INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES
IJPAES
Volume-6, Issue-3, July-Sept-2016 Coden: IJPAJX-CAS-USA, Copyrights@2016 ISSN-2231-4490
Received: 28th March 2016 Revised: 17th June 2016 Accepted: 29th July 2016
DOI: 10.21276/Ijpaes http://dx.doi.org/10.21276/ijpaes Research article

SCREENING OF THREATENED ECONOMICALLY IMPORTANT *GUNDELIA TOURNEFORTII* AND *SCORZONERA MOLLIS* SPECIES IN SHOUF BIOSPHERE RESERVE – LEBANON

Fadel Dani[a*], Bejjani Rami[a], Jaradi Ghassan R.[b] and Hani Nizar[c]

[a]Lebanese University, Faculty of Agriculture, Department of Plant Production, Dekwaneh - Lebanon

[b]UNESCO Regional Office for Education in the Arab States, Cité sportive Avenue, 11-5244, Beirut-Lebanon

[c]Ministry of Environment, Shouf Cedars Nature Reserve - Martyrs square, 11-435, Beirut Lebanon

ABSTRACT: Preliminary data on screening the two regional endemic threatened economically important species, Gundelia tournefortii and Scorzonera mollis, were presented for the first time. Our study covered the center and the northern side of Al-Shouf Cedar Nature Reserve that covers five percent of the total area of Lebanon. Gundelia tournefortii and Scorzonera mollis plant species were screened and their economic importance was studied. Topographical map showing the sampling site locations of these species of interest was settled and the Plant Species Importance Value (SIV) of the studied spp. was calculated after adding the relative frequency to relative density and to relative dominance and transforming it into "Importance Value Percentage" whereof their SIV was 46.6 % and 19.69 %respectively. Such a normal distribution reflects the normal but very restricted distribution of these species confirmed under threat within the biosphere reserve of Shouf.
Key words: threatened species, regional endemic, site locations, species importance value.

*Corresponding author: Fadel Dani, Lebanese University, Faculty of Agriculture, Department of Plant Production. Dekwaneh–Lebanon Email: dr.danifadel@gmail.com

INTRODUCTION

Based on the requirements of the Shouf biosphere reserve, the two species of tumble thistle plant, *Gundelia tournefortii (L.)* and salsify plant, *Scorzonera mollis (Bieb. ssp. Mollis),* that are under threat and of great economic importance were selected for this study. Tumble Thistle, *G. tournefortii*, a perennial growing plant to 0.4 m in height is grown on light (sandy) and medium (loamy) soils and prefers well-drained soil, belongs to Asteraceae family and can be found in many countries including Lebanon, Syria, Iran, Iraq, Azerbaijan, Jordan, Palestine, Armenia and Turkey [1] and is known as akub (akuub or aqub) in Arabic [2]. *G. tournefortii* plants have thick perennial rootstocks from which new growths arise each season. Depending on the rainfall and temperature profile of the season, the plants develop new rosettes [3]. *Gundelia tournefortii* garnered media attention in 1998 after its pollen grains were found in abundance on the Shroud of Turin [4] dating since more than 2000 years in Rome. *G. tournefortii*, one of the naturally growing plants is a perennial spiny herb of an Irano-turanian origin [3] and for this reason, it could be reported as regional endemic for the first time in our study. The stems, flowers, leaves and seeds of G. tournefortii could be used as food [5]. The young leaves are used in soup [6-7]. In Lebanon, *G. tournefortii* is used as a main dish in the traditional restaurants. In western and central Anatolia of Turkey G. tournefortii is used as roasted, salad and pickled. For example, its fruits are treated with vinegar, or lemon with salt and used as a garnish [8]. In Haymana District of Ankara, stem spiny part and stem of fresh plant are pounded and the juice obtained is applied on swelled part on neck [5]. The plant is also collected and dried for winter fodder [3].

