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Original Article

Prevalence study of weeds in some economic orchards trees

Haifa Abdul Aziz Sakit Alhaithloul
Department of Biology, College of Sciences, Jouf University, Sakaka, Saudi Arabia

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**Corresponding author email:*
haifasa.2020@gmail.com

Abstract

The objective of this work is to study the vegetation composition and variety of weeds in olive (*Olea europaea L.*) and date palm (*Phoenix dactylifera* L.) orchard trees in Aljouf, Saudi Arabia. The current study revealed the registration of 53 species affiliating to 51 genera in 17 families. A large number of species were registered in the family (Poaceae) that is represented by 13 species, while 11, 8 and 4 species registered in families Asteraceae, Boraginaceae and Amaranthaceae respectively. The TWINSPAN classification applied in the 40 stands resulted in 4 vegetation categories (A, B, C & D). Each vegetation category represented a group of stands. In this study, the therophytes are the most abundant life form which represented 64% of the collected species, followed by chamaephytes and hemicryptophytes are each represented by 13%, Geophytes by 8%, and phanerophytes by 2% of species. Three indicators of diversity were calculated, the species richness for vegetation group B shows a significant higher (14.04 species/stand) than the other vegetation groups, while no significant differences were interpreted by Shannon index among the different vegetation groups. On the other hand, the evenness index for vegetation group B was significantly higher than the other vegetation groups. The present study provides essential information about the ecology of weeds in olive and dates palm agroecosystem and it acts as a driving force to monitor the weedy vegetation changes in Aljouf region.

Keywords: *Olea europaea*, *Phoenix dactylifera*, Weed flora

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Introduction

Plant society plays a significant role in sustainable management by conserving biodiversity (Kandi et al., 2011). Weeds are widely distributed plant species that can be considered as biological components of various ecosystems. On the other hand, weeds are undesirable and are different from other plants because of their disturbing presence and stronger biological and ecological characteristics that make them successful competitors in agricultural ecosystems. It is clear that the presence of weeds in these systems greatly reduces the amount of harvest, by competing vigorously with cultivated species for the area, water, nutrients and light (Wang et al., 2007).

Weeds could be considered as hosts of pests and diseases. The floristic composition and distribution of weed species in a field are different due to crop nature, agricultural practices, soil type, humidity availability, climate, and other external and biological factors (Fried et al., 2008; Ahmad et al., 2016).

According to Jabeen and Ahmed (2009) some weeds have an allelopathic effect, the biological phenomenon by which they produce biochemicals that are hostile to

the germination, survival, growth and reproduction of other plants in the ecosystem.

The study of weed dynamics is essential to formulate a management strategy for the cropping and use of the suitable herbicides. It is also useful to exploiting abundance of weeds as a cover crop or pasture and for other economic uses (Derksen et al., 2002; Sit et al., 2007).

The olive (*Olea europaea L.*) a small tree from the Oleaceae family, is distributed within the Mediterranean Basin from the Levant to Portugal and in the Arabian Peninsula, in South Asia and in the Far East (Terral et al., 2004). Olive fruits are of high economic importance, rich in nutrients and are also a source of olive oil. Approximately 90% of the harvest is converted into the oil (Patumi et al., 2002).

The information about the floristic diversity of weed communities in the KSA is still limited (Al-Yemeni and Sher, 2010).

The overgrowing weeds in orchards are considered particularly problematic in the first years of tree life. If the presence of herbs is not properly controlled, this can lead to critical consequences, as weeds can increase the activity of pests and can create a risk of fire in summer when dry. The objective of this work is to study the plants' composition and variety of weeds in olive & date palm orchard trees in Aljouf province, KSA.

Material and Methods

Location

Aljouf province is located in the northern part of KSA between latitudes 29˚ to 32˚N and longitudes 37˚ to 42˚E. This region is important for agriculture; a large variety of cultivated plants, such as olive, citrus and date palm, besides barley, wheat, vegetables and alfalfa are grown there. The soils involved in research are rich in organic compounds and minerals, usually clayey with coarse-grained sand.

