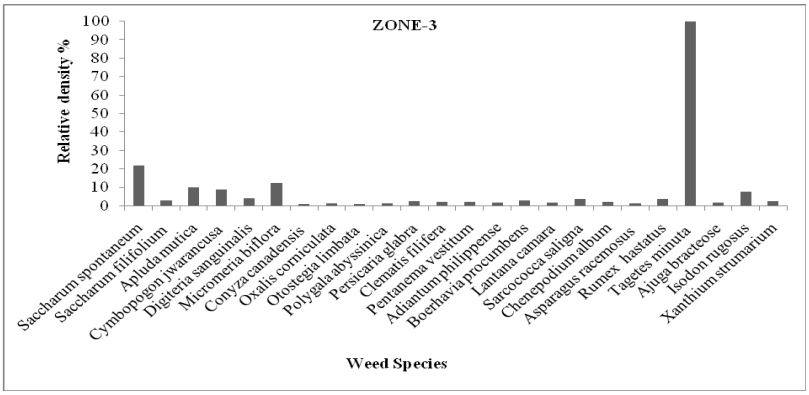

Figure 8. Relative density % of weed species in Zone-3 of Hazar Nao hills District Malakand

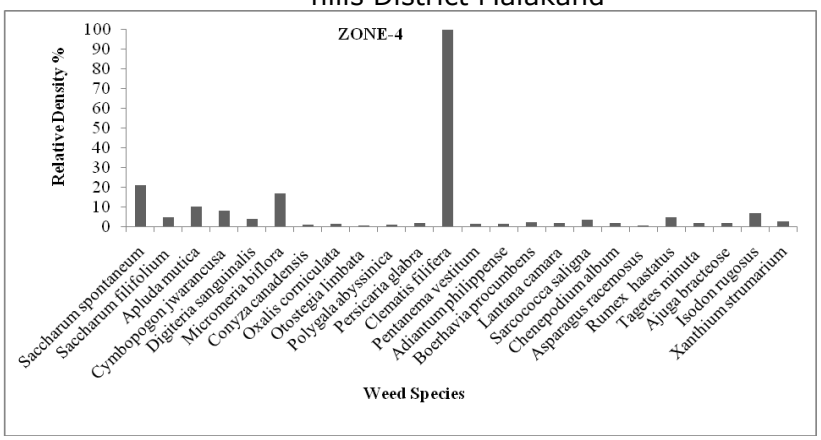

Figure 9. Relative density % of weed species in Zone-4 of Hazar Nao hills District Malakand

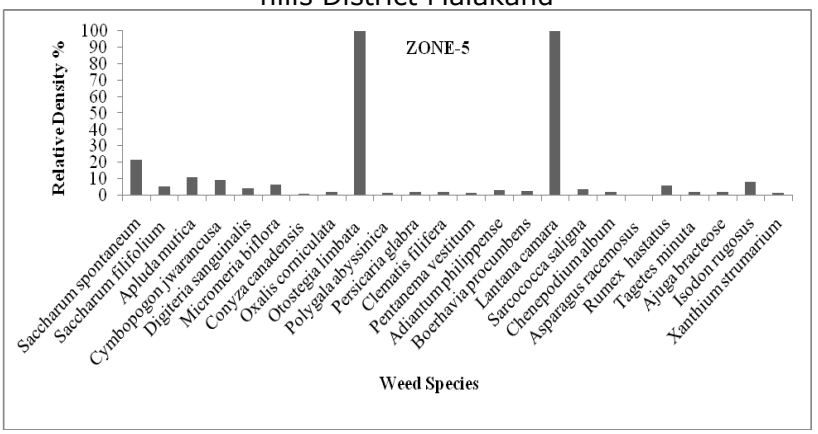

Figure 10. Relative density % of various weed species in Zone-5 of Hazar Nao hills District Malakand

