VOLUME-III

Glimpses of CCRAS Contributions
(50 Glorious Years)

MEDICINAL PLANTS RESEARCH

CENTRAL COUNCIL FOR RESEARCH IN AYURVEDIC SCIENCES
Ministry of AYUSH, Government of India
New Delhi

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PROLOGUE

Plants form a major source of drugs and the information relating to their occurrence, distribution, vernacular names and full knowledge regarding the position of the plant wealth is required for knowing the availability of the drug. It is a well known fact that the drug (Dravya) is the primary tool of the entire research programme. Therefore survey of medicinal plants, cultivation of medicinal plants in the demonstrative gardens occupies a pivotal position in the field of Medicinal plant research. The council has planned research programmes in various fields and one such programme is the Medicinal plant research of the country. The exploration of Medicinal flora of the country is of paramount important to procure authentic drugs (dravya) for other research programme and as well as to meet the demands of the growing Ayurvedic pharmaceutical industry. The estimation of Medicinal plant research potential of the country extending from alpine Himalayas ranges to the coastal areas penetrating to the arid zones helps to determine the areas where particular plant grows in abundance or it is scare in a particular region. This shall ultimately lead to the qualitative and quantitative estimation of several Ayurvedic drugs which are currently in demand for research work and pharmaceutical industry.

CCRAS under Medicinal Plant Research major components are Medico- Ethno Botanical Survey Programme ,Demonstrative cultivation of Medicinal Plants and study of Propogation techniques including in vitro methods and Pharmacognosy research. Medico-Ethno Botanical Survey Programme has played a pivotal role in the Medicinal Plant research programme of the council. The survey work has greatly helped in the estimation of Medico-Ethno Botanical potential of the country. Various varieties of the Medicinal and Aromatic Plants are present uncultivated in the forests and are being utilized in one or the other form. In their natural occurrence the plants found strewn and it is intricate as well as extravagant to collect and to process these plants. Considering the above facts the CCRAS Council has initiated the steps for developing medicinal plant gardens /Forms for experimental and as well as mass scale cultivation of medicinal plants. It is also a well known fact that with the increase of demand for the medicinal plants, there is an inclination to implement arbitrary and chaotic ways to collect drug material from plants unconcerned of their status that is threatened plants or plants at the verge of extinction.

Medico-Ethno Botanical Survey (MEBS) was initiated by Central Council for Research in Ayurvedic Sciences (CCRAS) in 1969 with a main aim of survey and documentation of Medicinal plants of India used in Ayurveda system of medicine. Through its 5 peripheral Institutes, namely RARIMD Bengaluru, RARIGID Guwahati, RARI Itanagar, RARI Jhansi and RARI Ranikhet. Demonstrative Gardens of CCRAS have taken up cultivation of Medicinal plants under Medicinal Plant Research Programme; it is being carried out mainly in four gardens at Regional Ayurveda Research Institute (RARI), Jhansi (Uttar Pradesh), Regional Ayurveda Institute for Fundamental Research (RAIFR), Pune (Maharashtra); Ayurveda Regional Ayurveda Research Institute (RARI), Itanagar (Arunachal Pradesh) and Regional Ayurveda Research Institute (RARI), Ranikhet (Uttarakhand). The main aim of the programme Medicinal plant research is to provide quality drug material in adequate quantity for research / Pharmaceutical purposes. The survey work has greatly helped in the estimation of Medico-Ethno Botanical potential of the country. And cultivation of Medicinal plants in these different demonstrative herbal gardens also provides suitable agro-techniques for successful growth of scarcely distributed, threatened plant species of plants.

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CHAPTER-1

GENESIS AND OVERVIEW

BACKGROUND

The science of Ayurveda has been in vogue in this country from the earliest times and serving the medical needs of most of our people. These systems were developed by ancient scholars on the basis of their own philosophy, oriental methodologies and practices prevalent in that era and have popularised and almost completed it in all aspects as a system of medicine. The advent of foreign invasions and cross cultural interaction had definite impact on these systems. The beginning of twentieth century saw efforts to revive these systems. The members of the Imperial Legislative Council got the resolution of investigations and recognition of these systems was accepted in the year 1916. The Indian National Congress also passed similar resolution in 1920. This led to establishment to number of colleges of Ayurveda.

In the post independence era, the efforts to develop research gained momentum. As per recommendation of the various Committees, grant-in-aid projects were sanctioned to selected colleges. The Central Council for Ayurvedic Research as an Advisory body was established in 1962 and finally the Central Council for Research in Indian medicine & Homoeopathy (CCRIM&H) was established in 1969. This Council initiated research programmes in the Indian systems of Medicine & Homoeopathy in different parts of the country and started coordination at the National level for the first time.

The Central Council for Research in Ayurveda & Siddha (CCRAS), an apex body for the formulation, coordination and development of research in Ayurveda & Siddha on scientific lines was established in March 1978 after reorganization of CCRIM&H. The Minister of Health & Family Welfare is the President of the Governing Body of the Council while the Joint Secretary chairs the Standing Finance Committee. The Scientific /Research Programmes are supervised by the respective Scientific Advisory Committee chaired by eminent scholars of the system.

The Central Council for Research in Ayurvedic Sciences is a Registered Society under Societies Registration Act XXI of 1860 on 29.07.2011 (Formerly Registered as Central Council for Research in Ayurveda and Siddha on 30th March, 1978).

Research areas

The Central Council for Research in Ayurvedic sciences (CCRAS), an autonomous body under Ministry of AYUSH, Govt. of India is apex body in India for undertaking, coordinating, formulating, developing and promoting research on scientific lines in Ayurvedic sciences. The activities are carried out through its 30 Institutes/Centres/Units located all over India and also

through collaborative studies with various Universities, Hospitals and Institutes. The research activities of the Council include Medicinal Plant Research (Medico-ethno Botanical Survey, Pharmacognosy and Tissue Culture), Drug Standardization, Pharmacological Research, Clinical Research, Literary Research & Documentation. Besides this, Council has conducting outreach activities viz. Tribal Health Care Research Programme, Ayurveda Mobile Health Care programme, Swasthya Rakshan Programme and National Programme for Prevention and control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS).

Objectives

1. The formulation of aims and patterns of research on scientific lines in Ayurvedic sciences.
2. To undertake any research or other programs in Ayurvedic sciences.
3. The prosecution of and assistance in research, the propagation of knowledge and experimental measures generally in connection with the causation, mode of spread and prevention of diseases.
4. To initiate, aid, develop and co-ordinate scientific research in different aspects, fundamental and applied of Ayurvedic sciences and to promote and assist institutions of research for the study of diseases, their prevention, causation and remedy.
5. To finance enquiries and researches for the furtherance of objects of the Central Council.
6. To exchange information with other institutions, associations and societies interested in the objects similar to those of the Central Council and especially in observation and study of diseases in East and in India in particular.
7. To prepare, print, publish and exhibit any papers, posters, pamphlets, periodicals and books for furtherance of the objects of the Central Council and contribute to such literature.
8. To issue appeals and make applications for money and funds in furtherance of the objects of the Central Council and to accept for the aforesaid purpose gifts, donations and subscriptions of cash and securities and of any property whether movable or immovable.
9. To borrow or raise monies with or without security or on security mortgage charge, hypothecation or pledge of all or any of the immovable or movable properties belonging to the Central Council or in any other manner whatsoever.
10. To invest and deal with the funds and monies of the Central Council or entrusted to the Central Council not immediately required in such manner as may from time to time be determined by the Governing Body of the Central Council.
11. To permit the funds of the Central Council to be held by the Government of India.

12. To acquire and hold, whether temporarily or permanently any movable or immovable property necessary or convenient for the furtherance of the objects of the Central Council.

13. To sell, lease, mortgage and exchange, and otherwise transfer any of the properties movable or immovable of the Central Council provided prior approval of the Central Government is obtained for the transfer of immovable property.

14. To purchase, construct, maintain and alter any buildings or works necessary or convenient for the purpose of the Central Council.

15. To undertake and accept the management of any endowment or trust fund for donation, the undertaking or acceptance whereof may seem desirable.

16. To offer prizes and grant of scholarships, including travelling scholarships in furtherance of the objects of the Central Council.

17. To create administrative, technical and ministerial and other posts under the Society and to make appointments thereto in accordance with the rules and regulations of the Society.

18. To establish a provident fund and/or pension fund for the benefit of the Central Council's employees and/or their family members.

19. To do all such other lawful things either alone or in conjunction with others as the Central Council may consider necessary or as being incidental or conducive to the attainment of the above objects.

20. To undertake R & D Consultancy projects and transfer of patents on drugs and process to industry.

21. To undertake R & D projects sponsored by industries in public/private sector.

22. To undertake international and interagency collaboration.

23. Utilization of results of research conducted and payment of share of royalties/consultancy fees to those who has contributed towards pursuit of such research.

24. To enter into arrangements with scientific agencies of other countries for exchange of scientists, study tours, training in specialized areas, conducting joint projects etc.

25. To provide technical assistance to Govt./Private agencies in matters consistent with the activities of the Council.

26. To assist Medicinal Plants Board, Government of India in achieving its objectives.

27. To constitute small Management Committees consisting of eminent Scientists/ Physicians of local areas to monitor the R & D activities and suggest remedial measures for the improvement of activities of all Central as well as Research Institutes of the Council.

CHAPTER-2

MEDICO-ETHNO BOTANICAL SURVEY

BACKGROUND

Medico-Ethno Botanical Survey (MEBS) was initiated by Central Council for Research in Ayurvedic Sciences (CCRAS) in 1969 with a main aim of survey and documentation of Medicinal plants of India used in Ayurveda system of medicine. Through its 5 peripheral Institutes, namely RARIMD Bengaluru, RARIGID Guwahati, RARI Itanagar, RARI Jhansi and RARI Ranikhet, The Council has surveyed every part of Phyto-geographic regions across the country including the Andaman & Nicobar Islands and Lakshadweep. During these survey tours various Medicinal plants were collected and preserved as Herbarium and Museum specimens. The survey team collects and supply authentic raw drug samples for studies under various projects inside and outside the Council including the projects under Central Scheme of Ayurvedic Pharmacopoeia Committee (APC). Herbarium and Museum centers located in various Institutes of CCRAS are being used as reference centers for UG/PG/M.Phil/Ph.D students and researchers for correct identification/ authentication of their plant specimens or raw drug materials. Further, the folk-claims collected during the exploration work provide lead for validation and effective development of drugs based on traditional knowledge and not from any codified system of medicine. Ayurvedic ancient texts like *Sushruta Samhita & Charaka Samhita* also explains the importance of Medicinal Plant survey.

The Central Council for Research in Ayurvedic Sciences (Formerly Central Council for Research in Ayurveda and Siddha established on 30th March, 1978 and reconstituted with present name on 11th April, 2011) is an autonomous body under Ministry of AYUSH, Government of India. It is an apex organization for undertaking, coordinating, formulating, developing and promoting research in Ayurvedic sciences on scientific lines. Core Research activities comprise of Medicinal Plant Research (Medico-Ethno Botanical Survey (MEBS), Pharmacognosy and Invitro-propagation technique), Drug Standardization, Pharmacological Research, Clinical Research, Literary Research & Documentation and Tribal Health Care Research Programme (THCRP). Research activities are carried out through its 30 peripheral Institutes located across the country and also in collaboration with various Universities, Hospitals and Institutes.

VISION & MISSION

Medicinal Plants play an important role in Drug Development, as these are the source of majority of ingredients in Ayurvedic as well as Modern medicine. For successful and effective development of a drug, the basic requirement is the correct identification of the source of biologically active compound, its availability and processing. It is important to understand the medicinal plant diversity of our country, their distribution, propagation methods to frame strategies for their sustainable utilization. The Central Council for Research in Ayurvedic Sciences is an apex body in India for the formulation, co-ordination, development and promotion of research on scientific lines in Ayurveda through a planned research programme that includes Medico Ethno Botanical Research.

CORE OBJECTIVES

1. To access the distribution and availability of medicinal plant species in different phyto-geographic regions across the country.

2. Collection of specimens during the survey tours acts as the reference materials for description and characterization of raw drugs and their botanical source to avoid adulteration and substitution.
3. Morphological characterization of Medicinal Plants for their correct identification.
4. Collection of Folk-Medicinal claims and information on local health tradition (LHT) from the area visited during the tours provide the lead for validation and effective development of drugs based on traditional knowledge and not from any codified system of medicine.
5. Identification of plants or plant parts associated with the Folk-Claims and their preservation in the form of Herbarium.
6. Development of Regional Herbarium and Museum for reference purpose.

MATERIAL AND METHODS

The gross physical achievements including the beneficiaries of Medico-Ethno Botanical survey, Details of Forest divisions, Medicinal plant species collected and documented Herbarium specimens during the reporting period 1969-2016 were compiled, summarized and presented based on the information available in the published Monographs, Technical reports and Annual reports of CCRAS.

INTRODUCTION

India is rich in its diverse natural resources and treated as one of the 17 biggest natural biodiversity countries of the world. The Eastern Himalayas, Western Ghats, and Indo-Burma regions are the major intense biodiversity hotspots of India. Presently, it has rich vegetation of more than 45,000 plant species, out of which 15,000 to 20,000 plants have medicinal values. Out of these, only 7,000 to 7,500 plants are used for medicinal purpose by established communities. The details mentioned by the World Health Organization show that 80% of world's Population still depends on natural products of medicines as they are efficient, safe, cost-effective, affordable, and easily accessible by the poor.

The folk or tribal societies of various regions of the planet have exposed to various uses of natural resources around them. Traditional drugs of herbal origin have been used since the dawn of civilization to maintain health and alleviate human suffering from disease. In India, history of medicine can be traced back in the past. The foremost mention of medicine can be found in *Rigveda*, which is the storehouse of wisdom and knowledge that describes the importance of 67 medicinal plants. *Yajurveda* describes 81 medicinal plants. *Atharvaveda* describes 289 medicinal plants. *Sushruta Samhita* and *Charaka Samhita* contain various chapters on therapeutic uses of nearly about 500 medicinal plants.

In recent time's people from all walks of life are switching over to traditional medicines due to their no or less side effects, low cost etc. The basic traditional knowledge of medicine is based not only on plants but also on some animal products .The benefit of Medico-Ethno-Botanical explorations has been increased in recently at the national and international level. A perusal of the literature reveals that there is still a huge gap in knowledge of Ethno-Medicine and its scientific validation in this part of the world.

Traditional use of plants and plant-parts has been a deep rooted practical knowledge in the culture and livelihood of the people living in the remote parts of the world. They used these different medicinal plants in their daily healthcare practices. Medico-Ethno Botanical survey acts as the correlation linking between Ethno Botany and Tribal knowledge regarding medicinal properties of the plants. The plant based knowledge has become a known device in explore for novel sources of medicines. Knowledge about the Medicinal Plants has also been descended through generations, and has survived through times. To restore stability through various techniques, procedures, regimes, diet and medicine constitute treatment. Medicinal Plants form the major resource base of our indigenous healthcare traditions or Indian System of Medicines. Medicinal Plants used even in modern system of medicine and are of Plant based origin. The Knowledge of Ayurveda has been passed through Guru-Shishya tradition or from father to son.

Charaka in the following verse quotes about knowledge process

कृत्स्नो हि लोको बुद्धिमतामाचार्यः शत्रुश्चाबुद्धिमताम्। (Charaka Samhita Viman Sthana. 08/14)

It means that, one should acquire excellence even from the enemies, because for the wise, whole world is a teacher.Roots of Tribal knowledge about medicinal plants found in ancient Ayurvedic texts as stated in the below verse

गोपालास्तापसा व्याधा ये चान्ये वनचारिणः ।

मूलाहाराश्च ये तेभ्यो भेषजव्यक्तिरिष्यते ।। (Sushruta Samhita Sutra Sthana. 36/10)

Acharya Sushruta in above verse quoted that 'Medicinal herbs and plants should be recognized and identified with the help of cowherds,Goatherds, shepherd, hermits, huntsmen, forest-dwellers, and those who cull the fruits and edible roots of the forest'.

In Sushruta Samhita while describing the importance of Survey of Medicinal Plants quoted following verse

नदीशु षैलेशु सरःसु चापि पुण्येश्वरण्येशु तथाऽऽश्रमेशु ।

सर्वत्र सर्वाः परिमार्गितव्याः सर्वत्र भूमिर्हि वसूनि धत्ते।। (Sushruta Samhita Chikitsa Sthana. 30/40)

Sushruta stated that "Medicinal Plants are to be sought in the rivers, the holy forests and hermitages, as well as in lakes and on hills, since this world is a bed of gems and is known to hold priceless treasures in all places".

Sushruta while mentioning the Dravya quotes following verse

द्रव्याणि यत्र तत्रैव तद्गुणानि विशेषतः। (Sushruta Samhita Sutra Sthana.36/14)

It was stated by sushruta that the 'properties of Dravya depends upon qualities of place of origin or region from which it originates ; so with taxonomical knowledge a good physician has to know the habitat of plant because according to Samhita text there is a variation in the properties and efficacy of same drug collected from different regions.

The main viewpoint of Ayurveda is based on the theory of Pancha Mahabhoota (five element theory) as explained in the following verse

सर्वं द्रव्यं पाञ्चभौतिकमस्मिन्नर्थे। (Charaka Samhita Sutra Sthana. 26/10)

Above said theory tells that all the objects and living things are composed of Pancha Mahab-hoota .The principle of Ayurveda is as follows

प्रयोजनं चास्य स्वस्थस्य स्वास्थ्यरक्षणमातुरस्य विकारप्रशमनं च। ।(Charaka Samhita Sutra Sthana. 30/26)

Ayurveda aims to keep structural and functional entities of healthy person in a purposeful state of stability, which signifies good health. Any discrepancy due to internal and external aspect may cause disease.

Ayurveda describes four basic factors, which are most essential for advocating proper treatment as follows

भिषग्द्रव्याण्युपस्थाता रोगी पादचतुष्टयम्।

गुणवत् कारणं ज्ञेयं विकारव्युपशान्तये।। (Charaka Samhita Sutra Sthana. 9/3)

Among these four factors i.e Bhishak (physician), Dravya, Upasthata (attendant) and Rogi (Patient). Dravya (Medicinal Plants,Minerals etc.) is graded at the second rank, which is the main source of therapeutics.Though the Physician occupies the most important position, but he becomes lame without Drug.

BRIEF SCENARIO ON MEBS PROGRAMME

Medico-Ethno Botanical Survey Programme has played a pivotal role in the Medicinal Plant research programme of the council. The survey work has greatly helped in the estimation of Medico-Ethno Botanical potential of the country. The survey units spread all over the country with scope to work at different climatic and altitudinal levels. They have extended their work from Alpine Himalayan ranges to the Coastal areas and also penetrating into the arid zones of the country to achieve their objective and quantitative evaluation of the herbal wealth of the different geographical areas. It is a well known fact that Drugs (Dravyas) play an important position in the entire research programme. Hence it is of prime significance to explore the medicinal flora of our country in the past. The council has established several survey units in different areas of the country extending from Jammu to Trivandrum and Itanagar to Junagadh. Apart from the regular survey tours the council has also conducted special Medico-Ethno Botanical survey Programme in the forest and tribal areas including Ladakh, Sikkim, Arunachal Pradesh, Andaman & Nicobar Islands etc,.

The visits of different areas shall also be extensively useful to introduce social forestry in the country in an effective manner by way of preservation of the herbal wealth by adopting the right methods of collection, rotation of collection and introduction of the plants in the areas of extinction. The units have also been providing clues and materials for identification of drugs which are mention in Ayurvedic literature but the botanical identification was previously not clear /unknown. The survey units also reported the occurrence of some important and rare medicinal plants species in their respective territories. Besides the survey tours the survey units have also initiated the market survey of drugs and this has been helpful in the identification of adulterated and substituted drugs.

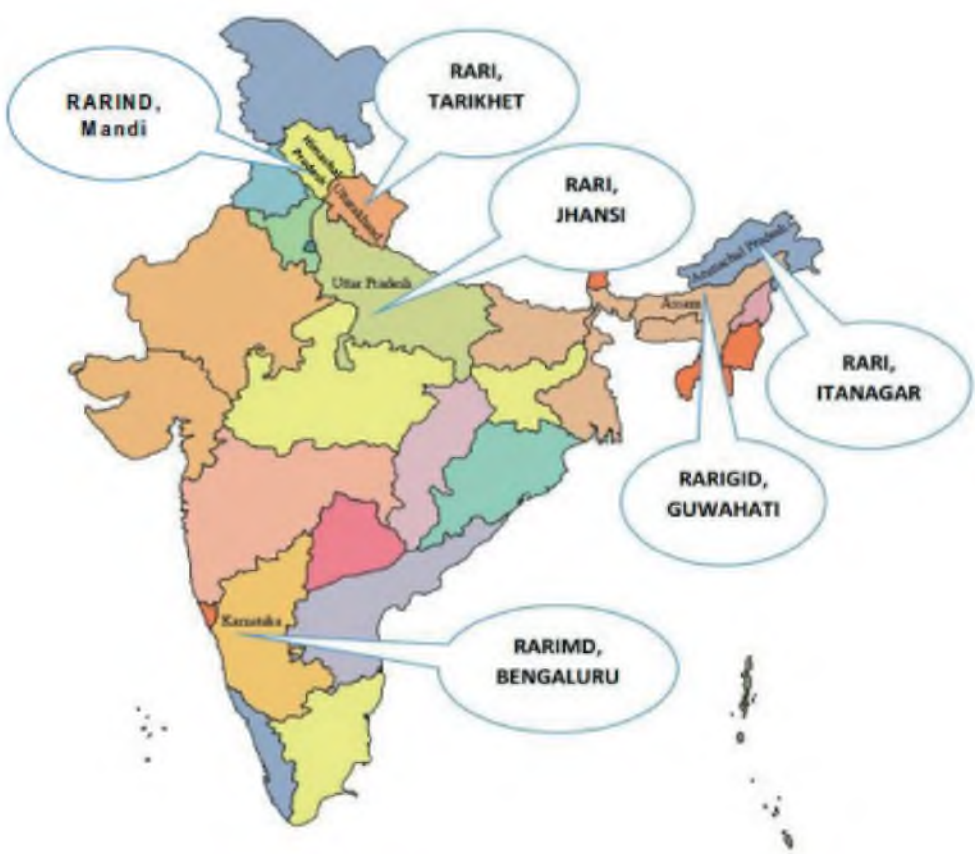
FOLLOWING AREAS HAVE BEEN COVERED UNDER THE MEDICO- ETHNO BOTANICAL SURVEY

S.No	States	Areas Surveyed
1	**Andhra Pradesh & Telangana.**	Rajahmundry, Kakinada, Coringa-Ramananplem, Tallarevu, Yanam (Pondicherry-union Territory), Kadiam-Burrilanka-Dowleshwaram, Razole, Antarvedi-KesavadasuPalem, Gollaprolu, Kathipudi, Thotapalli, Sarabhavaram, Jaggampet, Sudikonda, Gokavaram, RampaChodavaram-Devarapalli, Maredumilli-Valamuru, Kutrawada, Satlavada, Devipatnam, Kondamodalu, Tadivada, Yeleswaram, Addatigala, Kovvuru, Polavaram-Kondrukota-Cheeduru, Koraturu-Sirivaka, Ravigudem-Papi Hills, Chintapalli-Vurrinka, Pulitramudigudem, Khannapuram, JangareddiGudem, Eluru.Medak, Warangal, Karimnagar district, Nalgonda, Nizamabad, Mehaboob nagar and Rangaredy North and South Bhadrachalam.
2	**Arunachal Pradesh**	KurungkumeyBanderdewa, Shergaon, Bomdila, Seppa, Khellong, Hapoli, Tawang, Lohit, Namsai, Dibang, Anini, Deomali, Khonsa, Nampong, Changlang, Pasighat, Along, Yingkiong, Daporijo, East Kameng,Namdafa, Itanagar, Sagali, Tirap, Likabali.
3	**Assam**	Lakhimpur, Dhemaji , East Kamrup, North Kamrup, West Kamrup, Nagaon, Goalpara, Sonitpur, Darang, Silchar, Sibsagar, Sonari, Dhubri, Shiv Sagar, Jorhat, Digboi, Haflong.
4	**Bihar**	Jamui, Chakai, Vamdaha,Sono, Batiya, Patna, Khorkhra.
5	**Chhattisgarh**	Bilaspur
6	**Gujarat**	Adeshwar, Adipur, Anjar, Bhachau,Bhimeshwar,Bhuj, Chandarva, Chitrod, Desalpar, Dewari, Dhauleshwar, Dhavada,Dhawadodungar, DhinodarHill,Gandhidham, Kachrad, Kandla, Koteshwar/Narainsarobar, Kukma, Kair area, Lakhpat, Leelpar, Madhapar, Mandavi, Matanumath, Mundra, Nakhtrana,Naila, Puwareshwar, Raper, Ratnal, Rav, Seradirekhal, Shamkhiary, Surajbari, Tapkeshwar, Trambo,Kadana, Godhara, Chhotaudaypur, Dangas, Junagadh,Balsar range (Dharmapur, Kaparadha, Nandpada, Disal and adjoing its areas) Banaskadha range (Panpur, Nalarasa, Amirgardh, Danta, Ambaji, Ekabalgardh, Jaisur, Desha), Gir(Shasan, Raidi, Kamleshwar, Jamwala, Tulshishyam, Dharim, Dalkhariya),Bhavnagar, Jamnagar,Dang, Godhra, Surrendrnagar,Kachchh,Rajkot.
7	**Himachal Pradesh**	Kunihar-Nalagarh, Hamirpur, Kangara, Bilaspur, Sundarnagar, Nahan, Mandi, Renuka
8	**Jammu & Kashmir**	Katra hills, Lalkunwa, Rajauri, Udhampur, Jammu, Sahufort, Ladadhar, Gurez, Laliyaljagir, Soi, Guraj.
9	**Jharkhand**	Palamau.

10	**Karnataka**	Davanagere, Haveri, Bellary, Dharawad, Chitradurga, Mandya, Bangalore, Hassan, South Kanara, North Kanara, Belgaum, Shimoga, Coorg, Kolar, Tumkur, Bhadravathi, Koppa, Chikmagalur, Kollegal, Chamarajanagar, Mysore.
11	**Kerala**	Trivandrum, Chalakudy, Idukki, Malayattor, Tormala, Munnar, Nilambur and Agustiar, Wynad, Kottayam.
12	**Madhya Pradesh**	Pachmarhi, Amarakantak, Chitrakoot, Satna, Rewa, Dindori, Sidhi, Sagar, Rahatgarh, Bhopal, Bastar, Rajgardh.
13	**Maharashtra**	Nagpur, Bhandar,Wardha, Amravati, Chandrapur, Allapalli Bhamragad, Gondia , West Melghat, Gadchiroli, Buldana, Yavatmal, Pusad, Akola, Vidarbha.
14	**Manipur**	East Imphal, West Imphal, Bishnupur, Thoubal, Senapati, Chandal,Ukarul of East.
15	**Meghalaya**	Shillong, Jawai, East Khasi, Jayantia , West Khasi, Pynursula, Da-waki, Nongjri, Siatbakong, Bornihat, Garo,Cherapunji, Muktapur, Nongpoh.
16	**Mizoram**	Aizawl, Mamit, Vairangte, Kolasib, Champhai, darlawn
17	**Nagaland**	Kohima, Mokokchung, Dimapur, Phek.
18	**Odisha**	Nayagarh, Puri, Phulbani, Koraput,Kalinga, G. Udayagiri, Nakadisaroo, Baba dongia, Phirangia, Katrangia-Gatchpoda, Gurupoda,Gumma –Kumbikota, Balimela, Chadrapur, Gupteswar, Bonda hills, Metpad, Dudhadeda, Karka, Ramgiri, Pottangi, Kalimela, Rajagada, Kalimela-Podia, Anugal,Dhenaknal,Katak.
19	**Rajasthan**	Bharatpur, Alwar, Dausa, Jaipur, Sawaimadhopur, Barmer, Banswara, Bikaner, Bundi, Chittorgarh, Jaisalmer, Jodhpur, Sirohi, Ajmer, Kota.
20	**Sikkim**	South Sikkim, Gangtok, West Sikkim, Rhenock, North Sikkim, East Sikkim.
21	**Tamil Nadu**	Nilgiri, Nirgaehalmand, Tarachalmand, Todamund above the botanical garden, Ooty, Kotagiri, Kollimallai, Tiruchikkady, Masiagudi surroundings, Mavinahalla, Anaikatti, Kunjuppanai, Gudalur, Chermabadi, Nadugani (nellikandi, Kampanikundas surroundings), Devala, Kayaunni, Erumad, Shencottai, Madurai, Kanyakumari Tirunelveli, Ramanathapuram, Coimbatore, Tanjore, Salem,Tiruchy, Virudhunagar Dindugal, Srivilliputhur, Sivagangai, Tuticorin, Kalakadu, Mundanthurai, Papanasam, Courtallam, Therkumalai, Chathuragiri, Anamalai,Valparai.
22	**Tripura**	Kailashahar, Kanchanpur, Ambasa, Manu, Bagafa, Gumti, Udaipur, Sadar, Teliamura.

23	**Uttar Pradesh**	Meerut, Agra, Mathura, Aligarh, Alahabad, Jhansi, Lalitpur, Bareilly, Saharanpur, Muzaffarnagar, mirzapur, Fatehpursikri, Ghaziabad, Bansudhari, Karsauta, Ghorawal, Mukhadri, Bhawana, Shivdwar, Robertsganj, Panooganj, Ramgarh, Siltham, Harnakchhar, Majhauli, Vindhamganj, Govindpur, Jharokhas, Katahwa, Dudhi, Rasphari, Gurmura, Hathinala, Kodrakodari, Hathwani, Gardarwa, Rajkhar, Dumardih, Gambhirpur, Shaill, Nagwa, Myorpur, Baghmandava, Gohra, Mirgarani, Piparhar, Ahirbudhwa, Jignahwa, Dumarhar, Babhani, Jamlipahari, Edari and Bichhiari areas of Sonebhadra district.
24	**Uttarakhand**	Pithoragarh, Uttarkashi, Tarai, Chamoli, Tehri, Tungnath, Almora, Udhamsinghnagar Distt., Bageshwer, Alaknanda, Nainital, Pauri, TaraiBhabar, Ramnagar, Haridwar , Rudraprayag, Haldwani, Kathgodam.
25	**West Bengal**	Darjeeling, Kurseong, Kalimpong, Sunderbans, Andul, Amta, Jagaballawpur, Bauria, Baluhati, Howrah, East Midnapur, Jalpaiguri.
26	**Andaman and Nicobar Islands**	South Andaman, Baratang, Little Andaman (Hut Bay), Mayabunder, Port Blair, Wimberlygunj.

LOCATION OF MAP SHOWING VARIOUS MEDICO ETHNO BOTANICAL SURVEY UNITS OF CCRAS



INSTITUTES INVOLVED IN SURVEY

1. Regional Ayurveda Research Institute of Metabolic Disorders (RARIMD), Bangalore

Survey of Medicinal Plant Unit (SMPU) of Regional Ayurveda Research Institute of Metabolic Disorders, Bengaluru under the Central Council for Research in Ayurvedic Sciences, Ministry of AYUSH, Govt. of India was established in 1971 in Mysore and was later shifted to Bengaluru.

Main objectives of SMPU:

- Medico Ethno Botanical Survey in the forest divisions of Karnataka State
- Collection & Supply of genuine crude drugs for research
- Documentation of Local Healthcare Practices
- Crude drug market survey.

The SMPU is actively engaged in conducting Medico-Ethno Botanical Survey in forest divisions of Karnataka State. Special tours have also been conducted in Nilgiri Hills (Ooty), Andaman and Nicobar Islands. This Unit is having good collection of Herbarium specimens from various parts of Karnataka state (31956 specimens), Andhra Pradesh (8500 specimens), Madhya Pradesh (623 specimens), Orissa (82 specimens) and Andaman and Nicobar Islands (1436 specimens). About 766 Museum samples (plant, mineral & animal origin) from different corners of Southern India are exhibited for demonstration purpose. Having large number of Herbarium and Museum specimens, SMP Unit Herbarium was internationally recognized as **'Index Herbarium'** by the New York Botanical Garden and accredited with Herbarium code **'RRCBI'** (Regional Research Centre Bangalore India).

This unit has been organized for short term training programmes on Collection, Identification, Herbarium preparation of Medicinal Plants for Graduate and Post-Graduate students. This unit is also rendering technical support in Identification and Authentication of plant material (Fresh/Crude drugs) for Academic and Research Scholars across India.

Major Areas under Survey Covered by the SMPU

Karnataka (Chickmangaluru, Mysore, Chamarajnagar, Shimoga, Tumkur, Coorg, Kolar, North Canara, Bangalore rural, Belgaum South Canara, Hassan, Mandya, Dharawad, Chikkaballapur, Chitradurga, Udipi, Davanagere, Haveri, Koppal, Gadag, Bellary, Bagalkot, Raichur and Vijayapura forest divisions).

TamilNadu (Nilagiris – South and North divisions)

Andaman & Nicobar Islands (Little Andaman, Car Nicobar, Upper Kutchal, Kuppinga, Trinket Island, Nan cowry Island, Campbell Bay, South Bay, Hut Bay, West Bay).

Present Status of Herbarium Sheets.

Sl. No.	Place of Collection	Number of Herbarium
1.	Karnataka	31956 specimens
2.	Andhra Pradesh	8500 specimens
3.	Madhya Pradesh	623 specimens
4.	Orissa	82 specimens
5.	Andaman and Nicobar Islands	1436 specimens

Present Status of Museum Samples.

Sl. No.	Origin	Number of Museum Samples
1.	Plant origin	744 samples
2.	Mineral origin	20 samples
3.	Animal origin	02 samples

Important Medicinal Plants Available (in the office premises) for Demonstration

During survey tours, some rare and interesting Medicinal Plants have been collected and maintained in the office premises for Demonstration. The following are few important Medicinal Plants summarised as under

Sl. No.	Sanskrit name	Botanical name
1	Bilva	*Aegle marmelos* (L.) Corr.
2	Panasa	*Artocarpus heterophyllus* Lam.
3	Satavari	*Asparagus racemosus* Willd.
4	Danti	*Baliospermum montanum* (Willd.) Muell-Arg.
5	Putunga	*Caesalpinia sappan* L.
6	Punnaaga	*Calophyllum inophyllum* L.
7	Asthi samhari	*Cissus quadrangularis* L.
8	Sveta sariva	*Decalepis hamiltonii* Wight & Arn.
9	Udumbara	*Ficus racemosa* L.
10	Vrksaamla	*Garcinia indica* (Thouars) Choisy
11	Gambhaari	*Gmelina arborea* Roxb.
12	Meshashringi	*Gymnema syslvestre* (Retz.) R. Br. ex Sm.
13	Ksira vidaari	*Ipomoea mauritiana* Jacq.
14	Jati	*Jasminum grandiflorum*L.
15	Kampilla	*Mallotus philippensis* (Lam.) Muell.-Arg.
16	Naagakesara	*Mesua ferrea* L.
17	Campaka	*Michelia champaca* L.
18	-	*Nothapodytes nimmoniana* (J.Graham) Mabb.
19	Aamalaki	*Phyllanthus emblica* L.
20	Pippali	*Piper longum* L.
21	Citraka	*Plumbago zeylanica* L.
22	Agnimanta	*Premna integrifolia* L.
23	Sveta candana	*Santalum album* L.
24	Asoka	*Saraca asoka* (Roxb) De.Wilde
25	Somavalli	*Sacostemma acidum* (Roxb.) Voigt
26	Jambu	*Syzygium cumini* (L.) Skeels
27	Arjuna	*Terminalia arjuna* Wt. & Arn.
28	Vibhitaka	*Terminalia bellirica* (Gaertn.) Roxb.
29	Guduci	*Tinospora cordifolia* (Willd.) Miers
30	Nirgundi	*Vitex negundo* L.

Details of Hitherto New Plant Reports for Indian Flora

Extensive field explorations resulted in finding10 new species to plant kingdom. The research findings were published in book form like Flora of Chikmangalur, Flora of Coorg, Medicinal Plants of Karnataka, Medicinal Plants of Tamil Nadu (Volume 1 & 2) and Monograph of Tribal Pockets of Nilgiris (Ooty) and details follows as under.

S.No.	Botanical name & Family	Place of report	Reference
1	*Marsdenia raziana* Yog. (Asclepiadaceae)	Chikmangalur dist.	Holotype-1448, isotype-1448 A-B Proc. Indian Acad. Sci. Vol. 83B, No. 4, 1976, pp. 147-149
2	*Oldenlandia nudicaulis* Yog. (Rubiaceae)	Chikmangalur dist.	J. Res. Ind. Med. Yoga & Homoeo, 1987 Vol. 13, No. 3, pp. 87-88
3	*Utricularia sampathii* Subr. & Yogan. (Lentibulariaceae)	Bangalore	Cuur. Sci. 1982, Vol. 51, No. 8, pp. 902-904
4	*Chilocarpus sunainianus* Yog. (Apocynaceae)	Andaman & Nicobar	Holotype-602, isotype-602 A Curr. Sci., 1982, Vol 51, No. 18, pp. 902-903
5	*Ilex tadiandamolense* Keshav. et Yog. (Aquifoliaceae)	Kodagu dist.	Holotype-3711 A, iso type-3711 B-C Curr. Sci., 1987, Vol 56, No. 6, pp. 270-271
6	*Litsea lakshmammaniana* Keshav. et Yog. (Lauraceae)	Kodagu dist	Holotype-4414 A, isotype-4414 B Curr. Sci., 1987, Vol 56, No. 8, pp. 371
7	*Garcinia darwiniana* Keshav. et Yog. (Clusiaceae)	Kodagu dist	Holotype-4828A, iso type-4828 B-C Curr. Sci., 1987, Vol 56, No. 9, pp. 425-426
8	*Baliospermum raziana* Keshav. et Yog. (Euphorbiaceae)	Kodagu dist	Holotype-4281 A, isotype-4281 B-C Curr. Sci., 1987, Vol 56, No.10, pp. 486
9	*Hopea ponga* Mabb. var. cauveriana Kehav. et Yog. (Dipterocarpaceae)	Kodagu dist	Holotype-4818A, iso type-4818 B-C Curr. Sci., 1987, Vol 56, No. 11, pp. 544-545
10	*Oberonia ranganniana* Keshav. et Yog. (Orchidaceae)	Kodagu dist.	Holo type-4233A, iso type-4233 B-D Curr. Sci., 1987, Vol 56, No. 12, pp. 621-622

RARIMD, Bengaluru

Crude drugs preserved in Museum

2. Regional Ayurveda Research Institute (RARI), Jhansi

Survey of Medicinal Plants being the boon of the Institute. It is in function since inception of the Institute for the exploration of Medicinal Plant Wealth of Bundelkhand and Uttar Pradesh as a whole and collection, providing authenticated Crude Raw Drugs to the drug standardization Units of the Council and Ministry as a whole. The unit has explored the medicinal plant wealth initially in Uttar Pradesh and extended its activities in Madhya Pradesh, Chhattisgadh and Rajasthan. During exploration, collection of Medicinal Plants, preparation of Herbarium vouchers, collection of Museum samples, Crude drug samples for Drug Standardization units of the Council as well as Ministry of AYUSH, Government of India and Folklore use of Medicinal Plants for the cure of ailments are taken in consideration along with population studies of Medicinal Plants in field.

