https://doi.org/10.26682/ajuod.2022.25.2.5
Journal of University of Duhok., Vol. 25, No.2 (Agri. and Vet. Sciences), Pp 37-55, 2022

SOIL SEED BANK COMPATIBILITY WITH ABOVEGROUND PLANTS UNDER DIFFERENT TOPOGRAPHICAL PARAMETERS IN THE ZAWITA MOUNTAINS FOREST

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(Received: June 9, 2022; Accepted for Publication: August 16, 2022)

1. ABSTRACT

One of the strategies for survival and distribution of individual species in natural regeneration which is affected by environmental factors. The vegetation covers and seedling's emergence from the soil bank were studied by the effect of topographical factors (aspects, elevation, and slope gradient), in the forest` of Zawita mountains, and the Sorensen similarity index was estimated between vegetation cover and soil seed bank. The experiment was factorial with a strip-split plot design and four blocks. The results are summarized by the identification of 109 species belonging to 25 families with both vegetation and soil seed bank in the south aspect, while in the north aspect, 138 species combined with vegetation and soil seed bank, which were belongs to 29 families. The results recorded that the highest density of plants and species richness in the north aspect increased significantly with increasing elevation (214.92 and 246.72 plants.m-2), (20.79 and 19.94) respectively. While the highest density of seed banks emerged and species richness was recorded in the south aspect with increasing in the elevation and low slope gradient (3554.9, 2778.41, and 2692.59 plant.m^{-2}), (16.75, 16.88, and 17.58) respectively. The degree of similarity with the Sorensen index between vegetation cover and soil seed bank was low under these topographical variables.

***KEYWORDS*:** Vegetation, Seed Bank, Plant Density, Species Richness, Sorensen Similarity Index.

2. INTRODUCTION

Species composition of the soil seed banks is influenced by the historical composition of the existing vegetation, the survival of the seed and the regeneration strategies of the individual species depends on the environmental factors which affecting the persistence of the seed in the soil (Harper, 1977). Seed bank density and species richness have been recorded to increase through period succession and spatial altitude and latitude gradients (Thompson et al., 1997; Warr and Thompson, 1993). The composition of the seed banks is variable and is marked as Transient or Persistent when the vegetation is regenerated at different times of the year. Transient seed banks consist of short-lived seeds which are not dormant and spread over a short period of time during the year (Garwood, 1989). Persistent seed banks consist of seeds that are more than one year old and the seed stocks remain in the soil year after year, and typically buried in the soil (Bowes et al., 1995). Assessments of seed banks have key relationships with understanding ecological processes and many cornerstone topics of major interest in plant ecology and biological conservation. For example, seed banks are related to propagule pressure and invasiveness in invasion biology (Robertson and Hickman, 2012). Reliable estimates of seed banks have direct practical importance when they are used for such purposes as to evaluate plant regeneration potential, resources available to seed eating organisms, site history (e.g., evidence of past disturbance), which species in the vegetation form seed banks (Bakker et al., 1996; Espeland et al., 2010), and conservation applications such as managing rare species that rely on seed banks or for detecting exotic plant species (Schneider & Allen, 2012). Soil seed banks are an essential component of the reproduction and restoration of ecosystems. Recruitment and seed bank production at different habitat locations is inherently linked to variations in physical

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conditions, such as soil temperature, moisture and light, and different biotic conditions, such as abundance of seed pests, herbivores and pathogens (Alpert and Mooney, 1996). Seed longevity in soil varies between plants, seed characteristics, depth of burial and climatic conditions (Steckel et al., 2007). The size of the soil seed bank tends to be influenced by elevation, slope and the depth of soil (Huang et al., 2013). The soil at different levels is rapidly increased by a number of seed dispersal mediums (animals, wind, water, etc.), which are responsible for the introduction of seed to the soil. Seeds are responsible for the non-vegetative reproduction of seedlings that could give rise to naturally regenerated forests, aided natural regeneration and artificial forest regeneration (Taiwo et al., 2018). Soil seed bank comprises of all viable vegetation, dormant and non-dormant seeds present in the soil profile (Forcella et al., 2003). Knowing of soil seed bank is important for population dynamics studies, the establishment of appropriate vegetation management programs (Ambrosio et al., 2004) and forecasting of species infestations (Ball and Miller, 1989). Soil seed banks play an important role in restoring former species diversity (Bakker et al., 1996). Seed bank is clearly important to understanding a plant community, yet are difficult to quantify. An ideal seed bank characterization method would detect all species and accurately estimate viable seed density (only viable seeds are considered part of the living seed bank), while being as easy as possible to implement. The main categories of methods for characterizing seeds species in soil samples is emergence of seedlings (Baskin and Baskin, 1998; Thompson et al., 1997). In the emergence method, soil samples are placed in pots or flats in greenhouses or similar environments. Seedlings emerging from the soil are identified and counted as an estimate of seeds in the soil seed bank. The advantages of this method is that all viable detected seeds are known (Poiani and Johnson, 1988). The lack of information about soil seed banks of Zawita mountains due to the limited number of researches implanted in this area. Therefore, the aims of this study is to investigate the soil seed bank of natural habitat in the Zawita Mountains and its compatibility with aboveground vegetation, and the impact of aspects, elevation and slope gradient on the soil seed bank richness and densities.

3. MATERIALS AND METHODS

3.1. Study sites

The study was carried out in Zawita mountains Duhok governorate – Kurdistan Region of Iraq, this area recorded under management of the Directorate of Forestry and Rangelands -Zawita. The botanical plants of the Zawita area contain a diversity of trees, shrubs, and herbaceous (Ghazanfar and McDaniel, 2015). The mountains situated at different elevations. The mean of minimum temperature from winter to summer through study period was (1.4 – 20.8 ˚C) and maximum from (7.9 – 39.8 ˚C) respectively, and total rainfall season from November to April was (1000 mm), with a dry season from Jun to September (Agriculture Directorate for Duhok District Center at Zawita, 2021).

Fig(1):-The selected topographic of the study site at Zawita mountains (Pin pointer).

