THE FIRST EVER FLORISTIC AND PHYTOSOCIOLOGACL STUDIES ON C*annabissativa* L. IN THE FIELDS OF TIRAH-MAIDANDISTRICT KHYBER, PAKISTAN

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ABSTRACT

Tirah-Maidan Valley, District Khyber is a remote botanically unexplored area of Pakistan. Recently access has been provided by law enforcing bodies for the visits of outsiders, which made possible this first preliminary piece of work on weeds of Cannabis sativaL. fields. Although, the cultivation of C. sativa is legally banned in Pakistan vide the Control of Narcotics Substance Act of 1997, yet it is a regular cash crop in Tirah-Maidan Valley. Cannabis sativa fields were analyzed in three localities: Kalona, Zangai and Kawarli during August 2019. Ten fields were analyzed using 10, 1m^{2}quadrats in duplicate for the identification and determining phytosociological features. The study revealed 56 weed species distributed among 42 genera and 23 families in the area. Dryopteris fragrans was the only pterodophyte. There were 2 families, 6 genera and 9 species of monocots. Dicots had 35 genera, 46 species and 20 families. Based on the floristic and FIV data Poaceae, Asteraceae, Brassicaceae, Cyperaceae, Papilionaceae, Euphorbiaceae and Lamiaceae emerged as the important families. The phytosociological data pointed out the dominance of annuals and therophytes (34 spp.),mesophyllous (50%) and leptophyllous& microohyllous (each 19.64%) species. Of the 8 types of leaves, simple entire leaves were dominant (67.86%).Three closely similar communities: Echinochloa-Salvia-Hypericum, Cynodon-Echinochloa-Eragrostis and Eragrostis-Echinochloa-Impatien swere established in the three sites. The Jaccord (82.14-90.01) and Motyka similarity (69.33- 76.40), IVCI and CMI (1.3-1.5) indices showed narrow differences among the communities and sites. Constancy value showed that 40 species were in class V and 14 species in class IV. Cynodon dactylon and Echinochloa crus-galli respectively scored IVCI of 43.3 and 42.75 among the component species. Interestingly male plant is respected as part of the crop till the pollination and fertilization of female flowers; and thereafter it is weeded out. There is need for extensively surveys and ecological analysis from more localities in the valley to get further information about the weed flora, their distribution, population size and possible losses due to these weeds. It is an established cash crop in the entire valley that can be respected for improving the socio-economic uplift of the area.

Keywords: C*annabissativa* L., TIRAH, *pterodophyte*

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INTRODUCTION

Weeds are undesirable because they grow against the will of man; and compete by sharing the available resources that ultimately reduce the productivity and yield of crops desired by man. Although, some weeds are beneficial (Ali *et al.,* 2018; Naveed *et al*., 2019; Shah & Hussain, 2016), yet they reduce production of various crops and vegetables ranging from 35 to 89% in Pakistan (Zeb, 2020; Safdar *et al*., 2019).Crop yield can be improved by curtailing weed infestation. With this approach in mind the identification, distribution, population size and ecological features must be known to weed management scientists. Sher *et al*. (2011) recorded 47 weed species of 21 families from Lahor District Swabi. The important families were Poaceae, Brassicaceae, Asteraceae and some other. Anwar *et al*. (2020) established 20 weed communities in District Swabi.Fazal *et al*. (2019) listed 23weed species including *Digitaria sanguinalis, Amaranthus viridis*, *Rumex dentatus*subsp*. klotzschianus*, *Solanum nigrum*, *Chenopodium album* and *Setaria viridis* as the important weeds of maize, potato and mung-bean crops in Kalash Valley. The important life forms were therophytes and geophytes. Naveed *et al.* (2019) reported 62 medicinally important weeds among 57 genera and 28 families including *Cannabis sativa* from Tehsil Razzar, District Swabi. Poaceae, Asteraceae Amaranthaceae and Brassicaceae were the dominant families*.* Muntaha *et al.* (2018) recorded 14 weed species including *C. sativa*as the most problematic weed of wheat crop from District Dir Lower. Shah and Hussain (2016) determined population, distribution, leaf and life form spectra of43 weed species from maize fields of Mastuj. They judged Asteraceae, Papilionaceae, Polygonaceae and Poaceae as the important families. Khan *et al.* (2018) described 40 weed species including 25 annual and 9 perennial herbs of 21 families. The major families were Asteraceae, Fabaceae and Poaceae and Ranunculaceae .Ali *et al*. (2019) reported 32 weed species from wheat fields of Charsadda with Brassicaceae, Poaceae, Fabaceae and Asteraceae as the leading families. They also stated that life form was dominated by therophytes and hemicryptophytes; while leaf spectra consisted of microphylls, nanophylls and leptophylls.

*Cannabis sativa*L is a worldwide cosmopolitan notoriously cumbersome problematic weed of many crops from plains to high altitude croplands including Pakistan. It is locally known by various names like Bhang, charas, hemp and marijuana etc. Ali and Khan (2017) regarded *C. sativa* as problematic weed in Khyber Pakhtunkhwa. *Cannabis sativa* allelopathically reduces crop growth and yield(Inam*et al*., 1989; Mahmood zadeh*et al*., 2015; Pudełko *et al*., 2014). Hall *et al*. (2014) and Zofija *et al*. (2014) observed that increasing population density of *C. sativa* suppresses the growth, fiber yield and quality of crop. Hussain *et al.* (2016) observed that mulching fields with *Cannabis* plants reduced the weed density and increased the crop yield.

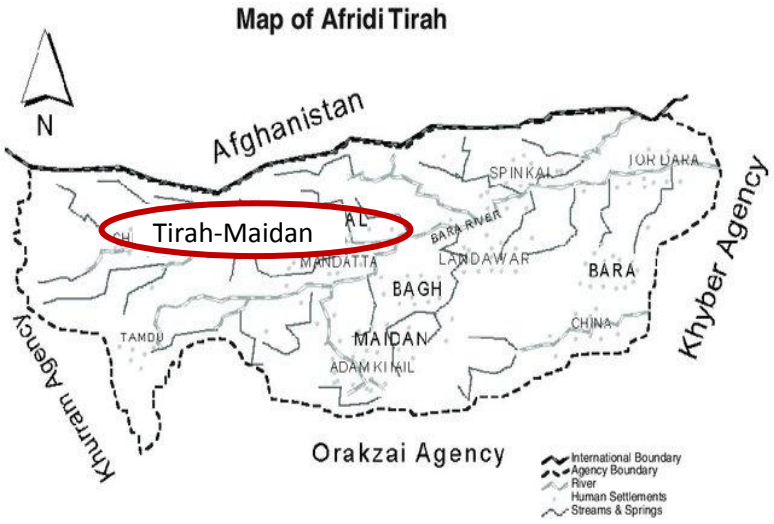
It is a fact that it has been cultivated for centuries in more than 30 countries including Eurasia and North America for seeds and flowers, textile fibers, oilseed, and intoxicating drugs such as marijuana (Sandler and Gibson, 2019;Small *et al.,*2003). Żuk-Gołaszewska and Gołaszewski (2018) regard edit as a preferred industrial and medicinal cannabis marijuana crop.It is grown commercially for the production of cannabinoids:9-*trans*-tetrahydrocannabinol (THC) and cannabidiol (CBD) and for pharmaceutical applications. The seeds contain oil, proteins, vitamins and minerals. The presence of cannabinoids makes cannabis a unique medicinal plant.

