



# CSIR-CIMAP

(Established in 1959)



## CSIR-Central Institute of Medicinal and Aromatic Plants

(Council of Scientific and Industrial Research)



# वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद प्लेटिनम जयंती स्थापना दिवस समारोह

24 सितम्बर 2016, विज्ञान भवन, नई दिल्ली

Council of Scientific & Industrial Research

PLATINUM JAYANTI ESTABLISHMENT DAY CELEBRATION

24 SEPTEMBER 2016, VIGYAN BHAVAN, NEW DELHI



CSIR Technology Award 2016



CSIR Technology Award 2015



CSIR Award for Rural Development (CAIRD) 2014



Ultra International Award 2018



## About us

CSIR-Central Institute of Medicinal and Aromatic Plants (CSIR-CIMAP) is a premier multidisciplinary research institute of Council of Scientific and Industrial Research (CSIR), India with its major focus on exploiting the potential of medicinal and aromatic plants (MAPs) by cultivation, bioprospection, chemical characterization, extraction, and formulation of bioactive phytomolecules. With a strength of 100 scientists, 162 technical officers, 129 support staff and nearly 300 doctoral and post-doctoral scholars at its HQ in Lucknow and research centers at Bengaluru, Hyderabad, Pantnagar, and Purara, CSIR-CIMAP has played a key role in positioning India as a global leader in production of mints, vetiver and other aromatic grasses, and in ensuring indigenous production of artemisinin - a WHO approved anti-malarial. CSIR-CIMAP houses a National Gene Bank on MAPs, which is one of the three of its kind in India. CSIR-CIMAP has played a key role in successfully commercializing an ayurvedic herbs-based anti-diabetic formulation, which has now benefitted millions. The institute is presently accredited by ICS-UNIDO and Indian-Ocean Rim Association (IORA) as a focal point for research and training on Medicinal Plants among 21 participating member countries.

## History at a Glance

- Initially set up as Central Indian Medicinal Plants Organisation (CIMPO) in the year 1957 with a mandate to work and stimulate research on medicinal plants; subsequently aromatic plants also brought under its ambit
- CIMPO started functioning from 26th March 1959 and rechristened as Central Institute of Medicinal and Aromatic Plants (CIMAP) in the year 1978
- The institute shifted to its present campus near Kukrail forest, Lucknow in the year 1980

## Our Mandate

CSIR-CIMAP is engaged in multi-disciplinary high-quality research in agricultural, biological and chemical sciences and extending technologies and services to the growers and entrepreneurs of MAPs with the following mandate:

- Genetic improvement, cultivation, production and chemical processing of economically important MAPs
- Characterization and conservation of genetic resources
- Production of planting material of the improved cultivars
- Bioprospecting plants and their constituents for various biological activities using different *in vitro* and *in vivo* techniques
- Metabolic pathway studies for identifying and modulating yield determinants
- Herbal products and formulations for better life
- Knowledge management for the enhancement and dissemination of R&D
- Human resource development for R&D in the basic and applied areas of MAPs



## Improved Varieties and Agrotechnologies

CSIR-CIMAP has developed high yielding varieties and their agrotechnologies for a number of commercially important MAPs. These varieties apart from being early maturing have higher yield potential and are rich in the commercially desired chemical components. Likewise, several agrotechnologies have been developed for maximizing production with minimal inputs. These varieties and agrotechnologies have been disseminated to the growers all over India and adopted by them successfully. The improved varieties and agrotechnologies are helping India to become self-reliant and a global leader. Some of the important MAPs for which improved varieties and agrotechnologies have been developed are listed below:

Plant Name	Variety	Potential
<i>Mentha arvensis</i> (Menthol mint)	Kosi	Early maturing : 90-100 days, Tolerant to leaf spot, rust and powdery-mildew diseases
	CIM-Kranti	Cold tolerant, high yielding
<i>Mentha piperita</i> (Peppermint)	CIM-Madhuras	High oil yielding (120-125 kg/ha) and sweet smelling.
	CIM-Patra	Menthofuran content : 35-46%
	Kukrail	Erect plant habit with vigorous growth, menthol content: 34.5%
<i>Cymbopogon Winterianus</i> (Citronella)	CIM-Jeeva	Enhance field establishment quality
	Manjari	Suitable for Gangetic plains, citronellal content : 45%
	CIAP-Bio 13	High tiller regeneration potential, less incidence of yellowing leaf syndrome during rainy season, citronellal:35-38%
<i>Cymbopogon martinii</i> (Palmarosa)	CIM-Harsh	High geraniol content: 94%
	PRC-1	Very tall, medium inflorescence
<i>Cymbopogon flexuosus</i> (Lemongrass)	Krishna	High citral content : 75-80%
<i>Pelargonium graveolens</i> (Geranium)	CIM-Bio 171	Oil yield : 40-50 kg/ha, geraniol content: 21%
	CIM-Pawan	Oil yield : 50 kg/ha, geraniol content: 21%
<i>Rosa damascena</i> (Rose):	Noorjahan	Suitable for north Indian plains and hills, citronellol 20.8%, geraniol 25.3%
	Rani Sahiba	Synchronous flowering; high flower biomass, geraniol 30-35%
<i>Chrysopogon zizanioides</i> (Vetiver, Khus)	KS-1	Cultivation period: 1 year; oil yield potential of 20-25 kg/ha





