XXIV Group Meeting of All India Coordinated Research Project on Medicinal & Aromatic Plants and Betelvine

The 24th annual group meeting of All India Coordinated Research Project on Medicinal & Aromatic Plants and Betelvine (AICRP-MAP&B) was held at the Dr. Y.S. Parmar University of Horticulture and Forestry (Dr. YSPUH&F), Solan, Himachal Pradesh during 28th September to 1st October, 2016. Dr. T. Janakiram, Assistant Director General (Hort. Science), Indian Council of Agricultural Research (ICAR), New Delhi inaugurated the group meeting. Dr. Jitendra Kumar, the Project Co-ordinator, presented the project report and highlighted the actions taken for the implementation of the technical programme effectively. Dr. Kumar also highlighted some of the achievements at AICRPMAP&B centres such as region wise customization of agro-technologies, estimation of agro-economics, development of nursery for quality planting materials.
Medicinal and Aromatic Plants (MAP) have occupied an important position in the socio-cultural, spiritual and medicinal arena of rural and tribal lives of India. They have contributed immensely by producing diverse range of plant based intermediary compounds and value added downstream end products used in several applications; drug formulation, food flavouring, perfumery, culinary, toiletry, health products, food supplements, cosmetics, incense and other anthropogenic applications and animal care products. MAP use has begun since time immemorial with the recognition that smelling, chewing, and/or eating of some plant materials could provide relief from nausea, pain, and/or other infirmities. Over the last two decades, there has been a tremendous growing interest in traditional systems of medicines mainly because of advantages that they are natural products, non-narcotic, have minimum side-effects, easily accessible at affordable prices, and also due to inadequacy of conventional medicines in the treatment of modern incurable diseases such as cancer, HIV, AIDS, rheumatic arthritis etc. Preference of plant based drugs over the conventional medicines in the national and international market is growing and will further grow with the rising global population. In the recent past changing concepts of consumers from ‘health to healthy living’ and balance between ‘mind and body’ have also grown the MAP demand and expanded the status from essentially unknown, minor forest products to the crops that many farmers consider worth producing as an alternative to conventional food and feed crops. Besides, their role in prevention as well as curing of human health and global market, MAP are also increasingly being recognized as a source of significant livelihood opportunities for many rural communities, especially, primitive forest-dwellers, landless poor and marginalized farmers.

The ICAR-Directorate of Medicinal and Aromatic Plants Research (ICAR-DMAPR) with its outreach programme of All India Coordinated Research Project on Medicinal and Aromatic Plants and Betelvine (AICRP-MAPB) is marching towards the targeted goal of “Health for all” to address the ever-increasing world population by ensuring quality raw drug production and supply through planning, coordinating, implementing and monitoring of research and development programmes. This is being achieved through the development of new varieties, good agricultural practices and quality assessment methodologies using frontier cutting age technologies. We hope that we can create better understanding of the subject and facilitate for further action on sustainable development of medicinal and aromatic plant resources, encourages the stakeholders to make timely interventions and boost the exports resulting in enhanced socio-economic benefits to the cultivators/collectors/extractors/exporters. Attempting preparation of a long term perspective plan is a difficult task in this fast changing environment of modern science where developments are happening at an exponential rate. However, we have tried our best to put the concerted efforts to address the challenges and research strategies in the domain of available environment and opportunities in the perspective of Indian agriculture. With this positive approach we are presenting before you the interim updates from the Directorate.

Boriavi

Jai Hind!
Jitendra Kumar

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(QPM) and facilitation centres for capacity building, development of primary processing facilities and work on development of high yielding varieties of medicinal plants. Dr. T. Janakiram highlighted few important issues concerning the project, in particular climate change, species erosion, species mapping, high yielding varieties, seed standards, marketing and post harvest technology of MAP&B crops. Dr. P. L. Gautam, in his address said that medicinal and aromatic plants play vital role in ensuring comprehensive healthcare needs of people. He emphasised need for documentation, protection of biodiversity and conservation of MAP&B species. The formal inaugural function was concluded by the vote of thanks proposed by Dr. R. Raina, Professor and Head of the AICRP-MAP&B centre, Dr. YSPUH&F, Solan. During the 4-day deliberations, research achievements and future technical programme of AICRP-MAP&B project was reviewed in different technical sessions such as Plant Genetic Resource Management, Betelvine, Crop Improvement, Crop production, Crop protection and Phytochemistry. An interaction meeting with the developmental agencies was also organized. The annual group meeting was attended by more than 150 participants including researchers, academicians, students, entrepreneurs, farmers and policy makers working on Medicinal and Aromatic plants & Betelvine across the country. In the end, Dr. R. Raina, Professor and Head of the AICRP-MAP&B centre, Department of Forest products, College of Forestry, Dr. YSPUH&F, Solan proposed the vote of thanks. Plenary session was held on October 1, 2017 under the Chairmanship of Dr. T. Janakiram, Assistant Director General (Horticultural Science), ICAR, New Delhi. Recommendations of each session and technical programme for the next one year were presented in plenary session and approved by the house.
**Breakthrough and Research Highlights**

