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Ethnobotanical Importance of Wild Plants in Wadi Kaam, Northwestern Libya

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THIS PAPER compares four indices; each index is designed to assess the cultural significance of plant species through the study of the goods provided by wild plants in the study area and the assessment of the Cultural Importance (CI) index, which reflects the cultural importance of wild plant usage. The results show that 94 species have a useful use (63.8% for medicinal use, 60.6% for beekeeping, 43.6% for fodder plants, 27.7% for human food, 8.5% as fuel and 2.1% in hand-made industries). The total **CI** of each category indicated that plants used in beekeeping are the most common among inhabitants (9.54), followed by medicinal use (9.46), and grazing (7.77), while hand-made was the least (0.27). *Ziziphus lotus* (total CI=1.22) had first rank in cultural using the four quantitative indices; CI, the relative frequency of citation (RFC), relative importance (RI) and cultural value (CV); with five number of uses (NU), 82 number of use reports (UR) and 41 frequency of citation (FC). There is a positive and significant relationship between the NU and FC (r = 0.876). At the same time, **CI** is significantly highly correlated with **FC** (r= 0.975), and **CV** was the most correlated with **FC** (r= 0.98). Despite the controversy surrounding the use of cultural significance indices, authors believe that indices based on interviews are the only way to fill passive knowledge about valuable plants. It is crucial to study the inhabitant's cultural uses of wild plants, to reflect their economic importance and the importance to be conservation.

Keywords: Cultural importance, Goods, Hand-made industries, Wadi Kaam, Wild plants.

Introduction

Libya is located in northern Africa between latitudes 20 and 34° N and 10 and 25° E. Its borders are Egypt (1150 km) to the east, Tunisia (459 km) and Algeria (982 km) to the west, the Mediterranean Sea (1770 km) to the north, Sudan (383 km), Chad (1055 km), and Niger (354 km) to the south (Fig. 1) (Zurqani, 2021). Due to its advantageous physical location at the geographic center of Africa's northern rim, it has many advantages. There are 1.76 million km^2 in all of Libya. More than 95% of Libya is desert; it is the largest area of extreme aridity in the Sahara (El-Tantawi, 2005; Zurqani & Ben Mahmoud, 2021). Libyan flora consists of 1750 vascular species divided into 744 genera and 118 plant families (Al-Idrissi et al., 1996). Lakes, valleys (wadis), and springs (Ain) in Libya are the sources of life in coastal areas (Ighwela, 2016). Valleys are an important type of habitat in the Libyan desert. The amount of water present due to the flood differs from that of other nearby habitats.

Ethnobotany has improved dramatically in recent decades and has become a widely recognized scientific discipline after using mathematical methods. CI index as a tool to evaluate plants' use-value (UV) is an essential quantitative method in many ethnobotanical studies, including those

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that depend on folk uses (Hoffman & Gallaher, 2007). Ethnobotany is the study of the interaction between plants and humans; however, the current use of this term is implicit in the study of native or traditional benefits of plants. It includes the indigenous knowledge of plant classification, cultivation, and use as food, medicine and shelter, especially ethnomedicinal knowledge related to many drug industries (Faruque et al., 2018; Ahmed et al., 2020).

Plants were universally recognized as a critical component of biodiversity and global sustainability (e.g. plants provide food, fiber, fuel, shelter, and medicine). Plants are essential resources and have an immense impact on ecosystems and a vital role in the socio-economic conditions of the people (Ahmed, 2009; Shaltout & Ahmed, 2012).

Strenuous efforts are made in enhancing the traditional compilation style of ethnobotanical studies by integrating quantitative research methods in data collection, processing, and interpretation of results (Höft et al., 1999). In the last two decades, the benefit of quantitative ethnobotany has grown-up steadily. Researchers have advanced and applied quantitative techniques to ethnobotanical information for testing various hypotheses about the relationship between humans and plant taxa (Reyes-Garcia et al., 2006). Ethnobotanists and anthropologists have proposed numerous indices to assess the cultural significance of plant taxa for people. For example, Turner (1988) proposed a cultural significant index, drawing on the intensity, quality, and exclusivity of plant uses. Pieroni (2001) presented some cultural variables to assess the value of plants fit for consumption.

Ethnobotanists have constructed different indices for measuring the UV of plant species (e.g. UV is the relation between the number of conducted interviews and the number of uses recorded in these interviews) (Phillips & Gentry, 1993a, b). The most frequent plants mentioned were assigned more use value than plants reported with less frequency. Begossi (1996) suggested applying ecological diversity indices to collect ethnobotanical data during survey interviews. According to this method, Ethnobotanists have calculated indices of diversity using the number of participants data who mentioned a plant species during meetings (Figueiredo et al., 1997; Rossato et al., 1999; Shaltout et al., 2023).

Using CI to calculate the UV of plants is a growing trend in quantitative ethnobotanical research. In recent years, scientists have become interested in the information lacking on the relative importance and cultural significance of valuable plants within a culture (Moerman, 1994). The present study highlights the goods afforded by wild plants in the study area and the assessment of their cultural importance, which reflects the cultural consensus of wild plant usage.

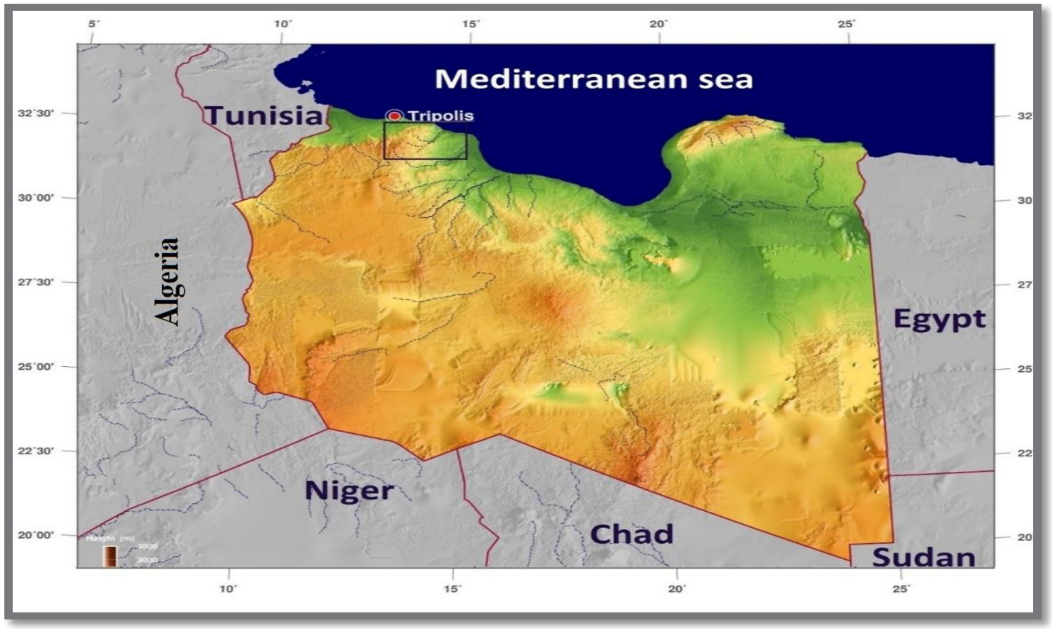

Fig. 1. A map illustrates the position and location of Libya (Google Earth Map)

Materials and Methods

Study area

The study area includes the entire Kaam Valley and its tributaries in northwestern Libya (Fig. 2). The length of its main course was 130km (Abu Rawy et al., 2017). It extends from the headwaters at Jabal Nafosa to the estuary in the Mediterranean Sea. Its basin area is approximately 2,500km^2, while the annual flood volume of the valley is about 15 million m^3 (Salim, 2016), resulting from the rain falling on the headwaters at Nafusa Mountains, at an annual rate of 240-280 million m^3 (**https://power.larc.nasa.gov/data-access-viewer/,2020**) A big dam was constructed in (1979) to control the valley's seasonal runoff, with a storage capacity of 111 million m^3, Ain Kaam is also a characteristic of the valley with a flow of 350L sec^{-1} (Nour & Abufayed, 2014).

