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Qualitative investigation techniques used for analysis of ethnobotanical data from Thal Desert, Punjab Pakistan

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Abstract
In this study two quantitative techniques were used to investigate ethnobotanical data from Thal Desert, Punjab Pakistan. The relative importance of 124 native species reported as being useful by 90 informants was calculated employing the Use-Value (UV) and Relative Importance (RI) techniques. Both techniques place value on a given taxon based on the number of uses attributed to it. Results obtained for both techniques are positively correlated, suggesting that they can be used interchangeably to evaluate local knowledge of a given resource. The implications and interpretation limitations of these two techniques are discussed in detail.

Keywords: Ethnobotany, Use-Value, Relative Importance, Thal Desert, Pakistan

1. Introduction
Quantitative techniques have been used in ethnobotany to compare the uses and the cultural importance of different plant taxa. These analyses are of great scientific interest as they reflect cultural value systems, and they may also aid in the conservation of biodiversity. It is expected that people will be motivated to conserve resources that are most important to them, in contrast to resources perceived as less useful (Byg and Balslev 2001 [10], Garibaldi and Turner 2004) [13]. Phillips (1996) [26], in a review of ethnobotanical techniques, pointed out that procedures based on "informant consensus" tend be more objective as they are designed to eliminate investigator bias in attributing relative importance to a given plant.

The use of quantitative techniques to evaluate the relative importance of plants in a given culture is common in ethnobotanical literature. Ever since the publication of the Use-Value index proposed by Phillips and Gentry (1993a, 1993b) [23-24-25] (modified from Prance *et al*., 1987) [27], similar approaches have been widely used by many different authors (Albuquerque *et al*., 2005a [5], Cunha and Albuquerque 2006 [11], Galeano 2000 [12], Gomez-Beloz 2002 [14], Kristensen and Balslev 2003 [17], Kvist *et al*., 2001 [18], Torre-Cuadros and Islebe 2003) [36]. The most popular techniques (indices) are based on "informant consensus" the degree of agreement among the different people interviewed concerning the use of a given resource (e.g. Byg and Balslev 2001) [10]. Numerous authors have applied these techniques to investigate the impact of exploitation of locally important resources, based on the supposition that however more important a resource is, the greater will be the exploitation pressure placed upon it. Although these interpretations have sometimes been questioned (Albuquerque and Lucena 2005 [1], Silva and Albuquerque 2004) [32], neither their use as tools for evaluating the importance of a given resource, nor their limitations or scope, have been critically examined. According to Reyes-García *et al*. (2006) it is necessary now for "studies that assess the reliability of the different indices que presumably proxy for the same phenomena".

We performed a rapid and simple evaluation of the Use-Value (UV) and Relative Importance (RI) quantitative techniques. The goal was to assess the correspondence between these indices. The technique of Use-Value, which is based on the number of uses and the number of people that cite a given plant, has been widely used within the ethnobotanical community to indicate the species that are considered most important by a given population (e.g. Galeano 2000 [12], Torre-Cuadros and Islebe 2003) [36]. One of the most common approaches has been to associate the Use-Value with questions of conservation, based on the idea that the most important species will suffer the greatest harvesting pressure (Albuquerque and Lucena 2005 [1] for a critical review of published works on this subject). The technique of Relative

Importance (RI), Proposed by Bennett and Prance (2000) [9], was developed primarily for measuring the usefulness of medicinal plants. The RI value is derived from the number of indications (of pharmacological properties) for that species and from the number ailments that it is used to treat. As such, the importance of a species increases if it is used to treat more infirmities. As this technique was conceived, it would be possible to calculate the Relative Importance of a medicinal plant based only on secondary sources. A majority of the published works that have used this technique sought to identify the most important species to a given culture (Almeida and Albuquerque 2002, Janni and Bastien 2004) [16]; compare differences between the historically documented and contemporary importance of species (Janni and Bastien 2000) [15]; and to test hypothesis related to the use, knowledge, and conservation of medicinal plants (Almeida *et al*., 2005, Silva and Albuquerque 2005) [34].

