ETNHOBOTANICAL AND PHYSIOLOGICAL STUDIES OF SOME ENDANGERED PLANT SPECIES COLLECTED FROM TWO DIFFERENT ALTITUDES IN GILGIT BALTISTAN

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Abstract

This paper was aimed to study the endangered plant species collected from two different altitudes in Gilgit Baltistan. There were total 105 identified species from the field areas of Naltar (2700-4350 m.a.s.l) and Karga (1400-1700 m.a.s.l) belonging to 36 families. The important families were Asteraceae (27 species), Poaceae (6 species), Fabaceae (8 species), Lamiaceae (8 species) and Rosaceae (3 species). The observed species richness pattern in the field areas showed that Naltar with 60 species had the highest species richness while Karga with 45 species inhabit minimum number of species. There are few species such as Artomsia lacinita, Artemisia maritima, Aconitum napellus, Angelica glauca, Betula utilis var. D. Don, Bergenia himalacia, Carum carvi, Onosma hispalm, Ephedra gerardiana, Glycyrhiza glabra, Hippophae rhamnoides, Picrorhiza kurrooa, Podophyllum emodi, Sussurea lappa, Thymus serphylum, Valeria walllchii that are endangered due to endemic nature of plants, high domestic as well as export demand. In above endangered plant species 10 belong to Naltar while 6 belong to Karga. Artemisia lacinita is used for jaundice, gall bladder and for high fever. Leaf paste of Artemisia maritima is utilized for skin infections. Angelica glauca is being used for such diverse medical problems as chest congestion, insomnia, flatulence, headache, fever, skin rashes and wounds. Betula utilis var. D. Don is used for ear pain and its related problems. It was observed that there was increase in sugar, protein and proline contents of medicinal plant leaves at high altitude which were lower at low altitude. Similarly ABA contents also increased at high altitude while IAA and GA contents were found maximum at lower altitude.

Introduction

Men have always used natural resources of healing substances to cure human diseases. Effort to cure the diseases by means of traditional phyto-therapy has been made in all parts of the world (Heinrich, 2003; 2005; Abella et al., 2000; Bodeker et al., 2005). At present, ethno botanical and ethno pharmacological experiences of certain nation are used in the treatment of wide range of diseases (Sheng-Ji, 2001; Uniyal et al., 2006; Hameed et al., 2011) including as cancer, AIDS, Alzheimer’s disease, alcoholism, etc. (Ferry et al., 1999; Bailly et al., 2005; Sajem & Gosai, 2006).

Northern Areas of Pakistan has extreme climatic condition (Ahmad 1951; Ahmad et al., 2011a). Consequently, it has diverse climatic and vegetation zones which has distinct ethno botanically important plants are important for the economy of a country (Ahmad et al., 2008; Ahmad et al., 2011b).

Gilgit-Baltistan (GB) formerly known as Northern Areas of Pakistan, possess peculiar geographic and climatic conditions and a diverse range of biodiversity, spreading across an area of 72,496 square kilometres bordering China, Afghanistan and India. Situated between longitude 72°-75° North and latitude 35°-37°East, the region has been administratively divided into seven districts: Gilgit, Baltistan, Ganche, Diamer, Ghizar, Astore and Hunza-Nagar. The region represents sundry range of natural ecosystems comprising wetlands and globally exceptional fauna and diverse flora with endemic plants.

According to an estimate given by the locals about 4000 kg of Carum bulbocastanum is collected every alternate year from Rattu and adjacent areas of upper Astore. Another important plant is Picrorhiza kurrooa, which has become endangered due to over exploitation from Qamari, Burzil pass and Deosai plains (Rasool, 1998). Podophyllum emodi (bankakri) exploited from the forests of Astore has already been overexploited and now become endangered (Rasool, 1998).

Over harvesting is common for the more valuable plants such as Kurth, Ephedra, Artemisia, Sea buckthorn, and Berberis species. Increasing population and enhanced awareness about very few side effects of medicinal plants also encourage their over harvesting (Ahmad et al., 2008b). Therefore, this study was conducted to record indigenous knowledge of some endangered plant species collected from different altitudes in Gilgit Baltistan.

