ASSESSMENT OF WEED SPECIES IN WHEAT FIELDS OF Miandoab-Iran

Sirous Hassannejad, Nariman Sepehrianphar, Elham Abbasvand

Abstract— **In order to assessment of weed species in wheat (*Triticum aestivum* L.) of Miandoab county (northwest of Iran), 46 fields were surveyed in 2014. Weed species density and cover percentage were recorded for ranking of species and families by relative dominance (RD) and Family dominance index (FDI). A total 61 weed species belonging to 21 plant families were recorded. 75.41% of weed species were dicotyledonous, and 24.59% of them were monocotyledonous. 67.21 27.86, and 4.91% of weeds were annual, perennial, and biennial, respectively. 57.38% and 36.07% of weeds were therophytes and hemicryptophytes, respectively. Geophyte and phanrophyte with 4.91 and 1.63% of plants respectively have minimum frequency in this region. Poaceae, Asteraceae and Chenopodiaceae families were dominant plant families and *Polygonum arvicular*, *Chenopodium album*, *Convolvulus arvensis*, *Cynodon dactylon* and *Alhaji persarum* were dominant weed species in wheat fields. *Convolvulus arvensis* had maximum density (11.65 plants m^{-2}). *Convolvulus arvensis*, *Polygonum arvicular* and *Chenopodium album* with maximum uniformity in distribution in wheat fields of this county, were weeds that had tolerant to management methods.**

Index Terms— Family dominance, Miandoab, Relative dominance, Wheat, Weeds

I. INTRODUCTION

Weeds are constant component of agro-ecosystem that has harmful effects on crop quality and quantity (Powell and Justum, 1993). Weed flora composition in each region depend on the appearance of the new species, adaptation and the cultivating measures (Damghani and Kamkar, 2009). These unwanted plants compete with crops for light, water and nutrients (Wang *et al*., 2007). The yield losses due to weed crop competition mainly depend on kind of weed species, their density and cover percentage. Zand *et al.* (2007) reported that weeds reduce wheat yield up to 30% in Iran. Some studies have been conducted on weed flora in annual crops in many countries such as Iran (Minbashi *et al*. 2008; Hassannejad 2011; Hassannejad and Porheidar-Ghafarbi 2012), Bulgaria (Milanova *et al.* 2009), Denmark (Andreasen and Stryhn 2008; Andreasen and Skovgaard 2009), France (Fried *et al*. 2008), Hungary (Novak *et al*. 2010), the United Kingdom (Potts *et al.* 2010), and the United States (Conn *et al*. 2011).

Appearance and existence of any plant community is entirely a subject of its floristic composition and the life form spectrum of its individual components (Kranti *et al*., 2012). Life form is good indicator of climate and is assumed to have evolved in response to environmental conditions (Pandit and Puhurkar, 1998). In order to diminish weed species damage, we have to learn more about their physiology and ecology. The basic step is correct determination of weed species and knowledge about their composition in the cropping systems. And also for an effective weed management program, we need to have accurate information on the systematic of weeds, their frequency, uniformity, density, coverage, growth habit, and phenology (Ghersa and Holt, 1995; Hassannejad and Porheidar-Ghafarbi, 2013). So information about weed species presence in wheat fields would be a main point in management and reduce of their dominance. There is a little information available about weed flora and relative dominance weed species distributed in wheat fields of Miandoab county. Thus, the aim of this study was to weed flora survey and ranking of weed species distributed in wheat fields to find dominant weed species and plant families, classification of them with Raunkiaer's life form specifications.

II. MATERIAL AND METHODS

A. Data Sampling

Weed species assessment were done in 46 wheat fields of Miandoab county (northwest of Iran) in 2014. Data sampling was started by beginning of stem elongation until the end of heading stages of wheat (Minbashi *et al.*, 2008). In each field, 20 quadrates (0.25 m^2) were randomly placed along a "W" pattern (5 quadrates in

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each line of this pattern) (Thomas, 1985) and in each quadrat, weed species were coded and recorded (density and cover percentage) for subsequent data entry and analysis. Weed specimens were identified according to flora Iranica (Rechinger, 1963-2007) and Turkey (Davis, 1965-85). Plant phenotypes were determined according to the Raunkiaer's life form specifications (Raunkiaer, 1934), so that these species were located in four classes (Geophyte, Hemicryptophyte, Phanrophyte and Therophyte).

