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Weed flora survey of Tabriz wheat (*Triticum aestivum* L.) fields

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Key words: Disturbing weeds, Dominant plant families, Wheat, Relative dominance, Weed vegetation.

Abstract

In order to recognize, identify and determine the relative dominance of weed species distributed in wheat fields of Tabriz county-Iran, a total 118 weed species belonging to 24 plant family were observed. Ermopyrum bonaepartis (Spreng.) Nevski, Acroptilon repens (L.) DC., Cardria Draba (L.) Desv., Chenopodium album L., Polygonum aviculare L., and Convolvulus arvensis L. with relative dominance (RD) index equal 30, 20.2, 19.1, 18.1, 17.5, and 17.5 respectively were dominant weed species. Poaceae, Brassicaceae and Asteraceae with Family Dominance Index (FDI) equal 63.08, 45.54, and 45.46 were dominant plant families observed in wheat fields. A. repens (L.) DC., C. Draba (L.) Desv., C. album L., P. aviculare L., and C. arvensis L. with frequency level 82.2, 75.6, 62.2, 64.4 and 64.4 respectively were the main disturbing weeds prior to harvesting wheat in Tabriz county. Eighty-nine percent of weeds were below average, because they founded below thirty percent of wheat fields. However, nearly four percent of weeds were assertive and distributed in more than sixty percent of wheat fields. So, the revised management procedure about these weeds in different districts of this county is very important.

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Introduction

Weeds due to their distribution, fast growing ability and the high level of reproduction are the important barriers in control of this natural enemy in the wheat fields. These unwanted plants in our fields cause reduction in quality and quantity of crops. The damage caused by weeds through the loss of nutrients and water is a major cause of interest to the growers (Memon, 2004). Weeds expended three to four times more than nitrogen, potassium and magnesium than crop (Schwerzel and Thomas, 1971).

The ability of weeds to compete successfully with crops for light, water, and nutrients depends timing of weed emergence in relation to crop emergence, the growth form of the weed, and the density of weed present in the crop (Memon, 2004). According to Khalaghani (2007) report, average damages coming from the pretense of weeds in wheat fields in Iran, was about 23 percent.

Weed flora assessing is useful for determining relative importance of weed species in farmlands (Thomas, 1985; Frick and Thomas, 1992; McCully *et al.,* 1991). Various studies have been done about weed flora in annual crops in many countries like Iran (Minbashi *et al,.* 2008; Hassannejad 2011; Hassannejad and Porheidar Ghafarbi, 2012 and 2013; Nazer Kakhki *et al.,* 2013), Bulgaria (Milanova *et al.,* 2009), Denmark (Andreasen and Stryhn, 2008; Andreasen and Skovgaard, 2009), France (Fried *et al.* 2008), Hungray (Novak *et al.,* 2010), the UK (Potts *et al.,* 2010) and the US (Conn *et al.,* 2011). Tastan and Erics (1994), investigated weed distribution and density in wheat fields of four provinces of central Anatolia. Sinzar (1996), reported weed communities of wheat in Kosmaj region- Yugoslavia. Abusteit *et al.* (1998) surveyed the composition and relative abundance of the weed flora of wheat in northern Egypt. Salonen *et al.* (2001) determined weed species in grown spring cereals including wheat of southern and central Finland.

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. So, identifying and distinguish of these uninvited guests is useful for reduce their distribution and dominance in our fields. There is a little information available about weed flora and relative dominance weed species distributed in Tabriz county wheat fields. Thus the aim of this study was to weed flora survey and determine the relative dominance of weeds in natural conditions in wheat fields at Tabriz County (northwest of Iran).

Materials and methods

Survey of area

Tabriz county is located between 350 7´ latitude and 46 o 26´ longitudes. This county has cold semi-aried climates, with average annual rainfall equal 289 mm, mean temperature 12.50, average annual sunshine hours 2794.3 (Fig. 1.).

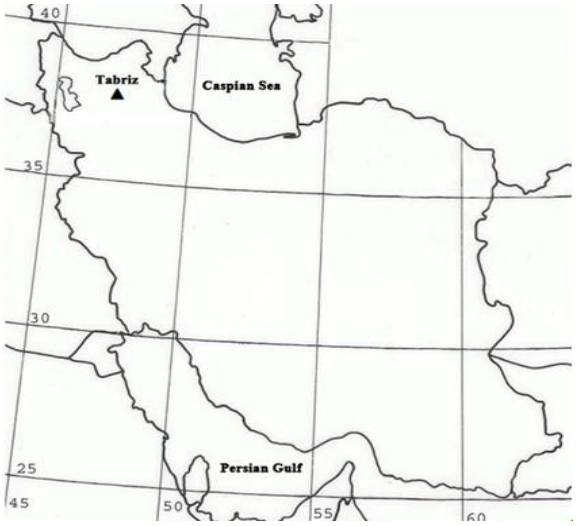

Fig. 1. Tabriz county in northwest of Iran.

