



## COMPARISON DIVERSITY OF *Asphodeline lutea* PLANT SPECIES AMONG SIX LOCATIONS AT ALSHOUBAK AND ALNAQAB ECOSYSTEMS IN JORDAN

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### ABSTRACT

*Asphodeline lutea* plant species is an edible plant with sweet taste used by local communities as a medicinal plant and it can be taken fresh or roast. The diversity of *Asphodeline lutea* plant species was studied at AlShoubak and AlNaqab regions of Ma'an governorate Southern part of Jordan. Quadrat-transect method was randomly used to determine the density, richness, dominance and evenness indices under selected sites. A total of 90 quadrats of 0.5m x 0.5m size were laid down at 50m intervals along parallel line transects. A total of 15 vegetation species were recorded during this study. Of the 15 species, the most popular medicinal plants used in folk medicine (*Paronychia argentea* and *Teucrium polium*) were not recorded in all sites. Shannon diversity value was higher at AlJhair site with elevation 1548m. Among studied sites West direction showed high species richness (9) while the South direction recorded the lowest species richness (4) at AlNaqab/AlHiyad site with elevation 1554m. Among studied sites high density and frequency values of *Asphodeline lutea* species were recorded to AlShoubak castle and AlNaqab/AlHiyad, 5.33 and 0.93, respectively. *Cyndon dactylon* species has the highest density values (10.8 and 5.8). Approximately at all studied site *Artemisia herba-alba* Asso. considered the dominant plant and an associated for most vegetation species. Management plan for conserving the plant genetic resources at their natural habitats is necessary for next and present generations.

**Keywords:** diversity, quadrat-transect, Jordan, Shannon's, species richness.

### INTRODUCTION

Yellow asphodel (*Asphodeline lutea*) Reichenb belongs to Xanthorrhoeaceae family and described as a showy, perennial herb, usually with a single stem and many fusiform roots, spreading under the ground to form a colony. Leaves fleshy, rounded, semi hollow, concentrated at the base, with some leaves spreading along the flowering stalk. Flowers 23cm in diameter, irregular, yellow-orange or lemon with brown midrib. Habitat: heavy soil of waste high mountains, Irbid, Ajloun, Salt, Amman, and Ras-an-Naqab. Flowering time during March to May (Al-Esawi, 1998). Yellow asphodel is a wild plant species used as a food and in folk medicine, known as (Qtat Abu-Ammar and Asmoul in Arabic) and grown at Alshoubak region Southern part of Jordan. *Asphodeline lutea* has potentially a good source of antimicrobial agents can be used to cure certain diseases (Ali-Shtayeh *et al.*, 1998). Ivanova *et al.* (2010) found that the methanol and chloroform extracts from *Asphodeline lutea* caused a marked inhibition of multidrug resistance (MDR) in cancer cells. Various indices of diversity are used for estimating the genetic diversity within wild habitats such as species richness is a measure of the number of species found in a sample or defined area based on quadrat domain. Quadrat is a frame designed with circle or rectangular shape either metal or wood to establish a standard area for examining the vegetation (Kent and Coker, 1992). They defined the transect as a stripe along which samples of herbaceous species are recorded or taken. Density is defined as the number of plants of individual species per unit area (Rajan, 2001). Frequency is the percentage of quadrates in which a species was recorded (Hussain *et al.*, 2009). Whereas Shameem and

