# Annual Report 2024

**ICAR-NATIONAL BUREAU OF AGRICULTURAL INSECT RESOURCES**

**Bengaluru - 560 024, India**

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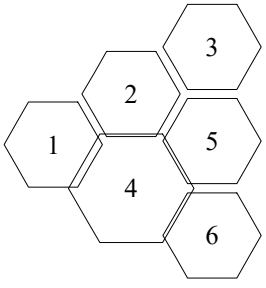


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1. Live Insect Repository Unit at ICAR, NBAIR Bengaluru (courtesy: Prakya Sreerama Kumar)

# PREFACE

The ICAR-National Bureau of Agricultural Insect Resources (ICAR-NBAIR) is a premier institution that seamlessly integrates basic and applied sciences in agricultural entomology. In 2024, extensive exploratory surveys led to the discovery and description of 48 insect species across various orders, including Coleoptera, Diptera, Hemiptera, Hymenoptera, and Thysanoptera, along with a new species of spider. Advanced taxonomic studies, including revisionary works, taxonomic rectifications, and redescriptions, were conducted. To support farmers, extension agencies, and researchers, a database on Indian Dryophthorinae species was developed. Additionally, the taxonomic expertise at ICAR-NBAIR extended identification services to State Agricultural Universities, private companies, and ICAR institutes, with a total of 185 identifications provided. Diagnostic keys were published for multiple insect taxa, including *Orionis*, *Leluthia*, *Yelicones*, *Dacus*, *Gynaikothrips*, *Scirtothrips*, *Paraputo*, and *Carrhotus*. Furthermore, new host and pest records were documented for key agricultural and horticultural crops.

The molecular biology laboratories, recently upgraded at ICAR-NBAIR, have made significant progress in DNA barcoding and gene editing of agriculturally important insect pests. Molecular characterization techniques, utilizing COI gene, elongation factor, 28S rRNA gene, LAMP, RPA, and species-specific markers, were employed to study key invasive pests such as *Hypogeococcus pungens*, *Fistulococcus pokfulamensis*, and *Leucoptera malifoliella*. A major milestone was the genome sequencing and chromosome-scale de novo genome assembly of *Polyphagotarsonemus latus*. NBAIR BtG4 10% WSL strain of *Bacillus thuringiensis* serovar kurstaki was the first biopesticide from the institute to be successfully registered under CIB & RC under section 9(3) for the management of *Helicoverpa armigera* on pigeon pea. Additionally, research on black soldier fly (BSF) focused on its potential in organic waste degradation, with studies characterizing its gut microflora to enhance understanding of the degradation process.

ICAR-NBAIR has established a state of art Live Insect Repository Unit (LIRU) for maintenance of nucleus culture of live insects and the facility continues to develop mass multiplication techniques of natural enemies in pest management. The institute identified native natural enemies of invasive pests, including *Blaptostethus pallescens*, which was demonstrated to effectively reduce *Thrips parvispinus* populations in chilli crop. Novel oil-based biopesticide formulations were developed for managing pests like chilli thrips, Fall Armyworm and rugose whiteflies. Additionally, chemoecology based platforms were employed to identify attractant and repellent compounds, which were then incorporated into nanomatrix-based delivery systems. Safety assessments were also conducted to evaluate the impact of nanoparticles on non-target beneficial insects such as *Trichogramma japonicum, T. chilonis*, and *Chrysoperla zastrowi sillemi*, ensuring their compatibility with biological control programs.

The institute also advanced research on plant-derived bioactive compounds for stored product pest management. A modified wooden rectangular hive with a median partition was developed, enabling the harvest of pollen-free stingless bee honey without damaging the brood. Additionally, ICAR-NBAIR successfully supplied 544.05 lakh insects, comprising 239.24 lakh host insects and 304.81 lakh natural enemies, to various organizations. Over 145 research papers in high rated journals were published and 2 patents & 4 copyrights were granted.

Through taxonomic expertise, molecular advancements, and eco-friendly pest management solutions, ICAR-NBAIR continues to address critical challenges in sustainable agriculture, contributing significantly to insect biodiversity conservation and pest management strategies.

My gratitude to Dr Himanshu Pathak, Secretary (DARE) & Director General (ICAR), Dr T.R. Sharma, DDG (Crop Science), ICAR and Dr Poonam Jasrotia, ADG (Plant Protection & Biosafety) for their unwavering support and guidance. I would also like to acknowledge the funding agencies such as ICAR, FAO, DST, DBT, CSB, CDB and other private companies for supporting 37 externally funded projects.

I sincerely appreciate the efforts made by the editorial team in bringing out the annual report in time.

Looking forward to many more productive years ahead.

Bengaluru
28 February 2025
Director

(S.N. Sushil)

# 1. EXECUTIVE SUMMARY

## ICAR-National Bureau of Agricultural Insect Resources

### Germplasm Collection and Characterisation

Exploratory surveys for the arthropod diversity in India during January–December 2024 yielded 148 species of aphids and coccids; 117 species of Scarabaeidae (23 genera); 61 species of leafhoppers; 61 species of Tephritidae, Platystomatidae, Pyrgotidae, Lauxaniidae and Diposidae (25 genera); 50 species of Pentatomidae and Tessaratomidae (39 genera); 27 species of weevils; 26 species of Thripidae (15 genera); 874 specimens of trichogrammatids and 400 specimens of spiders. Samples were collected from Andaman Islands, Andhra Pradesh, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Maharashtra, Meghalaya, Odisha, Puducherry, Punjab, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh and West Bengal. In addition, scarab specimens were also received from Arunachal Pradesh, Bihar, Maharashtra, Punjab, Uttarakhand and Uttar Pradesh for faunal studies.

Seven *Heterorhabditis* and fifteen *Steinernema* species were isolated from Karnataka and added to NBAIR's repository of entomopathogenic nematodes. A total of 123 isolates/species of *Steinernema*, *Heterorhabditis* and *Oscheius* nematodes were maintained on wax moth larvae.

Fourty nine new species across the country were described. In Hymenoptera: eight new species of parasitoids, *Goniozus apoderophagus*, *Leluthia pongamiacola*, *Orionis shillongensis*, *O. femorator*, *Stenothremma flavator*, *Sycosoter ordinarius*, *Yelicones andamanensis* and *Y. elaeodendronicus*; in Diptera, six species of fruit flies, *Bactrocera ettinabhuja*, *B. kyrdemkulai*, *Dacus nagarathnae*, *D. venkateshi*, *Ptilona confracta* and *Tritaeniopteron obscurum* and one gall midge species, *Asphondylia mangiferi*; in Coleoptera, two species of weevils, *Myllocerus depressus* and *M. vathalmalaensis*; in Hemiptera, one mealybug, *Paraputo blackmani* and one pentatomid bug, *Meridindia magnolia*; in Thysanoptera, two species of thrips, *Scirtothrips donumdei* and *S. lami* and in Araneae, one species of spider, *Carrhotus piperus*.

Revisionary works include a review of the pentatomid genus, *Meridindia*, braconid genus, *Yelicones* and Indian members of the braconid genera, viz. *Orionis* and *Stenothremma*; establishment of two new combinations and rectification of twelve misidentifications in Pentatomidae; identification of seven erroneous reports of Heteroptera and excluded from the fauna of India; redescriptions of five scarab beetle species (genus *Rhinyptia*); four weevil pest species, viz. *Cionus meleagris*, *Paramecops farinosus*, *Patialus tecomella* and *Pempherulus affinis* with biological data on their different life stages along with molecular characterization; two pentatomid species, *Meridindia kaniza* and *M. salmana* based on the type specimens; one mealybug species, *Hypogeococcus pungens*; one scale insect, *Hyalococcus striatus* and one braconid parasitoid, *Ipodoryctes signipennis*.

In Pentatomidae, *Priassus exemptus* from Laos, *Priassus spiniger* from Malaysia and *Tolumnia maxima* from Brunei were reported. New distributional records for India include two braconid genera, *Orionis* and *Stenothremma*; five armoured scale insect species, viz. *Duplaspidiotus claviger*, *Lepidosaphes laterochitinosa*, *Kuwanaspis howardi*, *Rutherfordia malloti* and *Aulacaspis alisiana*; four species of fruit flies, viz. *Bactrocera wuzhishana*, *Erectovena desperata*, *Felderimyia gombakensis* and *Phorelliosoma hilaratum*; four terebrantian thrips species, viz. *Neohydatothrips flavicingulus*, *Thrips hanifahi, T. razanii* and *T. sumatrensis* and two spider species, *Cosmophasis rakata* and *Gea jingdong*.

New distributional records for the union territories in India include a braconid genus, *Yelicones*; nineteen leafhopper species, viz. *Aconurella prolixa, Cofana* sp., *Deltocephalus vulgaris*, *Exitianus indicus, Kolla ceylonica, Krisna strigicollis, Maiestas* sp., *Neodartus acocephaloides, Nirvana placida, Orosius* sp., *Penthimia compacta, Scaphoideus decorates, Sophonia* sp., *Stirellus indrus, Tamsonia* sp., *Tartessus ferrugineus, Thagria* sp., *Uzelina thaloriensis* and *Xestocephalus* sp. and a spider species, *Epeus albus* from Andaman & Nicobar islands and two scarab species, viz. *Maladera schenklingi* and *M. affinis* from Jammu & Kashmir.

New distribution records for the states in India include ten aphid species, *Acyrthosiphon gossypii*, *Astegopteryx formosana, Cerataphis brasiliensis, Greenidea artocarpi*, *Macrosiphum euphorbiae*, *M. rosae*, *M. sanborni*, *Rhopalosiphum nymphaeae*, *R. rufiabdominalis and Uroleucon compositae* and two terebrantian thrips species, viz. *Leucothrips nigripennis* and *Priesneriola oneillae* from Kerala; five terebrantian thrips species, viz. *Alathrips roonwali*, *Ernothrips lobatus*, *Heliothrips aino*, *Scirtothrips oligochaetus* and *Thrips levatus,* two aphid species, viz. *Aulacorthum magnoliae* and *Greenideoidea ceyloniae* and one scarab species, *Microsericaria quadripunctata* from Karnataka; one aphid species, *Metopolophium dirhodum* from Tamil Nadu and a terebrantian thrips species, *Noathrips prakashii* from Uttarakhand. Four scarab species, viz. *Tetraserica impar* was reported from Nagaland, *Serica* (s. str.) *thibetana* and *Oxyserica pruinosa* from Himachal Pradesh and *Maladera hauseri* from Andhra Pradesh, Tamil Nadu and Telangana. Three spider species, viz. *Orientattus aurantius* was reported from Chhattisgarh and *Neoscona odites* and *N.* vigilans from Himachal Pradesh.

New host/pest records documented were: *Mangifera indica* for *Asphondylia mangifer*; *Tecomella undulate* for *Phenacoccus solenopsis; Alternanthera brasiliana* and *A. ficoidea* for *Hypogeococcus pungens; Schefflera arboricola* for *Aulacorthum magnolia; Mesua ferrea* for *Aphis (Toxoptera) auranti; Syzigium montanum* for *Duplaspidiotus claviger* and *Cinamomum verum* for *Aulacaspis alisiana.*

Diagnostic keys were published for several insect taxa: Old World species of the genus *Orionis;* Indian species of the genera *Leluthia* and *Yelicones;* Indian species of the tribe Acanthonevrini; South and Southeast Asian species of the genus *Dacus;* Indian species of the genera *Gynaikothrips* and *Scirtothrips;* Indian species of the genus *Paraputo* and Indian species of the genus *Carrhotus.*

A database was prepared for the Indian species of Dryophthorinae. Distribution maps for the predominant white grub species across India were prepared. Species of the economically important genera, viz. *Anomala, Brahmina, Holotrichia* and *Phyllognathus* were documented and geotagged.

A total of 185 identification services were provided to researchers from agricultural universities, private companies and ICAR institutes.

## Genomic Resources

Insect specimens were collected and received from various locations across India, including the Andaman & Nicobar Islands, Andhra Pradesh, Assam, Delhi, Haryana, Jammu & Kashmir, Karnataka, Kerala, Maharashtra, Meghalaya, Rajasthan, Tamil Nadu, and Uttar Pradesh. These specimens underwent molecular characterization, and DNA barcodes were generated for agriculturally significant insect pests. Key invasive species characterized included the mealybug (*Hypogeococcus pungens*), soft-scale insect (*Fistulococcus pokfulamensis*), fall armyworm (*Spodoptera frugiperda*), and apple leaf blotch miner (*Leucoptera malifoliella*), utilizing COI gene, elongation factor, 28S rRNA gene, LAMP, RPA, and various species-specific markers.

The genome sequence and chromosome-scale de novo genome assembly of *Polyphagotarsonemus latus* were developed by NBAIR, marking a significant milestone. This assembly represents the third smallest arthropod genome sequenced to date and is the first genome deciphered within the Acari family Tarsonemidae. Notably, its genome was assembled into just two contigs, the fewest among mite species.

The CYPome and Halloween gene families of *Maconellicoccus hirsutus* were identified and classified, while sex determination in *M. hirsutus* was analyzed using transcriptome data, revealing seven genes associated with the sex-determination pathway. Additionally, the cassava mealybug (*Phenacoccus manihoti*) transcriptome was sequenced, leading to the identification of key gene families and pathways for the first time.

Extensive research on *Bacillus thuringiensis* (Bt) strains across India's agroclimatic zones focused on their isolation, characterization, and bioefficacy. Among 100 isolates, *NBAIR BtAe* demonstrated the highest larval mortality against *Holotrichia serrata*, confirmed through whole genome sequencing and biochemical analysis. These strains also exhibited plant growth-promoting traits, enhancing their potential as biopesticides. Furthermore, a molecular diagnostic assay was

developed for the specific detection of *Bacillus subtilis* in bioformulations, ensuring quality control in the biopesticide market.

The NBAIR BtG4 10% WSL strain of *Bacillus thuringiensis* serovar *kurstaki* was successfully registered under CIB & RC Section 9(3) for controlling *Helicoverpa armigera* on pigeon pea. Additionally, the Biopesticide Production Unit (BPU) was inaugurated.

Detoxifying enzyme studies provided insights into insecticide resistance mechanisms in *Trichogramma chilonis* against Emamectin Benzoate, utilizing spectrophotometric analyses. Additionally, stable reference genes for *Chrysoperla zastrowi sillemi* under temperature stress conditions were identified to ensure accurate qRT-PCR-based gene expression studies. Among 14 candidate genes, Actin and SDH were identified as the most reliable for normalization, validated using geNorm, NormFinder, BestKeeper, and RefFinder algorithms.

Research on microflora from the gut of the black soldier fly explored their organic waste degradation potential. Strains *Bacillus subtilis* (SF4-4), *Bacillus cereus* (BSFK7), and *Priestia megaterium* (BSFK9) emerged as the most effective degraders, confirmed through qualitative and quantitative assays. These strains were applied to kitchen, vegetable, and fruit waste (20 ml/kg) to evaluate degradation efficiency, revealing a significant reduction in organic carbon and changes in other physicochemical parameters.

Further studies on shrimp shell waste degradation were conducted using soil samples from five locations in Andhra Pradesh. A total of 117 bacterial morphotypes were isolated, of which 57 were discarded due to β-hemolysis. Among the remaining isolates, 35 exhibited chitinase activity, 23 showed protease activity, 20 demonstrated lipase activity, and 17 exhibited lecithinase activity, highlighting their potential in biodegradation applications.

The GIS portal for insect pests and their natural enemies in India was updated with data on the cassava mealybug and its natural enemies. Additionally, an automated detection system powered by machine learning was developed for classifying insect pests and natural enemies in tomato crops. This system, trained on 1,500 images, utilizes Convolutional Neural Networks (CNNs) for pest detection and can be integrated into a mobile app, enhancing support for biological control initiatives.

## Germplasm Conservation and Utilization

A total about 15 explorative survey programmes were undertaken and 400 samples of whiteflies and their natural enemies were collected. An invasive whitefly, *Aleurotrachelus anonae* (Corbett) along with their parasitoids was documented for the first time from India on custard apple and *Canna indica*. A potential parasitoid, *Encarsia cubensis* on *Aleurothrixus floccosus* and *Aleurotrachelus trachoides* was recorded for the first time from India.

The egg-larval parasitoid *Chelonus blackburni*, reared continuously in the laboratory, initially exhibited low preference and parasitism rates when exposed to olfactory cues from its natural target pest host. However, after undergoing training or conditioning, its preference and parasitism rates increased significantly up to 20%.

The fifth instar and female of *Blaptostethus pallescens* exhibited a theoretical maximum number of *Thrips parvispinus* killed in one hour and a/T h increased with each instar. Release of *B. pallescens* @ 5 adults per meter sq area at weekly intervals resulted in a significant reduction in *T. parvispinus* population in chilli. *Dortus primarius*, a predatory mirid bug exhibited a higher feeding potential of untreated thrips larvae compared to entomopathogenic fungi-treated larvae. Moreover, given a choice between treated and entomopathogenic fungi treated thrips larvae, all the immature instars and adults preferred untreated over treated thrips larvae highlighting the possibility of combined release of *D. primarius* and entomopathogenic fungi to manage thrips.

As species within the Cheyletidae family (Acari: Acariformes: Trombidiformes) have untapped potential as biocontrol agents, we studied *Cheletomimus berlesei*, a versatile predatory mite known for its active searching and ambush predation strategies. Investigations on its biological characteristics, targeting the storage mite *Tyrophagus putrescentiae* and the spider mite *Tetranychus urticae*, indicated that its average lifespan

varies significantly depending on the prey. It preyed on the larval, nymphal and adult stages of various spider mites, as well as on *Polyphagotarsonemus latus*, *Raoiella indica* and early-instar thrips. In field studies, *C. berlesei* could sustained under protected conditions and reduced the pest population.

The potential habitat distribution of walnut leaf miner, *Caloptilia roscipennella* (Lepidoptera: Gracillariidae) was modeled using the MaxEnt algorithm. Population dynamics and species composition of thrips was studied on horticultural crops like marigold, chrysanthemum, lablab and chilli. The efficacy of entomopathogens against thrips was studied on marigold and chrysanthemum. Among the entomopathogens evaluated under field conditions, *Beauveria bassiana* (NBAIR strain) was found effective in reducing the incidence of thrips.

Isolation, purification and characterization of entomofungal pathogens were performed to deposit the microbial cultures in the ICAR-NBAIR microbial culture repository. The potential use of *Metarhizium anisopliae* NBAIR- Ma35 oil formulation for the management of invasive fall armyworm in maize under field conditions was evaluated. Entomopathogenic fungi and bacteria for the management of *Scirtothrips dorsalis* infestation in mango under protected cultivation were evaluated.

The effect of four bacterial isolates viz., *Pseudomonas fluorescens*, *Bacillus subtilis*, *B. cereus* and *B. thuringiensis* and one fungal isolate *Trichoderma harzianum* on maize fall armyworm *Spodoptera frugiperda* and maize soil borne pathogens was carried out under laboratory condition. *B. thuringiensis* and *P. fluorescens* were found highly effective against maize fall armyworm, *S. frugiperda* and both bacteria showed 65 to 71% larval mortality. $LC_{50}$ value for *B. thuringiensis* was 1.85 x $10^3$cfu/ml and for *P. fluorescens* was 2.84 x $10^3$ cfu/ml. *B. subtilis* and *P. fluorescens* were found highly effective in inhibiting the growth of the soil-borne pathogens of maize viz., *Fusarium verticillioides*, *Macrophomina phaseolina* and *Rhizoctonia solani*. All four antagonistic bacteria i.e *B. subtilis*, *B. cereus*, *B. thuringiensis* and *P. fluorescens* were compatible among themselves under *in vitro* conditions.

Basil oil, *Ocimum basillicum* and its constituents methyl chavicol and linalool were toxic to rice weevil. Essential Oils (EO) of *O. basilicum* and its constituents inhibited the AcHE and carboxyl esterases (Car E).

The impact of urea, nanourea, and chitosan alginate nanoparticles on key natural pest-control agents, including *Trichogramma japonicum* Ashmead, *Trichogramma chilonis* Ishii, and *Chrysoperla zastrowi sillemi* was studied. Our findings revealed that nanourea substantially improved the parasitism rates compared to traditional urea, positioning it as a viable, sustainable alternative for agricultural use. Moreover, chitosan alginate nanoparticles were safe and effective, without any negative impact on the developmental stages of *C. z. sillemi*. Parallel to these advancements, our innovative pest control strategies focused on the development of controlled-release pheromone formulations that target male attractants. By strategically trapping male Plassey borers and Gurdaspur borers, an approach to disrupt the mating cycles, significantly reducing population growth was developed. This tactic is crucial for controlling the rise in pest populations, predominantly driven by unchecked reproductive activities of females.

The colony performance of the invitro-reared stingless bee queen was assessed. A modified wooden rectangular hive type with a median partition separating the brood and honey chamber was developed to enable the harvest of clear pollen-free stingless bee honey without damaging the broods. Cannibalism behaviour of final instar larvae of mealworm, *Tenebrio molitor* on the pupae were recorded.

Total 544.05 Lakhs Insects (host insects: 239.24 lakhs and natural enemies: 304.81 lakhs) were supplied to different organizations. Total Rs. 8.50 lakhs revenue was generated through sale of insect cultures during 2024.

## 2. INTRODUCTION

ICAR–National Bureau of Agricultural Insect Resources (NBAIR), Bengaluru had a long history of changes in names and objectives to cater effectively to the changing needs of the farming community of our country. The Indian station of the CIBC was established at Bengaluru in 1957 with the express purpose of promoting and strengthening biological control of agricultural pests including weeds in various parts of the world. Recognizing the need for a national programme on biocontrol, the All India Coordinated Research Project on the Biological Control of Pests and Weeds (AICRP–BC) was launched by the ICAR with funds from the Department of Science and Technology, New Delhi in 1977 to cater exclusively to conceive and implement pest management programmes using bioagents (both indigenous and exotic) in the context of Indian Agriculture.

Having gained over a decade of experience in the field of biological control, the AICRP–BC took over the Indian Station of CIBC in 1988. The biological control programme from then on was national. This programme was coordinated by the Project Coordinator stationed at Bengaluru but under the administrative control of the National Centre for Integrated Pest Management (NCIPM), Faridabad for a short while. However, in the VIII five-year plan, the Bengaluru Centre was elevated to the Project Directorate of Biological Control (PDBC) with effect from 19 October 1993. Subsequently in 2009, in the XI plan, the PDBC was upgraded to the National Bureau of Agriculturally Important Insects (NBAII) to act as a nodal agency for the collection, characterization, documentation, conservation, exchange and utilization of agriculturally important insect resources (including mites, spiders and related arthropods) for sustainable agriculture. In the twelfth five-year plan in September 2014, the Bureau was re-named as National Bureau of Agricultural Insect Resources (NBAIR) and the bureau's activities are undertaken under three divisions. It won the Best ICAR Institute award in 1998 and the Sardar Patel Outstanding Institution Award during the year 2015. The Bureau does not have any regional centres.

NBAIR Museum has been designated by the Ministry of Environment & Forests as the "National Repository" under the Biological Diversity Act, 2002 on 12 September 2012 for agriculturally important insects, mites & spiders. The National Insect Museum now holds around 2,82,498 insect specimens (excluding wet collections) which include 514 types. The Bureau has described nearly 500 new species in important insect groups such as Hymenoptera, Coleoptera, Diptera, Hemiptera, and Thysanoptera.

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, Coleoptera (Coccinellidae), along with major collections of groups with members which are pests, viz. Coleoptera, Hemiptera, Diptera, Lepidoptera, Thysanoptera and Orthoptera. Besides holding the world's smallest insect, *Kikiki huna*, in its collection, the museum also holds many undescribed species, and some species not found in other collections in the world. Online web diagnostic portals/web pages are hosted in NBAIR domain. Presently there are 33 databases in the NBAIR website.

### Vision

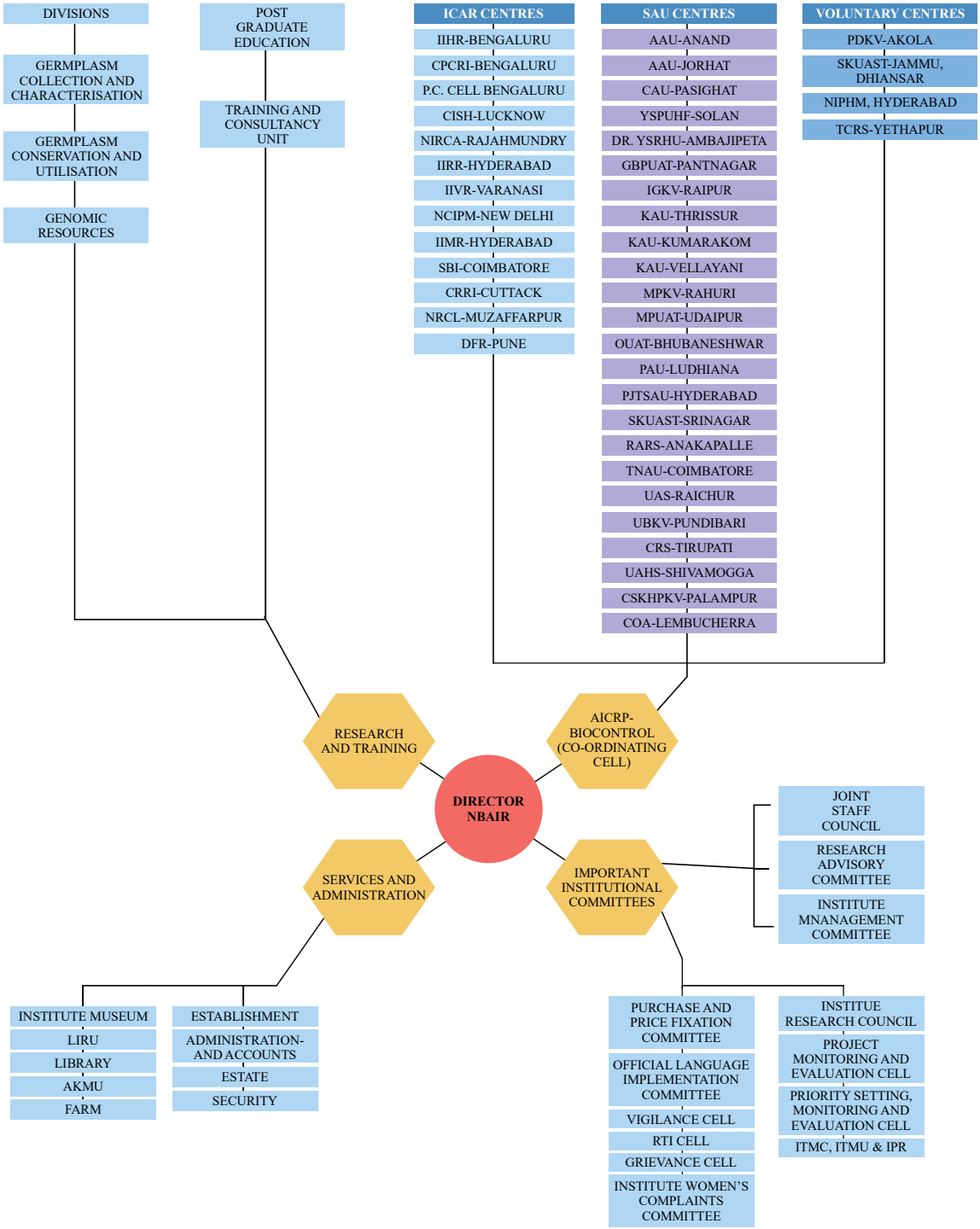
Catalogue, monitor, conserve and harness the biodiversity of agricultural insect resources, insect derived organisms and bioagents for sustainable agriculture ensuring biosafety, biosecurity and benefit sharing.

## Mandate

To act as a nodal agency for collection, characterisation, documentation, conservation, exchange, research and utilisation of agriculturally important insect resources (including mites, spiders and related arthropods) and insect-derived resources for sustainable agriculture.

Capacity building, development of technologies for non-chemical pest management, dissemination of technologies and forging linkages with stakeholders.

## ORGANOGRAM



## All India Coordinated Research Project on Biological Control of Crop Pests

| Name of the Centre | Salary | TA | RC | TSP | TOTAL (₹ in Lakhs) |
|---|---|---|---|---|---|
| AAU, Anand | 49.15 | 2.00 | 19.25 | 1.75 | 72.15 |
| AAU, Jorhat | 33.60 | 2.00 | 24.80 | 5.00 | 65.40 |
| RARS-Anakapalle | 25.10 | 2.50 | 22.50 | 6.00 | 56.10 |
| PJSTAU, Telangana | 25.03 | 1.00 | 11.50 | 3.00 | 40.53 |
| DR. YSPUH&F, Solan | 37.30 | 2.50 | 17.00 | 2.00 | 58.80 |
| GBPUAT, Pantnagar | 25.70 | 3.00 | 17.80 | 12.00 | 58.50 |
| KAU, Thrissur | 22.37 | 1.00 | 13.50 | 0.00 | 36.87 |
| MPKV, Pune | 25.70 | 1.00 | 12.36 | 2.00 | 41.06 |
| PAU, Ludhiana | 40.40 | 2.00 | 14.30 | 0.00 | 56.70 |
| SKUAST, Srinagar | 32.50 | 2.00 | 5.00 | 4.25 | 43.75 |
| TNAU, Coimbatore | 28.15 | 1.50 | 15.50 | 0.00 | 45.15 |
| MPUAT, Udaipur | 0.00 | 1.25 | 3.20 | 11.50 | 15.95 |
| OUAT, Bubanes hwar | 0.00 | 0.00 | 0.90 | 0.00 | 0.90 |
| CAU, Pasighat | 0.00 | 1.00 | 3.15 | 1.00 | 5.15 |
| UAS, Raichur | 0.00 | 0.50 | 10.80 | 0.00 | 11.30 |
| ICAR- CPCRI, Kayankulam | 0.00 | 1.40 | 4.50 | 0.00 | 5.90 |
| ICAR- IIHR, Bangalore | 0.00 | 0.50 | 2.70 | 0.00 | 3.20 |
| ICAR-P.C. CELL, Bangalore | 0.00 | 0.00 | 204.49 | 0.00 | 204.49 |
| ICAR-IIRR, Hyderabad | 0.00 | 1.00 | 1.50 | 0.00 | 2.50 |
| ICAR-IIMR, Hyderabad | 0.00 | 0.50 | 2.50 | 0.00 | 3.00 |
| ICAR-IIVR, Varanasi | 0.00 | 0.30 | 0.70 | 0.00 | 1.00 |
| ICAR-NRIPM, New Delhi | 0.00 | 1.17 | 0.28 | 0.00 | 1.45 |
| IGKV, Raipur | 0.00 | 1.50 | 3.50 | 10.00 | 15.00 |
| KAU, Kumarakom | 0.00 | 1.00 | 4.10 | 0.00 | 5.10 |
| KAU, Vellayani | 0.00 | 1.00 | 4.00 | 0.00 | 5.00 |
| Dr.YSRHU, Ambajipeta | 0.00 | 1.35 | 8.80 | 1.50 | 11.65 |
| UBKV, Pundibari | 0.00 | 1.00 | 4.80 | 1.00 | 6.80 |
| UAHS, Shimoga | 0.00 | 0.10 | 1.20 | 0.00 | 1.30 |
| SBI, Coimbatore | 0.00 | 0.20 | 0.80 | 0.00 | 1.00 |
| NIPHM, Hyderabad | 0.00 | 0.10 | 0.60 | 0.00 | 0.70 |
| SKUAST, Jammu | 0.00 | 0.20 | 0.80 | 0.00 | 1.00 |
| ICAR NRRI, Cuttack | 0.00 | 0.30 | 0.70 | 0.00 | 1.00 |
| NRC, Litchy | 0.00 | 0.60 | 0.45 | 0.00 | 1.05 |
| HPKVV, Himachal Pradesh | 0.00 | 0.20 | 0.80 | 0.00 | 1.00 |
| TNAU, Yethapur | 0.00 | 0.20 | 1.00 | 0.00 | 1.20 |
| CTRI, Rajamundry | 0.00 | 0.20 | 0.80 | 0.00 | 1.00 |
| YSRHU, Tirupathi | 0.00 | 0.03 | 0.27 | 0.00 | 0.30 |
| PC cell NEH | 0.00 | 0.00 | 2.05 | 0.00 | 2.05 |
| **TOTAL** | **345.00** | **36.10** | **442.90** | **61.00** | **885.00** |

| FINANCIAL STATEMENT 2024 | |
|---|---|
| **ICAR–NATIONAL BUREAU OF AGRICULTURAL INSECT RESOURCES** | |
| **HEADS** | **Amount (₹ in Lakhs)** |
| Pay & Allowance | 1673.93 |
| TA | 16.82 |
| Other charges, including equipment and office building | 440.03 |
| Information technology | 13.77 |
| Works and petty works | 5.99 |
| HRD | 2.08 |
| Pension | 167.87 |
| Loan | 0 |
| **Total** | **2320.49** |

## 3. RESEARCH ACHIEVEMENTS

### ICAR-National Bureau of Agricultural Insect Resources

### Germplasm Collection and Characterisation

#### Surveys and explorations

Surveys were undertaken to document the fauna of insects, spiders, mites and entomopathogenic nematodes across Andaman Islands, Andhra Pradesh, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Maharashtra, Meghalaya, Odisha, Puducherry, Punjab, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh and West Bengal. Scarab specimens were received from Arunachal Pradesh, Bihar, Maharashtra, Punjab, Uttarakhand and Uttar Pradesh for faunal studies. Expeditions undertaken yielded, 148 species of aphids and coccids; 117 species of scarabaeids representing 23 genera; 61 species of leafhoppers; 61 species of Tephritidae, Platystomatidae, Pyrgotidae, Lauxaniidae and Diposidae in 25 genera; 50 species of Pentatomidae and Tessaratomidae in 39 genera; 27 species of weevils; 26 species of thrips in 15 genera; 874 specimens of trichogrammatids and 400 specimens of spiders.

#### Description of new species

Forty eight species of insects across various orders, viz. Coleoptera, Diptera, Hemiptera, Hymenoptera and Thysanoptera, and one species of spider were described. Twenty seven species of Scelionidae in two genera, six species of Tephritidae in four genera, two each of Curculionidae and Thripidae in a single genus, one each of Bethylidae, Cecidomyiidae, Pentatomidae and Pseudococcidae; one spider species of Salticidae were described from India (Table 1).

**Table 1.** List of new species described

| SI. No | Scientific name | Family | Holotype deposited |
|---|---|---|---|
| | **Coleoptera** | | |
| 1 | *Myllocerus depressus* Mahendiran (Fig. 9) | Curculionidae | NIM, ICAR-NBAIR, Bengaluru |
| 2 | *Myllocerus vathalmalaensis* Mahendiran (Fig. 10) | Curculionidae | NIM, ICAR-NBAIR, Bengaluru |
| | **Diptera** | | |
| 3 | *Asphondylia mangiferi* Kolesik & David | Cecidomyiidae | NIM, ICAR-NBAIR, Bengaluru |
| 4 | *Bactrocera ettinabhuja* Abhishek & David | Tephritidae | NIM, ICAR-NBAIR, Bengaluru |
| 5 | *Bactrocera kyrdemkulai* Abhishek & David | Tephritidae | NIM, ICAR-NBAIR, Bengaluru |
| 6 | *Dacus nagarathnae* Abhishek & David (Fig. 15) | Tephritidae | NIM, ICAR-NBAIR, Bengaluru |

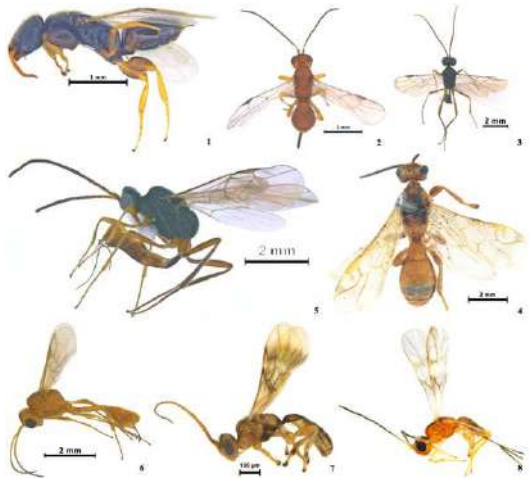
| | | | |
|---|---|---|---|
| **7** | *Dacus venkateshi* Abhishek & David | Tephritidae | NIM, ICAR-NBAIR, Bengaluru |
| **8** | *Ptilona confracta* David & Hancock (Fig. 14) | Tephritidae | NIM, ICAR-NBAIR, Bengaluru |
| **9** | *Tritaeniopteron obscurum* David, Salini & Nikhil (Fig. 13) | Tephritidae | NIM, ICAR-NBAIR, Bengaluru |
| | **Hemiptera** | | |
| **10** | *Meridindia magnolia* Salini (Fig. 17) | Pentatomidae | NIM, ICAR-NBAIR, Bengaluru |
| **11** | *Paraputo blackmani* Joshi (Fig. 11) | Pseudococcidae | NIM, ICAR-NBAIR, Bengaluru |
| | **Hymenoptera** | | |
| **12** | *Embidobia agastya* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **13** | *Embidobia barbarika* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **14** | *Embidobia dooranetra* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **15** | *Embidobia gauriputra* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **16** | *Embidobia hiranya* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **17** | *Embidobia hrdaya* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **18** | *Embidobia jatayu* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **19** | *Embidobia mahabali* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **20** | *Embidobia omkara* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **21** | *Embidobia procera* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |

| | | | |
|---|---|---|---|
| **22** | *Embidobia sankirna* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **23** | *Embidobia saroma* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **24** | *Embidobia yuyutsu* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **25** | *Goniozus apoderophagus* Gupta & Azevedo (Fig. 1) | Bethylidae | NIM, ICAR-NBAIR, Bengaluru |
| **26** | *Hadronotus altmannae* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **27** | *Hadronotus cookeae* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **28** | *Hadronotus divergens* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **29** | *Hadronotus galdikasae* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **30** | *Hadronotus goodallae* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **31** | *Hadronotus gowatyae* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **32** | *Hadronotus hrdyae* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **33** | *Hadronotus irregularis* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **34** | *Hadronotus peludo* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **35** | *Hadronotus randhra* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **36** | *Hadronotus samantara* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **37** | *Hadronotus stupa* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |

| | | | |
|---|---|---|---|
| **38** | *Hadronotus taraka* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **39** | *Hadronotus westeberhardae* Veenakumari | Scelionidae | NIM, ICAR-NBAIR, Bengaluru |
| **40** | *Leluthia pongamiacola* Gupta & Belokobylskij (Fig. 2) | Braconidae | NIM, ICAR-NBAIR, Bengaluru |
| **41** | *Orionis shillongensis* Gupta, van Achterberg & Pattar (Fig. 5) | Braconidae | NIM, ICAR-NBAIR, Bengaluru |
| **42** | *Orionis femorator* Gupta, van Achterberg & Pattar (Fig. 3) | Braconidae | NIM, ICAR-NBAIR, Bengaluru |
| **43** | *Stenothremma flavator* Gupta & van Achterberg (Fig. 6) | Braconidae | NIM, ICAR-NBAIR, Bengaluru |
| **44** | *Sycosoter ordinarius* Gupta & Belokobylskij (Fig. 8) | Braconidae | NIM, ICAR-NBAIR, Bengaluru |
| **45** | *Yelicones andamanensis* Gupta & Pattar (Fig. 7) | Braconidae | NIM, ICAR-NBAIR, Bengaluru |
| **46** | *Yelicones elaeodendronicus* Gupta (Fig. 4) | Braconidae | NIM, ICAR-NBAIR, Bengaluru |
| | **Thysanoptera** | | |
| **47** | *Scirtothrips donumdei* Rachana *et al.* (Fig. 16) | Thripidae | NIM, ICAR-NBAIR, Bengaluru |
| **48** | *Scirtothrips lami* Rachana, Amarendra & Sushil (Fig. 12) | Thripidae | NIM, ICAR-NBAIR, Bengaluru |
| | **Araneae** | | |
| **49** | *Carrhotus piperus* Caleb & Sampathkumar (Fig. 18) | Salticidae | NIM, ICAR-NBAIR, Bengaluru |

## Revisions/redescriptions of taxa

In Pentatomidae, revised the genus *Meridindia* Ghauri and two new combinations were made: *Neojurtina indica* (Kushwaha & Jahan) and *Antheminia sariabensis* (Ahmad & Zaidi). Twelve misidentifications were rectified. Seven erroneous reports of Heteroptera were identified and excluded from the fauna of India. The genus *Yelicones* Cameron (Braconidae) was revised from India. The Indian species of the genera *Orionis* Shaw and *Stenothremma* Shaw (Braconidae) were reviewed. Five scarab species of the genus *Rhinyptia*, viz. *R. flava* Brunetti, *R. fradulenta* Blanchard, *R. indica* Burmeister, *R. laeviceps* Sharp and *R. meridionalis* Arrow were redescribed with important species delineating characters along with morphometric measurements. Four weevil pest species, viz. *Cionus meleagris* Marshall, *Paramecops farinosus* (Wiedemann), *Patialus tecomella* (Pajni, Kumar & Rose) and *Pempherulus affinis* (Faust) were redescribed with biological data on their different life stages along with molecular characterization. Two pentatomid species, *Meridindia kaniza* Ghauri and *Meridindia salmana* Ghauri were redescribed based on the type specimens. The mealybug species, *Hypogeococcus pungens* Granara de Willink and the pit scale insect, *Hyalococcus striatus* (Russell) were redescribed. A braconid species, viz. *Ipodoryctes signipennis* (Walker, 1860) (Fig. 19), reared from the coleopteran-infested logs of *Pongamia pinnata* (L.) Pierre was redescribed.