Data sampling

Weed samplings were performed from 42 wheat fields in 14 districts of Tabriz County in 2012. Time of sampling was started by beginning of stem elongation until the end of heading stages of wheat (Minbashi et al., 2008). Longitude, latitude, and elevation information of each field was recorded using the GPS. Weed sampling method in each field was according to the methodology defined by Thomas (1985), so that 20 quadrates (0.25 m2) were randomly placed along a "W" pattern (5 quadrates in each line of this pattern).

All weed species in each quadrat were coded and recorded (density and cover percentage) for subsequent data entry and analysis. The collected

weed specimens were catalogued, pressed, and identified with the help of *flora Iranica* (Rechinger, 1963-2007) and Turkey (Davis, 1965-85).

The position of weed species in order to their frequency is proposed as assertive (observed in more than 60% of fields), ascendant (observed in 50-60% of fields), average (observed in 30-49% of fields), and below average (observed in less than 30% of fields) (Memon, 2004).

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:

$$(1)\quad \text{Relative Diversity} = \frac{\text{Number of species in family}}{\text{Total number of species}} \times 100$$

$$(2)\quad \text{Relative Density} = \frac{\text{Number of individuals in family}}{\text{Total number of individuals}} \times 100$$

$$(3)\text{Relative Coverage} = \frac{\text{Coverage of individuals in family}}{\text{Total coverage of individuals}} \times 100$$

$$(4)\ \text{FDI} = \text{Relative Diversity} + \text{Relative Density} + \text{Relative Co}$$

Estimation of relative dominance (RD) index

The data were summarized in relative dominance (RD) index used four measures (relative frequency, relative uniformity, relative density, and relative coverage) as outlined by Hassannejad and Porheidar-Ghafarbi (2012). The frequency (F) value was the percentage of fields infested by a species k, at least in one quadrate per field. This measure is an estimate of the geographical extent of the infestation in the field (formula 5), where Fk 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.

$$(5)\quad Fk = \frac{\sum_1^n Yi}{n} \times 100$$

The relative frequency for species k (RF) was calculated as follow (formula 6):

$$(6)\ (RF) = \frac{\text{frequency value of species k}}{\text{sum of frequency values for all species}} \times 100$$

The field uniformity (U) value indicates the percentage of quadrates infested by a species. This measure is an estimate of the area infested by weed species (formula 7), where Uk is the field uniformity value of species k, Xij is the presence (1) or absence (0) of species k in quadrat j in field i, and n is the number of fields surveyed.

$$(7)\ Uk = \frac{\sum_1^n Xij}{n} \times 100$$

The relative uniformity for species k (RU) was calculated as follow (formula 8):

$$(8)(RU) = \frac{\text{field uniformity value of species k}}{\text{sum of field uniformity values for all species}} \times 100$$

The density (D) value was calculated as the mean number of plant per m² for each weed species, expressed over all fields surveyed (formula 9), where Dki is the density (individuals per m²) of species k in fields i, Zj is the number of plants of each species in quadrat j (each quadrat is 0.25 m²), and n is the number of fields surveyed. This measure indicated the seriousness of the weeds in fields in which they occurred.

$$(9)Dki = \frac{\sum Zj}{n} \times 4$$

The mean field density (MD) value indicates the number of plants per m² for each species averaged over all fields sampled (formula 10), where MDk is the mean field density of species k, Dki is the density (numbers per m²) of species k in field i, and n is the number of fields surveyed. This measure was used to magnitude of the infestation in fields surveyed.

$$(10)MDk = \frac{\sum_1^n Dki}{n}$$

The relative mean field density for species k (RMD) was calculated as follow (formula 11):

$$(11)(RMD) = \frac{\text{mean field density value of species k}}{\text{sum of mean field density values for all species}} \times 100$$

The coverage (Cki) value indicates the vertical projection on the ground, based on visual estimates (formula 12), where Cki is the coverage of species k in field i, Zj is the coverage of species k in quadrate j, and n is the number of fields surveyed. For visual estimates, some count "empty space" within a clump and others do not.

