

Studies on Traditional Knowledge of Medicinal Flora and its Contribution to Livelihood Enhancement in the Doon-Valley, Uttarakhand (India)

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ABSTRACT– Uttarakhand has tremendous potential for medicinal plants cultivation and in becoming one of the important options for sustainable livelihood in the Doon valley as well as all hilly regions. Doon-valley, Uttarakhand can take advantages of increasing demand and low availability of medicinal and aromatic plants resources in the other parts of the country and start to grow highly valuable medicinal plants in high altitude areas. Medicinal and aromatic plants can play an important role in the subsistence livelihood enhancement rural people, especially women through an environmentally sustainable manner while maintaining the biodiversity of these natural products.

Key-words- Endangered plants, Indigenous use, Medicinal and aromatic plants, Medicinal flora

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INTRODUCTION

The plants have been used as a source of medicines by the man from ancient times to the present day. Initially, these were the main parts of folk or ethno medicine practiced in India and other parts of the world like China, Middle East Africa, and South America. Later a considerable part of this indigenous knowledge was formulated, documented and eventually passed into the organized systems of medicines such as Ayurveda, Yunani, Siddha or other systems. Subsequently, with the advance in the techniques of phytochemistry and pharmacology, a number of active principles of medicinal plants were isolated and introduced as valuable drugs in the modern system of medicine ^[1].

Demands for medicinal plants are increasing in both developing and developed countries. As per WHO estimate, about 80% of the population in developing countries depends directly on plants for medicine.

Medicine has maintained its popularity in all regions of the developing world and its use is rapidly expanding in the industrialized countries ^[2].

The Rigveda believed to have been written about 5000 B.C. and regarded as a first authentic record of human civilization, mentioning many plants for their beneficial effects. The systematic study of Indian vegetable drugs was carried out in early nineteenth century. Probably the botanical observations of selected plants are the first step in such a direction. The Catalogue of Indian Medicinal Plants and Drugs was followed by the Bengal Dispensary and Pharmacopoeia of O'Shaughnessy (1841), where in the properties and uses of the medicinal plants were mentioned. Probably the botanical observations of selected plants are the first step in such a direction. The Translation of Sanskrit Materia Medica and the Materia Medica of Madras brought a good account of drugs used by the then Hindu physicians. India has one of world's richest medicinal plant heritages. The wealth is not only in terms of the number of unique species documented, but also in terms of tremendous depth of traditional knowledge for the uses of human and livestock health and also for agriculture. Historically, the medicinal plants have played a significant role in the most convenient and effective manner in health care because these are not only naturally easily available, cost effective, safe and regenerative but also the tribal have had the

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knowledge about these medicinal plants, as a result of their long term association with the forest for time.

Garhwal Himalaya is referred to as a land of gods as many important religious shrines are located besides the confluence of five tributaries of sacred river Ganges. The Hindu community regards a variety of natural objects sacred. These include the river Ganges and its tributaries and their confluence amongst the religious shrines, Badrinath, Kedarnath, Yamunotri, and Gangotri. The sacred mountain peaks are Nanda Devi, Trishul, Chaukhamba, Kailash, Binsar and Syahi Devi and Doon valley. The Himalaya and its foothills are covered with thick vegetation and rich biodiversity^[3].

Traditionally, the tribal and rural poor population of Uttaranchal has had close socioeconomic developmental links with medicinal plants. These resources have provided them not only primary herbal medicines for their survival but also a substantial part of their income. Even today, the majority of the populations living in and around the forests derive their income from a collection of medicinal plants. The State Government in 2003 declared Uttaranchal as an "Herbal State" 5.

Doon Valley covers the outer Himalayan ranges in the north and north-east and Shiwalik ridge in the south and south-west, with rivers Ganga and Yamuna forming the other two sides. Due to wide variations in topography and other factors, Doon valley possesses a very rich and varied medicinal flora and has been explored by various workers. The study sites chosen for the present study are experiencing the wide range of anthropogenic disturbances like a collection of fuel and fodder, cattle grazing, increase in the population near the villages of the study sites. In recent years, especially after the inception of Uttarakhand in year the 2000 and Dehradun's (Doon Valley) becoming the capital of this state, this valley is expanding exponentially^[4].

