

## Biodiversity and insect pest management\*

Biodiversity is the full range of variety and variability within and among living organisms, their associations and habitat-oriented ecological complexes. Before the advent of the 'Green Revolution', our farmers largely relied on organic manures and cultural methods of pest management, which were helpful in promoting parasitoid and predatory populations. Diversity of natural enemy complexes attacking various stages of the pests prevalent in poly crop and intercropping systems tends to prevent severe pest outbreaks, maintain the biotic balance and reduce pest populations below the economic injury level.

Sustainable crop protection would involve an array of interactions among the herbivores, natural enemies and vegetation. An agroecosystem which is free from chemical pesticides harbours rich arthropod community, including different kinds of natural enemies; and their abundance is sometimes greater than the pests (Table 1). To achieve sustainability in agriculture through integrated farming practices, we should maintain and conserve biodiversity. With a view to explore the emerging trends in pest management practices through biodiversity conservation and enhancement, a national symposium on biodiversity and insect pest management was organized recently in Chennai.

Deliberations during the symposium covered various aspects of biodiversity in relation to host plants, pests and natural enemy complexes in different agroecosystems, traditional pest-control practices, chemical ecology, tritrophic relationships of insect pests and natural enemies, conservation and enhancement. J. R. B. Alfred (Director, Zoological Survey of India, Kolkata) in his inaugural address, stated that everything in the world has relationship with biodiversity. He categorized the bioresources into genetic, organismic and ecosystem resources and commented that habitat destruction and introduction of exotics and hybrids are two principal causes among others for loss of native biodiversity. He noted that 10,000 insects are sporadic pests and 1000 insects are serious pests in the world. He recom-

mended institutional collaboration for cost-effective means of addressing the current collections and creation of a database for the insect diversity studies.

S. Jayaraj (S. Jayaraj Research Foundation, Chennai) introduced the theme of the symposium, emphasizing the need for biodiversity conservation and enhancement by modifying agroecosystem, which largely includes biodiversity of crops and their cultivars, intensive agronomic practices, abundance of beneficial and harmful fauna and land-use pattern and weather, thus reducing the chances for pest outbreak considerably. Gunathilagaraj (Tamil Nadu Agricultural University (TNAU), Coimbatore) stated that biodiversity in wetland ecosystem helps in the generation of nutrients for rice cultivation and provides human food items like hygrophytic vegetation and fish. P. M. M. David (Agricultural College and Research Institute, Killikulam) emphasized the need for adopting new methods of rice cultivation like System of Rice Intensification, for supporting more natural enemy complexes.

B. V. David (Sun Agro Biotech Research Centre, Chennai) said that the host plants of whiteflies play an important role, besides empty puparial cases, in whitefly systematics. Alexander Jesudasan (Madras Christian College, Chennai) talked about various ethological interactions between ants and whiteflies in the Western Ghats of India. He stated that the genera of ants associated with whiteflies belonged to *Rhachisphora*, *Tetraleurodes*, *Sphericaeyrodes* and *Aleuromarginatus*. Biodiversity and classification of reduviids was enunciated by Dunston P. Ambrose (Entomology Research Unit, St. Xavier's College, Palayamkottai) on the basis of ethology, ecology, morphology and biology. S. K. A. Rizvi (Aligarh Muslim University, Aligarh) spoke on biodiversity and biocontrol of grasshoppers. He said that the mite *Podapolipus diander* Volkonsky (Acarina: Podapolipodidae) is parasitic on the rice grasshopper *Oxya velox*. This parasitic mite was said to be reducing the fertility of the female grasshopper and was also predeceous on eggs of *O. velox* in marshy niches.

George Mathew (Kerala Forest Research Institute, Peechi) talked about butterfly gardens and butterfly houses for *in situ* conservation of butterflies and also for environmental education. R. Selvaraj Pan-

dian (American College, Madurai) detailed biodiversity of mosquitoes in rice ecosystem and discussed control measures for mosquito population. A paste of turmeric and *Aloe vera* was said to be an effective repellent against mosquitoes. G. Ravi (Tamil Nadu Rice Research Institute, Aduthurai) suggested that the trap crop African marigold can be used as *Parasynomone* source, since it increases the activity of *Trichogramma* against the pod borer *Helicoverpa armigera* and is said to be a *Trichogramma*-friendly crop.

