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Biodiversity and Phytosociological Analysis of Plants in Wadi Al-Quf Nursery Reserve North - Western of Hebron City in Palestine

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Abstract: This paper presents a vegetation study of the Wadi Al-Quf Nursery Reserve territories of the west-north of Hebron-Palestine. These site is a very important at a local level of species of plant and flora with a high endemicity average. The floristic analysis revealed the existence of 82 species, of which 16 (19.51%) are endemic and ninety plots of vegetation distributed in this area. The phytosociological approach and analysis are based on the Braun- Blanquet methodology 1979, and used classification of the land for Salvador Rivas Martinez to analysis of the physical factors of the bioclimate and climate. However, Wadi Al-Quf Nursery Reserve, is located at the western of Hebron area and belong to infra Mediterranean to meso-Mediterranean thermotype, this area has a characteristic arid, dry and very little of sub-humid and located between Mediterranean basin, Negev, desert Sinai and Red Sea region. We took 300 samples of different species plants from Wadi Al-Quf Nursery Reserve. In the statistical treatment we obtained two large groups in the cluster; group (A), representing forests, copses and high shrub lands influenced by climate (climatophilous); and group (B), representing *pino* copses which are influenced by climatophilous. We have three associations limited as *Pistacio lentisci-Quercetum lokii* Ighbareyeh J. M. H., A. A. Suliemieh, A. Cano-Ortiz & E. Cano nova. *hoc loco*., *Ceratonio siliquae-Quercetum callipinii* ass. nova. and *Pino halepensis-Cupressetum sempervirentis* ass. nova., with a three alliance as *Pistachio- Quercion lokii, Ceratonio siliquae - Quercion calliprinae* and *Pino halepensis-Cupression sempervirentis.*

Keywords: Palestine, Wadi Al-Quf, Biology, Flora, Phytosociology and Plant Communities

1. Introduction

Palestine's particular geographic location, in conjunction with a series of environmental, bioclimatic factors, soil type, makes this a very fertile land [1]. Climate and bio-climate were played an important role in influence on biodiversity [2], plant communities [2-4], biology process and biological resources [5]. Flora of Palestine contains 149 species of endemic (6% of all plants), 43% of which are common, 27.5% rare and 25.6% very rare. The Leguminaceae family, for example, has 268 species, including 21 species of which endemic, whereas 23 species of Iridaceae, eight of which are endemic [6], but today there are more than 155 species of endemics [2, 5]. However, it is the meeting ground for plant species that originate from various regions of the world, such as Western Europe, Central Asia and East Africa. They are characterized by a wide range of wildlife resources and represent a rich base of flora and fauna in which natural organisms are formed by an estimated 2,483 species of plants living in Palestine [7], also Palestine, located in the Mediterranean Basin, is considered the hot spot of the world's biodiversity that should be conserved [8, 9], these plants are ecologically adapted in different parts of

Palestine, extending from the extreme north to south, especially in the Negev Desert, Sinai and the Mediterranean Sea to the west, and the Dead Sea to the east [10, 11]. Flora Palestine is rich in important economic plants and includes vegetables, crops fields, fruit trees and the plants are use in the medical, and the recent studies there are more than 2,750 species of plants, including 138 families of Palestinian plants [12]. In Palestine (Palestinian territories occupied in 1967), about 2780 plant taxa were recorded as native or endemic, from the native taxa, 162 taxa were recorded as endemics [1, 2], were showed 1881 deference species of plant, which of them 53 species endemic rare in the fourth areas of Palestine an area of 1145 km^2 as *Trifolium palaestinum Boiss., Paronychia palaestina Eig., Suaeda philistaeum Zohary* and *Trifolium philistaeum.*

In general, the forests of Hebron governorate are distributed throughout the governorate and are characterized by their Mediterranean environmental system, there are almost 14,949 dunms of forested areas in the Hebron, it accounts for 22% of Palestine's forests. The climate tends to be sub-humid to dry from west to east [13-16], providing suitable environments for the growth of most plant species. Most of the forests of Hebron are located on fertile soils (Terra Rosa, Brown Ruinsenas and Pali Rindzinas) and in areas with favorable climatic, bioclimatic conditions for agriculture [17, 18].

During the past decade and tenth years ago, several studies have analyzed the phytosociological and flora [5, 19-25] and gathering of wild edible plants in specific countries in the Mediterranean area including, Italy [26, 27] and Spain [28, 29] and others regions [30].

The main aims of the present study are to contribute to the knowledge of plant taxa, biodiversity, flora, and to phytosociological with others characteristics biologicals and ecologically of plant in Wadi Al-Quf Nursery Reserve, Hebron of Palestine.

2. Methods

Due to the lack of significant meteorological data, we selected a sampling area in the region of Wadi Al-Quf in Hebron, in which inventories were taken of 300 woody plants in this location (Figure 1). Wadi Al-Quf Forest or Nursery Reserve and a little of scrub-lands were sampled to obtain biological, environmental indicators and vegetation for ombrotype & thermotype. The inventories were made following Braun-Blanquet (1979) [31], and the flora of Palestine, Syria, Lebanon, Jordan, and Sinai desert were used for the floristic study. Addition to our study deals with the vegetation of the western Hebron, located to the east of the occupied Palestinian coast as Beit Jibreen, Al Manshiyya Iraq, Ajur, Dawayima and the Mediterranean coast, they are therefore part of this nearby plant environment. Besides, we transformed the Braun-Blanquet species abundance dominance values into Van der Maarel (1979) [32]. We found only a few phytosociological works on areas in Palestine [3], Egypt which have no relation with our communities [33, 34], and others of an ecological nature [35]. The vegetation was interpreted according to several methodological works as [36-40].