Plant Name	Variety	Potential
	CIM-Khusinalika	Cultivation period: 6-8 months
	CIM-Vriddhi	Suitable for drought and marginal lands
<i>Pogostemon patchouli</i> (Patchouli)	CIM-Shreshtha	Tolerant to diseases, oil yield: 80-100 kg/ha
<i>Catharanthus roseus</i> (Periwinkle)	Dhawal	Resistant to die-back, total leaf alkaloids content: 1.3-1.7%, total root alkaloids content: 1.6-1.8%
	Nirmal	Possess high level of resistance in a die-back and collar and root rot
<i>Withania somnifera</i> (Ashwagandha)	Poshita	Herb yield: 2.83 q/ha, dry root yield: 14 q/ha, alkaloids: 1.3 kg/ha, withaferin content: 0.54% in dry leaves
	NIMTLI-118	Dry root yield - 15-17 q/ha, withaferin content: 2% in dry root
<i>Ocimum sanctum</i> (Krishna Tulsi)	CIM-Angna	Herb yield: 181 q/ha, eugenol: 40.4%,
	CIM-Ayu	Herb yield: 200 q/ha, eugenol: 83%
<i>Plantago ovata</i> (Isabgol)	Niharika	Seed yield: 10-11 q/ha ,swelling index/mucilage: 442
	Mayuri	Early maturity, swelling index/mucilage: 443
<i>Cassia angustifolia</i> (Senna)	Sona	Dry leaf yield: 11 q/ha, seed yield: 4 q/ha, sennoside content : 3.51%.
<i>Asparagus racemosus</i> (Sataver)	CIM-Shakti	Dry root biomass: 80-100 q/ha, saponin content: 21%
	CIM-Sunheri	Dry root yeild 97.5 q/ha, saponin content: 11.03%
<i>Artemisia annua</i> (Sweet wormwood)	CIM-Arogya	Herb yield: 450-475 q/ha, artemisinin content: 0.8-1.0%, artemisinic acid content: 0.002 - 0.004%
	CIM-Sanjivani	Artemisinin content: 1.2%
<i>Aloe vera</i> (Ghrithkumari)	CIM-Sheetal	High leaf and sap yielding, foliage yield: 400-500 q/ha.
<i>Andrographis paniculata</i> (Kalmegh)	CIM-Megha	High yield of dry biomass : 32-40 q/ha, Andrographolide content : 1.90%





## Important Process Technologies

Improved process technologies and plant design on distillation/extraction of economically important MAPs have been developed and disseminated to farmers and entrepreneurs. The technologies are available to willing growers and entrepreneurs. Some of the important process technologies are as under

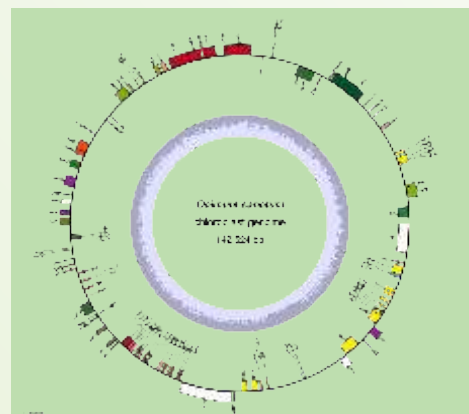
- Improved distillation and extraction technologies for essential oils from high value rose (*R. damascena*), geranium, mints, vetiver, patchouli, lemongrass, basil, palmarosa, citronella, nagarmotha etc., and rose water
- Improved extraction and production of artemisinin (anti-malarial) from *Artemisia annua* herb, Cliv-92 (hepato-protective) from *Cleome viscosa* seeds, calliterpenone (plant growth promoter) from *Callicarpa macrophylla* leaves, silymarin (hepato-protective) from *Silybum marianum* seeds etc.
- Production of menthol crystals (flakes and bold) by processing *Mentha arvensis* oil and de-mentholated oil (D.M.O.)
- Production of concrete and absolute from tuberose, rose and jasmine flowers
- Production of juice, sap, gel, cream and powder from *Aloe vera*
- Production of Pyrethrum oleoresin from the pyrethrum flowers
- Fractionation and value-addition of essential oils like citral from lemongrass oil, geraniol from palmarosa, etc.



