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Evaluation of Weed Species Richness and Similarity of Iran's Provinces in the Fields of Some Species of Poceae Family

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Abstract

In order to evaluate the weed diversity in crop fields such as corn (*Zea mays* L.), barley (*Hordeum vulgar* L.) and Sorghum (*Sorghum bicolor* L.) in different provinces of Iran, a study was conducted by using data from reports of the Plant Protection Organization, Ministry of Agriculture during 2008. After evaluation of weed species and definition of weed family the species were classified based on functional diversity in four groups such as growth recycling, growth type, photosynthetic pathway and persistence degreebased on effect of yield loss. The results indicated that the number of weed species in corn fields of Iran's provinces were 31 species that these species belong to 15 different families. The greatest weed diversity was obtained in the provinces of Semnan, Khuzestan and Chaharmahal-o-Bakhtiari with 31 species. Among the provinces, the highest weed similarity index in corn fields (100%) was obtained between Provinces of Chaharmahal-o-Bakhtiari- Semnan and Chaharmahal-o-Bakhtiari- Khuzestan. Thirty- six (36) species from 13 families were found in the fields of barley. The highest species diversity of weeds was observed in Gazvin with 36 species from 13 plant families. The lowest weed diversity was obtained in Zanjan province with 2 species from 2 plant families. Similarity index of different provinces for weeds of barley fields showed that the highest similarity index was observed between the provinces of Zanjan and Lorestan (80%). In sorghum fields of Iran's provinces, 8 species was observed that belonged to 5 plant families. Also, in these fields, the highest species diversity of weeds was observed in Semnan with 8 weed species belonged to 5 plant families. The highest similarity index for weeds was observed between the provinces of Esfahan- Semnan (77%). The provinces of Boushehr- Semnan with 55% and Boushehr- Esfahan with 50% of similarity were in the second and third places, respectively. In the total studied fields, the greatest number of species was observed in Poaceae family.

Keywords

Corn, Barley, Sorghum, Similarity Index, Species Diversity

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1. Introduction

Agricultural ecosystems are destructed environments that are usually managed by farmers in order to maintain the system in the early stages of ecological succession. In these ecosystems, hundreds of plant species are cultivated, which have been transferred from their origin to other parts of the world [19]. By mimicking natural ecological processes, increasing plant diversity in farming ecological systems leads to effective use of resources, increased biodiversity and thereby, sustainability of these systems [9]. The role of weeds in the creation and development of diversity in agricultural systems is of particular importance, since many agricultural crops are closely related to these plants and genetic exchange occurs between them. On the other hand, many weeds are considered as shelter and a place for living and multiplying

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of natural predators of crop pests, birds and small mammals [1, 4]. Hossain et al. [12] suggested that weeds are an appropriate place for natural enemies of pests by providing pollen and nectar. Therefore, the weeds management should be done based on living organisms and their functioning in the ecosystems.

The weeds directly cause the crop yield reduction through competition for light, water, nutrients and space, and reduce the crop quality by contaminating the harvested seed [25, 26]. However, a small percentage of weeds species have considerable harmful effects, and most of species rarely lead to reduced yield and are involved in increasing diversity [3]. In recent decades, due to compression in agriculture and the use of pesticides, the diversity of weeds has decreased [11, 13, 24, 27]. However, recent studies have shown that increased variety of weeds can have a positive impact on the functioning of ecological farming systems [3, 8, 22].

Albercht [3] suggested that the weeds of arable lands are key species that their absence leads to serious changes in the habitats and food chains relations. Keeping down the weeds population in the fields increases the wildlife sanctuaries and increases the functional diversity of crop prospects. However, this usefulness should reach to a balance by reducing the risk of crop production due to competition with weeds [30, 31]. Grice & Martin [10] stated that the pastures and lands under cultivation of forage plants are effective in increasing the diversity of plant and animal of ecosystems. They suggested that invasive plant and animal species have threatened and affected the Australian rangeland biodiversity. The analysis of farm marginal effect on weed diversity showed that regardless of the type of management, the weed diversity on the edges of the fields was more than the diversity inside them [28].

As identifying and comparing the diversity of weed populations in Iran's agricultural ecosystems is important, this study was conducted to examine the diversity of weeds in the farms under cultivation of some crops of Poaceae family in different provinces of the country.

2. Materials & Methods

The study was performed in fields of corn (*Zea mays* L.), barley (*Hordeumvulgare* L.) and Sorghum (*Sorghum bicolor* L.) throughout Iran's provinces. The results of this study were extracted from the published information of Plant Protection Ministry of Agriculture Organization. The codes of studied provinces are listed in Tables 1, 2 and 3.

Table 1. Identification code for provinces (corn fields).

Code	Province	Code	Province	Code	Province	Code	Province	Code	Province
1	East Azerbaijan	7	Tehran	13	Sistan-o-Baluchestan	19	Kermanshah	25	Markazi
2	West Azerbaijan	8	Chaharmahal-o-Bakhtiari	14	Fars	20	Kohgiluyah-o-Boyerahmad	26	Hormozgan
3	Ardabil	9	Khorasan	15	Qum	21	Golestan	27	Hamadan
4	Isfahan	10	Khuzestan	16	Qazvin	22	Gilan	28	Yazd
5	Ilam	11	Zanjan	17	Kordestan	23	Lorestan		
6	Boushehr	12	Semnan	18	Kerman	24	Mazandaran		

Table 2. Identification code for provinces (barley field).

Code	Province	Code	Province	Code	Province	Code	Province
1	East Azerbaijan	7	Semnan	13	Gilan	19	Yazd
2	West Azerbaijan	8	Fars	14	Lorestan		
3	Isfahan	9	Qum	15	Mazandaran		
4	Boushehr	10	Qazvin	16	Markazi		
5	Khorasan	11	Kerman	17	Hormozgan		
6	Zanjan	12	Golestan	18	Hamadan		

Table 3. Identification code for provinces (sorghum field).

Code	Province
1	Isfahan
2	Boushehr
3	Khuzestan
4	Semnan

After examining the weed species and determining the families in the fields, the species were classified based on the functional diversity in three growth cycles (annual, biennial and perennial), vegetative form (monocots and dicot), photosynthetic pathway (three carbon and four carbon) and the degree of persistence (persistent and non-persistent) [17, 23, 29]. The degree of persistence was determined based on weed competition ability and yield loss in comparison with other crops.