3.2. Aboveground vegetation sampling

The study was conducted by selecting two aspects included south and north aspects. Within each aspect, three elevation gradients were marked by GPS (Global Positioning System (eTrex Vista TM) GARMIN Ltd. 2001-2002, Along the elevation gradient for distance separating between each elevation was 100 m ± 10 m (J. T. Zhang et al., 2013). Sample's collection survey of all botanical plants was started from May to September in 2020. Starting at 900 m elevation for each aspect, which is settled transect every 100 m along the elevation gradient, up to 1200 m for each topographical aspect.//Each elevation was divided into two slope gradients (10% and 20%), and the vegetation of herbaceous plants survey was conducted by zig-zag transect method (Hnatiuk et al., 2009) reference sampling occurring every 10 m and staggered to the left and the right of the transect. Sampling herbaceous was carried out by surveying one m^{-2} quadrat and all vegetation in the quadrat was recorded (Daubenmire, 1948) for a total of 8 quadrats per transect. The vegetative cover plants were identified according to the flora of Iraq (Guest and Townsend, 1966), and also depending on online flora as a guide (Ismail et al., 2014; Shahbaz, 2018) and deposited in the Herbarium, Department of Forestry, College of Agricultural Engineering Sciences, University of Duhok, Iraq. The design was factorial of three factors in a strip-split plot complete block arrangement with four blocks. Within each block, the two aspect levels in vertical strips, and the three elevations in horizontal strips and the two slope levels within every intersection of aspect and elevation as subplots factor. The total numbers of samplings during the study were 96 of quadrat of vegetation (2 aspects X 3 elevations X two slopes, with 8 samples).

3.3. Sampling of soil seed bank

Samples of the soil seed bank were taken from the same area of vegetative under forest Zawita mountains, which has been labeled (in each elevation). Soil samples were collected in late August 2020 before rainfall and seed germination. Within each replicate two soil samples were randomly collected (2 aspects X 3 elevations X 2 slopes X 4 blocks X 2 sample = 96 total samples). The samples were taken by hammering a square metal box frame 40 cm×40 cm into the soil at depth (0-10 cm)(Ghermandi, 2018). The samples of soil seed bank were eliminated from plant fragments and stones and stored in a laboratory room which was dark, cold store (1°C) for 3 months (Özaslan Parlak et al., 2011).

Compound samples of soil were taken from each aspect and elevation from two slopes analyzed for physiochemical properties, in soil and water Laboratories department of the College of Agricultural Engineering Sciences (Table 1).

Table (1) :-Physical and chemical characteristics of soil samples at Zawita mountains forest.

ASPECT	ELEVATION (m a.s.l.)	SLOPE %	Clay %	Silt %	Sand %	pH	EC,dS. m -1	Bulk density g.cm-3	Organic matter %
SOUTH	900-1000	10%	27.88	36.01	36.11	8.105	0.4155	0.98	4.52
		20%	29.13	37.49	33.385	8.005	0.395	0.92	5.57
	1000-1100	10%	49.24	31.13	19.635	8.08	0.405	0.935	6.165
		20%	50.04	32.38	17.585	8.055	0.465	1.04	5.115
	1100-1200	10%	40.89	35.39	23.723	8.1	0.415	0.98	4.62
		20%	29.02	29.43	41.56	8.28	0.3	1.06	4.175
NORTH	900-1000	10%	42.77	28.4	28.835	7.82	0.415	0.965	4.59
		20%	39.02	41.01	19.973	7.87	0.46	0.86	6.04
	1000-1100	10%	62.54	26.13	11.335	8.07	0.5	0.915	5.065
		20%	50.89	32.89	16.223	8.15	0.415	0.965	3.195
	1100-1200	10%	40.89	47.78	11.335	8.01	0.565	1	5.705
		20%	51.52	34.88	13.61	7.865	0.585	0.835	6.3

3.4. Greenhouse trial

To find out diagnosed number of seedlings, collected soil from each plot was spread on a plastic box (30 x 50 x 5 cm), and then covered with 2 cm, head sand soil by A typical autoclave cycle for soil sterilization is 30–60 minutes at 121° C (McGovern and McSorley, 2018) to avoid contamination with other plants. The plastic box was distributed randomly in the greenhouse with natural light; the daily temperature was measured (Table, 2), and watered repeatedly during traits between October 2020 to May 2021 approximately 8 months. The daily emerged seedlings were counted, and removed per square (40 x 40 cm) which was (0.16 m^2) was converted to $1m^2$ by simple proportional as each number was multiplying 6.25, and diagnosed according to flora of Bikhair mountains-Duhok-Iraq (Shahbaz, 2018) and deposited specimens in the Herbarium, Department of Forestry, College of Agricultural Engineering Sciences, University of Duhok, Iraq.

Table (2) :-Mean temperature during trial period in the greenhouse.

Year	Months	Week 1		Week 2		Week 3		Week 4	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
2020	November	15.2	28.6	12.8	29.2	8.2	33	6.8	35
	December	5.3	25.6	5.1	27.9	6.4	27.5	1.3	27.1
2021	January	2.5	32.4	4.5	27.8	3.5	22.4	3.6	30.7
	February	7.2	27.4	6.9	35.3	8.6	31.0	2.6	35.3
	March	7.8	34.6	8.6	33.8	8.3	37.1	7.3	35.8
	April	10.4	37.5	9.3	38.9	15.7	43.1	17.6	44.6
	May	17.4	46.2	18.4	46.2	19.0	47.4	18.4	49.2

3.5. Data analysis

Density and species richness equations (Hegazy et al., 2007) of the under-forest vegetation from different aspects, elevation and slope gradient were analyzed, using analysis of variance (ANOVA) and the Duncan multiple range test (Duncan, 1955) for comparisons of means at 5% level of significance. These data were performed with SAS 9.4 software (SAS Institute, 2017).

Density = $\frac{\text{Number of individual plants}}{\text{quadrats area m}-2}$ (Lyon, 1968)

Richness = number of species per specified number of individual plants (Gotelli and Chao, 2018).

Variations in density and species richness of soil seed bank among different aspect, elevations, slope and soil depth were also analyzed. To study the similarity between soil seed bank species and understory vegetation according to Sorensen similarity index (Sorensen, 1948) using the formula:

$$SI = \frac{2C}{a+b} \text{ X } 100$$

Where SI is Sorensen similarity index; {c}is the number of plant species common with both soil seed bank and understory vegetation; {a} is the number of understory vegetation species and {b} is represented seed species from soil seed bank.

4. RESULTS

4.1. Understory vegetation

The mean of plant individuals at the north aspect was (214.92 plants.m^{-2}) which significantly higher than the south aspect (138.17 plants.m^{-2}), and the highest density of the plant individual was (246.72 plants.m^{-2}) at high elevation compared with other elevations (Table, 3). The highest density of plants (415.25 plants.m^{-2}) was recorded with the interaction of north aspect with high elevations (1100-1200 m.a.sl) and a slope of 20%. While the lowest value of density of plants number was recorded for north aspect and low elevations (900-1000 m.a.sl) and slope 20%.

Table (3): -Effect of aspects, elevations, slope gradient and their interactions on density (indivi.m-^{2}) of understory vegetation.