Materials and Methods

The vegetation survey was conducted during summer 2010 along different mountain sites at various locations from Kargha (1400-1700 m.a.s.l) and Naltar (2700-4500 m.a.s.l), Gilgit-Baltistan. The selected areas differ in having slight plains with continuous and gently sloping hills. Different quadrat sites were established by selecting sites where least human activity was carried out, however influenced by frequent grazing. While collecting data at particular site care was taken to place a quadrat having a similar aspect. The total number of plant species, their presence or absence was recorded from each quadrat. Quadrat data were collected by 1m² while in upper area of Naltar data were taken in 10 cm². Number of plants occurring in every quadrat was identified and their population were recorded.

Information regarding traditional uses of medicinal plants was gathered through questionnaires, interviews, and group discussions with local farmers, elders, students and traditional healers.
A floristic checklist (alphabetical order) was compiled form extensive field collections. Place of collection, date of collection, were noted on the spot. blotting papers and a presser was used for drying and preservation of specimens. The fully dried specimens were mounted on herbarium sheet and specimens were identified with the help of the herbarium of Quaid-e-Azam University, Islamabad and compared with the available literature (Stewart, 1972; Nasir & Ali (1971-2001).

Protein content of leaves was determined following the method of Lowery et al., (1951) using BSA as standard. Sugar estimation of fresh leaves was done following method of Dubois et al., (1956). The proline contents of leaves were measured by the method of Bates et al., (1973). The ABA, IAA and GA concentrations were determined by the method of Kettner and Doerffling (1995).

**Results and Discussion**

Some plants species have long used by human as a source of food and others for curing diseases and injuries. During our present investigations 16 endangered species of medicinal importance were collected and identified. All the species were used by the local people to cure different diseases. Plants collected belonged to 14 different plant families. The dominant families were Asteraceae and Apiaceae, each with two species while the remaining families have single species.

All the plant species were collected at the range of 1400 and 4500 m a.s.l. Species of Artemisia (Artemisia laciniataWilld, Artemisia maritima) have been widely used for many centuries as therapeutics plants in the conventional medication (Zinczuk et al., 2007; Negahban et al., 2007; Ahmad et al., 2010). Use of Artemisia based therapeutics is also common practice in the northern areas of Pakistan. Aziz (1996) reported that A. maritima was used against abdominal pain, fever and intestinal worms in Chitrval valley. The species of Angelica glauca have been assigned as endangered for the Himalayan region due to grazing pressure (Ved et al., 2003; Ahmad et al., 2009). On the basis of population survey from Garhwal Himalaya the status of Angelica spp., as endangered was reported by Vashistha et al., (2006).

Rajkumar et al., (2010) extracted and evaluated the antioxidant activities from Bergenia ciliata. Bergenin is one of the most researched organic compounds among the many bioactive ingredients (Singh et al., 2007; Dhalwal et al., 2008), due to quite high medicinal value. Bergenia hispida has also been used for food as presence of many kinds of amino acids and mineral elements which are helpful in health care (Yang et al., 2009). For cosmetic application, Arbutin is used in cosmetics to make skin whiten (Guo et al., 2004).

Traditionally, Onosma plants are used as stimulant in rheumatism, bladder pain, kidney irritation and palpitation of heart (Ahmed, 2005). Hispidone, a new flavanone has been isolated from Onosma hispidum that have choline esterase inhibitory activity (Ahmad et al., 2003). Onosma hispida can be used as colorant (Shahina, 2005). While anticaner activity of Onosma limitaneum and antioxidant and antimicrobial activities of Onosma argenatum have been reported (Ahmad et al., 2005).

Glycyrrhiza glabra is one of the most commonly used herbs in Western and Eastern herbal medicine and has a very long history of use, both as a medicine and also as a flavouring to disguise the unpleasant flavour of other medications (Mitscher et al., 1978). It is a very sweet, moist, soothing herb that detoxifies and protects the liver and is also powerfully anti-inflammatory, used in arthritis and mouth ulcers (Fujioka et al., 2003).