Viewed from the fact that there is a serious threat to the medicinal plant diversity in this region, it is reissuing to know that various research institutions and individuals have suggested cultivation practices and documentation of traditional knowledge of medicinal plants prevalent in Himalayan region for their long term conservation^[5].

In this purposed work an update on the distribution, plant parts used for various diseases by local people residing in the outer fringes of the Doon valley, has been presented. Main aim of the present study was to document the indigenous medicinal knowledge of rural population and to suggest appropriate conservation practices and its utilization in poverty alleviation of rural peoples.

MATERIALS AND METHODS

Study site

The study site is located in Doon valley which is bound by lesser Himalayas in the north and younger Siwaliks in the south and is limited by river Ganga and Yumuna in east and west respectively. It lies between longitude 77° 35' to 78° 24' east and latitude 29° 55' and 30° 30' north and covers

an area of more than 2000 sq. km.

The present study was conducted during the year 2016 in Sahastradhara region and adjacent area. The area was exhaustively surveyed for this study. Usual methods of collection, preservation and maintenance of specimen in herbarium were followed^[6]. During the field study the specimen of plants with flower and fruit were recorded. A collection of plant species were made throughout the year. After collection, the specimen was processed, preserved, and mounted on herbarium sheets. The herbarium sheets identified from the BSI herbaria and FRI herbaria and after that deposited in the laboratory, department of Botany, UCST College, Dehradun, India.

Present study based Inventory on field level information Sahastradhara region of Dehradun. Sahastradhara region and adjoining area of Nagal Hatnala and some Catchment areas of Doon valley where we find out medicinal plants for our purposed work.

The study was conducted during the first week of March and Mid of July month in the Year 2016. To find out the economic potential of Medicinal and aromatic plants crop in Sahastradhara region Dehradun, India. The data was collected through secondary sources, mainly from the website of the Government of Uttarakhand, State Medicine Plant Board of Uttarakhand and Forest department of Uttarakhand. UCST and FRI library, References from research papers, books, articles, and newspaper were taken for interpretation of data.

All the collected plant specimens were identified with the help of recent and relevant floras and confirmed after matching with the authentic specimens, housed in the Herbaria of Botanical Survey of India, Northern Circle (BSI), and Forest Research Institute (FRI), Dehradun. All the collected plant specimens will be deposited in the department of botany, UCST, Dehradun, UK.

The present study is based on the extensive surveys on the representative parts of North Western and Western Himalaya specially Doon valley and scrupulous review of the information available on medicinal plants. While conducting the surveys of biodiversity, including medicinal plants of the above regions, information was also gathered from local inhabitants about the medicinal properties of the medicinal plants. For this local knowledgeable persons were interviewed on indigenous uses and medicinal properties the medicinal plants. The additional information includes local names, part(s) used, altitudinal distribution, habitat, etc.