Aspects A	Elevations E	Slopes S: S1	S2	A*E	A
South	E1	178.13 cd	109.63 de	143.88 b	138.17 b
	E2	116.13 cde	120.75 cde	118.44 b	
	E3	164.13 cde	140.25 cde	152.19 b	
North	E1	178.88 cd	104.13 e	141.50 b	214.92 a
	E2	140.75 cde	183.25 c	162.00 b	
	E3	267.25 b	415.25 a	341.25 a	
A*S	A1	152.79 c	123.54 c		
	A2	195.63 b	234.21 a	E	
S*E	E1	178.50 bc	106.88 e	142.69 b	
	E2	128.44 de	152.00 cd	140.22 b	
	E3	215.69 b	277.75 a	246.72 a	
Slope		174.21 a	178.88 a		

with each factor or their interactions value sharing similar alphabetical letter at one not significantly differences at (5%) have according to Duncan's test (Duncan, 1955).

Table (4):- Effect of aspects, elevation, slope angles and their interactions on richness understory vegetation.

Aspects A	Elevations E	Slopes S: S1	S2	A*E	A
South	E1	24.00 ab	16.00 c	20.00 ab	17.88 a
	E2	17.50 bc	17.50 bc	17.50 b	
	E3	17.25 bc	15.00 c	16.13 b	
North	E1	16.25 c	19.00 abc	17.63 b	20.79 a
	E2	20.00 abc	22.00 abc	21.00 ab	
	E3	25.25 a	22.25 abc	23.75 a	
A*S	A1	19.58 ab	16.17 b		
	A2	20.50 a	21.08 a	E	
S*E	E1	20.13 a	17.50 a	18.81 a	
	E2	18.75 a	19.75 a	19.25 a	
	E3	21.25 a	18.63 a	19.94 a	
Slope		20.04 a	18.63 a		

+ with each factor or their interactions value sharing similar alphabetical letter at one not significantly differences at (5%) have according to Duncan's test (Duncan, 1955).

Species richness of the north aspect was (20.79) compared with the south aspect (17.88), and highest species richness with a high elevation and low slope gradient (19.94, 20.04) respectively. While the richness at the northern aspect, and high elevation and low slope gradient was (25.25) (Table, 4).

4.2. Composition of soil seed bank

The data displays in table (5), shows that the south aspect and medium elevation (1000-1100 m.a.sl) and narrow slope 10% recorded (3554.9, 2778.41 and 2692.59 seedlings.m^{-2}) respectively. On the other hand, the triple interaction of south aspect with a medium elevation and narrow slope gradient was superior as recorded (4334.46 seedlings.m^{-2}).

Table (5):- Effect of aspects, elevation, slope angles and their interactions on density (indivi.m-^{2}) of the emerged seedlings from the soil seed bank.

Aspects A	Elevations E	Slopes S		A*E	A
		S1	**S2**		
South	**E1**	**3878.75 a**	**2428.31 cd**	**3153.53 b**	**3554.90 a**
	E2	**4334.46 a**	**4307.46 a**	**4320.96 a**	
	E3	**3541.84 ab**	**2838.56 bc**	**3190.20 b**	
North	**E1**	**1424.91 ef**	**1032.30 f**	**1228.60 d**	**1466.10 b**
	E2	**942.39 f**	**1529.32 ef**	**1235.85 d**	
	E3	**2033.19 cde**	**1834.50 def**	**1933.85 c**	
A*S	**A1**	**3918.35 a**	**3191.44 b**	**E**	
	A2	**1466.83 c**	**1465.37 c**		
S*E	**E1**	**2651.83 a**	**1730.30 b**	**2191.07 b**	
	E2	**2638.42 a**	**2918.39 a**	**2778.41 a**	
	E3	**2787.52 a**	**2336.53 a**	**2562.02 a**	
Slope		**2692.59 a**	**2328.41 a**		

with each factor or their interactions value sharing similar alphabetical letter at one not significantly differences at (5%) have according to Duncan's test (Duncan, 1955).

The values show in table (6) revealed that the south aspect consisting of (16.75) which was more richness than the north aspect (12.79), and the narrow slope containing high species richness (17.58) compared with a steep slope (11.96). Although elevation was not significant, but richness was increased with increasing elevation.

4.3. Sorensen similarity index

The mean Sorensen similarity index was compared the vegetation under story tree forest and soil seed bank species were non significantly affects by aspect, elevations and slope gradient, as well as most interaction (Table 7). The south aspect more similarity (24.75) between vegetation and soil seed bank than north aspect (22.16), while the elevation at (1000 – 1100 m asl) greatest value (24.23) of similarity than other elevations, narrow slope more similarities than steep slope (Table 7).

Table (6):- Effect of aspects, elevation, slope gradient and their interactions on richness, seedlings emergence in the soil seed bank.

Aspects A	Elevations E	Slopes S		A*E	A
		S1	S2		
South	E1	23.00 a	10.00 de	16.50 a	16.75 a
	E2	16.50 abcd	14.50 bcde	15.50 a	
	E3	21.50 ab	15.00 bcde	18.25 a	
North	E1	11.25 cde	8.00 e	9.63 b	12.79 b
	E2	15.75 bcd	10.75 cde	13.25 ab	
	E3	17.50 abc	13.50 cde	15.50 a	
A*S	A1	20.33 a	13.17 b	E	
	A2	14.83 b	10.75 b		
S*E	E1	17.13 ab	9.00 c	13.06 a	
	E2	16.13 ab	12.63 bc	14.38 a	
	E3	19.50 a	14.25 b	16.88 a	
Slope		17.58 a	11.96 b		

with each factor or their interactions value sharing similar alphabetical letter at one not significantly differences at (5%) have according to Duncan's test (Duncan, 1955).

Table (7):- Mean Sorensen’s similarity index comparing the species composition of the vegetation and the soil seed bank according to aspects, elevation, and slope gradient.

Aspects A	Elevations E	Slopes S		A*E	A
		S1	S2		
South	E1	25.78 abc	26.91 abc	26.34 a	24.75 a
	E2	34.32 a	18.78 bc	26.55 a	
	E3	28.25 ab	14.45 c	21.35 a	
North	E1	23.14 abc	18.95 bc	21.05 a	22.16 a
	E2	20.93 bc	22.90 abc	21.92 a	
	E3	19.00 bc	28.02 ab	23.51 a	
A*S	A1	29.45 a	20.04 b	E	
	A2	21.03 b	23.29 ab		
S*E	E1	24.46 a	22.93 a	23.69 a	
	E2	27.62 a	20.84 a	24.23 a	
	E3	23.62 a	21.23 a	22.43 a	
Slope		25.24 a	21.67 a		

with each factor or their interactions value sharing similar alphabetical letter at one not significantly differences at (5%) have according to Duncan's test (Duncan, 1955).

