

EXPLORING THE ECONOMIC VALUE OF UNDERUTILIZED PLANT SPECIES IN AYUBIA NATIONAL PARK

SHEIKH SAEED AHMAD* AND SUMAIRA JAVED

*Department of Environmental Sciences,
Fatima Jinnah Women University, Rawalpindi, Pakistan.*

Abstract

This research was conducted on selected underutilized plant species in Ayubia National Park, Pakistan. The six most prominently used medicinal and food species viz., *Adhatoda vasica*, *Artemisia scoparia*, *Galium aparine*, *Amaranthus viridis*, *Hedera nepalensis* and *Urtica dioica* that gain little attention by scientific research and local community were selected as underutilized species. Due to their underutilized characteristics they were investigated in detail for exploring their economic values. About 50 informants were interviewed in this regard to study their ethnomedicinal and ecological properties. *Amaranthus viridis*, *Hedera nepalensis* and *Urtica dioica* were also chemically analyzed for ash, total proteins, fats, and carbohydrates. The results of the study demonstrated that these 6 selected underutilized species have great medicinal and nutritional importance could be good sources of some important nutrients for humans and can become a source of poverty alleviation of poor local community of the study area. The precious ethno botanical knowledge about underutilized plants is disappearing very fast, however this study could be helpful in conserving the precious knowledge.

Introduction

Ayubia National Park is situated in the Gullies Forest division of Abbottabad between 34-1 to 34-3.8 N latitude and 73-22.8 to 73-27.1 E longitudes over an area of 1684 hectares. The park is located on range of hills running north to south in proximity of Abbottabad and northwestern end of Murree. The park headquarter is at Dongagali. The study area Ayubia National Park is the only moist temperate forest in Pakistan with a high diversity of vulnerable plant and animal species. A total of 757 vascular plant species have been recorded in park. About 200 species of herbs and shrubs and about 10 species of Gymnosperm trees are found in park area (Farooque, 2002).

Underutilized plants are those species with under-exploited potential for contributing to food security, health (nutritional/medicinal), income generation and environmental services (Anon., 2006). Underutilized plant species have a potential, not fully exploited, to contribute to food security and poverty alleviation. Promotion of their use should be done in a sustainable fashion” (Hoeschle-Zeledon & Bordoni, 2003). The range of these species covered is wide, including plants that provide edible fruits, grains, leaves, nuts, oils, roots and tubers, fibres, medicines, spices, stimulants and other products. Freiburger *et al.*, (1998) investigated the nutritional role of wild underutilized plants in the Nigerian diet. Pugalenthi *et al.*, (2005) studied the nutritional potential of an underutilized legume *Mucuna pruriens* var. *utilis* and current state of its utilization as food/feed for both human beings and livestock throughout the world. Windle (2006) gave a brief history and description of the medicinal plant *Hedera nepalensis* cv. Boaxing Star; underutilized specie discovered growing in the wild in 1996 during a plant hunting expedition in Boaxing, Sichuan Province, China. Pico & Nuez (2000) presented the historic and current medicinal utilizations of some minor or underutilized plants in Mexico. The conservation assessment of these plants revealed that due to increased exploitation and un-sustainable harvesting, 49% of these economically valued medicinal plant species are threatened.

*Corresponding Author: drsaeed@fjwu.edu.pk, shsaeed1@yahoo.com

In human history, 40-100,000 plant species have been regularly used for food, fibers, industrial, cultural and medicinal purposes. Today, only 30 plant species are used to meet 95% of the world's food energy needs (Anon., 1996). About 50 % of the world's food dry weight is derived from four cereals: rice and wheat (which account for 22% each), maize and barley. These crops are widely and intensively cultivated and have been selected from a large agro biodiversity basket containing more than 7,000 food species (Wilson, 1992). At the other end of the range of food items consumed by humans, there are species of regional importance grown by traditional farmers or species that lost their former importance for human consumption. These species are commonly called neglected or underutilized species. Numerous terms have been employed to characterize these less well-known species including minor crops, underutilized species, neglected species or orphan crops, underexploited, underdeveloped species, abandoned, new, lost, underused, local, traditional, forgotten, alternative, niche and promising species (Padulosi *et al.*, 2003).

