Quantitative Ethnobotanical Profile of Understory Vegetation in Acacia Modesta (Wall) Forests of Malakand Division, Pakistan

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Abstract: Floristically rich areas on the earth provide socioeconomic, ethnobotanical and ecologically stable ecosystems for the inhabitants of that area. Keeping in view the importance of regional flora, we surveyed the area for ethno-botanically important species during 2014. Plant specimens were collected, identified and preserved at Herbarium, University of Malakand, Dir (lower), Pakistan, using as references, the collected specimens were interviewed from local people, using semi structured questionnaire. Results indicate that 32 ground species are used for seven ailments by the local people of the study area. Ailments with the highest FIC value (0.99) were Skeletomuscular and respiratory each. High specie fidelity (100%) was found for Dodonea viscosa and Vitex negundo. Maximum respondents agreed to use, Dodonea viscosa and Vitex negundo for the treatment of Skeletomuscular and respiratory diseases. Species such as Vitex negundo, Dodonea viscosa, Zizypus nummularia and Mellotus philpineses were ranked higher in terms of use. In the study area, some species, like Vitex negundo, Dodonea viscosa, Zizypus nummularia and Mellotus philpineses, were harvested regularly without conservation measure, which can be vanished in next few years. Further studies on active compounds of the regional plants are required.

Key words: Ground flora, fidelity, information censes factor, Malakand division, Pakistan

INTRODUCTION

Plants are used since ancient human civilizations for making food items, curing an ailment, forage for cattle, fuel-wood, decoration, construction purposes and collecting various timbered and non-timbered products (Ahmed et al., 2006). Total phanerogamous species recorded are 275,000 and different parts of these plants’ species are used against various ailments by humans, especially caused by microbes (Prasad et al., 2013). Among all these, ethnobotanical uses are the most common, acting as important contribution to human health care (Nair et al., 2005; Kufer et al., 2005) and affecting economic status of remote distant areas (Barkatullah et al., 2009). Ethnobotanical studies are most often used in different regions of the world, due to their significant role in health care improvement (Sardar and Khan, 2009). Like other remote areas of the country, inhabitants of subtropical dry temperate ecosystems in mountainous regions of the Malakand division, ethnobotanical studies are in practice, providing an opportunity in studying local traditional knowledge and resource management (Barkatullah and Ibrar, 2011). Ethnobotanical studies not only document the traditional knowledge of medicinal plants but also help the ecologists, environmentalists, bio-conservationists, pharma-cologists, taxonomists, watersheds, wild life managers and foresters for their efforts in these areas. Malakand division is God gifted by a wealth of medicinal plants and their traditional knowledge. As human population of the study area are poor depending upon agriculture, services and environmental resources, therefore, local vegetation are the active resources for the socioeconomic development of the area and its people. Due to large dependence on local vegetation, these diverse floral ecosystems are facing severe biotic stress. Due to anthropogenic activities, natural disturbance and lack of management, these vegetation are on the threshold of extinction. According to Ibrar et al. (2007), a stable forest ecosystem should have a balance between biotic and abiotic components, maintaining genetic diversity of plants and animals with respect to their ecological needs. Present study would provide quantitative ethnobotanical profile, using traditional knowledge and folk uses of ground vegetation in Acacia modesta forests of Malakand division, Pakistan.

MATERIALS AND METHODS

Filed methods: A total of 125 respondents were interviewed through semi structured questionnaire, to collect ethnobotanical informations of regional flora, used...
by local inhabitants for curing various ailments, following
the method, described by Cotton (1996). Selection criteria
of the respondents was as follows: (1) They were living
in the area for at least 10 years and (2) Using regional flora
for various ailments. Out of 125, we selected only 85
respondents (65 men and 20 women) on the basis of the
information and key knowledge. Selected informants were
local inhabitants, aged between 30-70 years. The
information collected in local language, was local name
of plant, its socioeconomic uses, the part used, disease
treated, remedy preparation and dosage employed.
Unidentified species were collected, dried and preserved
on standard herbarium sheet (Judd et al., 2002) for
laboratory identifications. All voucher species were stored
in Herbarium, Laboratory of Plant Ecology, University of
Malakand, Dir (lower), Pakistan, for future references.

