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Ethno-Medicinal Flora vis-à-vis agro-climatic conditions of Uttar Pradesh

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Abstract
Medicinal plants are viewed as possible bridge between sustainable economic development, affordable health care and conservation of biodiversity. The present paper deals with enumeration of medicinally important plants grown in different districts of Uttar Pradesh for treatment of different ailments such as cold, cough, fever, gastro intestinal disorders, etc. This study provides immense scope for biochemical analysis and screening of the active principle of the medicinal plants present in Uttar Pradesh for futuristic growth in the field of drug development.

Keywords: Medicinal Plants, Tribals, Ayurvedic industries, Herbal medicines, Uttar Pradesh.

1. Introduction
There has been a shift in universal trend from synthetic to herbal medicine recently. It is ancient wisdom that plants have therapeutic value and are used to treat various diseases since Neanderthal age. All ancient civilizations in the world are known to use plants for medicinal purposes. Ayurveda and traditional Chinese medicines are well known to the world for their natural ingredients and multiple benefits. Nature has bestowed our country with an enormous wealth of medicinal plants; therefore India has often been referred to as the medicinal garden of the world [1]. Medicinal plants play an important role in human life to combat diseases since time immemorial. The rural folks and tribals in India even now depend largely on the surrounding plants/forests for their day to day needs. Medicinal plants are being looked upon not only as a source of health care but also as a source of income. The value of medicinal plants related trade in India is of the order of 7.5 billion US dollar and is further increasing day-by-day. The international market of herbal products is estimated to be US $62 billion. India share in the global market of medicinal plants trade is less than 0.5%. In view of the innate Indian strengths, which include diverse eco-systems for growth of medicinal plants, technical/farming capacity, strong manufacturing sector, the medicinal plants sector can provide a huge export opportunity after fulfilling domestic needs [2].

The government of India has recently set-up a national level body, the NMPB for the growth and development medicinal plants sector (MPS) in the country. There is a need to streamline and strengthen MPS with a view to promote integrated development by co-ordinating, stimulating production, processing, marketing and establishing a sound infrastructure of the sector in the country. Government of India aims to make the cultivation of medicinal plants and its sustainable management, a people movement [3]. The varied agro-climate conditions in India make it suitable for growing a wide range of valuable medicinal plants. The production of medicinal plants being labor intensive generates increased employment opportunities for the farmers particularly the rural masses/tribals and enhances their incomes. Growing medicinal plants is much more remunerative as compared to growing cereals, horticulture crops etc.

Indian herbal market is rising sharply and the herbal market has an annual compounded growth rate of 20 and 25%, respectively. India is followed by china as the largest producer of medicinal plants having more than 40% global diversity. Worldwide, the ayurvedic industry is put at $3 billion and is slowly gaining acceptance as an alternative system of medicine and health care. The world health organization (WHO) has projected that the global herbal market will grow to $5 trillion by 2050.

The annual turnover of the Indian herbal medicinal industry is about Rs. 7,500 crore as against the pharmaceutical industry's turnover of Rs. 14,500 crores with a growth rate of more than 15 percent. India has a vast and rich resource of herbal raw materials and it can create a niche for itself in the global herbal market if the domestic industry produced quality products of international standards [4].

2. Geography and Climate

Uttar Pradesh is India's fifth largest and most populous state, located in the north-western part of the country. Uttar Pradesh is bounded by Nepal on the north, Uttrakhand on the north-east, Himachal Pradesh on the north-west, Haryana on the west, Rajasthan on the south-west, Madhya Pradesh on the south and south-west, and Bihar on the east. Situated between 23°52 and 31°28'n latitudes and 77°3' and 84°39'e longitudes, this is the fifth largest state in the country in terms of area, and the first in terms of population. It spreads over a large area, and the plains of the state are quite distinctly different from the high mountains in the north. The climate of Uttar Pradesh can also vary widely, with temperatures as high as 47°c in summer, and as low as -1 °c in winter. Uttar Pradesh is a big state having geographical area of 2, 40,928 sq.km. Area with the population of 16.62 crores and population density is 690 per sq.km. Uttar Pradesh is being covered by following 9 agro climatic zones:

Fig 1: The Map of Study Area (Uttar Pradesh)

Zone-1 Tarai Region- Some part of the district Saharanpur, Muzaffar Nagar, Bijnore, Moradabad, Rampur, Bareilly, Pilibhit, Shahjahanpur, Lakhimpur, Bahraich & Shravasti are under this zone. The soil type of this zone is mostly alluvial and clayey alluvial and contains sufficient quality of carbonic materials. The average annual rainfall of this zone is 1150 mm.