Major Areas under Survey Covered by the SMPU

Uttar Pradesh, (forest areas of Bundelkhand i.e. Lalitpur, Banda, Chitrakoot, Aligarh, Jalaun, Hamirpur, Mahoba, Gorakhpur, Kushinagar, Mahrajganj, Balrampur, Gonda, Shiddharthanagar, Sant Kabir Nagar, Ambedakarnagar, Deoria forest divisions).

Madhya Pradesh (Satna, Dindori, Rewa and Sidhi forest divisions, in Chhattisgarh, Bilaspur, Sarguja, Dharamjaygarh, Raipur, Durg, Balod Rajgarh divisions).

Rajasthan (Ajmer, Bharatpur, Alwar, Ranthambore, Sawaimadhopur, Saroi, Jaipur, Banswara, Karauli and Barmer divisions etc. were surveyed).

Present Status of Herbarium Sheets Available

23967 specimens

Present Status of Museum Samples Available

Plant origin - 690

Animal origin - 04

Mineral origin - 16

Important Medicinal Plants Available in the Demonstrative Garden are

During survey tours, some rare and interesting Medicinal Plants have been collected and maintained in the office premises for demonstration. The following are few important Medicinal Plants summarised as under.

Sl. No.	Sanskrit Name	Botanical Name
1.	Gunja	*Abrus precatorius* L.
2.	Ulat Kambala	*Abroma augusta* L.
3.	Atibala	*Abutilon indicum* (L.) Sweet
4.	Bilwa	*Aegle marmelos* (L.) Correa
5.	Matsykshi	*Alternanthera sessilis* DC.
6.	-	*Argyreia serica* Dalzell & Gibson
7.	Danti	*Baliospermum montanum* Muell.-Arg.
8.	Daruk haridra	*Berberis aristata* DC.
9.	Avartaki	*Cassia auriculata* L.
10.	-	*Chlorophytum tuberosum* (Roxb.) Baker
11.	-	*Melastoma malabathricum* L.
12.	Parijath	*Nyctanthes arbortristis* L
13.	Katuk	*Pandanus odoratissimus* L. f.
14.	Sarpagandha Bedh	*Rauvolfia tetraphylla* (L.) Benth. Ex. Kurz.
15.	Mokshak	*Schrebera swietenioides* Roxb.
16.	Shal	*Shorea robusta* Gaertn.f.
17.	Bhumiseh	*Tectona grandis L.f.*
18.	Vibhitak	*Terminalia bellirica Roxb.*
19.	Masyang	*Vigna umbellata (Thunb.) Ohwi & Ohashi*
20.	Hemjivanti	*Wattakaka volubilis (L.f.) Stapf.*
21.	Aarthghal	*Xanthium strumarium L.*
22.	-	*Zamia furfur L.f. ex Aiton*
23.	Mahabarivarch	*Zingiber zerumbet Rosc. ex Sm*

This unit has been organized Herbarium consultation and authentication of Herbarium samples plants for graduate and Post-Graduate students. This unit is also rendering technical support in Identification and Authentication of plant material (Fresh/Crude drugs) for Academic and Research Scholars across India. Visit of Medicinal Plants Garden for students. Transfer of cultivation technique to farmers. Training on cultivation of Medicinal Plants. And also Training to Traditional healers for updating their Herbal Knowledge. Developing village Botanists team for protection and conservation of Medicinal Plants in the forest and village areas.

RARI, Jhansi

Central Herbarium Repository along with Compactors

3. Regional Research Ayurveda Research Institute for Gastro-Intestinal Disorders (RARIGID), Guwahati

The Survey of Medicinal Plant Unit was established in Guwahati (Assam) working since May 1971 with a major objective of Medico-Ethno Botanical Survey along with development of Herbarium, Museum and Botanical garden for demonstration purpose. Since then the survey unit has surveyed many Rural and Tribal pockets of all the seven states of North East India. More than 6500 Herbarium accessions are collected along with about 400 Museum samples during Medico-Ethno Botanical Survey conducted to Collect and Document Folk-Medico Claims from the Folk Healers. Many publications and technical reports were resulted from these surveys covering entire North Eastern Region of India along with collection of photographs of Medicinal Plants in their wild habitat. Collection and supply of genuine raw drug material has been one of the primary objectives of this unit since establishment to different scientific community in India for research purpose.

Major Areas under Survey Covered by the SMPU

Arunachal Pradesh (Forest divisions of Bomdila, Tawang, Likabali, Hapoli, Nampong along with Kameng and Tirap district).

Meghalaya (Forest divisions of Khasi Hills, Garo Hills and Jayantia Hills).

Manipur (Forest divisions of East Ukhrul, Central Div, Senapati, Bishnupur, Thoubal, West Imphal, East Imphal).

Mizoram (Forest division of Kolashib).

Tripura (Forest divisions of Sadar, Teliamura, Kailashahar, Kanchanpur, Manu, Ambasa, Udaipur, Bagafa and Gumti).

Assam (Forest divisions including Kamrup (North, East, South), Jorhat, Sibsagar, Nagaon, Dhubri, Darrang, Digboi, Lakhimpur, Goalpara and N.C. Hills).

Present Status of Herbarium Sheets Available

At present the Herbarium of the Institute is having 6521 nos. of Herbarium sheets covering about 1200 medicinal plant species collected from various regions of North East India and Bihar which is growing in recent time.

Present Status of Museum Samples Available

At present the Museum of the Institute is having about 400 nos. of Museum specimens of various parts of raw drugs used both in Ayurveda and folk medicine collected from different tribal pockets and markets of North East India.

Important Medicinal Plants Available in Demonstrative Garden

The Institute is having a very small Demonstrative Botanical Garden within the premise which is having more than 100 medicinal plant species including annuals and perennials for demonstration are summarised as under.

Sl. No.	Sanskrit Name	Botanical Name
1.	Vacha	*Acorus calamus* L.
2.	Kalmegh	*Andrographis paniculata* (Burm.f.) Nees
3.	Karnasphota	*Cardiospermum halicacabum* L.
4.	Mandukparni	*Centella asiatica* (L.) Urb.
5.	Asthishrinkla	*Cissus quadrangularis* L.
6.	Kebut	*Costus speciosus* (J.Koenig) Sm.
7.	Amlaki	*Emblica officinalis* Gaertn.
8.	Kutaj	*Holarrhena antidysenterica* (Roth) Wall. ex A.DC.
9.	Madyentka	*Lawsonia inermis* L.
10.	Bakul	*Mimusops elengi* L.
11.	Parijata	*Nyctanthes arbor-tristis* L.
12.	Shyonaka	*Oroxylum indicum* (L.) Kurz
13.	Bhumyamlaki	*Phyllanthus fraternus* G.L.Webster
14.	Putrajivaka	*Putranjiva roxburghii* Wall.
15.	Sarpagandha	*Rauvolfia serpentina* (L.) Benth. ex Kurz
16.	Erand	*Ricinus communis* L.
17.	Ashoka	*Saraca asoca* (Roxb.) Willd.
18.	Arjuna	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.
19.	Vibhitak	*Terminalia bellirica* (Gaertn.) Roxb.
20.	Haritakibhed	*Terminalia citrina* Roxb. ex Fleming

This Institute provides consultancy services related to Medicinal Plants (specially related to Medico-Ehno Botanical Survey) for various govt. or other agencies; training to Students/ Researchers/General public etc. for Ex-Situ conservation, Identification, Herbarium preparation and data mining on Medico-Ethno Botanical data of North East India etc. may be provided with systematic approach.

RARIGID, Guwahati

Herbarium

4. Regional Ayurveda Research Institute (RARI), Tarikhet

The Regional Ayurveda Research Institute (RARI), Tarikhet is a premier Institute for Research on Medicinal Plants of North-West Himalayan Region of India. The Institute was set up as a grant-in-aid unit for survey of Medicinal Plants of the Himalayan region of the then Uttar Pradesh in the year 1964. The total land of the premises is 0.602 hectare and situated in between 29036.877'N and 790-24.277'E at an elevation of 5506 feet, and the ownership is with the department. The Institutes has a well developed Herbarium and Museum with Acroynm **"RKT"**. Medico-Ethno Botanical Survey conducting on Medicinal Plants of North-West region of Himalaya. Every year four Medico-Ethno Botanical Survey tours are being conducted in each quarter respectively as per the annual action plan assigned by council for the assessment of the distribution and availability of Medicinal Plants of particular areas. As per the demand of different project running in the councils (Pharmacological research work, Quality standards, Pharmacopoeial monograph etc), short duration tour of Submontane, Montane, Sivalik forest areas of Uttarakhand were conducted periodically to collect the authentic raw drug samples as per the requirement. Two Demonstrative Herbal Gardens were maintained by the Institute one at Ranikhet, Distt. Almora and another at Chamma, Distt. New Tehri. Cultivation of medicinal plant at Ranikhet was started in 1964; the net area under cultivation is 2.5 acre. The land is on rent basis. Total 157 Medicinal Plants including RET species are maintained in the garden for demonstrative purpose as well as to supply authentic curde drug as per requirement of different projects running in the Council.

Major Areas under Survey Covered by the SMPU

Uttarakhand (The SMPU unit of RARI (CCRAS) have been explored 42 forest divisions covering approx 54,000 Km sq. area accounting to about 25% of Western- Himalaya from Tarai-Bhabar to Alpine Zones of North–West Himalayan region of Uttarakhand).

Present Status of Herbarium Sheets Available

Institute Herbarium is big repository of 62935 Herbarium sheets belonging 218 families, 1410 genera and 3670 species of Angiosperm, Gymnosperm and Pteridopytes representing North West part of Himalaya (Uttarakhand, Himanchal Pradesh, Jammu Kashmir, and Uttar Pradesh).

Present Status of Museum Samples Available

624 authentic samples of Medicinal Plants part, mineral origin were being maintained in the Institute's Museum.

Important Medicinal Plants Available in Demonstrative Garden

Two Demonstrative Herbal Gardens are maintained by the Institute one at Ranikhet, Distt. Almora and another at Chamma, Distt. New Tehri. Cultivation of Medicinal Plant at Ranikhet was started in 1964; the net area under cultivation is 2.5 acre. The land is on rent basis. Total 157 Medicinal Plants including **RARE, ENDAGERED & THRETEND (RET)** species are maintained in the garden for demonstrative purpose. At Chamma the net area under cultivation is one acre and total 68 plants are maintained in Chamma Garden. Some important Medicinal Plants are summarised as under.

Sl. No.	Sanskrit Name	Botanical Name
1.	Chirayata	*Swertia chirayita* (Roxb. ex Flem.) Karsten.
2.	Giriparta	*Podophyllum haxandrum* Royle.
3.	Joytismati	*Celastrus paniculatus* Willd.
4.	Jivak	*Microstylis wallichii* Royle.
5.	Manduparni	*Taxus wallichiana* Zucc.
6.	Parsik Vacha	*Paris polyphylla* Smith.
7.	Daruharidra	*Berberis aristata* DC.
8.	Mahadeda	*Polygonatum cirrhifolium* (Wall.) Royle.
9.	Meda	*Polygonatum verticilatum* Royle.
10.	Pashanbhed	*Berginia ciliata* Strng.
11.	Bharangi	*Clerodendrum serratum* (L.) Moon.
12.	Shyonaka	*Oroxylum indicum* (L.) Vent.
13.	Vacha	*Acorus calamus* L.
14.	Kustha	*Sousurea costus* (Falc.) Lipsch.
15.	Guduchi	*Tinospora cordifolia* L.

Identified many Shilajeet bearing spots in Uttarakhand. New records made on occurrence of Indian Ginseng (*Panax pseudogenseg* Wall) and an orchid (*Diplomeris hirsute* Lindl.) from Western–Himalaya. Plants like *Wallichia densiflora* Mart and *Phrynium placentrium* Nees, considered diminished from about a century have been noticed and collected. Apart from the survey the Institute is able to impart Training on Medicinal Plants Identification; Conservation and the role of Medicinal Plants in ISM to School Going Children, Students, Research Scholars, Farmers, NGO volunteers, Foresters and Administrators of different Ministries Trainees.

RARI, Ranikhet

Museum

5. Regional Ayurveda Research Institute (RARI), Itanagar

The Regional Ayurveda Research Institute (RARI), Itanagar, Arunachal Pradesh, was established in the year 1979 Under the programme of survey of Medicinal Plants exploration of different districts of Arunachal Pradesh namely Tawang, West Kameng, East Kameng, Papumpare, Lower Subansiri, Upper Subansiri, Kurungkumey, East, West and Upper Siang, Lower Dibang Valley, Dibang Valley, Lohit, Anjaw, Changlang and Tirap have been completed. During the course of survey 24 Forest Divisions and their 52 Ranges in Arunachal Pradesh were explored for which 6473 plants specimens were collected and two special survey tours of Mizoram covering Kolasib, Aizawl, Champhai, Lunglei and Mamit districts, one survey tour in Nagaland covering Mokokchung, Kohima Phek, Wokha districts and one in Assam covering North Lakhimpur and Dhemaji districts, Darjeeling Forest Division/District of West Bengal and Namchi Forest Division in Sikkim, five survey tours in Meghalaya covering Shillong, Tura, William Nagar, Baghmara and Jawai Forest Divisions in East Khasi, West Garo, East Garo, South Garo and Jayantiya Districts and one tour in Manipur covering East Imphal, West Imphal, Senapati and Thoubal forest divisions. Medicinal Garden is developed in about 15 acres land introducing more than 200 Medicinal Plants.

Major Areas under Survey Covered by the SMPU

Arunachal Pradesh Itanagar, Chimpu, Banderdewa, Balijan, Doimukh, Chessa, Kimin, Phulbani, Sagalee in Bandardewa Forest Division of Papum Pare District Yazali, Ziro, Damin, Palin, in Hapoli Forest Division of Lower Subansiri District, Khonsa and Deomali ranges of respective Forest Division of Tirap District, Tawang Forest Division and it's Ranges of Tawang District, Deomali, Dirang Forest Renges in Deomali Forest Division, Sessa, Tipti and Bhalukpong in Khellang Forest Division, Rupa, Shergaon and Kalaktang in Shergoan Forest Division of West Kameng District Pasighat and Along Ranges of respective Forest Division of West Siang District, Roing, Dambuk and Hunli Ranges in Roing Forest Division of Lower Dibang Valley District, Anini Forest Ranges in Anini Forest Division in Divang Vally District, Sejusa, Seppa and Chaiangtajo Ranges of East Kameng District, Namsai, Mahadevpur, Kamala Nagar, Wakro, Chowkham, Ranges in Namsai Forest Division, Tezu, Lohit, Sunpura and Demwe Ranges in Lohit Forest Division of Lohit District, Duporija, Maro and Talia ranges in Duporija Forest Division of Upper Subansiri District, Yingkiong and Karko Ranges of Yingkiong Forest Division of Upper

Siang District, Nampang, Namphai Ranges in Nampong Forest Division and Changlang Ranges of Changlang Forest Division of Changlang District. Re-exploration of adjoining areas of Itanagar, Chimpu, Kheel in Papum Pare District, Yajali, Ziro, Palin, Deed in Hapoli Forest Division, Pasighat and Along Forest Division and Lohit and Namsai Forest Division in Lohit District, Kamlang, Hawai, Hayuliyang, Wallong areas of Anjaw district, Koloriang, Sangram, Nyaping, Sarli areas of Kurungkumey district, these are some of the major areas have been explored by this Institute).

Special surveys were conducted in Different states like

Mizoram- Aizawal, Champhai, Serchhip, Lunglei and Kolasib Forest divisions with their ranges in Mizoram.

Nagaland- Dimapur, Mokokchung, Kohima, Zunheboto, Tuensang and Wokha forest divisions. Dimapur, Kohima and Mokokchung of Nagaland, were surveyed

Sikkim- Namchi Forest Division in Sikkim, Gangtok, Namchi, Gyalseng of Sikkim.

Assam- Dhemaji and North Lakhimpur pur forest divisions in Assam

Meghalaya- Shillong, Tura, WilliamNagar and Jowai forest divisions and their ranges in Meghalaya and East Imphal, West Imphal, Patharkhmah in Ri-Bhoi district in Khasi hills of Meghalaya and nearby village areas like Umsaw, Umkadhor, Nongdom, Nongrim, Barigaon, Umkynsier, Nongdom etc. Jirang in Ri-Bhoi district in Khasi hills of Meghalaya and nearby village areas like Jirang market, Centre village, East and West Imphal districts Ukhrul, Senapati and Tamenglong forest division and their ranges in Imphal, Mynnar Jirang, New Jirang, Umlakro, Umsohpanan, Iew sohksang, Paham, Diwon in Ri-Bhoi district in Khasi hills of Meghalaya and nearby village areas like Marngar, Paham Birthem, Pahamshken, Plasha, Umden, Umshaikait, Umkon have been explored.

West Bengal- Darjeeling forest division, Kolkata, Burdwan, Alipur Dwar and Siliguri market of West Bengal.

Manipur- Bishnupur and Thoubal forest division and same ranges, Lalronching and Heyabong from Senapati and Sumok, Yainganag Pokpi, Sareikhon, Huntant, Mungshangkong, Shokvao, Rombni, Sonsai, Sanaok, Julangbung, Sinakeithei, Siroi of Ukhrul in Manipur have been explored.

Present Status of Herbarium Sheets Available

Total no. of Herbariums collected is 2869 species.
Currently total number of Herbarium sheet available is 1342 (2007-15).
No. of single set of Herbarium is 928 (2007-15).

Present Status of Museum Samples Available

1038 species.

Important Medicinal Plants Available in Demonstrative Garden

This Institute is maintaining one Demonstrative Garden in about 15 acres land introducing more than 200 Medicinal Plants. Some important Medicinal Plants are summarised as under

Sl. No.	Sanskrit Name	Botanical Name
1.	Kalmegh	*Andrographis paniculata* (Burm.f.) Nees
2.	Ulatkambal	*Abroma augusta* L.
3.	Mucktavarcha	*Acalypha indica* L.
4.	Vacha	*Acorus calamus* L.
5.	Vasaka	*Adhatoda zeylanica* Medik.
6.	Bilwa	*Aegle marmelos* (L.) Correa
7.	Saptaparna	*Alstonia scholaris* R.Br.
8.	Suran	*Amorphophallus paeoniifolius* (Dennst.) Nicolson
9.	Ananas	*Ananas comosus* Merr.
10.	-	*Atalantia racemosa* Wight. & Arn.
11.	Danti	*Baliospermum montanum* Muell.-Arg.
12.	Rath ki rani	*Cestrum nocturnum* L.
13.	Patha	*Cissampelos pareira* L.
14.	Rudraksha	*Elaeocarpus sphericus* (Gaertn) Schum.
15.	Gambhari	*Gmelina arborea* Roxb.
16.	Vaarshiki	*Jasmimum sambak* (L.) Ait
17.	-	*Lygodium flexuosum* (L.) Sw.
18.	Kapikachhu	*Mucuna pruriens* (L.) DC.
19.	Gandha Prasarini Bhed	*Paederia scandens* L.
20.	Gajpippali	*Piper mullesua* L.
21.	Vidhari	*Pueraria tuberosa* (Roxb.ex Willd) DC.
22.	Akurkrabh	*Spilanthus paniculata* Wall.
23.	Jivani	*Trema orientalis* Blume
24.	Nirgundi	*Vitex negundo* L.
25.	Dhataki	*Woodfordia fruticosa* Kurz
26.	Tumbaru	*Zanthoxylum alatum* Roxb.
27.	Badar Bhed	*Zizyphus jujuba* Lam.
28.	Shunthi	*Zingiber officinale* Rosc.

Apart from the survey the Institute have been organized Seminars and workshops to provide the information about the Medicinal Plants of North East, agro techniques, awareness and values about Medicinal Plants, to make awareness about the formulation of medicine among the traditional healers. Students from various schools and colleges visit the Institute regarding the identification and collection of Medicinal Plants for Herbarium.

RARI, Itanagar

Museum

Some Important Herbarium sheets preserved in various CCRAS Institutes

OBSERVATIONS AND PHYSICAL ACHIEVEMENTS

The gross physical achievements including the beneficiaries of Medico-Ethno Botanical survey, details of Forest divisions, Medicinal plant species collected and documented Herbarium specimens during the period 1969-2016 were compiled , summarized and presented based on the information available in the published monographs, technical reports and annual reports of CCRAS. Medico-Ethno Botanical Survey programme (MEBS) under Medicinal plant research was initiated by Central Council for Research in Ayurvedic Sciences (CCRAS) in 1969 with a main aim of survey and documentation of Medicinal plants of India used in Ayurveda system of medicine. Another aspect of survey is to access the distribution and availability of medicinal plant species in India. The survey has been conducted through its 5 peripheral Institutes, namely RARIMD Bengaluru, RARIGID Guwahati, RARI Itanagar, RARI Jhansi and RARI Ranikhet, The Council has surveyed part of every phyto-geographic region across the country including the Andaman & Nicobar Islands and Lakshadweep. During these survey tours various Medicinal plants were collected and preserved as Herbarium and Museum specimens.

CHRONOLOGICAL DEVELOPMENTS

The Medico-Ethno Botanical survey programme has been continued through its 7 peripheral units located at Banglore, Jhansi, Tarikhet, Guwahati, Pune, Gwalior and Itanagar from 1969 up to 2011. Currently the Programme is being executed in 25 States through 5 Peripheral Institutes of CCRAS under Medico-Ethno Botanical survey (MEBS).They are RARIMD Bengaluru, RARIGID Guwahati, RARI Itanagar, RARI Jhansi and RARI Ranikhet.

DETAILS OF ESTABLISHMENT OF MEDICO-ETHNO BOTANICAL SURVEY PROGRAMME SINCE INCEPTION

State wise details	Name of the Institute and Location	Year of Establishment	Merge with Institute
Gujarat, Maharashtra,	Govt. Ayurvedic Pharmacy College, Rajpipla, Gujara	1969-71	NRIBAS, Pune
	SMPU, Gujarat	1972-73	NRIBAS, Pune
	Maharastra JNAMPGH &Musuem)	1972-73	NRIBAS, Pune
	SMPU, Rajpipla	1975-76	NRIBAS, Pune
	RRC, Nagpur	1976-77	NRIBAS, Pune
	Tribal pockets of West Melghat (Nagpur)	1979-80	NRIBAS, Pune
	RRI, Junagarh	1980-81	NRIBAS, Pune
	AMHRI, Nagpur	2009-10	NRIBAS, Pune

Rajasthan, **West Bengal,** **Punjab,** **Uttar Pradesh.**	Department of Ayurveda, Ajmer	1969-71	RARI, Jhansi
	SMPU, Uttar Pradesh	1971-72	RARI, Jhansi
	SMPU, West Bengal	1971-72	RARI, Jhansi
	SMPU, Rajasthan	1972-73	RARI, Jhansi
	CRI, Patiala	1975-76	RARI, Jhansi
	RRI, Calcutta	1975-76	RARI, Jhansi
	RRI, Jaipur	1975-76	RARI, Jhansi
	SMPU, Lucknow	1976-77	RARI, Jhansi
	Survey and Supply Enquiry, Lucknow	1978-79	RARI, Jhansi
	RRI, Calcutta	1978-79	RARI, Jhansi
	SMPU, Rajasthan	1978-79	RARI, Jhansi
	RRC, Jhansi	1984-85	RARI, Jhansi
	NVARI, Jhansi	2009-10	RARI, Jhansi
Himachal Pradesh, **Jammu and Kashmir ,** **Sikkim,** **Uttarakhand.**	Pharmaceutical Laboratory, Ranikhet	1969-71	RARI, Ranikhet
	Institue for Research in Indian System of Medicine, Jogindernagar	1969-71	RARI, Ranikhet
	SMPU, Himachal Pradesh	1971-72	RARI, Ranikhet
	SMPU, Jammu	1971-72	RARI, Ranikhet
	RRC, Jogindernagar	1975-76	RARI, Ranikhet
	SMPU, Ladhak	1975-76	RARI, Ranikhet
	SMPU, Tarikhet	1976-77	RARI, Ranikhet
	RRC, Sikkim	1978-79	RARI, Ranikhet
	Tribal pockets of Mirzapur	1979-80	RARI, Ranikhet
	Tribal pockets of Nainital	1979-80	RARI, Ranikhet
	RRC, Gangtok	1980-81	RARI, Ranikhet
	Amalgamated Units, Tarikhet	1980-81	RARI, Ranikhet
	RRC, Mandi	1993-94	RARI, Ranikhet
	IIADR, Tarikhet	1994-95	RARI, Ranikhet
	RRI, Tarikhet	2001-02	RARI, Ranikhet
	RRIHF, Tarikhet	2009-10	RARI, Ranikhet

Madhya Pradesh.	Govt. Ayurvedic College, Gwalior	1969-71	NRIASHRD, Gwalior
	SMPU, Madhya Pradesh	1971-72	NRIASHRD, Gwalior
	SMPU, Gwalior	1974-75	NRIASHRD, Gwalior
	Medico Botanical Survey of Bastar District of Madhya Pradesh	1978-79	NRIASHRD, Gwalior
	Medico Botanical Survey Pachmarhi, Amarkantak and Chitrakoot areas in Madhya Pradesh	1978-79	NRIASHRD, Gwalior
	RRI, Gwalior	1979-80	NRIASHRD, Gwalior
	CRI, Gwalior	2002-03	NRIASHRD, Gwalior
Arunachal Pradesh.	SMPU, Arunachal Pradesh	1975-76	RARI, Itanagar
	RRC, New Itanagar	1980-81	RARI, Itanagar
	RRI, Itanagar	2001-02	RARI, Itanagar
	ARRI, Itanagar	2009-10	RARI, Itanagar
Karnataka **Kerala,** **Andra pradesh,** **Telangana,** **Tamil nadu,** **Andaman&Niobar Islands.**	Ayurvedic Research Institute, Trivandrum	1969-71	RARIMD, Bengaluru
	SMPU, Andhra Pradesh	1971-72	RARIMD, Bengaluru
	SMPU, Kerala	1971-72	RARIMD, Bengaluru
	SMPU, Mysore	1971-72	RARIMD, Bengaluru
	SMPU, Tamil Nadu	1971-72	RARIMD, Bengaluru
	SMPU, Thirunelveli Siddha	1972-73	RARIMD, Bengaluru
	CRI, Cheruthuruthy	1975-76	RARIMD, Bengaluru
	RRI, Trivendrum	1975-76	RARIMD, Bengaluru
	RRC, Bangalore	1975-76	RARIMD, Bengaluru
	RRC, Vijayawada	1975-76	RARIMD, Bengaluru
	SMPU, Andaman	1975-76	RARIMD, Bengaluru
	SMPU, Tribal pockets of Nilgiris	1975-76	RARIMD, Bengaluru
	SMPU, Palayamkottai	1975-76	RARIMD, Bengaluru
	RRI, Trivandrum	1976-77	RARIMD, Bengaluru
	MBRP, Palayamkottai	1996-97	RARIMD, Bengaluru
	ARIMCHC, Trivandrum	2009-10	RARIMD, Bengaluru
	NADRI, Banglore	2009-10	RARIMD, Bengaluru

Assam, Bihar, Orissa.	SMPU, Assam	1971-72	RARIGID, Guwahati
	SMPU, Bihar	1971-72	RARIGID, Guwahati
	SMPU, Orissa	1971-72	RARIGID, Guwahati
	SMPU, Guwahati	1975-76	RARIGID, Guwahati
	SMPU, Patna	1975-76	RARIGID, Guwahati
	RRI, Bhubaneshwar	1975-76	RARIGID, Guwahati
	RRC, Guwahati	1979-80	RARIGID, Guwahati
	RRI, Patna	1979-80	RARIGID, Guwahati
	Medico Botanical Survey, Assam.	1979-80	RARIGID, Guwahati
	CRI, Guwahati	1991-92	RARIGID, Guwahati
	NEIARI, Guwahati	2009-10	RARIGID, Guwahati

GUIDE LINES/ METHODOLOGY

In order to document the utilization of indigenous Medicinal Plants, survey was carried out during the years, 1969 to 2016. The information on medicinal uses of the indigenous plants have been described after gathering information's from experienced rural folk, traditional herbal medicine practitioners who were having knowledge of traditional healing practices. Medico-Ethno Botanical Surveys were conducted by various survey units of CCRAS located at RARIGID Guwahati, RARI Itanagar, RARI Jhansi, RARIMD Bangalore and RARI Tarikhet in various parts of India. A brief group discussion was made with the informants in their local language, prior to folklore data collection to get their consent and explain to them that their valuable contribution to the documentation of the traditional plant used by them. By using standard Local Heath tradition format (LHT) which includes interview and questionnaire which was used to explore the information from their source persons using this standard method. Information on local name of the plant, plant parts used for curing disease, their recipes and mode of administration were recorded for future reference study. Expert opinion of plant taxonomists was also sought for cross checking and confirmation on identity. Herbariums at four institutes have got international recognition as these are accredited with acronyms by the **New York Botanical Garden, USA.**

- Regional Ayurveda Research Institute, Tarikhet— **"RKT"**
- Regional Ayurveda Research Institute, Jhansi—**"JHS"**
- Regional Ayurveda Research Institute for Metabolic Disorders, Bengaluru—**"RRCBI"**
- Regional Ayurveda Research Institute, Itanagar— **"ARRI"**

THE SURVEY TEAM AND METHOD OF WORK

- Normally the survey team consists of a botanist, one Ayurvedic physician, one field assistant and other supporting staffs.

- The Botanist is responsible for spot identification of the medicinal plants or its relatives collected during the tour.
- Final identification is done in consultation with relevant published floras and regional or national herbaria.
- The Ayurvedic Physician use to diagnose the disease condition while collecting information on folk-claims. This helps in identification of a particular part in certain ailment and documentation of all the claims recorded during a survey tour. Also, the Ayurvedic Physician use to check if the information collected in the folk-claims are mentioned in any codified text or not.
- Primarily members of the survey team observe the general vegetation and forest type of the locality.
- During the tour, plant specimens are collected with a number tag on each specimen and relevant field note recorded in the corresponding page of the field book.
- After reaching the camp, all the specimens are pressed with blotting sheets and conventional method of preparing herbarium specimen is followed.
- Local people including the 'Hakims' or 'Vaidya' or 'Medicine men' are interviewed with a questionnaire and information regarding the local use of the plants are noted.
- Sometimes one or two local inhabitants are hired to stay with the survey team and provide all the requisite information required.

STANDARD SURVEY METHODOLOGY FOR SURVEY OF MEDICINAL PLANTS

1. BELT TRANSACTS METHOD

One of the popular methods for survey of plants is Belt Transact Method. Because this is suitable in forests where there are different vegetation pattern is observed. In this method, generally survey team will walk straight from a randomly selected point in the forest up to 2-3 km (approximate) or there is no scope of new species encounter in transect. Sampling (recording individual plant details in filed note books as well as collection of two Herbarium specimens, preferably flowering or fruiting twigs) of Medicinal Plants is done within 5 m width along the line. Documentation in the form of photographs of various plants parts also done during the survey. (This method of sampling is used in Karnataka state forests, because most of the forest areas having different terrain with vegetation difference). Sometimes direction of the transect may change, depending up on the vegetation pattern or topography of the area. Belt transects are laid in such a way so that to cover different forest vegetation such as Ravine forest, Hill forest, Shola forests, Plain forest, Wet land forest, etc. in a particular forest area. Because transect is continuous through the study area, it can be applied in studying the gradual and continuous changes in the vegetation. The belt transect method is used to estimate abundance, frequency and distribution of species in the community. Generally the survey should be conducted in natural forest areas not in Plantation sites and man-made forests. for study of Medicinal Plants. (Fig. 1)

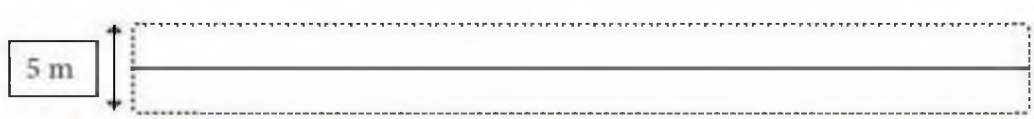


Fig. 1 : Belt Transect (2-3 km or till new species are not encountered)

OTHER PLANT SAMPLING METHODS

1. Quadrant

It is another Plant Sampling Method and more suitable in plant areas with uniform vegetation pattern. Quadrant is a square sample or unit for a detailed analysis of vegetation. Quadrants of one-fifth acre size established to include maximum number of tree, while for studying shrubs and grass covers usually the quadrants of smaller sizes are used.

2. Loop Method

This is a simple, accurate and quick method for sampling of only grassland and low.

3. Pointless or Point Method

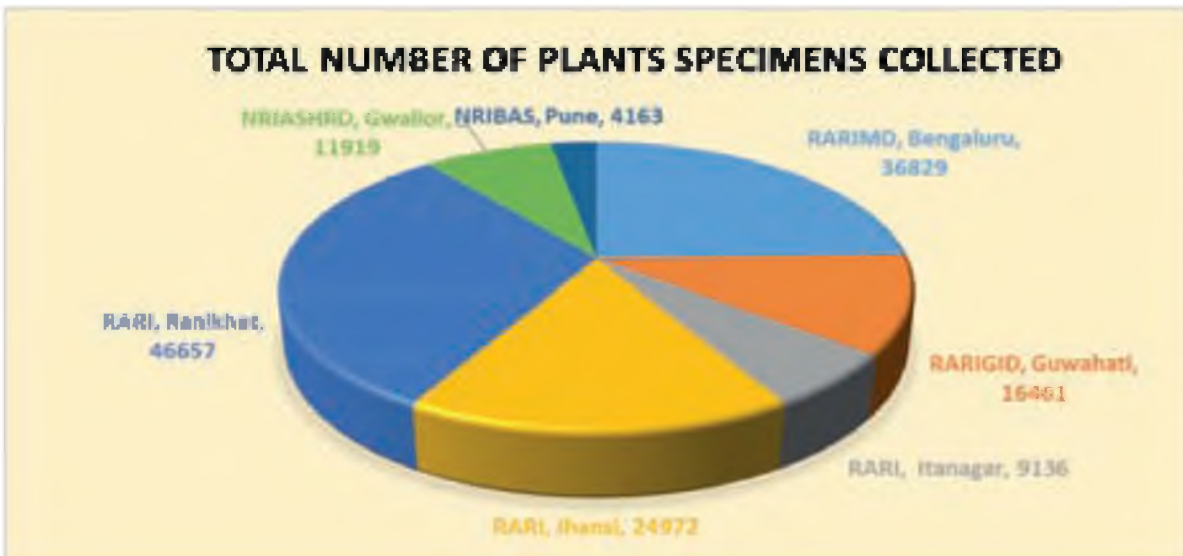
This also suitable in the study of grassland low herbaceous communities.

ACHIEVEMENTS DURING 1969-2016

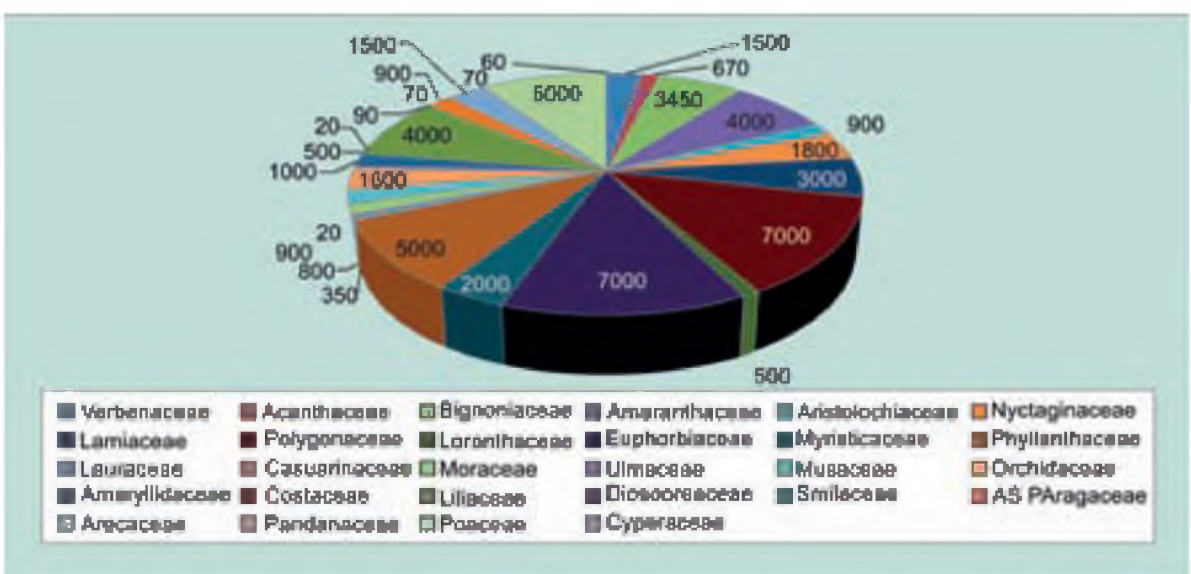
Through this Medico-Ethno Botanical survey program during the period 1969-2016, the council has surveyed every part of phyto-geographic region across the country including the Andaman & Nicobar Islands and Lakshadweep and conducted 974 survey tours, covered more than 976 forest areas across the country. During survey more than 1.5 Lakh Medicinal Plant were collected alongwith 10,000 folk claims (Approximately). 19,000 Museum samples were preserved and 1 lakh (Approximately) Herbarium sheets were documented.