Data analysis: Information Consensus Factor (ICF) was
employed for vegetation of the study area, used by local
people. The ICF of a plant community indicates that
how many plants are used for curing an ailment
within a culture and thus help in plant selection for
various pharmacological and phytochemical evaluation
(Giday et al., 2007). The ICF values lie within 0.00 and
1.00. High ICF value indicates that a large number of
plants are used by the majority of people for curing a
specific ailment, while low ICF value means that,
respondents disagree to cure a disease by this plant
(Canales et al., 2005). In other words, information
consistency of various respondents was calculated as ICF
(Trotter and Logan, 1986), using the formula:

\[
CF = \frac{\text{Nur} - \text{Nt}}{\text{Nur} - 1}
\]  

Where:
Nur = Number of responses, by each respondents for
curing an ailment, using local plants
Nt = Number of plant species used

Fidelity Level (FL) was used to identify, which
plant species are frequently used by majority of
respondents in curing a disease. High FL value of a plant
species designates popularity of that plant widely used by
the people. The FL is used for the quantitative importance
of a specie, used for a given purpose by the following
formula (Friedman et al., 1986):

\[
\text{FL} = \frac{\text{Np}}{\text{N}} \times 100
\]  

Where:
Np = Number of respondents reported a plant species
for a specific ailment
N = Number of respondents reported a plant species
for any ailment

High fidelity level for large number of plants
indicates their active biological role.

Direct Matrix Ranking (DMR) was used to measure
quantitative socioeconomic usage of plant species on the
basis of collected information from local people
(Martin, 1995). Respondents were asked to give a use
value, i.e., (0 = no use, 1 = less use, 3 = good to use,
4 = very good to use and 5 = best for use) to each studied
specie. The given use values of each plant were added and
ordered. Plants with first orders are commonly used for
various domestic purposes than high order ranking.

RESULTS AND DISCUSSION

Reported informants: A total of 85 informants were
interviewed through semi-structured questionnaire.
Among these, 65 were men and 20 were women. 50% of
them were above 60 years. Literacy level revealed that
among the respondents, 60% were illiterate, 18%
primary, 11% matric, 7% intermediate and 4%
nonformally educated. Based on traditional medicinal
knowledge, the males were highly informed than females.
Among males, farmers (52%) were highly aware of
traditional knowledge of medicinal plants followed by
labourers (27%). Low traditional knowledge ratio in
younger individulas is either lack of intrest or availabilty
of modern health systems.

Reported medicinal flora: In the present study,
32 medicinal plants belonging to 21 angiosperm families
were reported from dry temperate areas of Malakand
division, Pakistan (Table 1). The study area provides a
variety of microclimate and habitats, due to which
floristically rich zonations are found like in other parts of
the country. Due to present studies in hot summer, few
species (32) were reported. Majority of the medicinal
flora of the study area were occupied by herbs (67%) and
shrubs (33%). Excessive use of these life-forms for
various ailments indicates their high curing efficiency and
easily availability near households and villages. Dominant
floral families were Asteraceae (6 species) and Poaceae
(3 species), other families were comprised of one species
Table 1: Reported medicinal flora and their calculated fidelity level for various observed ailments