## Implementation of Biotechnology for Better MAPs and Product Yield

The institute has a mandate for implementation of biotechnological approaches towards improvement of MAPs and higher production of important secondary metabolites. Few highlights of the achievements and the activities are as under

- Implementation of somaclonal variations, somatic hybridization and marker-assisted breeding techniques for generation of improved MAPs varieties like 'Bio13' of Citronella, 'CIM-Arogya' of *Artemisia annua*.
- Increased production of commercially important metabolite like vanillin, pyrethrin etc. by *in vitro* culture, metabolic engineering and transgenic approaches
- *Ocimum sanctum* genome sequencing - the first published complete genome sequence of any medicinal plant from India
- Transcriptome analysis of MAPs (like *Mentha*, *Artemisia*, *Withania*, *Ocimum*, *Andrographis*, *Bacopa*, *Asparagus* etc.) for isolation of biosynthetic genes of important metabolites like terpenes, withanolides, terpenoid indoyl and Benzyl isoquinoline alkaloides, L-DOPA etc,
- Utilizing transcriptome data for improving metabolite content, trichome phenotype and stress tolerance
- Synthetic biology approaches for production of important metabolites.

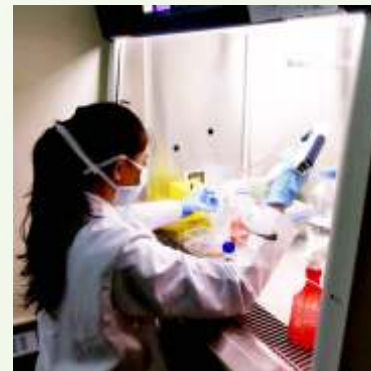




## Bio-prospection of Natural Resources

CSIR-CIMAP aims to strengthen the traditional system of medicine as well as herbal medicine through bioprospection of natural resources for novel genes, bioactive molecules and value added products. The major achievements and activities related to bioprospection are as focus on

- MAPs based anti-infective agents against sensitive and drug resistant pathogens alone and/or in combination.
- Novel MAPs-derived bioactives against metabolic and lifestyle related disorders like cancer, diabetes, inflammation, psoriasis, hypertension and liver malfunction.
- Bioavailability/Pharmacokinetic studies of bioactive marker compound(s)
- Development of herbal drugs and products, and its evaluation for safety and toxicity
- Effective role in the development of commercially released products like anti-malarial formulation (trade name 'E-mal'), anti-diabetic formulation (trade name 'BGR-34'), and anti-inflammatory product (Relaxomap) etc.



## Development of Implements for Harvest and Post-harvest Processing

- Low cost, efficient boiler operated steam distillation units for large-scale operations and directly-fired type field distillation units for small-scale production of essential oils from mints, aromatic grasses, vetiver, geranium, basil, etc.
- Multi-utility portable distillation unit "CIMAP-ASVIKA" and improved "CIMAP-UNNAT ASVIKA" for small-scale farmers and entrepreneurs for the production of high quality rose water, spice oils, essential oils, etc.
- Tractor-trolley mounted directly-fired type mobile distillation unit for mints, lemongrass, palmarosa, citronella, basil, patchouli, vetiver, etc.
- Other newly developed agriculture implements include Khus digger, Shataver digger, Solar powered distillation unit, Mentha-harvester, etc.



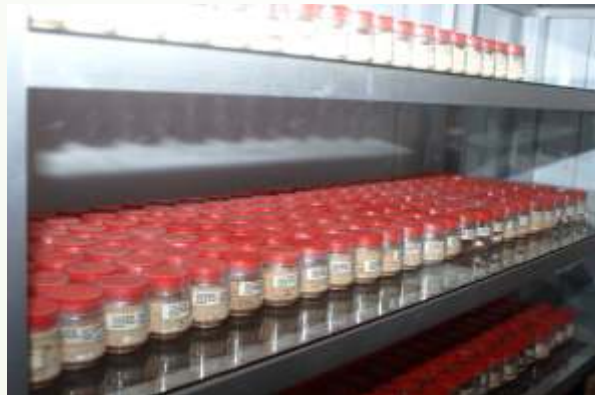
## National Facilities at CSIR-CIMAP

- **National Gene Bank on Medicinal and Aromatic Plants (NGBMAP)** was established in 1993 following the summit of G-15 countries held at Caracas. It is one of the three National Gene Banks of the country that focuses on the conservation of MAPs of India in the form of seed, field, tissue (*in vitro* cultures) and DNA gene banks. Research institutes and universities are welcome to deposit their MAPs accessions in the National Gene Bank. Currently, in the seed bank, 2476 accessions of MAPs belonging to 336 families, 152