DETAILS OF SURVEY CONDUCTED UNDER MEDICO ETHNO BOTANICAL SURVEY PROGRAMME FROM 1969-2016

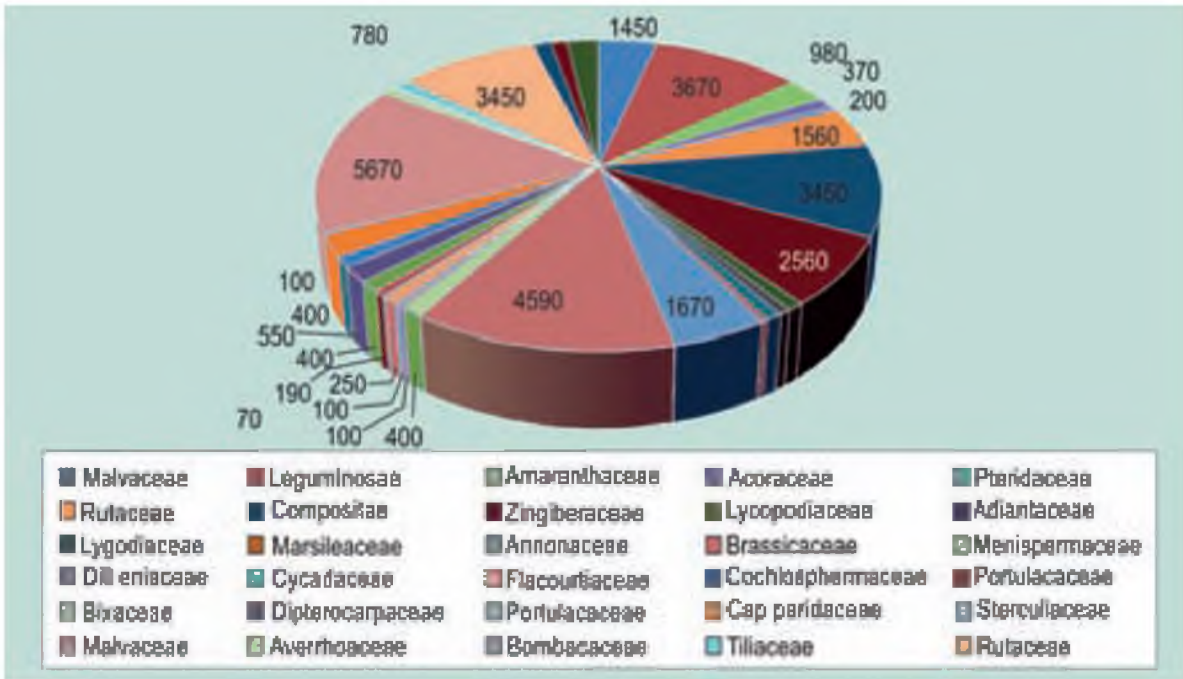
S.No.	Name of the Institute	Total number of specimens collected	Number of Herbarium sheet prepared (Including Duplicate sheets)	Number of Survey tours	Number of Forest area covered	Number of museum sample Collected	Number of Folk claims collected
1	**RARIMD, Bengaluru**	36829	37084	339	159	5601	5378
2	**RARIGID, Guwahati**	16461	15205	166	142	1587	1270
3	**RARI, Itanagar**	9136	5764	65	153	1078	546
4	**RARI, Jhansi**	24972	32005	116	99	3820	1616
5	**RARI, Ranikhet**	46657	55155	163	185	4053	1380
6	**NRIASHRD, Gwalior**	11919	9537	71	70	778	945
7	**NRIBAS, Pune**	4163	11205	54	156	2794	1657
	Total	**150137**	**165955**	**947**	**964**	**19711**	**12792**



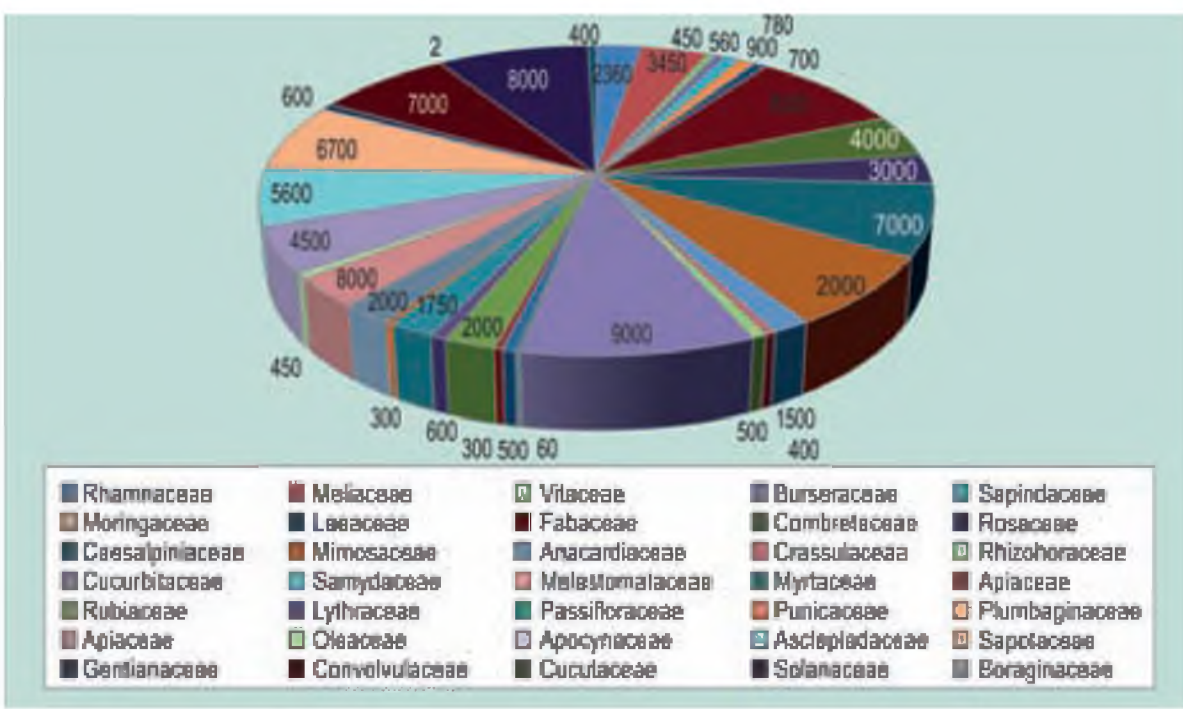
Plant Specimens Collected during the Survey



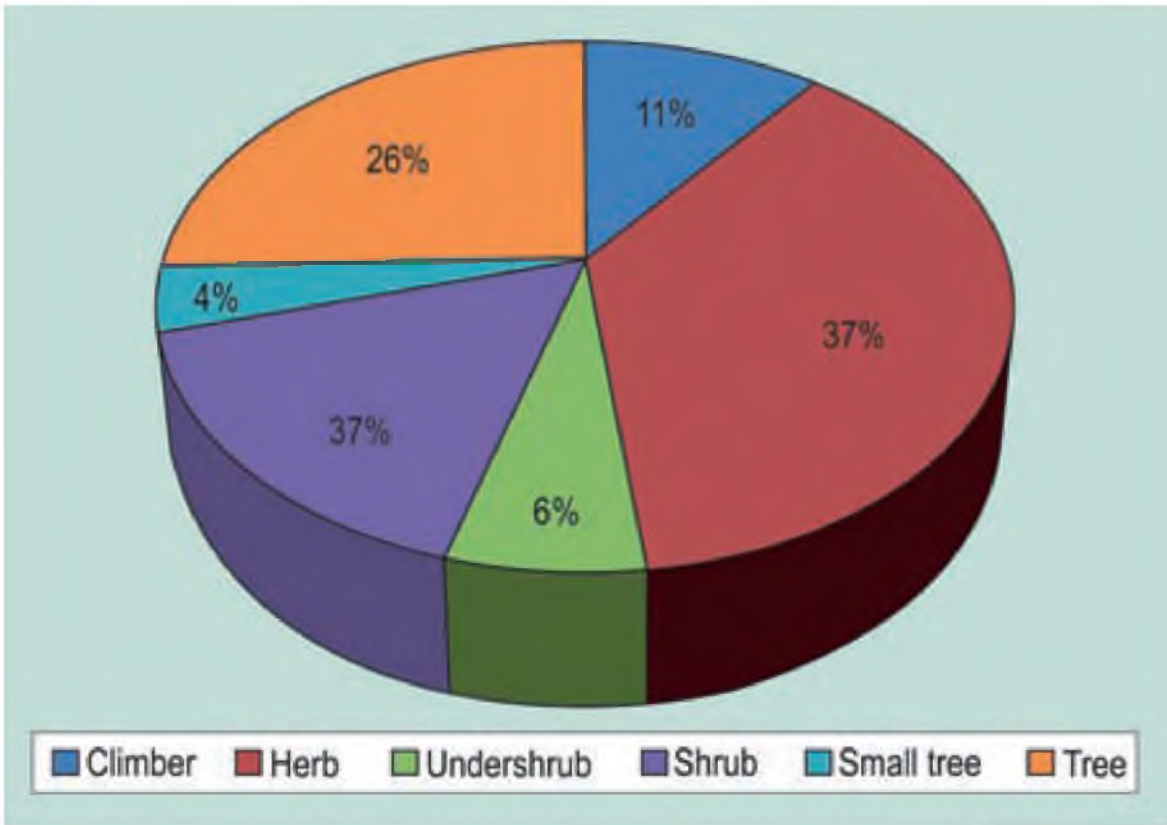
Details of total number of families



Details of total number of families



Details of total number of families



Growth form of medicinal plants

Some Important Medicinal Plants

Neanotis lancifolia (Hook.f.) W.H.Lewis

Alocasia macrorrhizos (L.) G.Don

Abutilon pannosum (G.Forst.) Schltdl.

Butea monosperma (Lam.) Taub.

Potentilla atrisanguinea Th.Wolf

Woodfordia fruticosa (L.) Kurz

Folk lore Claims

The use of plants or animal products for healing is as old as human civilization. The relationship between man and plant is inseparable and it can be said that humanity at large cannot survive without using the plants in one way or other. Our country has rich floristic and ethnic diversity. Hence it is of prime significance to explore the medicinal flora of our country in the past. To restore stability through various techniques, procedures, regimes, diet and medicine constitute treatment. Medicinal Plants form the major resource base of our indigenous healthcare traditions or Indian System of Medicines. Medicinal Plants used even in modern system of medicine are of Plant based origin. Traditional systems based medicines are affordable and accessible even to poor people. In view of this CCRAS from more than three decades fully engaged in collecting data on folklores/Ethno medicinal lores through its survey units located at different parts of the country. CCRAS has conducting Medico-Ethno Botanical Survey (MEBS), Tribal Health Care Research Programme (THCRP) across different forest areas/geographical regions to document the Ethno medical uses of the medicinal plants. The collection of folk lore claims includes the identification of the folk medicinal plant and Local people including the 'Hakims' or 'Vaidya' or 'Medicine men' are interviewed with a questionnaire and information regarding the local use of the plants are noted (LHT Format). And validation of these folk loreclaims should be done through classical literature of Ayurveda texts.

Details of Folklore claims collected under Medico-Ethno Botanical Survey:

S.No	Institute Name	Number of Folk claims collected
1.	**RARIMD, Bengaluru**	5378
2.	**RARIGID, Guwahati**	1270
3.	**RARI, Itanagar**	546
4.	**RARI, Jhansi**	1616
5.	**RARI, Ranikhet**	1380
6.	**NRIASHRD, Gwalior**	945
	Total	1657

LHT FORMAT

Central Council For Research In Ayurvedic Sciences
Ministry of AYUSH

Format for Documentation of Local Health Traditions
(By AYUSH Research Councils/individuals/NGOs etc.)

1. **Title of Proposal/Project:** _____

2. **Name and complete address of the Organization:**

3. **Whether Related to:**

Ayurveda	
Unani	
Homoeopathy	
Siddha	
Yoga & Naturopathy	

4. To be submitted to the Research Councils

CCRAS	
CCRUM	
CCRH	
CCRS	
CCRYN	

5. Objectives Covered:

1. Home Remedies	
2. Food and Nutrition	
3. Midwifery	
4. Bone setting	
5. Other specialized local health practices	
6. Ethno veterinary Practices	

6. Duration of the project:

7. Year wise objectives and deliverables:

8. Area/No. of blocks and districts covered:

9. Whether the drug or the formulation/ procedure has been mentioned for the same reference in literature:

Name of the system	Yes	No	Validation category											
Ayurveda			V1		V2		V3		V4		V5		V6	
Unani			V1		V2		V3		V4		V5		V6	
Homoeopathy			V1		V2		V3		V4		V5		V6	
Siddha			V1		V2		V3		V4		V5		V6	
Yoga & Naturopa-thy			-		-		-		-		-		-	

⁂ If yes then tick the appropriate **validation category** as per guidelines (Annexure–I)

10. Whether the information is to be submitted:

A. Drug wise	
B. Procedures	

Please tick (√) in appropriate box

A. DETAILS OF DRUG

i. Whether single/compound formulation: **Single** **Compound**

ii. Information on single drug

a)	Origin (√ Appropriate)	Plant origin √	Animal origin	Mineral/ Metal origin	Others
b)	Local/Regional name				
c)	Sanskrit name (If available)				
d)	Hindi name (If available)				
e)	Urdu name (If available)				
f)	Tamil name (If available)				
g)	English name				
h)	Botanical/Zoological / Chemical name				
i)	Part/parts used				
j)	Period of collection of plant				
k)	Storage condition (if any)				
l)	Photograph of the raw drug				
m)	Photograph of the final product				
n)	Specimen of raw drug				
o)	Specimen of final produ				
p)	Videography of method of preparation if available				

iii. Information on compound formulation

a)	Name of the formulation
b)	Form of formulation
c)	Method of preparation in detail including the no. and proportion of ingredients
d)	Videography of method of preparation if available
e)	Photograph of the raw drug
f)	Photograph of the final product
g)	Specimen of raw drug
h)	Specimen of final product
i)	**Details of ingredients**

	Local Name	Origin	Sanskrit Name	Hindi name (if available)	English name (if available)	Urdu Name (if available)	Tamil Name (if available)	Botanical/ Zoological/ Chemical name	Part/ Parts used	Period of collection of plant	Storage condition (if any)
	i										
	ii										

iv. Disease/ indicated condition

• Disease as mentioned by Healer	
• Possible correlation with codified system	
• Method of Diagnosis	
◊ Symptom	
◊ Observation	
◊ History	
◊ Pulse examination	
◊ Modern parameters	
◊ Others	

v. Mode of administration

• Route of administration (Oral/ local/ others etc.)	
• Dose	
• Duration	
• Vehicle (if any)	

vi. a) Dietary regimen during the treatment-

b) Lifestyle regimen during the treatment

vii. a) Concurrent medicine (if any) taken during treatment.

b) Concurrent procedure (if any) during treatment.

viii. Contra indication of the medicine (if any)

ix. Detail of Knowledge Provider

No. of Knowledge provider/introducer					
Name & Photo	Address	Age	Sex	Occupation	Education Qualification

x. Detail of Local Health Practitioner

No. of Local Health Practitioners using the medicine					
Name & Photo	Address	Age	Sex	Occupation	Education Qualification
Average Number of Patients of the disease treated in a year					
Details of Investigations before and after Treatment if any					
Results of Treatment					

B. Information on Procedures (Bones setting/Midwifery/Ethno-veterinary)

i.	Disease/ indicated condition	
	• Disease as mentioned by Healer	
	• Possible correlation with codified system	
	• Method of Diagnosis	
	• Symptom	
	• Observation	
	• History	
	• Pulse examination	
	• Modern parameters	
	• Others	

ii.	Whether the patients referred from other practitioners etc. for the same procedure	
iii.	Aids/ Tools used	
iv.	Description of the procedure/Technique	
v.	Care during procedure	
vi.	Pre procedure precautions/ care if any	
vii.	Post Procedure Care	
viii.	List of Medicines used in the process	
ix.	Outcome of the procedure	
x.	Video/ photograph if any – List here and provide CD in a universally open able format	

xi. Detail of Knowledge Provider

No. of Knowledge provider/introducer					
Name & Photo	Address	Age	Sex	Occupation	Education Qualification

xii. Detail of Local Health Practitioner

No. of Local Health Practitioners using the medicine					
Name & Photo	Address	Age	Sex	Occupation	Education Qualification

Average Number of Patients of the disease treated in a year	
Details of Investigations before and after Treatment if any	
Results of Treatment	
Any other information	

S.No. Name and designation of the team members **Signature(S)**

1.

2.

Annexure-I

Validation methodology: Ayurveda			
Sl. No.	**Categories of References**	**Reference Materials**	**Validation category**
	Classical literature and recent compilations from classical texts	1. API*, AFI** 2. Ayurveda principles 3. Dravyaguna Vijnan by P.V.Sharma	V1 V2 V3
	Published literature listing home remedies	4. Handbook of Domestic Remedies 5. Tribal Folk Remedies published by CCRAS (documented but not yet verified)	V4 V5
	Outside the above literature and non-classical proprietary medinines	6. Other than the above references/ Ayurveda line	V6
* API = The Ayurvedic Pharmacopoeia of India Part-I-V is a collection of plant origin single monographs (standards for Identity, Purity and strength) used in Ayurvedic formulations. API Part-II Volume-I+II is a collection of Pharmacopoeial standards for formulations used in Ayurveda. ** AFI = Ayurvedic Formulary of India Part I & II is a collection of 644 classical Ayurvedic Compound and single drug formulae covering plant, mineral and animal origin drugs.			

Selected books for validation of LHTs/Folk Claims:

1. Glossary of Indian medicinal plants by RN Chopra &ICChopra, P.No.-218
2. Bhava prakash nighantu
3. Priya nighantu
4. Dhanvantari nighantu
5. Raj nighantu
6. Kaidev nighantu
7. Shalaigram nighantu
8. Adarsh nighantu-1
9. Medicinal plants used in Ayurveda by RAV
10. Classical medicines used in Ayurveda by P.V. Sharma
11. CCRAS home remedies

12. Indian Materian Medica by K.M. Nadkarni

13. Database medicinal plantsVol.1-8

14. Charak Samhita

15. Sushruta Samhita

16. Ashtang Sangra 4&Hriday

17. Dravya Gun vigyan by P.V. Sharma

18. API

19. Brindha Madhav

20. Yoga Ratnakar

21. Chakradatt.

DATA COLLECTION FROM THE FOLK HEALERS

CHAPTER-3

DEMONSTRATIVE CULTIVATION OF MEDICINAL PLANTS

BACK GROUND

Medicinal plants have been used in the mitigation and treatment of various ailments since ancient time. Several medicinal plants described in various Traditional Medicine Systems serve as a potential lead for the development of lead compound in drug discovery process. Identification of the crude drug is the fundamental step in the formulation of plant-based drugs. The preeminent objectives for cultivation of medicinal plants include the adaptability, growth, flowering and fruiting time of medicinal plants, and suitable maturity time. Considering these facts, the Central Council for Research in Ayurvedic Sciences (CCRAS) has initiated the steps for developing of medicinal plant gardens at different geographical zones for demonstrative purposes, which are used in the traditional systems of medicine.

Materials and methods:

Cultivation of Medicinal Plants under Medicinal Plant Research Programme is being carried out mainly in four gardens located at different climatic zones, viz., Regional Ayurveda Research Institute (RARI), Jhansi (Uttar Pradesh), Regional Ayurveda Institute for Fundamental Research (RAIFR), Pune (Maharashtra), RARI Itanagar (Arunachal Pradesh), and RARI, Ranikhet (Tarikhet) (Uttarakhand).

Core Objectives:

- Prepare a demonstrative set of pharmacopoeial plant species in live condition.
- Introduce medicinal plants in the institute gardens from similar and different agro-climatic zones.
- Study their adaptability, growth pattern, flowering, fruiting and suitable maturity time of the drug part.
- Provide authentic raw drug materials for various research programme of the Council.
- Experimental study on propagation of medicinal plants including *in-vitro* methods.
- Act as *ex-situ* conservation sites and important germplasm collections of medicinal plants including several rare, endangered and threatened species.
- The live plants are to act as reference material for correct identification of medicinal plants.

OBSERVATIONS

Totally, 533 species of medicinal plants are maintained in these four gardens, out of which, 332 plant species were maintained by RARI, Jhansi; in which 4 species are critically endangered, 20 species are least concerned and rare. In RAIFR, Pune, 159 species of medicinal plants were maintained; out of which 12 species are least concerned and 1 species is vulnerable. In RARI, Itanagar, 126 plant species of medicinal plants were maintained; out of which 4 species under

cultivation are critically endangered, 6 species least concerned, 2 vulnerable and threatened. In RARI, Ranikhet, 119 plant species of medicinal plants were maintained; out of which 8 species under cultivation are rare, 4 species critically endangered and vulnerable. Saffron (Crocus sativus Linn.) is successfully cultivated in the Institute (RARI, Ranikhet) gardens situated at Ranikhet and Chamma.

INTRODUCTION

India is rich in its diverse natural resources. Most of the raw material from plants is extracted from wild resources for preparation of herbal formulations and the same are being used in health care systems. Due to the overexploitation of medicinal plants, a major part of phyto diversity is under threat, and to fill this lacuna conservation of medicinal and aromatic plants is one of the major step. Conservation at the site where plants occur in nature, i.e., "habitat conservation" or "in situ conservation," is an important strategy. Another important practice in research which is emerging at greater extent is "ex situ conservation," where cultivation of germ plasms away from their original habitats takes place. This method is also used for the protection of species that are at risk of devastation, substitution, and genetic deformation. There is a mandatory necessity to take steps to preserve the plant wealth by large-scale cultivation. India has different climatic and geographical situations and the medicinal plants are growing right from the Himalayan region to desert, plains, and coastal areas. Due to overexploitation of the medicinal plants, a large number of plants are under threat, resulting in the demand of plants growing in the high altitude region, which leads to substitution or adulteration of medicinal plant species.

DEVELOPMENT OF AGRO TECHNIQUES OF MEDICINAL PLANTS BY CCRAS

The CCRAS has initiated the steps for developing medicinal plant gardens for demonstrative purposes. At present the Council is maintaining four demonstrative gardens situated at RAIFR, Pune; RARI, Jhansi; RARI, Ranikhet; and RARI, Itanagar, located at different agro-climatic zones for demonstration .These gardens are ex situ conservation sites for germ plasm and medicinal plants, including rare, endangered and threatened species. Different study programs, viz., adaptability, growth pattern, flowering, fruiting and suitable maturity time studies of drugs part, etc. and authentic drug materials supply for various research programs are being carried out. These studies will help in designing protocol in framing strategies for conservation and sustainable utilization of highly valuable medicinal plants. The live plants act as specimen for referencing and correct identification of the medicinal plants. In addition to the above gardens, the Council is having two herbal gardens for the cultivation of saffron and Guggulu that are situated at RARI, Ranikhet, Uttarakhand and Mangaliawas, Ajmer, Rajasthan respectively. Experimental cultivation of *Crocus sativus* L. is being undertaken in non habitat region of Ranikhet (Almora) and Chamma (Tehri) at an altitude of 2000 m. Experimental application of agro techniques and adaptable practices are carried out to study the growth of corms and plants, yield of saffron, etc. These gardens work as reference centers for researchers/ students/ academicians for identification of their plants/plant parts, and the genuine materials collected from the gardens are used as a reference material for herbarium and museums.

STATUS OF DEMONSTRATIVE GARDENS OF CCRAS IN DIFFERENT GEOGRAPHIC REGIONS

These gardens are the source of authentic raw drug materials for research and development

work of the Council. The raw drugs collected from the gardens are also been used for numerous projects under Ayurvedic Pharmacopoeia Committee from time to time. Many experimental studies on growth and yield of certain medicinal plants are also being carried out by using different combinations of organic and farmyard manure. As per the recent observations, it was found that around 736 (including repetition) and 533 species (excluding repetition) of medicinal plants belonging to 124 families are grown in the four demonstrative herbal gardens of CCRAS located at different geographical zones .

Location of Map showing Different Demonstrative Gardens of CCRAS

State and zone-wise details of cultivation of medicinal plants

Sl. No.	State and zone	CCRAS Institute	Number of species maintained	Area under cultivation (acre)
1	Uttar Pradesh (North Zone)	Regional Ayurveda Research Institute (RARI), Jhansi	332	10
2	Maharashtra (West Zone)	Regional Ayurveda Institute for Fundamental Research (RAIFR), Pune	159	19.5
3	Arunachal Pradesh (North-East Zone)	Regional Ayurveda Research Institute (RARI), Itanagar	126	11.5

4	Uttarakhand (North Zone)	Regional Ayurveda Research Institute (RARI), Tarikhet	119	03

Critical Analysis of the Medicinal Plants Growing in the Gardens

Sanskrit name	Botanical name	Family	Habit	IUCN status	STATUS			
					Jhansi	Ranikhet	Itanagar	Pune
Gunja	*Abrus precatorius* L. (Black seed)	Leguminosae	Twiner	C	√		√	√
Latakasturi	*Abelmoschus moschatus* Medic.	Malvaceae	Soft, herbaceous trailing plant	C	√			
Pishachkarpas	*Abroma augusta* L.	Malvaceae	Shrub	C	√	√	√	
Gunja	*Abrus precatorius* L. (white seed)	Leguminosae	Twiner	C	√			
Atibala	*Abutilon indicum* (L.) Sweet	Malvaceae	Shrub	C	√			√
–	*Acacia auriculiformis* Benth.	Leguminosae	Evergreen tree	LC	√			√
Khadir	*Acacia catechu* (L.f.) Willd.	Leguminosae	Small tree	C	√			√
Saptala	*Acacia concinna* (Willd.) DC.	Leguminosae	Herb	C	√			
Irimeda	*Acacia farnesiana* (L.) Willd.	Leguminosae	Shrub	C	√			
Shweta Babul	*Acacia leucophloea* (Roxb.) Willd.	Leguminosae	Large thorny tree	C	√			√
Babul	*Acacia nilotica* ssp. *indica* (Benth.) Brenan	Leguminosae	Large thorny tree	C	√			√
Haritmanjari	*Acalypha indica* L.	Euphorbiaceae	Small erect herb	C	√			√
Gandana	*Achillea millefolium* L.	Compositae	Herbaceous perennials	NYR		√		
Apamarga	*Achyranthes aspera* L.	Amaranthaceae	Annual or perennial herb	C	√			√
Apamarga bhed	*Achyranthes bidentata* Blume	Amaranthaceae	Erect or straggling herb	NYR		√		
Vacha	*Acorus calamus* L.	Acoraceae	Perennial herb	LC	√	√	√	√
Kuchandana	*Adenanthera pavonina L.*	Leguminosae	Tree	C	√			√
Vasaka	*Adhatoda vasica* Nees	Acanthaceae	Sub-herbaceous bush	NYR		√		
Vasa bhed	*Adhatoda zeyianica* Medik.	Acanthaceae	Sub-herbaceous bush	C	√		√	√
Bilva	*Aegle marmelos* (L.) Correa	Rutaceae	Tree	C	√	√	√	√
Gorakshganja	*Aerva lanata* (L.) Juss.	Amaranthaceae	Perennial herb	C	√			
Sahdevl Bhed	*Ageratum conyzoides* L.	Compositae	Annual herbaceous weed	C	√			
Ankol	*Alangium salviifolium* (L.f.) Wang.	Cornaceae	Tall thorny tree	C	√			
Shirish	*Albizia lebbek* Benth.	Leguminosae	Large tree	C	√			
Jambo-phoran	*Allium coralinianum* L.L	Amaryllidaceae	Annual or perennial bulbous plant	NYR		√		

Maankand	*Alocasia indica* Schott	Araceae	Perennial herb	C	√			√
Kumari, Ghritkumarika	*Aloe barbadensis* Mill.	Xanthorrhoeaceae	Spiky, succulent, perennial plant	C	√			√
Ghrit Kumari	*Aloe vera* (L.) Brum.f.	Xanthorrhoeaceae	Succulent herb	NYR		√		
Kulanjan	*Alpinia macrophylla* Schum	Zingiberaceae	Perennial herb	NYR		√		
Saptaparna	*Alstonia scholaris* R.Br.	Apocynaceae	Elegant evergreen tree	LR	√		√	√
Matsyakshi bhed	*Alternanthera pungens* H.B.&K.	Amaranthaceae	Perennial herb	C	√			
Matsyakshi	*Alternanthera sessilis* DC.	Amaranthaceae	Perennial herb	LC	√			
–	*Althea rosea* Cav.	Malvaceae	Shrub	NYR		√		
Tanduliya bhed	*Amaranthus viridis* L.	Amaranthaceae	Annual herb	C	√			
–	*Ammannia baccifera* L.	Lythraceae	Annual herb	LC	√			
Brihad Ela	*Amomum subulatum* Roxb.	Zingiberaceae	Evergreen plant	NYR		√		
Suran	*Amorphophallus campanulatus.* Bl.ex Decne	Araceae	Perennial, stemless herb	C	√			
–	*Amorphophallus paeoniifolius* (Dennst.) Nicolson	Araceae	Deciduous herbaceous aroid shrub	C			√	
Kajutak	*Anacardium occidentale* L.	Anacardiaceae	Tree	C	√			
Akarkarabha	*Anacyclus pyrethrum* DC.	Compositae	Perennial herb	NYR		√		
Ananas	*Ananas comosus* Merr.	Bromeliaceae	Perennial monocotyledonous rosette plant	NYR			√	
Bhunimba Bhed	*Andrographis echioides* Nees.	Acanthaceae	Annual herb	C	√			
Bhunimba, Kalmegh	*Andrographis paniculata* Wall. ex Nees	Acanthaceae	Annual herb	C	√	√		
Shatpushpa	*Anethum sowa* L.	Apiaceae	Annual herb	C	√			
Gandgatra	*Annona squamosa* L.	Annonaceae	Small tropical tree	C	√			√
Dhav	*Anogeissus latifolia* Wall. ex Bedd.	Combretaceae	Medium-sized tree	C	√			
Kadamba	*Anthocephalus chinensis*ARich. exWalp.	Rubiaceae	Tall tree	C	√			
Guvaka	*Areca catechu* L.	Arecaceae	Medium-sized tree	C	√		√	
Swarnkshiri	*Argemone mexicana* L.	Papaveraceae	Prickly, hairless, branching herb	C	√			
Vridhadaru	*Argyreia nervosa* (Burm.f.) Boj.	Convolvulaceae	Creeper	C	√			√
Vridhadaru bhed	*Argyreia serica* Dalzell & Gibson	Convolvulaceae	Clambering silky twiner	C	√			
Sarpa	*Arisaema speciosum* Mart.	Araceae	Bulbous perennial	C	√			

Eshwari	*Aristolochia indica* L.	Aristolochiaceae	Twining perennial herb	C	√			
Damnak	*Artemisia annua* L.	Compositae	Annual short-day plant	NYR		√		
Nagadaman	*Artemisia nilagirica* (Clarke) Pampam.	Compositae	Aromatic shrub	NYR				√
Nagdamani	*Artemisia vulgaris* L	Compositae	Perennial shrub	NYR			√	
Panasa	*Artocarpus heterophyllus* Lam.	Moraceae	Large evergreen tree	NYR			√	
Lakuch	*Artocarpus lakoocha* Rox.	Moraceae	Deciduous tree	C	√			
Saptala	*Acacia sinuata (Lour.) Merrill.*	Leguminosae	Large evergreen tree	NYR				√
Gorakshi	*Adansonia digitata L.*	Bombacaceae	Large evergreen tree	C				√
–	*Adenocalymma alliaceum (Lam.) Miers.*	Bignoniaceae	Tree	C				√
–	*Agave sisalana Perr.*	Agavaceae	Twining perennial herb	C				√
Araluka	*Ailanthus excelsa Roxb.*	Simaroubaceae	Large deciduous tree	NYR				√
Shweta shirisa	*Albizia procera (Roxb.) Benth.*	Leguminosae	Deciduous and semi-evergreen tree	C				√
–	*Allamanda cathartica L.*	Apocynaceae	Tropical twining vine	C				√
Lavani	*Annona reticulata L.*	Annonaceae	Small deciduous or semi-evergreen tree	LC				√
Dhavbheda	*Anogeissus pendula* Edgew.	Combretaceae	Moderate tree	C				√
Harachampaka	*Artabotrys hexapetalous* (L) Bhandarl	Annonaceae	Perennial shrub	NYR				√
Panasa	*Artocarpus integrifolius L.f.*	Moraceae	Large tropical tree	NYR				√
Shweta mushali	*Asparagus adscendens Roxb.*	Asparagaceae	Annual or perennial bulbous plant	C				√
–	*Atalantia racemosa Wight. &Arn.*	Rutaceae	Small evergreen tree	NYR				√
Kakatundi	*Asclepias curassavica* L.	Apocynaceae	Erect, evergreen perennial sub-shrub	NYR		√		
Satavari bhed	*Asparagus curillus* Buch-Ham.	Asparagaceae	Shrub	NYR		√		
Satavari	*Asparagus racemosus* Willd	Asparagaceae	Woody climber	NYR	√	√	√	√
	Asphodelus tenuifolius Cav.	Xanthorrhoeaceae	Annual herb	NYR	√			
Kokilaksha	*Astercantha longifolia* Nees	Acanthaceae	Perennial shrub	C	√			
Vankulattha	*Atylosia scarabaeoides (L.)*Benth.	Leguminosae	Perennial climber	C	√			

Karmaranga	*Averrhoa carambola* L.	Oxalidaceae	Small tropical tree	C	√			√
Nimba	*Azadirachta indica*A. Juss.	Meliaceae	Evergreen large tree	C	√			√
Bramhi	*Bacopa monnieri* (L.) Penn.	Scrophulariaceae	Perennial, creeping herb	LC	√			√
Danti	*Baliospermum montanum* Muell.-Arg.	Euphorbiaceae	Undershrub	C	√			√
Shwet Saireyak	*Barleria cristata L.*	Acanthaceae	Shrub	C	√			
Saireyak	*Barleria prionitis* L.	Acanthaceae	Erect, prickly shrub	C	√			√
Kovidara	*Bauhinia purpurea* L.	Caesalpiniaceae	Tropical tree	LC				√
Ashmantak	*Bauhinia racemosa* Lam.	Caesalpiniaceae	Small crooked tree	C	√			√
Malukaparna	*Bauhinia vahlii* W &A.	Caesalpiniaceae	Largest creeper	C	√			
Kanchnar	*Bauhinia variegata* L.	Caesalpiniaceae	Small crooked tree	LC	√	√		
	Begonia roxburghii Roxb.	Begoniaceae	Perennial	NYR			√	
Pashan Bheda	*Bergenia ciliata*(Haw.) Sternb.	Saxifragaceae	Perennial herb	NYR			√	
	Bidens chinensis (L.) Willd	Compositae	Annual herb	C	√		√	√
Sindoori	*Bixa orellana* L.	Bixaceae	Shrub	C	√		√	√
Punarnava	*Boerhavia diffusa* L.	Nyctaginaceae	Prostrate herb	C	√	√		√
Rakta punarnava	*Boerhavia erecta* L.	Nyctaginaceae	Perennial herb	C	√			
Taal	B*orassus flabeliformis* L.	Arecaceae	Robust tree	C	√			
Shallaki	*Bosweliia serrata* Roxb.	Burseraceae	Deciduous tree	C	√			
Shweta sarshapa	*Brassica alba* (L.) Rabenh.	Brassicaceae	Season annual herb	C	√			
Shivlingi	*Bryonopsis laciniosa* (L.) Naud.	Cucurbitaceae	Annual scandent herb	C	√			√
Parnabeej	*Bryophyllum pinnatum*(Lam.) Kurz	Crassulaceae	Succulent perennial herb	C	√			
Priyal	*Buchnania lanzan* Spreng.	Anacardiaceae	Medium-sized deciduous tree	C	√			
Palash	*Butea monosperma* (Lam.) Kuntze	Fabaceae	Medium-sized tree	C	√			
Lata karanj	*Caesalpinia bonduc* L.	Caesalpiniaceae	Large, thorny, straggling shrub	C	√		√	√
Lata karanja	*Caesalpinia cristata* Flem.	Caesalpiniaceae	Shrub	NYR		√		
Vetra	*Calamus rotang* L.	Arecaceae	Clustering palm	C	√			
Arka	*Calatropis procera* (Aiton.) Dryan.	Asclepiadaceae	Shrub or a small tree	C	√	√		
Hajari Genda	*Calendula officinalis*L.	Compositae	Annual herb	C	√			
Priyangu	*Callicarpa macrophylla* Vahl.	Verbenaceae	Erect, evergreen shrub	C	√			
Alarka	*Calotropis gigantea* (L.) R. Br. exAit.	Asclepiadacea	Shrub or a small tree	C	√			√