**Figures 1–8.** New taxa of Hymenoptera described from India. 1, *Goniozus apoderophagus* Gupta & Azevedo; 2, *Leluthia pongamiacola* Gupta & Belokobylskij; 3, *Orionis femorator* Gupta, van Achterberg & Pattar; 4, *Yelicones elaeodendronicus* Gupta; 5, *Orionis shillongensis* Gupta, van Achterberg & Pattar; 6, *Stenothremma flavator* Gupta & van Achterberg; 7, *Yelicones andamanensis* Gupta & Pattar; 8, *Sycosoter ordinarius* Gupta & Belokobylskij

**Figures 9–18.** New taxa described from India. 9, *Myllocerus depressus* Mahendiran; 10, *Myllocerus vathalmalaensis* Mahendiran; 11, *Paraputo blackmani* Joshi; 12, *Scirtothrips lami* Rachana, Amarendra & Sushil; 13, *Tritaeniopteron obscurum* David, Salini & Nikhil; 14, *Ptilona confracta* David & Hancock; 15, *Dacus nagarathnae* Abhishek & David; 16, *Scirtothrips donumdei* Rachana et al.; 17, *Meridindia magnolia* Salini; 18, *Carrhotus piperus* Caleb & Sampathkumar

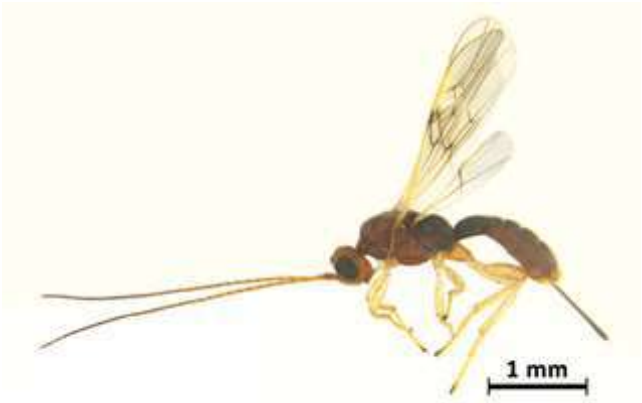
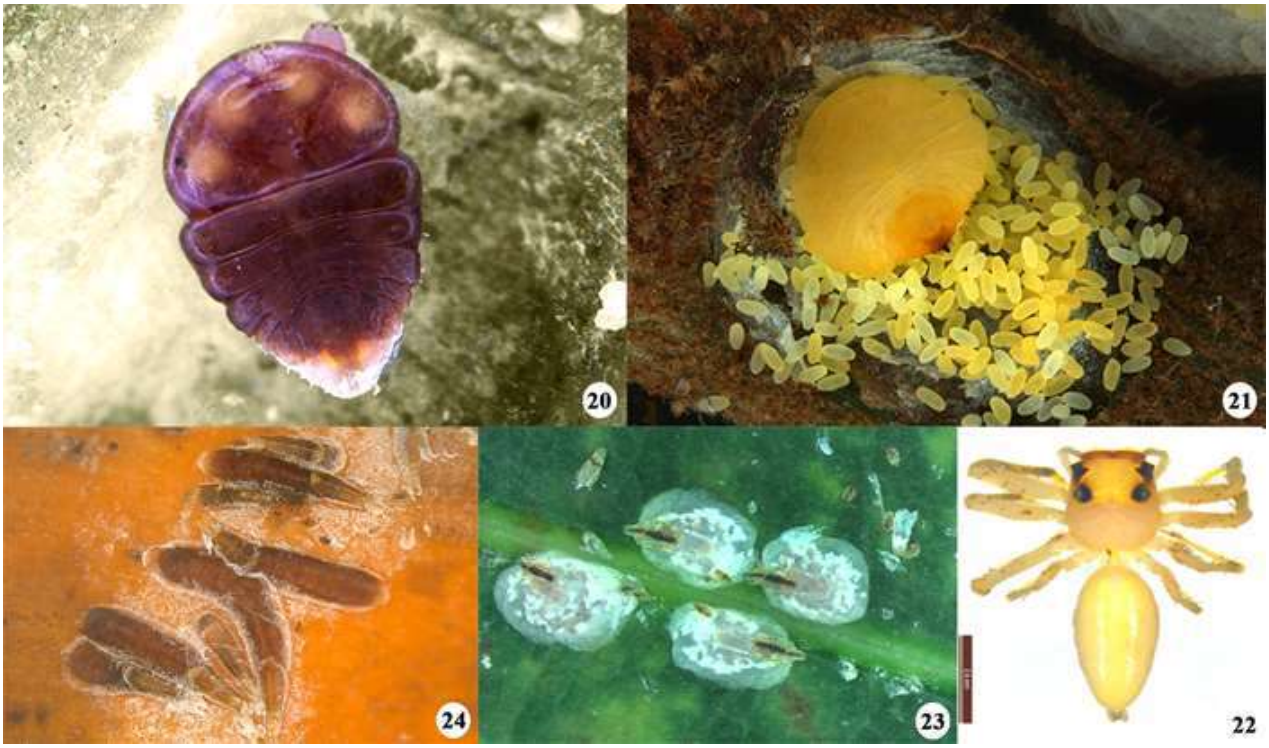



**Figure 19.** *Ipodoryctes signipennis*

## New distributional records

In Pentatomidae, *Priassus exemptus* (walker) from Laos, *Priassus spiniger* (Haglund) from Malaysia and *Tolumnia maxima* Distant from Brunei were reported. New distributional records for India include two braconid genera, *Orionis* Shaw and *Stenothremma* Shaw. Five armoured scale insect species, viz. *Duplaspidiotus claviger* (Cockerell) (Fig. 20), *Lepidosaphes laterochitinosa* Green (Fig. 24), *Kuwanaspis howardi* (Cooley), *Rutherfordia malloti* (Rutherford) (Fig. 21) and *Aulacaspis alisiana* Takagi (Fig. 23) were reported in Hemiptera. In Diptera, four fruit flies, viz. *Bactrocera wuzhishana* Lin & Yang, *Erectovena desperata* (Hering), *Felderimyia gombakensis* Hancock & Drew and *Phorelliosoma hilaratum* Hering were recorded. Four terebrantian thrips species, viz. *Neohydatothrips flavicingulus* Mirab-balou, Tong & Yong, *Thrips hanifahi* Mound & Azidah, *Thrips razanii* Ng, Eow & Mound and *Thrips sumatrensis* Priesner were reported. Two spider species, *Cosmophasis rakata* Żabka & Waldock and *Gea jingdong* Mi, Wang & Gan were new reports for India. Regarding new distribution records for the union territory; a braconid genus, *Yelicones*, nineteen leafhopper species, viz. *Aconurella prolixa* (Lethierry), *Cofana* sp., *Deltocephalus vulgaris* Dash & Viraktmath, *Exitianus indicus* (Distant), *Kolla ceylonica* (Melichar), *Krisna strigicollis* (Spinola), *Maiestas* sp., *Neodartus acocephaloides* Melichar, *Nirvana placida* Stal, *Orosius* sp., *Penthimia compacta* Walker, *Scaphoideus decorates* Ball, *Sophonia* sp., *Stirellus indrus* (Distant), *Tamsonia* sp., *Tartessus ferrugineus* (*Walker*), *Thagria* sp., *Uzelina thaloriensis* Sharma and *Xestocephalus* sp. and a salticid spider species, *Epeus albus* Prószyński (Fig. 22) were reported from Andaman and Nicobar islands and two scarab species, viz. *Maladera schenklingi* (Moser) and *Maladera affinis* (Blanchard) from Jammu and Kashmir. New distribution records for the state include; ten aphid species, *Acyrthosiphon gossypii* Mordvilko, *Astegopteryx formosana* (Takahashi), *Cerataphis brasiliensis* (Hempel), *Greenidea artocarpi* (Westwood), *Macrosiphum euphorbiae* (Thomas), *Macrosiphum rosae* Linnaeus, *Macrosiphoniella sanborni* (Gillette), *Rhopalosiphum nymphaeae* (Linnaeus), *Rhopalosiphum rufiabdominalis* (Sasaki) and *Uroleucon compositae* (Theobald) and two terebrantian thrips species, viz. *Leucothrips nigripennis* Reuter and *Priesneriola oneillae* Ananthakrishnan were reported from Kerala; five terebrantian thrips species, viz. *Alathrips roonwali* (Bhatti), *Ernothrips lobatus* (Bhatti), *Heliothrips aino* Ishida, *Scirtothrips oligochaetus* (Karny) and *Thrips levatus* Bhatti, two aphid species, viz. *Aulacorthum magnoliae* (Kaltenbach) and *Greenideoidea ceyloniae* van der Goot and one scarab species, *Microsericaria quadripunctata* (Brenske) from Karnataka; one aphid species, *Metopolophium dirhodum* (Walker) from Tamil Nadu and a terebrantian thrips species, *Noathrips prakashii* (Bhatti) from Uttarakhand. Four scarab species, viz. *Tetraserica impar* Ahrens & Fabrizi was reported from Nagaland, *Serica* (s. str.) *thibetana* Brenske and *Oxyserica pruinosa* (Hope) from Himachal Pradesh and *Maladera hauseri* (Brenske) from Andhra Pradesh, Tamil Nadu and Telangana. Three spider species, viz. *Orientattus aurantius* (Kanesharatnam & Benjamin) was reported from Chhattisgarh and *Neoscona odites* (Simon) and *Neoscona vigilans* (Blackwall) from Himachal Pradesh.




**Figures 20–24.** New distributional records. 20, *Duplaspidiotus claviger*; 21, *Rutherfordia malloti*; 22, *Epeus albus*; 23, *Aulacaspis alisiana*; 24, *Lepidosaphes laterochitinosa*

## New host records/pest records

Gall midge species, *Asphondylia mangiferi* was reported to infest mango fruits at pea-size stage in Kakinada district of Andhra Pradesh. *Tecomella undulata* was documented as a new host plant for the mealybug species, *Phenacoccus solenopsis* Tinsley. *Alternanthera brasiliana* and *A. ficoidea* were the new host plants recorded for the mealybug species, *Hypogeococcus pungens* Granara de Willink (Fig. 25). *Aulacorthum magnoliae* was recorded on *Schefflera arboricola* and *Aphis* (*Toxoptera*) *auranti* on *Mesua ferrea*. *Syzigium montanum* and *Cinamomum verum* were the new host plants recorded for the diaspid species, *Duplaspidiotus claviger* (Cockerell) and *Aulacaspis alisiana* Takagi, respectively. The intercepted hemipteran pests were identified (Table 2).

**Figure 25.** *Hypogeococcus pungens*

**Table 2:** Insects identified for Directorate of Plant Protection Quarantine and Storage (DPPQ&S) stations

| DPPQ&S station | Date of interception | Fruit/plant imported | Country from which imported | Identified intercepted insect |
|---|---|---|---|---|
| Hyderabad | January 2024 | *Persia americana* | Australia | *Hemiberlesia lataniae* (Signoret) |
| Mumbai | February 2024 | *Nephelium lappaceum* | Thailand | *Ferrisia dasylirii* (Cockerell) |
| Mumbai | March 2024 | *Persia americana* | Greece | *Hemiberlesia lataniae* |

### Development of diagnostic keys/ tools/websites/ checklists/distribution maps

Diagnostic keys to the following taxa have been published

- Old World species of the genus *Orionis* Shaw and Indian species of the genera *Leluthia* Cameron and *Yelicones* Cameron
- Indian species of the tribe Acanthonevrini and South and Southeast Asian species of the genus *Dacus* Fabricius
- Indian species of the genera *Gynaikothrips* Karny and *Scirtothrips* Hood
- Indian species of the genus *Paraputo* Laing
- Updated key to the Indian species of the genus *Carrhotus* Thorell

Database was prepared for the Indian species of Dryophthorinae. Distribution maps for the predominant white grub species across India were prepared. Species of the economically important genera, viz. *Anomala* Samouelle, *Brahmina* Blanchard, *Holotrichia* Hope and *Phyllognathus* Eschscholtz were documented and geotagged.

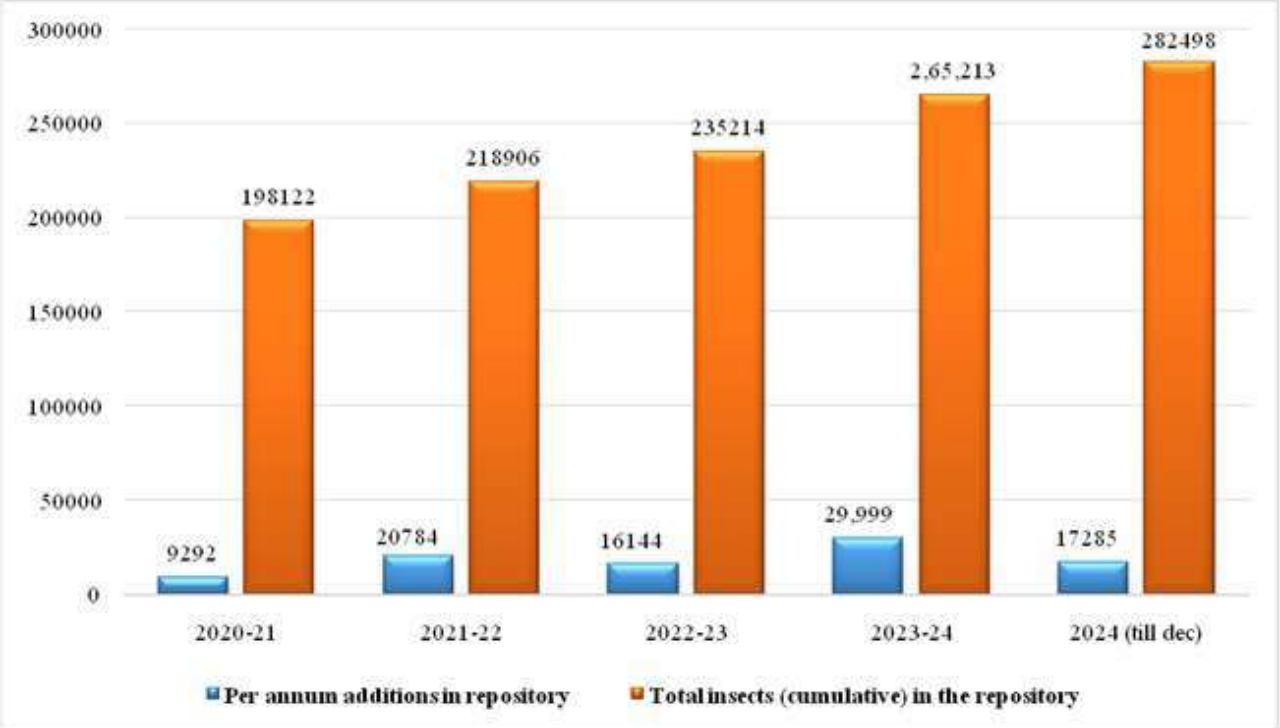
### Diversity studies

The diversity of thrips species on cotton in North India and mulberry in Karnataka were studied. The studies revealed the presence of seven species, viz. *Scitothrips dorsalis* Hood, *Scirtothrips oligochaetus* (Karny), *Thrips palmi* Karny, *Thrips tabaci* Lindeman, *Frankliniella schultzei* Trybom, *Chaetanaphothrips orchidii* (Moulton) and *Asprothrips bimaculatus* Michel & Ryckewaert on cotton and five species on mulberry, viz. *Bathrips melanicornis* Shumsher, *Pseudodendrothrips darci* Girault, *S. dorsalis, T. palmi* and *Thrips parvispinus* Karny.

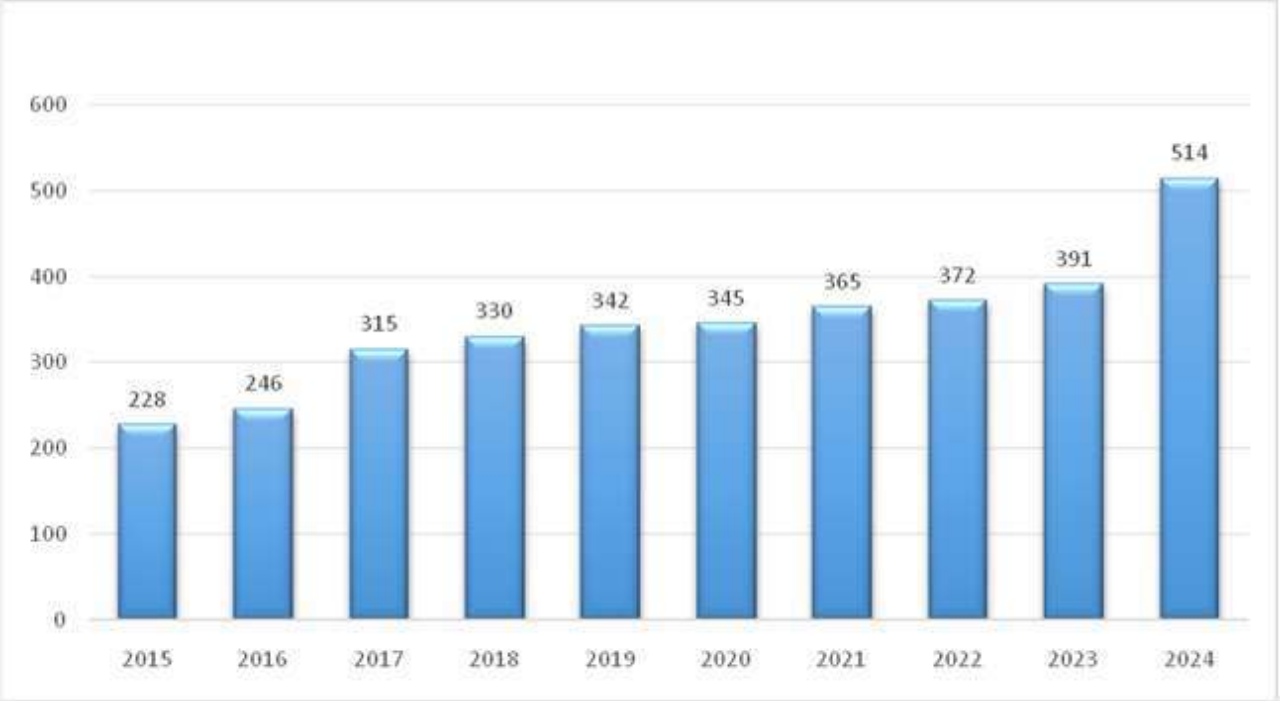
Seasonal occurrence and diversity of the trichogrammatids were studied in different agroecosystems. The highest occurrence of the trichogrammatids was observed during the 33$^{rd}$ and 34$^{th}$ Standard Meteorological Weeks (SMW). Frequent genera of the trichogrammatids encountered were *Trichogramma* Westwood (36.5%), *Oligosita* Walker (16.3%), *Megaphragma* Timberlake (13.8%) and *Trichogrammatoidea* Girault (13.4%).

The species composition of white grubs associated with ridge gourd at Byakud, Karnataka was documented. The study revealed the presence of eight species and the predominant species associated was *Holotrichia serrata* (Fabricius). Infestation of *H. serrata* was found to be high in Tapioca ecosystem also.

**Yearwise -number of insects in the ICAR-NBAIR museum: Annual additions and cumulative figures - updated December 2024**




**Year wise -number of type specimens at the National Insect Museum (ICAR-NBAIR) updated December 2024**




Total number of insects in dry state: 2,82,498
Total number of insects in wet collection: 1 lakh
Total number of types: 514

## Division of Genomic Resources

### Molecular diagnostics of invasive and emerging pests

The first occurrence of the destructive mealybug *Hypogeococcus pungens* was reported in India, infesting two species of *Alternanthera* and a wild *Portulaca* sp. The identity of the mealybug was confirmed through molecular studies by sequencing the *Cytochrome Oxidase 1* (*CO1*) gene and the *28S* ribosomal gene. The sequence results matched with *H. pungens* in the NCBI database for both the *CO1* and *28S* genes, with 97% and 99% similarity, respectively. Four sequences for each gene-*COX1* (PQ203598–PQ203601) and *28S D2-D3* (PQ206262–PQ206265), were submitted to the NCBI and assigned accession numbers.

The occurrence and rapid spread of an adventive species of soft scale insect, *Fistulococcus pokfulamensis* (Hemiptera: Coccidae), was reported in India. DNA barcoding was accomplished for *F. pokfulamensis* for the first time in the country. In 2024, this scale insect was found to be rapidly spreading to various ornamental and fruit crops, highlighting the need for quick identification using molecular methods. Through molecular analysis, 27 species of scale insects were DNA barcoded using the universal *COX1* gene.

A total of 36 fruit fly species were barcoded, all of which are significant agricultural pests and of quarantine importance. Among them, *Bactrocera ettinabhuja* and *Bactrocera kyrdemkulai* were identified as new species from India. Thirty specimens of invasive apple leaf blotch miner, *Leucoptera malifoliella* from five locations in Jammu and Kashmir were characterized using the *CO1*, *28S rRNA*, and *elongation factor* genes. Termite samples collected from Anatharajupeta and Kolur, Andhra Pradesh, were processed for identification using the universal *CO1* gene, and the resulting sequences confirmed the species as *Odontotermes formosanus*.

Mealybug specimens were collected from 14 states, covering 49 different locations and 95 host plants. The samples underwent morphological and molecular identification using a partial (658 bp) mitochondrial cytochrome oxidase 1 gene. The results revealed that *Phenacoccus solenopsis* was the most prevalent species, followed by *Planococcus citri*, *Dysmicoccus brevipes*, and *Dysmicoccus neobrevipes*.

### Development of species-specific markers for *Thrips parvispinus* and stored grain pests

A study was conducted to develop species-specific primers for *Thrips parvispinus* to enable the rapid identification of thrips species coexisting in the same niche. Different sets of primers were designed to test specificity, and primers that amplify only *Thrips parvispinus* were successfully developed. Further research on Loop-mediated isothermal amplification (LAMP) for *T. parvispinus* was conducted, with DNA isolated from seven thrips species–*Neohydatothrips samayunkur, Scirtothrips dorsalis, Selenothrips rubrocinctus, Thrips florum,* and *Thrips palmi,* which were used as negative controls for the LAMP assay.

Species-specific primers for five economically important stored grain pests–*Callosobruchus maculatus, Corcyra cephalonica, Rhyzopertha dominica, Sitophilus oryzae, Tribolium castaneum*, were developed based on mitochondrial *COI* gene regions. Nine pairs of primers were tested through PCR, with all but one (MTSo1) showing species specificity, making them suitable for accurate pest identification.

### Rapid detection assays for the identification of insect pests

PCR, LAMP, and RPA-based assays were developed for the rapid and specific detection of *Spodoptera frugiperda*, facilitating timely pest monitoring and management in the field. The assays demonstrated high sensitivity, with RPA detecting as low as 100 fg/µL, enabling early detection even at low pest infestations. The study introduced the RPA colorimetric assay for *S. frugiperda*, offering for the first time, a time-efficient and cost-effective detection method that requires minimal equipment, making it ideal for on-site field applications.

### miR-92a-3p regulates egg fertilization through ribogenesis in fall armyworm, *Spodoptera frugiperda*

There is limited research on egg control in *S. frugiperda* due to the challenging barrier posed by eggshells, which restrict the penetration of insecticides. A study was conducted to elucidate important epigenetic regulatory mechanisms in *S. frugiperda* through miRNA-mRNA interactions that govern key reproductive events,

including egg development and fertilization. Attempts were made to identify differentially expressed miRNAs from small RNA sequencing of virgin adults and to examine miRNA expression in both virgin and mated male and female *S. frugiperda*, focusing on their roles in reproduction. A strong negative correlation was observed between miRNA expression levels and their target hub genes, confirming transcriptional regulation by miRNAs. Additionally, a protein-protein interaction (PPI) network identified a central hub gene, which was predicted to be the target of miR-92a-3p in *S. frugiperda* and is involved in the maturation of large ribosomal RNA subunits. The potential role of miR-92a-3p and the identified gene in egg formation and fertilization was studied. Experimental evidence showed that depletion of miR-92a-3p in virgin females or knockdown of the gene in virgin males resulted in the production of infertile eggs post-mating (Fig.26). These findings validate the regulatory role of the miR-92a-3p-gene interaction and underscore its importance in oogenesis and fertilization.

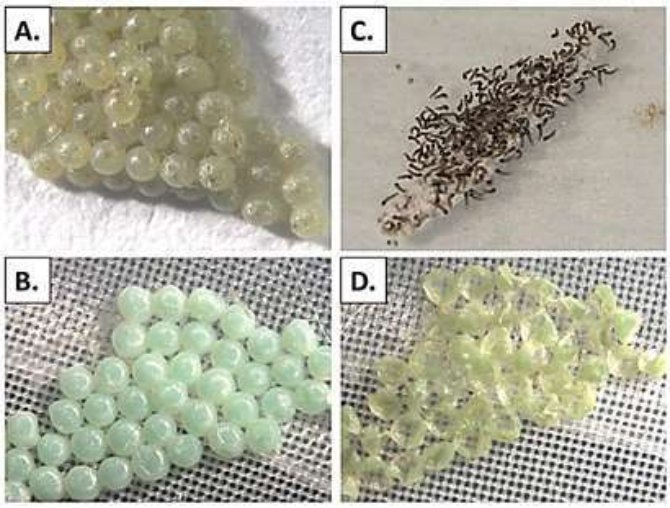



**Figure 26**. (A). Fresh laid eggs by control females, (B). Fresh laid eggs by mir-92a-3p inhibitor treated females, (C). Neonates hatched from fertile eggs produced by control female, (D). Infertile eggs desiccated after 7 days

### Whole genome sequencing of broad mite, *Polyphagotarsonemus latus*

The broad mite, *Polyphagotarsonemus latus* (Acari: Tarsonemidae), a highly polyphagous species damaging plant species across 57 different families, has developed high levels of resistance to some commonly used acaricides, and its genome was deciphered by ICAR-NBAIR through PacBio HiFi sequencing. *Polyphagotarsonemus latus* (Fig. 27) has the third smallest arthropod genome sequenced to date, with a size of 49.1 Mb. The entire genome was assembled into two contigs, and a set of 9,286 protein-coding genes were annotated. Its compact genome size can be attributed to several features, including a very low repeat content (5.1%) due to the lack of proliferation of transposable elements, high gene density (189.1/Mb), a higher proportion of intron less genes (20.3%), and low microsatellite density (0.63%).

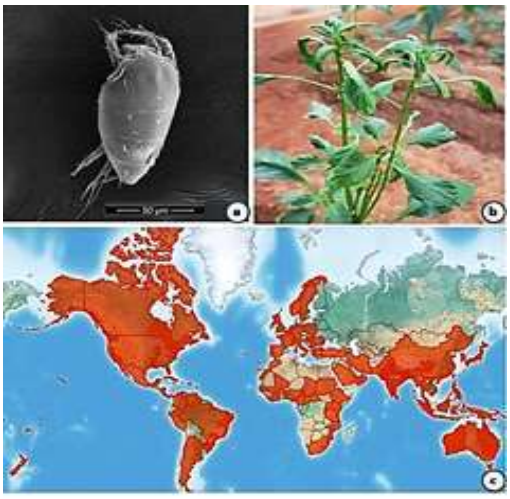


**Figure 27.** (a) Scanning Electron Microscopy (SEM) image of *Polyphagotarsonemus latus* female (1200x magnification), (b) Damage by broad mite on hot pepper, (c) Distribution map of broad mite- Courtesy: Centre for Agriculture and Biosciences International (CABI, UK)

### Chemosensory repertoire in broad mite, *Polyphagotarsonemus latus*

The chemosensory receptors in *P. latus* are responsible for processing chemical stimuli from the environment. Remarkably, there are eight gustatory receptors dedicated to perceiving taste, while odorant receptors for smell are conspicuously absent. However, the presence of one odorant-binding protein is noteworthy, suggesting a fundamental role in binding hydrophobic odorants, including pheromones and plant volatiles, within the sensilla pores.

Ionotropic receptors (IRs) exhibit multiple transmembrane domains, including an extracellular Ligand Binding Domain (LBD) composed of two half-

domains (S1 and S2). The S1 and S2 domains bind to agonists such as L-glutamate, glycine, or serine. Additionally, IRs possess an Ion Channel Domain (ICD) that forms an ion channel, consisting of three transmembrane domains (M1, M2, M3) and a pore loop (P). Furthermore, 24 ionotropic receptors, seven Transient Receptor Potential (TRP) ion channels, and 18 G-Protein Coupled Receptor (GPCR) proteins were identified. Four Epithelial Na+ channel (ENaC) genes associated with taste signalling were also recognized. Additionally, a single Niemann-Pick class C2 soluble protein gene was mined from the genome (Fig. 28). The GenBank accession IDs for chemosensory genes are PP154981–PP155036.

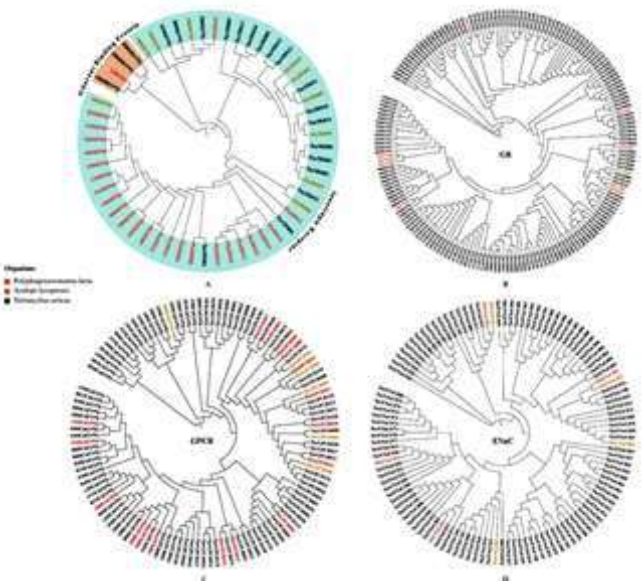


**Figure 28.** Phylogenetic analysis of chemoreceptor genes in *Polyphagotarsonemus latus* by neighbour-joining tree method with 1000 bootstrap replicates. (A) Ionotropic Receptors and Odorant Binding Proteins, (B) Gustatory Receptors (GR), (C) G-Protein Coupled Receptors (GPCR) Rhodopsin-like, and (D) Epithelial Na+ Channel family receptors.

## CYPome and Halloween gene family of *Maconellicoccus hirsutus*

The CYPome and Halloween gene family of *Maconellicoccus hirsutus* were identified, characterized, and classified, with gene expression studies carried out to explore their roles. The identification of *CYP* genes revealed that Clan 2 consists of eight *CYP* genes from six families (*CYP307*, *CYP18*, *CYP3637*, *CYP303*, *CYP15*, and *CYP305*) along with two subfamilies. Clan 3 contains 48 genes from five families (*CYP6*, *CYP3636*, *CYP3633*, *CYP4445*, and *CYP3635*) and 15 subfamilies. Clan 4 includes 57 *CYP* genes from six families (*CYP4*, *CYP3639*, *CYP3634*, *CYP380*, *CYP4461*, and *CYP3638*) and 18 subfamilies. The mitochondrial clan contains seven CYP genes from five families (*CYP315*, *CYP314*, *CYP404*, *CYP302*, and *CYP301*). In total, 22 CYP450 families and 30 subfamilies were identified, with *CYP6* being the largest family (Table 3).

**Table 3.** Number of *CYP* families, subfamilies in different P450 clans in *Maconellicoccus hirsutus*

| | Clan 2 | Clan 3 | Clan 4 | Mitochondrial clan |
|---|---|---|---|---|
| **Number of *CYP* families** | 6 (CYP307, 18, 3637, 303, 15, 305) | 5 (CYP6,3636, 3633,4445,3635) | 6 (CYP4, 3639, 3634, 380, 4461, 3638) | 5 (CYP315, 314, 404, 302, 301) |
| **Number of subfamilies** | 2 | 15 | 18 | 3 |
| **Total number of genes** | 8 | 48 | 57 | 7 |

Furthermore, 40 novel CYP subfamilies were identified, which are highly divergent in nature and belong to Clan 3 and Clan 4. The Halloween genes, which are members of the mitochondrial clan and clan 2, including *neverland* (nvd), *shroud* (sro), *spook* (spo; CYP307A1), *phantom* (CYP306A1), *disembodied* (CYP302A1), *shadow* (CYP315A1), and *shade* (CYP314A1), are involved in the transformation of dietary cholesterol into 20-hydroxyecdysone (20E), the active moulting hormone. Spook has two paralogs, *spookier* (CYP307A2) and *spookiest* (CYP307B1). *Shadow* (sad) transforms 2-deoxyecdysone into ecdysone, and *shade* (shd) catalyses the final step of converting ecdysone into the active hormone, 20E. The expression of these genes at various developmental stages was examined using RT-qPCR.

### Gene mining of sex-determination pathway in *Maconellicoccus hirsutus*

Gene mining in *M. hirsutus* led to the identification of seven genes associated with the sex-determination pathway from the *de novo* transcriptome assembly. These genes were characterized, and domain prediction revealed key domains essential for their functions. The stage-specific expression analysis using qRT-PCR of sex-determining genes, such as *Sex lethal*, *Doublesex*, *Fruitless*, and *Transformer*-2, showed significant downregulation in males. The fold change values for these genes were as follows: Sex *lethal* (-13.56), *Doublesex* (-93.10), *Fruitless* (-17.97), and *Transformer*-2 (-24.86).

### Cuticular protein genes in *Maconellicoccus hirsutus*

The transcriptome analysis of *M. hirsutus* identified 118 cuticular protein genes, which were classified into several groups. These included CPF/CPFLs (2 genes), the CPAP family (6 genes), the CPR family (90 genes), and other genes (16 genes). The expression patterns of these genes were studied after treatment with Buprofezin, an analogue of chitin synthesis inhibitors, and compared to untreated controls. The qRT-PCR analysis revealed distinct expression patterns, indicating that these genes play specific roles in cuticle formation. The findings suggest that the complexity of the wide range of genes involved in cuticle production may be linked to the molting cycle, shedding light on the gene networks responsible for cuticle creation.

### Transcriptome of cassava mealybug, *Phenacoccus manihoti*

The transcriptomes of the cassava mealybug, *Phenacoccus manihoti*, at the crawler and adult life stages were sequenced using the Illumina NovaSeq 6000. The de novo assembly generated 258,482 contigs from clean reads, with a total nucleotide length of 381,947,169 base pairs (bp) and the largest contig measuring 84,049 bp. The assembly quality of *P. manihoti* was assessed using BUSCO, which showed 99.60% completeness compared to arthropod lineages. This transcriptome had low levels of fragmented and missing BUSCOs, both at 0.12%. Differential expression analysis identified 14,773 differentially expressed genes (DEGs). Among these, 55 cytochrome P450 (CYP450) genes were identified and classified into 17 families and 20 subfamilies, with four novel subfamilies discovered (CYP7IGU, CYP87M, CYP7064L, and CYP706AM).

### Aggregation behaviour of mating in potato tuber moth, *Phthorimaea operculella*

The aggregation behaviour of *Phthorimaea operculella* is a critical aspect of its mating and reproduction. Experiments were conducted by pairing adults in different male-to-female ratios (1:1, 2:2, 3:3, 4:4, and 5:5). The results revealed that the 3:3 ratio resulted in the highest fecundity per female. This highlights the importance of aggregation in optimizing reproductive success. Understanding the factors influencing this behaviour provides valuable insights into the ecology of this pest species, aiding in its effective management.

### Isolation, characterization, and bioefficacy of *Bacillus thuringiensis* strains

Approximately 100 *Bacillus thuringiensis* strains were isolated from soil samples and insect cadavers collected across different agroclimatic zones of India. The isolated bacteria were morphologically characterized based on colony traits and various staining techniques. Additionally, molecular characterization was performed using the 16S rDNA marker.

The bioefficacy of each strain was tested against white grub, *Holotrichia serrata*, and results showed that the *B. thuringiensis* strain, NBAIR BtAe exhibited the highest larval mortality, with the lowest $LC_{50}$ value of 148.75 µg/mL. Whole genome sequencing of NBAIR BtAe provided insights into its genetic makeup and the

genetic factors responsible for its bioefficacy (Fig. 29). The annotated genome revealed novel pesticidal proteins, secondary metabolite biosynthesis genes, and other essential genes involved in pest control (Fig. 30).

Biochemical characterization of these strains demonstrated their ability to produce hydrolytic enzymes such as protease, lipase, lecithinase, and chitinase, which enhance their pest control potential (Fig. 31). Additionally, studies on plant growth-promoting (PGP) activity highlighted their role in improving plant health through the production of indole-3-acetic acid (IAA) and ammonia, phosphate solubilization, and antagonistic activity against plant pathogens *via* siderophore production (Fig. 32).

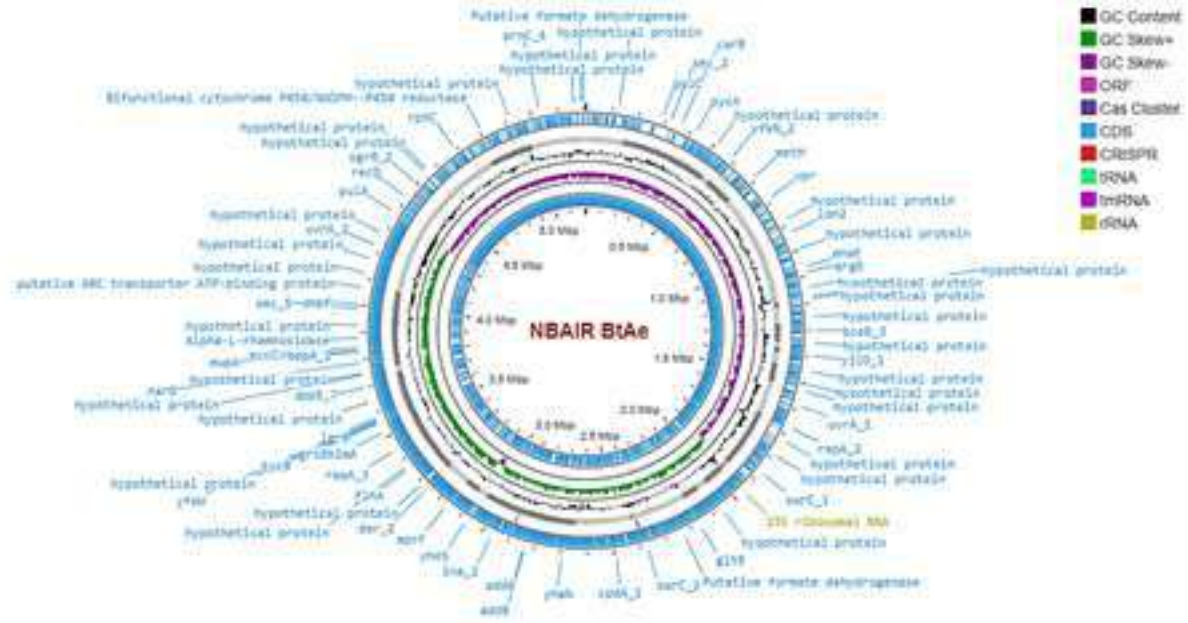



**Figure 29.** Circular map for *Bacillus thuringiensis* strain NBAIR BtAe genome with 5.67 Mb visualized by Proksee tool. The circular genome showed the distribution of rings from inwards to outwards: ring 1 and ring 5 for protein-coding genes; ring 2 for GC skew; ring 3 for GC content and ring 4 represents contig boundaries.

