Application of the Participatory Rural Appraisal (PRA) to assess the ethnobotany and forest conservation status of the Zarghoon Juniper Ecosystem, Balochistan, Pakistan

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Abstract. The data collection approach called Participatory Rural Appraisal (PRA) was used in five villages: Killi Tor Shore; Medadzai; Ghunda; Kala Ragha and Killi Shaban. Up to five groups were sampled in each village, comprising a total of 17 villages within the Zarghoon Juniper ecosystem. This area is rich both historically and culturally for using medicinal plants, mostly by women (60%). In this study, 26 species of medicinal plants fit in 20 genera and 13 families. They are used by aboriginal people via the indigenous knowledge they have for the treatment of many diseases. About 60, 35, and 5% of the medicines are prepared to be used orally, topically and boiled to inhale, respectively. Percentage distribution of plant parts used with purpose is 57, 26, 10 and 7% for leaves, seeds, flowers and roots, respectively. It is important to preserve the indigenous knowledge that people have for using vegetation as medicines for a sustainable utilization of the renewable natural resources. The PRA tools used consisted of social maps, transit walks, structured and semi-structured interviews, and pie diagrams. The socio-economic conditions revealed around 20000 people living in 400 households distributed in 17 villages, and livelihood depended on the forest. The community lacks basic amenities of life. The major sources of income (90%) are agriculture and livestock raising, and only 10% comes from trade, services and labor. The current high anthropogenic pressure on the ecosystem can be reduced by regulation, service implementations and financial assistance. This should contribute to sustainable resource utilization in the unique juniper ecosystem of Zarghoon.

Keywords: Juniper ecosystem; Zarghoon; PRA; Ethnobotany; Medicinal plants; Biodiversity.
INTRODUCTION

The Juniper forest ecosystem in the Province of Balochistan, Pakistan, is the second largest in the world, the first being in California. It is one of the places having the oldest slow growing juniper trees of the world. It has trees as old as 900 years old. Population growth and urbanization are among the major causes of deforestation (Marcoux, 2000). Balochistan is the largest province, representing 44% of the land in Pakistan. The rapid degradation of juniper forests is correlated with human disturbances (Ahmed et al., 1990).

Geo-Climate of Zarghoon region. Zarghoon region is located in the southern part of Quetta valley (30º 39' N, 67º 15' E). It covers an area of about 354 square miles. Of these, 86 sq miles are piedmont, 101 square miles is valley floor and the rest is high mountain land (Hunting Survey Corporation, 1960). The locality has a tremendous variation from the hill tops to the valley bottoms, and there are gentle slopes with grasses and scattered trees. Rain and snow fall occur in winter; the mean maximum temperature in summer is 25 °C, and the mean minimum temperature in winter is −15 °C.

Few previous ethnomedical studies were conducted in Balochistan. Shinwari & Malik (1989) studied plant richness of the Dera Bugti area, and Malik et al. (1990) collected little initial ethnomedical information from different districts of Balochistan. Leporatti & Lattanzi (1994) studied medicinal plants in Makran. Tareen et al. (2002a, 2002b) conducted ethnomedical studies of medicinal and aromatic plants in the Shireen valley and juniper forest of Ziarat. Shah et al. (2006) used ethnomedical knowledge to investigate the flora of Musakhail and Barkan areas in Balochistan. Achakzai & Bazai (2006) used PRA to study the use and effects of wastewater irrigation on vegetables in Quetta City.

The current study was conducted to investigate the cultural aspects, livelihood pattern and people behavior towards plants by the use of different tools like questionnaires, social map, semi-structured interviews (SSI), and focus group discussions (FGDs) (i.e., the famous data collection technique called participatory rural appraisal: PRA) (Mukherjee, 1994). The aim of this survey was to provide insight of different aspects of medicinal plant use and their socio-economic influence on them.

MATERIALS AND METHODS

Reconnaissance of the area was conducted by a team of six members including males and females. The notables were contacted to get the entry points. There are 17 villages in Zarghoon area and five clusters were made, each composed of community members from 3 villages. PRA was conducted in five villages: Killi Tor Shore; Medadza; Ghunda; Kala Ragha, and Killi Shaban, each as a central place of five clusters which comprised the total 17 villages in the Zarghoon Juniper ecosystem. Different tools of PRA were applied like semi-structured interviews (SSI) conducted with different groups, and social maps were made as a useful basis for identifying problems in different households, their strengths and characteristics. The individual interviews, key-informant interviews, group interviews, pie charts, transect walls and focus group discussions revealed many facts.

Medicinal plants. Women involved in medicinal plant collection and its utilization were interviewed by female members of the team to get acquainted with their indigenous plant knowledge. This ethnomedical study helped to prioritize the medicinal plants in need of urgent conservation by using Ethnomedical knowledge and making recommendations.