Sarvajaya	*Canna indica* L.	Cannaceae	Shrub	C	√			
Vijaya	*Cannabis sativa* L.	Cannabaceae	Annual herb	C	√			
Hinsra Bhed	*Capparis sepiaria* L.	Capparaceae	Climbing, much branched shrub	C	√			
Katuveera	*Capsicum annum* L.	Solanaceae	Annual herb	C	√			
Erandkarkati	*Carica papaya* L.	Caricaceae	Succulent and soft wooded small tree	C	√	√	√	√
Karmada	*Carissa carandas* L.	Apocynaceae	Sprawling semi-vine shrub	C	√			
Dadrughna	*Cassia alata* L.	Caesalpiniaceae	Perennial shrub	LC			√	
Avartaki	*Cassia auriculata* L.	Caesalpiniaceae	Perennial shrub	C	√			
Aragvadha	*Cassia fistula* L.	Caesalpiniaceae	Perennial shrub	C	√	√		√
	Cassia laevigata Willd.	Caesalpiniaceae	Herbaceous undershrub	NYR		√		
Kasmarda	*Cassia occidentalis* L.	Caesalpiniaceae	Shrub	C	√			
Chakramarda	*Cassia tora* L.	Caesalpiniaceae	Small erect hairless shrub	C	√			
Sandapushpi	*Cathranthus roseus* (L.) G.Don	Apocynaceae	Shrub	LC			√	
KootShalmali	*Ceiba pentandra* (L.) Gaertn.	Bombacaceae	Emergent tree	C	√			
Jyotishmati	*Celastrus paniculatus* Willd.	Celastraceae	Large woody climber	C	√			√
Salambhida	*Celogyne cristata* Lindly	Orchidaceae	Epiphytic orchid	NYR		√		
Shitivarak	*Celosia argentea* L.	Amaranthaceae	Erect shrub	C	√			
Mandukparni	*Centella asiatica* (L.) Urban	Apocynaceae	Small creeping herb	C	√			√
Raat ki rani	*Cestrum nocturnum* L.	Solanaceae	Sprawling shrub	NYR			√	
Vastuk Bhed	*Chenopodium album* L.	Amaranthaceae	Annual herb	C	√			
Shwet Musli Bhed	*Chlorophytum tuberosum* (Roxb.) Baker	Liliaceae	Herb	LC	√			
Shatpatri	*Chrysanthemum indicum* L.	Compositae	Perennial herb	C	√			
Chanak	*Cicer aeritinum* L.	Leguminosae	Annual herb	C	√			
Kasni	*Cichorium intybus* Linn.	Compositae	Perennial herb	C	√			
Karpura	*Cinnamomum camphora* Nees	Lauraceae	Large evergreen tree	NYR			√	
Tamalaka	*Cinnamomum tamala* Nees	Lauraceae	Small evergreen tree	LR			√	
Tvaka	*Cinnamomum zeylanicum* Nees	Lauraceae	Small evergreen tree	NYR			√	
Ambashtha, Patha	*Cissampelos pareira* L.	Menispermaceae	Small climber	NYR	√		√	√
Asthishrankhla	*Cissus quadrangularis* L.	Vitaceae	Perennial shrub	C	√			

Maha Nimbu	*Citrus limon* (L.) Nees	Rutaceae	Small ever-green tree	NYR			√	
Bijapura	*Citrus medica L.*	Rutaceae	Small ever-green tree	C		√		
Narang	*Citrus reticulata* Blanco	Rutaceae	Small ever-green tree	C	√			
Ajagandha	*Cleome gynandra* L.	Cleomaceae	Annual herb	NYR		√		
Vanyuthika	*Clerodendron inerme* (L.) Gaertn.	Verbenaceae	Evergreen shrub	C	√			
LaghuAgniman-tha	*Clerodendron phlomidis* L.f.	Verbenaceae	Shrub	C	√			
Bharangi bhed	*Clerodendrum indicum* (L.) Kuntze	Verbenaceae	Shrub	NYR	√			
Aparajita	*Clitoria ternatea* L.	Leguminosae	Twining plant	C	√		√	
Bimbi	*Coccinia indica* W.&A.	Cucurbita-ceae	Climbing vine	C	√			
Patalgaruni	*Cocculus hirsutus* (L.) Diels	Menisper-maceae	Climbing un-dershrub	C	√			√
Rajapiluh	*Coffea arabica* L.	Rubiaceae	Shrub or small tree	NYR			√	
Gavedhuka	*Coix lachrymal* jobi L.	Poaceae	Annual herb	C			√	
Parnayavani	*Coleus amboinicus* Lour.	Lamiaceae	Succulent herb	NYR	√			
–	*Coleus barbatus* Benth.	Lamiaceae	Succulent herb	C	√			
Pashanbheda	*Coleus forskohlii* Briq.	Lamiaceae	Perennial herb	NYR		√		
	Coleus scutellarioides (L.) Benth. In Walllch	Lamiaceae	Succulent evergreen perennial	C	√			
Kanchat, Kar-namorat	*Commelina benghalen-sis* L.	Commelina-ceae	Diffuse herb	LC	√			
Sankhpushpi	*Convolvulus pluricaulis* Cholsy.	Convolvu-laceae	Perennial, wild herb	C	√			
Pattashak	*Corchorus olitorius* L.	Tiliaceae	Annual, much -branched herb	C	√			
Sleshmataka	*Cordia dichotoma* Forst. F.	Boraginaceae	Small to mod-erate-sized deciduous tree	NYR		√		√
Hasthimantha	*Cordia macleodi* (Griff.) Hook. F.	Boraginaceae	Small to mod-erate-sized deciduous tree	C	√			
–	*Cordia myxa* Roxb.	Boraginaceae	Large ever-green shrub or tree	C	√			
Kebuk	*Costus speciosus* (Koenig) Sm.	Costaceae	Tall and dramatic land-scape plant	C	√		√	
Varun	*Crataeva nurvala* Buch.-Ham.	Capparaceae	Medium-sized, deciduous tree	C	√			
Sudarshan bhed	*Crinum asiatlcum* L.	Amarylli-daceae	Annual or pe-rennial bulbous plant	NYR			√	
Sudarshan	*Crinum latifolium* L.	Amarylli-daceae	Annual or pe-rennial bulbous plant	C	√			
Sudarshan bhed	*Crinum viviparum* (Lam.) R.Ansari &V.J.Nair	Amarylli-daceae	Aquatic plant	LC	√			

Kumkum	*Crocus sativus* L.	Iridaceae	Perennial plant	C		√		
Krishna Sariva	*Crypatolepis buchanani* Roem. & Sch.	Asclepiad-aceae	Large ever-green twiner	C		√		
Trapush	*Cucumis sativus* L.	Cucurbita-ceae	Tendril-bearing vines	C	√			
Jeerak	*Cuminum cyminum* L.	Apalaceae	Herb	DD	√			
Talmuli	*Curculigo orchioides* Gaertn.	Hypoxldaceae	Herbaceous tuberous pe-rennial	C	√			
Amragand hi-haridra	*Curcuma amada* L.	Zingiberaceae	Underground rhizome	C	√		√	
Tavaksheer	*Curcuma angustifolia* Roxb.	Zingiberaceae	Underground rhizome	NYR	√			
Vanharidra	*Curcuma aromatica* Salisb.	Zingiberaceae	Underground rhizome	NYR	√		√	
Krishna Haridra	*Curcuma caesia* Roxb.	Zingiberaceae	Underground rhizome	C	√			
Haridra	*Curcuma longa* L.	Zingiberaceae	Rhizomatous herb	C	√			√
Karchur	*Curcuma zedoaria* Rosc.	Zingiberaceae	Perennial herb	C	√	√		
	Cyathea gigantea (Wall. ex Hook.) Holttum.	Cyatheaceae	Small to medi-um-sized tree fern	C			√	
Bhutika	*Cymbopogon citratus* DC. Stapf.	Poaceae	Fragrant herb	NYR		√		√
Rohishtrina bhed	*Cymbopogon flexuo-sus*(Nees ex Steud.) W.Watson	Poaceae	Perennial grass	C	√			√
Durva	*Cynodon dactylon* (L.) Pers.	Poaceae	Perennial grass	C	√			√
Shinshpa	*Dalbergia sissoo* DC.	Leguminosae	Large decidu-ous tree	C	√			√
Dhattur	*Datura metel* L.	Solanaceae	Herbaceous perennial	C	√			√
Krishna Dhattur	*Datura stramonium* L.	Solanaceae	Herbaceous perennial	C	√			
Shalparni	*Desmodium gangeticum* DC.	Leguminosae	Coarse herb	C	√			√
–	*Desmodium gyroides* DC.	Leguminosae	Erect, often much -branched shrub	C			√	
Kush	*Desmostachya bipinnata* Stapf	Poaceae	Rihozomous perennial grass	LC	√			
Veertaru	*Dichrostachys cinerea* W. &A.	Mimosaceae	Small Mimo-sa-related tree	LC	√			
Hritpatri Bheda	*Digitalis lanata* Ehrh.	Plantagina-ceae	Herb	NYR		√		
Hritpatri	*Digitalis* purpurea L.	Plantagina-ceae	Biennial plant	C		√		
Ashvakatri	*Dillenia indica* L.	Dilleniaceae	Evergreen large shrub or small to medium-sized tree	C			√	
Vidarikand Pra-tinidhi	*Dillenia pentagyna* Roxb.	Dilleniaceae	Large decidu-ous tree	C	√			
Kashthaluk	*Dioscorea alata* L.	Dio-scoreaceae	Tuberous root	C	√			√

Varahikand	*Dioscorea bulbifera* L.	Dio-scoreaceae	Tuberous root	NYR		√		
Baniatakar	*Dioscorea deltoidea* Wall.	Dio-scoreaceae	Hairless vine	C		√	√	
Madhvaluk	*Dioscorea esculenta* Burkill var. spinosa	Dio-scoreaceae	Perennial, climbing plant	C	√			√
Hastyaluk	*Dioscorea hispida* Dennst.	Dio-scoreaceae	Twining vine	C	√			√
Vidarikand Pratinidhi	*Dioscorea pentaphylia* L.	Dio-scoreaceae	Climbing plant	C	√			
	Drymeria diandra Bl.	Caryophyllaceae	Annual herb	NYR			√	
	Drynaria quercifolia J.Sm.	Polypodiaceae	Robust, epiphytic fern	NYR			√	
Bhringraj	*Eclipta alba* (L.) Hassk.	Compositae	Annual herb	C	√	√	√	
Rudarksh	*Elaeocarpus ganitrus* Roxb.	Elaeocarpaceae	Evergreen tree	C		√	√	
–	*Elaeocarpus munronii* (Wt.) Mast.	Elaeocarpaceae	Evergreen tree	T				
Ela	*Eletteria cardamomum* (L.) Maton.	Zingiberaceae	Pungent aromatic herbaceous perennial plant	C		√		
Vidanga	*Embelia ribes* Burm. f.	Primulaceae	Climber	C			√	
Vidang Bhed	*Emblia robusta* Roxb.	Primulaceae	Small tree	C	√			
Amalaki	*Emblica officinalis* Gaertn.	Phyllanthaceae	Small to medium-sized deciduous tree	C	√	√		
Hirankhuri	*Emilia sonchifera* (L.) DC.	Compositae	Annual herb	NYR			√	
Hilmochika	*Enhydra fluctuens* Lour.	Compositae	Trailing marsh herb	DD	√			
Mamajjak	*Enicostemma littorale* Blume	Gentianaceae	Glabrous herb	C	√			
Tagara Bhed	*Ervatamia coronaria* Stapf.	Apocynaceae	Small perennial shrub	C			√	
Van Daniya	*Eryngium foetidum* L.	Apiaceae	Annual herb	C			√	
Paribhadra	*Erythrina indica* Lam.	Leguminosae	Deciduous tree	C	√			√
Mura	*Erythrina stricta* Roxb.	Leguminosae	Medium-sized thorny tree	C			√	
Tailparna	*Eucalyptus umbellata* Domin	Myrtaceae	Large deciduous tree	C	√			
Nadijambu	*Eugenia heyneana* Wall.	Myrtaceae	Large shrub or small tree	C	√			
–	*Euonymus pendulus* Wall.	Celastraceae	Evergreen shrub or small tree	C		√		
Dugdhika bhed	*Euphorbia hirta* L.	Euphorbiaceae	Annual hairy plant	C	√			
	Euphorbia cotinifolia L.	Euphorbiaceae	Shrub	NYR			√	
Snuhi Bhed	*Euphorbia milii* Des Moul.	Euphorbiaceae	Succulent plant	C	√			

Snuhi	*Euphorbia nerifolia* L.	Euphorbia-ceae	Erect, branched, prickly, succulent shrub, or small tree	C			√	
	Euphorbia pulcherima Willd ex Clott.	Euphorbia-ceae	Shrub	C			√	
Snuhi	*Euphorbia royleana* Boiss.	Euphorbia-ceae	Large cactus-like shrub	C			√	
Laghu-Dudhika	*Euphorbia thymifolia* L.	Euphorbia-ceae	Prostrate annual plant	C		√		
Saptlabhed	*Euphorbia tirucalli* L.	Euphorbia-ceae	Deciduous tree	LC	√		√	
Vishnukranta	*Evolvulus alsinoides* L.	Convolvu-laceae	Slender twine	C	√			
Kapitha	*Feronia limonia* (L.) Swingle	Rutaceae	Moderate-sized tree	C	√			
Udumber	*Ficus racemosa* L.	Moraceae	Large tree	C	√		√	√
Nyagrodha, Vat	*Ficus benghalensis* L.	Moraceae	Very large, fast growing, evergreen tree	C	√			√
Kakodumber	*Ficus hispida* L.f.	Moraceae	Shrub or small tree	C	√			√
Ashvatha	*Ficus religiosa* L.	Moraceae	Very large, fast growing, evergreen tree	C	√		√	√
Anjira	*Ficus roxburghii* L.	Moraceae	Very large, fast growing, evergreen tree	C		√		
Mishreya	*Foeniculum vulgare* Mill.	Aplaceae	Aromatic biennial herb	C	√			
Parpataka	*Fumaria parviflora* Lam.	Fumarlaceae	Delicate much -branched annual herb	C		√		
Parpatki	*Gardenia latifolia*Ait.	Rubiaceae	Small deciduous tree or large shrub	C	√			
	Geranium graveolens L.	Geraniaceae	Erect, much -branched shrub	C		√		
	Ginkgo biloba L.	Ginkgoaceae	Small tree	NYR		√		
Langli	*Gloriosa superba* L.	Colchlcaceae	Perennial herb	LC	√		√	
Madhuyashti	*Glycyrrhiza glabra* L.	Leguminosae	Perennial herb	C	√			
Gambhari	*Gmelina arborea* Roxb.	Verbenaceae	Deciduous tree	C	√	√	√	√
UdhyanKarpas	*Gossypium arboreum* L.	Malvaceae	Perennial shrub	C	√	√		
Kapas	*Gossypium herbaceum* L.	Malvaceae	Perennial shrub	C	√			
Nagbala-pratinidhi	*Grewia abutilifolia* Vent. ex Juss.	Malvaceae	Small tree	C	√			√
Gudsharkara	*Grewia helicterifolia* Wall. ex G.Don.	Malvaceae	Small tree	C	√			
Nagbala	*Grewia hirsuta* Vahl.	Malvaceae	Perennial shrub	C	√			

Parushak	*Grewia subinaequalis* DC.	Malvaceae	Small tree	C	√			
Koot Rudraksha	*Guazuma tomentosa* H.B. & K.	Malvaceae	Medium-sized tree	C	√			
Meshshringi	*Gymnema sylvestre* R.Br.	Apocynaceae	Large climber	C	√			√
Ajgandha	*Gynandropis gynandra* (L.) Briq.	Cappari-daceae	Annual herb	C	√			
Chaalmoogra	*Gynocordia odorata* R.Br.	Achariaceae	Evergreen tree	C			√	
Haridru	*Haldinia cordifolia* (Roxb.) Ridsd.	Rubiaceae	Deciduous tree	C	√			
	Hedychium coronarium J.Koenig	Zingiberaceae	Perennial underground rhizome	C		√		
Shathi	*Hedychium spicatum* Buch-Ham	Zingiberaceae	Small, hardy perennial	C		√	√	
Avartani	*Helicteres isora* L.	Malvaceae	Sub-deciduous shrub or small tree	C	√			√
Kamraj	*Helminthostachys zelan-ica* L.	Ophioglos-saceae	Terrestrial, herba-ceous, fern-like plant	DD	√			
Sariva	*Hemidesmus indicus* R. Br.	Apocynaceae	Perennial vine	C	√			√
Japa	*Hibiscus rosa-sinensis* L.	Malvaceae	Large shrub or small tree	C	√			
Ambashthaki	*Hibiscus sabdariffa* L.	Malvaceae	Annual, erect, bushy, herbaceous shrub	C	√			
Kutaj	*Holarrhena antidysenter-ica* Wall.	Apocynaceae	Bushy shrub	C	√		√	√
Putikaranj, chirbilva	*Hoioptelea integrifolia* Planch.	Ulmaceae	Large decidu-ous tree	C	√			√
Jivanti bhed	*Hoiostemma ada-kodien* Schult.	Apocynaceae	Twining shrub	C	√			
Sugandhmantri	*Homalomena aromatica* Schott.	Araceae	Rhizom-atous aromatic perennial herb	C			√	
Yava	*Hordeum vulgare* L.	Poaceae	Annual grass	C	√			
–	*Houttuynla cor-data*Thunb.	Saururaceae	Herbaceous perennial plant	NYR			√	
Parasikayavani	*Hyoscyamus niger* L.	Solanaceae	Robust, leafy plant	C		√		
–	*Hyptis suveolens* Poit.	Lamiaceae	Branching pseudocereal plant	C	√			
Krshna Sariva	*Ichnocarpus frutescens* R. Br.	Apocynaceae	Evergreen woody twiner	C	√			
Darbha	*Imperata cylindrica* Beauv	Poaceae	Perennial rhizomatous grass	C	√			
Nili	*Indigofera tinctoria* L.	Leguminosae	Erect, branched, half-woody shrub	C	√			
Kalambi	*Ipomoea aquatica* Forsk.	Convolvu-laceae	Semi-aquatic tropical plant	LC	√		√	

–	*Ixora arborea* Roxb.	Rubiaceae	Evergreen tree	C	√			
–	*Ixora coccinea* L.	Rubiaceae	Evergreen small tree	C	√			√
Mallika	*Jasmimum sambak* (L.) Ait	Oleaceae	Small shrub	C	√		√	
Gandka	*Jasminum officinale* L.	Oleaceae	Small shrub	C		√		
Vyaghreranda bhed	*Jatropha curcas* L.	Euphorbia-ceae	Perennial poi-sonous shrub	C	√	√		√
Rakt-Vyaghre-randa	*Jatropha gossipifolia* L.	Euphorbia-ceae	Small shrub	C	√			
Chandramool	*Kaempferia galangal* L.	Zingiberaceae	Rhizom-atous aromatic perennial herb	C	√			
Ashthibhaksha	*Kalanchoe pinnata* Pers.	Crassulaceae	Small shrub	C			√	√
Kahu	*Lactuca sativa* L.	Compositae	Annual plant	C		√		
Alabu	*Lagenaria siceraria* (Mo-lina) Standi.	Cucurbita-ceae	Annual, running or climbing vine	C	√			√
–	*Lagerastomia parviflo-ra*Roxb.	Lythraceae	Deciduous tree	C			√	
Jingini	*Lannea coromandelica* (Houtt.) Merrill.	Anacardia-ceae	Deciduous tree	C	√			√
Chaturangi	*Lantana camara* L.	Verbenaceae	Evergreen shrub	NYR	√			√
Madyantika	*Lawsonia inermis* L.	Lythraceae	Small perennial shrub	C	√			√
Masoor	*Lens culinaris Medic.*	Leguminosae	Annual herb	C	√			
Chandrashur	*Lepidium sativum* Linn.	Brassicaceae	Annual herb	C	√	√		
Jeevanti	*Leptadenia reticulata* (Retz.) Wight &Arn.	Apocynaceae	Twining shrub	C	√			
Babool bhed	*Leucaena leucocephala* (Lam.) de Wit	Leguminosae	Deciduous tree	C	√			
Dronpushpi	*Leucas cephalotus* (Roth) Spreng.	Lamiaceae	Annual herb	C	√			
–	*Leucas indica* (L.) Br.	Lamiaceae	Erect, annual plant	C			√	
Atasi	*Linum usitatisimum* L.	Linaceae	Annual herb	C	√			
Jalpippali	*Lippia nodiflora*R.	Verbenaceae	Perennial shrub	C	√			
Litchi	*Litchi chinensis* Sonn.	Sapindaceae	Evergreen tree	NYR			√	
Kankol	*Litsea cubeba* (Lour.) pers.	Lauraceae	Evergreen tree	C			√	
Medasak	*Litsea glutinosa* (Lour.) Robinson	Lauraceae	Evergreen or deciduous tree	C	√			
Medak	*Litsea umbrosa* Nees.	Lauraceae	EvergreenTree	NYR		√		
Devdali	*Luffa echnita* Roxb.	Cucurbeta-ceae	Climber	C	√			
Raktavrintak	*Lycopersicon esculentum* Mill	Solanaceae	Annual plant	C	√			
–	*Lygodium flexuosum* (L.) Sw.	Lygodiaceae	Perennial vine	NYR			√	
Madhuk	*Madhuca longifolia* (Koen.) Macbr.	Sapotaceae	Deciduous tree	C	√			√

–	*Maesa indica* (Roxb.) A. DC.	Primulaceae	Large, evergreen, glabrous shrub	C			√	
Kampilla	*Mallotus phillippinensis* (Lam.) Müll.Arg.	Euphorbiaceae	Evergreen tree	C			√	
–	*Malvaviscus arboreus* Cav. var. *arboreus*	Malvaceae	Shrub	NYR			√	
–	*Malvaviscus conzattii* Greenm.	Malvaceae	Shrub	NYR		√		
Amra	*Mangifera indica* L.	Anacardiaceae	Evergreen tree	DD	√		√	
–	*Manihot esculenta* Cratz.	Euphorbiaceae	Semi-woody perennial shrub	C			√	
Tavakshir Pratinidhi	*Maranta arundinacea* L.	Marantaceae	Perennial plant	C	√			
–	*Marjorana hostensis* L.	Lamiaceae	Herb	C		√		
Kaknasa	*Martynia annua* L.	Martyniaceae	Bushy annual herb	C	√			√
–	*Melastoma malabathricum* L.	Melastomataceae	Evergreen shrub	NYR			√	
Mahanimb	*Melia azadirachta L.*	Mellaceae	Evergreen tree	C	√			
–	*Mentha arvensis* L.	Lamiaceae	Herbaceous perennial plant	C			√	
–	*Mentha piperita* L.	Lamiaceae	Herbaceous perennial plant	C		√		
Putiha	*Mentha spicata* L.	Lamiaceae	Herbaceous perennial plant	C	√			
Nagakeshara	*Mesua ferrea* L.	Cluslaceae	Evergreen tree	NYR			√	
Jeevak/Risbaak?	*Microstylis wallichi* Lindl.	Orchidaceae	Terrestrial or lithophytic orchid	C		√		
Akashnimba	*Millingtonia hortensis* L. f.	Bignoniaceae	Evergreen tree	NYR	√			
Lajjalu	*Mimosa pudica* L.	Mlmosaceae	Perennial plant	C	√	√		√
Bakul	*Mimusops elengi* L.	Sapotaceae	Small tree	C	√			√
Rajadan	*Mimusops hexandra* Roxb.	Sapotaceae	Tree or a shrub	C	√			√
Krishnakeli	*Mirabilis jalapa* L.	Nyctaglnaceae	Perennial shrub				√	√
Girikadamba	*Mitragyna parviflora* (Roxb.) Korth.	Rubiaceae	Evergreen or deciduous tree	C	√			√
Karkotaki	*Momordica dioica* Roxb.	Cucurbitaceae	Large perennial climber	C	√			
Shigru	*Moringa oleifera* Lam.	Moringaceae	Small, deciduous tree	NYR		√		√
Shigru(Shwet)	*Moringa pterygosperma* Gaertn.	Moringaceae	Small, deciduous tree	C	√			
Toot	*Morus alba L.*	Moraceae	Evergreen tree	C	√			√
Kaplkacchu	*Mucuna pruriens* (L.) DC.	Leguminosae	Annual, climbing shrub	C	√	√	√	
Kaidarya	*Murraya koenigii* (L.) Spreng.	Rutaceae	Small or medium-sized tree	C	√	√	√	√
Kamlni	*Murraya panniculata* (L.) Jack	Rutaceae	Tropical, evergreen plant	C	√			
Kadall	*Musa paradisiaca* L.	Musaceae	Tropical tree-like herb	C	√			

–	*Musa sapientum* L.	Musaceae	Herbaceous perennial	C			√	
Kaiyaphal	*Myrica esculenta* Buch-Ham	Myricaceae	Medium-sized tree	C		√		
–	*Nephrolepis cordifolia* (L.) Presl	Nephrolepi-daceae	Fern	NYR			√	
Karveer	*Nerium indicum* Mill.	Apocynaceae	Small, deciduous tree	C	√		√	√
Tamraparna	*Nicotiana tabacum* L.	Solanaceae	Herbaceous perennial	C	√		√	
Kalajaji	*Nigella sativa* L.	Ranuncu-laceae	Annual flowering plant	C	√			
Parijatak	*Nyctanthes arbortristis* L	Oleaceae	Large shrub or small tree	C	√			
Kumud	*Nymphaea nouchali* Burm.f.	Nym-phaeaceae	Water-lily	C	√			
Munjariki	*Ocimum basilicum* L.	Lamiaceae	Annual herb	C			√	
Tulsi bhed	*Ocimum gratissimum* L.	Lamiaceae	Perennial herb	C	√			
Tulsi	*Ocimum sanctum* L.	Lamiaceae	Perennial herb	C	√	√		
Trivrtta	*Operculina turpethum* (L.) Silva Manso	Convolvu-laceae	Herbaceous vine	C	√			√
–	*Opuntia dillenii* Haw.	Cactaceae	Fleshy shrub	C	√			
–	*Opuntia stricta* (Haw.) Haw.	Cactaceae	Fleshy shrub	C			√	√
Marubak	*Origanum majorana* L.	Lamiaceae	Perennial herb	NYR	√			
VanTulsi	*Origanum vulgare* L.	Lamiaceae	Perennial herb	C		√		
Shaali	*Oriza sativa* L.	Poaceae	Annual grass	C	√			
Shyonak	*Oroxylum indicum* (L.) Vent.	Bignoniaceae	Evergreen tree	C	√	√	√	√
Tinish, Syandan	*Ougenia oojeinsis* (Roxb.) Hochr.	Leguminosae	Medium-sized deciduous tree	C	√			
	Oxalis debilis L.	Oxalidaceae	Bulbous plant	C			√	
Changeri	*Oxaiis corniculata* L.	Oxalidaceae	Creeping weed	C	√			
Prasarini	*Paederia foetida* L.	Rubiaceae	Perennial twining vine	C	√			
–	*Paederia scandens* L.	Rubiaceae	Perennial herb	C			√	
Chandra	*Paeonia emodi* Wall.	Paeoniaceae	Robust shrubby perennial	NYR		√		
Ketaki	*Pandanus odoratissimus* L. f.	Pandanaceae	Small branched tree or shrub	C	√			√
Khakhasa bhed	*Papaver somniferum* L.	Papaver-aceae	Annual herb	C		√		
Haimavati	*Paris polyphylla* J.E. Smith	Melanthia-ceae	Creeping rhizomatous forest plant	C		√		
–	*Pedilanthus tithy-maloides* (L.) Poit.	Euphorbia-ceae	Succulent plant	NYR			√	
Uttamarni	*Pergularia extensa* N.E. Br.	Apocynaceae	Perennial twining herb	C	√			
Kakjangha	*Peristrophe bicalyculata* Nees	Acanthaceae	Herb	C	√			
Mudga	*Phaseoius radiatus L.*	Leguminosae	Annual plant	C	√			

Lai basak	*Phlogacanthus thyrsiflo-rus*Nees	Acanthaceae	Shrub	C			√	
Kharjur	*Phoenix sylvestris* Roxb	Arecaceae	Xerophytic tree	C	√			
Nal	*Phragmites karka*Trin ex Steud.	Poaceae	Perennial reed, with creeping rhizomes	C	√			
Bhumyamalaki	*Phyllanthus fraternus* Webster.	Phyllan-thaceae	Erect annual herb	C	√			√
Tankari	*Physaiis minima* L.	Solanaceae	Erect annual herb	C	√			
Tambul	*Piper betel* L.	Piperaceae	Perennial vine	C			√	
Pippali	*Piper longum* L.	Piperaceae	Climber	C	√	√		√
–	*Piper mullesua* L.	Piperaceae	Woody climber	C			√	
Amrood	*Pisidium guajava* L.	Myrtaceae	Small tree	C		√		
Jangal Jalebi	*Pithecellobium dulce* Benth.	Mimosaceae	Large, thorny evergreen tree	C	√			√
Aswagola bheda	*Plantago erosa* Wall.	Plantagina-ceae	Perennial herb	C			√	
Rasna	*Pluchea lanceolata* C.B.Clarke	Compositae	Undershrub	C	√			
Neel-Chltrak	*Plumbago capensis*T-hunb.	Plumbagina-ceae	Evergreen shrub	C	√			
Chitrak	*Plumbago zeylanica* L.	Plumbagina-ceae	Herb	C	√	√		√
Devaganagalu	*Plumeria acuminate*Ait.L.	Apocynaceae	Small tree	DD			√	
Vankakadi	*Podophyllum hexendrum* Royle.	Berberi-daceae	Succulent herb	C		√		
Kashthdaru	*Polyalthia longifolia* (Sonn.)Thwaites.	Annonaceae	Tall tree	C	√		√	√
Meda	*Polygonatum cirrhifolium* (Wall.) Royle	Aspara-gaceae	Rhizomatous perennial herb	NYR		√		
Maha-meda	*Polygonatum verticilla-tum* (L)Alloni.	Aspara-gaceae	Erect, robust plant	NYR		√		
Karanja	*Pongamia pinnata* (L.) Pierre.	Leguminosae	Deciduous tree	C	√	√	√	√
Lonlka	*Portulaca oleracea* L.	Portulacac-eae	Succulent herb	C			√	
Vajradanti	*Potentilla fulgens* Wallich	Rosaceae	Perennial her-baceous plant	C		√		
–	*Pouzolzia hirta* Hassk..	Urticaceae	Shrub	NYR			√	
Agnlmanth	*Premna latifolia* Roxb.	Lamiaceae	Tree	C		√		
Shaml	*Prosopis cineria* Druce.	Mimosaceae	Evergreen thorny tree	C	√			
Padmak	*Prunus cerasoides* D.Don	Rosaceae	Deciduous tree	C		√		
Alu Bukhara	*Prunus domestica* L.	Rosaceae	Deciduous tree	NYR			√	
Aaruk	*Prunus persica* Batsch.	Rosaceae	Deciduous tree	DD			√	
Madhuri	*Psidium guajava* L.	Myrtaceae	Evergreen tree	LC	√		√	
Kharjurl	*Phoenix sylvestris Roxb.*	Arecaceae	Date palm	C				√

Amalaki	*Phyllanthus emblica* L.	Phyllan-thaceae	Small to medium-sized deciduous tree	C				√
Bakuchi	*Psoralea corylifolia* L.	Leguminosae	Annual herb	C	√			√
Bijak	*Pterocarpus marsupium* Roxb.	Leguminosae	Deciduous tree	C	√			√
Muchukunda	*Pterospermum acerifo-lium* Willd.	Sterculiaceae	Tropical trees and shrubs	C	√			√
Vidarikanda	*Pueraria tuberosa* (Roxb. ex Willd) DC.	Leguminosae	Large peren-nial climber	NYR			√	√
Jalapippali	*Phyla nodiflora* (L.) Greene	Verbenaceae	Herb	C				√
Bhumyaamalaki Bheda	*Phyllanthus madaraspat-ensis* L.	Phyllan-thaceae	Erect or spreading subshrub	C				√
Lavali-phala	*Phyllanthus acidus* (L.) Skeels	Phyllan-thaceae	Small decidu-ous tree	C				√
Dadim	*Punica granatum* L.	Lythraceae	Shrub	C		√		
Putranjiva	*Putranjiva roxburghii* Wall.	Putranjiva-ceae	Moderate-sized, ever-green tree	NYR	√			√
–	*Quamoclit coccinea Moench.*	Convolvu-laceae	Shrub	NYR				√
–	*Radermachera xylocarpa* (Roxb.) K. Schum.	Bignoniaceae	Large decidu-ous tree	C	√			
Madana	*Randia dumetorum* (Retz.) Lam.	Rubiaceae	Tree	C		√		
Devkandar Kandeer	*Ranunculus sceleratus* L.	Ranuncu-laceae	Annual herb	C	√			
Sarpagan-dhab-hed	*Rauvolfia canescens*L.	Apocynaceae	Small tree or shrub	C	√			
Sarpagandha	*Rauvolfia serpentin-a*Benth. ex. Kurz	Apocynaceae	Antipsychotic herb	C	√	√	√	√
Sarpagandha Bheda	*Rauvolfia tetraphylla*(L.) Benth. Ex. Kurz.	Apocynaceae	Small tree or shrub	DD			√	√
–	*Rhododendron arboreum* Sm.	Ericaceae	Evergreen large tree	NYR		√		
Tintidaka	*Rhus parviflora* Roxb.	Anacardia-ceae	Shrub	NYR		√		√
Eranda	*Ricinus communis* L.	Euphorbia-ceae	Erect, tropical shrub or small tree	C	√	√	√	√
Kakoli/ Kshir Kakoli	*Roscoea procera* Wall	Zingiberaceae	Perennial plant	C		√		
–	*Rosmarinus officinaiis*L.	Lamiaceae	Woody, peren-nial herb	C		√		
Manjstha	*Rubia cordifolia* L.	Rubiaceae	Perennial climbing herb	C		√		
Chukra	*Rumex vesicarius* L.	Polygonaceae	Annual herb	C	√			
Ikshu	*Saccharum officinarum* L.	Poaceae	Giant grass	C	√		√	
Kash	*Saccharum spontaneum* L.	Poaceae	Perennial grass	C			√	
Shar	*Sacchraum munja* Roxb.	Poaceae	Perennial grass	C	√			
Shalmali	*Salmalia malabarica* (DC.) Schott & Endl.	Bombacac-eae	Evergreen tree	C	√			

Pillu	*Salvadora persica* L.	Salva-doraceae	Small tree or shrub	C	√			
Nagdaman	*Sansevieria roxbergiana* Schult. f.	Aspara-gaceae	Herb	NYR			√	
Ashok	*Saraca asoca (Roxb.) Willd.*	Leguminosae	Evergreen tree	C	√		√	√
Ashoka	*Saraca indica* L.	Leguminosae	Evergreen tree	C		√		
Somvalli	*Sarcostemma acidum* Voigt.	Apocynaceae	Perennial shrub	C	√			
Kustha	*Saussurea lappa* C.B. Clarke	Compositae	Tall perennial herb	C		√		
Koshamra	*Schleichera oleosa* (Lour.) Oken.	Sapindaceae	Tree	NYR	√			
Shwet Mokshak	*Schrebera swietenioides* Roxb.	Oleaceae	Moderate-sized deciduous tree	C	√			
Talmishri	*Scoparia duicis* L.	Scrophularia-ceae	Branched herb	C	√			
Bhallatak	*Semicarpus anacardium* L.f.	Anacardia-ceae	Small tree or shrub	C	√	√		√
Til	*Sesamum indicum* L.	Pedaliaceae	Herb	C	√			
Shal	*Shorea robusta* Gaertn.f.	Dipterocar-paceae	Moderate to slow-growing tree	C	√			
Bala bhed	*Sida cordata* L.	Malvaceae	Herb	C	√			
Bala	*Sida cordifolia* L.	Malvaceae	Undershrub	C	√			√
Mahabala	*Sida rhombifolia* L.	Malvaceae	Shrubby plant	C	√			
–	*Smilax aspera* L	Smilacaceae	Climbing shrub	C			√	
Brahatl Bhed	*Solanum anguvi* Lamk.	Solanaceae	Shrub	C	√			√
Brahatl Bhed	*Solanum incanum* L.	Solanaceae	Shrubby plant	C	√			
Brahatl	*Solanum indicum* L.	Solanaceae	Shrub	LC		√		
Kakmachl	*Solanum nigrum* L.	Solanaceae	Annual weed	C	√		√	√
Kantkari Bhed	*Solanum sisymbrifolium* Lamk.	Solanaceae	Shrub	C	√			
–	*Solanum surattense* Burm.f.	Solanaceae	Shrub	C	√			
Brahatl Bhed (shwet)	*Solanum torvum* Sw.	Solanaceae	Evergreen shrub or small tree	C	√		√	√
–	*Solanum viarum* Dunal.	Solanaceae	Perennial shrub	LC			√	
–	*Sonchus oleraceus* L.	Compositae	Erect annual herb	C			√	
Mansrohini	*Soymida febrifuga*A. Juss.	Meliaceae	Deciduous tree	C	√			
Akarkara	*Spiianthes acmella* Murr	Compositae	Annual erect or ascending stout herbs	C		√		√
–	*Spilanthus paniculata* Wall.	Compositae	Herb	C			√	
Amratak	*Spondias pinnata* (L.f.) Kurz.	Anacardia-ceae	Deciduous tree	C	√			
Rajpatha	*Stephania japonica* (Thunb.) Miers	Menisper-maceae	Climber	C			√	

Katira	*Sterculia urens* Roxb.	Malvaceae	Medium-sized, deciduous tree	C	√			
–	*Sterculia alata Roxb.*	Malvaceae	Tall tree	NYR				√
–	*Sterculia foetida* L.	Malvaceae	Tall, straight tree	NYR				√
–	*Spathodea companulat-aDeauv.*	Bignoniaceae	Tall, straight tree	NYR				√
–	*Stachytarpheta ja-maicensisVahl.*	Verbenaceae	Sprawling shrub	C				√
–	*Solanum virginianum* L.	Solanaceae	Perennial shrub	C				√
Uddalak vrkha	*Sterculia villosa* Roxb.	Sterculiaceae	Medium-sized, deciduous tree	C	√			
Patala	*Stereospermum suavel-olens* Dc.	Bignoniaceae	Large deciduous tree	C		√		
–	*Stevia rebaudiana* (Bert.) Bertoni	Compositae	Herbaceous perennial	C		√		
Chirayata	*Swertia chirayata* (Roxb. ex fleming.) Karsten.	Gentianaceae	Shrub	C		√		
–	Swietenia mahagoni(L.) Jacq.	Meliaceae	Large deciduous tree	LC				√
–	*Syzygium rubicundum* Wight &Arn.	Myrtaceae	Herb	C				√
Jambu	*Syzygium cuminii* (Linn.) Skeel	Myrtaceae	Deciduous tree	NYR		√		
Chincha	*Tamarindus indica* L.	Caesalpiniaceae	Large tree	C	√			√
–	*Tabebuia argentea* (Bureau & K.Schum.) *Britton*	Bignoniaceae	Tree	C				√
Zhandu	*Tagetes erecta* L.	Compositae	Annual herb	C				√
–	*Taxus baccata* L.	Taxaceae	Medium-sized evergreen coniferous tree	C		√		
Gallu	*Taxus wallichiana* Zucc.	Taxaceae	Medium-sized evergreen coniferous tree	C			√	
Rohitak	*Tecomella undulata* (Sm.) seem	Bignoniaceae	Evergreen tree	C	√			√
Shak	*Tectona grandis* L.f.	Verbenaceae	Large deciduous tree	C	√			√
Jivanti-bhed	*Tellosma pallida* (Roxb.) Craib	Asclepiadaceae	Vine with slender stem	LC	√			
Shwet-Sharpunkha	*Tephrosia villosa* Pers.	Leguminosae	Annual or perennial bushy herb	NYR	√			
Sharpunkha	*Tephrosia purpurea* Pers.	Leguminosae	Annual or perennial bushy herb	C	√			
Mashparni	*Teramnus labialis* Spreng.	Leguminosae	Perennial climber	C	√			
Arjun	*Terminalia arjuna* (Roxb) W. &A.	Combretaceae	Large, evergreen tree	C	√			√
Bibhitak	*Terminalia bellirica* Roxb.	Combretaceae	Tall tree	C	√			√