Hippophae rhamnoides oil effectively combats wrinkles, dryness and other symptoms of malnourished or prematurely aging skin and is utilized in anti-aging skin creams and lotions (Lanave et al., 1995; Zhou Yuampeng, 1998). All these beneficial compounds are derived from the berry of the Hippophae rhamnoides bush, which originally grew in the harsh climate of the Himalayan Mountains but has now spread all over the world.

Picrocriza kurrooa Royle ex. Benth native to Western Himalayan region, between 3000-5000 m elevation (Agrawal 2003) was valued as hepato-protective, anti-periodic, chologouge, stomach pain, anti-amoebic, anti-oxidant, anthelmitic, anti-inflammatory, cardio- tonic, laxative, carminative and expectorant, etc. (Prajapati, 2003).

In order to fulfill the increasing national and international demand, the raw drug was largely extracted from wild species that have very limited cultivation so it has made them critically endangered (Rai et al., 2000).

Sugar, protein and proline content of leaves were significantly higher in all plants species collected at 4350 m a.s.l. All the three contents were found to be maximum in Angelica glauca at altitude of 4350 m a.s.l, while minimum was found in Artemisia maritima at altitude of 1650 ma.s.l. (Fig.1). Plants adopted to low temperature stress involve changes in several metabolic pathways, including carbohydrates synthesis (Guy et al., 1992). Sugar played an important role in plant stress tolerance. In many plants sucrose was accumulated during cold stress (Kandler & Hopf, 1982). Protein content of leaves with respect to altitudinal variation was studied in many plant species. It was observed that during acclimation of cold, most freezing tolerant plant species produce new set of proteins that was correlated with the increase of cold hardiness (Guy, 1990). Altitudinal variation had also significant effect on proline contents of medicinal plant leaves. Different experiments had shown that, besides other solutes, the level of free amino acids, especially proline, increased during cold hardening (Galiba et al., 1994).

Variations in altitude had significant effect on endogenous level of ABA, IAA and GA contents of plant leaves. Endogenous ABA content of the plant was found to be higher collected from 4350 m a.s.l as compared to that plant collected from 1650 m a.s.l. Angelica glauca showed highest content of ABA which was collected from altitudinal range of 4350 m a.s.l as compared to that collected at altitude of 1650 m a.s.l.
The IAA and GA contents were found maximum in plant leaves collected from altitude of 1650 m.a.s.l as compared to that collected from altitude of 4350 m.a.s.l. Both the contents were found maximum in *Artemisia maritima* collected from 1650 m.a.s.l while in *Angelica glauca* exhibited least IAA and GA contents (Fig. 2).

During stress reactions, the concentration of phytohormones-inhibitors increased (Neumann *et al.*, 1989). Changes in the hormonal balance were thought to be responsible for the cessation of plant growth in the cold (Kacperska- palacz, 1978). Abscisic acid (ABA) accumulates in plants with response to a range of environmental stresses, including low temperature and water stress and evidence demonstrate that adaption of plants to low temperature is mediated, at least in part, by ABA (Quarrie *et al.*, 1994, Wilkinson & Davies 2002).

**Conclusion**

There is dire need for the sustainable utilization of these plant resources. Efforts have to be made to protect and conserve rare and endangered species by adopting methods such as tissue culture, control of grazing and over exploitation.
Table 1. Plants used for different ailments by the inhabitants of Gilgit–Baltistan.