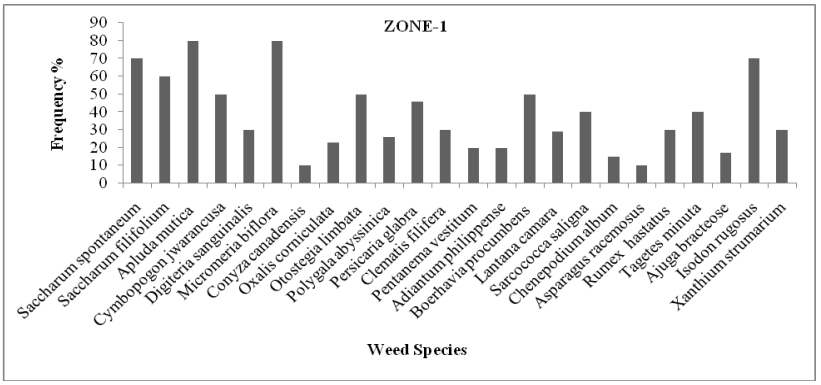

Figure 11. Frequency % of weed species in Zone-1 of Hazar Nao hills District Malakand

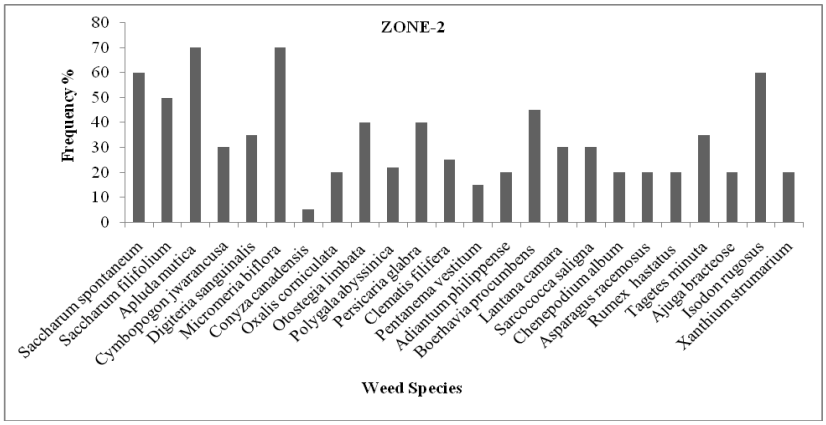

Figure 12. Frequency % of weed species in Zone-2 of Hazar Nao hills District Malakand

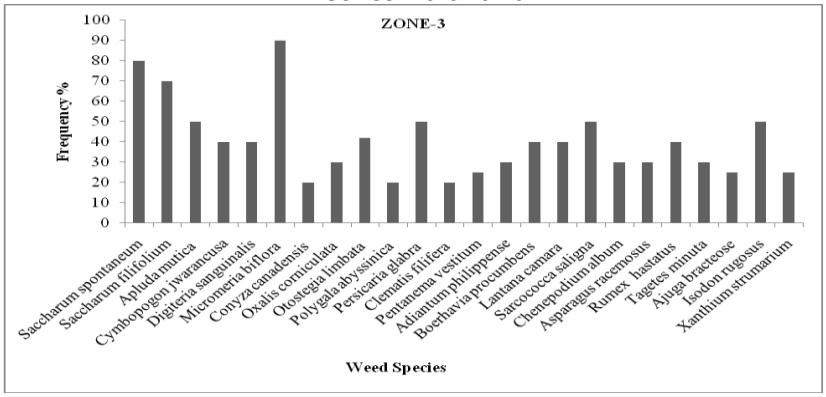

Figure 13. Frequency % of weed species in Zone-3 of Hazar Nao hills District Malakand

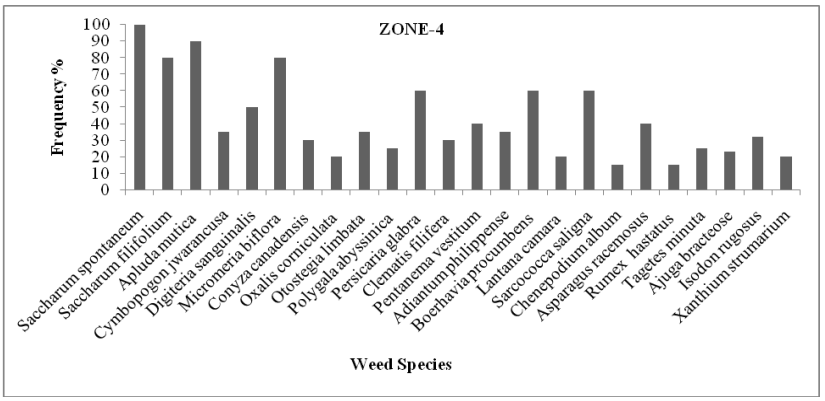

Figure 14. Frequency % of weed species in Zone-4 of Hazar Nao hills District Malakand

