

Conservation of indigenous knowledge of medicinal plants of Western Himalayan region Rawalakot, Azad Kashmir, Pakistan

Sajjad Hussain*¹, Ghulam Murtaza¹, Ansar Mehmood*² and Rizwana Aleem Qureshi³

¹Department of botany, University of Azad Jammu and Kashmir (UAJK) Muzaffarabad, Pakistan

²Department of Botany, University of Poonch Rawalakot (UPR), Rawalakot, Pakistan

³Department of Plant Sciences, Quaid-e-Azam University (QAU), Islamabad, Pakistan

Abstract: The aim of present was to document indigenous knowledge of medicinal plants traditionally used by inhabitants of Rawalakot Azad Kashmir and to screen selected medicinal plants for their antibacterial potential. Several field surveys were conducted to document indigenous knowledge of medicinal plants through interviews from local inhabitants during 2010-2013. During the study, 58 plant species, belonging to 37 families, were identified and their medicinal uses were recorded. Ethnobotanical data indicates that inhabitants of Rawalakot use medicinal plant mainly for the treatment of stomach, liver and sexual disorders. Usually fresh plant materials were used for medicinal preparations and administered orally. Among all the species studied, three most frequently used medicinal plants *Achillea millefolium*, *Berberis lycium* and *Zanthoxylum armatum* were screened for their antibacterial potential by using disc diffusion method. The crude aqueous, petroleum ether and ethanolic extracts were found to be very active against selected bacterial strains. The present study contributes significantly to the medicinal plant knowledge and shows that medicinal plant knowledge is deteriorating among younger generations. Therefore, further research is needed to document indigenous knowledge, to find conservation status of medicinal plant species and to find antimicrobial compounds for more sophisticated usage of medicinal plants in future.

Keywords: Medicinal plants, Rawalakot, Western Himalaya, conservation, indigenous knowledge, antimicrobial activity

INTRODUCTION

Medicinal plants have been used for the treatment of both microbial and non-microbial ailments for many centuries (Akinyemi *et al.*, 2006). There are more than 35,000 plant species being used in various human cultures around the world for medicinal purpose (Philip *et al.*, 2009). Himalaya is known to provide support to large number of people (Sarver *et al.*, 2009). Rural population is economically weak and largely depends on plants for medicines (Kothari *et al.*, 1989). In Himalaya about 70% of the plants are medicinal and more than 70% of the population depends on these medicinal plants (Bano *et al.*, 2011, Shaheen *et al.*, 2011). In Pakistan out of about 5700 (Stewart, 1972) to 6000 species (Shinwari 2004) of vascular plants 400-600 species are medicinal. In 1950s up to 84% of Pakistan population was dependent on traditional medicines for treatment of all or most of their diseases (Shaheen *et al.*, 2011; Bano *et al.* 2011). Bano *et al.* (2011) studied the ethnobotanical and conservation status of flora of Azad Kashmir and its allied areas and reported 168 ethnobotanically important species. Out of these plants, 140 have medicinal uses. Khan *et al.* (2010) conducted vegetation survey of selected localities of Poonch valley Azad Kashmir and recorded 56 medicinal plant species. They concluded that indigenous knowledge came from aged women between ages of 29-50. An ethnobotanical survey was carried out by Shaukat *et al.*

(2012) from five villages of Bangion Rawalakot reported 26 important medicinal plants of 19 families. Azad Kashmir is rich in medicinal plants and local population of area widely depends on plants for medicines and other domestic and commercial purposes. The recorded threats to the flora of area are unawareness and poor living status (Gorsi and Shahzad, 2002; Ishtiaq *et al.*, 2006). There is a need to document ethnobotanical knowledge and conservation status of flora of area for safe and scientific use of plant wealth.

Natural products play important role in the pharmaceutical industry (Baker *et al.*, 1995) as over 50 % of all modern clinical drugs are of natural products (Steffens and Douros, 1982). Due to increase awareness of limited range of synthetic products and their possible negative effects has led to discover new natural products from plants for treatment of diseases. The effects of plant based products have been studied by number of workers (Reddy *et al.*, 2001; Ates and Urdogru, 2003) and much of work has been done on ethnomedicinal plants (Maheshwari *et al.*, 1986).

MATERIALS AND METHODS

Materials and methods section is divided into two subsections i.e. Ethnobotanical survey and Antimicrobial activity.

*Corresponding author: e-mail: ansar.mehmood321@gmail.com

Ethnobotanical survey

Study area

Azad Jammu & Kashmir comprises foothills of Western Himalayas with an area of about 13,269 Km² lies in the North-east of Pakistan. Rawalakot (also called Pearl Valley) is one of the tehsil of District Poonch of Azad Kashmir (Fig.1). It occupied an area of about 381 Km² and is located between 73° to 75° east longitude and 33° to 35° north latitude at the elevation ranging of 3500 ft to 8700 ft above the sea level. The study area is hilly and mountainous and can be divided into subtropical, temperate and alpine zones. The climate of Rawalakot is predominantly moist temperate to alpine with cold winter and moderately hot summer.

