ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES Knowledge to Innovation

Vol 6, Suppl 4, 2013

ISSN - 0974-2441

Research Article

TRADITIONAL HERBAL BASED DISEASE TREATMENT IN SOME RURAL AREAS OF BANDIPORA DISTRICT OF JAMMU AND KASHMIR, INDIA

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Received: 14 April 2013, Revised and Accepted: 9 May 2013

ABSTRACT

Objective: Plants have been traditionally used for hundreds of years as a source of medicine by indigenous people of different ethnic groups inhabiting various terrains for the control of various ailments afflicting humans and their domestic animals. Today not only the medicinal plants but also their associated traditional knowledge is threatened due to a range of both natural and anthropogenic factors. In this backdrop, urgent ethnobotanical investigations and subsequent conservation measures are required to save these resources from further loss. Present study was designed with the sole purpose of eliciting the firsthand precious wealth of information on the traditional medicinal uses of plants practiced by the people residing in far flung and remote areas of the Bandipora district of Jammu and Kashmir, India.

Methods: Frequent field trips and plant collections were made from various far flung and remote areas of the Bandipora district from March 2012 to September 2012. The district is floristically rich with sizable population of tribal communities and forest dwellers. Methods used to document the traditional knowledge included interviews and discussions with local knowledgeable persons, herbal healers called "*Bhoris*" and Tribals (*Gujjars* and *Bakkerwals*).

Results: A total of 25 different plant species belonging to equal number of genera and 21 different families were found to be used as effective remedies by the local people in their day to day life to cure various human and livestock ailments. Angiosperms comprised the highest number (23 species) followed by one pteridophytic and one gymnospermic species.

Conclusion: Traditional uses of medicinal plants against different ailments plays a significant role in meeting the primary health care needs of the local people especially rural communities of the study area. The information on traditional uses of plants could serve a useful source for pharmacologists, phytochemists, botanists and to those interested in the development of alternative therapies.

Keywords: Traditional knowledge, ailments, *Bhoris*, tribals, Bandipora.

INTRODUCTION

India and China are two of the largest countries in Asia which have the richest arrays of registered and relatively well known medicinal plants [1]. India endowed with a rich wealth of medicinal plants is unique in the use of plants/plant parts by all sections of people either directly as folk remedies in different indigenous systems of medicine or indirectly in the pharmaceutical preparations of modern medicine. The knowledge of medicinal plants has been accumulated in the course of many centuries based on different Indian systems of medicines such as Ayurveda, Unani and Siddha [2]. Rigveda and Atharveda which date back to 2000-1000 BC and several post Vedic treatises such as Charakasamhita (100 AD), Sushruthasamhitha (100-800 AD) and Dhanwanthari Nighantu (1200 AD) are the important ancient sources of information on medicinal plants [3]. Research interest and activities in the area of ethnomedicine have increased tremendously in the last decade. It has lead to the well established Asian systems of medicines including Ayurveda and Siddha of India, Unani system of Middle and East Asia, Ying and Yan principles of Chinese herbal medicines, Jamu of Indonesia and others [4].

Sixty percent of the world population and 80% of the population in developing countries rely on traditional medicine, mostly plant drugs, for their primary health care needs [5]. Out of the total known number of higher plants from India, approximately 46% are endemic to the Himalayas. Of the total medicinal plant species, 62 species of medicinal plants are endemic to the Himalayas and 208 species extend their distribution to the adjacent areas and are, therefore classified as near endemic [6]. Over 200 species of Himalayan medicinal plants are consumed as raw, roasted, boiled, fried, cooked, or they are used in the form of oil, spices, jams or pickles. The indigenous communities use some medicinal plant species as a source of food, fodder, timber as well as for various other ethnobotanical purposes. Out of the total 675 wild edible plant species of Himalaya, 171 species are used for the treatment of diseases. The crop plant diversity is also a source of traditional medicine [7]. In India, there are 550 ethnic tribes having rich traditional and indigenous knowledge of medicinal uses of different plants [8,2].

The state of Jammu and Kashmir, cradled in the lap of Himalayas, has been recognized as heaven on earth and is also called "Biomass" state of India. It is located in the far north of the Indian Republic and has a diverse variety of plant species especially those having medicinal properties due to wide variations in its topography and microclimatic conditions. Many studies have been carried out from time to time to document the traditional knowledge information of the medicinal plants from different areas of the region [9-18]. But so far as Bandipora district is concerned, a little amount of documented information is available [19,20,12]. Therefore, an attempt has been made in the present study with a view to document the medicinal plants that are used traditionally for the treatment of various diseases by the people living in the far flung and remote areas of this floristically rich district of Jammu & Kashmir state. Such studies would definitely prove useful for the identification of important medicinal plant species so that appropriate measures may be taken for their conservation.

MATERIAL AND METHODS

Study Area

Bandipora district is one of the 10 districts of Kashmir division in Northern India with a geographical area of 398 km^2. It is located on the northern bank of the Wular Lake- the largest fresh water lake in Asia. The district lies 34^0 64' N latitude and 74^0 96' E longitude and is situated at an average height of 1701 meters above mean sea level (AMSL). Most of area of the district is hilly terrain and is bounded in the west by district Kupwara, in the south-east by district Ganderbal

and in the east by district Kargil, Baramulla in the south and on the north side it is bounded by LOC (Line of Control). The climate of the district has its own peculiarities. The seasons are marked with sudden change and the climate can be divided into six seasons of two months each. These include, Spring (16 March to 15 May), Summer (16 May to 15 July), Rainy Season (16 July to 15 September), Autumn (16 September to 15 November), Winter (16 November to 15 January) and Ice Cold (16 January 15 March). All these seasons are locally known as '*Sont', 'Retkol', 'Waharat', 'Harud', 'Wandh'* and *'Shishur'* respectively. Winters are usually harsh due to heavy snowfall and low temperatures. The district is divided into three tehsils namely Bandipora, Gureiz and Sonawari (Fig. 1).