As a part of northwestern Libya, Wadi Kaam is influenced by the coastal and mountain ecosystems. Coastal ecosystems are from 25-100km wide in northern Libyan regions. In this area, the annual rainfall is about 200-250mm. Natural vegetation is sparse and generally restricted to drought-resistant plants. The only common phreatophytes are the date palms growing along the coast, where the water table is close to the land surface. Reeds and other marsh grasses also exist locally.

Goods provided by wild plants

Ethnobotanical information was collected during 2019 and 2020 by interviewing 67 people in the local communities, herbalists, visitors, herders and beekeepers, their ages starting from 35 yr old upward. A direct question; asking them about the uses of each collected species. and literature review such as; El-Gadi (1989), Ahmed (2009), Shaltout et al. (2010), Shaltout et al. (2015), Valderrábano (2018), Hamad & Alaila (2019). The most important direct benefits (goods) were classified into five major categories; medicinal, human food, fuel, beekeeping, grazing and hand-made industries.

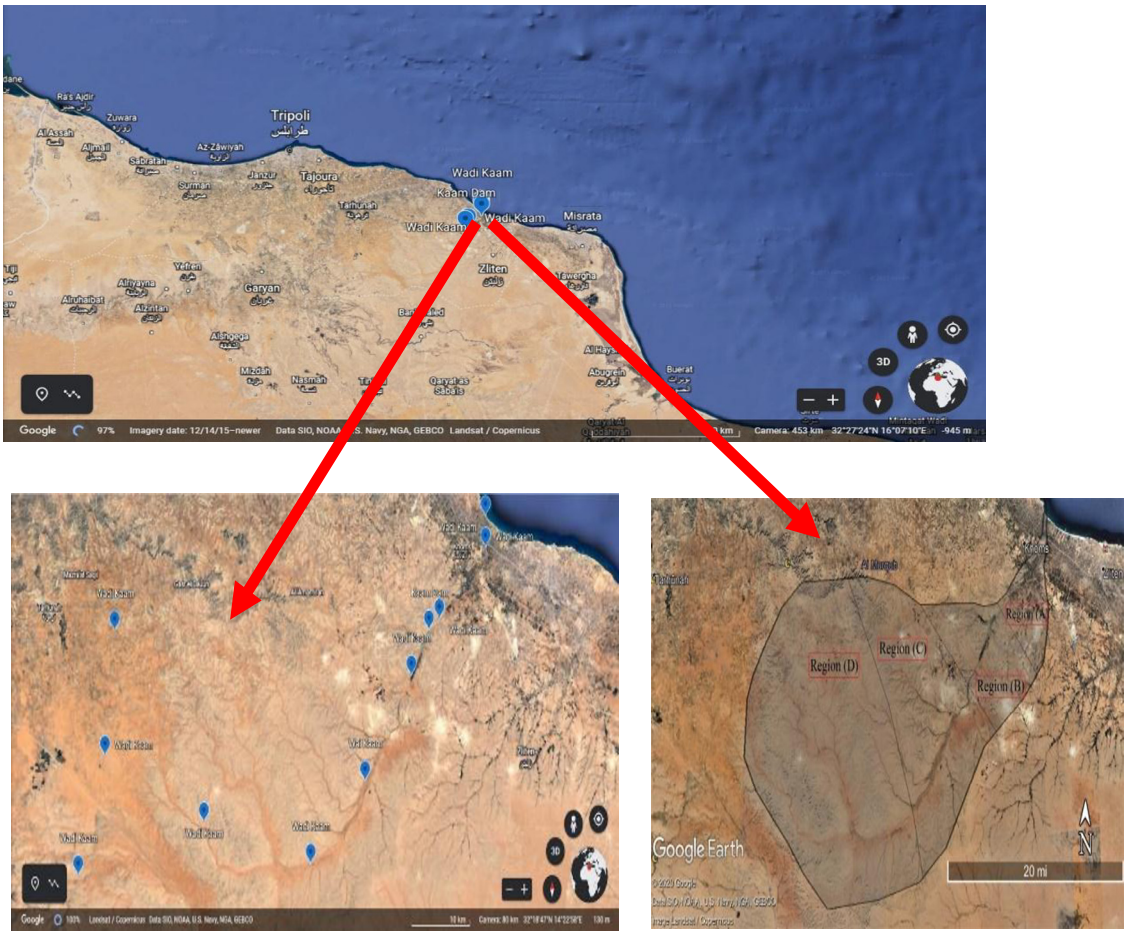

Fig. 2. Wadi Kaam, Libya (Google Earth Map)

Number of use reports (UR)

Ethnobotanical indices are founded on the basic structure of ethnobotanical information: informant "i" mentions the use of the species "s" in the use-category "u". The event resulting from the combination of these three variables has been defined as a use report (UR) (Kufer et al., 2005). In a particular survey that yields NS species (s1, s2,,, sNS), with a total number of use-categories NC (u1, u2,..., uNC) and N informants (i1, i2,..., iN), URsui can reach the value of 1 when a combination exists or 0 when this combination is not mentioned. These ethnobotanical data can be gathered in different methods by fixing one or two variables. The total number of UR for each species is one of the most popular tools for studying the cultural importance of plants, i.e., fixing the variable s. This can be mathematically expressed as:

$$UR_s = \sum_{u=u_1}^{u_{NC}} \sum_{i=i_1}^{i_N} UR_{ui}$$

Relative frequency of citation (RFC)

Use category variable (u) is not considered in this index. RFC is obtained by dividing the number of informants who mention the use of the species, also known as the frequency of citation (FC), by the number of informants participating in the survey (N). Using the same terminology, the numerator can be seen as the summation of the UR of all informants interviewed for the species without considering the use category

$$RFC_s = \frac{FC_s}{N} = \frac{\sum_{i=i_1}^{i_N} UR_i}{N}$$

Relative importance index (RI)

Created by Pardo-de-Santayana (2003), this index considers only the use-categories using the following formula.

$$RI_s = \frac{RFC_{s(max)} + RNU_{s(max)}}{2}$$

where RFCs(max) is the relative frequency of citation over the maximum, i.e., it is obtained by dividing FCs by the maximum value in all the species of the survey [$RFC_{s\,(max)} = FC_s / \max(FC)$], and RNUs (max) is the relative number of use-categories over the maximum, obtained dividing the number of uses of the species ($NU_s = \sum_{u=u_1}^{u_{NC}} UR_u$) by the maximum value in all the species of the survey [RNs (max) = NUs / max (NU)].

Cultural value index (CV)

This index, developed by Reyes-García et al. (2006), is calculated using the following formula.

$$CV_s = \left[NU_s/_{NC}\right] X \left[FC_s/_N\right] X \left[\sum_{u=u_1}^{u_{NC}} \sum_{i=i_1}^{i_N} UR_{iu}/_N\right]$$

The first factor is the relationship between the number of different uses reported for the species and the total number of use-categories considered in the study (NUs divided by NC). The second factor is the relative frequency of citation of the species (previously defined). Finally, the third factor is the sum of all the UR for the species, i.e., the sum of the number of participants who mentioned each use of the species, divided by N. These three factors are then multiplied together

Cultural Importance Index (CI) and Use Value (UV) Index

The following formula defines the cultural importance index (CI).

$$CI_s = \sum_{u=u_1}^{u_{NC}} \sum_{i=i_1}^{i_N} UR_{iu}/_N$$

This index, the third factor of the previously defined CV index, also can be seen as the sum of the proportion of informants that mention each species use. The CI index measures the relative importance of each plant's use. It is worth noting that the total figure of the CI index is identical to the simplified formula for the UV index, although both indices are defined in different ways. Following the same notation we have previously used, the following formula can determine the UV index.