B. Estimation of Family Dominance index (FDI)

Family dominance index (FDI) was counted following the methodology of Hassannejad and Porheidar-Ghafarbi (2012) to compare the relative contribution of each taxonomic family to weed species composition. It was calculated as the sum of the relative diversity, relative density, and relative coverage, as follow:

$$\text{Relative Diversity} = \frac{\text{Number of species in family}}{\text{Total number of species}} \times 100$$

$$\text{Relative Density} = \frac{\text{Number of individuals in family}}{\text{Total number of individuals}} \times 100$$

$$\text{Relative Coverage} = \frac{\text{Coverage of individuals in family}}{\text{Total coverage of individuals}} \times 100$$

FDI= Relative Diversity + Relative Density + Relative Coverage

C. Estimation Relative Dominance (RD) Index

The data were summarized using by relative frequency, relative uniformity, relative mean density (Thomas, 1985) and relative mean cover (Hassannejad, 2011).

The Frequency (F) value was the percentage of fields infested by a species k, at least in one quadrate per field.

$$Fk = \frac{\sum_1^n Yi}{n} \times 100$$

Where F_k the frequency value of species k, Yi is the presence (1) or absence (0) of species k in field i, and n is the number of fields surveyed.

The Uniformity (U) value indicates the percentage of quadrates infested by a species. This measure is an estimate of the area infested by a plant species.

$$Uk = \frac{\sum XIJ}{n} \times 100$$

Where U_k is the field uniformity value of species k, X_{ij} is the presence (1) or absence (0) of species k in quadrate j in field i, and n is the number of fields surveyed.

The Mean Density (MD) value indicates the number of plants per square meter for each species averaged. This measure was used to magnitude of the infestation in all fields surveyed.

$$MDki = \frac{\sum DKi}{n} \times 100$$

Where MD_{ki} is the mean field density of species k, D_{ki} is the density (numbers per square meter) of species k in fields i, and n is the number of all fields surveyed.

The Mean Cover percentage (MC) value indicates the cover of plants per square meter for each species averaged.

$$MCki = \frac{\sum Cki}{n} \times 100$$

Where MC_{ki} is the mean field cover k, C_{ki} is the cover percentage of species k in field i, and n is the number of fields surveyed.

Relative Dominance (RD) index calculated from relative frequency, relative uniformity, relative density, and relative coverage (Hassannejad & Porheidar Ghafarbi, 2013).

RD= RF+ RU+ RMD+ RMC

III. RESEULTS AND DISCUTION

A. Weed flora in wheat fields

A total 61 weed species belonging to 21 plant families were recorded in wheat fields of Miandoab county. Regarding their plant form, 75.41% of weed species were dicotyledonous, and 24.59% of them were monocotyledonous. Hyvonen et al. (2003) mentioned that low-input cultivations were expected to favor the species numbers and abundance of dicotyledonous. Regarding to life cycle of plants, 67.21, 27.86, and 4.91% of weeds were annual, perennial, and biennial, respectively. High contribution of annual weeds can be due to their short life cycle and high allocation of resources to the reproductive organs that enables them to resist the instability of the agro-ecosystem (Gomma, 2012). According to Radosvich and Holt (1984) assessments, soil disturbance frequently cause to dominant of annual weeds in the fields

B. Life form of weed species

According to the life form of plant species, 57.38% and 36.07% of weeds were therophytes and hemicryptophytes, respectively (Fig. 1). Therophytes were the most abundant life forms in Garmsar county of Semnan province (Iranbakhsh et al., 2008) and Kalat highlands of Gonabad county of Khorasan Razavi province (Vaseghi et al., 2008). Hemicryptophytes were dominant in Fereizi county of Khorasan Razavi (Memariani et al., 2009). High frequency of therophytes in one district can be due to high destruction (Amiri et al., 2009), relatively dry season and a high percentage of weeds in one area's plant community (Ashrafi et al., 2004). Ashrafi et al. (2004)

believed that therophytes can complete their regeneration cycle before achieve dry season. Hemicryptophytic are adapted to the conditions of a particular area and develop different ways to survive, especially for reserving water, using ground water, reducing their water need by losing their leaves, reduction of vegetative growth and producing their vegetative parts underground during difficult conditions (Yavari & Shahgolzarii, 2010). Also abundant of hemicryptophytes can be indicate of cold climate and mountainous region (Archibold, 1995). The results of this study showed that Geophyte and phanrophyte with 4.91 and 1.63% of plants respectively have minimum frequency in this region.