Methods

During investigation, frequent field trips and plant collections were made from various far flung and remote regions of the study area from March 2012 to September 2012. Methods used to document the traditional knowledge included interviews and discussions with local knowledgeable persons, herbal healers called "*Bhoris*" and Tribals (*Gujjars* and *Bakkerwals*). During surveys a total of about 79 informants were consulted who were between the ages of 37-98 years. A semi-structured and close-ended questionnaire [21] was used to gather the information about medicinal plants and their uses from local people especially those residing in hilly remote areas. Informants were asked questions in Kashmiri language that was understandable in most of the cases. However, Urdu language (official language of Jammu & Kashmir) was also used in tribal areas. In order to provide independent information, informants were separately asked to share their traditional knowledge on the utilization of medicinal plants such as the local name, plant part used, ailment(s) in which the part(s) of the plant is used and mode of administration. Data was collected according to an appropriate methodology [22-24].

With a view to bring an element of accuracy, the information was cross-checked with others. Efforts were made to collect the plants, from the natural habitats, in their flowering and fruiting stages. Field photographs of the plants were taken for easy identification and habitat recognition. Collected plants were dried, pressed, preserved (poisoned) and finally mounted on herbarium sheets by following a standard herbarium technique [25]. Plant specimens were identified and then accessioned by matching them with the labelled herbarium specimens lying in the departmental herbarium (KASH Herbarium) of Kashmir University, Srinagar (Jammu & Kashmir), where one copy of every specimen was deposited for authenticity and future use. Apart from that, available floristic literature [26-32] and various publications dealing with the flora of temperate regions were also consulted for identification purposes. Finally one more copy of every specimen was deposited in the herbarium section of the Department of Botany, Government Narmada Post Graduate College, Hoshangabad (M.P), for authenticity and future use.

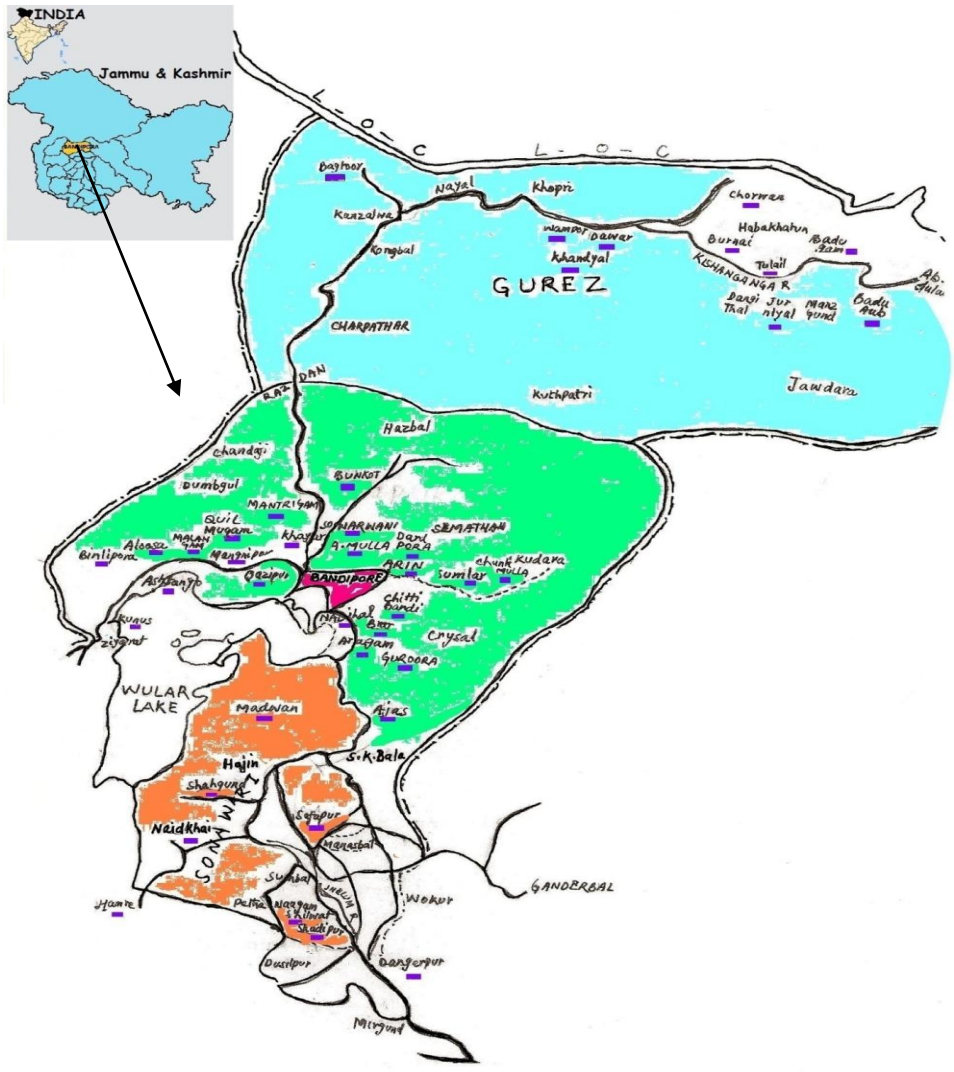


Fig.1: Map of Bandipora District (Study Area)

RESULTS AND DISCUSSION

Herbal remedies are considered the oldest forms of healthcare known to mankind on this earth. Medicinal plants are living resources, depletable if overused, but sustainable if used with care and wisdom. It is noticed that the people living in urban areas have almost no knowledge about medicinal properties of plants [33,34]. In rural areas however, the people especially elders have a sufficient knowledge about this prosperous natural treasure, which is gifted to mankind by God. The important factor supporting the use of plants to cure various ailments is the higher prices of allopathic medicine and the unavailability of better medical facilities [35]. Thus, rural communities have useful knowledge about various herbal remedies which they have received after generations of experimentation and is often kept as a heavily guarded secret. The ways they diagnose various ailments are very interesting because they live in the interior areas and lack the use of modern scientific equipments for diagnosis and treatment. They however treat diseases using locally available medicinal plants [36].

Topographically Bandipora district is mainly hilly and mountainous with stretches of plains. The area is full of natural beauty with thick forests. The hilly and mountainous areas of Bandipora district form an important northern part of Kashmir Himalaya. These areas remain cut off from the rest of the district at least for 2-3 months every year due to harsh climatic conditions such as heavy snowfall and low temperature (sometimes below minus 10^0C) during winter. Thus, the people have to depend upon wild resources for their daily needs.