$$(12)\text{Cki} = \frac{\sum \text{Zj}}{\text{n}}$$

The mean coverage (MCki) value indicates the coverage of plants per m^2 for each species averaged over fields sampled (formula 13), where MCki is the mean field coverage of weed species k, Cki is the coverage of species k in field i, and n is the number of fields surveyed.

$$(13)\text{MCki} = \frac{\sum \text{Cki}}{\text{n}}$$

The relative mean field coverage for species k (RC) was calculated as follow (formula 14):

$$(14)(\text{RC}) = \frac{\text{mean field coverage value of species k}}{\text{sum of mean field coverage values for all species}} \times 100$$

In order to summarize the relative dominance (RD) of a species as the final quantitative measures, relative form of four of the above measures were combined into relative dominance (RD) index (formula 15):

$$(15) \quad \text{RD} = \text{RF} + \text{RU} + \text{RMD} + \text{RMC}$$

Results and discussion

Weed flora of alfalfa fields

A total 118 weed species belonging to 25 plant families were recorded in wheat fields of Tabriz county (Tab. 1). Regarding their plant form, 77.12% of weed species were dicotyledonous, and 22.88% of them were monocotyledonous. According to Hyvonen *et al.* (2003), low-input cultivations were expected to favor the species numbers and abundance of dicotyledonous. Regarding weed species life cycle, 78.81, 18.64, and 2.54% were annual, perennial, and biennial respectively. According to Gomma (2012), the 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. Radosvich and Holt (1984) reported that frequently soil disturbance can be dominance of annual weeds in the fields.

Between 118 weed species, 4.24, 0, 6.78, and 89% of weeds were found assertive (founded over 60% of fields), ascendant (frequency 50-60%), average (frequency 30-49%), and below average (founded in less than 30% of fields). *A. repens* (L.) DC., *C. draba* (L.) Desv.,*P. aviculare* L., *C. arvensis* L., and *C. album* L. with frequency level 82.22, 75.56, 64.44, 64.44, and 62.22 percent, respectively were founded frequently in Tabriz wheat fields (Tab. 2). These weed species were the most important disturbing weeds prior to harvesting in this county wheat fields like Khodabandeh, Tarom and some other counties of Zanjan province that reported in Nazer Kakhki *et al* (2013) research. We need an especial attention to management of these assertive and disturbing species prior or after harvesting to reduce their densities for next years. These weeds were distributed in different districts of Tabriz county and were adopted to farmers management methods. High frequency percentage of some weeds suggests the wider presence of such species in terms of areas (Memon 2004).

Main plant families according to family dominance index (FDI)

Dominant plant families were Poaceae, Brassicaceae, and Asteraceae with 63.08, 45.54, and 45.46 FDI, respectively (Tab.1). The maximum richness, relative diversity and relative coverage were found in Asteraceae family (Tab. 1). However, Poaceae with highest mean density was located in top order by FDI. Although Brassicaceae compare to Asteraceae had minimum richness and relative diversity, but due to had a high density and vegetation coverage, was 2th important family infested in Tabriz wheat fields (Tab. 1). Convolvulaceae family with minimum richness (only with one species; *C. arvensis* L.), was located between ten dominant families in wheat fields according to FDI score. Presence of *C. arvensis* L. as a noxious weed species in Convolvulaceae family caused that this get top order in ranking compared with Polygonaceae, Papaveraceae, Euphorbiaceae,

and etc (Table 1.). So, the highest amount of FDI for one family compares others can be due to well adaptability of it's members in dominant environmentally conditions.

Table 1. Order, Family Name, Richness, Relative Diversity, Relative Density, Relative Coverage, and Family Dominance Index (FDI) of weeds in wheat fields at Tabriz county.