Although, the cultivation of *C. sativa* as crop is legally banned in Pakistan vide the Control of Narcotics Substance Act of 1997, it is illegal to produce, manufacture, extract, prepare, possess, offer for sale, sell, purchase or distribute cannabis in Pakistan after acquiring a permit from provincial or federal government its cultivation is allowed for medical, scientific or industrial purposes (Wikipedia, 2020) due to its narcotic nature, yet it is grown as a cash crop in Tirah-Maidan, District

Khyber. It is an annual dioecious species with separate male and female plants. The locals cultivate and process it for preparing hashish, charas or marijuana. The locals follow all the agronomic efforts such as application of fertilizers, hoeing, irrigation, weeding and apply other means for getting good cash crop.

Sandler and Gibson (2019) stressed the need for research-based weed-cannabis interactions for providing a research-based framework for weed management in industrial cannabis. The existing knowledge on the cultivation of medicinal *C. sativa*is fragmented. The agronomic requirements of medicinal cannabis grown under field condition seven in Europe are little known and Tirah-Maidan Valley is no exception to this legacy. This present first preliminary study aims to identify the weeds and their ecological features for the benefits of medicinal cannabis as a crop. This study will improve the agronomic knowledge about this narcotic cash crop in Tirah-Maidan Valley, District Khyber.

Fig.1. Map of Tirah-Maidan, District Khyber showing the encircled study area.



MATERIALS AND METHODS

Location and Environment of the area

Tirah-Maidan Valley, District Khyber **(**Fig. 1)is situated between34° 44' 42" North, 71° 36' 28" East with altitude varying from1700 to 2500+ meters. Afghanistan borders it on the north. District Orakzai lies on its South and to the west lies District Kurram. Although, no Metrology station is present within or near to Tirah-Maidan, yet the climate of Tirah-Maidan Valley can be classified as Moist Temperate type with pleasant summer and severe cold in winter. During winter frequent snowfall is received from December to January with the lowest recorded temperature below −7°C. The investigated sites fall within the moist temperate forest covered with blue pine.

Fig. 2. *Cannabis sativa* field: A. Female plant. B General View of field

Floristic Composition

Three villages namely: Kalona, Zangai and Kawarali within the radius of 10 km were surveyed for weeds of *C. sativa* fields during August, 2019. Weedy plant species were collected, dried and identified following Flora of Pakistan (Nasir & Ali, 1970-1989; Ali & Nasir, 1989-1991; Ali & Qaiser, 1993-2019). The identified plants were arranged alphabetically within major groups, families, genera and species. Some morpho-ecological features were recorded. The voucher specimens were numbered and deposited in IBS-Herbarium, Sarhad University Peshawar. These have been added in Table 1.

Phytosociological study of weeds

Frequency and density of weeds was determined in 10 fields in each locality using 10, 1 m^2quadrats in duplicate (Fig. 2). Frequency, density, relative frequency, relative density and importance values were calculated after Hussain (1989). Constancy, life form and leaf size spectra were determined following standard methods (Oosting, 1956; Hussain, 1989; Raunkiaer, 1934). Jaccord and Motyka indices were calculated (Hussain, 1989, Muller-Dumbois and Ellenberg, 1974) for determining similarity among the communities/locations. Homogeneity or heterogeneity was worked out by applying Raunkiaerian Law of frequency (Raunkiaer, 1934).Family importance value (FIV) was based on adding total importance values of all the species within a family. Community maturity index (CMI) was determined by dividing the total number of individuals (Density) in stand by total number of species within that stand/community. Importance value-Constancy index (IVCI) was calculated following Hussain *et al.* (2004).

RESULTS AND DISCUSSION

Floristic composition and their ecological characteristics

Floristic composition consisted of 56 species, 42 genera and 23 families in the investigated area (Tables 1, 2).

There were 55, 47 and 50 species of weeds respectively in Kalona, Zangai and Kawarali sites. *Dryopteris fragrans* was the only pteridophyte. Monocots had 2 families, 8 genera and 9 species. Cyperaceae had *Cyperus difformis* and *Cyperus rotundus* Linn; while Poaceae had6 genera and 7 species. Dicots contributed 35 genera with 46 species scattered among 20 families. Based on the number of species, Asteraceae with 9 genera and13 species; andPoaceae with 6 genera and 7 species were the leading families. There were respectively 4 and 3 species in Lamiaceae and Euphorbiaceae families. Hadi *et al.* (2009), Hussain *et al.* (2009), Sher *et al*. (2011), Naveed *et al*., (2019), Ali *et al*. (2019), Hussain *et al*. (2004, 2009) also recognized these families as the leading families in their studies. These families also contain the highest number of species in Flora of Pakistan (Nasir & Ali, 1970-1989; Ali & Nasir, 1999-1991; Ali & Qaiser, 1993-2019). The remaining 19families had 1-2 species. Family importance value (FIV)also disclosed that Poaceae (FIV= 44.49), Asteraceae (FIV=29.84), Brassicaceae (FIV=15.15), Cyperaceae (FIV=13.5), Papilionaceae (FIV=11.55), Euphorbiaceae (FIV=10.94), Lamiaceae (FIV=9.91) and Plantaginaceae (FIV=7.65) were the important families (Table-3). The remaining families had FIV less than 6 in the sampled fields. Akhtar & Hussain (2007) and Ali *et al*. (2019) also reported the same families as the important of families based on FIV. The number of species provides qualitative importance of the families; whereas FIV based on quantitative parameter is achieved through determination of density, frequency, importance values, which give a better picture of the importance of species/ family.