Climate

The KSA climate is dry and hot. Two types of climate affect it, namely: Monsoon and Mediterranean. The southern part is affected by the Monsoon climate while The Mediterranean climate affects the northern part (Vincent, 2008). Aljouf region is characterized by a hot and dry climate in the summer while it is cold in winter. The average minimum of temperature are 9.76 ºC in January while in August it averages 32.96 ºC. Rain fall during the year in the period from October to May. The rainfall is irregular and with an annual average of 55 mm (Sakaka meteorological station).

Collection of plant samples

Weed communities were studied in 40 stands in olive and date palm orchard trees of four districts located in the Aljouf Region (Doumat Aljandal, Sakaka, Tabarjal and Alqurayat) during 2018 seasons. In each location, the samples of weeds were collected from 10 stands of olive and date palm orchard, 20 stands from each orchard. The dimension of the stand was 10 X 10 m^2. The recorded species coverage was visually assessed from the ground surface as a percentage in 5 sampled quadrats (1 X 1 m^2) selected randomly. Classifications and identification of species were according to Chaudhary and Akram (1987), Collentette (1999) and Chaudhary (2001).

Statistical analysis

The floristic presence or absence data matrix included 40 stands. The registered species were classified by Two-way indicator species analysis (TWINSPAN) using the classification of stands into weeds plant categories based on the species coverage (Hill, 1979). Species richness within each separated TWINSPAN vegetation category was calculated as the average number of species per stand. The Shannon-index of diversity (H′) was calculated from the formula

$$H' = -\Sigma_i^{S} P_i \log_e P_i .$$

Evenness index = $(-\Sigma_i^{S} P_i \log_e P_i) / \ln S$ (Pielou, 1975).

Where S = species number, P = frequency of the *i*th species

The diversity indices of the identified vegetation (TWINSPAN) categories were compared by using One-way ANOVA and Tukey's post-hoc test. This test was performed by SPSS program, version 22.0.0, 2013.

Results and Discussion

The current study revealed the registration of 53 species affiliating to 51 genera in 17 families of weed plants (Tables 1 & 2). A large number of species were registered in the family (Poaceae) that is represented by 13 species, while families Asteraceae, Boraginaceae and Amaranthaceae were represented by 11, 8 and 4 species respectively.

Table-1: Species registered in the orchards of the study area in four vegetation categories resulted by TWINSPAN analysis.