Both techniques are used as measures of relative importance, but neither distinguishes knowledge of a resource from its actual use and, as such, they are both treated here a measures of knowledge (for a brief review of the question of knowledge concerning a plant versus its effective use, refer to Reyes-Garcia *et al*., 2005) [29], or of "theoretical dimension" according to Reyes-Garcia *et al*. (2006) [28]. Although the Relative Importance technique is much less used than the Use-Value, we chose to examine it here due its useful manner of calculation. Both techniques consider the number of uses attributed to a given taxon in determining its importance (Albuquerque and Lucena 2005 [1], Phillips 1996 [26], Silva and Albuquerque 2004 [33], Silva *et al*., 2006) [34], but they differ in that only the Use-Value technique includes the number of people that cite information for a given taxon (i.e. it is directly based on informant consensus).

2. Material and Methods

Study Area

The Thal desert is situated between 31° 10' N and 71° 30' E in the Punjab, province, Pakistan (Fig. 1). The area is subtropical sandy desert spread over 190 miles with its maximum breadth of 70 miles. The tract is bound by the piedmont of the Salt Range in the north, the Indus River flood plains in the west and Jhelum and Chenab River flood plains in the east. This region is divided into the districts of Bhakkar, Khushab, Mianwali, Jhang, Layyah and Muzaffargarh. Geographically, the Thal Desert resembles the Deserts of Cholistan and Thar. The main towns of Thal are Roda Thal, Mankera, Hayderabad Thal, Dullewala, Piplan, Kundiyan, Koat Aazam, Sarauy Muhajir, Mehmood Shaheed Thal, Rang Pur, Jandan Wala, Mari Shah Sakhira, Noor Pur Thal, and Muzafar Garh.

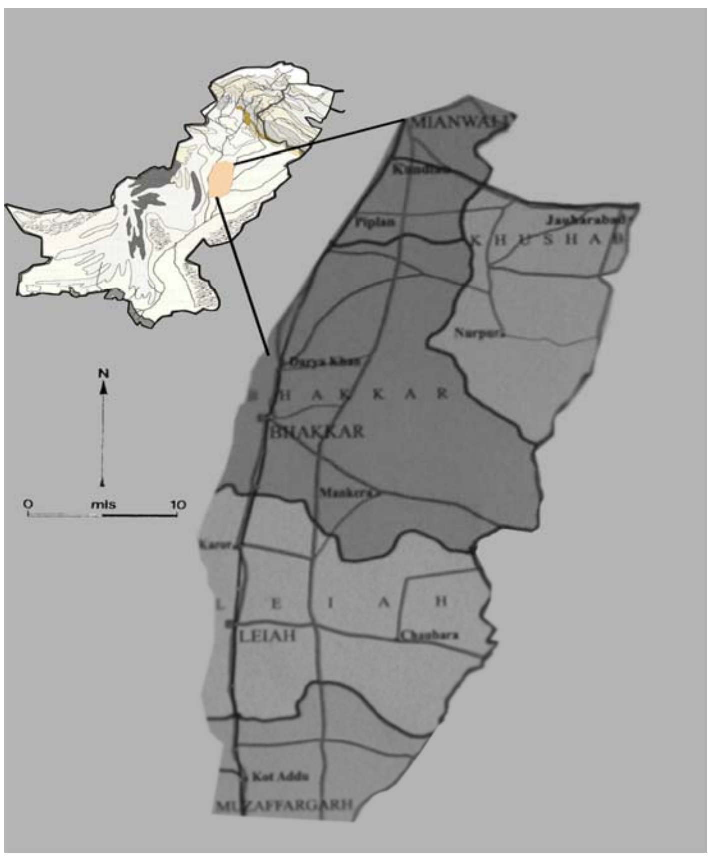

Fig 1: Map showing location of Thal Desert, Punjab, Pakistan.

Collection of ethnobotanical information

During the floristic survey, indigenous knowledge of plants was extracted by using semi-structured questionnaire (Annexture-1) following Shaheen *et al*. (2012) and Shaheen *et al*. (2014) Local inhabitants, including older people, herbalists (Hakeems) and midwives (Daai), were interviewed to obtain ethnobotanical information about the plants that are being used by these nomads (migratory) for food, medicine, fodder/forage, fuel & timber, etc. In addition, a literature survey has done to seek any novel uses as well as to verify the authenticity of the uses recorded from the study area.