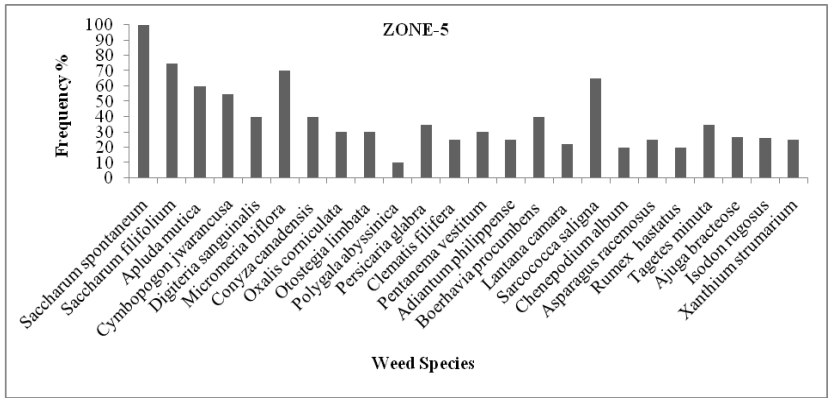

Figure 15. Frequency % of weed species in Zone-5 of Hazar Nao hills District Malakand

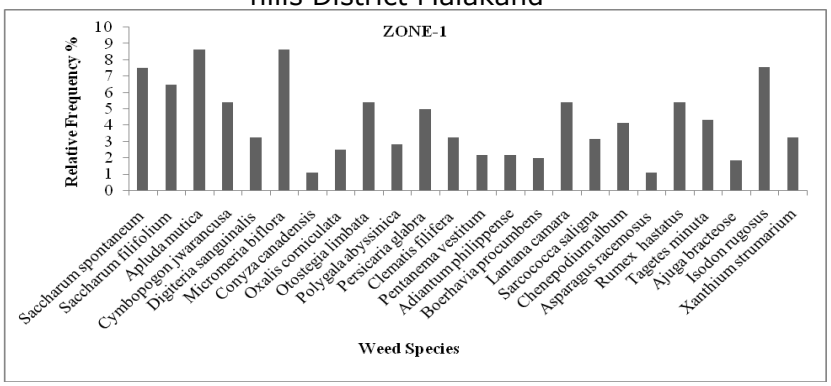

Figure 16. Relative frequency (%) of weed species in Zone-1 of Hazar Nao hills District Malakand

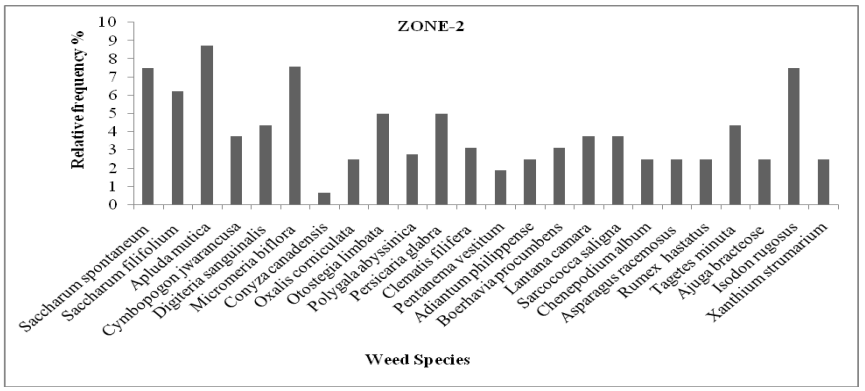

Figure 17. Reltive frequency (%) of weed species in Zone-2 of Hazar Nao hills District Malakand