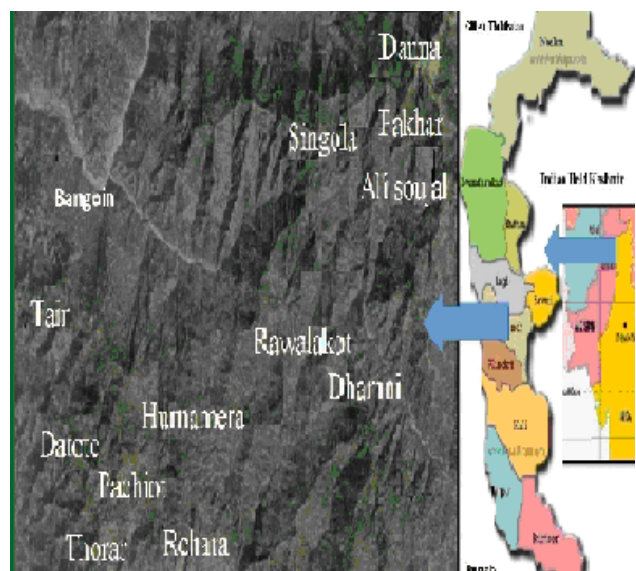


Fig. 1: Geographic location of study area (Right) and satellite imagery of sampling sites (Left):

Field surveys and data collection

Field surveys were conducted during 2010- 2013 to document indigenous knowledge of medicinal plants through interviews and by questionnaire from local inhabitants. During the surveys local inhabitants were selected based on age and gender (table 1).

Plant identification

Collected plant specimens were pressed, dried and mounted on herbarium sheets and identified by comparing with identified herbarium specimens at Quaid-e-Azam University Islamabad and with the help of Flora of Pakistan (Nasir and Ali, 1970-1979; Nasir and Ali, 1980-1989; Ali and Nasir, 1989-1992; Ali and Qaiser, 1993-1995 & 2000-2008). Finally the medicinal plant inventory included vernacular names, uses, parts used and derived botanical names. All the specimens were deposited in herbarium of Department of botany Azad Kashmir University (HAJKU), Muzaffarabad.

Antimicrobial activity

Plant materials

Out of 58 medicinal plants *Achillea millefolium*, *Berberis lycium* and *Zanthoxylum armatum* were selected for antimicrobial activity against selected microorganisms. For this purpose rhizome of *Achillea millefolium*, root bark of *Berberis lycium* and seeds and leaves of *Zanthoxylum armatum* were dried under shade and ground to powder using electric grinder. 25 grams powder of each sample were soaked in ethanol (250 ml), water ((250 ml) and of petroleum ether ((250 ml) separately for five days at room temperature. All samples were then filtered to obtain solvent containing plant extracts. Excess solvents were evaporated under reduced pressure by using rotary evaporator. All the extracts were stored at 4°C for determination of antimicrobial activity.

Test microorganisms

All the lab facilities were provided by microbiology lab National institute of Health (NIH) Islamabad Pakistan. Four bacterial strains were selected for this study: Gram positive bacteria; *Staphylococcus aureus* and *Bacillus subtilis*, Gram negative bacteria; *Escherichia coli* and *Salmonella typhi*.

Preparation of dilution

The dried ethanoic, aqueous and petroleum ether extracts were then dissolved in their respective solvents in a proportion of 100 mg/ml. The concentration of reference antibiotic that is Tetracycline was 50 µg/ml.

Antimicrobial assay

A 24 hour old culture of each bacterium was used for the test. The nutrient agar medium was used for bacterial growth. *In vitro* antimicrobial screening was performed by Disc diffusion method (Vander and Vlietnck 1991). The sterilized nutrient agar medium (20 ml) was poured in petri dishes containing bacterial suspension. At the same time, sterile Whatman Antibiotic disc (5 mm in diameter) were placed on the surface of the inoculated agar plates. Finally appropriate concentrations of crude extracts and tetracycline were applied on the discs. The petri dishes were incubated at 37°C for 16-18 hours. The antimicrobial activity was evaluated by measuring zone of growth inhibition in mm surrounding discs by using Vernier Calipers. A zone of inhibition of 15 mm or more was considered as high antimicrobial activity.

RESULTS

Medicinal plants survey

Ethnomedicinal data of Rawalakot consists of 58 plant species belonging to 37 families (table 2). Data inventory constitute botanical name, family, vernacular name, part used, local uses and percentage of respondents having medicinal plant knowledge. Among the respondents above the age of fifty 39 % women and 22 % of men have

medicinal plant knowledge. The respondents below the age of 50 and above age 30, 18% women and 11% men have medicinal plant knowledge but respondents below the age of 30 have least knowledge of medicinal plants (Fig 2). Ethno medicinal data indicate that these plant species are mainly used to treat digestive tract disorders, respiratory, skin, liver and sexual problems. Plant parts usually used are leaves, roots, flowers and fruits. It was noted that whatever the plant part used people unwisely uprooted plant as a result population of many plants greatly reduce.