$$UV_s = \sum_{i=i_1}^{i_N} \sum_{u=u_1}^{u_{NC}} UR_{iu}/_N$$

It can be seen that we are summing the same data (URs), but grouping them differently. In the case of CI index, it is the first sum of the UR grouping by uses (the sum of the informants who cited each given use) and then the sum of all these UR. However, in the case of the UV index, we first sum the UR grouping by informants (the sum

of the uses cited by each informant) and then sum all these data. Obviously, they yield the same result because we are adding the same events

Results

In the present study, 94 species (62% 0f the total recorded species) of 152 species offer at least one good to the local inhabitants (Table 1, Appendix). Essential direct benefits (Goods) were classified into medicinal, beekeeping, grazing and fodder industry, human food, fuel, and hand-made (Fig. 3). Plants used in folk medicine represented 60 species (63.8% of total economic species) to treat some diseases and relieve pain; significantly, 43 play an essential role in Libyan folk medicine (Table 2). Taxa used in beekeeping were represented by 57 species (60.6%), grazing and fodder industry taxa by 41 species (43.6%), human food by 26 species (27.7%), plants used as fuel (charcoal industry) by 8 species (8.5%) and plants used in hand-made industries by only two species (*Lygeum spartum* and *Stipa tenacissima*) (Appendix).

The total **CI** of each category indicated that plants used in beekeeping are the most common among inhabitants (9.54), followed by medicinal use (9.46), grazing (7.77), human food (5.19), fuel (1.83) and hand-made was the least (0.27) (Table 3). The ranking of species according to the calculated indices (CI, RFC, RI and CV) indicated clear differences in the species ranking yielded by the various indices set, the ranking of the species varies depending on the selected index (Table 4).

Ziziphus lotus (total CI=1.22, table 3) had the first rank in culture using the four quantitative indices; CI, RFC, RI and CV; with five NU, 82 UR and 41 FC (Table 4). The second-ranked species *Malva sylvestris* (total CI= 1.07) with 4 NU, 72 UR and 36 FC and the third-rank species *Olea europaea* (total CI= 1.03) using CI and CV indices, but it had the sixth rank using RI and the eighth-rank using RFC; with 4 NU, 69 UR and 23 FC (Tables 3 and 4).

TABLE 1. Number of use reports (UR) and percentage of use categories

Categories	Code	Number of species	Use reports (UR)	Percentage (%)
Medicinal	ME	60	642	28.1
Human food	HF	26	349	15.3
Beekeeping	BE	57	637	27.9
Grazing	GR	41	525	23.0
Fuel	FU	8	113	4.9
Hand-made	HM	2	18	0.8
Total			2284	100

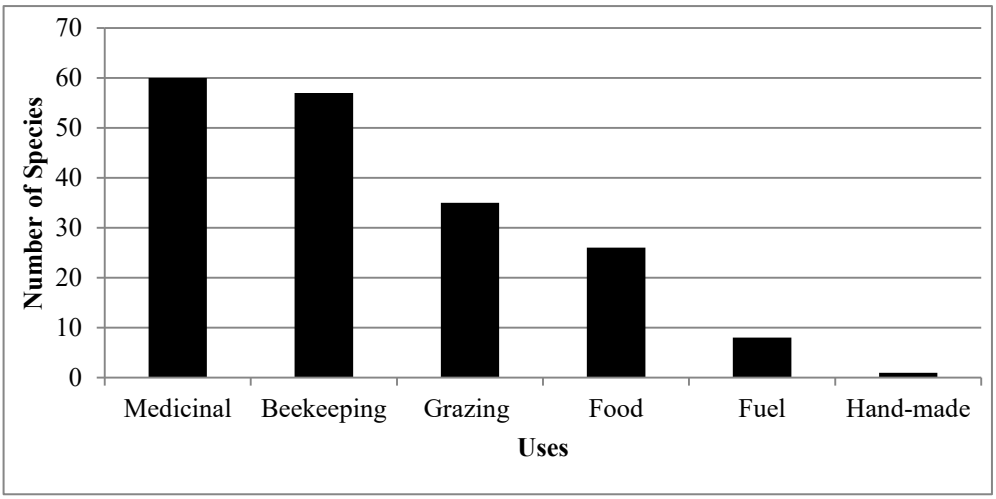

Fig. 3. Number of the recorded species in relation to the provided uses in Wadi Kaam

TABLE 2. Medicinal species with local names and their usage in Libyan folk medicine. Author interviews, Louhaichi et al. (2011) and Agiel & Mericli (2017)

No	Species	Local name	Used part	Traditional medicinal uses
1	*Ajuga iva*	Chendagora	shoot	Gastritis, vomiting, diarrhea, gastric Ulcer, anthelminthic, anti-diabetic, Pulmonary disorders
2	*Alkanna tinctoria*	Rell Hamam		Ulcers and stomach infections
3	*Ammi visnaga*	Camun	seeds	Tranquilizers, spasmolytics, cough, tonic, diuretic, digestive, increase uterine contractility and lactagogue
4	*Anacyclus clavatus*	Falyia	leaves	GIT disorders (flatulence, gastritis), skin diseases (dermatitis), menstruation colic, diuretic urinary tract infection, expectorant, for laryngitis, sinusitis, cracks of feet and hands, and asthma
5	*Artemisia herba-alba*	Sheeh		Infectious worms and parasites
6	*Artemisia judaica*	Amna- maryam	leaves	Enhance uterine contractility, skin ulcers, and kidney stones.
7	*Atractylis serratuloides*	Shabram	seeds	Rheumatism treatment
8	*Calotropis procera*	Branbakh	fruits	Treating cold diseases
9	*Chenopodium murale*	Effina	leaves	To treat Heat children
10	*Citrullus colocynthis*	Handal	fruits	Chronic constipation
11	*Cleome amblyocarpa*	Um Jlajel	seeds	Treatment of female infertility
12	*Convolvulus arvensis*	Ulliq	flowers leaves	For cough and cold
13	*Conyza bonariensis*	Ain Katkot	leaves	Diuretic
14	*Cynara cardunculus*	Shok Albel	seeds	Anemia, diuretic and rheumatism
15	*Cynodon dactylon*	Nagm	leaves	To treat abscesses, muscle pain and cystitis
16	*Deverra denudata*	Qzah	seeds	Treating blood pressure, Spider bites, Constipation Medicinal
17	*Diplotaxis harra*	Jarjir	leaves	Dandruff and hair strengthening
18	*Diplotaxis muralis*	Jarjir	leaves	Stomach diseases and bone strengthening
19	*Echium angustifolium*	Hinat arab	flowers	Snake bite and scorpion sting
20	*Erodium laciniatum*	Ebrat ra'iy	flowers seeds	Facilitate birth, Dresser for wounds
21	*Herniaria hirsuta*	Um Kabd	shoot	Treatment of kidney stones
22	*Launaea nudicaulis*	Addida	flowers	Increasing of milk production
23	*Lavandula multifida*	Al-kuzami	leaves	Externally: antiseptic for wounds, Internally: CNS disorders (stress, Depression, headache), asthma, antirheumatic, diuretic and for gastritis

TABLE 2. Cont.