2.1. Study Area

Wadi Al-Quf Nursery or Forest Reserve (WANR) is located 6 km north-west of Hebron, it is the largest green area in the West Bank, covering more than 4,600 dunums planted (which of 2500 dunums with Palestinian) (Figure 1), rises 450-900 m above sea level and between longitudes 35° 02′ east and latitudes 31° 34′ north (Table 1), there are also five springs and a historic cave in the Reserve (Figure 2). Wadi Al-Quf Nursery Reserve is also located on a series of mountain hills and a large valley, extending from the highest central and eastern heights of the city of Hebron towards the lowlands in the semi-coastal area. It is worth noting that the Wadi Al-Quf Nursery Reserve was established in the middle of the eighteenth century, i.e. in the Ottoman era, what distinguishes the Wadi Al-Quf Nursery Reserve is that it has maintained its permanence in its green zone and its biodiversity throughout history, from the Ottoman era (before 1870-1927) to the British Mandate (1927-1948) and then the Israeli occupation (1948 to present).

Figure 1. *Represents study area, plants sampled in Wadi Al-Guf Nursery Reserve in Hebron of Palestine by satellite.*

Figure 2. *Represents of the famous cave in the Wadi Al-Quf, which has inside Nursery Reserve west of the north of Hebron.*

Figure 3. *An image representing part of the plants in the Wadi Al-Guf Nursery Reserve.*

2.2. Targeting and Collection of Plant Data

We took 300 samples of different species plants from Wadi Al-Quf Forest or Nursery Reserve during February to Mayo 2020 to study the plant taxa and communities, phytosociology and flora. The western Hebron has a dry ombroclimate with rainfall rates ranging from 300-600 mm, ombrothermic index records for these one sites are 2.5 as Idna village [20], and the thermotype is infratropical with thermicity index/compensated thermicity index values of 350/460 in Idna village [5, 21].

3. Results

Statistical Analysis

In this work, bioclimatic, biogeographical and geobotanical analyses are dependent on the contributions of Salvador Rivas-Martínez (2011) [39], (Figure 2), our floral study has adopted suggestions for Liogier (1996) [41]. To determine the groups for statistical purposes, we first created a matrix consisting of 83 rows x 19 columns of relevance (s), which led to the conversion of the phytosociological plant indexes of Braun- Blanquet, +, 1, 2, 3, 4, 5 to those in Van der Maarel 2, 3, 4, 5, 6, 7. However, we conducted Euclidean Distance Clustering and a Principal Component Analysis, to avoid any loss of information related to proper plant analysis, all sampled studied of plant were taken into account with the groups identified and selected in our statistical analysis as a valid reference basis and Rivas-Martínez [39, 40] (2011, 1999) followed us to create dynamically Phytosociology.

Our statistical analysis, conducted on a clean matrix consisting of 82 rows (species) in 19 columns, resulted in a grouping with two clearly distinct groups (Group A and B). The group A consists of two forest samples group 1 and 2 (G1 and G2). The group G1 (1-14) is dominated by species belonging to the *Quercus* and *Pistacia* genus and forests growing in thermomediterranean - Mesomediterranean thermotype and dry to subhumid environments on carbonated substrates as Terra Rosa and Brown Ruinsenas with neutral pH, and this leads us to a proposal, in the Asian regions of the eastern Mediterranean, the association is Group 1. *Pistacio lentisci-Quercetum lokii* (Table 1: ASL 1._1-14).

Group G2 (2–11) was dominated by *Quercus calliprinos Webb., Ceratonia siliqua L.* and *Quercus look Kotschy* forests growing in infra-thermomediterranean thermotype and where the ombrotype is arid-semiarid, and the soil types are Terra Rosa and lithosoils and loess with neutral pH, and this we propose the association of the eastern Mediterranean, is *Ceratonio siliquae-Quercetum callipinii* (Table 2: ASL 2. 2-11).

Association B is consist of one group forest (9-19) representing by species *Cupressus macrocarpaa* L., *Pinus halepensis* L., *Pinus Pinea* L. *Cupressus arizonica* Greene., Cupressus macrocarpaa L. with companions *Pistacia palaestina* Boiss. forests growing a climatophilic community in steppe environments with a semiarid, arid -dry ombroclimate and inframediterranean thermotype. Therefore, we propose the association *Pino halepensis-Cupressetum sempervirentis* (Table 3: ASL 3. 9-19). The principal components analysis confirms the separation of plant groups (GA as G1, G2 and GB) (Figure 4).