Order	Family Name	Richness	Relative Diversity	Relative Density	Relative Coverage	FDI
1	Poaceae	23	19.5	31.3	12.3	63.08
2	Brassicaceae	14	11.9	14.7	19	45.54
3	Asteraceae	24	20.3	12.5	12.6	45.46
4	Boraginaceae	6	5.08	3.81	13.7	22.57
5	Chenopodiaceae	6	5.08	9.69	6.41	21.19
6	Ranunculaceae	4	3.39	4.33	10.7	18.41
7	Apiaceae	6	5.08	8.56	3.08	16.72
8	Papilionaceae	7	5.93	1.96	3.84	11.72
9	Convolvulaceae	1	0.85	3.75	5.13	9.731
10	Polygonaceae	2	1.69	5.05	2.05	8.794
11	Papaverraceae	4	3.39	0.82	4.33	8.542
12	Euphorbiaceae	5	4.24	0.27	0.29	4.802
13	Fumariaceae	1	0.85	1.8	1.86	4.51
14	Caryophyllaceae	3	2.54	0.36	1.21	4.109
15	Scrophulariaceae	2	1.69	0.19	0.7	2.578
16	Zygophyllaceae	1	0.85	0.01	1.16	2.009
17	Aliaceae	2	1.69	0.11	0.04	1.849
18	Liliaceae	1	0.85	0.42	0.31	1.57
19	Labiatae	1	0.85	0.01	0.69	1.547
20	Plantaginaceae	1	0.85	0.01	0.37	1.221
21	Malvaceae	1	0.85	0.11	0.19	1.151
22	Rubiaceae	1	0.85	0.12	0.02	0.988
23	Amaryllidaceae	1	0.85	0.1	0.03	0.976
24	Amaranthaceae	1	0.85	0.07	0.01	0.93
	Total	118	100	100	100	300

Weed species ranking by relative dominance (RD)

Results of this study showed that *E. bonaepatis* (Spreng.) Nevski, *A. repens* (L.) DC., *C. Draba* (L.) Desv, *C. album* L., *P. aviculare* L., and *C. arvensis* L. with RD equal 30.01, 20.23, 19.1, 18.09, 17.51, and 17.48, respectively were dominant weed species in wheat fields according to RD score (Tab. 2). High share of these six weed species from RD total (122:400) indicated that they are troublesome and hard controlling weeds in Tabriz wheat fields.

According to Hassannejad and Porheidar-Ghafarbi (2013), Tabriz farmers relatively do not attention to herbicides usage in their fields or their information about herbicide application is not sufficient. Observation of *C. album* L. with frequency level 62.22 and uniformity value 21.5, as fourth dominant weed species in Tabriz wheat fields, indicated that the application of MCPA+2,4-D in Tabriz wheat fields is not correct. Because Thomas *et al.* (1994) recorded that this weed is susceptible to MCPA+2,4-D. Weed species such as *A. repens* (L.) DC., *P. aviculare* L., and *C. arvensis* L. are tolerant weeds to 2,4-D + MCPA (Hassannejad and Porheidar-Ghafarbi, 2013). Furthermore, these weeds as troublesome species have the adaptability to flourish under a wide range of conditions (Hassannejad, 2011). Tolerance of these frequently weeds in different niches is an important factor in their success. *E. bonaepartis* (Spreng.) Nevski as dominance weed specie observed in wheat fields at Tabriz county, is more demanding and the interaction of particular features of the environment with its requirements results in weed communities characteristics of particular habitats. So that this weed only was observed in 33.33 percent of wheat fields (Tab. 1). This weed with highest uniformity and mean density in distribution has more competitive or reproductive ability than other weeds. Thus, highest values for uniformity of this weed indicated it's tolerant to management's methods (Hassannejad and Porheidar Ghafarbi, 2013).

Table 2. Order, Scientific Name, Family Name, Habit, Frequency (F), Relative Frequency (RF), Uniformity (U), Relative Uniformity (RU), Mean density (MD), Relative Mean Density (RMD), Mean coverage (MC), Relative Mean Coverage (RMC), and Relative Dominance (RD) of weeds in wheat fields at Tabriz county.

