



Research Journal of **Botany**

ISSN 1816-4919



Academic
Journals Inc.

www.academicjournals.com

Ethnobotany of Folk Medicinal Potentiality of Aquatic Plants in Jordan

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Abstract: Eighty seven species belonging to 59 genera and 33 plant families were identified and presented in the area of study. The largest 3 families are: *Labiatae* (9 aquatic species), *Compositae* (7 species) and *Salicaceae* (7 species). The largest genera are *Mentha* (6 species), *Polygonum* (5 species) and *Salix* (5 species). Sixty three folk medicinal aquatic species (73.3%) have therapeutic similarities with neighbouring countries, while the 24 remaining species (26.7%) haven't such therapeutic similarity. Emerged species (living with close contact with water body) were the most recorded, while amphibious, submerged or floating species were the least. The folk medicinal importance value of aquatic species recorded was identified according to Friedman *et al.* (1986). Twenty one species (24%) have ROP values higher than 50 and therefore; have the highest popularity in folk medicinal potentiality. Twenty six species (29.9%) have therapeutic effects informed by less than three informants and therefore, excluded from further consideration. Forty species (46.1%) have ROP values less than 50 and therefore; considered nonpopular medicinal plants.

Key words: Rank Order Priority (ROP), Relative Popular Level (RPL), therapeutic effects, ethnobotany, Fidelity Level (FL), medicinal plants

Introduction

Jordan is located between longitudes 53° 40' E and 39°E and between latitudes 29° 30' N and 34° N. Most of the area comprises deserts especially in south eastern and north eastern part in Ma'an, Jafer, Bayir, Azraq, H5 and H4. The area of study is dominated mainly by Saharo-arabian element which has annual precipitation not exceeding 100 mm, this is in addition to Mediterranean (which dominated the southern and the northern heights with annual precipitation of about 400 mm), Irano-turanian and Nubo-sindian along the Jordan rift valley and the strip from Tafilah to Aqaba region. The western regions that have high altitudes more than 1000 m above sea level in Shoubek, Karak and Sharah series which have high annual precipitation, were dominated by certain kind of vegetation similar to those found in northern heights in Ajlun mountains. While *Artemisia* vegetation is characterizing Irano-turanian element which is extended between Petra to Tafilah (Al-Eisawi, 1982; Bender, 1974; Boulos, 1977; Boulos and Al-Eisawi, 1977; Boulos and Lehham, 1977; Karim and Al-Quran, 1988; Zohary, 1973; Zohary and Feinbrun-Dothan, 1986).

The aquatic species are mainly distributed in or around the water resources in Jordan which are very limited, since Jordan is considered from the first ten poorest countries in the world. Jordan and Yarmouk river banks, marshes, swamps, ditches, geothermal springs (like Hammeh, northern Shouneh, Abo Dableh, Afra, Burbaitah), desert oases (like in Azraq, Jafer, Bayer), in addition to the small ponds and springs distributed in Jordan are the most popular water surfaces that exhibited highly diversified aquatic species exhibited therapeutic effects (Karim and Al-Qura'n, 1986).

It is obvious that plants have been used for medication early in history and the history, this herbal medicine is very old and popular worldwide. Those who practice these methods were called herbalists.

The Medicinal plants remained widely used in many areas of the world specially southern parts of Jordan even after the recent flourishing of chemistry of plants (phytochemistry). Greek and Egyptians were the most popular and famous nations in this field, who distributed this knowledge through ancient trade ways which influenced the development of the medicinal potentiality of the plants (Adailkan and Gauthaman, 2001; Stickel *et al.*, 2000).

The therapeutic effects of medicinal plants of Jordan and neighbouring countries were investigated during the recent years. Most of these plants were wild of mediterranean and saharo-arabian elements. They are considered the major natural resource of folk medication by local rural inhabitants and experienced cattle owners during the grazing movements and forage requirements (Karim and Al-Qura'n, 1986; Khayyat and Mursi, 1981).

Many botanists and pharmacologists all over the world investigated the medicinal plants species specially used in traditions and folklore to extract the active constituents. The proper scientific means and techniques of extractions and identifications to determine finally the therapeutic effects and dosages (Eddouks *et al.*, 2002; Harbonne, 1997; Heinrich, 2000, 2002; Joud *et al.*, 2001).

The use of plants in medicine promoted the chemical analysis of medicinal plants for the active chemical constituents to be extracted and later synthesized (Krebs, 2001; Prance, 2001; Rates, 2001; Stickel *et al.*, 2000).

There are many botanical resources to depend upon to compare the ethnobotany in southern Jordan and neighbouring countries, specially Syria, Palestine and Iraq. This kind of comparison may be helpful to know the degree of similarity between them, which consequently gives the evidence of new records of therapeutic effects not recorded previously.

