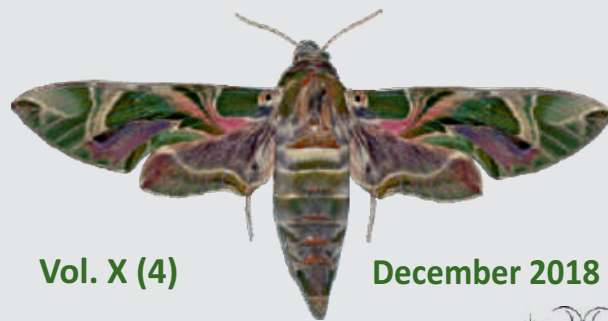


NBAIR Newsletter



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ICAR–National Bureau of Agricultural Insect Resources



NBAIR attempts to rub away the paw marks of FAW sans chemicals

The fall armyworm (FAW), *Spodoptera frugiperda*, after spreading across sub-Saharan Africa, has entered South Asia, creating total distress to small farmers. In India, the occurrence of FAW was first reported by NBAIR as a 'PEST ALERT' on its website in July 2018. The damage on maize was first noticed in Karnataka, where the incidence ranged from 9 to 62.5 per cent at various locations. The pest was identified based on molecular characterisation. The GenBank accession number MH704433 of Chikkaballapura population was released on 1 August 2018, and the barcode was obtained from BOLD System (AGIMP054-18). A search for indigenous natural enemies resulted in a report (Shylesha *et al.*, 2018) of an indigenous natural enemy complex comprising egg parasitoids (*Telenomus* sp. and *Trichogramma* sp.), an egg-larval parasitoid (*Chelonus* sp.), a gregarious larval parasitoid (*Glyptapanteles creatonoti*), a solitary larval parasitoid (*Camptolepis chlorideae*), a solitary ichneumonid larval-pupal parasitoid and a larval-pupal pteromalid parasitoid (*Trichomalopsis* sp.). Several predators, including an earwig (*Forficula* sp.) and two predatory bugs (*Andrallus spinidens* and *Eocantbecona furcellata*) were also reported. Epizootics of the entomopathogenic fungus *Nomuraea rileyi* were also recorded in Chikkaballapura, Shivamogga and Bengaluru, causing considerable mortality of the pest in larval stage.

Through very intensive searches in several infested fields, virus-infected FAW larvae were also collected. As FAW started spreading across different states, NBAIR with its expertise in the field of biological control, and armed with its large repository of bioagents, swung into action on evaluating all the promising bioagents, including egg parasitoids, entomopathogenic fungi, *Bt*, NPV and entomopathogenic nematodes (EPN). The initial laboratory testing and small-plot trials led to the identification of the following bioagents which could form an integral part of an IPM module: egg parasitoids *Trichogramma pretiosum* and/or *Telenomus remus*, microbials *Metarhizium anisopliae* (Ma-35), *Beauveria bassiana* (Bb-45), *Bacillus thuringiensis* (Bt-25) and EPN (Hi-38 & Hi-101). These bioagents developed by NBAIR are now being widely tested and validated in the different states under

FAW attack through farmer field trials and also through the AICRP Biocontrol centres and KVKs. The initial results are highly promising, thus encouraging us to move ahead with the formalities for CIBRC registration for the promising NBAIR microbials.



It is important to emphasise that NBAIR holds the unique technology for wettable powder formulation of EPN and has transferred the same to several commercial companies. This will ensure to some extent the availability of EPN formulations for farmers. However, the fact that EPN are exempt from CIBRC registration should encourage more commercial entrepreneurs to take up EPN production and supply to needy farmers. Through a public-private partnership mode, NBAIR has also developed a controlled-release dispenser for delivery of FAW pheromone. Field trials using the NBAIR controlled-release dispenser at different field locations indicated a significantly higher trap catch and persistence in comparison with the widely used rubber septa, leading to commercialisation of the technology.

Our future thrust would be on the following areas: mass production of *SpfNPV*; identification of volatiles as female attractants for an attract-and-kill strategy; field validation of the push-pull strategy; utilisation of bioinformatics tools in detecting insecticide resistance development and designing safer insecticide molecules; and encouraging more commercial units to take up production of microbial and macrobial bioagents.