In the Middle East, undeveloped flower buds are locally available just like artichoke hearts [9-10]. The oil-rich ripe nuts are considered as a kind of tasty dish. Thick stems, flower buds, leaves and roots may be consumed as food while toasted seeds are consumed as kenger coffee [10]. In the Palestinian traditional culture and ethnobotany, its roots are used as vegetables and consumed as fried in olive oil especially in an omelette. G. tournefortii inflorescence and leaves are an ingredient of akoub in which the inflorescence, young stems and leaves are fried by olive oil, then accompanied with meat chops, boiled and after *Gundelia* becomes well cooked; a boiled yogurt suspension is usually introduced to be mixed [11]. Mature tumbleweed hay is sometimes used for feeding camels [12-13]. When young heads are still at ground level, they are eaten as a fresh or cooked artichoke-like vegetable by several ethnicities in the Palestine and surrounding countries [3-10]. Further properties of Gundelia tournefortii were cited for prevention and treatment of liver diseases or pain killer and anti-inflammatory [14]. Ethnobotanical survey of herbal remedies traditionally used in Iran showed that roots of G. tournefortii have antiparasitic effect for digestive system orally [15]. Also, *G. tournefortii* was used among Jordanian Bedouins for the treatment of chest pain and heart stroke and to treat diabetes by the tribal people [9]. Traditionally, *G. tournefortii* is believed in Lebanon, to have hypoglycemic and laxative properties [16-17]. In Turkey, it is proposed to enhance gingivas and used as an appetizer [18]. Its stem is used for treatment in case of gastric pain, diarrhea, bronchitis, inflammations and kidney and stem spiny part and stem of fresh plant are used as mumps [5]. The dry seeds of this plant are also known, in Eastern Anatolia folk medicine, to be effective for the treatment of vitiligo disease. Fresh seeds are effective diuretics and used in pickles [7-19]. In addition, this plant is used in folk medicine to remove water from patients with splenomegaly [9-20]. In Duke's handbook of medicinal plants of the Bible, some of activities such as antiseptic, bactericide and emetic have been mentioned for G. tournefortii; it could also act as an inhibitor of multidrug resistance and a vulnerary agent.

Salsify plant or soft viper's grass, *Scorzonera mollis*, belongs also to Asteraceae family, widely spread in the arid regions of Eurasia and Africa [21-22], can grow to a height of 0.3 meters and up to meter wide. The preferred habitat is calcareous cliffs, rocky phrygana and maritime sands at an altitude of 1400- 2450 m. Salsify is a perennial dwarf plant with a long, fragile taproot that is blackish on the outside and white and milky inside, which increases in size each year. The stems are often unbranched and mostly not leafy. In recent years, Scorzonera has been the subject of caryological [22], ethnobotanical [23-24], chemical [25] and phenetic studies that have improved our understanding of the systematics of this genus [26] whereof, the Dictionary of Spanish languages states that "Scorzonera" derives from the Latin "black root" because of its external colour and the dictionary of Italian languages states that "Scorzonera" means "root" and nera "black" and could be regional endemic to its Mediterranean countries whereof it is named as "meshe" in Arabic. *Scorzonera mollis* found in Lebanon, are used as vegetables that can be eaten fresh or cooked while other Scorzonera vegetables such as *S.suberosa C.Koch*, *S. cana*, or *S. latifolia* are not found locally till now. The roots and green buds of all these edible plants are consumed fresh or after being cooked. Moreover, the plants of the genus Scorzonera have importance in folk medicine due to their treatment of a variety of illnesses including arteriosclerosis, kidney diseases, hypertension, diabetes mellitus, and rheumatism, as well as for pain relief and wound healing [27]. *Scorzonera mollis* has diuretic and depurative properties. The root has restorative and sudorific properties and is an ingredient of many infusions. It is very suitable for a diabetic diet. In some areas, the latex is added to milk as a cure for colds. Its ground, fresh leaves are used against viper bites to soothe the pain. Its peeled root, fresh or cooked, acts as a tonic for the stomach and fortifies the body. It is also considered to be an antidote to the bite of poisonous animals [28]. The main objectives were to determine the location, verify and identify our species of concern, to calculate the species importance value and obtain a confirmation on the status of these economically important species after studying the density, relative density, frequency, relative frequency, coverage and relative coverage of the studied species and to control and maintain a better harvest of such vulnerable species to endangerment after giving a permit for specific farmers to harvest them in the natural Shouf reserve mainly in Barouk and Ayn el Lijji areas in the right way and at the appropriate time.

