

E-PRACTICAL CUM TEACHING MANUAL

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Ethnobotany, Medicinal and Aromatics Plants

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B.Sc. (Hons) Forestry



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E-PRACTICAL CUM TEACHING MANUAL

Ethnobotany, Medicinal and Aromatics Plants

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Preface

Man has depended on plants from this immemorial. Our knowledge of the intimate relationship between early man and plants has come to us mainly through surviving tradition. This relationship which now forms the core of the interdisciplinary science i.e. Ethno botany has attracted much attention, not only due to its great academic or historical importance, but also due to many economic applications.

I am thankful to all those persons from whom, I have gathered plants identification along with a photographs used in this E-Manual. I would also like to extend my thankfulness to all those who have offered assistance, encouragement and cooperation during the entire period of preparation and publication of this E-Manual.

Therefore, it is extremely desirable to document this precious traditional knowledge before it is last forever. The present e-manual has been written with a view to give a glimpse of the rich treasure possessed by this region in its great ethnic diversity. Unlike a large majority of ethno botanical researchers who confine themselves either to ethno medicine or to one or more socio-economic aspect in their work, the present manual deals with almost all aspects of Ethno-botany. Besides this information about land, people, and ethno-medicinal use of traditional plants species, their use, families and local names as well as a glossary of words used by tribal people of Vindhya region are also appended, the data presented are based on actual ethno-botanical surveys conducted by the author for a period spread over more than one year's to collect a firsthand account of ethno botanically interesting species at flowers or fruiting stage.

I would like to particularly acknowledge the help of Dr. (Prof.) Narendra Pratap Singh Honorable Vice-Chancellor, Banda University of Agriculture and Technology Banda. Dr.A.K.Shrivastava, Director PMEC, BUAT, Banda, Dr. A.K. Mishra Director Research BUAT, Banda, Dr. Sanjeev Kumar Dean, CoF, BUAT, Banda for all legal permissions to the editor of the E-Teaching cum Practical Manual of Ethno-Botany, Medicinal and Aromatic Plants.



Dr. Yogesh Y. Sumthane
Editor/Author

Foreword

Ethnomedicinal plants have always been a fundamental are of tribal men. Ethnic are repository of experience and knowledge on indigenous flora and fauna, Unfortunately, this traditional wisdom developed over years of observation, trial and error, is vanishing rapidly due to the assault of modern civilization into ethnic areas.

These compilation lists of Ethnic Medicinal plants and their specific feature will further enrich the know-how of readers in the treatments of various diseases. The botanical name of each plant has been followed by their common names prevalent in different language and then is provided with various aspects of uses. The information is comprehensive and consolidated.

Diseases cured by Ethno-medicinal plants are often one of the most dreaded ailments afflicting the mankind today. It's like a slow poison which usually stays unnoticed and permanently in the human body. Weakness the immune system and predisposes human beings for greater health hazards and clinical complications. The modern man looks optimistically towards genetic engineering for final resolution of the ailment but that is still a far cry. Till then, every individual suffering from any diseases has to rely on the medicinal aid available for controlling the disease. In the Indian system of medicine, there are many plants species which have been traditionally used for control and cure of diseases. But the indigenous knowledge has not been scientifically and property document. Moreover, this information is fragmented and scattered. The first step therefore is to collect and select the available information on plants that have been used since ancient times for curing many diseases. This e-Teaching cum Practical manual on Ethno-Botany, Medicinal and Aromatic Plants is an honest effort to gather and compile the information.

I am sure that the e-Teaching cum Practical manual on Ethno-Botany, Medicinal and Aromatic Plants will serve as a good base for further researches, research scholars, study material for college students and will be useful to different strata of society.

I wish the authors success in their endeavour.



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Ethnobotany: Definition, Development and Importance

Ethnobotanical knowledge is very ancient. It provides information regarding the traditional uses of plant wealth which can be utilized in integrated tribal development.

The ethno botanical studies throw light on certain unknown useful plants and new uses of many known plants which can be exploited for developing new sources for some plants products known products and agro based industries.

The term ethno botany was coined by J. W. Harshberger in 1895 to include the study of plants used by the primitive and aboriginal people. Though this discipline has existed for ages, ethno botany emerged as a distinct branch of natural science in twentieth century.

Definition and Concept:

Several definitions have been assigned to ethno botany but the basic concept has not changed much and the scope of ethno botany is increasing day by day.

According to Schultes (1962), ethno botany is defined as the study of the relationships between the people of a primitive society and plants.

Alcom (1984) state that ethno botany is the study of contextualized plant use.

Jain (1987) elaborated it is as the total natural and traditional relationship and interaction between man and his surrounding plant wealth. Recently, Wickens (1990) defined ethno botany as the study of useful plant prior to commercial exploitation and eventful domestication. In fact, ethno botany is the first knowledge of plant which primitive and aboriginal people had acquired by sheer necessity, intuition, observation and experimentation in the forest.

It is now almost universally recognized as the total direct or natural relationship between man and plants and it include the use of plants by both tribal's and non-tribal without any implication of primitive or development societies. Ethno botany is an interdisciplinary science and has relevance to sociology, anthropology, taxonomy, photochemistry, archaeology, ecology, agriculture, medicine, linguistics etc.

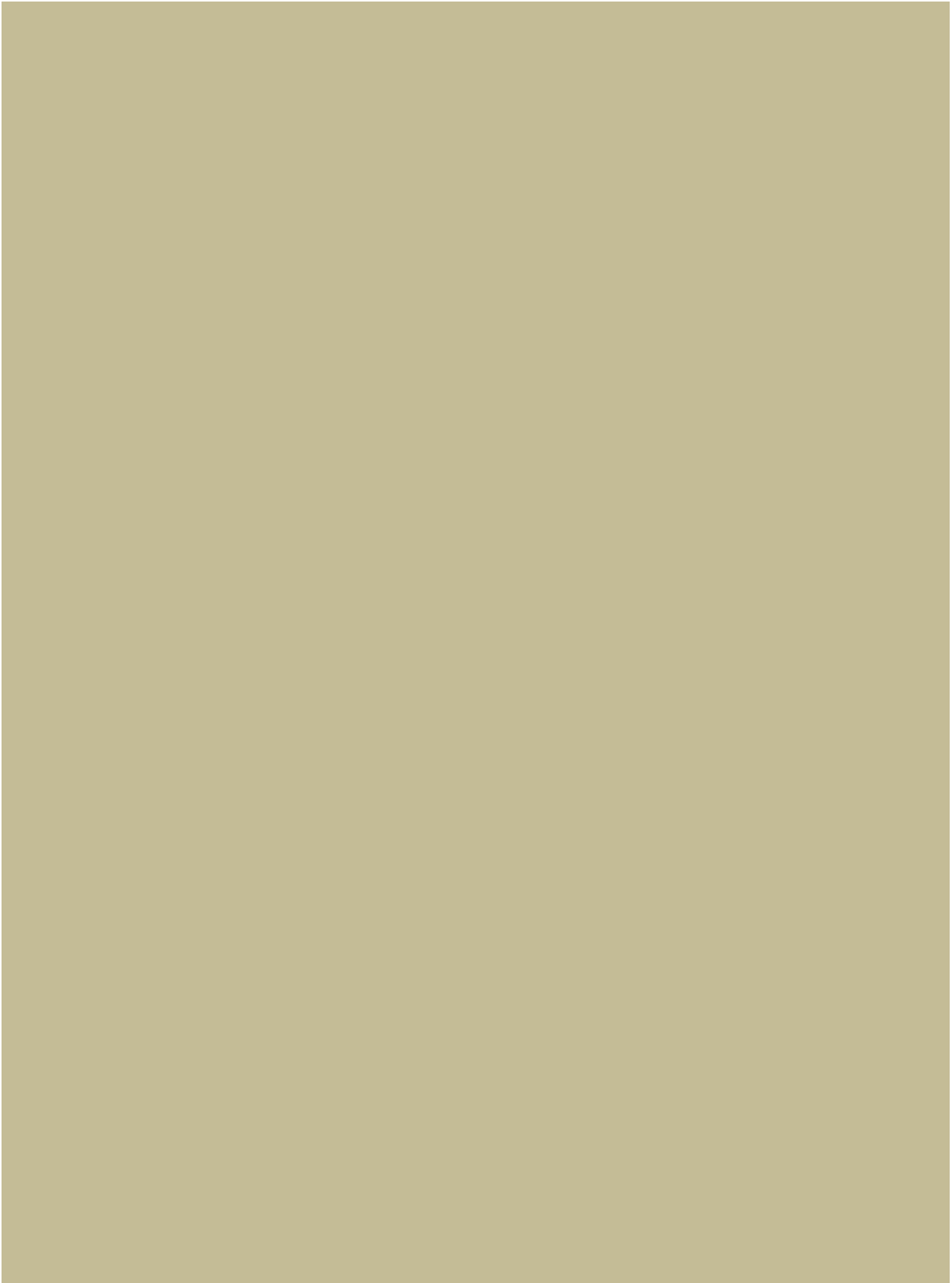
Today ethno botany has become an important and crucial area of research and development in resource management, sustainable utilization and conservation of biodiversity and socioeconomic development. Now the botanists, social scientist, anthropologists, the practitioners of indigenous medicines all over the world are engaged in the study of man-plant interaction in natural environment.

