DISTRIBUTION AND RESOURCES OF MEDICINAL PLANTS (*ACONITUM VIOLACEUM, ANGELICA GLAUCA, ALYSICARPUS VAGINALIS* AND *PERISTROPHE BICALYCULATA*) IN GARHWAL HIMALAYA

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ABSTRACT

The main aim of present study was to explore the distribution of some medicinal plants in Garhwal Himalaya and perform antibacterial activity of medicinal plant *Alysicarpus vaginalis* against respiratory tract pathogens. The *Aconitum violaceum* is herbaceous perennial plantbelonging to the family Ranunculaceae, mainly found in Atalakoti Glacier (Hemkund Sahib Region) and Valley of flowers. *Peristrophe bicalyculata* belongs to the family Acanthaceae is an erect, herbs distributed in Srinagar, Srikot and Pauri Garhwal.*Angelica glauca*belongs family Apiaceae, locally called as Choru, fund in Chandrashilla and way of Rudaranath in Uttarakhand.*Alysicarpus vaginalis*belongs to family Papilionaceae, mainly found in Chauras and Kirtinagar. The results of antibacterial activity showed that the methanol extract were more active than other extracts. The zone of inhibition exhibited by methanol extract against tested microorganisms ranged between 20.6±1.28mm to 26.6±0.46mm, respectively. This investigation supports a good response to the use of *A. vaginalis* in herbal medicine as a base for the development of new drugs and phytomedicine in rationale for its use in treatment of respiratory infectious diseases.

Keywords: Respiratory tract infections, Himalayan Medicinal Plants, Traditional Knowledge Systems, *Aconitum violaceum*, *Angelica glauca*, *Peristrophe bicalyculata*, *Alysicarpus vaginalis*, Phytoconstituents.

INTRODUCTION

Our earth is full of medicinal plants. These medicinal plants having therapeutical properties these properties are very useful in curing various diseases. Almost all our present medicines exhaled from medicinal plants. Approximately, 8000 species of medicinal plants are used as different systems of medicines in India (Planning Commission 2000). The Indian state of Uttarakhand, located in central Himalayan region, is richly gifted with a large variety of plant species, many of which have medicinal properties. These medicinal plants play an important role in the lives of people in Uttarakhand by providing basic health care and employment to the farmers (Alam *et al.*, 2005). The Central Himalayan Region covers the new state of India, provides excellent opportunities for studying the Traditional Knowledge Systems (TKS). The Indian Himalayan region alone supports about 18,440 species of plants (Angiosperms: 8000 spp., Gymnosperm: 44 spp., Pteridophytes: 600 spp., Bryophytes: 1736 spp., Lichens: 1159 spp. and Fungi: 6900 spp.) of which about 45% are having medicinal properties. According to Samant *et al., 1998* out of the total species of vascular plants, 1748 spp. species are medicinal. So we can say the Uttarakhand is a store house of a rich variety herbs and medicinal and aromatic plant species.

Medicinal plants produce a wide variety of compounds which in addition to give them characteristic pigments, odour and flavor characteristics may also have antimicrobial properties (Cowan 1999). For thousands of years, traditional plant derived medicines have been used in most parts of the world and their use in fighting microbial disease is becoming the focus on study (Bhavnani *et al.*, 2000; Chariandy *et al*., 1999). The various parts of such plants like root, tubers, bark, flowers, leaves and seeds are used for several medicinal purposes. More so, many of these plants have been known to synthesize active secondary metabolites such as phenolic compound found in essential oils with established potent insecticidal (Kambu *et al*., 1982) and antimicrobial activities, which indeed has formed the basis for their applications in some pharmaceuticals, alternative medicines and natural therapies (Rios *et al.*, 2005; Lis-Balchin *et al.*, 1997; Reynolds 1996). The major aim of present study was to explore the distribution of some medicinal plants in Garhwal Himalaya and perform antibacterial activity of medicinal

plant *Alysicarpus vaginalis* against respiratory tract pathogens.