3. Data Compilation

The local importance of each species cited was calculated using two different techniques: Use-Value (UV) and Relative Importance (RI).

i. Use-Value (UV)

The Use-Value was calculated using the formula UV = ∑Ui/n (Rossato *et al*., 1999; Silva and Albuquerque 2004 [32]; modified from Phillips and Gentry 1993a, 1993b) [23-24-25], where: Ui = the number of uses mentioned by each informant for a given species, n = the total number of informants. For example, if informant X mentioned 7 uses for species a, and informant Y mentioned 3 uses for the same species, the UV of species a would therefore be 5, (7+3) uses mentioned divided by 2 informants. As such, the Use-Value of a given plant is determined by the number of uses locally attributed to it in relation to the number of informants. In the original formulation of Phillips and Gentry (1993a) [23-24], these authors considered in their calculations the number of times that each informant referred to a given species.

ii. Relative Importance (RI)

Relative Importance (RI) is calculated using the formula RI = NUC + NT (Bennett & Prance 2000) [9], where: NUC = number of use-categories of a given species (NUCS) divided by the total number of use-categories of the most versatile species (NUCVS). NT = is given by the number of types of uses attributed to a given species (NTS) divided by the total number of types of uses attributed to the most important taxon (NT- MIT), independent of the number of informants that cite the species. For example, species a is cited as being used in medicine and construction (2 use-categories), and as a medicine it is used to treat coughs, headaches, and stomach aches, while in construction it is used to make fences and build houses (thus totaling 5 types of uses). On the other hand, species b might be more verastil, being used in various categories and types of uses (possibly 4 and 10, respectively). As such, the IR of species a would be 1.0 = (2/4) + (5/10).

The Kolmogorov-Smirnov test was used to verify data normality (Zar 1996) [37]. In order to test if there was a relationship between the values obtained for each of the two indexes, the Spearman correlation coefficient was employed (Sokal and Rholf 1995) [35]. A correlation analysis was also performed, taking into account the value obtained with each technique versus the number of use-categories, the number of informants that cited a given species as being useful, and the total of all the use citations.

4. Results

Altogether 90 informants gave information about 124 medicinal plants from Thal desert, which they use in their life for the treatment of health problems. Use-value index and Relative Importance techniques were used for the authentication of information (Table 1). The two techniques were strongly correlated (rs= 0.75; P< 0.0001), however, indicating that a given species tends to have the same importance irrespective of the technique employed.

Table 1: Classification of plants on based of two quantitative measures of relative importance. # = Number of use categories. Inf. = Number of informants. ∑ = Number of citations. UV = Use-Value. RI = relative importance. *Plant material collected in the same area, although at different times.

