

Ecofriendly insect pest management*

The ever-increasing world population and consequent demands on agricultural products have led to a critical situation in the country, with regard to agriculture. Productivity of foodgrains has to be increased from a limited area in spite of many problems, among which pest and diseases come first. The use of chemicals in pest-management programmes has created many unwanted effects. Events during the past several decades have clearly shown that the use of chemical pesticides will not give adequate and lasting solutions to pest management. The most important side effect due to synthetic chemicals is the development of resistance to pesticides. Pest resurgence and secondary pest outbreak are the other two major problems. Besides these, humans are exposed to several health hazards.

Farmers in developing countries are showing renewed interest towards approaches like biological control, biopesticides and cultural control. In future, ecofriendly methods will play an important role in pest management, since they will bring about sustainable development. Applied research is required to develop and adopt ecofriendly approaches for many crops and modern production practices.

To discuss the current trends in ecofriendly insect pest-management practices, the Entomology Research Institute (ERI), Loyola College, Chennai organized a two-day national symposium on 'Ecofriendly Insect Pest Management'. The symposium focused on the following themes: Preparation and application methods of new botanical and microbial pesticide formulations, mass rearing techniques for biocontrol agents, evaluation of field bioefficacy and conservation of biological agents, cultural control measures, vector control, genetic techniques in pest and vector management, and

pheromones, attractants and repellents. Totally 51 papers were presented by invited speakers and other contributors in nine different sessions.

In his inaugural address, B. Vasantharaj David (Sun Agro Biotech Research Centre, Chennai) emphasized the need for organic crop-protection methods. His speech was centred on promotion of export agriculture and commercial mass production of biocontrol agents.

S. Jayaraj (S. Jayaraj Research Foundation, Chennai) stressed that the results of experiments should go from laboratory to field through farmer field schools and adoption of integrated pest management (IPM). He also noted that the threats and risks of crop production should be shared by scientists. A. Prakash (Central Rice Research Institute, Cuttack) stated that yellow stem borer is an important pest of rice and that the yield loss in rice every year in India caused by pests, diseases and weeds was about 25–35%. He urged the research community to focus on IPM, with special reference to bio-intensive IPM having pest-resistant varieties, bio-agents and biopesticides, and natural products like botanical pesticides and pheromones. A. Babu (UPASI Tea Research Foundation, Valparai) mentioned that many insects attack tea during the dry season, while a few are abundant during wet weather. Switching over to non-chemical control strategies like neem-based formulations, microbial control and biological control on a large scale is essential in order to compete in the international market. He suggested that neem kernel aqueous extract is effective against mites.

K. Narayanan (Multiplex Bio-tech Pvt Ltd, Bangalore) explained the bioefficacy of entomopathogenic viruses, bacterial pathogens like *Bacillus sphaericus* and *B. israelensis* and entomopathogenic fungi, viz. *Beuveria bassiana* and *Metarhizium anisopliae* in housefly and mosquito management. He also noted that the entomopathogenic nematode, *Heterorhabditis indica* along with its associated bacterium, *Photorhabdus luminescens* is a potential biocontrol agent against a wide range of pests. Narayanan further stated that application of 1×10^3

infective juveniles at weekly intervals was found to be highly effective against mustard sawfly. The possible use of *Wolbachia*, a common and widespread group of rickettsia-like bacteria found in the reproductive tissues of arthropods, in biological control was explained by J. S. Kennedy (TNAU, Coimbatore). He also highlighted the biodegradation of endosulphan by phyllosphere bacteria, selection of *Trichogramma* for improved host-searching ability and predatory potential of *Micromus igorotus* on sugarcane woolly aphid. Kennedy stated that the host-searching ability of *Trichogramma* increased after several generations of practice.

Hem Saxena (Indian Institute of Pulses Research, Kanpur) dealt with successful cases of biological control with parasitoids and predators. She indicated that *Campoletis chloridae* is an effective larval parasitoid of *Helicoverpa armigera* in chickpea. She also presented the bioefficacy of various fungi, bacteria and entomopathogenic nematodes. R. K. Murali Baskaran (Agricultural College and Research Institute, Madurai) reported that eight rounds of application of neemgold (1.5 ml/l) was effective in reducing the incidence of sucking pests of senna (*Cassia angustifolia*) and this treatment recorded the highest dry leaf and pod yield.

S. Sithanatham (Sun Agro Biosystems, Chennai) elucidated the improved fruit-fly trap models used for monitoring and mass trapping of the adult fruit flies. Shape, colour and size are the three important trap attributes and trap catches could be significantly enhanced by white cylindrical containers. Pathipati Usha Rani (Indian Institute of Chemical Technology, Hyderabad) discussed the role of plant volatiles in pest management and stated that the egg parasitoid, *Trichogramma chilonis* is guided by volatile chemicals emitted by rice plants due to the leaf folder herbivory. A. Jebanesan (Annamalai University, Annamalai Nagar) elaborated on the bioefficacy of methanol extract of 13 sea weeds in mosquito control. He reported that *Dictyota dichotoma* and *Gracilaria edulis* extracts presented maximum larvicidal and repellent activities against *Culex quinquefasciatus*.