History of Development of Ethno botany

Prior to coining of the term ethno botany usage of plants by human being for various purpose found place in the ancient Sanskrit, Greek, Arabic literature, ethnographic, travelogues etc. Some compilation work of repute are Foods and Drinks through Ages (2500 BC to 1937) (Anonymous, 1937), Arabian medicines and influence on the middle ages by Campbell (1926), Indo-European and Greek Legends by Halliday (1932), Foods and Drinks in ancient India by Ray (1933), The Economic plants of Bible by Moldenke (1954), Glossary of vegetable Drugs in Vaagbhatta by Godbole et al (1966), Plants used against cancer by Hartweh (1967-1971), Glossary of vegetable Drugs in Vrihatrayi by Singh and Chunekar (1972), Economics plants of ancient North China as mentioned in Shih Ching by Keng (1974), Flora and Fauna in Sanskrit literature by Banejee (1980), Plants of Quran by Farooqi (1989), In the early nineteenth century the isolation of alkaloids such as morphine, quinine etc. as effective drugs from the herbs heralded new era in the use of plants products in modern medicines. The last thirty year or so witnessed resurgence of interest in the traditional medicines, ethno medicines and drugs derived from the plants all over the world.

The twentieth century has witnessed the emergence of ethno botany as a distinct academic branch of natural science. There has been increasing interest in the scientific study of ethnic plant used by various indigenous people commonly designated as aboriginal natives, first people, original settlers, adivasees, Vanya Jaati (forest caste), Aadim Jaati (primitive caste), Jan Jaati (folk communities) and tribals. More than a dozen book and a thousand research publication on ethno botany has appeared in the world.

Field visit to different tribal regions to gain ethnobotanical knowledge or the inter-relationship between Plant and People.



Useful threatened plants in the state of Uttar Pradesh

Name of the Plant	Family	Local Names	Locality	Tribe	Uses	Distribution	Status of Rarity
Acorus calamus L.	Araceae	Bach, Bal, Ghorbach	Jaunsar, Kheri, Sonbhadra	Jaunsari, Tharu, Gond	For curing bronchitis, cough and cold and diarrhea. As antidote for snakebite.	In marshy places, wild, throughout India, ascending the Himalaya to 2500 m., in Sikkim, north temperate and warm region. Sri Lanka, Europe and North America.	The plant is vulnerable (VU)
Asparagus adscendens Roxb.	Liliaceae	Satavar	Gorakhpur, Sonbhadra Varanasi	Tharu, Gond, Kol	To women which increases secretion of milk. The decoction of the root mixed with decoction of Bombax ceiba is used for sexual strength and vigour.	Sal forests of terai region of Uttar Pradesh, Western Himalaya from Kumaon eastwards to Hazara extending to Affghanistan, Decan Peninsula.	The plant is vulnerable (VU) in Uttar Pradesh
Berberis aristata DC	Berberida ceae	Chitra, Daruhald. Rasaut, Kashmol	Garhwal, Pithrogarh	Garhwali Bhotia	In the treatment of snakebite, Ophthalmic diseases and Blood pressure.	Temperate Himalaya attitude 2500-4000 m. from Bhutan to W. Himalaya. Nilgiri and Sri Lanka attitude 2500- 3000 m.	The plant is endangered (EN) in Uttarakhand

B. Lycium Royle	Berberida ceae	Kashmoe e	Jaunsar	Jaunsari	As eye drops in eye inflammation. In skin diseases and diabetes.	Dry valleys of the Himalaya, alt. 1300-3000 m.; from Bhutan to W. Himalaya, Bihar on Parasnath, alt. 1450m. Edgewood, Afghanistan	The plant is endangered (EN) in Uttarakhand
Celastrus paniculatus Willd.	Celastrace ae	Umjan, Mujhani, Malkanga ni Kakundan	Sonbhadra, Varanasi, , Nainital, Kheri,	Gond, Kol., Tharu	For the treatment of tumour cancer, for treating rheumatism and gout. Seed oil is massaged on joint pain.	Occurs in Dehra Dun subtropical Himalayas up to 1600 m; and in the Hill parts of India from Punjab eastward and south, Sri Lanka.	The plant is critically endangered (CR) in Uttar Pradesh and Uttarakhand
Chlorophyt um tuberosum Bak.	Liliaceae	Safed Musli	Gorakhpur	Tharu	for maintaining sexual strength and vitality	Sal forests of terai region of Uttar Pradesh. Bihar, Bengal, Madhya Pradesh and South India; also in Myanmar, extending in tropics.	The plant is critically endangered (CR) in Uttar Pradesh
Drimia indica L.	Liliaceae	Ban Piyaz	Varanasi	Kol	For abortion	Plains of Uttar Pradesh. On rocky soil, more or less throughout India.	The plant is critically endangered (CR) in Uttar

							Pradesh and Uttrakhand.
Euphorbia fusiformis Buch.-Ham. ex D. Don	Euphorbiaceae	Banmuli	Gorakhpur, Bahraich, Kheri	Tharu	In paralysis, for the treatment of rheumatism and gout.	W. Himalaya foothills	The plant is critically endangered (CR).
Gloriosa superba L.	Liliaceae	Karihari. Kalihari	Varanasi, Gorakhpur, Pithrogarh	Kol, Tharu, Bhotia	In rheumatism and gout	Uttar Pradesh, along the sub-Himalayan tracts of Rohilkhand and Terai region, usually in outskirts of forests also in Bundelkhand and Marwara, Bihar and Madhya Pradesh etc. Mostly in tropical parts of India.	The plant is critically endangered (CR) in Uttar Pradesh and Uttrakhand.
Gymnena sylvestre (Retz.) Schult	Asclepiadaceae	Gurmar	Varanasi Sonbhadra	Kol	In the treatment of diabetes.	Bundelkhand, Saharanpur, dry hills in Uttar Pradesh, S. India, extending tropical Africa. Malaysia. Asia.	The plant is vulnerable (VU).
Hedychium	Zingibe-	Kapoor-	Pithoragarh	Bhotia	Used as anti-	Subtropical region	The plant is

spicatum Buch.-Ham	raceae	kachri			inflammatory	of Western Himalaya, Nepal.	vulnerable (VU) in Uttaranchal
Helminthostachys zeylanica Hook.f.	Ophioglossaceae	Kamraj:	Gorakhpur	Tharu	Given in spermatorrhoea and to improve memory.	More or less throughout India but extremely rare. Occur rarely in the Sal forest of Terai region of Uttar Pradesh, Madhya Pradesh etc.	The plant is critically endangered (CR)
Hemidesmus indicus (L.) R. Br.	Asclepiadaceae	Chherdudhiya, Padhin, Kapoori;	Sonbhadra Varanasi	Gond, Kol	For the treatment of diabetes. Given orally as an antidote to snake bite.	Forest of Uttar Pradesh. Madhya Pradesh, Bihar eastwards to Bengal and the Sundarbans to South India and Sri Lanka.	The plant is vulnerable (VU)
Perilla frutescens (L.) Britt.	Lamiaceae	Bhanjiri	Jaunsar	Jaunsari	Seed oil is massaged twice a day in arthritis for a long time.	Western Himalaya, extending up to 2500 m. Sikkim, Arunanchal Pradesh:	The plant is vulnerable (VU) locally in Uttar Pradesh and Uttarakhand
Piper longum L.	Piperaceae	Peeper, Farpiper	Nainital, Kheri;	Tharu	The ripe fruit powder mixed with honey is given for cough and cold.	Wild in terai region of Himalaya and cultivated at some places of India	The plant is endangered (EN) in Uttar Pradesh

					Root powdered for headache.		
Pygmeopremna herbacea (Roxb.) Mold.	Verbenaceae	Gathiyavadi. Bhand, Gathiavat	Varanasi, Kheri	Kol, Tharu	The paste of the whole plant is made into pills and given three times a day for fifteen days for the treatment of rheumatism and gout. Warm root paste is applied externally for the treatment of rheumatoid arthritis and gout.	Subtropical Himalaya from Kumaon east to Assam extending South through W. Bengal, Bihar, Orissa into the Deccan Peninsula	The plant is critically endangered (CR) in forest area due to illegal grazing.
Rauvolfia serpentina (L.) Benth. ex Kurz	Apocynaceae	Jhabarbarua, Chhotachand, Sarpagandha	Kheri, Nainital	Tharu, Bhoja	The extract of the root is given two times for three days to cure fever and blood pressure	More or less throughout the hotter parts of India, Pakistan, Sri Lanka, Myanmar, Malaysia and Thailand.	The plant is vulnerable (VU) in Uttar Pradesh and Uttarakhand
Andrographis paniculata (Burm.) Wall. ex Nees	Acanthaceae	Kirayat kalmegh	Gorakhpur Varanasi	Tharu,	Used as tonic, Influenza, bronchitis Decoction is used in jaundice.	In waste cultivated, in gardens places, more or less throughout India	The plant is vulnerable (VU) in Uttar Pradesh.
Costus	Dioscoria	Kewa	Kheri,	Tharu,	Rhizomes are	Sal forest of Uttar	The plant is

speciosus (Koenig ex Retz.) Smith	ceae		Gorakhpur		cooked and eaten, used as tonic, in fever etc.	Pradesh, Madhya Pradesh, Bihar and Orissa, more or less throughout India, Indomalaysia.	endangered (EN) in Uttar Pradesh
Dioscorea deltoidea Wall. ex kunth	Dioscoria ceae	Gun, kithi	Jaunsar	Jaunsari	Used in rheumatic and ophthalmic diseases as a oral contraceptive	Western Himalaya	The plant is endangered (EN) in Uttarakhand.

