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Weed Flora of Vineyards in Diyarbakır Province, Turkey

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ABSTRACT

Background: Viticulture occupies an important place in agricultural production of Diyarbakır province, Turkey. However, weeds significantly impair the productivity of vineyards in the province. The knowledge of weed flora of a particular region is crucial to develop region-specific weed management strategies.

Methods: This study was carried out to determine the weed species, their densities and frequency of occurrence in 78 vineyards of 13 districts in Diyarbakır province. Exploratory surveys were conducted to record the occurrence, density and coverage area of weed species. A 1×1 m quadrate was used, which was randomly placed in vineyards and weed species falling within the quadrate were noted.

Results: A total 165 weed species and 128 taxa belonging to 35 botanical families (1 parasitic, 16 monocotyledons and 18 dicotyledons) were identified from the surveyed area. The weed species' density over the whole province was 91 weeds m^{-2}. *Avena sterilis* L. was the most widespread weed with the highest density (9.93 plants m^{-2}) in the surveyed area followed by *Fumaria asepale* Boiss. (7.18), *Galium tricornutum* (4.85), *Ranunculus arvensis* (3.82), *Silene aegyptiaca* (3.70), *Bromus sterilis* (3.64) *Lamium purpureum* (3.58), *Hordeum spontaneum* (3.35), *Anthemis* sp. (3.07), *Crepis alpina* (2.94), *Thlaspi perfoliatum* (2.91), *Alopecurus myosuroides* (2.81), *Bongardia chrysogonum* (2.80), *Scandix pecten-veneris* (2.24), *Cynodon dactylon* (1.71), *Hypecoum procumbens* (1.69), *Lolium perenne* (1.41), *Sorghum halepense* (1.33), *Sinapis arvensis* (1.24), *Buglossoides arvense* (1.22), *Daucus carota* (1.21), *Trifolium nigrescens* (1.21), *Vicia hybrida* (1.05), *Senecio vernalis* (1.04) and *Ornithogalum narbonense* (1.02). The most prevalent weed were *L. purpureum* (66.68%), *Papaver* sp. (66.49%), *S. vernalis* (65.82%), *Anthemis* sp. (65.10%), *A. sterilis* (63.07%), *R. arvensis* (60.44%), *Convolvulus arvensis* (56.76%), *Carduus pycnocephalus* (55.79%), *G. tricornutum* (55.43%), *Fumaria asepale* (55.05%), *Crepis alpina* (54.08%), *Thlaspi perfoliatum* (51.95%) and *S. arvensis* (51.04%).

Key words: Density, Diyarbakır, Prevalence, Vineyards, Weed flora.

INTRODUCTION

Grapevine (*Vitis vinifera* L.) is an economically important species that has a very old historical background and is widely cultivated in the world. Numerous countries in the temperate zone, especially the USA, see grapes as the most valuable fruit. Similarly, grapes are regarded an important fruit in Turkey also (Çelik, 2013). Turkey, located in the most favorable climate zone for viticulture, has a rich vineyard gene potential with a very old and deep-rooted grapevine cultivation culture due to its location at the center of the geography where grapevine genes intersect and are cultured for the first time (Çelik *et al.,* 1998; Ağaoğlu, 1999; Ağaoğlu, 2002). Southeastern Anatolia is an important region in terms of its vineyard area and grape production. Simultaneously, the region has diverse genetic potential for cultured (*Vitis vinifera* ssp. *sativa*) and wild (*Vitis vinifera* ssp. *sylvestris*) grapevine species (Karataş *et al.,* 2015).

Turkey ranks fifth globally in terms of vineyard production area after Spain, France, Italy and China (FAO, 2014). Different countries have showed considerable variability in the production of grapes and similar trend has been observed in Turkey. Turkey ranks sixth in terms of grape production following China, Italy, USA, France and Spain.

