

NBAIR Newsletter

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ICAR–National Bureau of Agricultural Insect Resources

The National Insect Museum comes into existence

The ICAR–National Bureau of Agricultural Insect Resources was recognised by the Ministry of Environment & Forests (presently MoEF&CC) in 2012 as the designated National Repository for preservation of insects, spiders and mites. The NBAIR repository holds nearly 1,80,000 dry-mounted voucher specimens, more than 2,00,000 specimens in wet preservation, 322 primary/secondary types and 233 vouchers deposited as per the guidelines of the National Biodiversity Authority of India. This is the only national bureau under the National Agricultural Research System (NARS) that acts as the nodal agency for collection, characterisation, documentation, conservation, exchange, research and utilisation of agriculturally important insect resources (including mites, spiders and related arthropods) for sustainable agriculture. Most of the specimens in the collection are Indian, but there is a unique representation of exotic beetles, wasps, flies and moths from various countries, including Australia, Argentina, the West Indies, Japan and USA. The museum is also unique in having one of India's largest collections of economically important taxa, including various biological control agents, viz. parasitic Hymenoptera (parasitoids), Coleoptera (Coccinellidae), along with major collections of groups with members which are pests, viz. Coleoptera, Hemiptera, Diptera, Lepidoptera and Orthoptera. Besides holding the world's smallest insect, *Kikiki huma*, in its collection, our

museum also holds many undescribed species, and some species found in no other collections in the world.

Based on the repository and bureau status of NBAIR and considering the huge collection building up in the existing museum, the need was felt to create a full-fledged National Insect Museum. The foundation stone of the museum was laid on 20 May 2016 by Dr Trilochan Mohapatra, Secretary, DARE and Director-General, ICAR. Further, on 10 March 2019, the National Insect Museum was inaugurated by Dr Mohapatra. Dr P.K. Chakrabarty, Assistant Director-General (Plant Protection & Biosafety) was also present during the occasion.



After unveiling the inaugural stone and visiting the insect museum premises, Dr Mohapatra addressed the gathering. For strengthening the museum facility at NBAIR, he suggested that the museum should have an SEM facility. He emphasised that the collections in the museum should be arranged in an intellectual and aesthetic manner and that molecular data have to be generated for all the preserved specimens. For future evolutionary and ecological studies, he felt that the preserved specimens should be complemented with ecological data. He complimented the

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Research Highlights

Two new species of *Rhogadopsis*

During surveys for the natural enemies of *Merochlorops* species complex, the biocontrol agents of the invasive weed *Hedychium gardnerianum* (Zingiberaceae), two new species of *Rhogadopsis* (Braconidae: Opiinae), viz. *R. gratia* (Fig. 1) and *R. macrusa* (Fig. 2), were reared as solitary larval-pupal parasitoids (Fig. 3). Interestingly, both wasp species have very different ovipositor lengths, in addition to other characters for species delimitation. Perhaps parasitism by the respective wasp species depends on the thickness of the stem harbouring the chloropid larvae. For the first time, the genus *Rhogadopsis* was found associated with Chloropidae; earlier records concern Agromyzidae.

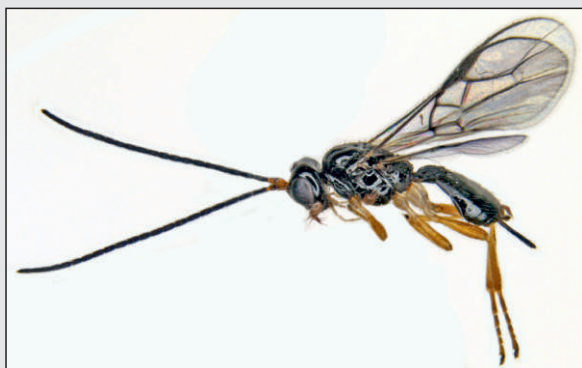


Fig. 1: *Rhogadopsis gratia*



Fig. 2: *Rhogadopsis macrusa*



Fig. 3: Puparium of *Merochlorops* sp. inside the stem of *Hedychium gardnerianum*