Thus, the overall aim is to manage FAW by any or all means. Taxonomic support for identification of FAW was offered to neighbouring countries by NBAIR's molecular taxonomists. Besides, the report presented by the NBAIR team on biocontrol options for FAW during the "Regional Workshop on New Invasive Species Threats in South and South-East Asia" proved to be a road map for several other Asian countries, which are already under FAW attack, and also to those which are under potential threat.

Chandish R. Ballal
Director

Research Highlights

New species of *Ooencyrtus*

A new species of *Ooencyrtus* (Hymenoptera: Encyrtidae), *O. xenasteiae* (Figs 1 & 3), was described. This species was reared from the pupae of a *Xenasteia* sp. (Diptera: Xenasteiidae) (Fig. 2), a sooty mould scavenger found associated with the invasive rugose spiralling whitefly (RSW), *Aleurodicus rugiperculatus*, in coastal Karnataka.

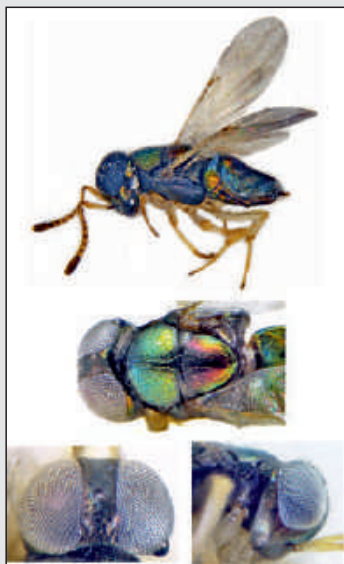


Fig. 1: *Ooencyrtus xenasteiae*

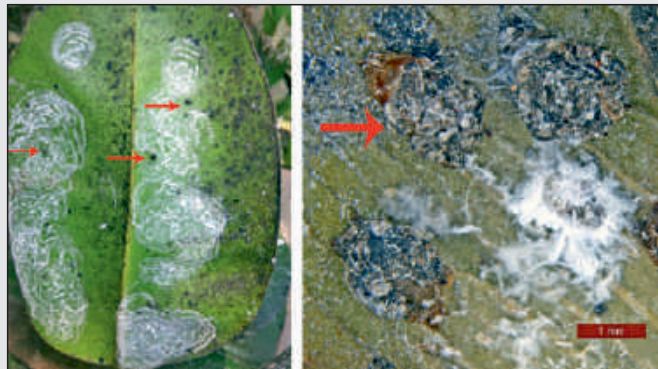


Fig. 2: Pupae of *Xenasteia* sp. on leaf of *Calophyllum inophyllum* along with RSW colony



Fig. 3: *Ooencyrtus xenasteiae* emerging from a pupa of *Xenasteia* sp.

Biology and feeding potential of *Dortus primarius*, a predatory mirid

Biology, morphology and feeding potential of *Dortus primarius* (Miridae: Deracorinae) (Fig. 4) were studied for the first time in the laboratory (at $26 \pm 2^\circ\text{C}$ and $65 \pm 2\%$ RH) on UV-irradiated *Corcyra cephalonica* eggs. A total of five instars were observed, with nymphal duration of 17.2 days. The mean fecundity was 127.6 eggs per female. The male and female adults lived for 14.6 and 20.2 days, respectively. One nymph could consume a total of 363 *C. cephalonica* eggs in its lifespan. Per day feeding potential of female (50.8) was slightly higher than that of male (47.5).



Fig. 4: Life stages of *Dortus primarius*

Natural occurrence of nucleopolyhedrovirus of *Spodoptera frugiperda*

Spodoptera frugiperda was serious on maize in Chikkaballapura, Hassan, Shivamogga, Davanagere and Chitradurga districts of Karnataka during July/August 2018. A nucleopolyhedrovirus (NPV) was isolated from a few dead caterpillars of the pest (Fig. 5) collected from the maize fields of Eluvahalli village, Chikkaballapura district. Occlusion bodies of *Spf*NPV were observed under light and electron microscopes (Fig. 6). Under electron microscopy, occlusion bodies appeared as tetrahedral structures (Fig. 7). Pathogenicity of NPV was also determined against second instar larvae of *S. frugiperda* maintained on artificial diet. Further work on confirmation of identity through molecular tools is progressing.