Underutilized species hold great genetic diversity, and a vast heritage of indigenous knowledge is linked to these species (Padulosi *et al.*, 1999; Frison *et al.*, 2000). Increased public awareness about underutilized species was prompted by the Convention on Biological Diversity (Anon., 1992) and the Global plan of action for the conservation and sustainable utilization of plant genetic resources for food and agriculture (Anon., 1996). The Pakistan Agricultural Research Council (PARC) has recently initiated research and development programme with underutilized crops. Keeping in view the importance of underutilized plant species this research was done to explore the economic importance of six selected underutilized species in the study area Ayubia National Park.

Material and Methods

At the beginning of research a preliminary survey of Ayubia National Park was conducted in the month of February where large number of plant species are being used as domestic fuel, food, shelter, health, medicines, fodder and other needs of local communities of the study area. Besides growing a few crops, people frequently collect wild edible plants for food and other plants from natural habitats to meet their subsistence needs. The methods employed in this study were designed with the purpose of providing baseline information on the use of plant species in local system through surveys and field visits. The species potential was investigated by surveying the three most popular markets (Khanuspur, Ayubia and Murree) for one month. Information on extent of availability and local prices was collected. Among various edible and medicinal plants, selected species were prioritized for detailed study. The selection was undertaken on the basis of (a) multipurpose utility (b) occurrence in natural habitats (c) preferred species of the local people (d) market value (e) scanty information available on nutrient content and growth performance of the species and finally (f) extent of anthropogenic pressure on species.

A total of six species (*Adhatoda vasica*, *Artemisia scenario*, *Galium aparine*, *Amaranthus viridis*, *Hedera nepalensis* and *Urtica dioica*) satisfied these criteria and were selected as underutilized.

The research area of National park was visited again in the months of April and June for data collection and to study medicinal, ecological, nutritional and economic aspects of six selected underutilized plant species (*Adhatoda vasica*, *Artemisia scoparia*, *Galium aparine*, *Amaranthus viridis*, *Hedera nepalensis*, *Urtica dioica*) in the area and to explore economic importance of these plant species. These plants were collected during frequent field trips. They were given field numbers and then were pressed by plant presser containing blotting papers. The collected plants were dried. They were brought to

herbarium, Department of Environmental Sciences, Fatima Jinnah Women University, Rawalpindi and were deposited, identified with the help of available literature (Stewart, 1972; Nasir & Rafique, 1995).

Questionnaire method was adopted during these investigations. For simplicity most of the answer to some question in the questionnaire had only 2 categories, Yes and No. For analysis purposes, the responses were coded as yes (1) and No (2). The response variable is therefore, a categorical binary variable with values 0 and 1 (Agresti, 1990; Collett, 2003).

To get ethnomedicinal data including common and local names, parts used, medicinal uses and folk medicinal recipes of *Adhatoda vasica*, *Artemisia scoparia* and *Galium aparine* 30 local plant collectors, hakeems and pansaris were interviewed. *Amaranthus viridis*, *Hedera nepalensis* and *Urtica dioica* were found useful by local people and animals as food/fodder (Fig. 1).

To find out the market potential of these 6 species a survey was also carried out in markets of Khanuspur, Ayubia and Murree the closest towns to the field work area where edible and medicinal plants were sold, where the prices of all the edible plants on sale were recorded. In this regard shopkeepers, elders and plant traders were interviewed.

Results

Ayubia National Park is one of the fourteen declared National Parks in the country that falls in the IUCN-Category V. The Park is purely built to protect this beautiful landscape predominantly enriched with coniferous forest. The results of present study revealed that the inhabitants of Ayubia National Park and its surrounding population utilize these 6 underutilized plants (*Adhatoda vasica*, *Artemisia scoparia*, *Galium aparine*, *Amaranthus viridis*, *Hedera nepalensis* and *Urtica dioica*) for various domestic needs (food, medicines, fodder etc.).