S. No.	Botanical name	Local name	Family Name	#	Inf.	∑	UV	RI
1	*Abutilon pakistanicum* Jafri & Ali	Kanghi Buti	Malvaceae	4	10	50	0.56	0.58
2	*Acacia jacquemontii* Benth.	Kanda	Mimosaceae	6	60	188	2.09	0.58
3	*Acacia nilotica* (L.) DeL. subsp. *indica* (Benth.) Brenan	Kikar	Mimosaceae	6	70	190	2.11	1
4	*Acacia nilotica* subsp. *cupressiformis* (T.L. Stewart) Ali	Kabli kikar	Mimosaceae	4	65	190	2.11	0.58
5	*Achyranthes aspera* L.	Puth Kanda	Amaranthaceae	3	30	120	1.33	0.83
6	*Aerva javanica* (Burm. f.) Juss ex J. A. Shultes.	Boi	Amaranthaceae	5	45	60	0.67	0.92
7	*Agave sislana* Perr. Ex Engelm.	Shirin	Agavaceae	3	45	70	0.78	1.08
8	*Albizzia lebbeck* (L.) Bth.	Shirin	Mimosaceae	3	50	80	0.89	0.75
9	*Alhagi maurorum* Medic.	Jwanha/Goghi dhaman	Fabaceae	3	60	170	1.89	0.83
10	*Aloe vera* L.	Kunwar gandal	Alloaceae	2	80	190	2.11	0.67
11	*Alternanthera pungens* Kunth in H.B.K.	Ludhri	Amaranthaceae	3	40	150	1.67	0.58
12	*Alysicarpus longifolius* (Rottler ex Spreng.) Wight & Arn.		Fabaceae	3	33	120	1.33	0.5
13	*Amaranthus graecizans* L.	Choleri	Amaranthaceae	3	50	166	1.84	0.5
14	*Amaranthus ovalifolius* L.	Kalga	Amaranthaceae	2	55	170	1.89	0.42
15	*Amaranthus viridis* L.	Choleri	Amaranthaceae	3	60	170	1.89	0.5
16	*Amberboa ramosa*	Tirkanda/Birhami buti	Asteraceae	1	55	140	1.56	0.67
17	*Anethum graveolens* L.	Soya	Apiaceae	4	77	130	1.44	0.5
18	*Argemone mexicana* L.	Sawi pohli	Papaveraceae	3	65	166	1.84	0.58
19	*Asphodelus tenuifolius* Cavan.	Bokat	Asphodeloideae	3	30	10	0.11	0.5
20	*Azadirachta indica* (L.) A. Juss.	Neem	Meliaceae	5	67	177	1.97	1.33
21	*Bacopa monirii* L.		Scrophulariaceae	2	50	100	1.11	0.75
22	*Boerhavia diffusa* L.	Tangri	Nyctaginaceae	3	30	77	0.86	0.58
23	*Boerhavia procumbens* Banks ex Roxb.		Nyctaginaceae	1	45	102	1.13	0.58
24	*Bombax malabaricum* DC.	Sumbul	Bombacaceae	3	55	81	0.90	0.67
25	*Brassica campestris* L.	Sarson	Brassicaceae	3	85	190	2.11	0.83
26	*Calotropis procera* (Willd.) R. Br.	Ak	Asclepiadaceae	4	87	199	2.21	1.08
27	*Capparis decidua* (Forssk.) Edgew.	Kareenh/Kari	Capparidaceae	4	67	185	2.06	1
28	*Carthamus oxyacantha* M.B.	Pohli	Asteraceae	4	57	180	2.00	0.67
29	*Cassia fistula* L.	Girrad Nalli	Caesalpiniaceae	3	46	100	1.11	0.5
30	*Cassia italica* (Mill.) F.W.Andr.		Caesalpiniaceae	5	70	170	1.89	0.83
31	*Celosia argentea* L.	Kalga	Amaranthaceae	2	50	50	0.56	0.75
32	*Centaurea iberica* Trev.		Asteraceae	2	33	100	1.11	0.33
33	*Chenopodium album* L.	Bathu	Chenopodiaceae	3	76	150	1.67	0.58
34	*Chenopodium murale* L.	Bathu	Chenopodiaceae	3	50	170	1.89	0.58
35	*Chrozophora tinctoria* (L.) Juss.	Neel buti	Euphorbiaceae	3	34	120	1.33	0.5