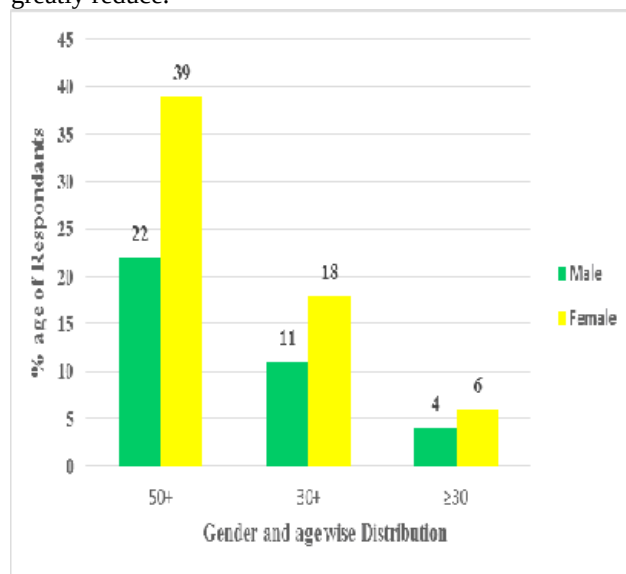


Fig. 2: Gender and age wise distribution of medicinal plant knowledge of Rawalakot

Antimicrobial activity

Out of 58 medicinal plants, *Berberis lycium*, *Achillea millefolium* and *Zanthoxylum armatum* were selected for antimicrobial activity (table 3). The mean zone of inhibitions formed by aqueous, ethanoic and petroleum ether extracts of roots of *Berberis lycium*, rhizome of *Achillea millefolium* and leaves and fruits of *Zanthoxylum armatum* are recorded and compared with reference tetracycline antibiotic discs. Ethanol extract of root of *Berberis lycium* showed highest antimicrobial activity (25.00 ± 1.00 mm) against *S. aureus* while it showed moderate activity against all other tested microorganisms. Aqueous extract also showed highest antimicrobial activity against all tested microorganisms while petroleum ether did not show any activity. Similarly ethanol extract of *A. millefolium* rhizome showed highest activity 27.67 ± 0.33 mm, 25.33 ± 1.20 mm, 23.33 ± 0.33 mm, and 20.33 ± 0.88 mm against *S. typhi*, *B. subtilis*, *S. aureus* and *E. coli* respectively. Petroleum ether extract of *A. millefolium* also showed good inhibitory activity against all tested microorganisms. While water extract of *A. millefolium* had shown no effect on growth of tested bacteria. In case of *Z. armatum* fruit, only ethanol extracts were found to be active against *S. aureus* and *S. typhi*. On the other hand root of all

The medicinal plant knowledge is not homogenous in the study area. It is more or less distributed by gender and cast, education. People above the age of 50 are more informative than younger ones among them women are more informative than men. This fact is consistent with earlier reports (Khan *et al.*, 2011; Hamayun, 2003). Medicinal plants are widely used in domestic remedies and by physicians of traditional system of medicines, particularly in developing world, where public health services are restricted. According to Shinwari *et al.* (2003) 25 percent of all described medicines in developed world contained ingredients derived from plants and roughly 80 percent of the world population living in developing countries depends on herbal medicines for their primary health care. Pakistan is also blessed with medicinal plants and has about 6000 species of plants of which about 600 species are medicinal (Hamayun 2003). According to Choudhry *et al.* (2000) about 5000 tons of medicinal plants are collected by local families from different regions of Pakistan. Himalayas with extraordinary diversity has been considered as emporium of medicinal plants. Rawalakot also gifted with medicinal plant resources which are used extensively as source of medicines for treatment of many diseases. People use 58 medicinal plants for the treatment of stomach, liver, skin and sexual disorder. But indigenous knowledge of medicinal plants is deteriorating. As proposed by Shinwari (2004) that the traditional knowledge of medicinal plants is disappearing and people above the age of 60 have valuable knowledge which could only be conserved by surveys on scientific basis. The present scenario of study area is not different from rest of Azad Kashmir and Pakistan and number of factors such as over grazing, illegal extraction of medicinal plant resource, deforestation, annual fire practices, lack of knowledge about conservation status of species, population explosion, unplanned urbanization are threatening to the flora (Malik and Malik 2004; Alam and Ali 2010; Khan *et al.*, 2011; Ahmed *et al.*, 2012; Dar *et al.*, 2012). However there is urgent need for sustainable use of plant resources in the area as unwise use of these plants will result in loss of valuable medicinal flora and medicinal plant knowledge. So it is necessary that the medicinal plants and indigenous knowledge of the study area must be preserved and documented.