**Identification of polymorphic SSR markers in Safed musli**

Safed musli (Chlorophytum borivilianum) is one of the most commercially exploited species due to its celebrated aphrodisiac as well as immunomodulatory properties. A total of 745 EST sequences obtained after CAP3 assembly having 740 singletons and 5 contigs available at NCBI (https://www.ncbi.nlm.nih.go) were analyzed for redundancy. Using MISA (Microsatellite searching tool) analysis indicated that among 745 sequences analyzed 58 sequences had repeat units. All sequences with repeat units were subjected to Primer-3 to obtain primers flanking repeat units. These primers were further examined for the amplification of EST sequences having repeat units using BLAST tool. Finally, randomly 42 primers pairs were further selected for SSR analysis out of which 21 were amplified but only 12 primers showed clear, polymorphic and reproducible band pattern which were chosen for generation of markers profile. These 12 polymorphic markers were used for diversity analysis of 50 genotypes of C. borivilianum collected from different locations. (Investigator: Dr. Hemlata Bharti, ICAR-DMAPR)

**DOS-1: New potential eugenol rich accession of tulsi**

An elite accession DOS-1 was identified in tulsi (Ocimum sanctum). Leaf, petiole, new branches and inflorescence are green in colour. DOS-1 has lower stem girth (12.59 mm), with compact and semi dwarf plant stature. The highest dry leaf weight (0.234 kg kg⁻¹) and leaf recovery (23.40%) were observed in DOS-1. Leaves had highest total chlorophyll (1.25 mg g⁻¹), carotenoids content (8.52 mg ml⁻¹), oil percent (0.50), oil yield (73.13 kg ha⁻¹) and eugenol yield (66.95 kg ha⁻¹) in green herbage. The maximum share of eugenol elements and β-Caryophyllene were observed at onset of flowering (86%; 10.06%), full flowering (89.29%; 8.63%) and crop maturity (99.36%). Overall, DOS-1 was found superior for leaf recovery, oil yield and secondary metabolites, therefore, it may be a better option for herbal/tea industry. (Investigator: Dr. P. L. Saran & Ajoy Saha, ICAR-DMAPR)

**miRNA and their targets in kalmegh**

miRNAs are known to play important role in growth and development of plants as well as various stress. Various miRNAs were identified and their targets were predicted using raw transcriptome sequence assembly database of Kalmegh (Andrographis paniculata). A total of 22285 contigs were used to indentify miRNAs. Identified miRNAs belong to 191 miRNA families and their targets belong to various molecular function, biological process, and cellular component as revealed by GO annotation of predicted targets. Simultaneously, some members regulating enzymes of andrographolides biosynthesis were also identified. (Investigator: Dr. Manish Suthar, ICAR-DMAPR)

**Four key enzymes for andrographolide biosynthesis identified from kalmegh**

Biosynthesis of andrographolide in kalmegh occurs through cytosolic mevalonate (MVA) and plastid-mediated methyl-D-erythritol 4-phosphate/Deoxy xylulose (MEP/DXP) pathways. However, the key enzymes regulating the andrographolide synthesis remain unknown. 1-deoxyxylulose 5-phosphate synthase (DXS) is the key enzyme of MEP pathway. Transcriptome assembly database of kalmegh was utilized for gene mining and four DXS isoforms were identified. Homology models were generated for these isoforms using Modeller. Homology models were validated by Ramachandran Plot analysis. Molecular dynamic simulations were performed for these models using GROMACS-5.0. Finally, active sites were analyzed by docking with thiamine diphosphate and Mg²⁺. This analysis indicated differences in binding site of different isoforms. (Investigator: Dr. Manish Suthar, ICAR-DMAPR)