Distribution of some medicinal plants in Garhwal Himalaya

Aconitum violaceum

Aconitum is the Botanical name of genus commonly known as Aconite, etc. locally called as Bhauea and Atees, The genus *Aconitum* belonging to the family Ranunculaceae is widely distributed in alpine and sub alpine regions of tropical parts of Northern hemisphere. There are over 250 species that have been reported in this genus (Lane 2004). These are herbaceous perennial plants growing in moisture retentive but well draining soils of mountain meadows at an altitude of 1,800-3,800m amsl. They are mainly found in Hemkund Region (Atalakoti), valley of flowers and the way of Rudaranath in Garhwal region (Fig. 1). Aconite produced from the tubers, a number of different species of *Aconitum* is used in curing wide range of diseases. "Aconite" has a bitter taste and a cooling tendency. It is anti-inflammatory and febrifuge. It is also used in the treatment of snake and scorpion bites.

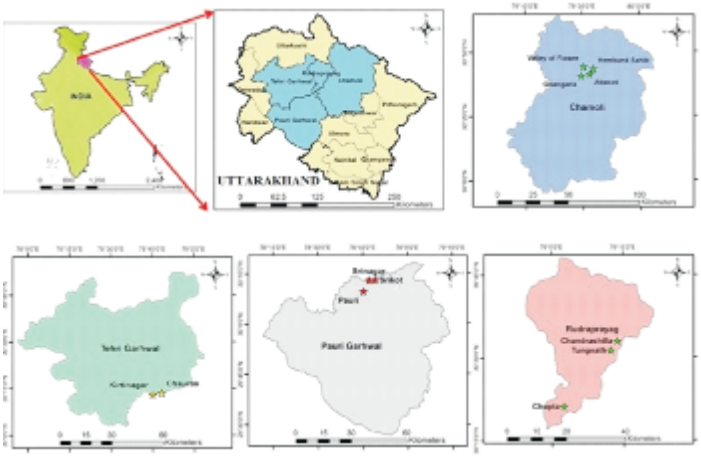

Fig.1. Map of Study area: distribution of some important medicinal plants in Uttarakhand

Chemical constitutions of *Aconitum violaceum*

Alkaloids, Aconitine, Mesaconitine, Hypoconitine (Cuspor *et al*., 2009). Benzoylmecasonine, Mesaconitine, Aconitine, Heteratisine, Heterophylline, Heterophyllisine, Heterophyllidine, Hetidine, Hetsinone and Benzoylheteratisine (Wang *et al*., 2006) Linoleic acid, Swatinine, Lappaconitine and Puberanine Flavanoids, Quercitin, and Kaempferol (Shaheen *et al*., 2005).

Angelica glauca

The genus *Angelica* (family: Apiaceae) is recognized globally for its uses in traditional and modern system of medicine. The estimated 110–115 species of the genus worldwide, 87 species occur in Asia (Pimenov *et al.*, 2004). Three species namely *Angelica glauca* Edgew, *A. archangelica* L. and *A. nubigena* Cl. are reported from the Indian Himalaya (Samant *et al.*, 1998). *A. glauca* locally called as Choru being native and endemic of the Himalayan region is distributed along 2000 to 3,800m mainly in Tungnath, Chandrashilla way of Rudranaths and Valley of Flowers Uttarakhand Jammu Kashmir and Himachal Pradesh (Butola *et al.*, 2004) (Fig. 1). The species is well known for its aromatic as well as medicinal values. Choru also used as spices in Uttarakhand.

Chemical constitutions of *Angelica glauca*

Some of the chemicals which have been isolated from Angelica's leaves and roots include alpha-phellandrene, trans-carveol, beta-pinene, thujene, beta-caryophyllene oxide, beta-caryophyllene, gamma-terpinene, nerolidol, beta-bisabolene, germacrene D. The root contains furocoumarins, also dimeric, lingusticum lactone (Agnihotri *et al*., 2011-2013).Plant was collected from Chauras Kirtinagar (Tehri Garhwal) Uttarakhand and authenticated at Botanical Survey of India (BSI), Northern Regional Center Dehradun Where a herbarium voucher specimen (Acc. No. 115354) was deposited. Collected plant Root material was washed properly, dried under shade at room temperature and crushed to small pieces by using pestle and motor.

Preparation of extract

Plant extracts were prepared by immersing 200g of powdered plant material in 600 ml of four different solvents i.e. petroleum ether (PT), Chloroform(CH), methanol (MH) and water (WT), loaded in Soxhlet assembly and extracted for 72 h through successive method (Ahmed *et al*., 1998). Plant extracts were filtered through Whatman No. 1 filter paper and crude extracts obtained by removing solvent in vacuum evaporator at 30°C. Residues were stored at 4°C until further use. Extracts were dissolved in dimethyl Sulphoxide (DMSO) to a final concentration of 200mg/ml for agar well diffusion method.

