Species diversity and ethno botanical study of Khanpur Valley in the Sub Himalayan mountains of Pakistan

Shah Masaud Khan\textsuperscript{1,4}, Noor ul Amin\textsuperscript{1}, Habib Ahmad\textsuperscript{3}

\textsuperscript{1}Department of Horticulture, The University of Agriculture Peshawar, Pakistan
\textsuperscript{2}Department of Agriculture (Horticulture) University of Haripur, Pakistan
\textsuperscript{3}Department of Genetics, Hazara University, Mansehra Pakistan

Key words: Plant species, Medicinal plants, Local preferences, Khanpur valley.

http://dx.doi.org/10.12692/ijb/6.11.49-57 Article published on June 08, 2015

Abstract

Khanpur Valley, in the sub Himalayan Mountains of Pakistan, is a rich repository of diverse flora of immense medicinal importance. A detailed survey was conducted during 2010-2011 for documentation of indigenous flora of the valley. On the basis of preliminary survey of the valley and discussion with the inhabitants, four ecologically diverse sites namely Dam, Dabola, Jabri and Mang were selected for current study. A total of 202 plant species belonging to 48 families were recorded. Maximum species were from family Asteraceae (19), followed by Poaceae (18) and Fabaceae (12). Similarly maximum species were herbs (141), followed by trees (31), while minimum species were shrubs (30). Moreover, out of total 202 plant species, 71 species (34%) belonging to 42 families were identified as medicinally important. The results revealed that the top 3 medicinally important species in terms of percent preferences were \textit{Adhatoda vasica} (17.32\%), \textit{Fumaria officinalis} (13.22\%) and \textit{Ajuga bracteosa} (12.27\%). The findings further established that the largest number of ailments cured with medicinal plants were associated with the digestive system (36.05\%) followed by respiratory disorders (14.83\%) and blood purification (14.42\%). In case of part of plant used, maximum preferences (37.52\%) were expressed for whole plant in case of herbs and leaves (23.32\%) of woody plants. Finally, the study found that maximum utilization of medicinal plants was in the form of powder (39.14\%) followed by decoction (21.22\%).

*Corresponding Author: Shah Masaud Khan \email{shahmasaudkhan@gmail.com}
Introduction
Species diversity contributes to the main ingredients of medicines in traditional systems of healing and has been the source of inspiration for a large number of major pharmaceutical drugs. There are more than 8,000 plants species in South Asia used in the alternative medicines and are an integral part of traditional health care systems (Hussain et al., 2007). Degradation in natural resources is caused by increased human activities related to the growing population coupled with, human destruction of natural habitats and migration of human population (Haq et al. 2010). This resulted in the change of land use pattern, spread of invasive species, the growing demand for natural resources and its inappropriate management. In addition, neither systematic work has been carried out on the status and threats to ecosystems, nor the effects of global climate change are grasped by ecosystem managers. The management of an appropriate combination of resources, in various locations and under diverse conditions would be one of the efficient ways to conserve ecosystem that offers the medicinal wealth.

In developing countries it is estimated that birth attendants (dhais) assist in up to 95% of rural and 70% of urban births (Shinwari et al., 2005) and mainly relies on herbal medicines as pre and post maternity care. The herbal medicine have been used by locals since time immemorial. Research suggested that a large number of medicines have been derived from the folk-use by the traditional civilizations (Shinwari et al., 2005). About 50 drugs have been discovered from ethno-botanical technologies through translating folk knowledge into new pharmaceuticals. Moreover, very few of the wide medicinal species have been domesticated globally and most of these species are still collected from their wild habitats (Gupta and Chadha, 1995). Very little work has been undertaken on their selection and improvement, for developing suitable varieties.

Plant species have contributed significantly to the development of modern drugs. The use of medicinal plants is increasing worldwide due to expansion of traditional medicine and a growing interest in herbal treatments. Traditional Greek (Unani) medicine is quite a popular practice. It originated in Greece and was developed and documented by Muslims during the glorious period of Islamic civilization. This trade of medicine was introduced to the subcontinent by Muslim scholars and practiced successfully for centuries. In subcontinent, it gets benefited from the Ayurvedic system of medicine, which was an important component of Hindu civilization and all these systems of healing greatly depend on wild plant collections. It has been estimated that around 95% of the medicinal plants are harvested and collected in wild (Lucy and DaSilva, 1999). Such excessive exploitation of natural resources is threatening to some plant species. The alarming levels of deforestation and ecosystem degradation have severely reduced the availability of medicinal plants and the overall environmental sustainability of the subcontinent. Due to high market and community demand many medicinal plants today, face either extinction or loss of genetic diversity (Lucy and DaSilva, 1999).