After determining the functional groups of existing weeds, to assess the degree of similarity of country's provinces in terms of their functional diversity in the fields of corn, barley and Sorghum,the cluster analysis was performed, and the similarity index between the different provinces of the country in terms of weed species by using equation (1) [23].

$$SI = \frac{2Cij}{Ci + Cj} \quad (1)$$

Where,

SI: Similarity index

Cij: Number of weed species common between the two comparing provinces

Ci: Number of weed species in the first province

Cj: Number of weed species in the second province

Cluster analysis was done with using Minitab software, Ver. 14.1, while the similarity index was determined using Excel software.

3. Results and Discussion

The number of weed species in corn fields of Iran's provinces were 31 species that these species belong to 15 different families. In corn field, broad-leaf and narrow-leaf weeds were 21 and 10 species, respectively.For the photosynthetic pathway in these fields, C4 and C3 species were 8 and 23 species, respectively. Also, results indicated that for vegetative cycle, annual species of weeds with 21 species were dominant plants compared with perennial species.In general, the greatest number of species was observed in Poaceae family with 9 and second place was Brassicaceae family with 3 species. So that Poaceae and Brassicaceae were the most diverse family of monocotyledonous and dicotyledonous weeds in corn fields, respectively (Table 4).It seems that in arable lands due to continuous tillage, growth conditions aremore favorable for annual weeds in comparison with perennial weeds.

36 species from 13 families were found in the fields of barley. Among these weed families;poaceae with 4 species was the most divers' family for weed species number. Also, for photosynthetic pathway, many weed species (33 species) in barley field were c3 and 3 species were c4. Result showed that in these fields, 23 weed species were annual and 8 species, perennial, for vegetative cycle (Table 5).

In sorghum fields of Iran's provinces, 8 species was observed that belonged to 5 plant families. The greatest species diversity was obtained in Poaceae family with 4 species. For photosynthetic pathway, each of C3 and C4 species were 4 species.

The results indicated that total weed species in sorghum fields was annual and wasn't record perennial species in these fields. Perhaps, it was because of the high tillage and the lack of appropriate conditions for perennial plants. Also, weed investigation for degree of persistence indicated that 6 species of weeds were Persistent (Table 6). It seems that use of chemical fertilizers, particularly, nitrogen fertilizer, affect on composition and diversity of weed species in agroecosystems. As the use of nitrogen fertilizers in the long term leads to dominance of nitrophyl species with high persistece such oat (*Avenafutua* L.) (16).

Table 4. Functional groups of weed in corn fields.

Weeds of corn field	Plant family	Functional groups			
		Vegetative form	Photosynthetic pathway	Vegetative cycle	Degree of persistence
Rhaponticumrepens L.	Asteraceae	Dicotyledonous	C3	Perennial	Persistent
AvenafatuaL.	Poaceae	Monocotyledonous	C3	Annual	Persistent
Cyperusrotundus L.	Cyperaceae	Monocotyledonous	C4	Annual	Persistent
Polygonumaviculare L.	Polygonaceae	Dicotyledonous	C3	Annual	
Raphanusraphanistrum L.	Brassicaceae	Dicotyledonous	C3	Annual	
Setariaglauca L.	Poaceae	Monocotyledonous	C4	Annual	Persistent
Paspalumdistichum L.	Poaceae	Monocotyledonous	C3	Perennial	
*Malvasylvestris*L.	Malvaceae	Dicotyledonous	C3	Perennial	
Convolvulusarvensis L.	Convolvulaceae	Dicotyledonous	C3	Perennial	Persistent
Amaranthusretroflexus L.	Amarantaceae	Dicotyledonous	C4	Annual	Persistent
Solanumnigrum L.	Solanaceae	Dicotyledonous	C3	Annual	
Xanthium spinosum L.	Solanaceae	Dicotyledonous	C3	Annual	
Beta maritime L.	Chenopodiaceae	Dicotyledonous	C3	Annual	
*Alhagipersarum*Boiss.& Buhse	Fabaceae	Dicotyledonous	C3	Perennial	
Sinapisarvensis L.	Brassicaceae	Dicotyledonous	C3	Annual	Persistent
Portulacaoleracea L.	Portulacaceae	Dicotyledonous	C4	Annual	
*Setariaviridis*L.	Poaceae	Monocotyledonous	C4	Annual	Persistent
Chenopodium album L.	Chenopodiaceae	Dicotyledonous	C3	Annual	
Sorghumbicolor L.	Poaceae	Monocotyledonous	C4	Annual	
Echinochloa crus-galli L.	Poaceae	Monocotyledonous	C3	Annual	Persistent
Rapistrumrugosum L.	Brassicaceae	Dicotyledonous	C3	Annual	
*Suaedaarcuata*Bunge	Boraginaceae	Dicotyledonous	C3	Annual	
Physalisalkekengi L.	Solanaceae	Dicotyledonous	C3	Perennial	
Euphorbiahelioscopia L.	Euphorbiaceae	Dicotyledonous	C3	Annual	
Sorghum halepense L.	Poaceae	Monocotyledonous	C4	Annual	Persistent
Cardariadraba L.	Brassicaceae	Dicotyledonous	C3	Perennial	

Weeds of corn field	Plant family	Functional groups			
		Vegetative form	Photosynthetic pathway	Vegetative cycle	Degree of persistence
*Cirsiumarvense*L.	Asteraceae	Dicotyledonous	C3	Perennial	Persistent
*Abutilon theophrasti*Medik.	Malvaceae	Dicotyledonous	C3	Annual	
Loliumtemulentum L.	Poaceae	Monocotyledonous	C3	Perennial	
Cynodondactylon L.	Poaceae	Monocotyledonous	C4	Perennial	Persistent
Citrulluscolocynthis L.	Cucurbitaceae	Dicotyledonous	C3	Annual	

Table 5. Functional groups of weed in barley fields.