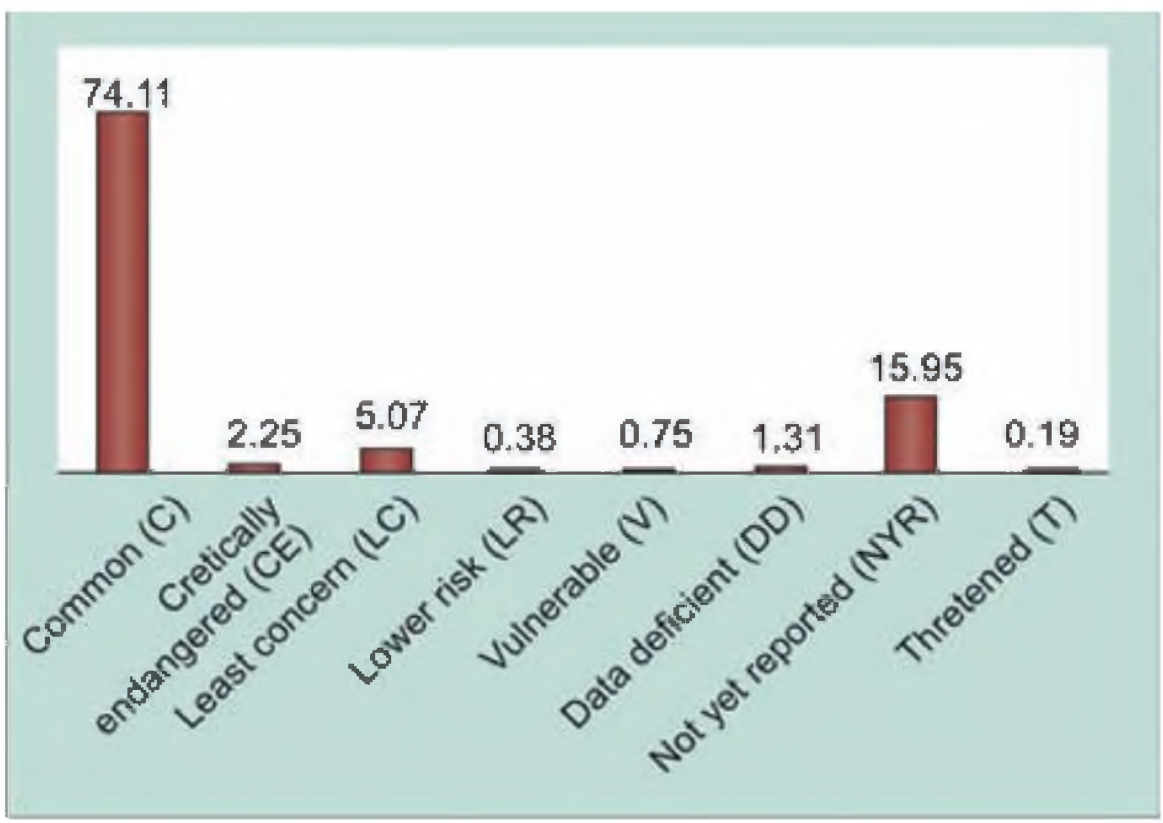
Kshudrabija	*Terminalia catapa* L.	Combretaceae	Small tree	LC				√
Haritaki	*Terminalia chebula* Retz.	Combretaceae	Evergreen tree	C	√	√	√	
Mamira	*Thalictrum foliolosum* DC.	Ranunculaceae	Herb	C		√		
Aranyakarpas, Bharadwaji Vankapas	*Thespesia lampas*(Cav.) Alef.	Malvaceae	Erect, slightly branched shrub	C	√		√	
Parish	*Thespesia populnea* Sobnd. ex Correa	Malvaceae	Evergreen tree	C	√			
Ashvamara	*Thevetia peruviana* (Pers.) Merrill	Apocynaceae	Large shrub or a small tree	C	√	√		
BanAjmod	*Thymus serpyllum* L.	Lamiaceae	Creeping shrub	NYR		√		
Guduchi	*Tinospora cordifolia* (Willd.) Miers	Menispermaceae	Climbing shrub	C	√			√
–	*Trema orientalis* Blume	Cannabaceae	Shade tree	C			√	
Varshabhu	*Trianthema portulacastrum* L.	Aizoaceae	Succulent shrub	LC	√			
Gokhur	*Tribulus terrestris* L.	Zygophyllaceae	Perennial vine	C	√			√
Jayanti	*Tridax procumbens* L.	Compositae	Herb	C	√			√
Methika	*Trigonella foenum-graecum* L.	Leguminosae	Herb	C	√			
Arkaparni	*Tylophora indica* (Burm.f.) Merrill	Asclepiadaceae	Twining or climbing herb	C	√			√
Gundra	*Typha angustifolia* Watt non L.	Typhaceae	Perennial plant	C	√			
Triparni	*Uraria lagopoides* DC.	Leguminosae	Herb	C	√			
Prshniparni	*Uraria picta* Desv.ex DC.	Leguminosae	Erect perennial, undershrub	C	√			√
Vanpalandu	*Urginea indica* Kunth.	Asparagaceae	Perennial herb	C	√			
Tagar	*Valeriana jatamansi* DC	Caprifoliaceae	Rhizomatous herb	C		√		
Vrkshadni	*Vanda roxburghii* R. Br.	Orchidaceae	Epiphytic orchid	C	√			
Kaivartika	*Ventilago denticulata* Willd.	Rhamnaceae	Herb	C	√			
Kaalijiri	*Vernonia anthelmintica* (L.) Wild.	Compositae	Annual herb	NYR		√		
Sahadevi	*Vernonia cinerea* Less.	Compositae	Annual herb	C	√			
Ushir	*Vetiveria zizanioides* (L.) Nash	Poaceae	Aromatic grass	C	√			√
Mashparni-bhed	*Vigna umbellata* (Thunb.) Ohwi & Ohashi	Poaceae	Annual herb	C	√			
Sandpushpa BHed	*Vinca rosea* L.	Apocynaceae	Small subshrub	LC	√	√		
Banfsa	*Viola serpens* Wall	Violaceae	Perennial herb	C		√		
Nirgundi	*Vitex negundo* L.	Verbenaceae	Small tree	C		√	√	√
Nirgundi	*Vitex negundo* L. (Violet flowered)	Verbenaceae	Small tree	C	√			
–	*Vitex negundo* L. (White flowered)	Verbenaceae	Small tree	C	√			

–	*Vitis trifolia* L.	Vitaceae	Climbing vine	NYR		√		
Draksha	*Vitis vinifera* L.	Vitaceae	Perennial liana	C	√			
–	*Waltheria indica* L.	Sterculiaceae	Shrub or sub-shrub	C	√			
Lakhanmurva	*Wattakaka volubilis* (L.f.) Stapf.	Asclepiad-aceae	Woody vine	LC	√			
-	*Withania caogulans* Dunal	Solanaceae	Herb	C	√			
Ashwagandha	*Withania Somnifera* Dunal	Solanaceae	Perennial herb	C	√	√		√
Dhataki	*Woodfordia fruticosa* Kurz	Lythraceae	Shrub (or) small tree	C	√		√	
Strikutaj	*Wrightia tinctoria* R.Br.	Apocynaceae	Small. Deciduous tree	C	√			√
Artagal	*Xanthium strumarium* L.	Compositae	Annual herb	C	√			
-	*Zamia furfur* L.f. ex Alton	Zamiacea	Cycad	NYR	√			
Tejovati	*Zanthoxylum alatum* Roxb.	Rutaceae	Small tree or large spiny shrub	C		√		
Kola/Badar	*Zizyphus mauritiana* Lamk.	Rhamnaceae	Spiny, evergreen shrub or small tree	C				√
Badar-Bheda	*Zizyphus oenoplia* Mill.	Rhamnaceae	Small deciduous tree or shrub	C				√
Kol, Kuval	*Zizyphus jujube* Lam.	Rhamnaceae	Small deciduous tree or shrub	C	√		√	
Shunthi, Ardraka	*Zingiber officinale* Rosc.	Zingiberaceae	Herbaceous perennial	C			√	
Sthoolgranthi Vacha	*Zingiber zerumbet* Rosc. Ex Sm.	Zingiberaceae	Herbaceous perennial	C	√			√

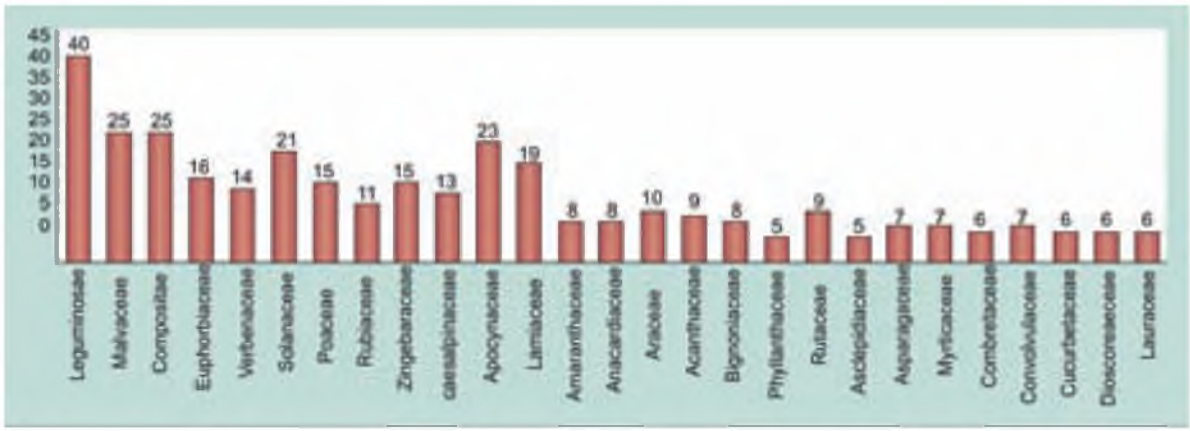
There are around 736 plant species which are grown in the gardens of the institutes located at different ecological/ geographical zones. After analysis, it was found that 533 species (excluding repetition) of medicinal plants are growing in these four gardens, out of which, 332 plant species maintained in the garden of RARI, Jhansi. As per the IUCN status, four plant species are critically endangered, viz., *Bambusa arundinacea* Willd., *Chlorophytum borovillianum* Baker, *Commiphora wightii* (Arn.) Bhandari, and *Sida acuta* Burm.f.; 20 species are least concerned and rare. In RAIFR, Pune, 159 species of plants were maintained; out of which 12 species are least concerned and 1 species is vulnerable. In RARI, Itanagar, 126 plant species were maintained; out of which 4 species are critically endangered viz. *Brugmansia suaveolens* syn. *Datura metel* L., *Hydnocarpus kurzii* (king.) warb., *Rhyncostylis retusa* (L.) Blume and *Thuja orientalis* L., 6 species least concerned, 2 vulnerable and threatened. One hundred and nineteen plant species of medicinal plants were maintained by RARI, Tarikhet; out of which 4 species critically endangered, viz., *Bambusa arundinacea* Willd., *Pistacia integerrima* Stew.

Ex Brandis., *Sapindus mukorossi* Gaertn and *Solanum xanthocarpum* Schard.; 8 species are rare and vulnerable. It was also observed that 10 plant species, viz., *Acorus calamus* L., *Aegle marmelos* (L.) Correa, *Asparagus racemosus* Willd., Carica papaya L., *Gmelina arborea* Roxb., *Murraya koenigii* (L.) Spreng., *Oroxylum indicum* (L.) Vent., *Pongamia pinnata* (L.) Pierre., *Rauvolfia serpentina* Benth. ex. Kurz. And *Ricinus communis* L. are present in all the four gardens of the Council. This seems that these plants can be cultivated in all the geographical zones from the altitude ranging between 285 and 1638 m.

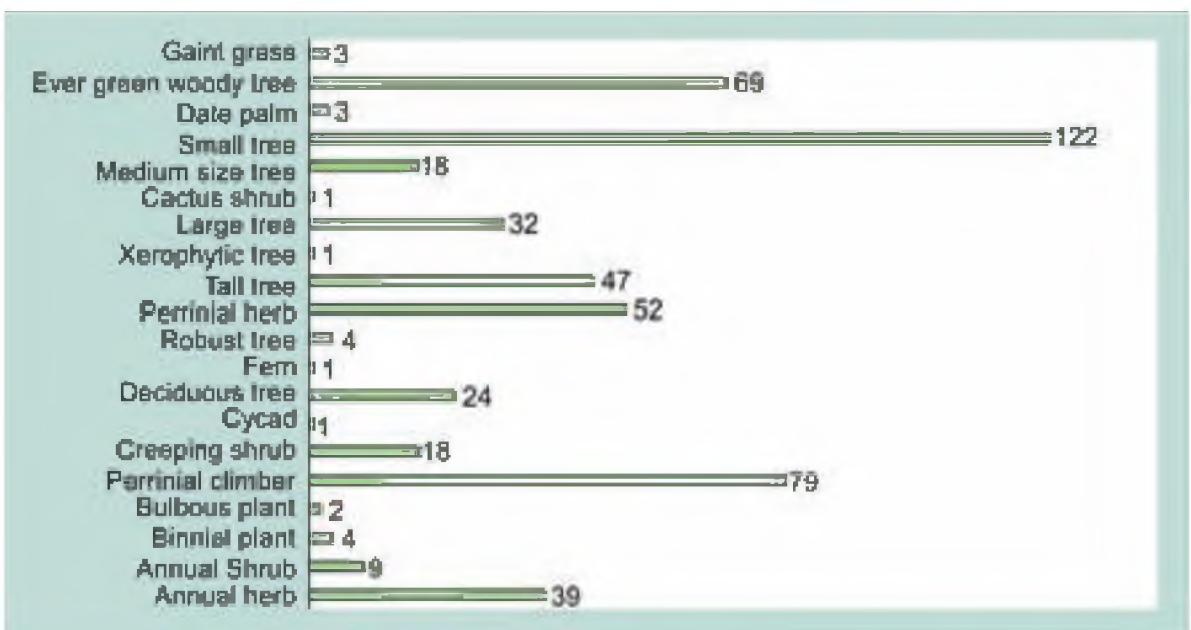
Forty species of medicinal plants belonging to family Fabaceae are largest in number followed by 25 species each from Malvaceae, Asteraceae; 23 species from Apocynaceae; 21 species from Solanaceae; 16 species from Euphorbiaceae; 15 species from Zingiberaceae; 13 each from Lamiaceae, Caesalpiniaceae, Rubiaceae, Rutaceae, Verbenaceae, and Mimosaceae; 9 species each from Bignoniaceae, Cucurbitaceae, Amaranthaceae, and Araceae. Among these plants, herbs were dominating other life forms, such as big trees, shrubs, climbers, under shrubs, and small trees.



Graphical representation of the presence of plants species maintained in CCRAS demonstrative gardens according to the IUCN status



Distribution of families of the plant species maintained at CCRAS demonstrative gardens



Habits of plants species maintained at CCRAS demonstrative gardens

Number of medicinal plant species maintained in CCRAS gardens

Regional Ayurveda Research Institute for Fundamental Research, Pune (Maharashtra)

Entrance to the Demonstrative Garden

Monoculture of Ayurvedic plants

Seedlings of Ayurvedic plants

Regional Ayurveda Research Institute, Jhansi (Uttar Pradesh)

The Demonstrative garden

Plots inside the garden

Lemon grass (***Cymbopogon flexuous*** L.)
(Kalam variety)

Pṛśniparṇī (***Uraria picta*** (Jacq.) DC.)

Regional Research Institute of Himalayan Flora, Ranikhet (Uttarakhand)

Kuṅkuma (***Crocus sativus*** L.)

Dāruharidrā (***Berberis aristata*** DC.)

Ayurveda Regional Research Institute, Itanagar (Arunachal Pradesh)

Viḍaṅga (*Embelia ribes* Burm.f.)

Granthimūla (*Alpinia calcarata* Rosc.)

CHAPTER-4

STUDY OF PROPOGATION TECHNIQUES

INTRODUCTION

The CCRAS has initiated the steps for developing medicinal plant gardens for demonstrative purposes. At present the Council is maintaining three demonstrative gardens situated at RARI, Ranikhet , RAIFR, Pune; RARI, Jhansi; located at different agro-climatic zones for demonstration .These gardens are ex situ conservation sites for germ plasm and medicinal plants, including rare, endangered and threatened species. Different study programs, viz.,adaptability, growth pattern, flowering, fruiting and suitable maturity time studies of drugs part, etc. and authentic drug materials supply for various research programs are being carried out. These studies will help in designing protocol in framing strategies for conservation and sustainable utilization of highly valuable medicinal plants. Total 30 protocols were prepared for conservation of these highly valued medicinal plants. The live plants act as specimen for referencing and correct identification of the medicinal plants. Experimental application of agro techniques and adaptable practices are carried out to study the growth of corms and plants, yield of saffron, etc. These gardens work as reference centers for researchers/ students/ academicians for identification of their plants/plant parts, and the genuine materials collected from the gardens are used as a reference material for herbarium and museums.

ACTIVITIES & ACHIEVEMENTS

- Total 30 protocols were prepared for conservation of these highly valued medicinal plants Viz. *Aconitum heterophyllum, Acorus calamus, Mucuna pruriens, Digitalis purpurea etc.*
- The live plants act as specimen for referencing and correct identification of the medicinal plants. Experimental application of agro techniques and adaptable practices are carried out to study the growth of corms and plants, yield of saffron, etc.
- These gardens work as reference centers for researchers/ students/academicians for identification of their plants/plant parts, and the genuine materials collected from the gardens are used as a reference material for herbarium and museums.

RARI, Tarikhet:

1. ***Aconitum heterophyllum* Wall. ex Royle**

Botanical name : *Aconitum heterophyllum* Wall. ex Royle

Ayurvedic name/Sanskrit name : Ativisa,Atis

English name :

Hindi name/trade name : Atis

Family : Ranunculaceae

Distribution:

Generally occurs in alpine region at an altitude of 3000-4000 m from Indus to Kumaun.

Botanical description: It is a perennial herb, 1-4 ft tall

Part Used: Tuberous root

Cultivation and Agro techniques: Propagation and multiplication should be done through seeds, tubers and stem cuttings.

2. ***Acorus calamus* L.**

Botanical name : *Acorus calamus* L.

Ayurvedic name/Sanskrit name : Vacha

English name : Sweet flag

Hindi name/trade name : Bach, gorbace

Family : Araceae

Distribution:

It grows wild on the edges of swamps, on the bank of river and ponds in North America, Europe and Asia. In India the leading states are Karnataka, Kashmir, Manipur, Arunachal Pradesh, Meghalaya and in the foothills of the Himalayas up to 1800m.

Botanical description: Sweet flag is a herbaceous perennial, 30–100 cm (12–39 in) tall. **Part Used:** Rhizome

Cultivation and Agro techniques: Vacha is cultivated in almost the same way as rice and grown in any part of the country where suitable irrigation facilities are available.

3. ***Mucuna pruriens* (L.) DC.**

Botanical name : *Mucuna pruriens* (L.) DC.

Ayurvedic name/Sanskrit name : Kapikacchu

English name : Cow hage, Cowitch

Hindi name/trade name : Gonca,Kaunc, Kivacc

Family : Leguminosae

Distribution:

In India it is found in the foot hills of the Himalayas and in the plains of west Bengal, Madhya Pradesh, Karnataka, Kerala, Andhra pradesh, Uttarakhand, Uttar pradesh, the Andaman and Nicobar Islands and Srilanka.

Botanical description: It is an annual, half woody twining herb.

Part Used: Seeds, Roots and Bristles of the pods.

Cultivation and Agro techniques: The crop can be grown on a wide ranged soil, but well drained sandy to clayey loom soils are best suited.

4. ***Digitalis purpurea* L.**

Botanical name : *Digitalis purpurea* L.

Ayurvedic name/Sanskrit name : Hrit patri

English name : Common Foxglove,Purple

Hindi name/trade name : Digitalis

Family : Plantaginaceae

Distribution:

This plant is native of west Europe, the British Islands and the erstwhile USSR countries. In India it is cultivated in Kashmir at Tangmarg and Kishtwar, Darjeeling, Solan and Kodaikanal(Tamil Nadu)

Botanical description: An erect branched biennial herb attaining a height of 60-90 cm.

Part Used: Leaves

Cultivation and Agro techniques: It requires a well drained sandy loam soil rich in organic matter it prefers warm climate. The cultivation can be done by two methods

a) By direct seed sowing. b) By Nursery raising.

5. ***Asparagus racemosus* Willd**

Botanical name : *Asparagus racemosus* Willd

Ayurvedic name/Sanskrit name : Shatavari

English name : Wild asparagus

Hindi name/trade name : Shatavari,Satamuli ,Kerua

Family : Asparagaceae

Distribution:

It commonly occurs in upper gangatic plains, Bihar plateau and cultivated in gardens. It is also distributed throughout tropical and sub-tropical India up to 1400m elevation.

Botanical description: Climbing under shrub with woody stem and curved or straight spines young stem are brittle smooth and delicate leaves have a minute spiny appearance.

Part Used: Tuberous roots.

Cultivation and Agro techniques: Cultivation can be done by propagation of seeds. It thrives better in porous black to rich loam sandy soil, well drainage (PH. 6-7) an optimum temperature of 10-40 c with plenty of sunshine and annual rain fall of 50-100cm. The best time for direct sowing is May to July.

6. ***Rauvolfia serpentina* Benth. ex. Kurz**

Botanical name : *Rauvolfia serpentina* Benth. ex. Kurz

Ayurvedic name/Sanskrit name : Sarpagandha

English name : Serpentine root

Hindi name/trade name : Chota chand , Sarpagandha

Family : Apocynaceae

Distribution:

It is indigenous to the moist deciduous forests of south East Asia. In India it is found in shady moist regions of uttarpradesh, Bihar, Assam Kerala Orissa, Andra Pradesh and Himachal Pradesh.

Botanical description: A perennial under shrub growing to a height of 60-90cm.

Part Used: Roots

Cultivation and Agro techniques: Cultivation can be done by propagation of seeds. It grows in a wide range of soil from sandy alluvial loam to red loam prefers clay or clayey loam with a large percentage of humus (ph 4.6-6.2)

7. ***Podophyllum hexendrum* Royle.**

Botanical name : *Podophyllum hexendrum* Royle.

Ayurvedic name/Sanskrit name : Giriparpat Van Kakri

English name : Mandarke

Hindi name/trade name : Bakra chimak ,Bhavan bakra ,Papra,Papri

Family : Berberidaceae

Distribution:

In India it is found in the temperate zones of Himalaya.

Botanical description: An erect glabrous succulent perennial herb.

Part Used: Rhizome and Roots

Cultivation and Agro techniques: Propagation should be done through seeds and Rhizome cuttings. The plant flourishes well in the soils rich in humus and decayed organic matter.

8. ***Piper longum* L.**

Botanical name : *Piper longum* L.

Ayurvedic name/Sanskrit name : Pippali,Magadh ,Kana

English name : Indian long pepper

Hindi name/trade name : Pipali

Family : Piperaceae

Distribution:

It is a native of the Indo-Malaya region. It is found growing wild in the tropical rainforest of India.

Botanical description: A creeping climbing shrub.

Part Used: Spikes (Berries), Roots.

Cultivation and Agro techniques: Propagation should be done through seeds, Suckers and Stem cuttings. It flourishes well in a rich well drained loamy soils, Lime stone soil, and laterite soil rich in organic matter content.

9. ***Valeriana wallichii* DC.**

Botanical name : *Valeriana wallichii DC.* Syn.*Valeriana jatamansi* Jones

Ayurvedic name/Sanskrit name : Tagar

English name : Indian Valerian

Hindi name/trade name : Muskabala

Family : Caprifoliaceae

Distribution:

It is a native of the Europe and Asia. It is found growing in moist and shady localities in temperate and sub alpine regions in India, Africa, America, Bhutan and Afghanistan. In India it is distributed in throughout Indian Himalayan regions.

Botanical description: A perennial, pubescent herb.

Part Used: Roots.

Cultivation and Agro techniques: Propagation should be done by Seeds and Roots.

10. ***Hedychium spicatum* Buch-Ham**

Botanical name : *Hedychium spicatum* Buch-Ham

Ayurvedic name/Sanskrit name : Kapurakachali

English name : Spiked ginger lily

Hindi name/trade name : Sathi, Kapur kachari

Family : Zingiberaceae

Distribution:

It is widely distributed in sub tropical and sub temperate region in Madagascar, South west China and India. In India it is distributed in damp shady places in Indian Himalayan region from 1500m to 2500m.

Botanical description: Annual or perennial erect herb.

Part Used: Rhizome

Cultivation and Agro techniques: Propagation should be done by Rhizome. The rhizomes are planted in furrows at a depth of 10-12cm at an optimum spacing of 45cm x 30cm.

11. ***Gloriosa superba* L.**

Botanical name : *Gloriosa superba* L.

Ayurvedic name/Sanskrit name : Langali

English name : Glory lily

Hindi name/trade name : Kalihari , Langali

Family : Colchicaceae

Distribution:

It is widely distributed in tropical Asia and Africa. In India it is distributed throughout in tropical India from North –West Himalayas to Assam.

Botanical description: A beautiful, herbaceous tall glabrous branching leaf tip climber.

Part Used: Tubers.

Cultivation and Agro techniques: Propagation should be done by both seeds and V-shaped tubers. The best time for plantation of these tubers is June-July about 2.5 to 3.0 t/ha of the tubers are required for plantation.

RAIFR, Pune:

12. ***Helicteres isora* L.**

Botanical name : *Helicteres isora* L.

Ayurvedic name/Sanskrit name : Avartani

English name : East-Indian screw tree

Hindi name/trade name : Maror phali

Family : Malvaceae

Distribution:

It is widely distributed in Asia including Indian Subcontinent, South China, Malay Peninsula, Java and Saudi Arabia. Also, found in Australia.

Botanical description: It is a deciduous shrub found in moist forest.

Part Used: Seeds

Cultivation and Agro techniques: Propagation should be done by Seeds. Seeds germinate in the humus rich soil and required rainfall is about 300cm.

13. ***Psoralea corylifolia* L.**

Botanical name : *Psoralea corylifolia* L.

Ayurvedic name/Sanskrit name : Bakuchi

English name : Scurfy Pea

Hindi name/trade name : Babachi, Babchi, Bakuchi,

Family : Leguminosae

Distribution:

It is native to India and Ceylon and was occasionally cultivated in Arabia for its medicinal properties

Botanical description: 50-90cm tall and is an erect, annual herb.

Part Used: Seeds

Cultivation and Agro techniques: Propagation should be done by Seeds. Six months Seeds germinated after first shower of monsoon (June)

14. ***Operculina turpethum* (L.) Silva Manso**

Botanical name : *Operculina turpethum* (L.) Silva Manso

Ayurvedic name/Sanskrit name : Trivrita

English name : Transparent Wood Rose

Hindi name/trade name :

Family : Convolvulaceae

Distribution:

It is endemic to India. It is commonly found in North Circars and Deccan region up to 3000 ft.

Botanical description: herbaceous, somewhat hairy vine reaching a length of 5 meters or more.

Part Used: Roots,Seeds

Cultivation and Agro techniques: Propagation should be done by Vegetative propagation.

15. ***Asparagus racemosus* Willd**

Botanical name : *Asparagus racemosus* Willd

Ayurvedic name/Sanskrit name : Shatavari

English name : Wild asparagus

Hindi name/trade name : Shatavari,Satamuli ,Kerua

Family : Asparagaceae

Distribution:

It commonly occurs in upper gangatic plains, Bihar plateau and cultivated in gardens. It is also distributed throughout tropical and sub-tropical India up to 1400m elevation.

Botanical description: Climbing under shrub with woody stem and curved or straight spines young stem are brittle smooth and delicate leaves have a minute spiny appearance.

Part Used: Tuberous roots.

Cultivation and Agro techniques: Cultivation can be done by propagation of seeds. And also vegetative propagation by division rhizomatic disc.

16. ***Rauvolfia serpentina* Benth. ex. Kurz**

Botanical name : *Rauvolfia serpentina* Benth. ex. Kurz

Ayurvedic name/Sanskrit name : Sarpagandha

English name : Serpentine root

Hindi name/trade name : Chota chand , Sarpagandha

Family : Apocynaceae

Distribution:

It is indigenous to the moist deciduous forests of south East Asia. In India it is found in shady moist regions of uttarpradesh, Bihar, Assam Kerala Orissa, Andra Pradesh and Himachal Pradesh.

Botanical description: A perennial under shrub growing to a height of 60-90cm.

Part Used: Roots

Cultivation and Agro techniques: Cultivation can be done by propagation of seeds. It grows in a wide range of soil from sandy alluvial loam to red loam prefers clay or clayey loam with a large percentage of humus (ph4.6-6.2)

17. ***Gmelina arborea Roxb.***

Botanical name : *Gmelina arborea Roxb.*

Ayurvedic name/Sanskrit name : Gambhari

English name : English beechwood

Hindi name/trade name : Gamhar

Family : Lamiaceae

Distribution:

It naturally occurs throughout greater part of India at altitudes up to 1,500 meters.

Botanical description: Beautiful fast growing deciduous tree.

Part Used: Roots

Cultivation and Agro techniques: Cultivation can be done by propagation of seeds. Plants were cultivated in rocky soil. The annual rainfall is 75 cm and humidity is low with varying temperature from 10-40^{0}c.

18. ***Tinospora cordifolia* (Willd.)Miers**

Botanical name : *Tinospora cordifolia* (Willd.)Miers

Ayurvedic name/Sanskrit name : Guduchi

English name : Indian Tinospora , Heart-leaved moonseed

Hindi name/trade name : Giloy

Family : Menispermaceae

Distribution:

It is a native plant from India, also known to be found in Far East, primarily in rainforests.

Botanical description: Climbing shrub with heart-shaped leaves.

Part Used: Stem

Cultivation and Agro techniques: Propagation should be done by Stem cuttings.

19. ***Withania somnifera* Dunal**

Botanical name : *Withania somnifera* Dunal

Ayurvedic name/Sanskrit name : Ashwagandha

English name : Indian ginseng

Hindi name/trade name : Ashwagandha , Rasbhari

Family : Solanaceae

Distribution:

Ashwagandha, is native to drier parts of India.

Botanical description: It is a perennial herb that reaches about 6 feet in nature.

Part Used: Seeds

Cultivation and Agro techniques: Propagation should be done by Seeds. The seeds were treated with 24 different concentrations of GA_3 Seeds were cultivated in the month of August.

20. ***Acacia sinuata* (Lour.) Merr.**

Botanical name : *Acacia sinuata* (Lour.) Merr.

Ayurvedic name/Sanskrit name : Saptala

English name : Soap pod tree

Hindi name/trade name : Ban Ritha

Family : Leguminosae

Distribution: It is found in tropical jungles, especially in Peninsular India.

Botanical description: A perennial, woody, large climbing shrub grows on big trees.

Part Used: Seeds

Cultivation and Agro techniques: Propagation should be done by Seeds.

21. ***Desmodium gangeticum DC.***

Botanical name : *Desmodium gangeticum DC.*

Ayurvedic name/Sanskrit name : Shalparni

English name : Sal Leaved Desmodium

Hindi name/trade name : Shalparni

Family : Leguminosae

Distribution: Grows wild on the lower hills and plains throughout India; on the Himalayan regions it ascends to 5,000 feet.

Botanical description: Slender, sub erect diffusely branched under shrub growing about 2 –3 feet hight.

Part Used: Seeds

Cultivation and Agro techniques: Propagation should be done by Seeds and Vegetative propagation. Seeds were cultivated in the month of July.

22. ***Andrographis paniculata Wall. ex Nees***

Botanical name : *Andrographis paniculata Wall. ex Nees*

Ayurvedic name/Sanskrit name : Bhunimba, Kalmegh

English name : Kariyat, Creat

Hindi name/trade name : Kirayat, Kalpanath

Family : Acanthaceae

Botanical description: It is an erect annual herbaceous plant extremely bitter in taste in all parts of the plant.

Part Used: Seeds

Cultivation and Agro techniques: Propagation should be done by Seeds. Seeds were cultivated in the month of May.

RARI, Jhansi

23. ***Allium sativum L.***

Botanical name : *Allium sativum L.*

Ayurvedic name/Sanskrit name : Lahasun

English name : Garlic

Hindi name/trade name : Lassan

Family : Amaryllidaceae

Distribution: Garlic is native to Central Asia and northeastern Iran. In India it is cultivated in Madras, Andhra Pradesh, Uttar Pradesh and Gujarat (Rajkot division).

Botanical description: Garlic is a commonly cultivated herb. Aerial stems are up to 1 m tall, erect, simple, herbaceous, green, hairless, round, mostly hollow. Bulb consists of many bulblets, with a papery coating and fibrous roots

Part Used: Bulb

Cultivation and Agro techniques: Propagation should be done by Bulbs. It requires medium black to well drained loamy soils rich in humus, with fairly good content of potash.

24. ***Uraria picta Desv.ex DC.***

Botanical name : *Uraria picta Desv.ex DC.*

Ayurvedic name/Sanskrit name : Prshniparni

English name : Dabra

Hindi name/trade name : Dabra, Pithavan

Family : Leguminosae

Distribution: Uraria picta is not a very common species, but occurs throughout tropical India, extending up to 300 m altitude in Tarai region of the Himalayas.

Botanical description: It is an erect, undershrub, 60–75 cm tall, with several branches. Leaves are generally three to five in number, up to nine-foliate.

Part Used: Root, Seeds

Cultivation and Agro techniques: Propagation should be done by Seeds. The crop can be raised successfully by seeds, which can be collected in November–January.

25. ***Withania somnifera* Dunal**

Botanical name : *Withania somnifera* Dunal

Ayurvedic name/Sanskrit name : Ashwagandha

English name : Indian ginseng

Hindi name/trade name : Ashwagandha , Rasbhari

Family : Solanaceae

Distribution:

Ashwagandha, is native to drier parts of India.

Botanical description: It is a perennial herb that reaches about 6 feet in nature.

Part Used: Root, leaf, seed.

Cultivation and Agro techniques: Propagation should be done by root cuttings. *Withania somnifera* has been grown as a residual crop after the harvesting of the Uraria picta in a crop cycle. It was found that the residual crop responded well to the fertilizers applied to the preceding crop of Uraria picta. It grows well in sandy loam or light red soil, having pH 7.5-8.0 with good drainage. It can be cultivated between 600-1200 m altitudes.

26. ***Gymnema sylvestre R.Br.***

Botanical name : *Gymnema sylvestre R.Br.*

Ayurvedic name/Sanskrit name : madhunashin

English name : Australian cowplant

Hindi name/trade name : gurmar

Family : Apocynaceae

Distribution: Present in tropical areas of India, Africa, and Australia

Botanical description: It is a perennial woody vine

Part Used: Root, seed.

Cultivation and Agro techniques: Propagation should be done by Seeds and root cuttings.

27. ***Pluchea lanceolata (DC.) C.B.Clarke***

Botanical name : *Pluchea lanceolata (DC.) C.B.Clarke*

Ayurvedic name/Sanskrit name : Elaparni

English name : Rasna

Hindi name/trade name : Phaar

Family : Compositae

Distribution: It is occurring in Indo-Gangetic plainsof India

Botanical description: Rasna is an undershrub, growing up to 1.5 m tall, with whitish or greyish branches.

Part Used: Whole plant

Cultivation and Agro techniques: Propagation should be done by Seeds and roots.

28. ***Abroma augusta L.***

Botanical name : *Abroma augusta L.*

Ayurvedic name/Sanskrit name : Pishachkarpas

English name : Devil's ,cotton

Hindi name/trade name : Ulatkambal

Family : Malvaceae

Distribution: The species is of Indo-Malayan origin and occurs throughout tropical forests of India, particularly in North-East and East Coast.

Botanical description: It is a shrub or a small tree, attaining a height of 3–5 m, with horizontal and velvety branches.

Part Used: Root, Root bark, Stem, Leaves

Cultivation and Agro techniques: Propagation should be done by Seeds. Mature seeds, which are black in colour at maturity, can be collected during December to January. July is the best time period for the seed sowing in *Abroma augusta* L., Germination is completed in about 12–15 days.

29. ***Cassia angustifolia Vahl***

Botanical name : *Cassia angustifolia Vahl*

Ayurvedic name/Sanskrit name : Savarnapatri

English name : Senna

Hindi name/trade name : sanna ka patta

Family : Caesalpiniaceae

Distribution: It is a native of Yemen and South Arabia. The leaves and pods contain sennosides used for their laxative properties. It was introduced in to Tamil Nadu in the eighteenth century where it grown as an annual crop of 5 to 7 months duration in 8000

to 10,000 Ha both under rainfed and irrigated condition. Successful cultivation also has been demonstrated in Karnataka (Bangalore) , Gujrat(Anand) , and Delhi.

Botanical description: Senna (*Cassia angustifolia* Vahl) is a small shrub.