4. Discussion

Plant Communities Analysis

The cluster in group GA can be broken down into two plant communities. Subgroup G1 which includes inventories 1–14 (Figure 4) of the cluster that were taken in the Wadi Al-Guf Nursery Reserve mountains, in thermotropical environments with a dry –semidry ombrotype on Terra Rossa. We indicated endemic species in this community, of which the following are: *Quercus look Kotschy, Pistacia palaestina Boiss., Pyrus syriacus Boiss*., which are companions with *Rhamnus palaestinus Boiss.* species, a with slope is between 10-30%, coverage rate of 75% of plant, and average height of vegetation (3-6m.) (Table 1).

Table 1. *Sampling plots.*

	Coordinates	Site	Altitude	Biogeographic unit
P1	31.578854, 35.061280	Wadi Al-Quf	580	Mediterranean basin territories
P2	31.580999, 35.025151	Wadi Al-Quf	460	Mediterranean basin territories
P3	31.573196, 35.032914	Wadi Al-Quf- near of settlement Telem	600	Mediterranean basin territories
P4	31.580999, 35.035150	Wadi Al-Quf	660	Mediterranean basin territories
P5	31.578854, 35.071380	Wadi Al-Quf-near of Beit Kahil village	550	Mediterranean basin territories
P6	31.571885, 35.076915	Wadi Al-Quf	630	Mediterranean basin territories
P7	31.577608, 35.026301	Wadi Al-Quf-near of Tarqumia village	800	Mediterranean basin territories
P8	31.571885, 35.076915	Wadi Al-Quf	660	Mediterranean basin territories
P9	31.578854, 35.061270	Wadi Al-Quf	550	Mediterranean basin territories
P10	31.571885, 35.076715	Wadi Al-Quf	900	Mediterranean basin territories
P11	31.580999, 35.035753	Wadi Al-Quf	450	Mediterranean basin territories

	Coordinates	Site	Altitude	Biogeographic unit
P12	31.582071, 35.047959	Wadi Al-Quf	520	Mediterranean basin territories
P13	31.580999, 35.035555	Wadi Al-Quf	490	Mediterranean basin territories
P14	31.580999, 35.061256	Wadi Al-Quf	850	Mediterranean basin territories
P15	31.571885, 35.076925	Wadi Al-Quf	750	Mediterranean basin territories
P16	31.580999, 35.035158	Wadi Al-Quf	700	Mediterranean basin territories
P17	31.582071, 35.047759	Wadi Al-Quf	520	Mediterranean basin territories
P18	31.578854, 35.061280	Wadi Al-Quf	550	Mediterranean basin territories
P19	31.580999, 35.035161	Wadi Al-Quf	460	Mediterranean basin territories

Subgroup G2 includes inventories 2–11 of the cluster and in (Table 2), the community grows in the areas of the Wadi Al-Quf Nursery Reserve in the dry infra and thermotropical thermotype. This is a dense forest with 16% endemic plants, of which the following are: *Quercus look* Kotschy*, Pistacia palaestina* Boiss. and *Rhamnus palaestinus* Bois, which are companions *with Pistacia palaestina Boiss. s*pecies, a with slope is between 15-30%, coverage rate of 70% of plant, and average height of vegetation (3.5-6m.).

Table 2. *Association 1: Pistacio palestinae-Quercetum lokii Ighbareyeh J. M.. H., A. A. Suliemieh, A. Cano-Ortiz & E. Cano nova. hoc loco.* 2014.

Species								
Releve of cluster	1	4	12	10	7	14	P	S
Surface in m^2 1 = 10	250	270	300	290	280	240	R	T
Cover rate %	60	75	75	80	85	75	E	A
Altitude in m.	580	660	520	900	800	850	S	T
Average height of veg. (m.)	3	4.5	5	4	6	3.5	N	U
Slope %	25	30	15	20	25	10	C	S
Orientation	E	N	N	W	W	E	I	
Order number	5	2	2	3	1	0		
Characteristic of association and higher units								
Quercus look Kotschy	4	3	2	2	2	1	V	E
*Pistacia lentiscu*s L.	3		2	2		1	Iv	N
Pistacia palaestina Boiss.	2		2		2		III	E
Quercus calliprinos Webb.	2						I	N
Quercus coccifera L.		1					I	N
Pyrus syriaca Boiss.				2			I	E
Quercus inthaburensis L.		1		2			III	N
Quercus libani G. Olivie		1				1	II	N
Companions								
Rhamnus palaestinus Boiss.	3		1	2		1	Iv	E
Rhamnus alaternus L.		1					I	N
Zizyphus Spina-christi L.		1					I	N
Zizyphus Lotus L.			+				I	N
Hypecoum pendulum L.								N
Rhamnus lycioides L	1						I	E
Schinus molle L.				+			I	N
Pistacia saportae Burnat.		1			1		II	N
Rhus coriaria L.			+				I	N
Pistacia atlantica Desf.			+				I	N
Pinus halepensis Miller			1				I	N
Pinus Pinea L.						1	I	N
Pinus canariensis C. Smith					2		I	N
Pinus brutia Tenore			2				I	N
Cupressus sempervirens L. *var. horizontalis* Miller					1		I	N
Cupressus arizonica Greene			1				I	N
Thuja occidentalis L.		1			1		I	N
Cupressus sempervirens L.		1				1	I	N
Crataegus oriana (L) DC.								N
Crataegus azarolus L.								N
Amygdalus communis L.				1			I	N
Prunus dulcis (Miller) D. A. Webb.	1		1		1		III	N
Sarcopoterium spinosum (L.) Spach		1	+		1		III	E
Ceratonia siliqua L.				1			I	N
Retama raetam (Forssk) Webb & Berthel.		1					I	N
Acacia salicina Lindl.					2		I	N
Acacia cyanophylla Lindl.		1					I	N
Sophora japonica L.			+				I	N
Calicotome villosa (Poir) Link.	1						I	N
Spartium junceum L.	1						I	N
Cersis siliquastrum L.		1	1				II	N