4.4. Compatibility of understory vegetation and soil seed bank

The results display in table (8) revealed to 109 species was recorded with under forest vegetation and soil seed bank in the south aspect, which was 84 species in the surveying vegetation, and 67 species were identified from emerged seedlings of the soil seed bank. In this aspect, 42 species were combined in the soil seed bank and above soil vegetation. While the largest number of species found in the north aspect, which was recorded 138 species in both emerged seedlings of soil seed bank and understanding vegetation. Out of 113 species found in the above-ground vegetation, 67 species which was emerged in the soil seed bank. This was 42 species combined with soil seed bank and vegetation (Table, 9).

5. DISCUSSION

5.1. Vegetation cover

The findings data from this study mention that vegetation cover, like many individuals of plants and species richness influenced by their topographic factors (aspects, elevations, and slope gradient) in the understory forest mountains. Our results indicate that the highest density of vegetation understory forest was shown at north aspect, and increasing density of plant at increasing elevation, but non-significantly with slope gradient. On the other hand, the species richness in this research was non-effect by topographical conditions maybe due to the study area having less distance between elevations no more than (100 m) between them from the same microhabitat, and less range of slope gradient. The research conducted at Duhok Province at Ashawa mountains by (Al-Alousy and Al-Botany, 2013) references the effect of competition for sunlight. On the other hand, light and water, which is limited source could lead to a strong competition among plant species in respect to the aspects (Pugnaire and Valladares, 1999; Tilman, 1994). According to rainwater in natural mountains, which is increasing the number of vegetation in north aspect varied with south aspect (Badano et al., 2005; Ismail et al., 2014; Pugnaire and Luque, 2001). In addition to, high radiation of direct sunlight which is exposure to the south aspect more than with north aspect due to low humidity, high temperature by evaporation (Daubenmire, 1948; Mata-González et al., 2002). Also, microtopographic conditions like soil properties (Table, 1), influenced the distribution of the community of vegetation (Bochet and García-Fayos, 2004; Senbeta and Teketay, 2001). Based on the previous interpretation, the explanation for the obtained results can be attributed to the steep slope direction from top to bottom of the profile study area which exposed the soil to erosion by water, and that led to loss of soil properties by runoff of water (Snelder and Bryan, 1995; Wischmeier and Smith, 1978). The results of this study were also confirmed by (Bennie et al., 2008) who demonstrated that the microclimate of slope angle from top to bottom valley causes the dispersal of species to the valley with the runoff of water.

5.2. Soil seed bank

Our findings from soil seed banks, suggest that the higher density and richness of seedling emergence from soil trial were recorded with south aspect, and medium elevation, and narrow slope gradient (10 %). A similar study of soil seed banks of mountain elevation in Argentina were founded by (Funes et al., 2003); they reported that the density was increased with increasing elevation. Inverse results were found by (Ortega et al., 1997), in Spain, as density was increased with the low elevation of mountains, or the results of Cummins and Miller, (2002) ; Ma et al., (2010), who demonstrated decreasing in soil seed bank density with the increasing of elevation. This can be interpreted that at high elevations the temperature was lower and colder, which help in maintaining an increased persistence of seed banks and increasing seed bank density (Cavieres and Arroyo, 2001; Murdoch and Ellis, 2000). Also, seed predators and pathogenic fungi are low for high elevation at cold climates and low temperature which is associated with seed longevity and low embryonic metabolic rates (McGraw, 1989). These results are consistent with (Mirzaei and Karami, 2015) who found that the species richness decline within different elevations. In a study conducted for some areas of Argentina mountains, species richness increases with increasing elevation (Funes et al., 2003). Similarly, the results of Ortega et al. (1997), indicated that the seedling's emergence of seed bank species was increased with increasing gradient altitude in Spain. As well as, physical and chemical soil properties such as pH, bulk density, and organic matter (Table, 1), may have a critical contribution in changing the soil seed bank with various altitudes. These results are also in agreement with those of Ortega et al., (1997).

5.3. Soil seed bank compatibility with aboveground plants.

The low similarity between seed banks and vegetation may be due to the erosion or degraded vegetation in these mountains, which adversely reflected on the soil seed bank that cannot be involved in the regeneration of the seedling (Gomaa, 2012). Variation of species from the seed bank and above soil vegetation is due to the seed dispersal and infrequently disturbance restoration of natural forest has been reported by Baskin and Baskin, (1998) and Decocq et al., (2004). In addition, the south aspect is often drier, seeds are dispersal from different elevations and slope areas during high winds and storms or erosion, which is retained viable seeds under soil for a longer period (Looney and Gibson, 1995). The species which was a large size of seeds are more deposed with predation in the soil seed bank than small seeds of vegetation (Bertiller, 1998). These results agrees with those of Aziz and Khan (1996), who reported a low relationship between vegetation and soil seed banks, the similar results which show low relationship with a soil seed bank and vegetation due to predation of seeds was also reported by each of Baskin and Baskin (1998); Crowley and Garnett (1999) and Marone et al. (2000), depending on reproduction of vegetative propagation (Baker, 1989), and reduced the mechanisms of dormancy (Esmailzadeh et al., 2011).

Table(8) :-List of botanical species recorded in the understory plants and soil seed bank at South-facing aspect at different elevation and slope gradient at 0-10 cm depth. The sign + (existed), while – (nil).

