NBAII Newsletter

National Bureau of Agriculturally Important Insects

Indian Council of Agricultural Research

Vol. V (1) March 2013

Conservation of agriculturally important insects

In spite of creation of awareness on the ill effects of indiscriminate use of chemical pesticides, their usage is increasing day by day in India. The strong pesticide lobby has been ensuring that several new toxic molecules or mixtures of molecules are regularly introduced in the Indian market for controlling various pests, especially on commercial crops. These new molecules are highly persistent and more toxic against crop pests. But when used, these may also kill and destroy a range of agriculturally important beneficial insects like parasitoids, predators, productive insects, pollinators, scavengers and soil arthropods.

Sadly, a recent investigation by an independent environmental research organisation revealed that several national and state agricultural departments and universities have been promoting the use of harmful pesticides which are not even registered with the Central Insecticides Board. There is an urgent need to devise different methods of conservation of agriculturally important insects.

Conservation of existing natural enemies in an environment is one of the three methods of biological pest control, the other two being the classical biological control and augmentation. Protecting and preserving the natural enemies that are already adapted to a given habitat and to the target pest is both simple and cost-effective. Coccinellids, chrysopids, syrphids and/or trichogrammatids are invariably found in most cropping systems in India. Though conserving them is a challenge, practices such as habitat manipulation come in handy.

Ant control and selective use of safe pesticides are also considered as conservation biocontrol measures. Wherever possible, cultural and mechanical methods should be preferred rather than using broad-spectrum chemical pesticides that might harm the natural enemies in the long run. Planting of diverse, nectar-rich plant species with staggered flowering periods is recommended to ensure the sustained survival of natural enemies, many of which are nectivorous during the adult stage, but parasitic or predatory as larvae.

Promoting organic farming is an excellent option for the conservation of agriculturally important beneficial insects. Establishing butterfly parks in government-run zoological and botanical parks is another option for the conservation of several beneficial pollinators and natural enemies such as parasitoids and predators.

B.S. Bhumannavar
Director (Acting)

NBAII's new laboratory complex at Yelahanka inaugurated

Dr S. Ayyappan, Secretary, DARE & Director-General, ICAR, inaugurated the new laboratory complex at the Yelahanka Campus of NBAII in Bangalore on 16 March 2013. Deputy Director-General (Horticulture), ICAR, Dr N.K. Krishna Kumar, engineers from the Central Public Works Department and a host of eminent scientists were present during the event. Dr Ayyappan honoured those involved in the construction and also released NBAII's new publications.

Research Highlights

New platygastrid species

Three new species of platygastrids belonging to the subfamily Sceliotrachelinae, viz. *Plutomerus veereshi* Veenakumari, Buhl & Rajmohana; *Fidiobia nagarajae* Veenakumari, Buhl & Rajmohana; and *F. viraktamathi* Veenakumari, Buhl & Rajmohana have been described from south India. The last two (Fig. 1) are the first representatives of *Fidiobia* in India.

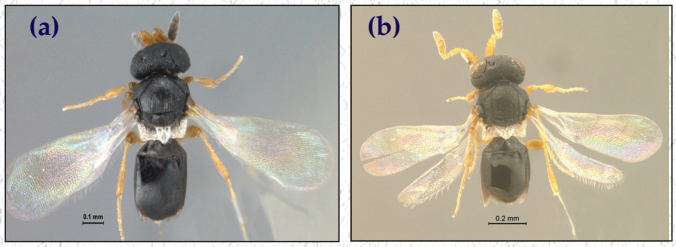

Fig. 1: New platygastrids: (a) *Fidiobia nagarajae*; (b) *Fidiobia viraktamathi*

Trichogrammatids from Andaman islands

Agricultural and natural ecosystems in South, Little and Middle Andaman islands were surveyed for their *Trichogramma* and *Trichogrammatoidea* fauna. *Trichogramma rabindrai* and *Trichogrammatoidea bactrae* were collected from agricultural fields and forest areas in the islands. *Trichogrammatoidea bactrae* was for the first time collected from the eggs of *Prosotas nora*, a pest of citrus. The only species of these genera known earlier from these islands were *Trichogramma japonica* and *T. chilonis*.

New records of Tephritidae for India

Four species of the tribe Adramini, viz. *Coelotrypes latilimbatus* (Fig. 2a), *Dimeringophrys pallidipennis* (Fig. 2b), *D. parilis*, *Hardyadrama excoecariae* and an undescribed species of *Coelopacidia* were recently discovered in India.