Zone-2 Western Plain Region- District Bijnore, Moradabad, Jyoti-ba-Phule Nagar, Rampur, Bareilly, Badaun & Pilibhit are under this zone. This is very fertile region and the soil type is mostly sandy and the average annual rainfall of this zone is 700-1000 mm.

Zone-3 Central Western Region- District saharanpur, muzaffarnagar, meerut, baghpat, ghaziabad, gautambudh nagar & buland shahar are under this zone. The soil of this region are clayey- alluvial, alluvial, sandy alluvial and sandy types. The average annual rainfall of this zone is 600-965 mm

Zone-4 South Western Region- District Agra, Firozabad, Mainpuri, Etawah, Aligarh, Hathras & Mathura are under this zone, the soil is mostly of aravalli, sandy, sandy-alluvial, alluvial & clayay alluvial type. Some area also has saline & sodic soils. The average annual rainfall of this zone is 750 mm.

Zone-5 Central Plain Region- District Lucknow, Unnao, Raibareilly, Sitapur, Hardoi, Kheeri, Kanpur Nagar, Kanpur Dehat, Etawah, Kannauj are under this zone.

Zone-6 Bundelkhand Region- District Jhansi, lalitpur, jalaun, hamirpur, mahoba, chitrakoot and banda falls under this zone. The soil type is mostly rocky. The average annual rainfall is 800-1000 mm.

Zone-7 North Eastern Plain Region- District Gonda, Baharaich, Balrampur, Shravasti, Gorakhpur, Maharajganj, Kushinagar, Siddarth Nagar, Basti, Sant Kabir Nagar and Deoria are under this zone. Major soil types are sand-alluvial and clayey alluvial. The average annual rainfall is 1000-1200 mm.

Zone-8 Eastern Plain Region- District Barabanki, Faizabad, Ambedkarnagar, Sultanpur, Pratapgarh, Jaunpur, Azamgarh, Mau, Ballia, Sant Ravidas Nagar, Ghazipur, Varanasi and Chandauli are under this zone. Major soil types are sandy alluvial, clayey & sodic soil. The average annual rainfall of this region is 1000-1200 mm. Maximum temperature ranges between 40-42°c.

Zone 9 Vindhyachal Region- District Mirzapur, Sonbhadra and Allahabad are under this zone. The maximum area is undulated and rocky. The soil of plain is light black clay and red alluvial. Average annual rainfall of this zone is 1100 mm.

3. Methodology

The study was performed in different regions of Uttar Pradesh. Information was collected during field excursion through interviews with herbalists and elderly person whose knowledge was widely accepted. More than 5-10 informants for each plant species were interviewed at different places of study area. The plant species were then collected and identified; recorded information was compared with the Flora of Etawah District, Flora of Agra District, Medicinal Plants of India, Indigenous Drug of India and other important medicinal plant literatures [5, 6, 7, 8, 9, 10].

4. Cultivation of Medicinal Plants in Uttar Pradesh

With the increase in demand for herbal medicines, is growing the popularity of cultivation of medicinal plants as well. Moreover, easy availability of finance and huge profit margins is generating interest among farmers to opt for such plants. The importance of medicinal plants in pharmaceutical industry has been proved beyond any doubt. A large number of medicines prescribed even by allopath doctors are those with medicinal plant or herbal contents, such as Ashwgandha, Arjuna, Amalki, Triphala, Neem, Lasuna, Brahmi, etc and include formulations such as *Rumalaya Cream*, *Shankhapushpi syrup* and so on [11, 12, 13, 14]. This has aroused large interest amongst entrepreneurs to opt for cultivation of medicinal plants for commercial purposes. In various districts of Uttar Pradesh, farming of medicinal plants has emerged as a profit-making business venture. Lured by the huge profit margins and availability of institutional finance, a number of landowners and farmers are now turning to such plants instead of growing seasonal crops. People who are not traditional farmers are also showing interest.