This study aims to verify the phytomedicinal wealth present in the investigated area depending on some verifying steps to differentiate among the different levels of popularity since the investigated area is unique with high level of species diversity. The inhabitants have intimate relationship with the earth and its natural resources as source of their food and medication. The majority of the people are beduins and rural, oriented and well-experienced in this field of science, which therefore increases the responsibilities for protecting these species from the factors of threatening and endangering. Consequently, this kind of cultural heritage may be reinforced and layed down in the track of scientific measures (Rates, 2001; Stickel *et al.*, 2000).

Materials and Methods

During the period of February 2001- October 2002, field work investigation was done to formulate the ethnobotanical information and their medicinal verification in the area of study. Interviews with 80 informants was done; 50 men and 30 women from different parts of the area, whose age ranged from 40-70 years, most of the interviewees (60 persons) were more than 60 years old and they belong to families which have a strong linkage with folk medicine since they were beduins and rural inhabitants with long experience. Most of the people were either native borne or had been living in the area for more than 30 years, they were mainly either local healers, herbalists, shepherds, experienced adults or old patients.

During the first phase, preliminary data were collected from the informants through the field work. Experienced people were asked to inform where the medicinal species were located and what were the major therapeutic effects. Structured interviews were then conducted to collect more specific information, which was used to detect the traditional methods of preparation and remedation for each species quoted.

The taxonomic identity of medicinal taxa mentioned by interviewees was confirmed precisely by several methods; either by comparison with the already identified specimens preserved in the herbaria of Jordan Universities and Ministry of Agriculture, or fresh plant specimens or dried samples were

shown to the interviewees for precise recognition. Questions addressed to the informants were mainly focused on the purpose of plant application, ways of preparation, medicinal plant parts and dosages required.

Each species not recognized by the interviewees was photographed before collection. Flora Palaestina (Zohary and Feinbrun-Dothan, 1986) in its four volumes and the herbaria of research centers in Jordanian Universities and Ministry of Agriculture were used for the identification of the specimens collected. Thirteen geographical sites were investigated; they were: (1) Ajlun springs, (2) Araba valley, (3) Dissi and Towisi, (4) Aqaba region, (5) Zarah springs, (6) Azraq, (7) Maa'n, (8) Afra, (9) Tafleleh springs (10) Northern Hammeh, (11) Jafer, (12) Bayir and (13) Burbaitah.

The pharmacological terms used in this study were taken from different pharmacological resources and specialized dictionaries (Karim and Al-Qura'n, 1986; Khayyat and Mursi, 1981; Prance, 2001; Stickel *et al.*, 2000) which dealt mainly with the terms in the field of pharmacognosy relating medicinal and pharmaceutical materials of the plants.

The therapeutic effects of the medicinal species were accepted if mentioned by at least 3 informants native to the area of survey and/or have been living in the area for at least 30 years, while those mentioned by less than 3 informants were not accepted and excluded from further consideration. Three verifying parameters were used to reach this goal; Fidelity Level (FL), Relative Popularity Level (RPL) and Rank Order Priority (ROP), similar to that calculated by Friedman *et al.* (1986).

FL was calculated typically: $(I_p/I_u) \times 100$, where I_p is the number of informants who informed the specific therapeutic effect of the plant, while I_u is the number of informants who informed any therapeutic effect of the plant. Then RPL (calculated as percentage of $I_u/30$) was given a score of 1 if mentioned by at least half the number of informants (15 or more since the highest number of informants of any therapeutic effect is 30) and in this case it was considered popular, while given less than 1 if mentioned by more than 3 but less than 15 and in this case it was considered as nonpopular, while the value of less than 3 informants is excluded. ROP was calculated typically as: $FL \times RPL$, ROP value represents the high popularity of the medicinal plants.

Results

Eighty seven native medicinal species were mentioned by 80 informants interviewed in this study, 26 species (29.9%) were mentioned by less than 3 informants and so excluded from further consideration, while 33 species (38%) were mentioned by 3 informants or more but less than 15 and therefore considered as nonpopular medicinal plants, but 23 species (32.1%) were considered as popular medicinal plants since they were mentioned by 15 or more informants (Table 1 and 2).

Table 1: List of wild aquatic dicots in Jordan with their families, common names, number of vouchers, quotation frequency, medicinal parts and records of similar therapeutic effects in neighbouring countries

Plant No.	Plant species	Family	Com. name	Voch No.	Hab	Quot. freq.	Med part	Sim. Reco
1	<i>Alternanthera sessilis</i> (L.) D.C.	Amaranthaceae	Cooks comb	454	A	...	Wh	No
2	<i>Anagyris foetida</i> L.	Leguminosae	Stink herb	W	A	•	L, Fl	Yes
3	<i>Apium graveolens</i> L.	Umbelliferae	Celery	W	E	...	Wh	Yes
4	<i>Apium nodiflorum</i> (L.) Lag	Umbelliferae	Celery	W	E	...	Wh	Yes
5	<i>Atropa belladonna</i> L.	Solanaceae	Night shade	W	A	...	L, Fl	Yes
6	<i>Bacopa monnieri</i> (L.) Pennell	Scrophulariaceae	Thyme gratiola	477	E	...	Wh	Yes
7	<i>Boerhavia repens</i> L.	Nyctaginaceae	Water herb	459	A	•	Wh	Yes
8	<i>Ceratophyllum demersum</i> L.	Ceratophyllaceae	Wind herb	469	E	...	Wh	No
9	<i>Cercis siliquastrum</i> L.	Leguminosae	Shade tree	W	A	...	L, Fl	Yes
10	<i>Cistus creticus</i> L.	Cistaceae	Stick plant	W	A	•	L, Fl	Yes