Pakistan is among the reasonably diverse countries in plant resources, where people’s reliance on biological sources for the survival and well-being is very strong (Ahmad et al., 2008). Additionally, the country has rich and unbroken traditions of the use of medicinal plants and its natural products for healthcare needs (Ahmad et al., 2008). A focus on medicinal plants raises some major questions of conservation and endangered species. Conservation and livelihoods are closely linked with medicinal plants. If conserved, medicinal plants will continue to be available to provide benefits for healthcare, income and support of cultural heritage. The overexploitation of habitats in terms of farm conversions and human interference is a major threat to biodiversity (Khan et al., 2013). Like humans, animals do have been treated by herbal medicines, since long. It has been observed that livestock raisers and healers everywhere in the world have traditional ways of classifying, diagnosing, preventing and treating common animal diseases. Many of these “ethno-veterinary” ways of treatment are used as alternative to western medicines because
The latter is hardly available and costly or irrelevant. The use of medicinal plants constitutes major part of ethno-veterinary medicine (EVM) in Pakistan. Use of medicinal plants as de-wormer is an example (Iqbal et al., 2005).

The sub Himalayan mountainous valley of Khanpur has a unique ecosystem which provides all eco-physiological support to its inhabitants. It has reserve forests, cultivated lands, range lands, water reservoirs, uplands, diverse plants and wildlife, as well as climatic extremes. The valley is at the gate way of great Himalayan Mountains and easily approached from different population centers like the capital city Islamabad and Taxila on its one side and Haripur and Abbottabad on the other side. So there is a huge pressure on the natural resources especially on medicinal flora of the valley, which otherwise magnify its immense scope for conservation.

Keeping in view the importance of species diversity, its traditional uses and conservation of the medicinal wealth, the current study was initiated by the Department of Horticulture University of Agriculture, Peshawar. The Khanpur Valley was selected for this study because the valley is very rich in indigenous medicinal flora and is located adjacent to medicinal and food industries at Hattar Industrial Estate. The Khanpur Valley can become a source of raw material supply to Hattar industries, if scientific methods of collection and utilization are adopted.

The current study was designed to achieve the following objectives:
1. To enlist the available plant species in the valley
2. To identify the medicinally important species of the valley
3. To determine the locally preferred medicinal plant species and its parts used in the preparation of different recipes for curing various ailments.

Materials and methods
The study titled “Species Diversity and Ethno Botanical Study of Khanpur Valley in the Sub Himalayan Mountains of Pakistan” was conducted during 2010-2011. At first instance during early 2010, the whole valley was extensively visited and agricultural, industrial & forest experts, local elders, herbalists and leaders were interviewed. These interviews were randomly face to face meetings and group discussions and the information collected was utilized in the designing and planning of the research project. The valley was divided into four ecologically diverse sites to cover all ecological diversities of the study area.

Selection of sites
On the basis of preliminary survey of the valley and discussion with stakeholders, four ecologically diverse sites namely Mang, Dam, Dabola and Jabri were identified and selected. These sites were different from one another in their environmental attributes especially variation in altitude, slope, topography, habitat, vegetation type and plant community. A brief description of the selected sites is given below:

Dam site
It is situated in the center of the valley with a beautiful lake (Khanpur Dam), which is located at longitude 72° 55' 52.38 E and latitude 33° 48' 45.87 N with an altitude of 1940 feet.

Dabola site
This site of Khanpur valley comprises area upstream from Tarnawa to Kohala villages. Dabola is located at longitude 73° 04’ 33.36 E and latitude 33° 49’ 50.73 N with an altitude of 3940 feet.

Jabri site
It is situated at the north-east of the Khanpur valley. Jabri is located at longitude 73° 10’ 08.98 E and latitude 33° 54’ 11.69 N with an altitude of 3120 feet.

Mang site
It is situated at north-west of the khanpur valley. Mang is located at longitude 72° 54’ 49.24 E and latitude 33° 54’ 21.12 N with an altitude of 1885 feet.

Selection of seasons
Medicinal plants of Khanpur valley were studied in two major seasons: winter and summer. Plants specimens for identification and data on various parameters were collected during October to March for winter and during April to September for summer season.

The study was divided into three parts.

Part 1. Enlistment of the total plant species available at Khanpur Valley
The research area was visited on weekly basis in both summer & winter and specimens of all the available species were collected from all of the four sites and brought to the herbarium of Hazara University, Mansehra, for identification by the experts and with the help of flora of Pakistan. The local names, common names, technical names, family names and type of plant or growth habit was properly documented.

Part 2. Identification of medicinally important plant species
Local herbalists, agricultural and forest experts, local elders, and leaders were interviewed and the plant species enlisted in the first part of the study were discussed with them. Moreover, the available literature on the subject was thoroughly studied and relevant information was used to help document the plant species which were medicinally important and available in the valley.