MATERIALS AND METHODS

Description of the study area

Al-Shouf Cedar Nature Reserve, the largest of Lebanon nature reserves is located on the slopes of Barouk and has an area of 550 km2, nearly 5.3% of the Lebanese territory. The reserve contains the Lebanon Cedar forests of Barouk, Maaser el Shouf and Ain Zhalta-Bmohray. It hosts 32 species of wild mammals, 200 species of birds, and 500 identified plant species distributed over 61 families. Also the reserve is habitat to 25 internationally and nationally threatened species, 48 endemic to Lebanon and 14 rare species endemic to Lebanon and surrounding countries such as Syria and Palestine as in the case of *Gundelia tournefortii L.* whilst 214 species are restricted to the Eastern Mediterranean or Middle East area as in the case of *Scorzonera mollis*.

The Shouf Biosphere Reserve lies between longitude 35° 28'- 35° 47' East and latitude 33° 32'- 35° 48' North at an altitude ranging from 1200-1980 meters. It is located along a mountain range comprising the Barouk and Niha Mountains, which is a southern extension of the Mount Lebanon Range. The range runs parallel to the Mediterranean coast. Our study covered the central as well as the northern sides covering about 30 percent of Shouf biosphere reserve total area based on the recommendations of specific plant collectors.

Sampling methodology

The area where the survey distribution of *Gundelia* and *Scorzonera spp*. was performed occupies about 30% of the Shouf biosphere reserve. The method used was that of plot sampling. Forty nine plots of 10 m length x 1 m width each, were chosen randomly located at the edges of the agricultural roads or at the drainage slopes whereof wild species can grow easily. In each plot, *Gundelia* and *Scorzonera* individuals were identified, counted, measured and recorded on a GPS tracking unit delivered from the respected reserve.

The exact geographical coordinates for each individual were recorded by geographic positioning system delivered from the respected Shouf biosphere reserve and field observations were achieved. Sampling sites were also photographed for reference and where enumerated from 1 to 49 plots.

Analytical procedures

In this study, the density, relative density, frequency, relative frequency, coverage, relative coverage were calculated and species importance value with their percentage were calculated using Excel 2010 progam for screened *Gundelia* and *Scorzonera* spp. that were found in the randomly selected plots. The values were calculated using the following formulas:

Density (D) is the number of individual in a unit area:

$$Di = \frac{ni}{A}$$

Where D_i is the density for species i, ni is the total number of individuals counted for species i, and A is the total area sampled.

Relative species density (RD) is the number of individuals of a given specie $(\sum n)$:

$$RDi = \frac{ni}{\sum n}$$

Frequency (f) is the chance of finding a given species within a sample:

$$Fi = \frac{ji}{k}$$

Where f_i is the frequency of the species i, j_i is the number of samples in which the species i occurs, and k is the total number of samples taken. Relative frequency (R_f) is the frequency of a given species (f_i) as a proportion of the sum of frequencies of all species ($\sum f$):

$$Rfi = \frac{fi}{\sum f}$$

Coverage is the proportion of the ground occupied by a vertical projection to the ground from the aerial parts of the plant:

$$Ci = \frac{ai}{A}$$

Where a_i is the total area covered by the species i, and A is the total habitat area sampled. The relative coverage (C_i) for species i is the coverage for that species (C_i) expressed as proportion of the total coverage (TC) for all species:

$$RCi = \frac{Ci}{TC} = \frac{Ci}{\sum C}$$

Plant Species Importance Value (SIV) or Importance Value Index (IVI), is a reasonable measure to assess the overall significance of a species since it takes into account several properties of the species in the vegetation. The parameters assessed for the purpose were density, frequency, and dominance, while importance value index (IVI) was calculated as:

SIV=IVI = Relative Frequency + Relative Density + Relative Dominance.