During surveys, data regarding the traditional uses of plants was gathered by consulting people of different ethnic groups such as *Gujjars*, *Bakkerwals* and *Bhoris*. Besides, knowledgeable persons of the plains, who themselves have used these plant-based therapies for health treatments, were interviewed to prove veracity of the curative features of plants. All of them were asked for their consent to share their knowledge only for the purpose of study. *Gujjars* are generally permanent settlers at the foot hills of Himalayas and live in environment characterized by defined area with specific food habits, language, cultural homogeneity, a unified social organization and a unique way of nomadic life style (Fig.2). *Bakkerwals* on the other hand are goat/sheep herders generally. They are nomadic tribe and lead a lonely and tough life in the high altitude meadows of the Himalayas and Pir Panjal ranges [37]. While interacting with the *Bakkerwals* it was found that they actually belonged to far-flung Rajouri and Poonch districts of Jammu & Kashmir and visited the study area every year in the months of April and May [38]. They take their livestock animals high into the mountains, above the tree line to graze in the lush meadows. They travel by foot and it takes them more than thirty days to reach these meadows. They are accompanied by their dogs to guard the sheep/goats and their pack animals. During summer, they move from one meadow to another and ultimately leave the district in the months of August and September. However, some of them have settled permanently at the foothills of the Himalayas of the district. For example, a few could be easily found near Saderkoot Bala area of the Bandipora district, living there for years. Both these ethnic groups (*Gujjars* and *Bakkerwals*) have their own knowledge of traditional herbal medicine inherited from their fore-fathers. They have to rely on the traditional system as they do not have the modern medicinal facilities available in the vicinity.

Traditionally, *Bhoris* are the herbal medicine practitioners of this indigenous medicine system, who use to buy important medicinal plants from needy people living both in plains as well as in tribal areas [38]. They either visit the areas by themselves or the same people come to them for selling these plants. The people especially tribals, who sell herbal medicine in return get a little money to sustain their basic needs of livelihood. Bought medicinal plants are then prescribed and sold simply by establishing small shops not only in small villages but also in semi urban and urban areas. These practitioners commonly diagnose each health problem by an interview and by physical/visual inspection of the patient. Changes in eye and skin colour, tongue and throat regions, body temperature and status of sores are all visually inspected by the practitioner and the remedy is prescribed. Earlier prescribing herbal medicine to the patients by them was free of cost, because taking fees for any kind of treatment was highly discouraged as they bleaved that health care was an essential need and if a fee was charged that the poor might be deprived from treatment. In return, local people would provide them some donation in the form of cereals, pulses and vegetables. But now they not only prescribe herbal medicines but also sell it at the cost of money. However, the low cost of herbal medicine and its unlikely income is one of the reasons that youth of *Bhoris* are discouraged from carrying forward this ethnomedicine prescribing profession and this is the reason that only few *Bhoris*, practicing in this field, were found in the study area (Fig. 3).

It would be appropriate to mention here that, earlier, in the study area, *Bhoris* were mainly the Kashmiri Pundits (followers of Hinduism) who had vast deep rooted knowledge of prescribing the patients by traditional herbal medicine. This knowledge was descended to them from their forefathers in the form of oral folklores, and is not yet documented. They enjoyed high respect and social status among the communities. But due to uprising turmoil that started in 1989 in the valley, they left the district in order to defend themselves and migrated along with this precious knowledge to other parts of the country. This is the reason that a few abandoned shops that belonged to them were reported during the course of survey in the main market of Bandipora town (Fig. 4). Until they stayed in the district they shared their precious medicinal knowledge with some Kashmiri Muslims among whom a few at present are carrying forward and practicing this profession.

Fig. 2: Research scholar on field trip accompanied by a *Gujjar* at Zadkhushi Nallah Gureiz, Bandipora.

Fig. 3: Research scholar interviewing a *Bhori* at Shadipora (Bandipora)

Fig. 4: Two abandoned shops of *Bhoris* in the main market of Bandipora town.

All the medicinal plants collected in this study are described alphabetically on the basis of their botanical name below wherein each medicinal plant species is provided with its scientific name and author citation; followed by local name, family to which it belongs, flowering period, accession number, plant part(s) used, ailments in which plant/plant part(s) used and mode of administration.

***Actaea spicata* Linn.**

Local name: - "Banparthi"
Family: - Ranunculaceae
Flowering period: - May-June
Accession number: - 39278
Plant part(s) used: - Roots and fruits.
Ailments in which plant/plant part(s) used: - Sprains, wounds and paralysis.
Mode of administration: - Fresh roots are crushed and tied as poultice on sprains and wounds to give immediate relief from pains. Fruits and roots after complete drying are grinded into powder which is given to cattle with water against paralysis.

***Allium sativum* Linn.**

Local name: - "Rhoon"
Family: - Liliaceae
Flowering period: - June-August
Accession number: - 38867
Plant part(s) used: - Bulb/cloves
Ailments in which plant/plant part(s) used: - Stomach problems, hypertension, asthma, respiratory disorders, greenish diarrhoea, rodent repellent and eye vision.
Mode of administration: - Roasted bulbs/cloves are taken to cure stomach problems, hypertension and asthma. A mixture of crushed cloves with a small amount of water is packed in bottles. It is then given to poultry as a remedy against respiratory disorders and greenish diarrhoea. The same mixture is also sprayed around the poultry so as to check the rodent attack. Eye stick is first pierced through the clove and then applied in between the two eyelids to improve the eye vision.

***Brassica compestris* Linn.**

Local name: - "Telgogul"
Family: - Brassicaceae
Flowering period: - April-June
Accession number: - 38848
Plant part(s) used: - Seeds
Ailments in which plant/plant part(s) used: - Hair fall, dandruff, rheumatic pains, thorns pricks and skin eruptions.
Mode of administration: - Oil extracted from seeds is applied on scalp to nourish hair, prevent hair fall and to check dandruff. The oil is gently warmed and massaged on painful joints to cure rheumatic pains. It is also applied externally to ease the removal of spines and thorns. Oil after mixing with candle wax is warmed. The preparation so formed is locally called "*Shamma Teel*". During winter the same is applied on exposed body parts such as face, hands and feet as a moisturizer and to cure skin eruptions. The seed cakes locally known as "*Khaej*" are given to bulls in a mixture of water and paddy chaff to maintain their vitality and vigour and cows to enhance milk production. Moreover the oil forms an important ingredient of many medicinal preparations.