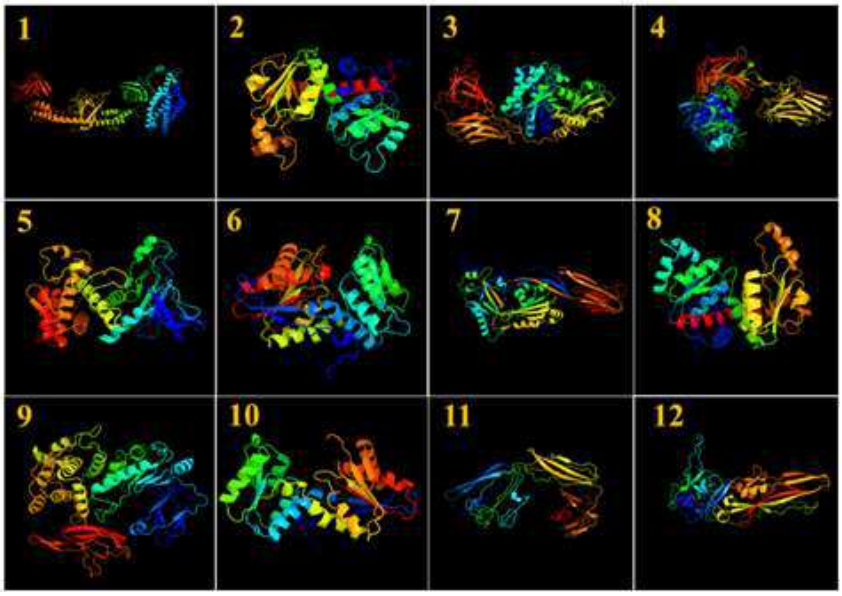



**Figure 30.** 3D structure of pesticidal proteins of *Bacillus thuringiensis* strain, NBAIR BtAe (1) cry21Aa2, (2) zwa6, (3) chitinase C, (4) inhA2, (5) bmp1, (6) zwa5A, (7) spp1Aa1, (8) zwa6, (9) enhancin, (10) zwa5A, (11) bmp1, (12) tpp80Ab1

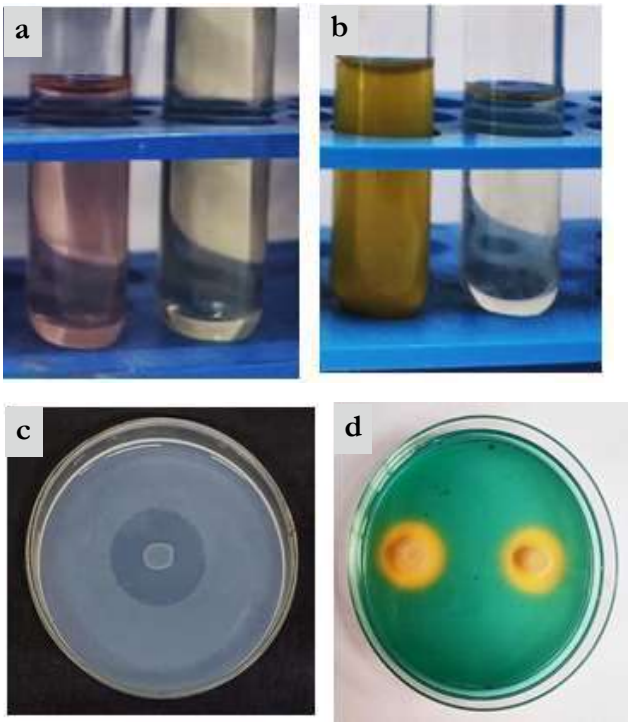



**Figure 31.** Plant growth-promoting (PGP) activities of *Bacillus thuringiensis* strains **(a)** IAA production test: pink colouration indicates a positive result for IAA production, while colourless indicates no IAA production, **(b)** Ammonia production test: brown colouration represents a positive result for ammonia production, while colourless indicates a negative result, **(c)** Phosphate solubilization test: the presence of a halo zone around the colonies signifies a positive result for phosphate solubilization, **(d)** Siderophore production test: a yellow zone around the colony indicates a positive result for iron reduction

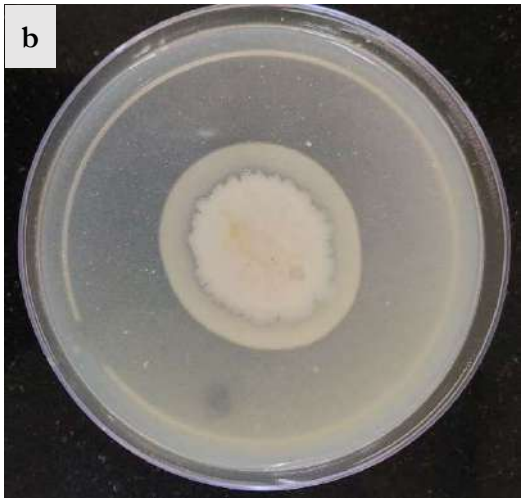




**Figure 32.** Biochemical characterization of *Bacillus thuringiensis* strains showing enzyme production. (a) Lipase test showing a halo zone around the colony, indicating positive lipase enzyme production, (b) Lecithinase test showing an opaque zone around the colony, indicating positive lecithinase enzyme production

### Diagnostic assay for the specific detection of *Bacillus subtilis*

A point-of-need diagnostic assay was developed for the specific detection of *Bacillus subtilis* in bioformulations to regulate the quality of biopesticides in the market. A region specific to *B. subtilis* that codes for shikimate dehydrogenase was identified through in silico analysis. Conventional PCR, Loop-mediated isothermal amplification (LAMP), Recombinase Polymerase Amplification (RPA), and qPCR were employed for the specific detection of *B. subtilis* in soil samples and biopesticide formulations. Specificity tests showed that the PCR primers amplified an amplicon of 521 bp in only four strains of *B. subtilis*, with no amplification observed in negative control samples. Similarly, the LAMP assay showed a sky-blue colour in all four strains of *B. subtilis* and a violet colour in negative control samples. In the RPA assay, upon the addition of SYBR Green dye, a bright green colour was seen in *B. subtilis* strains, while a brick-red colour was observed in negative control samples when visualized under a UV transilluminator. The qPCR assay showed specific amplifications with a Ct value of 12 for *B. subtilis* strains and no amplification in negative control samples (Fig. 33).

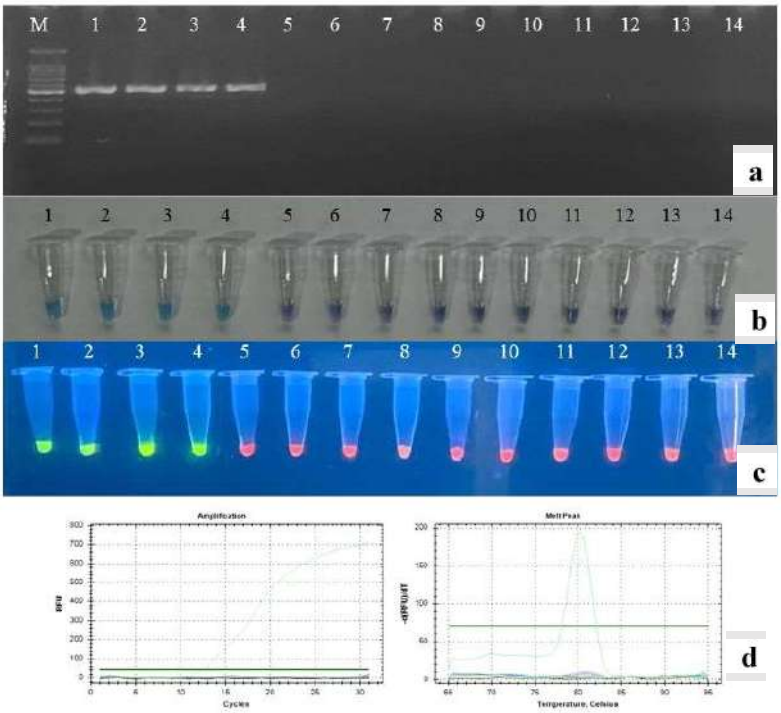



**Figure 33.** (a) Agarose gel showing PCR specificity assay using *Bacillus subtilis*-specific primers, (b) LAMP specificity assay for species-specific primers with HNB dye, (c) RPA specificity assay for species-specific primers with SYBR Green I dye, (d) qPCR specificity assay for species-specific primers showing cycle threshold (Ct) and melting curve for *B. subtilis* only. Lanes: M-100 bp marker; 1-*B. subtilis* strain NBAIR BSWG1; 2-*B. subtilis* strain NBAIR BSWG2; 3-*B. subtilis* strain NBAIR BSWG3; 4-*B. subtilis* strain NBAIR BSWG4; 5-*Bacillus albus*; 6-*Bacillus amyloliquefaciens*; 7-*Bacillus cereus*; 8-*Bacillus megaterium*; 9-*Bacillus velezensis*; 10-*Bacillus sphaericus*; 11-*Bacillus thuringiensis*; 12-*Bacillus toyonensis*; 13-*Bacillus pumilus*; 14-non-template control

## Development of improved strains of selected natural enemies for insecticide resistance

Detoxifying enzyme studies were conducted to understand the metabolic basis of insecticide resistance in *Trichogramma chilonis* against Emamectin Benzoate. Acetylcholinesterase (AChE) activity was measured by monitoring the formation of 5-thio-2-nitrobenzoic acid at 412 nm using a UV-Vis spectrophotometer. The AChE activity, expressed in nmoles of 5-thio-2-nitrobenzoic acid per minute per milliliter of enzyme, was 1.781 in the susceptible population and 3.093 in the resistant population. This indicates that the AChE activity in the resistant *T. chilonis* population was 1.736 times higher than that of the susceptible population, suggesting a potential role of enhanced AChE activity in insecticide resistance.

## Selection of suitable reference genes in *Chrysoperla zastrowi sillemi*

To identify stable reference genes under temperature stress, second-instar larvae of *C. zastrowi sillemi* were exposed to 4°C, 25°C, and 37°C. RNA was extracted from 30 larvae per treatment, and 14 candidate reference genes were selected based on literature. Specific primers were designed and validated, with amplification efficiencies ranging from 92% to 105.5%, falling within the ideal range. High-quality RNA with good integrity was confirmed through spectrophotometry and gel electrophoresis before cDNA synthesis.

The stability of the reference genes was evaluated using geNorm, NormFinder, BestKeeper, and RefFinder algorithms. GeNorm ranked *ARF2* as the most stable gene, followed by *CS6* and *SDH* (Fig. 34). NormFinder identified *Actin* as the most stable gene, with a stability value of 0.377, and determined that the best combination of

genes for normalization was *Actin* and *SDH*. BestKeeper also ranked *Actin* as the most stable gene, based on its low standard eviation of 0.74, followed by *GAPDH* and *RAB1A*. RefFinder, which integrates results from multiple algorithms, confirmed *SDH* and *Actin* as the most stable genes (Fig. 35).

Melt curve analysis confirmed that single amplicons were produced for each reference gene, demonstrating minimal variation across experimental conditions (Fig. 36). This study established *Actin* and *SDH* as the most reliable reference genes for normalization in gene expression studies under temperature stress, ensuring accurate and reproducible results.

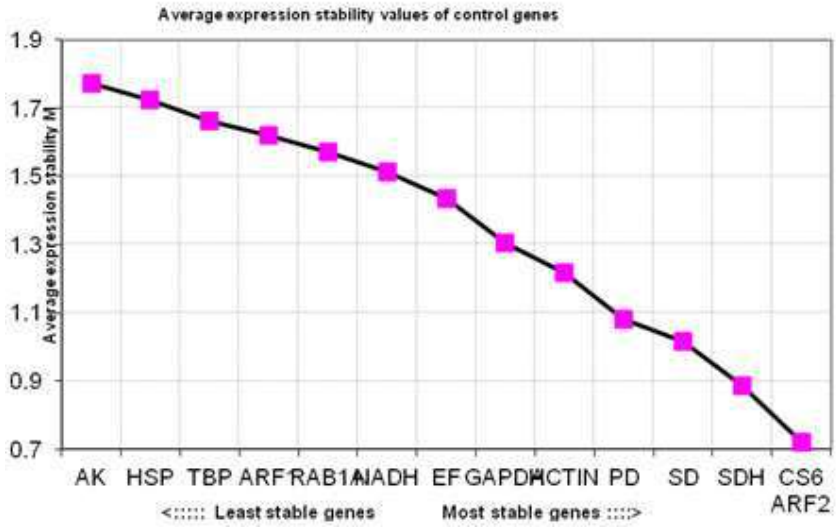



**Figure 34.** Average expression stability values of candidate reference genes in *Chrysoperla zastrowi sillemi* analyzed using geNorm

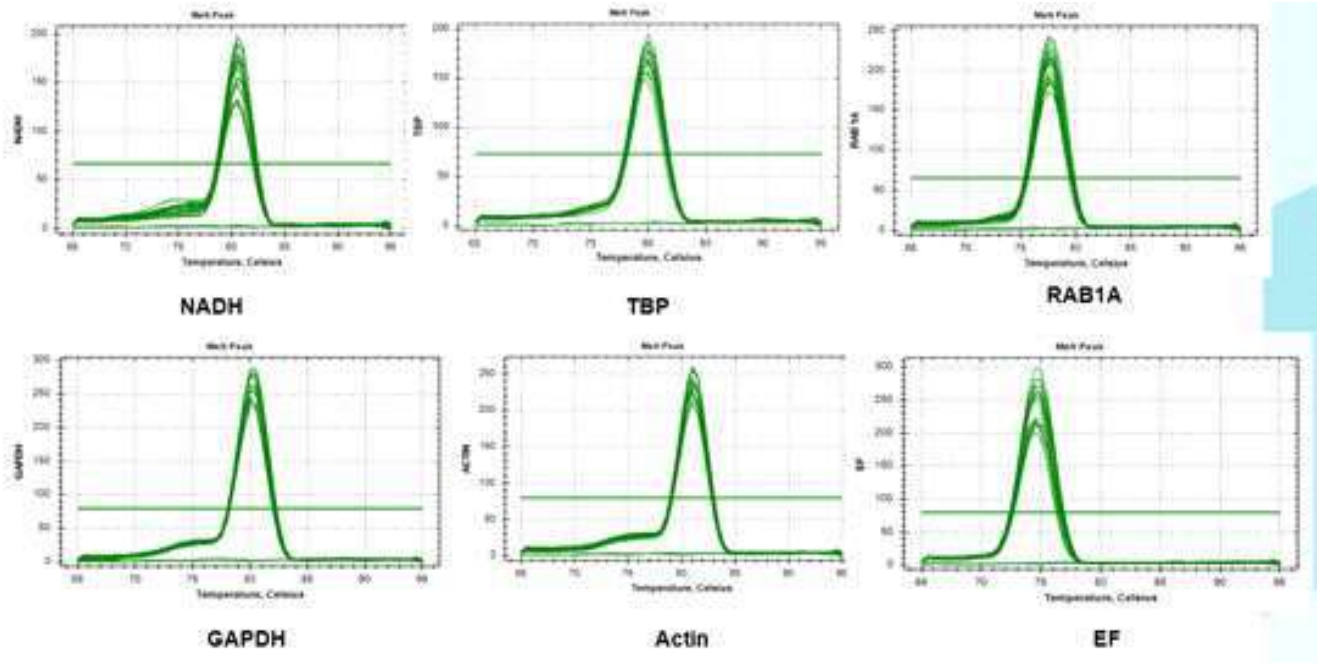



**Figure 35.** Ranking of candidate reference genes in *Chrysoperla zastrowi sillemi* based on four algorithms: Delta CT, BestKeeper, NormFinder, and geNorm using RefFinder

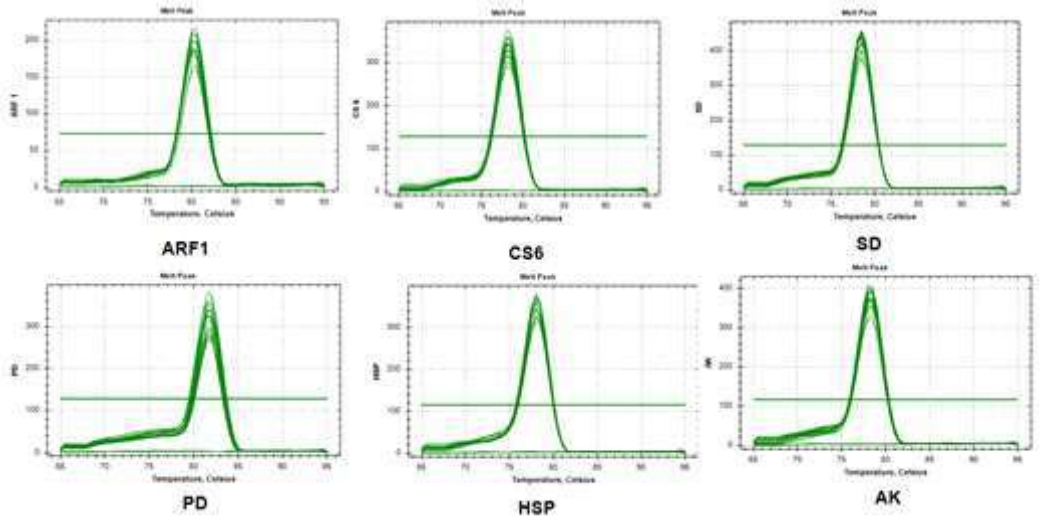



**Figure 36.** Melt curve analysis confirming that single amplicons were produced for each reference gene

## Microflora associated with insects and their role in farm waste management

A total of 14 bacteria were isolated from the gut of the black soldier fly, *Hermetia illucens*, and identified using biochemical and molecular tools. The bacterial isolates were characterized for the presence of hydrolytic enzymes such as amylase, cellulase, protease, lipase, pectinase, and gelatinase. Through qualitative and quantitative assays, three isolates–*Bacillus subtilis* (SF4-4), *Bacillus cereus* (BSFK7), and *Prestia megaterium* (BSFK9) were proved to be the most effective degraders.

Further, these promising bacterial isolates were evaluated for organic waste degradation in pot degradation trials. The organic wastes included kitchen waste, vegetable waste, and fruit waste. Each treatment, conducted in triplicate, was inoculated with 2% of a one-day-old bacterial inoculum (Fig. 37). The organic substrate samples were analyzed on the 0$^{th}$ and 30$^{th}$ day for various physicochemical parameters. A significant difference was observed over 30 days in the rate of degradation. The physicochemical parameters showed an increase in pH and ash content, while electrical conductivity (EC) decreased as the rate of degradation increased. The substrates before bacterial inoculation had an acidic pH ranging between 3 and 4, which turned alkaline by the 30$^{th}$ day, ranging from pH 7–8.

Evaluation of the macro- and micronutrient content of the degrading materials showed a significant increase in all nutrients by the 30$^{th}$ day after inoculation (Table 4).

The C:N ratio of the organic waste decreased by 61.8% in the treatment inoculated with *Bacillus subtilis* (SF4-4), 58.1% with *Bacillus cereus* (BSFK7), and 57.7% with *Prestia megaterium* (BSFK9), compared to 54.7% in the control after 30 days. The best C:N ratio of 33:1 was recorded for SF4-4 at 30 days.

Black soldier fly prepupae meal was evaluated for fatty acid content, including saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), and polyunsaturated fatty acids (PUFA), in the egg yolk of hens at 10% and 20% replacement levels. The experiments revealed that black soldier fly prepupae meal can be economically included in layer chicken diets up to 10%, with organoleptic evaluation of eggs showing no significant difference between treatments. In broiler chicken experimentation, diets containing 5%, 10%, and 15% black soldier fly prepupae meal were tested. The results indicated that BSF prepupae meal can be included up to 15% in the diet of broiler chickens without adverse effects.


**Figure 37.** Organic waste degradation trial with black soldier fly associated microflora

**Table 4**. Physicochemical properties of the organic waste (Substrate analysis)

| Physico-chemical parameters | Treatments/ days of sampling | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | SF4-4 | BSFK7 | BSFK9 | Control | SF4-4 | BSFK7 | BSFK9 | Control |
| | Before inoculation | | | | 30 days after inoculation | | | |
| pH | 4.09 | 3.86 | 4.00 | 4.03 | 8.13 | 7.69 | 7.75 | 8.06 |
| EC (dS/m) | 7.27 | 5.75 | 6.93 | 6.53 | 5.55 | 4.66 | 4.05 | 5.22 |
| Ash (%) | 6.59 | 4.53 | 5.62 | 5.54 | 12.18 | 11.39 | 11.92 | 12.77 |
| Organic carbon (%) | 93.41 | 95.47 | 94.38 | 94.46 | 87.82 | 88.61 | 88.08 | 87.23 |
| N (%) | 1.12 | 1.13 | 1.11 | 1.32 | 2.65 | 2.20 | 2.38 | 2.27 |
| P (%) | 0.15 | 0.14 | 0.14 | 0.15 | 0.21 | 0.21 | 0.21 | 0.22 |
| K (%) | 1.91 | 1.24 | 1.65 | 1.92 | 1.81 | 1.43 | 1.30 | 1.55 |
| Ca (%) | 0.35 | 0.25 | 0.25 | 0.40 | 0.50 | 0.65 | 0.75 | 1.00 |
| Mg (%) | 0.15 | 0.21 | 0.21 | 0.21 | 0.63 | 0.33 | 0.33 | 0.30 |
| S (%) | 0.09 | 0.07 | 0.08 | 0.09 | 0.28 | 0.28 | 0.21 | 0.26 |
| Zn (ppm) | 25.73 | 34.77 | 68.12 | 25.84 | 44.89 | 52.59 | 40.09 | 54.44 |
| Mn (ppm) | 10.49 | 17.14 | 24.93 | 15.86 | 49.09 | 41.23 | 46.78 | 47.09 |
| Fe (ppm) | 225.21 | 244.89 | 214.34 | 299.16 | 675.01 | 599.78 | 655.80 | 702.56 |
| Cu (ppm) | 7.24 | 5.73 | 9.94 | 6.75 | 13.09 | 8.29 | 9.21 | 10.85 |
| C:N | 83.40 | 84.49 | 85.03 | 71.56 | 33.14 | 40.28 | 37.01 | 38.43 |

### Prospects of chitinolytic bacteria from shrimp waste for lepidopteran pest management

Shrimp shell waste and soil were collected from five different parts of Andhra Pradesh, namely Amalapuram, Bhimavaram, Kakinada, Ravulapalem, and Vishakhapatnam. A total of 117 different bacterial morphotypes were isolated from the enriched shell and soil mixture and qualitatively characterized for pathogenicity tests. Of the 117 isolates, 57 showed β-hemolysis, indicating that the isolates were pathogenic to humans and were discarded. Sixty bacterial isolates were qualitatively screened for chitinase and protease enzyme production (Fig. 38). Thirty-five bacterial isolates showed positive chitinase activity, and 23 bacterial isolates showed positive protease activity. The zone potency index was calculated for both enzymes. Sixty bacterial isolates were also qualitatively characterized for lipase and lecithinase activity. Out of the 60 bacterial isolates, 20 showed lipase activity, and 17 showed lecithinase enzyme activity.

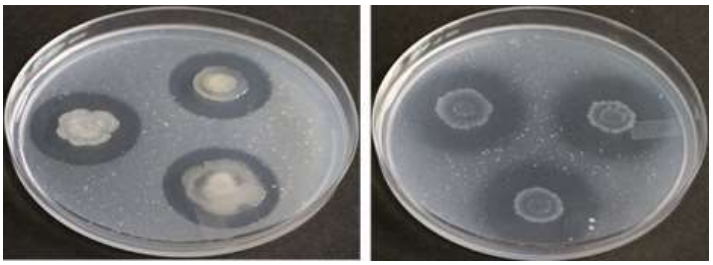


**Figure 38.** Chitinase and protease enzyme activity

### Geo-mapping of predominant insect pests and their natural enemies in India and development of IoT based crop advisory system

The GIS portal for insect pests and their natural enemies in India was updated with additional data (Fig. 39). The distribution data of the invasive pest, cassava mealy bug, *Phenacoccus manihoti* and its natural enemies, *Acerophagus papayae, Cryptolaemus montrouzieri, Hyperaspis maindroni, Menochilus sexmaculatus, Scymnus* sp., and *Spalgis epius* were uploaded to this portal.


**Figure 39.** Home page of GIS portal for insect pests and their natural enemies in India

An automatic detection and classification system for insect pests and their natural enemies in tomato crops was developed using modern machine learning algorithms. An image dataset was created for pests and their natural enemies in tomato crop (Fig. 40). The dataset contains approximately 1,500 images of various tomato pests, including *Bemisia tabaci*, *Helicoverpa armigera*, *Liriomyza trifolii*, *Phthorimaea absoluta*, and *Spodoptera litura*, along with their natural enemies. It includes adult, larval, and nymphal stages of pests and adult stages of natural enemies, categorized into 23 classes. The state-of-the-art machine learning method, Convolutional Neural Network (CNN), was used for the detection of pests and natural enemies in tomato. This application can be integrated with a mobile application for easy and automated detection of pests and natural enemies in tomato fields, and for promoting biological control for effective pest management.

**Figure 40.** Image dataset of pests and natural enemies in tomato crop

A mobile phone-based advisory system for tomato growers was developed using an Artificial Intelligence (AI)-based Large Language Model (LLM). This system provides pest alerts and management practices with a special focus on biological control.

## Division of Germplasm Conservation and Utilisation

### Geographical distribution of invasive whiteflies

Around 15 exploratory surveys were conducted, resulting in the collection of 400 samples of whiteflies and their natural enemies from Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra, Gujarat, and Orissa. The surveys identified several commonly occurring whitefly species, including *Aleurodicus dispersus, Aleurodicus rugioperculatus, Paraleyrodes bondari, P. minei, Pealius nagerkoilensis, Aleurocanthus* sp., and *Dialeropora decempunctata*.

Notably, native parasitoids such as *Encarsia cubensis* and *Eretmocerus* sp., associated with woolly whitefly infestations on guava, were recorded for the first time in India. The parasitoid *Encarsia* spp. was recovered from various whitefly species, including *A. rugioperculatus, A. dispersus, P. nagerkoilensis, D. decempunctata, Aleurocanthus woglumi, Aleurolobus* sp., *Aleuroclava* sp., and *Trialeurodes vaporarium*. Similarly, the parasitoid *Eretmocerus* spp. was found parasitizing *P. nagerkoilensis, D. decempunctata*, and *Bemisia breyniae*.

## New invasive whitefly, *Aleurotrachelus anonae*

A new invasive whitefly, *Aleurotrachelus anonae* (Corbett), was reported for the first time in India during July-August 2024 on custard apple (*Annona squamosa*), cherimoya (*Annona cherimola*), and Indian shot (*Canna indica*) (Fig. 41-44). Surveys revealed the presence of nymphal parasitoids, including *Encarsia sophia, Encarsia* sp., and *Eretmocerus* sp., along with the predator *Scymnus latemaculatus*, in plants infested with *A. anonae* colonies. Additionally, the parasitoid *Encarsia cubensis* was observed expanding its host range to parasitize other invasive whiteflies, such as *A. trachoides* on *Duranta* and *Aleurothrixus floccosus* on guava, marking its first recorded occurrence in India (Fig. 45).

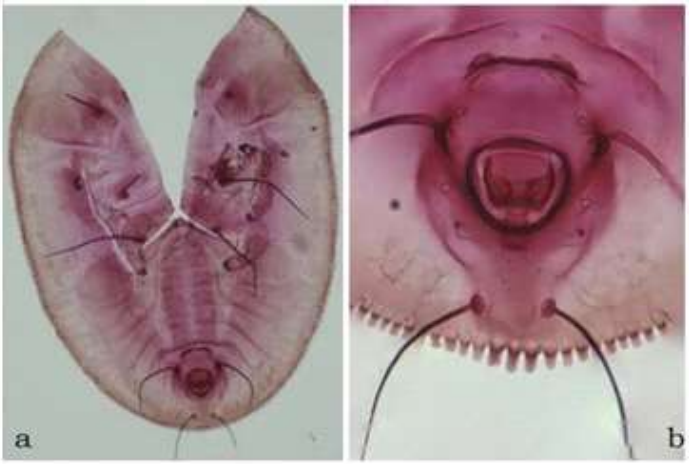



**Figure 41.** Mounted puparium of *Aleurotrachelus anonae*: a. dorsal views with submarginal setae. b, posterior end of puparium and vasiform orifice

**Figure 42.** Symptoms of annona whitefly, *Aleurotrachelus anonae* on custard apple

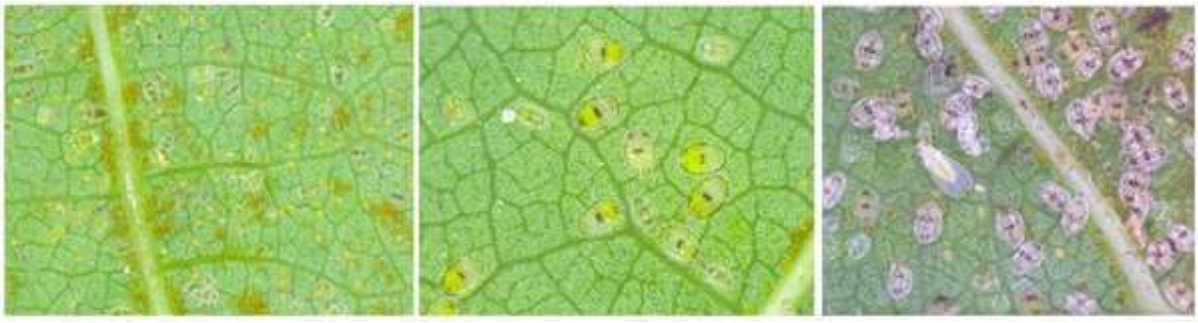


**Figure 43.** Life stages of *Aleurotrachelus anonae* on custard apple

**Figure 44.** Natural enemies associated with *Aleurotrachelus anonae*: a-b). Parasitoid, *Encarsia* sp. and c). Predator, *Scymnus latemaculatus*

### Survey and collection of *Chelonus* spp.

Field surveys were carried out in farmers' fields across various crops in Karnataka to collect *Chelonus* spp. During these surveys, *Chelonus blackburni* and *C. formosanus* were collected, reared, and deposited in a live insect repository for further rearing.

### Associative learning of *Chelonus blackburni* on different host insects

In laboratory settings, the preference and parasitizing efficiency of *C. blackburni* were evaluated using three host insects: *Spodoptera frugiperda*, *Earias vittella*, and *Corcyra cephalonica*. When presented with the eggs of these hosts, the laboratory-reared *C. blackburni* females showed a distinct preference for *C. cephalonica* eggs, parasitizing them in significantly less time compared to the eggs of *S. frugiperda* and *E. vittella*. This behavior may be linked to associative learning or olfactory conditioning, as the parasitoids appeared to be more responsive to the odor of *C. cephalonica*, their laboratory host.

Interestingly, when female *C. blackburni* that emerged from natural target hosts were reintroduced to the eggs of these natural hosts, their preference and parasitism rates increased by over 20% compared to unconditioned or laboratory-reared parasitoids, which exhibited much lower parasitism rates (around 5%). These initial findings underscore the potential of olfactory conditioning to enhance the field performance of parasitoids, suggesting its utility in improving their preference and parasitism efficiency for targeted biological control initiatives.

### Performance of *Blaptostethus pallescens* against *Thrips parvispinus*

Functional response studies revealed that fifth instar nymphs and adult females of *B. pallescens* exhibited a Type II functional response, where the proportion of *Thrips parvispinus* consumed decreased as prey density increased. Adult *B. pallescens* displayed a significantly higher attack rate compared to the fifth instar nymphs. The theoretical maximum number of preys were killed in one hour and $a/T_h$ increased with each instar (Fig 45-46).

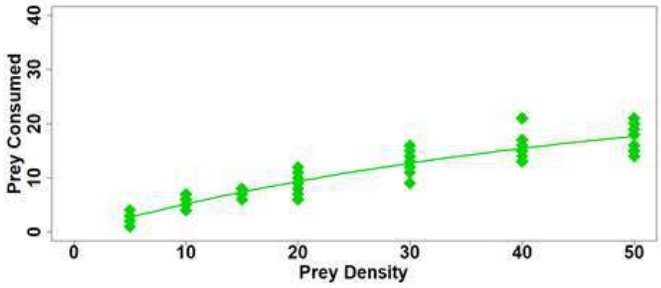



**Figure 45.** Functional response of fifth instar of *Blaptostethus pallescens* at different density of *Thrips parvispinus* adult during a 24 h period

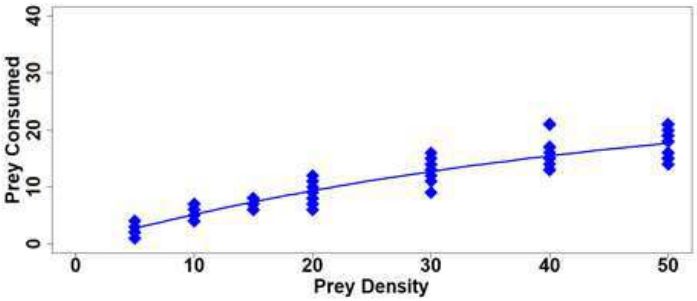



**Figure 46.** Functional response of female of *B. pallescens* at different density of *Thrips parvispinus* adult during a 24 h period

### Predator's first approach for chilli thrips management

Under open-field conditions, *Blaptostethus pallescens* was introduced as a proactive predator control measure, with four releases at weekly intervals at a rate of five adults per square meter before the pest's arrival. This approach led to a significant reduction in the *Thrips parvispinus* population on chilli, decreasing from 4.5 per tap to 0.5 per tap within 30 days of the initial predator release.

### Investigation on interactions between predatory bug, *Dortus primarius* and *Lecanicillium fusisporum* (Vl-8)

### Feeding potential of predatory mirid bug, *Dortus primarius* on *Lecanicillium fusisporum* (Vl-8) treated *Frankliniella schultzei* larvae

A nymph of *D. primarius* consumed a significantly higher number of untreated *F. schultzei* larvae (114.05 ± 1.5) compared to *L. fusisporum*-treated *F. schultzei* larvae (93.03 ± 0.61) over a nymphal duration of 17 to 21 days. Similarly, an adult female of *D. primarius* consumed 61.44 ± 1.38 *Vl-8*-treated thrips larvae within a week (Fig. 47).

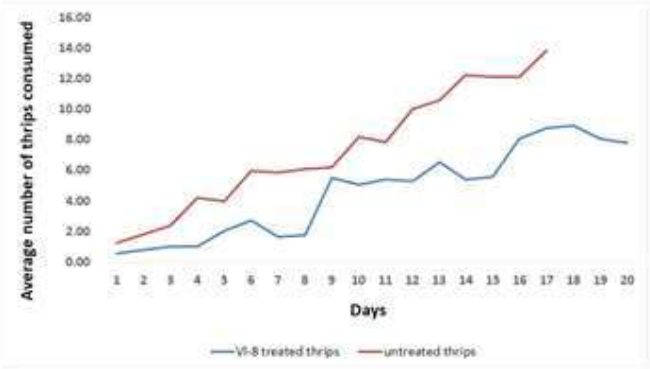



**Figure 47.** Feeding potential of predatory mirid bug, *Dortus primarius* on thrips larvae treated with *Lecanicillium fusisporum*

### Prey preference of *Dortus primarius*, a predatory mirid bug with *Lecanicillium fusisporum* treated *Frankliniella schultzei* larvae

Immature stages of *Dortus primarius* second instar (t=-6.928, df=6, p=0.0001), third instar (t=-4.00, df=6, p=0.007); fourth instar (t=-5.908, df=6, p=0.001); fifth instar (t=-6.640, df=4.7, p=0.001) and adult female (t=-14.758, df=4.9 p=0.0001 preferred significantly more untreated *Frankliniella schultzei* larvae compared to *L. fusisporum* treated *F. schultzei* larvae. This result was confirmed by Manly's preference index of 0.85 ± 0.06; 0.76 ± 0.07; 0.72 ± 0.05; 0.80 ± 0.04 and 0.83 ± 0.02 for second, third, fourth, fifth and adult female of *D. primarius* respectively.

### Seasonal parasitism of trichogrammatids on *Lampides* species infesting *Crotalaria*

Parasitism by three species viz.,*Trichogramma chilonis, T. armigera,* and *T. bactrae* was observed on the eggs of *Lampides* species infesting *Crotalaria*. Among them, *T. armigera* showed the highest abundance and parasitism rate (3.4–15.6%), followed by *T. bactrae* (6.2%) and *T. chilonis* (2.9%). The overall parasitism rate by trichogrammatids was recorded at 13.13%.

### Field parasitism by *Trichogramma* on *Helicoverpa armigera* eggs in menthol mint

Field parasitism of *Helicoverpa armigera* eggs by *Trichogramma* species in menthol mint was studied. Parasitism rates varied among species, with *T. achaeae* ranging from 3.85% to 18.18%, *T. chilonis* from 13.04% to 28.57%, and *T. chilotrae* at 2.22%. The overall field parasitism by *Trichogramma* species ranged between 2.22% and 28.57%, with an average parasitism rate of 18.45% in menthol mint fields.

### Development of microbial consortia for the management of crop pests

Eight new isolates of *Helicoverpa armigera* nucleopolyhedrovirus (HearNPV) were isolated from dead *Helicoverpa armigera* larvae collected in chickpea-growing regions of Karnataka. Additionally, five recently gathered soil microbes were tested for their efficacy against the maize fall armyworm (FAW), *Spodoptera frugiperda*, under laboratory conditions. Among these, four bacterial isolates—*Pseudomonas fluorescens*, *Bacillus subtilis*, *Bacillus cereus*, and *Bacillus thuringiensis*—demonstrated effectiveness against FAW. However, the soil fungus *Trichoderma harzianum* showed no significant impact on the fall armyworm. Notably, *Bacillus thuringiensis* and *Pseudomonas fluorescens* were highly effective, causing 65% to 71% larval mortality. The $LC_{50}$ values for all microbial isolates ranged from $1.85 \times 10^3$ to $10.25 \times 10^3$ cfu/ml. Specifically, the $LC_{50}$ values for *Bacillus thuringiensis* and *Pseudomonas fluorescens* against FAW were $1.85 \times 10^3$ cfu/ml and $2.84 \times 10^3$ cfu/ml, respectively (Table 5).

**Table 5.** Efficacy of bacterial and fungal isolates against maize fall armyworm *Spodoptera frugiperda*

| Microbial isolates | $LC_{50}$ (cfu/ml) | 95% CI | $\chi^2$ |
|---|---|---|---|
| *Pseudomonas fluorescens* | $2.84 \times 10^3$ | $8.82 \times 10^2 - 6.91 \times 10^3$ | 11.45 |
| *Bacillus subtilis* | $4.67 \times 10^3$ | $4.52 \times 10^3 - 7.91 \times 10^3$ | 9.35 |
| *Bacillus cereus* | $4.45 \times 10^3$ | $3.25 \times 10^3 - 6.54 \times 10^3$ | 10.15 |
| *Bacillus thuringiensis* | $1.85 \times 10^3$ | $7.20 \times 10^2 - 4.47 \times 10^3$ | 12.65 |
| *Trichoderma harzianum* | $10.25 \times 10^3$ | $4.52 \times 10^3 - 8.91 \times 10^3$ | 9.35 |

All five antagonistic microbes demonstrated the ability to inhibit the mycelial growth of soil-borne pathogens affecting maize. The antagonistic bacterium *Bacillus subtilis* exhibited the strongest inhibition against the maize stalk rot pathogen *Fusarium verticillioides* in vitro, producing the largest inhibition zone of 3.2 cm, followed by *Bacillus cereus* (2.5 cm) and *Pseudomonas fluorescens* (2.2 cm), compared to the control. The antagonistic fungus *Trichoderma harzianum* was highly effective against the charcoal rot pathogen *Macrophomina phaseolina*, showing the highest inhibition zone of 3.0 cm, trailed by *Bacillus subtilis* (2.9 cm) and *Pseudomonas fluorescens* (2.0 cm), relative to the control. Additionally, the antagonistic bacterium *Pseudomonas fluorescens* displayed the strongest inhibition against the banded leaf and sheath blight pathogen *Rhizoctonia solani* in vitro, with an inhibition zone of 3.3 cm, followed by *Bacillus cereus* (3.0 cm) and *Bacillus thuringiensis* (2.8 cm), compared to the control (Table 6). Among the five antagonistic microbes, *Bacillus subtilis* and *Pseudomonas fluorescens* were particularly effective in suppressing the growth of key soil-borne maize pathogens, namely *Fusarium verticillioides*, *Macrophomina phaseolina*, and *Rhizoctonia solani*. Furthermore, all four antagonistic bacteria *Bacillus subtilis*, *Bacillus cereus*, *Bacillus thuringiensis*, and *Pseudomonas fluorescens* were found to be compatible with each other under in vitro conditions.

**Table 6.** *In vitro* screening of antagonistic microbes against soil borne pathogens of maize

| Antagonistic microbes | Inhibition Zone (cm) | | |
|---|---|---|---|
| | **Stalk rot** (*Fusarium verticillioides*) | **Charcoal rot** (*Macrophomina phaseolina*) | **Banded Leaf and Sheath Blight** (*Rhizoctonia solani*) |
| *Bacillus subtilis* | 3.2 | 2.9 | 2.8 |
| *Bacillus cereus* | 2.5 | 1.5 | 3.0 |
| *Bacillus thuringiensis* | 1.5 | 1.2 | 1.7 |
| *Pseudomonas fluorescens* | 2.2 | 2.0 | 3.3 |
| *Trichoderma harzianum* | 2.0 | 3.0 | 2.0 |
| Control | 0.0 | 0.0 | 0.1 |
| SEM | 0.14 | 0.06 | 0.15 |
| CD (P= 0.01) | 0.47 | 0.25 | 0.61 |

## Isolation, purification and characterization of entomopathogenic fungus

ICAR-NBAIR has identified promising fungal strains, including *Metarhizium anisopliae* and *Beauveria bassiana*, for controlling lepidopteran and sucking pests. Several strains of entomopathogenic fungi, such as *M. anisopliae*, *B. bassiana*, and *Isaria fumosorosea*, were isolated from insect cadavers and fertile soil samples collected from Tamil Nadu. Through single conidia purification and PCR-based internal transcribed spacer (ITS) region sequencing, seven strains of *M. anisopliae*, along with one strain each of *B. bassiana* and *I. fumosorosea*, were confirmed (Fig. 48).