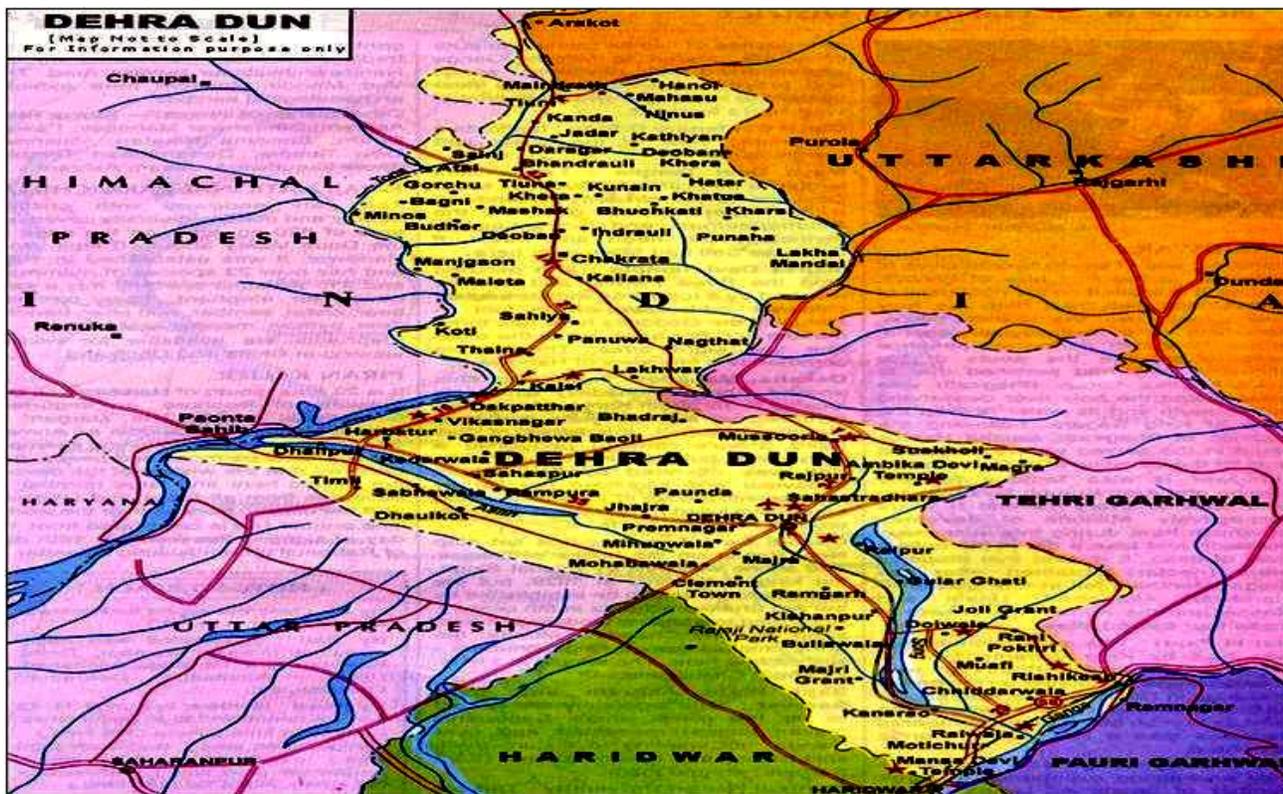


Fig. 1: Study site of Doon valley, Dehradun, Uttarakhand, India

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RESULTS AND DISCUSSION

Each medicinal plants were provided with its scientific name and author citation; followed by a local name, common name, family, morphology, distribution status and plant part used. The sequence of plant species, collected and identified in the present investigation, is given below in an alphabetical order (Table 1).

During this period 50 ethno-medicinal plants belonging to 32 families have been reported from the study sites. Of which 21 were herbs, 13 were shrubs and 15 were trees. All were angiosperms Out of 50 species, Dicotyledons were represented by 45 and monocotyledons were represented by only 5 species. Among all, herbs are more used as ethno- medicines as compared to shrubs and trees. Fifty plant species belongs to Thirty two genera and Thirty two families were reported from the study area. Asteraceae are four species and, Fabaceae and Rutaceae, Moraceae were the most common used families with three elements each followed by Amaranthaceae with 3 species, Apiaceae, Solanaceae, Caesalpinaceae, Miliaceae and Lamiaceae with 2 species.

All the remaining 22 Families, Araceae, Papaveraceae, Asparagaceae, Asphodelaceae, Lauraceae, Cannabaceae, Poaceae, Cyperaceae, Chenopodaceae, Verbinaceae, Asclepidaceae, Myrtaceae, Euphorbiaceae, Oxalaceae, Lythreaceae, Polygonaceae, Acanthaceae, Fabaceae, Malvaceae, Meliaceae, Mimosaceae, Rhamnaceae, Urticaceae, and Convolvaceae represents a single species each.

Table 1: Sequences of some selected plant species, collected and identified in the present investigation is given below