Weeds of barley field	Plant family	Functional groups			
		Vegetative form	Photosynthetic pathway	Vegetative cycle	Degree of persistence
*Avenafatua*L.	Poaceae	Monocotyledonous	C3	Annual	Persistent
Cirsiumarvense L.	Asteraceae	Dicotyledonous	C3	Perennial	Persistent
Erucasativa Mill.	Brassicaceae	Dicotyledonous	C3	Annual	
Glycyrrhizaglabra L.	Fabaceae	Dicotyledonous	C3	Annual	
Raphanusraphanistrum L.	Brassicaceae	Dicotyledonous	C3	Annual	
Sinapisarvensis L.	Brassicaceae	Dicotyledonous	C3	Annual	
Sisymbriumirio L.	Brassicaceae	Dicotyledonous	C3	Annual	
*Atriplex*sp.	Chenopodiaceae	Dicotyledonous	C3	Annual	
Bromustomentellus Boiss.	Poaceae	Monocotyledonous	C3	Annual	
Galiumtricornutum Dandy	Rubiaceae	Dicotyledonous	C3	Annual	
Malvasylvestris L.	Malvaceae	Dicotyledonous	C3	Perennial	
*Convolvulus arvensis*L.	Convolvulaceae	Dicotyledonous	C3	Perennial	Persistent
*Emexspinosa*L.	Polygonaceae	Dicotyledonous	C3	Annual	
Sophoraalopecuroides L.	Fabaceae	Dicotyledonous	C3	Perennial	
Hordeummurinum L.	Poaceae	Monocotyledonous	C3	Annual	
Secalecereale L.	Poaceae	Monocotyledonous	C3	Annual	
Loliumperenne L.	Poaceae	Monocotyledonous	C3	Perennial	
Alhagipersarum Boiss. & Buhse	Fabaceae	Dicotyledonous	C3	Perennial	
Lathyrusannuus L.	Fabaceae	Dicotyledonous	C3	Annual	
Phalarisminor Retz.	Poaceae	Monocotyledonous	C4	Annual	
Setariaviridis L.	Poaceae	Monocotyledonous	C4	Annual	Persistent
Chenopodiumalbum L.	Chenopodiaceae	Dicotyledonous	C3	Annual	
Veronicapersica Poir	Schrophulariaceae	Dicotyledonous	C3	Annual	
Sileneapetala Willd.	Caryophyllaceae	Dicotyledonous	C3	Annual	
Papaverdubium L.	Papaveraceae	Dicotyledonous	C3	Annual	
Rapistrumrugosum L.	Brassicaceae	Dicotyledonous	C3	Annual	
Salsolakali L.	Chenopodiaceae	Dicotyledonous	C4	Annual	
Polygonumaviculare L.	Polygonaceae	Dicotyledonous	C3	Annual	
Ixioliriontataricum Pall.	Ixioliriaceae	Monocotyledonous	C3	Perennial	
Centaureadepressa M.Bieb.	Asteraceae	Dicotyledonous	C3	Annual	
Goldbachialaevigata DC.	Brassicaceae	Dicotyledonous	C3	Annual	
Carthamusoxyacantha M.Bieb.	Asteraceae	Dicotyledonous	C3	Annual	
Viciasativa L.	Fabaceae	Dicotyledonous	C3	Annual	
Medicagohispida Gaertn.	Fabaceae	Dicotyledonous	C3	Annual	

Table 6. Functional groups of weed in sorghum fields.

Weeds of sorghum field	Plant family	Functional groups			
		Vegetative form	Photosynthetic pathway	Vegetative cycle	Degree of persistence
Portulacaoleracea L.	Portulacaceae	Dicotyledonous	C4	Annual	
*Avenafatua*L.	Poaceae	Monocotyledonous	C3	Annual	Persistent
*Malva*sp.	Malvaceae	Dicotyledonous	C3	Annual	
*Lolium*sp.	Poaceae	Monocotyledonous	C3	Annual	
Echinocloa crus-galli L.	Poaceae	Monocotyledonous	C4	Annual	Persistent
Amaranthusretroflexus L.	Amaranthaceae	Dicotyledonous	C4	Annual	
Setariaviridis L.	Poaceae	Monocotyledonous	C3	Annual	
Solanumnigrum L.	Solanaceae	Dicotyledonous	C3	Annual	

The results indicated that the greatest diverse family of weed was Poaceae. It included 30 percentage of total weed species of Iran. In corn fields, the greatest weed diversity was obtained in the provinces of Semnan, Khuzestan and Chaharmahal-o-Bakhtiari with 31 species. Among plant families observed in 3 provinces, The greatest number of weed species were observed in poaceae family with 9 species (Table 8).

In barley fields of Iran, The highest diversity and abundance of weeds was observed in Poaceae (30 percentage of total weed species). Also, Brassicaceae with 17 percentage of total weed species was in the second place. Among Iran's provinces, the

highest species diversity of weeds was observed in Gazvin with 36 species from 13 plant families.West Azerbaijan with 13 weed species from 9 plant families and Fars with 13 weed species from 5 plant families were in second place. The lowest weed diversity was obtained in Zanjan province with 2 species from 2 plant families (Table 8).

The study of weed species and families in sorghum fields of different provinces showed that sorghum suppressed weeds and as a result, it decreased weed species diversity. The highest weed species diversity was obtained in Poaceae that it included 61 percentage of total weeds of Iran. Among studied provinces, the highest species diversity of weeds was observed in Semnan with 8 weed species belonged to 5 plant families (Table 9).

Among the provinces, the highest weed similarity index in corn fields (100 percentage) was obtained between Provinces of Chaharmahal-o-Bakhtiari- Semnan and Chaharmahal-o-Bakhtiari- Khuzestan. Also, East Azerbaijan- Kermanshah and Fars- Golestan were similar in the level of 75 perecentage (Table 10).

The investigation of Similarity index of different provinces for weeds of barley fields showed thatthe highest similarity index was observed between the provinces of Zanjan and Lorestan (80%). The provinces of Fars- Qum with 63 percentage similarity and Fars- Esfahan with 61 percentage were in second and third places, respectively (Table 11).

In sorghum fields, the highest similarity index for weeds was observed between the provinces of Esfahan- Semnan(77%). The provinces of Boushehr- Semnan with 55 pernentage and Boushehr- Esfahan with 50 percentage of similarity were in the second and third places, respectively. The lowest value of this index was allocated to the provinces of Bushehr- Khuzestan (Table 12).

Table 7. Species number in different families of weeds in corn fields of provinces.

Plantfamily \ Province	EastAzerbaijan	WestAzerbaijan	Ardabil	Esfahan	Ilam	Boushehr	Tehran	Chaharmahal-o-Bakhtiari	Khorasan	khuzestan	Zanjan	Semnan	Sistan-o-Bluchestan	Fars
Portulacaceae	1			1			1	1		1		1	1	1
Chenopodiaceae	1			1	1	2	1	3	1	3	1	3	1	1
Gramineae	3		3	2	1		8	9		9		9	2	3
Convolvulaceae	1			1				1	1	1	1	1		1
Amaranthaceae	1	1		1		1	1	1	1	1	1	1	1	1
Fabaceae					1	1		1		1		1		
Cucurbitaceae					1			1		1		1		
Malvaceae					1			2	1	2		2		1
Compositae		1						3		3	1	3		
Cruciferae	1	2	1					4		4	1	4		
Solanaceae	1							2		2		2		2
Cyperaceae							1	1		1		1	1	
Euphorbiaceae								1		1		1		
Polygonaceae	1							1		1		1		
Total	10	4	4	6	5	4	12	31	4	31	5	31	6	10

Table 7. Continue.