RESULTS

Socio-economic findings by using Participatory Rural Appraisal (PRA). Results showed that more than 20000 people lived in the Zarghoon area in approximately 400 households distributed in 17 villages. The community is deprived of basic life requirements like (1) clean drinking water, (2) gas as an energy source in winter, (3) health facilities, (4) telephone, (5) educational institutes etc. The community is totally dependent on the forest for their different needs.

It is also dependent on the medicinal plants and berries of juniper for treatment of diseases, as the allopathic medicines are mostly unavailable, and poor communities are not capable of taking patients to other cities for proper medical treatment. The major source of income is agriculture but only few people are land owners; most of the farmers are tenants. On average, 50, 33, 11 and 6% of the people have agriculture, livestock production, services and trade, respectively, as their way of livelihood (Fig.1).

Fig. 1. Average income sources of the community in percentage.
Fig. 1. Fuentes de ingreso promedio de la comunidad en porcentaje.
The information collected via the PRA indicated that the community consumption of the wood products is much greater than the regeneration capacity of the forest, and the situation is further aggravated by the smuggling of the juniper wood and other natural and anthropogenic changes in the environment.

It is estimated through PRA studies that approximately 15000-18000 trees are used annually by the community; the total amount of wood used daily is approximately 7000 kg. This figure will increase in the future with the (1) unchecked population growth in the area and (2) the increase in the illegal logging business. A large proportion of the community uses forest wood for fuel, by cutting the stems or branches. Many use the bark of the Juniper trees, which make them vulnerable to diseases, and ultimately to death. Juniper trees are also used for making fences around the cultivated areas and poles.

**Ethnobotanical aspects.** Women have a major role in preserving the ethnobotanical knowledge about the local herbs and their usefulness (Fig. 2). This is not only useful knowledge but a cultural and historical heritage. However, an alarming issue is that the local communities of the area consider the plant resources as limitless, and they use plants beyond their natural regeneration capacity. The number of illiterate people in the community is large and they have no knowledge about the importance of conserving the plant species (e.g., by growing them domestically or commercially).

The community used the medicinal plants for treating some common illnesses like cough, cold, stomachache and other pains. Other serious diseases like asthma, high blood pressure, diabetes, etc. can also be treated using the medicinal plants from the valley. The medicines were mostly known by the older women in the families as they were responsible for taking care of men and the young people. Overall, 60% of women, and only 40% of men had some ethnobotanical knowledge.

**Mode of administration of different medicinal preparations.** The medicinal preparations are used with various purposes by the community. They have this knowledge from their forefathers and use it in the same way. Most of the preparations are used orally (i.e. 60%), while 35% of them are used topically. Moreover, 5% of the medicines are boiled and inhaled to heal ailments (Fig. 3).

Some medicinal plants used by local inhabitants for treatment of different diseases. There are 26 medicinal plant species which fit in 20 genera and 13 families. They are used by aboriginal people via indigenous knowledge for the treatment of many diseases. About 60, 35, and 5% of the medicines are prepared to be used orally, topically and boiled to inhale, respectively. These medicines are prepared using 57, 26, 10 and 7% of leaves, seeds, flower and roots, respectively. It is inevitable to preserve the indigenous knowledge for the sustainable utilization of the renewable natural resource (i.e., vegetation). A detailed description of all 26 medicinal plants used in the area (in terms of botanical and vernacular names, family, plant parts used, and folk medicinal uses) is given in Table 1.