Ethno medicinal use of plants of semi-arid region of Central India

Botanical name	English/Hindi name	Family	Uses
Herbs and shrub species			
Achyranthus asperu L	prickles chat latira	Amaranthacea	Its juice is useful in piles, hails skin eruptions, large doses produces abortion, also used in cough, oral infection
Acorus calamus L	sweet flag safe bank chorabach	Araceae	Is aromatic rhizomes are used as carminative, stimulant to central nervous system as a tonic. Externally used in chrome rheumatism, also useful in diarrhea and dysentery.
Aerva lantana (L) Juss	gorakh booti, chaya	Amaranthacea	It has anthelmatic and diuretic properties Roots are used as demulcent diuretic and for headache.
Ageration conyzoides L	goat weed, while weed, conyzoid floss flower	Asteraceae	Its juice is used for cure of allergic rhinitis.

Aloe barbadensis Mill.	Barbados aloe/ ghikanvar guarpatta	Liliaceae	Resinous drug of leaves is used as purgative, fruit pulp in piles, intestinal wounds in children.
Amaranthus tricolor L	tampal, amaranthus bari chaulie	Amaranthaceae	It is astringent, used in diarrhea dysentery, used externally in throat and mouth and as wash for ulcers
Andrographis paniculata (Burm. F.) Wall Ex Nees	king of bitters/kiryat kalmegh	Acanthaceae	Used as tonic, fevers, worm dysentery, useful for children suffering from liver and digestive complaints.
Argemone mexicana L	mexican poppy, yellow thistle/pila dhatura, pili kateli	Papaveraceae	
Aristolochia indica L	indian bertheort/isharmal	Aristolochiaceae	Its drug promotes digestion and regulates menstruation, used as stimulant, fevers, gastric stimulant.
Asparagus racemosus Willd	asparagus/satavar	Liliaceae	Root paste used as aphrodisiac, diuretic, anti-dysenteric in veterinary medicines.
Boerhavia diffusa L.	spreading hogweed, horse purslane/punarnava, bushkhapra, sent	Nyctaginaceae	Root is laxative, diuretic and anthelmintic As diuretic it is useful in gonorrhoea, successful in asthma. Whole plant constitutes the drug punarnava which contains an active principle: "Punarnavine"
Cannabis sativa L.	hemp ganja, bhang charas	Cannabinaceae	Drug is also used as stomachic, antispasmodic, analgesic and sedative. The leaves juice applied to removes dandruff and vermin.
Cassia tora L.	sickle senna,	Caesalpiniaceae	Seeds are tonic and stomachic, but they are

	lamer/chakunda, pamar		particularly used externally in skin diseases, leprosy.
Catharathus roseus (L). G. Don.	madagascar periwinkle/sada sawagan sadabahuar	Apocynaceae	The roots and leaves decoction or extract active on hypertension and flower is used in Cancer therapy and diabetes.
Celosia argenta L.	feather cocks comb, quill grass/safed murga	Amaranthaceae	Seeds are useful in blood diseases and mouth sores and or eye diseases.
Centella asiatica (L.) Urban	asiatic pennywort/brahmi	Hydrocotylaceae	Leaf and stem drug, used as an alternative, tonic and diuretic, also used in nervous system and skin diseases.
Centratherum anthelminticum (L.) O. Kuntze.	Somraj	Asteraceae	Seeds are used as an anthelmintic and are effective against thread worms.
Chenopodium album L	pigweed/bathua	Chenopodiaceae	Leaves are rich in vitamin C. It is mildly laxative. Plant is used to relive stomach pain
Cleome viscosa L.	wild mustard jangli hurhur	Capparidaceae	Useful in case of round worms, recent wounds. They are anthelmintic, carminative and stimulant in action.
Clitoria ternatea L	aparajita, gokarni	Fabaceae	Seeds are used as purgative and roots as cathartic, diuretic and purgative, also employed in weakness of sight, sore throat and mucous disorders, in tumours and

			dropsy.
Cocculus hirsutus (L.)		Menispermaceae	Roots are useful in chronic rheumatism and venereal diseases. Root is sedative, hypotensive, cardiotonic and spasmolytic.
Cynodon dactylon (L.)	grass, couch grass, creeping panic grass/ durban, doob	Poaceae	The fresh juice of the grass is astringent and is useful in haematuria and as an application in catarrhal ophthalmia, also for cuts and wounds.
Cyperus rotundus L.	Motha	Cyperaceae	The tubers have tonic and stimulant effect. It is also used as a demulcent, diuretic, diaphoretic, astringent, vermifuge. Properties in fever, diarrhea, dysentery, dyspepsia, vomiting, cholera.
Datura stramonium L.	thorn apple, jimson weed/ dhatura	Solanaceae	Leaves and seeds are narcotic and sometimes used for criminal poisoning. Drug consists of dried leaves, flowering tops and seeds which are used in treatment of asthma.
Desmodium triflorum	kudaliya	Fabaceae	The fresh juice of the plant is given to children for cough. It is also used in cough, bronchitis, wounds, dysentery, burning sensation.
Desmostachya bipinnata(L.) Stapf	kusa	Poaceae	Used as ingredient of medicine in dysentery.

Echinops echinatus	utakanta	Asteraceae	Plant is diuretic, nerve tonic and used in cough, indigestion and ophthalmic. Powdered roots are applied to wounds in cattle to destroy maggots
Eclipta prostrate (L.)	trailing eclipta/ bhangra, babri	Asteraceae	Plant juice used for catarrhal jaundice, hair oil for blackening and strengthening hair. Root used as tonic. Seeds are aphrodisiac
Euphorbia hirta L.	pill-bearing spurge /asthma plant, Lal dudhi	Euphorbiaceae	Drug is used in bronchial affections, cough, and asthma and in removing worms in children. Also in bronchitis and other respiratory tract conditions.
Hemidesmus indicus (L) Schult.	indian sanoparilla. magrabee/anantmil kapor	Periplocaceae	The fragrant root-bark possesses demulcent, alternative tonic properties, its hot infusion with milk and sugar is a good alternative tonic especially for children in cases of chronic cough and diarrhea.

Botanical name	English/Hindi name	Family	Uses
Herbs and shrub species (cont.)			
Hybanthus enneaspermus (L) F.V. Muell	Ratanpurus	Violaceae	Leaves and tender stalks are used as demulcent and roots in bowel complaints of children.
Hyptis suaveolens	Vilaiti Tulsi	Lamiaceae	Herb is useful for insect bites and other wounds, leaves are used in Poultices for headache and also applied on abdomen of children worms.
liberis amara L.	rocket candy tuft	Brasicaceae	An infusion of herb is considered an excellent remedy for rheumatic complaints. It relieves the chronic cases of arthritis. Seeds are used in asthma and bronchitis.
Ipomoea purpurea (L.) Roth.	tall morning-glory	Convolvulaceae	A plant is reported to be used as laxative, purgative and antisyphilitic. A paste made from root is applied as a poultice to backaches and sore muscles
Leucas aspera (willd) Spreng.	thumbe chhota-balkusa	Lamiaceae	Mixed with honey, flowers are used for cough and cold. An alcoholic extract of leaves shows antibacterial activity. They are useful in colic. Dyspepsia, verminous, arthralgic chronic skin eruption, catarrh in

			children intermittent fever and ulcers.
<i>Leucas cephalotes</i>	goma, motapati	Lamiaceae	Syrup from flowers used for cough and cold
<i>Linum usitatissimum</i> L	flax, linseed/alsi	Lamiaceae	Linseed mucilage is used in pharmaceutical industries as demulcent.
<i>Malva Sylvestris</i> L.	the common mallow vilayati-kangai, gullkhais	Malvaceae	The seeds are employed internally in decoction as a demulcent. Leaves are made into a poultice as an emollient external application Flowers and immature fruits are used for whooping cough.
<i>Malva verticillata</i> L.	guchhapushp, mradupatra	Malvaceae	Root is used for whooping cough. Leaves and stems are given to women in advanced stage of pregnancy
<i>Mentha aquatica</i> L	water mint, marsh mint/tivra	Lamiaceae	Volatile oil from plant is used for headache and also in cholera.
<i>Mentha longifolia</i> (L).	Mint/Jangli pudina	Lamiaceae	Dried leaves are used as carminative and stimulant.
<i>Mirabilis jalapa</i> L.	Four O'clock plant Gulabbas	Nyctaginaceae	The dried root possess some nutrient qualities, its pest applied in contusions
<i>Nelumbo nucifera</i> Gaertn.	cast Indian lotus, sacred lotus/kamal	Nelumbonaceae	The flowers, Filaments and juice of the flower stalks are refrigerant and astringent,

			useful in fevers and cardiac tonic. The tubers use to cool the head and eyes, mucilaginous roots are dermal cent, given in piles. The seeds are used in skin affections.
Ocimum americanum L.	hoary basil/kali kulsi, mamri	Lamiaceae	The seeds are considered diuretic, tonic and preparation of cooling drinks. A decoction of the plant is taken for coughs, leaves for dysentery and also used as a mouth wash for reliving toothache
Ocimum basilicum L.	sweet basil bantulsi	Lamiaceae	The seeds are mucilaginous and demulcent and diuretic in effect. They are useful in internal piles and constipation. The cold infusion of the seeds is useful in after-pains of parturition; leaf juice is dropped into the ear in earache and dullness of hearing.
Operculina turpethum (L.)	Indian jalap/nisoth, pitobri	Convolvulaceae	A resinous substance (turpentine) obtained from the root bark is used as a purgative.
Oxalis acetosella L..	Common wood-sorrel/khati boonti	Oxalidaceae	The plant possesses refrigerant, diuretic, and antiscorbutic properties; it is used in liver and digestive disorder. The plant possess febrile diseases urinary affections, catarrh and to remove cancerous growth from the lips.