Four new species of fruit flies

Four new species of fruit flies were described from India. They included a cryptic species of *Bactrocera dorsalis* complex, namely, *Bactrocera* (*Bactrocera*) *prabhui* (Fig. 4) and *B. (Parazengodacus) conica* (Fig. 5). Two species of *Coelotrypes* described, namely, *C. merremiae* (Fig. 6) and *C. paralatilimbatus* (Fig. 7), were found infesting flowers of *Merremia vitifolia* and *Ipomoea purpurea*, respectively. Phylogenetic analysis of 62 species of fruit flies belonging to tribe Dacini based on 51 morphological characters revealed the monophyly of tribe Dacini and genera *Bactrocera*, *Dacus* and *Zengodacus*.



Fig. 4: *Bactrocera* (*Bactrocera*) *prabhui*



Fig. 5: *Bactrocera* (*Parazengodacus*) *conica*



Fig. 6: *Coelotrypes merremiae*

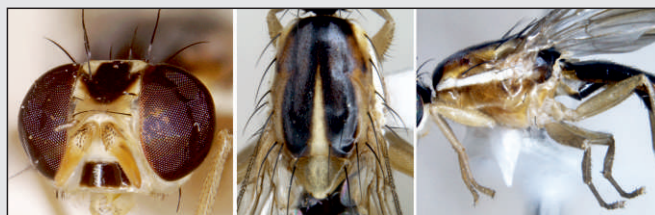


Fig. 7: *Coelotrypes paralatilimbatus*

Individual and mixed strains of entomopathogenic bacteria and fungi for the management of fall armyworm in hybrid maize

Hybrid maize on our Yelahanka campus showed more than 80% fall armyworm infestation at 25 days after sowing. Post-infestation spray with biopesticides, viz. *Pseudomonas fluorescens*, *Bacillus* sp., *Trichoderma* sp., *Metarhizium anisopliae* or consortia of these entomopathogens, effectively controlled the fall armyworm under field conditions. One hundred per cent recovery of the hybrid maize plants was observed and appropriate growth promotion activity of these biopesticides was also evident. (Figs 8–10).



Fig. 8: Representative image of *Pseudomonas fluorescens* applied as a biopesticide against fall armyworm in maize



Fig. 9: Representative image of *Bacillus cereus* applied as a biopesticide against fall armyworm in maize



Fig. 10: Field inspection by experts

Black soldier fly as an aquacultural feed

Global aquaculture industry requires alternatives to fish meal and fish oil used in fish feeds due to decreasing production and increased cost. The black soldier fly (BSF), *Hermetia illucens*, can efficiently convert protein-free organic wastes into protein-rich biomass that could serve as partial or complete replacement of fish feed. BSF prepupae (Fig. 11) were estimated to contain 32.5% crude protein, 22.1% crude lipid and 23.8% carbohydrates. Growth performance of monosex tilapia (*Oreochromis niloticus*) was evaluated using the pelleted formulation (Figs 12 & 13). The fish fed with fish meal diet or BSF-incorporated diet showed significantly higher final weight, per cent rate of survival and feed conversion ratio. The study indicated that BSF could be a suitable protein source for fish feed formulation in aquaculture.



Fig. 11: BSF prepupae



Fig. 12: BSF pellet fish feed



Fig. 13: Tilapia fed with BSF meal

Review meeting of AICRP on Biological Control centre at IGKV, Raipur

Dr Chandish R. Ballal, Director of NBAIR, reviewed the ongoing biocontrol field trials and visited the mass production facility of AICRP-BC centre at Indira Gandhi Krishi Vishwavidyalaya, Raipur, on 18 January 2019. She also delivered a lecture on “Challenges to and opportunities for biocontrol practices in India” for the benefit of postgraduate students at the Department of Entomology.



Participation of NBAIR in agricultural fairs

The “National Horticultural Fair 2019” was organised during 23–25 January 2019 at the ICAR–Indian Institute of Horticultural Research, Hesaraghatta, Bengaluru. A team from NBAIR participated in this fair and showcased various technologies developed at NBAIR.