The Uttar Pradesh government has sought minimum support price (MSP) for medicinal and aromatic plants (MAP). Farmers need a safety net of MSP before they adopt the cultivation of medicinal and aromatic plants in a big way, since the demand for herbal and natural products is rising in the world. In Uttar Pradesh, over 250,000 hectares come under herbs cultivation, especially in Ghazipur, Sitapur, Kannauj, Aligarh, Sonebhadra and Mirzapur districts. Bithoor near kanpur city, plants such as Ashwagandha or asgandh (*Withania somnifera* Dunal), Sarpagandha (*Rauvolfia serpentina* Benth. ex Kurz.), Satawar (*Asparagus racemosus* Willd.), Artemissia (*Artemisia absinthium* Linn.), Ghritkumari or guar ka patha (*Aloe vera* L.), Madhuyasthi or mulethi (*Glycyrrhiza glabra* Linn.), Madhupatra or stevia {*Stevia rebaudiana* (Bertoni) Bertoni}, Khas {*Vetiveria zizanioides* (Linn.) Nash}, Lemon grass {*Cymbopogon citrates* (DC.) Stapf. } and Rose (*Rosa damascena* Mill.) are grown. These plants, their parts or derivatives are much in demand by various agencies. At present, all the plants mentioned above are also being successfully grown in Kanpur, Kannauj, Unnao, Barabanki, Moradabad, Chandausi, Bareilly, Badaun, Sitapur, Sultanpur and Faizabad under favorable conditions. Many people from these areas have been attracted towards this business in view of the continuous and huge demand of these crops. Incidentally, many brokers have also come up in this trade acting as a bridge between producers and end-users - that is the companies making the medicinal formulations. These brokers are also actively engaged in procuring raw materials from the farmers and cultivator entrepreneurs.

The Lucknow based Central Institute of Medicinal and Aromatic Plants (CIMAP) and various agricultural universities has started organizing awareness camps among the farmers on cultivation of medicinal and aromatic crops through training and demonstration programs conducted from time to time. They organize programs to train the interested people in short duration and charge a small fee. Successful cultivators like Subedar are also providing information to those who are interested.

Farmers of long standing are considering it as a profitable alternative to the traditional crops due to various reasons. In a short duration, they could achieve better results. Single crop provides two to three cuttings in a year. Initial investment is low as compared to the final outcome. Huge demand is already in the market. To begin with, not very big farms are required for such cultivation, but care and proper irrigation is must.

The cultivators must know every minute detail related to it, such as about the favorable time period for the plant, amount of water requirement, numbers of cuttings and about the pharmaceutical companies interested in their crops. The basic needs for the cultivation are easily available and this is encouraging farmers to grow medicinal plants.

For the traditional farmers, the initial funds for this business could be available through the kisan credit card. Others can obtain the capital from the banks. The land is also easily available on the lease. The primary stock is available in the market at a reasonable rate. Agricultural universities are also helping by providing the stocks as well as technical information to the needy people. It is observed that there is a growing interest amongst the farmers who visit kisan melas organised from time to time at the kanpur-based Chandra Shekhar Azad University of Agriculture and Technology (CSAUAT). Similar activities are going on at agricultural universities like Narendra Deo University of agriculture and technology in faizabad, the Pantnagar Univerity and other institutions.

It is interesting that people with non-agricultural background are also getting attracted towards this field. Those who are not traditional farmers also feel that this is a good business idea. One positive thing is that people from any educational background can cultivate these plants; no specific educational background is required. The only requirement is the person's determination and interest in cultivation. Therefore now-a-days when biodiversity and forest conservation is focused all around so there is utter need of herbal resources towards eradication of famishment and unemployment [15].

5. Results and Discussion

Plant species belonging to different genera and families were used by most of the local people for the treatment of common diseases [16, 17, 18, 19, 20]. The data of botanical name, family, local name, plant parts used and their medicinal uses are tabulated in Table-1. From earlier times people made use of plants for their basic needs, medical care and livelihood. Some plants used by people are cultivated while others grow in wild conditions. The tribal depends predominantly on plants for food, clothing, medicine, oil, agricultural implements, art, crafts, and huts and for other requirements. Plant species were also used to prevent eye, gastric, respiratory problems, fever, antidote for snake and scorpion bites, sunstroke, arthritis, hydroceal, toothache, cough, dysentery and jaundice.

