Proceedings of National Web Symposium on 'Recent Advances in Beneficial Insects, Natural Resins and Gums'

ICAR-Indian Institute of Natural Resins and Gums (IINRG) and Society for Advancement of Natural Resins and Gums (SANRAG) jointly organized the National Web Symposium on 'Recent Advances in Beneficial Insects, Natural Resins and Gums' virtually in partnership with Entomological Society of India, All India Coordinated Research Project on Honeybees and Pollinators and Dr. B. Vasantharaj David Foundation on 25-26 February 2021.

The inauguration of the symposium was graced by Dr. T Mohapatra, Secretary DARE and DG, ICAR, Dr. TR Sharma, DDG (Crop Science) and Dr. KK Singh, ADG (Farm Engineering). A total of 423 registered delegates attended the symposium wherein 17 lead papers by eminent workers of respective fields, 64 oral papers and 101 poster presentations were made.

Dr. T Mohapatra, Secretary DARE and DG, ICAR Chief Guest on the occasion emphasized upon the importance of beneficial insects and natural resins and gums especially lac and also the parasitoids and predators in organic agriculture. He urged the researchers, particularly, young investigators to take up the studies on biosystematics, genomics and epigenomics of pest resistance, evolution of the parasitoids and predators in relation with the pests, adaptation of the pests to withstand environmental changes. He highlighted few examples of beneficial insects such as control of papaya mealy bugs by parasitoids, exploration of bumble bees in deploying them for pollination in natural field conditions and protected horticultural systems and possibility of utilizing the locusts as edible insects. He stressed the importance of habitat restoration for the conservation and deployment of beneficial insects and proper economic analysis to convince the policy makers for the promotion of beneficial insects. He insisted that this symposium would discuss the beneficial insects in totality, bring out newer insights in the unexplored areas of beneficial insect farming and utilization, understanding the various aspects of the biology of insects and bringing about policy dimensions in promoting beneficial insects.

Dr. TR Sharma, DDG (Crop Science) complemented IINRG on being a unique institute in dealing with lac. Internationally, 1200 insect genome projects are registered in National Center for Biotechnology Information (NCBI), comprising 401 genome assemblies and 155 gene sets of annotated protein coding genes. However, at national level these numbers are meager and there is a pressing demand to take insect genomics forward, which is very important for carrying out studies on molecular mechanism of evolutionary biology, immunology, adaptation and others. He stated to give a high priority in the present scenario to research on tritrophic interaction comprising of insect - crop plant - pathogen, molecular mechanism of insect resistance in crop plants, evolutionary biology of the insects, insect gut microbiome and genome sequencing of beneficial insects especially lac insects. To achieve laurels in these areas, collaboration across the divisions, domains, crops and systems is indispensable.

Dr. KK Singh, ADG (Farm Engineering) in his opening remarks mentioned that NRGs including lac form valuable means of subsistence, employment and cash flow to growers and collectors and serve as the raw materials for various industries and used in food, fodder and medicine. In 2016, India produced 8.43 lakh tons of NRGs, out of which 97% was guar gum and exported 2.72 lakh tons of NRGs worth 3440 Crore rupees. Guar gum was the third largest agricultural commodity exported after rice and buffalo meat. He informed that we carry out only primary process and export raw and semi refined forms of NRGs and import the value added products, which is a precarious situation. In the recent years, IINRG in collaboration with other institutes in Engineering SMD developed 50 cost effective and energy efficient tools, techniques and pilot plants for the production, processing and value addition of NRGs.

Increase in sustainable livelihood security of rural and tribal people is possible through three pronged strategy that is (a) adoption of NRG sector by the Govt., (b) declaring lac as an agricultural produce and (c) bringing these under Minimum Support System of Government of India.