Table 1: Continued

Plant No.	Plant species	Family	Com. name	Voch No.	Hab	Quot. freq.	Med part	Sim. Reco
11	<i>Commicarpus africanus</i> (Lour.) Dandy	Nyctaginaceae	Water herb	478	E	•	Wh	Yes
12	<i>Commicarpus verticillatus</i> (Poir.) Standl.	Nyctaginaceae	Water herb	481	E	•	Wh	Yes
13	<i>Corchorus olitorius</i> L.	Tiliaceae	Jews mallow	W	E	•••	L	Yes
14	<i>Corchorus trolocularis</i> L.	Tiliaceae	Jews mallow	W	E	•••	L	No
15	<i>Cynanchum acutum</i> L.	Asclepiadaceae	Field ivy	455	A	•••	Wh	Yes
16	<i>Digera muricata</i> (L.) Mart.	Amaranthaceae	Cooks comb	482	A	•	Wh	No
17	<i>Eclipta alba</i> (L.) Hassk.	Compositae	Water spurge	488	E	•	Wh	Yes
18	<i>Epilobium hirsutum</i> L.	Onagraceae	Water rose	458	E	••	L, St	Yes
19	<i>Eupatorium cannabinum</i> L.	Compositae	Water hemp	480	E	•	L, Fl	No
20	<i>Euphorbia exigua</i> L.	Eupobiaceae	Wolfs spurge	491	E	•••	Wh	No
21	<i>Gisekia pharnacioides</i> L.	Molluginaceae	Wolfs mallow	476	E	•	Wh	No
22	<i>Glinus lotoides</i> L.	Molluginaceae	Dwarf mallow	457	E	•	Wh	Yes
23	<i>Glycyrrhiza glabra</i> L.	Leguminosae	liquorice	W	A	•••	Wh	No
24	<i>Grewia tenax</i> (Forsk.) Fiori.	Tiliaceae	Water mallow	489	E	•	Wh	No
25	<i>Grewia villosa</i> Willd	Tiliaceae	Water mallow	490	E	•	Wh	No
26	<i>Heliotropium supinum</i> L.	Boraginaceae	Turnsole	483	A	•••	Wh	No
27	<i>Inula crithmoides</i> L.	Compositae	Inula	487	E	•••	Wh	Yes
28	<i>Inula graveolens</i> (L.) Desf.	Compositae	Inula	467	E	•••	Wh	Yes
29	<i>Inula viscosa</i> (L.) Aiton	Compositae	Inula	456	E	•••	Wh	Yes
30	<i>Jasminum fruticans</i> L.	Oleaceae	Jasmine	W	E	•••	Fl	Yes
31	<i>Laurus nobilis</i> L.	Lauraceae	Laurel	W	A	•••	L, Fl	Yes
32	<i>Lavandula coronopifolia</i> Lam.	Labiatae	Lavender	W	A	•••	L, Fl	No
33	<i>Lavandula pubescens</i> Decne	Labiatae	Lavender	W	E, A	•••	L, Fl	Yes
33	<i>Lavandula pubescens</i> Decne	Labiatae	Lavender	W	E, A	•••	L, Fl	Yes
34	<i>Lippia nodiflora</i> (L.) Rich.	Verbenaceae	Bird foot	479	E, A	•••	Wh	Yes
35	<i>Ludwigia stolonifera</i> (Guill. et Perr.) Raven.	Onagraceae	Water spurge	468	E	•	Wh	Yes
36	<i>Lycium europaeum</i> L.	Solanaceae	Snake berry	460	E	•••	L, Fr	Yes
37	<i>Lycopus europaeum</i> L.	Labiatae	Water hore	470	E	•••	Wh	Yes
38	<i>Lythrum hyssopifolia</i> L.	Lythraceae	Sally	484	E	•••	L, Se	Yes
39	<i>Lythrum junceum</i> Banks et Sol.	Lythraceae	Sally	453	E	•	L, Se	Yes
40	<i>Lythrum salicaria</i> L.	Lythraceae	Red sally	466	E	•	L, Se	No
41	<i>Mentha aquatica</i> L.	Labiatae	Mint	W	E	•••	L, St	Yes
42	<i>Mentha graveolens</i> Ehrh.	Labiatae	Mint	W	E	•••	L, St	Yes
43	<i>Mentha longifolia</i> (L.) Hudson	Labiatae	Horse Mint	W	E	•••	L, St	Yes
44	<i>Mentha piperita</i> L.	Labiatae	Mint	W	E	•	L, St	Yes
45	<i>Mentha pulegium</i> L.	Labiatae	Mint	W	E	•	L, St	No
46	<i>Mentha spicata</i> L.	Labiatae	Mint	W	E	•	L, St	Yes
47	<i>Mirabilis jalapa</i> L.	Nyctaginaceae	Four o'clock plant	492	E	•	L, St	Yes
48	<i>Myosotis discolor</i> Pers.	Boraginaceae	suckle	493	E	•	Wh	No
49	<i>Myriophyllum spicatum</i> L.	Haloragaceae	Soft mallow	452	E	•	L	Yes