Plantfamily \ Province	Qum	Ghazvin	Kordestan	Kerman	Kermanshah	Kohgiiloyah-o-Boyerahmad	Golestan	Gilan	Lorestan	Mazandaran	Markazi	Hormozgan	Hamadan	Yazd	total	Percentage
Portulacaceae	1	1	0		1	0	1		1			0			13.00	5.26
Chenopodiaceae	2	3	0	1	1	0	1	1	1	1	1	0	1	1	33.00	13.36
Gramineae		2	0	2	3	0	1	3	1	8	1	0	4		74.00	29.96
Convolvulaceae	1	1	0	1	1	0	1			1		0	1		15.00	6.07
Amaranthaceae	1	1	0	1	1	0	1	1	1	1	1	0	1	1	23.00	9.31
Fabaceae		1	0			0						0			6.00	2.43
Cucurbitaceae		1	0			0						0			5.00	2.02
Malvaceae		2	0			0	1		1			0	1	1	15.00	6.07
Compositae		2	0		1	0						0			14.00	5.67
Cruciferae		2	0			0			1	1		0			21.00	8.50
Solanaceae		2	0			0			1			0	1		13.00	5.26

Province / Plantfamily	Qum	Ghazvin	Kordestan	Kerman	Kermanshah	Kohgiloyah-o-Boyerahmad	Golestan	Gilan	Lorestan	Mazandaran	Markazi	Hormozgan	Hamadan	Yazd	total	Percentage
Cyperaceae			0			0		1		1		0			7.00	2.83
Euphorbiaceae		1	0			0						0			4.00	1.62
Polygonaceae			0			0						0			4.00	1.62
Total	5	19	0	5	8	0	6	6	7	13	3	0	9	3	247	

Table 8. Species number in different families of weeds in barley fields of provinces.

Province / Plantfamily	EastAzerbaijan	WestAzerbaijan	Esfahan	Boushehr	Khorasan	Zanjan	Semnan	Fars	Qum	Ghazvin
Gramineae			5	4	3	1	1	7	4	9
Chenopodiaceae	1	3	1	1	1		1	2	2	3
Compositae		1	1	2			1			3
Caryophyllaceae			1							1
Rubiaceae	1	1	1							1
Cruciferae	1	3	1			1	1	2		6
Malvaceae		1		1						1
Convolvulaceae	1			1	1		1			1
Fabaceae	2	1					1			6
Papaveraceae	1	1						1		1
Polygonaceae								1		2
Amaryllidaceae		1								1
Scrophulariaceae		1								1
Total	7	13	10	9	5	2	6	13	6	36

Table 8. Continue.

Province / Plantfamily	Kerman	Golestan	Gilan	Lorestan	Mazandaran	Markazi	Hormozgan	Hamadan	Yazd	total	Percentage
Gramineae	1		2	1	2		2		2	44.00	29.73
Chenopodiaceae		2								17.00	11.49
Compositae	1	1						1		11.00	7.43
Caryophyllaceae										2.00	1.35
Rubiaceae			1							5.00	3.38
Cruciferae		1	1	1	1	3	1	1	1	25.00	16.89
Malvaceae										3.00	2.03
Convolvulaceae	1	1		1				1		9.00	6.08
Fabaceae		1						3		14.00	9.46
Papaveraceae	1	1	1					1		8.00	5.41
Polygonaceae		1								4.00	2.70
Amaryllidaceae	1									3.00	2.03
Scrophulariaceae								1		3.00	2.03
Total	5	8	5	3	3	3	3	8	3	148	

Table 9. Species number in different families of weeds in sorghum fields of provinces.

	Esfahan	Brusher	khuzestan	Semnan	total	Percentage
Portulacaceae	1			1	2.00	11.11
Gramineae	4	2	1	4	11.00	61.11
Malvaceae		1		1	2.00	11.11
Amaranthaceae			1	1	2.00	11.11
Solanaceae				1	1.00	5.56
Total	5	3	2	8	18	

Table 10. Similarity Index for weeds in corn fields of provinces.

Provinces	West Azerbaijan	Ardabil	Esfahan	Ilam	Boushehr	Tehran	Chaharmahal-o-Bakhtiari	Khorasan	khuzestan	Zanjan	Semnan	Sistan-o-Bluchestan	Fars	Qum
East Azerbaijan	0.33	0.17	0.71	0.15	0.33	0.50	0.35	0.50	0.35	0.46	0.35	0.57	0.67	0.62
West Azerbaijan		0.00	0.20	0.00	0.25	0.13	0.13	0.25	0.13	0.44	0.25	0.20	0.14	0.22
Ardabil			0.00	0.00	0.00	0.25	0.20	0.00	0.20	0.22	0.20	0.20	0.14	0.00
Isfahan				0.18	0.40	0.56	0.38	0.60	0.38	0.55	0.38	0.50	0.63	0.73
Ilam					0.44	0.24	0.32	0.44	0.32	0.20	0.32	0.36	0.27	0.20
Boushehr						0.25	0.27	0.50	0.27	0.44	0.27	0.40	0.29	0.44
Tehran							0.63	0.25	0.63	0.24	0.63	0.67	0.55	0.35
Chaharmahal-o-Bakhtiari								0.27	1.00	0.32	1.00	0.38	0.56	0.32
Khorasan									0.27	0.67	0.27	0.40	0.43	0.67
Khuzestan										0.32	1.00	0.38	0.56	0.32
Zanjan											0.32	0.36	0.40	0.60
Semnan												0.38	0.56	0.32
Sistan-o-Baluchestan													0.63	0.55
Fars														0.53
Qum														
Qazvin														
Kordestan														
Kerman														
Kermanshah														
Kohgiluyah-o-Boyerahmad														
Golestan														
Gilan														
Lorestan														
Mazandaran														
Markazi														
Hormozgan														
Hamadan														

Table 10. Continued.