Order	Scientific Name	Family Name	F	FR	MU	UR	MD	MDR	MC	MCR	RD
1	*Eremopyrum Bonaepartis* (Spreng.) Nevski	Poaceae	33.3	2.36	70.1	15	2.08	12.6	0.02	0.05	30
2	*Acroptilon repens* (L.) DC.	Asteraceae	82.2	5.83	30.6	6.56	1.29	7.76	0.03	0.08	20.2
3	*Cardaria Draba* (L.) Desv.	Brassicaceae	75.6	5.35	22.6	4.84	0.56	3.37	1.7	5.53	19.1
4	*Chenopodium album* L.	Chenopodiaceae	62.2	4.41	21.5	4.61	0.88	5.32	1.15	3.75	18.1
5	*Polygonum aviculare* L.	Polygonaceae	64.4	4.57	29	6.23	0.83	4.98	0.53	1.73	17.5
6	*Convolvulus arvensis* L.	Convolvulaceae	64.4	4.57	18.8	4.03	0.62	3.75	1.58	5.13	17.5
7	*Adonis aestivalis* L.	Rununclaceae	31.1	2.2	6.45	1.38	0.07	0.42	2.88	9.36	13.4
8	*Alopecurus myosuroides* Hudson	Poaceae	40	2.83	16.8	3.6	1.06	6.38	0.07	0.22	13
9	*Lithospermum sibthorpianum*	Boraginaceae	13.3	0.94	1.91	0.41	0.07	0.42	2.87	9.35	11.1
10	*Ammi visnaga* (L.)Lam.	Umbelliferae	2.22	0.16	1.07	0.23	1.33	8.03	0.01	0.04	8.45
11	*Centaurea depressa* M. B.	Asteraceae	28.9	2.05	12.7	2.72	0.36	2.17	0.42	1.37	8.31
12	*Fumria vaillantii* Loise.	Fumariaceae	42.2	2.99	6.31	1.35	0.3	1.8	0.57	1.86	8.01
13	*Goldbachia laevigata* (M. B.) DC.	Brassicaceae	33.3	2.36	7.79	1.67	0.25	1.51	0.62	2.02	7.56
14	*Conringia orientalis* (L.) Andrz.	Brassicaceae	13.3	0.94	4.62	0.99	0.71	4.26	0.3	0.99	7.18

15	*Salsola kali* L.	Chenopodiaceae	33.3	2.36	6.55	1.4	0.34	2.04	0.28	0.91	6.71
16	*Bromus japonicum* (Thunb.)	Poaceae	13.3	0.94	1.91	0.41	0.3	1.79	0.9	2.91	6.05
17	*Hordeum murinum* L.	Poaceae	17.8	1.26	4.05	0.87	0.39	2.35	0.45	1.47	5.95
18	*Ceratocarpus arenarius* L.	Chenopodiaceae	15.6	1.1	13.5	2.9	0.26	1.55	0.04	0.12	5.67
19	*Alhagi persarum* Boiss. & Buhse.	Papilionaceae	40	2.83	9.83	2.11	0.09	0.52	0.04	0.13	5.59
20	*Consolida orientalis* (Gay.) Schrod.	Ranunculaceae	8.89	0.63	4.12	0.88	0.64	3.86	0.01	0.02	5.4
21	*Lithospermum arvensis* L.	Boraginaceae	2.22	0.16	6	1.29	0.3	1.8	0.57	1.86	5.11
22	*Descurainia Sophia* (L.) Schur	Brassicaceae	28.9	2.05	5.12	1.1	0.14	0.83	0.35	1.13	5.1
23	*Boissera squrrosa* Banks. Soland.	Poaceae	2.22	0.16	0.71	0.15	0.67	4.04	0.14	0.44	4.8
24	*Sisymbrium altissimum*	Brassicaceae	2.22	0.16	7	1.5	0.34	2.04	0.28	0.91	4.61
25	*Euclidium tenuissimum* (Pall.)	Brassicaceae	6.67	0.47	0.95	0.2	0.03	0.18	0.93	3.03	3.88
26	*Alyssum linifolium* Steph. ex Willd.	Brassicaceae	13.3	0.94	11.3	2.43	0.06	0.34	0.04	0.13	3.84
27	*Rapistrum rugosum* (L.) All.	Brassicaceae	15.6	1.1	3.1	0.66	0.11	0.67	0.42	1.38	3.82
28	*Ceratocephalus falcalus* (L.)Pers.	Ranunculaceae	13.3	0.94	8.36	1.79	0.01	0.03	0.31	1	3.77