Part Used: Seeds

Cultivation and Agro techniques: Propagation should be done by Seeds. senna is mostly cultivated in well ploughed, leveled , rich clayed semi irrigated land. Pulverization of the soil carried out by the use of plough. First sowing is done in February- March, while second in October to November. Before planting prepare the land by plugging, harrowing and being the soil to a fine tilth, apply BHC (10%) or Aldrin(5%) at 25 kg/ ha with last operation. It protects the young seedling from attack of white ants and cut worms.

30. ***Psoralea corylifolia L.***

Botanical name	: *Psoralea corylifolia L.*
Ayurvedic name/Sanskrit name	: Bakuchi
English name	:
Hindi name/trade name	:
Family	: Leguminosae

Distribution: It grows throught the plains of India specially in the semi-arid regions of Rajasthan and Eastern districts of Punjab,adjoining areas of Utterpradesh.It is also found in Himalaya,Dehradun,Bundelkhandand Karnataka. This plant is widely distributed in tropical and subtropical regions of China and South Africa.

Botanical description:It is a small erect, annual herb growing up to 60-120cm in height.

Part Used: Seeds, Leaves,Root,Stem.

Cultivation and Agro techniques: Propagation should be done by Seeds. senna is mostly cultivated in well ploughed, leveled , rich clayed semi irrigated land. Pulverization of the soil carried out by the use of plough. First sowing is done in February- March, while second in October to November. Before planting prepare the land by plugging, harrowing and being the soil to a fine tilth, apply BHC (10%) or Aldrin(5%) at 25 kg/ ha with last operation. It protects the young seedling from attack of white ants and cut worms.

Asparagus racemosus Willd.

Withania somnifera (L.) Dunal

Andrographis paniculata (Burm.f.) Nees

Psoralea corylifolia L.

CHAPTER-5

IN-VITRO PROPAGATION TECHNIQUES

INTRODUCTION

Most of the plants raised through seeds are highly heterozygous and show great variations in growth, habit and yield and may have to be discarded because of poor quality of products for their commercial release. Likewise, majority of the plants are not amenable to vegetative propagation through cutting and grafting, thus limiting multification of desired cultivators. Moreover many plants propagated by vegetative means contain systemic bacteria, fungi and viruses which may affect the quality and appearance of selected items. In recent years, tissue culture has emerged as a promising technique to obtain genetically pure elite population under in-vitro conditions. An ever increasing demand of uniform medicinal plants based medicines warrants their mass propagation through plant tissue culture strategy.

The propagation of a plant by using a plant part or single cell or group cell in a test tube under very controlled and hygienic conditions is called "tissue culture".

It plays an important role in conservation of medicinal plants in different ways like-

i. By quickly producing mature plants.

ii. By producing multiples of plants in the absence of seeds or necessary pollinator to produce seeds.

iii. By regenerating whole plants from plant cells that have been genetically modified.

iv. By producing plants from seeds that otherwise have very low chances of germinating and growing etc.

In -vitro propagation technique has been successfully used when wild grown plants are difficult to propagate through conventional ways. Such plants can be used as a source of seed for long term storage and if seed is not produced, the tissue culture lines themselves can be cryopreserved. Tissue culture technology is potent and has opened extensive areas of research for biodiversity conservation. Tissue culture protocols have been developed for a wide range of medicinal plants, which includes endangered, rare and threatened plant species. It has now become a well established technique for culturing and studying the physiological behaviour of isolated plant organs, tissues, cells, protoplasts and even cell organelles under precisely controlled physical and chemical conditions. The shoot multiplication through tissue culture usually has a short cycle and therefore results in logarithmic increases in the number of shoots. In addition tissue cultures can provide propagules such as minitubers or minicorms for plant mutipication throughout the year irrespective of the season. The Plant Tissue Culture Laboratory was established in 1989-1990 at Regional Research Institute (Ay.), Pune (National Research Institute of Basic Ayurvedic Sciences) under Pharmacognosy Research unit.

OBJECTIVES

- Initiation of *in-vitro* propagation trials.
- Comparative analysis of secondary metabolites from the *in vivo* and *in vitro* grown plants.

- Development of protocol by tissue culture techniques like micro propagation, somatic embryogenesis etc.

CORE ACHIEVEMENTS

- In vitro propagation trial conducted on 14 plants species
- In vitro propagation trial under pipeline 7 plants species

Detailed Overview on *In-Vitro* Protocols on certain medicinal plants developed by CCRAS since Inception

A. COMPLETED

S.N	Botanical Name	Sanskrit Name	Culture Techniques	Published Article
1	*Holarrhena antidysenterica* Wall.	*Kutaja*	Leaf, root and stem explants taken from seedlings of *Holarrhena antidysenterica* Wall. were cultured on MS medium supplemented with IAA, NAA, 2, 4-D, Kn of BAP alone or in combination of IAA+ Kn or 2, 4-D+ Kn. IAA (2.0 mg/litre) was found to be most favourable for callusing in root and stem and 2, 4-D (0.5 mg/litre) in leaf explants. Explants taken from leaf, root and inter-nodal part of stem did not show regeneration of shoots, but the explants consisting of nodal segments of stem regenerated two shoots on medium supplemented with IAA (1.0 mg/litre). On transfer to medium containing 3.0 mg/litre of IAA the shoots developed roots, leading to formation of complete plantlets. Stepwise transfer of the plantlets from the medium to vermiculite and then to soil was found necessary for proper hardening and survival.	*In-vitro* propagation of Kutaja (*Holarrhena antidysenterica* Wall). BMEBR, Vol. XIII, (3-4), 154-165, **1992**.
2	*Asparagus racemosus* Willd.	*Shatavari*	Shoot tips of *Asparagus racemosus* Willd. (*Shaivari*) were cultured on Murashige and Skoog's (MS) basal medium supplemented with different concentrations of Kinetin (Kn) and 6-benzylaminopurine (BAP). Regeneration of a large number of adventitious shoot buds was observed on medium containing BAP (0.5 mg/litre). On subculturing the shoot buds at 40 days intervals, identical results, i.e., differentiation of additional buds, were observed upto 16 months. These buds developed into shoots when maintained on the same medium for a longer time, i.e., more than 60 days. The shoots when transferred to half strength MS medium supplemented with NAA (1.0 mg/ litre) showed rooting leading to formation of complete planlets in 80-90 days. Thus a large number of plantlets were produced from a single shoot tip in about 4 months.	*In-vitro* propagation of *Asparagus racemosus* Willd. (Satavari) BMEBR, Vol.15, (1-4), 68-74, **1994**

3	*Hemidesmus indicus* R. Br.	*Sariva*	*Sariva (Hemidesmus indicus* R.Br.) is an important Ayurvedic plant, facing much depletion in nature. Due to its scarcity at least three other plants species, viz., *Cryptolepis buchanani* Roem & Schult, *Decalepis hamiltonii* Wight & Arn. And *Ichnocarpus frutescent* R. Br. are being exploited and generally their stem pieces are being sold as substitute of *Sariva moola* (root). Trails were made to propagate *Hemisdesmus indicus* R.Br. through tissue culture, using nodal segment of the stem as explants. MS medium supplemented with various growth regulators in different concentrations was used for the study. Callusing, shooting and multiple shooting were observed on MS medium, supplemented with NAA+IAA, BAP, BAP+ IAA respectively. The shoots, when transferred to Wights' medium developed roots forming complete plantlets.	Observation on *In vitro* propagation of *Hemidesmus indicus* R.Br. (Sariva) BMEBR, Vol. 16 (3-4), 129-132, **1995**.
4	*Bacopa monnieri* (L.) Pennell	Bramhi	Apical bud and nodal segment of *Bacopa monnieri* (L) Pennel, were cultured on MS medium supplemented with IAA, BAP & Kn singly or in combination with varying concentrations. The medium containing IAA+ BAP (2.5 mg/l each) was found to be most favourable for regeneration of multiple shoots. Full strength MS medium was found most suitable for rooting of the newly developed shoots leading to formation of complete plantlets. Stepwise transfer of the plantlets from the medium to vermiculite and then to soil was found necessary for proper hardening. On being transferred to the field 90% survival rate was recorded.	*In vitro* propagation of *Brahmi* (*Bacopa monnieri* (L.) Pennell. BMEBR, Vol. 18 (3-4), 145-150, **1997**.
			Leaf culture of *Brahmi* (*Bacopa monnieri* (L.)Pennell) was initiated by inoculation leaf explant on MS medium supplemented with different concentrations of auxins and cytokinins. IAA, IBA and BAP were used singly or in combinations. It has been observed that multiple shoot (more then 100) regeneration takes place from callus obtained from leaf explants on MS medium supplemented with IAA and BAP (2.5 mg/1 each) after three successive subcultures and subsequent transfer to ½ strength MS+IAA (1 mg/1) resulted in rooting forming complete plantlets. 90 percentage survival rate was recorded on transfer to field after hardening.	Observations on leaf culture of *Brahmi* – *Bacopa monnieri* (L.) BMEBR, Vol. 21 (1-2), 46-52, **2000**.

5	*Desmodium gangeticum* (L.) DC.	*Shalparni*	The seeds of *Desmodium gangeticum*(L) DC. showed very poor germination rate due to hard seed coat. To break the dormancy, seeds were subjected to various treatments. Pres owing treatment with Conc. H_2 SO_4 for 15 minutes was found most successful in breaking the seed dormancy, enhancing the germination rate from 6% to 96%. Mechanical scarification and hot water treatment were also helpful in increasing the germination percentage to a considerable extent.	Effect of various treatment on seed germination of *Desmodium gangeticum* (L.) DC. (Shalparni). BMEBR, Vol. 20 (1 – 4), **1999**.
			An *in vitro* procedure for rapid multiplication of medicinally important plant *Desmodium gangeticum (L.)* DC. (Fabaceae), has been developed using cotyledonary nodal explant. An average of 9.2 shoots per explant were obtained by culturing cotyledonary nodal explaint on Murashige and Skoog's medium containing 8.8 µM BAP and 21.2 µM NAA, in combination, within 28 days. These shoots were rooted on half strength MS medium supplemented with IAA 17.1 µM. Rooted plantlets were hardened using 1:1:1 mixture of soil, river sand and vermiculite under green house conditions	*In vitro* propagation of *Desmodium gangaticum* (L.) DC. From cotyledonary nodal explants PHCOG MAG, Vol.4, 145-150, **2009**.
6	*Paederia foetida* L.	*Prasarani*	The *in vitro* propagation of *Prasarani* (*Paedeia foetida* L.) through stem and leaf culture on MS and B-5 medium supplemented with varying concentrations of IAA, Kn and BAP. The results showed that out of all the growth regulators tried for multiple shooting, MS medium supplemented with BAP (2.5 mg/l)+IAA (5 mg/l)was found most suitable showing regeneration of 3-4 shoots from apical bud. In case of nodal sector MS medium supplemented 2.5 mg/l BAP + 5mg/l IAA was found most suitable for multiple shooting showing regeneration of 3-4 shoots after 28 days. The callus developed from leaf culture on MS medium supplemented with BAP (2 mg/l)+ IAA (2.5 mg/l)10-12 shoots from the marginal pats of the callus followed by additional 10-12 shoots from the central part of the callus in 3 weeks after inoculation. //Full strength MS medium having 2 mg/l IAA was found better for rooting and rooted plantlets were subjected to gradual hardening process from vermiculite (Soilrite)to finally in the field, were 50 percentage survival rate was observed.	*In vitro* propagation of *Paederia foetida* Linn. through stem and leaf culture BMEBR, Vol. 21 (1-2), 80-87, **2000**. 85-91.

7	*Uraria picta* (Jacq.) Desv. ex DC.	*Prisniparni*	The seed of *Uraria picta* Desv. showed very poor germination rate due to hard seed coat. To break the dormancy, seeds were subjected to various treatment with conc. H_2SO_4 for 30 minutes was found to be most successful in breaking the seed dormancy and enhanching the germination rate from 13.33% to 95% in fresh seeds, and 0% to 76.66% in twelve years old seeds. Mechanical scarification was also helpful in increasing the germination percentage.	Effect of various treatment on seed germination of *Uraria picta* Desv. (Prishniparni), BMEBR, Vol.22 (1-4), 60-68 (**2001**).
			Protocol for in vitro shoot organogenesis and plant establishment has been achieved in a medicinally important plant *Uraria picta* (Jacq.) Desv. ex DC. (Fabaceae). Cotyledonary node, node and cotyledons obtained from in vitro established shoot cultures were used for induction of direct shoot regeneration and callus formation. Shoot regeneration was achieved by culturing 1-1.5 cm length of the explant and whole cotyledons of about 4 weeks on Murashige and Skoog's (MS) basal medium enriched with 13.2 **µM** BAP. Multiple shoot formation was observed on media supplemented with 8.8 **µM**, 13.2 **µM** and 17.6 **µM** BAP respectively. The maximum number of adventitious shoots was regenerated from cotyledonary node within 4 weeks of culture on MS medium containing 13.2 **µM** BAP. The in vitro proliferated and elongated shoots were excised and planted individually on 1⁄2 MS medium supplemented with 9.8 **µM** IBA for rooting. These shoots produced profuse roots within 3 weeks. The in vitro regenerated plantlets were hardened using 1:1 mixture of sand and garden soil under greenhouse culture conditions. The developed protocol would be useful for mass propagation and germplasm conservation of *U. picta*.	*In vitro* Propagation of the medicinal plant *Uraria picta* (Jacq.) Desv. ex DC. from cotyledonary node and nodal explants. *Phcog Mag*, Vol.4, S239-S245, **2008**.

8	*Viola serpens* Wall.	*Banafsha*	Comparative phyto-chemical studies of naturally growing plants and tissue cultured plants *Viola serpens* Wall. have shown that the tissue cultured plants raised from petiole callus were better than naturally growing plants in synthesizing primary and secondary metabolities.	Comparative phytochemical studies of naturally growing and tissue cultured plants of *Viola serpens* Wall. BMEBR, Vol. 26 (3-4), 33-40, **2005**.
			Experiments were conducted to develop methodology for in vitro propagation and rapid multiplication of *Viola serpens* Wall. using petiole explant. The MS medium supplemented with 2, 4.D (6.78 µm) was found most suitable for callus induction in petiole explant. The best growth response and higher rate of shoot regeneration from petiole callus was observed on MS medium containing BAP (11.10 µm) as the average number of shoots could be increased to 36.4 on fourth successive subculturing. Higher rooting responses with larger number of roots were observed in shoots inoculated on the half–strength MS medium supplemented with IBA (19.68 µm).	Regeneration of multiple shoots from petiole callus of *Viola serpens* Wall. Phcog Res. Vol 5(2), 86-92, 2013
9	*Cissampelos pareira* L.	*Patha*	*Patha* (*Cissampelos pareira* L.) is an important drug of Ayurveda. Root of the plant, which constitutes the drug, is used in fever, diarrhoea, dysentery, dropsy, dyspepsia and nephritis etc. Since the root of this important drug of Ayurveda is used medicinally, it has become rare and no systematic efforts have been made for its ex situ cultivation. Therefore, in order to evolve method for rapid multiplication of the plant through tissue culture trials were made, MS medium containing BAP (3 mg/l) was found to be most favourable for regeneration of multiple shoots in nodal segments of *C. pareira* L. Early rooting was observed in in-vitro grown shoots inoculated on half strength MS medium supplemented with Indol-3- Butyric Acid (IBA) 3 mg/l.	In vitro propagation of Patha JDRAS, Vol. 29 (1-2), 39-46, 2008.

10	*Rubia cordifolia* L.	*Manjishtha*	*Rubia cordifolia* L. is an important medicinal plant used in various Ayurvedic formulations *viz., Manjishthadi Kwath, Manjishthadi taila, Chandanasav, Brihanmanjishthadi Kwath, Arvindasava, Ashwagandharishta.* Due to excessive collection from natural habitat, *Manjishtha* is becoming rare and vulnerable. To conserve the plant, it is necessary to develop a systematic *in situ* protocol for rapid multiplication of the plant. *In vitro* propagation protocol was developed using nodal segment as explants. Nodal segments were implanted on Murashige and Skoog medium, enriched with different cytokinins and auxins in various concentrations. Among the different growth hormones tried for shoot development and root induction, the best shoot multiplication (20-25nos.) was obtained on liquid MS + TDZ (0.5 mg/l). Early root induction was observed in MS + IBA (2mg/l) within two weeks. The developed *in vitro* protocol would be helpful to propagate and conserve the germ plasm of *Rubia cordifolia* L.	Conservation of Manjishtha – Rubia cordifolia Linn. through nodal culture. JDRAS,Vol 2 (4) , 267-273, 2017.
11	*Aegle marmelos* Corr.	*Bilwa*	Regeneration of whole plant from in vitro grown nodal explants was developed for *Aegle marmelos* (L.) Corr. Rapid micropropagation protocol of *Aegle marmelos* (L.) Corr. was achieved using in vitro grown seeds. Nodes of in vitro grown seedling were used as explants and inoculated on half and full strength MS media with different growth regulators varying in concentrations (singly or in combination). Single shoots were obtained after 7 days of inoculation on MS medium containing 3 mg/L BAP and 0.1mg/L NAA. MS medium fortified with 0.5 mg/L BAP proved most beneficial for the induction of shoot multiplication. The number of proliferated shoots obtained (3-4 per explant) was high on transfer to fresh medium. Root regeneration was achieved on half strength MS liquid medium supplemented with 6 mg/L IBA (in 30 days) and 12 mg/L IBA (in 45 days). Rooted plants survived well under maintained temperature and humidity.	Communicated to "Indian Journal of Experimental Biology"

12	*Operculina turpethum* (L.) Silva Manso.	*Trivrit*	*Operculina turpethum* (L.) Silva Manso is an important medicinal plant used in Indian systems of medicines. Root is used in various Ayurvedic and Unani formulations. It is reported as rare and endangered plant in Asian countries. In present study, a micro-propagation protocol through cotyledon, nodal segment and axillary bud have been developed. The explants were inoculated on to MS, ½ MS, Whites medium and MS in combination with different concentrations of BAP, AS, Kn, NAA, IAA, IBA. The average maximum number of shoots 19.72 achieved on MS supplemented with BAP (3mg/l). 100% root induction was obtained on all combinations which include ½ MS, MS, Whites medium alone and combination of MS with 1 – 4 mg/l concentrations of NAA, IBA, IAA. The developed *in vitro* protocol would be helpful for mass multiplication as well as to save the rare and endangered plant.	Communicated to JDRAS
13	*Aristolochia bracteata* Retz.	*Dhumrapatra*	*Aristolochia bracteata* Retz. is an important medicinal plant in Indian system of medicine with purgative, antipyretic, anti-inflammatory, anthelmintic, emmenogogue, alterative, and abortifaecient properties. In African continent, the flowers are used against snake bite and scorpion sting. An efficient in vitro regeneration protocol of *Aristolochia bracteolata* Lam. has been developed using nodal segments as explants. Shooting proliferation from nodal explants was achieved on MS enriched with BAP, Kn, TDZ singly and BAP in combination with 0.1% NAA. Best establishment of shoots (20 nos.) was found in MS media augmented with 0.5 mg/l. Kn. Excess leaching in the medium was controlled by incorporating 0.1% PVP. Maximum roots (2 -3 nos.) produced in MS fortified with 3mg/l IBA. Nodal explants inoculated on MS + Kn (0.5mg/l) + 0.1% PVP showed maximum number of shoots and roots.	Communicated to JDRAS

14.	*Clerodendrum serratum* (L.) Moon.	*Bharangi*	-	Article Drafted

Work under Progress

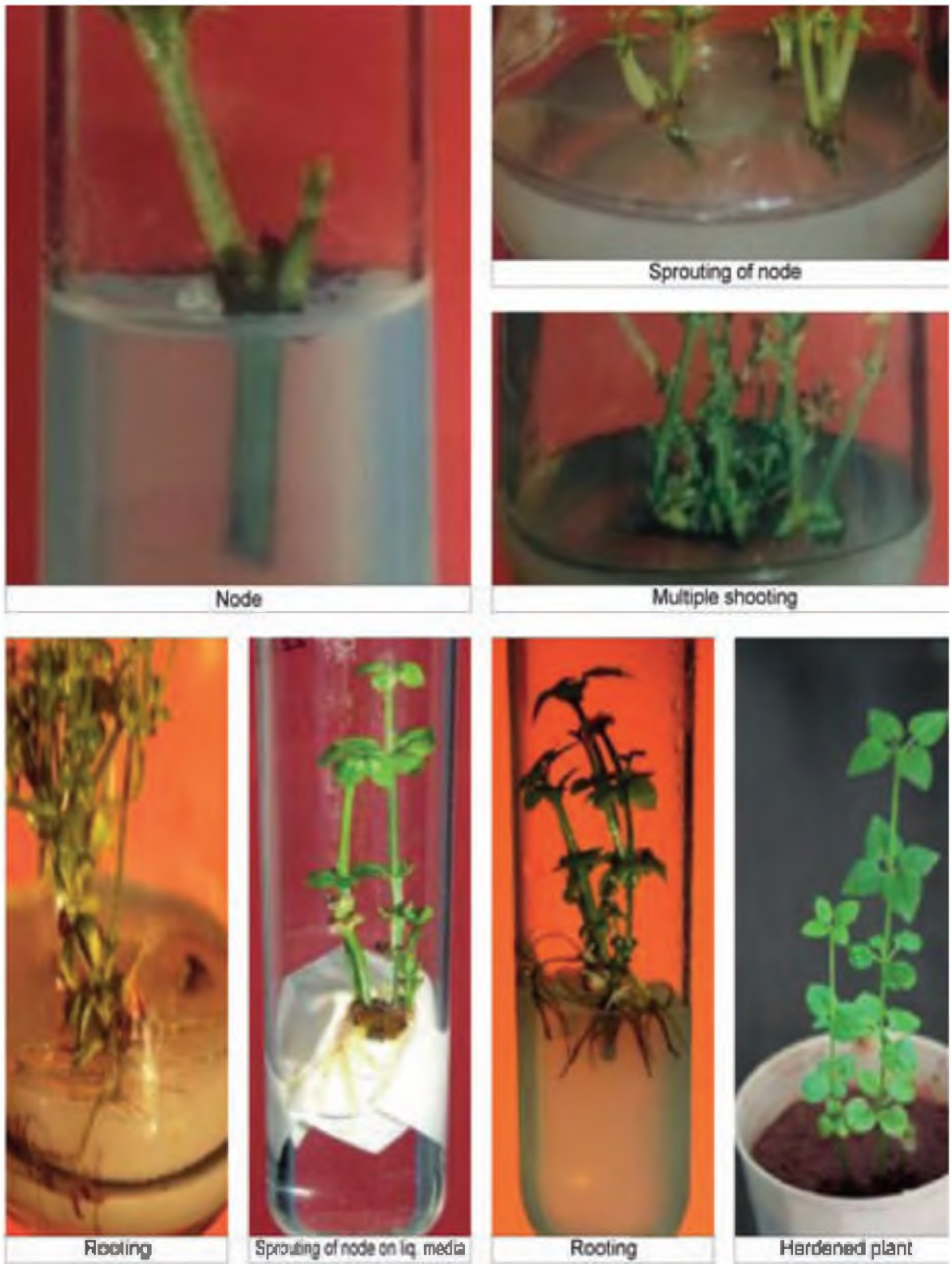
Sr. No.	Botanical Name	Sanskrit Name	Present Status
15	*Gmelina arborea* Roxb.	Gambhari	Rooting and hardening trial initiated
16	*Oroxylum indicum* (L.) Vent.	Shyonaka	*In vitro* trials under progress
17	*Stereospermum suaveolens DC.*	Patala	Work under progress
18	*Aristolochia indica L.*	Ishwari	Rooting and hardening trial under progress
19	*Vanda sp.*	Rasna	Work under progress
20	*Premna obtusifolia* Roxb. (Under IMR)	Agnimantha	Work under progress
21	*Clerodendrum phlomidis* (Under IMR)	Agnimantha	Work under progress

Reference Journals

BMEBR: Bulletin of Medico-Ethno-Botanical Research,

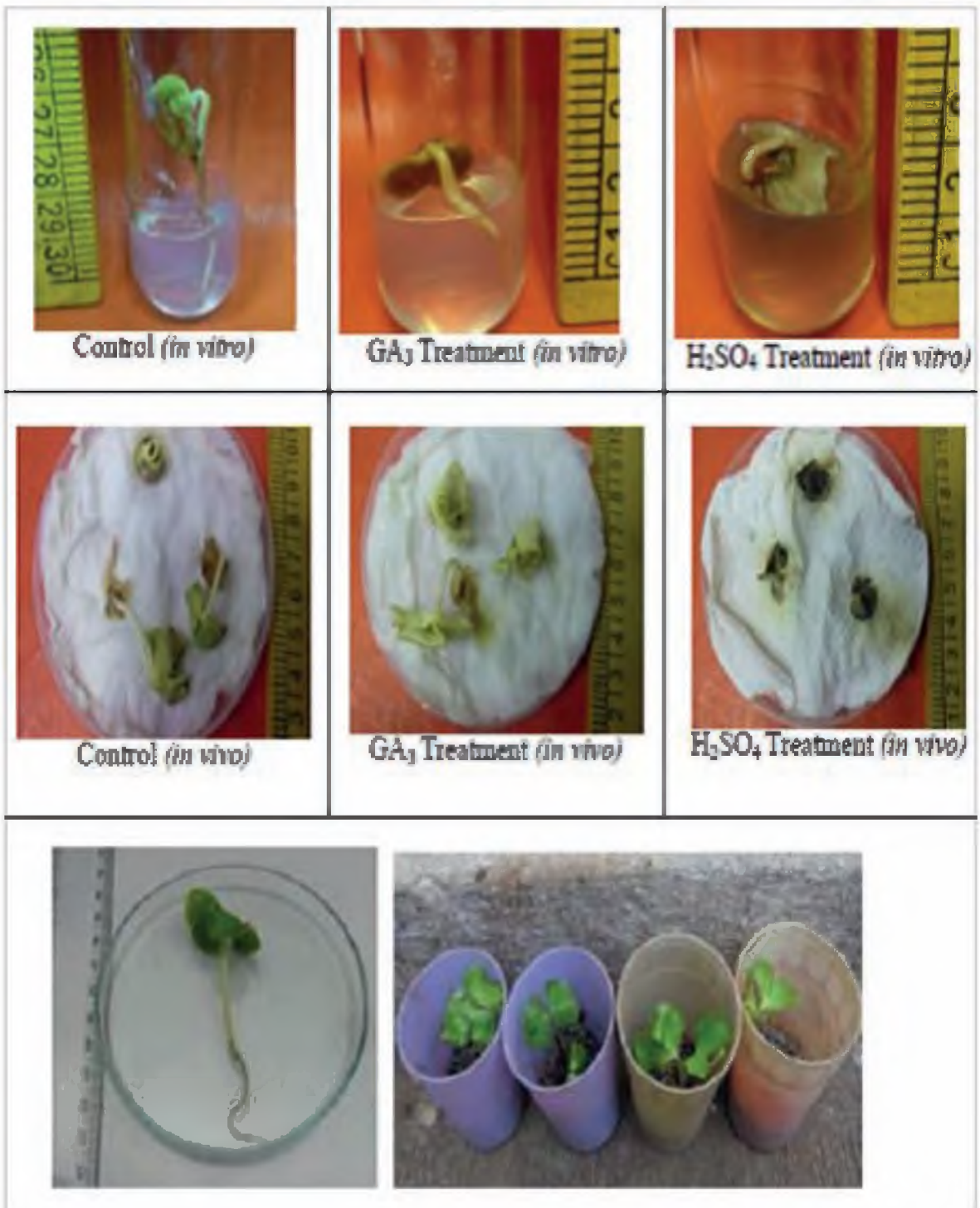
PHCOG MAG: Pharmacognosy Magzine,

JDRAS: Journal of Drug Research in Ayurvedic Sciences.



In vitro grown shoots roots, and hardening of the plant *Rubia cordifolia* L.

PHOTOGRAPHS DEPICTING *O. INDICUM* EXPERIMENT



In vivo grown seeds of the plant *Oroxylum indicum* (L.) Vent. Showing 1-2 cm shoots and 1-1.5 cm roots were transferred in a Plastic glass containing soilrite and checked for survival.

PHOTOGRAPHS DEPICTING *IN-VITRO* CULTIVATION RESPONSE:-

Photoplate 1: *In-Vitro* Cultivation Response of *Gmelina arborea* Roxb.

Seed culture

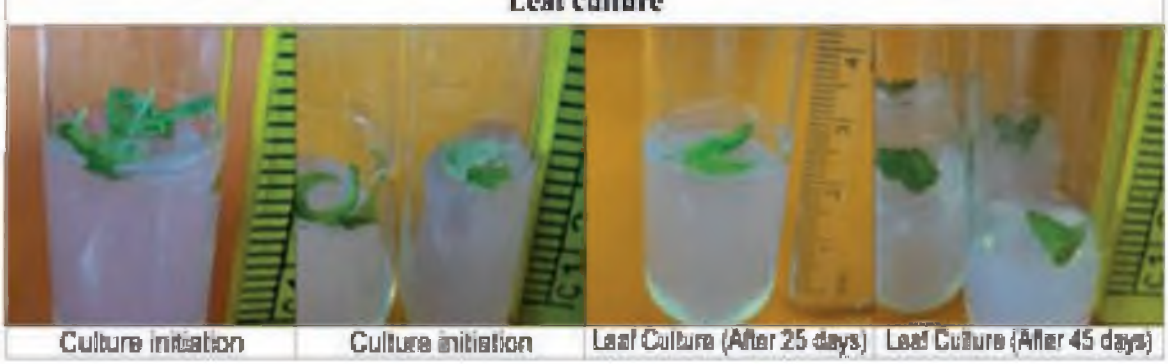
Collection of seeds | Culture initiation

Nodal culture

Culture initiation | Culture initiation | Sprouting from node

Node (After 45 days) | Elongation of shoot | Elongation of shoot | Elongation of shoot

Leaf culture



Culture initiation | Culture initiation | Leaf Culture (After 25 days) | Leaf Culture (After 45 days)

CHAPTER-6

PHARMACOGNOSY RESEARCH

INTRODUCTION:

India, from its prehistoric period it contains a literally well Traditional Medical Science of its own, with a rich and a veritable material medica which includes herbal ,animal and mineral products. Although research on medical science has opened new sources of remedies, herbals are continuing as a mainstay in the treatment due to easy availability coupled with their hold on the community at large. Pharmacognosy which is an applied science aims at a complete and systematic knowledge of crude drugs of vegetable, animal or mineral origin. It implies not only drugs but also includes a knowledge of sources from which the drugs are prepared, their history, properties and uses, distribution, cultivation, collection and selection.

Pharmacognosy, since its establishment as a distinct field of study has gradually acquired an importance of its own. Today it is considered as an important and indispensible part in the pharmaceutical education. As a new and expanding science it is now involved in the study of chemical physiology and production of cell constituents. As the crude drugs form the basis for the manufacture of a wide range of medicinal preparations needed by the people. The pharmacognosist has a serious responsibility to take the initiative not only in correctly locating the plants mentioned in the old treatises and pharmacopoeias but also in making them available to his associates in other disciplines to put to test the uses for which they are acclaimed. He is also to look for the allied species which may turn out to be superior to the drugs actually in use. Inspite of the fact that in modern pharmacognosy, many workers of the past have diverted towards chemical and biochemical aspects, macro and microscopical study still remains the predominant aspect of the study of the medicinal plants particularly in India, where the anatomical study of the many indigenous drugs have yet to be done. Reinvestigations with modern techniques and equipments of old known drugs offer to disclose some unknown facts. With a little more effort, a pharmacognosist can become the real link between a botanist, chemist, pharmacologist and there is no denying of the fact that co-operative association of these interdependent sciences is the only practical way of obtaining better and still better medicines for the service of the ailing humanity by utilizing the naturally occurring crude drugs.

OBJECTIVES

- Pharmacognosy is the study of crude drugs which are obtained from natural origin which include herbal, mineral, animal, microbes, herb mineral or marine drugs.
- Pharmacognosy is an interdisciplinary subject which deals with Quantitative standards, identification by description in the whole/powdered state with their history, collection, commerce, preparation and storage and preliminary phytochemical analysis.

CORE ACHIEVEMENTS

- Since inception till now council has taken up Pharmacognostical studies on 312 plants at 3 laboratories of CCRAS.

- The outcome of the Pharmacognostical studies has been documented in 3 Volumes of Book entitled Pharmacognosy of Indigenous Drugs(Vol 1-3)

List of Plants undergone for Pharmacognostical studies

Sl No.	Name of the Plant	Sanskrit Name	Part used
1	*Abelmoschus moschatus* Medik.	Latakasturika	Fruit
2	*Abies pindrow*Royle .	Talishpatra Bhed	Leaf
3	*Abies spectabilis* (D.Don)Mirbel	Talishpatra Bhed	Leaf
4	*Abies webbiana* Lindl.	Talisa/Talish patra	Leaf
5	*Abrus precatorius* L.	Gunja	a)Seed b)root
6	*Abutilon indicum* (L.) Sweet	Atibala	a)Root, b)stem, c)leaf, d)flower, e)fruit.
7	*Acacia catechu* (L.f.) Willd.	Khadir	Heart wood
8	*Acacia leucophloea* (Roxb.) Willd.	Arimeda	Stem bark
9	*Acacia nilotica* (L.) Delile	Babbula	Root
10	*Acalypha indica* L.	Harit manjari	Whole plant
11	*Achyranthes aspera* L.	Apamarga	a)Whole plant , b) Rhizome (Fresh)
12	*Aconitum chasmanthum* Stapf. ex Holmes	Vatsanabha	Root
13	*Aconitum heterophyllum* Wall. Ex. Royle	Ativisha	Root
14	*Acorus calamus* L.	Vacha	Rhizome
15	*Adhatoda vasica* Nees	Vasaka	Leaf
16	*Adhatoda zeylanica* Medik.	Vasa Bhed	Leaf juice
17	*Aegle marmelos* (L.) Corrêa	Bilva	Fruit Pulp
18	*Agave americana*L.	Aanaikatralai	Leaf
19	*Ailanthus excelsa* Roxb.	Aralu/Araluka	Stem Bark
20	*Alangium salvifolium* L.	Ankol	a)Leaf, b)Seed
21	*Albizia lebbeck* (L.) Benth	Shirish	a)seed, b) leaf, c) Flowers.
22	*Albizia procera* (Roxb.) Benth.	Shweta Shirish	a)seed, b)bark.
23	*Allium cepa* L	Palandu	Stem
24	*Alocasia macrorrhizos* (L.) G.Don	Manakanda	Rhizome
25	*Aloe barbadensis* Mill.	Kumari sar/krishna Bol	Leaf juice

26	*Aloe vera* (L.) Burm.f.	Kumari	Leaf juice
27	*Alstonia schiolaris* R. Br.	Saptaparna	Bark
28	*Alternanthera sessilis* (L.) R.Br. ex DC.	Matsyakshi	Whole plant
29	*Althaea officinalis* L.	Khatmi	Seed
30	*Amaranthus caudatus L.*	Rajadri	Leaf
31	*Anacyclus pyrethrum* DC	Akarkarabha	Root
32	*Ananas comosus* (L.) Merr.	-	Fruit
33	*Anethum sowa* Roxb. ex Fleming	Shatapushpa	Fruit
34	*Anthocephalus cadamba* (Roxb.) Miq.	Kadamba	a)Bark b) leaves
35	*Anthocephalus indicus* A.Rich.	Kadamba	Bark
36	*Apium leptophyllum* (Pers.) F. Muell. ex Benth.	Ajmoda / Banyamani	Fruit, Seed
37	*Aquilaria agallocha* Roxb	Aguru	Wood
38	*Areca catechu* L.	Poogiphalam	Nut
39	*Argemone mexicana* L.	Svarnakshiri	a)Seed, b)Root, c) latex.
40	*Aristolochia bracteata* Retz.	-	Root
41	*Artocarpus lakoocha* Roxb.	Lakoocha	Fruit
42	*Asparagus racemosus* Willd.	Shatavari	Root
43	*Asteracantha longifolia* Nees	Kokilaksha	a)Seed, b)Root, c)Whole plant.
44	*Azadirachta indica* A. Juss.	Nimba	Stem bark
45	*Bacopa monnieri* (L.) Wettst.	Brahmi	a)Whole Plant, b)Root.
46	*Baliospermum montanum* (Willd.) Müll. Arg.	Danti	Root
47	*Bambusa arundinacea* (Retz) Willd.	Vansha	Banshalochan
48	*Barleria prionitis* L.	-	a)Whole plant, b) leaf
49	*Barringtonia acutangula* (L.) Gaertn.	Hiijala	a)Leaf, b) stem c) fruit
50	*Barringtonia racemosa (L.) Spreng.*	Hijjalabheda, Samudra-phala	a)Leaf, b)Bark c) fruit
51	*Bauhinia balansae* Gagnep.	Kanchanar	Bark
52	*Bauhinia Purpurea* L.	Kovidara	a)Bark b) flower

53	*Bauhinia racemosa* Lam.	Svetakanchanar	a)Bark b) leaf c) fruit
54	*Bauhinia vahlii* Wight & Arn.	Kanchanar bhed	Leaf
55	*Bauhinia variegate* L.	Kanchanar	a)Bark b) Flower
56	*Berberis asiatica* Roxb. ex DC.	Daruharidra	Stem
57	*Bergenia ligulata* Wall.	-	Rhizome
58	*Blepharis edulis* (Forssk.) Pers.	Utangan	Seed
59	*Blumea lacera* D.C.	Kukuradru	Whole plant
60	*Boerhaavia diffusa* L.	Punarnava	a)Whole plant, b) Leaves, c)stems, d)roots
61	*Borassus flabellifer* L.	Tal	a) root, b) flower c) fruit.
62	*Brassica nigra* Koch.	Krishna sarshapa	Seed
63	*Brunella vulgaris* L.	Dharu or Ustukhudus	Whole plant
64	*Butea monosperma* (Lam.) Kuntze	Palash	a)Leaf b) flower
65	*Caesalpinia bonduc* (L.) Roxb.	Kuberakshi	a)Root bark b) seed
66	*Caesalpinia bonducella* (L.) Fleming	Latakaranja	a)Seed, b)Fruit, c)Root bark
67	*Cajanus candicans* Wall.	Adhaki	Seeds
68	*Calophyllum inophyllum* L.	Punnaga	Leaf
69	*Calotropis gigantea (L.) Dryand.*	Arka	Leaves
70	*Calotropis procera* (Aiton) Dryand.	Arka	fruit
71	*Capparis sepiaria* L.	Kakadani	Whole plant
72	*Carthamus tinctorius* L.	Kusumbha	Flower
73	*Carum carvi* L.	Krisna jiraka	Fruit
74	*Cassia angustifolia* M.Vahl	Svarnapatri	Leaf
75	*Cassia fistula* L.	Aragvadha	a)Seed b)Fruit pulp
76	*Cassia tora* L.	Chakramarda	flowers
77	*Centella asiatica (L.) Urb.*	Mandukaparni	Leaf
78	*Centratherum anthelminticum* O.Kuntze.	Aranyajiraka	Seed
79	*Chenopodium album* L.	Vastuka	a)Root, b) Stem, c) Leaf