Species								
Poinciana gillesii Hook.				1			I	N
Acacia radiana Savi.								N
Olea europaea L.					1		I	N
Phillyria media L.			1		1		II	N
Styrex officinalis L.								N
Laurus nobilis L.		1					I	N
Balanites aegyptiaca (L.) Delile	1			1			II	N
Salix alba L.								N
Populus alba L.						1	I	N
Populus nigra L.			1		1		I	N
Populus euphratica Oliv.				1			I	N
Arbatus andrachne L.	+		1				I	E
Platanus orientalis L.								N
Eucalyptus gomphosephala DC.								N
Eucalyptus camaldulensis Dehnh				1			I	N
Ailanthus glandulosa Desf.				1			I	N
Melia azedarach L.				1			I	N
Acer obtusifolium Sm.			1				I	E
Tamarix articulate Vahl.			1				I	N
Tamarix aphylla L.							I	N
Tamarix jordanis Boiss.			+				I	E
Tamarix palestina Bertol.			1				I	E
Atriplex halimus L.		1					I	N
Ficus retusa L.	1						I	N
Ficus sycomorus L.			1		1		II	N
Ficus cariaca L.				2		1	II	E
Ficus benjamiva L.		1					I	N
Morus alba L.		1					I	N
Morus nigara L.		1		1			II	N
Spartium junceum L.				2			I	N
Anagyris foetida L.			1					N
Lycium shawii Roem. & Schult.							I	E
Lycium barbarum L.			1				I	N
Lycium europaeum L.		1						N
Artemisia sieberi Besser.		1					I	N
Juglans regia L.	1						I	N
Casuarina equesitifolia L.				1			I	N
Celtis australis L.			1				I	N
Jacaranda mimosaefolia D. Don				+			I	N
Capparis spinosa L.	1						I	N
Cupressus macrocarpa Hartw.	1						I	N
Phlomis brachyodon (Boiss.) Zohary					1		I	E
Phlomis pungens Willd.					1		I	N

Group B includes inventories 9–19 of the cluster in (Table 3), the community or group grows in the areas of the Wadi Al-Quf Nursery Reserve in the dry infra Mediterranean to meso-Mediterranean thermotype. This is a dense forest with 19.51% endemic plants, of which the following are: *Rhamnus palaestinus* Bois, *Pistacia palaestina* Boiss., *Pyrus syriaca* Boiss. and *Arbatus andrachne* L which are companions with *Pistacia palaestina* Boiss. species, a with slope is between 5-30%, coverage rate of 72% of plant, and average height of vegetation (6-10m.).

Table 3. *Association 2: Ceratonio siliquae-Quercetum calliprini ass. nova.*

Species								
releve of cluster	2	11	8	5	3	6	P	S
Surface in m^2 1 = 10	250	270	300	290	280	240	R	T
Cover rate %	60	75	55	70	85	75	E	A
Altitude in m.	460	450	660	550	600	630	S	T
Average height of veg. (m.)	5	3.5	5	6	4	6	N	U
Slope %	20	30	15	25	25	15	C	S
Orientation	E	E	N	W	W	N	I	
Order number	1	2	3	4	5	6	a	
Characteristic of association and higher units								
Quercus calliprinos Webb.	4	3	2	1	1	2	V	N
Ceratonia siliqua L.	3	1	2	2			IV	N
Retama raetam (Forssk.) Webb & Berthel.	2	2		1			III	N
Quercus look Kotschy	2	1	1				IV	E
Quercus coccifera L.		1					I	N