Botanical names	Local name	Family	Part used	Aliment/Disease	Method of use
<i>Acorus calamus</i>	Bach	Araceae	Rhizome	Gastric problems	*Paste of the rhizome fixed with small quantity of sugar is used to cure gastric problems.
<i>Acacia catechu</i>	Khair	Mimosaceae	Root	Ulcer	*Root paste is applied for for the treatment of ulcer.
<i>Achyranthes aspera</i>	Chirchita/ Latzira	Amaranthaceae	Leaves/Root	Skin Disease/Snake bite	*Make fine paste of leaves and apply on infected parts. *Root paste is used for the treatment of snake bite
<i>Adhatoda vasica</i>	Safed bansa/Basingu	Acanthaceae	Leaves	Cancer	*Take 1 ml leaf juice and mix it with goat's milk. Drink 2 tsp. every morning. Use for 40 days.
<i>Artemisia wallichiana</i>	Kundju	Asteraceae	Leaves, Flower	Intestinal worms(Round worm,Pin worm)	*An extract made from this herb used to get rid the intestinal worms, hence the name worm wood.
<i>Argemone Mexicana</i>	Kandaru	Papveraceae	Whole plant	Leprosy,Skin Disease	*Use the juice of the plant to cure Leprosy and uses the oil to cure the Skin disease.
<i>Asparagus adscendens</i>	Ghirunu	Asperagaceae	Whole plant	Hormonal imbalance	*Patients suffering from hormonal imbalance are advised to intake asparagus capsules twice per day after meals with water.
<i>Aloe vera</i>	Patvaar	Asphodelaceae	Leaves	Skin Disorders, wounds, burns	*The clear gel contained within the leaf apply on the infected area, Speeding up the rate of healing and reducing the risk of infection.
<i>Amaranthus spinosus</i>	Kadya sagoti	Amaranthaceae	Seeds	Measles	*The children suffering from measles are advised to inhale smell that emanates from roasting dried seeds. Seeds once roasted are mixed with gur and made into small balls. *The balls are given to the children suffering from measles.
<i>Agreatum conyzoides</i>	Jangli pudina	Asteraceae	Whole plant	Cuts Wounds, Bruises	*The juice of the plant is used to treat cuts, wounds and bruises. Plant is also anti-inflammatory and antiallergic.
<i>Aegle marmelos</i>	Bael/Bel	Rutaceae	Leaves, Fruit	Diarrhea, Dysentery, Jaundice	*Fruit used in conduction like diarrhea, dysentery. *Juice of bael leaves with black pepper taken three times a day helpful in jaundice.
<i>Albizia lebbeck</i>	Shireesha	Miliaceae	Leaves, Flower	Snake bites	*Juice is extracted and given for oral intake in snake bites.
<i>Aerva sanguinolenta</i>	Escancel	Amaranthaceae	Leaves	Wound Healing, Headache	*Extract made from leaves used for wound healing and Headache and also has diuretic properties.
<i>Bauhinia variegata</i>	Kachnar/Kurail	Caesalpiniaceae	Stem ,bark, Flower	Bleeding disorders, Leprosy	*Bark powder is given for the treatment of leprosy. *Decoction of flower buds is given to treat bleeding disorders.
<i>Butea monosperma</i>	Dhak/plash	Fabaceae	Flower,Gum, Seeds and	Intestinal worms Diarrhoea and Blood	*The seed can be ground into a powdered form and this powder