Oxalis corniculata L.	Indian sorrel	Oxalidaceae	The leaves considered cooling, refrigerant and antiscorbutic, used for removing corns, warts and other excrescences on the skin. An infusion of the leaves is used to remove capacity of the cornea. The fresh leaves are made into a curry, which improves the appetite and digestion of Dyspeptic patients.
Phaulopsis dorsiflora (Retz) Santapau		Acanthaceae	Plant is used for dressing wounds. Fresh juice is applied to sores
Phyllanthus fraternus Webster	Jaramla, jangli amla	Euphorbiaceae	The plant is considered deobstruent, diuretic, astringent and cooling. used in jaundice, half ounce rubbed up in a cup of milk is given at morning and evening
Phyllanthus maderaspatensis L	kanocha bazarmani Ranaivali	Euphorbiaceae	An infusion of leaves is used for headache. Seeds possess laxative, carminative and diuretic properties.
Pistia stratiotes L	water lettuce, tropical Asian weed/jalkumbhi, takapana	Araceae	Plant juice is used in earache and ashes are applied to the ring worm Leaves are used in eczema, leprosy, ulcers, piles and skin diseases. Also made into poultice applied to hemorrhoid, mixed with rose water and sugar given in asthma and cough with coconut milk in dysentery. Plant is used for scurvy, liver diseases, spleen, kidney, bladder, cardio vascular diseases, dysentery.

Portulaca oleracea L.	common purslane/khursa kulfa	Portulacaceae	It is also used as blood purifier in homeopathy.
Psoralea corylifolia L.	babchi, babchi	Fabaceae	An oleo-resinous substance from its seeds is used in treatment of leucoderma, leprosy and other skin diseases, used as anthelmintic and for promoting urination.

Botanical name	English/Hindi name	Family	Uses
Herbs and shrubs species (Cont).			
Ranunculus sceleratus L.	blister butter cup	Ranunculaceae	Its juice is used in rheumatism dysuria asthma, pneumonia also used against skin disorder. Seeds are used as tonic and also prescribed in kindly troubles.
Rauvolfia serpentina	Chandrabhaga, surpagandha	Apocynaceae	Drug Rauvolfia, obtained from roots, used for relief from nervous disorders, hypertension and as a sedative and tranquilizing agent. Root extract is also used for intestinal disorders.
Scirpus grossus L.F.S. Kysoor (Roxb.)	Kaseru	Cyperaceae	Its tubers are edible and are also reported to possess laxative, tonic, cooling and diuretic properties
Sida cordifolia	bala	Malvaceae	Leaves are eaten as vegetables. It used in

			swelling to joints due to arthritis in animals.
Solanum nigrum L.	black nightshade	Solanaceae	Freshly prepared plant extract is considered useful in treating cirrhosis of liver. Boiled leaves and tender schools are recommended to patients suffering from dropsy
Solanum sursttense Burm. F.	yellow-berried highshade/kateri	Solanaceae	A root is an expectorant forming an ingredient of Ayurvedic medicine dasmula, used in cough asthma and pain of chest. Fruit juice is used in sore throat and leaf juice mixed with black pepper is recommended in rheumatism.
Tephrosia purpurea (L.) Pers. Tribulus terrestris L.	purple tephrosia/sarphonka, ban nil land-cal-trops/gokhni	Fabaceae Zygophyllaceae	Powdered leaves are smoked for relief from asthma and cough. It is a good brain tonic. Root decoction is mixed with little quantity of sugar to cure urinary diseases. Fruits have diuretic and tonic properties for treating calculus affection. Leaf paste is used for treatment of stones in bladder. Roots possess aperients and tonic properties.
Trichosanthes anguina L.	snake gourd/chachinda	Cucurbitaceae	Roots and seeds are used in medicines for expelling worms, and for treating diarrhea and syphilis. Leaf juice is rubbed over the liver in liver congestion and fever

Withania somnifera (L.) Dunal	Asgand, Ashwagandha	Solanaceae	The roots are the source of the drug Ashwagandha. It is useful in cough, dropsy, and rheumatism, and female disorders, and as a sedative in cases of sense of disability.
Adhatoda vasica Nees	adadodai / adulasa	Acanthaceae	Leaves and roots are used in cough, chronic, bronchitis, asthma
Tree species			
Aegle marmelos (L) Correa	Beal	Rutaceae	Pulp and fruit used as a Aroma, cooling, astringent
Ailanthus excelsa Roxb.	maharukh	Simaroubaceae	Bark extract used as aroma, tonic, antiseptic
Azadirachta indica A. Juss	neem	Meliaceae	All parts used for tonic, astringent, demulcent, stomach
Butea monosperma (Lamk) Taub.	Palas	Papilionaceae	Used of seed and leaves as anthelmintic, astringent, diuretic purgative and aphrodisiac
Bauhinia variagata (L)	Hijal, Kachnar	Caesalpiniaceae	Seed, bark and leaves used as alternative tonic, astringent and in dyspepsia. Dry flowers and buds used in diarrhea, piles, dysentery, bark extract also in tuberculosis, leprosy, ulcer, with honey used for various ladies disorders

Cassia fistula (L.)	indian laburum/amaltas	Caesalpiniaceae	Extract of all the parts used as laxative, astringent tonic, purgative.
Cassia auriculata (L)	Senna	Caesalpiniaceae	Root and bark extract used as diphor, expect, emetic astringent, tonic
Ceiba pentandra (L) Gaertn.	Kapok	Bombacaceae	Extract of leaves, roots and fruits used as tonic, astringent, demulcent.
Cordia dischotoma forst. f	sebestens	Boraginaceae	Fruit extract used as astringent, anthelum, diuretic, demulcent.
Ficus religiosa (L.)	Pipal	Moraceae	Bark extract used as astringent, gonorrhea, pain of bones.
Ficus bengalensis (L)	banyan/bargad	Moraceae	Infusion of bark used as tonic astringent, leaf extract in wounds.
Jatropha curcas (L)	pyhsic nut/ratanjot	Euphorbiaceae	Extract of nut, seed and other used as purg and fish poison.
Mallotus phillippensis (Lam) muell. arg	Kamela	Euphorbiaceae	Glands and hairs on fruit used as bitter, anthelm cath, stypic
Mangifera indica (L.)	Mango/Aam	Anacardiaceae	Ripe fruit, rind of fruit, kernel and bark used as laxative, diuretic, astringent, stimulant, tonic and anthelmintic.
Tamarindus indicun (L)	Imli	Caesalpiniaceae	Fruit extract used as refrigent, digestive, carminative and laxative.
Terminalia arjuna Bedd.	Arjun	Combrataceae	Extract of bark and fruit used as tonic, astringent, deobstruent, leaf extract in car pain.
Euphorbia neriifolia	mausa sij	Euphorbiaceae	Milky juice and root used for purgative,

Roxb.			expect in scorbian sting and snake bite, antiseptic, fish poison
Emblica officinalis Gaertn.	Amla	Euphorbiaceae	Fruit powder used in anemia, gastric, jaundice, liver swelling, urinary, asthma, lucoria, bronchitis etc., leaves in boiled water used un blood sugar
Syzium cummini (L) Skeels	Jamun	Myrtaceae	Flower and leaves extract used in diabetes, bark as blood purifier, bark with goat milk in dysentery, diarrhea.
Madhuca logifolia Macb	Mahua	Sapotaceae	Fruit and flower juice used in blood purifier, cardiac, and ear pain etc. bark extract used in ulcer, leprosy.
Zyzipus mauritiana Lamk	Ber	Rhamnaceae	Fruit is used for stomachs, anti-poisonous, leaves with areca nut used in typhoid.
Acacia nilotica(L) Willd. Ex Acacia catechu Willd	Babool Kath	Mimosoidaceae Mimosoidaceae	Bark extract used as astringent Bark and heart wood extract used as astringent
Albizia lebbek Beuth.	Siris	Fabaceae	Bark and seeds extract used as astringent tonic
Albizia procera (Roxb.) Beuth.	Safed siris	Fabaceae	Bark and seeds extract used as astringent tonic.
Pongamia pinnata	Karanj	Papilionaceae	Folk medicine for the treatment of rheumatism, human and animal skin diseases, leaf juice for colds, cough, diarrhea, dyspepsia, leprosy.