The larger the importance value is, the more dominant a species in that particular community.

RESULTS AND DISCUSSIONS

Sampling methodology

Forty nine plots of 10 m length x 1 m width each were chosen randomly to screen the distribution of *Gundelia* and *Scorzonera* spp. In each plot, *Gundelia* and *Scorzonera* individuals were identified, counted, measured and recorded on a GPS tracking unit delivered from the respected reserve. The exact geographical coordinates for each individual were recorded by geographic positioning system delivered from the respected Shouf biosphere reserve and field observations were achieved. Sampling sites were also photographed for reference and where enumerated from 1 to 49 plots as shown in Figure 1.

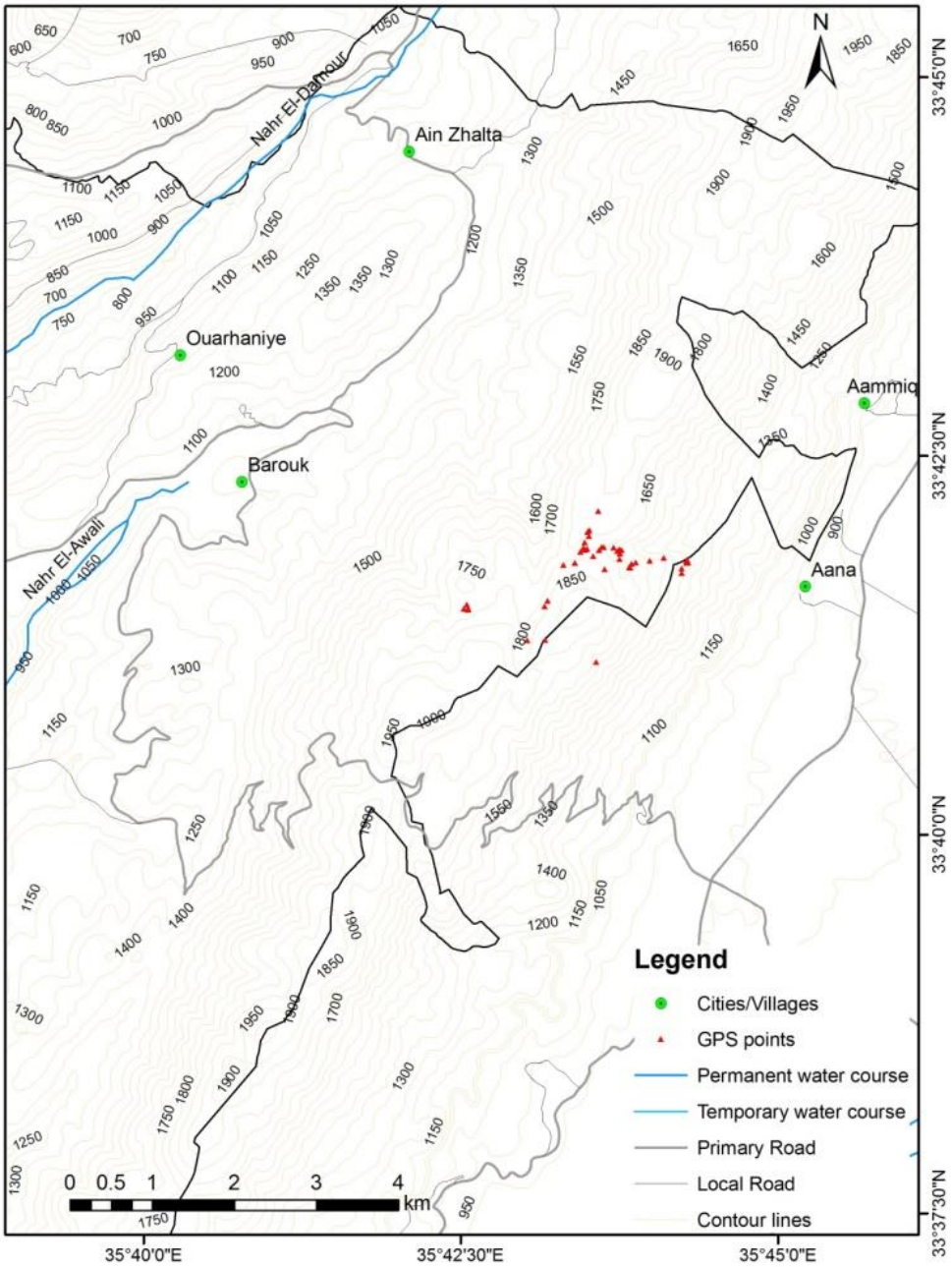

Figure 1: Topographical map showing the sampling site locations within the biosphere reserve of Shouf.

The descriptive statistics of the raw data are shown in table 1 to calculate the sum and the average of *Scorzonera* and *Gundelia* among 76925 counted living plants within the studied plots.

Table 1. Data collected from found *Scorzonera and Gundelia* plants in 49 sampling plots

Plot Number	Nb of Gundelia	Nb of Scorzonera	Nb of plants / plot	Nb of species
1	0	88	978	8
2	0	19	675	6
3	0	45	792	6
4	0	26	748	6
5	22	0	841	7
6	23	0	564	5
7	26	0	1057	8
8	21	0	539	6
9	41	0	986	8
10	8	0	495	5
11	2	0	726	6
12	16	0	1032	7
13	11	0	1095	6
14	5	0	670	11
15	0	4	656	12
16	0	7	735	12
17	0	26	256	6
18	2	0	3854	12
19	7	0	1957	10
20	5	0	1117	9
21	20	0	1104	8