C. Main plant families

Poaceae, Asteraceae and Brassicaceae with 14, 10 and 7 plant species, respectively were richness families, however according to their density; Poaceae with relative density equal 23.1 had highest density (Tab. 1). These results showed that only using diversity, density or coverage indices cannot be introducing family importance, therefore we have to use an index consists all three of them. Family dominance index (FDI) introduced by Hassannejad and Porheidar Ghafarbi (2012) comprising diversity, density, and coverage can be acceptable index for plant families ranking. According to FDI in the formation of plant communities, Poaceae, Asteraceae and Chenopodiaceae families with 74.05, 34.29 and 33.88 respectively were dominant plant families in wheat fields (Tab. 1). Dominance of these families can be due to their adaptability to climate and soil characteristics of their habits. Chenopodiaceae and Asteraceae are families that have tolerant to arid and semi-arid climates (Ghollassi Moud et al., 2007). Also species richness in some families like Poaceae and Asteraceae can be due to high destruction and arid or semiarid of their habits. These results confirm Vakili Shahrbabaki et al. (2001) and Ghollassi Moud et al. (2007) about Asteraceae family members. So, the highest amount of FDI for one family compares others can be due to well adaptability of its members in dominant environmentally conditions

D. Weed species ranking

Results of this study showed that Polygonum arvicular L., Chenopodium album L. Convolvulus arvensis L., Cynodon dactylon (L.) pers. and Alhaji persarum Boiss. & Buhse. with RD equal 48.07, 46.51, 44.53, 33.5 and 24.27, respectively were dominant weed species in wheat fields according to RD score (Tab. 2). High share of these five weed species from RD total (196.88:400) indicated that they are troublesome and hard controlling weeds in wheat fields of Miandoab county. Dominance of these weeds might be due to their better adaptability under environment conditions and management methods. Convolvulus arvensis L. with mean relative density 11.65 plants m-2 had highest density in this county (Tab. 2). Higher values for the mean field density of this weed species shows that this weed has more competitive or reproductive ability than other weeds. Convolvulus arvensis L., Polygonum arvicular L. and Chenopodium album L., respectively had maximum uniformity in distribution at wheat fields of Miandoab county. Higher values for uniformity of these weed species maybe indicate they're tolerant to managements methods used in the occurrence fields.

Table 2. Order, Family Name, Richness (Number of Species), Relative Diversity, Relative Density, Relative Coverage, and Family Dominance Index (FDI) in wheat fields of Miandoab County.

Order	Family Name	Richness	Relative Density	Relative Diversity	Relative Coverage	FDI
1	Poaceae	14	23.1	21.31	29.64	74.05
2	Asteraceae	10	11.23	16.39	6.676	34.29
3	Chenopodiaceae	4	12.85	4.918	16.12	33.88
4	Polygonaceae	2	10.92	3.279	18.2	32.4
5	Convulvulaceae	1	11.65	1.639	10.62	23.91
6	Brassicaceae	7	5.018	11.48	2.847	19.34
7	Papilionaceae	3	7.821	4.918	3.991	16.73
8	Amaranthaceae	1	6.771	1.639	4.408	12.82
9	Fabaceae	3	3.058	4.918	1.537	9.51
10	Solanaceae	3	0.97	4.918	0.282	6.17
11	Caryophyllaceae	2	0.951	3.279	0.961	5.19
12	Euphorbiaceae	2	1.206	3.279	0.631	5.12
13	Papaveraceae	2	0.511	3.279	0.38	4.17
14	Portulaceae	1	0.544	1.639	1.959	4.14
15	Cuscutaceae	1	1.481	1.639	0.79	3.91
16	Rununculaceae	1	0.282	3.279	0.257	3.82
17	Rubiaceae	1	0.72	1.639	0.288	2.65
18	Resedaceae	1	0.412	1.639	0.073	2.12

19	Plantaginaceae	1	0.206	1.639	0.11	1.96
20	Lamiaceae	1	0.143	1.639	0.147	1.93
21	Liliaceae	1	0.169	1.639	0.08	1.89

Table 1. Order, Scientific Name, Family Name, Relative Frequency (RF), Relative Uniformity (RU), Relative Mean Density (RMD), Relative Mean Coverage (RMC), and Relative Dominance (RD) of wheat fields in Miandoab County.