**Figure 48.** Pure culture of entomopathogenic fungus *Metarhizium anisopliae* (left) and *Beauveria bassiana* (centre) and *Isaria fumosorosea* (right)

## Potential efficacy of *Metarhizium anisopliae* NBAIR-Ma35 oil formulation against fall armyworm under field conditions

*Metarhizium anisopliae* NBAIR-Ma35 was effective for the management of FAW under field conditions. A significantly lesser number of larvae were recorded in the *M. anisopliae* NBAIR-35 (0.50 larvae/plant and 0.40 larvae/plant) treated plots and the highest post-larval count was recorded in the control plot (11.75 larvae/plant and 12.50 larvae/plant) on 7$^{th}$ and 14$^{th}$ day after spraying respectively (Fig. 49).

**Figure 49.** Field view of *Metarhizium anisopliae* NBAIR-Ma35 sprayed against fall armyworm (*Spodoptera frugiperda)* (left) and NBAIR-Ma35 treated plots showed mycosis FAW dead cadaver in field (right).

## Management of *Scirtothrips dorsalis* infestation on mango under protected cultivation

Potential use of the entomopathogens like *Beauveria bassiana* NBAIR-Bb5a and *Bacillus albus* NBAIR-BATP controlled the *S. dorsalis* on mango under protected cultivation. With single spray of above mentioned entomopathogens the overall reduction of *S. dorsalis* for the *B. bassiana* NBAIR-Bb5a (6.08 thrips/tap) and *B. albus* (1.21thrips/tap) compared to the untreated control (45.65thrips/tap) on mango under protected cultivation.

## Evaluation of entomopathogenic nematodes against *Spodoptera litura*

The susceptibility of the larval and pupal stages of *S. litura* to native entomopathogenic nematodes *Heterorhabditis indica* NBAIRH80, and *S. surkhetense* NBAIRS81 was studied. Bioassay results revealed that upon inoculating 400 infective juveniles (IJs) larva$^{-1}$ to fourth-instar *S. litura* larvae with *H. indica* and *S. surkhetense*, *H. indica* caused 100% mortality whereas *S. surkhetense* caused 54% mortality (Fig. 50). When *S. litura* pupae were inoculated with 50 IJs of *H. indica*, the pupal mortality was only 10% when the IJs concentration was increased to 600 IJs pupa$^{-1}$, the pupal mortality also increased to 80%. The percentage mortality in larvae and pupae of *S. litura* increased significantly with an increase in the exposure time. Both nematode species were able to penetrate the *S. litura* larvae and also completed their life cycle by producing large numbers of IJs. Pot and field experiments showed that cabbage plants sprayed with *H. indica* and flubendiamide significantly reduced the number of larvae, leaf injury (*H. indica*: 0.7: 0–4 scale flubendiamide: 0.4: 0–4 scale) (Fig. 51), head injury (*H. indica*: 0.5: 0–4 scale flubendiamide: 0.6: 0–4 scale) and increasing yield (*H. indica*: 23.57 tonnes ha$^{-1}$ flubendiamide: 25.53 tonnes ha$^{-1}$) (Fig. 52). These results showed that, *H. indica* performed equally well that of flubendiamide. Overall results showed that *H. indica* NBAIRH80 can be incorporated into an integrated pest management programme for *S. litura.*

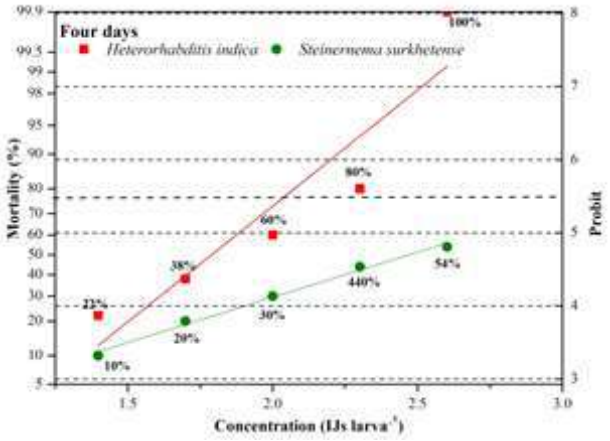



**Figure 50.** Effect of different concentrations of entomopathogenic nematodes, *Heterorhabditis indica* NBAIRH80 and *Steinernema surkhetense* NBAIRS81 on fourth-instar larvae of *Spodoptera litura* at 4 days after treatment (n = 50)

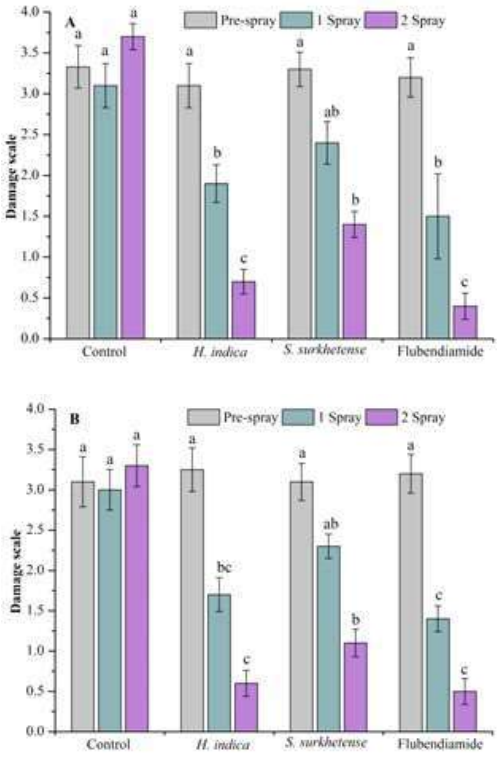



**Figure 51&52.** Mean leaf injury (0-4 scale) caused by *Spodoptera litura* larvae ± SE on 10 cabbage leaves (A) and Head injury (0-4 scale) (B) with different treatments at 7 days after application in a field experiment at FigChickballapur district in Karnataka, India. Columns with different letters indicate significant differences for different treatments (P <0.05, Tukey's test). Both *H. indica* and *S. carpocapsae* were applied at a rate of 1.25 × $10^8$ IJ ha$^{-1}$. Flubendiamide (Bayer flame 39.35SC at a dose of 0.5 ml l$^{-1}$) was sprayed in both sprays

### Assessment of invasion risk of invasive pest walnut leaf miner, *Caloptilia roscipennella* (Lepidoptera: Gracillariidae)

Potential habitat distribution *C. roscipennella* was modelled using the MaxEnt algorithm. The climate niche for *C. roscipennella* was also established by analysing the correlation between the 86 pest presence records and seven bioclimatic variables viz., bio01, bio02, bio03, bio05, bio06, bio12 and bio15, which were chosen for predicting the distribution of *C. roscipennella*. The model performance was good as it exhibited a strong Receiver Operating Characteristic Curve value of 0.984. Based on the Jackknife test, the Bio 6 exhibited the highest gain value and emerged as the primary abiotic factor exerting influence on the potential habitat distribution of this pest. Model predicted *C. roscipennella* spread in Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Arunachal Pradesh in India (Fig. 53).

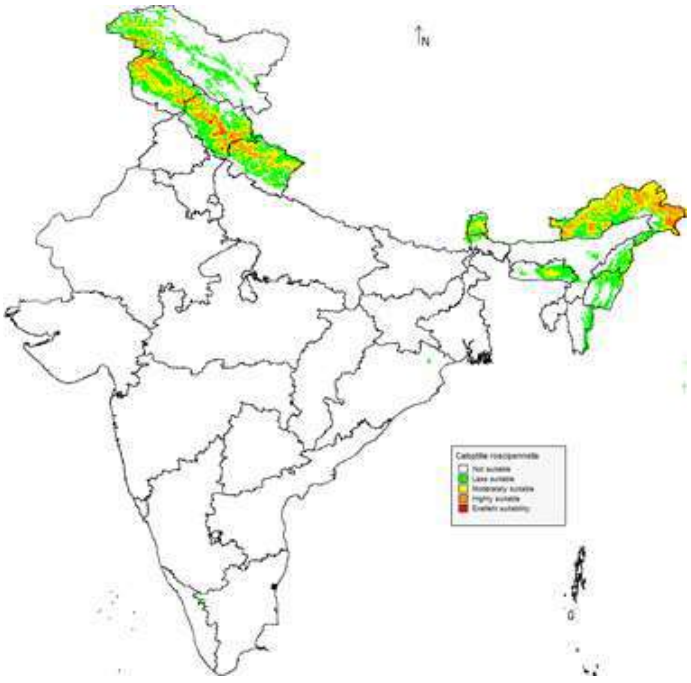


**Figure 53.** Potential distribution of *C. roscipennella in* India

### Population dynamics and species composition of thrips on horticultural crops

**Marigold:** Thrips population was monitored on marigold during 36 to 44 Standard meteorological weeks (SMW) of 2024. The peak occurrence of the thrips on marigold was recorded during 42nd SMW with 5.13 thrips per/tap. The different species of thrips species observed on the marigold are *Thrips parvispinus* (Karny), *Haplothrips (Haplothrips) gowdeyi* (Franklin), *Thrips florum* Schmutz and *Thrips hawaiiensis* (Morgan) with 74, 16, 5 and 5 percent occurrence respectively. Among the thrips species observed on marigold, *Thrips parvispinus* is the dominant species.

**Chrysanthemum:** Thrips population was monitored on chrysanthemum during 39 to 45 Standard meteorological weeks (SMW) of 2024. The peak occurrence of the thrips on chrysanthemum was recorded during 42nd SMW with 4.53 thrips per/tap. Thrips species observed on the chrysanthemum are *Microcephalothrips abdominalis* (D. L. Crawford), *Thrips parvispinus* (Karny), *Neohydatothrips samayunkur* Kudo, *Haplothrips* (*Haplothrips*) *gowdeyi* (Franklin) with 38, 37, 13 and 12 percent occurrence respectively. Among the thrips species observed on marigold, *Microcephalothrips abdominalis* is the dominant species.

***Lablab purpureus:*** Thrips population was monitored on *Lablab purpureus* during 42 to 51 Standard meteorological weeks (SMW) of 2024. The peak occurrence of the thrips on chrysanthemum was recorded during 50th SMW with 14.87 thrips per/tap. Thrips species observed on the *L. purpureus* are *Megalurothrips usitatus* (Bagnall), *Thrips parvispinus* (Karny), *Megalurothrips distalis* (Karny), *Thrips florum* Schmutz with 33, 33, 17 and 17 percent occurrence respectively.

**Chilli**: Thrips population was monitored on chilli during 41 to 51 Standard meteorological weeks (SMW) of 2024. The peak occurrence of the thrips on chilli was recorded during 51st SMW with 4.70 thrips per/tap. Thrips species observed on chilli are *Thrips parvispinus* (Karny), *Haplothrips (Haplothrips) gowdeyi* (Franklin), *Neohydatothrips samayunkur* Kudo, *Microcephalothrips abdominalis* (D.L. Crawford), *Thrips florum* Schmutz, *Haplothrips* (*Haplothrips*) *ganglbaueri* Schmutz, *Thrips hawaiiensis* (Morgan) with 55, 13, 11, 9, 8, 2 and 2 percent occurrence respectively. Among the thrips species observed on chilli, *Thrips parvispinus* is the dominant species.

## Efficacy of entomopathogens against thrips on horticultural crops

**Marigold:** Field experiment was conducted to evaluate the different entomopathogenic fungi against the marigold thrips. Among the entomopathogenic fungi evaluated, *Beauveria bassiana* (NBAIR strain) reduced the marigold thrips population up to 58 percent compared to the control.

**Chrysanthemum:** Field experiment was conducted to evaluate the different entomopathogenic fungi against the Chrysanthemum thrips. Among the entomopathogenic fungi tested *Beauveria bassiana* (NBAIR strain) reduced the Chrysanthemum thrips population up to 72 percent compared to the control.

## Toxicity and biochemical effect of essential oils on rice weevil, *Sitophilus oryzae*

Plant-derived parts have biological effect on rice weevil, *Sitophilus oryzae*. Oils extracted from sweet basil *Ocimum basillicum* having linalool and methyl chavicol as major constituents had potential biological effect on *S. oryzae*. On the acute toxicity, sweet basil oil caused an $LC_{50}$ value of 325.2 mg/dm$^3$ whilst its constituent's methyl chavicol (67.4 mg/dm$^3$) and linalool (228.17 mg/dm$^3$) had lower $LC_{50}$ confirming its higher toxicity over the essential oils (EO) as a whole.

On the biochemical effects, there was a reduction in the protein content of *S. oryzae* adults exposed to basil oil and its constituent's methyl chavicol and linalool as compared to the control. The basil oil EO as a whole, methyl chavicol and linalool caused inhibition of acetylcholine esterase and carboxyl esterases (Car E). The inhibition of AChE is an indication that the EO and its constituents could have neurotoxicity. EO and its constituent methyl chavicol and linalool inhibiting Car E offer the possibilities of their use as insecticide resistance mitigation measure as it's a major problem in stored product pest exposed continuously to chemical insecticides.

## Impact of Urea and Nanourea on Biological Control Agents

A detailed investigation into the effectiveness of urea and nanourea on the biological control agents *Trichogramma japonicum* Ashmead and *Trichogramma chilonis* Ishii yielded valuable insights for sustainable agriculture.

Utilizing various experimental approaches, such as Y dual-choice, eight-arm multiple-choice, and no-choice olfactometers, the study demonstrated that nanourea significantly improved parasitism and emergence rates compared to traditional urea (Table 7 & Fig. 54).

**Table 7.** Effect of nano urea on parasitisation of *Trichogramma* sp.

| Treatment | Mean Parasitisation (%) | Standard Deviation |
|---|---|---|
| Urea | 42.86 | 3.41 |
| Nano Urea | 57.11 | 4.12 |
| Control | 35.65 | 1.50 |

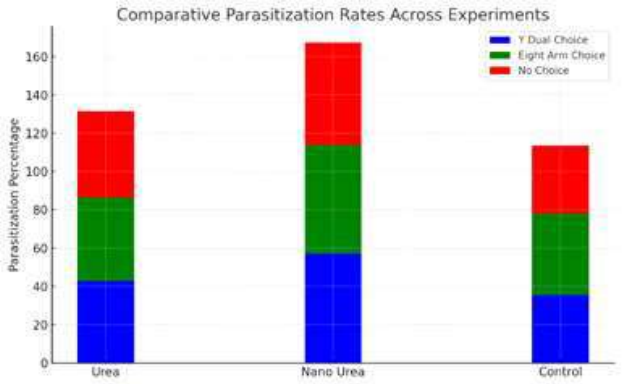



**Figure 54.** Percent parasitisation of treated *Trichogramma* sp. in behavioral assays

## Impact of Chitosan Alginate Nanoparticles on the survival rate of *Chrysoperla zastrowi sillemi*

*Chrysoperla zastrowi sillemi* treated with the chitosan alginate nanoparticles recorded no significant differences in the rate of survival of cocoon and cocoon to adult stages between treated and control groups, indicating the safety of nanoparticles on the developmental stages of *C. z. sillemi* (Table 8 & Fig. 55).

**Table 8.** Effect of chitosan alginate nanoparticles on the survival rate of *C. z. sillemi*

| Stage | Group | Mean Survival Rate (%) | P-Value |
|---|---|---|---|
| Cocoon | Control | 80.92 | NS |
| Cocoon | Treatment | 79.59 | NS |
| Cocoon to Adult | Control | 79.16 | NS |
| Cocoon to Adult | Treatment | 71.27 | NS |

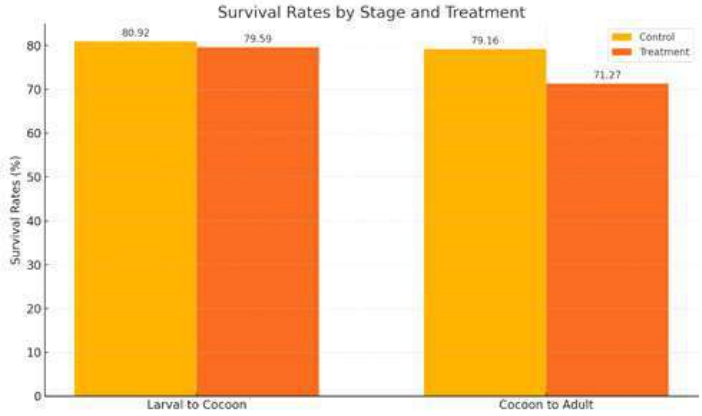



**Figure 55.** Effect of alginate chitosan alginate nanoparticles on the survival rate of *C. z. sillemi*

### Particle Size and Dispersion

Particle size analysis showed an average size of 371.8 nm, suitable for biological applications. Polydispersity index (PI) values indicated moderate size variation, which is acceptable for consistent biological efficacy.

### Controlled release pheromone formulations for management of the Plassey borer, *Chilo tumidicostallis* and Gurdaspur borer, *Acigona steniellus*

By capturing male Plassey borers and Gurdaspur borers, the developed methods disrupted the mating cycle, effectively curtailing population growth. This approach is pivotal in managing the surge in pest populations, which is largely fueled by unregulated oviposition by the females (Fig. 56).

**Figure 56.** Gregarious phase of Plassey borer larvae

### GCMS analysis of Plassey borer male extracts

Male Plassey borer extracts were crucial in pinpointing attractant compounds vital for the development of formulations. These compounds are specifically selected to trap the female population. The primary attractants, that influenced female behaviors.

### Nanogels for the Slow Release of Semiochemicals and Encapsulation of Microbial Cultures

The slow-release formulations of semiochemicals and encapsulated microbial cultures demonstrated the potential to reduce the environmental impact of pest control and improve crop health.

### Standardization of hive-design for easier honey harvest in stingless bees

A modified rectangular hive design with a central wood partition was developed and evaluated for the mode of construction of honey cells, the number and quantity of honey harvests per year. The mean number of honey harvests per hive per year in the rectangular hive (2.12±0.45 harvest/year) and modified rectangular hive (3.20±0.84 harvest/year). The mean interval of rebuilt of honeypots in the rectangular hive and modified rectangular hive were 52.40±8.87 and 78.80±10.44 days.

### Colony performance of invitro reared queen of *Tetragonula* sp.

Invitro queen rearing of stingless bees, *Tetragonula* sp was attempted. The advancing fronts in the stingless bee colonies inoculated with invitro-reared queen and feral queen were constructed in time span of 20.41±1.80 and 17.72±1.86 days, respectively. The first oviposition in the stingless bee colonies inoculated with invitro reared queen and feral queen was noticed at 17.67±1.96 and 12.63±2.80 days, respectively. The mean number of first-generation callows emerged from the stingless colonies inoculated with invitro-reared queen and feral queen were 59.31±10.11callows/colony and 79.50±9.71 callows/colony, respectively. Second-generation callows emerged from the stingless colonies inoculated with invitro-reared queen and feral queen were 72±8.22/colony and 97.17/colony, respectively. Third generation callows emerged from the stingless colonies inoculated with invitro reared queen and feral queen were 128.51±8.14/colony and 149.67±10.17/colony, respectively.

### Experiments on optimization of adult seeding for rearing of *Tenebrio molitor*

Experiments to standardize the optimum seeding of male beetles of *Tenebrio molitor* for pairing per tray for the optimum harvest of larvae were conducted. The mean number of larvae of *T. molitor* harvested per tray seeded with three, two and single male beetles were 154.20 larvae/day, 64.01 larvae/day and 29.40 larvae/day.

### Standardization of mating pairs of mealworms, *Tenebrio molitor* for optimum oviposition

The effect of single mating and continuous mating for the optimum harvest of larvae of *T. molitor* per tray were studied. In single-mated pair release of adult beetles of *T. molitor*, the mean number of eggs laid were 1, 2, 5, 2, 4 and 3 eggs per day per female beetle at 2, 4, 6, 8, 10, 12 and 14 hours after mating. In multiple mated pair release of adult beetles of *T. molitor*, the mean number of eggs laid were 3, 8, 7, 12, 15, 18 and 14 eggs per day per female beetle at 2, 4, 6, 8, 10, 12 and 14 hours after mating.

### Studies on rate of cannibalism in the group rearing of *Tenebrio molitor*

The cannibalistic nature of final instar larvae on the pupae of *T. molitor* during co-existence in the rearing trays was recorded. The percent bitten regions in the pupae of *T. molitor* during cannibalism was the highest in the head (25.2%), abdomen (22%), prothorax (21.6%), antennae (13.6%) and legs (12.2%).

### Field demonstrations on drone-based spraying of biopesticides for insect pest management

Approximately 30 biopesticide spraying demonstrations were conducted across three clusters (5 demonstrations per cluster) in Karnataka and Tamil Nadu, using an oil-based formulation on coconut, brinjal, mango, sugarcane, areca nut, and rice. These demonstrations aimed to raise farmers' awareness and promote drone technology, particularly in crop protection. The demonstrations were attended by around 500 progressive farmers and other key stakeholders.

## All India Coordinated Research Project on Biological Control of Crop Pests

### Cereals

Field trials in rice demonstrated that plots treated with *Metarhizium anisopliae* @ 5g/L recorded the lowest hopper population (13.52 per 25 hills) compared to *Beauveria bassiana* NBAIR Bb5a @ 5g/L (16.58 per 25 hills) and the untreated control (35.12 per 25 hills). The effectiveness of NBAIR-PEOWN (*Pseudomonas entomophila*) and NBAIR-BATP (*Bacillus albus*) was assessed against rice stem borer and rice leaf folder, alongside the recommended insecticide. The lowest numbers of dead hearts and white ears per square meter were observed in NBAIR-BATP and insecticide-treated plots (12.67 and 12.43, respectively).

In rice sheath blight management, plots treated with Pant bioagent PBAT-3 showed a 36.7% incidence rate, significantly lower than the 65.6% incidence in untreated plots. The highest yield (85.00 q/ha) was obtained from chemically treated plots, while PBAT-3-treated plots yielded 77.50 q/ha. The lowest yield (71.25 q/ha) was recorded in untreated control plots.

For fall armyworm control in maize, plots sprayed with three rounds of *Metarhizium rileyi* (Anakapalle strain AKP-Nr-1) recorded 30.33% infestation, while those treated with *Bacillus thuringiensis* RARS TPT–C33 had a 31.66% infestation, compared to 61.23% in untreated control plots. Additionally, maize dead heart incidence was 16.58% in fields where *Trichogramma chilonis* was released, compared to 10.24% in fields managed with standard farmer practices.

### Pulses

Treatment of chickpea fields with *Trichoderma harzianum* @ 5kg/ha led to a 65% reduction in soil-borne diseases, significantly higher than the 37% reduction observed in plots treated with Carbendazim 12% + Mancozeb 63% WP.

## Commercial Crops

In cotton, BIPM-treated plots recorded fewer rosette flowers (5.28%) and infested bolls (15.27%) compared to control plots (8.19% and 21.45%, respectively). Open boll damage was lower in BIPM-treated fields (2.40%) and chemical control (1.30%) compared to the untreated control (4.90%). Maximum yield was observed in insecticide-sprayed plots (1,727 kg/ha), followed by BIPM plots (1,654 kg/ha) and control plots (1,367 kg/ha).

The population reductions in cotton leafhoppers, thrips, and aphids were 59.84%, 55.92%, and 64.94%, respectively, in plots treated with *Lecanicillium lecanii* NBAIR-VL-8 @ 5g/L.

For sugarcane, early shoot borer incidence was significantly lower (4.98% DH) in Chlorantraniliprole-treated plots, comparable to those treated with *Metarhizium anisopliae* NBAIR Ma35 (6.52% DH), whereas control plots recorded 21.6% DH. Similarly, internode borer incidence was lowest in Chlorantraniliprole-treated plots (28.3%), with a higher cane yield of 67.7 t/ha, which was on par with *Metarhizium anisopliae* NBAIR Ma35 (32.32% incidence, 62.27 t/ha yield). Releasing 10–12 batches of *Trichogramma chilonis* @ 50,000 per ha every 10 days from July to October effectively managed stalk borers.

## Oilseeds

In groundnut, fields sprayed with Emamectin benzoate 5 SG @ 0.2g/L recorded the lowest leaf miner larval population (1.53 per 20 leaflets), followed by *Bacillus thuringiensis* RARS TPT-C33 (1.81 per 20 leaflets) and *Metarhizium rileyi* KK-Nr-1 (2.07 per 20 leaflets). The control plot had 4.84 larvae per 20 leaflets.

For *Spodoptera litura*, infestation was lowest (7.0%) in plots treated with *Metarhizium rileyi* (AKP Nr1) @ 5g/L, yielding 23.64 q/ha, followed by *Bacillus thuringiensis* RARS TPT-C33 @ 2g/L (9.0% incidence, 23.58 q/ha yield), comparable to Emamectin benzoate 5 SG @ 0.4 g/L.

In mustard, aphid populations were significantly lower in treated plots compared to control plots. Aphid reduction over control was 72.80% with *Beauveria bassiana* + Azadirachtin, 74.93% with Imidacloprid, and 70.84% with *Lecanicillium lecanii*.

## Fruits

In litchi, fruit damage from the litchi fruit borer was lowest in BIPM-treated plants (5.91%), comparable to chemical control (6.21%), while untreated control plots recorded 20.80% damage. The marketable yield was 159.48 q/ha in BIPM plots, 162.35 q/ha in chemical control plots, and 125.88 q/ha in untreated control plots.

For apple, root borer infestation was significantly lower in plots treated with *Metarhizium anisopliae* compared to control plots. The infestation reduction was 77.56% with *M. anisopliae* and 78.59% with Chlorpyriphos.

In banana, Chlorpyriphos-treated plants had the lowest weevil infestation (28.57%), followed by *Beauveria bassiana* NBAIR Bb5a (39.29%), both significantly better than the untreated control (51.79%).

For citrus, *Lecanicillium lecanii* @ 5g/L was most effective in reducing citrus thrips infestation (6.03%), followed by *Beauveria bassiana* (6.82%) and *Metarhizium anisopliae* (7.46%), while control plots recorded 11.59% infestation. *B. bassiana* @ 5g/L was also effective against citrus rust mites and green mites.

## Vegetables

In tomato, BIPM plots showed an 80.24% reduction in fruit damage and a 63.89% increase in yield compared to control. Yield was 25,632 kg/ha in BIPM plots, 25,985 kg/ha in Cypermethrin-treated plots, and 9,255 kg/ha in control plots.

In cabbage, the lowest aphid populations (*Myzus persicae* and *Brevicoryne brassicae*) were recorded in BIPM plots (2.65/leaf, 62.36% reduction), followed by PoP (4.97/leaf, 26.40% reduction) and control plots (7.04/leaf).

For bitter gourd, *Lecanicillium lecanii* NBAIR VL8 5g/L + Neem oil (2.5 ml/L) significantly reduced *Epilachna* beetle populations. Fruit damage reduction over control was 58.85% in BIPM and 51.63% in PoP recommendations, with yields of 44.41 q/ha and 42.35 q/ha, respectively.

In chilli, Fipronil @ 2.0 ml/L reduced thrips incidence by 68.77% and leaf damage by 51.11%, compared to *M. anisopliae* IIHR Strain (19.62% and 16.63%), *Beauveria bassiana* NBAIR Bb5a (25.19% and 10.35%), and untreated plots (100%).

## 4. GENBANK/BOLD ACCESSIONS

| Sl. No. | ORGANISM | ACCESSION NUMBER |
|---|---|---|
| | **BLATTODEA** | |
| 1. | *Odontotermes horni* | PQ146896 |
| | **BLATTODEA (28S)** | |
| 2. | *Odontotermes formosanus* | SUB15013433, SUB15013440, SUB15013448, SUB15013454 |
| | **COLEOPTERA** | |
| 3. | *Barioscapus cordiae* | PP973532 |
| 4. | *Cionus meleagris* | PQ149982 |
| 5. | *Paramecops farinosus* | PQ469579 |
| 6. | *Patialus tecomella* | PQ061094 |
| 7. | *Stereonychus phylireae* | SUB14598936 |
| | **DIPTERA** | |
| 8. | *Bactrocera (Parazeugodacus) abbreviata* | PQ047666 |
| 9. | *Bactrocera (Bactrocera) aethriobasis* | PQ047663 |
| 10. | *Bactrocera (Bactrocera) andamanensis* | PQ052893 |
| 11. | *Bactrocera (Parazeugodacus) bipustulata* | PQ047573 |
| 12. | *Bactrocera (Bactrocera) carambolae* | PQ047827 |
| 13. | *Bactrocera (Bactrocera) caryeae* | PQ056821 |
| 14. | *Bactrocera (Bactrocera) correcta* | PQ047593 |
| 15. | *Bactrocera (Bactrocera) digressa* | PQ047676 |
| 16. | *Bactrocera (Bactrocera) divenderi* | PQ047779 |
| 17. | *Bactrocera (Bactrocera) dorsalis* | PQ049598 |
| 18. | *Bactrocera (Bactrocera) ettinabhuja* | PQ052892 |
| 19. | *Bactrocera (Bactrocera) frauenfeldi* | PQ047821 |

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| 20. | *Bactrocera* (*Bactrocera*) *gombokensis* | PQ047781 |
| 21. | *Bactrocera* (*Bactrocera*) *kyrdemkulai* | PQ052891 |
| 22. | *Bactrocera* (*Bactrocera*) *latifrons* | PQ049599 |
| 23. | *Bactrocera* (*Bactrocera*) *limbifera* | PQ047835 |
| 24. | *Bactrocera* (*Bactrocera*) *lombokensis* | PQ047816 |
| 25. | *Bactrocera* (*Bactrocera*) *nigrofemoralis* | PQ047571 |
| 26. | *Bactrocera* (*Bactrocera*) *ochroma* | PQ047831 |
| 27. | *Bactrocera* (*Bactrocera*) *paraverbascifoliae* | PQ047580 |
| 28. | *Bactrocera* (*Bactrocera*) *syzygii* | PQ045441 |
| 29. | *Bactrocera* (*Bactrocera*) *thailandica* | PQ047630 |
| 30. | *Bactrocera* (*Bactrocera*) *tuberculata* | PQ047592 |
| 31. | *Bactrocera* (*Bactrocera*) *wuzhishana* | PQ047777 |
| 32. | *Bactrocera* (*Bactrocera*) *zonata* | PQ059646 |
| 33. | *Dacus* (*Didacus*) *ciliatus* | PQ047820 |
| 34. | *Dacus* (*Mellesis*) *crabroniformis* | PQ047636 |
| 35. | *Dacus* (*Callantra*) *longicornis* | PQ047818 |
| 36. | *Dacus* (*Mellesis*) *ramanii* | PQ047634 |
| 37. | *Exorista sorbillans* | PQ810091 |
| 38. | *Goniurellia* sp. | PQ760457 |
| 39. | *Ptilona confinis* | PP480610 |
| 40. | *Ptilona* sp. | PP480608, PP480609 |
| 41. | *Rhochmopterum* sp. | PQ760454, PQ760455, PQ760456, PQ740036, PQ740037, PQ740038, PP963498, PP963499 |
| 42. | *Rioxoptilona dunlopi* | PP480611 |

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| 43. | *Themara yunnana* | PP480612 |
| 44. | *Zeugodacus* (*Zeugodacus*) *cucurbitae* | PQ047631 |
| 45. | *Zeugodacus* (*Zeugodacus*) *havelockiae* | PQ047838 |
| 46. | *Zeugodacus* (*Zeugodacus*) *nasivittatus* | PQ059644 |
| 47. | *Zeugodacus* (*Zeugodacus*) *scutellaris* | PQ047969 |
| 48. | *Zeugodacus* (*Zeugodacus*) *semongokensis* | PQ047837 |
| 49. | *Zeugodacus* (*Zeugodacus*) *tau* | PQ047578 |
| **HEMIPTERA (COI)** | | |
| 50. | *Acyrthosiphon pisum* | PQ008596 |
| 51. | *Aleurotrachelus anonae* | PQ397348, PQ439204, PQ425730 |
| 52. | *Aleyrodes shizuokensis* | PQ867180, PQ867182 |
| 53. | *Aspidiotus destructor* | PP855275, PP855278, PP855283, PP855275, PP855283, PP855278 |
| 54. | *Bemisia tabaci* | PQ470035, PQ470139, PQ517554, PQ522347, PQ524985 |
| 55. | *Ceroplastes ceriferus* | PP855272, PP855272 |
| 56. | *Ceroplastes cirripediformis* | PP855276, PP855279, PP855276, PP855279 |
| 57. | *Ceroplastes rusci* | PP855282, PP855282 |
| 58. | *Coccus formicarii* | PP835735, PP835735 |
| 59. | *Coccus hesperidum* | PP855269, PP855271, PP855269 |
| 60. | *Coccus viridis* | PP855268, PP855270, PP855277, PP855268, PP855270, PP855271, PP855277 |
| 61. | *Dysmicoccus brevipes* | OQ924104, OQ942254, OQ992639, OQ955830 |
| 62. | *Dysmicoccus neobrevipes* | OQ942202, PP442572, PQ541519 |
| 63. | *Eucalymnatus tessellatus* | PP855262, PP855263, PP855266, PP855267, PP855273, PP855266, PP855267, PP855273, PP855263, PP855262 |
| 64. | *Ferrisia virgata* | OR068144, OR068143, PQ839667, PQ368691, PQ583147, PQ583146, PQ583145, PQ839667, OQ971879 |
| 65. | *Fistulococcus pokfulamensis* | OR515185, OR515185 |
| 66. | *Hypogeococcus pungens* | PQ203598, PQ203599, PQ203600, PQ203601, SUB14592247 |

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| 67. | *Maconellicoccus hirsutus* | PQ839668, PQ839668, PP442576, PP442574, PP442575 |
| 68. | *Milviscutulus mangiferae* | PP855264, PP855265, PP835737, PP855264, PP835737, PP855265 |
| 69. | *Nipaecoccus viridis* | PP297270 |
| 70. | *Parasaissetia nigra* | PP855280, PP855281, PP835734, PP835734, PP855280, PP855281 |
| 71. | *Phenacoccus manihoti* | PQ505164 to PQ505183 |
| 72. | *Phenacoccus parvus* | OQ992637 |
| 73. | *Phenacoccus solenopsis* | PP442573, PP442571, PP442568, PP442569, PP442570, PP379086, PP379088, PP379087, PP379091, PP379090, PP379089, PP379085, PP297250, PP297268, PQ541517, PQ541518, PQ541521, PQ583155, PQ583154, PQ583153, PQ583152, PQ583151, PQ583150, PQ583149, PQ583148, PQ839669, PQ839670, PQ839671, PQ839672, PQ839669, PQ839670, PQ839671, PQ839671, OR105913, OQ992638, OQ981242, OQ992640, OQ981243, OR085908, OR659465, OR659467, OR978585, OR978586, PP066834 |
| 74. | *Planococcus lilacinus* | PP442578, PP442577, OQ909528, PQ541520 |
| 75. | *Planococcus minor* | PP297269 |
| 76. | *Pulvinaria polygonata* | PP855261, PP855261 |
| 77. | *Rastrococcus iceryoides* | PP272412 |
| 78. | *Sycanus bifidus* | MW450669 |
| 79. | *Sycanus versicolor* | PQ213211 |
| 80. | *Trijuba oculata* | PP835736, PP855274, PP835736, PP855274 |
| **HEMIPTERA (28S)** | | |
| 81 | *Hypogeococcus pungens* | PQ206262, PQ206263, PQ206264, PQ206265 |
| **HYMENOPTERA (COI)** | | |
| 82. | *Aleiodes* sp. | PP480528, PP477762 |
| 83. | *Alysiasta* sp. | PP358575 |
| 84. | *Apanteles* sp. | OQ657330 |
| 85. | Braconidae | PQ630886 |
| 86. | Braconinae | PQ630873, PQ630874, PQ630875, PQ630878, PQ630880 |
| 87. | *Bracon garugaphagae* | PQ630872, PP480525, PP477759 |

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| 88. | *Bracon* sp. | PQ630876, PQ630882, PP358584, PQ630877, PQ776266, PQ776267, PQ776268, PQ776269, PQ776270, PQ776271, PP480522, PP480524, PP480523, PP480526, PP480527, PP477756, PP477757, PP477758, PP477760, PP477761 |
| 89. | *Canalirogas* sp. | PQ630885 |
| 90. | *Cheiropachus* sp. | PP358589 |
| 91. | Cheloninae | PQ630884 |
| 92. | *Cotesia ruficrus* | OQ657334 |
| 93. | *Crinibracon* sp. | PP358581, PP358592 |
| 94. | *Diachasmimorpha longicaudata* | OQ657336 |
| 95. | *Dolichogenidea* sp. | PP358579 |
| 96. | Doryctinae | PQ630871, PP358588, PP358590 |
| 97. | *Encarsia cubensis* | PQ397536, PQ456729, PQ456728, PQ456730 |
| 98. | *Encarsia* sp. | PQ439204 |
| 99. | *Ficobracon* sp. | PQ776272 |
| 100. | *Glyptapanteles* sp. | PP358576, PP358577, OQ657331 |
| 101. | Hymenoptera | PP358583 |
| 102. | *Ipodoryctes signipennis* | PP910125 |
| 103. | *Leluthia pongamiacola* | PQ630866 |
| 104. | *Leluthia* sp. | PP910126 |
| 105. | *Macrocentrus* sp. | OQ657333 |
| 106. | *Meteorus* sp. | PP358586, PP358591, OQ657329 |
| 107. | Opiinae | PP358585 |
| 108. | *Orgilonia* sp. | PQ630881 |
| 109. | *Pambolus* sp. | PP358582 |
| 110. | *Perilitus* sp. | PP358580 |
| 111. | *Phanerotoma* sp. | PQ630870, PP358593, PP480529, PP477763 |
| 112. | *Polystenus* sp. | PQ630867 |
| 113. | *Psyttalia fletcheri* | OQ657332, OQ657335 |
| 114. | *Pycnobracon* sp. | PP358578 |

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| 115. | *Spathius* sp. | PQ630864, PQ630865, PQ630868, PQ630869 |
| 116. | *Stantonia* sp. | PQ630879, PQ630883 |
| 117. | *Streblocera* sp. | PP358587 |
| **HYMENOPTERA (28S)** | | |
| 118. | Agathidinae | PQ819448 |
| 119. | *Aridelus* sp. | PQ819452 |
| 120. | Braconinae | PQ819454 |
| 121. | *Bracon* sp. | PQ819444, PQ819445, PQ819446, PQ819447, PQ819449, PQ819450, PQ819451, PQ819456 |
| 122. | Doryctinae | PQ819443 |
| 123. | *Ipodoryctes signipennis* | PQ819458, PQ819439 |
| 124. | *Leluthia pongamiacola* | PQ819459, PQ819440 |
| 125. | *Orgilonia* sp. | PQ819455 |
| 126. | *Polystenus* sp. | PQ819441, PQ819460 |
| 127. | *Spathius* sp. | PQ819442, PQ819461 |
| 128. | *Stantonia* sp. | PQ819453, PQ819457 |
| **LEPIDOPTERA (COI)** | | |
| 129. | Crambidae | PP236457 |
| 130. | *Eteoryctis syngramma* | PP226926 |
| 131. | *Helicoverpa armigera* | SUB14592235 |
| 132. | *Herpetogramma basalis* | PQ676279, PQ676280 |
| 133. | *Leucoptera malifoliella* | PP065673, PP065489, PP065488, PP065487, PP065486, OR528194 |
| 134. | *Mythimna impura* | PP994494 |
| 135. | *Orthaga euadrusalis* | PQ810093 |
| 136. | *Phthorimaea operculella* | PQ651453, PQ651454 |
| 137. | *Phyllonorycter populifoliella* | SUB15013368 |
| 138. | *Thalassodes immissaria* | PQ810088 |
| 139. | Tortricidae | PP236459, PP234977, PP236458 |

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| **LEPIDOPTERA (28S)** | | |
| 140. | *Leucoptera malifoliella* | PP065011, PP065484, PP065012, PP065010, PP064996, PP065485 |
| **LEPIDOPTERA (Elongation Factor)** | | |
| 141. | *Leucoptera malifoliella* | PP554233, PP554234, PP554232, PP554231, PP554230, PP554235 |
| **THYSANOPTERA** | | |
| 142. | *Caliothrips quadrifasciatus* | PQ203367 |
| 143. | *Frankliniella occidentalis* | OR018813, OR018992 |
| 144. | *Frankliniella schultzei* | PP580842 |
| 145. | *Megalurothrips typicus* | PQ312640 |
| 146. | *Neohydatothrips flavicingulus* | OQ908917 |
| 147. | *Neohydatothrips samayunkur* | PQ857711 |
| 148. | *Pseudodendrothrips darci* | OQ908918 |
| 149. | *Scirtothrips dorsalis* | PQ857714 |
| 150. | *Selenothrips rubrocinctus* | PQ857710 |
| 151. | *Thrips apicatus* | PQ219394 |
| 152. | *Thrips coloratus* | OQ877197 |
| 153 | *Thrips florum* | PQ857762 |
| 154. | *Thrips palmi* | PQ857731 |
| 155. | *Thrips parvispinus* | PQ219395, PQ857718 |
| **ARANEAE** | | |
| 156. | *Argiope aemula* | PQ346349 |
| 157. | *Hippasa lycosina* | PQ346348 |
| 158. | *Leucauge celebesiana* | PQ346350 |
| 159. | *Neoscona odites* | PQ346346 |
| 160. | *Oxyopes hindostanicus* | PQ346345 |
| 161. | *Oxyopes javanus* | PQ346351 |
| 162. | *Psechrus himalayanus* | PQ346347 |

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| **NEMATODES** | | |
| 163. | *Steinernema keralense* COI | PQ248558 |
| 164. | *Steinernema keralense* D2D3 | PQ249115 |
| 165. | *Xenorhabdus* sp. 16s | PQ584826 |
| 166. | *Xenorhabdus* sp. *gyrB* | PQ594192 |
| 167. | *Xenorhabdus* sp. *recA* | PQ594193 |
| **BACTERIA** | | |
| 168. | *Bacillus thuringiensis* NBAIR_Bt1–*Bacillus thuringiensis* NBAIR_Bt100 | PP474538, PP474657, PP474697, PP474698, PP494400, PP494402, PP494403, PP494404, PP494405, PP494407, PP494406, PP494408, PP494409, PP494411, PP494410, PP506167, PP506165, PP506166, PP506168, PP506231, PP506233, PP506235, PP506234, PP506261, PP690643, PP506262, PP506263, PP506265, PP506264, PP506469, PP506470, PP506472, PP528410, PP528411, PP528412, PP528413, PP528414, PP528416, PP528415, PP528417, PP528418, PP528419, PP528420, PP528421, PP528422, PP528423, PP528426, PP528424, PP528427, PP565367, PP565403, PP565405, PP565653, PP565654, PP565686, PP565685, PP565687, PP565688, PP565689, PP565695, PP565696, PP565698, PP572840, PP572839, PP572836, PP572841, PP572842, PP572843, PP572845, PP572844, PP627241, PP627244, PP627246, PP627247, PP627248, PP627256, PP627259, PP627261, PP627270, PP627262, PP627268, PP627271, PP627272, PP627274, PP627273, PP627275, PP627277, PP627276, PP627285, PP627286, PP627397, PP627398, PP683433, PP683434, PP683442, PP683441, PP683443, PP683460, PP683463, PP683465 |
| **FUNGUS** | | |
| 169. | *Lecanicillium fusisporum* ICAR–NBAIR–VL8 ITS | PP549998.1 |
| 170. | *Metarhizium anisopliae* ICAR–SBI–Ma 08 | JBKFYN000000000 |
| **VIRUS** | | |
| 171. | HearNPV NBAIR1–HearNPV NBAIR8 | PQ790021–PQ790028 |

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|---|---|---|
| **INSECT ASSOCIATED MICROFLORA** | | |
| 172. | Bacterial microflora isolated from gut of white grubs | PQ481636–PQ481646 |
| 173. | Rhinoceros beetle gut microflora | PP792861–PP792871, PP752648–PP752652 |
| **CYP FAMILY GENES** | | |
| 174. | *CYP* Family | PQ243143 –PQ243182 |
| **CUTICULAR PROTEIN GENES** | | |
| 175. | *RR2* Family | PQ243185 –PQ243233 |
| 176. | *CPF* Family | PQ243246 –PQ243247 |
| 177. | *CPAP1* Family | PQ243244 |
| 178. | *CPAP3* Family | PQ243239 –PQ243242 |
| 179. | *CPCFC and CPF* Family | PQ243235 –PQ243238 |
| 180. | CP Family | PQ243143 –PQ243182 |
| **WHOLE GENOME SEQUENCING** | | |
| 181. | *Maruca vitrata* | Bioproject ID: PRJNA1141734<br>Acc No. GCA_041475385.1<br>WGS No. JBFTXK000000000<br>Biosample ID: SAMN42900881 |

## 5. IDENTIFICATION SERVICES

One hundred and eighty two identification services were provided to 43 universities, 84 institutions and 11 private firms from 23 states in India. International services provided include two for Tribhuvan University, Nepal and one for the Department of Agriculture, Philippines. 449 taxa were identified belonging to 60 families in five insect orders apart from Phylum Nematoda(entomopathogenic nematodes) and Order Arenae (Spiders).