K. Narayanan (Project Directorate of Biological Control, Bangalore) dealt with diversity of insect viruses in the world as well as in India. He stated that out of 1100 host records covering 13 insect orders belonging to 12 viral families worldwide, India has 45 host records of 3 insect orders of primitive hymenoptera to advanced Lepidoptera, covering more than 20 families. He also discussed the use of recombinant baculoviruses as efficient biopesticides. H. C. Sharma (International Crop Research Institute for the Semi-Arid Tropics, Patancheru) stated that the effects of transgenic plants on the activity of natural enemies vary across crops and insect species involved and that there is a need to develop appropriate protocols to assess the effects of transgenic crops with insect resistance on non-target organisms. He stated that *Crocidolomia binotalis* NPV gave 33.3–90% mortality against late second instar larvae of *C. binotalis*, and the mortality was dose-dependent. He also reported that *C. binotalis* NPV was not found to be cross-infective to *Plutella xylostella*, *Hellula undalis*, *Trichoplusia ni*, *H. armigera*, *S. litura*, *S. exigua*, *Chilo partellus* and *Corcyra cephalonica*. Steve Clement (United States Department of Agriculture, USA) talked about biodiversity of plant resistance to insects and its implication for pest management. He said that the fungal endophytes in plants were offering resistance to insects. He placed stress on the need for long-term efforts to overcome impediments in research related to plant resistance to insects and their implications for pest management. P. Narayanasamy (Annamalai University, Annamalai Nagar) reported that *Mucor hiemalis* Wehmer, *Fusarium moniliforme* (Sheld) and *Scopulariopsis* sp. were important mothcidal fungi recovered from moths of yellow rice borer, leaf folder and

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**Table 1.** Number of families under class Insecta and Arachnida categorized into phytophages, natural enemies and scavengers recorded in the rice fields of India

Order	Phytophages	Natural enemies		Scavengers
		Predators	Parasitoids	
<b>Arachnids</b>				
Acari	–	1	–	–
Araneae	–	13	–	–
<b>Insects</b>				
Blattoidea	–	–	–	1
Coleoptera	3	4	–	1
Collembola	–	–	–	3
Dermaptera	–	1	–	–
Diptera	4	2	2	4
Heteroptera	3	7	–	–
Homoptera	4	–	–	–
Hymenoptera	–	5	17	–
Isoptera	1	–	–	–
Lepidoptera	4	–	–	–
Mantodea	–	1	–	–
Neuroptera	–	1	–	–
Odonata	–	4	–	–
Orthoptera	1	3	–	–
Phasmatoidea	–	1	–	–
Strepsiptera	–	–	2	–
Thysanoptera	1	–	–	–

yellow hairy caterpillar. *M. hiemalis* and *F. moniliforme* were found to be suitable and efficient fungal agents to check moths of yellow rice borer and leaf folder. M.

Mani (Indian Institute of Horticultural Research, Bangalore) said that *Anagyrus dactylopii* (How.) causes up to 70% parasitism on pink mealybug *Maconellicoc-*

*cus hirsutus* (Green) in grape gardens. He recommended the release of the coccinellids *Chilocorus nigrita* (Fab.) to check red scale on citrus and *C. montrouzieri* against green shield scale on guava for effective management. R. K. Murali Basakaran (Horticultural Research Station, Kodaikanal) said that the predators *Scymnus nibulus* Mulsant, *S. latemaculatus* Mots, *S. castaneus* Sic. and *S. coccivora* Ayyar were efficient biocontrol agents of aphids and mealybugs in Madurai, Theni and Sivagangai districts, and up to 82% control of *M. hirsutus* was achieved on guava in 56 days. A. Regupathy (TNAU) reported that in rice, cotton and coffee ecosystems 19, 21, and 57 species of spiders were recorded respectively, and foliar application of insecticides caused significant reduction in foliage-dwelling spiders.

During the panel discussion, the need for establishment of a national-level bureau for biodiversity issues, giving more attention to forest biodiversity studies, establishment of biodiversity clubs in schools and colleges, and encouraging use of traditional knowledge-based farmers' practices like biopesticides and organic farming for sustainable agriculture were stressed.

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