Vineyards are the source of livelihood of many families because of their easy adaptability and production in almost every region. The producers dealing with viticulture sector in Turkey are generally ranked in the small business group (Anonymous, 2014). Viticulture not only plays an important role in the livelihood of the people in many parts of Turkey, but also provides significant value addition to the national economy. Grapes are consumed fresh and dry on one hand, while several products obtained by the processing of grapes such as wine, vinegar, molasses, sausage, fruit pulp *etc*. are used in human nutrition (Ergenoğlu and Tangolar, 2000). The production and yield of vineyards varies by years in the country (TÜİK, 2016). The vineyards were cultivated on 435.227 ha during 2016 in the country. Diyarbakır ranked fifth in the country in terms of area under vineyard cultivation, with 19963 ha under vineyard cultivation.

Disease, pests and weeds are among the most important factors affecting yield and quality in crop production (Özer *et al.,* 2001). The seeds of weeds arrive in

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vineyards with fertilizers and composts. The biggest damage caused by these weed seeds to the vineyards is suppression of vine growth through nutrient uptake by emerging weeds. Thus, vines remain smaller in size, which result in low grape yield (Oraman, 1972). Weeds are one of the most important factors limiting vineyard production. Several weed species can be recorded in the vineyards (Özer *et al.,* 2001; Altınci *et al.,* 2001; Topçu Altınci *et al.,* 2017; Özcan *et al.,* 2014; Özcan 2016). While the management of annual weeds is easy, it is very difficult to manage perennial weeds that reproduce by stolon and rhizome (Uzun, 2004). Weeds are competitive and hard-to-control plant (Uygur *et al.,* 1984) and decrease quality and quantity of the crops produced (Güncan, 1982; Yeğen, 1984; Çınar and Uygun, 1987). Weeds also serve as alternative hosts for pests and pathogens (Sönmez, 1976; Özaslan, 2011).

Weed community ecology studies are aimed at determining the distribution patterns of the weeds and factors affecting their distribution. The weed surveys are critical in determining the distribution patterns of the weed species at spatial and landscape scales (Önen and Özer, 2001; Özaslan *et al.,* 2016; Korres *et al.,* 2015a, b; Önen, 2020). The surveys allow the land managers, ecologists and weed scientists to determine the presence of weed species at landscape scales, distribution patterns of the weed species and possible factors shaping the distribution patterns (Rankins *et al.,* 2005; Önen, 2015). This knowledge, in turn can be used to develop effective weed management strategies at regional and landscape scales.

The current survey study was conducted to determine the weed flora prevailing in the vineyards of Diyarbakır province, Turkey. The results will improve overall knowledge of the weed flora and will contribute towards the development of alternative site-specific weed management approaches for vineyards in the province.

MATERIALS AND METHODS

Geographic location

Survey studies were carried out in 78 vineyards in thirteen districts of Diyarbakır province during 2017. Diyarbakır is located in the north of Mesopotamia in the central part of the South-eastern Anatolia Region. It is surrounded by Elazığ and Bingöl provinces from the north, Siirt and Muş from the east, Mardin from the south and Şanlıurfa, Adıyaman, Malatya from the west. The total area of the province is 15,362 km^2 and lies between 37.90 and 40.23 north latitudes and 40.37 and 41.20 east longitudes.

Survey studies

Survey studies in vineyards were carried out in April and May, when weed species could be easily identified. Vineyards were selected from different directions and locations representing the whole province. Vineyards were surveyed by randomly stopping at every 5 km. The surveys were carried out starting from 10 meters inside, avoiding the border effect as much as possible. A 1 m² quadrate was used for density determination. The number of quadrates to be placed was determined through preliminary observations. The quadrates to be placed within a vineyard were; 3 for vineyard smaller than 0.5 ha, 5 for 0.5-1.0 ha and 8 for > 1.0 ha (Bora and Karaca, 1970; Önen *et al.,* 2018). The whole plant of broad-leaved weed species were accepted as one plant, whereas each tiller was considered a plant for the narrow leaved weed species. The recorded data on coverage area and density from different sub-sampling sites of the same vineyard were averaged to get the coverage and density for whole vineyard. Herbaria of the recorded weed species were prepared and stored in the Department of Plant Protection, Dicle University Diyarbakır, Turkey. The recorded weed species were identified with the help of Flora of Turkey (Davis, 1965-1989).