Test microorganisms

The five bacterial strains causing respiratory infections used in this study were *Klebsiella pneumoniae* MTCC 4030, *Pseudomonas aeruginosa* MTCC 2474, *Staphylococcus aureus* MTCC 1144, *Streptococcus pneumoniae* MTCC 655, *Streptococcus pyogenes* MTCC 442. These bacteria strains were procured from Institute of Microbial Technology (IMTECH), Chandigarh.

Preparation of inoculums

Stock cultures were maintained at 4°C on slopes of nutrient agar. Active cultures for experiment were prepared by transferring a loopful of cells from stock cultures to test tubes of Mueller-Hinton broth (MHB) for bacteria that were incubated without agitation for 24 h at 37°C.

Antibacterial testing

The antibacterial activity of different extracts was determined by agar well-diffusion method (Ahmed *et a*l., 1998). 0.1 ml of 12-16 h incubated cultures of bacterial species were mixed in molten Mueller Hinton Agar medium no. 173 (Hi media Pvt. Ltd., Mumbai, India) and poured in pre-sterilized petri plates. A cork borer (6 mm diameter) used to punch wells in solidified medium and filled with extracts of 45 µl of 200 mg/ml final concentration of extracts. DMSO was used as negative control. The efficacy of extracts against bacteria was compared with the broad spectrum antibiotic erythromycin (positive control). The plates were incubated at 37 ºC for 24 hours in BOD incubator and the diameter of the zone of inhibition was measured in millimeter. Each sample was analyzed in triplicate and the mean±SD values were observed. The antibacterial activity was interpreted from the size of diameter of zone of inhibition measured to the nearest millimeter (mm) as observed from the clear zones of the surrounding the wells.

RESULTS AND DISCUSSION

The distribution of some Himalayan medicinal plants are listed (Table 1) When we discussed regarding the resources of medicinal plants that means how to use medicinal plants at maximum rate for curing diseases. The earlier findings on *A. vaginalis* focus only n taxonomy, diversity and ethanobotanical aspects (Jain *et al.,* 2009). Some research communications are available on the antibacterial activity of *A. vaginalis* is limited in number. Further, any of these studies have been conducted just to find out the zone of inhibition against some common bacterial pathogens, but have not investigated the zone of inhibition (Silva *et al.,* 2015). This study investigated *in vitro* antibacterial activity of crude root extract of *A. vaginalis* from four different solvents.

This data characterizing the antibacterial activity of crude extract of *Alysicarpus vaginalis* Root (Table 2). The study showed that the crude extract of *A. vaginalis* was found active and exhibited moderate antibacterial activities against test bacterial organisms. The maximum inhibition by MH (methanol) extract was found against *Streptococcus aureus* (26.6±0.46 mm), *Streptococcus pneumoniae (23.6±0.57 mm), Staphylococcus pyogenes* (21.6±0.59) mm), *Klebsiella pneumoniae* (21.3±0.28 mm) and *Pseudomonas aeruginosa* (20.6±1.28 mm) respectively. The minimum activity was found against *Klebsiella pneumoniae* (9.3±0.45 mm) followed by CH, WT and PT extract. On the basis of results, it is concluded that root of *A. vaginalis*has good antimicrobial potential against selected respiratory tract pathogens. This study supports the traditional use of *A. vaginalis* and indicated that it contains some major bioactive compounds inhibiting the growth of microorganisms there by proving very effective source of derived drugs. Future aspect of *A. vaginalis* is phytochemical analysis and active compound analysis through various chromatography techniques.

CONCLUSION

Therefore, it can be concluded that the distribution of medicinal plants in Garhwal is depend on the bases of altitudinal variation. The methanol extract of *A. vaginalis* have excellent antibacterial potential against tested respiratory tract pathogens than other extract. Crude methanol extract of *A. vaginalis* have slightly less antibacterial activity then broad spectrum antibiotic erythromycin. The negative control Dimethyl sulphoxide showed no zone of inhibition. Root of *A. vaginalis* can be used in the treatment of various respiratory diseases. The synergistic effect between the antibiotics and plant extracts against selected pathogens leads to new choice of treatment. It is recommended that further research should be carried out to explore the bioactive component of these Himalayan medicinal herbs. The need for establishment of standard dosage cannot be over emphasized. This is necessary to investigate the toxicity level of extract resulting from over dosage or from any of phytochemical component present in plant material.