Fig. 5: Natural infection of NPV of *Spodoptera frugiperda* on maize

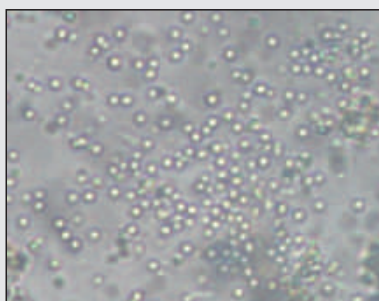


Fig. 6: Occlusion bodies of NPV under light microscope

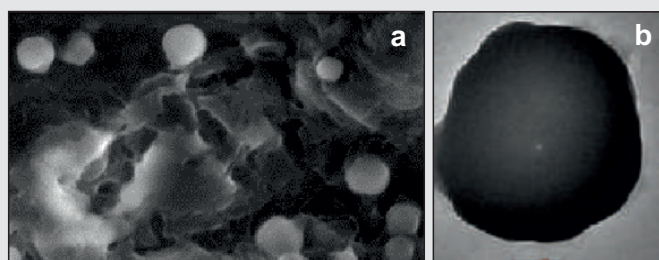


Fig. 7: Scanning (a) and transmission (b) electron micrographs of tetrahedral occlusion bodies extracted from *Spfr*NPV-infected larvae

IPM trial on management of fall armyworm

An IPM trial was conducted on the management of FAW in maize, covering an area of 1.5 acres at Gauribidanur in Chikkaballapura district of Karnataka.

The following IPM interventions were made:

1. Pheromone traps: 20 days after transplanting @ 10 traps/acre and replaced after 30 days.
2. Release of egg parasitoids: *Telenomus remus* (4,000/acre) and *Trichogramma pretiosum* (1 trichocard/acre): 4 releases at weekly intervals from 20 days after transplanting.
3. Neem oil (3 ml/litre): 1 spray, 1 week after the first release of egg parasitoids.
4. *Bt*: 1 spray, 15 days after the neem oil spray.
5. *Beauveria bassiana* (Bb-45) and *Metarhizium anisopliae* (Ma-35): 1 spray, 10 days after the *Bt* spray.

In IPM field, the decrease in egg mass was 98% at 80 DAT, while it was 8.5% in farmers' practice.

The larval population reduced by 79.2% in IPM field, whereas in farmers' practice, it was only 12.5%. In IPM field, parasitism by *Trichogramma pretiosum* varied from 8.2% to 18.3%.

Per cent parasitism was observed to be higher for *T. pretiosum* when compared with *T. remus*.

Management of rugose spiralling whitefly utilising biocontrol agents in East and West Godavari districts of Andhra Pradesh

Trials were laid out in farmers' fields in the villages of Kalavalapalli, Pullerukuttu and Madhavarayudupalem in West Godavari and East Godavari districts of Andhra Pradesh with inoculative releases of *Encarsia guadeloupae* (500 adults/tree) and foliar application of the entomopathogenic fungus *Isaria fumosorosea* (two sprays @ 5 g/litre at 15 days intervals) for managing the rugose spiralling whitefly (RSW). Foliar application of *I. fumosorosea* was successful in reducing RSW population to the extent of 50–60% by causing significant mortality of eggs and nymphs. Natural parasitism by *E. guadeloupae* also increased phenomenally in the gardens where parasitoids were released.

Interactive meeting and input distribution aimed at the management of RSW through biological control

An interactive meeting was organised with 40 farmers at Madhavarayudupalem in collaboration with the Department of Horticulture, Government of Andhra Pradesh, and the Horticultural Research Station of Dr Y.S.R. Horticultural University, Ambajipeta, wherein awareness was created on the RSW incidence, its host plants, appropriate control measures, mass production of *I. fumosorosea*, its mode of action, preparation of spray fluid and application methods. Nucleus cultures of the parasitoid, *E. guadeloupae* and formulation of *I. fumosorosea* were distributed among the farmers for subsequent releases and application in their gardens. Training was provided to the farmers on the on-farm production of *I. fumosorosea* using rice as the substrate.



Celebration of 150th birth anniversary of Mahatma Gandhi

NBAIR celebrated the 150th birth anniversary of the Father of the Nation, Mahatma Gandhi, on 2 October 2018. Renowned writer and theatre artist Ms Vatsala Warriar graced the occasion as the chief guest and presented an inspirational speech on “Gandhiji as the man and Gandhiji as the Mahatma”. An elocution competition was held on the “Relevance of Gandhian principles in agriculture” as part of the celebration to ignite young minds.