Families and Species	900-1000				1000-1100				1100-1200			
	10%		20%		10%		20%		10%		20%	
	Plants	seed bank	Plants	seed bank	Plants	seed bank	Plants	seed bank	Plants	seed bank	Plants	seed bank
Amaryllidaceae												
Allium spp.	-	+	-	-	-	-	-	-	-	-	-	+
***Allium stamineum* Boiss**	+	-	-	-	-	-	-	-	+	-	+	-
Apiaceae												
***Lagoecia cuminoides* L.**	+	-	+	-	-	-	-	-	-	-	-	-
***Pimpinella eriocarpa* Banks and Sol.**	+	-	-	-	-	-	-	-	+	+	-	+
***Scandix pectin-veneris* L.**	+	+	-	-	-	-	-	-	-	+	-	-
***Tordylium cordatum* (Jacq.) Poir.**	-	-	-	-	+	-	+	-	-	-	-	-
***Torilis nodosa* (L.) Gaertn.**	+	-	+	-	+	-	-	-	-	-	+	-
Asparagaceae												
***Muscari comosum* (L.) Mill.**	-	-	-	-	+	-	-	-	-	-	-	-
***Muscari inconstrictum* Rech. f.**	-	-	-	-	+	-	-	-	-	-	-	-
***Ornithogalum kurdicum* Bornm.**	-	-	-	-	+	-	+	-	-	-	-	-
Asteraceae												
***Centaurea rigida* Banks and Sol.**	+	-	-	-	-	-	-	-	-	-	-	-
***Centaurea virgate* Lam.**	+	-	-	-	-	-	+	-	+	-	-	-
***Chardinia orientalis* (L.) Kuntze.**	+	-	-	-	-	-	+	+	-	-	-	-
***Crepis foetida* L.**	+	-	-	-	-	-	+	-	-	-	+	-
***Crupina crupinastrum* (Moris) Vis.**	+	-	+	-	-	-	-	-	+	-	+	-
***Echinops ritro* L.**	+	+	-	-	+	-	+	-	-	-	-	-
***Filago anatolica* (Boiss. et. Heldr.)**	+	-	-	-	-	-	+	-	+	-	-	-
***Garhadiolus hedypnois* (Fisch. Et. Mey.) Jaub. et Spach.**	+	-	-	-	+	-	+	-	+	-	-	-
***Geropogon hybridus* (L.) Sch. Bip.**	+	-	+	-	-	-	-	-	-	-	-	-
***Gundelia tournefortii* L.**	+	-	-	-	+	-	-	-	+	-	-	-
***Hedypnois rhagadioloides* L.**	-	-	-	-	-	-	-	-	-	+	-	+
***Phagnalon rupestre* (L.) DC.**	-	-	-	-	-	-	-	-	-	+	-	-
***Picris pauciflora* Willd.**	+	-	+	+	+	+	+	+	-	+	+	+
***Rhagadiolus stellatus* (L.) Gaertn.**	+	-	-	-	-	-	+	-	+	-	-	-
***Serratula cerinthifolia* (Sm.) Boiss.**	-	-	+	-	+	-	-	-	+	-	+	-
***Tragopogon porrifolius* L.**	-	+	-	-	-	-	+	-	-	-	+	-
***Urospermum picroides* (L.) Scop. ex. Schmidt.**	+	-	+	-	+	+	+	+	+	-	+	-

Zoegea leptaurea **L.**	+	-	+	-	+	-	+	-	+	-	+	-
Boraginaceae												
Anchusa strigosa **Banks and Sol.**	+	-	-	-	-	-	-	-	-	-	-	-
Myosotis arvensis **(L.) Hill**	+	+	+	-	+	-	+	+	+	+	+	+
Myosotis ramosissima **Rochel**	-	-	-	-	-	-	-	-	-	+	-	-
Onosma alborosea **Fisch. and C.A. Mey.**	+	-	-	-	-	-	-	-	-	-	-	-
Brassicaceae												
Lepidium latifolium **L.**	-	-	+	-	+	-	-	-	-	-	+	-
Campanulaceae												
Legousia speculum-veneris **(L.) Chaix.**	+	+	+	-	+	+	+	+	+	+	-	+
Dipsacaceae												
Scabiosa calocephala **Boiss.**	-	-	-	-	-	+	-	+	-	-	-	+
Euphorbiaceae												
Euphorbia helioscopia **L.**	+	-	-	-	-	-	-	-	-	-	-	-
Fabaceae												
Astragalus hamosus **L.**	-	+	-	-	-	-	-	-	-	-	-	-
Astragalus oocephalus **Boiss.**	-	-	+	-	-	-	-	-	-	-	-	-
Astragalus spinosus **(Forssk.) Muschl.**	+	-	-	-	-	-	-	-	-	-	-	-
Coronilla scorpioides **(L.) Koch.**	-	+	-	-	-	-	-	-	+	-	-	+
Hippocrepis unisiliquosa **L.**	-	+	-	-	-	-	+	-	-	+	-	+
Hymenocarpos circinnatus **(L.) Savi.**	-	+	-	-	-	+	-	+	-	+	-	-
Lathyrus aphaca **L.**	+	-	-	-	-	-	-	-	-	-	-	-
Medicago polymorpha **L.**	-	+	-	-	-	-	-	-	-	-	+	-
Medicago radiate **L.**	+	-	+	+	+	+	+	-	+	-	+	+
Medicago rigidula **(L.) Desre.**	+	+	-	-	-	-	-	-	-	+	+	+
Onobrychis cardachorum **Townsend.**	+	-	+	+	+	-	+	-	+	-	+	-
Onobrychis crista-galli **(L.) Lam.**	-	+	-	+	-	+	+	+	-	+	-	-
Scorpiurus muricatus **L.**	+	+	-	-	+	+	+	-	+	+	-	-
Trifolium campestre **Schreb.**	+	+	+	-	+	+	+	+	+	+	+	+
Trifolium dasyurum **Presl.**	+	-	+	-	-	-	-	-	-	-	-	-
Trifolium nigrescens **Viv.**	-	+	-	-	-	-	-	-	-	-	-	-
Trifolium pilulare **Boiss.**	+	-	+	-	+	+	+	+	-	+	+	-
Trifolium purpureum **Lois.**	+	-	+	+	+	+	+	+	+	+	+	-
Trifolium repens **L.**	-	+	-	+	-	+	-	+	-	+	-	+
Trifolium resupinatum **L.**	-	-	+	-	+	-	+	+	+	+	-	-
Trifolium stellatum **L.**	+	-	-	-	+	+	+	+	+	+	+	-
Trifolium tomentosum **L.**	-	-	-	-	-	-	-	-	-	+	-	-
Trigonella monspeliaca **L.**	+	-	-	-	-	-	+	-	-	+	-	-
Trigonella spicata **Sm.**	+	+	-	-	-	-	-	-	-	+	-	-
Vicia hybrida **L.**	+	+	-	-	+	-	+	-	-	-	-	-
Vicia michauxii **Spreng.**	-	+	-	-	-	+	-	-	-	-	-	-
Vicia sativa **L.**	-	+	-	-	-	-	-	-	-	-	-	-
Geraniaceae												
Erodium malacoides **(L.) Lher.**	-	-	-	-	-	-	-	-	-	+	-	-