<i>Eucalyptus grandis</i> Hill ex Maiden	Eucalyptus	Myrtaceae	Leaves essential oil used as medicinal value in cough and cold.
<i>Dalbergia sissoo</i> Roxb. Ex DC.	Sissoo/sisham	Leguminosae	Root extract used in leprosy, leaves in gonorrhoea.
<i>Cassia angustifolia</i>	Senna	Leguminosae	Leaves and pods are used as laxatives.
<i>Pterocarpus marsupium</i> Roxb	Bija sal	Papilionaceae	Medicine for gonorrhoea.
<i>Holoptelia integrifolia</i> Planch	Kanju	Ulmaceae	Carminative, astringent.
<i>Lagerstroemia parviflora</i> Roxb.	Sidha banteak	Lythraceae	Bark used as expectorant, emetic, carmine.
<i>Melia azadirach</i> (L.)	Bakain	Meliaceae	Used for astringent, stomach, purgater and stimulant.
<i>Michelia champaca</i> (L.)	Champa	Magnoliaceae	Flower extract used as medicine.
<i>Schleichera oleosa</i> (Lour)	Kusum	Sapindaceae	Flower extract used as astringent and tonic
<i>Psidium guajava</i> Raddi	Amrud	Myrtaceae	Boiled leaf extract used traditionally in pyorrhoea



Piper longum



Rosa damascena



Salvia sclarea



Salvia officinalis



Spilanthes acmella



Solanum nigrum



Stevia rebaudiana



Tagetes minuta



Valeriana jatamansi



Viola odorata



Withania somnifera



Zingiber officinalis

Important ethnic medicinal plants



Abelmoschus moschatus



Andrographis paniculata



Asparagus racemosus



Atropa belladonna



Cassia angustifolia



Catharanthus roseus



Chrysanthemum cinerariifolium



Gentiana kurroo



Gloriosa superba



Hypericum perforatum



Mucuna pruriens



Pelargonium graveolens

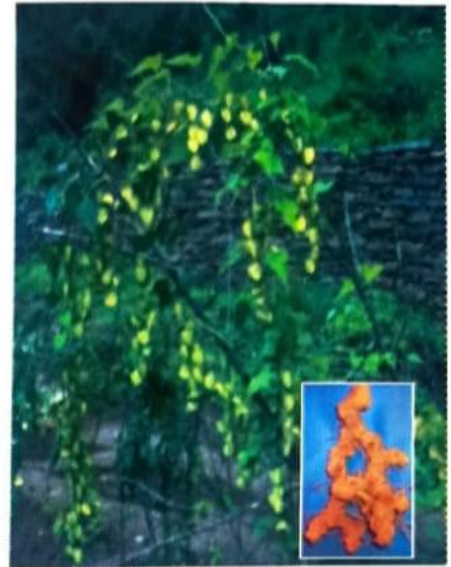
Important ethnic medicinal plants



Aconitum deinorrhizum



Aconitum heterophyllum



Dioscorea deltoidea



Ephedra gerardiana



Inula racemosa

Important ethnic medicinal plants



Swertia chirayata



Podophyllum hexandrum



Rauvolfia serpentina



Picrorrhiza kurroo



Taxus wallichiana

Important ethnic medicinal plant

Collection and preparation of herbarium specimen of medicinal and aromatic plants

HERBARIA

Definition and concept

Herbarium is a collection of dried specimens and arrangement of specimens in the sequence of an accepted classification for reference or other scientific study. "Herbarium" used in its original sense, however, referred not to collection of plants, but to a book about a medicinal plants.

The procedure of pressing and Specimens drying for storage has been successful. in terms of preservation of detail and specimen longevity, and the plants preserved provide a concrete basis for past present and future studies. With more than four-hundred-year history the herbarium has become an institution. Today herbarium is not only with preserved plant specimens but also with certain botanical activities. The herbarium is the basic reference source of the taxonomist and has become a center for research as well as teaching and public information.

Herbarium can also be considered as a data bank with vast quantities of raw data. Each preserved specimen has information content and value which will vary depending on completeness of specimen and data and the source of the material. Each specimen has information about the vegetation of an area, a population and the taxon to which it belongs. Therefore, collection represents a source of primary information about man's explorations and observations of the earth's vegetation and documents the results of much the past inquiry into the nature and relationships of plants.

Herbarium specimens are now used for studies in the disciplines which were never even thought of at the time early collections made and herbaria were organized. This study includes cytogeography, biochemical systematics, palynology) and genecology.

History:

The beginning of herbarium a collection of dried specimens and a fixed on a paper for a lasting record is attributed but to Luca Ghini during 1490 and 1456. He was the sole initiator of the art of herbarium-making and was disseminated over Europe by his students.

Gherards Cibo one of the student of Chini, collected and preserved specimens as early as 1532 and

his herbarium is extant today. Although the herbarium technique was a well-known botanical practice at the time of Linnaeus, he adapted the art of mounting specimens on a single sheets and storing them horizon tally as it is practiced today. Although this method became common during the second half of the 18th century, as late as 1833 As a Gray was offering bound volumes of grasses and sedges for sale.

The oldest herbaria initially existed in the United States during mid 1700's were later found their way to Europe where they are preserved. In addition to changes in mounting, early workers also began depositing specimens in established collections, as well as exchanging specimens. Many herbaria have been destroyed by fire, insects, war and ignorance, and all that remains are duplicates sent to other institutions on exchange. An unfortunate policy was the scanty field notes made by early collectors and the lack of concern for original labels as early herbarium specimens were exchanged, sold etc.

The nature of the herbarium as collection as well as institution had remained unchanged until about fifty years ago. Developments in genetics, biochemistry, cytology, ecology, and other fields leading to more experimental work. Most systematists are now using numerous approaches to problem solving and the herbarium should remain as the central facility, as indeed it is in many institutions.

In July, 1972 the Association of Systematic Collections (ASC) was established and began to address itself to many of the problems facing all systematic collections. The goal of the ASC, according to the constitution and by-laws, is to foster care, management, preservation and improvement of systematic collections and to facilitate their utilization in science and society by:

- Providing representation for institutions systematic housing collections;
- Encouraging direct interaction among those concerned with systematic collections and their use;
- Providing a forum for consideration of mutual problems;
- Promoting the role of systematic collections in research, education, and public service.
- Other means and devices which shall be determined from time to time by the membership.

Specimen processing and accessioning

The specimen

Traditionally the typical herbarium specimen has been a vascular plant affixed to 11 1/2" x 16 1/2 sheet, but recent developments have changed the concept of herbarium specimens. Wood samples, fossils, pollen and spores, micro slides, liquid-preserved materials, photographs, drawings

should be considered as specimens and therefore as part of the herbarium. Today most herbarium curators are urging collectors to make a concerted effort to make their collections as complete as possible by including material for chromosome counts, wood samples, slides, pollinators, associated species and detail habitat data. Weeds and cultivated species are at last being considered worthy of inclusion in the collections. If the herbarium is to be the source of information and documentation it should be, the materials used in bio systematic studies as well as other types of studies should be included in the herbarium.

Sources of materials: The influx of material into a herbarium is usually from the following sources:

A. Staff and student collections. These vary according to staff research, interests, speciality, and herbarium goals. Collections may be for floristic, monographic, biosystematics or taximetrics studies.

B. Exchange. Duplicates or special collections are exchanged among various institutions, usually on a one-for-one basis. This is one of the major means of adding to a collection and an efficient means of getting needed materials at minimal costs to all concerned.

C. Gifts. Some herbaria treat receipt of all specimens other than exchange or loans as gifts while others include only those for which no staff services are required. These may range from an entire herbarium to a few specimens sent to a staff specialist.

D. Loans. Loans are generally either temporary or indefinite. The latter is a particularly desirable procedure for historic and other collections which may be for the most part inaccessible to most botanists or where proper housing facilities are lacking.

E. Purchases. The purchase of a herbarium is an uncommon event today usually private or institutional herbaria are donated or are deposited on permanent loan at an institution. Most purchases today involve collections from specific areas.

F. Identification service. In general the specimens sent for identification are kept by receiving institutions unless other arrangements are made in advance. These specimens should be of such quality that they are desirable as specimens and should not be sent without some prior agreement.

Handling of incoming specimens

Irrespective of the source, most materials are first unpacked and treatment procedures vary, but the common methods are:

A. Fumigation. It is necessary to treat all new additions, loans upon arrival and the entire collection should be treated on a regular basis. This involves the use of fumigants viz., methyl bromide, carbon

bisulphide, carbon tetrachloride, ethylene dichloride, hydrocyanic gas, lindane, dichlorvos stripe, or paradichlorobenzene.

B. Poisoning. There are several methods of treating specimens making them either permanently poisonous or unpalatable to herbarium pest. Specimens may be poisoned by dipping or painting them with an alcoholic solution or mercuric chloride. Specimens so treated should always be clearly labelled since this compound is extremely poisonous.

Accessioning of collections:

Accessioning is defined by Fosberg and Sachet (1965) as the recording of the receipt and origin of lots of specimens coming into the herbarium. Each lot is assigned an accession number. The minimum data that is recorded is name of assigned The ender, date of receipt, type of transaction sender, (gift, exchange, purchase), number of sheets, place (country, province, etc.), and kind ads of plants (algae, fungi, vascular plants, etc.).

A practical and efficient way is to stamp sheets with the official herbarium seal and number them before specimens are mounted. Since exchange, loan, and gift records are kept as well as all correspondence, the separate accession record may be considered unnecessary. Sheet numbers, in addition to being used to assess growth and efficiency in herbarium operations, have importance directly related to taxonomic research. They are .an ideal means of referring to a particular specimen in a collection. The exclusive use of collectors' numbers may not be sufficient, particularly in designating types.

Specimen preparation:

There are good four main aspects to making good four herbarium specimens:

1. Collecting
2. Pressing & preserving
3. Mounting
4. Labelling

What to collect

The ideal specimen for identification and research is an entire plant. In general aim to collect

1. At least the terminal parts of the arial shoots including leaves and reproductive parts
2. A representative sample
3. More than one specimen from a single plant if the plant is variable. One specimen from different plants, to show variation within a population.