Table 1: Continued

Plant No.	Plant species	Family	Com. name	Voch No.	Hab	Quot. freq.	Med part	Sim. Reco
50	<i>Nasturtium officinale</i> R.Br.	Cruciferae	Water cress	494	E,A	***	Wh	Yes
51	<i>Nerium oleander</i> L.	Apocynaceae	Oleander	W	E,A	•	Wh	Yes
52	<i>Niphar lutea</i> (L.) Siebth. and Sm.	Nymphaeaceae	Water lily	W	F	•	Wh	Yes
53	<i>Oxystelma alpini</i> Decne.	Asclepiadaceae	Milk herb	471	E	**	Wh	No
54	<i>Platanus orientalis</i> L.	Platanaceae	Oriental tree	473	A	•	L, Se	Yes
55	<i>Polygonum acuminatum</i> Kenth	Polygonaceae	Peach wort	461	E	•	Wh	No
56	<i>Polygonum arenastrum</i> Bor.	Polygonaceae	Peach wort	485	E	•	Wh	Yes
57	<i>Polygonum equisetiforme</i> sibth et sm	Polygonaceae	Peach wort	486	E	•	Wh	No
58	<i>Polygonum persicaria</i> L.	Polygonaceae	Sorrel	W	E	•	Wh	Yes
59	<i>Polygonum salicifolium</i> Brouss.ex willd	Polygonaceae	Sorrel	472	E	***	Wh	Yes
60	<i>Populus euphratica</i> Oliver	Salicaceae	Abbey	W	E	***	L	Yes
61	<i>Populus nigra</i> L.	Salicaceae	Abbey	W	E	***	L	Yes
62	<i>Potentilla reptans</i> L.	Rosaceae	Five leaf grass	462	E	***	L, Se	Yes
63	<i>Pulicaria dysenterica</i> (L.) Bernh.	Compositae	Flea bane	465	E	•	Wh	No
64	<i>Ranunculus aquatilis</i> L.	Ranunculaceae	Butter cup	451	E	•	L, Se, R	Yes
65	<i>Rubus sanguineus</i>	Rosaceae	Water vine	W	E,A	•	L, Fr	Yes
66	<i>Ruppia maritima</i> L.	Ruppiaceae	Black water herb	W	E	•	Wh	No
67	<i>Salix acmophylla</i> Boiss	Salicaceae	Willow tree	W	A,E	***	L	Yes
68	<i>Salix alba</i> L.	Salicaceae	Willow tree	W	E	***	L	Yes
69	<i>Salix babylonica</i> Boiss.	Salicaceae	Willow tree	W	E	***	L	Yes
70	<i>Salix fragilis</i> L.	Salicaceae	Willow tree	W	E	***	L	Yes
71	<i>Salix triandra</i> L.	Salicaceae	Willow tree	W	E	***	L	No
72	<i>Sambucus nigra</i> L.	Caprifoliaceae	Black elder	W	A	**	L	Yes
73	<i>Samolus Yalerandi</i> L.	Primulaceae	Duck herb	464	E	**	Wh	Yes
74	<i>Sonchus maritimus</i> L.	Compositae	Milky herb	500	E	**	Wh	Yes
75	<i>Tamarix amplexicaulis</i> Ehrenb.	Tamaricaceae	Tamarisk	W	A	***	L, Fr	No
76	<i>Tamarix aphylla</i> (L.) Karst.	Tamaricaceae	Tamarisk	W	A	•	L, Fr	Yes
77	<i>Tamarix arvensis</i> zohary	Tamaricaceae	Tamarisk	W	A	**	L, Fr	Yes
78	<i>Tamarix jordanis</i> Boiss	Tamaricaceae	Tamarisk	W	A	•	L, Fr	No
79	<i>Tamarix Palaestina</i> Bertol.	Tamaricaceae	Tamarisk	W	A	•	L, Fr	Yes
80	<i>Trifolium fragiferum</i> L.	Leguminosae	Clover	475	E	•	Wh	Yes
81	<i>Verbena officinalis</i> L.	Verbenaceae	Horse whip	W	E	***	L, Se	Yes
82	<i>Verbena supine</i> L.	Verbenaceae	Horse whip	474	E	***	L, Se	Yes
83	<i>Veronica anagallis-aquatica</i> L.	Scrophulariaceae	Turtle herb	463	E,A	•		Yes
84	<i>Vinca herbacea</i> waldst.	Apocynaceae	Herbaceous	W	A	•	L, Se	Yes
85	<i>Vinca rosea</i> L.	Apocynaceae	Periwinkle	W	A	•	L, Se	Yes
86	<i>Vites angus-castus</i> L.	Verbenaceae	Chaste tree	450	A	•	L	No
87	<i>Withania somnifera</i> (L.) Dunel.	Solanaceae	Winter chirry	W	A	***	Wh	No