			Root	Pressure, melting kidney stone, Anaemia in kids, dermatitis	can then be consumed to kill worms in the intestine. *The root has been found to have some action on blood pressure. *The gum is valuable for treatment of diarrhea. *Flower soup use melting kidney stone
<i>Bombax ceiba</i>	Semal, semul (Cotten)	Malvaceae	Leaves	Loose motion	*Prepare a leaf decoction of <i>Bombax ceiba</i> . Consume 45 ml of it twice a day.
<i>Cinnamomum tamala</i>	Tejpatta (G.I. rank concern govt. of India)	Lauraceae	Leaves	Induced Diabetic rate, Antioxident	*The Cinnamomum leaves methanolic extract uses significant increase in the antioxidant enzyme and adjunct therapy in diabetics.
<i>Cannabis sativa</i>	Bhang	Cannabaceae	Leaves	Lice	*The leaves are grinded and leaf juice is applied on hair.
<i>Cassia tora</i>	Chakunda	Caesalpinaceae	Fruit	Fever	*Decoction of the fruit of <i>Cassia tora</i> is used in the treatment of fever.
<i>Centella asiatica</i>	Brahmi	Apiaceae	Leaves	Mouth ulcer	*Chwed 4-5 Leaves of the <i>Centella asiatica</i> which help in the treatment of mouth ulcer
<i>Cuscuta europaea</i>	Akashbail	Convolvulaceae	Whole plant	Cold	*The plant is boiled in water and some salt is added. The mixture is used to cure cold. The decoction of seeds in high doses causes abortion.
<i>Cynodon dactylon</i>	Dhoob	Poaceae	Whole plant	Acidity, Stomach infection, Stomach pain	*To treat acidity and Stomach infection, one should take of plant 3-4 tsp and water (1 glass) empty stomach in the morning.
<i>Cyperus rotundus</i>	Morya, Mothaa	Cyperaceae	Rhizomes	Improves eye sight and eye related problems	*The past is used to improve eye sight and helps in eye related ailments.
<i>Coriandrum sativum</i>	Dhaniya	Apiaceae	Leaves, Seeds	Digestive dysfunction, Diarrhea	*Juice is given to treat dysfunction in digestive system including vomiting and diarrhea.
<i>Chenopodium album</i>	Bethuwa	Chenopodiaceae	Leaf/ branches	Kidney stone	*Take tender leaves and branches and grind them to extract its juice and take 10-15gm of it daily with water. This also reduces the tendency of stone formation.
<i>Cleodandrum infortunatum</i>	Aranyo	Verbenaceae	Leaves	Fever	*Prepare leaf decoction of plant. Drink 40 ml of it once a day. It helps to all types of fever.
<i>Calotropis procera</i>	Aak/Aakha	Aselepidaceae	Leaves/latex	Snake bite	*Leaves were chewed and latex is applied over the wound
<i>Datura stramonium</i>	Dhatura	Solanaceae	Leaves	Relieve pain	*The paste of roasted leaves is applied over the area to relive pain.
<i>Eupatorium adenophorum</i>	Basya	Asteraceae	Leaves	Active immunity, Anti-inflammatory	*Extract of the leaves of the helps in immunity active and anti-inflammatory
<i>Eucalyptus globulus</i>	Safeeda	Myrataceae	Leaves	Infection, Skin disease, Antibacterial	Leaf extract are used to cure infection and some skin disease.
<i>Euphorbia hirta</i>	Dudhi ghas	Euphorbiaceae	Aerial parts	Skin disorder, Eye infection	*Paste of leaves are used to treat skin disorder and decoction made

<i>Ficus religiosa</i>	Pepal	Moraceae	Leaves	Bleeding or arresting secretion	from the flowers can aid in healing eye infection and inflammation. *About 50 ml of raw juice of the leaves or 1 tsp of powdered dried leaves can be taken with water.
<i>Ficus bengalensis</i>	Bargad/Bad	Moraceae	Leaves, Roots	Skin disorder, protecting gums	*A paste made from leaves can be used for relieving skin disorder; roots are used to clean the teeth.
<i>Ficus glomerata</i>	Umars/Gullar	Moraceae	Latex	Leucorrhoea	*About 5 drops of latex is used in treating leucorrhoea.
<i>Mentha longifolia</i>	Ban pudina	Lamiaceae	Leaves	Cough, indigestion, asthma, stomach cramps	*Leaves are used to make a tea that is drunk for cough, indigestion and stomach cramps.
<i>Mentha arvensis</i>	Pudina	Lamiaceae	Whole plants	Stomach aches, Cough	*Boil 6 tablespoons of chopped leaves in 2 glasses of water for 15 min. cool and strain. Divide the decoction into 3 parts and consume three times a day. This will help in treating cough and stomachaches.
<i>Murraya paniculata</i>	Kamini/Kadipatta	Rutaceae	Leaves	Diarrhea, dysentery	*Infusion of leaves is used for treatment of diarrhea and dysentery.
<i>Melia azedarach</i>	Bakain	Miliaceae	Root bark	Skin disease, Ringworm	*The root bark is emetic, vermifuge and highly effected and used against ringworm and skin disease.
<i>Mimosa pudica</i>	Chhui-mui, Lajwanti	Fabaceae	Leaves	Diabetes, Wound healing, Menorrhoea	*Decoction of leaves is used for diabetes. *Paste of leaves arrests bleeding and fasten the wound healing process. *The powder of Mimosa leaf 5gm is taken daily in empty stomach for one month to cure Menorrhoea.
<i>Oxalis corniculata</i>	Khati buti	Oxaliaceae	Leaves	Fever, Skin rashes	*Paste of leaves are used for remedy of Fever, skin rashes
<i>Phyllanthus emblica</i>	Amla	Euphorbiaceae	Fruit	Preserving eye sight	*1 tablespoon of Amala juice and honey taken every morning promotes vigor and vitality and useful in preserving eyesight.
<i>Punica granatum</i>	Anar	Lythraceae	Fruit	Weakness, fatigue, hair loss	*Juice of the fruit is taken to prevent weakness, fatigue and hair loss, as it provides support to the blood by supplying it with iron.
<i>Ricinus communis</i>	Arand	Euphorbiaceae	Seed	Arthritis	*Castor oil is obtained from the seed and used for alleviating symptoms of Arthritis.
<i>Rumex hastatus</i>	Almoda	Polygonaceae	Whole plant	Bloody dysentery	*The juice of the plant is astringent and is used in the treatment of bloody dysentery.
<i>Solanium nigrum</i>	Makoi, Geahwai	Solanaceae	Leaves	Stomachache and swollen testicles.	*The decoction of leaves is taken orally to cure stomachache. Hot leaves are applied with gratifying results over swollen scrotum and testicles.
<i>Trifolium repens</i>	Garila	Fabaceae	Leaves	Irregular menses	*Leaves are cooked and then eaten to restore irregular menses.
<i>Urtica dioica</i>	Kandali	Urticaceae	Leaves	Urinary tract infection	*Drinking tea made of stinging nettles help in the treatment of