No	Species	Local name	Used part	Traditional medicinal uses
24	*Lobularia libyca*	Awinat hanash	flowers seeds	Treatment of Lichen, Vitiligo
25	*Malva parviflora*	Khuppiza	flowers	Tonsillitis, Intestinal catarrh
26	*Marrubium vulgare*	Rubia	shoot	For rheumatism, antidiabetic, expectorant and analgesic for joint pains
27	*Matthiola longipetala*	Shagara	flowers	Treatment of hemorrhoids, kidney stones
28	*Nicotiana glauca*	Gardaq	flowers seeds	To treat Pimples and boils
29	*Nitraria retusa*	Akouz Musa	fruits	Stopping bleeding wounds
30	*Peganum harmala*	Harmal	seeds	Eczema, Arthritis
31	*Pistacia atlantica*	Batum	leaves	Chewed against respiratory affections.
32	*Retama raetam*	Al-ratem	shoot	Diabetes, sinusitis and antitumor
33	*Rosmarinus officinalis*	Eklil	leaves flowers	Externally: Skin cleanser, conjunctivitis and gargling in throat infections and voice cracks. Internally: Jaundice, Liver diseases, stomachic, and menstrual cramps.
34	*Rumex conglomeratus*	Humitha		Jaundice, Liver diseases, Constipation
35	*Ruta chalepensis*	Fagal	flowers leaves	Migraine and compresses for tired eyes. Aerial part used against rheumatic infections and Ecchymosis.
36	*Salvia egyptiaca*	Tefah El- Shahi	shoot	Digestive, drowsiness, nervousness,
37	*Salvia verbenaca*			
38	*Scorzonera undulata*	Qeiz	flowers	Eye cilia straightening
39	*Searsia tripartita*	Jdari	Leaves	Anti-inflammatory, expectorant, Antiseptic, emmenagogue and Vulnerary
40	*Solanum americanum*	Enab Al-deib	Fruits Leaves	Liver diseases, diuretic, constipation, dermatitis, rheumatic, hypertension
41	*Sonchus oleraceus*	Tifaf	Leaves	Scurvy disease, Diuretic
42	*Thymus capitatus*	Zather	Leaves	Externally: Gargle, for throat and gum, inflammation. Internally: Cough, anthelmintic, cardiotonic and spasmolytic
43	*Ziziphus lotus*	Sedr	fruits leaves	To treat a scorpion sting, Gastritis, Tract infection

TABLE 3. Cultural importance index (CI) of the recorded species in Wadi Kaam, with the CI component of each use category. The maximum values are highlighted regarding the total CI, while the minimum values are underlined. The use categories are coded as follows: ME: medicinal, HF: human food, BE: Beekeeping, GR: grazing, FU: fuel, HM: Hand-made

No	Species	ME	HF	BE	GR	FU	HM	Total CI
1	Adonis aestivalis	0.10			0.06			0.16
2	*Adonis microcarpa*			0.19	0.12			0.31
3	*Ajuga chamaepitys*	0.19						0.19
4	*Ajuga iva*				0.18			0.18
5	*Alkanna tinctoria*	0.07		0.18				0.25
6	*Amaranthus viridis*			0.15				0.15
7	*Ammi visnaga*	0.27		0.13				0.40
8	*Anacyclus clavatus*			0.12				0.12
9	*Anacyclus monanthos*			0.16				0.16
10	*Anagallis arvensis*		0.15					0.15
11	*Anthyllis vulneraria*	0.12			0.22			0.34
12	*Artemisia herba-alba*	0.19	0.07		0.15			0.42
13	*Artemisia judaica*	0.15			0.16			0.31
14	*Asparagus horridus*	0.13						0.13
15	*Atractylis carduus*				0.16			0.16
16	*Atractylis serratuloides*	0.16						0.16
17	*Brassica tournefortii*		0.45	0.13	0.19			0.78
18	*Bromus diandrus*			0.10	0.13			0.24
19	*Cakile maritima*			0.18				0.18
20	*Calicotome villosa*		0.18	0.22	0.09			0.49
21	*Calotropis procera*	0.18						0.18
22	*Carduus getulus*				0.22			0.22
23	*Cenchrus ciliaris*	0.09	0.16	0.21				0.46
24	*Citrullus colocynthis*	0.21	0.10					0.31
25	*Convolvulus arvensis*	0.24		0.12	0.21			0.57
26	*Cynara cardunculus*	0.10		0.13				0.24
27	*Cynodon dactylon*	0.10			0.24			0.34
28	*Deverra denudata*			0.15				0.15
29	*Diplotaxis harra*	0.22	0.13	0.15	0.24			0.75
30	*Diplotaxis muralis*	0.07	0.15	0.15	0.25			0.63
31	*Drimia maritima*	0.12			0.06			0.18
32	*Echium angustifolium*	0.16		0.25				0.42
33	*Emex spinosa*	0.30			0.16			0.46
34	*Erigeron bonariensis*	0.18		0.13				0.31
35	*Erodium laciniatum*			0.13				0.13
36	*Eucalyptus camaldulensis*			0.16		0.33		0.49
37	*Eucalyptus leucoxylon*			0.16		0.33		0.49
38	*Euphorbia terracina*		0.18	0.19				0.37
39	*Fagonia scabra*	0.21						0.21
40	*Fumaria parviflora*	0.19						0.19
41	*Gymnocarpos decander*		0.12	0.12	0.19			0.43
42	*Haloxylon scoparium*	0.15		0.16				0.31
43	*Helianthemum lippii*			0.13	0.22			0.36
44	*Herniaria hirsuta*	0.16						0.16
45	*Hordeum marinum*		0.33	0.09	0.27			0.69
46	*Juncus acutus*	0.19		0.12				0.31
47	*Launaea nudicaulis*	0.13		0.12	0.24			0.49

TABLE 3. Cont.

No	Species	ME	HF	BE	GR	FU	HM	Total CI
48	*Lavandula multifida*	0.16		0.15				0.31
49	*Limoniastrum monopetalum*			0.18				0.18
50	*Limonium pruinosum*	0.10						0.10
51	*Lobularia libyca*	0.09	0.15		0.16			0.40
52	*Lotus halophilus*			0.30				0.30
53	*Lygeum spartum*	0.15					0.27	0.15
54	*Malva parviflora*	0.19	0.22	0.09	0.16			0.67
55	*Malva sylvestris*	0.19	0.36	0.33	0.19			1.07
56	*Marrubium vulgare*	0.25	0.31	0.33				0.90
57	*Matthiola longipetal*	0.10	0.19	0.22	0.21			0.73
58	*Medicago laciniata*		0.12		0.15			0.27
59	*Neurada procumbens*	0.13						0.13
60	*Nicotiana glauca*	0.19		0.18				0.37
61	*Nitraria retusa*	0.07		0.12				0.19
62	*Olea europaea*	0.30	0.30	0.13		0.30		1.03
63	*Onopordum arenarium*			0.16				0.16
64	*Papaver rhoeas*	0.16		0.19	0.18			0.54
65	*Paronychia arabica*			0.18				0.18
66	*Peganum harmala*	0.22	0.16	0.18				0.57
67	*Pennisetum setaceum*	0.12			0.22			0.34
68	*Phragmites australis*	0.12			0.09			0.21
69	*Pinus canariensis*		0.18			0.16		0.34
70	*Pinus halepensis*		0.18			0.16		0.34
71	*Pistacia atlantica*	0.30		0.10		0.13		0.54
72	*Plantago albicans*	0.18		0.12	0.27			0.57
73	*Plantago lagopus*			0.16	0.27			0.43
74	*Plantago lanceolata*	0.07			0.27			0.34
75	*Polypogon monspeliensis*			0.07	0.13			0.21
76	*Pseuderucaria teretifolia*				0.21			0.21
77	*Retama raetam*	0.33		0.09	0.22			0.64
78	*Ricinus communis*	0.28		0.15				0.43
79	*Rosmarinus officinalis*	0.18	0.21	0.16				0.55
80	*Ruta chalepensis*	0.15		0.30				0.45
81	*Salvia aegyptiaca*			0.15				0.15
82	*Salvia verbenaca*			0.16				0.16
83	*Scorzonera undulata*	0.06			0.19			0.25
84	*Searsia tripartite*	0.04	0.24	0.12		0.12		0.52
85	*Silybum marianum*	0.01			0.22			0.24
86	*Solanum americanum*	0.01	0.12					0.13
87	*Sonchus oleraceus*	0.07		0.18				0.25
88	*Sonchus tenerrimus*			0.18				0.18
89	*Stipa capensis*	0.15						0.15
90	*Stipa tenacissima*	0.15			0.28		0.27	0.70
91	*Stipagrostis plumosa*	0.09			0.28			0.37
92	*Thymbra capitata*	0.25	0.13	0.30				0.69
93	*Trigonella anguina*				0.24			0.24
94	*Ziziphus lotus*	0.22	0.30	0.33	0.07	0.30		1.22
	Total	9.46	5.19	9.54	7.77	1.83	0.27	