Table 1: Medicinal plant species, its distribution, plant parts used and ailments treated

Sl. No.	Botanical Name with Family	Local Name	Distribution	Parts Used	Uses
1	*Acacia catechu* (L.f.) Willd. (Mimosaceae)	Kattha	Firozabad UP	Leaves	Wounds, bleeding
2	*Acorus calamus* L. (Araceae)	Vacha	North Eastern Tarai Districts of Uttar Pradesh. Abundently found at Sagar, Gangolgoan & Batarni-Dhara, 1200-1500 Mt, Chamoli,UP	Rhizome	Useful in disease of nervous system, loss of memory. In case of irritation of the throat, the rhizome simple chewed, produce copious salivation and an agreeable sensation of warmth. Bronchitis and sinusitis
3	*Ageratum conyzoides* L. (Asteraceae)	Ajgandh	Hardoi	Leaves	Decoction 3 times a days for peptic ulcer, leaves paste for dressing in callous ulcer.
4	*Allium cepa* L. (Liliaceae)	Pyaz	Fatehpur, UP.	Bulb	Largely eaten as vegetable, stimulant, diuretic, good for dysentery and flatulence
5	*Anaphalis contorta* (D.Don) Hook.f. (Asteraceae)	Bubula	Commonly found up to 1200-12500 Mt.	Leaves	Juice or decoction of leaves is useful in cut injuries and infection
6	*Andrographis paniculata* Wall. ex Nees (Acanthaceae)	Kalmegh	Phulpur, Allahabad, India	Whole Plant	It is useful in hyperdipsia, burning sensation, wounds, ulcers, chronic fever, malarial and intermittent fevers, inflammations, cough, bronchitis, skin diseases, leprosy, pruritis, intestinal worms, dyspepsia, flatulence, colic, diarrhoea, dysentery and haemorrhoids.
7	*Argemone mexicana* L. (Papaveraceae),	Pili Kateli	Aligarh,	Leaves, Roots and Seeds	Fresh leaves juice and root Pastes used for dressing in callous ulcer
8	*Azadirachta indica* A. Juss. (Meliaceae)	Neem	Phulpur, Allahabad, India	Whole Plant	Hypolipidaemic, hypoglycaemic, antiviral immunostimulant, hepatoprotective, anti-inflammatory, antifertility antidiabetic, antibacterial.
9	*Bacopa monnieri* (L.) Wettst. (Scrophulariaceae)	Brahmi	Phulpur, Allahabad, India.	Whole Plant	altheizmer's disease, parkinson's disease, attention deficit disorder and memory loss
10	*Bidens pilosa* L. (Asteraceae)	Gumra	Sitapur,	Leaves	Fine paste is prepared, used for Dressing in callous ulcer until the disease is cured.
11	*Buchanania lanzan* Spreng. (Anacardiacaeae)	Chiraonji	Muirpur Range, Renukoot Forest Division	Roots, Leaves and Fruits	The roots are acrid, astringent, cooling, depurative and constipating, and are useful in treatment of diarrhoea. Leaves are used in the treatment of skin diseases. Fruits are used in treating cough and asthma.
12	*Cassia tora* L. (Caesalpiniaceae)	Panwar	Sitapur,	Seeds	100g roasted seeds boiled in 100 ml of water for 1/2h. 10-15 ml decoction 2 times a days in peptic ulcer
13	*Curcuma longa* L. (Zingiberceae)	Haldi	Phulpur, Allahabad,India	Whole Plant	Analgesic, antipyretic, antidiabetic, hemorrhoids, anemia, jaundice, asthma, wound healing.
14	*Cuscuta reflexa* Roxb. (Cuscutaceae)	Akashbel	Commonly found in valley of Chambal, Mandel, UP	Plant Juice	The juice of plant is useful in hookworm infestations, and in diphtheria.
15	*Euphorbia hirta* L. (Euphorbiaceae)	Dudhi.	Commonly found in wet places, upto 2000 mts. Chamoli,UP	Leaves and Latex	Used as an ingredient of medicines for cough & asthma. Latex applied to warts.
16	*Glycyrrhiza glabra* L. (Papilonaceace)	Mulethi,	Sitapur	Rhizomes	Powder is used 4 to 5 times a day in case of stomach and intestinal cancer.
17	*Helicteres isora* L. (Sterculiaceae)	Marorfali	Sukrut Range, Mirzapur Forest Division	Fruits, Roots and Bark	Emphysema and diabetes expectorant, astringent, antigalactagogue, to reduce gripping and a cure for snakebite
18	*Holarrhena pubescens* Wall. ex G.Don (Apocynaceae)	Kutaj	Khoradeeh Forest Block, Bela Forest Block, Mirzapur Forest Division	Stem Root, Bark and Seeds.	Treatment of dysentery, disorders such as menorrhagia, haemorrhoids, diabetes and oedema and has been used for tumours, abscesses, aches and pains, bronchitis, colic, diarrhoea, splenitis and as a vermifuge, laxative and astringent.
19	*Justicia adhatoda* L. (Acanthaceae)	Vasinga.	Commonly found at road side of Gopeshwar, Pathali-	Leaves	Juice of fresh leave mixed with ginger juice used in cough and asthma.