There were 2 sedges (3.57%), 7 grasses (12.5%) and 47 forbs (83.93%). The annual and perennial species (Tables 1, 2) were 34 (60.71%) and 22 (39.29%), respectively. The dominance of annuals is attributable to disturbed habitat conditions that always prevail under cultivation and agronomic conditions due frequent ploughing and hoeing that prevents perennials from establishment. Moreover, annuals survive for one season or year and thereby finding time to reach up to reproductive stage with ultimate shedding of seeds for the next season. The present findings are in agreement with many workers who reported the predominance of annual weeds in their studies(Hadi *et al.,* 2009; Hussain *et al.,* 2009; Sher *et al*., 2011; Fazal *et al*., 2019; Ali *et al*., 2019).Of the 8 types of leaves simple entire leaves were present in 38 (679%) species, simple pinnatisect in 5 (8.93%) species. Simple pinnatifid and compound trifoliate leaves were recorded in 3 (5.36%) species. Simple lobed, simple pinnatisect and compound pinnate leaves were represented by two (3.57%) species in each case. Only one (1.79%) species had compound palmate type of leaf (Tables 1, 2). Compound and simple leaves with various incisions help in trapping light in shady conditions. *Convolvulus arvensis* and *Ipomoea purpurea* were weak herbaceous twiners. Leaf spectra indicated 28 (50.0%) mesophyllous, 11 (19.24%) leptophyllous, 11 (19.24%) microphyllous and 6 (10.71%) nanophyllous species (Tables 1, 2). The findings agree with Hadi *et al.* (2009), Hussain *et al.* (2009), Fazal *et al.* (2019) and Sher *et al*. (2011) who observed nanophylls and microphylls as the major contributors in cultivated fields. Life form was dominated by therophytes (34 sp; 60.71%), followed by geophytes (12 spp; 21.43%), hemicrptophytes (9 sp; 16.07%) and a single (1.79%) chamaephyte (Tables 1, 2). Regular plowing and weeding generally reduces the chances of survival of perennial species. *Solanum surattense* and *Amaranthus spinosus* were the only spiny weeds. The dominance of therophytes is common feature in agricultural fields and ecologically disturbed habitats. This agrees with other workers (Hadi *et al.,* 2009; Hussain *et al.,* 2009; Fazal *et al.,* 2019; Sher *et al*., 2011) in this regard.

Average and range of weed density in 3 localities

The average density m^{-2} varied from 0.1 (*Dryopteris, Prunella, Rumex, Salvia*) to 3.7 (*Echinochloa, Eragostris*) individuals among the species and

localities (Table-4). The overall average density m^{-2} was 2.6 (*Medicago, Poa*), 2.7 (*Bromus*), 2.8 (*Amaranthus, Dichanthium*), 3.1 (*Cyperus, Malcolmia*), 3.4 (*Impatience*) and 3.6 (*Cynodon*) (Table-4). The density of remaining species was less than 2.6plants m^{-2}. The total density in each stand was respectively 75.9, 60.9 and 74.15 in Kalona, Zangai and Kawarli. The density of individual species also varied among the stands and species. For example, the density (m^{-2}) was: 0.0-0.1 (*Salvia, Solanum*), 0.0-0.3 (*Hypericum*), 0.0 1.5 (*Anagallis, Matricaria*), 2.3-3.5 (*Amaranthus*), 2.4-3.2 (*Bromus*), 2.6-3.5 (*Malcolmia*), 2.7-3.0 (*Dichanthium*), 2.9-3.3 (*Cyperus*), 3.3-3.5 (*Impatiens*)3.6-3.8 (*Echinochloa*) and 3.4-4.0 (*Eragrostis*). The remaining species had low density.

Weed frequency and their distribution pattern in 3 localities

The frequency data (Table-5) indicated that Male *Cannabis, Cynodon, Eichnochloa, Eragrostis, Myriactus* and *Poa* had 100% distribution in all the sites. They were followed by *Impatience* and *Trifolium* with 90-100% range (AV=96.7%); and 80-100% range was shown by *Cyperus* and *Taraxacum* with an average of 93.3%. The frequency ranged in between 80-90% in *Cyperus*and *Euphorbia prostrata* with an average of 83.33%. *Medicago, Bromus* and *Malcolmia* registered average frequency of 80.0%. *Dichanthium* achieved average frequency of 76.3, followed by *Ranunculus*(73.3) and 66.7%by *Euphorbia hirtaOxalis* and *Plantago lanceolata*. The remaining species had low frequency with the least frequency exhibited by *Senecio* and *Matricaria* (13.3% each), *Rumex dentatus*(10%) and *Solanum surattense* (6.75) (Table-5).

Weed Communities and its ecological features

Communities were recognized based on the highest importance values of the component species within each site (Table-6). In the Kalona fields, *Echinocloa-Salvia-Hypericum* community (ESH) with 55 component species was established. The dominants were *Echinocloa cruss-galii* (IV=8.06), *Salvia hians* (IV=7.80) and *Hypericum perforatum* (IV=7.66). Other important associates were *Cynodon datylon* (IV= 7.53), *Mentha arvensis* (IV= 7.14) and *Cyperus* (IV=7.10). In Zangai site, *Cynodon dactylon* (IV=9.94), *Echinochloa crussgali* (IV=9.60) and *Eragrostis poaioides* (IV=9.27) dominated the *Cynodon-Echinochloa-Eragrostis* community (CEE) with 47 component species.The next important species shaping the community were *Malcolmi*a (IV= 8.94), *Poa annua* (IV=7.78), *Cyperus*(IV= 7.72) and *Trifolium* (IV=7.25). There were 50 species in Kawarali site with *Eragrostis-Echinochloa-Impatiens* community (EEI).The dominants respectively scored IV of 8.52, 7.98 and 7.53 in the area. *Poa annua* (IV=7.17), *Cyperus* and *Dichanthium* (each with IV=6.54), *Trifolium* (IV=6.49) and *Taraxacum* (IV=6.22) were the associated components. The average importance values ranged from 0.32 (*S. surratense*) to over 8 in *Cynodon* (8.66) and *Eichinochloa* (8.44(Table-6). It was 5-7 in 10 species and 3-5 in 19 species. The remaining 34 species had IV less than 3.0 (Table-5).

Based on Raunkiaer's Law of frequency, the number of species was higher in frequency classes B, C and D than in the Class E in stands at Kalona and Zangai, which indicated heterogeneous communities (Fig. 3); while in Kawarali the community was homogenous due to higher number of species in Class E than in the B, C and D.

Constancy, Importance value-Constancy index and Community maturity index

Constancy is indicator of occurrence of species in different stands/ communities of similar community types. The present study showed that 40(71.43%) species with100% constancy values occupied Class V; while 14(25.0%) species belonged to Class IV (66.7%)and 2 (3.57%) species were in Class II (33.3) in the investigated sites (Tables 2,6).The species belonging to Classes IV and V are designated as Constant species. Their high constancy in the area might be due to three

possible reasons; a) either these species have wide ecological amplitude that spread widely, or the habitat conditions are similar to each other or the stands might have been closer to each other, thus duplicating almost the same habitat conditions. In this case the first two reasons might have played the major role in their constant nature, as the stands spread within radius of 10 km.