80	*Chlorophytum arundinaceum* Baker	Shwet musali	Root
81	*Cinnamomum camphora* Nees & Eberm.	Karpura	Leaf
82	*Cinnamomum tamala* (Buch. Ham.) Nees & Eberm	Tvakpatra/	Leaf
83	*Cinnamomum zeylanicum Blume*	Tvak	Inner bark of stem
84	*Cissampelos pareira* L.	Patha	Root
85	*Cissus quadrangularis* L.	Asthisanhara/Asthishrink-hala	Stem
86	*Citrullus Colocynthis* (L.) Schrad.	Indravaruni	Fruit
87	*Citrus aurantifolia* (Christm.) Swingle	Elumicnam	Fruit
88	*Cleome gynandra* L.	Ajagandha	-
89	*Cleome viscosa* L.	-	a)Root, b)Stem, c)Leaf
90	*Clerodendrum siphonanthus* R.Br.	Bharngi bhed	a)Stem b)Leaf
91	*Clerodendrum serratum* L.(Moon)	Bharangi	a)Root b)Seed
92	*Clitorea ternatea* L.	Aparajita	a)Root, b)stem
93	*Coccinia indica* Wight & Arn.	Bimbi	a)Leaf b) Fruit
94	*Cocos nucifera* L.	Narikela	a)Flower b) Fruit dried endosperm
95	*Coleus amboinicus* Lour.	Parnayavani	Root
96	*Coleus vettiveroides* Jacob	Valaka	Root
97	*Commiphora mukul* (Hook. ex Stocks) Engl.	Guggulu	Exudate
98	*Commiphora wightii* (Arn.) Bhandari	Guggulu	Stem
99	*Convolvulus microphyllus* Sieber ex Spreng.	Shankhapushpi	Whole plant
100	*Convolvulus pluricaulis* Chois	Shankhapushpi	Whole plant
101	*Corchorus depressus* (L.) Stocks	Dadmari	Root
102	*Cordia dichotoma* G.Forst.	Shleshmatak	Fruit
103	*Coriandrum sativum* L.	Dhanyaka	Fruit
104	*Coscinium fenestratum* (Goetgh.) Colebr.	Kaliyaka	Stem
105	*Costus speciosus* (J.Koenig) Sm.	Kushtha	Rhizome
106	*Crinum defixum* Ker.	Sukhdarshan	a)Bulb b) Root
107	*Croton tiglium* L.	Jayapala	Seed
108	*Cryptolepis buchanani* Roem & Schult.	Krishna Sariva	Leaf

109	*Cucumis melo* L.	Ervaru	Whole plant
110	*Cuminum cyminum* L.	Sveta-Jiraka	Fruit
111	*Curcuma longa* L.	Haridra	Rhizome
112	*Cuscuta reflexa* Roxb.	Amarvalli	Whole plant
113	*Cymbopogon citratus* Stapf.	Jambiratrina	Rhizome
114	*Cynodon dactylon* L.	Durva	a)Whole plant, b)Rhizome, c)leaf, d)stem
115	*Cyperus rotundus* L.	Mustaka	a)Rhizome b)Root
116	*Cyperus scariosus* R. Br.	Nagarmustak	Rhizome
117	*Datura stramonium* L.	Dhattura	a)Stem b) Leaf
118	*Dendrophthoe falcata* (L.f.) Ettingsh.	-	a)Leaf b) Flower
119	*Dichrostachys cinerea* (L.) Wight & Arn.	Virataru	Stem bark
120	*Digitalis purpurea* L.	Hritpatri	Leaf
121	*Diospyros embryopteris* Pers.	Tinduka	a)Bark, b)Fruits.
122	*Dolichos bifloras* L.	-	Seed
123	*Eclipta alba* (L.) Hassk.	Bhringraja	Whole plant
124	*Elaeocarpus ganitrus* Roxb. ex G.Don	Rudraksha	a)Fruit b) Seed
125	*Elaeocarpus sphaericus* (Gaertn) Schum	Rudraksha	Fruit
126	*Elettaria cardamomum* (L.) Maton	Ela	a)Fruit, b) Seed
127	*Embelia ribes* Burm.f.	Vidanga	Fruit
128	*Emblica officinalis* Gaertn.	Amalaki	a)Whole plant, b)Fruit pulp (fresh & dried)
129	*Ephedra gerardiana* Wall. ex Stapf	Somlata	Stem
130	*Euphorbia dracunculoides* Lam.	Saptala	a)Root, b) stem, c)leaf
131	*Euphorbia hirta* L.	Dugdhika	Whole plant
132	*Euphorbia neriifolia* L.	Snuhi	a)Root b)Leaf c)Stem
133	*Euphorbia prostrata* Aiton	Dugdhika-bheda	Stem
134	*Euphorbia thymifolia* L.	Dugdhika	a)Root, b) stem, c)leaf, d)Whole plant

135	*Evolvulus alsinoides* (L.) L.	Vishnukranta	Whole plant
136	*Feronia limonia* (L.) Swingle	Kapittha	a)Leaves, b)stem bark, c)Root
137	*Ferula foetida* (Bunge) Regel	Hingu	Oleo-gum resin of Root
138	*Ficus hispida* L.f.	Kakodumbar	a)Bark b)fruit
139	*Ficus racemosa* L.	Udumbara	Stem bark
140	*Ficus religiosa* L.	Ashvattha	Stem bark
141	*Ficus rumphii* Blume	Ashmantaka	a)Aerial root , b)underground root c)Stem-bark
142	*Foeniculum vulgare* Mill.	-	a)Seed, b)Fruit
143	*Fritillaria roylei* Hook.	Kshirakakoli	Bulb
144	*Garcinia pedunculata* Roxb. ex Buch.-Ham.	Amlavetasa	Fruit
145	*Garuga Pinnata* Roxb.	Kinkirata, Paranki	Stem-bark
146	*Glycyrhiza glabra* L.	Yashtimadhu	Stolon Root
147	*Gmelina arborea* Roxb.	Gambhari	Stem bark
148	*Gmelina asiatica* L.	-	Root
149	*Grewia asiatica* L.	Parushak	a)Fruit, b) Leaf c)bark
150	*Gymnema sylvestre* (Retz.) R.Br. ex Sm.	-	Leaf
151	*Gynandropsis pentaphylla* (L.) DC.	Ajagandha	a)Root, b)stem, c) leaves
152	*Habenaria intermedia D.Don*	-	Root tuber
153	*Hedychium spicatum* Ham. ex Smith	Shathi	Rhizome
154	*Hemidesmus indicus* (L.) R. Br. ex Schult.	Shveta sariva	Root
155	*Hibiscus rosa -sinensis* L.	Japa	a)Leaf, b) Root, c)Flower
156	*Hiptage benghalensis* (L.) Kurz.	Madhavilata	a)Root, b)stem, c) leaf
157	*Holarrhena antidysenterica* (Roth.) A. DC	Kutaja	a)Stem bark b) Seed
158	*Holoptelea integrifolia* Planch.	Chirbilva	Stem bark
159	*Hydnocarpus laurifolia* (Dennst.) Sleum.	Tuwarak	Seed

160	*Inula racemosa* Hook f.	Pushkarmoola	Root
161	*Juglans regia* L.	Akshot	a)Fruits, b)Whole plant
162	*Kigelia pinnata* (Jacq.) DC.	Balamkhira	fruit
163	Laksha	-	Seed
164	*Lantana camara* L.	Ghaneri	a)Whole plant b)Leaf
165	*Lavendula bipinnata* L.	Shankhapushpi	a)Root, b) stem, c) leaves
166	*Lawsonia inermis* L.	Madayantika	Leaf
167	*Leea aequata* L.	Kakajangha	Whole plant
168	*Lepidium sativum* L.	Chandrashura	Seed.
169	*Leucas cephalotus* Spreng.	Dronapushpi	Seed
170	*Linum usitassimum* L.	Atasi	Seeds
171	*Litsea glutinosa* (Lour.) C.B.Rob.	Medasaka	a)Stem – bark b)Wood
172	*Madhuca indica* J. F. Gmel.	Madhuka	Flower
173	*Mangifera indica* L.	-	a)Seed, b)Endosperm , c) Whole plant
174	*Manilkara hexandra* (Roxb.) Dubard	Rajadani	a)Whole plant b)Leaf, c)root, d)stem e) stem-bark
175	*Marsilea minuta* L.	Sunishannaka	a)Whole plant Leaf b)sporocarp
176	*Martynia annua* L.	Vyaghranakha	Fruit
177	*Melaleuca leucodendron* L.	Kajuput	a)Leaf b) seed
178	*Melocanna bambusoides* Trin.	-	Whole plant
179	*Merremia gangetica* (L.) Cufo	Akhuparnika	Whole plant
180	*Mesua ferrea* L.	Nagakeshar	a)Stamen, b) Bark c) leaves
181	*Michelia champaca* L.	Champaka	Stem bark
182	*Microstylis muscifera* Ridley	Rishabhaka	Root tuber
183	*Microstylis wallichii* Lindl.	Jivaka	Pseudobulb
184	*Mimosa pudica* L.	Lajjalu	Whole plant
185	*Mimusops elengi* L.	Bakula	a)Leaf, b) Seed

186	*Mirabilis jalapa* L.	Andhimalligai	a)Root tuber, b)leaves
187	*Momordica charantia* L.	Karavellaka	a)Seed, b) Fruit
188	*Moringa oleifera* Lam.	Shigru	a)Seed, b) Root, c) bark, d)flower e) fruit
189	*Moringa pterygosperma* Gaertn.	Shigru	a)Root, b) stem bark, c) leave
190	*Mucuna prurita* L.	Atmagupta	a)Root, b) seed
191	*Musa paradisiaca* L.	Kadali	a)Root, b)rhizome, c)stem
192	*Myrica nagi* Thunb.	Katphala	Bark
193	*Myristica fragrans* Houtt.	Jatiphal	Seed
194	*Nardostachys jatamansi* (D.Don) DC.	Jatamansi	Root
195	*Nerium indicum* Mill.	Karvira	Leaf
196	*Nigella sativa* L.	Upakunchika	Seed
197	*Nilgirianthus heyneanus (Nees) Bremek.*	Sahachara	a)root b) leaf
198	*Nyctanthes arborstristies* L.	Parijata	Leaf flower
199	*Nymphaea nouchali* Burm.f.	Kumuda	a)Root, b)rhizome, c)Petiole, d) flower, e)seed
200	*Nymphaea stellata*Willd.	Utpala	Whole Plant
201	*Operculina turpethum* (L.) Silva Manso	Trivrit	Matured root
202	*Oroxylum indicum (L.) Kurz*	Shyonaka	a)Leaf, b) bark, c)fruit
203	*Ougeinia oojeinens*is (Roxb.) Hochr	Tinisha	Stem Bark
204	*Oxalis corniculata L.*	Changeri	Whole Plant Juice
205	*Paederia foetida* L.	Gandhaprasarani	Whole Plant
206	*Paspalum scrobiculatum* L.	Kodrava	Seed
207	*Pavonia odorata* Willd.	Hribera	a)Root b) shoot
208	*Pedalium murex* L.	Brihat Gokshura	Root & fruit
209	*Phaseolus radiatus* L.	Masha	Seed

210	*Phaseolus trilobus* Ait.	Mudgaparni	Whole plant
211	*Phyla nodiflora* L.	Jalapippli	Whole plant
212	*Phyllanthus emblica* L.	Amalaki	Pericarp
213	*Phyllanthus niruri* L.	Bhumyamalaki	a)Root, b) stem, c)leaf.
214	*Picrorhiza kurroea* Royale ex Benth.	Katuki	Rhizome with roots
215	*Pinus longifolia* Roxb.	Sarala	Leaf
216	*Piper cubeba* L.f.	Kankol	Fruit
217	*Piper longum* L.	Pippali	Fruit
218	*Piper nigram* L.	-	Fruit
219	*Piper retrofractum* Vahl.	Chavya	Stem
220	*Piper longum* L.	Pippali	Fruit
221	*Pistacia integerrima* J. L. Stewart ex Brandis	Karkatashringi	a)petiole gall b)Fruit/Gall
222	*Pistia stratiotes* L.	Jalakumbhi	-
223	*Plumbago rosea* L.	Chitraka	Root
224	*Plumbago zeylanica* L.	-	Root
225	*Pongamia pinnata* (L.) Pierre	Karanja	a)Bark, b)Whole Plant
226	*Portulacastrum monogynum* (L.) Medik.	-	-
227	*Premna integrifolia* L.	Agnimantha	Stem
228	*Prunus avium* L.	Elavaluka	a)Bark b) leaves
229	*Prunus cerasoides* Buch.-Ham. ex D.Don	Padmaka	a)Leaf, b)stem, c) Fruit d) bark
230	*Psoralea corylifolia* L.	Bakuchi	a)Seed b)Fruit
231	*Pterocarpus marsupium* Roxb.	Asana/Vijaysara	a)Stem b) Stem bark c) Heart Wood d) Leaf
232	*Pueraria tuberosa* (Willd.) DC.	Vidarikanda	Tuberous root
233	*Punica granatum* L.	Dadima	a)Leaf, b) bark c) fruit Pericarp , d)Seed
234	*Raphanus sativus*(L.) Domin	Moolaka	a)Root, b)Whole plant c) Seed
235	*Rheum australe* Wall.	Revandchini	Root

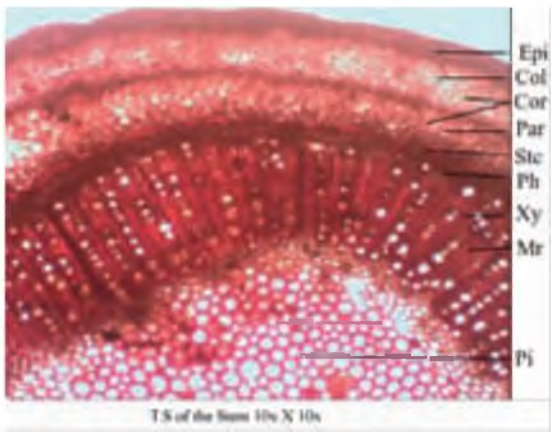
236	*Rhus parviflora* Roxb.	Tintidika	Whole plant
237	*Ricinus communis* L.	Eranda	a)Fruit, b) Root
238	*Ruta graveolens* L.	Sitabha	leaves
239	*Saccharum officinarum* L.	Ikshu	a)Stem b) leaf
240	*Saccharum spontaneum* L.	Kasha	a)Root, b)stem c) leaf
241	*Salmalia malabarica (DC.) Schott & Endl*	Shalmali	a)Flower b) fruit c) Root d) stem e) leaf Exudate
242	*Sapidoentum.kutz.*	Kadali, Rambha	-
243	*Sapindus pinnatus* Roxb. ex Hiern	Amratak	Fruits
244	*Sapindus trifoliatus* L.	-	Fruit
245	*Saraca asoca* (Roxb.) Willd.	Ashoka	Stem bark
246	*Saraca Indica* L.	Ashoka	Bark
247	*Sarcostemma acidum* (Roxb.) Voigt	Somlata	Stem
248	*Sarcostemma brevistigma* Wight & Arn.	Somlata	Stem
249	*Saussurea lappa* (Decne.) Sch.Bip.	Kustha	Root
250	*Scindapsus officinalis* (Roxb.) Schott	Gaja-pippali	a)Female spadix , b)Fruit
251	*Scirpus kysoor* Roxb.	Kasheruk	Roots.
252	*Selinum candollei* Edgew.	Mura	Root
253	*Semecarpus anacardium* L.	Bhallataka	Fruit
254	*Sesamum orienfale* L.	-	Seed
255	*Sesbania grandiflora* (L.) Pers.	Agastya	Flowers
256	*Sesbania sesban* (L.) Merr.	Jayanti	Seed
257	*Seseli indicum* Wight & Arn.	Banyamani	Fruit
258	*Sida acuta* Burm. f.	Bala Bhed	a)Root, b) Stem, c)Leaf
259	*Sida cordifolia* L.	Bala	a)Dried Roots, b) Whole Plant, c)Stem, d)Root
260	*Sida spinosa* L.	Bala Bhed	a)Root, b) Stem, c) Leaf
261	*Sida veronicifolia* Lam.	Bala Bhed	a)Root, b) Stem, c) Leaf

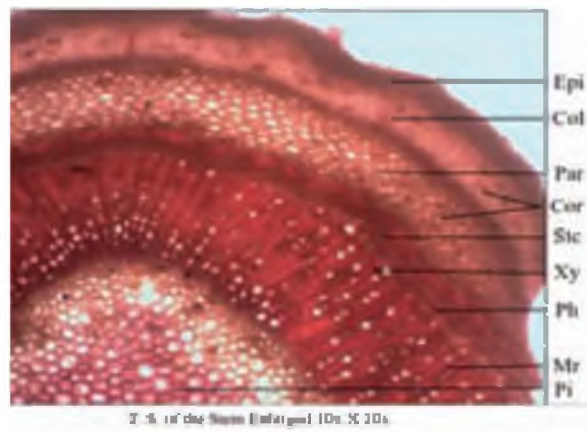
262	*Sisymbrium irio* L.	-	Fruit
263	*Solanum indicum* L.	Brihati	Root
264	*Solanum nigrum* L.	Kakamachi	Seed
265	*Solanum surattense* Burm. f.	Kantakari	Whole plant
266	*Solanum violaceum* Ortega	-	Whole plant
267	Soubhagya Vati Formulation	-	-
268	*Soymida febrifuga* A. Juss.	Rohini	Stem bark
269	*Spondias pinnata* (L. f.) Kurz	Amrataka	Stem bark
270	*Spondius magnifera* Willd.	Amrataka	a)Leaf, b) bark, c) fruit
271	*Streblus asper* Lour.	Shakhotata	a)Root, b)Stem bark, c)Bark
272	*Strychnos nux-vomica* L.	Kupilu	Seed
273	Sveta parpati.	-	-
274	*Symplocos racemosa* Roxb.	Lodhra	Stem bark
275	*Syzygium aromaticum*(L.) Merr. & L.M. Perry.	Lavanga	Flower bud
276	*Syzygium cumini* (L.) Skeels	Jambu	a)Seed , b)Fruit , c)Rhizome (dried)
277	*Tamarindus indica* L.	Chincha	Seed Root Leaves
278	*Taxus baccata L.*	Talispatra	Leaf
279	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn	Arjuna	a)Stem bark, b)fruit , c)Cotyledons
280	*Terminalia bellerica* (Gaertn.) Roxb.	Bibhitaka	a)Leaf, b) bark, c)fruit, d)Fruit pulp
281	*Terminalia catappa* L.	Grahadruma	a)Leaf, b)bark, c)fruit
282	*Terminalia chebula* Retz.	Haritaki	a)Fruit, b)bark, c)Pericarp
283	*Terminalia tomentosa* W. & A.	Arjuna bhed	a)Leaf b) bark
284	*Tinospora cordifolia* (Wild.)Miers.	Guduchi	Stem
285	*Trachyspermum ammi* (L.) Spargue ex Turril.	Yavani	Fruit
286	*Trapa bispinosa* Roxb.	Shringataka	Fruit

287	*Tribulus terrestris* L.	Gokshura	Fruit
288	*Trichosanthes Cucumerina* L.	Patola bhed/Chichinda	Whole plant
289	*Trichosanthes dioica* Roxb.	Patola	a)Root , b)leaf , c)fruit d)seed
290	*Trichosanthes palmata* Roxb.	Vishala	Fruit
291	*Tridax procumbens* L.	Jayanti bhed	Whole plant
292	*Trigonella foenum-graecum* L.	Methika	Seed
293	*Tylophora indica* (Burm. f.) Merr.	Arkaparni	Leaf
294	*Typha angustata* Bory & Chaub.	Gundra	Root.
295	*Typha australis* K. Schum. & Thonner	Gundra	Root
296	*Vallaris solanaceae* (Roth) Kuntze	Bhadravalli	a)Leaf, b)stem bark
297	*Vateria indica* L.	Sarja	-
298	*Vemonia anthelmintica* Willd.	Somraji	Seed
299	*Vernonia cinerea* (L.) Less.	Sahadevi	Whole plant
300	*Vigna radiata* (L.) R.Wilczek	Mudga	a)Root, b) stem, c) leaf
301	*Vigna trilobata* (L.) Verdc.	Mudgaparni	a)Root, b)stem, c)leaf
302	*Viola odorata* L.	Banafsha	a)Whole plant, b)Fruit
303	*Vitex negundo* L.	Nirgundi	a)Leaf juice, b)stem c) fruit
304	*Vitex trifolia* L.	Nirgundi bhed	Leaf
305	*Vitis venifera* L.	Draksha	a)Root, b)seed, c)Fruits d)leaf
306	*Wedelia chinensis* (Osbeck) Merr.	Pitbringraj	Whole plant
307	*Withania coagulans* (Stocks) Dunal	Rishyagandha	Fruit
308	*Withania somnifera* (L.) Dunal	Ashwagandha	Root
309	*Woodfordia fruiticosa* (L.) Kurz.	Dhataki	a)Flower, b) Leaf
310	*Wrightia tinctoria* (Roxb.) R.Br.	Shweta kutaja	Seed
311	*Zaleya pentandra* (L.) C.Jeffrey	Punarnava	Root
312	*Zingiber officinale* Roscoe	Ardraka	a)Rhizome (Fresh & dried), b)Stem bark

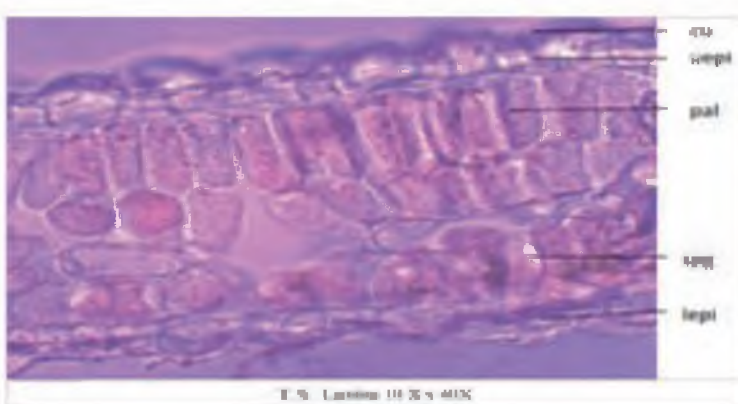
Plates of Photo Microscopy of selected Medicinal Plants

VASA (Stem) *Adhathoda zeylanica* Medik.





Abrus precatorius L. (Leaf)



Albizia lebbeck (L.) Benth.

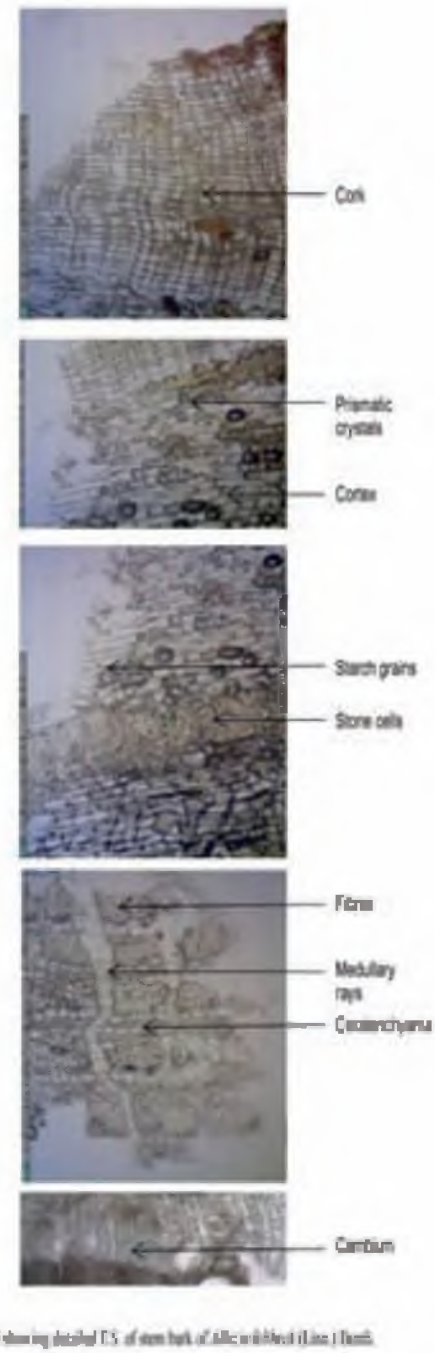


Figure Showing detailed T.S. of stem bark

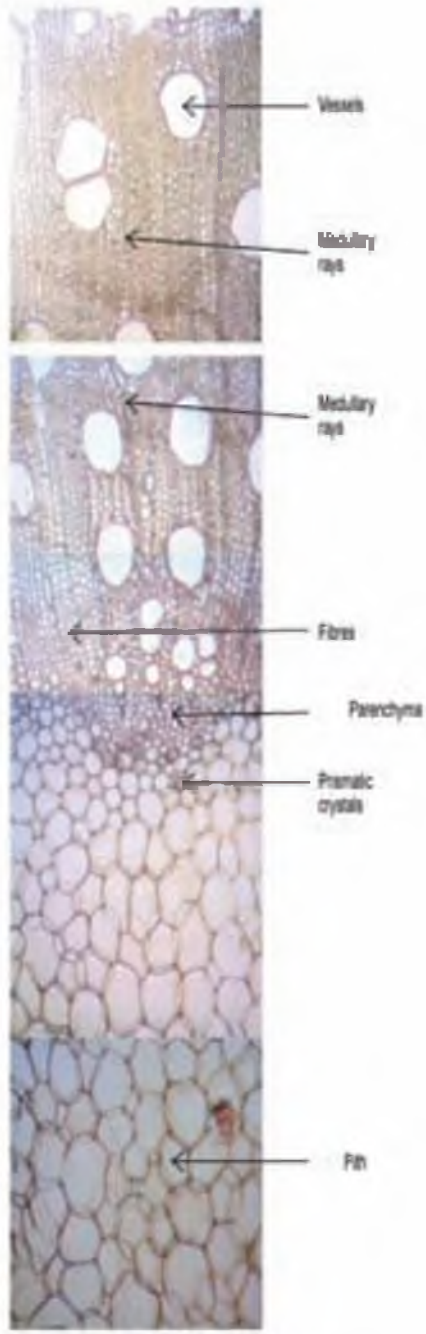
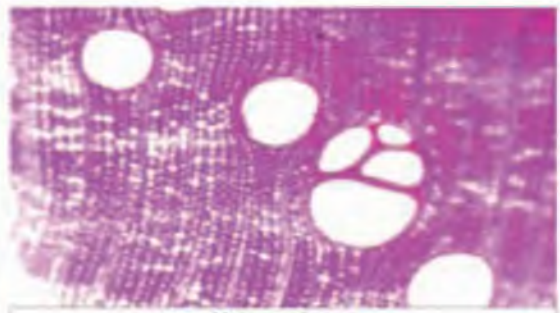


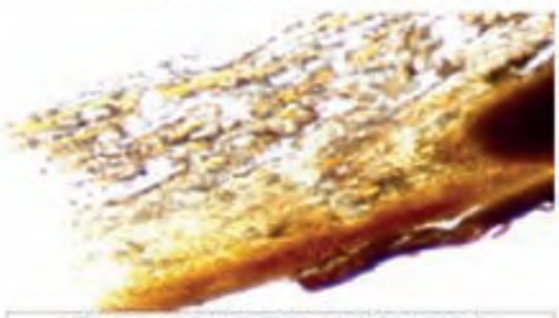
Figure Showing detailed T.S of wood

FIGURES OF POWDER MICROSCOPY

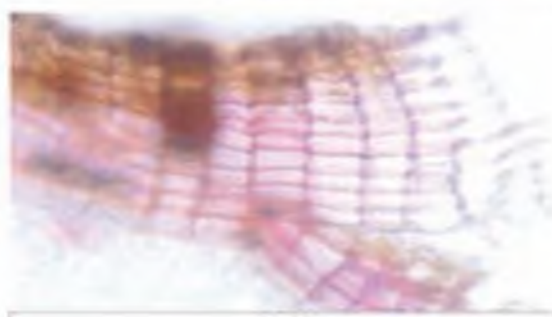
Cork cells with stone cells



Xylem of root



Transversally cut fragment of root bark



Cork

Powder microscopy of *Aristolochia indica* L. (leaf)

Powder microscopy of *Curcuma domestica* Valeton

CHAPTER-7

RESEARCH PROJECTS

Central Council for Research in Ayurvedic Sciences (CCRAS) has been involved in survey and documentation of medicinal plants of India used in Ayurveda system of medicine under programme projection of Annual action plan since 1969. conducted 974 survey tours, covered more than 976 forest areas across the country. During survey more than 1.5 Lakh Medicinal Plant were collected alongwith 10,000 folk claims (Approximately). 19,000 Museum samples were preserved and 1 lakh (Approximately) Herbarium sheets were documented.

CCRAS is also maintaining 4 Herbal gardens in different geographical regions for the demonstrative purpose and total number of 533 plant species were maintained in the Demonstrative gardens of CCRAS and Developed 30 Protocols on the medicinal plants has been developed for the cultivation. In vitro propagation studies on 21 Plants species has also been carried out by the council till date. Since inception to 2011, Council has developed Pharmacognastical standards on 312 Medicinal plant species.

From 2011 onwards In order to create acceptable scientific evidence on Ayurvedic formulations, Intra Mural Research projects (IMR) has been taken up in the field of Medicinal Plants research. The work done under 38 IMR projects out of them 14 were completed and 24 Projects were ongoing they are as follows:-

A) COMPLETED PROJECTS

Sl No.	Title of the project	Participating Institute
1.	Pharmacognostic and Preliminary Phytochemical Evaluation on selected Antidiabetic Medicinal Plants, with reference to its importance in Dietetic Preparations, Nutritional values, with Traditional uses.	RARI Bangalore
2.	Compendium of Ayurveda Dietetics with reference to Cereals and Pulses.	RARI Bangalore
3.	Cultivation of High valued Medicinal Plants in Medicinal Plants Garden	RARI, Itanagar
4.	Development of pharmacopoeial standards of traditionally Used Ayurvedic Formulations	RARISD, Patiala
5.	Pictorial guide of commonly used medicinal plants of Sowa Rigpa and Ayurveda	NRISR, Leh IC,
6.	Documentation of Folk healers and folk claims in the state of Assam and development of a database	RARIGD,Guwhati
7.	To establish the best procurement time for certain herbs by analyzing the seasonal variation in bioactive secondary metabolite with quantitative HPLC	RARI Jhansi
8.	Pharmacognostical evaluation of medicinal plants cited in Ayurvedic formulary of India excluding the plants mentioned in Ayurvedic Pharmacopoeia of India	CSMDRIADD, Chennai, RARIED, Lucknow, NRI-ADD, Kolkata, NRIBAS, Pune, NIAPR, Patiala and NADRI, Bangalore

9.	Documentation, critical analysis and interpretation of pharmacognostical data and parameters of single medicinal plants drugs from different published resources	RARIDD, Gwalior; CARIDD, Kolkata, RAIFR, Pune, RARIMD Bangaluru and CSMRADDI, Chennai
10.	Medico-Botanical Survey of Andaman & Nicobar Islands (selected areas)-	RRCA, Port Blair.
11.	Documentation of ethno-medicinal practices and remedial property of different plants used by the tribes of Kumaun region of Uttarakhand	RARI, Tarikhet
12.	Market survey on selected crude drugs of India for their authentication and commercial availability	CCRAS Hqrs., New Delhi.
13.	Digitization of Herbarium available in CCRAS	CCRAS Hqrs., New Delhi.
14.	Ethno-medicinal survey of plants used in various diseases by tribes of Thandarai, Chengalpattu, Kancheepuram District, Tamilnadu	CSMRADDI, Chennai

B) ON GOING PROJECTS

Sl No.	**Title of the project**	**Participating Institute**
1.	Studies on Development of Agro Techniques of two important Medicinal Plants of Laghu panchmool.	NRIBAS, Pune
2.	RAPD based DNA Fingerprinting to understand genetic variations and Phytochemical analysis of selected medicinal plants.	NRIBAS, Pune
3.	Exploration, acclimatization and *in vitro* propagation of Medicinal Plants being used under the name Agnimantha	NRIBAS, Pune
4.	Selection of salt-tolerant cell lines and regeneration of salt tolerant plantlets of Prishniparni (Uraria picta (Jacq.) Desv) and Shalaparni (Desmodium gangeticum (L.) DC.	NRIBAS, Pune
5.	Development of Data Bank on Ethno-botanical research and cross cultural study on sociology of reproductive healthcare of tribal societies involving medicinal plants across Northeast India	RARIGID, Guwahati
6.	Pharmacognostical evaluation of medicinal plants cited in Ayurvedic Formulary of India excluding the plants mentioned in Ayurvedic Pharmacopoeia of India.	CARIDD, Kolkata
7.	Pharmacognostical evaluation of medicinal plants cited in Ayurvedic Formulary of India excluding the plants mentioned in Ayurvedic Pharmacopoeia of India.	RAIFR, Pune

8.	Pharmacognostical evaluation of medicinal plants cited in Ayurvedic Formulary of India excluding the plants mentioned in Ayurvedic Pharmacopoeia of India.	RARIDD, Gwalior
9.	Pharmacognostical evaluation of medicinal plants cited in Ayurvedic Formulary of India excluding the plants mentioned in Ayurvedic Pharmacopoeia of India.	RARIMD, Banglore
10.	Pharmacognostical evaluation of medicinal plants cited in Ayurvedic Formulary of India excluding the plants mentioned in Ayurvedic Pharmacopoeia of India.	CSMRADDI, Chennai
11.	Authentication of selected crude drugs through Pharmacognostical evaluation collected from various markets of India	CARIDD, Kolkata
12.	Pharmacognostical evaluation of Selected crude drugs available in various markets of India	RARIUD Jammu and CSMRADDI, Chennai
13.	Compendium of Ayurveda dietetics with refrence to oil seeds	RARIMD, Banglore
14.	Development of pictorial database of economically important parts of selected medicinal plants of RAIFR Pune (Tree species)	RAIFR, Pune
15.	Developing Pharmaco gnostical standards for some Ambiguous Ayurvedic Drugs (Sandigdha Dravyas) appearing in the Ayurvedic formularies, part I to III	CSMRADDI, Chennai
16.	Development of agrotechniques for high altitude endangered medicinal plants of trans Himalaya	NRISR, Leh
17	Medico-Ethno Botanical Survey programme of Gyalshing , Mangan , Namchi , Gangtok forest divisions of Sikkim.	RARI, Itanagar
18.	Medico-Ethno Botanical Survey programme of Rudrprayag/Kedarnath wild life forest divisions in Uttarakhand.	RARI, Tarikhet
19.	Medico-Ethno Botanical Survey programme of Shahjahan Pur,Dhar, Jhabua, Pilibhit forest divisions .	RARI, Jhansi
20.	Medico-Ethno Botanical Survey programme of District Kullu of Himanchal Pradesh	RARIND,Mandi
21.	Development of Raw drug Museum on Pratinidhi dravyas along with adulterants used against medicinal plants in Ayurveda system	RARIGID, Guwahati
22.	Medico-Ethno Botanical Survey programme of Hasan & Yadgir Districts of Karnataka.	RARIMD, Banglore
23.	Medico-Ethno Botanical Survey programme of Khasi Hills (North part) in Meghalaya	RARIGID, Guwahati
24.	Digitization of Herbarium sheets and Development of Digital Herbarium at Regional Ayurveda Research Institute Jhansi.	RARI, Jhansi

CHAPTER-8

BOOKS &MONOGRAPHS

DETAILS OF BOOKS AND MONOGRAPHS PUBLISHED UNDER MEDICINAL PLANT RESEARCH

The Outcomes of Medicinal Plant Research which includes Documentation and inventories on Medicinal plants (Publications), Monographs and Articles covering the Ethno Medical Practices in different states.