36	*Cicer arietinum* L.	Chhana / Chholay	Fabaceae	5	60	120	1.33	0.67
37	*Citrullus colocynthis* (L.) Schrad.	Kaur Tuma	Cucurbitaceae	5	90	199	2.21	1.17
38	*Citrus grandis* (L.) Osbeck	Kinu	Rutaceae	6	69	150	1.67	0.92
39	*Citrus medica* var. *acida* Brandis	Gilgan	Rutaceae	5	70	155	1.72	0.83
40	*Citrus sinensis* (L.) Osbeck	Malta	Rutaceae	5	79	150	1.67	0.75
41	*Cleome brachycarpa* Vahl ex DC.	Ganduli	Capparidaceae	2	58	130	1.44	0.42
42	*Convolvulus arvensis* L.	Wand vehri	Convolvulaceae	3	55	100	1.11	0.5
43	*Convolvulus microphyllus* Sieb. ex Spreng.		Convolvulaceae	2	67	70	0.78	0.42
44	*Corchorus depressus* (Linn.) Stocks	Boophali	Tiliaceae	4	76	140	1.56	0.83
45	*Corchorus tridens* L.	Phali	Tiliaceae	4	55	111	1.23	0.67
46	*Cordia gharaf* (Forssk.) Ehren. ex Asch.	Lasura	Boraginaceae	5	69	120	1.33	0.67
47	*Cordia myxa* L.		Boraginaceae	5	70	110	1.22	0.67
48	*Cressa cretica* L.	Rudranti	Convolvulaceae	2	45	111	1.23	0.33
49	*Cuscuta monogyna* Vahl, Sym.	Amar bel	Cuscutaceae	2	50	80	0.89	0.5
50	*Cuscuta reflexa* Roxb.	Amar bel	Cuscutaceae	2	50	82	0.91	0.5
51	*Cymbopogon jwarancusa subsp. jwarancusa* (Jones) Schult.	Khavi	Poaceae	4	55	90	1.00	0.83
52	*Cynodon dactylon* (L.) Pers.	Talla	Poaceae	2	49	50	0.56	0.5
53	*Dalbergia sissoo Roxb.*	Talhi	Fabaceae	4	60	60	0.67	0.67
54	*Datura fastuosa* L.		Solanaceae	2	76	120	1.33	0.67
55	*Digera muricata* (L.) Mart.	Tandla	Amaranthaceae	3	56	70	0.78	0.58
56	*Echinops echinatus* Roxb.	Unt Katara	Asteraceae	3	45	40	0.44	0.58
57	*Eruca sativa* Miller	Jamaya	Brassicaceae	3	60	180	2.00	0.92
58	*Eucalyptus camaldulensis* Dehnh.	Sufeda	Myrtaceae	4	56	40	0.44	0.67
59	*Euphorbia granulata* Forssk.		Euphorbiaceae	3	66	30	0.33	0.5
60	*Euphorbia prostrata* Ait.	Dudhi	Euphorbiaceae	3	59	40	0.44	0.5
61	*Euphorbia thymifolia* L.	Hazar Dani	Euphorbiaceae	3	70	50	0.56	0.67
62	*Fagonia bruguieri* DC.		Zygophyllaceae	4	68	180	2.00	1.08
63	*Fagonia indica* var. *Schweinfuthii* Hadidi.	Dhaman	Zygophyllaceae	4	70	160	1.78	1.08
64	*Farsetia hamiltonii* Royle	Lathia	Brassicaceae	3	67	120	1.33	0.75
65	*Farsetia jacquemontii* Hook.f. & Thomson	Lathia	Brassicaceae	3	76	110	1.22	0.75
66	*Ficus bengalensis* L.	Barghad	Moraceae	5	80	170	1.89	1
67	*Ficus carica* L.	Injir	Moraceae	3	81	180	2.00	0.67
68	*Ficus religiosa* L.	Peepal	Moraceae	3	83	100	1.11	0.92
69	*Gisekia pharnaceoides* L.	Manjhatra	Aizoaceae	2	50	30	0.33	0.5
70	*Heliotropium europaeum* L.		Boraginaceae	2	67	50	0.56	0.58
71	*Heliotropium strigosum* Willd.	Gorakh paan	Boraginaceae	3	60	50	0.56	0.58
72	*Indigofera hochstetteri* Baker	Kano	Fabaceae	2	60	40	0.44	0.58
73	*Iphiona grantiodes* (Boiss.) Anderb.		Asteraceae	2	30	30	0.33	0.42
74	*Ipomoea cornea* ssp. *fistulosa* (Mart. ex Choisy) D. Austin		Convolvulaceae	3	44	110	1.22	0.5
75	*Launaea residifolia* (L.) O. Kuntze.	Bhattal	Asteraceae	2	54	100	1.11	0.33
76	*Lawsonia inermis* L.	Menhdi	Lathyraceae	2	80	180	2.00	0.33
77	*Limeum indicum* Stocks ex T. Anders.	Patar	Aizoaceae	2	66	120	1.33	0.42
78	*Melia azedarach* L.	Dharek	Meliaceae	5	88	110	1.22	0.5
79	*Mentha longifolia* (L.) L.	Chita podina	Lamiaceae	3	90	190	2.11	0.58
80	*Momordica balsamica* L.	Jangli Karela	Cucurbitaceae	4	70	180	2.00	0.5
81	*Moringa oleifera* Lamk.	Suhanjna	Moringaceae	6	66	60	0.67	1.5
82	*Morus alba* L.	Shetoot	Moraceae	4	88	160	1.78	0.83
83	*Morus nigra* L.	Toot	Moraceae	4	88	180	2.00	0.83
84	*Nonea edgeworthii* A. DC.	Kangher	Boraginaceae	3	70	50	0.56	0.58
85	*Peganum harmala* L.	Harmal	Zygophyllaceae	2	55	40	0.44	1
86	*Phoenix sylvestris* L.	Khaji	Arecaceae	3	30	30	0.33	0.58
87	*Phyla nodiflora* (Linn.) Greene		Verbenaceae	2	42	50	0.56	0.5
88	*Plantago lanceolata* L.	Janghli Isapghol	Plantaginaceae	4	70	190	2.11	0.58
89	*Plantago* major L.		Plantaginaceae	4	77	170	1.89	0.58
90	*Pongamia pinnata* (L.) Merril.	Sukh chain	Fabaceae	4	70	50	0.56	0.58
91	*Prosopis cineraria* (L.) Druce.	Jand	Mimosaceae	4	60	60	0.67	0.67
92	*Prosopis glandulosa* Torr.	Gul kanda	Mimosaceae	4	66	50	0.56	0.67
93	*Prosopis juliflora* (Swartz) DC.	Kabli kikar	Mimosaceae	5	70	40	0.44	0.58
94	*Psidium guajava* L.	Amrood	Myrtaceae	5	66	120	1.33	1
95	*Punica granatum* L.	Anar	Punicaceae	4	70	190	2.11	0.75
96	*Rhazya stricta* Decne.	Vinrraan	Apocynaceae	3	54	60	0.67	0.75
97	*Ricinus communis* L.	Harnoli	Euphorbiaceae	4	60	180	2.00	0.75
98	*Rumex dentatus* subsp. *klotzschianus* (Meisn.) Rech. f.	Jangli palak	Polygonaceae	3	35	130	1.44	0.5
99	*Saccharum spontaneum* L.		Poaceae	4	30	100	1.11	0.75
100	*Salvadora oleoides* Decne.	Peelu	Salvadoraceae	4	40	70	0.78	0.75
101	*Sisymbrium irio* L.	Khoob Kalan	Brassicaceae	2	55	80	0.89	0.5
102	*Sisymbrium orientale* L.	Khoob Kalan	Brassicaceae	2	45	70	0.78	0.5