Importance value-constancy index (IVCI) further indicated that only two species namely *Cynodon* and *Echinochloa* respectively scored IVCI of 43.3 and 42.75 (Table-6). Seven species including *Bromus, Cyperus, Malcolmia, Eragrostis, Cyperus, Dichanthium* and *Trifolium* were in the range of 32 to 37 IVCI. Eight species range in between 22 to 30; while another 9 species were classified within 15-21 IVCI. The remaining species had IVCI less than 21. The Community maturity index (Tables 2,4) closely approached each other as IVIC was slightly high (1.5) for *Eragrostis-Echinochloa-Impatiens* community in Kawarli stand, followed by *Echinocloa-Salvia-Hypericum* community (1.4) in Kalona and *Cynodon-Echinochloa- Eragrostis* community (1.3) in Zangai stands.

Dominance and similarity between communities

Of the 6 dominants in the three communities, *Echinochloacrus-galli* was the first dominant in a single community and 2nd dominant in 2 communities. *Eragrostis* had first and 3rddominant status in one of the communities. *Cynodon* was the first dominant in one of the communities; *Impatiens* was 3rd dominant in a single community; *Salvia* and *Hypericum* respectively gained 2nd and 3rd dominant position in one of the communities. Based on the Jaccord's floristic index, there was 82.14 similarity between ESH&CEE communities, 90.91 % between ESH&EEI communities and 84.14 between CEE&EEI communities (Table-2).Motyka's index based on IV values revealed that the ESH & CEE communities had 69.33% similarity; while 74.67% commonality was observed between ESH & EEI communities and 76.40% between CEE & EEI communities. The Jaccord's floristic index demonstrated high similarity among the 3 stands than Motyka's index because it is based on the absence or presence of species in the stands. However, trend in both the indices was similar. The narrow range similarity values, high constancy value, high IVCI and CMI values are suggestive of similar habitat conditions. The results in this aspect are parallel with other studies (Ali *et al*., 2019). Hussain *et al.* (2004) like the present study also reported close similarity among the weed communities in maize fields of Mastuj.

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Table-1. Alphabetical floristic list of weeds of *Cannabis sativa* fields of Tirah-Maidan and their morpho-ecological features.

Major Division/ Family	Species	Voucher No.	Leaf size	Life form	Habit	Leaf type
A. **Pteridophyte**						
Family **Dryopteridaceae** (1G; 1 Spp)						
	1. *Dryopteris fragrans* (L.) Schott	IBS-549	Nan	G	PH	CPin
B.	**Monocots (2 families; 6 genera; 9 spp)**					
1. Family **Cyperaceae** (1G, 2 Spp)						
	1. *Cyperus difformis* Linn	IBS-550	Lep	G	PH	SE
	2.*Cyperus rotundus* Linn	IBS-551	Lep	G	PH	SE
1. Family **Poaceae** (6 G; 7 spp)						
	1.Bromus tectorum Linn	IBS-552	Lep	Th	AH	SE
	2. *Cynodon dactylon* (Linn.) Pers	IBS-553	Lep	H	PH	SE
	3. *Dichanthium annulatum* (Forssk.) Stapf	IBS-554	Lep	H	PH	SE
	4. *Eragrostis poaeoides* P. Beauv	IBS-555	Lep	Th	AH	SE
	5. *Poa annua* L	IBS-556	Lep	Th	AH	SE
	6. *Echinochloa crus-galli* (Linn.) P. Beauv	IBS-557	Lep	Th	AH	SE
	7. *Polypogon monspeliensis* (Linn.) Desf.	IBS-558	Lep	Th	AH	SE
C.Dicots (20 families; 35 genera; 46 spp)						
Family **Amaranthaceae** (1G; 1 Spp)						
	1. *Amaranthus spinosus* Linn	IBS-559	Nan	Th	AH	SE
Family **Apiaceae** (1G; 1 Spp)						
	1. *Bupleurum longicaule* var. *himalayense* (Kl.) C.B. Clarke	IBS-560	Nan	H	PH	SE
Family **Asteraceae** (9 G; 13 Spp)			IBS			
	1. *Anthemis arvensis* Linn	IBS-561	Nan	Th	AH	SPin
	2. *Cichorium intybus* L	IBS-562	Mic	H	PH	SE
	3. *Cotula hemisphaerica (*Roxb.) Wall. ex Benth. & Hook. f.	IBS-563	Mic	Th	AH	SPin
	4. *Lactuca serriola* Linn	IBS-564	Mes	Th	AH	SE
	5. *Lactuca dissecta* D. Don	IBS-565	Mes	Th	AH	SE
	6. *Matricaria recutita* Linn.	IBS-566	Mes	Th	AH	SPin
	7. *Myriactus wallichii* Less	IBS-567	Mic	Th	AH	SE
	8. *Senecio analogus* Candolle	IBS-568	Mes	TH	PH	SPin
	9. *Sonchus asper* (Linn)Hill	IBS-569	Mes	Th	AH	SPf
	10.*Sonchus oleraceus* L	IBS-570	Mes	Th	AH	SPf
	11. *Tagetes patula* Linn	IBS-571	Lep	Th	AH	Spin
	12. *Taraxacum officinale* Webb	IBS-572	Mes	Th	AH	SPf
	13. *Xanthium strumarium* Linn.	IBS-573	Mes	Th	AH	SE
Family **Balsaminaceae** (1G; 1 Spp)						
	1. Impatiens glandulifera Royle	IBS-574	Mes	G	PH	SE
Family **Brassicaceae** (3G; 3 Spp)						
	1. *Coronopus didymus* (Linn.) Smith	IBS-575	Mic	Th	AH	SPs
	2. *Malcolmia scorpioides* (Bunge) Boiss	IBS-576	Mes	Th	AH	SE
	3. *Neslia apiculata* Fisch	IBS-577	Mes	Th	AH	SE
Family **Cannabaceae** (1G; 1 Spp)						
	1.*Cannabis sativa* L(Male plant only)	IBS-578	Mic	Th	AH	CP
Family **Convolvulaceae** (2 G; 2 Spp)						
	1. *Ipomoea purpurea* (Linn.) Roth	IBS-579	Mes	Th (Cl)	AH	CPin
	2. *Convolvulus arvensis* Linn	IBS-580	Mes	G (Cl)	PH	SE
Family **Euphorbiaceae** (1G; 3 Spp)						
	1. *Euphorbia hirta* L	IBS-581	Mic	Th	AH	SE

