



Session I

Crop Pest Management I—Microbial Biopesticides

Chair Dr A N Mukhopadhyay ■ Co-chair Dr Pam Marrone

Lead speakers

Keynote – International: Prof. Ilan Chet, Israel

Trichoderma: an environment-friendly biocontrol agent of plant disease

Keynote – National: Dr S P Singh, India

Microbial Control of Crop Pests in India



Session 1 in progress



The session began with a keynote presentation titled 'Trichoderma: an environment-friendly biocontrol agent of plant disease' by Prof. Ilan Chet, Israel. Prof. Chet is considered the Father of *Trichoderma* for the pioneering research he has done on *Trichoderma* for the past 30 years and for effectively transforming the academic knowledge into field application for the management of several pathogenic fungi through non-chemical means. In his keynote, Prof. Chet emphasized that this organism is sensitive to abiotic factors such as temperature, moisture, and pH like many other natural organisms, and in spite of 30 years of concerted efforts, *Trichoderma*'s uniform field performance continues to be evasive in all conditions. Therefore, the success depends largely on identifying ideal abiotic factors. He informed the gathering that his team has genetically evolved a strain of *Trichoderma* to suit the desert (arid) conditions and has been patented. Further, the mode of action and

mechanism of its virulence have been established. Fungal cell wall degrading enzymes (cellulases and chitinases) were identified as the virulence factors and ChiA was expressed in *E. coli* for developing transgenic tobacco. However, he explained that the pathogen suppression was a combined effect of mycoparasitism and induced resistance in host plant through phytoalexin system. He claimed that *Trichoderma* is effective against foliar diseases like *Botrytis* and fruit decaying fungi in post-harvest conditions.



In the second keynote address, Dr S P Singh gave an overview of research and development on microbial control of pests and biopesticides of microbial origin. About 110 entomopathogenic bacteria, 20 NPV, 2 GV, 92 species of entomopathogenic fungi, 60 isolates of entomopathogenic nematodes, about 300 species of antagonistic fungi for fungal pathogens and nematodes, several protozoan pathogens, and so on have been recorded

from India. Presently, about 150 commercial companies are operational in the production of biopesticides in the country with about 25 products of live organisms. Production technologies were worked out and transferred. A sporeless mutant of *Bacillus thuringiensis* has also been evolved. However, he identified that simplification of registration protocols, quality control, and regulation need immediate attention.

In his address, Dr A N Mukhopadhyay identified *Trichoderma* as a true bioagent, which can work against a wide array of



pathogens without any ill effects on environment and non-target organisms. He advocated seed treatment of *Trichoderma* for pathogen control in place of soil application in order to minimize the application dose with similar levels of control. He also proposed on-the-spot technical audit of production facilities of commercial firms to ensure quality of biopesticides.

Speakers

Prof. Brian Kerry, UK ■ Dr M V Deshpande, India ■ Prof. S R Niranjana, India ■ Dr A U Siddiqui, India ■ Dr H N Gour, India



Prof. Brian Kerry



Dr M V Deshpande



Prof. S R Niranjana



Dr A U Siddiqui



Dr H N Gour

Dr Brian Kerry spoke on 'Interactions between host plants and the nematophagous fungus *Pochonia chlamydosporia* used to regulate nematode populations'. He mentioned that application of *Pochonia chlamydosporia* colonized rice grain or chlamydospores is effective against root knot and cyst nematodes. However, the fungal isolates have exhibited host specificity to nematodes. The nutrition to the fungus is the triggering factor for its switchover from saprophytic stage to parasitic stage on nematodes.

Dr M V Deshpande's presentation focused on 'Microbial control of *Helicoverpa armigera* in pulses: comparison of metarhizium isolates to identify strains for commercialization'. Three effective isolates of metarhizium have been identified and their commercial formulations have also been developed.

Prof. S R Niranjana gave a presentation on 'Innovative entomopathogenic fungus *Beauveria*

bassiana as biopesticide against coffee berry borer in India'. Several isolates of *B. bassiana* have been identified, developed as commercial biopesticide against coffee berry borer, and patented.