A: amphibious plant (present near water). St: stem, E: emerge. Fl :Flower, F: floating. S: submerged. W: well-known wild plant.
 •: low frequency, **: medium frequency ***: high frequency, L: leaf R: Root, Se: Seed Fr :Fruit, Wh: Whole plant Com.:Common,
 Vouch ;Voucher Hab.:Habit, Quot.:Quotation Freq.:Frequency, Med.:Medicinal Sim.:Similar, Reco :Record

Table 2: List of wild aquatic dicots with relative to their number of informants, major therapeutic effects, FL, RPL, ROP, I_p and I_h values, human or cattle affected, administration and record place

Plant No.	Plant species	I _p	FL	RPL	ROP	Major therapeutic effects	I _h	H/C	Admin. and reco. place
1	<i>Alternanthera sessilis</i> (L.) D.C.	12	0.30	0.40	12.00	Cough healing, astringent	4+4	H, C	Int.4,8
2	<i>Anagyris foetida</i> L.	05	0.40	0.17	06.80	Antineuralgic	2	H	Ext.9,11
3	<i>Apium graveolens</i> L.	10	0.70	0.33	23.10	Carminative, antispasmodic	7+7	H, C	Eaten7,9
4	<i>Apium nodiflorum</i> (L.) Lag	14	0.71	0.47	33.40	Carminative, antispasmodic	10+10	H	Eaten1,4
5	<i>Atropa belladonna</i> L.	15	0.80	1.0	80.00	Narcotic, antispasmodic	12+12	H	Ext.2,3
6	<i>Bacopa monnieri</i> (L.) Pennell	10	0.80	0.33	26.40	For mania and epilepsy	8+8	H	Ext.6,8
7	<i>Boerhavia repens</i> L.	05	0.40	0.33	13.20	Astringent in diarrhea	2+2	H	Ext.5,10
8	<i>Ceratophyllum demersum</i> L.	02	0.27	0.07	01.90	Astringent, carminative	1+1	H, C	Ext.12,13
9	<i>Cercis siliquastrum</i> L.	02	0.23	0.07	01.75	Demulcent, cardiac tonic	1+1	H	Int.13,15
10	<i>Cistus creticus</i> L.	02	0.25	0.07	10.00	Carminative, anthelmintic	1+1	H	Ext.4,7
11	<i>Commicarpus africanus</i> (Lour.) Dandy	02	0.38	0.07	38.00	Antispasmodic	1+1	H, C	Ext.3,6
12	<i>Commicarpus verticillatus</i> (Poir.) Standl.	02	0.36	0.07	36.00	Antispasmodic	2+2	H	Ext.1,2
13	<i>Corchorus olitorius</i> L.	02	0.50	0.06	03	Demulcent, nutritive	1+1	H	Eaten3,6
14	<i>Corchorus trilocularis</i> L.	01	1.00	0.03	03	Demulcent, nutritive	1+1	H, C	Eaten3,6
15	<i>Cynanchum acutum</i> L.	03	0.67	0.10	6.70	Astringent	2	C	Int.5,6
16	<i>Digera muricata</i> (L.) Mart.	02	0.50	0.07	3.50	Antispasmodic	1	H	Ext.4,6
17	<i>Eclipta alba</i> (L.) Hassk.	05	0.40	0.17	6.80	Emmenagogue	2	H	Int.3,6
18	<i>Epilobium hirsutum</i> L.	16	0.31	1.00	3.10	Hypertensive	5	H	Int. or Ext.3
19	<i>Eupatorium cannabinum</i> L.	12	0.33	0.40	13.20	Narcotic, diuretic	4+4	H, C	Ext.6,7
20	<i>Euphorbia exigua</i> L.	15	0.80	1.00	80.0	Anthelmintic, antirheumatic	12+12	H	Ext.6,7
21	<i>Gisekia pharnacioides</i> L.	03	0.33	0.10	3.30	Laxative, analgesic	1+1	H	Eaten 6,7
22	<i>Glinus lotoides</i> L.	02	0.50	0.06	3.00	Laxative, analgesic	1+1	H	Int.8,10
23	<i>Glycyrrhiza glabra</i> L.	18	0.89	1.00	89.0	Hypertensive, antitussive	16+16	H	Eaten 3,6
24	<i>Grewia tenax</i> (Forssk) Fiori.	01	1.00	0.03	3.00	Demulcent, cardiac tonic	1+1	H	Eaten5,6
25	<i>Grewia villosa</i> Willd	02	0.50	0.07	3.50	Demulcent, cardiac tonic	1+1	C	Eaten3,6
26	<i>Heliotropium supinum</i> L.	17	0.71	1.0	71.0	Expectorant	12	H	Ext. or Int.8
27	<i>Imula crithmoides</i> L.	18	0.83	1.0	83.0	Cholagogue, emmenagogue	15+15	H	Ext.5,6
28	<i>Imula graveolens</i> (L.) Desf.	17	0.76	1.0	76.0	Anthelmintic, expectorant	13+13	C	Ext.3,6
29	<i>Imula viscosa</i> (L.) Aiton	17	0.82	1.0	82.0	Anthelmintic, expectorant	14+14	H, C	Ext.12,15
30	<i>Jasminum fruticans</i> L.	02	0.50	0.07	3.50	Sedative, analgesic	1+1	H	Ext.4,5
31	<i>Laurus nobilis</i> L.	14	0.57	0.47	26.80	Antirheumatic, antispasmodic	8+8	C	Eaten3,6
32	<i>Lavandula coronopifolia</i> Lam.	16	0.75	1.0	75.0	Antirheumatic, antispasmodic	12+12	H	Int.4,6
33	<i>Lavandula pubescens</i> Decne	15	0.27	1.0	27.0	Antiscabies, antirheumatic	4+4	H, C	Int.4,6