<table>
<thead>
<tr>
<th>No.</th>
<th>Botanical name</th>
<th>Family</th>
<th>Local name</th>
<th>Habit</th>
<th>Part used</th>
<th>Folk use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><em>Artemisia laciniata</em> Wild</td>
<td>Asteraceae</td>
<td>Khampa</td>
<td>Herb</td>
<td>Leaves</td>
<td>Plants used for wound healing</td>
</tr>
<tr>
<td>2.</td>
<td><em>Artemisia maritima</em></td>
<td>Asteraceae</td>
<td>Zoon</td>
<td>Shrub</td>
<td>Leaves</td>
<td>Leaf paste is utilized for skin infections</td>
</tr>
<tr>
<td>3.</td>
<td><em>Aconitum napellus</em></td>
<td>Ranunculaceae</td>
<td>SaiBooma</td>
<td>Herb</td>
<td>Whole plant used</td>
<td>Used for Anodyne, diuretic and diaphoretic</td>
</tr>
<tr>
<td>4.</td>
<td><em>Angelica glauca</em></td>
<td>Apiaceae</td>
<td>Choro</td>
<td>Herb</td>
<td>Root is aromatic and is used as a food flavouring</td>
<td>Used as a cordial stimulant in the treatment of dyspepsia and constipation</td>
</tr>
<tr>
<td>5.</td>
<td><em>Betula utilis</em> var. D. Don</td>
<td>Betulaceae</td>
<td>Halli</td>
<td>Tree</td>
<td>Bark</td>
<td>Butter is wrapped in the bark paper and stored. Also used as a substitute for writing paper</td>
</tr>
<tr>
<td>6.</td>
<td><em>Bergenia himalacia</em></td>
<td>Saxifragaceae</td>
<td>Sanspur</td>
<td>Herb</td>
<td>Root</td>
<td>Headache and wound healing</td>
</tr>
<tr>
<td>7.</td>
<td><em>Carum carvi</em></td>
<td>Apiaceae</td>
<td>Filizooh</td>
<td>Herb</td>
<td>seeds</td>
<td>Seeds are used for stomach problems, ulcers, uterine tumors, internal wounds and dysentery</td>
</tr>
<tr>
<td>8.</td>
<td><em>Onosma hispidum</em></td>
<td>Boraginaceae</td>
<td>Gaowzoban</td>
<td>Herb</td>
<td>Roots</td>
<td>It is used to treat pelvic inflammatory disease in combination with alum</td>
</tr>
<tr>
<td>9.</td>
<td><em>Ephedra gerardiana</em></td>
<td>Ephedraceae</td>
<td>Sopat</td>
<td>Shrub</td>
<td>Aerial parts</td>
<td>Used for the healing of wounds and for the Asthma.</td>
</tr>
<tr>
<td>11.</td>
<td><em>Hippophae rhamnoides</em></td>
<td>Elaeagnaceae</td>
<td></td>
<td>Herb</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Local name: Buru  
Habit: Shrub  
Part used: Fruits  
Folk use: Used for cytoprotective, anti-stress, immunomodulatory, hepatoprotective, radioprotective, anti-atherogenic, anti-tumor, anti-microbial and tissue regeneration.

12. Botanical name: Picrorhizaa kurrooa  
Family: Scrofulariaceae  
Local name: Karroo  
Habit: Herb  
Parts used: Leaf, bark, root and rhizomes  
Folk use: Protects the liver against hepatotoxins, hepatoprotective properties, Potent antioxidant activity, Modulates liver enzyme levels, anti-inflammatory action anti-allergy action.

13. Botanical name: Podophyllum emodi  
Family: Podophyllaceae  
Local name: Shingoy  
Habit: Herb  
Parts used: Leaf, bark, root and rhizomes  
Folk use: Protects the liver against hepatotoxins, hepatoprotective properties, Potent antioxidant activity, Modulates liver enzyme levels, anti-inflammatory action anti-allergy action.

14. Botanical name: Sussurea lappa  
Family: Compositae  
Local name: Minal  
Habit: Herb  
Part used: Root  
Folk use: Used for the treatment of flu, colds, sore throat, coughs, bronchitis, chest infections and sinusitis.

15. Botanical name: Thymus serpyllum  
Family: Labiatae  
Local name: Tumuro  
Habit: Herb  
Part used: Aerial part  
Folk use: Use for the treatment of flu, colds, sore throat, coughs, bronchitis, chest infections and sinusitis.

16. Botanical name: Valeriana wallichii  
Family: Valerianaceae  
Local name: Musk bala  
Habit: Herb  
Part used: Root  
Folk use: Used for diuretic, brain and nervous Conditions and cardiovascular conditions.

References


Rasool, G. 1998. Saving the plants that save us. Medicinal plants of the northern areas of Pakistan.—xi+92 pp., BASDO, Gilgit.


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