Ser.	Species	Vegetation categories			
		A	B	C	D
1.	*Amaranthus lividus* L.			0.5	0.3
2.	*Anagallis arvensis* L.		0.2		
3.	*Anthemis melampodina* subsp. *deserti* (Boiss.) Eig.		1.1	1.9	
4.	*Artemisia Judaica* L.			1.8	1.4
5.	*Avena barbata* Pott			0.4	0.7
6.	*Avena fatua* L.		0.2		
7.	*Bassia eriophora* (Schrad.) Asch.	0.2	1.3		
8.	*Brassica tournefortii* Gouan		0.5		
9.	*Chenopodium murale* L.		0.2		
10.	*Citrulus colocynthis* (L.) Schrad.	1.7	1.4		
11.	*Convolvulus arvensis* L.		0.5	0.4	
12.	*Conyza bonariensis* (L.) Cronquist.		0.8		
13.	*Cynodon dactylon* (L.) Pers.	0.5	16.7		
14.	*Dactylis glomerata* L.		1.5	0.5	
15.	*Dichanthium annulatum* (Forssk.) Stapf.			1.8	0.2
16.	*Diplotaxis acris* (Forssk.) Boiss.				0.5
17.	*Diplotaxis harra* (Forssk.) Boiss.	0.2	0.3		
18.	*Echinops spinosus* L.	0.8	1.2		
19.	*Ephedra alata* Decne.		1.5		
20.	*Eragrostis cilianensis* (All.) F.T. Hubb.	0.3	0.2		
21.	*Erodium cicutarium* (L.) L'Her			0.5	1.3
22.	*Eruca sativa* Mill.		0.2	0.3	
23.	*Euphorbia granulata* Forssk.		0.7		0.9
24.	*Euphorbia peplus* L.	1.8		2.2	
25.	*Farsetia aegyptia* Turra		2.7	2.9	
26.	*Halyxolon salicornicum* (Moq.) Bunge ex Boiss	3		3.1	
27.	*Heliotropium arbainense* Fresen.		0.3	0.2	
28.	*Hordeum marinum* Huds.		2.5	1.2	
29.	*Imperata cylindrical* (L.) Raeusch.	12.5	0.3	0.2	
30.	*Lactuca serriola* L.	0.3	0.2		
31.	*Launaea mucronata* (Forssk.) Muschl.			5.9	2.9
32.	*Launaea nudicaulis* (L.) Hook. F.	2.4	2.6		
33.	*Lolium perenne* L.	2.3	2.3	2.5	2.3
34.	*Malva parviflora* L.	1.7	2.3	1.8	0.1
35.	*Melilotus indicus* (L.) All.	2.2	0.8	1.9	
36.	*Morettia philaeana* (Delile) DC.		2.5	2.6	
37.	*Paronychia arabica* (L.) DC.	1.7	2.5	1.5	
38.	*Phragmites australis* (Cav.) Trin.ex Steud	4.6	3.2	5.1	3.1
39.	*Plantago albicans* L.	1.3	0.5		
40.	*Polypogon monspeliensis* (L.) Desf.	3.1	2.7	2.5	2.4
41.	*Portulaca oleracea* L.	2.5	3.1	2.5	1.7
42.	*Pulicaria undulata* (L.) C.A. Mey.	1.1	3.2		
43.	*Reichardia tingitana* (L.) Roth	1.4	1.2		
44.	*Rumex vesicarius* L.			1.8	2.5
45.	*Senecio glaucus* subsp. *coronopifolius* (Maire) C. Alexander	1.5	2.5		0.6
46.	*Setaria verticillata* (L.) P. Beauv.		2.5		
47.	*Sisymbrium irio* L.	3.8	2.5	1.7	12.1
48.	*Solanum nigrum* L.		0.5		
49.	*Sonchus oleraceous* L.		0.2	0.8	1.7
50.	*Stipa capensis* Thunb.	0.3		2.9	1.2
51.	*Tamarix nilotica* (Ehrenb.) Bunge		0.6		
52.	*Trigonella stellata* Forssk.	1.5	3.9		
53.	*Zilla spinosa* (L.) Prantl		0.7	0.5	0.1

Table-2: Genera and species number with their percentages in each family.

No.	Families	Genera (No.)	Species (No.)	Species (%)
1.	Amaranthaceae	4	4	7.54
2.	Asteraceae	10	11	20.75
3.	Boraginaceae	7	8	15.09
4.	Caryophyllaceae	2	2	3.77
5.	Cruciferae	1	1	1.89
6.	Cucurbitaceae	1	1	1.89
7.	Ephedraceae	1	1	1.89
8.	Euphorbiaceae	2	2	3.77
9.	Fabaceae	2	2	3.77
10.	Geraniaceae	1	1	1.89
11.	Malvaceae	1	1	1.89
12.	Plantaginaceae	1	1	1.89
13.	Poaceae	12	13	24.53
14.	Polygonaceae	2	2	3.77
15.	Primulaceae	1	1	1.89
16.	Solanaceae	1	1	1.89
17.	Tamaricaceae	1	1	1.89
Total		51	53	100

Thirteen families represented less than 32% of total families (Figure 1). Nine genera were represented by 1 species. Generally, thirteen families have less than or equal to 2 species and 4 families have more than 4 species.