Table 2: Continued

Plant No.	Plant species	L ₁	FL	RPL	ROP	Major therapeutic effects	L ₂	H/C	Admin. and reco. place
34	<i>Lippia nodiflora</i> (L.) Rich.	02	0.50	0.07	3.50	Laxative, for gout pain	1+1	H	Int.11,14
35	<i>Ludwigia stolonifera</i> (Guill. et perr.) Raven.	02	0.50	0.07	3.50	Analgesic, sedative	1+1	H, C	Int or Ext.4,7
36	<i>Lycium europaeum</i> L.	10	0.70	0.33	23.10	Antispasmodic	7	C	Int. or Ext.6
37	<i>Lycopus europaeum</i> L.	11	0.54	0.37	19.99	Febrifuge, astringent	6 + 6	H	Int. or Ext.6
38	<i>Lythrum hyssopifolia</i> L.	02	0.50	0.07	3.50	Haemorrhoides, internal bleeding	1+1	H	Ext.6,12
39	<i>Lythrum junceum</i> Banks et Sol.	01	1.00	0.03	3.00	Haemorrhoides, internal bleeding	1+1	H	Ext.8,13
40	<i>Lythrum salicaria</i> L.	02	0.50	0.07	3.50	Haemorrhoides, internal bleeding	1+1	H, C	Ext.12,15
41	<i>Mentha aquatica</i> L.	15	0.73	1.0	73.0	Relieves flatulence, antispasmodic	11 + 11	H	Eaten4,7
42	<i>Mentha graveolens</i> Ehrh.	16	0.75	1.0	75.0	Relieves flatulence, antispasmodic	12 + 12	H	Eaten5,6
43	<i>Mentha longifolia</i> (L.) Hudson	14	0.64	0.47	64.0	Relieves flatulence, antispasmodic	9 + 9	C	Eaten3,6
44	<i>Mentha piperita</i> L.	16	0.31	1.03	1.0	Relieves flatulence, antispasmodic	5 + 5	C	Eaten4,7
45	<i>Mentha pulegium</i> L.	16	0.38	1.0	38.0	Relieves flatulence, antispasmodic	6 + 6	H	Eaten5,6
46	<i>Mentha spicata</i> L.	16	0.31	1.03	1.0	Relieves flatulence, antispasmodic	5 + 5	H	Eaten3,6
47	<i>Mirabilis jalapa</i> L.	11	0.45	0.37	45.0	For healing of wounds and abscesses	5 + 5	H	Ext. or Int.5
48	<i>Myosotis discolor</i> Pers.	02	0.50	1.0	50.0	Cough healing, astringent	1+1	H, C	Ext.8
49	<i>Myriophyllum spicatum</i> L.	02	0.50	0.07	3.50	Diuretic	1	C	Int.2
50	<i>Nasturtium officinale</i> R.Br.	17	0.53	1.00	53.0	Vermifuge, diuretic	9+9	H	Ext.6,12
51	<i>Nerium oleander</i> L.	18	0.11	1.00	11.0	Cardiac tonic	2	H	Eaten2,6
52	<i>Nuphar lutea</i> (L.) Siebth. and Sm.	03	0.33	0.10	3.30	Vermifuge	1	H	Ext.13,15
53	<i>Oxystelma alpini</i> Decne.	02	0.50	0.07	3.50	Antipyretic	1	H	Int.6
54	<i>Platanus orientalis</i> L.	11	0.45	0.37	16.65	For ophthalmia, antirheumatic	5+5	H, C	Int.4,14
55	<i>Polygonum acuminatum</i> Kenth	14	0.21	0.47	9.87	Anti-inflammatory, astringent	3+3	H	Ext.5,6
56	<i>Polygonum arenastrum</i> Bor.	12	0.30	0.40	12.0	Anti-inflammatory, astringent	4+4	H, C	Eaten7,15
57	<i>Polygonum equisetiforme</i> Sibth et Sm	02	0.50	0.07	3.50	Anti-inflammatory, astringent	1+1	C	Eaten(9,11
58	<i>Polygonum persicaria</i> L.	13	0.46	0.43	19.78	Anti-inflammatory, astringent	6+6	H	Eaten4,7
59	<i>Polygonum salicifolium</i> Brouss. ex Willd	13	0.46	0.43	19.78	Anti-inflammatory, astringent	6+6	H	Eaten6,10
60	<i>Populus euphratica</i> Oliver	17	0.53	1.0	53.0	Febrifuge, diuretic	9+9	H	Eaten7,12
61	<i>Populus nigra</i> L.	16	0.81	1.0	81.0	Febrifuge, diuretic	13+13	HI	Int.3,5
62	<i>Potentilla reptans</i> L.	03	0.33	0.10	33.0	Antidysenteric, antidiarrheal	1+1	H	Int.2,7
63	<i>Pulicaria dysenterica</i> (L.) Bernh.	02	0.50	0.07	3.50	Astringent	1	C	Ext.5,8
64	<i>Ranunculus aquatilis</i> L.	02	0.50	0.07	3.50	Diuretic	1	H,C	Ext.7,10
65	<i>Rubus sanguineus</i> Friv.	16	0.19	1.00	19.0	Emmenagogue	3	H,C	Ext.7,9
66	<i>Ruppia maritima</i> L.	03	0.67	0.10	6.70	Antispasmodic	2	H	Eaten2,4
67	<i>Salix acmophylla</i> Boiss	17	0.65	1.00	65.0	Antiseptic, antipyretic	11+11	H	Eaten6,10
68	<i>Salix alba</i> L.	18	0.56	1.00	56.0	Antiseptic, antipyretic	10+10	H	Eaten2,13
69	<i>Salix babylonica</i> Boiss.	17	0.53	1.00	53.0	Antiseptic, antipyretic	9+9	H	Eaten1,5