TABLE 4. Evaluation of economic importance of the, using four quantitative indices. FC: frequency of citation, UR: number of use-reports, NU: number of uses, CI: cultural importance, RFC: relative frequency of citation, RI: relative importance, CV: cultural va

No.	Species	Basic value			Index				Ranking			
		FC	UR	NU	CI	RFC	RI	CV	CI	RFC	RI	CV
1	*Adonis aestivalis*	6	11	2	0.16	0.1	0.3	0.005	79	81	64	64
2	*Adonis microcarpa*	11	21	2	0.31	0.2	0.5	0.017	48	48	45	47
3	*Ajuga chamaepitys*	8	13	1	0.19	0.1	0.3	0.004	68	59	68	69
4	*Ajuga iva*	6	12	1	0.18	0.1	0.2	0.003	72	81	81	77
5	*Alkanna tinctoria*	9	17	2	0.25	0.1	0.4	0.011	56	55	54	54
6	*Amaranthus viridis*	5	10	1	0.15	0.1	0.2	0.002	84	90	90	91
7	*Ammi visnaga*	14	27	2	0.40	0.2	0.5	0.028	34	34	35	34
8	*Anacyclus clavatus*	4	8	1	0.12	0.1	0.2	0.001	93	94	94	94
9	*Anacyclus monanthos*	6	11	1	0.16	0.1	0.2	0.002	79	81	81	81
10	*Anagallis arvensis*	6	10	1	0.15	0.1	0.2	0.002	84	81	81	86
11	*Anthyllis vulneraria*	12	23	2	0.34	0.2	0.5	0.020	41	41	41	41
12	*Artemisia herba-alba*	14	28	3	0.42	0.2	0.6	0.044	32	34	25	25
13	*Artemisia judaica*	11	21	2	0.31	0.2	0.5	0.017	48	48	48	47
14	*Asparagus horridus*	6	9	1	0.13	0.1	0.2	0.002	90	81	81	88
15	*Atractylis carduus*	7	11	1	0.16	0.1	0.3	0.003	79	70	74	75
16	*Atractylis serratuloides*	6	11	1	0.16	0.1	0.2	0.002	79	81	85	84
17	*Brassica tournefortii*	26	52	3	0.78	0.4	0.9	0.151	5	4	8	7
18	*Bromus diandrus*	8	16	2	0.24	0.1	0.4	0.010	58	59	55	58
19	*Cakile maritima*	6	12	1	0.18	0.1	0.2	0.003	72	81	85	77
20	*Calicotome villosa*	16	33	3	0.49	0.2	0.7	0.059	23	23	22	22
21	*Calotropis procera*	7	12	1	0.18	0.1	0.3	0.003	72	70	74	74
22	*Carduus getulus*	8	15	1	0.22	0.1	0.3	0.004	61	59	68	66
23	*Cenchrus ciliaris*	15	31	3	0.46	0.2	0.7	0.052	26	27	24	23
24	*Citrullus colocynthis*	11	21	2	0.31	0.2	0.5	0.017	48	48	48	49
25	*Convolvulus arvensis*	19	38	3	0.57	0.3	0.8	0.080	14	16	17	17
26	*Cynara cardunculus*	8	16	2	0.24	0.1	0.4	0.010	58	59	58	58
27	*Cynodon dactylon*	12	23	2	0.34	0.2	0.5	0.020	41	41	41	41
28	*Deverra denudata*	7	10	1	0.15	0.1	0.3	0.003	86	70	74	80
29	*Diplotaxis harra*	25	50	4	0.75	0.4	1.0	0.186	6	5	4	5
30	*Diplotaxis muralis*	21	42	4	0.63	0.3	0.9	0.131	13	13	9	9
31	*Drimia maritima*	6	12	2	0.18	0.1	0.3	0.005	72	85	64	63
32	*Echium angustifolium*	14	28	2	0.42	0.2	0.5	0.029	32	34	35	33
33	*Emex spinosa*	16	31	2	0.46	0.2	0.6	0.037	26	25	29	28
34	*Erigeron bonariensis*	16	21	2	0.31	0.2	0.6	0.025	48	25	29	35
35	*Erodium laciniatum*	6	9	1	0.13	0.1	0.2	0.002	90	85	85	88
36	*Eucalyptus camaldulensis*	17	33	2	0.49	0.3	0.6	0.042	23	21	27	26
37	*Eucalyptus leucoxylon*	15	33	2	0.49	0.2	0.6	0.037	23	27	32	29
38	*Euphorbia terracina*	13	25	2	0.37	0.2	0.5	0.024	35	37	37	37
39	*Fagonia scabra*	7	14	1	0.21	0.1	0.3	0.004	63	70	77	71
40	*Fumaria parviflora*	8	13	1	0.19	0.1	0.3	0.004	68	62	68	69
41	*Gymnocarpos decander*	15	29	3	0.43	0.2	0.7	0.048	30	30	24	24
42	*Haloxylon scoparium*	11	21	2	0.31	0.2	0.5	0.017	51	48	48	49
43	*Helianthemum lippii*	12	24	2	0.36	0.2	0.5	0.021	38	41	41	38
44	*Herniaria hirsuta*	6	11	1	0.16	0.1	0.2	0.002	82	85	85	84
45	*Hordeum marinum*	23	46	3	0.69	0.3	0.9	0.118	10	8	12	12
46	*Juncus acutus*	12	21	2	0.31	0.2	0.5	0.019	51	41	41	44
47	*Launaea nudicaulis*	17	33	3	0.49	0.3	0.7	0.062	26	22	21	21

TABLE 4. Cont.