4. Collect at least a couple of specimens of each plant.

Numbering and Tagging

Record numbers are used to identify different herbarium specimens. The best numbering system is the simplest: start from number and continue for the rest. As a general rule, the same number is given to parts collected from a single plant on the same day. Specimen numbers are tagged and attached to the specimen.

Specimen preservation in the field

Mesophytic plants and those with delicate petals wilt and shrivel quickly once picked, resulting in poor quality herbarium specimens. The best and most practical way to reduce the damage is to with specimen the plant press immediately. Specimens such as aquatic plants delicate flowers deteriorate rapidly. These should be kept in extremely humid air, or pickled or passed immediately.

Collecting ferns, grasses, herbs, shrubs and trees

Collect the entire plant including rhizomes, underground organs (roots, rhizomes, tubers, etc), inflorescences (flowers), infructescences fruits) and other fertile structures. If the plant is small it is a good to collect tippel plants. These can all be given the same collecting number and put on the same sheet of herbarium card. In addition to the general parts of collecting, it is also a good to collect bark either from the trunk or ground, but make sure to note where it came from and how far up the tree.

Preserving and Pressing

Herbarium specimens are generally preserved by pressing until dry, or pickling in a liquid. Pressing means to apply enough pressure to hold the plant in a position that best displays the botanical features while drying.

The keys to achieving well pressed plants are:

1. Dry them as quickly as possible in a good plant press.
2. Care for the specimens as they dry. Plant Press

Plant presses come in various forms but usually consist of two wooden boards or lattices (30 x 45 cm), cardboard and newspaper arranged like a sandwich. Straps or belts are wrapped around the press to hold it together as well as to apply pressure.

Care while drying

Once in the press it is important that specimens are dried as quickly as possible to prevent

them from fungi attack. Normally specimens take 7-14 days to dry depending on the air temperature, humidity and the dampness and/or succulence of the plants.

The following points will facilitate quicker drying

1. Use a lattice press.
2. Use cardboard with internal corrugations.
3. Use blotting paper to absorb the moisture.
4. Stand the press in a warm, dry place, e.g. a cabinet type clothes drier set at low heat.
5. Replace the newspaper to remove moisture and fungal spores.

Handling Specimens

Always handle the specimens with care to prevent them from breaking or parts from falling off. As they dry, some plants inevitably drop their leaves, seeds or flowers. Hence, collect these parts and put them into a labelled paper envelope alongside the drying specimens. These will be added to the herbarium specimen at the mounting stage.

Mounting

To mount a specimen means to affix it onto a sheet of herbarium card. A well mounted specimen should display both artistic and botanical qualities. It should be arranged on the card in a balanced aesthetically pleasing way, paying attention to

1. Orientation and type of mounting card.
2. Arranging attaching and the specimen.
3. Position of label and accompanying annotations.
4. Keeping loose parts in specimen bag.

Mounting Card

Official herbarium specimens mounted on 29 x 43 are cm archival quality (acid free) white mounting card (250 GSM). The direction of the card is "portrait"(vertical).

Arranging the specimen

If pressed correctly, the plant specimen should fit perfectly on the mounting card. When arranging the specimen

Leave an 1 cm border around the edge to allow space for holding when picking up the card.

- Single specimens should be centered on the mounting card and are usually placed vertically or diagonally across the sheet.

- Small plants with multiple specimens should be arranged in evenly spaced rows spread over the whole card.
- Orientation of the plants should represent their habit, i.e. usually flowers to the top and roots towards the bottom.
- Flip the specimens onto the side that displays the most botanical features (i.e. flowers, fruits, both sides of leaves, etc).

Attaching the Specimen

Specimens can be attached to the mounting card by gluing, sewing or with tape. Although gluing is the quickest method, it is also the least flexible as glued specimens cannot be removed to expose the underside and cannot be removed.

White gummed tape is used for mounting. Gummed tape must be moistened on the shiny side to become pliable. Once the tape dries quickly. The tape should be large enough to cover the branch or leaf and hang over each side of the branch by 0.5-1cm.

When using gummed tape

Tape should be centered over the branch/stem/leaf with equal length flaps on each side.

- Place tape perpendicular to the branch, stem or leaf midrib.
- Do not tape over important botanical information i.e. ligules, flowers, fruits, stipules, etc.
- Hide tapes under neighboring leaves where possible.
- Use sufficient tape to secure specimen to the card so that it does not move, but not too much as it will destroy the beauty of the specimen.
- Extra tape may be needed to support delicate specimen parts near edges of the card or heavy parts such as woody fruits.
- Each tape should cover only one branch/stem.

Attaching the label

The label must contain information about the specimen's name and identification. When attaching the label

- Place label in the lower right hand corner.
- Place 1cm in from the edge of the card to allow space for holding and to prevent damaging the

label.

- Use archival clear gum glue.
- Glued down along the top edge only.
- Keep the label free from mounting tape and specimens.

Labelling

Traditionally herbarium labels were hand written, but recently most herbaria use database systems from which labels are printed. At a minimum label should include:

- Family and scientific name of the specimen, including the authority.
- Collector's name/s.
- Date of collection.
- Locality where the plant was collected, including latitude and longitude.

If possible label can also include

- Collector's specimen record number.
- Name of the person who determined the identification.
- Altitude.
- Habitat or type of plant community.
- Habit.
- Any other details about the plant that may be important.

Sorting and filing of specimens

Once the specimens have been prepared, they should be sorted for filing. Techniques and physical arrangements vary, but ultimately specimens are sorted to family, genus, species, and infraspecific taxa. If geographic provinces are recognized in the collection, additional sorting is required. Regardless of the filing system used, specimens should be arranged in the order they will occur in the herbarium. Specimens are filed on shelves in herbarium cases of 24" x 16 1/2" folders called genus covers. These are heavy manilla or bristol folders are often color coded. Specimens are either filed directly in these folders or in a thinner species folder. The genus cover often in reality serves as a species folder if the representation of a species warrants an entire folder. In small collections the commercial "genus cover" may serve as a family folder.

Arrangement of specimens in the Herbarium

A. The General collection: Although there are numerous possible systems of arrangement of specimens, some of the specific arrangements such as Bentham and Hooker, Englerian System,

Besseyan System, and Alphabetical system are adapted for general collections.

B. Special collections: In addition to general collection, many herbaria maintain various special collections.

Type collection

Type specimens such as holotypes, isotopes, co-types, are often housed separately from the general collection, where unnecessary handling of risk of damage can be greatly reduced. These are commonly filed in the same sequence as the general collection, or alphabetically but the types are placed in specially and conspicuously marked genus covers.

Synoptic collection

(Teaching or identification)

The synoptic collection can greatly reduce time spent consulting specimens in a herbarium as well as specimen wear. These collections are usually small may be arranged and rearranged (particularly for teaching purposes) according to schemes of classification like recent Cronquist, Thorne, Hutchinson, etc.

Special research collection

Mass collections, artificial hybrids, as well as pollen and spores, anatomical preparation and bud materials may often be housed separate or in special folders or cabinets. Some notation in the form of a dummy sheet or annotation should be made in the general collection so that the existence of these materials can be readily known by those consulting the herbarium. The arrangement of such systems varies according to the type of materials and inclination of the curators. Alphabetical, community, numerical (according to accession number) or phylogenetic systems are commonly used.

Historical collection

Many earlier collections were bound in volumes and these are often not amenable to inclusion in general collections. Some prefer to include these materials in the general collection in special folders. But many group types and other historical materials are housed (including letters, notes, etc.) into one special collection. Regardless of physical arrangements, a catalogue of materials and their arrangement should be included in the Herbarium Guide" and appropriate dummies" is to be inserted into the general collection.

Herbarium use, operation and maintenance

Herbarium use

Herbaria exist only for use regardless viz., of type of viz., collection research, identification (synoptic),

teaching, or other. Every effort for maximum efficiency in locating material in a collection (information retrieval) should be made without endangering the collection.

Herbarium guide

Every herbarium should have a printed guide to the collection. This guide should explain the systematic and geographic arrangement; folders; list of families with numbers and case number, map of case arrangement, color code of folders, list, location and arrangement of special collections, and a

Generic catalogue etc. The guide should also contain herbarium policy statements concerning reshelving of materials, handling of specimens, use of equipment and other facilities, loan procedures, and other pertinent information. Such guides can save considerable time on the part of visitors as well as the herbarium staff.

Specimen use

Specimens are preserved for use but should be handled with extreme care since they are of scientific value and generally irreplaceable. Hence the points need to be followed scrupulously in handling specimens properly.

1. Keep sheets flat as specimens are brittle and easily damaged.
2. Store properly. Preferably, specimens should be stored in herbarium cases or at least on shelves.
3. Do not lay books or other heavy objects on specimens.
4. Place loose fragments in packets or envelopes if the specimen to which the fragment belongs can be ascertained.
5. Use materials sparingly.
6. Support the specimens with a ventilator or other stiff board when carrying specimens.
7. Do not write on the herbarium sheet.

Assignment-1...