Species								
Pyrus syriaca Boiss.		1					I	E
Quercus inthaburensis L.	1	1		2			III	N
Quercus libani G. Olivier.	1		1			1	III	N
Companions								
Pistacia palaestina Boiss.	2	2	2	1			IV	E
Pistacia atlantica Desf.			1	1			III	N
Schinus molle L.	2		1			1	III	N
Pistacia saportae Burnat.				1			I	N
Rhus coriaria L.			1				I	N
Pistacia lentiscus L.	I		1		I		III	N
Pinus halepensis Miller	1				1		III	N
Pinus pinea L.		1		1			II	N
Pinus canariensis C. Smith						1	I	N
Pinus brutia Tenore				1		1	II	N
Cupressus sempervirens L. var. horizontalis Miller		1					I	N
Pinus brutia Tenore		2					I	N
Cupressus arizonica Greene		1			1		II	N
Cupressus macrocarpa Hartw.		1	1		1		III	N
Cupressus sempervirens L.	1						I	N
Thuja occidentalis L.					1		I	N
Zizyphus Spina-christi L.	1						I	N
Rhamnus palaestinus Boiss	1		1			1	III	E
Rhamnus alaternus L.	1		1		1		III	N
Zizyphus Lotus (L.) lam.					1		I	N
Rhamnus lycioides L.	1						I	E
Crataegus oriana (L.) DC.		1					I	N
Crataegus azarolus L.								N
Amygdalus communis L.		1		1			I	N
Prunus dulcis (Miller) D. A. Webb.							I	N
Sarcopoterium spinosum (L.) Spach	2			1	1		III	E
Acacia salicina Lindl.		1					I	N
Acacia cyanophylla Lindl.				1			I	N
Sophora japonica L.			1				I	N
Calicotome villosa (Poir) Link.	1						I	N
Spartium junceum L.					1		I	N
Cersis siliquastrum L.					1		I	N
Poinciana gillesii Hook.	1						I	N
Acacia radiana Savi.								N
Olea europaea L.					1		I	N
Phillyria media L.			1		1		I	N
Styrex officinalis L.							I	N
Laurus nobilis L.		1					I	N
Balanites aegyptiaca (L.) Delile					1		I	N
Salix alba L.								N
Populus alba L.				1			I	N
Populus nigra L.					1		I	N
Populus euphratica Oliv.								N
Arbatus andrachne L.			1				I	E
Platanus orientalis L.	1						I	N
Eucalyptus gomphosephala DC.		1					I	N
Eucalyptus camaldulensis Dehnh					1		I	N
Ailanthus glandulosa Desf.				1			I	N
Melia azedarach L.			1				I	N
Acer obtusifolium Sm.		1					I	E
Tamarix articulate Vahl.		1					I	N
Tamarix aphylla L.	1						I	N
Tamarix jordanis Boiss.		1					I	E
Tamarix palestina Bertol.		1					I	E
Atriplex halimus L.			1				I	N
Ficus retusa L.		1					I	N
Ficus sycomorus L.						1	I	N
Ficus cariaca L.	1						I	E
Ficus benjamina L.					1		I	N
Morus alba L.				1			I	N
Morus nigara L.						1	I	N
Brachychiton populneus (Schott & Endl.) R. Br.				1			I	N
Anagyris foetida L.			1				I	N

Species									
Lycium shawii Reom. & Schult.				1				I	E
Lycium barbarum L.			1					I	N
Lycium europaeum L.		1			1			I	N
Artemisia sieberi Besser						1		I	N
Juglans regia L.						1		I	N
Casuarina equesitifolia L.					1			I	N
Celtis australis L.									N
Jacaranda mimosaefolia D. Don			1					I	N
Capparis spinosa L.			1					I	N
Phlomis brachyodon (Boiss.) Zohary				1			1	I	E
Phlomis pungens Willd.					1			I	N

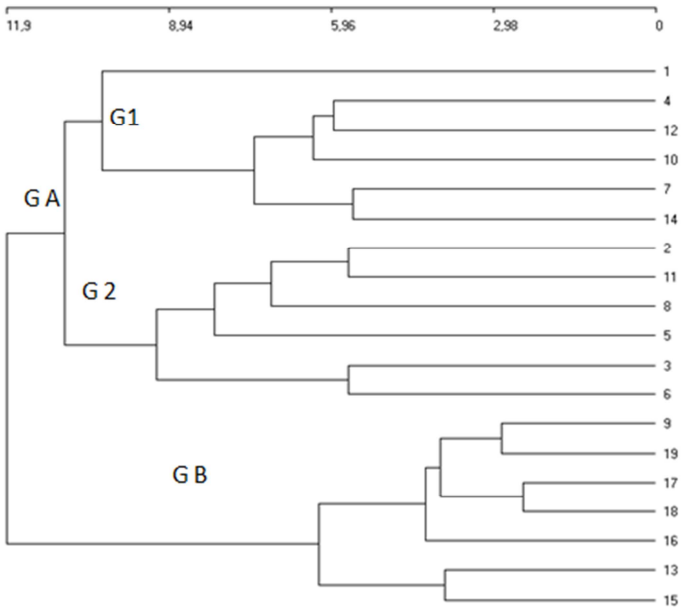

Figure 4. *Cluster Analysis.*

Table 4. *Association 3: Pino halepensis-Cupressetum sempervirentis ass. nova.*

Species									
Releve of cluster	9	19	17	18	16	13	15	P	S
Surface in m^2 1 = 10	330	350	600	570	530	580	490	R	T
Cover rate %	70	60	80	70	65	75	85	E	A
Altitude in m.	580	460	520	550	700	490	750	S	T
Average height of veg. (m.)	8	10	6	9	8	7	9	N	U
Slope %	25	30	15	20	25	10	5	C	S
Orientation	W	N	E	W	W	N	N	I	
Order number	1	2	3	4	5	6	7		
Characteristic of association and higher units									
Cupressus sempervirens L.	5	2	2	3	1			V	N
Pinus halepensis Miller	4	2	2	1	1			IV	N
Pinus Pinea L.	2	2			1		1	IV	N
Cupressus sempervirens L. var. horizontalis Miller	2			1	1			III	N
Cupressus arizonica Greene				1			1	I	N
Thuja occidentalis L.		1				1		I	N
Cupressus macrocarpa Hartw.			2		2		2	III	N
Companions									
Pistacia palaestina Boiss.	3		2		2		1	IV	E
Pistacia atlantica Desf.			2		1		1	III	N
Schinus molle L.		1					1	I	N
Pistacia saportae Burnat		1		1	1	1		III	N
Rhus coriaria L.	2			2			1	III	N
Pistacia lentiscus L.		1		1		1		III	N
Pinus canariensis C. Smith		1						I	N
Pinus brutia Tenore		1			2			I	N