Provinces	Ghazvin	Kordestan	Kerman	Kermanshah	Kohgiloyah-o-Boyerahmad	Golestan	Gilan	Lorestan	Mazandaran	Markazi	Hormozgan	Hamadan	Yazd
East Azerbaijan	0.37	0.00	0.62	0.75	0.00	0.71	0.43	0.40	0.48	0.55	0.00	0.47	0.36
West Azerbaijan	0.17	0.00	0.22	0.17	0.00	0.20	0.20	0.18	0.12	0.29	0.00	0.15	0.29
Ardabil	0.17	0.00	0.00	0.33	0.00	0.00	0.00	0.18	0.24	0.29	0.00	0.15	0.00
Isfahan	0.40	0.00	0.73	0.71	0.00	0.83	0.67	0.62	0.53	0.44	0.00	0.53	0.44
Ilam	0.33	0.00	0.40	0.15	0.00	0.18	0.18	0.17	0.22	0.25	0.00	0.29	0.50
Boushehr	0.35	0.00	0.44	0.33	0.00	0.40	0.40	0.36	0.24	0.57	0.00	0.31	0.57
Tehran	0.32	0.00	0.47	0.60	0.00	0.44	0.67	0.42	0.88	0.40	0.00	0.57	0.27
Chaharmahal-o-Bakhtiari	0.84	0.00	0.32	0.47	0.00	0.38	0.38	0.42	0.67	0.21	0.00	0.51	0.21
Khorasan	0.35	0.00	0.67	0.50	0.00	0.60	0.40	0.36	0.35	0.57	0.00	0.46	0.86
Khuzestan	0.84	0.00	0.32	0.47	0.00	0.38	0.38	0.42	0.67	0.21	0.00	0.51	0.21
Zanjan	0.42	0.00	0.60	0.46	0.00	0.55	0.36	0.50	0.33	0.50	0.00	0.43	0.50
Semnan	0.84	0.00	0.32	0.47	0.00	0.38	0.38	0.42	0.67	0.21	0.00	0.51	0.21
Sistan-o-Baluchestan	0.32	0.00	0.55	0.57	0.00	0.50	0.50	0.46	0.53	0.67	0.00	0.53	0.44
Fars	0.55	0.00	0.67	0.67	0.00	0.75	0.38	0.59	0.52	0.46	0.00	0.74	0.31
Qum	0.42	0.00	0.60	0.62	0.00	0.73	0.36	0.50	0.33	0.50	0.00	0.43	0.50
Qazvin		0.00	0.24	0.43	0.00	0.38	0.31	0.52	0.42	0.26	0.00	0.48	0.26
Kordestan			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kerman				0.62	0.00	0.73	0.55	0.00	0.56	0.50	0.00	0.57	0.50
Kermanshah					0.00	0.71	0.43	0.00	0.57	0.55	0.00	0.47	0.36
Kohgiluyah-o-Boyerahmad						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Provinces	Ghazvin	Kordestan	Kerman	Kermanshah	Kohgiiloyah-o-Boyerahmad	Golestan	Gilan	Lorestan	Mazandaran	Markazi	Hormozgan	Hamadan	Yazd
Golestan							0.50	0.62	0.42	0.44	0.00	0.53	0.44
Gilan								0.46	0.63	0.44	0.00	0.40	0.44
Lorestan									0.30	0.40	0.00	0.50	0.40
Mazandaran										0.38	0.00	0.64	0.25
Markazi											0.00	0.50	0.67
Hormozgan												0.00	0.00
Hamadan													0.33

Table 11. Similarity Index for weeds in barley fields of provinces.

Provinces	East Azerbaijan	West Azerbaijan	Esfahan	Boushehr	Khorasan	Zanjan	Semnan	Fars	Qum	Ghazvin	Kerman	Golestan	Gilan	Lorestan	Mazandaran	Markazi	Hormozgan	Hamadan	Yazd
East Azerbaijan		0.49	0.24	0.13	0.33	0.00	0.31	0.30	0.15	0.33	0.33	0.53	0.50	0.20	0.00	0.00	0.20	0.27	0.00
West Azerbaijan			0.17	0.18	0.11	0.13	0.21	0.23	0.21	0.53	0.33	0.29	0.22	0.13	0.13	0.13	0.00	0.19	0.13
Isfahan				0.42	0.53	0.17	0.38	0.61	0.50	0.43	0.13	0.22	0.27	0.15	0.15	0.15	0.15	0.22	0.15
Boushehr					0.43	0.18	0.40	0.27	0.27	0.40	0.29	0.24	0.14	0.33	00.17	0.00	0.17	0.24	0.17
Khorasan						0.29	0.55	0.44	0.55	0.24	0.40	0.31	0.20	0.50	0.25	0.00	0.25	0.15	0.25
Zanjan							0.50	0.13	0.25	0.11	0.29	0.00	0.29	0.80	0.40	0.00	0.40	0.00	0.40
Semnan								0.21	0.33	0.29	0.36	0.43	0.18	0.67	0.22	0.00	0.22	0.43	0.22
Fars									0.63	0.53	0.22	0.38	0.33	0.13	0.25	0.13	0.38	0.19	0.25
Qum										0.29	0.18	0.29	0.18	0.22	0.44	0.00	0.22	0.00	0.44
Qazvin											0.24	0.36	0.24	0.15	0.15	0.15	0.15	0.36	0.15
Kerman												0.31	0.40	0.50	0.25	0.00	0.25	0.31	0.25
Golestan													0.31	0.18	0.00	0.00	0.18	0.38	0.00
Gilan														0.25	0.25	0.00	0.50	0.15	0.25
Lorestan															0.33	0.00	0.33	0.18	0.33
Mazandaran																0.00	0.33	0.00	0.67
Markazi																	0.00	0.18	0.33
Hormozgan																		0.00	0.33
Hamadan																			0.00
Yazd																			

Table 12. Similarity Index for weeds in sorghum fields of provinces.

Provinces	Isfahan	Boushehr	Khuzestan	Semnan
Isfahan		0.50	0.29	0.77
Boushehr			0.00	0.55
Khuzestan				0.40
Semnan				

The investigation of similarity percentage of Iran's provinces for degree of weed persistentnessin corn fields showed that all provinces except Qazvin and Khuzestan puton a cluster and the provinces of Qazvin and Khuzestan were separate branches (Figure 1). In corn fields, the comparison of different provinces for photosynthetic pathway showed that, in the similarity level of 75 percentage, the provinces of Chaharmahal-o-Bakhtiari, Khuzestan and Semnan were in first cluster, The provinces of Tehran and Mazandaran in second cluster, the other provinceswith the exception of Qazvin were in third cluster and Gazvin was in separate branch (Figure 2).

As it can be seen in Figure 3, in corn fields, the investigation of similarity of Iran's provinces on the basis of vegetative cycle of weed showed that different provinces were in 4 clusters. In the similarity level of 75 percentage, Three provinces of Chaharmahal-o-Bakhtiari, Khuzestan and Semnan were in the first cluster, the provinces of Esfahan, Sistan-o-Baluchestan, Qum, Golestan, Lorestan, West Azerbaijan, Boushehr, Ilam, Zanjan, Kerman, Gilan, Ardabil, Khorasan, Markazi, Yazd, Kordestan and Kohgiluyah-o-Boyerahmad in the second cluster, the provinces of Tehran, Mazandaran, Fars, East Azerbaijan, Kermanshah and Hamadan in the third cluster and Gazvin in separate branch.

