



EDITORIAL



Director's image

Significance of new species discovery

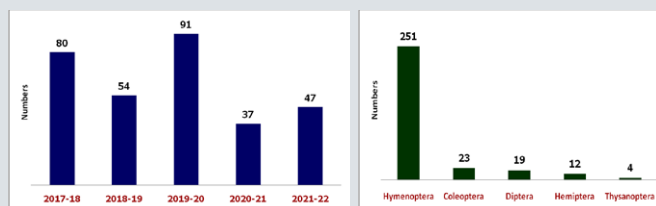
The ongoing exploration and documentation of the diversity of insects in India by the entomologists of Bengaluru based ICAR Institute, National Bureau of Agricultural Insect Resources (ICAR-NBAIR) led to the description of 309 new Indian insect species and three new genera in the last five years (2017-22). The new discoveries are important since millions of insect species on the planet are on the brink of extinction due to profound anthropogenic impacts.

The list of new species includes 251 minute wasps belong to the insect order Hymenoptera, 23 scarab beetles, 19 fruit flies, 12 bugs (including scales, mealybugs and pentatomids) and four thrips. Majority of these species were recovered from the biodiversity rice hot spot areas such as Western Ghats, North Eastern states and Andaman & Nicobar group of islands. All these new discoveries were formally named and described in scientific journals. The discoveries help greatly in understanding the biodiversity and managing the insect pests in India.

What impressed everyone was the vast catalogue of parasitoid wasp species discovered. Parasitoid wasps are well-known biological control agents for arthropod pests in agricultural and forest ecosystems. The adult female wasps usually lay their eggs in or on the eggs or larvae of other insect species, and as the wasp larva develops, it leads to the death of the host insect. In fact, for almost every insect pest species, there is at least one wasp species that parasitizes it. Globally, parasitic wasps are increasingly being used in the biological control of crop pests. The abundance of parasitoid wasps going to make the order Hymenoptera the most species-rich order of insects in the future.

The discovery of many new fruit flies also has its significance. Fruit flies pose major challenge in fruits and vegetable growing and their export from India. Similarly the discovery of pestiferous species of

thrips, bugs and beetles has its own implications in their management point of view.



Year wise description of new insect species

Order wise description of new insect species

During the period (2017-22), 232 insect species belonged to predators, parasitoids, host insects, spiders and EPN were reported as new records to India. It means that these species were recorded in other parts of the world, but documented for the first time in India.

Wrong identification and erroneous reports of invasive species could have implications on the trade and biosecurity of the country. One such harmful misidentification is the Indian species of pentatomid bug, *Halyomorpha picus* as the invasive brown marmorated stink bug (*H. halys*) by many authors. Such misidentifications are promptly resolved by the expertise available with ICAR-NBAIR and established the fact that the invasive *H. halys* is not present in India.

Apart from DPPQS and ICAR-NBPGR, ICAR-NBAIR also makes concerted efforts to prevent the risk of insect pest escape during quarantine processing and through other means. Through DNA barcoding and morphological identification, the intrusion pathways of insects such as the invasive subterranean termite, *Coptotermes gestroi* was detected and prevented its introduction into India.



Some of the new species discovered from India

RESEARCH HIGHLIGHTS

New species of fruit fly

Two new species of *Platensina* were described, *P. rabbani* (Fig. 1) from Meghalaya and *P. flavistigma* (Fig. 2) from Bengaluru, Karnataka.



Fig. 1: *Platensina rabbani* Fig. 2: *Platensina flavistigma*

A new thrips species

A new terebrantian thrips species of the genus *Pseudodendrothrips* (Thripidae: Dendrothripinae), *Pseudodendrothrips umbrolateralis* was described from India (Fig. 3). A key to seven species of *Pseudodendrothrips* recorded from India was also prepared.



Fig. 3: *Pseudodendrothrips umbrolateralis*

Encarsia cubensis, a potential parasitoid of palm infesting whitefly, *Aleurotrachelus atratus*

Immature stages of the Neotropical palm infesting whitefly, *Aleurotrachelus atratus* were found parasitised by an aphelinid parasitoid, *Encarsia cubensis* (Hymenoptera: Aphelinidae) (Fig. 4). Natural parasitism of 46–68% was reported on coconut across different locations in Karnataka. The parasitoid was identified by both morphological and molecular methods (GenBank accession number: ON881119). This is the first report of the occurrence of *E. cubensis* as a primary parasitoid on *A. atratus* in India. It was hypothesised that *E. cubensis* has entered India along with *A. atratus* and evolved as a potential biological control agent against *A. atratus*.