Some major medicinal uses of three underutilized plant species (*Adhatoda vasica*, *Artemisia scoparia*, *Galium aparine*) of Ayubia National Park are identified. The family, english and local names, parts used, medicinal uses and folk medicinal recipes of these species are given in detail.

1.1. *Adhatoda vasica* Nees.

Family:	Acanthaceae
English Name:	Malabar Nut Tree
Local Name:	Kolyar Sag
Voucher specimen No:	1
Parts used:	Leaves, flowers and root

Medicinal uses: It is used in snakebite and for apiculture. The leaves are powerful expectorant and antispasmodiac, used in disease of the respiratory tract, all kinds of coughs, chronic bronchitis, asthma and other chest diseases, diarrhoea and dysentery. The leaves decoction is useful for scabies and other skin diseases. The root is useful as expectorant, antispasmodial and their infusions are used as anthelmintic. Fresh flowers are used in hectic fever, gonorrhoea and ophthalmia.

Folk medicinal recipes: For tuberculosis, 500 grams of leaves are crushed and boiled in 2 liters water in an earthen till it is left to half. It is given to the patient with honey for fifteen days four times in a day. The juice of leaves is used for cough and asthma. Leaves are crushed and used as poultice on the wounds as antiseptic. Leaves are boiled and are given for throat pain.

1.2. *Artemisia scoparia* Walds & Kit.

Family: Asteraceae
English Name: Redstem wormwood
Local name: Chahu
Voucher specimen No: 3
Part used: Whole plant
Flowering Period: July-October

Medicinal uses: Infusion of the plant is used as purgative. Plant is also used as cure for earache. Smoke is known to be good for burns.

Folk Medicinal Recipe: The plant is boiled in water. This water is drunk during the night for removing intestinal parasites from the body.

1.3. *Galium aparine* L.

Family: Rubiaceae
English Name: Cleavers
Local Name: Karoon
Voucher specimen No: 6
Part used: Leaves and fruit

Medicinal uses: *Galium aparine* is one of the plants that traditionally is thought to act as a diuretic. It is used to relieve bloating and promote urine production. It has also been used by people with lymph swellings (especially tonsillitis and adenoid trouble), jaundice, wounds, cancer, insomnia, fever, hypertension, leukemia and scurvy.

Folk medicinal recipes: 1. The dried plant is often infused in hot water and drunk as a tea, 1 ounce of the dried herb being infused to 1 pint of water. This infusion, either hot or cold, is taken frequently in wine-glassful doses and has a most soothing effect in cases of insomnia and induces quiet and restful sleep.

2. Fresh plant is washed and still wet put into the juice extractor to make fresh juice. The expressed juice is recommended in dropsical complaints, as it operates with considerable power upon the urinary secretion and the urinary organs. It is given in obstructions of these organs, acting as a solvent of stone in the bladder.

3. Sufficient fresh juice is stirred into butter (room temperature) to provide an ointment-like consistency. This ointment is used for scalds, burns, colds and swelling.

2. Nutritional properties: Data about nutritional properties of (*Amaranthus viridis*, *Hedera nepalensis* and *Urtica dioica*) is given in Table 1 including local use, part used, feeding season and nutritional composition of these species.

3. Economic properties: The data relating to economic potential of *Adhatoda vasica*, *Amaranthus viridis*, *Artemisia scoparia*, *Galium aparine*, *Hedera nepalensis* and *Urtica dioica* is described in Table 2.

Economically these six species are important because commercially these species are not only used as medicinal plants, but also as dyes, essential oils, tonics and fibers.

Discussion

The present study showed that the area of National Park is rich in wild flora and fauna. To maintain the check and balance in the park and to avoid over exploitation of these 6 selected underutilized plant species, indigenous knowledge regarding the use of these species is not uniformly distributed among the people. Early people, vendor and hakeems were more experienced and had more knowledge. The people of the area had no proper training regarding harvesting, post harvest care, storage and marketing of these species. Meeting with local community revealed that they were interested in an agency that could train people in cultivation of these medicinal and other economically important fodder plants.