***Citrullus colocynthis* (Linn.) Schrad.**

Local name: - "Hoon Haendwaend"
Family: - Cucurbitaceae
Flowering period: - June-August
Accession number: - 38909
Plant part(s) used: - Roots
Ailments in which plant/plant part(s) used: - Toothache
Mode of administration: - Roots are collected and then sun dried. These dried roots are chewed to cure tooth ache.

***Cynodon dactylon* (Linn.) Pers.**

Local name: - "Dramun"
Family: - Poaceae
Flowering period: - April-November
Accession number: - 38829
Plant part(s) used: - Whole plant
Ailments in which plant/plant part(s) used: - Body muscular pains, thirst, common cold, fever, kidney and gall stones, dysentery, general body weakness, burning of feet, eye disorders and weak vision.
Mode of administration: - Whole plant along with the seeds of *Malva neglecta* and *Cucumis sativa* is boiled to get a composite decoction which is given to cure body muscular pains, thirst, common cold, fever, kidney and gall stones, dysentery and general body weakness. Walking bare foot on dew drops spread over mats of this plant early in the morning is considered to alleviate burning of feet, eye disorders and weak vision.

***Cypripedium cordigerum* D. Don**

Local name: - "Pholaan"
Family: - Orchidaceae
Flowering period: - June-July
Accession number: - 38842
Plant part(s) used: - Rhizome
Ailments in which plant/plant part(s) used: - Joint pains, heart palpitations and weakness.
Mode of administration: - Fresh leaves are used as vegetable. Rhizomes are dried, ground into powder and then mixed with wheat flour and sugar. The mixture is then fried in ghee to prepare Halwa. Later is given in case of joint pains, heart palpitations and as tonic.

***Dipsacus inermis* Wall.**

Local name: - "Wopal Hakh"
Family: - Dipsacaceae
Flowering period: - July-August
Accession number: - 38902
Plant part(s) used: - Leaves
Ailments in which plant/plant part(s) used: - Cough, general body weakness, tightening of blood vessels, pain and swelling of body parts and defective milk production.
Mode of administration: - Fresh leaves are used as vegetable for the treatment of cough, general body weakness and tightening of blood vessels. Dried leaves are boiled in water to prepare decoction which is used to wash the swollen body parts to cure their swellings and pains. Decoction is also given to cows, sheep and goats immediately after delivery to keep them healthy and enhance their milk production.

***Dryopteris barbigera* (Moore) Kuntze**

Local name: - "Dade"/"Kunji"
Family: - Pteridaceae
Flowering period:- Non-flowering (reproducing by means of spores).
Accession number: - 39276
Plant part(s) used: - Leaves and rhizome.
Ailments in which plant/plant part(s) used: - Constipation, worms and dysentery.
Mode of administration: - At juvenile stage leaves are cooked and used as vegetable for the treatment of constipation. Dried rhizome

powder is given to children with water or milk against worms. Rhizome decoction is given against dysentery.

***Lychnis coronaria* (Linn.) Desr.**

Local name: - "Shosh Ghasa"/"Angaarda"
Family: - Caryophyllaceae
Flowering period: - June-July
Accession number: - 38876
Plant part(s) used: - Roots
Ailments in which plant/plant part(s) used: - Constipation and chronic cough.
Mode of administration: - Crushed roots are added to a glass of water which is then kept outside open to the environment for overnight. The same extract is administered orally in case of constipation and chronic cough.

***Mentha longifolia* (Linn.) Huds.**

Local name: - "Veina"/"Jungli Pudnah"
Family: - Lamiaceae
Flowering period: - August-September
Accession number: - 38871
Plant part(s) used: - Leaves
Ailments in which plant/plant part(s) used: - Fever, headache, flatulence and digestive disorders.
Mode of administration: - Sun dried leaves are grinded to make powder which is mixed with lukewarm water to make an infusion. Infusion so prepared is widely used in the treatment of fever, headache, flatulence and digestive disorders.

***Oxalis corniculata* Linn.**

Local name: - "Khatti Golda"
Family: - Oxalidaceae
Flowering period: - June-September
Accession number: - 39287
Plant part(s) used: - Leaves
Ailments in which plant/plant part(s) used: - Gum bleeding, jaundice and stomach disorders.
Mode of administration: - Fresh leaves are rubbed over teeth to keep them clean and stop bleeding of gums. Fresh leaves are also eaten against jaundice and stomach disorders.

***Papaver dubium* Linn.**

Local name: - "Rut Gulala"
Family: - Papaveraceae
Flowering period: - May-July
Accession number: - 38831
Plant part(s) used: - Flowers
Ailments in which plant/plant part(s) used: - Skin problems and weak memory.
Mode of administration: - Flower petals are grinded to make powder which is mixed with cow butter to make paste. Paste is applied on hands and feet as a moisturizer. Flower powder is also administered orally with milk to enhance memory.

***Pinus wallichiana* A. B. Jacks.**

Local name: - "Kayur"
Family: - Pinaceae
Flowering period: - May-June
Accession number: - 38844
Plant part(s) used: - Resin
Ailments in which plant/plant part(s) used: - Boils, wounds, insect repellent, wormicide and intestinal infections.
Mode of administration: - Resin (locally called "*Kilam*") is obtained from the young trees and applied on painful boils and wounds to stimulate their healing. It is also applied on the limbs to check the attack of water borne insects, particularly at the time of rice transplantation. Resin is applied at the tip of nose of children to stimulate the expulsion of round worms. To cure intestinal infections, resin is made into small pills which are administered orally with milk.