No.	Species	Basic value			Index				Ranking			
		FC	UR	NU	CI	RFC	RI	CV	CI	RFC	RI	CV
48	*Lavandula multifida*	10	21	2	0.31	0.1	0.4	0.016	51	49	51	51
49	*Limoniastrum monopetalum*	8	12	1	0.18	0.1	0.3	0.004	75	62	71	72
50	*Limonium pruinosum*	5	7	1	0.10	0.1	0.2	0.001	94	90	90	93
51	*Lobularia libyca*	13	27	3	0.40	0.2	0.6	0.039	34	37	26	27
52	*Lotus halophilus*	10	20	1	0.30	0.1	0.3	0.007	53	52	65	59
53	*Lygeum spartum*	5	10	1	0.15	0.1	0.2	0.002	86	93	93	92
54	*Malva parviflora*	22	45	4	0.67	0.3	0.9	0.147	11	11	7	8
55	*Malva sylvestris*	36	72	4	1.07	0.5	1.3	0.385	2	2	2	2
56	*Marrubium vulgare*	30	60	3	0.90	0.4	1.0	0.200	4	3	3	4
57	*Matthiola longipetala*	24	49	4	0.73	0.4	1.0	0.175	7	6	5	6
58	*Medicago laciniata*	9	18	2	0.27	0.1	0.4	0.012	53	55	54	52
59	*Neurada procumbens*	7	9	1	0.13	0.1	0.3	0.002	92	70	77	85
60	*Nicotiana glauca*	10	25	2	0.37	0.1	0.4	0.019	37	52	51	45
61	*Nitraria retusa*	7	13	2	0.19	0.1	0.4	0.007	68	74	61	62
62	*Olea europaea*	23	69	4	1.03	0.3	1.0	0.236	3	8	6	3
63	*Onopordum arenarium*	8	11	1	0.16	0.1	0.3	0.003	82	62	71	73
64	*Papaver rhoeas*	18	36	3	0.54	0.3	0.7	0.072	19	19	20	20
65	*Paronychia arabica*	6	12	1	0.18	0.1	0.2	0.003	75	85	88	79
66	*Peganum harmala*	19	38	3	0.57	0.3	0.8	0.080	16	16	17	17
67	*Pennisetum setaceum*	12	23	2	0.34	0.2	0.5	0.020	41	44	44	41
68	*Phragmites australis*	7	14	2	0.21	0.1	0.4	0.007	63	74	61	61
69	*Pinus canariensis*	12	23	2	0.34	0.2	0.5	0.020	44	44	44	43
70	*Pinus halepensis*	10	23	2	0.34	0.1	0.4	0.017	44	52	51	50
71	*Pistacia atlantica*	18	36	3	0.54	0.3	0.7	0.072	19	19	20	20
72	*Plantago albicans*	19	38	3	0.57	0.3	0.8	0.080	16	16	17	17
73	*Plantago lagopus*	15	29	2	0.43	0.2	0.6	0.032	30	30	32	31
74	*Plantago lanceolata*	12	23	2	0.34	0.2	0.5	0.020	44	44	44	43
75	*Polypogon monspeliensis*	7	14	2	0.21	0.1	0.4	0.007	65	74	61	61
76	*Pseuderucaria teretifolia*	7	14	1	0.21	0.1	0.3	0.004	65	74	77	71
77	*Retama raetam*	21	43	3	0.64	0.3	0.8	0.101	12	13	14	13
78	*Ricinus communis*	14	29	2	0.43	0.2	0.5	0.030	30	34	35	32
79	*Rosmarinus officinalis*	18	37	3	0.55	0.3	0.7	0.074	17	19	20	18
80	*Ruta chalepensis*	15	30	2	0.45	0.2	0.6	0.033	27	30	32	30
81	*Salvia aegyptiaca*	5	10	1	0.15	0.1	0.2	0.002	87	93	93	92
82	*Salvia verbenaca*	6	11	1	0.16	0.1	0.2	0.002	82	88	88	84
83	*Scorzonera undulata*	8	17	2	0.25	0.1	0.4	0.010	54	65	58	55
84	*Searsia tripartita*	18	35	4	0.52	0.3	0.8	0.094	20	21	13	14
85	*Silybum marianum*	8	16	2	0.24	0.1	0.4	0.010	60	65	58	58
86	*Solanum americanum*	6	9	2	0.13	0.1	0.3	0.004	92	88	64	67
87	*Sonchus oleraceus*	9	17	2	0.25	0.1	0.4	0.011	56	55	54	54
88	*Sonchus tenerrimus*	6	12	1	0.18	0.1	0.2	0.003	75	88	88	79
89	*Stipa capensis*	5	10	1	0.15	0.1	0.2	0.002	88	93	93	92
90	*Stipa tenacissima*	23	47	3	0.70	0.3	0.9	0.120	8	10	12	10
91	*Stipagrostis plumosa*	13	25	2	0.37	0.2	0.5	0.024	37	37	37	37
92	*Thymbra capitata*	23	46	3	0.69	0.3	0.9	0.118	10	10	12	12
93	*Trigonella anguina*	8	16	1	0.24	0.1	0.3	0.005	60	65	71	65
94	*Ziziphus lotus*	41	82	5	1.22	0.6	1.5	0.624	1	1	1	1

On the other hand, *Limonium pruinosum* (total CI=0.10) and *Anacyclus clavatus* (total CI = 0.12) had the lowest cultural significance (Table 3). *Limonium pruinosum* had the ninety-four-rank (the last rank) using CI index and ninety-three-rank using CV index, but the ninety-rank using RFC and RI indices, with one NU, 7 UR and 5 FC. While *Anacyclus clavatus* had the ninety-three-rank using CI index and ninety-four-rank using RFC, RI and CV indices, with 1 NU, 8 UR and 4 FC (Table 4).

Spearman correlation among all variables in (Fig. 4) has a significant positive correlation at P≤ 0.01 (n=94). **NU** had a significant positive correlation with **FC** (0.876), **CV** was the highest correlated with **RI** (r= 0.985), **UR** and **CI** (each of r= 0.984) and **FC** (r=0.978). **CI** was completely correlated with **UR** (r=1000), **FC** (r= 0.975) and **RI** (r=0.961). In addition, **RI was** highly correlated with **FC** (r= 0.976) and **RFC** was highly correlated with FC (r= 0.929).

Discussion

According to the current study, the most important direct benefits were classified into six major categories: medicinal, beekeeping, grazing and fodder industry, human food, fuel, and traditional industries. However, this study discovered that 94 of the total species (62%) provide at least one good to the local inhabitants. Medicinal and aromatic plants have played an important role in the socio-cultural, spiritual, and healthcare needs of rural and tribal peoples in emerging and developing countries (Longo & Pizzio, 2003). A large portion of the population in many developing countries still relies on traditional medical systems to meet their healthcare needs. Furthermore, as more people in developed countries turn to alternative therapies and herbal drugs, the demand for medicinal plants and their products in these parts of the world has increased many-fold (**Agiel & Mericli, 2017**). Because of their low collection and cultivation costs, high economic returns per unit area, and the creation of new jobs in the value-added activities of processing and marketing, medicinal plants of the Libyan Mediterranean Coast represent an opportunity to reduce rural poverty in arid and semi-arid ecosystems (Louhaichi et al., 2011). In the current study, Sixty species play an essential role in Libyan folk medicine (63.8% of total recorded species offered good), including *Ziziphus lotus* (Sidr) (CI= 1.22), *Pistacica atlantica* (Baattoom) (CI= 0.54), *Euphorbia helioscobia* (Lebbana) and *Artemisia herba-alba* (sheeh) (CI= 0.42) have been used traditionally to treat some diseases and relieve pain (Bahri, 2017; Bedair et al., 2020).

In addition, fifty-seven species are considered palatable species that bees graze on. In the western region of Libya, there are three main honey flows, the heaviest from spring-flowering plants in late March and April. Many beekeepers move their colonies to the hilly lands east of Tripoli for the second flow from wild-flowers of Sider, Zizpihus lotus (Sidr), from May to June. The third flow from Thymus capitatus (Zaatar) is from June to July. Eucalyptus honey, from Eucalyptus species, is one of the main kinds of honey produced and consumed in Libya, especially in the north, where there are extensive areas of that flower in November and December. Because of the consecutive blooming of the different Eucalyptus species, it is regarded as the most important source of nectar and pollen to colonies in drought periods (Keshlaf, 2014). Libyans use honey primarily for medicinal purposes and many hand-made sweets, especially Baklawa, a popular Middle Eastern dessert (Brittan, 1956).

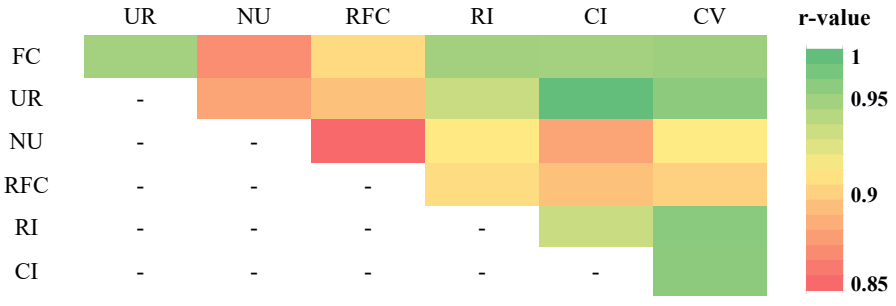

Fig. 4. Spearman correlation coefficient (r) of basic values and Indices. Basic values are coded as: FC: frequency of citation, UR: number of use-reports, NU: number of uses, while indices are coded as: CI: cultural importance, RFC: relative frequency of citation, RI: relative importance, CV: cultural value

Also, forty-one species were important for grazing in the study wadi. In comparison, 67 species were identified as the most important species for grazing in the Jabal Nafosa and its surrounding areas (Environment Public Authority, 2010). However, it can be seen that valleys are suitable places for grazing due to fresh weeds, grasses, and shrubs. In addition to direct grazing, weeds and grasses are harvested, dried and mixed with other components for the forage industry (Author observation). At the same time, twenty-six species such as; *Brassica tournefortii* (Aslouz) (CI= 0.78) is collected from the wild and used to make a traditional meal by local inhabitants. Moreover, seeds of *Zizpihus lotus* are eaten directly and leaves of *Thymus capitatus* (Zaatar) (CI= 0.69), *Rosmarinus officinalis* (Eklil) (CI= 0.55), and *Marrubium vulgare* (Robia) (CI= 0.90) to add a distinctive flavor to hot drinks (Author observation).