	2. *Euphorbia helioscopia* L	IBS-582	Nan	Th	AH	SE
	3. *Euphorbia prostata* Ait	IBS-583	Mes	Th	AH	SE
Family **Fumariaceae** (1G; 1 Spp)						
	1. *Fumaria indica* (Hausskn.) Pugsley	IBS-584	Mic	Th	AH	SPs
Family **Hypericaceae**(1G; 1 Spp)						
	1. *Hypericum perforatum* Linn	IBS-585	Mes	H	PH	SE
Family **Lamiaceae** (4G; 4 Spp)						
	1. *Mentha arvensis*	IBS-586	Mes	G	PH	SE
	2. *Nepeta erecta* (Boyle ex Benth.) Berth.	IBS-587	Mes	G	PH	SE
	3. *Prunella vulgaris* L	IBS-589	Mes	G	PH	SE
	4. *Salvia hians* Royle ex Benth.	IBS-590	Mes	H	PH	SE
Family **Oxalidaceae** (1G; 1 Spp)						
	1. *Oxalis corniculata* L	IBS-501	Mes	Th	AH	CT
Family **Papilionaceae** (2G; 2 Spp)						
	1. *Medicago falcata* Linn	IBS-592	Nan	H	PH	CT
	2. *Trifolium repens* Linn	IBS-593	Mes	H	PH	CT
Family **Plantaginaceae**(1G; 2 Spp)						
	1. *Plantago lanceolata* Linn	IBS-594	Mes	G	PH	SE
	2. *Plantago major* Linn	IBS-595	Mes	G	PH	SE
Family **Polygonaceae** (2G; 3 Spp)						
	1. *Persicaria nepalensis* (Meisn.) H. Gross	IBS-596	Mes	Th	AH	SE
	2. *Rumexdentatus* subsp. *klotzschianus* (Meisn.) Rech. f.	IBS-597	Mes	Th	AH	SE
	3. *Rumex nepalensis* Spreng	IBS-598	Mes	G	PH	SE
Family **Primulaceae** (1G; 1 Spp)						
	1. *Anagalis arvensis* Linn	IBS-599	Lep	Th	AH	SE
Family Ranunculaceae (1G; 2 Spp)						
	1. *Ranunculus muricatus* L	IBS-600	Mic	Th	AH	SL
	2. *Ranunculus sceleratus* L	IBS-601	Mic	Th	AH	SL
Family **Solanaceae** (1G; 2 Spp)						
	1. *Solanum nigrum* L	IBS-602	Mic	Th	AH	SE
	2. *Solanum surattense* Burm.	IBS-603	Mic	Th	AH	SE
1. Family **Violaceae** (1G; 1Spp)						
	1. *Viola pilosa* Blume	IBS-604	Mes	G	PH	SE
Family **Verbenacaeae** (1G; 1Spp)						
	1. *Verbena officinalis* Linn	IBS-605	Mes	Ch	PH	SE

Table-2. Summary of flora and its morpho-ecological features of weeds of *Cannabis sativa* fields of Tirah-Maidan Valley, District Khyber.

	Parameter	**No. of species**	**Percent**
A.	**Life form spectra**		
	Therophytes	34	60.71
	Geophytes	12	21.43
	Hemicryptophytes	9	16.07
	Chamaephytes	1	1.79
	Total	**56**	**100**
B.	**Leaf size spectra**		
	Mesophyll	28	50.0
	Leptophyll	11	19.64
	Microphyll	11	19.64
	Nanophyll	6	10.71
	Total	**56**	100
C.	**Habit**		
	Annuals	34	60.71
	Perennials	22	39.29
	Total	**56**	**100**
	Sedges	2	3.57
	Grasses	7	12.5
	Forbs	47	83.93
	Total	**56**	**100**
	G. Community Pairs	**Jaccord index**	**Motyka index**
	ESH & CEE	82.14	69.33
	ESC & EEI	90.91	74.67
	CEE & EEI	84.14	76.40

Key:

ESH=*Echinochloa-Salvia-Hypericum* Community

CEE=*Cynodon-Echinochloa-Eragrostis* Community

EEI=*Eragrostis-Echinochloa-Impatiens* Community

	Parameter	**No. of Families**	**No. of Genera**	**No. of species**
D.	**Floristics**			
	Pteridophyte	1	1	1
	Monocots	2	6	9
	Dicots	20	35	46
	Total	**23**	**45**	**56**

	E. Constancy	**No. of species**	**Percent**
	Class V	40	71.43
	Class IV	14	25.00
	Class II	02	3.57
	Total	**56**	100
F. CMI			
	Kalona	1.4	
	Zangai	1.3	
	Kawarli	1.5	

H. **No. of species**			
Stands	**No**	%	
Kalona)	55	98.21	
Zangai	47	83.92	
Kawarli	50	89.29	

Leaf features	**No.**	**%**
Simple Entire	38	67.86
Simple pinnatisect	05	8.93
Simple pinnatifid	03	5.36
Simple pinnatisect	02	3.57
Simple lobed	02	3.57
Compound palmate	01	1.79
Compound pinnate	02	3.57
Compound trifoliate	03	5.36
Total	**56**	**100**

Table-3. Family Importance Value based on No. of species and Cumulative importance values of species within a family.

S. No.	Family	No. of Genera	No. of species	FIV
1.	Poaaceae	6	7	44.49
2.	Asteraceae	9	13	29.84
3.	Brassicaceae	3	3	15.15
4.	Cyperaceae	1	2	13.5
5.	Papilionaceae	2	2	11.55
6.	Euphorbiaceae	1	3	10.94
7.	Lamiaceae	4	4	9.91
8.	Plantaginaceae	2	2	7.65
9.	Amaranthaceae	1	1	5.89
10.	Ranunculaceae	1	2	5.66
11.	Polygonaceae	2	3	4.95
12.	Cannabaceae	1	1	4.5
13.	Convolvulaceae	2	2	4.17
14.	Oxalidaceae	1	1	3.66
15.	Balsaminaceae	1	1	3.58
16.	Violaceae	1	1	3.25
17.	Hypericaceae	1	1	3.0
18.	Apiaceae	1	1	2.50
19.	Primulaceae	1	1	2.13
20.	Solanaceae	1	2	1.91
21.	Fumariaceae	1	1	1.62
22.	Verbenaceae	1	1	1.31
23.	Dryopteridaceae	1	1	0.34

Table-4. Weed Density in *Cannabis sativa* fields at three localities of Tirah-Maidan District Khyber.

