

Report of the
Seminar
on
Plant Volatiles in Forest Pest Management
Monday, 30 September 2019
Institute of Forest Genetics & Tree Breeding
Coimbatore

Insect pests are a problem in almost all sectors viz. agriculture, forestry, horticulture or medical. In addition to the native pests, we have invasive species spoiling our crops, environment and economy. Effective pest management is important to keep the serious pests at innocuous level. Chemical pesticides result in environment pollution, health hazards and various other problems. In forestry sector enough care have to be given while using chemical pesticides because the biodiversity associated with a tree/forest is enormous that many species will be affected due to chemical pesticides. Keeping this in mind IFGTB has conducted a seminar to discuss about plant volatiles which have significant role in insect attraction or repulsion, so that we can identify methods and means to utilise the plant volatiles for insect pests on tree crops on which this Institute is working to manage the associated pests properly.

Dr. John Prasanth Jacob *Scientist-G*, and Organiser of the Seminar welcomed the gathering and subject experts. **Dr. V. Mohan**, *Scientist-G*, & Head, Forest Protection Division elaborated on the theme of the seminar. In his opening remarks, **Dr. S. Murugesan**, *Director*, IFGTB mentioned that many of the ecosystem like soil, water and air need to be revived as they are spoiled by various human activities. Use of chemical pesticides is resulting in serious problems. He recalled the fall army worm incidence around the world including India. From inorganic methods, we need organic methods of management. He said that in this context, the topic of seminar is very relevant as volatiles in plants can play a significant role in pest management. Dr. Murugesan quoted examples of how plant volatiles attract pollinators, repel pest insects and attract natural enemies. He hoped that the discussions emanating from this seminar will identify areas suitable for further research as far as pest management in future is concerned in forestry crops.

Ongoing research at IFGTB

Dr. John Prasanth Jacob gave a brief presentation on the plant volatiles, its synthesis in plants and properties. He also mentioned about the key pests in forest trees and success of plant volatile based works carried out in IFGTB particularly with reference to the management of Eucalyptus gall wasp using Eucalyptus volatiles. He mentioned that based on the success made in the management of gall wasp similar works have been initiated for the management of Teak and Ailanthus defoliator in collaboration with NBAIR, Bengaluru.

Presentation by external resource persons

Dr. N. Bakthavatsalam, *Principle Scientist & Head*, Germplasm Conservation and Utilisation, NBAIR, Bengaluru spoke about **Can the plant volatiles play a role in insect pest management?**. He explained about the different type of volatiles, neuronal mechanism in insects to identify volatiles, functions of various volatiles like Eugenol, Pinene, Linalool, Hexen-1-ol, Limonene, Caryophyllene, monitoring insect pest prevalence with pheromones, male annihilation techniques, dispensers for trapping, package for management of pests with volatiles, synergistic effect of plant volatiles with pheromones, volatiles as multiple species attractant and bio-fumigants.

Dr K. Subaharan, *Principle Scientist*, Germplasm Conservation and Utilisation, NBAIR, Bengaluru spoke on **Olfactory basis of host selection in insects**. He elaborated on chemosensation in bioagents, simultaneous biological and chemical detection – Gas Chromatography and Single Cell Recording, detection to delivery of pheromone kairomone synergists for trapping Red palm weevil as a case

study, development of nanomatrix, bio safety of nanoparticles used in release of semiochemicals, chemoecological methods in biological control, Electro Antenogram (EAG) antennal response to host products, olfactory conditioning of parasitoids with host products and effect of sub lethal dose of insecticides on orientation of bioagents.

Dr. Balu, *Scientist-G* & former Head (Retired), Forest Protection Division, IFGTB in his remarks mentioned that the behaviour of insects modulated by plant volatiles can be identified in the field itself. Chemical ecological studies are an important area from where we can derive and develop insect management methods which are eco-friendly. In case IPM is a failure, such techniques with plant volatile can boost the process of pest management. He also stressed the need for development of application technology in forestry. Through metabolic engineering trait specific germplasm which can produce specific chemicals may be identified.

Discussion

In the discussions that followed **Dr. Bakthavatsalam** mentioned that NBAIR has identified volatiles to attract some of the wood boring insects like cashew and mango borer. He said that in collaboration with IFGTB testing some generic pheromones in hotspot areas can be done for forestry crops because it is an excellent tool for monitoring. Moreover ICAR and ICFRE have entered into an MOU for working together in various fields. An oil based bio-fumigant identified by NBAIR has tremendous scope as termite repellent. He added that many of the volatiles can be integrated with pheromones for successful pest management. He stressed the need for developing technology to put them in farmer's field.