NBAIR also participated in “Pusa Krishi Vigyan Mela 2019” during 5–7 March 2019 at the ICAR–Indian Agricultural Research Institute, New Delhi, to exhibit the biocontrol research activities of NBAIR for the benefit of farmers, students, researchers and extension workers. These fairs provided a good platform for scientist–farmer–stakeholder discussions on emerging challenges in agriculture and for effective dissemination of biocontrol technologies.



Republic Day at NBAIR

NBAIR celebrated the 70th “Republic Day” on 26 January 2019 with the hoisting of national flag and singing of national anthem by the staff at Hebbal. Director Dr Chandish R. Ballal addressed the staff and reminded them that India stands united because of the strength of its Constitution. Dr T.M. Shivalingaswamy, farm in-charge, unfurled the national tricolour on the other campus of NBAIR at Yelahanka.



Top officials of ICAR visit NBAIR

Dr Anand Kumar Singh, Deputy Director-General (Horticulture & Crop Sciences), visited NBAIR on 22 January 2019. He went around the laboratories to get firsthand information on the research activities, and later interacted with the personnel of the institute.

Dr P.K. Chakrabarty, Assistant Director-General (Plant Protection & Biosafety), visited NBAIR on 1 March 2019. He was felicitated by the Director and staff of NBAIR on being selected as Member, Agricultural Scientists' Recruitment Board, New Delhi.



Dr A.K. Singh



Dr P.K. Chakrabarty

Igniting young minds

Around 300 students from Mount Litera Zee School, Bengaluru, visited the Yelahanka campus of NBAIR on 12 February 2019. The students had an opportunity to go around the campus to explore the various agricultural crops being grown on the farm. They also visited the pollinator garden which has diverse flora of over 300 species. To arouse the young minds, live and preserved insects were displayed, which enlightened the students about the diversity of insects. The scientists also catered to the numerous questions of the young minds with great fervour.



International Women's Day celebrated at NBAIR

NBAIR celebrated the "International Women's Day" on 8 March 2019. Dr S. Uma, Director, ICAR–National Research Centre for Banana, Tiruchirappalli, was the chief guest, and Ms Geetha Menon, who is a well-known social activist and co-founder of Stree Jagruti Samiti, was the guest of honour. The programme started with the welcome address by Director Dr Chandish R. Ballal, followed by lighting of the lamp by the dignitaries. Ms Menon addressed the gathering and emphasised on women's rights. Dr Uma motivated women in facing challenges in official and personal spheres. Cultural events were conducted for the female staff members and prizes were distributed.



Transfer of technologies

NBAIR transferred the following technologies to different companies and organisations during January–March 2019:

1. Novel insecticidal WP formulations of *Heterorhabditis indica* for the biological control of white grubs and other soil insect pests: Nirmal Seeds Pvt. Ltd, Jalgaon, Maharashtra, 10 January 2019.
2. Adsorption and delivery of molecules using nanoporous materials: ATGC Biotech Pvt. Ltd, Hyderabad, Telangana, 14 January 2019.
3. Multiple insecticide-tolerant strain of the egg parasitoid *Trichogramma chilonis*; Powder-based formulation of *Pseudomonas fluorescens*, a DAPG-producing abiotic stress-tolerant isolate for rainfed and stressed agricultural soil; and Powder-based formulation of *Bacillus megaterium* as a growth promoter: Kerala Centre for Pest Management, Moncompu, Kerala, 21 January 2019.
4. Closed system for mass production of predatory mites: Darshana Horticulture LLP, Nashik, Maharashtra, 28 March 2019.