Part 3. Determination of community preferences
The preferences of local people for the treatment of various ailments in terms of medicinal plant used, part used, the category of diseases treated and the form of therapeutic use (recipe) were analyzed with the help of a questionnaire survey conducted in the whole valley. The questionnaire covered the following four major themes:

Most preferred medicinal plant species
The respondents were asked to mention the name of a medicinal plant species which was mostly preferred by the local people for traditional healthcare. The percent preferences for each mentioned species was calculated with the help of the following formula:
Percent preferences of species=Number of respondents who termed it as most preferred species*100 Total number of respondents.

Most preferred type/category of ailment, cured with medicinal plants
The respondents were asked to mention the type of an ailment which was mostly preferred by the local people for traditional healthcare. The percent preferences for each mentioned species was calculated with the help of the following formula:
Percent preferences of ailment=Number of respondents who termed it as most preferred ailment*100 Total number of respondents.

Most preferred type of plant part, used
The respondents were asked to mention the name of a plant part which was mostly preferred by the local people for traditional healthcare. The percent preferences for each mentioned plant part was calculated with the help of the following formula:
Percent preferences of a plant part=Number of respondents who termed it as most preferred part*100 Total number of respondents.

Most preferred form of utilization (recipe).
The respondents were asked to mention the form of utilization or recipe which was mostly preferred by the local people for traditional healthcare. The percent preferences for each mentioned form or recipe was calculated with the help of the following formula:
Percent preferences of a recipe=Number of respondents who termed it as most preferred recipe*100 Total number of respondents.

A Total of one hundred (100) respondents, 25 from each of the four sites, were interviewed. In each site 5 most populous villages were selected and from each village 5 available eldest respondents were interviewed (Khan et al., 2012) and the data on all the
parameters was recorded.

**Statistical analysis**

The data recorded was tabulated theme wise and Microsoft Excel program was used in the calculation of percent preferences and its presentation in graphic form.

**Results and discussions**

*Enlistment of the total plant species available at Khanpur Valley*

Total species identified were 202 (summary of classification is given in Table 1.1) belonging to 48 families. Maximum species 19 were from family Asteraceae (Compositae), followed by 18 species belonging to Poaceae family while Fabaceae and Solanaceae families were found with 12 species each and Euphorbeaceae, Brassicaceae and Moraceae were revealed with 9 species each. Similarly, maximum species were of growth habit herbs (141), followed by shrubs (31), while minimum plant species were trees (29) in nature.

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Families</th>
<th>Total Species /Families</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Asteraceae</td>
<td>Poaceae</td>
</tr>
<tr>
<td>Total Enlisted</td>
<td>19</td>
<td>18</td>
</tr>
<tr>
<td>Medicinally Important</td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Growth Habit</th>
<th>Herbs</th>
<th>%age</th>
<th>Shrubs</th>
<th>%age</th>
<th>Trees</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total enlisted</td>
<td>141</td>
<td>69.8</td>
<td>31</td>
<td>15.35</td>
<td>30</td>
<td>14.85</td>
</tr>
<tr>
<td>Medicinally Important</td>
<td>42</td>
<td>59.15</td>
<td>14</td>
<td>19.72</td>
<td>15</td>
<td>21.13</td>
</tr>
</tbody>
</table>

It is an obvious fact that the people of rural Pakistan extensively depends on herbal medicines for their traditional healthcare. The inhabitants of Khanpur valley are lucky to have hundreds of wild species available for use, as part of their ecosystem. The results show that Khanpur valley is very rich in terms of species diversity, as there were 202 total plant species belonging to 48 families, with 71 medicinally important species. Maximum species were from family Asteraceae (Compositae), followed by Poaceae family. Asteraceae and poaceae were two larger families of plant species indigenous to the valleys of Pakistan (Fazal et al., 2010). Similarly maximum species were of growth habit herbs, followed by trees, while minimum plant species were shrubs in nature. Similar results were obtained by Murad et al., (2011) for Malakand Agency, KP, Pakistan; Qureshi et al., (2009) for Chakwal district of Punjab, Alam et al., (2011) for Chagharzai area Buner Pakistan, and Fazal et al., (2010) who documented 211 species of wild and cultivated plants of Haripur, Pakistan, with all mention of plant type and part used.

**Identification of medicinally important plant species**

As a second part of the experiment, 71 species (35.15%) out of 202 total plant species were found to be medicinally important. These medicinally important species were belonging to 42 families (Table 1.1). Maximum species were from family...
Solanaceae (8) followed by Asteraceae (7) followed by Euphorbiaceae (4) while Fabaceae and Moraceae were found with 3 species each. Similarly maximum species were of growth habit herbs (42) followed by shrubs (15) while minimum plant species were of growth habit tree (14).