**Characterization of genotypes based on reproductive behaviour in guggul**

Sporophytic apomixis was reported from guggul (Commiphora wightii) which is an important medicinal species. Considering the great ecological and economical importance and the increasing interest of sporophytic apomixis and polyembryony in a threatened species like guggul, study was conducted to evaluate the frequency of this trait expression among 12 selected genotypes of guggul collected from different parts of Gujarat and Rajasthan. Studies on pollen pistil interaction, pattern of endosperm development and extent of polyembryony and sexual or apomictc reproduction based on molecular marker analysis of the progenies were carried out in the selected genotypes. It was found that among the of 12 genotypes, seven genotypes viz., GUJ CW 1, RAJ CW 1, RAJ CW 2, RAJ CW 4, and GUJ CW 6, GUJ CW 7 and GUJ CW 8 were obligate apomictic genotypes. Among the remaining five genotypes, three genotypes, i.e., GUJ CW 2, GUJ CW 3 and GUJ CW 4, were proved to be obligate sexual female genotypes However, the remaining two genotypes, RAJ CW 3 (female) and GUJ CW 5 (hermaphrodite), were proved to be facultative apomicts. The genotypes of guggul taken for the present study thus revealed that the species had the advantages of both sexual reproduction and apomixis and these genotypes can be further exploited for studies on apomixes and crop breeding programmes. (Investigators: Mr. Vaibhav Machhi, Mr. Ashok Kumar Bishoyi, Aarti Kawane & Dr. Geetha K.A., ICAR-DMAPR)
The Directorate celebrated its Silver Jubilee Foundation Day on 24th November 2016. The DMAPR was borne as NRCMAP in 1992 and walked through a long process of its transformation to a well equipped research organization which at a time was painful yet rewarding. The DMAPR serves as one of the important key players in providing wellbeing and marching towards achieving our ancient vision of “may all being be healthy”. Dr. T. Janakiram, ADG, ICAR, New Delhi was the Chief Guest and Smt. Shomita Biswas, CEO, NMPB, New Delhi was the Guest of Honour in the formal inaugural function. Dr. Jitendra Kumar, Director, ICAR-DMAPR, in his welcome address gave a brief report on journey of the Directorate, which was followed by short video clipping which showcased the Directorate’s achievements for the past 25 years.

The directorate also remembered with gratitude all our respected predecessors whose painstaking efforts had led the way for the establishment of this Directorate and felicitated a few among them viz., our senior colleagues Dr. Rajendra Gupta, former Project coordinator of AICRP MAPB and Dr. K.C. Dalal, former Director and Mr. V.S. Parmar, former Asst. Administrative Officer. Dr. Trilochan Mohapatra, DG, ICAR, in his congratulation message to the Directorate, expressed his hearty wishes to the DMAPR family and also wishes a grand success in all our future endeavours. To commemorate the auspicious day, a Workshop on “Medicinal Plants: Farmers to Consumers” was also organized.

Training on income generation through MAPs cultivation

One day training programme entitled “Income generation through MAPs cultivation” was organized on October 22nd, 2016 at Porda, Petlad, Anand (under central sector scheme-CSS). One hundred and fourteen participants were selected for the training from different villages of Anand. In this training programme, different aspects of MAPs were covered through lectures. Dr. P. L. Saran, Senior Scientist, ICAR-DMAPR presented an introduction about the scheme along with Agro-techniques for income generation of MAP crops. Disease management of Aromatic plants was explained by Mr. R.P. Meena and Good agricultural practices for MAPs was covered by Dr. K. A. Kalariya. Quality seed production of MAPs was explained by Dr. P. Manivel. Shri Neil Saha proposed the ways for marketing of the MAPs.

Tribal farmers’ training programme

Tribal farmers’ training programme entitled “HI-TECH HORTICULTURE” was organized during November 28th to December 04th, 2016 at ICAR-DMAPR which was sponsored by Department of Horticulture, Udaipur under “Van bandhu Yojana”. Fifty-seven tribal farmers were selected from different villages of Rajasthan. In this training programme, different crop specific hi-tech horticulture (including medicinal and spices) techniques were covered through 14 lectures and six field demonstration visits. The experienced resource persons of different subject were invited for delivering their lecture for the same. Dr Jitendra Kumar, Director, ICAR-DMAPR presented an introduction of the Directorate along with Agro-techniques for income generation of MAPs/horticultural crops. Quality seed production techniques of horticulture crops were presented by Dr. P. Manivel and a movie on GACP of MAPs was shown to the farmers. At the end of the programme, feedback and queries from the farmers were taken which was followed by certificate distribution to the farmers for the successful completion of the training.

Cultivation of Brahmi : A success story of Gujarat

Medicinal and aromatic plants are gradually recognized as source of significant livelihood opportunities besides conserving soil for marginal lands. The cultivation of
Brahmi (Bacopa monnieri) is less risky in terms of the incidence of disease and insect pests, weed management, etc. and the crop can be grown in degraded and marginal soils. The entire plant of brahmi is used in indigenous system of medicine as a nerve tonic and it is a cure for epilepsy and insanity. Farmers in low-lying area in Gujarat are facing water logging problem especially during rainy season. Under such unfavourable condition, cultivation is not possible for most of the crops. In this direction, ICAR-DMAPR demonstrated the successful cultivation of Brahmi in the low-lying area of Pandori village of Anand. The success story of this crop started with the plantation of one bigha by a farmer Sh. Neil Saha in consultation with scientists of ICAR-DMAPR, Boriavi. The farmer was provided with planting material from ICAR-DMAPR. Based on the performance and economics under marginal land, Brahmi was gradually recognized as source of income besides conserving soil for farmers of marginal land possession.