***Plantago lanceolata* Linn.**

Local name:-"Kashur Gulla"/"Chamchipeti"
Family: - Plantaginaceae
Flowering period: - May-September
Accession number: - 38827
Plant part(s) used: - Whole plant
Ailments in which plant/plant part(s) used: - Stomach acidity, vision and hearing problems, body pains, urinary irritation, dysentery, constipation, fever and yoke gall.
Mode of administration: - Young leaves are used as vegetable. Whole plant decoction with sugar is given to cure stomach acidity, to improve eye vision and hearing capability. Dried seeds are added to warm water to make an infusion which is then kept outside open to the environment for overnight. The cool infusion so prepared is then given on an empty stomach to cure body pains, urinary irritation, dysentery, constipation and fever. The herb is crushed and juice is obtained which is applied topically to cure yoke gall of bulls.

***Polygonum hydropiper* Linn.**

Local name: - "Chock Chine"
Family: - Polygonaceae
Flowering period: - July-September
Accession number: - 38898
Plant part(s) used: - Leaves
Ailments in which plant/plant part(s) used: - Abdominal pain, dysuria, high blood pressure, stomach heat up, and jaundice.
Mode of administration: - Leaves are used as vegetable. Leaf decoction is administered orally against abdominal pain, dysuria, high blood pressure, stomach heat up, and jaundice.

***Prunus persica* Linn.**

Local name: - "Chenun"
Family: - Rosaceae
Flowering period: - April
Accession number: - 38885
Plant part(s) used: - Fruits and leaves
Ailments in which plant/plant part(s) used: - Indigestion, cough, worms, joints pain, wounds, chilblain, burns
Mode of administration: - Fruits are edible and are used to cure indigestion. Fresh leaves are crushed to obtain juice which is taken orally against cough and worms. Fresh leaves after soaking in hot water are tied on pain full joints as poultice to alleviate pain. Fresh leaves are crushed to form poultice which is applied on non-healing wounds to stimulate quick healing both in humans and domestic livestock. Dried leaves and salt are vigorously boiled in water to prepare hot water extract which is used to wash the feet during severe cold in winter to treat Chilblain. Paste is made by mixing the ash produced by burning of fruits with mustard oil. This paste is then applied on fresh burns to avoid blister formation and stimulate quick healing.

***Pyrus communis* Linn.**

Local name: - "Faraish Tung"
Family: - Rosaceae
Flowering period: - May
Accession number: - 38839
Plant part(s) used: - Fruits
Ailments in which plant/plant part(s) used: - Chronic constipation, kidney stones, heart palpitation and urinary problems.
Mode of administration: - Ripe fruits are eaten as best home remedy against chronic constipation, kidney stones, palpitation of heart and also as diuretic.

***Raphanus sativus* Linn.**

Local name: - "Mujh"
Family: - Brassicaceae
Flowering period: - June-July
Accession number: - 38835
Plant part(s) used: - Roots
Ailments in which plant/plant part(s) used: - Indigestion, loss of appetite, jaundice, urinary problems and chronic constipation.
Mode of administration: - Roots are crushed to obtain juice which is used to cure indigestion, loss of appetite, jaundice, urinary problems and to stimulate stool evacuation during chronic constipation.

***Sisymbrium irio* Linn.**

Local name: - "Cheri Laschij"
Family: - Brassicaceae
Flowering period: - May-July
Accession number: - 38896
Plant part(s) used: - Seeds
Ailments in which plant/plant part(s) used: - Fever, body muscular pains, headache, cough, cold, measles.
Mode of administration: - Seed decoction is given to combat fever and body muscular pains. Seeds are dried, ground into a powder then mixed with water to make paste which is applied externally on forehead to cure headache. A mixture of seed powder, common salt and water is made into semi-solid balls which are given to cattle (especially horses) in winter against cough, cold and to keep them healthy. Seeds are spread on the bed and children suffering from measles are advised to sleep on the same bed. This is bleaved to facilitate the complete appearance of measles over the whole body and its subsequent disappearance.

***Solanum nigrum* Linn.**

Local name: - "Kambai"
Family: - Solanaceae
Flowering period: - June-October
Accession number: - 38912
Plant part(s) used: - Fruits
Ailments in which plant/plant part(s) used: - Stomach problems, jaundice, constipation, palpitation of heart and defective eye vision.
Mode of administration: - Ripe fruits (berries) are considered to be highly nutritive and are eaten fondly to cure stomach problems, jaundice, constipation, palpitation of heart and to enhance the eye vision.

***Sonchus arvensis* Linn.**

Local name: - "Dudh Kandij"
Family: - Asteraceae
Flowering period: - June-September
Accession number: - 38856
Plant part(s) used: - Latex
Ailments in which plant/plant part(s) used: - Boils, wounds and defective milk production.
Mode of administration: - Plant yields milky latex which is used for the treatment of boils and wounds by applying it externally. Fresh plants are fed to cows and goats to enhance their milk production.

***Thymus linearis* Benth.**

Local name: - "Jangli Javind"
Family: - Lamiaceae
Flowering period: - May-July
Accession number: - 38850
Plant part(s) used: - Whole plant
Ailments in which plant/plant part(s) used: - Cough, cold, fever, dropsy, pneumonia, indigestion, loss of appetite, asthma, chest infections and wounds.
Mode of administration: - Aerial portion is boiled and decoction is made which is given to domestic livestock to cure cough, cold and fever. In case of humans the same decoction is given against dropsy. Seed powder is mixed with oil to make paste and the resultant paste is gently warmed and finally applied externally on chest in children to cure pneumonia. In case of adults, powder is mixed with sugar and taken orally with water against cough, cold, fever, indigestion, loss of appetite, asthma, chest infections by removing phlegm. Dried root powder is applied directly on wounds to remove pus and stimulate the quick healing.

***Trapa natans* Linn.**

Local name: - "Gaer Kul"
Family: - Trapaceae
Flowering period: - June-July
Accession number: - 38855
Plant part(s) used: - Fruits
Ailments in which plant/plant part(s) used: - Chronic constipation, diabetes, leucorrhoea and cancer.
Mode of administration: - Fresh fruit kernels eaten raw in case of chronic constipation. Dried kernels are grinded to make powder which mixed with hot water to make a lotion locally called as *"Aertz"*. *"Aertz"* is taken against diabetes and leucorrhoea in females. It is also taken along with curd against cancer.