Companions										
Quercus look Kotschy		1			2		2	III	E
Quercus calliprinos Webb.	1				2			I	N
Quercus coccifera L.				1		1		I	N
Quercus inthaburensis L.				2			1	II	N
Quercus libani G. Olivier					2		1	I	N
Zizyphus Spina-christi L.			1					I	N
Rhamnus palaestinus Boiss	2					1		I	E
Rhamnus alaternus L.			1			1		I	N
Zizyphus Lotus (L) Lam.					1			I	N
Rhamnus lycioides L			1		1	1		II	E
Pyrus syriaca Boiss.			1				1	I	E
Crataegus oriana (L) DC.						1		I	N
Crataegus azarolus L.			1					I	N
Amygdalus communis L.					1			I	N
Prunus dulcis (Miller) D. A. Webb.		1	1			1		II	N
Sarcopoterium spinosum (L.) Spach	1			1				II	E
Ceratonia siliqua L.	2		1		2		1	III	N
Retama raetam (Forssk.) Webb & Berthel.		1						I	N
Acacia salicina Lindl.	1							I	N
Acacia cyanophylla Lindl.					1			I	N
Sophora japonica L.		1						I	N
Calicotome villosa (Poir) Link.			1					I	N
Spartium junceum L.				1				I	N
Cersis siliquastrum L.		1						I	N
Poinciana gillesii Hook.						1		I	N
Acacia radiana Savi				1				I	N
Olea europaea L.					1		1	I	N
Phillyria media L.			1		1			I	N
Styrex officinalis L.					1			I	N
Laurus nobilis L.			1					I	N
Balanites aegyptiaca (L.) Delile				2				I	N
Salix alba L.		1						I	N
Populus alba L.				2				I	N
Populus nigra L.		1						I	N
Populus euphratica Oliv.			1					I	N
Arbatus andrachne L.					1			I	E
Platanus orientalis L.						1		I	N
Eucalyptus gomphosephala DC.					1			I	N
Eucalyptus camaldulensis Dehnh				1				I	N
Ailanthus glandulosa Desf..			1					I	N
Melia azedarach L.			1					I	N
Acer obtusifolium Sm.				1				I	E
Tamarix articulate Vahl					1			I	N
Tamarix aphylla L.			1					I	N
Tamarix jordanis Boiss.			1					I	E
Tamarix palestina Bertol.			1					I	E
Atriplex halimus L.			1					I	N
Ficus retusa L.	1				2			I	N
Ficus sycomorus L.			1		1			I	N
Ficus cariaca L.	1							I	N
Ficus benjamina L.	1							I	N
Morus alba L.		1						I	N
Morus nigara L.		1		1				I	N
Spartium junceum L.				2				I	N
Anagyris foetida L.			1					I	N
Lycium shawii Reom. & Schult..						1		I	E
Lycium barbarum L.			1					I	N
Lycium europaeum L.		1						I	N
Artemisia sieberi Besser		1						I	N
Juglans regia L.	1							I	N
Casuarina equesitifolia L.				1				I	N
Celtis australis L.			1					I	N
Jacaranda mimosaefolia D. Don				1				I	N
Capparis spinosa L.	1							I	N
Brachychiton populneus (Schott & Endl.) R. Br.	1							I	N
Phlomis brachyodon (Boiss.) Zohary					+				E
Phlomis pungens Willd.					1			I	N