Capacity building programmes

A training programme on “DNA Barcoding and Bioinformatics Applications in Entomology” was organised at NBAIR during 25 February – 3 March 2019. Ten participants, representing Bihar, Haryana, Himachal Pradesh, Jharkhand, Kerala, Maharashtra, Rajasthan, Tamil Nadu and Uttarakhand, were given hands-on training on DNA extraction, PCR techniques, primer designing, sequence analysis using online tools, construction of molecular phylogeny, etc. Dr Praveen Karanth, Professor, Centre for Ecological Sciences, Indian Institute of Science, Bengaluru, delivered a lecture on molecular tree building methods during the training programme. Drs T. Venkatesan (Course Director), M. Mohan, R. Gandhi Gracy and R.S. Ramya (Course Coordinators) conducted the programme.



A four-day workshop on “Insect Taxonomy and Field Sampling Skills” was conducted by Drs Sunil Joshi, R. Gandhi Gracy, K.J. David and S. Salini during 25–28 March 2019 in collaboration with Calicut University, Thenjipalam, Kerala.



Lead lecture at the 8th Indian Horticulture Congress 2019

Dr Chandish R. Ballal, Director, NBAIR, delivered a lead lecture on “Recent advances in management of pests of horticultural crops through biological control” at the “8th Indian Horticulture Congress 2019: Shaping Future of Indian Horticulture” held during 17–21 January 2019 at the Indira Gandhi Krishi Vishwavidyalaya, Raipur.



Consultative Meeting on Fall Armyworm in Asia

Dr Chandish R. Ballal, Director, NBAIR, was nominated by the Ministry of Agriculture and Farmers' Welfare, Government of India, to participate in the “Consultative Meeting on Fall Armyworm in Asia” organised by the Food and Agriculture Organisation of the United Nations during 20–22 March 2019 in Bangkok, Thailand. She delivered a presentation on the management options developed at NBAIR for the fall armyworm, which are being evaluated in different parts of the country. She was also on the panel for discussion on the potential public–private partnerships for the management of the pest.



Live webcast of Pradhan Mantri Kisan Samman Nidhi Yojana

The Director along with all the permanent staff of NBAIR watched the live webcast of honourable Prime Minister launching the prestigious “Pradhan Mantri Kisan Samman Nidhi” on 24 February 2019. The staff also listened to the live “Mann Ki Baat” programme.



Foldscope workshops for farmers, students and researchers

A “Demonstration-cum-Training Workshop for Farmers on Utility of the Foldscope in Agriculture” was organised at the farmhouse of Ms Skola Kurbah (a tribal farmer practising organic farming) at Mynsain village of Ri Bhoi district of Meghalaya on 29 January 2019. It was a collaborative programme of NBAIR (Dr P. Sreerama Kumar, Principal Scientist), ICAR–Research Complex for North Eastern Hill Region, Umiam (RCNEHR: Dr R. Krishnappa, Scientist) and National Centre for Cell Science–National Centre for Microbial Resource, Pune (Dr Praveen Rahi, Scientist 'C'). The workshop formed part of the twinning



component under the project funded by the Department of Biotechnology, Ministry of Science and Technology, Government of India. Around 40 tribal farmers, who generally practise organic farming of field and horticultural crops on their smallholdings, participated in the workshop. A few Foldscopes were distributed to young farmers who were technically sound to utilise the device for day-to-day observations in organic agriculture.

On 22 February 2019, NBAIR and RCNEHR jointly organised a workshop at the College of Horticulture, Bengaluru. There were 109 participants, the majority of whom were B.Sc. (Horticulture) students. Dr M.K. Honnabyraiah (Dean), Dr G.K. Halesh (Assistant professor) and Dr Mohan Kumar (Assistant Professor) were present during the workshop. A similar workshop was organised on 28 February 2019 for B.Sc. (CBZ) students at BGS Science Academy and Research Center in Chikkaballapura, Karnataka, as part of the “National Science Day” celebrations. Over 370 students were in attendance. Dr N. Shivaram Reddy (CAO), Dr N. Madhusudhan (Dean), Mr H.B. Ramesh (Principal) were present during the workshop.

