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### MEDICINAL PLANTS IN MUJIB BIOSPHERE RESERVE, JORDAN

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#### ABSTRACT

Medicinal plants in Mujib Biosphere Reserve have been evaluated. A survey for the medicinal plants over a period of two consecutive years has been conducted. A total number of 148 medicinal plant species have been recorded. The medicinal plants are registered based on literature previous records and knowledge gathered from contacts with local people. This number of medicinal plants form 36 % of the total number of the vascular plants enumerated in the study area (148/408), reflecting the richness of this dry ecosystem that ranges in altitude from 900 m above sea level to (-400) m below sea level at the Dead Sea borders. The largest numbers of medicinal plants are recorded in the study area are belonging to the families: Asteraceae, Fabaceae, Poaceae, Lamiaceae, Boraginaceae and Chenopodiaceae.

**Key Words:-** Jordan, Mujib Biosphere Reserve, Medicinal Plants.

#### INTRODUCTION

Jordan is a small country with a total area of about 90,000 Km<sup>2</sup>, classified as a country with dry or semidry ecosystem, with almost 80% of the total area desert or steppe regions (Al-Eisawi, 1996). The Royal Society for the Conservation of Nature (RSCN) is a non-government society, highly active in conservation of nature, it has initiated and managed a series of wild reserves that are acting as safe haven for the protection of wild life biodiversity.

Mujib Reserve is one of the largest reserves in Jordan, where it falls almost in the middle of the mountain ranges extending from Northern to Southern Jordan with altitudes of 7425000 W to 757000 E and the latitudes of 3501000 N to 3474500 S.

The reserve comprises a rough terrain composed of a series of mountains, slopes and very deep valley formation with steep inclinations reaching a ratio exceeding 70% in some cases and often with inclinations ranging from 30 – 50 %. The reserve crosses a series of

well-known and important valleys (wadies) such as Zara, Zgara, Atoun, Wadi Abu Irteimeh, Wadi Um Ghreiba, Wadi Hidan, Wadi Um Zghaib and the most Famous is Wadi Mujib upon which the reserve is named.

The mountains ranges, in the study area vary from an altitude of about 900 m in the southern borders close to Faqu' site to about 680 m in the northern borders, near the site of Makawir. Again the mountains vary from 900-680 m in the eastern side and decline to about (-400) m at the Dead Sea level in the West.

Therefore, the reserve comprises a multi stages of geographical regions within which a series of microclimates. This kind of formation is reflected on the flora and vegetation distribution within the reserve, where three biogeographic regions are recognized, the Mediterranean, the Irano-Turanian and the Sub-tropical or Sudanian, biogeographic region (Al-Eisawi,1996) are confined within such a small area of about 220 km<sup>2</sup>.

The number of the used species in folk medicine as mentioned in the review of the literature do not exceed ten species with the most popular species as: *Teucrium polium*, *Origanum syriacum*, *Artemisia herba-alba*, *Achillea fragrantissima*, *Salvia triloba*, *Matricaria aurea*,

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*Paronychia argentea*, *Peganum harmala* and *Varthemia iphionoides* (RSCN, 2000).

Inventory of Medicinal and Herbal Plants for a series of reserves to investigate the assessment of botanical inventory, social anthropological assessment, ethno-pharmacological assessment for each reserve of Ajloun Woodland Reserve, Safawi and Azraq Study Area, Mujib Nature Reserve, Finan and Wadi Araba Study Area and Shaubak Study Area (RSCN, 2001).

Uses of medicinal plants for livestock treatment, plants frequently mentioned by locals, primary uses, species status and collection pattern were assessed in various reserves in Jordan, for the ethno-pharmacological uses methods of preparation and plants parts. In Mujib reserve four plants were registered for the medicinal use of live stocks, and these are: *Anchusa strigosa*, *Peganum harmala*, *Retama raetam* and *Phagnalon rupestre* (RSCN, 2001).