The results shown in Tables (1 & 2) were in agreement with Abd-ELghani et al. (2013) who conducted similar research in Egypt about weeds associated with some crops as olive and observed that a large number of species were registered in the family Poaceae followed by family Asteraceae. Sher and Al-Yemeny (2011) conducted a study in Alkharj, KSA and reported that the Poaceae followed by Asteraceae is the most recorded families. Al-Qahtani (2018) conducted a study about the diversity of weeds species in Tabuk region, KSA and found that the most diverse families were Poaceae, Asteraceae, Brassicaceae and Chenopodiaceae represented by (7, 5, 5 & 3 species) respectively. The other families were only represented by a single species. Terfa (2018) who conducted a study about weeds plant species diversity and distribution in Ethiopia concluded that Asteraceae and Poaceae were the most abundant weed families. This somewhat in disagreement with previous reports from date palm and olive orchards of Saudi Arabia (Al Harbi, 2017). El Halawany and Shaltout (1992) reported that weed species of *Euphorbia* sp. was one of the prevalent species in the agricultural landscape of Al-Hassa.

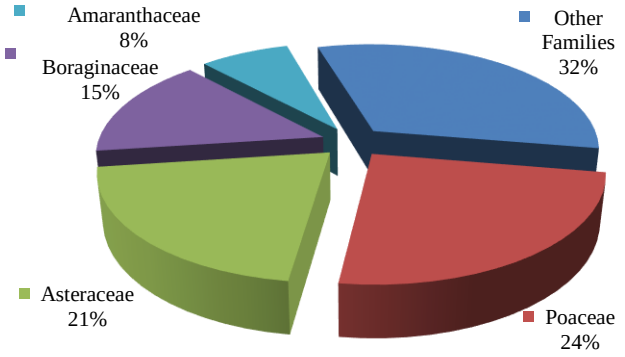
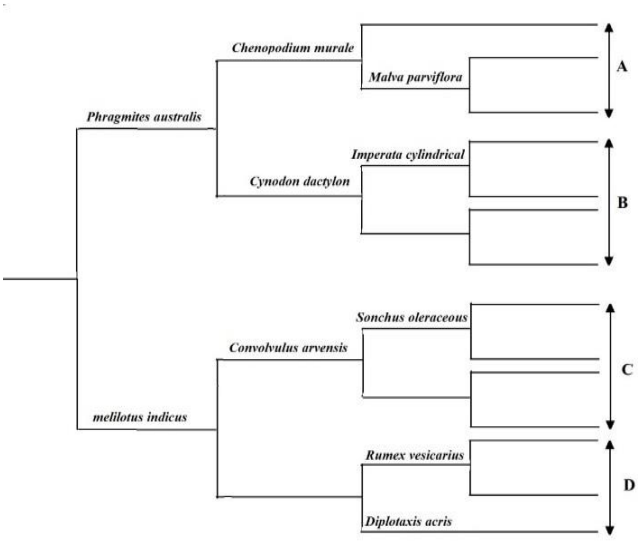


Figure-1: Percentage of families constituting of weeds

The TWINSPAN classification applied in the 40 stands resulted in 4 vegetation categories (A, B, C & D) Figure (2). Each vegetation category represented a group of stands. Two groups have been found most common in Sakaka and Dawmat Al-Jandal, these are groups B and C dominated by *Cynodon dactylon* and *Chenopodium murale* (B) and *Convolvulus arvensis* and *Diplotaxis acris* (C), respectively. Two other vegetation groups (A and D) have been recognized in Al-Qurayat and Tabarjal dominated by *Malva parviflora* and *Chenopodium murale* (A) and *Rumex vesicarius* and *Melilotus indicus* (D), respectively.

Figure-2: TWINSPAN dendrogram showing the presence of four weeds vegetation groups in the study area.



The results of dendrogram agree with Gazer (2011) who found that *C. dactylon* was the most common weed species in different orchards and cropping fields in the arid region including Saudi Arabia. The weeds in date palm and olive trees in the study area are dominated by *M. indicus*. This species was reported to prevail in similar studies in eastern KSA as well as in Egypt (El Halawany and Shaltout, 1992; Hegazy et al., 2004).