Three selected underutilized plant species viz., *Adhatoda vasica*, *Artemisia scoparia*, *Galium aparine* are reported to be quite effective remedies for different diseases. Similarly Shinwari and Khan (2000) recorded the medicinal uses of 50 species of herbs belonging to 27 families including *Artemisia scoparia*, *Amaranthus viridis*, *Euphorbia helioscopia* etc. used by inhabitants of the Margalla Hills National Park. In the same way Ahmad (2007) recorded the medicinal uses like fever, skin diseases, snakebit, jaundice and burns etc., of 81 plants belonging 44 families including *Artemisia scoparia* found in the first ever constructed motorway of the Pakistan. Gilani (2006) also recorded 21 important herbs belonging to 19 families which were used medicinally by the local inhabitants of Ayubia National Park, Abbottabad, Pakistan.

The local inhabitants and local practitioners in area through traditional knowledge collect the medicinal plants and use for common day ailment. Plant collectors are usually poor villagers and plant collection is there part time activity besides farming and live stock keeping. The women and children collect plants while on their way to work in the fields and surrounding areas of their work place (Farooque, 2002). The collectors carry with them digging tools and dig these medicinal plants wherever found. This type of collection of plants is carried out on daily basis.

Major proportions of plants collected are sold in fresh while some plants are stored in bags and sacks from one week to one year. Before storing, these plants are washed and kept under the sun for drying. The percentage of losses is much higher in the storage because the collectors are unaware about the proper storage methods of these plants. Similarly Hamayun *et al.*, (2006) explore folk medicinal knowledge and traditional pre and post harvesting techniques of some economically important medicinal plants of District Swat, Pakistan. It was also determined that traditional plant collection techniques have resulted in huge losses of these valuable plant resources. Women folk of the area provide the most valuable source of indigenous knowledge of plants.

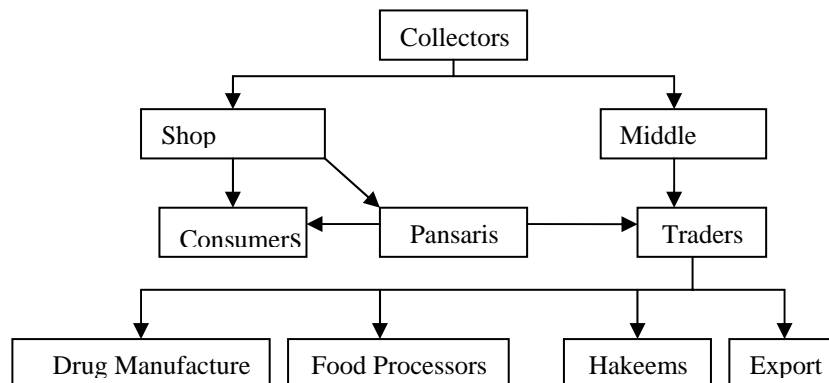


Fig. 1. Chain of people involved in the medicinal plant trade in Pakistan.

Protein contents in *Amaranthus viridis* are 34.2%, *Hedera nepalensis* 16.2% and *Urtica dioica* 22%. Fats in *Amaranthus viridis* are 5.3%, *Hedera nepalensis* 35.1% and in *Urtica dioica* 4%. Carbohydrates in *Amaranthus viridis*, *Hedera nepalensis* and *Urtica dioica* are 44.1, 10 and 30% respectively (Table 2). These three species show consistently high crude protein, variable but relatively low fat and relatively high carbohydrates. It is clear that these three selected underutilized species are an important source of protein for the local community of National Park. These are significantly higher in total protein than are local agricultural plants like sorghum (11.4% protein), millet (11.9% protein), and manioc (0.9% protein). Similarly Dhellit *et al.*, (2006) investigated the chemical composition and characterize nutritional status of oils of two varieties of *Amaranthus hybridus*.

During the present study, it was observed that these 6 selected underutilized species (*Adhatoda vasica*, *Amaranthus viridis*, *Artemisia scoparia*, *Galium aparine*, *Hedera nepalensis*, and *Urtica dioica*) belonging to different families were sold in local markets. Some of these medicinal plants are traded to national herb markets of Rawalpindi, Chakwal, Jhelum and Peshawar thus they play an important role in uplifting the socioeconomic conditions of the study area. Economic importance of wild plants was also studied by Rehman *et al.*, (2004). In this study 35 medicinal plants used by local community of Babuzai village in sakra mountain range (District Swat) were investigated to determine their economic importance as these plants are sold in local market.