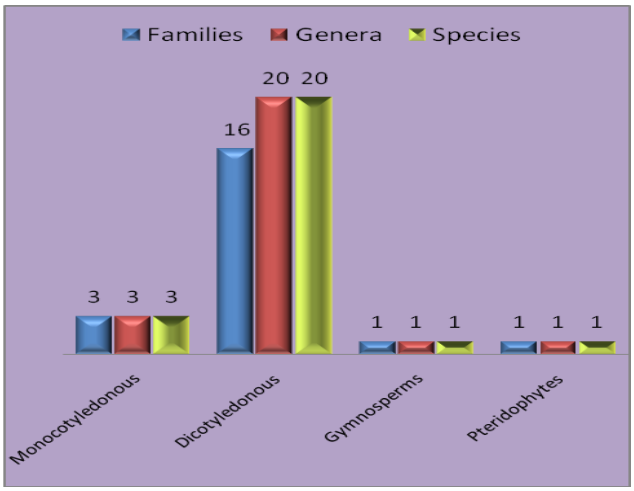
***Trigonella foenum-graecum* Linn.**

Local name: - "Meth"
Family: - Fabaceae
Flowering period: - May-July
Accession number: - 38828
Plant part(s) used: - Seeds
Ailments in which plant/plant part(s) used: - Diabetes, body pains, cold, itching of eyes, constipation, heart and liver problems, menstrual irregularities, stomach problems (ulcers, pain, acidity), intestinal infection and lumbago.
Mode of administration: - Dried seeds are chewed and swallowed to cure diabetes, body pains, cold and itching of eyes. Seed decoction is given to cure constipation, heart and liver problems. Seed decoction with turmeric and common salt is also given to ladies to check menstrual irregularities. Seed powder after mixing with honey is given to cure stomach problems (ulcers, pain and acidity) and intestinal infection. Dried seeds are cooked with rice to prepare a dish locally called as "*Braisth Bath*" which is taken to cure lumbago.

***Viola odorata* Linn.**

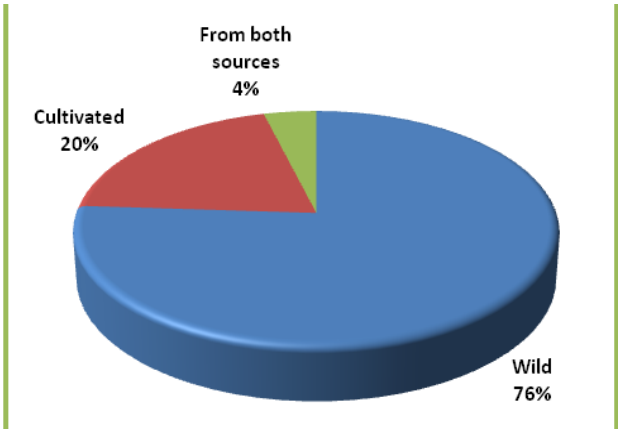
Local name: - "Nunposh"/"Bunfsha"
Family: - Violaceae
Flowering period: - May-July
Accession number: - 38870
Plant part(s) used: - Flowers
Ailments in which plant/plant part(s) used: - Cough, cold, throat infection and swelling, chest congestion, hoarseness of voice, body muscular pains, headache and bronchitis.
Mode of administration: - Sundried flowers and sugar after mixing are crushed. The mixture is then kept in a closed jar for about 10-15 days for fermentation. This fermented mixture is locally called as *"Khambiri Banafsha"*. It is given to cure cough, cold, sore throat, hoarseness of voice, body muscular pains, headache and bronchitis. Sometimes *"Khambiri Banafsha"* is added to a famous Kashmiri sweet drink *"Kehwa"* to treat above mentioned problems.

Thus, as a result of present investigation, a total of 25 different plant species belonging to an equal number of genera and 21 different families were found to be used as effective remedies by the local people to cure various human and livestock ailments. Out of 25 species, angiosperms comprised the highest number being represented by 23 species followed by one pteridophytic and one gymnospermic species. Dicotyledonous and monocotyledonous were represented by 20 species in 20 genera and 16 different families, and by 3 species in 3 genera, 3 different families, respectively (Graph 1)



Graph 1: Number of families, genera and species of different classes of tracheophytes.

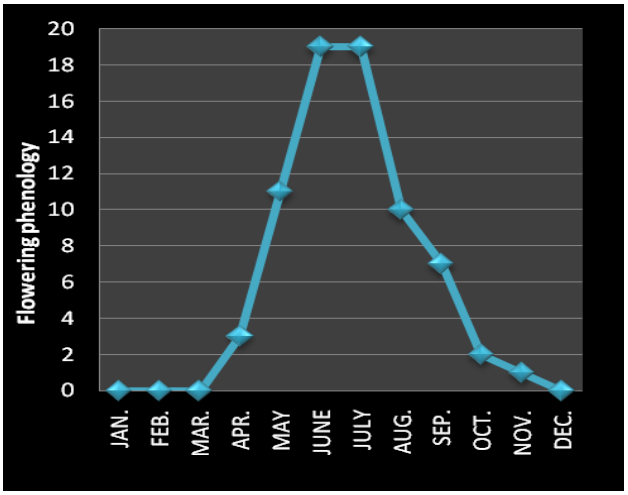
Though gymnosperms were represented by less number of taxa, they formed the dominant component in the forests of the study area on account of congenial physiographic conditions and altitudinal locations of the area. Out of the 25 species, 16 species were alone used as human medicine, 9 species were used for treating both human and livestock ailments but no species was reported to be used alone for the treatment of livestock ailments. The presence of these medicinal plant species and the associated ethnomedicinal knowledge in the district indicates that the area has a high diversity of medicinal plant species and is a site of precious indigenous knowledge. Amongst the species, 19 species were collected from the wild, 5 species from cultivation and only one species from both the sources (Graph 2). This indicates that the residents mainly depend on the wild source or the natural environment rather than on home/vegetable gardens to obtain the medicinal plants, and the activity of cultivating medicinal plants is very poor in the study area. It also indicates that the natural forests of Bandipora district are over-exploited by the local people particularly by *Gujjars*, *Bakkerwals* and traditional practitioners (*Bhoris*) for their medicinal plants compositions.