Fuel are perennial trees and used in the charcoal industry, mainly; species of *Eucalyptus* sp. and *Olea* sp. charcoal is the most refined local coal (Author observation). Eight of the total economic species were used in the coal industry, including *Eucalyptus camaldulensis, Eucalyptus leucoxylon* (CI=45) and *Olea europaea* (CI= 1.07). At the same time, dry branches and stumps of shrubs are collected and used directly to light a fire (Author observation).

The species of *Stipa tenacissima* (Halfa) (CI=70) was an important economic resource for northwestern Libya. It was exported out of the country in the 19th and early 20th centuries. However, its use now is limited to traditional industries such as mats, baskets and ropes (Al-Ayesh & Al-Shin, 2018). Also, *Lygeum spartum* is used in hand-made industries such as ropes, baskets and mats (Ahmed et al., 2023).

In the present study, CI and RI indices have the highest values in relation to other indices and this may be due to the relative frequency of citation and the relative number of use-categories are normalized by dividing by the maximum value, ranging from 0.04 to 1.22 (Tardio & Santayana, 2007). In addition, CI is interested in defining the specific uses of plants that better reflect the cultural aspects of plant utilization (Shaltout et al., 2023).

There is a positive and significant relationship between the species' number of uses (**NU**) and frequency of citation (**FC**). It appears to be a general rule that the more versatile a plant, the more widely useful it is. Furthermore, the number of use-categories in the study has a significant impact on NU, so, an objective index must rely on FC rather than NU (Tardio & Santayana, 2007). At the same time, **CI** (which is defined as the sum of the proportions of informants who mention each of the species' uses) is significantly highly correlated with **FC** (r= 0.975), and **CV** was the most correlated with **FC** (r= 0.98) this mean that use category is conveniently weighted by the number of informants who mention it (FC) (Tardio & Santayana, 2007). This result agrees with the results of Shaltout et al. (2023) for endemic taxa in Egypt.

Conclusion

The present study presents the ethnobotanical importance of 152 wild plants inhabiting Wadi Kaam (Northwestern of Libya) as reported by local information from local inhabitants. Ninety-four plants had economic uses (medicine, beekeeping, grazing and fodder industry, human food, fuel and hand-made). Collected information indicated that the total CI indicated that plants used in beekeeping are the most common among inhabitants (9.54), followed by medicinal use (9.46), grazing (7.77), human food (5.19), fuel (1.83) and hand-made was the least (0.27). There is a significant positive correlation at $P \leq 0.01$ (n=94) between all variables (FC, UR, NU, CI, RFC, RI and CV). The authors found that the economic importance (goods) depending on the information of local inhabitants is very realistic and important to be assessed.

Competing interests The authors report no conflicts of interest regarding this work.

Authors' contributions: All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Dalia Abd El-Azeem Ahmed, Mohamed El-khalafy and Fathi Almushghub. The first draft of the manuscript was written by Dalia Abd El-Azeem Ahmed, Fathi Almushghub and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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References

Abu Rawy, Mustfa, R., Mustsfa, F. (2017) Assessment of surface and groundwater quality standards for Wadi Kaam. Al-Tarbawi Magazine - Faculty of Education, Khums, Al-Marqab University, Libya. 869873, 143-157 (in Arabic).

Agiel, N., Mericli, F. (2017) A survey on the aromatic plants of Libya. *Indian Journal of Pharmaceutical Education and Research,* **51**(3), 304-308.

Ahmed, D. (2009) Current Situation of the Flora and Vegetation of the Western Mediterranean Desert of Egypt. *Ph.D. Thesis,* Tanta University, Tanta, pp. 424. Unpublished Dissertation

Ahmed, D., Ammar, E., Svenning, J., El-Beheiry, M., Shaltout, K. (2020) Wild Plant Species in Egyptian Gardens of the Nile Region: Conservation Viewpoint. *Egyptian Journal of Botany* **60**(3),719-732.

Ahmed, D.A., Shaltout, K., Slima, D.F., El-Masry, S. (2023). Threats affecting the distribution of *Lygeum spartum* Loefl. ex L. and its associated species in the Western Mediterranean desert of Egypt: Perspectives of conservation. *Journal For Nature Conservation,* **72**, 126351. https://doi.org/10.1016/j.jnc.2023.126351

Al-Ayesh, G., Al-Shin, F. (2018) West Tripoli and its trade during the nineteenth century (19). *MSc Thesis*, Université Echahid Hamma Lakhdar - El Oued. Unpublished Dissertation

Al-Idrissi, M., Sbeita, A., Jebriel, A., Zintani, A., Ghawawi, H. (1996) *Libya*: Country report to the FAO International Technical Conference on Plant Genetic Resources. Leipzig, Germany.5-27 .

Bahri, N.M. (2017) Identify, Limit and Determine the Vegetation Types. Botany Department, Faculty of Sciences, Sebha University, Sebha, *Libya*. **2**(3), 12-26. (In Arabic)

Bedair, H., Shaltout, K. H., **A**hmed, D. A., Sharaf El-Din, A., El-Fahhar, R. (2020) Characterization of wild trees and shrubs in the Egyptian Flora. *Egyptian Journal of Botany,* **60**(1), 147-168.

Begossi, A. (1996) Use of ecological methods in ethnobotany: Diversity indices. *Economic Botany* **50**, 280–289.

Brittan, O. (1956) Introduction of modern beekeeping to Cyrenacia (Libya). *Bee Craft*, **37**(12), 145-146.

El-Gadi, A. (1989) "*Flora of Libya*". Department of Botany, Al-Faateh Univ., Tripoli, Libya, Vol. 145-147.

El-Tantawi, A.M. (2005) Climate change in Libya and desertification of Jifara Plain using geographical information system and remote sensing techniques. Unpublished Dissertation Naturwissenschaften Fakultät Universität in Mainz, Germany.1-237 .

Environment Public Authority (2010) Fourth national report on the Implementation of the Convention on Biological Diversity of Libya. Tripoli, Libya. 1-124. (In Arabic).

Faruque, M.O., Bokhtear, U.S., Barlow, J.W., Hu, S., Dong, S., Cai, Q., Li, X., Hu, X. (2018) Quantitative ethnobotany of medicinal plants used by indigenous communities in Bandarban District of Bangladesh. *Frontiers in Pharmacology* **9**(40), 1-12. https://doi.org/10.3389/fphar.2018.00040

Figueiredo, G.M., Leitao-Filho, H., Begossi, A. (1997) Ethnobotany of Atlantic forest coastal communities: Diversity of plant uses at Sepetiba Bay (SE Brazil). *Human Ecology* **25**, 353–360.

Hamad, H.M., Alaila, A.K. (2019) Allelopathic activity of some medicinal plants against *Erwinia carotovora. Journal of Agriculture and Ecology Research International*, **18**(3), 1-7.

Hoffman, B., Gallaher, T. (2007) Importance Indices in Ethnobotany. *Ethnobotany Research and Applications,* **5**, 201–218.

Höft, M., Barik, S.K., Lykke, A.M. (1999) *Quantitative Ethnobotany. Applications of Multivariate and Statistical Analyses in Ethnobotany. People and Plants working paper 6*. United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris.