The deliberations of the symposium revolved under the following seven theme areas: (i) Systematics, conservation, insect behaviour and physiology Chaired by Dr. NK Krishna Kumar, former DDG (Horticultural Science), ICAR, New Delhi and Co-chaired by Dr. Chandish R Ballal, Former Director, National Bureau of Agriculturally Important Resources, Bengaluru; (ii) Host-plant, insect and environmental interaction Chaired by Dr. Pradyumn Kumar, Former Director, Indian Institute of Maize Research, New Delhi and Co-chaired by Dr. GK Mahapatro, Head, Indian Agricultural Research Institute Regional Station, Pune; (iii) Crop improvement using innovative tools including biotechnology, nanotechnology, molecular approaches *etc*. Chaired by Dr. R. Ramani, Former Director, Indian Institute of Natural Resins and Gums, Ranchi and Co-chaired by Dr. S. Subramanian, Principal Scientist, Indian Agricultural Research Institute, New Delhi; (iv) Production system management and impact of climate change; Chaired by Dr. Subhash Chander, Director, National Research Center on Integrated Pest Management, New Delhi and Co-chaired by Dr. KK Sharma, Director, Indian Institute of Natural Resins and Gums, Ranchi (v) Potential of Insects as Food and Medicinal resources Chaired by Dr. Balraj Singh, Project Coordinator, All India Coordinated Research Project on Honeybees and Pollinators, New Delhi and Co-chaired by Dr. Badal Bhattacharyya, Professor, Assam Agricultural University, Jorhat; (vi) Processing, application, value addition and export potential of NRGs Chaired by Dr. Bangali Baboo, Former National Director, National Agricultural Innovation Project, New Delhi and Co-chaired by Dr. KK Singh, ADG (FE), ICAR, New Delhi and (vii) Role of beneficial insects and NRGs in sustainable livelihood security Chaired by Dr. CM Bajpey, Director, Central Tasar Research and Training Institute, Ranchi and Co-chaired by Dr. V Sivaprasad, Director, Central Sericultural Research and Training Institute, Berhampore.

Several recommendations emerged at the end of the two days' intense deliberations during the Plenary Session which was chaired by Dr. R Ramani, Former Director, Indian Institute of Natural Resins and Gums, Ranchi and Co-chaired by Dr. VV Ramamurthy, eminent taxonomist and Former Professor at Indian Institute of Agricultural Research, New Delhi. It was emphasized that successful completion of the shellac safety studies currently in progress elsewhere is critical so that the requirements laid down by European Food Safety Authority are met for unhindered consumption and diversification of shellac in food and pharmaceutics.

Recommendations from all the theme areas were compiled area-wise for taking coherent action. These are:

A. Research thrust areas

- ✓ Elucidating the role of indigenous pollinators and solitary bees and studies on totality of pollinators including the effect of pollinators on yield and quality parameters, parasitism associated with pollinators particularly solitary bees are the need of the hour.
- ✓ Traditional and molecular techniques must go hand in hand in revealing the ecology of pollinators and other beneficial insects.
- ✓ Considering the scope of quality biocontrol agents in organic agriculture and the tremendous requirement, automation in the production of biocontrol agents shall be adopted and promoted.

- ✓ Identification of alternate host, water and soil management, selection of thermo tolerant varieties, crop insurance, weather based agro advisories, *etc*. are essential measures to mitigate the climate change effect in sericulture.
- ✓ The indigenous Muga silkworms may be explored and researched in a better way for their documentation, conservation and utilization.
- ✓ Whole genome sequencing of the Indian lac insect, *Kerria lacca* (Kerr) and its infra sub specific forms can be taken up on a priority basis for bioprospecting of genes of economic importance.
- ✓ Safety studies of edible insects and GI tags on indigenous edible insect species would take the edible insect industry to a new height.
- ✓ Potential of insect gut microbes for developing probiotics and microbiome consortium can be explored for improvement of insect farming and development of novel processing technologies for bioproducts from insects of commerce.
- ✓ Appropriate integration of productive insect cultivation comprising of lac, seri and api culture with the existing cropping pattern would enhance the income of farmers. Climate resilient lac host plants need to be assessed for their fitness and suitability under various agro climatic zones and promoted for lac cultivation in the wake of doubling farmers' income.
- ✓ There is an urging need to study the effect of climate change on productivity of beneficial insects and screen different beneficial insects to adopt under changing climate conditions for environmental sustainability and safety.
- ✓ Genetically engineered organisms may be appropriately explored to produce resins and gums under laboratory conditions which in turn would decrease the over exploitation of the gum yielding trees.
- ✓ Use of renewable energy for processing (eg. Solar dryer) and value addition of NRGs may be encouraged to save energy which in turn would help the resource poor farmers and tribes involved in this sector.
- ✓ Techno economic analysis of the research programmes on value addition of NRGs is indispensable for the success of any products or processes developed based on NRGs.
- ✓ Post Covid Scenario demands the ICT interventions in the period of new Normal to disseminate the Good Agricultural Practices (GAP) among different stakeholders of this secondary agriculture sector comprising of beneficial insects and NRGs for their improvement.