Order	Scientific Name	Family Name	RF	RU	RMD	RMC	RD
1	*Polygonum aviculare* L.	Polygonaceae	8.782	12.86	9.475	16.95	48.07
2	*Chenopodium album* L.	Chenopodiaceae	8.215	11.76	11.01	15.52	46.51
3	*Convolvulus arvensis* L.	Convulvulaceae	9.348	12.92	11.65	10.62	44.53
4	*Cynodon dactylon* (L.) pers.	Poaceae	4.533	5.715	4.378	18.88	33.5
5	*Alhaji persarum* Boiss. & Buhse.	Papilionaceae	6.799	7.392	6.756	3.324	24.27
6	*Avena loduviciana* L.	Poaceae	7.365	5.54	6.715	3.286	22.91
7	*Cirsium arvense* (L.) Scop.	Asteraceae	5.949	5.059	5.646	3.058	19.71
8	*Secale cereale* L.	Poaceae	5.949	6.033	4.53	2.661	19.17
9	*Suaeda maritima* (L.) Dumort	Chenopodiaceae	3.399	3.566	6.771	4.408	18.14
10	*Phragmites australis* (Cav.) Trin. ex Steud.	Poaceae	3.116	1.525	2.283	1.524	8.448
11	*Acroptilon repens* L.	Asteraceae	1.7	1.757	2.158	1.885	7.5
12	*Vicia villosa* Roth	Fabaceae	2.55	1.664	2.176	1.108	7.498
13	*Scarioloa orientalis*	Asteraceae	2.266	1.79	2.132	0.771	6.96
14	*Rumex crispus* L.	Polygonaceae	1.7	0.766	1.448	1.249	5.163
15	*Cuscuta campestris* L.	Cuscutaceae	1.983	0.597	1.481	0.79	4.851
16	*Descurainia Sophia* (L.) Schur	Brassicaceae	1.7	1	1.5	0.612	4.811
17	*Carthamus oxycantha* L.	Asteraceae	1.133	1.26	1.599	0.649	4.641
18	*Atriplex leucoclada* L.	Chenopodiaceae	1.416	1.127	1.555	0.508	4.606
19	*Silene conoidea* L.	Caryophyllaceae	1.416	1.425	0.731	0.9	4.472
20	*Portulaca oleraceae*	Portulaceae	0.85	0.762	0.544	1.959	4.115
21	*Cardaria draba* (L.) Desv.	Brassicaceae	1.133	0.762	0.97	0.563	3.429
22	*Galium aparine*	Rubiaceae	1.416	0.796	0.72	0.288	3.22
23	*Bromus tectorum* L.	Poaceae	0.85	0.762	0.845	0.71	3.168
24	*Sinapis arvensis*	Brassicaceae	0.85	0.862	0.838	0.447	2.997
25	*Hordeum glaucum* Steud.	Poaceae	0.85	0.696	0.669	0.563	2.778
26	*Allopecurus myosuroides* Hudson.	Poaceae	0.85	0.663	0.595	0.404	2.512
27	*Roemeria reflecta* L.	Papaveraceae	0.85	1.061	0.331	0.269	2.511
28	*Ephorbia vagtata* L.	Euphorbiaceae	0.85	0.53	0.581	0.331	2.292
29	*Medicago sativa* L.	Papilionaceae	0.85	0.497	0.618	0.318	2.283
30	*Capsella bursa-pastaris*	Brassicaceae	0.567	0.696	0.441	0.465	2.169
31	*Melilotus officinalis* (L.) Desr.	Papilionacea	0.567	0.796	0.448	0.349	2.159
32	*Euphorbia helioscopia* L.	Euphorbiaceae	0.567	0.597	0.625	0.3	2.088
33	*Coldbachia laevigata* (M. B.) DC.	Bracicaceae	0.567	0.696	0.423	0.294	1.979
34	*Sophora alopecuroides*	Fabaceae	0.567	0.365	0.691	0.294	1.916
35	*Allysum hirsutum* L.	Bracicaceae	0.567	0.365	0.625	0.257	1.813
36	*Sorghum halepense* (L.) Pers.	Poaceae	0.567	0.265	0.478	0.147	1.457
37	Trago*pogon graminifolius* DC.	Asteraceae	0.567	0.139	0.294	0.275	1.275
38	*Achilla millefolium* L.	Asteraceae	0.283	0.398	0.176	0.318	1.176
39	*Lepidium perfoliatum* L.	Brassicaceae	0.283	0.398	0.221	0.208	1.11
40	*Papaver dubium* L.	Papaveraceae	0.283	0.464	0.18	0.11	1.038
41	*Lycium ruthenicum* Murray	Solanaceae	0.283	0.166	0.463	0.098	1.01
42	*Bromus sterilis* L.	Poaceae	0.283	0.331	0.125	0.269	1.009
43	*Cenaturea depressa* M.B.	Asteraceae	0.283	0.199	0.368	0.122	0.972
44	*Reseda luteola* L.	Resedaceae	0.283	0.199	0.412	0.073	0.967
45	*Alium ampeloprasum* L.	Liliaceae	0.283	0.265	0.235	0.135	0.918
46	*Centaurea solstitialis* L.	Asteraceae	0.283	0.199	0.287	0.135	0.904
47	*Senecio vulgaris* L.	Asteraceae	0.283	0.199	0.309	0.086	0.877
48	*Solanum nigrum* L. Var *nigrum*	Solanaceae	0.283	0.199	0.272	0.11	0.864
49	*Bromus Danthoniae* Trin.	Poaceae	0.283	0.232	0.132	0.159	0.807
50	*Plantago lanceolata* L.	Plantaginaceae	0.283	0.199	0.206	0.11	0.798
51	*Lathyrus latifolius*	Fabaceae	0.283	0.166	0.191	0.135	0.775
52	*Lolium rigidum* Gaudin.	Poaceae	0.283	0.232	0.169	0.08	0.764