	Locations	**Locality 1: Village Kalona**	**Locality 2: Village Zangai**	**Locality 3: Village Kawarli**		
S. No.	**Species**	**Density m^{-2}**	**Density m^{-2}**	**Density m^{-2}**	**Range Min-Max**	**Average**
		ESH	**CEE**	**EEI**		
1.	*Amaranthus spinosus* Linn	3.5	2.3	2.5	2.3-3.5	2.8
2.	*Anagallis arvensis* L	-	1.5	1.5	0-1.5	1.0
3.	*Anthemis arvensis* Linn	2.4	1.5	1.5	1.5-2.4	1.8
4.	*Bromus tectorum* Linn	3.2	2.4	2.5	2.4-3.2	2.7
5.	*Bupleurum longicaule* var. *himalayense* (Kl.) C.B. Clarke	0.8	0.6	0.7	0.6-0.8	0.7
6.	*Cannabis sativa* L (Male plant only)	0.9	0.9	0.9	0.9-0.9	0.9
7.	*Cyperus rotundus* L	3.3	2.9	3.0	2.9-3.3	3.1
8.	*Cichorium intybus* L	0.7	0.6	0.7	0.6-0.7	0.7
9.	*Convolvulus arvensis* Linn	0.6	0.8	0.8	0.6-0.8	0.7
10.	*Coronopus didymus* (Linn.) Smith	1.9	-	2.0	2-1.9	1.3
11.	*Cotula hemisphaerica* (Roxb.) Wall. ex Benth. & Hook. f.	0.4	0.3	0.5	0.3-0.5	0.4
12.	*Malcolmia scorpioides* (Bunge) Boiss	2.6	3.2	3.5	2.6-3.5	3.1
13.	*Cynodon dactylon* (Linn.) Pers	3.0	3.8	4.0	3.0-4.0	3.6
14.	*Cyperus difformis* Linn	2.9	1.8	2.0	1.8-2.9	2.23
15.	*Dichanthium annulatum* (Forssk.) Stapf	2.8	2.7	3.0	2.7-3.0	2.8
16.	*Dryopteris fragrans* (L.) Schott	0.1	-	0.2	0.1-.2	0.1
17.	*Echinochloa crus-galli* (Linn.) P. Beauv	3.6	3.6	3.8	3.6-3.8	3.7
18.	*Eragrostis poaeoides* P. Beauv	3.8	3.4	4.0	3.4-4.0	3.7
19.	*Euphorbia hirta* L	1.9	2.4	2.7	1.9-2.7	2.3
20.	*Euphorbia helioscopia* L	0.7	-	2.5	0-2.5	1.1
21.	*Euphorbia prostrata* Ait.	1.7	1.7	2.0	1.7-2.0	1.8
22.	*Fumaria indica* (Hausskn.) Pugsley	0.4	0.3	0.5	0.3-0.5	0.4
23.	*Hypericum perforatum* Linn	0.3	-	0.3	0.0.0.3	0.2
24.	*Impatiens glandulifera* Royle	3.5	3.3	3.5	3.3-3.5	3.4
25.	*Ipomoea purpurea* (Linn.) Roth	0.4	0.4	0.3	0.3-0.4	0.4
26.	*Lactuca serriola* Linn	0.2	0.2	0.2	0.2-0.2	0.2
27.	*Lactuca dissecta* D. Don	0.2	0.2	0.2	0.2-0.2	0.2
28.	*Matricaria recutita* Linn.	1.5	-	-	0.0-1.5	0.4
29.	*Medicago falcata* Linn	2.2	2.5	3.0	2.2-3.0	2.6
30.	*Mentha arvensis* L	0.5	-	0.4	0.4-0.5	0.3
31.	*Myriactus wallichii* Less	3.1	1.4	2.0	2.0-3.1	2.2
32.	*Nepeta erecta* (Boyle ex Benth.) Berth.	0.4	0.4	0.4	0.4-0.4	0.4
33.	*Neslia apiculata* Fisch	1.5	1.5	1.5	1.5-1.5	1.5
34.	*Oxalis corniculata* L	1.5	0.9	1.0	0.9-1.5	1.1
35.	*Plantago lanceolata* Linn	1.4	1.3	1.5	1.3-1.5	1.4

36.	*Plantago major* Linn	0.9	0.9	1.0	0.9-1.0	0.9
37.	*Poa annua* L	2.2	2.5	3.0	2.2-3.0	2.6
38.	*Persicaria nepalensis* (Meisn.) H. Gross	0.8	0.8	0.6	0.6-0.8	0.7
39.	*Polypogon monspeliensis* (Linn.) Desf.	0.3	-	0.5	0.3-0.5	0.3
40.	*Prunella vulgaris* L	0.2	-	-	0.0-0.2	0.1
41.	*Ranunculus muricatus* L	1.1	0.6	0.7	0.6-1.1	0.8
42.	*Ranunculus sceleratus* L	1.3	0.8	0.8	0.8-1.3	1.0
43.	*Rumex dentatus* subsp. *klotzschianus* (Meisn.) Rech. f.	0.4	-	-	0.0-0.4	0.1
44.	*Rumex nepalensis* Spreng	0.4	0.4	0.5	0.4-0.5	0.4
45.	*Salvia hians* Royle ex Benth.	0.1	-	0.1	0.0-0.1	0.1
46.	*Senecio analogus* Candolle	-	0.8	-	0.0-0.8	0.3
47.	*Solanum nigrum* L	0.7	0.7	-	0.0-0.7	0.5
48.	*Solanum surattense* Burm.	0.1	0.1	-	0.0-0.1	0.1
49.	*Sonchus oleraceus* L	0.7	0.7	0.5	0.5-0.7	0.6
50.	*Sonchus asper* (Linn)Hill	0.4	0.4	0.7	0.4-0.7	0.5
51.	*Tagetes patula* Linn	0.6	0.6	0.5	0.5-0.6	0.6
52.	*Taraxacum officinale* Webb	2.3	1.8	2.1	1.8-2.3	2.1
53.	*Trifolium repens* Linn	2.4	2.4	2.5	2.4-2.5	2.4
54.	*Verbena officinalis* Linn	0.3	0.3	0.3	0.3-0.3	0.3
55.	*Viola pilosa* Blume	1.1	1.0	1.5	1.0-1.5	1.2
56.	*Xanthium strumarium* Linn.	0.4	0.5	0.4	0.4-05	0.4
	Total Density of stand	**75.9**	**60.9**	**74.15**		
	No. of species	**55**	**47**	**50**		
	CMI	**1.4**	**1.3**	**1.5**		

Key:
ESH= *Echinochloa-Salvia-Hypericum* Community
CEE= *Cynodon-Echinochloa-Eragrostis* Community
EEI= *Eragrostis-Echinochloa-Impatiens* Community

Table-5. Weed Frequency in *Cannabis sativa* fields at three localities of Tirah-Maidan District Khyber.