The efforts on the ethnobotany and documentation of valuable flora have been carried out since long. Abbasi et al., (2009) reported 30 plant species belonging to 24 families used by local practitioners for the treatment of jaundice and hepatitis. Alam et al., (2011) concluded that 141 plant species of medicinal importance are found at Chagharzai Area of Buner district, Pakistan. Khan, (1985) conducted another survey and reported that 95 species were used by Hakims and the annual consumption of medicinal plants was more than 5.65 million kg which valued approximately up to Rs. 36 million. Khan et al., (2012) identified use of Medicinal Plants in Folk Recipes by the Inhabitants of Himalayan Region Poonch Valley Azad Kashmir (Pakistan). Total 68 species of plants belonging to 44 families were recorded as used medicinally for preparations of folk recipes of 68 ailments. Leporatti and Lattanzi., (1994) studied 27 medicinal plants ethnobotanically in Makran (Southern Pakistan). They reported and discussed their traditional medicinal uses.

**Determination of Community Preferences**

Community preferences for medicinal plant species, part used, ailment addressed and mode of utilization or recipe, was judged with a scientific survey and the results are given below:

**Most preferred medicinal plant**

In terms of species preferences survey revealed that the top 12 medicinally important species were *Adhatoda vasica* (17.32%), *Fumaria officinale* (13.22%), *Ajuga bracteosa* (12.27%), *Euphorbia hirta* (12.02%), *Calostapis procera* (8.12%), *Recinus communis* (7.42%), *Mintha royaleana* (7.06%), *Berberis lyceum* (6.41%), *Punica granatum* (5.61%), *Xanthoxylum armatum* (4.22%), *Artemisia beifolia* (3.26%), and *Solanum nigrum* (3.08%).
Most preferred Type/category of ailment, cured with medicinal plants

The results obtained on this parameter are given in Figure 1.2. The results revealed that the largest number of ailments cured with medicinal plants were associated with the digestive system (36.05%) followed by those associated with respiratory, blood purification, reproductive, skin, urinary, nutritional and tonic, brain and nerves and bones and tonic (14.83%, 14.42%, 9.7%, 6.64%, 5.21%, 5.62, 4.73 and 2.8% respectively).

![Percentage of respondent’s preference for traditional use (recipe) of medicinal plants.](image)

**Fig. 4.** Percentage of respondent’s preference for traditional use (recipe) of medicinal plants.

Further finding were regarding ailments cured. The largest number of ailments cured with medicinal plants was associated with the digestive system followed by those associated with respiratory, blood purification, reproductive, skin, urinary, nutritional and tonic, brain and nerves and bones and joints. The logic behind this finding could be the most commonplace diseases are associated with the digestive and respiratory disorders (Jan et al., 2008, Rasool et al., 2010) and hence the people of the research area use medicinal plants for these ailments. Similar results were obtained by Khan et al., (2012) who identified the use of Medicinal Plants in Folk Recipes by the Inhabitants of Himalayan Region, Poonch Valley of Azad Kashmir (Pakistan).

Most preferred form of utilization (recipe)

The third outcome of the survey was regarding the type of use (recipe). Which revealed that maximum utilization of medicinal plants was in the form of powder (39.14%) followed by decoction (21.22%), tea (8.41%), paste (7.13%), fresh (7.1%), juice (6.04%), cooked (4.31%), cream (3.84%) and tincture (2.81%). The survey resulted in the finding that powder form followed by decoction were the most preferred forms of utilization by the local community of Khanpur valley. This may be due to ease of utilization in the preferred forms and is in connivance with the findings of other ethno botanists (Jan et al., 2008; Rasool et al., 2010; Khan et al., 2012). In line with the findings of this experiment, Khan et al., (2013) has also reported the preferences of respondents for part used, ailments cured and form of recipe, in Naran Valley of Pakistan.

Conclusions

The following conclusions can be derived from the current study.

The 202 species, belonging to 48 different families, recorded at Khanpur valley shows that the valley is
rich in species diversity.

The 71 medicinally important species were identified at the research area which means that 35.15% of the flora of Khanpur is pharmaceutically important.

The local preference for species revealed that Adhatoda vasica, Fumaria officinalis and Ajuga bracteosa are the most preferred medicinal plants of the valley.

It was concluded that the most preferred part of plant used is whole plant in case of herbs and leaves in case of woody plants.

The survey found that the people of Khanpur prefer medicinal plants used in the cure of ailments related to digestive and respiratory systems and they prefer powder and decoction form of its utilization.

References