B. Development domain

- ✓ Lac integrated agro-forestry system may be promoted by State Governments, SAUs and KVKs wherein there is a high scope for lac cultivation.
- ✓ The prospects of edible insect industry may be thoroughly explored by promoting their cultivation and commercialization through banking under start up schemes by *Bandhan*/*Mudra Bank Yojana* of the government. Trading of edible insects with South East Asian nations by the way of Act East Policy of Government of India would open new avenues for this potential yet less explored venture.

C. Policy interventions

- ✓ ***Declaration of lac as an agriculture produce:*** Lac production has been categorized as a Non-Wood Forest Produce and income generated from production of lac is taxable. It

discourages the progressive farmers to take lac cultivation on a larger scale. However, lac is no longer a Non-Wood Forest Produce simply collected by the forest dwellers. Lac Integrated Farming System Models are becoming popular among the farmers which have led to 15-20 % increase in farming income through land use diversification. Agricultural and Village industry products including lac based value added products are presently covered under *Vishesh Krishi* and *Gram Udyog Yojna* (VKGUY**)** in the Foreign Trade Policy 2015-2020. Hence, there is an urgent need to declare lac as an agricultural produce and MSP for lac can also be declared under Agricultural category to accelerate its growth and livelihood potential.

- ✓ ***Formation of National Lac Development Board:*** India is the leading lac producer, processor and exporter country in the world. There are policy differences in all the states regarding the cultivation and marketing of the lac. It has been classified as nationalized or non-nationalized or monopoly item in different states. Research on lac is mandate of IINRG (ICAR, Ministry of Agriculture); most of the lac production still comes from forest / sub-forest areas (ICFRE, Ministry of Environment and Forests); Promotion and export of lac is looked after by SHEFEXIL (Shellac and Forest Products Export Promotion Council, Ministry of Commerce) and cultivated mostly by tribals (Ministry of Tribal Affairs) which sometimes creates difficult situation in developing holistic approach for promotion and development of lac / NRGs. Hence, a policy intervention at national level is required to address this differentiation. Keeping in view of above scenario, the proposal of the National Lac Development Board (NLDB) under Ministry of Agriculture is proposed to replace the exploitation with empowerment, tradition with modernity, stagnation with growth, transforming lac cultivation into an instrument for the development of rural people, checking migration of tribals for livelihood and to provide the much needed fillip to accelerate the production of lac.
- ✓ The recent pandemic has taught us the importance of self-sustainability and our nation is also marching towards "*Atmanirbhar Bharat*". Conserving and utilizing our indigenous genetic resources is crucial in obtaining self-sustainability. The commercial insects such as lac insects, wild silk worms and honeybees are important not only in commercial aspects but also in ecosystem conservation. For instance, tribals resist deforestation wherever lac is cultivated on forest trees. There is a great scope for research of these tribal yet remunerative produces. Hence, a project proposal 'Tribal Produce Project' comprising of lac, wild silk, honey, edible insects and NTFPs including NRGs may be submitted to Government of India for funding the research projects and also for improvement of this indigenous agricultural sector.
- ✓ Beneficial insects face lot of challenges due to climate change, pollution and other anthropogenic activities. The ecological service provided by pollinators such as honey bees are under continuous threat due to climate change and extensive use of pesticides. Due emphasis may be given to the beneficial insects under a single umbrella for promoting research and addressing the problems of this sector. Hence, all the beneficial insects may be brought under the ambit of the SANRAG society or a new suitable forum be constituted for the purpose of better interaction of scientists working on these insects and improvement of these valuable insects.

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