1.	A Report on Medical Plants of Kachchh (Gujarat) – English(1998)
2.	Contribution to the Medico-Botany of East Godavari and West Godavari District of Andhra Pradesh (English)(1989)
3.	Glimpses of Medico-Botany of Bastar District (M.P.) –English(1990)
4.	Medicinal Plants of Nagpur and Wardha Forest Divisions, Maharashtra (E)(1999)
5.	Medico-Botanical Exploration of Phulbani and Koraput districts of Orissa (E)(1996)
6.	Medico-Botanical Exploration of Puri District (Orissa) – English(1989)
7.	Medico-Ethno-Botanical Explorations of Sikkim Himalayas(1991)
8.	Medico-Ethno-Botany of Sonebhadra District (English)(1993)
9.	Observations of Medico-Botany of Andaman-Nicobar Islands (English)(1988)
10.	Preliminary Techno Economical Survey of Natural Resources and Herbal Wealth of Laddakh (English)(1976)
11.	Tribal Pockets of Nilgiris Recordings of the Field Study on Medical Flora and Health Practices (English)(1976)
12.	Uttarakhand Vanoushadhi Darshika (English)(1977)
13.	Database on Medicinal Plants used in Ayurveda Vol. 1 (2000)
14.	Database on Medicinal Plants used in Ayurveda Vol. 2 (2001)
15.	Database on Medicinal Plants used in Ayurveda Vol. 3 (2001)
16.	Database on Medicinal Plants used in Ayurveda Vol. 4 (2002)
17.	Database on Medicinal Plants used in Ayurveda Vol. 5 (2002)
18.	Database on Medicinal Plants used in Ayurveda Vol. 6 (2004)
19.	Database on Medicinal Plants used in Ayurveda Vol. 7 (2005)
20.	Database on Medicinal Plants used in Ayurveda Vol. 8 (2007)
21.	Database on Medicinal Plants used in Ayurveda &Siddha Vol. 1 (2007)
22.	Database on Medicinal Plants used in Ayurveda &Siddha Vol. 5 (2008)
23.	Sadi Mittar Dugar Deeyan Jadiyan-Butiyan (Dogari)(1999)
24.	The Medico-Ethno-Botany of Lower Subansiri District (ArunachalPradesh) (1993)

25.	Hamari Mitra Jammu-Pradesh ki Vanaushdhiyan (Hindi)(2003)
26.	Healing Herbs of Himalaya (English)(2008)
27.	Himalaya ki Arogyadayi Vanaspatiyan (Hindi) (2008)
28.	Herbal Wealth of Uttarakhand-Vol 1(2014)
29.	Herbal Wealth of Uttarakhand-Vol 2(2015)
30.	Herbal Wealth of Western Ghats –Agasthyamalai (2016)
31.	Medico-Botany of Andaman & Nicobar Islands - Recent Study (2016)
32.	Comprehensive Technical Dossier on following plants prepared: Series-I, Number-1: Acorus calamus (2015).
33.	Series-1, Number-2: Alium cepa (2015).
34.	Series-I, Number-3: Commiphora wightii (2016).
35.	Series-1, Number-4: Juglans regia (2016).
36.	Medico-Ethno Botanical Survey Programme (2012-2017) Glimpses of CCRAS Contribution(2018)
37.	Pharmacognosy of Indigenous Drugs Vol. I to III (Reprint 2005)
38.	Conservation, cultivation and exploration of therapeutic potential of Medicinal plants (2014)
39.	Recent Trends in Good Agricultural and Collection Practices for Medicinal Plants: with special focus on identification and value addition (2015)

ABSTRACT OF THE BOOK / MONOGRAPHS

1. A Report on Medicinal Plants of Kachchh (Gujarat):

The assessment of herbal wealth of Kachchh was carried out by undertaking exhaustive survey of medicinal plants by Regional Research Institute (Ay.), Junagadh in different seasons and covering different localities. The main emphasis was given to locate the medicinal plants along with their abundance, prospects of collection and cultivation. The outcome of these survey tours, conducted between 1983 to 1987, resulted into recording of more than 400 plant species out of which 125 plants were identified to be of medicinal value. During the survey work 31 folk medicinal use of 23 plants were also been recorded.

2. Contribution to the Medico-Botany of East Godavari and West Godavari District of Andhra Pradesh

The survey team of the Regional Research Centre (Ay.) Vijayawada (A.P.) has particularly surveyed the interesting forest areas of the Papi hills and Maredumilli forests, besides other areas of the two districts from 16.12.1980 to 8.1.1981. The general notes on topography, vegetation, flora, medicinal plants etc. have been recorded together with collection of specimens/ raw drugs. In the present work 185 folk medicinal lore based on 128 medicinal plants have been recorded. Some claims are pertaining to the diseases of cattle/ birds while the others are related to human diseases like diarrhoea, dysentery, dental disorders, worm-infestation etc.

3. Glimpses of Medico-Botany of Bastar District (M.P.)

The Present Publication entitled "Glimpses of Medico-Botany of Bastar District (M.P.)" is the result of one such survey conducted in the tribal area of Bastar District in Madhya Pradesh. It was undertaken to assess both quantitatively and qualitatively the availability of all the drugs used in

the Ayurvedic and Siddha medicines. It is based on the data gathered during the period from 19th December 1978 to 18th Feb. 1979. This covers the various Medico-Botanical findings including the Tribal medicine and the medicinal flora. The commercial aspects with a particular reference to the medicinal plants of the Bastar District are also dealt with. The tribal pockets visited by the Survey team are those ones inhabited by the Dorla(Koya), Gond, Maria, Muria, Dandami-Maria, Bhatra, Halba and other tribes. The remotest pocket Abhujmar, popularly known as the `Unkown Plateau' inhabited by the Abhuj marias was also touched by this survey. A total of 750 plant species belonging to 499 genera in 147 families, have been collected.

4. Medicinal Plants of Nagpur and Wardha Forest Divisions, Maharashtra

In the present book about 300 plant species which are of medicinal importance have been enumerated along with Sanskrit/local names with brief description of the plant, flowering and fruiting season, medicinal uses and quantum o f availability. The folk medicinal uses of some plants are also included. Data on topography, soil, climate, forest and vegetation type, fauna etc. has also been presented in detail in the book. This publication will be of immense importance for scholars, foresters and all those connected with the utilization of medicinal plants. In this book data on topography, soil, climate, mineral, forests and vegetation, fauna, etc. of Nagpur and Wardha forest divisions, has been presented. An account of 297 medicinal plants of Nagpur and Wardha forest divisions with useful information on Sanskrit names, local names, habit, habitat, systematic description of plants, medicinal values and folk medical claims, wherever available have been presented.

5. Medico-Botanical Exploration of Phulbani and Koraput districts of Orissa

The present publication "Medico-Botanicai Exploration of Phulbani & Koraput districts of Orissa", is based on the field studies carried out by the special Survey team led by Dr.Koppula Hemadri, Survey Officer, Regional Research Centre (Ay.), Vijayawada during 40 days tour to the area in May-June, 1980, followed by 5 tours, each of about 10-12 days duration, undertaken by the teams of Survey of Medicinal Plants Unit,C.R.I.(Ay.) Bhubaneshwar, survey was conducted in different seasons during 1981-85. The first chapter, i.e., Introduction - besides presenting a general account of topography, geology, climate, vegetation & medicinal flora etc. also gives first hand information on socioreligious customs of various tribes inhabiting the area. Second chapter deals with the flora, wherein 726 species belonging to 489 genera and 140 families of Angiosperms, Gymnosperms & Pteridophytes, collected from and observed in the area, are enumerated along with Sanskrit & vernacular names of the plants, short field notes, abundance, distribution and field numbers. In addition, more than 375 folklore claims related to 209 medicinal plants were gathered from the tribal people of the area, which are described in Chapter-3. The last chapter deals with the prospects of trade with particular reference to medicinal plants, appending a list of important medicinal taxa of the area.

6. Medico-Botanical Exploration of Puri District (Orissa)

The publication "Medico-Botanical Exploration of Puri District (Orissa)"based on the field studies carried out between 1976-1980, has been presented in a comprehensive manner. The details of medicinal properties and possible uses of about 500 plant drugs are discussed briefly from modern as well as Ayurvedic point of view after enumeration of names of plants and area of their availability. The folk medical uses of the drugs observed. The emphasis on possible utilization from Ayurvedic literature appears to be the first attempt in this publication.

7. Medico-Ethno-Botanical Explorations of Sikkim Himalayas

Sikkim Himalayas have very less been explored for the medicinal plants wealth in the state. The Council has deputed two special survey team to explore these areas in two different seasons, Medico-Ethno-Botanical Survey of Sikkim Himalayas incorporates the approach, process of progress and observations relevant to aims and objects of special Survey tour programme for which this unique tour was conducted first tour in Sikkim areas for a period of 40 days. The second special survey tour was conducted for 75 days i.e. 20th July, 1978 to 5th October, 1978. The survey teams of the Council have gathered details regarding to the flora and fauna, mineral wealth, medical practices, folk-medicine, life and habits of local people and their socio-religious customs etc. Besides this, trade prospects and economics o f available drugs of Sikkim has also been studied and presented in this publication. A bout six thousand plant specimens have been collected which represent about 900 species. It includes 160 traditionally used drugs. 430 species o f medicinal importance and 25 of commercial value were also collected. A bout 100 species of medicinal orchids are collected from Sikkim area. This book is an outcome of these endeavours' and details out the work conducted on herbal plants in Sikkim.

8. Medico-Ethno-Botany of Sonebhadra District

The Indian Institute of Ayurveda for Drug Research Tarikhet (Ranikhet) U .P. undertook the task of survey work in tribal rich pockets of Mirzapur district (now falling in newly bifurcated district Sonebhadra) of Uttar Pradesh. The potential of the above work was assessed in June 1979. Later a team comprised of a Botanist and a person of Ayurveda discipline was deputed for a period of two months during 23rd October to 21st December, 1979. The survey team has visited 37 areas during which 290 Ethno-medicinal plants, 277 species of plants for herbarium samples of animal and mineral products related with the human and veterinary use were collected. The gains of the survey work presented here include the enumeration of herbarium specimens collected for identification of medicinal plants belonging to 277 species under 68 families, occurrence of 128 drug resources of the Ayurvedic importance.

9. Observations of Medico-Botany of Andaman-Nicobar Islands

The present publication entitled, "Observations on Medico-Botany of Andaman and Nicobar Islands", is the outcome of two special surveys conducted by CCRAS in the years 1975 and 1980 to assess both qualitatively and quantitatively the availability of all the drugs used in Ayurveda and Siddha medicines and to record a picture of socioeconomic habits of the tribes of the Islands and folk-lore claims etc.

The Andaman and Nicobar Islands encompasses some interesting flora and tribes totally different from the mainland of the country. The present work which is the resultant of two tours in 1975 and 1980 provides a glimpse of the Medico-Botanical potential of the Islands and deals with some of the socio-hygienic aspects of the local tribes/population.

A total number of 223 species are found as medicinal out of 306 species collected; a total number of 141 species are found to be useful in Ayurvedic system of medicine. Some folklore claims of the tribes are also recorded. The information in this publication will be useful not only for the establishment of Ayurveda in the Islands but also for exploiting the herbal potential of the Islands for the betterment of mankind.

10 . Preliminary Techno Economical Survey of Natural Resources and Herbal Wealth of Laddakh

The Central Council for Research in Indian Medicine and Homoeopathy conducted a three-month pilot techno-socioeconomic survey of Ladakh area often referred to as 'Dust Bowl o f

Earth' or a 'Land of Ruins'. The team during its pilot survey collected details relating to social life, customs, food habits, disease incidence, traditional medical knowledge, medical systems, medical practices, medico-botanical wealth, mineral deposits, fauna of the area, with an accent on the scope for minimizing importing of raw drug material involving foreign exchange. Ladakh is the northern-most district of Jammu and kashmir State. The team surveyed Drass, Kargil, Leh, Chumanthan and Nubra ranges and collected 1025 plants species. The important medicinal plants o f these various regions are also enumerated.

11. Tribal Pockets of Nilgiris Recordings of the Field Study on Medical Flora and Health Practices

The present publication provides information on the areas of tribal inhabitations selected for study from medico social angle along with information on medico-botanical aspects, folk medicine and other associated details. The team also utilized the information available with the Tribal and Harijan Welfare Officers, Divisional Forest Officers, and Census Reports published by the Govt, of India. The team collected the information on habits, diet patterns, marital status, marital customs, occupation; prakriti (constitutional studies) of certain tribes on the lines described in Ayurveda, disease incidence etc. The team collected a number of medical claims/taboos and folk-lore therapies considered to be of interest to scientific workers. A total number o f 287 field numbers of plants were collected; a total number of 93 folklore claims were gathered; a total number of 213 persons received incidental medical aid during the tour.

12. Healing Herbs of Himalaya

The Central Council for Research in Ayurveda and Siddha (CCRAS) has carried out commendable work in Medico-Ethno-Botanical Research through its peripheral Institutes located at Himalayan Regions. The present treatise on "Healing Herbs of Himalaya" offers itself as a pictorial and herbaria guide on 50 important medicinal plants available at Indian Himalayan Region. The book provides an overview of various facts of the herbal wealth of Indian Himalayan Region.

13. Database on Medicinal Plants used in Ayurveda Vol. 1 to 8(2000-2007)

Data base on Medicinal Plants is the first comprehensive work, which provides all aspects of medicinal plants used in Ayurveda. The publications has emerged out of the dedicated efforts of Dr. P.C. Sharma, the Assistant Director, in-charge, Jawaharlal Nehru medicinal Plants Garden and Herbarium, Pune one of the units of Central Council for Research in Ayurveda & Siddha. In these books there was a compilation of medicinal plants of Ayurvedic importance. And also it contains a wide spectrum of information covering almost all aspects of each plant, supported by a comprehensive bibliography incorporating Ayurvedic references as well as others.

14. Herbal Wealth of Uttarakhand-Vol- I&II (2014-2015)

The present monographs, retaining to the "Herbal Wealth of Uttarakhand"(Vol-I&II) is an attempt towards our understanding of the diversity of seed bearing plants from this important sector of Himalaya is characterized by wide topography which shared by the upper Gangetic plain, the Siwalik ranges and the high mountainous peaks. Attempts have been made to adopt the revised and up to date nomenclature as per the international code of Botanical Nomenclature. Latest the editors have made special efforts to record local names for a large number of species. Similarly equivalent English and Sanskrit names have also been included wherever

available. These local or common names are often useful in revealing the utility and value of the species. The present collection of plants was made from different districts of Uttarakhand during the various medico-botanical explorations since the inception of Regional Research Institute of Himalayan Flora, Tarikhet, under Central Council for Research in Ayurvedic Sciences.

15. Sadi Mittar Dugar Deeyan Jadiyan-Butiyan (Dogari)

In this present publication 56 medicinal plants were incorporated based on the field survey Field survey done in the areas near by Jammu Forest Division. Mostly identified by the people and medical practioners of Jammu Forest Division.

16. Himalaya ki Arogyadayi Vanaspatiyan

The Central Council for Research in Ayurveda and Siddha (CCRAS) has carried out commendable work in Medico-Ethno-Botanical Research through its peripheral Institutes located at Himalayan Regions. The present treatise on "Healing Herbs of Himalaya" offers itself as a pictorial and herbaria guide on 50 important medicinal plants available at Indian Himalayan Region. The book provides an overview of various facts of the herbal wealth of Indian Himalayan Region.

17. Uttarakhand Vanoushadhi Darshika

In the present publication 353 medicinal plants were incorporated based on field study, Geographical distribution of medicinal plants, local name, local folk uses, morphological distribution based on their Hindi scientific terminology.

18. Herbal Wealth of Western Ghats –Agasthyamalai

The present publication entitled "Herbal wealth of Western Ghats -Agasthyamalai" offers itself as a pictorial and herbaria guide on 67 important medicinal plants, its adulterants and substitutes. First hand information on 70 Folk claims drawn out of the reported plants. It is the outcome of extensive survey conducted by the then CCRAS Unit located at Palayamkottai Tamil Nadu. Sh.Chella Durai, Ex. R.O. (Botany), Dr. M.P.S. Subramanian, R.O. CCRS and their team collected folk claims and the basic information. Dr.G.V.R.Joseph, A.D. (Botany) is instrumental in carrying out Digitization of Herbarium project with the assistance of supporting staff Dr.Jagdish Arya, A.R.O in CCRAS. He scanned all herbaria with utmost care and visited Agasthyar hill for the collection of basic information with photographs. The book provides an overview of various facts including updated Botanical Nomenclature, Names used in different Indian Systems of Medicine, Distribution, IUCN status, Uses, Threat perspective, Formulation, etc. Safety / toxicity and contra-indications were also covered on the reported plants. Information on folk claims, current IUCN status of the reported plants, high quality images of plant and herbaria will certainly act as a ready reckoner for those who are working in herbal medicine sector. The book provides an overview of various facts of the herbal wealth of Agasthya malai hill region. Further, the book is an assimilation of information containing numerous published as well as unpublished data, herbarium, crude drugs and field photos.

19. Medico-Botany of Andaman & Nicobar Islands - Recent Study

CCRAS is serving the needs o f the Andaman & Nicobar population in the health sector since 1984. In 1988, CCRAS had published a book entitled; "Observation on Medico-Botany of

Andaman &Nicobar Islands" where it has covered 305 medicinal plants of this region along with the folklore uses, after the Tsunami in December 2004, there is a great change in the medicinal flora of Andaman &Nicobar. Hence, CCRAS has taken up a project entitled, "Medico-Botanical Survey of Andaman &Nicobar Islands (Selected areas)". The present publication, "Medico-Botany of Andaman & Nicobar Islands - Recent Study" is the outcome of the above mentioned project. The present publication encompasses data on 560 medicinal plants about their Botanical Name, Sanskrit Name, Local Name, Distribution, Availability, IUCN status and Threat status. Out of the studied plants, there are 163 plants being used in Ayurvedic System of Medicine; for these plants, Sanskrit Name, Distribution, Parts Used, Pharmacological Properties , Ayurvedic Preparation (Formulations), Major indications (Therapeutic Uses)are provided. There are 204 folk uses reported for various health ailments like Kamala (jaundice),Madhumeha (Diabetes), Netradosha (Opthamolic diseases, Tvak Roga (Skin diseases), Ashmari (kidneystones), Shewtha pradar (Leucorrhoea), E.N.T. diseases, Cuts & wounds (Vrana) etc, Besides, there are222 high quality digital photographs incorporated in the present publication.

20. Pharmacognosy of Indigenous Drugs Vol. I to III

Pharmacognosy of Indigenous Drugs Vol. I to III books contains 80 important drugs used in Indian System of Medicine which has been exclusively studied by Pharmacognosy Section of the Council. Each drug comprises of a wide spectrum of information about its source, history, distribution, cultivation & collection, identification and powder drug analysis.

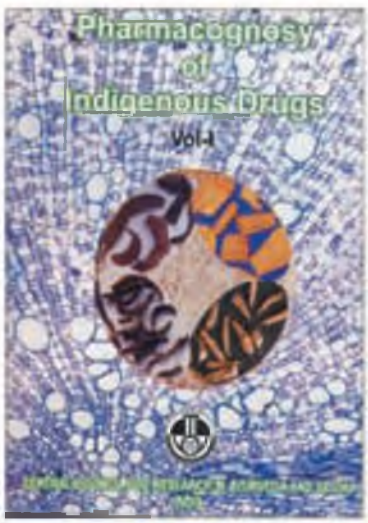
21. Conservation, cultivation and exploration of therapeutic potential of Medicinal plants

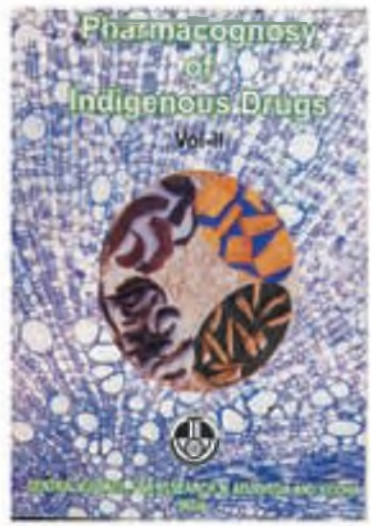
India, endowed with rich diversity in ts flora and fauna is considered to be one of the top twelve mega diversity countries of the world. This compendium enriched with proficient contributions by experienced workers in diverse interrelated fields would certainly serve as useful reference document for scientists and academicians.

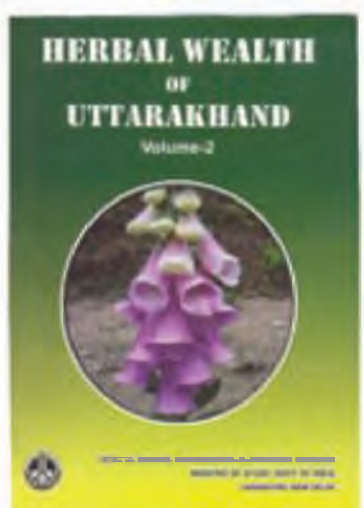
22. Recent Trends in Good Agricultural and Collection Practices for Medicinal Plants: with special focus on identification and value addition

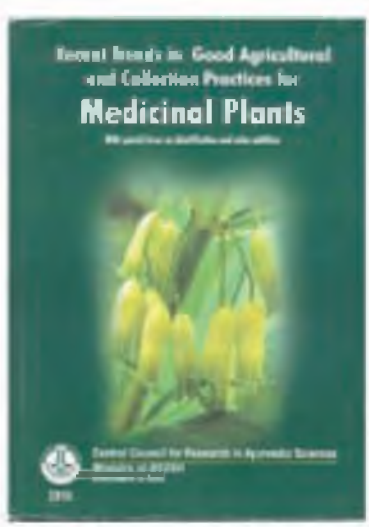
Several studies have revealed the presence of pesticides other contaminants hampering the quality of the botanical drug sources which forms ingredients of many herbal formulations used in Ayurveda Siddha Unani and other traditional system of medicines. Adding to this the synthetic fertilizers and pesticides are also spoiling the soil eco system and responsible for pollution of the soil. It is interesting to note that indigenous literatures from ancient in India such as Vrikshayurveda have codified numerous techniques and practices of cultivation and harvesting besides advocating the measures for management of plant diseases, crop management, bio-fertilizers soil selection and its suitability for growing selected crops etc. This book is a snapshot of current research trends in this field and made an anthology of valuable contributions from invited experts excelling this field.

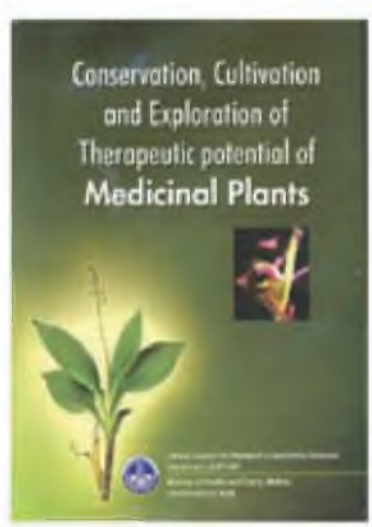
Important Books / Monographs published by CCRAS



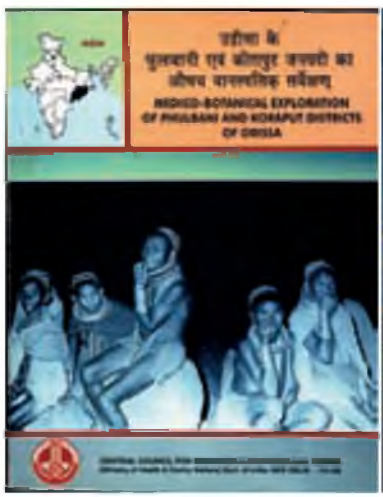


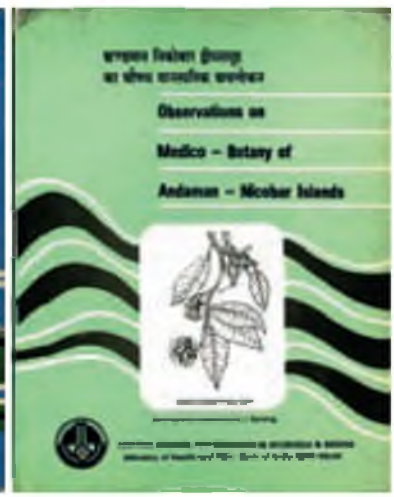


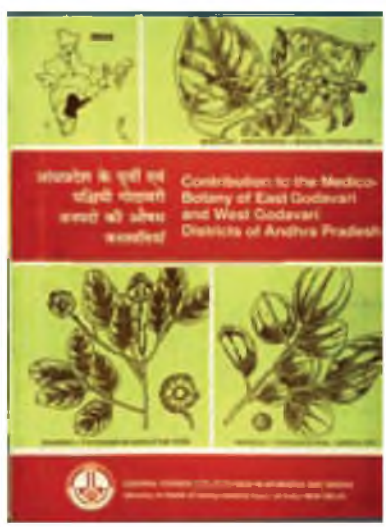


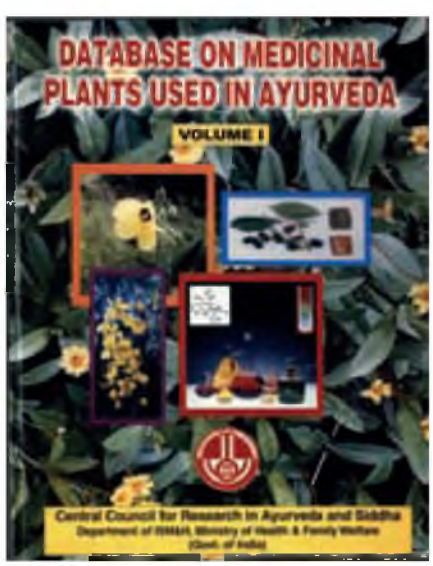


Important Books / Monographs published by CCRAS

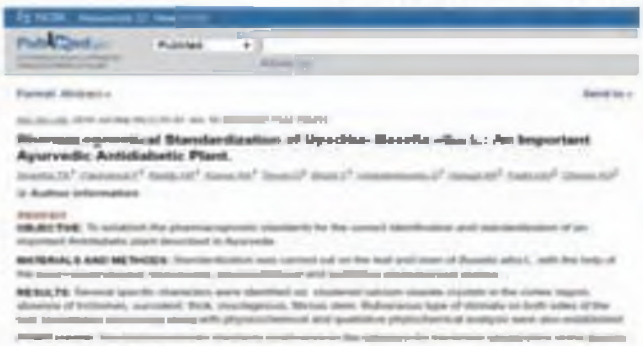




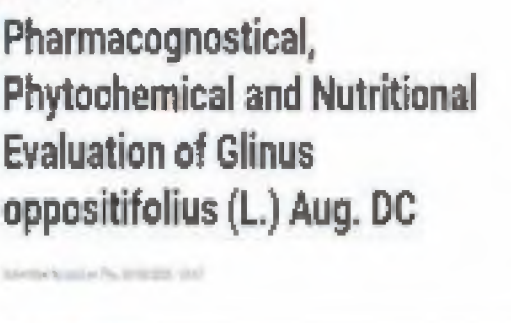




Recent Publications

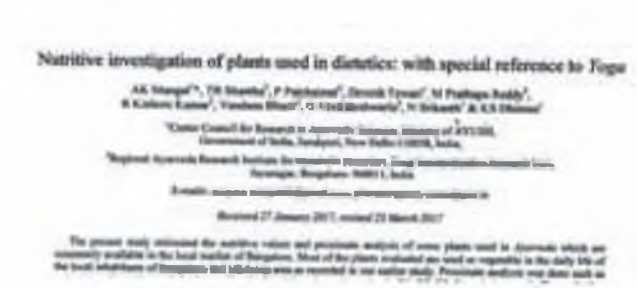


Microscopical and Preliminary Physicochemical Studies of Two Important Endangered Ayurvedic Medicinal Plants *Kutki* and *Trayamana* to establish their Identity



Pharmacognostical, Phytochemical and Nutritional Evaluation of Glinus oppositifolius (L.) Aug. DC

Pharmacognostical Standardization of Goralaka pods: an important Nutritive and antidiabetic Plant



Nutritive investigation of plants used in dietetics: with special reference to *Yoga*

Food adulteration: Sources, health risks, and detection methods

APPENDIX

Annexure-I

MEDICO ETHNO BOTANICAL SURVEY GUIDE LINES/ METHODOLOGY

In order to document the utilization of indigenous Medicinal Plants, survey was carried out during the years, 1969 to 2016. The information on medicinal uses of the indigenous plants have been described after gathering information's from experienced rural folk, traditional herbal medicine practitioners who were having knowledge of traditional healing practices. Medico-Ethno Botanical Surveys were conducted by various survey units of CCRAS located at RARIGID Guwahati, RARI Itanagar, RARI Jhansi, RARIMD Bangalore and RARI Tarikhet in various parts of India. A brief group discussion was made with the informants in their local language, prior to folklore data collection to get their consent and explain to them that their valuable contribution to the documentation of the traditional plant used by them. By using standard Local Heath tradition format (LHT) which includes interview and questionnaire which was used to explore the information from their source persons using this standard method. Information on local name of the plant, plant parts used for curing disease, their recipes and mode of administration were recorded for future reference study. Expert opinion of plant taxonomists was also sought for cross checking and confirmation on identity. Herbariums at four institutes have got international recognition as these are accredited with acronyms by the **New York Botanical Garden, USA.**

- Regional Ayurveda Research Institute, Tarikhet— **"RKT"**
- Regional Ayurveda Research Institute, Jhansi—**"JHS"**
- Regional Ayurveda Research Institute for Metabolic Disorders, Bengaluru—**"RRCBI"**
- Regional Ayurveda Research Institute, Itanagar— **"ARRI"**

THE SURVEY TEAM AND METHOD OF WORK

- Normally the survey team consists of a botanist, one Ayurvedic physician, one field assistant and other supporting staffs.
- The Botanist is responsible for spot identification of the medicinal plants or its relatives collected during the tour.
- Final identification is done in consultation with relevant published floras and regional or national herbaria.
- The Ayurvedic Physician use to diagnose the disease condition while collecting information on folk-claims. This helps in identification of a particular part in certain ailment and documentation of all the claims recorded during a survey tour. Also, the Ayurvedic Physician use to check if the information collected in the folk-claims are mentioned in any codified text or not.
- Primarily members of the survey team observe the general vegetation and forest type of the locality.
- During the tour, plant specimens are collected with a number tag on each specimen and relevant field note recorded in the corresponding page of the field book.
- After reaching the camp, all the specimens are pressed with blotting sheets and conven-

tional method of preparing herbarium specimen is followed.

- Local people including the 'Hakims' or 'Vaidya' or 'Medicine men' are interviewed with a questionnaire and information regarding the local use of the plants are noted.
- Sometimes one or two local inhabitants are hired to stay with the survey team and provide all the requisite information required.

STANDARD SURVEY METHODOLOGY FOR SURVEY OF MEDICINAL PLANTS

1. BELT TRANSACTS METHOD

One of the popular methods for survey of plants is Belt Transact Method. Because this is suitable in forests where there are different vegetation pattern is observed. In this method, generally survey team will walk straight from a randomly selected point in the forest up to 2-3 km (approximate) or there is no scope of new species encounter in transect. Sampling (recording individual plant details in filed note books as well as collection of two Herbarium specimens, preferably flowering or fruiting twigs) of Medicinal Plants is done within 5 m width along the line. Documentation in the form of photographs of various plants parts also done during the survey. (This method of sampling is used in Karnataka state forests, because most of the forest areas having different terrain with vegetation difference). Sometimes direction of the transect may change, depending up on the vegetation pattern or topography of the area. Belt transects are laid in such a way so that to cover different forest vegetation such as Ravine forest, Hill forest, Shola forests, Plain forest, Wet land forest, etc. in a particular forest area. Because transect is continuous through the study area, it can be applied in studying the gradual and continuous changes in the vegetation. The belt transect method is used to estimate abundance, frequency and distribution of species in the community. Generally the survey should be conducted in natural forest areas not in Plantation sites and man-made forests. for study of Medicinal Plants. (Fig. 1)

Fig. 1 : Belt Transect (2-3 km or till new species are not encountered)

OTHER PLANT SAMPLING METHODS

1. Quadrant

It is another Plant Sampling Method and more suitable in plant areas with uniform vegetation pattern. Quadrant is a square sample or unit for a detailed analysis of vegetation. Quadrants of one-fifth acre size established to include maximum number of tree, while for studying shrubs and grass covers usually the quadrants of smaller sizes are used.

2. Loop Method

This is a simple, accurate and quick method for sampling of only grassland and low

3. Pointless or Point Method

This also suitable in the study of grassland low herbaceous communities.

Annexure-II

LHT FORMAT

Central Council For Research In Ayurvedic Sciences

Ministry of AYUSH

Format for Documentation of Local Health Traditions

(By AYUSH Research Councils/individuals/NGOs etc.)

1. **Title of Proposal/Project:** _____

2. **Name and complete address of the Organization:**

3. **Whether Related to:**

Ayurveda	
Unani	
Homoeopathy	
Siddha	
Yoga & Naturopathy	

4. **To be submitted to the Research Councils**

CCRAS	
CCRUM	
CCRH	
CCRS	
CCRYN	

5. **Objectives Covered:**

1. Home Remedies	
2. Food and Nutrition	
3. Midwifery	
4. Bone setting	
5. Other specialized local health practices	
6. Ethno veterinary Practices	

6. **Duration of the project:**

7. **Year wise objectives and deliverables:**

8. Area/No. of blocks and districts covered:

9. Whether the drug or the formulation/ procedure has been mentioned for the same reference in literature:

Name of the system	Yes	No	Validation category									
Ayurveda			V1		V2		V3		V4		V5		V6	
Unani			V1		V2		V3		V4		V5		V6	
Homoeopathy			V1		V2		V3		V4		V5		V6	
Siddha			V1		V2		V3		V4		V5		V6	
Yoga & Naturopathy			-		-		-		-		-		-	

⁂ If yes then tick the appropriate **validation category** as per guidelines (Annexure–I)

10. Whether the information is to be submitted:

A. Drug wise	
B. Procedures	

Please tick (√) in appropriate box

A. DETAILS OF DRUG

i. Whether single/compound formulation: Single Compound

ii. Information on single drug

a)	Origin (√ Appropriate)	Plant origin √	Animal origin	Mineral/ Metal origin	Others
b)	Local/Regional name				
c)	Sanskrit name (If available)				
d)	Hindi name (If available)				
e)	Urdu name (If available)				
f)	Tamil name (If available)				
g)	English name				
h)	Botanical/Zoological /Chemical name				
i)	Part/parts used				
j)	Period of collection of plant				
k)	Storage condition (if any)				
l)	Photograph of the raw drug				
m)	Photograph of the final product				
n)	Specimen of raw drug				
o)	Specimen of final produ				

p)	Videography of method of preparation if available	

iii. Information on compound formulation

a)	Name of the formulation
b)	Form of formulation
c)	Method of preparation in detail including the no. and proportion of ingredients
d)	Videography of method of preparation if available
e)	Photograph of the raw drug
f)	Photograph of the final product
g)	Specimen of raw drug
h)	Specimen of final product
i)	**Details of ingredients**

	Local Name	Origin	Sanskrit Name	Hindi name (if available)	English name (if available)	Urdu Name (if available)	Tamil Name (if available)	Botanical/ Zoological/ Chemical name	Part/ Parts used	Period of collection of plant	Storage condition (if any)
	i										
	ii										

iv. Disease/ indicated condition

• Disease as mentioned by Healer	
• Possible correlation with codified system	
• Method of Diagnosis	
◊ Symptom	
◊ Observation	
◊ History	
◊ Pulse examination	
◊ Modern parameters	
◊ Others	

v. Mode of administration

• Route of administration (Oral/ local/ others etc.)	

• Dose	
• Duration	
• Vehicle (if any)	

vi. a) Dietary regimen during the treatment-

b) Lifestyle regimen during the treatment

vii. a) Concurrent medicine (if any) taken during treatment.

b) Concurrent procedure (if any) during treatment

viii. Contra indication of the medicine (if any)

ix. Detail of Knowledge Provider

No. of Knowledge provider/introducer					
Name & Photo	Address	Age	Sex	Occupation	Education Qualification

x. Detail of Local Health Practitioner

No. of Local Health Practitioners using the medicine					
Name & Photo	Address	Age	Sex	Occupation	Education Qualification
Average Number of Patients of the disease treated in a year					
Details of Investigations before and after Treatment if any					
Results of Treatment					

B. Information on Procedures (Bones setting/Midwifery/Ethno-veterinary)

i.	Disease/ indicated condition	
	• Disease as mentioned by Healer	
	• Possible correlation with codified system	
	• Method of Diagnosis	
	• Symptom	
	• Observation	
	• History	
	• Pulse examination	
	• Modern parameters	
	• Others	

ii.	Whether the patients referred from other practitioners etc. for the same procedure	
iii.	Aids/ Tools used	
iv.	Description of the procedure/Technique	
v.	Care during procedure	
vi.	Pre procedure precautions/ care if any	
vii.	Post Procedure Care	
viii.	List of Medicines used in the process	
ix.	Outcome of the procedure	
x.	Video/ photograph if any – List here and provide CD in a universally open able format	

xi. Detail of Knowledge Provider

No. of Knowledge provider/introducer					
Name & Photo	Address	Age	Sex	Occupation	Education Qualification

xii. Detail of Local Health Practitioner

No. of Local Health Practitioners using the medicine					
Name & Photo	Address	Age	Sex	Occupation	Education Qualification

Average Number of Patients of the disease treated in a year	
Details of Investigations before and after Treatment if any	
Results of Treatment	
Any other information	

S.No. Name and designation of the team members Signature(S)

1.

2.

Annexure-III

Validation methodology: Ayurveda			
Sl. No.	**Categories of References**	**Reference Materials**	**Validation category**
	Classical literature and recent compilations from classical texts	1. API*, AFI**	V1
		2. Ayurveda principles	V2
		3. Dravyaguna Vijnan by P.V.Sharma	V3
	Published literature listing home remedies	4. Handbook of Domestic Remedies	V4
		5. Tribal Folk Remedies published by CCRAS (documented but not yet verified)	V5
	Outside the above literature and non-classical proprietary medinines	6. Other than the above references/ Ayurveda line	V6
* API = The Ayurvedic Pharmacopoeia of India Part-I-V is a collection of plant origin single monographs (standards for Identity, Purity and strength) used in Ayurvedic formulations. API Part-II Volume-I+II is a collection of Pharmacopoeial standards for formulations used in Ayurveda. ** AFI = Ayurvedic Formulary of India Part I & II is a collection of 644 classical Ayurvedic Compound and single drug formulae covering plant, mineral and animal origin drugs.			

Selected books for validation of LHTs/Folk Claims:

1. Glossary of Indian medicinal plants by RN Chopra &ICChopra, P.No.-218
2. Bhava prakash nighantu
3. Priya nighantu
4. Dhanvantari nighantu
5. Raj nighantu
6. Kaidev nighantu
7. Shalaigram nighantu
8. Adarsh nighantu-1
9. Medicinal plants used in Ayurveda by RAV
10. Classical medicines used in Ayurveda by P.V. Sharma
11. CCRAS home remedies
12. Indian Materian Medica by K.M. Nadkarni

13. Database medicinal plantsVol.1-8
14. Charak Samhita
15. Sushruta Samhita
16. Ashtang Sangra 4&Hriday
17. Dravya Gun vigyan by P.V. Sharma
18. API
19. Brindha Madhav
20. Yoga Ratnakar
21. Chakradatt.

CENTRAL COUNCIL FOR RESEARCH IN AYURVEDIC SCIENCES

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