Different provinces on the basis of vegetative form of weeds in the similarity level of 75 percentage put on 4 clusters. East Azerbaijan, lamFars, Kermanshah, Hamadan, Ardabil, Markazi, Esfahan, Ilam, Sistan-o-Baluchestan, Kerman, West

Azerbaijan, Boushehr, Khorasan, Yazd, Zanjan, Qum, Golestan, Lorestan and Gilan were in the first cluster, the provinces of Tehran and Mazandaran in the second cluster, the provinces of Chaharmahal-o-Bakhtiari, Khuzestan, Semnan and Gazvin in the third cluster and the provinces of Kordestan and Kohgiluyah-o-Boyerahmad in the fourth cluster (Figure 4).

As it can be seen in Figure 5, Iran's provinces on the basis of all functional groups, put on 4 clusters. The provinces of Chaharmahal-o-Bakhtiari, Khuzestan and Semnan were in the first cluster, the provinces of Tehran and Mazandaran in the second cluster. The other provinceswith the exception of Qazvin were in third cluster and Gazvin was in separate branch.

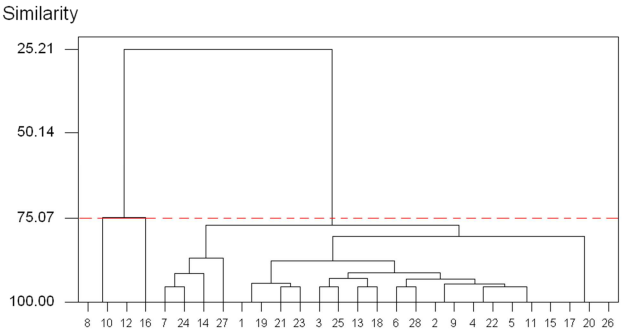

Fig. 1. Clusters of different provinces for similarity of weed persistentity in corn fields.

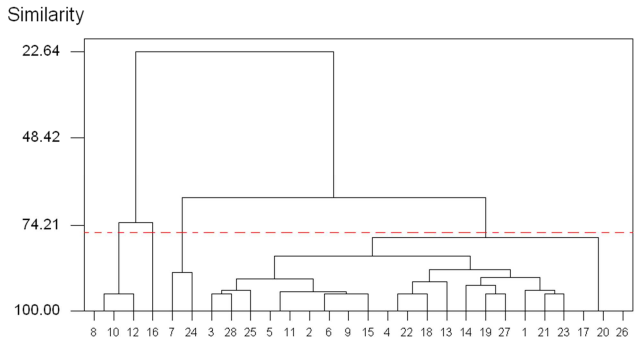

Fig. 2. Clusters different provinces for similarity in C3 and C4 weeds in corn fields.

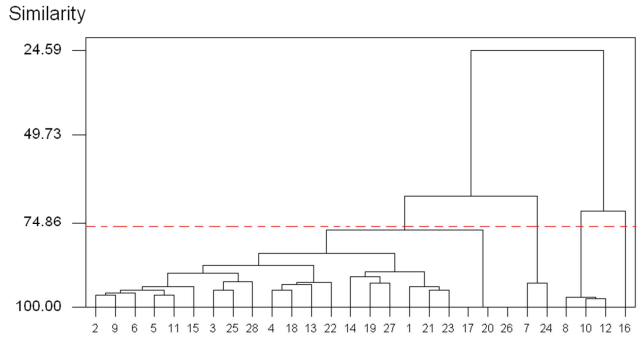

Fig. 5. Similarity level for weeds functional groups in corn fields.

(See table 1 for identification code).

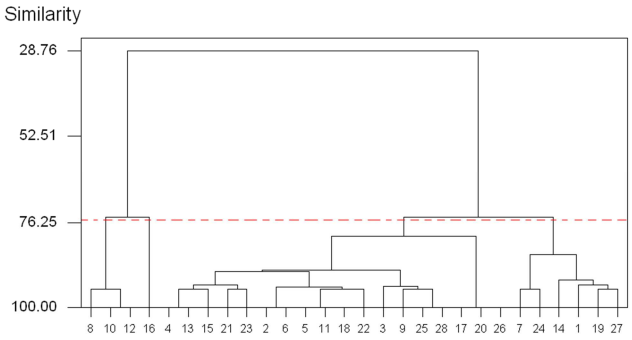

Fig. 3. Clusters of different provinces for similarity of annual, biennial and perennial weeds in corn fields.

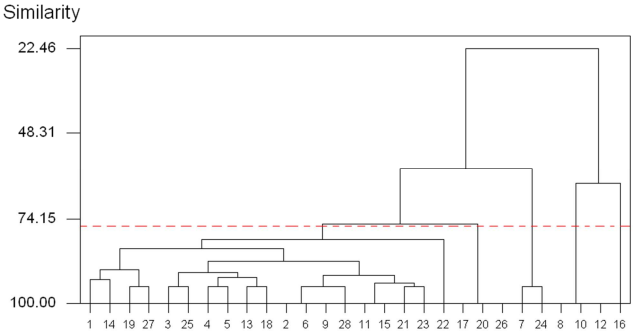

Fig. 4. Clusters of different provinces for similarity of broad and narrow leave weeds in corn fields.

As it's observed in Figure 6, Iran's provinces on the basis of degree of weed persistentness in barley fields put on 2 clusters (in the similarity level of 75 percentage). The first cluster included East Azerbaijan, West Aterbaijan, Esfahan, Boushehr, Khorasan, Zanjan, Semnan, Fars and Qum. The provinces of Gazvin, Kerman, Golestan, Gilan, Lorestan, Mazandaran, Markazi, Hormozgan, Hamadan and Yazd were in the second cluster.

All studied provinces with the exception of Gazvin were similar together for photosynthetic pathway, vegetative cycle and form and as a result, were observed in one cluster and Gazvin was in separate branch(similarity level was 75 percentage) (Figures 7, 8, 9). The investigation of the similarity of Iran's provinces on the basis of all functional groups of weeds in barley fields had the same result (Figure 10). In general, different clustering of the provinces is due to the difference in agricultural operations, input use management, weed community structure and soil properties.