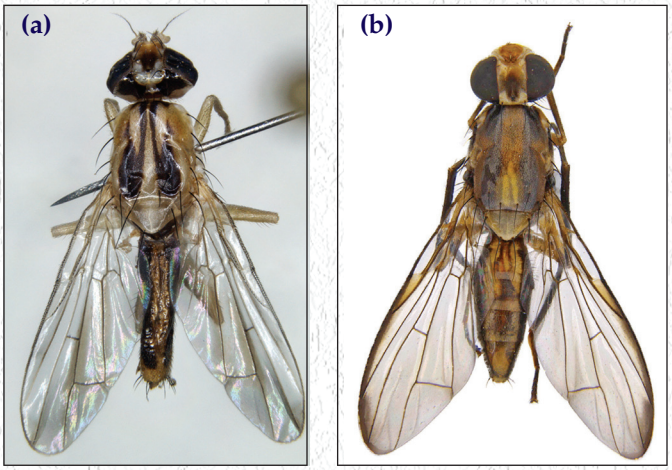

Fig. 2: New tephritids: (a) *Coelotrypes latilimbatus*; (b) *Dimeringophrys pallidipennis*

New taxa and new synonyms in Tephritidae

Four new species of *Euphranta*, namely, *E. dysoxyli* David, *E. diffusa* David, *E. thandikudi* David and *E. hyalipennis* David & Freidberg, have been described from India. Also described was a new species from Sri Lanka, *E. neochrysopila* David, Freidberg, Hancock & Goodger. An illustrated key to 12 species of *Euphranta* from India has been published. Further, *E. dissoluta* and *E. burtoni* were synonymised with *E. crux*.

First record of an anthocorid predator

An anthocorid predator, *Xylocoris* (*Proxylocoris*) *afer* (Fig. 3), was recorded for the first time in India from within the dry fruits of *Ficus* sp. and *Lagerstroemia flos-reginae*. It was found to be amenable to continuous laboratory rearing on *Corcyra cephalonica* eggs. Mated females could lay masses of eggs inside bean pods. The incubation period was 5.4 days and nymphal period, 16.9 days. There was 92.3% hatching and 90% adult emergence. The adult male and female *X. afer* survived for more than 34 and 20 days, respectively. Each female laid over 40 eggs.

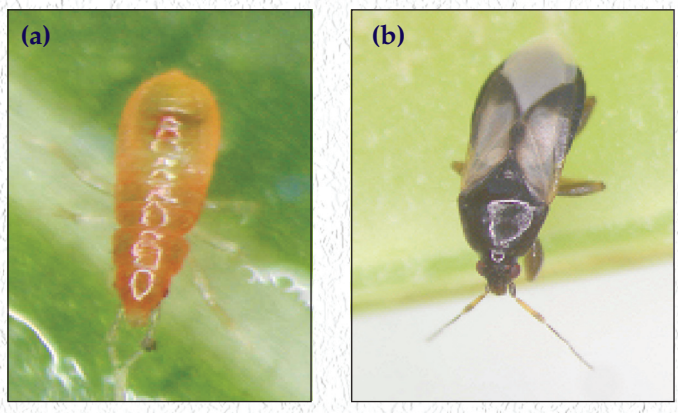

Fig. 3: *Xylocoris* (*Proxylocoris*) *afer*: (a) Nymph; (b) Adult

Novel nanoformulations

Novel nanoformulations (nanogels) were synthesised in collaboration with the Department of Organic Chemistry, Indian Institute of Science, Bangalore, to increase the field-life of various pheromones. These nanocomposites-absorbed pheromones can be more effectively used in the field to disrupt the life cycle of insect pests such as *Bactrocera dorsalis*, *Helicoverpa armigera*, *Scirpophaga incertulas*, *Leucinodes orbonalis* and *Xylotrechus quadripes*.

Culturable microflora from a planthopper

Several culturable microflora were recently isolated from *Nilaparvata lugens*, the brown planthopper of rice, sampled in Hyderabad. Molecular characterisation through sequencing the 16S rDNA gene revealed the identities of the isolated bacteria as *Acinetobacter gyllenbergii*, *A. bereziniae*, *Serratia marcescens*, *Staphylococcus sciuri* and *Stenotrophomonas* sp.

Award-winning farmer advocates biocontrol technologies

NBAII displayed biocontrol agents and technologies at the exhibition arranged as part of the "Krishi Vigyan Mela" organised by the Indian Agricultural Research Institute (IARI, New Delhi) from 6–8 March 2013. One of the most important visitors to the NBAII stall was Mr Man Mohan Dhoot, a progressive farmer from Madhya Pradesh, who was conferred with the *IARI Fellow Award* by the Honourable Union Minister of Agriculture & Food Processing Industries, Mr Sharad Pawar, on the occasion. Impressed with the concept of biocontrol and the technologies displayed, Mr Dhoot pronounced that biological control had the potential to revolutionise the management of crop pests in Indian agriculture, and that only publicity and extension of these methods were required for our farmers. Mr Satandra Kumar, Technical Officer, managed the NBAII stall.

Mr Dhoot receiving the award

Mr Dhoot at the NBAII stall

Advanced research on insect viruses

Insect viruses (baculoviruses) are one of the prospective biological control agents and are excellent candidates for species-specific and narrow-spectrum insecticidal applications. They have been successfully used for controlling insect pests on pulses, oilseeds, vegetables and many other crops. The insect-selective viruses consist of a nucleic acid core and a protein shell or capsid, called a polyhedron, that protects the genetic material from being easily destroyed.