Only ten plants species have been recorded as medicinal plants for the human use and these are: *Paronychia argentea*, *Teucrium polium*, *Arum dioscroides*, *Carthamus tectorum* (?*tenuis*), *Arum hygrophyllum*, *Chiliadenus iphionoides* (*Varthemia iphionoides*), *Peganum harmala*, *Matricaria aurea*, *Artemisia seiberi* and *Sarcopoterium spinosum*. It was mentioned that some herbs are being stored during drought such as: *Matricaria aurea*, *Chrysanthemum coronarium*, *Melilotus indicus* and *Foeniculum vulgare*, (RSCN, 2001).

Al-Noubani (2005), studied the distribution of *Teucrium polium* in addition to other elements of the flora of Mujib Reserve in her thesis titled: Productivity and Some Aspects of Phytochemical Analysis of *Teucrium polium* L. Grown in Different Environments. She recorded different numbers of vascular plants from the sampling sites.

An inventory and vegetation community analysis (Al-Eisawi, 2014) a list of the flora of the reserve has been produced. A list of the medicinal plants was extracted based on the previous records of such plants in the literature or in folk medicine. The recorded species are based on the knowledge gained from local people in addition to previously known in literature (Al-Kalil, 1995; Aburijai *et al.*, 2007; Abu-Irmaileh & Afifi, 2003; Muthu *et al.*, 2006, Al-Qura'n, 2009). A major survey for the medicinal plants in Jordan suggesting that 20% of the flora of Jordan are medicinal plants (Oran & Al-Eisawi, 1998).

In recent days very active research on medicinal plants and their effect on microbiological, physiological or immunological studies are carried out in Jordan and other parts of the world (Alzweri *et al.*, 2011; Bzour *et al.*,

2011; Erdogan *et al.*, 2014; Khatun *et al.*; Issa *et al.*, 2011) and many other works.

## MATERIALS AND METHODS

### Plant Collection

Plant collection was based originally on extensive survey to study plant communities and association in the reserve. Excisions of plant specimens were pressed, dried, mounted and preserved in mostly two copies based on the availability of enough living material. One of the copies was deposited in the Herbarium, Department of Biological Sciences, Faculty of Science, University of Jordan, Amman (AMM). Another copy was given to the Royal Society for the Conservation of Nature, Amman (RSCN).

### Plant Identification and Recognitions

After plants have been mounted on sheets and fully identified professionally, a checklist of the total plant inventory was produced. Then the plants were deposited in the herbaria as previously mentioned.

The list of medicinal plants is shown in Table 1, based on previous studies (Al-Kalil, 1995; Oran & Al-Eisawi, 1998; Oran & Al-Eisawi, 2014) and knowledge from local people during the field work on the flora of Jordan over the past 40 years or more.

## RESULTS

The results of Mujib Reserve survey for medicinal plants is listed in Table 1, showing plants species and the families they are belonging to. The highest number of medicinal plants recorded in each family is given in the first column of the table. It is clear that some families are much more represented since more species are recorded belonging to them.

The highest family in number of species is Asteraceae (Compositae) 20 species, Fabaceae (Leguminosae) 11 species, Lamiaceae (Labiatae) and Poaceae (Gramineae) 8 species each, Boraginaceae 7 species, Chenopodiaceae 6 species, Papaveraceae, Ranunculaceae and Apiaceae (Umbelliferae) 5 species each, Urophorbiaceae, Liliaceae, and Plantaginaceae 4 species each, Aizoaceae, Brassicaceae (Cruciferae), Caryophyllaceae, Ephedraceae, Schrophulariaceae, Solanaceae, Tamaricaceae and Urticaceae 3 species each. All those families are represented in Table 1 and Figure 1.

However, the majority of the families are represented by a single species or two species only and they are not listed in Table 2.