Dr A U Siddiqui's presentation focused on 'Entomopathogenic nematodes as potential biopesticide for insect pest control'. He mentioned that intensive research on commercialization of EPN is in progress at IARI, New Delhi; PDBC, Bangalore; IIPR, Kanpur; MPUAT, Udaipur; and TNAU, Coimbatore. Talc and cadaver formulations of EPN have been developed at PDBC, Bangalore with six months shelf life. A commercial formulation of *S. thermophilum* has also been developed at IARI.

Dr H N Gour in his presentation focused on 'Microbial insecticides in crop health management'. He emphasized that cataloguing, taxonomy, and conservation of for developing microbial insecticides in crop health management.

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Session II

Crop Pest Management II—Botanical Biopesticides

Chair Prof. G N Qazi ■ Co-chair Prof. Errol Hassan

Lead speakers

Keynote – International: Prof. Azucena Gonzalez-Coloma, Spain

Biopesticides: production and optimization through chemical and biotechnological processes

Keynote – National: Dr Opendar Koul, India

Botanical Biopesticides: potential and constraints



Session 2 in progress



Dr Azucena Gonzalez-Coloma began the session with a keynote address. Her presentation focused on 'Biopesticides: production and optimization through chemical and biotechnological processes'. She mentioned that biopesticides are not produced in sufficient amount to be available for commercialization. Therefore, in vitro cultivation of the transferred roots and aeroponic cultivation of plants for non-destructive production is being carried out. Supercritical fluid extraction method is also being used because of cheap availability of CO₂ for extraction of essential oils from the plants and further extraction with ethanol to obtain pelae

metabolites. She gave the example of *Persea indica* from where ryanodine type of compounds have been isolated, which are selective in their activity. According to her, *Persea indica* is a model plant for the production of biopesticides. In some plants, fungal endophytes have been identified. However, most of the secondary metabolites have been produced by the plant itself.



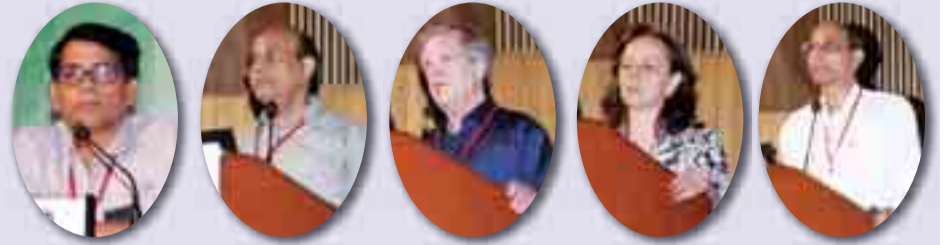
Dr Opendar Koul focused his keynote address on 'Botanical pesticides: potential and constraints'. He said there are about five lakh plant species available but only 10% of these have been really studied. Main focus has been on only pyrethrum and neem. According

to him, recent studies have shown that a combination of compounds/secondary metabolites is more desirable in that the insecticidal spectrum of the compounds in binary mixtures is increased because

of different responses to individual compounds. There are practical problems, which have to be overcome by changing consumer preference towards the use of natural or synthetic chemicals.

Speakers

Dr Dwijendra Singh, India ■ Dr A K Srivastava, India ■ Prof. Peter Baeckstrom, Sweden ■ Dr Pervin Erdogan, Turkey ■ Dr V L Maheshwari, India



Dr Dwijendra Singh

Dr A K Srivastava

Prof. Peter Baeckstrom

Dr Pervin Erdogan

Dr V L Maheshwari

Dr Dwijendra Singh spoke on the 'Prospects of medicinal and aromatic plants for potential biopesticides'. He said that there are very useful plants available producing a number of secondary metabolites that are used in many pharmaceutical and cosmetic companies, bakeries, and in foodstuffs. He focused on plant species namely *Alnthes excelsa*, *Artemisia annua*, *Cedrus deodera*, *Cathareanthus roseus*, and so on. He mentioned that alpha-amyrin acetate and oleanolic acid from *C. roseus* have shown potential as biopesticides against various insect pests.

Dr A K Srivastava focused on 'Production of Biopesticide (azadirachtin) by cell/hairy root cultivation in bioreactor'. An alternative method of production of azadirachtin has been standardized. He explained the mass cultivation of *A. indica* cell in a stirred tank bioreactor under batch mode of cultivation, which led to the production of 15.57 g/l biomass and 0.05 g/l of azadirachtin in 10 days. An unstructured mathematical model was developed to describe the kinetics

of growth production formation and substrate consumption. Finally, a bioreactor cultivation technique was developed for azadirachtin production.