29	*Aegilops cylindrica* Hos.	Poaceae	11.1	0.79	2.14	0.46	0.39	2.34	0.05	0.16	3.75
30	*Xanthium spinosum* L.	Asteraceae	8.89	0.63	0.24	0.05	0	0.01	0.93	3.01	3.71
31	*Silene conoidea* L.	Caryophyllaceae	22.2	1.57	3.02	0.65	0.03	0.19	0.36	1.17	3.59
32	*Kochia scoparia* (L.) Schrad.	Chenopodiaceae	35.6	2.52	1.12	0.24	0.05	0.27	0.14	0.44	3.47
33	*Tragopogon graminifolius* DC.	Asteraceae	24.4	1.73	4.21	0.9	0.06	0.34	0.15	0.48	3.46
34	*Asperugo procombens* L.	Boraginaceae	20	1.42	2.62	0.56	0.21	1.28	0.05	0.17	3.43
35	*Lathyrus sativus* L.	Papilionaceae	2.22	0.16	5	1.07	0.14	0.83	0.35	1.13	3.18
36	*Alium atreviolaceum* Boiss.	Liliaceae	24.4	1.73	3.1	0.66	0.07	0.42	0.09	0.31	3.12
37	*Cirsium arvense* (L.) Scop.	Asteraceae	22.2	1.57	3.57	0.77	0.06	0.38	0.02	0.05	2.77
38	*Scorzonera calyculata* Boiss.	Asteraceae	17.8	1.26	2.38	0.51	0.05	0.31	0.11	0.37	2.45
39	*Lactuca serriola* L.	Asteraceae	17.8	1.26	3.95	0.85	0.02	0.1	0.06	0.19	2.4
40	*Carthamus oxyacantha* M. B.	Asteraceae	17.8	1.26	4.38	0.94	0.03	0.15	0.01	0.03	2.38
41	*Papaver dubium* L.	Papaverraceae	4.44	0.31	2	0.43	0.01	0.08	0.46	1.48	2.31
42	*Koelpinia linearis* Pall.	Asteraceae	11.1	0.79	0.36	0.08	0.01	0.06	0.39	1.27	2.19
43	*Chaerophyllum crinitum* Boiss.	Papilionaceae	2.22	0.16	2	0.43	0.01	0.08	0.46	1.48	2.15
44	*Eremopyrum*	Poaceae	2.22	0.16	2	0.43	0.01	0.08	0.46	1.48	2.15

	orientalis										
45	*Hypecoum pendulum* L.	Papaverraceae	2.22	0.16	2	0.43	0.01	0.08	0.46	1.48	2.15
46	*Neslia apiculata* Fisch. et Mey.	Brassicaceae	2.22	0.16	2	0.43	0.01	0.08	0.46	1.48	2.15
47	*Nonnea caspica* (Willd.) G. Don	Boraginaceae	2.22	0.16	2	0.43	0.01	0.08	0.46	1.48	2.15
48	*Scariola orientalis* (Boiss.)Sojak	Asteraceae	2.22	0.16	2	0.43	0.01	0.08	0.46	1.48	2.15
49	*Malcolmia ofricana* (L.) R. Br.	Brassicaceae	8.89	0.63	2.74	0.59	0.15	0.88	0	0.01	2.1
50	*Anchusa italica* Retz.	Boraginaceae	8.89	0.63	2.55	0.55	0.03	0.18	0.22	0.72	2.07
51	*Suaeda maritima* (L.) Dumort	Chenopodiaceae	4.44	0.31	4	0.86	0.06	0.34	0.15	0.48	1.99
52	*Phragmites australis* (Cav.) Trin. exSteud	Poaceae	8.89	0.63	0.83	0.18	0.02	0.13	0.3	0.99	1.92
53	*Taraxacum syriacum* Boiss	Asteraceae	17.8	1.26	1.31	0.28	0.03	0.16	0.07	0.21	1.91
54	*Euphorbia heteradenia* Jaub. & Spach.	Euphorbiaceae	11.1	0.79	3.83	0.82	0	0.01	0.05	0.16	1.78
55	*Bupleurum rotundifolium*	Umbelliferae	2.22	0.16	0.24	0.05	0.01	0.08	0.46	1.48	1.77
56	*Daucus carota* L.	Umbelliferae	11.1	0.79	2.5	0.54	0.03	0.18	0.08	0.26	1.77
57	*Papaver rhoeas* L.	Papaverraceae	11.1	0.79	0.71	0.15	0.01	0.08	0.21	0.68	1.7
58	*Astragallus onobrychis*	Papilionaceae	2.22	0.16	3	0.64	0.03	0.18	0.22	0.72	1.69