103	*Solanum americanum* Miller	Katch Match	Solanaceae	4	56	100	1.11	0.75
104	*Solanum incanum* L.	Kori waal / Maahora	Solanaceae	4	61	170	1.89	0.58
105	*Solanum nigrum* L.	Mahori	Solanaceae	4	56	160	1.78	0.83
106	*Solanum surattense* Burm.f.	Mahokari/Kandiari	Solanaceae	4	60	160	1.78	1.08
107	*Solanum villosum* (L.) Mill.	Kaachmach	Solanaceae	4	66	160	1.78	0.5
108	*Spinacia oleracea* L.		Chenopodiaceae	3	45	180	2.00	0.5
109	*Suaeda fruticosa* Forssk. ex J. F.		Chenopodiaceae	4	45	190	2.11	0.83
110	*Syzygium cumini (*L.) Skeels	Jaman	Myrtaceae	5	50	180	2.00	1
111	*Tamarix aphylla* (L.) Karst.	Khaggal	Tamaricaceae	4	50	180	2.00	0.67
112	*Tephrosia purpurea* (L.) Pers.	Sarphonka	Fabaceae	4	55	150	1.67	0.67
113	*Tephrosia uniflora* Pers.	Sarphonka	Fabaceae	4	55	150	1.67	0.67
114	*Tephrosia uniflora* var. *petrosa*	Sarphonka	Fabaceae	4	55	150	1.67	0.67
115	*Trianthema portulacastrum* L.	Itsit	Aizoaceae	2	45	130	1.44	0.33
116	*Tribulus terrestris* L.	Bhakhra	Zygophyllaceae	2	70	190	2.11	0.83
117	*Trichodesma indicum* (L.) R. Br.	Handusi	Boraginaceae	2	77	140	1.56	0.92
118	*Typha elephantina* Roxb.	Kundar	Typhaceae	5	30	120	1.33	0.67
119	*Withania coagulans* (Stocks.) Dunal	Paneer	Solanaceae	4	80	195	2.17	1.08
120	*Withania somnifera* (L.) Dunal	Aksan/Ratkan	Solanaceae	4	87	180	2.00	0.83
121	*Zaleya pentandra* (L.) Jeffrey		Aizoaceae	2	33	50	0.56	0.42
122	*Ziziphus mauritiana* Lam.	Beri	Rhamnaceae	5	40	150	1.67	1
123	*Ziziphus nummularia* (Burm.f.) Wight & Arn.	Jhar beri	Rhamnaceae	5	43	170	1.89	0.92
124	*Ziziphus spina-christi* (L.)Willd.	Jhar beri	Rhamnaceae	5	41	160	1.78	0.92