| Voucher No. | Specie code | Specie                | System                | NP  | N    | FL value |
|-------------|-------------|-----------------------|-----------------------|-----|------|----------|
| 35861       | Dv          | Dodonea viscosa       | Skeletomuscular system| 85  | 85   | 100      |
| 35862       | Dm          | Daphne mucronata      | Circulatory system    | 57  | 67   | 85       |
| 35863       | Cp          | Calotrops procera     | Respiratory system    | 78  | 82   | 95       |
| 35864       | Gr          | Gymnosophia royallana | Nervous system        | 36  | 59   | 61       |
| 35865       | Ol          | Otostegia limbata     | Sense organs          | 43  | 61   | 70       |
| 35866       | VN          | Vitez negundo         | Digestive system     | 85  | 85   | 100      |
| 35867       | Ja          | Justicia adhatoda     | Digestive system     | 68  | 77   | 88       |
| 35868       | Zn          | Zyzipus nummularia    | Digestive system     | 59  | 81   | 73       |
| 35869       | Mp          | Mellotus philipines   | Digestive system     | 32  | 45   | 71       |
| 35870       | No          | Nerium odorum         | Sense organs          | 41  | 56   | 73       |
| 35871       | Go          | Grewia optivia        | Skeletomuscular system| 47  | 61   | 77       |
| 35872       | Od          | Opunita delaini       | Digestive system      | 56  | 73   | 77       |
| 35873       | Da          | Datura alba           | Nervous system        | 53  | 83   | 64       |
| 35874       | Av          | Amaranthus varidus    | Digestive system      | 78  | 84   | 93       |
| 35875       | Aa          | Acyranthus aspera     | Digestive system      | 36  | 76   | 47       |
| 35876       | Ab          | Ajuga bractosa        | Circulatory system    | 82  | 84   | 98       |
| 35877       | Co          | Carthamus occicantha  | Digestive system      | 62  | 85   | 73       |
| 35878       | Cal         | Chenopodium album     | Digestive system      | 32  | 70   | 46       |
| 35879       | Cs          | Canabas sativa        | Nervous system        | 81  | 85   | 95       |
| 35880       | Cj          | Cymbpogon Jawardencosa | Digestive system      | 58  | 71   | 82       |
| 35881       | Cae         | Conzya aegycptica     | Digestive system      | 25  | 59   | 42       |
| 35882       | Cc          | Cencharis ciliarus     | Digestive system      | 15  | 37   | 41       |
| 35883       | Eh          | Eshphoria hirta       | Digestive system      | 29  | 62   | 47       |
| 35884       | Mt          | Malvastrum tricuspidatum | Urinary system    | 12  | 38   | 32       |
| 35885       | Pt          | Parthenium integrifolium | Digestive system | 34  | 56   | 61       |
| 35886       | Sa          | Sonchus asper         | Circulatory system    | 27  | 59   | 46       |
| 35887       | Sn          | Solanum nigram        | Urinary system        | 75  | 85   | 88       |
| 35888       | Sx          | Solanum xanthocarpum  | Circulatory system    | 66  | 81   | 81       |
| 35889       | Sb          | Saccharum bengalenses | Respiratory system    | 36  | 73   | 49       |
| 35890       | Tm          | Taget minuta          | Sense organs          | 18  | 43   | 42       |
| 35891       | Vt          | Verbascum theopus     | Respiratory system    | 55  | 77   | 71       |
| 35892       | Xs          | Xanthum stromarium    | Circulatory system    | 11  | 53   | 21       |

Table 2: Information consensus factor of reported medicinal flora used against various human ailments

| System                | NUR | NT  | FIC value |
|-----------------------|-----|-----|-----------|
| Skeletomuscular system| 167 | 2   | 0.99      |
| Circulatory system    | 196 | 5   | 0.98      |
| Respiratory system    | 145 | 3   | 0.99      |
| Nervous system        | 125 | 3   | 0.98      |
| Sense organs          | 112 | 3   | 0.98      |
| Digestive system      | 670 | 14  | 0.98      |
| Urinary system        | 12  | 2   | 0.9       |

each. High consumption rate of family Asteraceae and Poaceae indicate that they have more biologically active compounds in comparision to other families.

**Reported disorders:** Local communities of the study area use these 32 ethnobotanically important flora for curing various diseases and other domestic purposes. Diseases were grouped on the basis of their incident in different body systems and thus seven major body system diseases were reported, i.e., skeletomuscular, circulatory, respiratory and nervous and so forth. Local communities use 14 plants for respiratory disorders, blood circulatory system disorders 5 plants and 2 each for respiratory, nervous and sense organs. Information consensus factor was higher (0.99) for skeletomuscular and respiratory systems disorders, while lowest (0.90) for urinary body system (Table 2). High degree of FIC value for a given disorder indicates the presence of these disorders in dry temperate regions of Malakand division, Pakistan, due to poor economy and harsh climatic conditions. High FL value for a particular plant species designates high popularity of that specie and extent of usage homogeneity among respondents. In the present study, fidelity level ranged from 21-100%. Species with the highest FL value includes Dodonea viscossa and Vitex negundo (Table 1). Nine species (Dhapeno mucronata, Calotrops procera, Justicia adhatoda, Amaranthus varidus, Ajuga bractosa, Canaba sativa, Cymbpogon jawarencosa, Solanum nigram and Solanum xanthocarpum) were reported with FL value greater than 80%. These plants with high FL value are rich source of phytochemicals, acting as curing agents for various disorders. These species can be further evaluated for phytochemical screening.