<i>Xanthium indicum</i>	Sarpakshi	Asteraceae	Root, Fruits	Bites of insect	urinary tract infection. *The Root paste is applied on the site of insect bite.
<i>Ziziphus mauritiana</i>	Ber	Rhamnaceae	Leaves, Fruit	Burning sensation, Fever, gastritis	*Paste made from leaves is applied externally to relieve burning sensation and fever. *Sweet and ripe fruit relieve gastritis.
<i>Zanthoxylum armatum</i>	Timur/Timbur	Rutaceae	Stem	Toothache	*The stem is used as toothbrush during gum problem and Toothache

Flowers of three plant species, Roots of six plant species, Leaves of twenty seven plant species, Seeds of two plant species, Aerial part of one plant species, fruits of six plants species, Latex from one and Rhizome of two plant species, whole plants of seven plants species are used.

In present study, about 50 ethno-medicinal plants have been enumerated, among them 21 were herbs, 13 shrubs, 15 tree and 1 climber. All selected 50 species were angiosperms; in this area angiosperm was dominance community. Dicotyledons were represented by 45 and monocotyledons were represented by only 5 species. It is evident from the Table-1 description that ethno-medicinal plants seem to be one of the remedial measures for the local Paharies community of this area. Ethno medicinal plant wealth which is used by local inhabitants for various ailments including a cough, joint pain, cholera, kidney stones, asthma, diabetes, fever, jaundice, Snake bites, gonorrhea, a disease of the liver, Gynecological problems, skin, stomach, Tooth-ache, etc. Our findings were parallel to the observation made by Badoni and Badoni [2]; Dangwall *et al.* [4]; Dhar *et al.* [5]; Malik [10]; and Uniyal and Shiva [15]. Our finding agreed with previous studie's of Atrey [1]; Bartwal *et al.* [3]; Joshi and Joshi [6]; Kapkoti *et al.* [9]; Prakash [12]; and Uttarakhand [16].

DISCUSSION

World Health organization (WHO) has estimated that the present demand of medicinal plants is about US \$14 billion a year and the projected demand by the year 2050 is US \$5 trillion. Medicinal plant related trade in India is estimated to be around Rs. 550 crores per year. While the value of global trade in medicinal plants has been put at over \$60 billion per year, of which India's total turnover of Rs. 2300 crores (US \$551 million) of *Ayurvedic* herbal products, major over-the-counter (OTC) products contribute around Rs. 1200 crores, other formulations fetch around Rs. 650 crores, while the classical *Ayurvedic* formulations contribute the remaining Rs. 450 crores. The export market

for herbal medicines appears to be growing faster than the Indian domestic market, especially with encouraging magnitudes resulting from contract farming of species in demand in foreign markets [7,8].