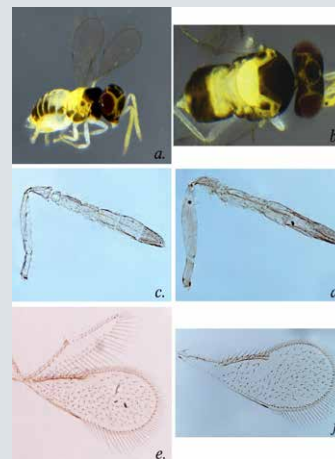


Fig. 4: *Encarsia cubensis* (a) female, habitus (b) dorsal view of head, meso and metasoma (c) female antenna (d) male antenna (e) female fore wing (f) male fore wing.

Microflora associated with black soldier fly and their role in farm waste management

A total of 14 microflora from all five instars of black soldier fly larvae were identified using 16S rRNA gene sequences as *Bacillus altitudinis*, *Citrobacter amalonaticus*, *Citrobacter farmeri*, *Escherichia marmotae*, *Klebsiella pneumoniae* (4), *Morganella morganii* (3), *Paenibacillus lautus*, *Providencia rettgeri* and *Providencia stuartii* (Fig. 5). Biochemical characterization of microflora from black soldier fly for hydrolytic enzymes like amylase, lipase and protease using qualitative and quantitative assays revealed that eight isolates are positive for starch hydrolysis, four isolates for casein hydrolysis and eight for cellulose hydrolysis.

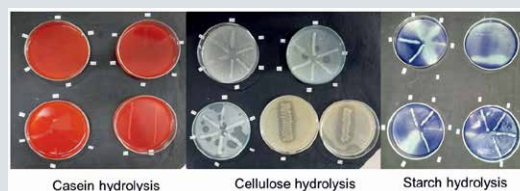


Fig. 5: Biochemical characterisation of microflora from black soldier fly

Metagenomic analysis of black soldier fly larvae yielded a total of 257 operational taxonomic units (OTUs). In the metagenomic analysis, *Acetobacter* genus was found to be dominant, followed by *Morganella*, *Campylobacter* and *Enterococcus*. Comparative transcriptome analysis was performed using the publicly available transcript sequences of *Drosophila melanogaster* (dmel-all-transcript-r6.44) from FlyBase and *Anopheles gambiae* from NCBI (GCF_000005575.2_AgamP). Gustatory receptors and olfactory receptors identified were homogenous with those earlier reported in *Hermetia illucens*. Ionotropic receptors and olfactory binding proteins identified were homogenous with those already reported in *H. illucens* and *D. melanogaster*.

ICAR-NBAIR organised farmers' training-cum-demonstration on biocontrol strategies for the management of invasive whiteflies in coconut

ICAR-NBAIR in collaboration with the Department of Horticulture, Mandya, Karnataka and Horticulture Farmer Producer Company, Nagathihalli, Mandya, Karnataka organised farmers' training-cum-demonstration on biocontrol strategies for the management of invasive whiteflies in coconut on 7 October 2022 at Nagathihalli, Mandya, Karnataka. The importance of bio-control in tackling these invasive whiteflies in coconut was highlighted to the farmers. Parasitoids and entomopathogenic fungus formulations were distributed to the farmers. Around 100 farmers participated in the programme. Release of parasitoid, *Encarsia guadeloupae*, preparation and foliar application of the entomopathogenic fungus, *Isaria fumosorosea* were demonstrated to the farmers.



PM Kisan Samman Sammelen programme at ICAR-NBAIR

Mr. D.V. Sadananda Gowda, Member of Parliament, Bengaluru North and Former Chief Minister, Government of Karnataka and Former Union Minister of Chemicals and Fertilizers joined the PM Kisan Samman Sammelen programme held at ICAR-NBAIR, Yelahanka campus on 17 October 2022. Dr S.N. Sushil, Director, ICAR-NBAIR welcomed the chief guest and briefed the activities of the Bureau and its services to the farming community by providing eco-friendly bio-control based technologies for insect pest management. Mr D.V. Sadananda Gowda, appraised the farmers about the initiatives taken by the Government in adopting novel technologies for enhancing agricultural production. He showed keen interest in the technologies developed by the institute to produce pesticide residue-free commodities that benefit the farmers. The start-up companies who purchased the technologies from ICAR-NBAIR participated in an exhibition which was organised as part of the programme.