**Multipurpose uses:** Table 3 represents the DMR score of each species, indicating their multipurpose uses by local people. From the DMR score, it can be found that, which plant faces more stress in the study area. From Table 3, it
Table 3: DMR score of reported flora, based on utilization of the species in the study area

| Agricultural tool | Construction | Fodder | Fuel wood | Medicinal | Rank |
|-------------------|--------------|--------|-----------|-----------|------|
| Dv                | 1            | 3      | 0         | 4         | 4    | 2    |
| Dm                | 1            | 2      | 0         | 4         | 3    | 4    |
| Cn                | 0            | 0      | 2         | 3         | 4    | 5    |
| Gr                | 0            | 0      | 0         | 2         | 3    | 9    |
| Ol                | 0            | 0      | 0         | 2         | 3    | 9    |
| V.N               | 3            | 4      | 1         | 4         | 4    | 1    |
| Ja                | 0            | 0      | 0         | 3         | 3    | 8    |
| Zn                | 0            | 1      | 4         | 4         | 3    | 2    |
| Mp                | 2            | 1      | 1         | 4         | 3    | 3    |
| No                | 0            | 0      | 0         | 2         | 3    | 9    |
| Go                | 0            | 1      | 3         | 1         | 2    | 5    |
| Od                | 0            | 0      | 1         | 0         | 2    | 11   |
| Da                | 0            | 0      | 0         | 2         | 4    | 8    |
| Av                | 0            | 0      | 3         | 0         | 4    | 7    |
| Aa                | 0            | 0      | 2         | 1         | 3    | 8    |
| Ab                | 0            | 0      | 0         | 1         | 4    | 9    |
| Co                | 0            | 0      | 3         | 2         | 4    | 5    |
| Cal               | 0            | 0      | 0         | 1         | 3    | 9    |
| Cs                | 0            | 0      | 1         | 1         | 4    | 8    |
| Cj                | 0            | 0      | 3         | 2         | 3    | 6    |
| Cae               | 0            | 0      | 3         | 1         | 2    | 10   |
| Cc                | 0            | 0      | 3         | 2         | 2    | 7    |
| Eh                | 0            | 0      | 0         | 2         | 2    | 11   |
| Mr                | 0            | 0      | 1         | 1         | 2    | 10   |
| Pi                | 0            | 0      | 0         | 2         | 3    | 9    |
| Sa                | 0            | 0      | 1         | 0         | 3    | 10   |
| Sn                | 0            | 0      | 2         | 1         | 4    | 7    |
| Sx                | 0            | 0      | 2         | 1         | 4    | 7    |
| Sb                | 0            | 0      | 0         | 2         | 2    | 5    |
| Tm                | 0            | 0      | 1         | 2         | 3    | 8    |
| Vt                | 0            | 0      | 0         | 2         | 3    | 9    |
| Xs                | 0            | 0      | 1         | 2         | 2    | 10   |
| rank              | 5            | 4      | 3         | 2         | 1    |

is clear that *Vitex negundo*, *Dodonea viscosa*, *Zizyphus nummularia* and *Mellotus philpineses* were ranked higher (Fig. 1). These higher ranked species are basically woody shrubs and harvested for multipurpose by the local inhabitants unwisely. Among these multipurpose uses and threats construction of agricultural tools and homes, fodder for cattle, fuel wood and medicinal uses are common. Harvesting for medicinal purpose and fuel wood were common in late summer, which were to be used in cold winter. Thus proper conservation management is required to control decline of highly utilizing species.