			Dhar, Gwargoush 900-1200 Mt., Chamoli,UP		
20	*Linum usitatissimum L.* (Linaceae)	Alsi	Firozabad UP	Flowers	Heart diseases, skin diseases
21	*Madhuca longifolia* (Koenig ex L.) J.F.Macbr. (Sapotaceae)	Mahua	North Eastern Tarai Districts Of Uttar Pradesh	Flowers	Cold, cough and headache
22	*Malva sylvestris* L. (Malvaceae)	Nari	Hardoi,	Flowers	100g dried flowers boiled in 1l of water for ½ h. 5-10ml decoction 2 times a day for gastric and. peptic ulcers.
23	*Nardostachya jatamansi* DC. (Valerianaceae)	Jatamashi	Commonly found in the alpine zone at Rudarnath Tungnath 2700-3500 Mt, Chamoli,UP	Root	The decoction of the roots is used in mental diseases, insomnia and cardio-vascular diseases.
24	*Nelumbo nucifera* Gaertn. (Nympaeaceae)	Kamal Kakri	Fatehpur, UP.	Rhizomes	Eaten as vegetable. Used in piles, chronic rhizome arrowroot given to children in diarrhea and dyspepsia.
25	*Polygonum barbatum* L. (Polygonaceae)	Safed Mirchi	Sitapur	Shoot	Fresh shoot boiled in 1 litre water for 15 minutes. Decoction is used for gargle to the patient of oral cancer after every 4 hours.
26	*Rauvolfia serpentina* (L.) Benth. ex Kurz (Apocynaceae)	Sarpgandha	Kanpur Forest Division, Kanpur	Roots	Mild high blood pressure, nervousness, trouble sleeping (insomnia), and mental disorders
27	*Tinospora cardifolia* (Thunb.) Miers (Meninspermaceae)	Gurch	Bela Forest Block, Mirzapur Forest Division, Firozabad UP	Roots, Stems and Leaves	Diabetes, high cholesterol, allergic rhinitis (hay fever), upset stomach, gout, lymphoma and other cancers, rheumatoid arthritis, hepatitis, peptic ulcer disease, fever, gonorrhea, syphilis, and to boost the immune system. Jaundice, snake bite
28	*Urtica dioica* L. (Urticaceae)	Kandali	Commonly found at the all valley of hill region, ascending 7000-8000ft. Chamoli, UP	Leaves	It is also used for jaundice and constipation.
29	*Withania somnifera* (L.) Dunal. (Solanaceae)	Ashwgandha	Jhansi Forest Division, Jhansi	Root and Berry	It is used for arthritis, anxiety, trouble sleeping (insomnia), tumors, tuberculosis, asthma, a skin condition marked by white patchiness (leukoderma), bronchitis, backache, fibromyalgia, menstrual problems, hiccups, and chronic liver disease.
30	*Xanthium strumarium* L. (Asteraceae)	Kuthuru	Firozabad UP	Leaf and Seeds	Malaria, chronic conjunctivitis & inflammation of eye
31	*Zanthoxylum armatum* DC. (Rutaceae)	Timru	Commonly found at Gopeshwar, Sayar, UP to 1200 Mt. Chamoli,UP	Bark and Seed	The decoction of the plant gives relief in rheumatic pain. Powdered fruits relieve tooth-ache.

6. Conclusion

Medicinal Plants are always considered as a very important source of medicine especially for the population of the rural areas and tribes because of the high cost and difficult accessibility to modern medicine. This study was conducted in different regions of Uttar Pradesh. Traditional knowledge of the area is greatly affected due to modernization and other factors and there is an urgent need to protect the cultural heritage and traditional knowledge of the natives by justifying the therapeutic potential and biological activities of the plants with reported scientific methods.

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