**Dr Sunil Joshi**

| Sl. No. | Taxon/taxa identified | Group/Family | Service provided to |
|---|---|---|---|
| 1. | *Aphis nerii, Aphis (Toxoptera) odinae, Aphis craccivora* | Aphididae | ICAR- National Bureau of Agricultural Insect Resources, Bengaluru |
| | *Antecerococcus indicus* | Cerococcidae | |
| | *Eucalymnatus tuscellatus*(6), *Coccus hesperidum, Fistulococcus pokfulamensis*(2), *Ceroplastes ?ceriferus, Milviscultulus mangiferae*(2), *Pulvinaria polygonata* | Coccidae | |
| | *Pseudaulacaspis pentagona, Pseudaonidia trilobitiformis* (2), *Aonidiella orientalis, Aonidomytilus albus* | Diaspididae | |
| | *Icerya ? purchasi*(2), *Drosicha* sp., *Icerya Seychellarum, Icerya* sp., *Perissopneumon* sp.(2) | Monophlebidae | |
| | *Nipaecoccus viridis*(4), *Planococcus lilacinus*(2), *Dysmicoccus neobrevipes*(3), *Ferrisia virgata*(19), *Phenacoccus manihoti*(17), *Dysmicoccus brevipes*(2), *Phenacoccus solenopsis*(13), *Planococcus* sp.(3), *Pseudococcus jackbeardsleyi*(3), *Pseudococcus ?cryptus, Rastrococcus iceryoides*(5), *Maconellicoccus hirsutus*(4), *Pseudococcus cryptus, Coccidohystrix insolita*(4), *Planococcus ?minor, Dactylopius ceylonicus, Paracoccus marginatus*(4), *Pseudococcus* sp., *Kiritshenkella sacchari, Pseudococcus longispinus, Rastrococcus invadens, Planococcus citri, Phenacoccus solani* | Pseudococcidae | |
| 2. | *Maculolachnus rubi, Aphis gossypii*(2), *Eutrichosiphum alnifoliae, Eutrichosiphum ?pyri* | Aphididae | Forest Research Institute, Dehradun, Uttarakhand |
| 3. | *Aphis gossypii, Aphis* sp.(2), *Pentalonia caladii, Aphis spiraecola*(3), *Sitobion avenae, Aphis aurantii, Aphis craccivora*(2), *Myzus persicae*(3), *Aphis fabae, Hyalopterus pruni, Uroleucon ?sonchi, Tetraneura nigriabdominalis, Rhopalosiphum maidis, Brachycaudus helichrysi*(2), *Aphis punicae, Hysteroneura setariae, Hyadaphis coriandri* | Aphididae | Himachal Pradesh University Summer Hill, Shimla |

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|---|---|---|---|
| 4. | *Ferrisia virgata, Maconellicoccus hirsutus* | Pseudococcidae | College of Agriculture, Vijayapura, University of Agricultural Sciences, Dharwad |
| 5. | *Pulvinaria aligarensis*<br>*Ferrisia virgata* | Coccidae<br>Pseudococcidae | Department of Agricultural Entomology, Vellayani, Thiruvananthapuram, Kerala |
| 6. | *Aphis craccivora, Rhopalosiphum nymphaeae* | Aphididae | College of Agriculture, Vellanikkara, Thrissur, Kerala |
| | *Megapulvinaria maxima*(2), *Coccus hesperidum, Marsipococcus marsupialis* | Coccidae | |
| | *Pseudaulacaspis pentagona, Aulacapsis alisiana*(3), *Chrysomphalus aonidum*(2), *Rutherfordia maloti, Pseudaulacaspis* sp. | Diaspididae | |
| | *Planococcus citri*(2), *Dysmicoccus brevipes, Planococcus lilacinus, Ferrisia virgata* | Pseudococcidae | |
| 7. | *Aphis craccivora*(4), *Astegopteryx* sp., *Hyadaphis coriandri*(3), *Myzus persicae*(4), *Aphis gossypii*(5), *Aphis spiraecola, Lipaphis pseudobrassicae, Schoutedenia emblica, Melanaphis sacchari* | Aphididae | C.P. College of Agriculture, S.D.A.U, Sardarkrushinagar, Gujarat |
| | *Icerya ?purchasi*(6), *Labioproctus poleii* | Monophlebidae | |
| | *Phenacoccus solenopsis*(10), *Rastrococcus iceryoides*(4), *Ferrisia virgata*(5), *Paracoccus marginatus*(7), *Planococcus lilacinus*(2), *Maconellicoccus hirsutus*(2), *Formicococcus ?robustus* | Pseudococcidae | |
| 8. | *Saissetia coffeae* | Coccidae | ICAR- NEH, Mizoram |
| 9. | *Aphis craccivora, Aphis gossypii* | Aphididae | ICAR- Central Arid Zone Research Institute, Jodhpur, Rajasthan |
| 10. | *Aspidiotus destructor* | Diaspididae | Cardamom Research Station, Pampadumpara, Idukki, Kerala |
| | *Ferrisia virgata, Phenacoccus solenopsis* | Pseudococcidae | |
| 11. | *Hemiberlesia lataniae* (Imported from Australia) | Diaspididae | Directorate of Plant Protection Quarantine & Storage, Plant Quarantine Station, Shamshabad, Hyderabad, Telangana State |
| 12. | *Aphis gossypii* | Aphididae | Morbi, Gujarat |
| 13. | *Hemiberlesia lataniae* (Imported from Greece) | Diaspididae | Directorate of Plant Protection Quarantine & Storage, Regional Plant Quarantine Station, Haji Bunder Road, Sewri (E), Mumbai |
| | *Ferrisia dasylirii* (Imported from Thailand) | Pseudococcidae | |
| 14. | *Myzus persicae*(2) | Aphididae | Shivaji University, Kolhapur |
| 15. | *Aonidiella orientalis* | Diaspididae | College of Horticulture, Venkataramannaguden, Andhra Pradesh |
| 16. | *Dysmicoccus neobrevipes* | Pseudococcidae | Dr. Rajendra Prasad Central Agricultural University, PUSA, Samastipur, Bihar |
| 17. | *Lipaphis pseudobrassicae* | Aphididae | AES Mandor, Agricultural University, Jodhpur |

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| 18. | *Coccus longulus, Trijuba oculata* | Coccidae | ICAR- Central Plantation Crops Research Institute, Regional Station, Kayamkulam, Krishnapuram, Kerala |
| 19. | *Aulacaspis madiunensis*(2) | Diaspididae | Rajeev Gandhi HSS, Panoor, Kannur, Kerala |
| 20. | *Brevicoryne brassicae*(2) | Aphididae | ICAR- Indian Agricultural Research Institute, New Delhi |
| 21. | *Pseudococcus longispinus* | Pseudococcidae | Mahatma Phule Krishi Vidyapeeth, Rahuri |
| 22. | *Rhopalosiphum Padi*(7) | Aphididae | R & D BASF Crop Solutions, Bengaluru |
| 23. | *Coccus* sp., *Parasaissetia nigra, Coccus longulus, Ceroplastes* sp. | Coccidae | ICAR- Indian Institute of Horticultural Research, Chettalli, Kodagu |
| | *Hemiberlesia cyanophylli, Hemiberlesia* sp. | Diaspididae | |
| | *Icerya aegyptiaca*(2), *Icerya seychellarum, Icerya* sp. | Monophlebidae | |
| | *Pseudococcus jackbeardsleyi, Paracoccus marginatus* | Pseudococcidae | |
| 24. | *Rhopalosiphum padi* | Aphididae | Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana |
| 25. | *Aphis gossypii, Aphis craccivora, Aphis aurantii* | Aphididae | ICAR-CPCRI, Regional Station, Vittal, Dakshina Kannada, Karnataka |
| | *Ferrisia virgata*(2), *Planococcus lilacinus*(2), *Criscicoccus hirsutus* | Pseudococcidae | |
| 26. | *Protopulvinaria longivalvata* | Coccidae | ICAR- Indian Institute of Horticultural Research, Bengaluru |
| | *Paracoccus marginatus* | Pseudococcidae | |
| 27. | *Bervicoryne brassicae* | Aphididae | DAV University, Jalandhar, Punjab |
| 28. | *Pseudaulacaspis cockerelli*(2) | Diaspididae | Agriculture Research Station, Thiruvalla, Pathanamthitta, Kerala |
| 29. | *Aphis craccivora, Aphis gossypii*(2), *Rhopalosiphum maidis* | Aphididae | Dr. Abraham Verghese |
| | *Ferrisia virgata, Paracoccus marginatus* | Pseudococcidae | |
| 30. | *Rhopalosiphum nymphaeae* | Aphididae | Regional Agricultural Research Station, Kumarakom |
| 31. | *Ceroplastes cirripediformis* | Coccidae | Anand Agricultural University, Khambholaj, Gujarat |
| 32. | *Aphis nerii*(2), *Myzuspersicae*(2), *Aphis* sp., *Myzus* sp.(2), *Formosaphis micheliae* | Aphididae | CSIR-Institute of Himalayan Bioresource Technology, Palampur, Himachal Pradesh |
| 33. | *Aphis gossypii* | Aphididae | Punjab Agricultural University, Ludhiana, Punjab |
| | *Saissetia oleae* | Coccidae | |
| | *Icerya* sp.(3) | Monophlebiade | |
| | *Phenacoccus solenopsis*(2) | Pseudococcidae | |
| 34. | *Maconellicoccus hirsutus* | Pseudococcidae | Sugar Research Institute, Dr.Rajendra Prasad Central Agricultural university, Pusa, Samastipur, Bihar |

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| 35. | *Uroleucon compositae* | Aphididae | College of Agriculture, UAS Campus, Raichur |
| 36. | *Phenacoccus solenopsis*(12), *Pseudococcus jackbeardsleyi*(5), *Paracoccus marginatus, Nipaecoccus viridis* | Pseudococcidae | ICAR- National Research Centre on Pomegranate, Solapur, Maharashtra |
| 37. | *Aphis gossypii, Greenidea psidii* | Aphididae | College of Sericulture, Chintamani, Chikkaballapura Dist. |
| | *Ceroplastes cirripediformis, Parasaissetia nigra, Pulvinaria psidii* | Coccidae | |
| | *Perissopneumon ferox*(2), *Labioproctus polei*(2), *Icerya purchasi* | Monophlebidae | |
| | *Phenacoccus solenopsis, Planococcus* sp.(2), *Ferrisia virgata* | Pseudococcidae | |
| 38. | *Pseudoregma bambucicola* | Aphididae | Assam Agricultural University, Jorhat |
| | *Planococcus citri, Paracoccus marginatus*(3), *Phenacoccus solenopsis* | Pseudococcidae | |
| 39. | *Brachycaudus helichrysi* | Aphididae | Krishi Vigyan Kendra Leh, Union Teritory of Ladakh |
| 40. | *Drosicha ?dalbergiae* | Monophlebidae | G.B.Pant University of Agriculture & Technology, Pantnagar, Uttarakhand |
| | *Phenacoccus saccharifolii*(2), *Kiritshenkella sacchari*(3), *Maconellicoccus hirsutus, Planococcus sp., Phenacoccus solenopsis* | Pseudococcidae | |
| 41. | *Ceroplastes ceriferus* | Coccidae | ICAR- Directorate of Cashew Research, Directorate of Cashew Research, Puttur, Dakshina Kannada |
| | *Pseudaulacaspis cockerelii, Lepidosaphes laterochitinosa* | Diaspididae | |
| 42. | *Hyalococcus striatus* | Asterolecaniidae | Citrus Research Station, Tirupati, Andhra Pradesh |
| 43. | *Aphis gossypii*(6), *Myzus persicae*(3), *Macrosiphum rosae, Aphis craccivora* | Aphididae | University of Agricultural Sciences, Bengaluru |
| 44. | *Planococcus lilacinus, Dysmicoccus brevipes, Maconellicoccus hirsutus*(2), *Paracoccus marginatus*(4) | Pseudococcidae | CROPNOSYS INDIA PVT. LTD., Doddaballapura, Bengaluru Rural |
| 45. | *Aphis gossypii*(2) | Aphididae | Corteva Agriscience India Pvt. Ltd., Telangana |
| 46. | *Pseudaulacaspis cockerelli* | Diaspididae | Agricultural College, Aswaraopet, Telangana |
| 47. | *Ferrisia* sp. | Pseudococcidae | ICAR- Directorate of Floricultural Research, Regional Station, Vemagiri, Andhra Pradesh |
| 48. | *Dysmicoccus carens, Phenacoccus saccharifolii* | Pseudococcidae | Tamil Nadu Agricultural University, Coimbatore |
| 49. | *Aphis solanella*(2) | Aphididae | Dr. Y.S. Parmar University of Horticulture & Forestry, Nauni (Solan), Himachal Pradesh |
| 50. | *Phenacoccus solenopsis*(3), *Paracoccus marginatus* | Pseudococcidae | Bihar Agricultural University, Bihar |
| 51. | *Ferrisia virgata*(4), *Planococcus* sp., *Phenacoccus solenopsis* | Pseudococcidae | ICAR- Directorate of Floricultural Research, Pune, Maharashtra |
| 52. | *Parasissetia nigra* | Coccidae | |

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| 53. | *Aphis gossypii*(2), *Patchiella* sp.(2), *Macrosiphoniella sanborni, Myzus persicae*(2), *Aphis craccivora* | Aphididae | College of Horticulture & Forestry, Pasighat, Arunachal Pradesh |
| | *Ceroplastes* sp., *Drepanococcus cajani, Pseudopulvinaria sikkimensis* | Coccidae | |
| | *Chionaspis* sp., *Pinnaspis* sp. | Diaspididae | |
| 54. | *Planococcus lilacinus* | Pseudococcidae | RVSKVV-College of Agriculture, Indore, Madhya Pradesh |

**Dr K. Sreedevi**

| Sl. No. | Taxon/taxa identified | Group/Family | Service provided to |
|---|---|---|---|
| 1. | *Orthotomicus erosus* (12) | Curculioindae | RPQS, Kandla, Guajarat |
| 2. | *Holotrichia* nr. *farinosa, Holotrichia nagpurensis*<br>*Holotrichia akolana*?, *Holotrichia serrata, Holotrichia consanguinea, Idionycha excisa, Schizonycha* sp., *Schizonycha ruficollis*<br>*Anomala polita, Anomala bengalensis, Anomala* sp., *Adoretus* sp., *Adoretus nitidus, Anomala dorsalis, Anomala dimidiata*<br>*Maladera insanabilis*<br>*Pentadon* sp./ *Alissonotum* sp., Dynastin beetle | Scarabaeidae | Shri. Jagpal Singh<br>Secretary, FARMER, Ghaziabad, Uttar Pradesh |
| | Hydrophilidae | Hydrophilidae | |
| 3. | *Amphicerus* sp. | Bostrichidae | Dr Mohan C<br>Balagat, Madhya Pradesh |
| 4. | *Callosobruchus maculatus* | Chrysomelidae | Chaudhary Charan Singh Haryana Agricultural University, Hisar |
| 5. | *Xylosandrus* sp., *Xyleborus* sp., *Xylosandrus crassiusculus, Xylosandrus compactus, Euplatypus parallelus* | Curculionidae | Central Horticultural Experiment Station Chettalli |
| | *Xylothrips flavipes* | Bostrichidae | |
| 6. | Cerambycid larva | Cerambycidae | Horticulture extension Education, Yadgir, UHS, Bagalkot |
| 7. | *Pentodon* sp. | Scarabaeidae | Sugarcane Research Institute<br>Dr Rajendra Prasad Central Agricultural University, Bihar |
| 8. | *Miridiba coromandeliana, Anomalochela bicolor, Holotrichia nilgiria*<br>*Maladera calicutensis, Maladera indica, Anomala communis, Mimela xanthorrhina, Anomala* sp. | Scarabaeidae | ICAR–Indian Agricultural Research Institute Wellington, Ooty, Tamil Nadu |

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| 9. | *Specularius* sp., *Callosobruchus maculatus* | Chrysomelidae | ICAR–Indian Institute of Pulses Research, Kalyanpur, Kanpur |
| 10. | *Xyleborus perforans, Xylosandrus compactus,* Scolytine species, *Xyleborus affinis, Xyleborus* sp., *Sinoxylon* sp. | Curculionidae | ICAR–National Research Centre on Pomegranate, Solapur, Maharashtra |
| 11 | *Trochoideus desjardinsi,* Endomychid beetle | Endomychidae | Directorate of Plant Protection, Quarantine & Storage, Hebbal, Bengaluru |
| 12 | *Tribolium castaneum* | Tenebrionidae | Anbil Dharmalingam Agricultural College & Research Institute, Tiruchirapalli, Tamil Nadu |
| | *Oryzaephilus surinamensis* | Silvanidae | |
| | *Holotrichia serrata, Holotrichia rufoflava, Holotrichia* sp., *Schizonycha fuscescens, Schizonycha* sp., *Anomala elata, Anomala bengalensis, Anomala dorsalis, Anomala* sp. | Scarabaeidae | |
| 13 | *Typhaea stercorea* | Mycetophagidae | Directorate of Plant Protection, Quarantine & Storage, Mangalore |
| 14 | *Adoretus versutus, Adoretus duvauceli, Apogonia ventralis*? | Scarabaeidae | Punjab Agricultural University, Ludhiana, Punjab |
| 15 | *Popillia schizonycha* | Scarabaeidae | ICAR–Indian Institute of Horticultural Research, Bengaluru |
| 16 | *Phyllognathus dionysius* | Scarabaeidae | ICAR–All India Coordinated Research Project on Cotton, Agricultural Research Station, Dharwad |
| 17 | *Celosterna scabrator* | Cerambycidae | ICAR–All India Coordinated Research Project on Bio-Control (Voluntary Centre) Citrus Research Station Dr YSR Horticultural University, Tirupati |
| 18 | *Sophrops* sp.,*Polyphylla* sp., *Holotrichia* sp., *Brahmina* sp., *Apogonia* sp., *Anomala* spp., *Popillia* sp., Cetoniinae, *Copris* sp. | Scarabaeidae | College of Horticulture & Forestry, Pasighat, Arunachal Pradesh |
| | Cerambycid beetle, Chrysomelid beetle, Dytiscid beetle, Hydrophilid beetle, Silphid beetle | Cerambycidae, Chrysomelidae, Dytiscidae, Hydrophilidae, Silphidae | |

**Dr G. Mahendiran**

| Sl. No. | Taxon/taxa identified | Group/family | Service provided to |
|---|---|---|---|
| 1 | *Sitophilus oryzae, Sitopilus linearis* | Dryophthorinae | ICAR–Indian Institute of Seed Science, Regional station, Bengaluru |
| | *Indozacladus theresiae* | Ceutorhynchinae | |
| 2 | *Sitophilus oryzae* | Dryophthorinae | University of Agricultural Sciences, Dharwad |
| 3 | *Pempherulus affinis* | Conoderinae | ICAR–Central Institute of Cotton Research, Regional station, Coimbatore |
| 4 | *Myllocerus viridanus, Myllocerus undecimpustulatus* | Entiminae | University of Agricultural Sciences, Dharwad |
| 5 | *Myllocerus discolor* | Entiminae | ICAR–Indian Institute of Horticultural Research, Bengaluru |
| 6 | *Acythopeus glyptorhis* | Baridinae | ICAR–Research Complex for NEH region, Meghalaya |
| 7 | *Alcidodes signatus* | Molytinae | Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur |
| 8 | *Platymycterus himalayanus* | Entiminae | Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST), Srinagar |
| 9 | *Myllocerus kashmirensis* | Entiminae | Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST), Srinagar |

**Dr Ankita Gupta**

| Sl.No. | Taxon/taxa identified | Group/ family | Services provided to |
|---|---|---|---|
| 1. | *Habrobracon brevicornis* (Wes.) | Braconidae | Department of Agriculture, Regional Crop Protection Center, Batangas, Philippines |
| 2. | *Chelonus formosanus* (Sonan), *Cotesia ruficrus* (Haliday), *Habrobracon hebetor* (Say) | Braconidae | Department of Entomology, Institute of Agriculture and Animal Science, Tribhuvan University, Kirtipur, Nepal |
| | *Campoletis chlorideae* Uchida *Charops bicolor* (Szepligeti) | Ichneumonidae | |
| 3. | *Antrocephalus mitys* | Chalcididae | Regional Central Integrated Pest Management Centre, Directorate of Plant Protection, Quarantine & Storage |
| | *Megaselia* sp. | Phoridae | |
| 4. | | Hymenoptera | Plant Quarantine Officer, Integrated Packhouse for Fruits and Vegetables, Thiruvaalangadu, Tamil Nadu |

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| 5 | *Distatrix papilionis* (V.) | Braconidae | ICAR–Indian Institute of Science, Bengaluru |
| | *Melalophacharops* sp. | Ichneumonidae | |
| | *Eurytoma* sp. | Eurytomidae | |
| | *Pteromalus puparum* (L.), *Pteromalus* sp. | Pteromalidae | |
| | *Tetrastichus* sp. | Eulophidae | |
| 6 | *Aphaereta* sp., *Aphidius* sp., *Aleiodes* sp., *Clinocentrus* sp., *Chaenusa* sp., *Chorebus* sp., *Ephedrus* sp., *Macrocentrus* sp., *Meteorus* sp., *Microctonus* sp., *Orgilus* sp., *Peristenus* sp., *Phaenocarpa* sp., *Praon* sp., *Townesilitus* sp., *Microplitis* sp., *Cotesia* sp. | Braconidae | University of Kashmir, Srinagar |
| 7. | *Aprostocetus gala* (Walker) | Eulophidae | Department of Entomology, College of Agriculture, Indore |
| 8. | *Heratemis* (*Heratemis*) nr. *filosa* Walker | Braconidae | Department of Plant Protection, CAU (Imphal), Pasighat, Arunachal Pradesh |
| | *Tetrastichus* sp. | Eulophidae | |
| 9. | Indet. species | Braconidae | ICAR–Central Institute for Subtropical Horticulture, Lucknow |
| 10. | *Dolichogenidea stantoni* (Ash.), *Dolichogenidea* sp. | Braconidae | ICAR–National Bureau of Agricultural Insect Resources, Bengaluru |
| | *Antrocephalus mitys* *Dirhinus* sp. | Chalcididae | |
| | *Allotrapa* sp. | Platygastridae | |
| | *Pachyneuron* sp. | Pteromalidae | |
| 11 | *Stenobracon* (*Stenobracon*) *nicevillei* (Bingham) | Braconidae | Ms Lavanya (student) |
| | *Ophion* sp. | Ichneumonidae | |
| 12 | *Anselmella kerrichi* (Narayanan, Subba Rao & Patel) | Eulophidae | ICAR–All India Coordinated Research Project on Bio-Control (Voluntary Centre) Citrus Research Station Dr YSR Horticultural University, Tirupati |

**Dr Jagadeesh Patil**

| Sl.No. | Taxon/taxa identified | Group/ family | Services provided to |
|---|---|---|---|
| 1 | *Heterorhabditis indica* | EPNs | Indira Gandhi Krishi Vishwavidyalaya, Raipur |
| 2 | *Steinernema abbasi* | EPNs | University of Agricultural Sceince, Dharwad |
| 3 | *Steinernema abbasi* | EPNs | School of crop protection, College of Post-Graduate studies in agricultural sciences, Central Agricultural University, Imphal, Umiam |

**Dr David K. J.**

| Sl.No. | Taxon/taxa identified | Group/ family | Services provided to |
|---|---|---|---|
| 1. | *Megaselia scalaris* (Schmitz, 1938) | Phoridae | Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani Maharashtra |
| 2. | *Bactrocera dorsalis, B. correcta* | Tephritidae | Junagadh Agricultural University, Junagadh |
| 3. | *Bactrocera dorsalis, B. correcta, Zeugodacus cucurbitae* | Tephritidae | College of Agriculture, Vijayapur |
| 4. | *Bactrocera latifrons, Zeugodacus cucurbitae, Zeugodacus tau, Zeugodacus nasivittatus, Zeugodacus atrifacies, Bactrocera dorsalis* | Tephritidae | ICAR–Research Complex for North Eastern Hill Region, Sikkim |
| 5 | *Bactrocera zonata, Bactrocera dorsalis, B. correcta, Zeugodacus cucurbitae* | Tephritidae | ICAR–All India Coordinated Research Project on Bio-Control (Voluntary Centre) Citrus Research Station Dr YSR Horticultural University, Tirupati |
| 6 | *Zeugodacus trilineatus, Zeugodacus cucurbitae, Zeugodacus tau, Bactrocera dorsalis* | Tephritidae | BASF India Limited, Agriculture Research Station, Lonikand, Haveli, Pune |
| 7 | *Holoplagia* sp. | Scatopsidae | Directorate of Plant Protection, Quarantine, and Storage, Regional Plant Quarantine Station Hebbal, Bengaluru |
| 8 | *Bactrocera zonata, Bactrocera dorsalis, B. correcta, Zeugodacus cucurbitae* | Tephritidae | C.P. College of Agriculture S.D. Agricultural University Sardarkrushinagar |
| 9 | *Bactrocera dorsalis, B. correcta* | Tephritidae | Dr YSR Horticultural University, College of Horticulture, Anantharajupeta |

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| 10 | *Bactrocera dorsalis, B. correcta* | Tephritidae | Dr YSR Horticultural University, College of Horticulture, Anantharajupeta |
| 11 | *Bactrocera dorsalis, B. correcta, Zeugodacus cucurbitae, Carpomya vesuviana* | Tephritidae | Agricultural College & Research Institute, Madurai |
| 12 | *Bactrocera dorsalis* | Tephritidae | Directorate of Plant Protection, Quarantine, Shillong |
| 13 | *Bactrocera digressa, Bactrocera nigrofemoralis, Bactrocera dorsalis, B. correcta, Zeugodacus caudatus, Bactrocera zonata, Bactrocera dorsalis, B. correcta, Zeugodacus cucurbitae* | Tephritidae | Department of Entomology, College of Horticulture, University of Horticultural Sciences |
| 14 | *Zeugodacus cucurbitae, Bactrocera dorsalis* | Tephritidae | College of Sericulture, University of Agricultural Sciences, Bengaluru |
| 15 | *Eristalinus* sp., *Eristalinus obscuritarsis* | Syrphidae | College of Agriculture Bapatla |
| | *Physiphora* sp. | Ulidiidae | |
| | *Chrysomya* sp. | Sarcophagidae | |
| 16 | *Cacoxenus* spp. | Drosophilidae | |

**Dr S. Salini**

| Sl. No. | Taxon/taxa identified | Group /family | Service provided to |
|---|---|---|---|
| 1. | *Anoplocnemis phasiana* (Fabricius, 1781) | Coreidae | ICAR–Indian Institute of Pulses Research, University of Agricultural Sceinces, Dharwad |
| | *Nezara viridula* (Linnaeus, 1758), *Niphe subferruginea* (Westwood, 1837), *Acrosternum gramineum* (Fabricius, 1787), *Eocanthecona furcellata* (Wolff, 1811) | Pentatomidae | |
| | *Riptortus linearis* (Linnaeus, 1775), *Riptortus pedestris* (Fabricius, 1775) | Alydidae | |
| | *Clavigralla gibbosa* Spinola, 1837 | Coreidae | |
| | *Platerus bhavani* Livingstone and Ravichandran | Reduviidae | |
| 2. | *Piezodorus hybneri* (Gmelin) | Pentatomidae | CSIR–Central Institute of Medicinal and Aromatic Plants, Lucknow |
| 3. | *Dysdercus koenigii* Fabricius | Pyrrhocoridae | Pandit Shiv Kumar Shastri, College of Agriculture and Research Station, Rajnandgaon, Chhattisgarh |
| 4. | *Malcus externus* Wang & Bu, 2020 | Malcidae | Rice Research Station, Moncompu, Alappuzha |

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| 5. | *Halyomorpha picus* (Fabr.), *Priassus exemptus* (Walker), *Eocanthecona furcellata* (Wolff), *Acrosternum gramineum* (Fabricius, 1787), *Dolycoris indicus* Stål, *Piezodorus hybneri* (Gmelin), *Erthesina* sp., *Halys serrigera* Westwood, *Adria parvula* (Dallas), *Eysarcoris montivagus* Distant, *Eysarcoris ?ventralis, Eurydema ?dominulus, Carbula crassiventris* (Dallas, 1849), *Cresphontes monsoni* (Westw.), *Bagrada hilaris* (Burmeister), *Carbula insocia* (Walker), *Plautia crossota* (Dallas), *Nezara viridula* (Linnaeus, 1758), *Nezara viridula* var. *torquata* (Fabr.), *Nezara viridula* var. *smaragdula* (Fabr.), *Zicrona caerulea* (Linnaeus), *Perillus bioculatus* (Fabr.), *Andrallus spinidens* (Fabricius), *Coridius janus* (Fabr.), *Aeliomorpha lineatocollis* (Westw.), *Lodosocoris santhae* Salini, 2021 | Pentatomidae | Punjab Agricultural University, Ludhiana |
| 6. | *Agonoscelis nubilis* (Fabricius) | Pentatomidae | ICAR–All India Coordinated Research Project on Bio-Control (Voluntary Centre) Citrus Research Station Dr YSR Horticultural University, Tirupati |
| 7. | *Stenozygum speciosum* (Dall.) | Pentatomidae | Kerala Agricultural University Regional Research Station, Moncompu, Kerala |
| 8. | *Coridius chinensis* | Dinidoridae | ICAR–Central Plantation Crops Research Institute, Kayamkulam, Kerala |
| 9. | *Leptocorisa oratoria* (Fabricius, 1794) | Alydidae | Department of Entomology ZAHRS, Brahmavar |
| | *Cletus bipunctatus* (Herrich-Schäffer, 1840) | Coreidae | |
| | *Dolycoris indicus* Stål, 1876, *Menida versicolor* (Gmelin, 1790) | Pentatomidae | |
| 10. | *Perillus bioculatus* (Fab), *Eocanthecona ?furcellata* | Pentatomidae | ICAR–Central Institute of Subtropical Horticulture, Lucknow |
| 11 | *Eurydema pulchra* (Westwood) | Pentatomidae | Zoological Survey of India, Kolkata |
| 12 | *Antestiopsis cruciata* (Fabricius) | Pentatomidae | Tamil Nadu Agricultural University, University |

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| 13 | *Madates* sp.*, Rhynchocoris patulus* (Breddin, 1904), *Rhynchocoris humeralis* (Thunberg, 1783), *Placosternum* sp., *Elasmucha truncatula* Walker, 1867, *Halyomorpha* sp., *Erthesina* sp., *Dalpada oculata* (Fabricius, 1775)*, Sarju nigricollis* (Westwood, 1837), *Glaucias albomaculatus* (Distant, 1902), | Pentatomidae | College of Horticulture & Forestry, Pasighat, Arunachal Pradesh |
| 14 | *Nezara viridula* (Linnaeus, 1758), *Halys* sp.*, Halys sulcata* (Thunberg, 1783), *Niphe subferruginea* (Westwood, 1837), *Carbula insocia* (Walker, 1868), *Dolycoris indicus* Stål, 1876, *Plautia crossota* (Dallas, 1851), *Piezodorus hybneri* (Gmelin, 1790), *Aeliomorpha lineatocollis* (Westwood, 1837), *Eysarcoris* sp., *Sciocoris indicus* Dallas, 1851, *Acrosternum gramineum* (Fabricius, 1787), *Adria parvula* Dallas, 1851, *Menida flavovaria* (Dallas, 1851), *Lelia octopunctata* Dallas, 1849, *Eysarcoris* sp., *Eysarcoris montivagus* Distant, 1902, *Piezodorus hybneri* (Gmelin, 1790) | Pentatomidae | Dr. Swaminathan Iyer Udaipur, Rajasthan |
| | *Megacopta cribraria* (Fabricius, 1798), *Coptosoma* sp. | Plataspidae | |

**Dr M. Sampath Kumar**

| Sl. No. | Taxon/taxa identified | Group /family | Service provided to |
|---|---|---|---|
| 1. | *Thanatus* sp. | Philodromidae | ICAR–All India Coordinated Research Project on cotton, Agricultural Research station, Dharwad |
| 2. | *Eriovixia ?laglaizei* (3), *Eriovixia* sp. | Araneidae | ICAR–National Research centre on Litchi, Muzaffarpur |
| 3. | *Leucauge* sp. | Tetragnathidae | College of Agriculture, Dharwad |
| | *Neoscona* spp. | Araneidae | |
| | *Oxyopes* sp. | Oxyopidae | |
| | *Runcinia* sp. | Thomisidae | |

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| 4. | *Neoscona theisi* (4) | Araneidae | Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh |
| | *Oxyopes* sp. (3) | Oxyopidae | |
| | *Cheiracanthium* sp. (2) | Cheiracanthiidae | |
| | *Cheiracanthium approximatum* (2) | Cheiracanthiidae | |
| | *Oxyopes javanus* (2) | Oxyopidae | |
| 5. | *Neoscona* sp. | Araneidae | College of Agriculture Kerala Agricultural University, Thrissur |
| | *Phintella* sp. | Salticidae | |
| | *Chrysso angulla , Meotipa pulcherrima* | Theridiidae | |
| | *Camaricus* sp. | Thomisidae | |
| 6. | *Tetragnatha* sp. (4) | Tetragnathidae | Zonal Agricultural and Horticultural Research Station, Brahmavar, Karnataka |
| | *Argiope* sp. | Araneidae | |
| 7. | *Neoscona* sp. | Araneidae | College of Agricuture, Vijayapura Image based service |
| | *Oxyopes* sp. | Oxyopidae | |
| 8. | *Neoscona theisi, Neoscona* sp. (2) | Araneidae | ICAR–Krishi Vigyan Kendra, Bidar |
| 9. | *Oxyopes* sp. (2), *Oxyopes shweta* | Oxyopidae | Division of Crop Protection ICAR–Central Institute for Subtropical Horticulture, Lucknow |
| | *Telamonia dimidiata* | Salticidae | |
| | *Neoscona* sp. | Araneidae | |
| 10. | *Thomisus* sp. | Thomisidae | Image based service |

**Dr Rachana, R.R.**

| Sl. No. | Taxon/taxa identified | Group /family | Service provided to |
|---|---|---|---|
| 1 | *Thrips palmi* Karny (2), *Scirtothrips dorsalis* Hood (2) | Thripidae | University of Agricultural Sciences, Dharwad |
| 2 | *Thrips palmi* Karny (4) , *Scirtothrips dorsalis* Hood (2), *Thrips tabaci* Lindeman, *Frankliniella schultzei* (Trybom) | Thripidae | Punjab Agricultural University, Ludhiana |
| 3 | *Thrips tabaci* Lindeman (3), *Thrips hawaiiensis* (Morgan) | Thripidae | University of Horticultural Sciences, Bagalkot |
| 4 | *Scirtothrips dorsalis* Hood | Thripidae | University of Agricultural Sciences, Dharwad |
| 5 | *Microcephalothrips abdominalis* (D. L. Crawford) | Thripidae | Punjab Agricultural University, Ludhiana |