Reported work includes scientific names, families, local names, parts used, ethnobotanical uses of wild flora of the dry temperate forests of Malakand division, Pakistan. The reported 32 species, belonging to 20 angiosperm families, were used for various human ailments, based on traditional folk knowledge. Quantitative analysis of semi-structured questionnaire reflects that majority of old-aged people (above 50 years), concerning with farming or labours, were frequently aware about traditional uses and medicinal applications of the local flora. From reported studies, it was analysed that majority of the local flora (44% species) have curing potential of various ailments of human digestive system, as also stated by Murad et al. (2011), followed by blood circulatory system (16% species). The excessive use of local flora for digestive system disorder in study area indicates various hygienic peculiarities. The inhabitants of the study area use a variety of herbs (62%), due to easy accessibility and high efficacy as compared to woody species (Singh et al., 2012). These herbacious vegetation are used throughout the world, for ethnobotanical uses (Tabuti et al., 2003; Uniyal et al., 2006). Dominant families were *Asteraceae* and *poaceae*, used in the study area, defining the presence of biologically well active compounds and their efficiency (Gazzaneo et al., 2005). In the present study, high Information Consensus Factor (ICF) was used to determine degree of homogenity among local inhabitants, while treating a disorder by a plant. The ICF helps in plant species with pharmacologically active compounds (Heinrich et al., 1998). High ICF values (0.99) were found for skeletomuscular and respiratory disorders, while lowest for urinary system.

Calculated fidelity level (FL%) indicates the use level and popularity of a plant specie in a culture and tradition. In this study, high (FL%) values were recorded for *Dodonea viscosa*, *Vitex negundo*, *Calotrops procera*,...
Fig. 1(a-c): Multipurpose species (*Vitex negundo*, *Dodonea viscosa* and *Mellotus philpineses*) according to DMR score and ranking

*Amaranthus varidus* and *Canabas sativa*, ranging from 90-100%. High FL value, for the above-mentioned species, indicates their most common uses in the study area. Therefore, we suggest that species with high FL values could be analyzed pharmacologically. Results of the present study indicate that these species can not act as environmental friendly, nontoxic, highly effective, low cost folk medicines for improving healthcare of local people (Ghorbani, 2005; Khafagi and Dewedar, 2000). Further research studies are required in the field of preparation and use of herbal folk medicines.

**CONCLUSION**

High consumption of dominant families *Asteraceae* (6 species) and *Poaceae* (3 Species) indicate that they have more biologically active compounds, acting as curing agents for various disorders, which can be further evaluated for phytochemical screening. Furthermore, woody species (*Vitex negundo*, *Dodonea viscosa*, *Zizyphus nummularia* and *Mellotus philpineses*) are harvested for multipurpose by the local inhabitants. It is concluded that the harvesting for medicinal purpose and fuel wood is common. Species (*Dodonea viscosa*, *Vitex negundo*, *Calotrops procera*, *Amaranthus varidus* and *Canabas sativa*) with high FL values could be analyzed pharmacologically.

**REFERENCES**

Ahmed, M., T. Husain, A.H. Sheikh, S.S. Hussain and M.F. Siddiqui, 2006. Phytosociology and structure of Himalayan forests from different climatic zones of Pakistan. Pak. J. Bot., 38: 361-383.

Barkatullah, B. and M. Ibrar, 2011. Plants profile of Malakand pass hills, District Malakand, Pakistan. Afr. J. Biotechnol., 10: 16521-16535.

Barkatullah, M. Ibrar and F. Hussain, 2009. Ethnobotanical studies of plants of Charkotli Hills, Batkhela District, Malakand, Pakistan. Front. Biol. China, 4: 539-548.

Canales, M., T. Hernandez, J. Caballero, A.R. de Vivar, G. Avila, A. Duran and R. Lira, 2005. Informant consensus factor and antibacterial activity of the medicinal plants used by the people of San Rafael Coxcatlan, Puebla, Mexico. J. Ethnopharmacol., 97: 429-439.

Cotton, C.M., 1996. Ethnobotany: Principles and Applications. John Wiley and Sons Ltd., Chichester, New York, USA., ISBN-13: 978-0471955375, Pages: 424.
Friedman, J., Z. Yaniv, A. Dafni and D. Palewitch, 1986. A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev Desert, Israel. J. Ethnopharmacol., 16: 275-278.