22	10	2	517	5
23	0	1	213	5
24	8	0	3356	10
25	3	0	5983	12
26	2	0	5407	12
27	5	4	3376	10
28	0	2	175	3
29	0	13	204	4
30	0	3	130	4
31	0	62	240	4
32	0	21	120	3
33	0	52	3952	10
34	1	33	259	7
35	1	16	187	6
36	3	0	2329	11
37	3	14	4887	12
38	2	36	4627	11
39	0	10	1241	7
40	6	14	1085	9
41	10	11	1215	9
42	14	2	988	7
43	4	0	2756	9
44	14	0	3491	8
45	15	0	4316	10
46	1	0	273	9
47	2	0	2380	9
48	15	0	1617	7
49	0	27	724	6
AVRG	**6.693**	**10.979**	**1569.898**	**7.816**
SUM	**328**	**538**	**76925**	

The present study is a first report demonstrating the Density, Relative Density, Frequency, Relative Frequency, Coverage and Relative Coverage of *Gundelia tournefortii* and *Scorzonera mollis*. Results were calculated as shown in table 2. Importance Value and Importance value percentage were also studied and shown in table 2.

Analysis of our results showed that the density of our studied plants varied from 0.67 to 1.09 plants/ m2. The measure of density is useful in detecting the response of plants to a given management action, more specifically to harvest. For example, density estimates can reveal the increase or loss of *Gundelia* and *Scorzonera* spp. within management areas. Similar studies were conducted [29] and the density reached 4.00 for *Gundelia tournefortii* and 0.86 for *Scorzonera mollis* [30]. Relative density or the study of numerical strength of a species in relation to the total number of individuals of all the species was for *Gundelia tournefortii* 4.2x10-3and for *Scorzonera mollis* 6.9x10-4 (Table 2).