ICAR-NBAIR celebrated its 30th Foundation Day

ICAR-NBAIR celebrated its 30th Foundation Day on 19 October 2022 at its campus in Yelahanka. Dr T.R. Sharma, Deputy Director General (Crop Science), ICAR, New Delhi was the chief guest and Dr S.C. Dubey, Assistant Director General (Plant Protection & Biosafety), ICAR, New Delhi was the guest of honour for the occasion. The dignitaries inaugurated "Bee Home" and "Black Soldier Fly Mass Production Unit" in Yelahanka campus. Dr S.N. Sushil, Director, ICAR-NBAIR highlighted the major research achievements of the Bureau, elaborating upon the lead taken for import and establishment of *Anagyrus lopezi* for the management of the recent invasive cassava mealybug in India. Dr T.R. Sharma stressed upon the importance of 4P's- Publications, Products, Patents and Partnerships. Dr S.C. Dubey urged the scientists to strengthen research in GPS based biodiversity surveys and in novel bio-pesticide formulations. He also encouraged the scientists to establish strong networking with other research institutes. Dr T.M. Manjunath, Ex-Director, Monsanto Research Centre, Bengaluru and former directors of the Bureau, Dr N.K. Krishna Kumar, Dr Abraham Verghese and Dr Chandish R. Ballal graced the occasion. Best workers under different categories were felicitated. Publications, technical folders and museum souvenirs were released by the dignitaries.



XXXI Workshop of AICRP on Biological Control of Crop Pests

ICAR-NBAIR organised the "XXXI Workshop of AICRP on Biological Control of Crop Pests" during 20-21 October 2022 in the North Block Auditorium, University of Agricultural Sciences, Bengaluru. Dr S.N. Sushil, Director, ICAR-NBAIR & Project Coordinator, AICRP on Biological Control welcomed the dignitaries and presented the project co-ordinator's report. In the inaugural address, Dr T.R. Sharma, Deputy Director General (Crop Science) stressed upon the need for conducting basic studies on biological control with special emphasis on rhizosphere biology and the interaction between rhizosphere and bio-control agents. Dr S.C. Dubey, Assistant Director General (Plant Protection & Biosafety) highlighted the need for stringent and scientifically proven procedures for survey and surveillance of crop pests and their natural enemies. Programme Advisory and Monitoring Committee members, Dr H.C. Sharma, Dr H.B. Singh and former directors of the Bureau, Dr N.K. Krishna Kumar, Dr Abraham Verghese, Dr Chandish R. Ballal, Dr N. Bakthavatsalam and senior retired biocontrol workers, Dr T.M. Manjunath, Dr M. Mani were present at the review meeting. Around 100 scientists and 10 company representatives from different parts of the country participated in the meeting.



ICAR-NBAIR organised Tribal Sub-Plan Programme

ICAR-NBAIR in collaboration with ICAR-Krishi Vigyan Kendra, Idukki organised Tribal Sub-Plan programme on 18 November 2022. Mr Milu Mathew, Plant Protection Officer, Central Integrated Pest Management Centre, Kakkanad, Kochi, Mr K. Sunil Lal, Range Forest Officer, Adimaly and Ms Shyma C.P., Assistant Director of Agriculture, Adimaly participated in the programme. Dr S.N. Sushil, Director, ICAR-NBAIR acknowledged the tribal farmers for their support and keen interest in implementing such agricultural projects with full enthusiasm. Dr S. Salini, Senior Scientist (Entomology) delivered a lecture on 'Role of macrobials in organic agriculture' and Dr R.R. Rachana, Scientist (Entomology) delivered a talk on 'Role of microbials in organic agriculture'. The role of black soldier fly in farm waste degradation was explained to the farmers. Scope of utilising entomopathogenic nematodes for the management of root grubs in cardamom was also discussed. Agricultural inputs like bee boxes and biofertilisers were distributed to the farmers. Around 100 tribal farmers participated in the programme.



ICAR-NBAIR and Society for Bio-control Advancement, Bengaluru organised Seventh National Conference on Biological Control (NCBC) - 75 years of Biological control of Pests and Diseases in Agriculture: Challenges and the Way Forward