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| 6 | *Anaphothrips sudanensis* Trybom | Thripidae | BASF Pvt. Ltd., Pune |
| 7 | *Thrips parvispinus* (Karny) (6), *Thrips hawaiiensis* (Morgan) (3) | Thripidae | University of Agricultural Sciences, Raichur |
| 8 | *Gynaikothrips uzeli* (Zimmermann) | Phlaeothripidae | Punjab Agricultural University, Ludhiana |
| 9 | *Thrips parvispinus* (Karny) (56) | Thripidae | ICAR–Indian Institute of Horticultural Research, Bengaluru |
| 10 | *Thrips parvispinus* (Karny) (78) | Thripidae | ICAR–Indian Institute of Horticultural Research, Bengaluru |
| 11 | *Thrips parvispinus* (Karny) (2), *Thrips hawaiiensis* (Morgan), *Thrips palmi* Karny | Thripidae | Directorate of Plant Protection Quarantine and Storage, Bengaluru |
| 12 | *Thrips parvispinus* (Karny) | Thripidae | Directorate of Plant Protection Quarantine and Storage, Telangana |
| 13 | *Thrips parvispinus* (Karny) (2) | Thripidae | Krishi Vigyan Kendra, Rajendranagar |
| 14 | *Thrips parvispinus* (Karny) (2), *Thrips palmi* Karny (2) | Thripidae | College of Horticulture, Mojerla |
| 15 | *Thrips parvispinus* (Karny), *Thrips hawaiiensis* (Morgan) | Thripidae | University of Horticultural Sciences, Bagalkot |
| 16 | *Thrips parvispinus* (Karny) (2) | Thripidae | Directorate of Plant Protection Quarantine and Storage, Andhra Pradesh |
| 17 | *Thrips parvispinus* (Karny) (2), *Thrips hawaiiensis* (Morgan) (2) *Thrips florum* Schmutz | Thripidae | Vegetable Research Station, Rajendranagar |
| 18 | *Thrips parvispinus* (Karny) (2), *Thrips hawaiiensis* (Morgan) | Thripidae | Syngenta Pvt. Ltd., Aurangabad |
| 19 | *Thrips parvispinus* (Karny), *Thrips hawaiiensis* (Morgan), *Frankliniella occidentalis* (Pergande),*Frankliniella schultzei* (Trybom) | Thripidae | Coverta agriscience Pvt Ltd., Telangana |
| 20 | *Thrips palmi* Karny (2), *Frankliniella schultzei* (Trybom), *Microcephalothrips abdominalis* (D. L. Crawford), *Thrips atactus* Bhatti | Thripidae | Coverta agriscience Pvt Ltd., Telangana |

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| 21 | *Rhipiphorothrips cruentatus* Hood, *Rhipiphorothrips pulchellus* Morgan, *Scirtothrips dorsalis* Hood, *Megalurothrips usitatus* (Bagnall) | Thripidae | ICAR–Indian Institute of Natural Resins and Gums, Ranchi |
| 22 | *Scolothrips rhagebianus* Priesner | Thripidae | ICAR–National Bureau of Agricultural Insect Resources, Bengaluru |
| 23 | *Thrips palmi* Karny | Thripidae | University of Horticultural Sciences, Shivamogga |
| 24 | *Pseudodendrothrips bhattii* Kudo (2), *Pseudodendrothrips mori* (Niwa) (2), *Bathrips melanicornis* (Shumsher) | Thripidae | Central Silk Board, Bengaluru |
| 25 | *Thrips parvispinus* (Karny), *Thrips hawaiiensis* (Morgan) | Thripidae | BASF Pvt. Ltd., Pune |
| 26 | *Scirtothrips dorsalis* Hood (3), *Thrips palmi* Karny, *Microcephalothrips abdominalis* (D. L. Crawford) | Thripidae | Central Institute of Medicinal and Aromatic Plants, Bengaluru |
| 27 | *Thrips parvispinus* (Karny) (9), *Scirtothrips dorsalis* Hood (3), *Thrips hawaiiensis* (Morgan), *Frankliniella schultzei* (Trybom) | Thripidae | HM Clause Pvt Ltd., Bengaluru |
| | *Haplothrips* (*Haplothrips*) *gowdeyi* (Franklin) | Phlaeothripidae | |
| | *Franklinothrips vespiformis* (Crawford, D.L.) (2) | Aeolothripidae | |
| 28 | *Megalurothrips usitatus* (Bagnall) (3), *Megalurothrips distalis* (Karny) (3), *Scirtothrips dorsalis* Hood | Thripidae | ICAR–Indian Institute of Pulses Research, Kanpur |
| 29 | *Thrips palmi* Karny (4), *Thrips hawaiiensis* (Morgan) | Thripidae | HM Clause Pvt Ltd., Bengaluru |
| 30 | *Thrips florum* Schmutz, *Thrips hawaiiensis* (Morgan), *Scirtothrips dorsalis* Hood | Thripidae | ICAR–National Bureau of Agricultural Insect Resources, Bengaluru |
| 31 | *Indothrips bhushani* Bhatti | Aeolothripidae | University of Agricultural Sciences, Raichur |
| | *Scirtothrips dorsalis* Hood | Thripidae | |
| 32 | *Thrips florum* Schmutz, *Thrips hawaiiensis* (Morgan), *Scirtothrips dorsalis* Hood, *Megalurothrips* sp. | Thripidae | University of Agricultural Sciences, Bengaluru |
| 33 | *Scirtothrips dorsalis* Hood (2), *Thrips palmi* Karny, *Thrips tabaci* Lindeman | Thripidae | Punjab Agricultural University, Ludhiana |

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| 34 | *Thrips florum* Schmutz (2), *Thrips hawaiiensis* (Morgan) (2), *Thrips orientalis* (Bagnall) | Thripidae | University of Horticultural Sciences, Shivamogga |
| 35 | *Frankliniella schultzei* (Trybom), *Anascirtothrips arorai* Bhatti (2), *Thrips palmi* Karny (2), *Thrips tabaci* Lindeman, *Scirtothrips dorsalis* Hood | Thripidae | ICAR–National Research Centre on Seed Spices, Ajmer |
| 36 | *Scirtothrips dorsalis* Hood (2), *Frankliniella schultzei* (Trybom), *Thrips palmi* Karny (2), *Thrips hawaiiensis* (Morgan) | Thripidae | Coverta agriscience Pvt Ltd., Telangana |
| 37 | *Thrips palmi* Karny (9) , *Scirtothrips dorsalis* Hood (10), *Frankliniella schultzei* (Trybom) (3), *Frankliniella occidentalis* (Pergande) (2), *Thrips florum* Schmutz (2), *Thrips hawaiiensis* (Morgan) (2) | Thripidae | Coverta agriscience Pvt Ltd., Telangana |
| | *Haplothrips* (*Haplothrips*) *gowdeyi* (Franklin) | Phlaeothripidae | |
| 38 | *Thrips florum* Schmutz (9), *Thrips hawaiiensis* (Morgan) (8) | Thripidae | Krishi Vigyan Kendra, Guntur |
| 39 | *Thrips palmi* Karny, *Scirtothrips dorsalis* Hood (3), *Frankliniella schultzei* (Trybom) | Thripidae | University of Agricultural Sciences, Raichur |
| 40 | *Frankliniella schultzei* (Trybom), *Thrips palmi* Karny, | Thripidae | Krishi Vigyan Kendra, Guntur |
| 41 | *Thrips florum* Schmutz , *Thrips hawaiiensis* (Morgan) | Thripidae | ICAR–Indian Institute of Horticultural Research, Bengaluru |
| 42 | *Scirtothrips dorsalis* Hood (4), *Thrips palmi* Karny, *Diarthrothrips nimbus* (Ananthakrishnan) | Thripidae | ICAR–Indian Institute of Horticultural Research, Bengaluru |
| 43 | *Thrips florum* Schmutz (3), *Thrips hawaiiensis* (Morgan) (3) | Thripidae | ICAR–Indian Institute of Horticultural Research, Bengaluru |

**Dr Navik Omprakash Samodhi**

| Sl. No. | Taxon/taxa identified | Group /family | Service provided to |
|---|---|---|---|
| 1 | *Trichogramma chilonis* (3) | Trichogrammatidae | Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh |
| 2 | *Trichogramma chilonis* (2) | Trichogrammatidae | Professor Jayashankar Telangana Agricultural University, Hyderabad, Telangana |

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| 3 | *Trichogramma achaeae* (3), *Trichogramma chilonis* (4), *Trichogramma chilotrae* (1) | Trichogrammatidae | CSIR–Central Institute of Medicinal and Aromatic Plants, Lucknow, Uttar Pradesh |

**Dr N.N. Rajgopal**

| Sl. No. | Taxon/taxa identified | Group/Family | Service provided to |
|---|---|---|---|
| 1. | *Idioscopus nitidulus* | Cicadellidae | BASF Crop Solutions, Bengaluru |
| 2. | *Nephotettix virescens, Nephotettix nigropictus, Cofana spectra,Cofana* sp. | Cicadellidae | Zonal Agricultural & Horticultural Research Station, Brahmavar, Shimogga |
| 3. | *Maiestas hospes, Neoaliturus (Circulifer) opacipennis, Typhlocybinae* sp., *Orosius albicinctus, Exitianus indicus Exitianus nanus, Aconurella prolixa* | Cicadellidae | Agricultural Research Station, Mandor, Jodhpur, Rajasthan |

## 6. EXTENSION ACTIVITIES

### ICAR-NBAIR Demonstrates Utility of Agri-drone in Crop Protection

ICAR- National Bureau of Agricultural Insect Resources, Bengaluru has been making efforts to develop novel and precise delivery mechanisms for biopesticides for the effective management of insect pests and diseases. ICAR-NBAIR has been selected as one of the ICAR Institutes for 'Drone technology demonstration' under the Sub Mission on Agricultural Mechanization to popularize the Agri-drone among farming communities. ICAR-NBAIR conducted about 15 bio pesticides spraying demonstrations in three clusters (5 demonstrations/cluster) using oil-based formulations in Karnataka and Tamil Nadu in different crops such as coconut, brinjal, mango, sugarcane, areca nut, and rice to create farmers' awareness and promotion of drone technology especially in crop protection. Drone technology effectively uses precision spraying of pesticides, reducing chemical usage and application costs, and enables real-time monitoring of pests, diseases, and weeds, enabling timely management strategies. Drone-based pesticide spraying is safer for farmers, and more convenient for inaccessible cropping systems, uneven terrain, and taller crops like coconut and areca nut. It offers higher work efficiency (7-8 minutes/acre) compared to manual spraying, making it a more efficient method. These demonstration programs were attended by about 500 progressive farmers and other stakeholders.

**Demonstration of agri-drone based delivery of biopesticide in coconut**

**Agri-drone demonstration**

## ICAR-NBAIR Celebrated 32nd Foundation Day & Biocontrol Expo 2024

ICAR-National Bureau of Agricultural Insect Resources, Bengaluru, the nodal agency for biological control research at the National level, organized Biocontrol Expo- 2024, the second year in continuous and celebrated its 32nd Foundation Day on October 19, 2024 at ICAR-NBAIR, Yelahanka campus, Attur Layout, Yelahanka New Town, Bengaluru. Dr Ashok Dalwai, IAS, Former Chief Executive officer, National Rainfed Area Authority, GOI graced the function as Chief Guest. Dr. S. N. Sushil, Director, ICAR-NBAIR convened the programme in the gracious presence of dignitaries from ASRB, MoA&FW and industry partners, Dr Major Singh, Member, Agricultural Scientist Recruitment Board (ASRB), New Delhi, Dr. Archana Sinha, Secretary, CIB & RC, GOI, Dr. Dnyaneshwar Waghchoure, President, AMMA association and Dr. K. Subaharan, Organizing Secretary & Head, Germplasm Conservation and Utilization (GCU), ICAR-NBAIR, Bengaluru.

The chief guest and the guest of honours inaugurated the Biocontrol Expo 2024. Director of the institute, Dr. S. N. Sushil presented achievements and cutting-edge research of ICAR-NBAIR. Dr Ashok Dalwai in his chief guest address emphasized the importance of climate change research and the development of climate-resilient biocontrol agents for farmers' need. Dr Major Singh in his remark stressed the intensive research on the virus-vector relationship and lauded the work of ICAR-NBAIR. Dr Archana Sinha in her remarks, spoke about the simplified guidelines for the registration of biopesticides at the National level. She also highlighted the concept of crop grouping to make pesticides more effective in a wider range of crops. The chief guest and the guest of honours felicitated the progressive farmers and distributed agricultural inputs. The Expo recorded a footfall of 300 farmers, with over 35 stalls showcasing their products and technologies. Besides, 250 school students participated in the Biocontrol Expo-2024. On this auspicious occasion, *Ek Ped Ma ke Naam* campaign drive was undertaken. Finally, Dr. K. Subaharan, Organizing Secretary & Head, GCU conveyed his vote of thanks to all dignitaries, farmers and staff.

**32nd Foundation day celebrations**

**View of Biocontrol Expo 2024**

**Distribution of agro inputs to farmers during 32nd Foundation day**

**Tree planting to commemorate Ek Ped Maa Ki Naam**

**An assemblage of ICAR NBAIR staff during 32nd Foundation day**

## ICAR-NBAIR celebrated Kisan Diwas 2024

ICAR-NBAIR, Bengaluru, celebrated Kisan Diwas (Farmer's Day) on December 23, 2024, with great enthusiasm. The event was attended by 100 farmers, with 50 each from Kolar and Hassan Krishi Vigyan Kendras (KVKs). The Chief Guest, Shri N.S. Govindaraju, IAS, Controller, HSFC, ISRO Bengaluru, inaugurated the event. In his address, he emphasized the importance of Farmers' Day and highlighted the role of bio-control technologies in managing insect pests and diseases effectively and sustainably. Dr. T. Venkatesan, In-charge Director, ICAR-NBAIR, Bengaluru, presented an overview of the institute's significant achievements in the biological control of insect pests. During the technical session, Dr.Kesavan Subaharan, HOD, DGCU, Dr. Sunil Joshi, HOD, DGCC and other scientists of the bureau educated farmers on the use of bio-control agents, slow-release pheromone formulations, and bio-pesticides for eco-friendly pest management. As part of the SCSP plan, the Chief Guest distributed bio-control agents, pheromone traps with lures, and other essential inputs, along with battery-operated sprayers, to 100 farmers from Kolar and Hassan. Additionally, Dr. B.S. Gotyal, Senior Scientist, conducted a workshop on the theme "Swachh Bharat: Bio-control Agents," where he highlighted the importance of the Swachh Bharat Abhiyan initiated by the Government of India. He elaborated on how maintaining cleanliness and using bio-control agents align with sustainable agricultural practices. This celebration of Kisan Diwas was a successful platform to bring together farmers and scientists, fostering awareness and collaboration for sustainable and eco-friendly pest management solutions.

**Exhibition organized on Kisan Diwas at ICAR NBAIR Yelahanka campus**


**Shri N.S. Govindaraju, IAS, Controller, HSFC, ISRO Bengaluru addressing the farmers on Kisan Diwas**

**Distribution of input to farmers during Kisan Diwas 2024**

## ICAR-NBAIR organised the Tribal sub plan programme at Kottayam

Under the Tribal Sub Plan (TSP) "Ensuring Sustainable Livelihood Security of Tribals through Capacity Building and Demonstration of Improved Production Technologies in Selected Horticultural Crops, The programme was held at Kottayam, the tribal farmers were provided with ICAR-NBAIR bio-control agents such as *Pochonia chlamydosporia*, *Bacillus thuringiensis*, *Trichoderma harzianum*, *Bacillus megaterium*, and *Metarhizium anisopliae* for effectively managing insect pests and disease in their horticultural crops.

**Distribution of ICAR-NBAIR bio-control agents to Tribal farmers of Kottayam, Kerala**

## 7. AWARDS AND RECOGNITIONS

**Dr Satya Nand Sushil**

Received Fellow award of National Academy of Agricultural Sciences, New Delhi.

Chairman, Research Advisory Committee of Central Sericultural Germplasm Resources Centre (CSGRC), Central Silk Board, Hosur.

Member, Research Advisory and Monitoring Committee meeting of Zoological Survey of India, Kolkatta.

Delivered an invited Keynote lecture on "Recent threats of Invasive Pests to Indian Agriculture: Challenges & Way Forward" National Conference on Plant Health for Food Security: Threats and Promises, ICAR–Indian Institute of Sugarcane Research, Lucknow, India, 01–03 February 2024.

Delivered Dr V.G. Prasad Memorial Lecture on "Recent Threats of Invasive and migratory Insect pests to Indian Agriculture: Challenges & Way Forward" organised by Association for Advancement of Pest Management in Horticultural Ecosystems, ICAR–Indian Institute of Horticultural Research, Bengaluru, 29 July 2024.

Delivered an invited Keynote lecture on "Prospects and issues in biological control of insect pests" Lessons learnt and Success stories in India", International Conference on Plant Protection, Kathmandu, Nepal, 26–27 April 2024.

Delivered a keynote address in Zonal Workshop of ATARI Zone-XI (Krishi Vigyan Kendra (KVKs) of Karnataka, Kerala and Lakshadweep) at ICAR-Indian Institute of Spices Research, Kozhikode (Kerala), 2–4 September 2024.

Delivered an invited plenary lecture on "Safeguarding sugarcane cultivation from insect pests through biocontrol and other compatible technologies in ASEAN countries vis-à-vis India", International Sugar Conference & Sugarcon 2024, Quy Nhon, Vietnam, 16–19 September 2024.

Delivered Keynote lecture during the Golden Jubilee celebration, ICAR-Indian Institute of Spices Research, Kozhikode (Kerala), 25 October 2024

**Dr T. Venkatesan**

Member, Research Advisory Committee of Central Sericultural Germplasm Resources Centre (CSGRC), Central Silk Board, Hosur.

Invited as a Panellist representing India for the Third International Congress of Biological Control, San Jose, Costa Rica, 24–27 June 2024.

Invited Speaker for the Third International Congress of Biological Control, San Jose, Costa Rica, 24-27 June 2024

**Dr Sunil Joshi**

Received Rao Sahib Dr T.V. Ramakrishna Ayyar Memorial Award 2024 for commendable contribution to Taxonomy of Aphididae, Pseudococcidae, Coccidae, Diaspididae and Monophlebidae by Dr Vasanthraj David Foundation, Chennai, 17 November 2024.

**Dr Kesavan Subaharan**

Food and Agriculture Organizations of United Nations expert on coconut rhinoceros beetle management at the Republic of Marshall Islands, December 2023 to January 2024.

Associate Editor International Journal of Tropical Insect Science (Springer)

Delivered lead lecture in Entomology 2024, Phoenix, United States of America, 10–14 November 2024.

Received Best presentation award for the paper titled 'A Controlled release dispenser to deliver the pheromone of cabbage diamond back moth *Plutella xylostella*' in the Nano 2024, Hotel Lalit Ashok, Bengaluru, 1–3 August, 2024.

Member of Research Advisory Group of Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore

Adjunct faculty at the Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore for the period 2023–2024.

Expert member for Entomology program of 83rd Institute Research Committee Meeting of ICAR–Directorate of Groundnut Research, 13 May 2024.

Expert member for Entomology program of Institute Research Committee Meeting of ICAR–Indian Institute of Pulses Research, Kanpur, 23 May 2024.

Expert member for Entomology program of Institute Research Committee Meeting of ICAR–Indian Institute of Horticultural Research, Bengaluru, 09 July 2024.

**Dr P. Sreeramakumar**

Delivered lead lecture in the 2024 International Congress on Invertebrate Pathology and Microbial Control Campus Gusshaus, Technical University of Vienna, Vienna, Austria, 28 July to 01 August 2024.

Membership through the President's Circle Program, ESA: Received membership through the President's Circle Program, Entomological Society of America, USA, for 2024. Twenty-Year Pin from SIP: Won the 20-Year Pin' during SIP 2023 held in College Park, Maryland, USA, for my contributions to the Society for Invertebrate Pathology. Received in the pin at SIP 2024, Vienna, Austria.

Served as Editor, SIP Newsletter: Editor of Society for Invertebrate Pathology (SIP) Newsletter in 2024.

Served as Ambassador: Ambassador for The Association of Applied Biologists, Warwick, United Kingdom, 2024.

Served as Member, Publications Committee: Member of the Publications Committee of the Society for Invertebrate Pathology, United States of America

**Dr G. Sivakumar**

Delivered a Lead Lecture on "Role of fungal biocontrol agents for the sustainable management of crop pests in Agriculture" in the International Conference on "Fungal Applications in Agriculture, Industry and Biomedical Process", Madurai Kamaraj University, Madurai, Tamil Nadu, 25 October, 2024

Delivered a lead lecture on "Utilization of microbial insect pathogens for the sustainable management of insect pests of crops in agriculture in the Ninth Asian PGPR India Chapter National Conference on "The Beneficial Microbes as Integrated Approach for Sustainable Agriculture: Opportunities and Challenges", Bharathiar University, Coimbatore, 29–30 July 2024.

Delivered a lead talk on "Role of microbes in sustainable management of crop pests in agriculture" in the International Conference on "Unleashing the Power of Seed and Crop Health Innovations for a Food Secure World", Tamil Nadu Agricultural University, Coimbatore, 21–22 November 21-22.

Member, Research Advisory Committee, Seri Biotech Research Laboratory, Central Silk Board, Kodathi, Bengaluru, 15 July 2024.

**Dr K. Sreedevi**

Awarded "Best Worker Award" under the Scientific category during 32nd Foundation Day celebrations ICAR–National Bureau of Agricultural Insect Resources, Bengaluru, 19 October 2024.

**Dr Deepa Bhagat**

Served as Task Force Member of Department of Biotechnology on Plant Biotechnology.

Appointed as the District Ambassador of Indian Science Technology and Engineering Facilities Map (i-STEM), Indian Institute of Sciences, Bengaluru, representing Tumkur, Karnataka with effective 31 January 2024

**Dr Mahesh Yandigeri**

Received 'Dr R.J. Rabindra Team Award' for the year 2024 for teamwork in developing technology 'Waste to Wealth: Technology on black soldier fly mediated bioconversion of farm and kitchen wastes' during 32nd Foundation Day celebrations ICAR–National Bureau of Agricultural Insect Resources, Bengaluru, 19 October 2024.

**Dr A. Kandan**

Received Best Oral Presentation award for the paper titled 'Entomopathogens as eco-friendly approaches for economically important crops pest management' in the National Conference on Plant Health for Food Security: Threats and Promises", ICAR–Indian Institute of Sugarcane Research (IISR), Lucknow, 01–03 February 2024

**Dr Gandhi Gracy**

Received ESI-Senior Entomologist Award-2024

Received Best Oral Presentation award in the International Conference on Plant Protection in Horticulture organised by Association for Advancement of Pest Management in Horticultural Ecosystems (AAPMHE), ICAR–Indian Institute of Horticultural Research, Bengaluru, 25–27 September 2024.

**Dr B.S. Gotyal**

Received Prof T.N. Ananthkrishnan Award for Senior Scientist during National Conference in Current Advances in Entomological Research at University of Madras, Department of Zoology, Guindy campus, Chennai, 4 October 2024

**Dr Ankita Gupta**

Received International Society of Hymenopterists sponsored membership on 30/1/24.

Served as Chairman for the Virtual session of "Biodiversity and Taxonomy" in First Entomology Student Conclave, University of Agricultural Sciences, Bengaluru, 21 February 2024

**Dr G. Mahendiran**

Received Agricultural Scientist Award -2024 for contribution to insect taxonomy and waste to wealth by Dr B. Vasantharaj David Foundation in the "Sixth National Conference on Advances in Agricultural and Industrial Entomology", Chennai, 17 November 2024.

Received Dr H.S. Pruthi Award for outstanding contribution in the field of Entomology –Insect Taxonomy on the occasion of International Conference on Current Innovations and Technological Advances in Agriculture and Allied Sciences (CITAAS-2024)" organised by Faculty of Agriculture, Guru Kashi University, Punjab, 29–31 August 2024.

Best poster presentation award for the paper entitled on 'Diversity of *Myllocerus* species (Curculionidae: Coleoptera) on fruit crops in India - an overview' in the International Conference on Plant Protection in Horticulture organised by Association for Advancement of Pest Management in Horticultural Ecosystems (AAPMHE), ICAR–Indian Institute of Horticultural Research, Bengaluru, 25–27 September 2024.

**Dr M. Sampathkumar**

Received Best paper presentation award for the research paper titled "Success Story of Managing the Alien Invasive Pest, Cassava Mealybug in India through its Classical Biological Control Agent, *Anagyrus lopezi*" during the International Conference on Plant Protection in Horticulture organised by Association for Advancement of Pest Management in Horticultural Ecosystems (AAPMHE), ICAR–Indian Institute of Horticultural Research, Bengaluru, 25–27 September 2024.

Best poster presentation award to the research paper titled on 'Assessing the Impact of Non-Mulched Mustard Crops on Nematodes in High-Altitude Nilgiris' in the National symposium on "Nematodes: the unseen foes and friends of plant and soil health, Indian Statistical institute, Kolkata, 31 January to 02 February 2024.

**Dr K.J. David**

Received Best Oral Presentation Award (First Prize) in Animal Taxonomy Summit 2024 held at Kolkata, 30 June 2024 to 03 July 2024.

Best Oral Presentation Award in National Conference on Managing Agro-Biodiversity in Northeastern India (NCMAN-2024), Umiam Meghalaya, 23–24 October, 2024

Best Oral Presentation Award in the International Conference on Plant Protection in Horticulture organised by Association for Advancement of Pest Management in Horticultural Ecosystems (AAPMHE), ICAR–Indian Institute of Horticultural Research, Bengaluru, 25–27 September 2024.

**Dr S. Salini**

Received Best paper presentation award for the paper titled, 'Revision and nomenclatural notes on the most common predatory Pentatomid genus *Eocanthecona* (Hemiptera: Heteroptera: Pentatomidae: Asopinae) from India' in the International Conference on Plant Protection in Horticulture organised by Association for Advancement of Pest Management in Horticultural Ecosystems (AAPMHE), ICAR–Indian Institute of Horticultural Research, Bengaluru, 25–27 September 2024.

**Dr K. Selvaraj**

Delivered an invited talk on 'Invasion and Expansion of Exotic Whiteflies Species in India and their Biocontrol Strategies' and 'Recent experiences and preparedness in management of invasive insects: Biosecurity and quarantine regulatory perspective' in advanced training course on "Recent Advances in Eco-friendly Management of Crop Pests", Centre for Advanced Faculty Training at Chaudhary Charan Singh Haryana Agricultural University (CCSHAU), Hissar, 24 January to 13 February 2024

**Dr U. Amala**

Received 'ESI Young Entomologist Award 2022' from Entomological Society of India, New Delhi, 22 February 2024

Served as Scientific committee member of Virtual congress on Third International Congress on Bee Sciences organised by Afyon Kocatepe University, Turkey, 24–26 April 2024

Received Best Oral presentation award for the paper titled, "A sustainable non-destructive method to multiply the colonies of stingless bees" during the International Conference on Plant Protection in Horticulture organised by Association for Advancement of Pest Management in Horticultural Ecosystems (AAPMHE), ICAR–Indian Institute of Horticultural Research, Bengaluru, 25–27 September 2024

**Dr Gundappa B.**

Selected as Fellow, Association for Advancement of Pest Management in Horticultural Ecosystems (AAPMHE), ICAR–Indian Institute of Horticultural Research, Bengaluru.

Served as External expert for IRC projects of ICAR–National Institute of Biotic Stress Management, Raipur, 19 January 2024.

**Dr Richa Varshney**

Received Dr M. Mani - AAPMHE Young Scientist Award for Excellence in Biocontrol Research" during the International Conference on Plant Protection in Horticulture organised by Association for Advancement of Pest Management in Horticultural Ecosystems (AAPMHE), ICAR–Indian Institute of Horticultural Research, Bengaluru, 25–27 September 2024.

**Dr C. Manjunatha**

Received Young Agricultural Scientist Award-2024 from Dr B. Vasanthraj David Foundation, Chennai

Received Rising Star Environmentalist Award-2024 from AVIAN Trust, Bengaluru

Served as a Member of the Expert committee for the establishment of the Molecular laboratory at Regional Plant Quarantine Station, Bengaluru

Received Best Poster Award at National Conference on Plant Health for Food Security: Threats and Promises, ICAR–Indian Institute of Sugarcane Research, Lucknow, 01–03 February 2024.

Received Best Poster Award in the International Conference on Plant Protection in Horticulture organised by Association for Advancement of Pest Management in Horticultural Ecosystems (AAPMHE), ICAR–Indian Institute of Horticultural Research, Bengaluru, 25–27 September 2024.

**Dr R.S. Ramya**

Received the Best oral presentation award for the paper titled "Building resilience by scaling the dosage ladder: Selection and enzyme dynamics in *Trichogramma chilonis* against Emamectin Benzoate" during the International Conference on Plant Protection in Horticulture organised by Association for Advancement of Pest Management in Horticultural Ecosystems (AAPMHE), ICAR–Indian Institute of Horticultural Research, Bengaluru, 25–27 September 2024.

**Dr Navik Omprakash Samodhi**

Received Dr B.V. David Young Scientist Award, 2024 in the Sixth National Conference on Advances in Agricultural Sciences organised by Dr B. Vasantharaj David Foundation, Chennai, 17 November 2024.

## AWARDS BAGGED BY ICAR-NBAIR

**Dr S.N. Sushil, Director received Rajbhasha Shield as the first prize for the year 2023-2024**

**ICAR-NBAIR won Best exhibition stall under ICAR category, National Horticulture Fair, ICAR–Indian Institute of Horticultural Research, Bengaluru**

## 8. AICRP COORDINATION UNIT AND CENTRES

| Sl. No | Centres |
|---|---|
| | **Regular centres** |
| 1 | Anand Agricultural University, Anand |
| 2 | Assam Agricultural University, Jorhat |
| 3 | Acharya N.G. Ranga Agricultural University, Anakapalle |
| 4 | Govind Ballabh Pant University of Agriculture and Technology, Pantnagar |
| 5 | Kerala Agricultural University, Thrissur |
| 6 | Mahatma Phule Krishi Vidyapeeth, Pune |
| 7 | Punjab Agricultural University, Ludhiana |
| 8 | Pandit Jayashankar Telangana State Agricultural University, Hyderabad |
| 9 | Sher -e-Kashmir University of Agricultural Science & Technology, Srinagar |
| 10 | Tamil Nadu Agricultural University, Coimbatore |
| 11 | Y.S. Parmar University of Horticulture and Forestry, Solan |
| | **Voluntary centres** |
| 12 | Central Agricultural University, Pasighat |
| 13 | Maharana Pratap University of Agriculture & Technology, Udaipur |
| 14 | Odisha University of Agriculture & Technology, Bhubaneswar |
| 15 | University of Agricultural Sciences, Raichur |
| 16 | ICAR-Central Institute of Subtropical Horticulture, Lucknow |
| 17 | ICAR-Central Plantation Crops Research Institute, Kayamkulam |
| 18 | ICAR-Indian Institute of Horticultural Research, Bangalore |
| 19 | ICAR-Indian Institute of Maize Research, WNC, Hyderabad |
| 20 | ICAR-Indian Institute of Rice Research, Hyderabad |
| 21 | ICAR-Indian Institute of Vegetable Research, Varanasi |
| 22 | National Research Institute for Integrated Pest Management, New Delhi |
| 23 | Dr. Y. S. R Horticultural University, Ambajipeta |
| 24 | Indira Gandhi Krishi Viswavidhyalaya, Raipur |
| 25 | Regional Agricultural Research Station (KAU), Kumarakom |
| 26 | Regional Agricultural Research Station (KAU), Vellayani |
| 27 | Uttar Banga Krishi Viswavidyalaya, Pundibari |
| 28 | Panjabrao Deshmukh Krishi Vidyapeeth, Akola |
| 29 | Sher -e-Kashmir University of Agricultural Science & Technology, Jammu |
| 30 | University of Agricultural and Horticultural Sciences, Shivamogga |
| 31 | Citrus Research Station, Dr. Y.S.R. Horticultural University, Tirupati |
| 32 | ICAR-Sugarcane Breeding Institute, Coimbatore |
| 33 | ICAR-Indian Institute of Shree Anna(Millet) Research, Hyderabad |
| 34 | National Institute of Plant Health Management, Hyderabad |
| 35 | College of Agriculture (CAU), Lembucherra, Agartala |
| 36 | ICAR-Central Rice Research Institute, Cuttack |

| | |
|---|---|
| 37 | Directorate of Floriculture Research, Pune |
| 38 | National Research Centre on Litchi, Muzafarpur |
| 39 | ICAR- National Institute for Research on Commercial Agriculture, Rajahmundry |
| 40 | CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur |
| 41 | Tapioca and Castor Research Station, (TNAU), Yethapur, Salem |

# 9. ONGOING RESEARCH PROJECTS

## A. Institute projects with Prinicipal Investigators (PI)

## DIVISION OF GERMPLASM COLLECTION AND CHARACTERISATION

### I. Biosystematics of agriculturally important insects and associated fauna

1. Taxonomic studies on Coccoidea (Hemiptera) with special reference to Pseudococcidae, Coccidae, Diapsididae, Monophlebidae and Rhizoecidae (01.08.2022 to 28.02.2027) – Dr Sunil Joshi

2. Taxonomic studies on Indian Curculionids (Coleoptera) with emphasis on Dryophthorinae (01.08.2022 to 31.03.2027) – Dr G. Mahendiran

3. Taxonomic studies on Braconidae with special reference to Cheloninae, Microgastrinae and Braconinae with emphasis on host-parasitoid association in India (01.04.2021 to 31.03.2026) – Dr Ankita Gupta

4. Biodiversity and Systematic studies on entomopathogenic nematodes with a special reference to Western Ghats of India (16.05.2023 to 16.04.2028) – Dr Jagadeesh Patil

5. Taxonomic studies on Tephritoidea (Diptera) of India with special reference to Tephritidae, Platystomatidae, Ulidiidae and Pyrgotidae (01.04.2020 to 31.03.2025) – Dr K.J. David

6. Taxonomy of Pentatomoidea (Hemiptera: Heteroptera) of India with special reference to Pentatomidae and Tessaratomidae (01.04.2020 to 31.03.2025) – Dr S. Salini

7. Taxonomy of Indian jumping spiders (Salticidae: Araneae) with reference to crop agroecosystem (01.04.2016 to 31.03.2026) – Dr M. Sampath Kumar

8. Taxonomic studies on Thysanoptera of India with special reference to Tubulifera (01.04.2024 to 31.03.2029) – Dr R.R. Rachana

9. Faunal composition and diversity of Trichogrammatidae (Chalcidoidea: Hymenoptera) in cultivated and natural habitats (16.05.2023 to 16.04.2028) – Dr Navik Om Prakash Samodhi

10. Taxonomy and diversity of Indian leafhoppers (Hemiptera: Cicadellidae) with special reference to subfamily Deltocephalinae from South India (01.04.2025 to 31.03.2029) – Dr Rajgopal, N.N.

## DIVISION OF GENOMIC RESOURCES

### II. Molecular characterisation, genomics and bioinformatics of agriculturally important insects, entomopathogenic nematodes and associated microorganisms

**1.** Molecular diagnostics of Agriculturally Important Insects through DNA Barcodes. (01.04.2020 to 31.03.2025) – Dr T. Venkatesan

**2.** Studies on the molecular and functional diversity of EPN-EPB-insect tritrophism and their utilization against soil pests (08.07.2016 to 31.07.2024) – Dr M. Nagesh

**3.** Genome analysis and gene knockout studies using genomic tools in selected insect species (16.05.2023 to 16.04.2027) – Dr M. Mohan

4. Geo Mapping of predominant insect pests and their natural enemies including invasive species in India (01.08.2022 to 31.03.2026) – Dr M. Pratheepa

5. Studies on black soldier fly and associated microorganisms for their utilization (01.04.2020 to 31.03.2025) – Dr Mahesh Yandigeri

6. Gene characterization, identification and validation of gene silencing approach against *Maconellicoccus hirsutus* and *Phenacoccus manihoti* (01.08.2022 to 31.03.2026) – Dr R. Gandhi Gracy

7. Molecular diversity of economically important mealybugs and their associated natural enemies in different ecosystems (01.08.2022 to 31.03.2026) – Dr B.S. Gotyal

8. CRISPR/Cas9 mediated gene editing in agriculturally important insect pests (01.04.2024 to 31.03.2029) – Dr Sagar, D

9. Molecular studies on the virulence of *Bacillus thuringiensis* a gainst fall armyworm and root grubs (01.04.2021 to 31.03.2026) – Dr C. Manjunatha

10. Development and molecular studies of improved strains of selected natural enemies for insecticide resistance (01.08.2022 to 31.03.2026) – Dr R.S. Ramya

11. Prospects of chitinolytic bacteria from shrimps waste for lepidopteran pest management (01.04.2024 to 31.03.2027) – Dr Manjunatha BS

## DIVISION OF GERMPLASM CONSERVATION AND UTILISATION

### III. Biodiversity conservation, behavioural studies and maintenance and utilization of arthropod germplasm

1. Exploiting the olfactory cues for management of key stored product pests (01.04.2019 to 31.03. 2024) – Dr K. Subaharan

2. Microbial volatilome for management of *Plutella xylostella* and *Phthroimaea (Tuta) absoluta* (01.04.2023 – 01.04.2028) – Dr K. Subaharan

3. Ecological studies on the establishment and management of invasive insects fall armyworm, *Spodoptera frugiperda* and cassava mealybug, *Phenacoccus manihoti* in India (01.10.2020 to 31.03.2024) – Dr A.N. Shylesha

4. Non-bee insect pollinators of important crops (01.04.2021 to 31.08.2024) – Dr T.M. Shivalingaswamy

5. Tailoring strategies to introduce acaropathogens and predatory mites for biological control in protected and open-field crops (01.08.2022 to 31.03.2027) – Dr P. Sreerama Kumar

6. Developing formulations of consortia of microbial biocontrol agents for the management of pests of crops of protected cultivation. (17.05.2023 to 17.04.2028) – Dr G. Sivakumar

7. Nanomaterials and their effects on natural pest-control agents including parasitoids, predators, and beneficial insects (17.05.2023 to 17.04.2028) – Dr Deepa Bhagat

8. Controlled release Pheromone Formulations for management of the Plassey borer, *Chilo tumidicostalis* Hampson. and the Gurdaspur borer, *Acigona steniellus* Hampson. (17.05.2023 to 17.04.2028) – Dr Deepa Bhagat

9. Collection, characterization and development of suitable formulation for entomopathogenic fungi and under exploited entomogeneous bacteria for the management of major lepidopteran and coleopteran pests (01.10.2020 to 31.03.2025) – Dr A. Kandan

10. Climate change effect on the diversity and bioecology of some important sucking pests (01.04.2014 to 31.03.2023) – Dr K. Selvaraj

11. Standard operating procedures for delivery of Bioagents using drones (01.04.2023 to 31.03.2026) – Dr K. Selvaraj

12. Mass culturing and utilisation of stingless bee *Tetragonula iridipennis* Smith (Hymenoptera: Apidae) for pollination of selected crops (01.10.2020 to 31.03.2024) – Dr U. Amala

13. Development of mass production protocols of selected insects of industrial importance (01.10.2020 to 31.03.2024) – Dr U. Amala

14. Development of colony establishment techniques for subterranean nesting solitary bees with special emphasis on subfamilies Anthophorinae and Nomiinae (01.04.2024 to 31.03.2029) – Dr U. Amala

15. Bio-ecology and management of thrips complex in horticultural crops (1.10. 2022 to 31.03.2027) - Dr Gundappa

16. Ecology and biosystematics studies on emerging lepidopteran insect pests and their associates natural enemies (01.04.2023 to 31.03.2028)- Dr Gundappa

17. Investigation on interactions between the entomopathogenic fungi and natural enemies (01.10.2020 to 31.03.2025) – Dr Richa Varshney

18. Ecological studies and exploration of biocontrol potential of egg-larval parasitoids *Chelonus blackburni* (Cameron) through olfactory condition (01.04.2024 to 31.03.2029) – Dr Prabhulinga, T.