	Locations	**Location 1: Village Kalona**	**Location 2: Village Zangai**	**Location 3: Village Kawarli**		
		ESH	**CEE**	**EEI**		
S. No.	**Species**	**Frequency (%)**	**Frequency (%)**	**Frequency (%)**	**Range Min-Max**	**Average**
1.	*Amaranthus spinosus* Linn	70	60	50	50-70	60
2.	*Anagallis arvensis* L	-	70	70	0-70	46.7
3.	*Anthemis arvensis* Linn	80	60	70	60-80	70
4.	*Bromus tectorum* Linn	90	60	90	60-90	80
5.	*Bupleurum longicaule* var. *himalayense* (Kl.) C.B. Clarke	50	30	60	30-60	46.7
6.	*Cannabis sativa* L (Male plant only)	100	100	100	100-100	100
7.	*Cyperus rotundus* L	90	80	80	80-90	83.3
8.	*Cichorium intybus* L	60	60	70	60-70	63.3
9.	*Convolvulus arvensis* Linn	60	60	60	60—60	60
10.	*Coronopus didymus* (Linn.) Smith	80	-	90	80-90	56.7
11.	*Cotula hemisphaerica* (Roxb.) Wall. ex Benth. &	40	40	50	40-50	43.3

	Hook. f.					
12.	*Malcolmia scorpioides* (Bunge) Boiss	80	100	60	60-100	80
13.	*Cynodon dactylon* (Linn.) Pers	100	100	100	100-100	100
14.	*Cyperus difformis* Linn	100	80	100	80-100	93.3
15.	*Dichanthium annulatum* (Forssk.) Stapf	80	70	80	70-80	76.7
16.	*Dryopteris fragrans* (L.) Schott	10	-	10	0-10	6.7
17.	*Echinochloa crus-galli* (Linn.) P. Beauv	100	100	100	100-100	100
18.	*Eragrostis poaeoides* P. Beauv	100	100	100	100-100	100
19.	*Euphorbia hirta* L	60	70	70	60-70	66.7
20.	*Euphorbia helioscopia* L	60	-	60	0-60	40
21.	*Euphorbia prostrata* Ait.	80	80	90	80-90	83.33
22.	*Fumaria indica* (Hausskn.) Pugsley	30	20	50	20-50	33.3
23.	*Hypericum perforatum* Linn	30	-	30	0-30	20
24.	*Impatiens glandulifera* Royle	100	100	90	90-100	96.7
25.	*Ipomoea purpurea* (Linn.) Roth	30	30	40	30-40	33.3
26.	*Lactuca serriola* Linnaeus	20	20	20	20-20	20
27.	*Lactuca dissecta* D. Don	20	20	30	20-30	23.3
28.	*Matricaria recutita* Linn.	40	-	-	0-40	13.3
29.	*Medicago falcata* Linn	80	90	70	70-90	80
30.	*Mentha arvensis* L	40	-	50	40-50	30
31.	*Myriactus wallichii* Less	100	100	100	100-100	100
32.	*Nepeta erecta* (Boyle ex Benth.) Berth.	30	30	30	30-30	30
33.	*Neslia apiculata* Fisch	70	70	80	70-80	73.3
34.	*Oxalis corniculata* L	80	50	70	50-80	66.7
35.	*Plantago lanceolata* Linn	80	60	60	60-80	66.7
36.	*Plantago major* Linn	50	50	40	40-50	46.7
37.	*Poa annua* L	100	100	100	100-100	100
38.	*Persicaria nepalensis* (Meisn.) H. Gross	60	50	70	50-70	60
39.	*Polypogon monspeliensis* (Linn.) Desf.	30	-	40	30-40	23.3
40.	*Prunella vulgaris* L	20	-	-	0-20	6.7
41.	*Ranunculus muricatus* L	80	50	90	50-90	73.3
42.	*Ranunculus sceleratus* L	50	30	60	30-60	46.7
43.	*Rumex dentatus subsp. klotzschianus* (Meisn.) Rech. f.	30	-	-	0-30	10
44.	*Rumex nepalensis* Spreng	40	40	40	40-40	40
45.	*Salvia hians* Royle ex Benth.	10	-	10	0-10	6.7
46.	*Senecio analogus* Candolle	-	40	-	0-40	13.3
47.	*Solanum nigrum* L	40	40	-	0-40	26.7
48.	*Solanum surattense* Burm.	10	10	-	0-10	6.7
49.	*Sonchus oleraceus* L	70	70	70	70-70	70
50.	*Sonchus asper* (Linn)Hill	30	30	60	30-60	40
51.	*Tagetes patula* Linnaeus	60	60	60	60-60	60
52.	*Taraxacum officinale* Webb	100	80	100	80-100	93.3
53.	*Trifolium repens* Linn	100	90	100	90-100	96.7

54.	*Verbena officinalis* Linn	30	30	20	20-30	26.7
55.	*Viola pilosa* Blume	50	40	60	40-60	50
56.	*Xanthium strumarium* Linn.	30	40	20	20-40	30

Key:
ESH= *Echinochloa-Salvia-Hypericum* Community
CEE= *Cynodon-Echinochloa-Eragrostis* Community
EEI= *Eragrostis-Echinochloa-Impatiens* Community

Table-6. Absolute, average and range of Importance values and Constancy of weeds in Cannabis *sativa* fields in 3 localities of Tirah-Maidan, District Khyber.

		Locality			IV			
#	**Species**	**Locality 1: Village Kalona**	**Locality 2: Village Zangai**	**Locality 3: Village Kawarli**	**Range Min-Max**	**AIV**	**% Constancy (Constancy Class)**	**IVCI**
		ESH	**CEE**	**EEI**				
1.	*Amaranthus spinosus* Linn	6.75	5.99	4.93	4.93-6.75	5.89	100 (V)	29.45
2.	*Anagallis arvensis* L	2.19	0.00	4.21	0.00-4.21	2.13	66.7 (IV)	4.52
3.	*Anthemis arvensis* Linn	5.60	4.67	4.21	4.21-5.60	4.83	100 (V)	24.15
4.	*Bromus tectorum* Linn	6.96	6.16	6.18	6.16-6.96	6.43	100 (V)	34.15
5.	*Bupleurum longicaule* var. *himalayense* (Kl.) C.B. Clarke	2.58	2.09	2.82	2.09-2.82	2.50	100 (V)	12.5
6.	*Cannabis sativa* L (Male plant only)	4.24	5.13	4.33	4.24-5.13	4.57	100 (V)	22.85
7.	*Cyperus rotundus* L.	7.10	7.72	6.54	6.54-7.72	7.12	100 (V)	35.6
8.	*Cichorium intybus* L	2.75	3.35	3.13	2.75-3.35	3.08	100 (V)	15.4
9.	*Convolvulus arvensis* Linn	2.62	3.51	2.95	2.62-3.51	3.03	100 (V)	15.15
10.	*Coronopus didymus* (Linn.) Smith	4.95	0.00	5.51	0.0-5.51	3.49	66.7 (IV)	13.96
11.	*Cotula hemisphaerica* (Roxb.) Wall. ex Benth. & Hook. f.	1.75	2.04	2.23	1.75-2.23	2.01	100 (V)	10.05
12.	*Malcolmia scorpioides* (Bunge) Boiss	5.87	8.94	6.19	5.87-8.94	7.00	100 (V)	35.0
13.	*Cynodon dactylon* (Linn.) Pers	7.53	9.94	8.52	7.53-9.94	8.66	100 (V)	43.3
14.	*Cyperus difformis* Linn	6.87	6.62	5.82	5.82-6.87	6.44	100 (V)	32.2
15.	*Dichanthium annulatum* (Forssk.) Stapf	6.13	7.10	6.54	6.13-7.10	6.59	100 (V)	32.95
16.	*Dryopteris fragrans* (L.) Schott	0.44	0.00	0.58	0.0-0.58	0.34	66.7 (IV)	1.36
17.	*Echinochloa crus-galli* (Linn.) P. Beauv	8.06	9.60	7.98	7.98-9.27	8.55	100 (V)	42.75
18.	*Eragrostis poaeoides* P. Beauv	4.34	9.27	8.52	0.0-8.52	7.38	100 (V)	36.9
19.	*Euphorbia hirta* L	2.75	0.00	5.83	0.00-5.83	2.86	66.7 (IV)	11.44