Identification of medicinal and aromatic plants

Cultivation of medicinal and aromatic plants

Globally, more than 70,000 species are used for medicinal purpose. In India, out of 17,000 species of the higher plants, 8,000 are known for medicinal uses, which is the highest proportion of plants known for their medicinal properties in any country of the world. Out of total number of higher plants 46% are endemic to the Himalaya region. Over 200 species of Himalayan medicinal plants are consumed raw, roasted, boiled, fried, cooked or used in the form of oils, spices, jams or pickles. Apart from human races, many plant species are used in animal husbandry in the North West Himalayan region. Difficulty in assessing and managing medicinal and aromatic plants resources due to their occurrence in a wide range of natural and semi natural habitats ranging from sub-tropical and temperate forests to scrublands, meadows, agricultural crop fields and gardens. Keeping in view the increased demand from local communities, pharmaceutical, perfumery and cosmetic industries, the pressure on the land and natural resources continues mounting and the time has come to replace wild harvesting with cultivation. Besides conserving wild resources, cultivation can present an opportunity for agricultural and rural development, especially in marginal areas. Extensive farming of medicinal and aromatic plant species can also preserve indigenous knowledge and medicinal tradition which is also the endangered resource.

Need for cultivation of medicinal and aromatic plants

- To ease pressure on natural resources.
- To make available fresh, genuine and quality raw material for manufacturing of standardized and efficacious drugs.
- To evolve better strains and high yielding crosses of medicinal and aromatic plants through improvement programmes and tissue culture techniques.
- To check the use of spurious substitutes and adulterants which have resulted in the deterioration of the standard of drugs of Indian System of Medicines.
- To standardized the collection, storage and post harvest technology for medicinal plants.
- To provide regular and alternative source of income to the farmers for amelioration of their economic conditions.
- For introduction and domestication of useful exotic drug plants to minimize import and maximize export.
- To conserve the biological and genetic diversity in medicinal plants for the posterity.
- Under WTO regime of which India is a signatory, the following conditions have to be strictly

adhered to;

- No industry will use the raw material collected from the wild and produce has to be cultivated on farmers field, organically cultured and free from toxicity.
- Information on the propagation of medicinal plants is available only for !% of the total known plants globally, which should be a major thrust area for developing agro-techniques. No systematic effort had been made in the past for developing the practices for cultivation of medicinal plants for providing raw material of standardized ingredients. The package of practices under the agro-techniques should essentially consist of the following:
 - Best method for raising the plants Best soil for the plants
 - Seasonal practices including time of sowing the seeds and determination of growth behavior Number of plants appropriate for plantation per unit area and for cropping/ intercropping system
 - Nutrient requirement
 - Water management and weed control
 - Maturity and best harvesting period
 - Best harvest techniques and storage/ packing methods Best period of harvesting, keeping in view the active chemical ingredients
 - Commercial viability keeping in view the per acre input/output

Good cultivation and harvesting practices

Medicinal plants have so far been collected from wild resources. However, the plant material collected from these sources is replete with the problems of adulteration and mis-identification. Further, the plant material collected from the wild may also differ with respect to the presence of the active constituents from area to area. All such conditions may have adverse consequences. In view of this, cultivation of genuine, authentic variety of plants may be the only way to have raw material of required quality. However, cultivation of these plants has never been easy and commercially viable because of various factors. This is the basic reason for their exploitation from wild sources. Non-availability of proper harvesting techniques, soils and authentic plantation material are also some of the main constraints.

The safety and quality of raw medicinal plant materials and finished products depends on various factors like genetic makeup, environmental conditions, collection and cultivation practices, harvest and post-harvest processing, transport and storage practices and so on. Inadvertent contamination by

microbial or chemical agents during any of the production/processing stages can also lead to deterioration in quality.

WHO guidelines on GACP's

The WHO (World Health Organization) has published guidelines for GACP's (good agricultural and collection practices) for medicinal plants. The national governments are required to develop country-specific guidelines for sustainable production of raw material of quality and standardized ingredients. The development of WHO guidelines on GACP's for medicinal plants is an important step to ensure quality of herbal medicines and ecologically sound cultivation practices.

The GACP's cover a wide spectrum of cultivation and collection activities, including site selection, climate and soil considerations and identification of seed, main post-harvest operations and legal aspects. It is necessary to concentrate on standardizing the cultivation practices, collection practices, and post-harvest technologies for these plants adhering to GACP's.

Certain basic guidelines are to be followed under GACP's for cultivation and harvesting of the crop some of which are described below:

- Select proper site for cultivation of a particular medicinal plant. Select correct time for cultivation.
- Select proper variety.
- Adopt organic farming.
- Prune and collect only desired mature part (s), without harming the mother plant. Do not collect the whole population; leave at least 30% - 40% for regeneration.
- Do not cut twigs/branches for collection of plant parts. Use proper equipment for cutting, shearing, peeling, and so on.
- Start drying process immediately after collection; ensure complete drying before packing and storage.
- Dry aromatic herbs and delicate fruits in shade and do not dry two or more herbs in close vicinity.
- Sift the herbs with appropriate sifter to remove dust and other undesirable matter.
- Pack the herbs in suitable packaging material to avoid losses due to external factors.
- Store the herbs in proper storage conditions to minimize loss on storage

For collection of underground part (s), bark, and whole plant, following guidelines should be adhered to:

- Collect after the seeds are shed to facilitate regeneration.
- Do least digging for collection of underground parts and leave some underground part to Facilitate regeneration.
- Collect underground parts when the mother plant is fully mature.
- Dry fleshy parts before packing and storing; cut large parts into smaller pieces.
- Do not harvests bark from immature plants but instead, collect from the branches of main trunk.
- Strip the bark longitudinally and not from all over the circumference of trunk/branches.
- Cut into small pieces to facilitate complete drying.
- Harvest only mature branches of stem.
- Dry the material properly before packing or storing.

For collection of leaves, flowers, fruits, seeds, floral parts and so on, adhere to the following recommendations:

- Harvest only mature parts from healthy plants.
- Do not collect all material of the plant at a time.
- Do not cut branches for collecting leaves, fruits, flowers, and so on.
- Leaves and some floral parts may be dried in the sun, but should preferably be dried in shade.
- Fleshy flowers may be dried in the sun, but should preferably be dried in shade.
- Parts like stigma, anthers, buds, and so on should be collected at appropriate time.
- Harvest the seeds once the fruits are completely mature.

For collection of gums, oils, resins, galls etc.:

- Make incisions only vertically on some portions of the tree and not horizontally.
- Treat the incisions after collection of the desired material for facilitating healing of the bark.
- Do not collect the gum or resin from a tree continuously and collect them in precisely right season.
- Do not leave gum/resin exposed in the field. Pack them in appropriate containers or drums with polyethylene lining.

Harvesting and oil extraction of aromatic plants

Essential oils are hydrophobic, hydrocarbon liquids extracted from plant material that are valued for their aromatic, flavoring, medicinal, antiseptic, antiviral, anti-inflammatory, and many other properties.

Custom extraction services from a toll processing partner puts botanical and herbal processing expertise in the hands of companies looking for the best ways to extract essential oils from fresh or dried plant biomass and create product formulations that deliver many benefits to their end users.

Essential oils, especially their volatile components, are the substances that give aromatic plants their characteristic scents and flavors. (Volatile oils evaporate readily at room temperature, while non-volatile oils have a slower rate of evaporation.)

Major industries that use essential oils include pharmaceuticals and nutraceuticals, food and beverage, personal care, cosmetics, home care, and even industrial and agricultural chemicals. Markets for these products are expected to grow as research into their benefits and applications continue, and with increasing consumer preferences for natural products.

High-value essential oils, concretes, and absolutes can be made up of more than 200 volatile and non-volatile constituent components. They are extracted from biomass that can include any or all of the parts of a plant, including:

- Roots
- Flowers
- Fruits
- Leaves
- Stems
- Seeds
- Bark

A few examples of popular and useful essential oils and extracts include:

- Lavender
- Peppermint
- Hemp extract
- Vanilla

- Citronella
- Pine
- And many more

There are several extraction methods commonly used to obtain the beneficial oils from plants. What's the best extraction method? The answer to this question depends on the plant, the volume of biomass and production scale, the intended end use of the product, and more. This can be a critical question, especially in the context of hemp processing services.

In this article, we'll review the top four ways to extract essential oils from plants, and how a toll processor can help you optimize essential oil extraction for cost-effectiveness and efficiency.

Conventional and advanced extraction methods

Humans have been developing and refining extraction methods for essential oils for thousands of years. The ancient Egyptians, Chinese, Indian, and Greek cultures all have records of using aromatic oils for perfume and/or medicine.

These oils have long been used for pharmacological properties that can include anti-inflammatory, antioxidant, and anticarcinogenic effects. Antimicrobial properties can include antibacterial, antifungal, and antiviral activity. Of course, many essential oils are also used to impart pleasant scents or flavors to foods, drinks, and other products, and can have relaxing or calming effects on users, as in aromatherapy.

The most common extraction methods include conventional and also newer, more advanced technologies. Conventional methods include cold pressing (or expression), distillation, and solvent extraction.

Supercritical and subcritical carbon dioxide (CO₂) extraction methods are more advanced and especially useful for the growing hemp processing industry.

1. Distillation

Simple distillation involves boiling water to vapor and allowing the steam to flow through biomass before condensing in a collection vessel. Because simple distillation subjects products to high temperatures, it can be a poor choice for heat-sensitive products — which includes volatile oils.

Steam distillation is the most common extraction technique for essential oils. In a still, pressurized steam is passed through the biomass, where it ruptures the plant structures that hold the essential oils, releasing constituent volatile and non-volatile compounds.