The frequency of occurrence of the observed weed species was computed using following formula;

$$\text{Frequency of Occurrence (\%)} = \frac{N}{M} \times 100$$

Here,

N = Number of vineyards where particular species was observed.

M = Total number of vineyards surveyed.

For density (plant/m^2) calculation, arithmetic averages were taken by counting the weeds in the quadrate according to their types and species and density was calculated. The density was calculated by following Odum (1971) and Uygur (1991). The plants that having density smaller than 0.05 were denoted with letter A. The density of parasitic weed species was measured by following 1-5 (a-e) scale devised by Tepe *et al.* (1997). In the scale a = no parasitic plant found, b = low density (host plants are safe and no danger of yield loss), c = medium density (parasitic plant can be visually observed and loss started), d = high density (significant yield losses) and e = very high density (host plant died).

Surveyed sites

The geographic location of the surveyed vineyards was recorded with the help of GPS. The surveyed sites are represented in Fig 1.

RESULTS AND DISCUSSION

Twenty-five weed species had density >1 m^{-2} and these are presented in Table 1. The weed species having density > 3 plants m^{-2} in the province were; *Avena sterili*s L. (9.93), *Fumaria asepale* Boiss. (7.18), *Galium tricornutum* (4.85), *Ranunculus arvensis* (3.82), *Silene aegyptiaca* (3.70), *Bromus sterilis* (3.64), *Lamium purpureum* (3.58), *Hordeum spontaneum* (3.35) and *Anthemis* sp. (3.07). There were 13 species in the province which had >50% frequency of occurrence. These species were; *L. purpureum* (66.68%), *Papaver* sp. (66.49%), *S. vernalis* (65.82%), *Anthemis* sp. (65.10%), *A. sterilis* (63.07%), *R. arvensis* (60.44%), *Convolvulus arvensis* (56.76%), *Carduus pycnocephalus*

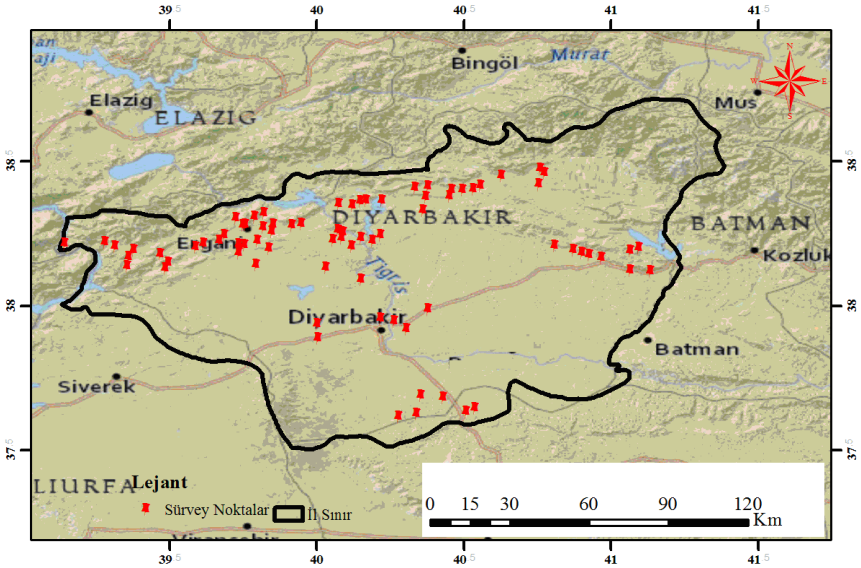


Fig 1: The locations of vineyards surveyed during the study.

(55.79), *G. tricornutum* (55.43%), *Fumaria asepale* (55.05%), *Crepis alpina* (54.08%), *Thlaspi perfoliatum* (51.95%) and *S. arvensis* (51.04%) (Table 1).

A total 165 weed species and 128 taxa belonging to 35 botanical families (1 parasitic, 16 monocotyledons and 18 dicotyledons) were identified from the surveyed area. The families represented by the highest number of weed species were; Asteraceae (24 species), Fabaceae (20 species), Poaceae (16 species), Brassicaceae (16 species), Apiaceae (14 species), Papaveraceae (9 species), Lamiaceae (7 species), Liliaceae (6 species) and Boraginaceae and Caryophyllaceae (5 species each). The remaining plant families were represented by 1-4 weed species. The weed density over the whole province was 91 plants m^{-2}. The families, Latin names, density in m^2 and frequency of occurrence of the recorded weed species is given in Table 2.