Graph 2: Availability of medicinal plants from various sources.

At some places it was also found that the richness of medicinal plants particularly the herbs decreased with increasing altitude but the percentage of plants used as medicine steadily increased with increasing altitude. The reason for this was due to preferences given to herbal medicines at high altitude areas as well as having no alternative choices, poverty and trust in the effectiveness of traditional herbal medicines. Similar findings were also reported in other ethnobotanical investigations [39,40].

The highest number of medicinal plants were recorded in Brassicaceae family (3 species) followed by Lamiaceae and Rosaceae (2 species each) while all other families were monotypic and included only one species. The general flowering calendar of collected medicinal plants depicted that maximum number of plant species were in flowering stages in the month of June and July followed by May, August and September whereas no plant species was reported in the flowering stage in the months of January, February, March and December (Graph 3). The species in flowering over 8 months of the year first shows an increasing trend reaching maximum in the month of June and July and then falling again. This trend of flowering during summer is attributable to the physiography of the study area, since a considerable portion of the study area remains covered with snow till the end of May, which prevents seedlings and other vegetative parts from coming out of the soil. One more reason for frequent occurrence of the majority of the medicinal plants species in summer season (June-July) in comparison to other seasons of the year could be attributed to the suitable temperature, enough moisture and availability of macronutrients [41]. The finding on existence of majority of the collected plants in flowering stage in the months of June and July is in accordance with other works [42].

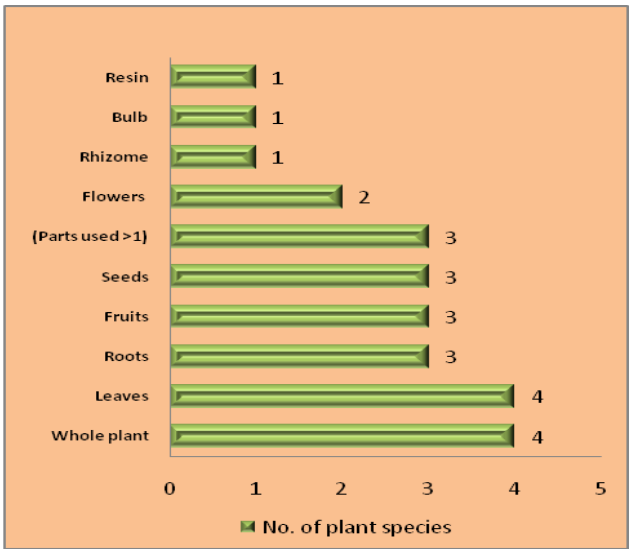


Graph 3: Flowering phenology of collected medicinal plants of Bandipora district.

As far as the life form (habit) of medicinal plants is concerned, herbs constituted the highest proportion being represented by 21 species followed by trees (3 species) and sub-shrubs (1 species). This finding is in conformity with earlier findings [43-52,19] where herbaceous medicinal plants were also reported to dominate. This could be associated to the abundance and year round availability of herbaceous species in the study area.

Regarding the life span of medicinal plants, perennials made up the highest proportion, being represented with 16 species, followed by annuals (8 species) and biennials (1 species only). On the basis of nature of habitat of collected medicinal plants, the highest number were represented by xerophytes (21 species) followed by mesophytes (3 species) and hydrophytes (1 species only). The maximum number of xerophytes was probably due to physiologically non-availability of usable form of water.

While on the basis of the plant parts used, maximum number of plant parts used were leaves and whole plants (4 species for each) followed by roots, seeds, fruits and parts greater than one (3 species for each), flowers (2 species), bulb, rhizome and resin (only one species for each) to cure various ailments (Graph 4). Mostly plant parts were used for herbal preparations in dried form rather than in fresh form and it was found that dried plant parts were stored for later season especially for the months of winter during which the life in the entire district becomes very tough and medicinal plants become scarce.



Graph 4: Number of plant parts used to cure various ailments.

Medicinal plants were used through different modes of preparation for curing various ailments, ranging from simple to highly complicated. The various forms included powder, paste, poultice, decoction, juice, infusion, lotion and raw. However, in the present study decoction constituted the highest type of preparation form, followed by paste, raw, powder, infusion, juice, poultice and lotion. In the preparation of various remedies water was most frequently used as solvent/dilutant but occasionally herbal formulations were prepared with milk, oil or ghee - clarified butter made from cow's milk [53,54]. Besides all these, human saliva was also used in some circumstances as dilutant in the preparation of remedies. Availability could be one of the criteria used in the selection of solvents/dilutants. This is in accordance with earlier findings [55].

Furthermore, most of the formulations were found to be prepared and administered at household level, which is in agreement with other studies [56,55]. Sometimes, when necessary, people would seek the help of knowledgeable persons in their respective localities with no or meager charges. Majority of the informants, however, reported that they kept their medicinal plant knowledge secret. They further revealed that free transfer of knowledge could only take place along the family line, usually from parents to sons and that is why in present study males were found to have a rich traditional knowledge of medicinal plants than females.

Of the collected medicinal plant species, only 1 species was used for the treatment of single ailment, 2 species for the treatment of two ailments while majority of species ware used to treat more than two ailments. Since, a majority of documented plant species were used for the treatment of more than one disease; it is very difficult to assess which plant is actually effective in curing a particular disease. Thus only clinical trials on these plants can give some indications. Majority of the collected plant species were also found to be medicinally used in other parts of Kashmir. Such widespread use of these plants by different groups of societies in Kashmir could be attributed for their efficacy against various ailments.

Results also reveal that a major proportion (75%) of folk medicinal knowledge comes from people above the age of 55 years, while a small proportion (25%) of it comes from people between the ages of 37 and 50. This finding is up to some extent in accordance with other investigations [57,58]. Gender wise, men especially old ones had more traditional knowledge about medicinal plants and their uses than females. This may be attributed to two reasons. Firstly, because of the involvement of males in collection and trade related activities. Secondly, higher reaches had been under seize of security forces since decades in response to terrorist threats thus posing hindrances in the movement of women. Informants below the age of 50 years were reported less aware of the potential of medicinal plants than their older counterparts who have also gathered knowledge from the point of view of their traditional healthcare and their day to day practices. This difference in the perception of the two age classes will likely result the knowledge loss over time. Discussions and interviews with old and young people and also with *Bhoris* indicated that the attitude of the younger generation was not towards continuing these traditional practices because they realized that there is less opportunity in this tradition for getting immediate benefits mainly in terms of cash in the form of money.