ICAR-NBAIR and Society for Bio-control Advancement (SBA), Bengaluru jointly organised the 'Seventh National Conference on Biological Control (NCBC) - 75 years of Biological control of Pests and Diseases in Agriculture: Challenges and the Way Forward' during 15-17 December 2022 at Hotel Ramada Wyndham, Yelahanka, Bengaluru. The Chief Guest was Dr Ashok Dalwai, Chief Executive Officer, National Rainfed Area Authority, who highlighted the need for adoption of climate-smart agriculture and advocated for the conservation of biodiversity to preserve ecosystem and to promote biological control. Dr A.N. Mukhopadhyay, Former Vice Chancellor, Assam Agricultural University, Jorhat shared his experiences on biological control of plant diseases using *Trichoderma*. Dr Sanjay Arya, Secretary, Central Insecticide Board & Registration Committee, New Delhi briefed about the recent guidelines and policies for simplifying registration of bio-pesticides. Dr K.L. Gurjar, Joint Director (Plant Protection), CIB & RC stressed upon the importance of quality check of the bio-pesticides available in the market. Dr T.M. Manjunath, Ex-Director, Monsanto Research Centre, Bengaluru highlighted the challenges and prospects of integrating augmentative biocontrol with synthetic pesticides and other IPM strategies. Former directors of ICAR-NBAIR, viz. Dr Abraham Verghese, Dr Chandish R. Ballal and Dr N. Bakthavatsalam spoke about the success stories of biological control of crop pests in India and future targets. During the conference, various awards constituted by the SBA were distributed to the scientists, research scholars and students. More than 250 delegates including 25 industry partners participated in the conference.



Transfer of Technology

"Novel insecticidal WP formulations of *Heterorhabditis indica* for the biological control of white grubs & other soil insect pests" to M/s. Greenkare Agro (OPC) Pvt. Ltd., 7B, Windsor Commerce, 4th floor, Near Atharva Residency, S. No 2/8/1, Baner, Pune, Maharashtra.

"Waste to Wealth: Technology on Black soldier fly mediated bioconversion of farm and kitchen wastes" to M/s. Abad Group of Companies, No. B 79, Mahadevpura, 7th Cross, Masjid Road, Devasandra Industrial Estate, Krishnarajapura, Bengaluru, Karnataka.

"Controlled release dispenser for delivery of semiochemicals" to Bannari Amman Sugars Ltd., Tamil Nadu.

Awards and Recognitions

Best Worker Awards received by NBAIR staff under different categories during the "30th Foundation Day" on 19 October 2022

Dr U. Amala, Senior Scientist- Scientific Category

Ms L. Lakshmi, Assistant Chief Technical Officer- Technical Category

Ms Naziya Anjum, Assistant- Administrative Category

Dr K. Selvaraj, Dr A. Kandan, B.V. Sumalatha, A. Sandeep, H.D. Swathi received the Dr R.J. Rabindra Team Award- 2022 for their research work on whitefly taxonomy, production, utilisation of parasitoid, *Encarsia guadeloupae* and entomopathogenic fungus, *Isaria fumosorosea* for the management of invasive whiteflies infesting coconut.

Entomological Society of India Awards received by NBAIR staff under different categories

Dr Ankita Gupta, Senior Scientist- Senior Entomologist category

Dr K. Selvaraj, Senior Scientist- Young Entomologist category

Society for Biocontrol Advancement awards received by NBAIR staff under different categories

Dr S. Salini, Senior Scientist- Dr H. Nagaraja Award for 'Outstanding Contributions in Insect Systematics'

Dr R.R. Rachana, Scientist- Dr Abraham Verghese Award for Best Ph.D. thesis in Entomology (Bioecology, Biosystematics, Bio-control and Biotechnology).

Publications

David, K.J., Hancock, D.L., Sachin, K., Gracy, R.G. & Salini, S. 2022. Two new species of *Platensina* Enderlein (Diptera, Tephritidae, Tephritinae, Dithrycini) from India. *ZooKeys*, 1092: 123-146.

David, K.J., Hancock, D.L., Gracy, R.G. & Sachin, K. 2022. A new genus of fruit fly in subfamily Dacinae (Diptera: Tephritidae) from India. *Zootaxa*, 5195 (6): 885-597.

Rachana, R.R., Amarendra, B. & Gracy, R.G. 2022. Studies on *Pseudodendrothrips* (Thysanoptera, Thripidae) from India, with one new species. *Zootaxa*, 5209(3): 365-372.

Sandeep, A., Kalleshwaraswamy, C.M., Selvaraj, K., Hanumanthaswamy, B.C. & Mallikarjuna, H.B. 2022. Species composition and host range of whiteflies (Hemiptera: Aleyrodidae) in the Malnad region of Karnataka, India. *National Academy of Science Letters*, 46: 11-16.

Sandeep, A., Selvaraj, K., Kalleshwaraswamy, C.M., Hanumanthaswamy, B.C. & Mallikarjuna H.B. 2022. Field efficacy of *Isaria fumosorosea* alone and in combination with insecticides against *Aleurodicus rugioperculatus* on coconut. *Egyptian Journal of Biological Pest Control*, 32: 106.

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