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scientists for the digitisation of the type collections and for the databases on agriculturally important insects and insect resources hosted on the NBAIR website. Dr Mohapatra said that taxonomists should be encouraged to visit global museums and the focus should be on developing the NBAIR National Insect Museum into a world-class facility so that it can become a hub for international collaborative research, training and identification.

The new National Insect Museum will be equipped with mobile racks with insect boxes for long-term storage of insects, mites and spiders and requisite facilities for dry/wet and cryopreservation. It will now house the types

of all the agriculturally important insect specimens. A state-of-the-art taxonomy training facility will also be in place for students and researchers. It is envisaged that this museum would create a platform for national and international students and taxonomists to study the insect specimens of their interest. This would not only lead to a more comprehensive documentation of Indian insect diversity, but would also lead to the creation of a well-knit group of Indian taxonomists who will also have the benefit of networking with international taxonomists.

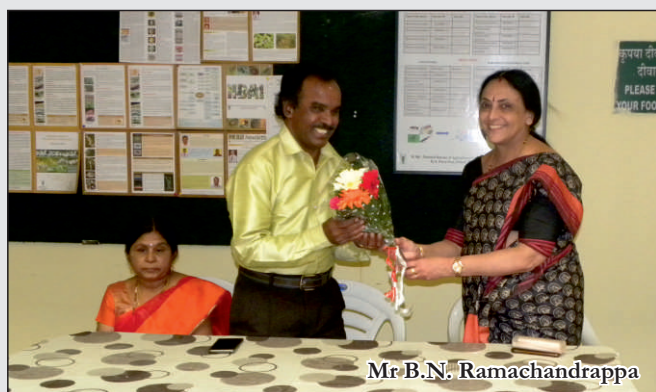
Chandish R. Ballal
Director

Recognition

Dr T. Venkatesan, Principal Scientist, Division of Genomic Resources, was elected as a *Fellow of the Royal Entomological Society* (FRES) by the Royal Entomological Society, London.

Superannuation

Dr K. Veenakumari, Principal Scientist, Division of Germplasm Collection and Characterisation, and **Mr B.N. Ramachandrapa**, Finance and Accounts Officer, superannuated from service on 31 January 2019 and 28 February 2019, respectively. To commemorate their retirement, colleagues at NBAIR organised farewell functions and felicitated them.



Selected Publications

- Amala, U. & Shivalingaswamy, T.M. 2019. Nest architecture and life cycle of small carpenter bee, *Ceratina binghami* Cockerell (Xylocopinae: Apidae: Hymenoptera). *Sociobiology*, 66(1): 61–65.
- David, K.J. & Hancock, D.L. 2019. Taxonomic notes on genus *Coelotrypes* Bezzi (Diptera: Tephritidae: Trypetinae) with description of two new species. *Zootaxa*, 4563(3): 584–594.
- David, K.J. & Ramani, S. 2019. New species, redescription and phylogenetic revision of tribe Dacini (Diptera: Tephritidae: Dacinae) from India based on morphological characters. *Zootaxa*, 4551(2): 101–146.
- Gupta, A., Achterberg, C.V., Ballal, C.R., Maczey, N., Djeddour, D., Bhutia, S.G. & Rajeshwari, S.K. 2019. Two new species of *Rbogadopsis* Brèthes (Braconidae: Opiinae) as solitary parasitoids of *Merochlorops* species complex (Diptera: Chloropidae) from India. *Zootaxa*, 4550(2): 268–276.
- Hussain, B., Sivakumar, G., Kannan, M., War, A.R. & Ballal, C.R. 2019. First record of a nucleopolyhedro virus infecting brown-tail moth larvae, *Euproctis chrysorrhoea* (L.) (Lepidoptera: Lymantriidae) in India. *Egyptian Journal of Biological Pest Control*, 29: 11.
- Joshi, S., Ramya, R.S., Navik, O., Pawar, S.A., Hole, U.B. & Tambe, A.B. 2019. Redescription of *Pulvinaria indica* Avasthi Shafee, 1985 (Hemiptera: Coccothraupidae: Coccidae) with new host and distribution records. *Zootaxa*, 4545(1): 133–138.

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