There exist large variations in the soil properties and weather data of surveyed province. Distribution and establishment of weed communities are affected by several factors including soil properties and weather attributes (Fried *et al.,* 2008; Pinke *et al.,* 2010). Temperature and rainfall have been considered as the main determinants of weed species' boundaries (Önen, 2006; Tanaka *et al.,* 2010; Belnap *et al.,* 2016). Different plant species and weeds have distinct soil and climatic requirements and both factors can strongly mediate the distribution patterns at different spatial and landscape scales (Udoh *et al.,* 2007). Preference of a weed species for a particular soil property may increase or decrease its density on different soils which are poor or rich in that particular soil property. Patchy distribution of weeds in arable fields and orchards is due to preference of weeds for a particular soil property (Otto *et al.,* 2007).

The commonly observed weed species in vineyards are more competitive in terms of their faster emergence than grapevines. Weeds directly harm vineyards by lowering yield and profitability, whereas indirectly damage by making harvesting difficult. The first step to devise effective weed management strategy is determining the species and their density. The selection of effective management methods is only possible with the determination of the weeds' species

Table 1: Weed species having density >1 plant m^{-2} in vineyards of Diyarbakır province.

Weed Species	Density (plant/m^2)	FO (%)
Avena sterilis L.	9.93	63.07
Fumaria asepale Boiss.	7.18	55.05
Galium tricornutum Dandy.	4.85	55.43
Ranunculus arvensis L.	3.82	60.44
Silene aegyptiaca (L.) L. F.	3.70	41.30
Bromus sterilis L.	3.64	33.73
Lamium purpureum L.	3.58	66.68
Hordeum spontaneum L.	3.35	28.79
Anthemis sp.	3.07	65.10
Crepis alpina L.	2.94	54.08
Thlaspi perfoliatum L.	2.91	18.09
Alopecurus myosuroides Huds.	2.81	16.21
Bongardia chrysogonum (L.) Spach.	2.80	16.32
Scandix pecten-veneris L.	2.24	35.69
Cynodon dactylon (L.) Pers.	1.71	16.11
Hypecoum procumbens L.	1.69	27.72
Lolium perenne L.	1.41	13.56
Sorghum halepense (L.) Pers.	1.33	32.16
Sinapis arvensis L.	1.24	51.04
Buglossoides arvense (L.) I.M. Johnst.	1.22	47.60
Daucus carota L.	1.21	26.81
Trifolium nigrescens L.	1.21	24.72
Vicia hybrida L.	1.05	39.92
Senecio vernalis Waldst. and Kit.	1.04	65.82
Ornithogalum narbonense L.	1.02	8.15

FO = frequency of occurrence.

Table 2: Weed species, their plant families, frequency of occurrence (FO) and density in vineyards of Diyarbakır province.