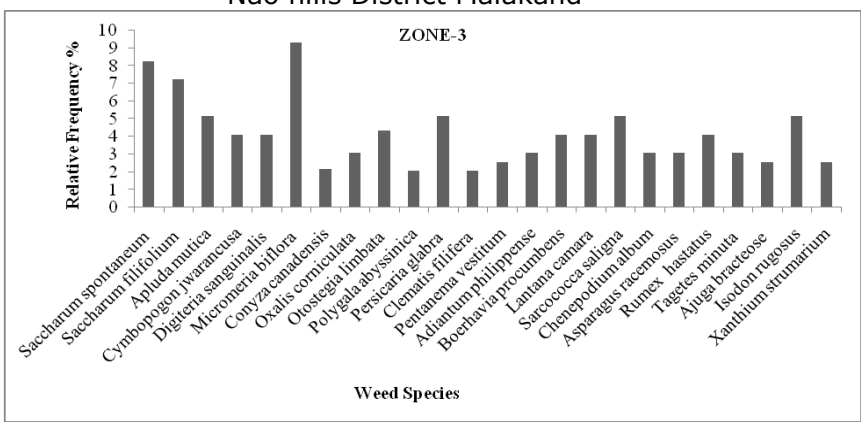

Figure 18. Relative frequency (%) of weed species in Zone-3 of Hazar Nao hills District Malakand

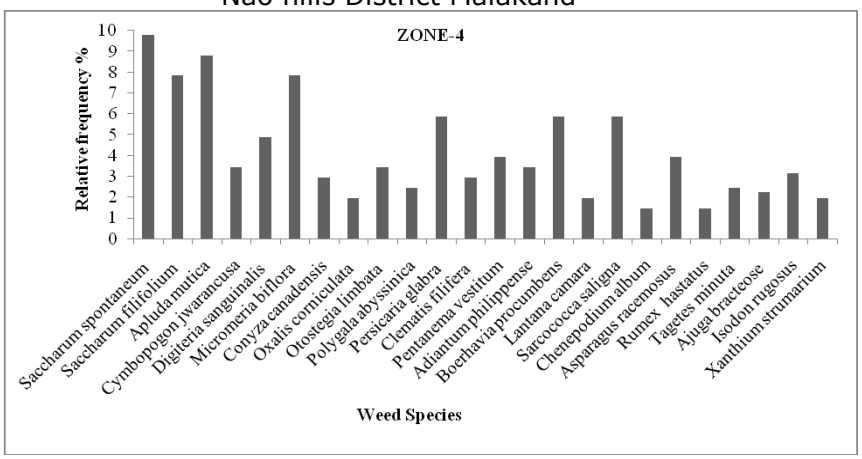

Figure 19. Relative frequency (%): of weed species in Zone-4 of Hazar Nao hills District Malakand

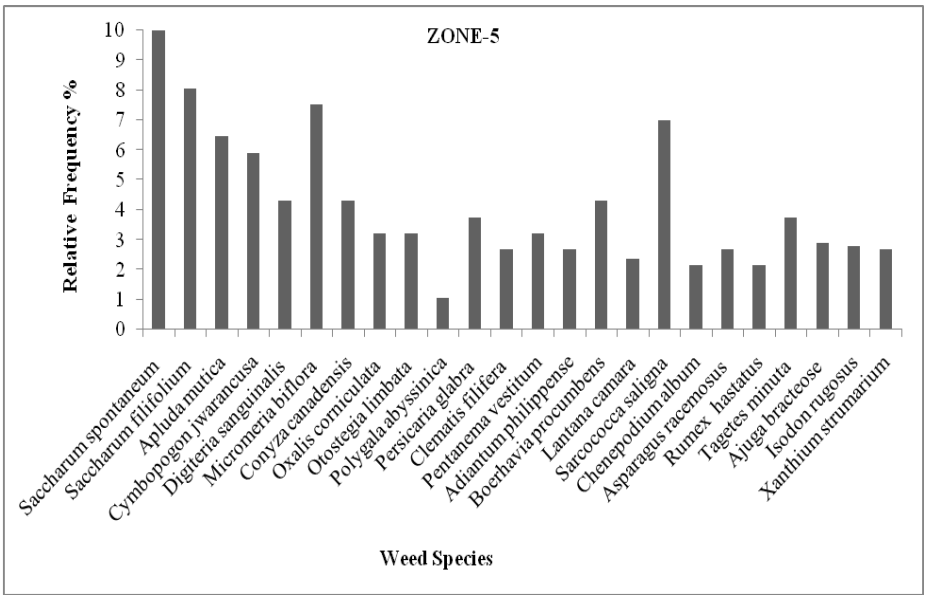

Figure 20. Relative frequency (%) of weed species in Zone-5 of Hazar Nao hills District Malakand