The selected medicinal plants (*Berberis lycium*, *Achillea millefolium* and *Zanthoxylum armatum*) were tested for their antibacterial potential. Ethanolic extract was proven to be highly antimicrobial. This is due to high polarity and most of the flavonoid components dissolved in it. These results are well correlated with previous studies (Chitemerere and Mukanganyaman 2011). The activity of plant extracts against the microorganisms may be due to presence of different bioactive compounds in them. Plant extracts usually contain polyphenols and flavonoids which could be the antibacterial agents. The biological

Table 1: Age, Gender and Education (those who can read and fill the questionnaire are considered as educated) wise distribution of respondents

Gender	Age groups		50+		30+		Total
	Male	Female	Male	Female	Male	Female	
No. of respondents	18	23	16	19	16	8	100

Table 2(A): Ethnobotanical uses of medicinal plants recorded from Rawalakot Azad Kashmir

Scientific Name	Family	Local Name	Part used	Uses	Respondents %age
<i>Achillea millefolium</i> L. [1177]	Asteraceae	Kangi	Rhizome Flowers	Chopped rhizome is soaked overnight in water. Extract is used in tongue infections as mouth wash. Grinded flowers and fruits mixed with linseeds and taken with milk stimulant.	17
<i>Achyranthes aspera</i> L. [688]	Amaranthaceae	Puth kanda	Whole plant	Extract of whole plant is used to treat bleeding piles and body injuries.	4
<i>Aesculus indica</i> (Wall. ex Camb.) Hook. [685]	Hippocastinaceae	Sunakkhor	Seeds	Seeds are grind to powder and cooked with wheat flour and given to cattle as stimulant	10
<i>Amaranthus viridis</i> L. [1532]	Amaranthaceae	Ghanyyar	Whole plant	A decoction of entire plant is used to treat dysentery. Leaves are cooked as vegetable to treat urinary tract inflammation.	12
<i>Aristolochia purjabensis</i> Lace [1512]	Aristolochiaceae	Ghnassri	Roots	Very minute quantity of grinded dried roots are taken with milk to treat swelling of body. Small quantity also taken with water to treat menstrual abnormalities.	3
<i>Bauhinia variegata</i> L [1263]	Caesalpinaceae	Kachnar	Floral buds flowers	Decoction made from floral buds is given in piles. Buds are also dried to treat diarrhea.	35
<i>Berberis lycium</i> Royle [793]	Berberidaceae	Sumbal	Root	Dried powder of root is cooked with milk for 3-4 hours and taken for healing of bone fractures. Powder is also taken in stomach, liver, urinary tract disorders.	56
<i>Bergenia ciliata</i> Sternb [1127]	Saxifragaceae	Zakhamjaat	Rhizome	Rhizome is chewed to treat acidity, diarrhea and cough and to improve blood circulation. A powder made from dried rhizome is applied on wounds to improve healing process.	26
<i>Calotropis procera</i> (Ait.) R.Br. [1107]	Asclepiadaceae	Akk	Flowers Leaves	Dried flowers taken against asthma. Minute quantity of leaf extract is used in dyspepsia.	16
<i>Cannabis sativa</i> L. [1985]	Cannabaceae	Bang	Leaves	Leaves fritters and used as sedative.	33
<i>Chenopodium album</i> Linn. [533]	Chenopodiaceae	Ustaak	Leaves	Leaves are cooked as vegetable and taken to relieve constipation.	18

Table 2(B): Ethnobotanical uses of medicinal plants recorded from Rawalakot Azad Kashmir

Scientific Name	Family	Local Name	Part used	Uses	Respondents %age
<i>Cichorium intybus</i> L. [1708]	Asteraceae	Kaasni	Whole plant	Plant extract is used in liver infection and as laxative and diuretic	9
<i>Colchicum luteum</i> Baker [1853]	Colchicaceae	Annwar Phul	Corm	Palp of corm is used externally to reduce pain and inflammation.	4
<i>Cynodon dactylon</i> (L.) Pers. [262]	Poaceae	Drubb	Whole plant	Plant extract is used to wash wounds and skin as antiseptic.	1
<i>Datura stramonium</i> L. [1755]	Solanaceae	Tatura/Datura	Flowers	Plant is considered as poisonous. The grinded flowers are filtered and used as ear drop against itching.	4
<i>Dicliptera bupleuroides</i> Nees [1992]	Acanthaceae	Choro	Whole plant	Decoction of plant used as tonic. Leave extract is used as ear drop.	5
<i>Dodonaea viscosa</i> Jacq. [877]	Sapindaceae	Snatha	Leaves	Leaves extract is used externally to treat wounds and burns.	14
<i>Duchesnea indica</i> (Andr.) Focks. [726]	Rosaceae	Sappana ammbulbud da	Leaves	Leave extract is used to improve blood circulation.	6
<i>Elaeagnus umbellata</i> Thunb. [1131]	Elaeagnaceae	Ghiyani	Fruits	Ripened fruits are taken to relieve constipation. Fruit is also known for cardiac stimulant and anticancer.	39
<i>Ficus palmata</i> Forssk [455]	Moraceae	Phagwara	Fruit	Fruits are eaten to relieve constipation also dried for winter and mixed with linseeds and taken with milk as stimulant.	31
<i>Foeniculum vulgare</i> Mill. [1320]	Apiaceae	Sanff	Seeds	A decoction of seeds is used to treat dyspepsia. Seeds are chewed to stimulate appetite.	24
<i>Geranium collinum</i> Stephan ex Willd. [1258]	Geraniaceae	Ratanjo	Flowers	Flower extract is used in headache.	10
<i>Juglans regia</i> L. [451]	Juglandaceae	Akkor	Leaves bark nuts	Leaves and bark are used as toothbrush in toothache. Nuts are taken against arthritis. Nut are also taken with dates as sex stimulant.	41
<i>Mallotus philippensis</i> (Lam.) Müll. Arg. [1307]	Euphorbiaceae	Kameela	Fruit	Powder of fruit is anthelmintic. Powder is also used as insect repellent.	7
<i>Melia azedarach</i> L. [1656]	Meliaceae	Drake	Leaves	Extract of leaves taken in fever. Leaves are also used as insect repellent.	24
<i>Mentha longifolia</i> (L.) L. [1555]	Lamiaceae	Breena	Leaves	Decoction of leaves taken to treat vomiting. Leaves are also taken in digestive disorders.	3