Frequency is most often used to compare plant communities and to detect changes in vegetation composition over time. In this way frequency can be used to assess vegetation trend. The relative frequency is the degree of dispersion of individual species in an area in relation to the number of all the species occurred. In our study, the frequency of *Gundelia tournefortii* was 0.67 while that of *Scorzonera mollis* was 0.48 percent and their relative frequency was 0.58 and 0.41 consequently. The frequency was also used to quantify and describe the distribution of a species in a community whereof a frequency value of 1.25 was obtained for a *Gundelia* specie [29]. Also, some references reported the frequency of *Scorzonera calyculata* [30] was about 77.78 and its relative frequency was about 4.37 while other references reported the current status of threatened plants in Nimar region of Madhya Pradesh [31]. Similar studies on the coverage of *Gundelia tournefortii* and *Scorzonera mollis* were also conducted and results were obtained as shown in table 2. Coverage is the area of the ground surface covered by vegetation. Coverage is expressed as a percent of area. In our study, *Gundelia tournefortii* coverage was 1.35 x 10-4 and that of *Scorzonera mollis* was 2.85 x 10-5. Relative coverage is the coverage value of a species with respect to the sum of coverage of the rest of the species in the area. Relative coverage of *Gundelia tournefortii* is 0.825 and of *Scorzonera mollis* is 0.174. Similar studies were conducted and relative coverage for *Scorzonera* specie [30] was 4.35. These results were extremely encouraging to calculate the plant species importance value with its percentage.

Plant Species Importance Value (SIV) is to assess the overall significance of a species by adding the Relative Frequency to Relative Density and Relative Dominance to take into account several properties of the species in the vegetation. The Plant Species Importance Value (SIV) of *Gundelia tournefortii* was 1.4 and that of *Scorzonera mollis* was about 0.59. A normal logarithmic distribution of SIV percentage ranging from 142.88% for *Fagus orientalis* to 1.40% for *Prunus divaricate* was also reported [32]. The Assessment of our Plant Species Importance Value percentage (SIVP) was 46.6 % for tumble thistle and 19.69 % for salsify. Such a normal distribution reflects their normal distribution on the topographical map (Figure 1) showing the sampling site locations within the biosphere reserve of Shouf. The highest value for *Gundelia tournefortii* confirmed its dominance in the layers when compared to *Scorzonera mollis* in its community only.

Table 2: Statistical values calculated for studied spp. of *Gundelia tournefortii* and *Scorzonera mollis*

Values Calculated for studied spp.	***Gundelia tournefortii***	***Scorzonera mollis***
Density	0.67	1.09
Relative Density	4.2×10^{-3}	6.9×10^{-3}
Frequency	0.67	0.48
Relative Frequency	0.58	0.41
Coverage	1.35×10^{-4}	2.85×10^{-5}
Relative Coverage	0.825	0.174
Specie Importance Value (0-3) (Importance Value percentage)	1.4 (46.6%)	0.59 (19.69%)

Economic Importance

The selection, identification and harvest of *Gundelia tournefortii* L. and *Scorzonera mollis* were achieved by specific farmers that follow the instructions of the Shouf biosphere reserve in order to control and maintain a better harvest of such vulnerable species to endangerment. These farmers have a permit to harvest these studied plants in the right way and at the appropriate time. The young and still undeveloped flower buds of *Gundelia tournefortii* L. are sold in the local markets just like artichoke hearts; it is a highly sought item [33]. Dry seeds of *G. tournefortii* are also known to be effective for the treatment of vitiligo disease, in Eastern Anatolia folk medicine. Fresh seeds of *G. tournefortii* are used in pickles and also are effective diuretics. The price of one freshly collected peeled kilogram of *G. tournefortii* is about 12000 LBP (~ 8 US $). Ten farmers only are allowed to collect this specie and each farmer collects an average of 70 Kg daily for 60 continuous days. Similar amount is collected for the case of *Scorzonera mollis* whereof the root is sold for almost 6 US $ per kilogram from same farmers.

CONCLUSIONS

The Assessment of our Plant Species Importance Value percentage (SIVP) was 46.6 % for *Gundelia tournefortii* and 19.69 % for *Scorzonera mollis*. Such a normal distribution reflects their normal distribution on the topographical map showing the sampling site locations within the biosphere reserve of Shouf. The highest value for *Gundelia* confirmed its dominance in the layers when compared to *Scorzonera* in its community only but this is critical since it is not spread everywhere in the reserve, though, extreme care has to be applied to conserve these threatened species.