Table 2: Continued

Plant No.	Plant species	I _e	FL	RPL	ROP	Major therapeutic effects	I _e	H/C	Admin and reco. place
70	<i>Salix fragilis</i> L.	17	0.59	1.00	59.0	Antiseptic, antipyretic	10+10	H	Eaten2,9
71	<i>Salix triandra</i> L.	17	0.71	1.00	71.0	Antiseptic, antipyretic	12+12	H	Eaten5,15
72	<i>Sambucus nigra</i> L.	10	0.40	0.33	13.2	Purgative, diuretic	4+4	H	Eaten6,10
73	<i>Samolus yelerandi</i> L.	02	0.50	0.07	3.50	Vermifuge	1	H	Int.6,11
74	<i>Sonchus maritimus</i> L.	14	0.43	0.47	20.2	Anti septic	6	C	Ext.7,12
75	<i>Tamarix amplexicaulis</i> Ehrenb.	03	0.33	0.03	0.99	Antirheumatic, astringent	1+1	H	Int 4,5
76	<i>Tamarix aphylla</i> (L.) Karst.	07	0.43	0.23	9.90	Antirheumatic, astringent	3+3	H,C	Int.14
77	<i>Tamarix arvensis</i> zohary	12	0.25	0.40	0.10	Antirheumatic, astringent	3+3	H, C	Int.13
78	<i>Tamarix jordanis</i> Boiss	10	0.20	0.33	6.60	Antirheumatic, astringent	2+2	H	Ext.7,9
79	<i>Tamarix Palaestina</i> Bertol.	08	0.25	0.27	6.75	Antirheumatic, astringent	2+2	H	Ext.(4,13
80	<i>Trifolium fragiferum</i> L.	02	0.50	0.07	3.50	Diuretic	1	H	Int.12,15
81	<i>Verbena officinalis</i> L.	15	0.60	1.00	60.0	Cholagogue, emmenagogue	9+9	H	Int.1,2
82	<i>Verbena supine</i> L.	14	0.36	0.47	16.92	Cholagogue, emmenagogue	5+5	C	Int.5
83	<i>Veronica anagallis – aquatica</i> L.	06	0.50	0.20	0.10	Antispasmodic	3	C	Ext.6
84	<i>Vinca herbacea</i> waldst.	10	0.60	0.33	19.80	Antirheumatic	6	H	Ext.4,7
85	<i>Vinca rosea</i> L.	10	0.40	0.33	13.2	Antirheumatic	4	C	Ext.5,14
86	<i>Vites angus-castus</i> L.	16	0.31	1.00	31.0	For colic and gastric disturbances	5	H	Int.6
87	<i>Withania somnifera</i> (L.) Dunel.	17	0.71	1.00	71.0	Vermifuge	12	H, C	Ext.7,10

FL: Fidelity Level ROP : Rank-Order Priority, RPL: Relative Popularity Level I_e: Number of informants for any effect, I_e: Number of informants for specific effect H : Human, C : Cattle Ext.: External, Int.: Internal Admin.: Administration, Reco : Record

Many of the medicinal species have no similarity in their medicinal uses and therapeutic effects with those recorded in the neighbouring countries specially Iraq and Palestine. These plants included 63 species (72.4%) while 24 species (27.6%) have such similarities, therefore the second group is considered as newly recorded medicinal uses and therapeutic effects.