Table 5. *Synesthetic representation of associations.*

Synesthetic representation						
Species	ASL1	ASL2	ASL3	Status	Life form	Family
Quercus look Kotschy	V	IV	III	E	T	Fagaceae
Pistacia lentiscus L.	Iv	III	III	N	Sh	Anacardiaceae
Pistacia palaestina Boiss.	III	IV	IV	E	T	Anacardiaceae
Quercus calliprinos Webb.	I	V	I	N	T	Fagaceae
Quercus coccifera L.	I	I	I	N	T	Fagaceae
Pyrus syriac Boiss.	I	I	I	E	T	Rosaceae
Quercus inthaburensis Decne.	III	III	II	N	T	Fagaceae
Quercus libani G. Olivier	II	III	I	N	T	Fagaceae
Companions						
Rhamnus palaestinus Boiss.	Iv	III	I	E	Pha.	Rhamnaceae
Rhamnus alaternus L.	I	III	I	N	T	Rhamnaceae
Zizyphus Spina-christi L.	I	I	I	N	T	Rhamnaceae
Zizyphus Lotus (L.) Lam.	I	I	I	N	Sh	Rhamnaceae
Rhamnus lycioides L.	I	I	II	E	Sh	Rhamnaceae
Schinus molle L.	I	III	I	N	T	Anacardiaceae
Pistacia saportae Burnat.	II	I	III	N	T	Anacardiaceae
Rhus coriaria L.	I	I	III	N	T	Anacardiaceae
Pistacia atlantica Desf.	I	III	III	N	T	Anacardiaceae
Pinus halepensis Miller	I	III	IV	N	T	Pinaceae
Pinus Pinea L.	I	II	IV	N	T	Pinaceae
Pinus canariensis C. Smith	I	I	I	N	T	Pinaceae
Pinus brutia Tenore	I	II	I	N	T	Pinaceae
Cupressus sempervirens L. var. horizontalis Miller	I	I	III	N	T	Cupressaceae
Cupressus arizonica Greene	I	II	I	N	T	Cupressaceae
Thuja occidentalis L.	I	I	I	N	T	Cupressaceae
Cupressus sempervirens L.	I	I	V	N	T	Cupressaceae
Crataegus oriana (L.) DC		I	I	N	T	Rosaceae
Crataegus azarolus L.			I	N	T	Rosaceae
Amygdalus communis L.	I	I	I	N	T	Rosaceae
Prunus dulcis (Mill.) D. A. Webb	III	I	II	N	T	Rosaceae
Sarcopoterium spinosum (L.) Spach	III	III	II	E	Cham	Rosaceae
Ceratonia siliqua L.	I	III	V	N	T	Fabaceae
Retama raetam (Forssk.) Webb & Berthel.	I	III	I	N	T	Fabaceae
Acacia salicina Lindl.	I	I	I	N	T	Fabaceae
Acacia cyanophylla Lindl.	I	I	I	N	T	Fabaceae
Sophora japonica L.	I	I	I	N	T	Fabaceae
Calicotome villosa (Poir.) Link	I	I	I	N	Sh	Fabaceae
Spartium junceum L.	I	I	I	N	Sh	Fabaceae
Cersis siliquastrum L.	II	I	I	N	T	Fabaceae
Poinciana gillesii Hook.	I	I	I	N	Sh	Fabaceae
Acacia radiana Savi.			I	N	T	Mimosaceae
Olea europaea L.	I	I	I	N	T	Oleaceae
Phillyria media L.	II	I	I	N	T	Oleaceae
Styrex officinalis L.		I	I	N	Sh	Styracaceae
Laurus nobilis L.	I	I	I	N	T	Lauraceae
Balanites aegyptiaca (L.) Delile	II	I	I	N	T	Zygophyllaceae
Salix alba L.			I	N	T	Salicaceae
Populus alba L.	I	I	I	N	T	Salicaceae
Populus nigra L.	I	I	I	N	T	Salicaceae
Populus euphratica Oliv.			I	N	T	Salicaceae
Arbatus andrachne L.	I	I	I	E	T	Ericaceae
Platanus orientalis L.		I	I	N	T	Platanaceae
Eucalyptus gomphosephala DC.		I	I	N	T	Myrtaceae
Eucalyptus camaldulensis Dehnh	I	I	I	N	T	Myrtaceae
Ailanthus glandulosa Desf.	I	I	I	N	T	Simaroubiaceae
Melia azedarach L.	I	I	I	N	T	Meliaceae
Acer obtusifolium Sm.	I	I	I	E	T	Aceracea
Tamarix articulate Vahl.	I	I	I	N	T	Tamaricaceae
Tamarix aphylla L.	I	I	I	N	T	Tamaricaceae
Tamarix jordanis Boiss.	I	I	I	E	T	Tamaricaceae
Tamarix palestina Bertol.	I	I	I	E	T	Tamaricaceae
Atriplex halimus L.	I	I	I	N	Sh	Amaranthaceae
Ficus retusa L.	I	I	I	N	T	Moraceae

Companions						
Ficus sycomorus L.	II	I	I	N	T	Moraceae
Ficus cariaca L.	II	I	I	E	T	Moraceae
Ficus benjamina L.	I	I	I	N	T	Moraceae
Morus alba L.	I	I	I	N	T	Moraceae
Morus nigara L.	II	I	I	N	T	Moraceae
Hypecoum pendulum L.		I	I	E	Annual	Papaveraceae
Anagyris foetida L.	I	I	I	N	Phan	Papilionaceace
Lycium shawii Roem. & Schult.		I	I	E	Sh	Solanaceae
Lycium barbarum L.	I	I	I	N	Sh	Solanaceae
Lycium europaeum L.		I	I	N	Sh	Solanaceae
Artemisia sieberi Besser	I	I	I	N	cham	Asteraceae
Juglans regia L.	I	I	I	N	T	Juglandaceae
Casuarina equesitifolia L.	I	I	I	N	T	Casuarenaceae
Celtis australis L.	I		I	N	T	Ulmaceae
Jacaranda mimosaefolia D. Don	I	I	I	N	T	Bignoniaceae
Capparis spinosa L.	I	I	I	N	Sh	Capparaceae
Brachychiton populneus (Schott & Endl.) R. Br.	I	I	I	N	T	Malvaceae
Phlomis brachyodon (Boiss.) Zohary	I	I	I	E	Sh	Lamiaceae
Phlomis chrysophylla Boiss.	I	I	I	E	cham	Lamiaceae
Phlomis pungens Willd	I	I	I	N	Sh	Lamiaceae

Percentage of plant species presence in the samples studies and communities: V = 100%, IV = 60.1% - 80%, III = 40.1% - 60%, II = 20.1% - 40% and I = 0.1% - 20%. N: Native and E: Endemic, Sh: Shrub. Association (ASL), GI: Group one, G II: Group two, GIII: Group three. ASL1: Pistacio lentisci-Quercetum lokii, ASL2: Ceratonio siliquae-Quercetum callipinii and ASL3: Pino halepensis-Curessetum sempervirentis.