genera and 515 species and in field gene bank 868 accessions of MAPs belonging to 80 families of 176 genera and 227 species are being maintained.

- **Designated National Repository**, established under the Biological Diversity Act 2002, operates to keep specimens of different categories of biological material in safe custody and is recognized by the National Biodiversity Authority of India.
- CSIR-CIMAP is one of the **Nodal Points for the Protection of Plant Variety (PPV) and Farmers Right Authority (FRA)** and is a recognized by **National DUS Center** for DUS testing of menthol mint, periwinkle, damask rose and brahmi.



## International collaboration: IORA-RCSTT Co-ordination Center

CSIR-CIMAP is a **co-ordination center on medicinal plants** in Indian-Ocean Rim Association's (IORA) Regional Center for Science and Technology Transfer (RCSTT). The important activities of the center are:

- Compilation of knowledge on medicinal plants in the 21 member states
- Promoting interaction and cooperation among IORA member states for conservation, technology development, trade and commerce of medicinal plants and their products,
- Imparting training on medicinal plants conservation/ cultivation/ processing/ analysis/ advanced technologies
- Help member nations in quality control of medicinal plants and products.



## R&D Facilities: our strength

### CIMAP Research Farm @ Lucknow



The Lucknow experimental farm (spread over 25 acres) is a central facility for conducting agricultural research and field experiments involving introduction of new crops, development and evaluation of improved varieties. It is equipped with conservatories of MAPs (like 'Manav' park), field gene bank, processing units, vermicompost units, meteorological station, water harvesting unit, ornamental plants, demonstration block, greenhouses, poly houses and environment controlled glass houses. The activities of the research farm include demonstration and dissemination of updated knowledge on MAPs, and ensuring availability of the quality seeds and planting material of important and improved varieties in a timely manner.





## CIMAP Research Center Bengaluru, Karnataka

CSIR-CIMAP Research Center at Bengaluru (established as South Zonal Center in 1959; spread over 15 ha) is a Center of Excellence in the Southern region for the benefit of MAPs farmers and industries in and around Karnataka, Tamil Nadu and Kerala. It functions through the promotion of large-scale cluster cultivation of MAPs for livelihood improvement and employment generation in rural areas, and entrepreneurship development. Additionally, state of art biotechnological research is being conducted at the center. It has been the centre for development of some of the most popular varieties of lemongrass.



## CIMAP Research Center Hyderabad, Telangana



The CIMAP's Hyderabad Research Center (established in 1952; spread over 12 ha) acts as the regional node for showcasing and promoting green technologies developed for Deccan Plateau. It is mainly involved in developing and disseminating farmer-friendly and sustainable production of high yielding varieties of economically important MAPs with export potential along with their distillation technologies. The centre functions in resource constraint environmental conditions for transforming wastelands and drylands into eco-friendly and profitable green herbal farms. The center has played instrumental role in popularizing cultivation of important varieties of Ashwagandha in Andhra Pradesh and Telangana.

## CIMAP Research Center Pantnagar, Uttarakhand

CSIR-CIMAP's Pantnagar Research Center (established in 1962; spread over 117 ha) is a large fertile land resource and is engaged in crop improvement, agrotechnology development and production of quality planting material in large quantities. The center is equipped with mechanized farming facility, pilot scale distillation units, glass house, poly-house, and facility for quality analysis of essential oils. The center has played an important role in the development of improved varieties of mints and is



a source of quality planting material of MAPs for farmers all over India.

## CIMAP Research Center Purara, Uttarakhand

The Purara research center (established in 1995; spread over 10 ha) is an important land resource for conservation and multiplication of MAPs of high altitude area. The center is equipped with small-scale distillation unit and poly-house. It helps in empowering farming of hilly areas through MAPs cultivation.