The medicinal species recorded were belonging to 59 genera and 33 families, 41 species were well-known wild, while 46 species were investigated and photographed in the field. Twenty one species (24%) have ROP values of 50 or more which represented the highest rank order priority among medicinal species investigated (Table 2).

Discussion

The highly ranked medicinal plants with ROP values of 50 or more were represented by only 21 species (24%) in this study and can be classified according to their medicinal uses and therapeutic effects into many different categories depending on the internal or external uses.

- Aquatic medicinal plants useful as expectorant, astringent, muscular relaxant of uterus and arteries, carminative, antispasmodic, antiepileptic, for impotency, narcotic, antipyretic, diaphoretic, cathartic, hypnotic, analgesic, antineuralgic, antiarthritis, antirheumatic and antitussive: *Atropa belladonna* L. (ROP 80), *Lavandula coronopifolia* Lam. (ROP 75), *Mentha aquatica* L. (ROP 73), *Mentha graveolens* Ehrb. (ROP 76), *Mentha longifolia* (L.) Hudson (ROP 64), *Myosotis discolor* Pers. (ROP 50), *Salix acmophylla* Boiss (ROP 65), *Salix triandra* L. (ROP 71) and *Withania somnifera* (L.) Dunel (ROP 71).

- Aquatic medicinal plants useful as anilithic, for intestinal colic, for gastric disturbances, antidysentric, cholagogue, emmenagogue, antiseptic and renal calculi: *Inula crithmoides* L. (ROP 83), *Salix acmophyla* Boiss (ROP 65), *Salix alba* L. (ROP 56), *Salix babylonica* Boiss (ROP 53) and *Verbena officinalis* L. (ROP 60).
- Aquatic medicinal plants useful in skin diseases, antiscabies, anti-inflammatory: *Euphorbia exigua* L. (ROP 80), *Glycyrrhiza glabra* L. (ROP 89) and *Inula viscosa* (L.) Aiton (ROP 82).
- Medicinal plants useful as aphrodisiac, diuretic and cardiac tonic: *Glycyrrhiza glabra* L. (ROP 89), *Nasturtium officinale* (ROP 53) and *Populus euphratica* Oliver (ROP 53).
- Medicinal plants useful as hypoglycemic and antidiabetic, for haemorrhoides, for internal bleeding, relieves flatulence, vermifuge and purgative: *Heliotropium supinum* L. (ROP 71), *Inula graveolens* (L.) Desf. (ROP 76), *Inula viscosa* (L.) Aiton (ROP 82), *Mentha aquatica* L. (ROP 73), *Mentha graveolens* Ehreb (ROP 75), *Nasturtium officinale* R.Br. (ROP 53), *Populus euphratica* Oliver (ROP 53), *Populus nigra* L. (ROP 81) and *Withania somnifera* (L.) Dunel (ROP 71).

Conclusions

It is obvious from the above data, that Jordan has exhibited highly diversified wild aquatic medicinal species (87 species belonging to 59 genera and 33 families), which were confirmed by three or more informants. This diversity refers to the fact that it has at least four main phytogeographical elements which includes the lowest point in their altitude under sea level in Dead sea area (-400 m) and the highest point in Sharah series (1440 m).

This high diversity is, in part, due to the type of people inhabited this area and interviewed, most of them were beduins and rural inhabitants have long experience in folk medicine as local healers, herbalists, shephards and well-experienced persons.

This plant wealth requires that researchers pay attention to this natural resource to be protected from the threatening and endangering factors especially rare and endemic species.

The ethnobotanical survey of folk medicinal aquatic plants in Jordan is considered as clear evidence for the intimate interconnected integration between the local people and earth natural resources, which support the return to the earth and discovering the cultural and traditional symbolism for this manifestation in form of sustainable development.

This study opens the doors widely to the scientific approach to approve the validity of folk medicine are improve the pharmaceutical industries based on natural resources. This challenge needs further investigations to recognize the active constituents found in each species.

It is obvious that the number of medicinal plants verified by calculating FL, RPL and finally ROP as three main popularity levels in Jordan is relatively high and this conclusion is contrary to that found by Friedman *et al.* (1986) among Bedouins in the Negev desert. Friedman found only eight medicinal species that have ROP values above 50 (12.7%), while in this study 21 medicinal species were found that have ROP values above 50 (24%) and this is because the kind of people in the southern part of Jordan still have higher linkage with folk medicine and natural resources.

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