Table 1. Distribution of some important medicinal plants in Uttarakhand

Medicinal Plant	Uses	Chemical Constituents	Distribution
Aconitum violaceum	Anti-inflammatory, febrifuge, treatment for snake and Scorpion bites.	Alkaloids, Aconitine, Mesaconitine, Hypoconitine,.Benzoylmecasonine, Mesaconitine, Aconitine, Heteratisine, Heterophylline,Heterophyllisine, Heterophyllidine,Hetidine,Hetsinone BenzoylheteratisineLinoleicacid,Swatinine, Lappaconitine, Puberanine Flavanoids, Quercitin, Kaempferol	Hemkund Region (Atalakoti Glacier), valley of flowers and the way of Rudaranath in Garhwal region
Angelica glauca	Aromatic plats, Spices, Anti-inflammatory	alpha-phellandrene, trans-carveol, beta-pinene, thujene, beta-caryophyllene oxide, beta-caryophyllene, gamma-terpinene, nerolidol, beta-bisabolene, germacrene D. The root contains furocoumarins, dimeric, lingusticum lactone.	Tungnath, Chandrashilla way of Rudranaths and Valley of Flowers
Alysicarpus vaginalis	Anti-inflammatory in stomachache, as an antidote to snake bite. Skin diseases, diuretic, curing of fever, jaundice and leaf paste is applied externally on skin allergy.	Caffeic acid, Catechol, Cumaric acid,Gentisic acid,Gallicacid,P-hydroxybenzoicacid Syringic acid, Vanillic acid, Salicyclic acid, Acetic Acid, Ethyl acetate.	Srinagar and Chauras in Garhwal Himalaya
Peristrophe bicalyculata	Analgesic, antipyretic, Anti-inflammatory, sedative, stomachic, anticancer, fertility, diuretics and diarrhea.	Ether (Propane,1,1-diethxoy), Alkene (6Z-nonen-1-01), Alkaloid (2H) pyrrole-2-carbonitrile 5 amino-3,4-dihydro, Aromatic alcohol (cyclooctyl alcohol), Oxirane (oxirane butyl), Cycnocompound (Ethane peroxoic acid 1-cyano-1-[2-(2-phenyl-1,3-dioxalon-2-yl)ethyl] pentyl ester, Aromatic ether with silicon(4-methyl-2,4-bis(4 try methyl silyloxyphenyl) pentenelpropane,1,1-diethoxy and (6Z)-nonen-1-ol 4-methyl-2,4-bis(4'-trimethylsilyloxyphenyl) pentene-1cyclooctyl alcohol, oxirane, butyl-(2H)pyrrole-2-carbonitrile, 5-amino-3,4-dihydro- and ethaneperoxoic acid, 1-cyano-1-[2-(2-phenyl-1,3-dioxolan-2-yl) ethyl] pentyl ester	Srinagar, Srikot, Kirtinagar and Pauri (Garhwal)

Table 2. Zone of inhibition of *Alysicarpus vaginalis* extracts (Root) and antibiotic (Erythromycin) against isolates and standard bacterial strains causing respiratory pathogens

Microorganism	Diameter of the inhibition zone (mm)				Positive Control	Negative Control
MTTC Strain	PT	CH	MH	WT	Erythro mycin	DMSO
Klebsiella pneumoniae	18.6±0.28	16.6±0.28	21.3±0.28	9.3±0.45	21.6±0.76	0
Streptococcus pyogenes	15.6±1.28	15.3±0.28	21.6±0.59	13.6±2.29	24.6±0.76	0
Streptococcus pneumoniae	17.6±1.62	21.3±0.63	23.6±0.57	19.0±1.43	23.0±1.32	0
Staphylococcus aureus	21.3±0.58	19.3±0.18	26.6±0.46	17.3±0.58	30.3±0.87	0
Pseudomonas aeruginosa	15.6±0.52	18.3±0.56	20.6±1.28	14.6±0.36	24.3±0.51	0

Values are Mean ± SD of three replicates, Cork borer diameter: 6 mm.

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