## Chemical Engineering and Pilot Plant Facility

The chemical engineering and pilot plant facility allows industries to carry out pilot scale/incubation studies and serve as a knowledge and technology resource point for translating basic research into industrial products and processes. The pilot plant has the following facilities

- Post-harvest processing units like controlled temperature dryers, multiple particle sizes grinding and pulverizing devices, stainless steel distillation and multipurpose extraction plants.



- Downstream processing facility for efficient concentration and purification of phytomolecules (including heat sensitive ones) which is equipped with wiped-film, falling film and rotary vacuum evaporators, reciprocating plate liquid-liquid extraction column and industrial scale continuous adsorption column chromatography and online solvent recycling units.
- Units for value-addition to MAP products which includes advanced fractional distillation columns, high-pressure glass lined and stainless steel CSTR and co-current spray drier and pilot scale freeze dryer
- An in-house quality control lab for analysis and validation of products and technologies

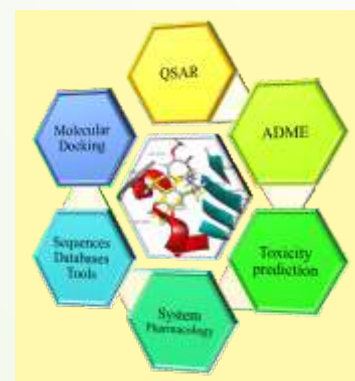
### ***In silico, In vitro, and In vivo testing facility***

CSIR-CIMAP is having *in silico, in vitro and in vivo* testing facility in the Lucknow campus.

- The *in silico* facility is devoted to the study of genome, transcriptome, proteome and metabolome, pattern identification and matching, molecular shape and properties analysis, modelling and simulation, Quantitative Structure–Activity Relationship (QSAR) studies, predictive Absorption Distribution Metabolism and Excretion (ADME) and toxicity studies, docking studies etc.
- The *in vitro* facility utilizes different mammalian cell lines (cancer, liver and macrophages) and microbial strains (bacterial and fungal) for evaluation of the efficacy of plant drugs.



- The *in vivo* testing facility carries out the preliminary biological activity testing for efficacy and toxicity on rodents, rabbits and guinea pigs. It meets its requirement of animals through its own breeding units within the animal house which is approved by CPCSEA. The facility has dedicated labs for host-pathogen interaction studies, experimental pharmacology, pharmacokinetics and vascular biology, histopathology and analytical biochemistry.



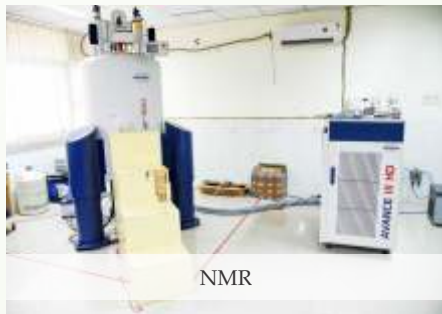
### **Analytical facility**

CSIR-CIMAP is equipped with advanced analytical instruments to conduct high quality research and provides analytical services. The entrepreneurs, industry and farmers are welcome to use the analytical facility for testing and analyses of their samples. The facility is equipped with:

- Nuclear Magnetic Resonance, 500 MHz
- Triple Quadrupole Mass Spectrometer (LC–MS/MS)
- High Resolution Mass Spectrometer (HRMS)
- Mass Directed Auto Purification (LC-PDA/ELS-MS)
- Gas Chromatography with Head Space Autosampler
- Gas Chromatography-Mass Spectrometry with Head Space



HRMS



NMR

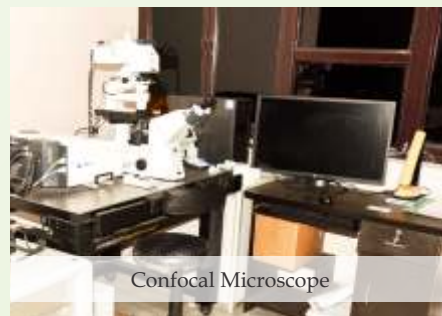


SEM

- High Performance Liquid Chromatography (HPLC) with LC- PDA and LC-ELSD detectors
- Semi-preparative High Performance Liquid Chromatography (HPLC)
- Ultra-Performance Liquid Chromatography (UPLC)
- High Performance Thin Layer Chromatography (HPTLC)
- Fourier Transform Infrared (FTIR) Spectrophotometer
- Near Infrared (NIR) Spectrophotometer
- Scanning Electron Microscope (SEM)
- Confocal Microscope
- Real Time PCR Machine
- Inductively Coupled Plasma (ICP-OES)
- NanoZS Zetasizer
- Gas Chromatography-Electron Capture Detector with Head Space Autosampler