Hypericaceae												
***Hypericum retusum* Auch ex Jaub.**	+	-	-	-	-	-	-	-	-	-	-	-
Iridaceae												
***Gladiolus kotschyanus* Boiss.**	+	-	-	-	+	-	-	-	-	-	+	-
***Glycyrrhiza glabra* L. var. glabra**	+	+	-	+	-	+	-	-	-	+	-	-
Lamiaceae												
***Salvia acetabolosa* L.**	+	-	+	-	-	-	+	-	-	-	+	-
***Salvia bracteata* Banks et Sol.**	-	-	+	-	-	-	+	-	-	-	-	-
***Teucrium polium* L.**	+	-	-	-	-	-	-	-	-	-	+	-
***Thymus kotschyanus* Boiss. et Hohen.**	+	-	-	-	-	-	+	-	-	-	+	-
***Ziziphora capitata* L.**	+	-	-	-	-	-	-	-	-	-	-	-
Linaceae												
***Linum nodiflorum* L.**	-	+	-	-	-	+	-	+	+	-	+	-
***Linum strictum* L.**	+	+	+	+	+	+	+	+	+	+	+	+
Malvaceae												
***Alcea kurdica* (Schlecht.) Alef.**	-	-	-	-	-	-	-	-	-	+	+	-
Orobanchaceae												
***Parentucellia latifolia subsp. Flaviflora* (Boiss)**	+	+	-	+	-	+	+	+	+	+	-	+
Plantaginaceae												
***Plantago lanceolata* L.**	+	-	-	-	-	-	-	-	+	-	-	-
Poaceae												
***Aegilops triuncialis* L.**	+	+	+	-	-	-	+	-	-	-	-	-
***Aegilops umbellulata* Zhur.**	+	+	+	+	-	-	+	+	+	-	+	-
***Alopecurus pratensis* L.**	-	-	-	+	-	-	-	+	-	+	-	+
***Avena fatua* L.**	+	+	+	+	-	-	-	+	+	+	+	+
***Avena ludoviciana* Dur.**	-	-	-	-	-	-	-	-	-	-	+	-
***Bromus danthoniae* Trin in Mey.**	+	-	+	-	+	-	+	-	+	-	+	-
***Bromus danthoniae var. danthoniae* Trin.**	+	+	+	+	-	+	+	+	+	+	+	+
***Bromus danthoniae var. lanuginosus* Rohe**	-	+	-	+	-	+	-	+	-	+	-	+
***Bromus madritensis* L.**	+	-	+	+	-	-	-	-	+	+	-	-
***Bromus scoparius* L.**	-	-	-	-	-	-	-	-	-	+	-	-
***Bromus sterilis* L.**	-	-	-	+	-	-	-	-	-	-	-	-
***Catapodium rigidum* (L.) C.E.Hubb.**	-	-	-	+	-	+	-	+	-	-	-	+
***Cynosures elegans* Desf.**	-	-	-	-	-	-	-	-	-	-	+	-
***Echinaria capitata* (L.) Desf.**	-	+	+	-	-	-	-	-	+	-	-	+
***Hordeum bulbosum* L.**	-	-	-	+	+	+	-	+	+	+	-	+
***Hordeum spontaneum* Koch.**	+	+	+	+	+	-	+	-	+	-	-	+
***Lolium rigidum* Gaud.**	+	+	+	-	+	-	-	-	+	+	-	-
***Lophochloa phleoides* (Vill.) Rchb.**	-	+	-	-	+	+	+	-	-	+	-	+
***Phalaris brachystachys* Link in Schrad.**	-	-	-	-	-	-	+	-	-	-	-	-
***Poa bulbosa* L.**	-	-	+	-	-	-	-	+	-	+	+	-

Polypogon monspeliensis **(L.) Desf.**	-	-	-	-	-	-	-	-	+	-	-	-
Sehima nervosum **(Rottler) Stapf**	-	+	-	-	-	+	-	+	-	+	-	+
Taeniatherum caput-medusae **(L.) Nevski**	-	+	-	+	-	+	-	+	-	-	-	-
Vulpia myuros **L.**	-	-	-	+	-	+	-	+	-	+	-	+
Primulaceae												
Anagallis arvensis **L.**	+	+	+	+	+	+	+	+	+	+	+	+
Ranunculaceae												
Anemone coronaria **L.**	-	+	-	+	-	-	-	-	-	-	-	-
Ceratocephala falcata **(L.) Pers.**	-	+	-	-	-	-	-	-	-	-	-	-
Rosaceae												
Poterium lasiocarpum **Bioss. et Haussken.**	-	-	-	-	+	-	-	-	-	-	-	-
Rubiaceae												
Galium mite **Boiss. et Hoh**	-	+	-	-	-	+	-	-	-	+	-	-
Sherardia arvensis **L.**	+	-	+	-	-	-	-	-	+	-	-	-
Scrophulariaceae												
Scrophularia xenoglossa **L.**	-	-	-	-	-	-	-	-	-	-	+	-
Thymelaeaceae												
Thymelaea passerina **(L.) Coss. & Germ.**	-	+	-	-	-	+	-	+	-	-	-	+

Table (9):- List of botanical species recorded in the understory plants and soil seed bank at North-facing aspect at different elevation and slope gradient at 0-10 cm depth. The sign + (existed), while – (nil).

Familied and Species	**900-1000**				**1000-1100**				**1100-1200**			
	10%		**20%**		**10%**		**20%**		**10%**		**20%**	
	plants	**seed bank**	**plants**	**seed bank**	**plants**	**seed bank**	**plants**	**seed bank**	**plants**	**seed bank**	**plants**	**seed bank**
Amaryllidaceae												
Allium stamineum **Boiss**	-	-	-	-	+	-	-	-	-	-	-	-
Apiaceae												
Ammi majus **L.**	-	-	-	-	-	-	-	-	-	+	-	-
Carum carvi **L.**	-	-	+	-	-	-	+	-	+	-	-	-
Lagoecia cuminoides	-	-	-	-	+	-	+	-	+	-	+	-
Pimpinella eriocarpa **Banks and Sol.**	+	-	-	+	-	+	+	-	+	-	-	-
Scandix pectin-veneris **L.**	-	+	-	-	-	+	-	-	-	+	-	+
Tordylium cordatum **(Jacq.) Poir.**	-	-	-	-	-	-	-	-	-	-	+	-
Torilis nodosa **(L.) Gaertn.**	-	-	+	-	+	-	+	+	+	-	+	+
Aristolochiaceae												
Aristolochia bottae **Jaub. et. Spach.**	-	-	-	-	+	-	+	-	-	-	-	-
Asparagaceae												
Muscari comosum **(L.) Mill.**	-	-	-	-	-	-	+	-	-	-	-	-
Muscari inconstrictum **Rech. f.**	+	-	-	-	-	-	+	-	-	-	-	-
Ornithogalum kurdicum **Bornm.**	-	-	+	-	-	-	+	-	-	-	-	-