20.	*Euphorbia helioscopia* L	4.68	1.67	5.24	4.68-5.73	3.86	100 (V)	19.3
21.	*Euphorbia prostrata* Ait.	1.44	5.7	5.51	1.31-5.51	4.22	100 (V)	21.1
22.	*Fumaria indica* (Hausskn.) Pugsley	1.31	1.31	2.23	0.0-2.23	1.62	100 (V)	8.1
23.	*Hypericum perforatum* Linn	7.66	0.00	1.34	0.00-7.66	3.0	66.7(IV)	12.0
24.	*Impatiens glandulifera* Royle	1.44	1.76	7.53	1.44-7.53	3.58	100 (V)	17.9
25.	*Ipomoea purpurea* (Linn.) Roth	0.87	1.06	1.48	0.87-1.48	1.14	100 (V)	5.7
26.	*Lactuca serriola* Linn.	0.87	1.06	0.89	0.87-1.76	0.94	100 (V)	4.7
27.	*Lactuca dissecta* D. Don	3.20	1.06	0.89	0.89-3.20	1.72	100 (V)	8.6
28.	*Matricaria recutita* Linn.	5.34	1.76	0.00	0.0-5.34	2.37	66.7 (IV)	9.48
29.	*Medicago falcata* Linn	1.88	7.23	5.73	1.88-7.23	4.95	100 (V)	24.75
30.	*Mentha arvensis* L	7.14	0.00	1.92	0.00-7.14	3.02	66.7(IV)	12.08
31.	*Myriactus wallichii* Less	1.44	5.96	6.09	1.44-6.09	4.50	100 (V)	22.5
32.	*Nepeta erecta* (Boyle ex Benth.) Berth.	4.11	1.76	1.48	1.48-5.03	2.45	100 (V)	12.25
33.	*Neslia apiculata* Fisch	4.42	5.03	4.52	3.15-4.52	4.66	100 (V)	23.3
34.	*Oxalis corniculata* L	4.29	3.15	3.53	3.53-4.42	3.66	100 (V)	18.3
35.	*Plantago lanceolata* Linn	2.71	4.42	3.69	2.71-3.69	3.61	100 (V)	18.05
36.	*Plantago major* Linn	6.22	3.31	2.59	2.59-7.78	4.04	100 (V)	20.2
37.	*Poa annua* L	2.89	7.78	7.17	2.89-7.17	5.95	100 (V)	24.75
38.	*Persicaria nepalensis* (Meisn.) H. Gross	1.31	3.00	3.26	1.31-3.26	2.52	66.7 (IV)	10.0
39.	*Polypogon monspeliensis* (Linn.) Desf.	0.87	0.00	1.92	0.0-1.92	0.93	66.7 (IV)	3.72
40.	*Prunella vulgaris L*	5.08	0.00	0.00	0.0-5.08	1.69	33.3 (II)	3.38
41.	*Ranunculus muricatus* L	3.24	2.82	3.75	2.78-3.75	3.27	100 (V)	16.35
42.	*Ranunculus sceleratus* L	1.44	2.78	2.95	0.88-2.95	2.39	100 (V)	11.95
43.	*Rumex dentatus* subsp. *klotzschianus* (Meisn.) Rech. f.	1.75	0.88	0.00	0.0-1.75	0.88	66.7 (IV)	3.52
44.	*Rumex nepalensis* Spreng	0.44	2.12	2.10	0.44-2.12	1.55	66.7 (IV)	6.2
45.	*Salvia hians* Royle ex Benth.	7.80	0.00	0.45	0.00-7.80	2.75	66.7 (IV)	11.0
46.	*Senecio analogus* Candolle	0.00	2.78	0.00	0.0-2.78	0.93	33.3 (II)	1.86
47.	*Solanum nigrum* L	2.14	2.62	0.00	0.0-2.62	1.59	66.7 (IV)	3.72
48.	*Solanum surattense* Burm.	0.44	0.53	0.00	0.0-0.53	0.32	66.7 (IV)	1.28
49.	*Sonchus*	3.06	3.71	2.82	2.82-	3.20	100 (V)	16.0

	oleraceus L				3.71			
50.	*Sonchus asper* (Linn)Hill	1.44	1.76	2.99	1.44-2.99	2.06	100 (V)	10.3
51.	*Tagetes patula* Linnaeus	2.62	3.18	2.68	2.62-3.18	2.83	100 (V)	14.15
52.	*Taraxacum officinale* Webb	6.08	4.57	6.22	4.57-6.22	5.62	100 (V)	28.1
53.	*Trifolium repens* Linn	6.06	7.25	6.49	6.06-7.25	6.60	100 (V)	33.0
54.	*Verbena officinalis* Linn	1.31	1.59	1.03	1.03-1.59	1.31	100 (V)	6.55
55.	*Viola pilosa* Blume	2.05	3.81	3.90	2.05-3.90	3.25	100 (V)	16.25
56.	*Xanthium strumarium* Linn.	1.44	2.02	0.58	0.58-2.02	1.35	100 (V)	6.75
	Total IV of stands	200	200	200				
	Total number of species	**55**	**47**	**50**				

Key:
ESH= *Echinochloa-Salvia-Hypericum* Community
CEE= *Cynodon-Echinochloa-Eragrostis* Community
EEI= *Eragrostis-Echinochloa-Impatiens* Community