Visit of DG, ICAR

Dr. Trilochan Mohapatra, Secretary, Department of Agricultural Research and Education (DARE) & Director General, Indian Council of Agricultural Research (ICAR), New Delhi visited the Directorate on 3.9.2016. He laid the foundation stone for the new Residential Quarters. Dr Jitendra Kumar, Director, ICAR-DMAPR welcomed the DG and other dignitaries and gave an overview of the Directorate. Addressing the scientists and staff, Dr. Mohapatra emphasized the need to develop technologies for doubling the income of the farmers of medicinal and aromatic plants (MAP) cultivation in the country. He also emphasized to complete the value chain of important medicinal and aromatic plants to ensure more income to the farmers.

Vigilance awareness week

The Directorate organized Vigilance Awareness Week from October 30th to November 05th, 2016. Different programmes were organized viz., essay writing competition entitled “Public participation in promoting integrity and eradicating corruption” and one day workshop entitled “Public participation in promoting integrity and eradicating corruption”. The other events related to vigilance awareness were also conducted in this week and all the staff of ICAR-DMAPR participated in these programmes.

Human Resource Development

Workshop/Conferences/ Training programmes attended

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<tr>
<th>Name</th>
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<tr>
<td>Dr. R. Nagaraja Reddy, Scientist (Plant Breeding)</td>
<td>Summer school on “Exploring Genomic Resources for the Improvement of Horticultural Crops” College of Horticulture, UHs, Bagalkot, GKV, Bangalore during July 01-21, 2016</td>
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<tr>
<td>Dr. Satyanshu Kumar, Principal Scientist (Organic Chemistry)</td>
<td>9th National Academy of Biological Sciences National Conference on New Biological Researches: Opportunity and Challenges for Sustainable Development, at Madurai Kamaraj University during August 11-12, 2016</td>
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<tr>
<td>Dr. Raghuraj Singh, Scientist (Farm Machinery and Power)</td>
<td>Brain Storming Session-Cum-Interaction Meet to identify researchable issues for mechanization in horticultural at CIAE, Bhopal during October 24-25, 2016</td>
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<td>Dr. Manivel, P., Principal Scientist (Plant Breeding) Dr. Hemlata Bharti, Scientist (Spices, Plantation crops and MAP)</td>
<td>7th Indian Horticultural Congress at IARI, New Dew Delhi during November 15-18, 2016</td>
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<tr>
<td>Dr. Manivel, P., Principal Scientist (Plant Breeding)</td>
<td>Brain storming session of germplasm of horticultural crops at NBPR during November 19, 2016</td>
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<tr>
<td>Dr. Kalariya, K.A., Scientist (Plant Physiology)</td>
<td>National Conference of Plant Physiology (NCPP-2016) on “Challenges in Crop Physiology Research: From Molecular to Whole Plant” at GKVK Campus, Bengaluru during December 8-10, 2016</td>
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Species of Conservation Interest

Uvaria narum A.DC.

The species belongs to family Annonaceae and known as South Indian uvaria, Neelavalli, Saplivel and Kooril in various languages. It is a large woody stellately pubescent straggling shrub with dark bluish green leaves. Leaves are oblong-lanceolate, acute or acuminate, hairless on both sides, leathery in appearance; stalks short, less than 6 mm. Leaves are aromatic and crushed leaves smell like cinnamon. Flowers are reddish in colours appears solitary at terminal branch positions or leaf-opposed, 2.5 cm in diameter. Stamens have anthers concealed by the overlapping connectives. Carpels are numerous which are free in arrangement, scarlet-red; Berries globose-cylindrical, red when ripe. Seeds ovoid or compressed, light brown or chestnut brown. Flowering and fruiting of the species occur during November to June. 0 The species is distributed in Western ghats from Maharashtra southwards up to an altitude of 1,200 m. Root and leaves are used in intermittent fevers, biliousness, jaundice, rheumatism, eczema; also in rheumatic affections; bruised in salt water it is used to treat skin diseases. The root is also fragrant and aromatic. A decoction of the root bark is given to women to control fits at the time of delivery. The species is propagated by seeds. Acetogenins, glutinone, glutinol, taraxerol, beta-sitastirol and benzyl benzoate are the major phytochemical present in the root bark may be responsible for the therapeutic action of the species. The plant is harvested from the wild for local use as a medicine and source of essential oil.