Table 2(C): Ethnobotanical uses of medicinal plants recorded from Rawalakot Azad Kashmir

Scientific Name	Family	Local Name	Part used	Uses	Respondents %age
<i>Mentha spicata</i> L. [965]	Lamiaceae	Leaves	Poodna	Leaves are cooked with eggs and taken in dyspepsia, acidity, cough and common cold.	28
<i>Micromeria biflora</i> (Buch.-Ham. ex D. Don) Benth. [1600]	Lamiaceae	Kani Booti	Leaves	Leaves extracts are taken with excess water against kidney stones.	19
<i>Morus alba</i> L. [669]	Moraceae	Toot	Fruit	Fruit taken to relieve constipation, sore throat and dyspepsia.	9
<i>Nasturtium officinale</i> W.T. Aiton [830]	(Brassicaceae	Chow	Leaves	Leaves cooked as vegetable and used against kidney disorders and blood purifier.	44
<i>Nerium oleander</i> L. [415]	Apocynaceae	Kanair	Leaves	Pasted leaves are used against ringworm and other skin disorders.	4
<i>Olea ferruginea</i> Wall. ex Aitch. [1116]	Oleaceae	Kow	Leaves	Leaves are chewed to treat stomach disorders. Twigs are used as miswak (toothbrush).	2
<i>Persicaria amplexicaulis</i> (D.Don) Ronse Decr. [787]	Polygonaceae	Masloon	: Rhizome	Rhizome extract is used in stomach disorders.	45
<i>Plantago major</i> L. [1718]	Plantaginaceae	Batti	Whole plant	Leaf extract is taken in dysentery. Whole Plant is given to cattle to avoid early miscarriage.	26
<i>Plantago lanceolata</i> L. [408]	Plantaginaceae	Isabgol	Leaves, inflorescence	Inflorescence is locally called chilka. Chilka is soaked overnight in water and taken before meal early in the morning against stomach disorders and to delay ejaculation.	22
<i>Prunus persica</i> (L.) Batsch [1256]	Rosaceae	Arwadi	Twigs Fruit	Twigs are used as miswak (tooth brush). Fruits are taken in dyspepsia.	4
<i>Punica granatum</i> L. [433]	Punicaceae	Darunna	Seeds	Fresh juice is taken in throat infections and stomach disorders. It is also considered to improve blood circulation and lowering of blood pressure. Seeds are also taken to improve sexual strength	34
<i>Pyrus pashia</i> Buch.-Ham. ex D.Don. [1261]	Rosaceae	Tangi	Leaves fruit	Pulp of young leaves leaped on soles against burning sensation of feet. Dried fruit is taken to relieve constipation.	12
<i>Pyrus pyrifolia</i> (Burm. f.) Nakai [377]	Rosaceae	Tang	Fruit Leaves	Fruit is edible. Young leaves are grinded to a cream and leaped on soles to treat burning sensation.	11
<i>Ranunculus arvensis</i> L. [943]	Ranunculaceae	Chuchumba	Leaves, rhizome	Pulp of leaves is used in skin diseases. Leaves extract is used in fever.	3

Table 2(D): Ethnobotanical uses of medicinal plants recorded from Rawalakot Azad Kashmir