DISCUSSION

Pakistan has an exceptional biodiversity, encompassing 9 ecological zones with around 6000 plant species, out of which 400-600 of these species are considered medicinally important (Hamayaun et al., 2005). Despite having a wide variety of medicinal plants, Pakistan still imports a fair amount of products for its industry, which has a great potential. In the Zarghoon area, any disease is treated by using plants, and women possess the ethnobotanical knowledge which is passed from generation to generation. Earlier ethnobotanical and medicinal plant utilization studies in Pakistan and Balochistan are rarely in agreement with the current study. The present study showed that roots and sap of *Berberis buchhanicani* can be used for the treatment of internal injuries and joint pain. This is in accordance with reports of Inam et al. (2000), Shah & Khan (2006); Hussain et al. (2008) and Abbasi et al. (2009). Seeds
Table 1. A detailed taxonomic description of medicinal plant species used in the study area in terms of their parts and folk medicinal uses.
Tabla 1. Descripción taxonómica detallada de especies de plantas medicinales utilizadas en el área de estudio en términos de sus partes y usos medicinales tradicionales.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Botanical Name *</th>
<th>Vernacular Name</th>
<th>Family</th>
<th>Part Used</th>
<th>Folk Medicinal Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Achillea santolina</em> (L.)</td>
<td>Brinjas</td>
<td>Asteraceae</td>
<td>Leaves</td>
<td>Plant extract is given to children to treat stomach ache and indigestion. Also used as blood purifier and refrigerent. It is used to treat diabetes and also as a cooling medicine to reduce heart shocks.</td>
</tr>
<tr>
<td>2</td>
<td><em>Achillea wilhelmsii</em></td>
<td>Boh-e-madran</td>
<td>Asteraceae</td>
<td>Whole plant</td>
<td>Whole plant is soaked in water or boiled to obtain the extract, and it is used to treat stomachache, diabetes, gastric troubles, fatness, and used as a blood purifier.</td>
</tr>
<tr>
<td>3</td>
<td><em>Artemisia maritime</em> (L.)</td>
<td>Tarkha</td>
<td>Asteraceae</td>
<td>Whole plant</td>
<td>Plant extract is used as a blood purifier and heart tonic. Also useful for treating pain in joints, fever, and, stomach ache/indigestion.</td>
</tr>
<tr>
<td>4</td>
<td><em>Berberis baluchistanica</em> Ahrendt</td>
<td>Zarlog</td>
<td>Berberidaceae</td>
<td>Roots and sap</td>
<td>Roots are boiled to make decoction, which is used to heal internal injuries in man and cattle. Also for the relief of joint pain.</td>
</tr>
<tr>
<td>5</td>
<td><em>B. callobotrys</em></td>
<td>Khar Zaaulg</td>
<td>Berberidaceae</td>
<td>Leaves and sap</td>
<td>Plants are used to treat jaundice. Leaf extracts are used as a blood purifier and for the treatment of acne.</td>
</tr>
<tr>
<td>6</td>
<td><em>Bunium persicum</em></td>
<td>Tora Zirak</td>
<td>Plantaginaceae</td>
<td>Leaves and sap</td>
<td>Fruits are aromatic and used as spice.</td>
</tr>
<tr>
<td>7</td>
<td><em>Centaurea phyllocephala</em>, Boiss.</td>
<td>Talkha</td>
<td>Asteraceae</td>
<td>Leaves</td>
<td>It is used to treat stomach ache, swelling up of body, and wounds in cattle.</td>
</tr>
<tr>
<td>8</td>
<td><em>Ephedra foliata</em>, Boiss and Kotschy</td>
<td>Oman</td>
<td>Ephedraceae</td>
<td>Whole plant</td>
<td>It’s a source of ephedrine, a well known alkaloid. It is used to treat heart diseases, high fever and asthma. Seeds are used as a cooling medicine. Stem is used to heal the wound of ear piercing.</td>
</tr>
<tr>
<td>9</td>
<td><em>E. intermedia</em>, Schrenk and Meyer</td>
<td>Oman</td>
<td>Ephedraceae</td>
<td>Whole plant</td>
<td>The plant is used for the extraction of ephedrine. Used for asthma and cough, and to heal wounds.</td>
</tr>
<tr>
<td>10</td>
<td><em>Ferula oopoda</em></td>
<td>Hing</td>
<td>Apiaceae</td>
<td>Seeds, leaves and sap</td>
<td>Boiled seeds and decoction for infant cough, and stems to kill intestinal worms. Sap locally called Ingapatric is used for toothache.</td>
</tr>
<tr>
<td>11</td>
<td><em>Juniperus excelsa</em> Boiss</td>
<td>Obusht</td>
<td>Cupressaceae</td>
<td>Seeds and leaves</td>
<td>Oil is obtained from berries (fruit), which is carminative, diuretic and stimulant.</td>
</tr>
<tr>
<td>12</td>
<td><em>Lepidium repens</em>, Boiss</td>
<td>Garbust Bashka</td>
<td>Brassicaceae</td>
<td>Leaves</td>
<td>It is used to treat skin infections. Leaves are cooked and eaten to warm the body.</td>
</tr>
<tr>
<td>13</td>
<td><em>Malva neglecta</em></td>
<td>Khatmi</td>
<td>Malvaceae</td>
<td>Whole plant</td>
<td>It is useful to treat cough; roots are used as a cooling medicine; leaves are cooked and eaten to treat gynecological disorders, and boiled leaves are applied to the body for treating sterility.</td>
</tr>
<tr>
<td>14</td>
<td><em>Mentha longifolia</em></td>
<td>Vialani</td>
<td>Lamiaceae</td>
<td>Leaves and roots</td>
<td>Leaves are used to treat gastric troubles, diarrhea. Juice of leaves is mixed with raw apple juice to treat motion and vomiting.</td>
</tr>
<tr>
<td>15</td>
<td><em>Nepeta practervisa</em></td>
<td>Simsok</td>
<td>Lamiaceae</td>
<td>Leaves</td>
<td>For treatment of flu, cough. Leaves are used to make tea which is useful to warm the body.</td>
</tr>
<tr>
<td>16</td>
<td><em>Peganum harmala</em></td>
<td>Kisankoor/spanda</td>
<td>Zygophyllaceae</td>
<td>Leaves and seeds</td>
<td>Seeds are used to treat indigestion, stomach ache. Used to treat diabetes, joints ailments and measles. Seeds are mixed in bathing water to treat pain.</td>
</tr>
<tr>
<td>17</td>
<td><em>Perozia abrotanosides</em> Karel</td>
<td>Gowaridanai</td>
<td>Lamiaceae</td>
<td>Leaves, flower and seeds</td>
<td>Flower and leaves are used for the treatment of typhoid and headache. Whole plant is ground and soaked for vomiting.</td>
</tr>
<tr>
<td>18</td>
<td><em>Pistacia atlantica</em> ssp., Stocks <em>Pistacia cabulica</em> Stocks.</td>
<td>Sharawan</td>
<td>Anacardiaceae</td>
<td>Leaves, fruits and gum</td>
<td>Leaf extracts are used to treat indigestion. Oil is obtained by grinding the seeds, and the oil is used for cooking. It warms the body and treat cough when applied on to the skin. Oil is used for many other purposes.</td>
</tr>
<tr>
<td>19</td>
<td><em>Plantago lanceolata</em></td>
<td>Ispaghool/ Phidori</td>
<td>Plantaginaceae</td>
<td>Seeds</td>
<td>Seeds are useful in constipation, purgative and to control fatness. Leaves are applied to wounds.</td>
</tr>
<tr>
<td>20</td>
<td><em>Plantago major</em> (L.)</td>
<td>Bar-e-tang</td>
<td>Plantaginaceae</td>
<td>Seeds</td>
<td>Seeds are cooked with sugar and butter, and fed to infants to control appetite. Also used to control phlegm, cough. Seed tonic useful for dysentery, chest congestion and cough.</td>
</tr>
</tbody>
</table>
and leaves of *Peganum harmala* are good for stomach and leg problems, and measles in Zarghoon. This plant is also useful for asthma and bone fractures (Shah et al., 2006). The indigenous knowledge about *Ziziphora clinopodioides* in Zarghoon is that it is used for motion and vomiting; an analogous utilization was reported by Ali & Qaiser (2009). Seeds of *Plantage major* are cooked with sugar and butter, and fed to infants to control appetite, phlegm and cough. Tonic made from seeds is useful for dysentery, chest congestion and cough. Abbasi et al. (2005) also reported that *P. major* is used to control cough, asthma and phlegm.