Observance of Vigilance Awareness Week

“Vigilance Awareness Week” was observed at NBAIR during 29 October – 3 November 2018. The pledge to eradicate corruption was taken by all the staff as administered by the Director Dr Chandish R. Ballal on 29 October 2018. The bureau and the staff took integrity pledge online, as an organisation and as citizens at <https://pledge.cvc.nic.in/> as per the guidelines of the CVC. Essay and elocution competitions were conducted during the week. The theme areas were “Eradicate corruption – build a new India” and “RTI and whistleblowing are productive in vigilance or counterproductive to administrative machinery”. Chief guest Ms Dimple Dua, Police Inspector from CBI, Hebbal, Bengaluru, delivered an interactive talk on “Detection and eradication of corruption”.



Celebration of Kannada Rajyotsava

“Kannada Rajyostava” was celebrated at NBAIR on 17 November 2018. Dr T.S. Channesh, Director, Centre for Public Understanding of Science, Bengaluru, was the chief guest. He spoke on the perception of the general public about science and technology. The event was celebrated with gale and gaiety through the active participation of staff in the competitions such as singing, debate and quiz on Karnataka, and rangoli competition on the theme ‘Save the girl child’.



Biocontrol training programme for officers of the NEH region

A five-day training programme on “Biological Control for Pest Management in NEH Region” was organised at NBAIR during 3–7 December 2018. Fifteen participants, employed as subject matter specialists, field officers and extension workers, from Arunachal Pradesh, Assam, Meghalaya and Sikkim participated in the training. The participants were trained on mass production of various biocontrol agents that have relevance to their region.



Efforts to popularise Hindi as the official language

A workshop on “Hindi as Official Language” was organised on 19 December 2018 at NBAIR, in which Dr D.P. Singh from ICAR–Indian Veterinary Research Institute, Bengaluru, delivered a talk on “Compliance of rules related to official language implementation.” He emphasised the feasibility of using Hindi for official work which would result in effective implementation of the official language.



Celebration of Kisan Diwas

Popularly known as “Kisan Diwas”, the “National Farmers' Day” was celebrated at NBAIR on 23 December 2018 to commemorate the birth anniversary of the fifth Prime Minister of India, Shri Chaudhary Charan Singh. An interactive meeting was held in farmers' fields in Gauribidanur, Chikkaballapura district of Karnataka. Drs Richa Varshney, R.S. Ramya and Y. Lalitha from NBAIR interacted with the farmers and answered their queries. Crop advisory services were rendered for efficient management of the fall armyworm in maize. Biocontrol inputs such as *Trichogramma*, *Telenomus*, *Beauveria bassiana*, *Metarhizium anisopliae* and *Bacillus thuringiensis* were supplied to the farmers and the methods of releasing the parasitoids were also demonstrated.



Director, NBAIR, reviews biocontrol programmes in Telangana

Dr Chandish R. Ballal (Director, NBAIR) visited the Agricultural Research Station (ARS) in Adilabad along with Dr S.J. Rahman, Principal Investigator of the AICRP on Biological Control, Professor Jayashankar Telangana State Agricultural University (PJTSAU), to review the experimental trials taken up by the PJTSAU Centre. An interactive meeting was arranged with local scientists of the ARS and Krishi Vigyan Kendra (KVK). A field trip to cotton-growing areas of Adilabad, Zainab and Bela tehsils of Northern Telangana Zone was undertaken with scientists of the ARS, the District Agricultural Advisory and Transfer of Technology Centre and the KVK of Adilabad. During the visit, Dr Ballal interacted with the cotton farmers and suggested several ecofriendly approaches to minimise the pink bollworm (PBW) damage on cotton by using neem formulations, biocontrol agents and pheromone traps. She advocated the increased use of bioagents and emphasised the importance of *Trichogramma* in minimising the PBW damage in Telangana. She also visited the State Biocontrol Laboratory (Production Centre) located in Adilabad and gave suggestions to improve the quality of bioagents. The visit was well covered by the local media.



Director, NBAIR, reviews biocontrol programmes in Punjab

Dr Chandish R. Ballal (Director, NBAIR) visited the AICRP-BC centre at Punjab Agricultural University (PAU), Ludhiana, on 18 November 2018. She also visited the Nahar Sugar Mills and monitored the trichocard production unit being operated there for the benefit of the sugarcane growers in the region. She delivered a lecture on "Perception on and opportunities for biological control practices in India" at the "Winter School on Advances in the Management of Agriculturally Important Insects" organised by PAU's Department of Entomology.