The resulting liquid is condensed and naturally separates into two layers: essential oil and hydrosol. Examples of familiar hydrosols include rosewater and orange flower water.

In steam distillation, care must be taken to control pressure and temperature to avoid degrading the essential oils in the process of extracting them. Depending on the plant, steam distillation can take anywhere from a few hours to several days to fully distill oils from the biomass.

2. Cold pressing (also called expression)

Cold pressing is a traditional method that's used for many oils that degrade when exposed to heat, such as lemon, orange, and grapefruit. This very simple extraction technique involves scraping or pricking the biomass, usually fruit peels, before pressing and rinsing the oils away using water. The water and oils are then separated.

Cold-pressed oils retain natural flavors, colors, sterols, and vitamins. But not all plant biomass is suitable for cold pressing, many constituents can be left behind within the biomass, and it is not efficient for high-volume extraction.

3. Solvent extraction

Solvent-based extraction can use ethanol, methanol, or any of several petroleum-based hydrocarbon solvents, including:

- Hexane
- Pentane
- Acetone

The solvent, selected for its affinity with the desired plant compounds, flows through the prepared biomass to penetrate the plant structures and release the essential oils. The resulting mixture of solvent, plant oils, and botanical solids is typically filtered and vacuum distilled to remove as much solvent as possible, especially when petroleum-based hydrocarbons are used. A small percentage of chemical solvent residues can remain in the final product.

Vanilla extract is an example of a commonly used solvent extraction. The essential oils from the plant remain in alcohol, which was used to extract the desirable aromatic compounds from the structures of the vanilla bean pods.

4. Supercritical and subcritical CO₂ extraction

The use of carbon dioxide as a solvent is in high demand, especially industrial hemp extraction services, to produce high-quality full-spectrum and broad-spectrum CBD extracts. In CO₂

extraction, the carbon dioxide is subjected to specific temperature and pressure conditions to achieve specific effects.

Whether supercritical or subcritical, CO₂ works as a highly “tunable” solvent. This means that variables can be adjusted to most effectively extract targeted compounds, leaving behind the undesirable constituents in the biomass.

What is the difference between supercritical and subcritical CO₂? In short, the difference is in pressure and temperature. Above critical temperature and pressure, CO₂ becomes a supercritical fluid, which means it has properties of both a liquid and a gas. These properties enable the CO₂ to penetrate raw hemp biomass and break down the plant structures to release important compounds, including cannabinoids and terpenes.

Subcritical CO₂ extraction works similarly, though it can be a slower, less efficient process that results in lower overall yields. However, subcritical CO₂ is gentler on some of the more delicate active constituents of the hemp plant. For producers of full-spectrum and broad-spectrum cannabis extracts, this is crucial for producing a whole-plant extract that delivers the “entourage effect.” Depending on the targeted compounds and the desired final product, subcritical CO₂ may be the preferred extraction technique.

In both methods, after extraction, pressure and temperature are allowed to return to ambient levels and the CO₂ evaporates, leaving no solvent residue, for a pure, unadulterated final product. Unlike other solvents, CO₂ is environmentally friendly, nonflammable, and nonhazardous.

CO₂ extraction processes are more efficient, less energy intensive, and even less costly than some of the other methods. They’re also suited to scale up to high-volume production.

Creating finished herbal extract products

Most products of the botanical extraction process are liquids: oils, hydrosols, or tinctures in a base of alcohol or glycerin. But they may also be waxy extracts that are solid at room temperature.

After your toll processor has finished your extraction project, you may need additional steps to create fully commercialized products for your end users - so it’s worth having the conversation with your tolling partner about their capabilities to help transform botanical extracts into finished products.

These services can include:

- Product formulation R&D
- Testing and analysis

- Liquid blending
- Emulsifying
- And more

Bottling and repackaging herbal extracts

Minimizing time to shelf, freight, logistics, and other costs can be key to success in nutraceuticals, cosmetics, food, and beverage. So if your toll manufacturer can help you take your final, blended products from bulk formats to consumer or end-user packaging, the savings you realize in time, efficiency, and cost can make a real difference to your bottom line.

Be sure to ask whether your tolling partner can also offer fully automated, high-speed, cGMP-certified bottling of your liquid and liquefiable herbal extract products. Herbal and botanical extracts can end up in broad range of value-added products and formulations, including:

- Extracts and tinctures in dropper bottles
- Lip balms and salves
- Lotions and creams
- Body oils
- Herb-infused drinks
- And more

A toll processor that you can trust to achieve top-quality extracts, formulate in-demand products, and bottle and repackage for your end-user can help you deliver on your own brand promise of quality.

Glossary of Medicinal Terms

Abrotifacient	An agent that causes abortion
Alopecia	Baldness, loss of hair in patches or circles
Anodyne	Capable of relieving pain
Anaesthetic	Medicines to produce anaesthesia or unconsciousness
Antacids	To correct excessive acidity in the stomach
Anthelmintic	Destroys or expels intestinal worms
Antidote	Counteracts poison
Antiemetics	Medicinal which check vomiting
Antiperiodics	Medicines used for the relief of malarial fevers
Antipyretics	A drug which reduces body temperature in fevers
Antispasmodic	Employed against spasm of intestines
Aphrodisiac	Arousing sexual desire
Aromatics	Substances characterized by fragrant spicy taste or odour
Aperient	Mild purgatives
Astringent	Causing contraction of body tissue
Autopsy	Personal inspection, examination of body after death
Bronchitis	An inflammation acute or chronic, of the mucous lining of the bronchial tube
Capitula	A bony protuberance articulating with another bone
Cardiotonic	Exerting a favourable effect on the action of heart
Carminative	Having property of relieving flatulence
Cathartic	Strong purgative
Chlorosis	Severe anaemia due to iron deficiency
Colic	Acute abdominal pain caused by various abnormal conditions in the body
Convalescence	A period between the end of a disease and the patient's restoration to normal health
Cutaneous	Affecting the skin
Cystitis	Inflammation of urinary bladder
Demulcents	Medicines which soothe and protect the parts to which they are applied
Deodorants	Substances which destroy or hide foul odours
Depressants	Diminishes functional activities of any cell, tissue, organ, system

Demulscent	Soothes, softens, relaxes and protects mucus surface from irritation
Deobstuent	Removes obstruction in bowels
Diaphoretic	That induces/promotes sweating
Diarrhoea	A condition of excessively frequent and loose bowel movements
Diuretic	Increase urine flow
Dyspepsia	Indigestion
Emetic	A substance that cause vomiting
Emollient	That makes skin soft, soothes, relaxes and protects the skin
Emmenagogues	Remedies that restore the menstrual function
Epilepsy	Condition in which person has intermittent paroxysmal attack of disordered brain function usually causing a loss of awareness or consciousness and sometime convulsions (a violent spasm)
Epistaxis	Nose bleed; nasal haemorrhage
Expectorant	Facilitating clearance of the bronchial passages causing increased production of sputum.
Febrifuge	A medicine to reduce fever, a coating drink
Flatulence	Excessive formation of gases in stomach and intestine
Galactagogue	An agent that promotes secretion of breast-milk
Gangrene	Decay of tissue in a part of the body when the blood supply is obstructed by injury, diseases etc.
Goiter	A chronic enlargement of thyroid gland not due to neoplasm
Homeostatic	Arresting bleeding
Hepatic	Acts on liver
Hypertension	Excessively high pressure of arterial blood/great emotional or nervous tension
Hypnotic	Causing sleep
Inflammatory	Causing swollen condition
Insomnia	Inability to sleep over a period of time
Intoxicant	Poisonous (smeared with poison)
Laxative	Tending to cause evacuation of the bowels

Leprosy	Any disfiguring skin diseases
Leucorrhoea	Discharge from vagina of white or yellowish or more or less viscid fluid containing mucous and pus cells
Lumbago	Pain in mid and lower back
Menorrhagia	Excessively heavy bleeding at menstruation
Narcotic	A drug causing drowsiness, sleep or anesthesia when infested or infected
Ophthalmia	Inflammation of deeper structure of eyes
Otorrhoea	A discharge from the ear
Pectoral	Useful in diseases of respiratory tract
Rheumatism	Pain and inflammation in joints or connective joints
Ringworm	Contagious itching skin-disease occurring in small circular patches
Scrofula	A glandular swelling
Sedative	Sleep inducing drug administered for its calming effect especially in hysteria and other nervous disorders
Seminal	Weakness of the nature of semen
Spasmodic	Intermittent spasms characterized by emotional out thrusts or excitability
Stimulant	That stimulates activity of body or mind
Stomachic	Good for stomach improves appetite and digestion
Sudorific	Diaphoretic promotes sweating
Therapeutic	One who treats medically, sewing to cure or heal curatives.
Therapy	The art of healing
Vermicide	Destroys or kills intestinal worms
Syphilitic	An agent that causes killing or expulsion of intestinal worms.
Vertigo	Dizziness
Vasodilators	Produces dilation of the peripheral vessals and the arteoles, lowers blood pressure, relieves the heart, increases circulation and equalize blood pressure.

Assignment-2...

Visit to know commercial units of medicinal plants of nearby areas of District, Town, Village etc.

Assignment-3...

Q.1. Enlist an ethnic medicinal plants used by an indigenous people of Uttar Pradesh, India.

Q.2. Enlist different tribes of Uttar Pradesh, collect their photos and write in brief about their traditional methodology as per an importance of ethnic value of trees, shrubs, herbs and grasses.

Dr. Yogesh. Y. Sumr