Asteraceae												
***Andryala integrifolia* L.**	-	-	-	-	-	+	-	-	-	+	-	-
***Calendula arvensis* L.**	-	-	-	-	-	-	-	-	+	-	-	-
***Carduus pycnocephalus* L.**	-	-	-	-	-	-	-	-	+	-	-	-
Centaurea rigida	-	-	-	-	-	-	-	-	-	-	+	-
***Centaurea virgate* Lam.**	-	-	+	-	-	-	-	-	-	-	-	-
***Chardinia orientalis* (L.) Kuntze.**	-	-	+	-	+	+	+	-	-	+	+	-
***Crepis foetida* L.**	-	-	-	-	+	-	-	-	+	-	+	-
***Crepis sancta* (L.) Babcok.**	-	+	-	-	-	-	-	-	-	-	-	-
***Crupina crupinastrum* (Moris) Vis.**	+	+	+	-	-	+	+	-	-	-	+	-
***Echinops ritro* L.**	-	+	-	-	+	-	+	-	+	-	-	-
***Filago anatolica* (Boiss. et. Heldr.) Chrtek et. Holub.**	-	-	-	-	-	-	-	+	-	-	+	-
***Garhadiolus hedypnois* (Fisch. Et. Mey.) Jaub. et Spach.**	-	-	-	-	-	-	-	-	+	-	-	-
***Geropogon hybridus* (L.) Sch. Bip.**	+	+	-	-	+	-	+	-	-	-	-	-
***Gundelia tournefortii* L.**	-	-	+	-	-	-	-	-	-	-	-	-
***Lactuca serriola* L.**	-	-	-	-	-	-	-	-	-	+	-	+
***Onopordum carduchorm* Born. et Beau.**	-	-	+	-	-	-	-	-	-	-	-	-
***Phagnalon rupestre* (L.) DC.**	-	-	-	-	+	-	-	-	-	+	-	-
***Picris pauciflora* Willd.**	+	-	-	-	-	+	+	-	+	-	+	-
Picris SPP.	-	-	+	-	-	-	-	-	-	-	+	-
***Rhagadiolus stellatus* (L.) Gaertn.**	-	-	-	-	+	-	-	-	-	-	+	-
***Senecio vulgaris* L.**	-	-	-	-	-	-	-	-	-	-	+	-
***Serratula cerinthifolia* (Sm.) Boiss.**	-	-	+	-	-	-	+	-	+	-	+	-
***Sonchus oleraceous* L.**	-	-	-	-	-	-	-	-	+	-	-	-
***Taraxacum officinale* (L.) Web. ex Wigg.**	-	-	-	-	-	-	+	-	-	-	-	-
***Tragopogon porrifolius* L.**	+	-	-	-	+	-	-	-	+	-	+	+
***Urospermum picroides* (L.) Scop. ex. Schmidt.**	+	-	+	-	+	-	+	-	-	-	+	-
***Zoegea leptaurea* L.**	+	-	+	-	+	-	+	-	+	-	+	-
Boraginaceae												
***Myosotis arvensis* (L.) Hill**	+	+	-	-	+	+	+	-	+	+	+	+
***Onosma alborosea* Fisch. and C.A. Mey.**	-	-	-	-	+	-	+	-	+	-	+	-
***Onosma sericeum* Willd.**	-	-	-	-	-	-	+	-	-	-	-	-
***Alkanna kotschyana* DC.**	-	-	-	-	-	-	+	-	-	-	-	-
***Anchusa azurea* Mill.**	-	-	-	-	+	-	+	-	-	-	-	-
***Anchusa strigosa* Banks and Sol.**	+	-	-	-	-	-	+	-	-	-	-	-
Brassicaceae												
***Biscutilla didyma* L.**	-	-	-	-	-	+	-	-	-	-	-	-
Cardaria draba	-	-	+	-	-	-	-	-	-	-	-	-
***Lepidium latifolium* L.**	-	-	-	-	-	-	+	-	+	-	+	-

Sinapis alba **L.**	-	-	+	-	-	-	-	-	-	-	-	-
Campanulaceae												
Legousia speculum-veneris **(L.) Chaix.**	+	-	+	+	-	-	+	-	-	-	-	-
Caprifoliaceae												
Cephalaria cetosa	-	-	+	-	+	-	+	-	-	-	-	-
Caryophyllaceae												
Petrorhagia prolifera **L.**	-	-	-	-	-	+	-	+	-	+	-	-
Euphorbiaceae												
Euphorbia macroclada **Boiss.**	-	-	-	-	-	-	+	-	-	-	-	-
Fabaceae												
Astragalus oocephalus **Boiss.**	-	-	-	-	+	-	-	-	-	-	-	-
Astragalus spinosus **(Forssk.) Muschl.**	+	-	+	-	-	-	-	-	-	-	-	-
Coronilla scorpioides **(L.) Koch.**	+	-	+	-	-	-	+	+	+	+	-	-
Glycyrrhiza glabra **L.**	-	+	-	-	-	+	-	-	-	-	-	-
Hippocrepis unisiliquosa **L.**	+	-	+	-	-	+	+	-	+	+	-	-
Hymenocarpos circinnatus **(L.) Savi.**	-	+	-	+	-	+	-	-	-	-	-	-
Lens orientalis **(Boiss.) Schmalh.**	-	+	-	-	-	+	+	+	+	+	+	+
Medicago polymorpha **L.**	+	-	+	-	-	-	-	-	-	-	+	-
Medicago radiate **L.**	+	-	+	+	+	-	-	-	-	+	+	-
Medicago rigidula **(L.) Desre.**	-	+	-	-	+	+	+	-	+	+	-	-
Onobrychis cardachorum **Townsend.**	+	-	+	-	-	-	-	-	-	-	-	-
Onobrychis crista-galli **(L.) Lam.**	-	+	-	-	-	-	-	-	-	-	+	-
Onobrychis kotschyana **Fenzl.**	-	-	-	-	+	-	-	-	-	-	+	-
Onobrychis ptolemaica **(Delile) DC. subsp.** ***macroptera.***	+	-	+	-	-	-	+	-	-	-	-	-
Ononis sicula **Guss. Spiny.**	-	-	-	-	+	-	-	-	-	-	-	-
Scorpiurus muricatus **L.**	-	+	+	+	-	-	-	+	-	-	-	-
Trifolium campestre **Schreb.**	+	+	+	+	+	+	+	+	+	+	+	+
Trifolium dasyurum **Presl.**	-	-	-	-	+	-	-	-	-	-	-	-
Trifolium nigrescens **Viv.**	-	+	-	+	-	-	-	-	-	+	-	+
Trifolium pilulare **Boiss.**	+	+	+	+	+	+	+	-	+	+	-	+
Trifolium purpureum **Lois.**	-	-	-	-	+	-	+	-	+	+	+	-
Trifolium repens **L.**	-	+	-	+	-	+	+	-	-	+	-	-
Trifolium resupinatum **L.**	-	+	-	+	-	-	-	-	+	+	+	+
Trifolium stellatum **L.**	+	+	-	-	+	-	-	-	+	+	+	+
Trifolium tomentosum **L.**	-	-	-	-	-	-	-	-	-	+	-	-
Trigonella monspeliaca **L.**	+	-	-	+	+	-	+	-	-	+	-	-
Trigonella spicata **Sm.**	+	-	-	-	+	-	-	-	-	-	-	-
Vicia hybrid **L.**	-	-	-	-	+	-	-	-	+	-	+	-
Vicia michauxii **Spreng.**	-	-	-	-	-	-	-	-	-	-	-	+
Vicia narbonensis **L.**	-	-	-	-	-	-	-	-	-	-	+	-
Vicia sativa **L.**	-	+	-	-	-	+	+	-	+	-	-	+
Geraniaceae												
Erodium cicutarium **(L.) L 'Her'**	-	-	+	-	-	-	-	-	-	+	-	-