UPLC



Confocal Microscope



GC-MS



ICP



LC-MS



HPTLC



Zetasizer



GC-ECD



## Technology Business Incubation Center (TBIC)

Established in 2016, TBIC facilitates technology transfer and enables new entrepreneurs/start-ups in the area of MAPs based herbal products to start production at a small scale before scaling up further at their own end. It houses multi-mix plant, liquid manufacturing units, tube filling, sealing and coding unit, liquid filling and a cap sealing and packaging unit for ~ 100 kg batch size of creams, gels, shampoo, oils, face wash etc. This facility helps technology buyers and users to develop confidence in the CSIR-CIMAP herbal products. Several budding entrepreneurs are using and being benefited by this facility.



## Participation in National Mission Programs

### CSIR-Aroma Mission

Aroma mission, launched in 2017, is a flagship program of CSIR for catalyzing rural empowerment through cultivation, processing, value addition, and marketing of aromatic plants which is being led by CSIR-CIMAP along with other CSIR labs, namely CSIR-NBRI Lucknow, CSIR-IIIM Jammu, CSIR-IHBT Palampur, CSIR-NEIST Jorhat and CSIR-URDIP Pune. The aroma mission aims to deliver 29 new improved varieties and 16 products, install 352 processing units and bring more than 10,000 acres of land under cultivation of high-value aromatic crops for the benefit of the growers, processors, and



entrepreneurs related to aroma industry.



From this mission, an additional annual production of 700 tonnes of essential oil worth more than INR 1.1 billion for the aroma industries expected along with an annual enhancement of the farmer's income by INR 30,000-60,000. The mission will benefit 25,000 farming families, generate rural employment of 15 to 20 lakh man-days and produce about 45,000 skilled human resources capable of multiplying planting material, distilling, fractionating and adding value to the essential oil.



## CSIR Phyto-pharmaceutical Mission

CSIR-CIMAP is also participating in the ambitious phytopharmaceutical mission of CSIR (launched in 2017 and led by CSIR-IIIM, Jammu) which aims to catalyze phyto-pharmaceutical drug discovery as per global standards for unmet medical needs from indigenous medicinal plants under captive cultivation. Other participating laboratories are, CSIR-CDRI Lucknow, CSIR-IHBT Palampur, CSIR-IICB Kolkata, CSIR-NEIST Jorhat, CSIR-NBRI Lucknow, and CSIR-URDIP Pune. CSIR-CIMAP is contributing in the following programme of the mission

- Captive cultivation of selected medicinal plants including high value rare endangered and threatened (RET) ones
- Technology packages for production of GMP grade medicinal plant extracts
- Phyto-pharmaceutical drug development from important medicinal plants as per regulatory guidelines of DCG(I)
- Making public aware of mission activities and achievements using appropriate interface

## Important contributions to Medicinal Plants

- **Development of high artemisinin containing variety ‘CIM-Arogya’ of an anti-malarial drug plant *Artemisia annua*** and demonstration of its agrotechnology package for higher income via CSIR-CIMAP’s Artemisia bio-village programme involving about 1500 farmers from several districts of Uttar Pradesh, Bihar, and Uttarakhand in a public-private partnership (PPP) mode.
- **Development and popularization of cultivation of improved varieties of high-on-demand Ashwagandha (*W. somnifera*)** which enabled utilization of dryland of Deccan plateau by 6,000 small and marginal farmers to earn an income that is two times higher than the earnings from traditional crops.
- **Integration of MAPs cultivation in shaded environment of orchards** which provides higher net profits from the same area by growing plants like *Rawolfia* and Kalmegh.
- **Development of eight *Ocimum* varieties rich in constituents of industrial importance like cosmetic, food and flavour, sanitation and hygiene** which bring rich profit to farmers.



## Important contributions to Aromatic Plants

- **Development of short-duration menthol-rich mint (*M. arvensis*) varieties and agrotechnologies** for its integration into existing food cropping systems which offer a profit of up to INR 60,000 per hectare in about three months and are being cultivated on ~250,000 hectares benefitting about 5,00,000 farming families. These varieties have emerged as major industrial mint crop and made India a global leader in the production of menthol mint.
- **Development of a new variety CIM-Vridhi of Vetiver (Khus)** which has improved oil yield (~25 kg/ha) and quality along with lower growth cycle (10-12 months as compared to 18-20 months) and generates higher profits in shorter periods.
- **Development and popularization of cultivation and processing (by training) of high yielding variety of citronella ‘BIO-13’** among tribal farmers of Uttara Koppa, Kolegeri and Kachhodi of Bhatkal Taluk of Karnataka which revived the cultivation of the plant and improved their economy.