## ITMU

### IV. Technologies developed and commercialised by the Bureau

1. ICAR under NAIF Component -1 : Strengthening of the institutional mechanism to protect / manage innovations / intellectual properties (IPs) generated at ICAR-NBAIR (01.04.2020 to 31.03.2025) – Dr Gandhi Gracy

## B. List of external funded projects

### DIVISION OF GERMPLASM COLLECTION AND CHARACTERISATION

1. ICAR–National Fellow: Biogeography and biosystematics of whitegrub fauna (coleopteran: Scarabaeidae) of various agroclimatic zones of India (28.10.2022 to 28.10.2027) – Dr K. Sreedevi

2. ICAR under CRP Agrobiodiversity: Insect Biodiversity (2021-2026) – Dr K. Sreedevi

3. DST–ANRF: Biodiversity and systematic studies on weevils (Curculionidae: Coleoptera) with special reference to Eastern Ghats of India (10.02.2022 to 09.02.2025) – Dr G. Mahendiran

4. DST–ANRF: Taxonomic studies on species complexes in selected parasitoids (Braconidae: Hymenoptera (10.02.2022 to 09.02.2025) – Dr Ankita Gupta

5. DST–ANRF: Community structure and dynamics of parasitoid wasps and their butterfly hosts in a complex ecological system (14.08.2023 to 13.08.2026) – Dr Ankita Gupta

6. DST–ANRF: Faunistic studies on bamboo-shoot fruit flies (Dipetera: Tephritidae) of western Ghats and Northeast India (14.08.2023 to 13.08.2026) – Dr K.J. David

7. Godrej Agrovet: To study the efficacy of fruit fly trap in attracting peach fruit fly, *Bacterocera zonata* (01.04.2023 to 31.03.2024) – Dr K.J. David

8. DST–ANRF: Taxonomy and diversity of Terebrantian thrips (Thysanoptera: Terebrantia) from south India with special reference to Western Ghats (10.02.2022 to 09.02.2025) – Dr R.R. Rachana

9. ICAR–DCR: Species complex of thrips infesting cashew, molecular characterization, and their management measures – Dr R.R. Rachana

### DIVISION OF GENOMIC RESOURCES

1. CABin Network: Genome Manipulation for the management of important agricultural insect pests (01.04.2020 to 31.03 2025) – Dr T. Venkatesan

2. All India Network Project (AINP) on Emerging Pests: Management of Desert locust *Schistocera gregaria* (14.11.2024 to 31.03.2026 )-Dr T. Venkatesan

3. Arthro Biotech: Evaluating the bio efficacy of Entomopathogenic Nematodes (EPN) produced using various insect larvae (04.10.2023 to 04.04.2024) – Dr M. Nagesh

4. ICAR under CRP Genomics mode: Insect Genomics - Whole genome and transcriptome sequencing (01.04.2020 to 31.03.2026) – Dr M. Mohan

5. ICAR-IARI: Enhancing climate resilience and ensuring food security with genome editing tools (01.04.2023 to 31.03.2026) – Dr M. Mohan

6. DCM Shriram: Generation of baseline susceptibility data for *Bacillus thuringiensis* Cry2Ai (201D) toxin against field collected populations of cotton pink bollworm, *Pectinophora gossypiella* (20.09.2023 to 20.08.2024) – Dr M. Mohan

7. Bioseed Research, Hyderabad: Toxicity and specific studies of *Bacillus thuringiensis* recombinant toxins (24.07.2024 to 23.01.2025) – Dr M. Mohan

8. Rasi Seeds, Salem: Baseline –sensitivity studies of cotton bollworms to a novel insecticidal protein (27.9.2024 to 27.9.2025) – Dr M. Mohan

9. AMAAS: Exploitation of endosymbionts of insect pests for pest management (01.04.2017 to 31.03.2026) – Dr Mahesh S. Yandigeri

10. ICAR–NNP (Agri-Genomic Repository and Intelligent Analytical System) of ICAR-Indian Agricultural Statistics Research Institute, New Delhi (23.01.2024 to 23.01.2029)– Dr Gandhi Gracy

11. Draslowka Services India: Laboratory bio-assay of newer fumigant molecular against storage insects (12.9.2023 to 31.03.2024) – Dr R. S. Ramya

12. ICAR–IISS: Integrated approaches for the management of pulse beetle, *Callosobruchus* spp (01.8.2022 to 31.03.2026) – Dr R.S. Ramya

## DIVISION OF GERMPLASM CONSERVATION AND UTILISATION

1. DBT: Controlled release of olfactory cues for management of lesser grain weevil, *Sitophilus oryzae* a stored product pest of rice (26.12.2023 to 26.12.2026) – Dr K. Subaharan

2. CSB: Profiling of lipid, protein and carbohydrate of mulberry mealybug *Maconellicoccus hirsutus* (Green) for its control (21.10.2023 to 31.03.2025) – Dr K. Subaharan

3. ICAR–NIBSM: Evaluation of nanoformulations of insect sex pheromones (01.7.2021 to 30.6.2026)-Dr. K. Subaharan

4. All India Network Project (AINP) on Emerging Pests (Non pesticidal approaches for the management of Fall armyworm, *Spodoptera frugiperda* and their adoption in containing the pest spread in India (14.11.2024 to 31.03.2026)-Dr K. Subaharan

5. ICAR-DWR: Introduction of the new bio-agent *Megamelus scutellaris* and evaluation of *Neochetina* spp. Dynamics in *Eichornia crassipes* management (12.7.2024 to 30.6.2026)- Dr. A.N. Shylesha

6. CSB–CSRTI: Development of an integrated management packages for the broad mite, *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae) in mulberry (03.11.2022 to 30.12.2024) – Dr P. Sreerama Kumar

7. AMAAS: Development of formulations of *Beauveria bassiana*, *Metarhizium anisopliae* and *Lecanicillium* spp. for the management of sucking pests in vegetable crops (01.04.2017 to 31.03.2026) – Dr A. Kandan

8. FAO: A collaborative research project for conducting training and demonstration for the farmers of microbial biopesticides for the management of Fall armyworm (03.04.2023 to 03.04.2024) – Dr A. Kandan

9. ICAR–DCR: Development of an eco-friendly and cost effective pest management strategy for cashew using plant and microbial-based pesticides –Dr A. Kandan

10. Microplex India, Wardha: Development of Nanogels for the slow release of Semiochemicals and encapsulation of Microbial Culture (24.06.2024 to 24.12.2024) –Dr Deepa Bhagat

11. Bioscience Research Foundation, Tamil Nadu: Post entry quarantine (PEQ) testing of exotic bioagents, against non-target organisms (2024-25)-Dr M. Sampathkumar

12. ICAR–ATARI: Drone Technology demonstrations (20.06.2022 to 31.03.2025) - Dr K. Selvaraj

13. CDB: Generation of toxicological data for registration of *Isaria fumosorosea* in CIBRC and demonstration of biocontrol agents for management of Invasive Whiteflies in Coconut (01.12.2023 to 31.03.2025) – Dr K. Selvaraj

14. DST–ANRF: Integrative taxonomic studies on species diversity of whiteflies (Hemiptera: Aleyrodidae) and their potential natural enemies (19.02.2024 to 19.02.2027)-Dr K. Selvaraj

15. DST–ANRF: Enhancing the pollination in fennel (*Foeniculum vulgare* Mill.) by syrphid fly, *Ischiodon scutellaris* Fabricius (10.02.2022 to 09.02.2025) – Dr U. Amala

16. DBT under Establishment of Biotech-KISAN Hub: Establishment of Biotech-KISAN Hub: Establishment of Organic Hub for supporting organic and alike farming through promotion of bio-inputs technologies in farmers' field of North East India (16.03.2022 to 16.02.2024) – Dr Richa Varshney

# 10. PUBLICATIONS

## Peer-reviewed articles


Aarthi N, Dubey VK, Shylesha AN, Kukreti A, Patil J, Chandrashekara KM, Channappa M. 2024. Insights into the whole genome sequence of *Bacillus thuringiensis* NBAIR BtPl, a strain toxic to the melon fruit fly, *Zeugodacus cucurbitae*. *Curr Genet.* 70(1): 13.

Aarthi N, Shylesha AN, Dubey VK, Aditya K, Kandan A, Rangeshwaran R, Manjunatha C. 2024. Screening of indigenous *Bacillus thuringiensis* for dipteran active cry gene profiles and potential toxicity against melon fruit fly, *Zeugodacus cucurbitae* (Coquillett). *Egypt J Biol Pest Control.* 34: 45.

Abhishek V, David KJ, Hancock DL, Pradeep S, Kalleswaraswamy CM, Sridhara S, Satish KM. 2024. New Indian species of *Dacus* Fabricius (Diptera: Tephritidae: Dacinae: Dacini) similar to *Dacus crabroniformis* (Bezzi), endemic to the Western Ghats and Northeast Himalayas. *Zootaxa.* 5446(3): 366−382.

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Amala U, Venu HS, Kandan A, Sampathkumar M, Arvind M, Shivalingaswamy TM. 2024. First report of *Trypoxylon clavicerum* (Crabronidae: Hymenoptera) from the Indian subcontinent: its nesting behaviour and prey preference. *Anim Biol.* 74(3):309–322.

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Anjitha G, David KJ, Kiran Kumar K, Behere GT. 2024. Species composition of frugivorous insects of citrus and attractant–repellent-based management of primary fruit piercer, *Eudocima materna*. *Curr Sci.* 126(2): 255−262.

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## 11. TECHNOLOGY, PRODUCTS AND PATENTS

### Technologies developed

- A simple, rapid, calorimetric technique for the species identification of invasive Cassava mealybug, *Phenacoccus manihoti* Matile-Ferrero.
- Coir dust based matrix for pheromone delivery.

### Technologies commercialized

- Liquid formulation of indigenous *Bacillus thuringiensis kurstaki* (Btk) isolates against lepidopteran pests.
- Controlled release dispenser for delivery of semiochemicals.
- Novel insecticidal WP formulations of *Heterorhabditis indica* for the biological control of white grubs and other soil insect pests.
- Multiple insecticide tolerant strain of egg parasitoid, *Trichogramma chilonis* for the management of Fall Army Worm, *Spodoptera frugiperda* (MITS-FAW).
- Adsorption and delivery of molecules using nanoporous materials' for use in effective management of Fall Armyworm, *Spodoptera frugiperda.*

**MOU exchange between ICAR-NBAIR, JNCASR and ATGC Biotech Limited**

**MOU exchange between ICAR-NBAIR and Arihant Bio Science (India) Pvt. Ltd., Gujarat**

**MOU exchange between ICAR-NBAIR, JNCASR and Krishi Vikas Sahakari Samiti Ltd., Haryana**

MOU exchange between ICAR-NBAIR and HIL (India) Ltd., New Delhi

Certificate from ICAR for ICAR-NBAIR technology during 96th ICAR Foundation day

Industry meeting held on 20 March 2024 at ICAR NABIR

**Number of licensees**

| S No | Name of Technology/ Know-How | Name of Contracting Party | Mode of Partnership | Date | Revenue Earned (₹ in Lakhs) |
|---|---|---|---|---|---|
| 1. | Liquid formulation of indigenous *Bacillus thuringiensis kurstaki* (Btk)isolates against lepidopteran pests | Tropical nano sciences Pvt. Ltd., Thondebhavi, Karnataka | MOU | 22-01-2024 | 2,00,000 |
| 2. | Controlled release dispenser for delivery of semiochemicals | ATGC, Biotech Private Limited, Hyderabad | MOU | 19-03-2024 | 5,00,000 |
| 3. | Novel insecticidal WP formulations of *Heterorhabditis indica* for the biological control of white grubs & other soil insect pests | Arihant Bio Science (India) Pvt. Ltd., Paras chokdi, Gujarat | MOU | 26-06-2024 | 2,00,000 |
| 4. | Multiple insecticide tolerant strain of egg parasitoid, *Trichogramma chilonis* for the management of Fall Army Worm, *Spodoptera frugiperda* (MITS-FAW) | Krishi Vikas Sahakari Samiti Limited, Gurugram, Haryana | MOU | 19-07-2024 | 2,00,000 |
| 5. | Adsorption and delivery of molecules using nanoporous materials' for use in effective management of Fall Army Worm, *Spodoptera frugiperda* | Krishi Vikas Sahakari Samiti Limited, Gurugram, Haryana | MOU | 19-07-2024 | 4,00,000 |
| 6. | Novel insecticidal WP formulations of *Heterorhabditis indica* for the biological control of white grubs & other soil insect pests | Coromandel International Ltd., Secunderabad, Telangana | MOU | 27-08-2024 | 2,00,000 |
| 7. | Liquid formulation of indigenous *Bacillus thuringiensis kurstaki* (Btk)isolates against lepidopteran pests | HIL (India)Limited, New Delhi | MOU | 31-12-2024 | 15,00,000 |

**Patents granted**

- Nanoemulsion composition for pest management (Grant No. 526935).
- A herbal based repellent for termites on woody trees (Grant No. 535555).

**Copyrights granted**

- Insect taxonomy website creation software tool (instax website tool) (Grant No. SW-18340/2024).
- Mobile application development - BIPM on FAW - NE (IND) (Grant No. SW-18358/2024).
- Database on "Vespidae of India" (Grant No. L-159029/2024).
- Database on "Terebrantian Thrips of India (Thysanoptera: Terebrantia)" (Grant No. L-158753/2024).

**ICAR-NBAIR Industry Interface Meet**

ICAR-NBAIR organised Industry Interface meet at Yelahanka campus on 19 October 2024 during 32nd Foundation Day & Biocontrol Expo 2024. Dr. Archana Sinha, Secretary, CIB&RC inaugurated the meeting and released the Technical bulletin on "ICAR-NBAIR Technology package for the management of Fall Army Worm". She briefed on the simplified guidelines for the registration of biopesticides at national level and also highlighted the concept of crop groups to make pesticides more effective in wider range of crops. An exhibition of the technologies/ products developed by the Bureau was also organized. After the inaugural session, one-to-one interaction between the technology innovators and private entrepreneurs was held. Around 20 private companies participated in the programme.

**List of Memorandum of Understanding (MOUs) signed**

| S. No. | Name of the Institute | Name of the Organisation with which the MoU has been signed, please Specify (Centre Govt./State Govt./ PSU/ NGO/Pvt.) | Duration | Area of Collaboration of MoU (only 2-3 lines) |
|---|---|---|---|---|
| 1. | ICAR-NBAIR, Bengaluru | a-IDEA, ICAR-NAARM, Hyderabad | 19 February 2024 to 18 February 2027 | MoU signed to boost the entrepreneurship development of the startups in the field of biological control |
| 2. | ICAR-NBAIR, Bengaluru | Dayananda Sagar Univ ersity (Deemed to be University), Bengaluru (University) | 25 March 2024 to 24 March 2027 | MoU signed for Students and Faculty exchange for the training, research/dissertation work of the students |
| 3. | ICAR-NBAIR, Bengaluru | Zoological Survey of India, Kolkata (Central Government Organisation) | 02 April 2024 to 01 April 2029 | To promote complementary research, training and extension cooperation between two institutions on Genetic resources with respect to Insects, Mites and Spiders and conserving biodiversity of the country. |
| 4. | ICAR-NBAIR, Bengaluru | Sri Padmavati Mahila Visvavidyalayam, Tirupati (University) | 24 May 2024 to 23 May 2027 | MoU signed for Students and Faculty exchange for the training, research/dissertation work of the students |

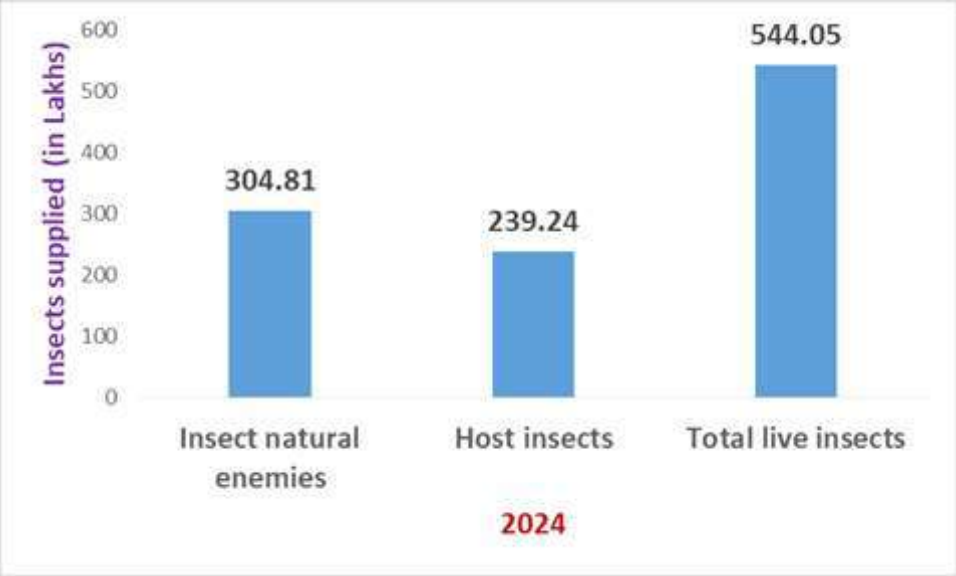
| | | | | |
|---|---|---|---|---|
| 1. | ICAR-NBAIR, Bengaluru | Microplex (India) Pvt Ltd, Wardha (Private Organisation) | 24 June 2024 to 23 December 2024 | MoU signed for contract Research project- Development of Nanogels for the Slow release of Semiochemicals and encapsulation of Microbial Culture |
| 2. | ICAR-NBAIR, Bengaluru | Shriram Bioseed Research India Pvt Ltd, Hyderabad (Private Organisation) | 24 July 2024 to 23 January 2025 | MoU signed for contract Research project –Toxicity and specificity studies of *Bacillus thuringiensis* recombinant toxins |
| 3. | ICAR-NBAIR, Bengaluru | Rasi Seeds Limited Pvt Ltd, Salem, Tamil Nadu (Private Organisation) | 25 October 2024 to 24 October 2025 | MoU signed for contract Research project-Baseline sensitivity studies of a novel Bt insecticidal protein to the field -collected populations of cotton bollworms |


**MoU exchange between ICAR-NBAIR and Zoological Survey of India, Kolkata**

**Revenue generated during 2024**

**The total revenue generated was ₹ 80,13,653 through following activities.**

| Details | Revenue generated (₹ in Lakhs) |
|---|---|
| Commercialisation of technologies | 30,00,000 |
| Sale of microbials | 20,23,260 |
| Sale of macrobials | 8,50,000 |
| Sale of farm produce | 4,27,913 |
| PG cell activities | 2,35,000 |
| HRD activities | 11,93,580 |
| Contract Research | 2,43,400 |
| Insect identification services | 40,500 |
| **Total** | **80,13,653/-** |




**ICAR-NBAIR Supply of Live insect cultures**

Total 544.05 Lakhs Insects (host insects: 239.24 lakhs and natural enemies: 304.81 lakhs) were supplied to different organizations. Total Rs. 8.50 lakhs revenue was generated through sale of insect cultures during 2024.

## 12. CONFERENCE PAPERS

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## 13. MEETINGS AND DECISIONS

### XXVIII Research Advisory Committee Meeting

The Director General, ICAR has reconstituted the Research Advisory Committee of ICAR-National Bureau of Agricultural Insect Resources, Bengaluru, vide letter No. F.NO.CS15/5/2007-IA.III (e 17141), dated 24th January 2023, as per the provisions contained under 71 A (a) of the Rules and Bye-laws of the ICAR.

| | | |
|---|---|---|
| Dr B.V. Patil (Chairman, RAC) | - | Former Vice Chancellor, University of Agricultural Sciences, Raichur |
| Dr S.C. Dubey (Member, RAC) | - | Assistant Director General (Plant Protection & Biosafety), Indian Council of Agricultural Research, New Delhi |
| Dr V.V. Ramamurthy (Member, RAC) | - | Former Principal Scientist, Division of Entomology, ICAR-Indian Agricultural Research Institute, New Delhi |
| Dr B. Sarath Babu (Member, RAC) | - | Former Head, ICAR-National Bureau of Plant Genetic Resources Regional Station, Hyderabad |
| Dr P.N. Sharma (Member, RAC) | - | Former Head, Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya (CSKHPKV), Palampur, Himachal Pradesh |
| Dr S. Desai (Member, RAC) | - | Former Principal Scientist & Head, ICAR-Central Research Institute for Dryland Agriculture; Dean, School of Agricultural Sciences and Technology, NMIMS, Shirpur |
| Dr A. Sundaresan (Member, RAC) | - | Professor & Chair, Chemistry and Physics of Material Unit, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCSAR), Jakkur, Bengaluru |
| Dr S.N. Sushil | - | Director, ICAR-National Bureau of Agricultural Insect Resources, Bengaluru |
| Dr M. Mohan (Member Secretary, RAC) | - | Principal Scientist & Officer In-charge PME Cell, ICAR-National Bureau of Agricultural Insect Resources, Bengaluru |

The XXVIII meeting of the Research Advisory Committee (RAC) of the National Bureau of Agricultural Insect Resources was held on 10 May 2024.

The following specific issues, emerging from the presentations and follow up discussions, were deliberated at length.

**Advisory to the Head of the Divisions**

1. To save taxonomists valuable time, useful automated identification techniques may be developed to allow insect identification (common species) by non-experts at the source of collection itself.
2. Promote the integration of molecular and classical taxonomy by developing molecular data for resolving the species complex. The barcode data should be reflected in molecular database of Indian Insects (MODII), ICAR-NBAIR.
3. Functional role of different gene families of the insects should be studied to identify the traits/genes which are actually involved in metabolic functions.
4. Research and validation should be undertaken on parameters like suitable pesticide formulations, time and height of application, droplet size/ drift, influence of weather parameters and on insect pests and effect on natural enemies etc. while using drones.
5. Under protected cultivation, basic research with emphasis on the effect of microclimatic conditions on the performance of bioagents including natural enemies should be evaluated.
6. NBAIR should felicitate large scale multiplication and supply of biopesticides and bioagents through training and demonstration to various stakeholders.
7. Intensified research should be undertaken on biological control of thrips, whiteflies and invasive insect pests.
8. The incidence and damage caused by *Thrips parvispinus* on chilli has come down in many places. The reason behind the decline may be analysed critically, with focus on natural enemies, if any.
9. Forecasting model should be refined to predict the spread of apple leaf blotch miner to new areas by taking into consideration the pest life table, agroecologies, and climate change aspects.

**Recommendations**

1. NBAIR should further transform into "National Insect Taxonomy Hub" considering the available expertise. At ICAR level, necessary support should be extended for the same along with a world class insect museum to enhance the Institute's global visibility. The blue print of new museum along with proposal on taxonomy hub should be prepared and submitted to ADG (PP&B) for funding.
2. The work on taxonomic aspects should be tagged with ecological functions which will add value to the taxonomy work and hence will attract more funding.
3. Research on development of quick molecular diagnostics using species-specific markers should be intensified to cater to all stakeholders including the quarantine officials. A flagship programme may be proposed on this line for funding under ICAR Corpus fund or by any other agency.
4. Research on insects and the gut flora which are capable of digesting/degrading polyethylene-containing materials may be undertaken.
5. Synergism / compatibility between entomopathogenic fungi and bacteria should be studied in detail using the NBAIR's culture collections before making any effective microbial consortia.
6. Pheromone formulations available in the market though effective, are costly. Hence cost-effective slow-release pheromone formulations may be developed and commercialised for the benefit of the farmers.
7. Area wide pest management involving the technologies developed by NBAIR may be demonstrated for better visibility of the Bureau in different agro climatic / cropping situations. After confirmation of the reversal of insecticide resistance, ADHOC recommendations may be suggested to the extension agencies for the benefit of farmers.
8. Since NBAIR is one of the constituent colleges of IARI, the vision and mandate should be revisited and required infrastructure facilities for students may be created. Further expansion of Hebbal campus and utilising the facilities from the nearby veterinary college campus may also be explored. Proper logistics to be provided to the PG students and scientists of the Institute for efficient teaching and research programmes.


**XXVIII Meeting of the Research Advisory Committee at ICAR–NBAIR Bengaluru**

### XLVIII Institute Research Council Meeting

The XLVIII Institute Research Council Meeting of the ICAR-NBAIR, Bengaluru, was held on 20–22 May 2024 under the Chairmanship of Dr S.N. Sushil, Director, ICAR–National Bureau of Agricultural Insect Resources, Bengaluru.

### General Comments to the Divisions

### I. Division of Germplasm Collection and Characterization

- New reports may be mapped with crops whether it is a major or minor pest.
- Geographical reach/maps may be created for the identification services provided to various stakeholders over the last five years.
- A training program may be conducted for all quarantine officials to identify recently intercepted insects.
- NIM accession may be given to all specimens that are with the respective scientists, especially Mites and EPNs.
- A request letter may be sent to Drs Prashant Mohanraj and Veena for submission of type specimens with NIM.
- Intercepted insects may be maintained separately as a quarantine pest section in the Museum repository.

## II. Division of Genomic Resources

- Organize a brainstorming session on "Insect Genomics and its prospects in pest management"
- In the long term, scientists working on "Insect Genomics" works should be substantiated with the commercialisation of technology.
- A letter may be drafted for framing guidelines for DsRNA based technologies to CIBRC, an ex-officio member of GEAC
- Non-destructive method of DNA extraction may be attempted and tried for the type species

## III. Division of Germplasm Conservation and Utilization

- Prepare a document highlighting crop-specific issues and available solutions from ICAR-NBAIR.
- Newly described insect species from the Bureau may be studied for their use in ecological services.
- Extensive studies may be done on economically important pests like yellow stem borer, *Leptocorisa*, leaf folders etc.
- Management of *Drosicha mangiferae* with microbials (native isolate) may be explored.


**XLVIII Institute Research Council Meeting at ICAR-NBAIR, Bengaluru, 20–22 May 2024**

**Dr Himanshu Pathak, Secretary, Department of Agricultural Research and Education (DARE) & Director General, ICAR inaugurated laboratories at ICAR-NBAIR, Bengaluru.**

Honorable Secretary, DARE and Director General, ICAR, Dr Himanshu Pathak visited ICAR-National Bureau of Agricultural Insect Resources on 19 April 2024. During his visit, he inaugurated newly developed research facilities at ICAR-NBAIR, Hebbal campus.

Dr Pathak inaugurated the renovated India's largest 'Live Insects Repository' housing 137 live species/strains of insects and 8 laboratories viz., Helix Lab, Epi-genetics Lab, Uracil Lab, CRISPER Lab, Scarabaeid Molecular Lab, Insect Bacteriology lab, *Phera sense* Nanotech Lab and Chemical Synthesis lab. "An overview of ICAR-NBAIR's activities and achievements" presented by Dr S.N. Sushil, Director, ICAR-NBAIR was appreciated by the DG, ICAR. During the programme, Dr Pathak, DG, ICAR released databases on "Terebrantian thrips of India" and "National Insect Museum Type QR Codes" and a technical bulletin titled "Predominant white grub species of India-Diagnostics and QR codes. He inaugurated the website of 2nd International Conference on Biological Control (2icbc2025) to be held in Bengaluru during February 12-15, 2025. During DG's interaction with the staff of ICAR-NBAIR, he appraised and briefed the various initiatives and directives of ICAR. The meeting was also attended by Directors of ICAR institutes and In-charge of regional stations based at Bengaluru. Dr. Kolla Sreedevi, ICAR National Fellow and I/c PME, ICAR-NBAIR presented vote of thanks and thanked profusely Dr Himanshu Pathak, DG, ICAR for his visit and inspirational guidance, support, suggestions and directions.

**Inuaguration of renovated India's largest Live Insect Repository by Honourable DG, ICAR, Dr. Himanshu Pathak**

**Inauguration of renovated laboratories**

Visit to the Laboratories and National Insect Museum

Dr Himanshu Pathak, Secretary, DARE & DG, ICAR interacting with the staff of ICAR–NBAIR

DR T.R.Sharma, Deputy Director General (Crop Sciences) visited Pollinator Ecology Laboratory

Dr T.R.Sharma, Deputy Director General (Crop Sciences) visited AI &IoT laboratory

## ICAR–NBAIR celebrated World Environment Day

ICAR–National Bureau of Agricultural Insect Resources (NBAIR), Bengaluru, celebrated World Environment Day on June 5, 2024, at its Yelahanka campus. Dr. S.N. Sushil, Director of ICAR–NBAIR, emphasized the significance of maintaining a healthy ecosystem for the well-being of humankind. The chief guest, Dr. V. Venkatasubramanian, Director of ICAR–Agricultural Technology Application Research Institute, Bengaluru, highlighted the vital role of trees in sustaining the environment by providing habitats for birds, insects, and various life forms. As part of the celebration, twenty different plant species, including *Allamanda, Tecoma, Butterfly Bush, Ocimum sanctum, Ixora* sp., and *Nerium*, were planted in the butterfly garden at the ICAR–NBAIR Yelahanka campus.



**ICAR–NBAIR organised One day National Brainstorming session on "Insect Genomics and its Prospects in Pest Management"**

ICAR–National Bureau of Agricultural Insect Resources, Bengaluru organized one day National Brainstorming session on "Insect Genomics and its Prospects in Pest Management" on 23 August 2024. The session was inaugurated and chaired by Dr Rakesh Mishra, Director, Tata Institute for Genetics and Society (TIGS), Bengaluru, and co-chaired by Dr L. S. Shashidhara, Director, National Centre for Biological Sciences (NCBS), Bengaluru, along with Dr S.N. Sushil, Director, ICAR–NBAIR, Bengaluru. Dr Sushil welcomed all the delegates, briefed about the major achievements of NBAIR, and reiterated the commitment of the Bureau towards harnessing the potential of the insects for sustainable agriculture. Dr Rakesh Mishra emphasized the importance of exploring innovative molecular techniques to develop ecofriendly pest management strategies to reduce the ill effects of chemical pesticides. He also insisted on the importance of developing regulatory guidelines for the molecular derived technologies. Dr L. S. Shashidhara stressed upon the significance of dsRNA sprayable formulations and gene-drive technologies for pest management. Dr T. Venkatesan, Head of Division, Division of Genomic Resources presented an overview and status of genomic research at ICAR–NBAIR and prevailing guidelines in India and across the globe. Prominent expert panellists included Dr Y.G. Prasad, Director, ICAR–Central Institute for Cotton Research (CICR), Nagpur, Dr C. Vishwanathan, Joint Director (Research), ICAR–Indian Agricultural Research Institute (IARI), New Delhi, Dr R.C. Bhattacharya, Director, ICAR–National Institute of Plant Biotechnology (NIPB), New Delhi, Dr Vibha Ahuja, Chief General Manager, Biotech Consortium India Limited and Dr D.K. Nagaraju, Joint Director (Entomology), Regional Plant Quarantine Station, Bengaluru. The discussions focused on the utilization of genomic techniques like RNAi and CRISPR on various insect species, challenges in insect molecular research, guidelines for dsRNA sprayable formulations, and existing guidelines on insect genome editing for developing novel cutting-edge technologies in pest management. The session concluded with recommendations for sharing insect genomic data through collaborative platforms, addressing ethical and regulatory issues, and formulating policies for future action plans. The session brought together around fifty participants and twenty expert panelists from various research institutes across the country along with the scientists and students.

**National Brainstorming session on "Insect Genomics and its Prospects in Pest Management**

## ICAR–NBAIR organised 'Ek Ped Ma ke Naam' programme

ICAR–National Bureau of Agricultural Insect Resources (NBAIR), Bengaluru organised "Ek Ped Ma ke Naam" programme on 29 August 2024, at Hebbal and Yelahanka campuses in line with the tree planting drive taken up by Ministry of Agriculture & Farmers Welfare where the Honourable Minister of Agriculture and Farmers Welfare has planted the sapling at ICAR–Indian Agricultural Research Institute campus as part of the Global Campaign "EK Ped Maa Ke Naam" "Plant 4 Mother", which was launched on the World Environment Day 2024 by the Honourable Prime Minister of India. Dr S.N. Sushil, Director, ICAR–NBAIR Bengaluru, inaugurated the program by planting a Champaka sapling at Yelahanka campus. Around 100 different tree saplings, that includes Champaka, Fig, Pongamia, Cassia, Coconut, and Tabebuia, were planted at ICAR–NBAIR, Bengaluru. The staff of NBAIR including scientists, technical, administration, finance, students, scholars, supporting and farm workers participated in the tree planting drive.

**Tree plantation programme at ICAR-NBAIR Yelahanka campus**

## ICAR–NBAIR Celebrated 32nd Foundation Day & Biocontrol Expo 2024

ICAR–National Bureau of Agricultural Insect Resources (NBAIR), Bengaluru, the nodal agency for biological control research at the National level, organised Biocontrol Expo 2024, second year in continuous and celebrated its 32nd Foundation Day on October 19, 2024 at ICAR–NBAIR, Yelahanka campus, Bengaluru. Dr Ashok Dalwai, IAS, Former Chief Executive officer, National Rainfed Area Authority, Government of India, graced the function as Chief Guest. Dr S.N. Sushil, Director, ICAR-NBAIR convened the programme in the gracious presence of dignitaries from ASRB, and industry partners including, Dr Major Singh, Member, Agricultural Scientist Recruitment Board (ASRB), New Delhi, Dr Archana Sinha, Secretary, Central Insecticides Board & Registration Committee, Government of India, Dr Dnyaneshwar Waghchoure, President, AMMA association and Dr K. Subaharan, Organising Secretary & Head, Germplasm Conservation and Utilization (GCU), ICAR–NBAIR, Bengaluru. The chief guest and the guest of honours inaugurated the Biocontrol Expo 2024. Dr S.N. Sushil, Director presented achievements and cutting-edge research of the Bureau. Dr Ashok Dalwai in his chief guest address emphasized the importance of climate change research and development of climate-resilient biocontrol agents for farmer's need. Dr Major Singh in his remark stressed about the intensive research on virus-vector relationship and lauded the work of the Bureau. Dr Archana Sinha in her remarks, spoke about the simplified guidelines for the registration of biopesticides at the National level. She also highlighted the concept of crop grouping to make pesticides more effective in a wider range of crops. The chief guest and the guest of honours felicitated the progressive farmers and distributed agricultural inputs. The Expo recorded a footfall of 1000 personnel comprising farmers, students, stakeholders and the general public, with over 35 stalls showcasing their products and technologies. Besides, 250 school students participated in the Biocontrol Expo-2024. On this auspicious occasion, "Ek Ped Ma ke Naam campaign drive" was undertaken. Dr K. Subaharan, Organizing Secretary & Head, GCU conveyed his vote of thanks to all dignitaries, farmers and staff.


**Foundation day and Biocontrol Expo 2024 organized at ICAR NBAIR Yelahanka campus**

## ICAR–NBAIR organised Swachhta Hi Sewa programme

ICAR–National Bureau of Agricultural Insect Resources (NBAIR), Bengaluru, organized a series of events from September 17 to October 1, 2024, as part of the Swachhta Hi Sewa program.

A Preventive Health Check-up was conducted for sanitation workers and their families to promote their well-being. The Bureau also launched the 'Ek Ped Maa Ke Naam' Plantation Drive and a Social Media Campaign to raise awareness about the Swachhta initiative.

As part of its Engagement with School Children, NBAIR organized a Swachhta Quiz Competition and Swachhta Ki Pathshaala at the University of Agricultural Sciences Campus School in Bengaluru. Additionally, initiatives were undertaken to improve access to healthcare services for sanitation workers and their dependents, ensuring a better quality of life. Personal Protective Equipment (PPE) kits and safety gear were distributed to safeguard them from occupational hazards.

'Swachhata Samvad', a dialogue and discussion platform, was held to encourage community participation in cleanliness initiatives. The Bureau also promoted 'Waste to Art' activities, transforming discarded materials into creative pieces, such as using dried tree branches for artwork, crafting flowers from silkworm cocoons, repurposing plastic into tree leaves, and utilizing waste fish nets for thematic signboards.

A 'Safai Mitra Samman: Waste to Wealth' Workshop was conducted to educate sanitation workers on cleanliness and waste management within office premises. On 'Swachhta Bharat Diwas', local sanitation workers were honored for their contributions to the Swachh Bharat Mission, and welfare benefits were distributed to Safai Mitras. Additionally, efforts were made to link sanitation workers and their families to various social welfare schemes.

The event concluded with a Human Chain Formation, symbolizing the mission to Reduce, Reuse, and Recycle, aligning with Mission LiFE (Lifestyle for Environment) and reinforcing the commitment to sustainable environmental practices.


**Activities organised at ICAR-NBAIR for Swachhta Hi Sewa programme**

## ICAR–NBAIR organized Pest Management Decision Guide (PMDG) Workshop for South-East Asian Thrips

ICAR–National Bureau of Agricultural Insect Resources (NBAIR), Bengaluru and Centre for Agriculture and Bioscience International (CABI) jointly organized Pest Management Decision Guide (PMDG) Workshop for South-East Asian Thrips at ICAR–NBAIR, Bengaluru in hybrid mode. Around 40 officials from various organizations participated in the workshop.


**Pest Management Decision Guide (PMDG) Workshop for South-East Asian Thrips**

## Deputy Director General (Crop Sciences), Indian Council of Agricultural Research (ICAR), New Delhi inaugurated Laboratories at ICAR-NBAIR Bengaluru

Dr. T.R. Sharma, Deputy Director General (Crop Sciences), Indian Council of Agricultural Research (ICAR), New Delhi, inaugurated the biopesticide production unit at the Hebbal campus and the butterfly garden at the Yelahanka campus on November 19, 2024, in the presence of Dr. Poonam Jasrotia, Assistant Director Genera (Plant Protection and Biosafety), ICAR, and Dr. S.N. Sushil, Director, ICAR–NBAIR, Bengaluru. He also laid the foundation stone for the vertical extension of laboratories at the Yelahanka campus.

Dr. T.R. Sharma commended ICAR–NBAIR for its contributions to biodiversity conservation and emphasized the critical role of pollinators in agriculture. He highlighted that butterflies serve as environmental indicators and play a crucial role in pollination, directly impacting crop productivity and ecosystem health. He also noted that the butterfly garden not only serves as a recreational and educational space but also aligns with ICAR's commitment to integrating science with nature.

Dr. Poonam Jasrotia stressed the urgent need to protect pollinators, given the increasing environmental challenges. In his remarks, Dr. S.N. Sushil stated that the newly established facility would serve as a research platform to study pollinator biology, behavior, and ecology. Additionally, it will function as an outreach tool to educate students, farmers, and the community on the importance of pollinator conservation. The garden features a diverse range of host plants, providing a supportive environment for the feeding and survival of various butterfly species.

This initiative underscores ICAR–NBAIR's commitment to addressing the challenges posed by declining pollinator populations and highlights the organization's proactive efforts in promoting environmental sustainability and ecological balance.


**Dr T.R. Sharma inaugurated Butterfly Garden and Biopesticide production unit and foundation stone laying ceremony for laboratories at ICAR–NBAIR**

## ICAR-NBAIR organised 'Vigilance Awareness Week'

ICAR–National Bureau of Agricultural Insect Resources (NBAIR), Bengaluru, observed Vigilance Awareness Week from October 28 to November 3, 2024, under the theme "Culture of Integrity for Nation's Prosperity." The Bureau's staff took the Integrity Pledge in the presence of Dr. S.N. Sushil, Director, ICAR–NBAIR, Bengaluru, and Dr. T. Venkatesan, Head of Division & Vigilance Officer.

As part of the observance, various competitions, including essay writing and elocution, were organized to promote awareness and engagement. The event featured Mr. Sathish Jha, Additional Superintendent of Police, Anti-Corruption Branch, Central Bureau of Investigation, Bengaluru, as the Chief Guest. He delivered an insightful talk on vigilance and anti-corruption measures, sharing his experiences and emphasizing the importance of integrity in fostering national prosperity.


**ICAR–NBAIR organised Vigilance Awareness Week**

## ICAR-NBAIR organised 'Kannada Rajyotsava'

ICAR–National Bureau of Agricultural Insect Resources (NBAIR), Bengaluru celebrated Kannada Rajyotsava on 18 November 2024 at Yelahanka campus. Karnataka flag was unfurled by the Dr. S.N. Sushil, Director, ICAR-NBAIR Bengaluru in the presence of the staff of the Bureau. Chief guest M.S. Narasimhamurthy emphasized the cultural importance of the festival and the unification history of the Karnataka state. Several cultural events like ramp walks, songs and dances were organized.

**ICAR–NBAIR celebrated Kannada Rajyotsava**

**ICAR–NBAIR organised Brainstorming session on "Soil Arthropods: As treasures for soil health"**

ICAR–National Bureau of Agricultural Insect Resources, Bengaluru organised Brainstorming session on "Soil Arthropods: As treasures for soil health" to commemorate World Soil Day on 5 December 2024. The challenges in the identification and biodiversity of soil arthropods were discussed. The concepts of ecological engineering to boost the ecosystem services offered by soil arthropods were deliberated. The possible exploration of soil arthropods for the mitigation of soil microplastic content was discussed. All Scientists and technical staff are requested to attend the same.

**ICAR–NBAIR organised Brainstorming session on "Soil Arthropods: As treasures for soil health"**

**ICAR–NBAIR organised Kisan Diwas**

ICAR–National Bureau of Agricultural Insect Resources (NBAIR), Bengaluru, enthusiastically celebrated Kisan Diwas on 23 Decembe 2024. The event saw the participation of 100 farmers, with 50 each from Kolar and Hassan Krishi Vigyan Kendras (KVKs).

The event was inaugurated by Shri N.S. Govindaraju, IAS, Controller, HSFC, ISRO Bengaluru, who served as the Chief Guest. In his address, he underscored the significance of Farmers' Day and emphasized the role of bio-control technologies in effectively and sustainably managing insect pests and diseases.

Dr. T. Venkatesan, In-charge Director, ICAR–NBAIR, Bengaluru, provided an overview of the institute's key achievements in biological control of insect pests. During the technical session, Dr. Kesavan Subaharan, Head of the Division of Germplasm Conservation and Utilization, Dr. Sunil Joshi, Head of the Division of Germplasm Collection and Characterization, and other NBAIR scientists educated farmers on the application of bio-control agents, slow-release pheromone formulations, and bio-pesticides for environmentally friendly pest management.

Dr. C. Manjunatha, Scientist, facilitated the participation of 100 SCSP farmers from the two KVKs and coordinated the distribution of bio-inputs. As part of the SCSP plan, the Chief Guest distributed bio-control agents, pheromone traps with lures, and other essential agricultural inputs, including battery-operated sprayers, to the farmers.

Additionally, Dr. B.S. Gotyal, Senior Scientist, conducted a workshop on the theme "Swachh Bharat: Bio-control Agents", where he highlighted the importance of the Swachh Bharat Abhiyan and its alignment with sustainable agricultural practices.