Kangroo, (2011) defined the frequency as a measure of the uniformity of the distribution of a species; thus a low frequency indicates that a species is either irregularly distributed or rare in a particular stand or forest. Species diversity is one of the most important indices used for evaluating the sustainability of forest communities (Rad *et al.*, 2009). Shannon's and Simpson's index can show considerable variation in response to changes in landscape richness and evenness (Nagendra, 2002). Distribution of plant communities along climatic and topographic gradients were determined based on species richness, stand density, Shannon index of diversity, basal area, and Simpson index of dominance (Joseph *et al.*, 2008). Species richness showed a unimodal distribution with respect to elevation gradient, low (<800 m) and high (>1000) elevation zones had lower species richness, while medium elevation zones (800-1000 m) showed higher species richness and diversity (Joseph *et al.*, 2008). Variation structure was determined by species diversity and relative densities of constituent species at Sri Lanka (Jayakody *et al.*, 2008). Variation in quantitative parameters like, species richness and species diversity is related to variations in edaphic factors, elevation, slope aspect and micro-climatic conditions between the two sites (Shameem and Kangroo, 2011). However, to my knowledge no studies were dealt with biodiversity analysis or habitat variation in the Alshoubak region mainly for *Asphodeline lutea*, therefore, the present study is the first time done and conducted with the objective of determining the genetic diversity in the wild habitat of *Asphodeline lutea* using indices of diversity such as richness, density, frequency and Shannon's index parameters.



## MATERIALS AND METHODS

### Study area

AlShoubak region is a portion of Ma'an governorate sited at Southern part of Jordan. Three transects established with 50m length per transect to study the diversity of *Asphodeline lutea* (Figure-1). A total of 15 quadrats with an area (0.5m x 0.5m) randomly done per each region. These quadrats were sampled during the survey in March of year 2015. The number of individuals and occurrence of each species in the quadrats was then used to calculate its diversity indices also density and frequency, respectively. The collected data directly inserted in the excel sheet for analysis. The spatial location (latitude, longitude and altitude) of each site was measured by using Global Positioning System (GPS) (Table-1).

### Data analysis

Species richness was estimated as the number of the species present in the quadrat. To quantify the diversity of the plant species, the Shannon index ( $H'$ ) as a measure of species abundance and richness applied. The

data for each site were analyzed separately. Excel program 2007 was used in the organization and presentation of data statistically. Density and frequency calculated based on equations used by Hussain, (1989) as follow:

$$\text{Frequency} = \frac{\text{Number of quadrates in which species occurs} \times 100}{\text{Total number of quadrates}}$$

$$\text{Density} = \frac{\text{Number of plants of a certain species} \times 100}{\text{Total area sampled}}$$

Whereas, the qualitative and quantitative diversity indices such as Shannon's diversity, Dominance, Simpson, and Equitability were analyzed using the PAST software program ver. 2.18c (Hammer *et al.*, 2001).

## RESULTS

Coordinates and diversity indices of *Asphodeline lutea* species at six sites within Alshoubak region of Ma'an governorate Southern part of Jordan presented at (Table-1).

**Table-1.** Coordinates and diversity indices for *Asphodeline lutea* species in six sites of AlShoubak district at Jordan.

Direction	North	Middle	West		South	
Location	AlMugariah	AlShoubak castle	Al Jhair 1	Al Jhair 2	Al Naqab Al Hiyad	Taibeh-Naqab cross
N°	30 33.142"	30 32.082"	30 32.136"	30 32.609"	30 02.334"	30 02.528"
E°	035 33.792"	035 33.334"	035 30.961"	035 31.246"	035 28.534"	035 27.330"
Elevation (m)	1229	1430	1535	1548	1554	1702
Diversity indices per 15 Quadrat						
Species richness	8	5	4	9	4	5
Taxa_S	8	5	4	9	4	5
Individuals	180	132	223	149	109	39
Dominance_D	0.429	0.464	0.574	0.393	0.566	0.617
Shannon_H	1.032	0.949	0.777	1.183	0.772	0.772
Simpson_1-D	0.571	0.536	0.426	0.607	0.434	0.382
Evenness_e^H/S	0.351	0.517	0.544	0.363	0.541	0.433
Equitability_J	0.496	0.580	0.561	0.539	0.557	0.479