**Table 1. Showing the total number of medicinal plant species recorded in Mujib Reserve. The number of medicinal plants in each family is recorded in column 1 in this table.**

N. M. F.	Family	NO	Species
1	Acanthaceae	1.	<i>Blepharis ciliaris</i>
1	Adiantaceae	2.	<i>Adiantum capillus-veneris</i>
3	Aizoaceae	3.	<i>Aizoon canariense</i>
		4.	<i>Aizoon hispanicum</i>
		5.	<i>Mesembryanthemum nodiflorum</i>
		6.	<i>Aerva javanica</i>
1	Amaranthaceae	7.	<i>Pancratium parviflorum</i>
2	Amaryllidaceae	8.	<i>Pancratium parviflorum</i>
		9.	<i>Pistacia atlantica</i>
2	Anacardiaceae	10.	<i>Rhus tripartite</i>
		11.	<i>Nerium oleander</i>
1	Apocynaceae	12.	<i>Phoenix dactylifera</i>
1	Aricaceae	13.	<i>Pergularia tomentosa</i>
1	Asclepiadaceae	14.	<i>Alkanna tinctoria</i>
		15.	<i>Heliotropium bacciferum</i>
		16.	<i>Heliotropium europaeum</i>
		17.	<i>Heliotropium rotundifolium</i>
		18.	<i>Heliotropium sp.</i>
		19.	<i>Trichodesma africana</i>
		20.	<i>Trichodesma ehrenbergii</i>
1	Capparaceae	21.	<i>Capparis cartilaginea</i>
3	Caryophyllaceae	22.	<i>Herniaria hirsute</i>
		23.	<i>Paronychia argentea</i>
		24.	<i>Stellaria media</i>
6	Chenopodiaceae	25.	<i>Anabasis articulata</i>
		26.	<i>Atriplex halimus</i>
		27.	<i>Bassia eriophora</i>
		28.	<i>Chenopodium album</i>
		29.	<i>Hammada scoparia</i>
		30.	<i>Salsola vermiculata</i>
20	Asteraceae (Compositae)	31.	<i>Achillea aleppica</i>
		32.	<i>Achillea falcata</i>
		33.	<i>Achillea santolina</i>
		34.	<i>Artemisia herba-alba.</i>
		35.	<i>Calendula palaestina</i>
		36.	<i>Calendula tripterocarpa</i>
		37.	<i>Cichorium pumilum</i>
		38.	<i>Dittrichia viscosa</i>
		39.	<i>Echinops glaberrimus</i>
		40.	<i>Inula crithmoides</i>
		41.	<i>Matricaria aurea</i>
		42.	<i>Phagnalon rupestre</i>
		43.	<i>Pluchea dioscroides</i>
		44.	<i>Pulicaria incise</i>
		45.	<i>Senecio vernalis</i>
		46.	<i>Silybum marianum</i>
		47.	<i>Senecio vernalis</i>
		48.	<i>Sonchus oleraceus</i>
		49.	<i>Taraxacum officinale</i>
		50.	<i>Varthemia iphionoides</i>
ceae rae)		51.	<i>Anastatica hierochuntica</i>
		52.	<i>Capsella bursa-pastoris</i>