The baculovirus genome, ranging in size from 80–180 kbp, comprises conserved gene regions as well as several small repeated sequences known as homologous regions. The conserved genes, in particular, are involved in several stages during the successful baculoviral infection. Some of these are the polyhedrin gene (*polh*) encoding the matrix protein of the virus occlusion body that provides the embedded virions protection against environmental decomposition; the late-expression factor-8 gene (*lef-8*) that encodes the largest subunit of the virally encoded DNA-directed RNA polymerase; *per-os* infectivity factor gene, the product of which is an occlusion body-derived structural protein essential for first steps of oral infection; anti-apoptotic genes that prevent apoptosis exhibited by insect cells in response to baculoviral infection; and DNA-binding protein gene responsible for condensing the large dsDNA genome to facilitate packaging into the baculoviral nucleocapsids.

Scientists at NBAII have successfully characterised the *lef-8* gene of three serious lepidopteran pests, *Spodoptera litura*, *Amsacta albistriga* and *Helicoverpa armigera*. Species-specific primers were used in a hot-start PCR approach for amplifying the amplicons of 689, 699 and 665 bp. Polyhedrin, apoptosis inhibitor, *per-os* infectivity factor and DNA-binding protein genes were also amplified with an intention to describe these genes as easy, reliable, quick and correct identification of baculoviral isolates. Attempts are now being made to sequence the whole genome of *Ha*NPV (130 kbp). The successful accomplishment of the same will be the first record in India, which will enable the analysis and study of variations, if any, visible at the gene level.

Synthetic microRNAs (miRNAs) were designed from a pool of small RNAs involved in the upregulation of the luciferase reporter gene and examined for larvicidal activity. Ultimately, it was found to be very effective in arresting the molting of larvae. It has subsequently been used for constructing plant transformation vectors and developing transgenics.

Principal Scientist Dr. S.K. Jalali's group is into this research.

NBAII scientists reach out to school children

An interactive learning session for the senior students of Delhi Public School (North Bangalore) was organised by GreenLocality (www.greenlocality.com) with Dr Chandish R. Ballal and Dr Prashanth Mohanraj, Principal Scientists, as the experts. Students from the biology stream and concerned subject teachers participated in this session. Besides giving PowerPoint presentations on taxonomy, biodiversity and biocontrol, the scientists exposed the students to live cultures of beneficial insects and also to museum specimens, thus focussing on various aspects of insects for the protection of biodiversity, agriculture and a plethora of areas having a direct bearing on farmers and people in general. The event was a preliminary attempt to take classroom teaching to a new level of practical education and excellence in learning and to stimulate interest in entomological research in school students.

More details are available at http://www.greenlocality.com/interactive-learning-session-dps-it-ideally-two-way-traffic/.


Dr Ballal


Dr Mohanraj

International acclaim for NBAII scientist

A catalogue on Microgastrinae (Hymenoptera: Braconidae) of Reunion Island (Indian Ocean), which resulted from collaborative taxonomic studies by Dr Ankita Gupta (NBAII) and Dr Pascal Rousse (Iziko South African Museum, Cape Town, South Africa), has received international acclaim. Microgastrines are important biocontrol agents and over 100 species have so far been used across the world.

Annual supply of live insects

During 2012-13, live cultures of 113 insects were maintained at NBAII, which included host insects, predators and parasitoids. Totally, 887 consignments were supplied to different organisations (private and government), students, researchers and farmers based on demand. A revenue of ₹ 2,45,135 was generated through the sale of these insect cultures. The cultures were also utilised by NBAII scientists for various experiments.

Trademark for NBAII products

A unique logo carrying the Sanskrit word 'SHATPADA' (meaning 'six-legged') will hereafter be used as a trademark on all the products that result from research efforts at NBAII. It has been provisionally registered with the Indian Trademarks Registry at Chennai under Class 31 (Application No. 2365261). Dr P. Sreerama Kumar, Principal Scientist, designed this logo. The Institute Technology Management Unit at NBAII guides the producers and suppliers of NBAII products on the appropriate use of this trademark.

Selected Publications

Bhagat, D., Samanta, S.K. & Bhattacharya, S. 2013. Pheromone nanogels for efficient management of fruit flies. *Protocol Exchange (Nature Protocols)*, 20 March 2013.

Bhagat, D., Samanta, S.K. & Bhattacharya, S. 2013. Efficient management of fruit pests by pheromone nanogels. *Scientific Reports*, 3: 1294–1302.

David, K. J., Hancock, D.L., Freidberg, A. & Goodger, K.F.M. 2013. New species and records of *Euphranta* Loew and other Adamini (Diptera: Tephritidae: Trypetinae) from south and southeast Asia. *Zootaxa*, 3635(4): 439–458.

Rousse, P. & Gupta, A. 2013. Microgastrinae (Hymenoptera: Braconidae) of Reunion Island: a catalogue of the local species, including 18 new taxa and a key to species. *Zootaxa*, 3616(6): 501–547.

Compiled and edited by: **P. Sreerama Kumar, B.S. Bhumannavar & Abraham Verghese**

Published by: Director, National Bureau of Agriculturally Important Insects, Hebbal, Bangalore 560 024, India

Phone: +91 80 2341 4220 • Fax: +91 80 2341 1961 • Website: www.nbaii.res.in

Printed at: Brilliant Printers Private Limited, Bangalore 560 094