Four directions were selected according to the existence of *Asphodeline lutea* species. Among studied sites West direction showed high species richness (9) while the South direction recorded the lowest species richness (4) at AlNaqab - AlHiyad site with elevation 1554m (Table-1). High species richness 9 was recorded for AlJhair (2), 8 for AlMugariah, 5 for both Alshoubak castle and Taibeh-Naqab cross and 4 for both AlJhair (1) and AlNaqab-AlHiyad with elevations 1548m, 1229m, 1430m, 1702m 1535 and 1554m, respectively (Table-1). High number of individuals of plant species was recorded for sites of low plant species richness such as AlJhair (1) 223 while Taibeh-AlNaqab cross with 39 individuals. Dominance value recorded less than 1.00 with high value

showed by Taibeh-AlNaqab (0.617) but AlJhair 2 had the lowest value (0.393) (Table-1). Shannon diversity index was higher at AlJhair 2 with value 1.183 followed by 1.032, 0.494, 0.574 and 0.772 for AlMugariah, Alshoubak castle, AlJhair (1), AlNaqab-AlHiyad and Taibeh-AlNaqab, respectively. High value of Simpson (0.607) registered by AlJhair 2, (0.571) to AlMugariah, 0.536 for AlShoubak castle and (0.382) to Taibeh-AlNaqab (Table-1). Evenness ranged from (0.351 to 0.544) with lowest value (0.351) to AlMugariah while AlJhair registered the highest value (0.544) (Table-1). The values of equitability was ranged from (0.477 to 0.580) were AlShoubak castle has 0.580, AlJhair 1 (0.561), AlNaqab-AlHiyad (0.557), AlJhair 2 (0.539), AlMugariah (0.496) and 0.479 for



Taibeh-AlNaqab cross. Density and frequency values presented in the Table-2 and Table-3. Among studied sites high density and frequency values of *Asphodeline lutea* species were recorded to AlShoubak castle and AlNaqab-AlHiyad, 5.33 and 0.93, respectively. The values of density were 5.33, 5.13, 5.2, 3.93, 3.2 and 2.0 to AlShoubak castle, AlMugariah, AlNaqab-AlHiyad, (AlJhair 2 and AlJhair 1) and Taibeh-AlNaqab, respectively (Table-2 and Table-3). Among these sites

AlMugariah showed the lowest value of frequency. Comparing among sites, *Cyndon dactylon* has the highest density values (10.8 and 5.8) (Table-2), *Asphodeline lutea* 5.33, 5.2 and 2.0 for AlShoubak castle, AlNaqab-AlHiyad and Taibeh-AlNaqab cross. Four medicinal plant species were registered during this study mainly, *Artemisia herba-alba* Asso, *Teucrium polium*, *Paronychia argentea* and *Peganum harmala*.

**Table-2.** Density and frequency of plant species diversity at AlMugariah, Alshoubak castle and Al Jhair 1 sites in Ma'an governorate during 2015.

AlMugariah			Alshoubak castle			Al Jhair 1		
Species	Density	Frequency	Species	Density	Frequency	Species	Density	Frequency
<i>Anthemis palaestina</i> Reuter	0.07	0.10	<i>Artemisia herba-alba</i> Asso.	0.47	0.67	<i>Artemisia herba-alba</i> Asso.	0.53	0.33
<i>Asphodeline lutea</i>	5.13	0.67	<i>Asphodeline lutea</i>	5.33	0.73	<i>Asphodeline lutea</i>	3.20	0.80
<i>Centaurea</i> sp. ( <i>eryngioides</i> Lam.)	0.33	0.2	<i>Cholchicum brachyphyllum</i> Bioss. And Hausskn.	0.67	0.13	<i>Cyndon dactylon</i>	10.80	0.73
<i>Cynodon dactylon</i>	5.8	0.47	<i>Cyndon dactylon</i>	2.67	0.73	<i>Noaea mucronata</i>	0.40	0.40
<i>Lactuca orientalis</i> (Boiss.) Boiss	0.67	0.20	<i>Noaea mucronata</i>	0.20	0.20			
<i>Noaea mucronata</i>	0.13	0.20						
<i>Paronychia argentea</i>	0.07	0.10						
<i>Peganum harmala</i>	0.07	0.10						

**Table-3.** Density and frequency of plant species diversity at Al Jhair 2, AlNaqab-AlHiyad sites and AlTaibh-Naqab cross in Ma'an governorate during 2015.