Table 2: Descriptive statistics of the two quantitative measures of relative importance.
UV = Use-Value. RI = relative importance.

Statistics	UV	RI
Average	1.347	0.69
Standard deviation	0.59	0.215
Minimum	0.11	0.33
Maximum	2.17	1.08
Percent Variation	135.74%	49.64%

The average number of Use value categories in the sample was 1.347 and Relative Importance average value is 0.69, maximum used value is 2.17 and maximum relative value is 1.08, *Withania coagulans* is highly important plant it have higest relative importance and use-value. *Acacia nilotica* (L.) DeL. subsp. *Indica*, *Tribulus terrestris*, *Brassica campestris*, *Suaeda fruticosa, Punica granatum*, *Aloe vera*, *Plantago lanceolata*, *Mentha longifolia*, *Acacia nilotica* subsp. *Cupressiformis* have 2.11 used value and their relative importance are 1, 0.83, 0.83, 0.83, 0.75, 0.67, 0.58, 0.58, 0.58 respectively. The techniques depended strongly on the number of use-categories attributed to any plant, although this relationship was much stronger (as would be expected) for the Relative Importance technique (rs= 0.93; P< 0.0001) than it was for the Use-Value (rs= 0.65; P< 0.0001). It was seen that there was a strong relationship between the two techniques, being even greater among species that had more local uses.

Fruit of *Momordica balsamica*

Capparis decidua

Momordica balsamica

Overview of desert

Themeda triandra

Cuscuta monogyna

Sand dunes of Thal desert

Sand dunes of Thal desert

5. Discussion

The results demonstrated that both techniques have basic limitations that interfere with the values that can be attributed to a species: the RI technique gives more importance to species with elevated numbers of uses, but without taking into consideration the number of people that cite these uses; the Use-Value technique, on the other hand, is greatly influenced by the number of people citing the uses of a species, thus a plant may be highly rated even if its many uses were cited by only a small number of people. As such, differences tend to increase when a species is heavily used (Use-Value), or when it has many uses attributed to it (RI). The two techniques can be similarly affected by individual informants who intensively use, or cite, a single species. A disadvantage of both techniques is that they do not distinguish between past use, knowledge, and actual use (or real use, for some authors). Although both techniques can be influenced by "individual competence" (for example, the participation of someone with exception- al knowledge may favor a given plant), the RI technique is less vulnerable to this variable as it does not take into account the number of informants in calculating the final results. However, the technique of Use-Value may indicate how knowledge about a certain plant is distributed in a community, but it requires that each informant be interviewed separately in order to avoid influencing one another, which involves much more time and effort in data collecting.

6. References

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