- **Revitalizing degraded/salt affected soils** unsuitable for food/vegetable growth by promoting cultivation of aromatic grasses such as lemongrass, palmarosa, vetiver, and plants like chamomile which provide annual profits of ~ INR 25,000 -30,000/ha to the farmers.
- **Development of a novel agrosystem “Early Mint Technology (EMT)”** which potentially reduces harvesting time by 20-30 days, increases the productivity of menthol mint by 15-20% and minimizes expenditure on land, labour, water and fuel by about 20-25%.
- **Geranium cultivation technology for Northern Indian Plains** to save the geranium planting materials under extreme climatic conditions of Northern Plains, which otherwise is a major impediment in popularization of this high value aromatic plants.

## Important Contribution for Women Empowerment

- Utilization of waste bio-resources like flower offerings made at places of worship as a raw material for making incense sticks is empowering women with an additional income of INR 2,000-3,000 per month.
- CSIR-CIMAP organizes entrepreneurship training program on *Aloe vera* processing and rose water production through which a number of women entrepreneurs have been trained to start their own processing unit.



## Knowledge Dissemination

CSIR-CIMAP continuously disseminates the acquired knowledge on MAPs through research publication, books, farm bulletins, JMAPs (a periodic research journal), annual reports and technical literature on MAPs.

## IP Portfolio

CIMAP has an IP portfolio of more than 87 foreign and Indian patents which include molecules and bioactives (17) improved new processes (18), formulations and compositions (25), new methods / techniques / strains (5) and plants varieties (22). In last ten year more than fourteen patents have been commercialized to various industries that are already doing well in the market. Patented varieties have also been given to farmer without any charge to promote their agriculture in our country and increase the farmer's income.





## Business Development Initiatives and Success Stories

Over the last decade, CSIR-CIMAP has signed about 45 technology transfer agreements with different industries. These include technologies of different herbal formulations, improved varieties of *Artemisia annua*, herbal formulation for diabetes type 2 (jointly developed with CSIR-NBRI), anti-inflammatory oil, mosquito repellents etc. Some of the popular herbal products based on CIMAP technologies are available in the markets with different brand name e.g. BGR-34, Just Spray, Relaxomap etc.



Several consultancy agreements were also signed with different industries.



## Services Offered

- Training-cum-demonstration on cultivation and processing of MAPs
- Seeds and planting material of high yielding varieties
- Survey of land and preparation of techno-economic feasibility reports
- Consultancy services and technology licensing
- Engineering designs and turn-key projects for improved distillation units
- Publications on major medicinal and aromatic plants
- Guidance in marketing and industrial linkages
- Herbal product formulations
- Quality testing of MAPs and related products
- Pilot facility for extraction and distillation of MAPs

## Human Resource Development

CIMAP has a proactive HRD unit that is involved in following activities

- Recruitment and assessment of Ph.D/RAs/Project fellows.
- Running two major Ph.D. programmes—JNU-CIMAP Ph.D. programme (degree registration from Jawaharlal Nehru University, New Delhi) and AcSIR Ph.D programme (coordinated by Academy of Scientific and Innovative Research, Ghaziabad).
- Organizing traineeship ranging from 6 to 12 months for the students of M.Sc and M.Tech.
- Supporting the institute for signing has memorandum of understanding (MoUs) with several universities and colleges for collaborative research work.
- Supporting a student organized symposium and cultural event 'JIGYASA' every year.
- Short-term and long-term skill development/upgradation programs.



## People Connect programmes

### **Kisan Mela (farmer's fair):**

A Kisan Mela is organized at Lucknow on 31<sup>st</sup> January every year. During this event, the cultivators are given first-hand information on the improved varieties, agrotechnologies, post-harvest processing, and latest developments in the area of MAPs. Planting material of the newly developed varieties are made available to the progressive farmers attending the fair. etc. At least 5000-6000 farmers are benefited by the endeavor every year and has a multiplier effect in the farming community. In recent times, it is also being organized at the CSIR-CIMAP research centres.



### **Student Scientist Connect Programme: CSIR-KVS Jigyasa**

CSIR-KVS Jigyasa is a Student Scientist Connect Programme between CSIR laboratories and Kendriya Vidyalaya Sangathan (KVS) and has been initiated to extend the student's classroom learning with that of a very well planned research laboratory visit-based learning. Under this programme, CSIR-CIMAP welcomes the visit of KVS students and demonstrates to them the high-end research going on in the field of MAPs.