59	*Gallium tricornutum* Dandy.	Rubiaceae	8.89	0.63	4.12	0.88	0.02	0.12	0.01	0.02	1.65
60	*Secale cereale* L.	Poaceae	2.22	0.16	1	0.21	0	0.01	0.38	1.25	1.62
61	*Sinapis arvensis* L.	Brassicaceae	2.22	0.16	1	0.21	0	0.01	0.38	1.25	1.62
62	*Alium ampeloprasum* L.	Aliaceae	15.6	1.1	2.14	0.46	0	0.02	0	0	1.59
63	*Cnicus benedictus* L.	Asteraceae	4.44	0.31	2.12	0.45	0.01	0.04	0.24	0.77	1.57
64	*Chorispora tenella* (Pall.) Dc.	Brassicaceae	11.1	0.79	1.95	0.42	0.03	0.15	0.06	0.2	1.55
65	*Melilotus officinalis* (L.) Desr.	Papilionaceae	6.67	0.47	3.95	0.85	0.03	0.19	0.01	0.02	1.52
66	*Chondrilla juncea* L.	Asteraceae	11.1	0.79	2.48	0.53	0.01	0.04	0.04	0.13	1.48
67	*Gypsophila leioclada* Rech.	Caryophyllaceae	11.1	0.79	2.98	0.64	0.01	0.04	0.01	0.02	1.48
68	*Atriplex leucoclada* (Boiss.) Aellen	Chenopodiaceae	2.22	0.16	2	0.43	0.03	0.18	0.22	0.72	1.48
69	*Bromus tectorum* L.	Poaceae	2.22	0.16	2	0.43	0.03	0.18	0.22	0.72	1.48
70	*Roemeria hybrida* (L.) DC.	Papaverraceae	2.22	0.16	0.12	0.03	0.1	0.57	0.21	0.69	1.45
71	*Scandix stellata* Banks. Soland.	Umbelliferae	2.22	0.16	0.12	0.03	0	0.01	0.38	1.25	1.44
72	*Zygophyllum fabago* L.	Zygophyllaceae	2.22	0.16	0.36	0.08	0	0.01	0.36	1.16	1.4
73	*Cousunia calocephala* Jub. Spach.	Asteraceae	2.22	0.16	0.12	0.03	0.04	0.23	0.28	0.92	1.33

74	*Euphorbia boissieriana* (Woronow) Prokh.	Euphorbiaceae	11.1	0.79	1.67	0.36	0.02	0.1	0.01	0.02	1.27
75	*Alyssum desertorum* Stapf	Brassicaceae	2.22	0.16	1	0.21	0.03	0.18	0.22	0.72	1.26
76	*Euclidium syriacum* (L.) R. Br.	Brassicaceae	2.22	0.16	3	0.64	0.03	0.18	0.08	0.26	1.24
77	*Poa timoleontis* Helder.& Boiss.	Poaceae	4.44	0.31	2.98	0.64	0.01	0.07	0.06	0.18	1.2
78	*Centaura iberica* Terv.	Asteraceae	6.67	0.47	1.07	0.23	0.03	0.18	0.07	0.24	1.12
79	*Veronica persica* Poir.	Scrophulariaceae	11.1	0.79	0.24	0.05	0.03	0.18	0.03	0.1	1.12
80	*Senecio glaucus* L.	Asteraceae	2.22	0.16	1	0.21	0	0.01	0.21	0.69	1.07
81	*Trifolium repens* L.	Papilionaceae	4.44	0.31	1.31	0.28	0.01	0.06	0.11	0.34	1
82	*Poa bulbosa* L.	Poaceae	8.89	0.63	0.24	0.05	0.03	0.19	0.03	0.1	0.97
83	*Stellaria pallida* (Dumort.)Pire.	Poaceae	4.44	0.31	0.6	0.13	0.04	0.22	0.1	0.31	0.97
84	*Aeluropus lithoralis* (Gouan.)Parl.	Poaceae	2.22	0.16	2.86	0.61	0.01	0.07	0.03	0.1	0.93
85	*Agropyrum intermedium* (Host.) P. Beauv.	Poaceae	2.22	0.16	2.86	0.61	0.01	0.07	0.03	0.1	0.93
86	*Bormus danthoniae* var. *lanuginosus* (Trin.)	Poaceae	2.22	0.16	0.71	0.15	0.03	0.18	0.14	0.44	0.93
87	*Setaria viridis* (L.) P. Beauv	Poaceae	2.22	0.16	0.36	0.08	0.01	0.04	0.2	0.65	0.92