Visit of NBAIR scientists to FAW-affected maize fields in Andhra Pradesh

On 14 December 2018, NBAIR scientists Drs B. Ramanujam, R. Rangeshwaran and A.N. Shylesha visited Balijapalli and Morumpalli villages in Hindupur district of Andhra Pradesh where rabi maize was infested with FAW. The team provided *Trichogramma pretiosum* cards, *Bt*, *Metarhizium anisopliae*, EPN formulations and pheromone traps for the management of FAW. The treatments were imposed in collaboration with the Assistant Director of Agriculture (ADA), Department of Agriculture, Government of Andhra Pradesh. In a reciprocal visit, a team of officials including the ADA and five Agricultural Officers from the Department of Agriculture, Government of Andhra Pradesh, were at NBAIR on 24 December 2018 to get acquainted with the biological control agents such as *M. anisopliae*, EPN and *Trichogramma* parasitoids.



Foldscope workshop for tribal farmers in Meghalaya

A day-long workshop entitled “Foldscope for Farmers: Field Demonstration in Meghalaya” was organised by NBAIR (Dr P. Sreerama Kumar) in collaboration with the Division of Crop Production, ICAR Research Complex for North Eastern Hill Region (Dr R. Krishnappa), at Mynsain village in Ri Bhoi district on 17 December 2018. The intent was to attest the utility of the Foldscope (a paper-based microscope) in advocating management practices against microscopic pests in organic farming. Around 35 tribal farmers, who generally practise organic farming of field and horticultural crops on their smallholdings, participated in the workshop. The programme started with field observations for pest incidence and sample collection. Later, the farmers were exposed to handling the Foldscope, with special emphasis on its utility in the identification of microscopic insects and mites, both harmful and beneficial alike.



Awards and Recognitions

Dr Chandish R. Ballal

Received *Lifetime Achievement Award* at the “International Conference on Sustainable Organic Agri-Horti Systems” held during 28–30 November 2018 in Lucknow.



Dr K. Subaharan

Received *Prof. T.N. Ananthakrishnan Senior Scientist Award* for the biennium 2016–2017 at the “National Symposium on Entomology 2018: Advances and Challenges” held during 10–12 December 2018 in Hyderabad.



Dr Jagadeesh Patil

Received *Prof. T.N. Ananthakrishnan Young Scientist Award* for the biennium 2016–2017 at the “National Symposium on Entomology 2018: Advances and Challenges” held during 10–12 December 2018 in Hyderabad.



Dr K. Selvaraj

Received *Young Entomologist Award* at the “National Symposium on Entomology 2018: Advances and Challenges” held during 10–12 December 2018 in Hyderabad.

International Travel Support

Dr S. Salini presented a paper entitled “Systematics of Cappacini (Heteroptera: Pentatomidae: Pentatominae) with description of two new species of *Habymorpha* from India” at the “International Conference, 6th Quadrennial Meeting of International Heteropterists’ Society”, Paseo del Bosque, Argentina, 3–7 December 2018. She received International Travel Support from the Science and Engineering Research Board of the Department of Science and Technology, Government of India.

Lead lecture at the 42nd Annual Conference of Ethological Society of India

Dr Chandish R. Ballal, Director, NBAIR, delivered a lead lecture on “Ecology and insect behaviour interfacing biological control” at the “42nd Annual Conference of Ethological Society of India and National Symposium on Animal Behaviour, Biodiversity and Human Future” held during 4–6 December 2018 at the Department of Zoology of the University of Calicut, Thenjipalam.



Selected Publications

- Hayat, M., Gupta, A. & Selvaraj, K. 2018. A new species of *Ooencyrtus* Ashmead (Hymenoptera: Encyrtidae), parasitoid on pupae of *Xenasteia* sp. (Diptera: Xenasteiidae) from Karnataka, India. *Zootaxa*, 4521(2): 258–264.
- Varshney, R., Budhalakoti, N. & Ballal, C.R. 2018. Functional response of *Geocoris ochropterus* Fieber (Hemiptera: Geocoridae) to different egg densities of *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae). *Phytoparasitica*, 46: 451–458.
- Varshney, R. & Yeshwanth, H.M. 2018. First record of *Termtaphylum orientale* Poppius (Hemiptera: Miridae: Deraeocorinae) from India with biological note. *Journal of Entomological Research Society*, 20(3): 67–73.

Compiled and edited by: **P. Sreerama Kumar, R.S. Ramya, U. Amala & Chandish R. Ballal**

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