In sorghum fields, clustering provinces on the basis of degree of weed persistentness showed that all provinces were in one cluster (Figure 11), but 4 studied provinces were different for photosynthetic pathway in the similarity level of 75 percentage and put on separate branches (Figure 12). The comparison of similarity percentage of Iran's provinces on the basis of vegetative cycle indicated that the provinces of Esfahan, Boushehr and Khuzestan were in one cluster and

Semnan province was in separate branch (Figure 13).

The investigation of similarity percentage of Iran's provinces on the basis of vegetative form and all functional groups of weeds in sorghum fields showed that the provinces of Boushehr and Khuzestan were in one cluster and Esfahan and Semnan provinces were in the separate branches (Figure 14 and 15). Perhaps, the reason of this was climatic similarity between Khuzestan and Boushehr provinces.

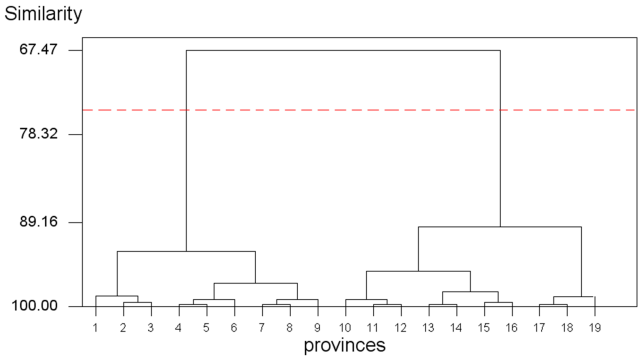

Fig. 6. Clusters of different provinces for similarity of weed persistentity in barley fields.

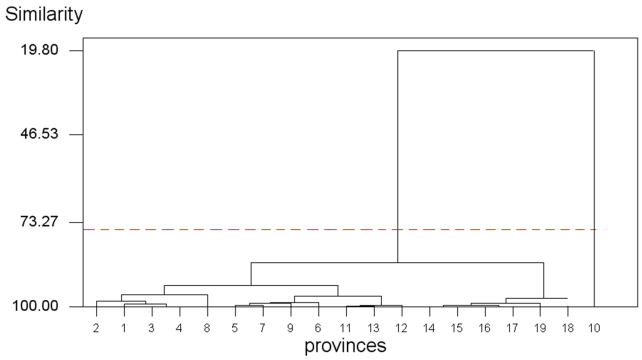

Fig. 7. Clusters different provinces for similarity in C3 and C4 weeds in barley fields.

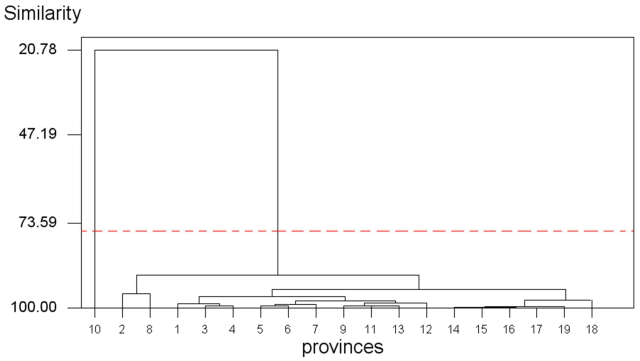

Fig. 10. Similarity level for weeds functional groups in barley fields.

(See table 2 for identification code).

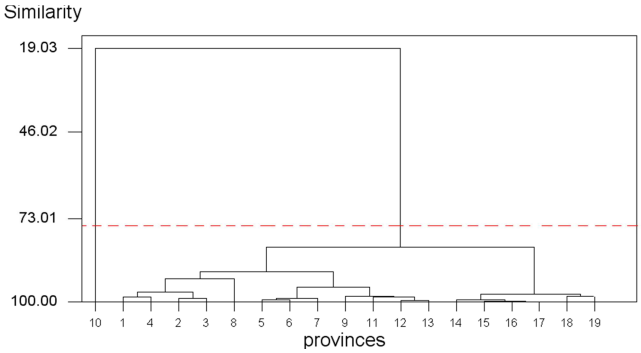

Fig. 8. Clusters of different provinces for similarity of annual, biennial and perennial weeds in alfalfa fields.

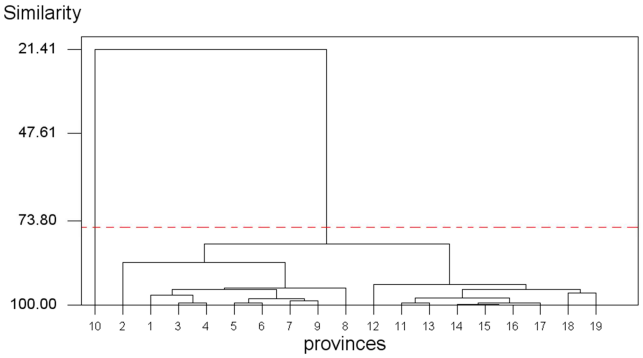

Fig. 9. Clusters of different provinces for similarity of broad and narrow leave weeds in barley fields.

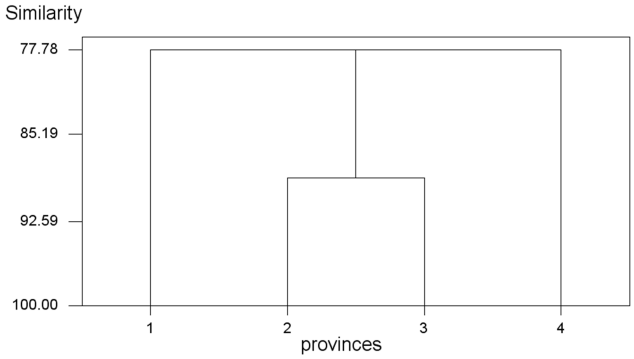

Fig. 11. Clusters of different provinces for similarity of weed persistentity in sorghum fields.

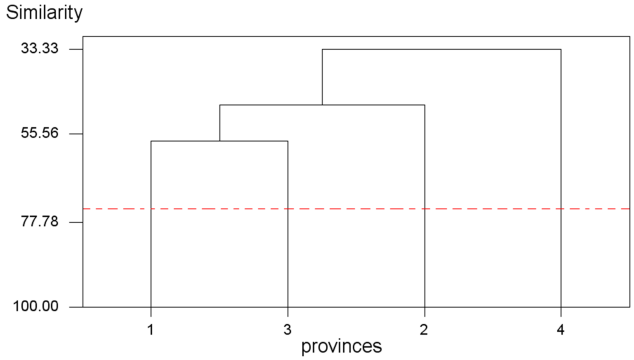

Fig. 12. Clusters different provinces for similarity in C3 and C4 weeds in sorghum fields.