		53.	<i>Sinapis alba</i>
	aceae	54.	<i>Citrullus colocynthis</i>
	peae	55.	<i>Cuscuta sp.</i>
1	Cyperaceae	56.	<i>Cyperus rotundus</i>
3	Ephedraceae	57.	<i>Ephedra alte</i>
		58.	<i>Ephedra campylopoda</i>
		59.	<i>Ephedra sp.</i>
4	Euphorbiaceae	60.	<i>Chrozophora obliqua</i>
		61.	<i>Euphorbia hierosolymitana</i>
		62.	<i>Mercurialis annua</i>
		63.	<i>Ricinus communis</i>
8	Poaceae (Gramineae)	64.	<i>Arundo donax</i>
		65.	<i>Avena sterilis</i>
		66.	<i>Avena sp.</i>
		67.	<i>Cynodon dactylon</i>
		68.	<i>Imperata cylindrica</i>
		69.	<i>Lolium rigidum</i>
		70.	<i>Panicum turgidum</i>
		71.	<i>Phragmites australis</i>
1	Guttiferae	72.	<i>Hypericum triquetrifolium</i>
1	Hypecoaceae	73.	<i>Hypecoum imberbe</i>
1	Iridaceae	74.	<i>Crocus cartwrightianus</i>
1	Juncaceae	75.	<i>Juncus maritimus</i>
8	Lamiaceae (Labiatae)	76.	<i>Ajuga chia</i>
		77.	<i>Ballota undulate</i>
		78.	<i>Micromeria nervosa</i>
		79.	<i>Salvia aegyptiaca</i>
		80.	<i>Salvia dominica</i>
		81.	<i>Salvia lanigera</i>
		82.	<i>Salvia palaestina</i>
		83.	<i>Teucrium polium</i>
11	Fabaceae (Leguminosae)	84.	<i>Alhagi maurorum</i>
		85.	<i>Astragalus annularis</i>
		86.	<i>Astragalus spinosus</i>
		87.	<i>Lathyrus cicera</i>
		88.	<i>Onobrychis caput-galli</i>
		89.	<i>Ononis natrix</i>
		90.	<i>Ononis spinosa subsp. Antiquorum</i>
		91.	<i>Pisum syriacum</i>
		92.	<i>Prosopis farcta</i>
		93.	<i>Retama raetam</i>
		94.	<i>Trigonella arabica</i>
4	Liliaceae	95.	<i>Asphodelus aestivus</i>
		96.	<i>Asphodelus fistulosus</i>
		97.	<i>Colchicum brachyphyllum</i>
		98.	<i>Urginea maritima</i>
1	Loranthaceae	99.	<i>Loranthus acaciae</i>
3	Malvaceae	100.	<i>Alcea acaulis</i>
		101.	<i>Malva nicaeensis</i>
		102.	<i>Malva parviflora</i>
1	Moraceae	103.	<i>Ficus carica</i>
1	ceae	104.	<i>Moringa peregrine</i>
1	aceae	105.	<i>Commicarpus africanus</i>
5	Papveraceae	106.	<i>Glaucium arabicum</i>
		107.	<i>Papaver argemone</i>

		108.	<i>Papaver sp</i>
		109.	<i>Papaver subpiriforme</i>
		110.	<i>Roemeria hybrida</i>
4	Plantaginaceae	111.	<i>Plantago afra</i>
		112.	<i>Plantago coronopus</i>
		113.	<i>Plantago ovata</i>
		114.	<i>Plantago pusilla</i>
1	Primulaceae	115.	<i>Anagallis arvensis</i>
5	Ranunculaceae	116.	<i>Adonis dentate</i>
		117.	<i>Anemone coronarium</i>
		118.	<i>Consolida scleroclada</i>
		119.	<i>Ceratocephalus falcatus</i>
		120.	<i>Ranunculus asiaticus</i>
1	Resedaceae	121.	<i>Ochradenus baccatus</i>
2	Rhamnaceae	122.	<i>Ziziphus lotus</i>
		123.	<i>Ziziphus spina-christi</i>
1	Rosaceae	124.	<i>Sarcopoterium spinosum</i>
1	Rubiaceae	125.	<i>Galium sinaicum</i>
1	Rutaceae	126.	<i>Haplophyllum tuberculatum</i>
2	Salicaceae	127.	<i>Salix alba</i>
		128.	<i>Salix sp.</i>
3	Scrophulariaceae	129.	<i>Verbascum fruticosum</i>
		130.	<i>Verbascum sinaiticum</i>
		131.	<i>Veronica anagallis-aquatica</i>
1	Sinopteridaceae	132.	<i>Cheilanthes vellea</i>
3	Solanaceae	133.	<i>Hyoscyamus aureus</i>
		134.	<i>Lycium europaeum</i>
		135.	<i>Withania somifera</i>
3	Tamaricaceae	136.	<i>Tamarix amplexicaulis</i>
		137.	<i>Tamarix nilotica</i>
		138.	<i>Tamarix tetragyna</i>
5	Umbelliferae	139.	<i>Eryngium creticum</i>
		140.	<i>Eryngium glomeratum</i>
		141.	<i>Lagoecia cuminoides</i>
		142.	<i>Pimpinella cretica</i>
		143.	<i>Pimpinella eriocarpa</i>
3	Urticaceae	144.	<i>Forsskaolea tenacissima</i>
		145.	<i>Parietaria alsinifolia</i>
		146.	<i>Urtica pilulifera</i>
2	Zygophyllaceae	147.	<i>Nitraria retusa</i>
		148.	<i>Peganum harmala</i>