In the present investigation, it was noticed that the majority of the species (19 species) used for medicines were collected from the wild sources, 5 species from cultivation and only 1 species from both the sources. It is well known fact that the wild populations of medicinal plants are the main sources of raw materials to the pharmaceutical industries [59]. The local inhabitants, who lived at high altitudes, were found to impose a great deal of pressure on medicinal plant populations because at higher altitudes health care facilities were almost nonexistent and people met their medicinal requirements with forest products. At lower altitudes people also used medicinal plants, but owing to better infrastructure, they also used nearby health centers for the treatment of various diseases. In Bandipora district, various factors that are considered as main threats to medicinal plants were recorded by interviewing the informants. The major factors claimed were increasing population of the area, indiscriminate harvesting by unskilled gatherers, over-grazing by animals, developmental works, deforestation, agricultural expansion, lack of job opportunities, increased marketing pressure and trading of charcoal and firewood. In the lap of the dense forests of Bandipora district, work on 330 MW Kishenganga Hydro Electric Power Project by Hindustan Construction Company (HCC) was found on during the course of study. The company was reported violating the environment conservation norms and not only destroying the scenic topography but also causing destruction of valuable plant resources including beautiful coniferous trees and other crucial medicinal plants. Efforts to conserve medicinal plants in the district were observed to be very poor. It has been already reported in India that, most of the traditional ethnobotanical knowledge is eroding at faster rate day after day due to losses of the ancient traditions and cultures as they are mostly oral [60].

Thus, it is evident from the present investigation that, if the above mentioned factors continue to operate in the area of study, there will be a time in near future when majority of these plants find their place in different threatened categories as described by IUCN. With a view to protect these natural resources, medicinal plants must be looked after and managed. In order to conserve these resources, local people should be actively involved in the implementation, planning, evaluation and monitoring processes of plans and projects, as they are not only the well known persons but also beneficiaries of the area. The following efforts need to be made to conserve the existing medicinal flora of the Bandipora district and to reap the greatest benefits from the available resources:

- The thinking of people must be changed about current indiscriminate harvesting practices which can be done by skill development, training and attitudinal change.
- The cultivation of medicinal plants should be encouraged more and more and steps should be taken to promote their vegetative propagation through grafting, layering, cuttings and also by employing various propagules such as roots, rhizomes, bulbs, corms and buds.
- Local people must be involved as leaders of activities geared towards environmental conservation awareness and this can be done by local organizations. It would be better, if local school teachers and religious leaders are involved in such awareness programmes.
- More and more attention should be paid by the concerned authorities to facilitate the sustainable use of medicinal plant resources.
- The medicinal plants should be harvested on priority for one's own consumption and not for commercial purposes.
- For proper conservation and sustainable utilization, rules and regulations at community level should be implemented, with the help of dignitaries of the community, so that the goal of economic development could be achieved in parallel with the goal of ecosystem conservation.
- Short training courses should be organized for the collectors, farmers and traders on designed module covering the areas of proper identification, collection and cultivation of medicinal plants and to improve processing and post harvest treatment of crude drugs.
- Lessons learnt from success stories should also be implemented at wider scale to train local people for the cultivation of medicinal plants.
- Important medicinal plants should be subjected to thorough pharmacological investigation so that new potent compounds could be discovered as there is no doubt that botanic gems are still found in the world.
- Small domestic industries such as beekeeping, gardening, handicrafts etc. must be encouraged through social organizations within the local communities so that the pressure on medicinal plants for their trade can be reduced to a great extent.
- Reforestation activities must be encouraged to reduce pressure on fuel wood and fodder species and alternate sources like gas cylinders and energy-efficient cook stoves should be made available to local people especially those

who are poor and needy which may lead to a 25–40% fuel saving.

- Both in-situ and ex-situ conservation of medicinal plants in the study area should be promoted and the district's Traditional Healers Association should be supported, by providing funds, suitable land for cultivating medicinal plants and assistance in their activities with professional guidance which will definitely help in conservation of the fast eroding precious medicinal plants of the study area.

CONCLUSIONS

An indispensable obligation for sustaining the medicinal and cultural resources of mankind is the preservation and recording of ethnomedicinal uses of plants. Such an effort is widely considered as an asset for the welfare of present and future generations and extensive research on such traditional plants is of prime importance to scientifically validate their ethnomedicinal claims. Keeping in view the high cost and side effects of allopathic medicine, the use of medicinal plants against different ailments plays a significant role in meeting the primary health care needs of the local people especially rural communities of the study area. Bandipora district is fairly rich not only in medicinal plant species but also has deeply rooted traditional knowledge of these medicinal plants associated with the people. An immensely valuable database could be the outcome of this knowledge which in turn could provide baseline information for the commercial exploitation of bioresources. Besides, the information could prove a useful source for pharmacologists, phytochemists, botanists and to those interested in the development of alternative therapies provided that they work collaboratively. In addition to this, the utilization of indigenous plant-based drug resources will increase the importance of the local industry on the one hand and will minimize the expenditure incurred on the purchase of foreign drugs on the other. Hence there is a need for the inclusion of herbal medicines at primary health care level, since their long standing use as plant drugs without toxic effects would reasonably guarantee their medical efficacy and safety.

AKNOWLEDGEMENTS

We are sincerely thankful to Mr. Anzar Ahmad Khuroo (Assistant Professor) and Mr. Akthar H. Malik (Curator, KASH Herbarium), Centre of Plant Taxonomy, Department of Botany, University of Kashmir for their help in identification of plant species. Thanks to the knowledgeable and experienced persons of the study area whom we consulted during the course of field observations. Financial assistance provided by Department of Science and Technology (DST), New Delhi, Government of India is duly acknowledged.

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