ACKNOWLEDGMENTS

The authors would like to thank UNESCO Regional Office for Education in the Arab States especially Dr. George Awad, Dr. Ghassan Jaradi and Mrs. Lilian Eido-Bazzi for their assistance in granting Mr. Rami Bejjani, a scholarship to cover his expenses during his field trip and research. We would like also to thank Mrs. Elissar Touma and Mrs Salma Rammal for their help and guidance during the laboratory work.

Furthermore, we would like to thank the respected team in Shouf Biosphere Reserve mainly Mr. Nizar Hani for his guidance, as well as his beloved team of work for their explanation and help when inserting relevant data. We never forget Dr. Amin Shaban in Remote Sensing Center - National Council for Scientific Research in Beirut for delivering us the topographical map showing the sampling site locations within the reserve of Shouf.

Conflict of interest statement

We declare that we have no conflict of interest.

REFERENCES

[1] Karis, P.O., Eldenas, P., M. Kallersjo. 2001. New evidence for the systematic-position of Gundelia L. With notes on delimitation of Arctoteae (Asteraceae). Taxon, 50: 105-114.

[2] Mosaddegh M., Naghibi F., Moazzeni H., Pirani A., Esmaeili S. 2012. Ethnobotanical survey of herbal remedies traditionally used in kohghiluyeh va boyer ahmad province of iran. J. Ethnopharmacol., 141: 80-95.

[3] Lev-Yadun S., Abbo S. 1999. Traditional use of a'kub (*Gundelia tournefortii*, Asteraceae), in Israel and the Palestinian authority area. Eco. Bot., 53: 217-219.

[4] Vivian T., 1996. Journeying Into God: Seven Early Monastic Lives. Augsburg Fortress Publication, Minneapolis, MN.

[5] Sarper F., Akaydin G., Simsek I., Yesilada, E. 2009. An ethnobotanical field survey in the haymana district of Ankara province in Turkey. Turk. J. Biol., 33: 79-88.

[6] Aburjai T., Darwish M., Al-Khalil S., Mahajznh A., Al-Abbadi A. 2001. Screening of antibiotic resistance inhibitors from local plant materials against two different strains of *Pseudomonas aeruginosa*. J. Ethnopharmacol., 76: 39-44.

[7] Matthaus B., Ozcan M.M. 2011. Chemical evaluation of flower bud and oils of tumbleweed (*Gundelia tourneforti L.*) as a new potential nutrition sources. J. Food Biochem., 35: 1257-1266.

[8] Dogan Y., Baslar S., Ay G., Huseyin M.H. 2004. The use of wild edible plants in western and central Anatolia (Turkey). Econ. Bot., 58: 684-690.

[9] Halabi S., Battah A.A., Aburjai T., Hudaib M. 2005. Phytochemical and antiplatelet investigation of *Gundelia tournifortii*. Pharm. Biol., 43: 496-500.

[10] Duke J.A., 2008. Duke's Handbook of Medicinal Plants of the Bible. CRC Press, USA.

[11] Ali-Shtayeh M.S., Jamous R.M., Al-Shafie J.H., Elgharabah W.A., Kherfan F.A. 2008. Traditional knowledge of wild edible plants used in Palestine (northern west bank): A comparative study. J. Ethnobiol. Ethnomed., Vol. 4. 10.1186/1746-4269-4-13.

[12] Bailey C., Danin A. 1981. Bedouin plant utilisation in Sinai and Negev. Ec. Bot. 35:145-162.

[13] Kamalak A., Canbolat O., Gurbuz Y., Erol A., Ozay O. 2005. Effect of maturity on the chemical composition, *in vitro* and *in situ* dry matter degradation of tumbleweed hay (*Gundelia tournefortii L.*) Small Rum. Res. 58(2):149-156.

[14] Jamshidzadeh A., Fereidooni F., Salehi Z., Niknahad H. 2005. Hepatoprotective activity of Gundelia tourenfortii. J. Ethnopharmacol., 101: 233-237.