Al Jhair 2			AlNaqab-AlHiyad			AlTaibh-Naqab cross		
Species	Density	Frequency	Species	Density	Frequency	Species	Density	Frequency
<i>Artemisia herba-alba</i> Asso.	0.67	0.67	<i>Artemisia herba-alba</i> Asso.	0.27	0.13	<i>Artemisia herba-alba</i> Asso.	0.07	0.07
<i>Asphodeline lutea</i>	3.93	0.80	<i>Asphodeline lutea</i>	5.2	0.93	<i>Asphodeline lutea</i>	2.00	0.73
<i>Centaurea</i> sp.	0.07	0.07	<i>Lactuca orientalis</i> (Boiss.) Boiss	0.13	0.07	<i>Centaurea</i> sp.	0.07	0.07
<i>Cynodon dactylon</i>	4.80	0.73	<i>Lasiopogon muscoides</i>	1.67	0.07	<i>Lactuca orientalis</i> (Boiss.) Boiss	0.07	0.07
<i>Hordeum vulgare</i>	0.20	0.07				<i>Peganum harmala</i>	0.07	0.07
<i>Lactuca orientalis</i> (Boiss.) Boiss	0.07	0.07						
<i>Noaea mucronata</i>	0.67	0.07						
<i>Teucrium polium</i>	0.07	0.07						
<i>Tragopogon collinus</i> DC.	0.33	0.07						



**Figure-1.** *Asphodeline lutea* species grown at AlMugaraiah, Alshoubak.

## DISCUSSIONS

Estimation of species diversity helps in understanding the ecological significance of the species in the moist deciduous forest (Dash *et al.*, 2009). Compared between sites the South direction with elevation 1554m and 1702m had low species richness, this related to the low amount of rain fall, severe grazing and over exploitation. Such type of variations in species diversity may be due to nature of soil i.e. acidity, nutrient availability and other micro-climatic factors (Sigdel, 2009). Also, he said that the number of herb species was higher in rainy season than in dry season. The area with highest annual rainfall and drainage density combined with a relatively high elevation and low annual temperature and slope, showed maximum species richness. Josph *et al.* (2008) pointed that the area with highest annual rainfall and drainage density combined with a relatively high elevation and low annual temperature and slope, showed maximum species richness. However, plant nutrient availability and its uptake by plant as well area slope play a great role in variability of species richness. *Asphodeline lutea* density was higher at low elevation 1229m and 1554m this related to self-generation and according to the ecological conditions. Sigdel, (2009) said that the the highest number of species (109) was found in site II (1900-2300M), he pointed this may be due to the transition zone of sub-tropical and temperate zone. In our study, South part has less number of biodiversity compared to west direction but here higher diversity was reported in lower altitude rather than higher altitude.

AlJhair 2 site has a high diversity compared to the rest sites which reflects the high biodiversity of its natural ecosystem. The study areas are considered as a pasture for animals in which highly affected on distribution and growth of plant species. Grazing pressure not only brought about a reduction in the plant density and vegetation cover, but also caused a significant change in plant growth pattern (Shameem and Kangroo, 2011). Herbaceous species that were observed in the quadrats was recorded but it does not mean it includes all vegetation types because there is another species may not grow or complete its life cycle before starting the study. Further study is needed for testing the active ingredient extract against cancer cell lines.

## CONCLUSIONS

Determination of herbaceous diversity lead to understanding the community structure of plant species. Species richness and diversity were observed to decrease with increasing the altitude. Due to vibrations in the amount of rainfall from year to year has resulted absent some of species also severe grazing and human interfering have highly influenced on species composition. On the other hand, monitoring time of wild habitats is a key for knowing the presence or absent vegetations cover. Promoting a comprehensive management and monitoring plans are necessary to conserve and sustain of species diversity in the areas either poor or rich of biodiversity.

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