Ighwela, K.A. (2016) Study of some chemical indicators of water quality in Ain Kaam Zliten City. ICCPGE, Al-Mergib University, Alkhoms. Libya, (1), pp. 25-30.

Keshlaf, M. (2014) Beekeeping in Libya. *International Journal of Biological, Biomolecular, Agricultural, Food and Biotechnological Engineering,* **8**, 32-35.

Kufer, J., Heinrich, M., Förther, H., Pöll, E. (2005) Historical and modern medicinal plant uses—the example of the Ch›orti 'Maya and Ladinos in Eastern Guatemala. *Journal of Pharmacy and pharmacology* **57**, 1127-115.

Longo, G., Pizzio, F. (2003) *Medicinal plants and their utilization*. Earth, Environmental and Marine Sciences and Technologies, Trieste, Italy, 99, 34012.

Louhaichi, M., Salkini, A., Estita, H., Belkhir, S. (2011) Initial assessment of medicinal plants across the Libyan Mediterranean coast. *Advances in Environmental Biology*, **5**(2), 359-370.

Moerman, D. (1994) *North American food and drug plants*. Pages 166–181in NL Etkin, ed., Eating on the wild side, in, The University of Arizona Press, Tucson, AZ.

Nour, M., Abufayed, A. (2014) Unpublished Dissertation Unpublished Dissertation Unpublished Dissertation Libya Water Sector (monitoring and evaluation) rapid Assessment Report, Monitoring & Evaluation for Water In North Africa (MEWINA) Project, Water Resources Management Program, CEDARE. 2-83.

Pardo-de-Santayana, M. (2003) Las plantas en la cultura tradicional de la antiguaMerindad de Campoo. Ph.D. dissertation, Departamento de Biología, Facultad de Ciencias, Universidad Autónoma de Madrid, Spain. Unpublished.

Phillips, O., Gentry, A.H. (1993a) The Useful Plants of Tambopata, Peru: I. Statistical Hypotheses Tests with A New Quantitative Technique. *Economic Botany,* **47**(1), 15–32.

Phillips, O., Gentry, A.H. (1993b). The Useful Plants of Tambopata, Peru: II. Additional Hypothesis-Testing in Quantitative Ethnobotany. *Economic Botany,* **47**(1), 33–43.

Pieroni, A. (2001) Evaluation of the Cultural Significance of Wild Food Botanicals Traditionally Consumed in Northwestern Tuscany, Italy. *Journal of Ethnobiology,* **21**(1), 89–104.

Reyes-Garcia, V., Huanca, T., Vadez, V., Leonard, W., Wilkie, D. (2006) Cultural, Practical, and Economic Value of Wild Plants: A Quantitative Study in the Bolivian Amazon1. *Economic Botany*, **60**(1), 62–74.

Rossato, S.V.C., Leitao-Filho, H., Begossi, A. (1999) Ethnobotany of Caicaras of the Atlantic Forest Coast (Brazil). *Economic Botany,* **53**, 387–395.

Salim, M.S. (2016) *Analysis of the morphometric characteristics of Wadi Kaam basin-Libya using geographical information systems*. International Geospatial Conference and Exhibition - Libya Geotech, 2 Tripoli, Libya, 195-211. (In Arabic).

Shaltout, K.H., Ahmed, D.A. (2012) Ecosystem Services of the Flora of Southern Mediterranean Desert of Egypt. *Ethnobotany Research & Applications,* **10**, 403-422.

Shaltout, K.H., Sharaf El-Din, A., Ahmed, D.A. (2010) "*Plant Life in the Nile Delta*". Tanta: Tanta University Press. 158p.

Shaltout, K.H., Hosni H., El-Fahar, R. Ahmed, D.A. (2015) Flora and vegetation of the different habitats of the western Mediterranean region of Egypt. *Taeckholmia*, **35**, 45-76.

Shaltout, K.H., Ahmed, D.A., Al-Sodany Y.M., Haroun S., El-Khalafy, M. (2023) Cultural importance indices of the endemic plants in Egypt. *Egyptian Journal of Botany*, **63**(2), 649-663.

Tardio, J., Santayana, M. (2007) Cultural Importance Indices: A Comparative Analysis Based on the Useful Wild Plants of Southern Cantabria (Northern Spain)1. *Economic Botany*, **62**(1), 24–39.

Turner, N.J. (1988) The Importance of a Rose": Evaluating the Cultural Significance of Plants in Thompson and Lilloet Interior Salish. *American Anthropologist,* **90**, 272–290.

Valderrábano, M. (2018) *Conserving wild plants in the south and east Mediterranean region* (No. BOOK B). IUCN, Gland, Switzerland, and IUCN Centre for Mediterranean. Cooperation, Málaga, Spain, (22), 12-12.

Zurqani, H.A. (ed.) (2021) The Soils of Libya, World Soils Book Series, In: "*World Soil Book Series*", Hartemink, A.E. (Ed.), Springer Nature Switzerland AG. https://doi.org/10.1007/978-3-030-66368-1_1

Zurqani, H.A., Ben Mahmoud, K.R. (2021) Land cover, land use and vegetation. In: " *World Soil Book Series*", Hartemink, A.E. (Ed.) Springer Nature Switzerland AG. pp.77-89. https://doi.org/10.1007/978-3-030-66368-1_1

https://power.larc.nasa.gov/data-access-viewer/ (March 2023)

الأهمية العرقية للنباتات النباتات البرية بوادي كعام (شمال غرب ليبيا)

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تقارن هذه الورقة أربعة مؤشرات. تم تصميم كل مؤشر لتقييم الأهمية الثقافية لأنواع النباتات من خلال دراسة السلع التي يوفرها الغطاء النباتي الطبيعي لمنطقة الدراسة وتقييم مؤشر الأهمية الثقافية CI، والذي يعكس الإتفاق الثقافي لاستخدام النباتات البرية. استخدمنا البيانات من النباتات المستخدمة تقليديا في منطقة الدراسة للمقارنة. تظهر النتائج التي توصلنا إليها أن 94 نوعًا لها استخدام مفيد (63.8٪ استخدام طبي، 60.6٪ تربية النحل، 43.6٪ نباتات علف، 27.7٪ غذاء بشري، 8.5٪ كوقود و2.1٪ في صناعات يدوية). أشار مجموع المؤشر الثقافي لكل فئة إلى أن النباتات المستخدمة في تربية النحل هي الأكثر شيوعًا بين السكان (9.54)، تليها الإستخدامات الطبية (9.46)، والرعي (7.77)، بينما كانت الصناعات اليدوية أقلها (0.27). احتل نبات السدر (مجموع CI = 1.22) المرتبة الأولى في ثقافة السكان باستخدام المؤشرات الكمية الأربعة؛ المؤشر الثقافي، التكرار النسبي لاستخدام النبات (RFC)، الأهمية النسبية (RI) والقيمة الثقافية (CV)؛ مع خمسة عدد من الاستخدامات (NU)، وعدد 82 من تقارير الإستخدام (UR) و41 تكرار التسجيل (FC). هناك علاقة إيجابية وهامة بين عدد الإستخدامات وعدد تكرار تسجيلها (r = 0.876). في الوقت نفسه، يرتبط مؤشر الثقافة CI ارتباطًا وثيقًا بعدد مرات التسجيل (r = 0.975) FC ، وكانت الأهمية الثقافية هي الأكثر ارتباطًا بتكرار مرات التسجيل (r = 0.98) FC. وعلى الرغم من الجدل الدائر حول استخدام مؤشرات الأهمية الثقافية، يعتقد المؤلفون أن المؤشرات المبنية على مقابلات السكان هي الطريقة الوحيدة لسد فجوة المعلومات حول أهمية النباتات البرية. ومن الأهمية بمكان، دراسة الإستخدامات الثقافية للسكان للنباتات البرية لتعكس أهميتها الإقتصادية وأهمية الحفاظ عليها.