Adhatoda vasica, *Artemisia scoparia*, *Galium aparine* have medicinal importance. *Amaranthus viridis*, *Hedera epilepsies* and *Urtica dioica* are not only important as food supplement for animals and local inhabitants of study area but also have some other commercial uses such as medicinal plants, essentials, fiber and dyes resources e.g., Nettles are one of the most undervalued of economic plants. Various parts of the nettle plant can be used as food, medicines, fibres, cosmetics, industry and biodynamic agriculture and is also very important plant for wildlife.

The study explicitly explains that these selected species have great medicinal and nutritional importance and can become a source of poverty alleviation of poor local community of study area, but proper harvesting and management is the need of time. These 6 underutilized species (*Adhatoda vasica*, *Artemisia scoparia*, *Galium aparine*, *Amaranthus viridis*, *Hedera nepalensis* and *Urtica dioica*) need to be conserved in their natural habitats. Better communication with local communities can raise and improve the awareness, importance and preservation of the diversity of these underutilized species and build capacity among stakeholders.

Table 1. Uses, part used, feeding season, mode of feeding and nutritional composition of selected underutilized species.

Species	Uses	Part used	Feeding season	Mode of feeding	Nutritional properties
<i>Amaranthus viridis</i>	HF	Lf, S	March- November	Leaves cooked as spinach.	Leaves contain 16.4% ash, 34.2% protein, 5.3% fat, 44.1% carbohydrate.
<i>Hedera nepalensis</i>	HF, F	Wp, S	Leaf all year/ seeds ripen from May to June	Seed cooked. Very small but easy to harvest and very nutritious	The seeds contain 8.6% ash, 16.2% protein, 35.1% fat and 10% carbohydrate
<i>Urtica dioica</i>	HF, F	Lf, Sh	March- November	Young leaves cooked as a potherb and added to soups etc.	<i>Urtica dioica</i> is very nutritious and contains 24% ash, 22% crude protein, 4% fat, 30% carbohydrate

F= Fodder, HF= Human Food, Lf= Leaf, S= Seed, Wp= Whole plant, Sh= Shoot

Table 2. Local prices, sold in dry or fresh form, sold in indigenous or local market and commercial utilization of selected underutilized species.

Species	Mk.Price	SoldDF	Sold in L/N market	CU	Other uses
<i>Adhatoda vasica</i>	45-55	B	B	MP	1. The leaves are rich in vitamin C and carotene and yield an essential oil. 2. Leaves are dried and smoked in the form of cigarettes.
<i>Artemisia scoparia</i>	20-35	B	B	MP	The seed and flowering stems contain 0.75% essential oil.
<i>Galium aparine</i>	30-45	F	B	MP	1. A red dye is obtained from a decoction of the root. When ingested it can dye the bones red. 2. The dried plant is used as tinder. 3. The plant can be rubbed on the hand to remove pitch (tar). 4. The stems are placed in a layer 8cm or more thick then used as a sieve for filtering liquids.
<i>Amaranthus viridis</i>	25-30	B	B	HF	1. Medicinal Plant 2. Yellow and green dyes can be obtained from the whole plant.
<i>Hedera nepalensis</i>	30-45	F	B	HF, F	MP: The leaves and the berries are said to be cathartic, diaphoretic and stimulant.
<i>Urtica dioica</i>	15-20	B	B	HF, F	1. Whole plant has medicinal uses. 2. A strong flax-like fiber is obtained from the stems used for making paper and cloth. 3. A hair wash is made from the infused leaves and this is used as a tonic and antidandruff treatment. 4. The roots and leaves produce strong dyes.

Mk.Pr= Market Price, L= Local, N= National, CU= Commercial Utilization, F= Fresh, D= Dry, B= Both, MP= Medicinal plants

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