Dr. Balu mentioned about Sal, Teak and Casuarina bores which need solid management measures. **Dr. Bakthavatsalam** pointed out that two types of pheromones in Cerambycid viz. aggregation and sex pheromones which can be utilized as the need arise. He added that if specific pheromone does not work it cannot be used across different pests species.

For a query posed by **Dr. Balu** on whether the pesticides used have interference with biocontrol agents, **Dr. Subaharan** replied that sub lethal dose of pesticides can interfere with the orientation, walking and approaching ability of natural enemies.

Dr. Nagaragan, *Scientist G*, IFGTB enquired about the use of volatiles in pollination in addition to the plant protection aspects. **Dr. Subaharan** replied that continuous pest problems and economic loss warrants priority for pest management and pollination aspects are not considered to that extent. Moreover availability of funds is also a problem.

Dr. Mathish, *Scientist-F*, IFGTB clarified about the variation in volatile profiles in pest susceptible and tolerant germplasm. **Dr. Bakthavatsalam** mentioned that based on the electro physiological response it can be understood that the quality and quantity of volatiles in different germplasm varies and a female insect goes in search of a susceptible germplasm on which its progeny can survive. A similar variation observed in eucalyptus germplasm of IFGTB helped IFGTB and NBAIR to jointly develop *EuGalLure*, an attractant for trapping eucalyptus gall wasp recently.

Dr. A. Nicodmus, *Scientist F*, IFGTB recalled that the tree crop being a long rotation crop takes usually half of its cultivation time to get a feedback from stakeholders about the merits and demerits of aspects like cultivation practices and pest management measures. He sought means and ways to hasten this so as to make information available to stakeholders as early as possible. **Dr. Bakthavatsalam** replied that broad based measures can be attempted to quickly deliver results at initial stages and fine tuning can be done at later stages of crop cultivation time.

Dr. Senthilkumar, *Scientist-F*, IFGTB enquired about the regulatory implication for kairamone and pheromone. **Dr. Bakthavatsalam** replied that as such there is no regulation associated with

kairamone and pheromone. Only for those which interferes with the biological cycle of the organism such as mating disruption require approval from Central Insecticide Board and Registration Committee (CIB&RC). So far there is no Insecticidal Act for pheromones.

Dr. Senthilkumar also enquired about the impact of microbial bio pesticides on the plant volatiles. **Dr. Subharan** pointed out that studies have shown that female insects usually can detect surface treated with the fungus *Metarhizium anisopliae* and avoid laying eggs on such substratum. Plant based bio pesticides do influence bio control agents to a level. Above a limit neem and entomopathogens are toxic to biocontrol agents.

Dr. Subaharan recalled that there are 40-50 common volatile chemicals in all plants. Difference will be with few of the chemicals. Even external application of specific plant chemicals have shown to enhance pest/natural enemy activity.

Dr. Murugesan thanked all for the active participants in the discussion. He recalled about the biodiversity loss due to various reasons and the possible threat of bio war or bio terrorism with pest insect species. He mentioned the potential of identifying volatile chemicals like caryophyllene from invasive plant species Lantana which can attract biocontrol agents. He stressed the need for developing models and hoped that the association of ICAR and ICFRE through the MOU will open further avenues of collaboration in research.

Research Gaps for Future Works

Wrapping up the discussions **Dr. John Prasanth Jacob** tagged few areas where future works can be initiated in forest pest management using plant volatiles.

1. Identification of management measures for forest tree borers based on the advancements made in the management of agriculture/horticulture pests like mango and cashew wood borers through volatiles.
2. Studies on the role of pheromones in combination with plant volatiles to give synergy in pest attraction (for trapping/monitoring) or repulsion.
3. Development of Bio-fumigants for management of insects associated with stored forest products.
4. Development of Nanotechnology to enhance delivery and coverage in forest pest management with proper application technology.
5. Identification of relevant plant volatiles for enhancing biological control of forest insect pests.

Dr. A. Karthikeyan, *Scientist-F* IFTGB proposed the Vote of Thanks

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Inaugural Address by Dr. S. Murugesan, Director, IFGTB



Dr. J. P. Jacob, Scientist-G presenting the ongoing research on plant volatiles at IFGTB



Dr. K. Subaharan, Principal Scientist, NBAIR



Dr. N. Bakhavatsalam, Principal Scientist, NBAIR



Dr. A. Balu, Scientist-G & former Head (Retired), Forest Protection Division



View of the gathering