Weed Species and Families	Density (plants m^{-2})	FO (%)
Parasitic Species		
Fam: Cuscutaceae		
Cuscuta monogyna Vahl	b	41.70
MONOCOTYLEDONEAE		
Fam: Liliaceae		
Allium noeanum Reuter ex Regel	A	6.50
Bellevalia sp.	0.10	13.83
Gagea sp.	A	9.19
Muscari comosum (L.) Miller	A	30.25
Ornithogalum narbonense L.	1.02	8.15
Tulipa aleppensis Boiss. ex Regel	0.23	19.77
Fam: Poaceae		
Aegilops cylindrica Host	0.19	1.11
Alopecurus myosuroides Huds.	2.81	16.21
Apera spica-venti (L). P.B.	A	10.72
Avena sterilis L.	9.93	63.07
Bromus hordeaceus L.	A	12.97
Bromus sterilis L.	3.64	33.73
Cornucopiae cucullatum L.	A	2.00
Cynodon dactylon (L.) Pers.	1.71	16.11
Echinaria capitata (L.) Desf.	0.40	19.88
Hordeum murinum L.	A	5.67
Hordeum spontaneum L.	3.35	28.79
Imperata cylindrica (L.) Raeuschel	0.31	1.11
Lolium perenne L.	1.41	13.56
Poa bulbosa L.	A	7.95
Sorghum halepense (L.) Pers.	1.33	32.16
DICOTYLEDONEAE		
Fam: Apiaceae (Umbelliferae)		
Ainsworthia trachycarpa Boiss.	A	2.57
Ammi visnaga (L.) Lam.	0.69	8.83
Artedia squamata L.	A	2.00
Bubleurum rotundifolium L.	0.13	7.58
Caucalis platycarpos L.	0.63	20.95
Daucus carota L.	1.21	26.81
Echinophora tenuifolia L.	0.40	19.88
Falcaria vulgaris Bernh.	A	3.50
Lagoecia cuminoides L.	A	4.53
Lisaea strigosa (Banks Et Sol.) Eig	A	25.07
Malabaila secacul Banks and Sol.	A	11.57
Scandix pecten-veneris L.	2.24	35.69
Scandix stelleta Banks et Sol.	0.59	9.32
Turgenia latifolia (L.) Hoffm.	A	15.38
Fam: Araceae		
Eminium rauwolffii (Blume) Schott var. *kotschyi* (Schott) H. Riedl	0.17	25.10
Fam: Amaryllidaceae		
Ixiolirion tataricum (Pallas) Herbert	A	5.43

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Fam: Arıstolochiaceae		
Aristolochia bottae Jaub. and Spach.	0.73	29.63
Fam: Asteraceae (Compositae)		
Achillea millefolium L.	A	8.52
Achillea wilhelmsii C. Koch	A	5.52
Anthemis sp.	3.07	65.10
Carduus pycnocephalus L.	0.96	55.79
Centaurea balsamita Lam.	0.17	18.58
Centaurea behen L.	A	9.50
Centaurea depressa M. Bieb.	0.34	7.06
Centaurea solstitialis L.	A	25.34
Centaurea stapfiana (HAND.-MAZZ.)	A	6.94
Crepis alpina L.	2.94	54.08
Crepis foetida L.	0.89	33.86
Crupina crupinastrum (Moris) Vis.	A	3.54
Echinops orientalis Trautv.	A	7.11
Lactuca aculeata Boiss.	A	6.88
Lactuca saligna L.	A	7.38
Lactuca serriole L.	0.38	22.15
Notabasis syriaca (L.) Cass.	A	9.25
Onopordum acanthium L.	A	4.50
Picnomon acarna (L.) Cass.	A	14.8
Senecio vernalis Waldst. And Kit.	1.04	65.82
Serratula cerinthifolia (Sm.) Boiss.	A	2.50
Sonchus sp.	0.25	13.99
Tragopogon longirostis Bısch. ex Schultz Bıp.	A	20.21
Xanthium strumarium L.	0.96	31.96
Fam: Berberidaceae		
Bongardia chrysogonum (L.) Spach.	2.80	16.32
Leontice leontopetalum L.	A	8.82
Fam: Boraginaceae		
Alkanna trichophila Hub.-Mor.	0.28	24.40
Anchusa azurea Miller.	0.18	22.93
Anchusa italica Retz.	0.28	28.8
Buglossoides arvense (L.) I.M. Johnst.	1.22	47.60
Onosma albo-roseum Fısch. et Mey.	0.28	23.3
Fam: Brassicaceae (Cruciferae)		
Aethionema arabicum (L.) Andrz. ex Dc.	A	12.45
Alyssum desertorum Stapf.	0.38	16.7
Alyssum linifolium Steph. Ex Wılld.	0.89	23.20
Capsella bursa-pastoris (L.) Medik.	0.36	14.11
Cardaria draba (L.) Desv.	0.12	7.86
Clypeola aspera (Grauer) Turrıll	A	3.25
Clypeola jonthlaspi L.	0.16	5.86
Conringia perfoliata (C.A. Meyer) Busch.	0.39	10.44
Crambe orientalis L.	A	11.39
Erysimum repandum L.	A	13.27
Myagrum perfoliatum L.	0.63	26.73
Neslia apiculata Fısch.	0.12	9.00
Sinapis arvensis L.	1.24	51.04
Sisymbrium officinale (L.) Scop.	A	1.11