[15] Mosaddegh M., Naghibi F., Moazzeni H., Pirani A., Esmaeili S., 2012. Ethnobotanical survey of herbal remedies traditionally used in kohghiluyeh va boyer Ahmad province of Iran. J. Ethnopharmacol., 141: 80-95.

[16] Khalil S.A. 1995. A survey of plants used in Jordanian traditional medicine. Int.J.Pharmacogn. 33: 317-321.
[17] Jeambay Z., John T., Talhouk S., Batal M., 2009. Perceived health and medicinal properties of six species of wild edible plants in north-east Lebanon. Food security, 12: 1902-1911.
[18] Cakilcioglu, U., Khatun S. 2011. Nitrate, moisture and ash contents of edible wild plants. J. Cell Plant Sci., 2: 1-5.
[19] Coruh, N., Celep A.G.S., Ogokce F., Iscan M., 2007. Antioxidant capacities of Gundelia tournefortii L. extracts and inhibition of glutathione S-transferase activity. Food Chem., 100: 1249-1253.
[20] Sezik E., Yesilada E., Honda G., Takaishi Y., Takeda Y.,Tanaka T. 2001. Traditional medicine in Turkey X. Folk medicine in central Anatolia. J. Ethnopharmacol, 75: 95-115.
[21] Bremer K., Anderberg A. A. 1994: Asteraceae: Cladistics and classification. Timbers Press, Portland.
[22] Nazarova E. A. 1997: Karyosystematic investigation of the genus *Scorzonera L.* (Lactuceae, Asteraceae). Caryologia 50, 239–261.
[23] Rivera D., Obon C., Heinrich M., Inocencio C., Verde A., Fajardo J. 2006. Gathered Mediterranean food plants–ethnobotanical investigations and historical development. Forum of Nutrition 59, 18–74.
[24] Ertud F. 2000. An ethnobotanical study of Central Anatolia (Turkey). Economic Botany 54, 155–182.
[25] Zidorn C., Ellmerer E. P., Sturum S., Stuppner H., 2003. Trylobibenzyls E and F from *Scorzonera humilis* and distribution of caffeic acid derivatives, lignans and tyrolobibenzyls in European taxa of the subtribe *Scorzonerinae* (Lactuceae, Asteraceae). Phytochemistry 63, 61–67.
[26] Mavrodiev E. V., Edwards C. E., Albach D. C., Gitzendanner A., Soltis P. S., Soltis D. E. 2004. Phylogenetic relationships in subtribe Scorzonerinae (Asteraceae: Cichorioideae: Cichorieae) based on ITS seguence data. Taxon 53, 699–712.
[27] Baytop T. 1999. Therapy with medicinal plants in Turkey - past and present. Ankara: Nobel Publishers, 1999 pp. 236-237.
[28] Hernández Bermejo J.E. V., León J. 1994. Neglected crops: 1492 from a different perspective (FAO Plant Production and Protection Series, no.26) ISBN 92-5-103217-3.
[29] Taleshi R., Aliakbar, S. 2014, Biodiversitas, A comparative study on plant diversity in alder (*Alnus subcordata*) stands of natural and plantation areas, 1-15 : 39-47.
[30] Hassannejad S. and Ghafarbi S. P. 2012. Introducing new indices for weed flora studies. International Journal of Agriculture and Crop Sciences. 4-22: 1653-1659.
[31] Ray Sudip, Sainkhediya Jeetendra. 2014. Rare and threatened plants of Nimar region, Madyha Pradesh. International Journal of Plant, Animal and Environmental Sciences, 4-4: 235-243.
[32] Razavi S.M., Mattaji A., Rahmani R., Naghavi F. 2012. The Assessment of Plant Species Importance Value (SIV) in Beech (*Fagus orientalis*) Forests of Iran. International Research Journal of Applied and Basic Sciences, 3-2: 433-439.
[33] Hedrick, U.P. 1972. Sturtevant's Edible Plants of the World. Dover Publications, New York, USA.

INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES

ISSN 2231-4490

International Journal of Plant, Animal and Environmental Sciences