Gazzaneo, L.R.S., R.F.P. de Lucena and U.P. de Albuquerque, 2005. Knowledge and use of medicinal plants by local specialists in an region of Atlantic Forest in the state of Pernambuco (Northeastern Brazil). J. Ethnobiol. Ethnomed., Vol. 1. 10.1186/1746-4269-1-9

Ghorbani, A., 2005. Studies on pharmaceutical ethnobotany in the region of Turkmen Sahra, North of Iran: (Part 1): General results. J. Ethnopharmacol., 102: 58-68.

Giday, M., T. Teklehaymanot, A. Animut and Y. Mekonnen, 2007. Medicinal plants of the Shinasha, Agewawi and Amhara peoples in northwest Ethiopia. J. Ethnopharmacol., 110: 516-525.

Heinrich, M., A. Ankli, B. Frei, C. Weimann and O. Sticher, 1998. Medicinal plants in Mexico: Healers’ consensus and cultural importance. Soc. Sci. Med., 47: 1859-1871.

Ibrar, M., F. Hussain and A. Sultan, 2007. Ethnobotanical studies on plant resources of Ranyal Hills, District Shangla, Pakistan. Pak. J. Bot., 39: 329-337.

Judd, C., S. Kellogge and Dontoghue, 2002. Plant Systematic: A Phylogenetic Approach. 2nd Edn., Snauer Associates, Inc., Sunderland.

Khafagi, I.K. and A. Dewedar, 2000. The efficiency of random versus ethno-directed research in the evaluation of Sinai medicinal plants for bioactive compounds. J. Ethno-Pharmacol., 71: 365-376.

Kufer, J., M. Heinrich, H. Forther and E. Poll, 2005. Historical and modern medicinal plant uses—the example of the Ch’orti Maya and Ladinos in Eastern Guatemala. J. Pharm. Pharmacol., 57: 1127-1152.

Martin, G.J., 1995. Ethnobotany: A Methods Manual. Earthscan, London, ISBN: 9781844070848, Pages: 268.

Murad, W., A. Ahmad, S.A. Gilani and M.A. Khan, 2011. Indigenous knowledge and folk use of medicinal plants by the tribal communities of Hazar Nao Forest, Malakand District, North Pakistan. J. Med. Plants Res., 5: 1072-1086.

Nair, R., T. Kalariya and S. Chanda, 2005. Antibacterial activity of some selected Indian medicinal flora. Turk. J. Biol., 29: 41-47.

Nasir, E. and S.I. Ali, 1972. Flora of West Pakistan. Published under P.L. 480, Research Project of USAD, with Coordination of ARC, Pakistan, pp: 1-1028.

Prasad, A.G.D., T.B. Shyma and M.P. Ragavendra, 2013. Informant consensus factor and antimicrobial activity of ethno medicines used by the tribes of wayanad district kerala. Afr. J. Microbiol. Res., 7: 5657-5663.

Sardar, A.A. and Z.U.D. Khan, 2009. Ethnomedicinal studies on plant resources of tehsil Shakargrah, district Narowal, Pakistan. Pak. J. Bot., 41: 11-18.

Singh, A.A., A. Kumar and D.D. Tewari, 2012. An ethnobotanical survey of medicinal plants used in Terai forest of Western Nepal. J. Ethnobiol. Ethnomed., Vol. 8. 10.1186/1746-4269-8-19

Tabuti, J.R.S., K.A. Lye and S.S. Dhillion, 2003. Traditional herbal drugs of bulamogi, uganda: Plants, use and administration. J. Ethnopharmacol., 88: 19-44.

Trotter, R.T. and M.H. Logan, 1986. Informants Consensus: A New Approach for Identifying 600 Potentially Effective Medicinal Plants. In: Plants in Indigenous Medicine and Diet, Etkin, N.L. (Ed.). Redgrave Publishers, Bedford Hill, NY., pp: 91-112.

Uniyal, S.K., K.N. Singh, P. Jamwal and B. Lal, 2006. Traditional use of medicinal plants among the tribal communities of Chhota Bhangal, Western Himalaya. J. Ethnobiol. Ethnomed., Vol. 2. 10.1186/1746-4269-2-14