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Thlaspi arvense L.	A	11.61
Thlaspi perfoliatum L.	A	18.09
Fam: Campanulaceae		
Campanula strigosa Banks Et Sol.	A	5.83
Fam: Caryophyllaceae		
Cerastium dichotomum L.	0.26	7.00
Silene aegyptiaca (L.) L. F.	3.70	41.30
Silene conica L.	0.20	19.52
Silene conoidea L.	0.30	24.21
Vaccaria pyramidata Medik.	A	13.08
Fam: Cistaceae		
Helianthemum ledifolium (L.) Miller	A	3.92
Fam: Convolvulaceae		
Convolvulus arvensis L.	0.56	56.76
Convolvulus betonicifolius Mill.	A	14.04
Convolvulus galaticus Roston. ex Choisy	0.21	14.26
Fam: Dipsacaceae		
Cephalaria syriaca (L.) Schrad	0.92	14.73
Scabiosa caucasica Bieb.	0.34	4.75
Fam: Euphorbiaceae		
Euphorbia aleppica L.	0.29	22.84
Euphorbia helioscopia L.	0.24	27.02
Euphorbia sp.	0.69	30.98
Fam: Fabaceae		
Onobrychis galegifolia Boiss.	A	2.5
Trigonella mesopotamica	A	5.00
Alhagi pseudoalhagi (Bieb.) Desv.	A	6.34
Astragalus sp.	A	5.27
Coronilla scorpioides (L.) Koch	A	6.74
Lathyrus aphaca L.	0.18	9.44
Lathyrus gorgoni Parl.	0.19	7.77
Lathyrus sylvestris L.	0.32	10.72
Medicago sp.	0.16	14.60
Pisum sativum L.	A	13.97
Psoralea jaubertina Fenzl	A	1.00
Trifolium nigrescens L. üçgül	1.21	24.72
Trifolium pauciflorum Da´urv.	0.82	19.50
Trifolium campestre Schreb.	0.18	4.76
Trifolium purpureum Lois.	0.12	5.97
Trifolium resupinatum L.	A	3.97
Trifolium spumosum L.	A	5.17
Vicia ervilia (L.) Willd.	A	3.92
Vicia hybrida L.	1.05	39.92
Vicia narbonensis L.	0.25	35.56
Fam: Geraniaceae		
Erodium gruinum (L.) L' Herit.	0.42	20.67
Geranium tuberosum L.	0.46	29.41
Geranium molle L.	0.54	12.28
Fam: Guttiferae		
Hypericum triquetrifolium Turra.	A	5.83
Fam: Irıdaceae		
Gladiolus atroviolaceus Boiss.	A	4.00