## DISCUSSION AND CONCLUSION

Mujib biosphere reserve is designated by the International Union for the Conservation of Nature (IUCN) as a biosphere reserve since it is the largest reserves among the established reserves in Jordan. Mujib Reserve is highly used for grazing of animal herds especially, sheep and goats, since it has the water for drinking and the feed for animals. Nevertheless, it is still a very rich place in biodiversity in general and medicinal plants in particular.

Mujib reserve is not only important in medicinal plants, but there are other important plants such as edible

and ornamental plants. Therefore, such biosphere reserve is acting as safe haven for important resources of medicinal plants, where some of them are rare and endemic species.

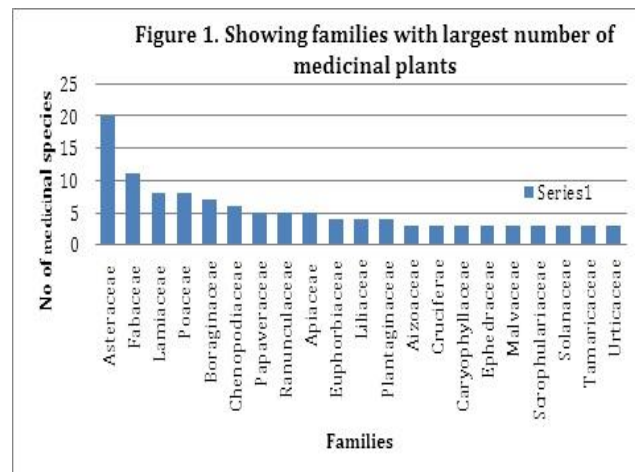
In comparison with previous studies the total number of recorded medicinal plants constituting 36% out of the total number of the flora in the same area. Recently published work (Oran & Al-Eisawi, 2014) recorded a total number of 227 species out of about 670 (33%) species in northern Jordan. Although in northern mountains, a much better rainfall, better soil quality, less prevailing

temperature degrees than the Mujib reserve which is bordering the Dead Sea at (-400) m below sea level, yet Mujib reserve recorded a higher ratio of medicinal plants. Similarly the most comprehensive study of Jordan medicinal plants (Oran & Al-Eisawi, 1998) stated that in general Jordan has about 20% of the total flora.

This study gives the proper value and importance of the amount of medicinal plants in comparison to 10 species recorded by RSCN (RSCN, 2001).

**Table 2. Showing the highest numbers of medicinal plant species in each family. Families with numbers of only two or one species are not included.**

Family	No. of Medicinal Species (more than 2)
Asteraceae	20
Fabaceae	11
Lamiaceae	8
Poaceae	8
Boraginaceae	7
Chenopodiaceae	6
Papaveraceae	5
Ranunculaceae	5
Apiaceae	5
Euphorbiaceae	4
Liliaceae	4
Plantaginaceae	4
Aizoaceae	3
Cruciferae	3
Caryophyllaceae	3
Ephedraceae	3
Malvaceae	3
Scrophulariaceae	3
Solanaceae	3
Tamaricaceae	3
Urticaceae	3



A number of 147 species of medicinal plants in Mujib Reserve is really a huge number of the total medicinal plants known in Jordan. The presence of such big number in this reserve shows the future importance of such wealth and their future potential in the medicinal use and medical industry. It is very lucky for Jordan as a country to have such wealth and even more lucky, that these plants are occurring within the boundaries of a natural reserve.

Pharmacological, Pharmacognostical, phytochemical and other chemical, physiological studies needed to find out the future potential of such wild plants. Therefore, the records of medicinal plants open a wide field of scientific research for scientist and industry.

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