Scientific Name	Family	Local Name	Part used	Uses	Respondents %age
<i>Rhamnus purpurea</i> Edgew. [1353]	Rhamnaceae	Kandur	Bark	Bark of stem is chewed to relieve constipation. Fresh fruits are given to cattle as anthelmintic.	10
<i>Rubus fruticosus</i> L. [1522]	Rosaceae	Akhray	Roots Leaves	A decoction of roots used against dysentery and cough. Leaves extract are used against diarrhoea.	41
<i>Rumex acetosa</i> L. [534]	Polygonaceae	Halfi	Leaves	Fresh juice is used as coagulant after minor cuts. Leaves are also cooked as vegetable for cooling effects.	21
<i>Rumex hastatus</i> D.Don [1836]	Polygonaceae	Chukhri	Leaves	Leaves are chewed in sour throat.	2
<i>Otostegia limbata</i> (Benth.) Boiss. [1024]	Lamiaceae	Jand	Leaves	Leaves extract are used to improve eye vision.	4
<i>Sapindus mukorossi</i> Gaertn.[430]	Sapindaceae	Reetha	Fruit	Skin of dried fruit taken with milk as sex stimulant. Young ladies also wash hair with fruit against dandruff.	45
<i>Sarcococca saligna</i> (D.Don.) Müll. Arg. [427]	Buxaceae	Nadroon	Leaves roots	Leaf extract is used to treat rheumatism and fever. Extract of root is used to treat vaginal thrash	4
<i>Sinopodophyllum hexandrum</i> (Royle) T.S. Ying [1037]	Berberidaceae	Ban Kakkri	Whole Plant	: Leaf extract is used to treat skin diseases.	7
<i>Solanum nigrum</i> L. [1248]	Solanaceae	Kachmach	Fruit leaves	Ripened fruits are taken as laxative, cough and cold. Leaf extract is used against liver disorders.	22
<i>S.surattense</i> Burm. f. [226]	Solanaceae	Kandyri	Leaves fruit	Leaves extracts are used to treat, cough, vomiting, kidney stones. Fruit is used against skin diseases.	24
<i>Sonchus asper</i> (L.) Hill. [224]	Asteraceae	Duhdal	Whole plant	Leaves are boiled with salt to aid taste. The filtered leaves are taken in abdominal pain and dyspepsia.	22
<i>Swertia petiolata</i> D.Don [1062]	Gentianaceae	Cherayetta	Whole plant	The whole plant is taken in ulcer and in liver inflammations.	3
<i>Taraxacum officinale</i> F.H. Wigg. [1952]	Asteraceae	Hand	Roots leaves	Root and leaves extracts are diuretic. Decoction used against liver and kidney disorders	42
<i>Trichodesma indicum</i> (L.) Lehm. [714]	Boraginaceae	Handusi Poda	Whole plant	A decoction made from the roots is used to treat diarrhea and fever.	7
<i>Viola odorata</i> L. [882]	Violaceae	Gulnaksha	Flowers	Dry flowers are taken with water or milk in stomach disorders and cough.	52
<i>Zanthoxylum armatum</i> DC. [465]	Rutaceae	Timber	Twigs furits	Twigs are used as miswak in toothache. Sauce made of fruits taken with meal for cooling effects	28
<i>Ziziphus jujuba</i> Mill. [1560]	Rhamnaceae	Bheir	Fruit leaves	Fruit are taken for cooling effects.	12
<i>Ziziphus nummularia</i> (Burm.f.) Wight & Arn. [1560]	Rhamnaceae	Bhermunni	Fruit Leaves	Fruit is eaten to delay ejaculation. Leaf pulp is used against skin diseases.	10

Table 3: Antimicrobial activity of *Berberis lycium* (root bark), *Achillea Millefolium* (rhizome) and *Zanthoxylum armatum* (fruit and leaves)

Plants	Extracts 100 mg/ml	Mean Zone of inhibition in mm $\pm$ Standard errors of means (SEM)			
		<i>E. coli</i>	<i>S. aureus</i>	<i>S. typhi</i>	<i>B. subtilis</i>
<i>B. lycium</i> (root bark)	Aqueous	23.00 $\pm$ 0.67	23.00 $\pm$ 0.67	23.00 $\pm$ 0.67	23.00 $\pm$ 0.67
	Pet Ether	--	--	--	--
	Ethanol	15.00 $\pm$ 0.67	25.00 $\pm$ 1.00	16.67 $\pm$ 0.33	15.67 $\pm$ 0.33
<i>A. millefolium</i> (rhizome)	Aqueous	--	--	--	--
	Pet Ether	20.25 $\pm$ 0.40	23.00 $\pm$ 0.58	25.00 $\pm$ 0.58	22.33 $\pm$ 1.20
	Ethanol	20.33 $\pm$ 0.88	23.33 $\pm$ 0.33	27.67 $\pm$ 0.33	25.33 $\pm$ 1.20
<i>Z. armatum</i> (fruit)	Aqueous	--	--	--	--
	Pet Ether	--	--	--	--
	Ethanol	--	16.33 $\pm$ 1.45	15.33 $\pm$ 0.88	--
<i>Z. armatum</i> (leaves)	Aqueous	15.07 $\pm$ 1.24	17.30 $\pm$ 0.58	15 $\pm$ 0.67	16.67 $\pm$ 0.30
	Pet Ether	27.33 $\pm$ 1.40	26.00 $\pm$ 0.67	28.00 $\pm$ 0.67	27.33 $\pm$ 1.40
	Ethanol	17.00 $\pm$ 0.67	17.33 $\pm$ 1.20	17.00 $\pm$ 1.15	16.33 $\pm$ 0.88
Tetracycline	50 μ g/ml	27.33 $\pm$ 0.33	26.67 $\pm$ 0.67	28.67 $\pm$ 0.33	26.66 $\pm$ 0.67

activity of plant extracts is associated to phytochemicals present in them. The antiviral (Karamodini *et al.*, 2011), antimicrobial (Bastos *et al.*, 2009) and spasmolytic (Lima *et al.*, 2011) activity of flavonoids have been reported. Similarly plants extracted alkaloids have also found to be antimicrobial (Ahmed *et al.*, 2010). The antibacterial activities of these compounds might be due to their ability to complex with bacterial cell wall and therefore, inhibiting the microbial growth.