53	*Hordeum murinum* L.	Poaceae	0.283	0.166	0.162	0.122	0.733
54	*Consolida orientalis* (Gay.) Schrod. *Centaurea bruguierana* (DC.)	Rununculaceae	0.283	0.265	0.047	0.122	0.718
55	Hand-Mzt.	Asteraceae	0.283	0.133	0.184	0.11	0.71
56	*Vaccaria pyramidata* Medi.	Carypphyllaceae	0.283	0.133	0.221	0.061	0.698
57	*Hyosiamus niger* L.	Solanaceae	0.283	0.099	0.235	0.073	0.691
58	*Atriplex patulum* L.	Chenopodiaceae	0.283	0.011	0.276	0.092	0.661
59	*Aegilops cylindrica* Host.	Poaceae	0.283	0.166	0.051	0.147	0.647
60	*Cichorum intybus* L.	Asteraceae	0.283	0.099	0.206	0.037	0.625
61	*Lamium amplexicue* L.	Lamiaceae	0.283	0.012	0.143	0.147	0.585

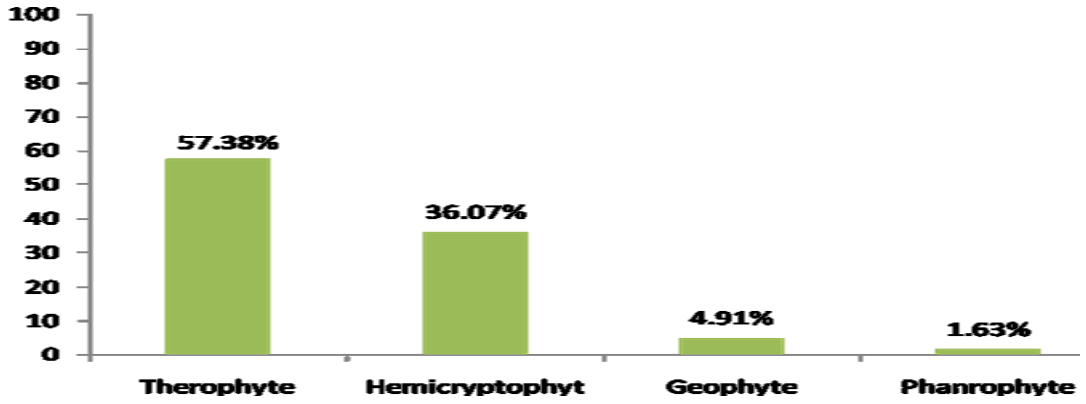

Figure 1. The life-forms of weed species observed in wheat fields of Miandoab County.

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