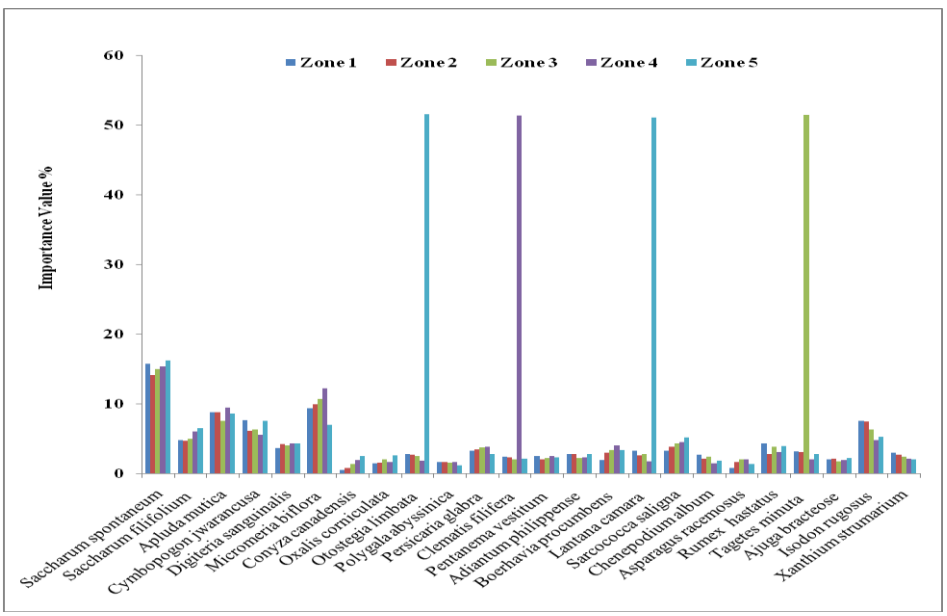

Figure 21. Importance value % of weed species in five Zones of Hazar Nao hills District Malakand

Table-1. Absolute density m^{-2} of weed species in five Zones of Hazar Nao hills, District Malakand

Weed species	Family	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Mean
Saccharum spontaneum (L)	Poaceae	28.83	22.89	21.50	19.17	15.94	21.67
Saccharum filifolium (Steud)	Poaceae	3.78	3.50	2.83	4.06	3.72	3.58
Apluda mutica (L)	Poaceae	10.83	9.73	9.94	9.27	8.00	9.55
Cymbopogon jwarancusa (Jones)	Poaceae	11.95	9.37	8.52	7.19	6.83	8.77
Digiteria sanguinalis (L)	Poaceae	5.22	4.61	4.06	3.50	3.22	4.12
Micromeria biflora (buch)	Lamiaceae	12.17	13.61	11.94	15.28	4.83	11.57
Conyza canadensis (L)	Asteraceae	0.11	1.22	0.72	0.94	0.61	0.72
Oxalis corniculata (L)	Oxalidaceae	0.78	0.89	1.06	1.28	1.50	1.10
Ostostegia limbata (Benth)	Lamiaceae	0.39	0.61	0.72	0.28	0.17	0.43
Polygala abyssinica (L)	Polygalaceae	0.72	0.94	1.17	0.83	1.06	0.94
Persicaria glabra (Willdenow)	Polygonaceae	1.94	2.17	2.39	1.72	1.50	1.94
Clematis filifera (Benth)	Ranunculaceae	2.17	1.78	2.06	1.33	1.28	1.72
Pentanema vestitum (Wallich ex Candolle)	Asteraceae	3.61	2.50	1.94	1.17	1.17	2.08
Adiantum philippense (L)	Pteridaceae	4.28	3.50	1.50	1.17	2.17	2.52
Boerhavia procumbens (Banks ex Roxb)	Nyctaginaceae	2.39	3.17	2.72	2.06	1.83	2.43
Lantana camara (L)	Verbenaceae	1.61	1.72	1.61	1.50	1.39	1.57
Sarcococca saligna (D.Don) Muecll	Buxceae	4.27	4.50	3.50	3.00	2.61	3.58
Chenepodium album (L)	Chenopodiaceae	1.77	2.00	1.83	1.39	1.28	1.65
Asparagus racemosus (Shatavari)	Asperegaceae	0.72	0.94	1.06	0.28	0.17	0.63
Rumex hastatus (L)	Polygonaceae	4.05	3.50	3.60	4.36	4.35	3.97
Tagetes minuta (L)	Asteraceae	2.50	2.15	1.94	1.65	1.44	1.94
Ajuga bracteosa (wal-ex Benth)	Lamiaceae	2.94	2.16	1.77	1.55	1.27	1.94
Isodon rugosus (Wall. ex Benth)	Lamiaceae	9.30	8.35	7.47	5.95	5.85	7.38
Xanthium strumarium (L)	Asteraceae	3.38	3.27	2.38	2.16	1.16	2.47
Total		119.71	109.08	98.22	91.07	73.34	