**Conclusions and recommendations.** The previous discussion clearly indicates that local people are intensively dependent on the Juniper ecosystem either for fuel wood or medicinal plants. However, its utilization is not sustainable because natural resources of the area are heavily exploited. The juniper forest is under a major threat of degradation due to the (1) high rate of deforestation, and (2) comparatively low rate of regeneration.

The study area encompasses a rich biodiversity that includes a large variety of medicinal and other useful plants. Growing medicinal plants both in situ and *in vitro* is inevitable for the development and conservation of the area. Extensive research must be carried out in the fields of pharmacology, biotechnology and biochemistry. If it continues, the tremendous decrease in the transmission of knowledge from local Herbalists to local people can reduce the knowledge of aboriginal people about their natural resources. The community should be aware of the importance of the (1) forest, (2) medicinal plants, and (3) current vulnerability of the forest due to the community activities. The community should be trained about the sustainable use of products other than those provided by the tree forest, particularly medicinal plants and their commercialization, which might contribute to raise their economy.

**REFERENCES**


**21**  *Salvia cabulica* | Metetay | Lamiaceae | Leaves | It is used to treat stomachache and indigestion.

**22**  *Salvia glutinosa* L. | Gul-e-Kakar | Lamiaceae | Leaves and flowers | Used to treat Jaundice and as refrigerant.

**23**  Whole plant | Tora mourai | Lamiaceae | Whole plant | Plant is ground and the oil is added to cure typhoid fever. Decocction is used for cough.

**24**  *Viola kunnsewarensis* <i>Rayle</i> | Gul-e-Banafsha | Violaceae | Leaves and sap | Useful to treat pain and swelling of liver. Also to treat stomachache.

**25**  *Ziziphora clinopodioides Lam* | Spina mourai | Laminaceae | Whole plant | Whole plant is soaked in water, and decoction is given to children to reduce their thirst. Good for motion and gastric problems.

**26**  *Z. tenuior* (L.) | Mourai | Laminaceae | Seeds | Seeds are used to cure dysentery.

* Vernacular name is in Pashto, Pushto or Pakh