88	*Salvia nemerosa* L.	Labiatae	2.22	0.16	0.12	0.03	0	0.01	0.21	0.69	0.88
89	*Agropyrum repens* (L.) P. Beauv.	Poaceae	4.67	0.33	1.19	0.26	0.03	0.19	0.03	0.09	0.87
90	*Malva neglecta* (Wallr.)	Malvaceae	6.67	0.47	0.36	0.08	0.02	0.11	0.06	0.19	0.85
91	*Turgenia latifolia* (L.) Hoffm.	Umbelliferae	6.67	0.47	0.71	0.15	0.03	0.18	0.01	0.05	0.85
92	*Eryngium billardiere* F.Delaroche.	Umbelliferae	8.89	0.63	0.6	0.13	0.01	0.08	0	0.01	0.85
93	*Ranunculus arvensis* L.	Ranunculaceae	4.44	0.31	0.95	0.2	0	0.01	0.1	0.31	0.84
94	*Amaranthus retroflexus* L.	Amaranthaceae	8.89	0.63	0.48	0.1	0.01	0.07	0	0.01	0.81
95	*Verbascum thapsus*	Scrophulariaceae	2.22	0.16	0.12	0.03	0	0.01	0.18	0.6	0.78
96	*Rumex abtusifolium* L.	Polygonaceae	4.44	0.31	0.24	0.05	0.01	0.07	0.1	0.31	0.75
97	*Onopordon leptoleptoepis* DC. Rech.	Asteraceae	8.89	0.63	0.36	0.08	0.01	0.03	0	0	0.74
98	*Centaura virgata* (Lam.)	Asteraceae	6.67	0.47	0.36	0.08	0	0.02	0.04	0.13	0.7
99	*Xanyhium strumarium* L.	Asteraceae	2.22	0.16	0.41	0.09	0.02	0.14	0.09	0.31	0.7
100	*Cerpis foetida* L.	Asteraceae	2.22	0.16	0.12	0.03	0	0.01	0.14	0.47	0.65
101	*Sorghum halepense* (L.) Pers.	Poaceae	2.22	0.16	0.29	0.06	0.03	0.15	0.08	0.26	0.63
102	*Vaccaria pyramidata* Medi.	Caryophyllaceae	4.44	0.31	0.71	0.15	0.02	0.12	0.01	0.02	0.61

103	*Plantago atrata* Hoppe.	Plantaginaceae	2.22	0.16	0.12	0.03	0	0.01	0.11	0.37	0.56
104	*Euphorbia chrirdenia* Boiss. & Hohen.	Euphorbiaceae	4.44	0.31	0.48	0.1	0.02	0.1	0.01	0.03	0.55
105	*Bellevalia pycantha* (C.Koch) A. Los.	Aliaceae	2.22	0.16	1.07	0.23	0.02	0.09	0.01	0.04	0.51
106	*Sclerochloa woronowii* (Hack.)Tzvel.	Poaceae	2.22	0.16	0.95	0.2	0.01	0.04	0.03	0.11	0.51
107	*Ixiolirion tataricum* (pall.) Herb.	Amaryllidaceae	2.22	0.16	1	0.21	0.02	0.1	0.01	0.03	0.5
108	*Lolium persicum* Boiss& Hohen.	Poaceae	2.22	0.16	1	0.21	0.02	0.1	0.01	0.03	0.5
109	*Medicago monantha* C. A. Meyer	Papilionaceae	2.22	0.16	1	0.21	0.02	0.1	0.01	0.03	0.5
110	*Cynodon dactylon* (L.) pers.	Poaceae	4.44	0.31	0.36	0.08	0.01	0.06	0.01	0.02	0.47
111	*Digitaria sanguinalis* L. Scop	Poaceae	2.22	0.16	0.12	0.03	0.01	0.03	0.08	0.26	0.47
112	*Achillea millefolium* L.	Asteraceae	2.22	0.16	0.12	0.03	0.01	0.07	0.06	0.2	0.45
113	*Picnomon acarna* (L.) Cass.	Asteraceae	4.44	0.31	0.36	0.08	0.01	0.05	0	0	0.44
114	*Achilla micrantha* Wild.	Asteraceae	2.22	0.16	0.12	0.03	0.01	0.04	0.06	0.19	0.41
115	*Euphorbia helioscopia* L.	Euphorbiaceae	2.22	0.16	0.95	0.2	0.01	0.03	0	0	0.4
116	*Nonnea pulla* (L.) DC.	Boraginaceae	2.22	0.16	0.24	0.05	0.01	0.05	0.03	0.1	0.36

117	*Achilea bibersteinii* Afar.	Asteraceae	2.22	0.16	0.24	0.05	0.02	0.14	0	0.01	0.36
118	*Plantago lanceolata* L.	Euphorbiaceae	2.22	0.16	0.24	0.05	0.01	0.03	0.03	0.08	0.32
	Total		1411	100	466	100	16.6	100	30.7	100	400

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