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S. Ignacimuthu (ERI) reviewed the various pest-management options that have been investigated recently. He emphasized that the interrelationships among edaphic factors, attributes of primary producers, herbivore–carnivore–neutral–detritivore interactions and the ever-changing climatic factors have to be considered in great depth with a view to developing eco-friendly IPM models.

During the panel discussion, the following action plans were discussed: strengthening insect taxonomy and biodiversity expertise for authentic identification of the wide range of pestiferous and beneficial insect fauna; promoting botanically derived biopesticides; enhancing field stability and cost-effectiveness of the biopesticides; suitable extraction and evaluation methods; exploiting induced systemic resistance in crop plants as secondary benefit from beneficial mi-

crobes like *Pseudomonas* and endophytic association; greater attention towards identification of more virulent insecticidal microbial strains; extending the shelf-life and standardizing liquid formulations to enhance their adoption; improving the impact potential of mass-reared parasitoids and predators; exploring more aggressive and adapted strains of parasitoids and predators and improving female sex ratio through cost-effective methods; enhancing the efficiency of attractants, including parapheromones as lures and improving trap-design development; evaluating the use of traps and attractants in mating disruption; refining and validating different cultural and organic methods as affordable components of IPM; inventing more efficient bioagents/bioproducts and dispensing/delivery systems for the three major thrusts for vector control, namely preventive, larvicidal

and adulticidal, towards more holistic and area-based strategies, and standardizing the parameters and protocols for in-house compliance in quality control of biocontrol agents and biopesticides.

The meeting reports of ERI have been published in *Current Science* from time to time. Many scientists have interacted with us after reading these reports. They have also interacted with the respective scientists of their specific field of interest. In this sense it has played an important catalytic role. Occasionally, some funding agencies have also contacted us for greater details regarding the deliberations.

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MEETING REPORT

Plant taxonomy*

A two-week training programme in 'plant taxonomy' was held recently at the Forest Research Institute (FRI), Dehradun. A total of 26 participants (including research scholars, lecturers/readers) from different institutions and universities covering nine states of India attended the programme. Resource persons from different organizations delivered lectures on various topics. Two field visits were also organized to Mussoorie and Lachhiwala, and the surrounding areas. S. S. Negi, Director (FRI, Dehradun) inaugurated the programme. He spoke on the history and achievements of the FRI and the importance of taxonomy in today's context. Veena Chandra (FRI) introduced the theme of the training. The programme was intended to provide basic training of systematic botany with complete methodologies and techniques for plant collec-

tion. P. K. Hajra (formerly of Botanical Survey of India, Dehradun) delivered lectures on topics entitled 'History of botanical research in India' and 'Floristic diversity in India'. He discussed about the various collectors during different periods, areas of their collection, and about the diversity of different groups of plants and endemism.

D. K. Upreti (NBRI, Lucknow) discussed the basic facts about the lichen thallus, including collection, preservation and identification methods for beginners. In addition, he shared his Antarctica experience with the participants. P. K. Mishra (Lucknow University) gave a lecture on morphotaxonomic studies on freshwater algae in northern India. He pointed out the activities of the AICOPTAX scheme on freshwater algae of India and spelt out the different species found in different states of northern India. Dinabandhu Sahoo (University of Delhi) spoke about the importance of sea-weeds cultivation as an alternate source of livelihood. J. R. Sharma (BSI, Dehradun) dealt with conservation measures for fungi. His lecture consisted of major groups of fungi, their macro and

micromorphology, threats and conservation measures. He also talked about the methods of fungi collection and preservation. A. N. Shukla (FRI) discussed the different forest fungi and the extent of damage caused by them.

D. K. Singh (BSI, Dehradun) delivered a lecture on 'Bryophytes in India – an appraisal', in which he emphasized on the exploration and inventorying of bryophytes and also identification and mapping of RET species. Singh also discussed in brief about the historical overview of bryological studies in India. He talked about the diversity and distribution and economic importance of bryophytes in India and also phytogeographical affinities. He also shared his Antarctica experience with the participants. N. Punetha (L. S. M. Government P.G. College, Pithoragarh) spoke on pteridophytes in India, covering their diversity, classification and taxonomy. Veena Chandra (FRI) delivered lectures on 'Ethnobotany and its significance' and 'Digitization of Dehradun herbarium'. She emphasized the importance of virtual herbarium and presented the digitization aspects of a herbarium. She also delivered a talk on

*A report on the two-week training programme in 'Plant Taxonomy' organized and held at the Systemic Botany Division, Forest Research Institute, Dehradun during 21–31 January 2008 and sponsored by the Ministry of Environment and Forests, Government of India.