Again considering the demand of individual species from export and domestic market also has a huge untapped potential for more than 500 species. The domestic market comprises of the formal industrial or pharmaceutical and traditional practitioners demand. There is a consistent demand for the natural resources over long periods when they are used in domestic markets; while the demands for export markets have shown fluctuations. This has a direct impact on the socio-economic conditions of the medicinal plant suppliers and cultivators. Therefore, it is urgently required to evolve appropriate strategies for supply linkages based on market tendencies [9-12].

So, according to our findings, we said that in recent times, focus on plant research has increased all over the world and a large body of evidence has collected to show immense potential of medicinal plants used in various traditional systems. Uttarakhand state is the hub of medicinal plants species due to its rich biodiversity. Uttarakhand has just 14% of the total land under cultivation and most of the population depends on agriculture for their livelihood. The cultivation of medicinal plants is considered to be of great importance for the safeguarding of biodiversity and contribute to rural livelihoods in the Doon valley, Uttarakhand [13-17].

It is hoped that cultivated medicinal plant material will provide an alternative source of supply to the market, and thereby reduce the need for collection of these plants from the wild. Cultivation will also provide an additional source of income for the state's rural poor. Since agricultural income cannot sustain the families for more than four months in a year. Under these conditions, the major challenges before the state are to achieve economic prosperity without losing out on its biodiversity.



Fig. 2: *Acorus calamis*



Fig. 3: *Acacia catechu*



Fig. 4: *Achyranthes aspera*



Fig. 5: *Adhatoda vasica*



Fig. 6: *Aerva sanguinolenta*



Fig. 7: *Bauhinia variegata*



Fig. 8: *Butea monosperma*



Fig. 9: *Bombax ceiba*



Fig. 10: *Cinnamomum tamala*



Fig. 11: *Rumex hastatus*



Fig. 12: *Mentha longifolia*



Fig. 13: *Centella asiatica*

Fig. 2-13: Some selected Medicinal plants of Doonvalley, Dehradun, UK, India

CONCLUSIONS

The objective of the study is to provide sufficient information about ethno-medicinal plants in the Doon Valley, Uttarakhand, India. The study reveals that locals' people still depend on a number of plants for their daily needs specially medicines. Among 50 identified medicinal plants most of them were commonly found our study site of near village surroundings, wetlands and forest area. The community near village surroundings, plants some tree species which are chiefly used for curing stomach pain, fever, snake bite, cough, diarrhoea, burns, skin problems, and gynecological problems. Plants used by the respondents are tabulated in alphabetical order of plant name and local name and uses. Uttarakhand has tremendous potential for medicinal plants cultivation and in becoming one of the important options for sustainable livelihood in the Doon valley and all hilly regions. About 50 ethnomedicinal plants species have been documented from Doon Valley, Uttarakhand, indicate its potential as an herbal state and for strengthening herbal-based in this region. New approaches to biotechnology and conservation strategy can help preserve and utilization the indigenous knowledge of medicinal plants for human kind. The study shows that the cultivation of medicinal plants can play an important role in the livelihood strategies of the villagers in the high altitude of Doon Valley region of Uttarakhand. As all family in the region have own land, the cultivation of medicinal plants can benefit most households. At the same time, it is clear that the success of cultivation will largely depend on the returns from medicinal plants, compared to other crops. Our field survey and data collection confirm that cultivation of medicinal plants is a viable option to improve the livelihoods of poor farmers.

The study revealed that the growing demand for medicinal plants is related to the great cultural significance attached to medicinal plants and following factors are needed for success in this sector:

1. To promote the cultivation of those medicinal plants with a large market potential.
2. Select a suitable area with favorable agro-ecological conditions and relatively low levels of economic development
3. Research and development need to be carried out to understand and find out favorable conditions for the cultivation of important medicinal plants. This can help to improve productivity and production of herbal and medicinal plants through increasing cooperation between researchers and farmers.
4. Identifying a buyer in the market who can guarantee to purchase the whole production at a good price with a higher return than other crops and increase their trade in the state.
5. Find out the role of cultural factors in medicinal plant use and cultivation for maintaining biodiversity.

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