Comparisons with pertinent data from literature indicates that, according to the methodology adopted in studies on antimicrobial activity, the most diverse results can be obtained. Plant extracts have shown inhibitory effect on the growth of the bacteria studied, although of distinct forms. It is therefore recommended that the nature and the number of the active antibacterial principles involved in each plant extract be studied in detail.

CONCLUSION

During research work it was noted that Rawalakot is not explored fully from ethno-medicinal point of view and medicinal plant knowledge is declining among younger generation. The present study contributes significantly to the ethno-medicinal knowledge and shows that medicinal plants do have potent antibacterial compounds. Therefore, further research is needed to conserve medicinal plants knowledge and to find active antimicrobial compounds in these medicinal plants. Anthropogenic activities like unwise extraction of medicinal plants, deforestation, annual fire practices and unawareness are the factors which deteriorating not only medicinal flora but also overall floral wealth. Therefore awareness programs and coordination among communities, research institutes and forest department is urgently needed to conserve medicinal flora of Rawalakot. Government and NGOs should play role in this regard.

REFERENCES

- Afshan NS, Iqbal SH, Khalid AN and Niazi AR (2011). Some Additions to the Uredinales of Azad Jammu and Kashmir (AJ & K), Pakistan. *Pak. J. Bot.* **43**(2): 1373-1379.
- Ahmad I, Mumtaz H, Abdul R, Irfan M, Muhammad FA, Sehrish J and Sadia Z (2012). Threats to medicinal plant diversity in Soon valley (Salt Range) of Punjab, Pakistan. *Int. Res.*, **1**(4): 158-169.
- Ahmed e-HM and Nour BY., Mohammed YG and Khalid H S (2010). Antiplasmodial activity of some medicinal plants used in Sudanese folk-medicine. *Environ. Health Insights*, **4**: 1-6.
- Akinyemi KO, Oluwa OK and Omomigbehin EO (2006). Antimicrobial activity of crude extracts of three medicinal plants used in south-west Nigerian folk