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Fam: Lamiaceae		
Lallemantia iberica (Bieb.) Fisch. and Mey.	0.31	16.06
Lamium purpureum L.	3.58	66.68
Molucella laevis L.	0.12	7.33
Phlomis kurdica Rech. Fil.	0.14	11.2
Salvia multicaulis Vahl.	0.14	11.93
Teucrium polium L.	A	5.33
Ziziphora capitata L.	A	2.54
Fam: Linaceae		
Linum pubescens Banks et Sol.	0.38	2.54
Fam: Malvaceae		
Alcea sp.	A	22.39
Malva sp.	A	2.78
Fam: Papaveraceae		
Fumaria asepale Boiss.	7.18	55.05
Fumaria cilicica Hausskn.	A	16.37
Fumaria parviflora Lam.	A	21.80
Glaucium grandiflorum Boiss. Et Huet.	A	11.80
Hypecoum procumbens L.	1.69	27.72
Papaver macrostomum Boiss and Huet. ex Boiss	A	13.20
Papaver sp.	0.80	66.49
Roemeria hybrida (L.) Dc.	A	12.44
Roemeria sp.	A	1.0
Fam: Plantaginaceae		
Plantago lanceolata L.	A	0.5
Fam: Polygonaceae		
Polygonum aviculare L.	0.26	4.11
Polygonum convolvulus L.	A	3.43
Fam: Primulaceae		
Anagallis arvensis L.	A	12.70
Fam: Ranunculaceae		
Adonis aleppica Boiss.	A	2.00
Adonis aestivalis L.	A	21.00
Ceratocephalus falcatus (L.) Pers.	A	12.63
Ranunculus arvensis L.	3.82	60.44
Fam: Rosaceae		
Sanguisorba minör Scop.	A	6.00
Fam: Rubiaceae		
Asperula orientalis Boiss et Hohen	A	2.78
Callipeltis cucullaria (L.) Steven	A	5.83
Cruciata taurica (Pallas Ex Willd.) Ehrend.	A	11.11
Galium tricornutum Dandy.	4.85	55.43
Fam: Scrophulariaceae		
Veronica bozakmanii M. A. Fischer	A	3.97
Veronica hederifolia L.	A	1.00
Verbascum sp.	A	3.00
Fam: Solanaceae		
Hyacyamus niger L.	A	11.00
Fam: Valerianaceae		
Valerianella vesicaria (L.) Moench.	0.35	14.49
Fam: Violaceae		
Viola occulta LEHM.	A	12.22
Viola sp.	A	3.11

FO = frequency of occurrence, A = density <0.05 plants m^{-2}.

and density (Özer *et al.,* 2001; Eroğlu, 2006). The presence of weed species in the cultivated areas reduces the effectiveness of agricultural inputs, promotes the development of harmful microorganisms and consequently reduces the yield and quality of crops (Uygur *et al.,* 1984; Önen *et al.,* 2006; Önen, 2020).

A total 165 weed species and 128 taxa belonging to 35 botanical families (1 parasitic, 16 monocotyledons and 18 dicotyledons) were identified from the surveyed area. The families represented by the highest number of weed species were; Asteraceae (24 species), Fabaceae (20 species), Poaceae (16 species), Brassicaceae (16 species), Apiaceae (14 species), Papaveraceae (9 species), Lamiaceae (7 species), Liliaceae (6 species) and Boraginaceae and Caryophyllaceae (5 species each).

Five out of 35 otanical families (*i.e*., Asteraceae, Fabaceae, Poaceae, Brassicaceae and Apiaceae) had >50% of the weed species observed during the surveys. The highest contribution of these families to the observed weed flora is attributed to the higher presence of weedy species in these families (Düzenli *et al.,* 1993; Özer *et al.,* 1999). The predominance of annuals could be attributed to their short life span and higher allocation resources for reproduction even under harsh climatic conditions (Sans and Masalles, 1995). Large variations were observed in density and frequency of occurrence of the recorded weed species in different surveyed fields (Table 1). The variation in the weed densities and frequency of occurrence could be explained by heterogeneity in the soil properties and microclimatic conditions (James *et al.,* 2006).

Kaçan (2014) found 54 weed species in the vineyards of Manisa province. The study also reported that Asteraceae, Fabaceae and Poaceae were the most represented families in the region. Thus, these results support our findings. Similarly, Topçu (2011) recorded 67 weed species from vineyards in Tokat province. *Senecio vernalis* Wald. and Kit., *Thlapsi arvense* L., *Stellaria media* L. Vill. and *Lamium amplexicaule* L. were the most frequently observed weed species in Tokat province. These results also support our findings.

Southeastern Anatolia region occupies an important position in term of vineyard production in the country. Diyarbakır is an important province in the region having intensive vineyard cultivation (Karataş *et al.,* 2015). However, it was noted that vineyard producers do not fully apply modern viticulture practices, do not have knowledge of recent production techniques and are not sensitive to weeds. Furthermore, the producers manage weeds late in the season, which increase weed density and in turn reduces yield.

CONCLUSION

It is concluded that the problematic weed species in the surveyed vineyards are generally cosmopolite species and it is possible to imply a general recommendation for their management. The existence of large-scale spatial variation in weed distribution and soil properties necessitates the adoption of site-specific management practices for successful weed management in the region.

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