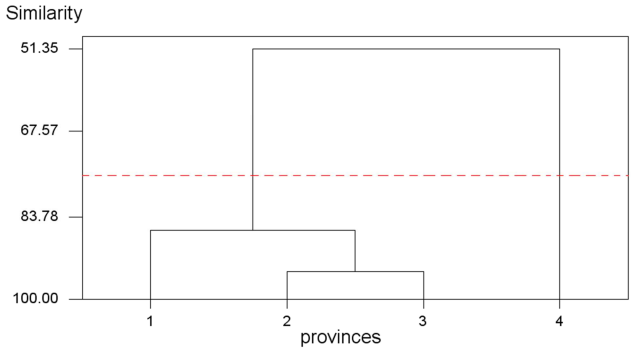

Fig. 13. Clusters of different provinces for similarity of annual, biennial and perennial weeds in sorghum fields.

(See table 3 for identification code)

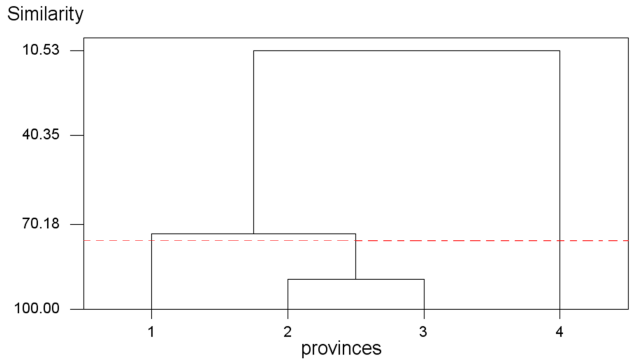

Fig. 14. Clusters of different provinces for similarity of broad and narrow leave weeds in sorghum fields.

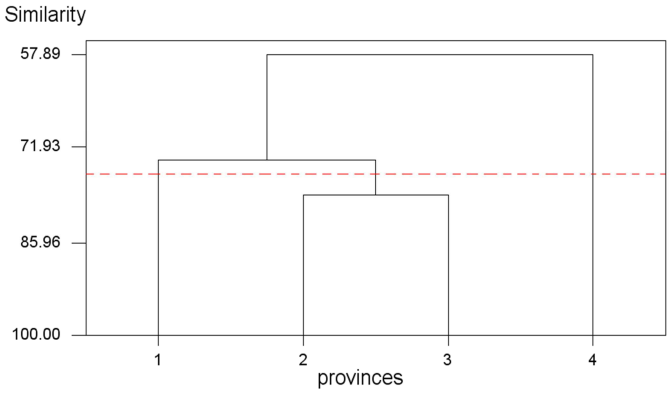

Fig. 15. Similarity level for weeds functional groups in sorghum fields.

The biological diversity can considers in 3 main levels included genetic, species and ecosystem diversity. Many weeds affect each diversity levels, of course, these effects were quantified, rarely [1].

The results of this research indicated that in spite of high species richness of weeds in different agroecosystems, Iran's provinces had a considerable similarity for all functional traits of weeds.

In a research, Ahmadvand et al. [2] examined the weeds species composition and biodiversity of fruit orchards in the Abbas Abad region of Hamedan and identified a total of 21 weed species, of which, the average population density of 12 dominant species were introduced. Of all identified species, 14 species were perennial weeds, and 7 species were annual weeds. They suggested that the reason is the perennial feature of garden plants and non-manipulation of soil during the period. By investigating the weed communities in the fields of chickpea (*Cicerarietinum* L.) and wheat (*Triticumaestivum* L.) in Argentina, Poggio et al. [23] also found that the populations of weeds in chickpea fields are more diverse than the wheat fields. According to them, the difference was due to crop management, including the use of fertilizers, pesticides and the field crop rotation. They suggested that the proportions of monocots and dicotyledonous weeds were the same in both fields. In examining the structure of weed communities in gardens influenced by common and organic management, Teresa et al. [32] found that the weeds species composition is significantly affected by the management on planting rows. In other research weed diversity in wheat's field was investigated and found 76 weed species that included 24 dicotyledons of different families such as Asterceae, Fabaceae, Amaranthaceae, and Euphorbiaceae and other weeds were monocotyledons of cyperaceae and Poaceae families [14]. Azizi et al [6] with evaluation of plant diversity and nutrient resource effects on weed diversity indicated that plant species affected density, dry weight and diversity of weeds. The highest Shannon index of weed was obtained in monocultures compared to intercropping systems.

Differences in crop management practices, including fertilization and use of pesticides, were the most important factors in determining the composition of weed species, and thus, their diversity [7, 17]. Environmental factors at regional scale may also reflect the differences between existing farms regarding the weeds functional diversity [20]. Also, the significant uses of inputs, especially nitrogen fertilizer in common ecological farming systems that are common in the country's production systems are one of the factors influencing the species composition of weeds [17]. The evidence suggests that high level of soil fertility is the most important factor determining the functional diversity of plant species, so that the functional diversity is minimized in high levels of fertility1 [15].

Also, the other factors can affect weed diversity in fields such as agronomy management, and tillage, for example, Tillage reduced root penetration and resistance of weeds and growth and development of them [33]. Nichols et al. [21] demonstrated that decreased tillage affected weed kind, as it may cause that dicotyledons replace with annual and perennial monocotyledons.

By examining the beta diversity of weed communities in the fields of organic and conventional crops in two different areas, Armengot et al. [5] suggested that the combination of

weed species in the two studied areas was very different, so that only 18 species out of 135 species identified between the two regions were similar and common. They stated that in both regions, the diversity of alpha, beta and gamma of all functional groups was higher in organic farms than conventional farms.

Ecological services such as pollination and pest control system have major benefits for farmers. However, in the current century, intensive agriculture has led to the loss of significant biodiversity. Krauss et al. [18] with comparison of organic and conventional systems reported that the species richness of plants and pollinating species in the studied organic farms were five and twenty times more than conventional farms, but the cereal aphid population on organic farms was one- fifth of the conventional farms.

4. Conclusion

In general, weeds are important organisms in agroecosystems for biodiversity, Ecosystem function and food security.Weeds were used as shelter and food for natural predators and other benefit organisms. However they cause reducing of crop yield through competition with these crops.Weed diversity is not similar in different regions and can alter through climate and agricultural operations such as fertilizers, planting date, rotation and cropping pattern. Biodiversity and ecosystem services can be restored and maintained with the help of agricultural-environmental programs. One of the most successful programs in this regard is organic farming. Often, in organic farming systems compared with conventional systems, the weed biomass reduce, but the diversity of functional groups increase [18].

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