## Major awards

- **CSIR Certificate of Merit** (Technology award for Life Science 2018) for Ocimum based technological interventions to facilitate industrial growth, societal health and rural prosperity
- **Ultra International Award 2018** for outstanding contribution in Aroma Sector
- **CSIR Technology award for Life Science** (2016) for herbal composition (NBRMAP-DB) for the management of diabetes type 2
- **Scientist of the year award 2016** to the team CSIR-CIMAP for development of Aroma Crops by Essential Oil Association of India
- **CSIR Technology Award for Life Sciences** (2015) for 'Development of improved varieties and promotion of cultivation of medicinally important Ashwagandha (*Withania somnifera*) for improving the economy of small and marginal farmers in Semi-arid Tropical (SAT) regions of Deccan Plateau'
- **CSIR Award for S&T Innovation for Rural Development** (2014) for enhancing incomes of farm communities through vetiver (khus) based technological interventions
- **CSIR Technology Award** (2012) for development and commercialization of anti-malarial drug plant *Artemisia annua* technology package facilitating industrial growth, societal health, and rural prosperity presented
- **CSIR Award for S&T Innovation for Rural Development** (2008) for 'Biovillage strategy for agribusiness of medicinal and aromatic plants'
- **FICCI Award for Rural Development** (2005) for outstanding work towards catalyzing rural employment and income enhancement through MAPs based entrepreneurship with special reference to CIMAP's "Bio Village mission"
- **Essential Oil Association of India - SOM Award** (2003-04) for development and dissemination of a new variety of Menthol Mint 'Kosi' which has made a substantial contribution to the economy of mint growers in Uttar Pradesh and development of mint industry in India, as a whole
- **CSIR Technology Prize** (1999) for the development and popularization of improved varieties of menthol mint *Himalaya* and *Kosi* which are being widely cultivated in Indo-Gangetic Plains enabling India to emerge as the largest producer of mint oil in the world
- **CSIR Technology Shield for Process Technology** (1998; jointly awarded to CIMAP and CDRI) for development of an epimeric mixture of  $\alpha,\beta$ -arteether: a new anti-malarial drug





## Impact

CSIR-CIMAP is relentlessly engaged in high-end R&D activities and development and dissemination of newer and better varieties of MAPs and related products. It played a pivotal role in expanding the cultivation of the varieties of mints, basils, lemongrass, palmarosa, citronella, vetiver (khus), ashwagandha, senna, *Artemisia*, etc. to approx. 3,70,000 hectares producing medicinal herbs and essential oils worth about INR 4800 crore. It is tirelessly working to improve processing of raw herbs which has benefitted hundred of growers and budding entrepreneurs. The institute has served the society by developing many important herbal products namely anti-diabetic formulation (jointly with CSIR-NBRI and commercialized as 'BGR-34'), anti-inflammatory oil 'Relaxomap', mosquito repellent spray 'Mospray' and a polyherbal toothpaste. BGR-34 alone has done a total business of more than INR 250 crore.



## Cultivation



## Processing



## Product Development



## Salient Contributions of CSIR-CIMAP

- Catalysed transformation of India from menthol importing country to the largest global producer and exporter of menthol mint oil by spreading *Mentha* cultivation in more than 300,000 hectares, developing short-duration and high yielding varieties, and superior agro and processing technologies which enhanced the income of nearly 600,000 farmers.
- Ensured 'Make in India' of the anti-malarial drug artemisinin by developing high yielding varieties of *Artemesia annua*, chemical process for extraction and derivatization of artemisinin and promoting cultivation of improved varieties in farmers field.
- Profitable utilization of salt-affected and flood-prone coastal and river bank areas by developing and deploying short duration and high yielding varieties of Vetiver (Khus).
- Development and deployment of improved varieties of lemon grass, palmarosa, ashwagandha, and tulsi cultivation in under-utilized rain deficit areas like Bundelkhand, Vidharbha, Kutch and Marathwada.
- Develop one of the most successful herbal formulation for the management of diabetes type 2 (With CSIR-NBRI) using medicinal plants mentioned in Ayurveda and ensuring clinical efficacy and safety.
- Leading CSIR Aroma Mission to empower Indian farmers and aroma industries by cultivation, processing, value addition and marketing of aromatic crops.
- Coordinating promotion of exchange of knowledge and trade of medicinal plants among IORA member states of Indian-Ocean Rim Association.



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Variety Portal: [intranet.cimap.res.in/cimvariety](http://intranet.cimap.res.in/cimvariety)

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