Finally, in the first association, the high proportion of *Pistacia lentiscus* L., *Pistacia palestina* Boiss., and *Rhamnus palestina* Boiss*, Rhamnus lycioides*., *Rhamnus alaternus* L., allows us to include the communities in dry-xeric shrublands from Mediterranean region and centre of Asia minor in the order *Pistachio lentisci -Rhamnetalia alaterni* Rivas-Martínez, S., 1975 [42] in the alliance of the *Oleo sylvestris-Ceratonion siliquae* Br.-Bl. ex Guinochet & Drouineau 1944 [43, 44], and the forests adapting in dry to sub-humid environments as *Rhamnus spp. and Quercus spp*. in the order *Rhamno lycioidis-Quercion cocciferae* Rivas Goday *ex* Rivas-Martinez 1975 [42], class of the Quercetalia calliprini Zohary 1955 [45] and *Quercetalia ilicis* Br.-Bl. ex Molinier [46-48]. Furthermore, in the second community, Sclerophyllous oaks, conifer forests and macchia with the high frequency of *Ceratonia siliqua* L. and *Quercus look* Kotschy*, Quercus calliprinos* Webb*., Quercus coccifera* L. and others species at arid, dry, sub-humid and humid area and n the thermo- to supramediterranean belts of the Eastern Mediterranean or Asia minor, as the same in alliance, the order and class of the first association. In the last association, we obtained high frequency of *Pinus halepensis* Miller, *Pinus Pinea* L., *Cupressus sempervirens* L., *Cupressus macrocarpaa* L., *Cupressus arizonica* Greene species in dry, subhumid and humid region and thermo-mesomediterranean in order *Pinetalia halepensis* Biondi et al. (2014) [49], class of the Quercetalia calliprini Zohary 1955 [45], and *Quercetalia ilicis* Br.-Bl. ex Molinier [46-48].

Syntaxonomical showing of these associations is:

Quercetalia ilicis Br.-Bl. ex Molinier 1934, Quercetalia calliprini Zohary 1955.

Rhamno lycioidis-Quercion cocciferae Rivas Goday *ex* Rivas-Martinez 1975

Pistachio lentisci -Rhamnetalia alaterni Rivas-Martínez 1975

1. *Pistacio lentisci-Quercetum lokii* Ighbareyeh J. M. H., A. A. Suliemieh, A. Cano-Ortiz & E. Cano nova. *hoc loco.*

Rhamno lycioidis-Quercion cocciferae Rivas Goday *ex* Rivas-Martinez 1975

Quercetalia calliprini Zohary 1955

2. *Ceratonio siliquae-Quercetum callipinii* ass. nova.

Quercetalia ilicis Br.-Bl. ex Molinier 1934

Pinetalia halepensis Biondi et al. (2014)

3. *Pino halepensis-Cupressetum sempervirentis* ass. nova.

5. Conclusion

Despite the fact that more than a century and a half ago the establishment of the Wadi Al-Quf Forest Reserve, since the Ottoman era in the middle of the eighteenth century, but this Forest was able to preserve its environment and biodiversity, where it found more than 82 species of plants, including 16 plants a endemic rare. Wadi Al-Quf Forest Reserve belongs to Infra-thermomediterranean with a little Mesomediterranean thermotype and dry to sub-humid ombrotype. Moreover, during our study, we have three associations limited as *Pistacio lentisci-Quercetum lokii* Ighbareyeh M. H. J, A. A. Suliemieh, A. Cano-Ortiz & E. Cano nova. *hoc loco*., *Ceratonio siliquae-Quercetum callipinii* ass. nova. and *Pino halepensis-Curessetum sempervirentis* ass. nova., with three alliance as *Pistachio-Quercion lokii, Ceratonia siliquae -Quercion calliprinae* and *Pino halepensis-Cupression sempervirentis*

In recent years, especially in the areas surrounding the study in the Hebron area as Idna Village, we were indicted eight new plant associations [5, 21, 22]:

Pistacio palaestinae-Quercetum Lokii*

Capparido sinaicae-Ceratonietum siliquae

Cerasus microcarpae-Quercetum ithaburensis*

Pyro siriacae-Abietetum cilicicae*

Abio ciliciae-Ceratonietum siliquae

Periploco aphylli-Pinetum halepensis
Cytisopsis pseudocytiso-Tamaricetum tetragynae
Crataego sinaicae-Tamaricetum jordanii.

Whereas, in the last study 2018 by Ighbareyeh [21, 22], we describe three new plant associations:

Pino halepinsis -Quercetum lookii *.
Pistacio paletinae -Ceratonietum siliquae *.
Quercus libanii -Tamaricetum palestineae *.
* Associations in which olive cultivation is possible.

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