- medicine on some food borne bacterial pathogens. *Afr. J. Tradit. Complement. Altern. Med.*, **3**(4): 13-22.
- Alam J and Ali SI (2010). Contribution to the Red List of the Plants of Pakistan. *Pak. J. Bot.*, **42**(5) 2967-2971.
- Ali SI and Qaiser M (Eds.) (1993-2007). *Flora of Pakistan*. No.-204-2015. Islamabad Pakistan.
- Ali SI and Nasir YJ (Eds.) (1989-1992). *Flora of Pakistan*. No.191-204. Islamabad Pakistan.
- Ates DA and Erdogru OT (2003). Antimicrobial activities of various medicinal and commercial plant extracts. *Turk. J. Biol.*, **27**: 157-162.
- Baker JT, Borris RP, Carté B, Cordell GA, Soejarto DD, Cragg GM, Gupta MP, Iwu MM, Madulid DR and Tyler VE (1995). Natural product drug discovery and development: New perspective on international collaboration. *J. Nat. Prod.* **58**: 1325-1357.
- Bano A, Ayub M, Rashid S, Sultana S and Sadia H (2011.) Ethnobotany and conservation status of floral diversity of Himalayan Range of Azad Jammu and Kashmir-Pakistan. *Pak. J. Bot.*, **45**: 243-251.
- Chandra GV and Purohit M (1980). Medicinal plants of India. ICMR, New Delhi. 377 pp.
- Chitemerere TA and Mukanganyama S (2011). In-vitro antimicrobial activity of selected medicinal plants from Zimbabwe. *Afr. J. Plant Sci. Tech.*, **5**(1): 1-7.
- Chaudhary MS, Ahmad AA, Sher H and Malik S (2000). Technical Report on Market study of medicinal herbs in Malakand, Peshawar, Lahore and Karachi. SDC-Inter-cooperation, Peshawar, Pakistan
- Dar ME ul-I, Cochard R, Shrestha RP and Ahmad S (2012). Floristic composition of Machiara National Park, District Muzaffarabad Azad Kashmir, Pakistan. *Int. J. Biosci.*, **2**(4): 28-45.
- Gorsi MS and Shahzad M (2002). Medicinal uses of Plants with particular reference to the people of Dirkot, District Poonch, Azad Jammu and Kashmir. *Asian J. Agric Sci.*, **1**: 222-223.
- Hamayun M (2003). Ethnobotanical studies of some useful shrubs and trees of District Buner, NWFP, Pakistan. *Ethnobot. Leaflets* 7: www.siu.edu/~ebli/.
- Irshad AH, Pervaiz AH, Abrar YB, Fahelboun I and Awen BZS (2013). Antibacterial Activity of *Berberis Lycium* Root Extract. *Trakia. J. Sci.*, **1**: 88-90.
- Ishtiaq CM, Khan MA and Hanif W (2006). Ethno veterinary medicinal uses of plants from Samahni valley, Bhimber Azad Kashmir, Pakistan. *Asian J. Plant Sci.*, **5**: 390-396.
- Jaiswal V (2010). Culture and Ethnobotany of Jaintia Tribal Community of Meghalaya, Northeast India-A Review. *Indian J. Traditional Knowledge*. **9**(1): 38-44.
- Lima JT, Almeida JRGS, Mota KSL, Lucio ASSC, Camara CA, Filho JMB and Silva BA (2011). Selective spasmolytic effect of a new furanoflavoquinone derivative from diplotropin on quinea- pig trachea. *J. Chem. Pharm. Res.*, **3**(1): 249- 258.
- Khan MA, Khan MA, Hussain M and Mujtaba G (2010). An ethnobotanical inventory of Himalayan Region Poonch Valley Azad Kashmir. *Ethnobot. Res. Applications.*, **8**: 107-123.
- Khan M, Hussain F, Musharraf S and Abdullah IM (2011). Floristic composition, life form and leaf size spectra of the coal mine area vegetation of Darra Adam Khel, Khyber Pakhtunkhwa, Pakistan. *JBES.*, **1**(3): 1-6.
- Kharshiing EV (2012). Aqueous extracts of dried fruits of *Zanthoxylum armatum* DC., (Rutaceae) induce cellular and nuclear damage coupled with inhibition of mitotic activity *In vivo*. *Am. J. Plant. Sci.*, **3**: 1646-1653.
- Kothari A, Pande P, Singh S and Variava D (1989). Management of national parks and wildlife sanctuaries in India: A status report. Indian institute of Public Administration, Delhi India. Pp.----?
- Makkar HPS, Blummel M, Borowy NK and Becker K (1993). Gravimetric determination of tannins and their correlations with chemical and protein precipitation methods. *J. Sci. Food Agric.* **61** (2): 161-165.
- Malik NZ and Malik ZH (2004). Present status of subtropical chirpine vegetation of Kotli Hills, Azad Jammu and Kashmir. *J. Res. Sci.*, **15**(1): 85-90.
- Bastos MLA, Lima MRF, Consrva LM, Andrade VS, Rocha EMM and Lemos RPL (2009). Studies on the antimicrobial activity and brine shrimp toxicity of *Zeyheria tuberculosa* extracts and their main constituents. *Ann. Clin. Microbiol. Antimicrob.*, **8**: 16.
- Karamoddini MK, Emami SA, Ghannad MS and Alizadeh E Sahebkar A (2011). Antiviral activities of aerial subsets of *Artemisia species* against Herpes Simplex virus type 1 (HSV 1) *in vitro*. *Asian Biomed.*, **5**: 63- 68.
- Nasir E. and Ali S. I. (Eds.) 1970-197. *Flora of West Pakistan*. No. 1-131. Islamabad, Pakistan.
- Nasir E and Ali SI (Eds.) (1980-1989). *Flora of Pakistan*. No. 132-190. Islamabad, Pakistan.
- Hasson RN (2011). Antibacterial activity of water and alcoholic crude extract of flower *Achillea millefolium*. *Raf. J. Sci.*, **22**(3): 11- 20.
- Reddy PS, Jamil K, Madhusudhan P, Anjani G and Das B (2001). Antimicrobial activity of isolates from *Piper longum* and *Taxus baccata*. *Pharm. Biol.*, **39**: 236-238.
- Sarver J, Kumar S, Khan M, Ara M and Anand (2009). Diversity, distribution and utilization pattern of economically important woody plants associated with agro-forestry in District Rajouri, J & K (Northwest Himalaya). *Ethnobot. Leaflets*, **13**: 801-809.
- Shaheen H, Khan SM, Harper DM, Khan SU, Zahidullah and Qureshi RA (2011). Species diversity, community structure and distribution patterns in Western Himalayan alpine pastures of Kashmir, Pakistan. *Mt. Res. Dev.*, **31**(2): 153-159.
- Shaukat SA, Shah SZA, Ahmad MJ, Shaukat SK and Shaukat SW (2012). Ethnobotanical Studies of Some Medicinal Plants of Union Council Bangoi, Tehsil Rawalakot Azad Kashmir. *Sci. J. Agric.* **1**(4): 105-109.
- Shinwari ZK (2004). How to sustainably use Medicinal Plants: Looking Ahead. Proceeding of International Workshop held in Islamabad. pp.47-56.

- Shinwari ZK and Gilani SS (2003). Sustainable harvest of medicinal plants at Bulashbar Nullah, Astore, Northern Pakistan. *J. Ethnopharmacol.*, **84**: 289-298.
- Stewart RR (1972). An Annotated Catalogue of the Vascular Plants of West Pakistan and Kashmir, Fakhri Printing Press Karachi p.1028.
- Stuffness M and Douros J (1982). Current status of the NCL plant and animal product program. *J. Nat. Prod.* **45**: 1-14.
- Vander BDA and Vlietnck AJ (1991). Screening methods for higher plants assay for Bioactivity K. Hostietzman (Ed.) Academic press, London. pp.43-69.