Prof. Peter Baeckstrom made a presentation on 'Isolation of compounds from plant material using column chromatography'. He explained that a new column chromatographic method for isolation of compounds from plant material was standardized using silica gel column with pressure of 2 bars. The method could easily isolate azadirachtin from neem seeds in few fractions.

Dr Pervin Erdogan talked about mite control in potato using plant extracts from henbane plant. The plant extract did not show any ovicidal effect but higher concentrations showed mortality.

Dr V L Maheshwari spoke on 'Plants as bioresource for sustainable pest management'. He explained about the activity of flavonoids isolated from *Anona squamosa* and from rhizomes of *Acorus calamus* as adulticide and control of insects infesting green gram.

Session III

Crop Pest Management III—Semio-chemicals

Chair Prof. Alan Cork ■ Co-chair Dr K Krishnaiah

Lead Speakers

Keynote – International: Prof. Alan Cork, UK

Making pheromones work for farmers in an IPM context

Keynote – National: Dr S Narasimhan, India

Application of semiochemicals in crop protection: Indian perspectives



Session 3 in progress



In his keynote address, Prof. Alan Cork spoke on the need to follow a systemic approach with focus on single crops. Use of pheromones is one such technical option but quality monitoring is essential and useful especially in a situation where resistance to chemicals is noticed. He stressed that IPM can be successful only if practiced over a larger area rather than on individual farms. Through the use of pheromones in mating disruption and in combination with the other methods, at times the total eradication of the pest problem has been possible. He discussed about the 'push-pull strategy' for the control of lepidopteron pest and monitoring and MD techniques to control borer insects. He mentioned that Mythyl eugenol is an effective

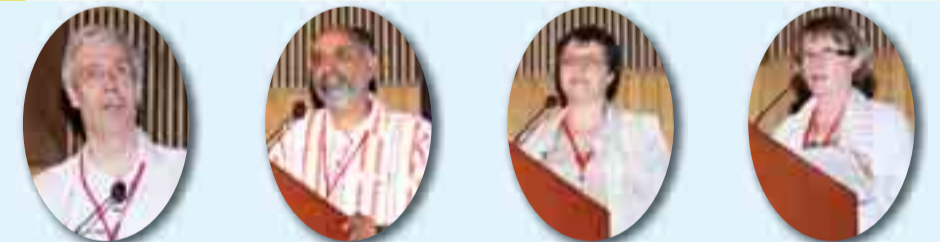
pheromone compound to control fruit fly in India.



Dr S Narasimhan, in his keynote, discussed the imported and indigenous pheromone strategy in the Indian scenario. He spoke about pheromone application using monitoring, mass trapping, and MD against sugar cane pest. He also pointed out that most of the pheromones available in India are imported and not indigenous, which may be the cause of their poor acceptance by the Indian farmers. He mentioned that there is a need to develop indigenous systems for making pheromone compounds and traps for economically important pests. He stressed on the need to have promotional programmes for pheromone by the government and other stakeholders.

Speakers

Dr Gabor Szocs, Hungary ■ Dr A R Prasad, India ■ Prof. Hristina Kutinkova, Bulgaria ■ Prof. Brigitte Frerot, France



Dr Gabor Szocs

Dr A R Prasad

Prof. Hristina Kutinkova

Prof. Brigitte Frerot

Dr Gabor Szocs outlined successful implementation of pheromone in Hungary for managing crop pests. Minor compounds were found to have 10 times higher capture rate than the major compound. Application of lower population density using sticky traps and higher population using funnel trap can be used. He also mentioned the need to develop specific pheromone technology for different geographical locations.

Dr A R Prasad talked about the constraints in the implementation of pheromone technology in India. This includes lack of indigenous pheromones in India, awareness, and of field evaluation. He emphasized the

need for government intervention for promotion of pheromone and also the urgent need to prevent the spurious products.

Prof. Hristina Kutinkova spoke about pheromone traps for successfully controlling the codling moth in apple orchid. A 1000/hr dispenser is needed for capturing the codling moth using MD techniques. However, good interventions are required to undertaken this programme in large area.

Prof. Brigitte Frerot talked about the plant compounds in relation with insect behaviour. She briefly described the identification of insect pheromone using GC and GC-MS.

Poster session