Table-2. Relative density % of weed species in five Zones of Hazar Nao hills District Malakand

Weed species	Family	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Mean
Saccharum spontaneum (L)	Poaceae	24.09	20.98	21.89	21.05	21.74	21.95
Saccharum filifolium (Steud)	Poaceae	3.16	3.21	2.88	4.45	5.08	3.75
Apluda mutica (L)	Poaceae	9.05	8.92	10.12	10.18	10.91	9.84
Cymbopogon jwarancusa (Jones)	Poaceae	9.98	8.59	8.67	7.90	9.31	8.89
Digiteria sanguinalis (L)	Poaceae	4.36	4.23	4.13	3.84	4.39	4.19
Micromeria biflora (buch)	Lamiaceae	10.16	12.48	12.16	16.78	6.59	11.63
Conyza canadensis (L)	Asteraceae	0.09	1.12	0.74	1.04	0.83	0.76
Oxalis corniculata (L)	Oxalidaceae	0.65	0.81	1.07	1.40	2.05	1.20
Otostegia limbata (Benth)	Lamiaceae	0.32	0.56	0.74	0.30	100.00	20.38
Polygala abyssinica (L)	Polygalaceae	0.60	0.87	1.19	0.91	1.44	1.00
Persicaria glabra (Willdenow)	Polygonaceae	1.62	1.99	2.43	1.89	2.05	2.00
Clematis filifera (Benth)	Ranunculaceae	1.81	1.63	2.09	100.00	1.74	21.45
Pentanema vestitum (Wallich ex Candolle)	Asteraceae	3.02	2.29	1.98	1.28	1.59	2.03
Adiantum philippense (L)	Pteridaceae	3.57	3.21	1.53	1.28	2.95	2.51
Boerhavia procumbens (Banks ex Roxb)	Nyctaginaceae	1.99	2.90	2.77	2.26	2.50	2.48
Lantana camara (L)	Verbenaceae	1.35	1.58	1.64	1.65	100.00	21.24
Sarcococca saligna	Buxceae	3.57	4.13	3.56	3.29	3.56	3.62
Chenepodium album (L)	Chenopodiaceae	1.48	1.83	1.87	1.52	1.74	1.69
Asparagus racemosus (Shatavari)	Asperegaceae	0.60	0.87	1.07	0.30	0.23	0.61
Rumex hastatus (L)	Polygonaceae	3.38	3.21	3.67	4.79	5.93	4.20
Tagetes minuta (L)	Asteraceae	2.09	1.97	100.00	1.81	1.96	21.57
Ajuga bracteosa (wal-ex Benth)	Lamiaceae	2.46	1.98	1.80	1.70	1.73	1.93
Isodon rugosus (Wall. ex Benth)	Lamiaceae	7.77	7.65	7.61	6.53	7.98	7.51
Xanthium strumarium (L)	Asteraceae	2.82	3.00	2.42	2.37	1.58	2.44

Table 3. Frequency % of weed species in five Zone of Hazar Nao hills District Malakand