Hypericaceae												
***Hypericum lydium* Boiss.**	-	-	+	-	-	-	-	-	-	-	-	-
Iridaceae												
***Gladiolus kotschyanus* Boiss.**	+	-	+	-	+	-	+	-	+	-	+	-
Lamiaceae												
***Teucrium polium* L.**	+	-	+	-	-	-	-	-	-	-	-	-
***Thymus kotschyanus* Boiss. et Hohen.**	+	-	+	-	-	-	-	-	-	-	-	-
***Salvia acetabolosa* L.**	+	-	+	-	-	-	+	-	+	-	+	-
***Salvia bracteata* Banks et Sol.**	-	-	-	-	-	-	-	-	+	-	+	-
***Salvia syriaca* L.**	-	-	-	-	-	-	-	-	-	-	+	-
***Ziziphora capitata* L.**	-	-	-	-	-	-	-	-	-	-	+	-
Linaceae												
***Linum nodiflorum* L.**	-	-	-	-	-	-	+	-	-	-	+	-
***Linum strictum* L.**	+	+	+	+	+	+	+	+	+	+	+	-
Malvaceae												
***Alcea kurdica* (Schltdl.) Alef.**	-	-	-	-	+	-	-	-	+	-	-	-
Orobanchaceae												
***Parentucellia latifolia* subsp. *flaviflora* (Boiss.) Hand**	+	-	+	+	-	+	+	+	-	-	+	+
Papaveraceae												
***Papaver macrostomum* Boiss. et. Huet.**	-	-	+	-	+	-	-	-	-	-	-	-
Plantaginaceae												
Plantago lanceolata L.	-	+	+	-	+	-	-	-	+	+	-	-
***Plantago psyllium* L.**	-	-	-	-	-	-	-	-	-	-	+	-
Poaceae												
***Aegilops triuncialis* L.**	+	+	+	+	+	+	+	+	+	+	+	+
***Aegilops ovate* L.**	-	-	-	-	-	-	-	-	-	-	+	-
***Aegilops umbellulata* Zhur.**	+	+	+	+	+	+	+	+	+	+	+	+
***Alopecurus pratensis* L.**	-	-	-	-	-	-	-	-	-	+	-	-
***Avena fatue* L.**	-	+	-	+	+	+	+	+	+	+	+	+
***Avena ludoviciana* Dur.**	-	-	-	-	-	-	+	-	-	-	+	-
***Bromus danthoniae* Trin in Mey.**	-	-	+	-	+	-	+	-	+	-	+	-
***Bromus danthoniae var. danthoniae* Trin.**	+	+	+	-	+	+	-	+	+	+	+	+
Bromus danthoniae var. lanuginosus Rohe	-	-	-	+	-	+	-	+	-	+	-	+
***Bromus madritensis* L.**	-	-	-	-	+	-	-	+	-	-	+	+
***Bromus sterilis* L.**	-	-	-	-	-	+	-	+	-	+	-	+
***Catapodium rigidum* (L.) C.E.Hubb.**	-	-	-	+	-	+	-	+	-	+	-	-
***Corynephorus canescens* L.**	-	-	-	+	-	-	-	-	-	+	-	-
***Cynosures elegans* Desf.**	-	-	-	-	-	-	-	-	+	-	-	-
***Dactylis glomerata* L.**	-	-	-	-	-	-	-	-	+	-	-	-
***Echinaria capitata* (L.) Desf.**	-	-	-	-	-	-	-	-	-	+	-	-
***Hordeum bulbosum* L.**	+	-	-	-	+	-	+	+	+	+	+	-

Hordeum spontaneum **Koch.**	-	-	-	+	+	+	+	+	+	+	+	+
Lolium rigidum **Gaud.**	-	+	-	-	-	-	-	-	+	+	+	-
Lophochloa phleoides **(Vill) Rchb.**	-	-	+	-	-	-	-	-	+	-	-	-
Milium pedicellarae **(Bornm.) Rozhe.**	-	-	-	-	-	+	-	+	-	-	-	-
Phalaris brachystachys **Link in Schrad.**	-	-	-	-	-	-	-	-	+	-	-	-
Poa bulbosa **L.**	-	-	+	+	-	-	-	-	+	-	-	-
Polypogon monspeliensis **(L.) Desf.**	+	-	-	-	-	-	-	-	-	-	-	-
Sehima nervosum **(Rottler) Stapf**	-	+	-	+	-	+	-	+	-	+	-	+
Taeniatherum caput-medusae **(L.) Nevski**	-	-	-	-	-	+	-	-	-	+	-	+
Vulpia myuros **L.**	-	+	-	+	-	-	-	+	-	+	-	+
Polygalaceae												
Polygala monspeliaca **L.**	-	-	+	-	-	-	-	-	-	-	-	-
Primulaceae												
Anagallis arvensis **L.**	+	+	+	-	-	+	+	-	-	-	-	+
Ranunculaceae												
Ranunculus asiaticus **L.**	-	-	-	-	-	-	-	-	-	-	+	-
Ranunculus spp.	-	-	+	-	-	-	-	-	-	-	-	-
Anemone coronaria **L.**	-	+	-	-	-	+	-	-	-	-	-	+
Rhamnaceae												
Paliurus spina-christi **Mill.**	-	-	-	-	-	-	-	-	-	+	-	-
Rosaceae												
Poterium lasiocarpum **Bioss. et.Hausskn**	+	+	+	+	+	+	+	-	+	+	-	-
Rubiaceae												
Galium mite **Boiss. et Hoh**	-	+	-	-	-	+	-	+	-	+	-	+
Sherardia arvensis **L.**	+	-	-	-	+	-	+	-	+	-	+	-
Scrophulariaceae												
Verbascum speciosum **Schrad.**	-	-	-	-	-	-	-	-	-	-	+	-
Verbascum Thapsus **L.**	-	-	+	-	-	-	-	-	-	-	+	-

6. CONCLUSION

We conclude that the change in density of plants understory forest vegetation and soil seed bank was affected by aspects and elevations. At the same time, the slope gradient has no effect on these characters, as well as on the species richness. In addition, the Sorensen similarity index was low between understory vegetation and soil seed bank, possibly as a consequence of a little of samples from wide areas to fully cover vegetation, which needs to be investigated in future studies.

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