Three diversity indices were calculated. The species richness for vegetation group B shows a significant difference (14.04 species/stand) than the other vegetation groups, while no significant differences were interpreted by Shannon index among the different vegetation groups. On the other hand, the evenness index for vegetation group B was significantly higher than the other vegetation groups (Table 3). Palmer and Maurer (1997) mentioned that the difference in species richness is relatively high in orchards, which could be affected by different light conditions and environmental heterogeneity that enhances diversity in which light conditions varies from, the relatively sunny habitat between trees to shaded places present under the trees. Pyšek and Lepš (1991) and Andersson and Milberg (1998) reported that the cultivated plants and season affect the variability of weed communities. In addition, agricultural procedures that occur in agricultural lands such as tillage, irrigation, fertilization and herbicides significantly affect the presence and variety of weed associated with crops. Licznar-Malanczuk and Sygutowska (2016) pointed out that the presence and diversity of weeds in cultivated fields throughout the year are less than the meadows.

Table-3: Diversity indices of the four vegetation categories obtained by TWINSPAN on the study groups, Aljouf region.

Vegetation group	Species richness	Shannon index	Evenness index
A	9.8 ± 1.51 [a]	2.04 ± 0.49 [a]	0.98 ± 0.27 [a]
B	14.04 ± 1.81 [b]	1.8 ± 0.40 [a]	1.40 ± 0.33 [b]
C	9.31 ± 1.37 [a]	1.8 ± 0.26 [a]	0.98 ± 0.19 [a]
D	8.78 ± 1.49 [a]	1.9 ± 0.61 [a]	0.88 ± 0.25 [a]

The values are the Mean ± SD.

Means in a column followed by different letters are significantly different (LSD Test, $P < 0.05$)

Classification of life form was classified depending on Raunkiaer's (1937), the registered species in the study area are shown in figure (3). The most common life form is therophytes representing 64% of the collected species, while chamaephytes and hemicryptophytes are each represented by 13% of the collected species. The geophytes and phanerophytes are 8 % and 2% represented in the collected species respectively. Our results were in agreement with Sher and Al-Yemeny (2011) who revealed in their study that most of the registered species were therophytes and hemicryptophytes. The abundance of therophytes, hemicryptophytes and chaemophytes in the weed flora of Aljouf region was inconsistent with the prevalence of plants in semi-desert regions and deserts in different parts of KSA (Fahmy and Hassan, 2005; El-Ghanim et al., 2010). Similar results were documented in other regions in the Middle East (El-Bana and Al-Mathnani, 2009).

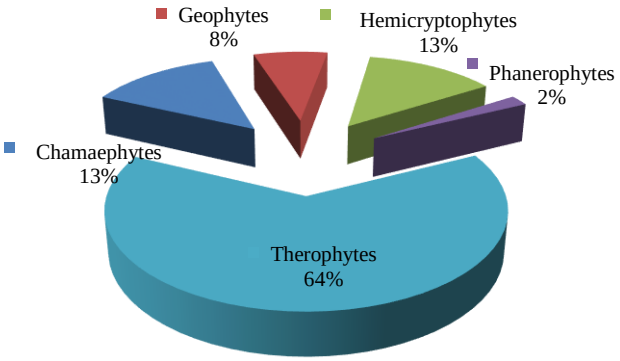


Figure-3: Life form percentage recorded in weed species

Conclusion

The present study provides essential information about the ecology of weeds in olive and dates palm agroecosystem and it acts as a driving force to monitor the weedy vegetation changes in Aljouf region as it revealed the registration of 53 species affiliating to 51 genera in 17 families. It is recommended to carry out further studies on the diverse vegetation of other parts of Aljouf region and its relation to other economic plants growing in this region. The study of the diversity of weeds associated with economic crops is useful in the management of these unwanted plants and can be exploited in pasture and other economic uses.

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