Weed species	Family	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Mean
Saccharum spontaneum (L)	Poaceae	70	60	80	100	100	82
Saccharum filifolium (Steud)	Poaceae	60	50	70	80	75	67
Apluda mutica (L)	Poaceae	80	70	50	90	60	70
Cymbopogon jwarancusa (Jones)	Poaceae	50	30	40	35	55	42
Digiteria sanguinalis (L)	Poaceae	30	35	40	50	40	39
Micromeria biflora (buch)	Lamiaceae	80	70	90	80	70	78
Conyza canadensis (L)	Asteraceae	10	5	20	30	40	21
Oxalis corniculata (L)	Oxalidaceae	23	20	30	20	30	24.6
Otostegia limbata (Benth)	Lamiaceae	50	40	42	35	30	39.4
Polygala abyssinica (L)	Polygalaceae	26	22	20	25	10	20.6
Persicaria glabra (Willdenow)	Polygonaceae	46	40	50	60	35	46.2
Clematis filifera (Benth)	Ranunculaceae	30	25	20	30	25	26
Pentanema vestitum (Wallich ex Candolle)	Asteraceae	20	15	25	40	30	26
Adiantum philippense (L)	Pteridaceae	20	20	30	35	25	26
Boerhavia procumbens (Banks ex Roxb)	Nyctaginaceae	50	45	40	60	40	47
Lantana camara (L)	Verbenaceae	29	30	40	20	22	28.2
Sarcococca saligna	Buxceae	40	30	50	60	65	49
Chenepodium album (L)	Chenopodiaceae	15	20	30	15	20	20
Asparagus racemosus (Shatavari)	Asperegaceae	10	20	30	40	25	25
Rumex hastatus (L)	Polygonaceae	30	20	40	15	20	25
Tagetes minuta (L)	Asteraceae	40	35	30	25	35	33
Ajuga bracteosa (wal-ex Benth)	Lamiaceae	17	20	25	23	27	22.4
Isodon rugosus (Wall. ex Benth)	Lamiaceae	70	60	50	32	26	47.6
Xanthium strumarium (L)	Asteraceae	30	20	25	20	25	24
Total		926	802	967	1020	930	

Table 4. Relative frequency (%) of weed species in five Zones of Hazar Nao hills District Malakand

Weed species	Family	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Mean
Saccharum spontaneum (L)	Poaceae	7.50	7.48	8.27	9.80	10.75	8.76
Saccharum filifolium (Steud)	Poaceae	6.47	6.23	7.23	7.84	8.06	7.16
Apluda mutica (L)	Poaceae	8.63	8.72	5.17	8.82	6.45	7.55
Cymbopogon jwarancusa (Jones)	Poaceae	5.39	3.74	4.13	3.43	5.91	4.52
Digiteria sanguinalis (L)	Poaceae	3.23	4.36	4.13	4.90	4.30	4.18
Micromeria biflora (buch)	Lamiaceae	8.63	7.55	9.30	7.84	7.52	8.16
Conyza canadensis (L)	Asteraceae	1.07	0.62	2.15	2.94	4.30	2.21
Oxalis corniculata (L)	Oxalidaceae	2.48	2.49	3.10	1.96	3.22	2.65
Otostegia limbata (Benth)	Lamiaceae	5.39	4.98	4.34	3.43	3.22	4.27
Polygala abyssinica (L)	Polygalaceae	2.80	2.74	2.06	2.45	1.07	2.22
Persicaria glabra (Willdenow)	Polygonaceae	4.96	4.98	5.17	5.88	3.76	4.95
Clematis filifera (Benth)	Ranunculaceae	3.23	3.11	2.06	2.94	2.68	2.80
Pentanema vestitum (Wallich ex Candolle)	Asteraceae	2.15	1.87	2.58	3.92	3.22	2.74
Adiantum philippense (L)	Pteridaceae	2.15	2.49	3.10	3.43	2.68	2.77
Boerhavia procumbens (Banks ex Roxb)	Nyctaginaceae	1.99	3.11	4.13	5.88	4.30	3.88
Lantana camara (L)	Verbenaceae	5.39	3.74	4.13	1.96	2.36	3.51
Sarcococca saligna	Buxceae	3.13	3.74	5.17	5.88	6.98	4.98
Chenepodium album (L)	Chenopodiaceae	4.13	2.49	3.10	1.47	2.15	2.66
Asparagus racemosus (Shatavari)	Asperegaceae	1.07	2.49	3.10	3.92	2.68	2.65
Rumex hastatus (L)	Polygonaceae	5.39	2.49	4.13	1.47	2.15	3.12
Tagetes minuta (L)	Asteraceae	4.31	4.36	3.10	2.45	3.76	3.59
Ajuga bracteosa (wal-ex Benth)	Lamiaceae	1.83	2.49	2.58	2.25	2.90	2.41
Isodon rugosus (Wall. ex Benth)	Lamiaceae	7.55	7.48	5.17	3.13	2.79	5.22
Xanthium strumarium (L)	Asteraceae	3.23	2.49	2.58	1.96	2.68	2.58

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