The Kisan Diwas celebration served as a valuable platform for farmers and scientists to collaborate and exchange knowledge, fostering awareness and promoting eco-friendly and sustainable pest management solutions.

**Distribution of inputs to farmers on Kisan Diwas**

**ICAR- National Bureau of Agricultural Insect Resources, Bengaluru organized a Hindi Workshop for the officers of all ICAR Institutes/ Regional Centers located at Bengaluru**

In compliance with the Official Language Policy of the Government of India, at ICAR-National Bureau of Agricultural Insect Resources, Bengaluru, a one-day Hindi workshop was organized on 10 January 2024 for the officers handling the work of Official Language of all ICAR institutes/regional centers located in Bengaluru, with the objective of making the employees/officers in government offices aware of the provisions, rules, acts and guidelines issued from time to time by the Department of Official Language, Ministry of Home Affairs, and the indigenous translation tool "Kanthastha-2.0" and for its maximum use in offices.

The "One Day Hindi Workshop for Official Language Officers of all ICAR Institutes/Regional Centres located in Bengaluru" was inaugurated by lighting of the lamp by Dr. T. Venkatesan, Director-in-Charge of the Bureau and Head of the Department, Genomic Resources; Dr. Sunil Joshi, Head of the Department, Germplasm Collection and Conservation; Shri Anirban Kumar Biswas, Deputy Director (Official Language Implementation), Regional Official Language Implementation Office (South), Department of Official Language, Ministry of Home Affairs, Government of India; Dr. Dheeraj Kumar Mishra, Deputy Director (Official Language), Coffee Board, Ministry of Commerce and Industry, Bengaluru; Shri Y. Subrahmanyam, Senior Translation Officer, Office of the Principal Chief Commissioner of Central Tax, Bengaluru and Shri J. Mathew, Administrative Officer of the Bureau.

In this workshop, as faculty members, Shri Anirban Kumar Biswas, Dr. Dheeraj Kumar Mishra and Shri Y. Subrahmanyam, in compliance with the Official Language Policy of the Government of India, gave detailed information to the participants present in the workshop about the provisions, rules, acts and guidelines issued by the Department of Official Language, Ministry of Home Affairs and the indigenous translation tool "Kanthastha-2.0" related to the official language to the employees/officers in government offices.

The workshop was attended by Dr. Anjumani Mech, Principal Scientist and Mrs. J. V. Jyothi, Assistant from ICAR-National Institute of Animal Nutrition and Physiology; Mrs. Pooja Kumari, Assistant Administrative Officer from ICAR-Indian Institute of Horticultural Research; Ms. Jesna P. K., Scientist from ICAR-Central Inland Fisheries Research Institute, Bengaluru Centre; Dr. Chandramohan S., Scientist and Mr. Amol Magre, Technical Assistant from ICAR-Indian Veterinary Research Institute, Bengaluru Centre; Mr. Awadhesh Prajapati, Senior Technical Officer and Ms. Achal Palewar, Assistant Administrative Officer from ICAR-National Institute of Veterinary Epidemiology and Disease Informatics; Dr. Bhojraj Nayak, Scientist and Dr. Anjitha George, Scientist from ICAR-Indian Institute of Seed Science, Bengaluru Centre; Dr. Ranbir Chakraborty, Senior Technical Officer and Mr. Pankaj Gopal Vani, Junior Clerk from ICAR-National Bureau of Soil Survey and Land Use Planning, Bengaluru Centre and Dr. M. Pratheepa, Principal Scientist, Dr. R. R. Rachana, Scientist, Mrs. Nazia Anjum, Assistant, Mrs. M. S. Uma, Private Secretary and Mrs. Anitha P., Senior Clerk from ICAR-National Bureau of Agricultural Insect Resources were participated in the Hindi workshop.

In presidential address, the Director of the Bureau, Dr. S.N. Sushil said that today is also the 50th anniversary of "World Hindi Day" and on this auspicious occasion, it is our pride to organize the Workshop for the officials associated with the Official Language of ICAR Institutes situated in Bangalore. This will lead to encourage and implement of the Official Language in their respective institutes.

Thereafter certificates were distributed to the participants by the Director of the Bureau, Dr. S. N. Sushil and Deputy Director Regional Official Language Implementation Office (South), Shri Anirban Kumar Biswas.

**ICAR- National Bureau of Agricultural Insect Resources, Bengaluru organized a Hindi Workshop**

## 14. PARTICIPATION OF SCIENTISTS IN MEETINGS

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| Dr S.N. Sushil | International Conference on Plant Protection, Kathmandu, Nepal, 26–27 April 2024<br><br>International Sugar Conference & Sugarcon 2024, Quy Nhon, Vietnam, 16–19 September 2024 |
| Dr T. Venkatesan | Third International Congress of Biological Control, San Jose, Costa Rica, 23–27 June 2024 |
| Dr P Sreeramakumar | International Congress on Invertebrate Pathology and Microbial Control and the 56th Annual Meeting of the Society for Invertebrate Pathology (SIP 2024), Campus Gusshaus, Technical University of Vienna, Vienna, Austria, 28 July to 01 August 2024 |
| Dr K. Subaharan | Entomology 2024 organised by Entomology Society of America, Phoenix, United States of America, 10–14 November 2024 |

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| Dr S.N. Sushil<br>Dr K. Sreedevi<br>Dr N.N. Rajagopal | Farmers meeting to distribute inputs under Tribal Sub Plan (TSP) scheme, Krishi Vigyan Kendra, Chintamani, 14 March 2024 |
| Dr S.N. Sushil<br>Dr B.S. Manjunath | Farmers meeting to distribute inputs under SCSP scheme, Krishi Vigyan Kendra, Kolar, 16 March 2024 |
| Dr S.N. Sushil | Science & Engineering Research Board (SERB), GOI sponsored National Workshop on "Taxonomy of Indian Scarabaeidae: Diversity and life strategies of white grubs" held at GKVK, University of Agricultural Science, Bengaluru, Karnataka, 12 March 2024.<br><br>Research Advisory Committee meeting of Zoological Survey of India, Kolkata held at Panchmarhi, Madhya Pradesh, 11 April 2024<br><br>National Conference on Expanding the horizons of microbial research in Agriculture, ICAR–National Bureau of Agriculturally Important Microorganisms, Mau, 10–11 June 2024<br><br>33rd Annual Group Meeting of All India Co-ordinated Research Project on Biological Control of Insect Pest, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Solan, 13–14 June 2024<br><br>3rd Dr V.G. Prasad Memorial Lecture on "Recent Threats of Invasive and migratory Insect Pests to Indian Agriculture: Challenges & Way forward " organised by Association for Advancement of Pest Management in Horticultural Ecosystems (AAPMHE) at ICAR–Indian Institute of Horticultural Research, Bengaluru, 29 July 2024 |

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| | Zonal Workshop of ATARI Zone -XI in which all the Krishi Vigyan Kendra (KVKs) of Karnataka, Kerala and Lak shadweep at ICAR-Indian Institute of Spices Research, Kozhikode, Kerala, 3–4 September 2024<br><br>Karnataka State Agriculture Summit, Taj West End, Bengaluru, 26 September 2024 |
| Dr T. Venkatesan | XXX Annual General Body Meeting of National Academy of Agricultural Sciences, New Delhi, 6 January 2024<br><br>Regional Committee Meeting (Zone VIII) convened by Director General, Indian Council of Agricultural Research, National Institute of Ocean Technology, Chennai, 16 February 2024<br><br>Vice Chancellor and Directors Meeting convened by Director General, Indian Council of Agricultural Research, NASC Complex, New Delhi,26–27 February 2024<br><br>Meeting on Ecoregional Working Group Programme, 12 April 2024<br><br>46th Research Advisory Committee meeting of Central Sericultural Germplasm Resources Centre (CSGRC), Hosur, 03 June 2024<br>Stakeholder Consultation Meet on the theme "Transforming Agriculture Research (TAR) – Enhancing role of Private Sector" organised by Ministry of Agriculture and Farmers Welfare in association with concerned Department, 03 September 2024<br><br>Expert review meeting on Strategic area "Biotechnology, genomics and allele mining in plants, animals and fisheries" under the National Agricultural Science Fund project "Identification and validation of newer approaches for the management of whitefly *Bemisia tabaci* (Hemiptera: Aleyrodidae), 25 October 2024<br><br>XXVIII Virtual Meeting of Regional Committee No. I at ICAR –Central Potato Research Institute, Shimla (online), Indian Council of Agricultural Research, New Delhi, 22 November 2024 |
| Dr K. Subaharan | Served as an expert member for Entomology program of 83rd Institute Research Committee Meeting of ICAR-DGR held 13thMay, 2024.<br><br>Served as an expert member for Entomology program of the Institute Research Committee Meeting of ICAR-Indian Institute of Pulses Research held on 23 May, 2024. |

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| | Served as a Co-Chairman for a session on 'Biological Suppression of pests of Pulses and Oilseeds' in XXXIII Annual Group meeting of AICRP on Biological Control of Pest and Diseases, Dr Y.S. Parmer University of Horticulture and Forestry at Solan, Himachal Pradesh, 13–14 June 2024<br><br>Served as DG nominee in Career Advancement Scheme of Entomology Scientist at ICAR–Central Plantation Crops Research Institute, Kasaragod, 21 June 2024<br><br>Project Review and Monitoring Committee Meeting (PRMC) of BeSt Cluster by the Office of Principal Scientific Advisor to Government of India, Indian Institute of Sciences, Bengaluru, 26 June 2024<br><br>Invited to participate in Innovation Development Centre, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) and Hemavathi Hostel CeNS at Shivanapura by Prof. Abhay Karandikar, Department of Science and Technology, Secretary, Government of India in the presence of Bharat Ratna Prof. CNR Rao, 08 July 2024<br><br>Round table discussion on Translational Research chaired by Dr Manoranjan Mohanty, Head of the Autonomous Institution Division, Department of Science and Technology, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), 08 July 2024<br><br>Served as an expert member for Entomology program of Institute Research Committee Meeting of ICAR-Indian Institute of Horticultural Research held on 09 July, 2024.<br><br>Expert review meeting on Strategic area "Biotechnology, genomics and allele mining in plants, animals and fisheries" under the National Agricultural Science Fund project "Identification and validation of newer approaches for the management of whitefly *Bemisia tabaci* (Hemiptera: Aleyrodidae), 25 October 2024 |
| Dr G. Sivakumar | Ninth Asian PGPR India Chapter National Conference on"The Beneficial Microbes as Integrated Approach for Sustainable Agriculture: Opportunities and Challenges, Bharathiar University, Coimbatore, 29–30 July 2024<br><br>International Conference on "Fungal Applications in Agriculture, Industry and Biomedical Process" Madurai Kamaraj University, Madurai, Tamil Nadu, 25 October 2024 |

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| | International Conference on "Unleashing the Power of Seed and Crop Health Innovations for a Food Secure World" (ICUCF 2024), Tamil Nadu Agricultural University, Coimbatore, 21–22 November 2024 |
| Dr P Sreeramakumar | National Conference on Current Scenario in Biological Sciences (CSBS - 2024) organised by PG Research Department of Zoology, Poompuhar College (Autonomous), Melaiyur, Tamil Nadu, in association with Asian Society of Aquaculture Academics and supported by Tamil Nadu State Council for Science and Technology, 09–10 December 2024<br><br>National Conference on Plant Health for Food Security: Threats and Promises, Indian Phytopathological Society, New Delhi, and ICAR–Indian Institute of Sugarcane Research, Lucknow, Lucknow,01–03 February 2024 |
| Dr M. Mohan | Eighth Annual Review Workshop ICAR –Consortium Research Platform on Genomics, NASC complex, New Delhi, 18 September 2024 |
| Dr K. Sreedevi | Biodiversity SSD 20 Technical Committee Meeting (virtual) conducted by Service Section Committee, Bureau of Indian Standards, New Delhi, 23 April 2024 |
| Dr Deepa Bhagat | SAMAVESHA Event: Uniting Minds and Igniting Innovation event, I - STEM, Indian Institute of Sciences, Bengaluru, 16 January 2024<br><br>Global Chemicals Regulatory Outlook 2024, 29 February 2024<br><br>Pedagogy Training, ICAR –Indian Agricultural Research Institute, New Delhi, 01–05 April 2024<br><br>Bengaluru India Nano 2024, Hotel Lalit Ashok, Bengaluru, 01–03 August 2024<br><br>Global Conference on Nano Connect 2024, Centre for Agricultural Nanotechnology, 05–06 September 2024 |
| Dr Ankita Gupta | Seventh Meeting of Biodiversity Sectional Committee, SSD 20, 11 January 2024<br><br>Attended International online conference and business meeting of ISH Hymathon, 05–06 December 2024 |
| Dr G. Mahendiran | International Conference on Impact of Climate change on biodiversity – A global perspective organised by Tamil Nadu Veterinary and Animal Sciences University in collaboration with Centre for International Forestry Research (CIFOR), ICAR –Central Agroforestry Research Institute, M.S. Swaminathan Research Foundation and Agricultural Scientific Tamil Society, Madras Veterinary College, Chennai, 11–13 July 2024 |

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| Dr M. Sampath Kumar | Virtual Works hop on 'National Network of Plant Health Experts ' organised by National Institute of Plant Health Management, Hyderabad 23 February 2024<br><br>Attended one day workshop on quarantine procedures in silkworm seed sector under commemoration of Central Silk Board 75 years celebrations organised by Silkworm Seed Testing Laboratory, Kodathi, Bengaluru, 03 September 2024<br><br>International Conference on Plant Health in Asia: Research Priorities and Partnerships, organised by Vignan 's Foundation for Science, Technology and Research, APPARI EUPHRESCO III at Vignan 's Foundation, Vadlamudi, Guntur, Andhra Pradesh, 17–18 December 2024 |
| Dr Sagar, D. | Group monitori ng workshop of PAC Organismal and Evolutionary Biology – Animal Sciences (OEB -AS) of SERB -CRG Project entitled "Studies on thermal stress vis-à-vis reproductive physiology in invasive fall armyworm, *Spodoptera frugiperda* (J.E. Smith) ", Hotel Hindusthan International, Kolkata, 19–20 March 2024 |
| Dr K. Selvaraj | Brainstorming session to evolve management strategies for the root wilt and whitefly in coconut organised by Coconut Development Board (CDB), Kochi at Pollachi, 04 January 2024<br><br>Meeting organised by M ember of the Legislative Assembly of 91 Talala Sutrapada, Gujarat, 12 January 2024<br><br>Centre for Advanced Faculty Training on "Recent Advances in Eco - friendly Management of Crop Pests ", Chaudhary Charan Singh Haryana Agricultural University (CCSHAU), Hissar, 24 January to 13 February 2024 |
| Dr Gundappa | Expert Sub Committee meeting (virtual) to conduct Survey cum Mapping of Root (wilt) and Whiteflies affected areas in Tamil Nadu, 07 May 2024<br><br>NSCHMN project meeting at ICAR –National Institute of Biotic Stress Management, Raipur, 06 November 2024 |
| Dr Gundappa<br>Dr Navik Omprakash Samodhi | Coconut Festival organised by Krishi Vigyan Kendra, Kavaratti, Lakshadweep, 20–22 November 2024 |
| Dr S.N. Sushil<br>Dr Ankita Gupta<br>Dr G. Mahendiran<br>Dr U. Amala<br>Dr Richa Varshney | Consortium Research Platform Agrobiodiversity project mid -term review meeting, 11 December 2024 |
| Dr S.N. Sushil<br>Dr T. Venkatesan | Brainstorming on Insect Genomics and its Prospects in Pest Management, Division of Genomic Resources, ICAR –National Bureau of Agricultural Insect Resources, Bengaluru, 23 August 2024 |

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| Dr S.N. Sushil<br>Dr T. Venkatesan<br>Dr Sunil Joshi<br>Dr K. Subaharan | Official Language Implementation Committee Quarterly Meeting, ICAR–National Bureau of Agricultural Insect Resources, Bengaluru, 03 July 2024 |
| Dr S.N. Sushil<br>Dr T.M. Shivalingaswamy<br>Dr M. Nagesh<br>Dr T. Venkatesan<br>Dr Sunil Joshi<br>Dr.Kesavan Subaharan<br>Dr K. Sreedevi<br>Dr Mahesh Yandigeri<br>Dr U. Amala<br>Dr Gundappa | Tree plantation programme to celebrate World Environment Day, ICAR–National Bureau of Agricultural Insect Resources Yelahanka campus, Bengaluru, 05 June 2024 |
| Dr Gundappa<br>Dr Prabhulinga T | ICAR Foundation Day, NASC complex New Delhi, 15–16 July 2024 |
| Dr S.N. Sushil<br>Dr K. Sreedevi<br>Dr A. Kandan<br>Dr Rachana, R.R.<br>Dr Richa Varshney | Pest Management Decision Guide (PMDG) Workshop for South -East Asian Thrips, ICAR –National Bureau of Agricultural Insect Resources, Bengaluru, 04 September 2024 |
| Dr S.N. Sushil<br>Dr A.N. Shylesha<br>Dr Gundappa<br>Dr Sagar, D. | Farmers meeting to distribute inputs under Tribal Sub Plan (TSP) scheme, Krishi Vigyan Kendra, Chamarajanagar, 07 May 2024 |
| Dr S.N. Sushil<br>Dr Sunil Joshi<br>Dr K. Subaharan<br>Dr G. Mahendiran<br>Dr K.J. David<br>Dr S. Salini<br>Dr M. Sampathkumar<br>Dr U. Amala<br>Dr Richa Varshney<br>Dr R.S. Ramya | International Conference on Plant Protection in Horticulture (ICPPH -2024), ICAR–Indian Institute of Horticultural Research, Bengaluru,25–27 December 2024 |
| Dr T. Venkatesan<br>Dr Sunil Joshi<br>Dr K. Subaharan<br>Dr Mahesh Yandigeri<br>Dr K. Selvaraj<br>Dr U. Amala<br>Dr Gundappa<br>Dr C. Manjunatha<br>Dr N.N. Rajgopal | Kisan Diwas Celebration, 23 December 2024 |

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| Dr S.N. Sushil<br>Dr T. Venkatesan<br>Dr Sunil Joshi<br>Dr M. Nagesh<br>Dr K. Subaharan<br>Dr K. Sreedevi<br>Dr B.S. Gotyal<br>Dr K.J. David<br>Dr S. Salini<br>Dr U. Amala<br>Dr Gundappa<br>Dr Rachana, R.R.<br>Dr Ramya, R.S.<br>Dr N.N. Rajgopal<br>Dr Sagar, D. | First Entomology Student Conclave, Entomological Society of India, New Delhi, University of Agricultural Sciences, Bengaluru, 21–23 February 2024 |
| All the Scientists | 'Matribhasha Diwas' (Mother Language Day), ICAR–National Bureau of Agricultural Insect Resources, Bengaluru, 21 February 2024<br><br>International Women 's Day Programme, ICAR –National Bureau of Agricultural Insect Resources, Bengaluru, 08 March 2024<br><br>Industry Interface Meet, ICAR –National Bureau of Agricultural Insect Resources, 22 March 2024<br><br>Tree plantation on World Environment Day 2024, ICAR–National Bureau of Agricultural Insect Resources, Bengaluru Yelahanka campus, 05 June 2024<br><br>Biocontrol Expo 2024 & 32nd Foundation Day, ICAR–National Bureau of Agricultural Insect Resources, Bengaluru, 19 October 2024<br><br>Rashtriya Ekta Diwas, 30 October 2024<br><br>Vigilance Awareness Week, 28 October to 03 November 2024 |

## 15. TRAININGS CONDUCTED

| Sl. No. | Trainee(s) | Particulars of the training programme | Date(s) | Coordinator(s) or resource person(s) | No. of Participants | Income generation If any (in ?) |
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| 1. | Scientists and Asst. Professors of ICAR/SAU Institutes | ICAR Sponsored Winter School on Recent Advances in Molecular Diagnostics of Insect Species including Invasive and their Natural Enemies. | 18 January 2024 – 7 February 2024 | Dr. T. Venkatesan<br>Dr. R Gandhi Gracy<br>Dr. B. S. Gotyal | 25 | 6,56, 000.00 |
| 2 | Scientists and Asst. Professors of ICAR/SAU Institutes | ICAR Sponsored Short Course on Nano technological Methods in Pest and Disease Management | 13 - 22 February 2024 | Dr K. Subaharan<br>Dr M. SampathKumar<br>Dr U Amala | 18 | 3,49,000.00 |
| 3 | Technical officials of ICAR | Unique Identification characteristics of insect pests and their damaging symptoms and management (Hybrid mode) | 18-22 March 2024 | Dr M Sampath Kumar<br>Dr Gundappa<br>Dr D. Sagar | 16 | ---- |
| 4 | SMSs of KVKs Under ICAR-ATARI-Guwahati | Mass production of Biocontrol agents for the management of crop pests. | 16-20, December, 2024 | Dr G. Sivakumar<br>Dr A Kandan<br>Dr B S Gotyal | 09 | ---- |

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| 5 | Dr. Mohd Abas Shah, Scientist (Entomology) ICAR - Central Institute of Temperate Horticulture, Srinagar, Jammu & Kashmir | Training on "Fruit fly taxonomy ". | 08-12 January 2024 | Dr K. J. David | 01 | 1000=00 |
| 6 | Dr. Kishore Chandra Sahoo, Scientist, ICAR-IARI, Assam | Professional attachment training | 30 October 2023 – 29 January 2024 | Dr Kolla Sreedevi | 01 | ----- |
| **7** | Students and Research professionals | Hands-on Training Program "Bioinformatics for Academicians" Sponsored by DBT funded project "NNP (Agri-Genomics Repository and Intelligent Analytical System)" | 20-22 November 2024 | Dr R Gandhi Gracy | | ----- |

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| 8 | Subject Matter Specialist (Plant Protection) of ICAR-KVKs, Plant Protection officers (Entomology) of CIPMC Centres, Extension officials from department of Horticulture, Development Officers of CDB | Coconut Development Board sponsored "Training on recent Advances in Good Agricultural Practices of Management of Emerging Insect pests in Coconut " | April 29 – May 03, 2024 | Dr K. Selvaraj Dr A. Kandan Dr K.J. David | | |

**Institute in-house training programme for entrepreneurship**

| Sl. No. | Trainee(s) | Particulars of the training programme | Date(s) | Coordinator(s) or resource person(s) | No. of Participants | Income generation If any(in ?) |
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| 1 | Mr. Anil Khomane Mr. Vijay Jaybhaye Eco India Agro industries, Pune | Training on mass culturing of *Galleria mallonella* & production of entomopathogenic nematodes. | 12-14 February, 2024 | Dr Jagadeesh Patil | 02 | 21,240 |
| 2 | Mr. Rajesh, Bengaluru | Training on mass production of Syrphids and chrysopids. | 19 February 2024 | Dr U. Amala Dr Richa Varshney | 01 | 3,540 |
| 3 | Rajendra G Pawar Maharashtra | Scientific mass production techniques of Chrysopids | 15 March 2024 | Dr Richa Varshney | 01 | 3,540 |
| 4 | ITBP personnel | Training on Meliponiculture | 25–29 June, 2024. | Dr U. Amala Dr. Prabhulinga T | 20 | 20000 |

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| 5 | ITBP personnel | Training on Stingless Bee Keeping | 22-26 October, 2024 | Dr U. Amala Dr A.N. Shylesha Dr. Prabhulinga T | 26 | 26000 |
| 6 | CRPF personnel | Training on Bee keeping | 11-15 November, 2024 | Dr U. Amala Dr A.N. Shylesha Dr Prabhulinga T | 11 | 11000 |
| 7 | Mr Daljeet Singh, Mr M Sonaimutharasan Army Service Corps | Training on Meliponiculture | 24-26 September, 2024 | Dr U. Amala | 02 | 4000 |

| Student training programme | | | | | | |
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| **Sl. No.** | **Trainee(s)** | **Particulars of the training programme** | **Dates** | **Coordinator(s) or resource person(s)** | **No. of Partici Pants** | **Income generation If any (in ?)** |
| 1 | M.Sc. Zoology students St. Joseph University, Bengaluru | Student internship programme | 01 January 2024- 31 March 2024 | Dr K. Sreedevi Dr Ankita Gupta Dr R.R. Rachana Dr Omprakash Navik | 06 | 1,41,600 |
| 2 | M.Sc. Zoology student St. Joseph University, Bengaluru | Student internship programme | 15 January 2024 15 April 2024 | Dr R. Gandhi Gracy | 01 | 23,600 |

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| 3 | Final year B.Sc. Agri. students UAS, GKVK, Bengaluru | Rural Agricultural Work Experience Programme (RAWEP) / Agro Industrial Attachment (AIA) programme BATCH - I | 16 -22 January 2024 | Dr M. Sampath Kumar<br>Dr Richa Varshney<br>Dr Omprakash Navik<br>Mr P. Raveendran<br>Dr Jagadee sh Patil<br>Dr C. Manjunatha<br>Dr A Kandan<br>Dr G Sivakumar | 09 | ---- |
| 4 | a. Ms. Shraddha Keshetti, M.Sc. scholar, Dept. of Agricultural Entomology, UHS, Bagalkot and<br><br>b.Ms. Anjana, M.Sc. scholar, Dept. of Agricultural Entomology, KAU, | Training on taxonomy and identification of thrips species on chilli | 01-05 July 2024 | Dr R. R. Rachana | 02 | ---- |

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| 5 | Ms. Chava Asritha. Ph.D. student, PJTSAU, Agricultural information and communication centre & PJTSAU press Agricultural Research Institute Campus, Rajendranagar, Hyderabad - 30, Telangana | Taxonomic identification of mealybugs" | 29 July to 3rd August, 2024 | Dr Sunil Joshi | 01 | ---- |
| 6 | Ms. Dipti Joshi Ph.D. Student GB Pant University of Agriculture and Technology, Pantanagar, Uttarakhand | Taxonomic identification of mealybugs" | 29th June-02nd July 2024 | Dr Sunil Joshi | 01 | ---- |
| 7 | M. Sc. Microbiology students from MHES College of Science and technology, Vadakara, Kerala | Student internship programme | 01 November 2023 - 31 January 2024 | Dr G. Sivakumar Dr C. Manjunatha | 04 | 94,400 |
| 8 | Ms. Bhavitha B. Sc. Biotechnology, Jain University, Bengaluru | Student internship programme | 01 December 2023 - 29 February 2024 | Dr Ramya. R. S | 01 | 11,800 |

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| 9 | M. Tech Biotechnology students of Karunya Institute of Technology and Sciences, Coimbatore | Student internship programme | 06 December 2023 - 19 April 2024 | Dr T. Venkatesan Dr M Mohan Dr R Gandhi Gracy | 03 | 1,06,200 |
| 10 | Ms. Aradhana Panda Ph. D., Div. of Entomology, Faculty of Agriculture, Wadura, Sopore SKUAST-Kashmir | Inhouse training on DNA barcoding | 26 December. 2023-09 February 2024 | Dr T. Venkatesan | 01 | ---- |
| 11 | Ms. Ummal Huda Sri Padmavati Mahila Visvavidyalayam (Women's University) - Tirupati | Training program on taxonomy of armoured scale insect | 16 May 2024-05 June 2024 | Dr Sunil Joshi | 01 | |
| 12 | Mr. Ajith, S. B.Tech (Biotechnology) Tamil Nadu Agricultural University. | Student internship programme | April - May 2024 | Dr Ramya, R.S | 01 | |
| 13 | Ms. Meghana Sri Padmavati Mahila Visvavidyalayam (Women's University) - Tirupati | Training program on Spider taxonomy | 16 May 2024-05 June 2024 | Dr M. Sampath Kumar | 01 | |

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|---|---|---|---|---|---|---|
| 14 | Ms. SumanNayak Mizoram University | Training on mass rearing of fall armyworm | 11-12 Dec 2024 | Dr T. Prabhulinga | 01 | |
| 15 | Ms. Deetya Magolu Rajath 10th grade student, Stonehill International School, Bengaluru | Training on Bioconversion of farm and kitchen wastes to manure by black soldier fly | 29 July 2024 to 29 August 2024 | Dr Mahesh Yandigeri | 01 | |
| 16 | M. Sc student Sri Padmavati Mahila Visvavidyalayam (Women's University) - Tirupati | Student internship programme | 16 May 2024 - 05 June 2024 | Dr K. Subaharan | 01 | |
| 17 | Ms Jana Sindhuja, MSc. Zoology | Student internship programme | 15 May 2024 - June 2024 | Dr U. Amala | 01 | |
| 18 | Mr Gagan, B. M.Sc (Apiculture) Dept of Apiculture, UAS, Bengaluru | Student internship programme | August to October 2024 | Dr U. Amala | 01 | |
| 19 | Ms Fiza Farooq, PhD scholar, University of Kashmir, Srinagar<br><br>Ms Kriti Arpana Minz | Student internship/fellowship programme | June–September 2024 | Dr Ankita Gupta | 02 | |

| Professional attachment training | | | | | | |
|---|---|---|---|---|---|---|
| 1 | Dr. M. G. Deeksha ICAR - Directorate of Weed Research (DWR) Maharajpur, Jabalpur | Professional attachment training | 04 December 2023-04 March 2024 | Dr Richa Varshney | 01 | ---- |
| 2 | Dr. Harish M.N, Scientist (Agronomy), ICAR-ATARI, Jabalpur, MP | Professional Attachment Training (PAT) on "Assessing the Geographic Distribution of Ipomoea and it 's Association with Insect Diversity in Southern India". | 02.04.2024 to 01.07.2024 | Dr A. N. Shylesha | 01 | ---- |
| 3 | Dr. Ramya N, Scientist, ICAR-IIAB, Ranchi | Professional Attachment Training (PAT) on Genome editing techniques for agricultural insect pest management from | 5.08. 24 to 04. 11. 024 | Dr M. Mohan | 01 | ---- |
| 4. | Dr. Kishore Chandra Sahoo, Scientist, ICAR-IARI, Assam | Professional attachment training | 30. October 2023 – 29. January 2024. | Dr Kolla Sreedevi | 01 | ---- |

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| 5. | Dr. M. G. Deeksha ICAR - Directorate of Weed Research (DWR) Maharajpur, Jabalpur | Professional attachment training | 04. December2023 - 04. March 2024 | Dr Richa Varshney | 01 | ---- |

| Farmers visit cum training programme | | | | | | |
|---|---|---|---|---|---|---|
| 1 | Tamil Nadu Farmers, Rasipuram Block, Namakkal District, Tamil Nadu | Biocontrol pest and disease management in Horticultural crops | 30 January 2024 | Dr M. Sampath Kumar and Lakshmi. L | 24 | ---- |
| 2 | Tamil Nadu Farmers, Tirunelveli District | Interstate Exposure visit-Organic Farming | 23.09.2024 | Dr M. Sampath Kumar, Dr B.S. Gotyal and Dr Richa Varshney | 20 | ---- |
| 3 | Tamil Nadu Farmers, Avelappanpatti, Pollachi, Coimbatore district | Farmers training cum demonstration on biocontrol strategies for management of invasive whiteflies in coconut in collaboration with Coconut Development Board, Regional office, Chennai and Department of Horticulture, Coimbatore district, | 14.3.2024 | Dr K Selvaraj | 100 | |

## a. Capacity building programme undergone by NBAIR staff

| Sl. No | Name, Designation and Division | Name of the training programme attended | Place | Dates |
|---|---|---|---|---|
| | | | | |
| 1 | Dr M. Sampath Kumar Senior Scientist, DGCC | Online training programme on "Digital competency, new tools and software for efficient computer applications" | ICAR- IASRI, New Delhi | 03-09 January, 2024 |
| 2 | Dr Gundappa Senior Scientist, DGCU | ICAR- Sponsored Short course on "Application of Drone technology for site specific crop management" | University of Agricultural Sciences, Raichur | 30 January 2024-08February2024 |
| 3 | Dr C. Manjunatha Scientist, DGR | Enhancing Pedagogical Competencies for Agricultural Education" | National Academy of Agricultural Sciences, New Delhi | 29 January 2024-2 February2024 |
| 4 | Dr K. J. David, Senior Scientist, DGCC | NABL – 2nd refresher training programme for testing and calibration assessors | Fortune park JP Celestial Hotels Ltd., Bengaluru | 9 February 2024 |
| 5 | Dr S. N. Sushil Director, ICAR-NBAIR | Executive Development Programme on Leadership Excellence | ICAR-NAARM, Hyderabad | 12-17 February 2024 |
| 6 | Dr Birendra Kumar Chaubey Chief Technical Officer | RPAS Pilot course | PBCS aero Hub, Pune | 18-22, March 2024 |
| 7 | Mr R. Maruthi Mehanth Technical Assistant | RPAS Pilot course | PBCS aero Hub, Pune | 18-22, March 2024 |
| 8 | Mr Satendra Kumar Chief Technical Officer | Training programme for technical staff on Unique Identification characteristics of insect pests and their damaging symptoms and management | ICAR-NBAIR, Bengaluru | 18-22, March 2024 |

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|---|---|---|---|---|
| 9 | Ms L. Lakshmi Asst. Chief Technical Officer | Training programme for technical staff o Unique Identificatio characteristics of insect pests and thei damaging symptom and management | ICAR -NBAIR, Bengaluru | 18-22, March 2024 |
| 10 | Mr H. Jayaram Asst. Chief Technical Officer | Training programme for technical staff on Unique Identification characteristics of insect pests and their damaging symptoms and management | ICAR-NBAIR, Bengaluru | 18-22, March 2024 |
| 11 | Mr P. Raveendran Technical Officer | Training programme for technical staff on Unique Identification characteristics of inse ct pests and their damaging symptoms and management | ICAR-NBAIR, Bengaluru | 18-22, March 2024 |
| 12 | Dr A. Raghavendra Technical Officer | Training programme for technical staff on Unique Identification characteristics of insect pests and their damaging symptoms and management | ICAR-NBAIR, Bengaluru | 18-22, March 2024 |
| 13 | Mr Umeshkumar Sanjeev Technical Assistant | Training programme for technical staff on Unique Identification characteristics of insect pests and their damaging symptoms and management | ICAR-NBAIR, Bengaluru | 18-22, March 2024 |
| 14 | Dr R. Gandhi Gracy | Training program on Innovation Management during at ICAR -NAARM, Hyderabad | ICAR-NAARM, Hyderabad | July, 8-12, 2024 |

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|---|---|---|---|---|
| 15 | Mr R. Maruthi Mehanth | "Workshop on Sensitization to Intellectual Property Rights " | Online workshop Sensitization to Intellectual property Rights Issues, ITMU, NAIF, Central Institute for Research on Buffaloes, Hisar. | 13.9.2024 |
| 16 | Dr R.S. Ramya | Workshop on Molecular Phylogenetics | University of Hyderabad | 10-14 October, 2024 |
| 17 | Dr R.S. Ramya | Workshop on Genome editing mediated by CRISPR Cas9-tools, experimental design and its applications | NABI, Mohali | 21-24th October, 2024 |
| 18 | Dr M. Mohan | Hands on Training Program on Genome Editing – Basic Principles and Practices | Division of Plant Physiology, IARI, New Delhi | 2-6th December, 2024 |
| 19 | Dr D. Sagar | Hands on Training Program on Genome Editing – Basic Principles and Practices | Division of Plant Physiology, IARI, New Delhi | 2-6th December, 2024 |
| 20 | Dr K. Selvaraj | Training cum workshop on Drone Technology and its Application at ICAR - CIFRI, Barrackpore (Online Mode) | ICAR-CIFRI, Barrackpore | 11.12.2024 |
| 21 | Dr D. Sagar | First International workshop cum webinar on CRISPR Genome Editing during (Online Mode) | | 22-26 July 2024 |
| 22 | Dr T. Prabhulinga | ICAR- Sponsored Short course on Nanotechnological Methods for pest and disease management | ICAR-NBAIR, Bengaluru | 13 – 22 February 2 024 |
| 23 | All NBAIR staffs | Lok Sabha Elections 2024- Micro observer Training | Bengaluru | 20 and 23 April 2024 |

| INSTITUTE VISITS -2024 | | | | |
|---|---|---|---|---|
| **Sl. No** | **Category** | **Date(s)** | **Institute/company they belong to** | **Number of visitors** |
| 1 | B.Sc Zoology students | 04 January 2024 | MES KeVeeYam College, Valanchery, Malappuram, Kerala | 39+ 2 Staff |
| 2 | Final year, B. Sc. Agri students | 17 January 2024 | College of Agriculture, Kerala Agricultural University, Vellanikkara Thrissur, Kerala | 100+ 3staff |
| 3 | Second year, B. Sc. (Hons.) students | 19 January 2024 | PGP College of Agricultural Sciences, Palani Nagar, Namakkal | 132+ 2staff |
| 4 | Final year, B.Sc. Hons.(Ag.) students | 30 January 2024 | College of Agriculture, Vellayani, Kerala Agriculture University | 154+ 6 staff |
| 5 | Third year, B.Sc.(Sericulture) students | 12 February 2024 | College of sericulture, Assam Agricultural University | 20 + 2 staff |
| 6 | Final year, B.Sc. Hons. (Ag.) students | 15 February 2024 | College of Horticulture and Forestry, Pasighat | 37+ 2staff |
| 7 | Third year, B.Sc. (Agri.) students | 15 February 2024 | BN College of Agriculture (BNCA), Assam Agricultural University | 38 +2 staff |
| 8 | Final Year, B. Tech., | 29 February 2024 | College of Agricultural Engineering and Technology (COAE&T), SKUAST-K | 17+1 staff |
| 9 | B. Sc (Ag.) students | 4 March 2024 | SRSIAT College, Vedasandur, Dindigul, Tamil Nadu | 87+ 4 staff |
| 10 | Junior M. Sc (Horticulture) students | 4 March 2024 | College of Horticulture, Mudigere, Karnataka | 30 + 1 Staff |
| 11 | B. Sc. (Ag.) students | 6 March 2024 | AC & RI College, T.V. Malai, Tamil Nadu | 78 + 2 staff |
| 12 | B. Sc (Ag.) Students | 8 March 2024 | Sethu Bhaskara Agricultural college and Research Foundation, Karaikudi, Tamil Nadu | 84 + 2 staff |
| 13 | B.Sc.(Horticulture) students | 25 March 2024 | Horticultural College and Research Institute for Women, Navalurkuttapattu, Trichy, Tamil Nadu | 54+2 staff |
| 14 | Grade 10 | 01.08.2024 | Christ School, S G Palaya, Dharmaram College Po, Bengaluru. | 146+8 staffs |
| 15 | KVK Scientists | 7.6.2024 | KVK Scientists of Karnataka and Kerala states | 46+1 staff |

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|---|---|---|---|---|
| 16 | B.E.S.T Innovation University students | 11.6.2024 | B.E.S.T Innovation University Anantpur (AP) students and faculties. | 130+50 staffs |
| 17 | Agriculture officers | 12.6.2024 | Agriculture officers of Kancheepuram District from Tamilnadu, Agri Department on interstate exposure visit | 10 |
| 18 | Extension officers from Agril. Department | 18.6.2024 | Deputy directors of vAgriculture, Asst Directors of Agriculture, Agriculture officers from Coimbatore on ATMA interstate exposure visit. | 10 |
| 19 | Agriculture officers | 02.07.2024 | Dept. of Agriculture, Thanjavur District exposure visit. | 10 |
| 20 | Deputy Director and Joint Director of Agriculture | 18.7.2024 | Deputy Director and Joint Director of Agriculture, Tirupur, TN exposure visit | 10 |
| 21 | PG Diploma (Agriculture) students | 3.9.2024 | GPS Institute of Agricultural Management, Bangalore | 13+1 staff |
| 22 | B Sc (Agri), 3 rd Year students | 17.9.2024 | ANGRAU- Agril. College, Naira – South India Educational Institutes tour | 110+2 staff |
| 23 | 3rd Year BSc (Hons) Agri. Students. | 25.9.2024 | Agriculture College , Bapatla, South India Educational tour Programme for 3 rd Year BSc (Hons) Agri. Students. | 82 + 4 staffs |
| 24 | 3rd Years students of Agricultural Biotechnology | 27.9.2024 | MGM College of Agricultural Biotechnology, Gandheli, Aurangabad ( Maharashtra) | 52+4 staffs |
| 25 | 2nd M.Sc. (Biotechnology) | 21.10.2024 | Industrial visit Krishtu Jayanti College, Dept. of life Sciences | 03 |
| 26 | 4th Year B.Sc. (Horticulture) students, College of Horticulture, Mudigere | 11.11.2024 to 15.11.2024 | As a part of curriculum research institute visit | 15 |
| 27 | B. Sc. (Ag.) students, GKVK | 12.11.2024 | Exposure visit | 25 |


**ICAR Sponsored Winter School on "Recent Advances in Molecular Diagnostics of Insect Species including Invasive and their Natural Enemies" (18 January 2024 – 7 February 2024)**


**ICAR Sponsored Short Course on Nano technological Methods in Pest and Disease Management (13 - 22 February 2024)**

**Technical officials of ICAR attending training on Unique Identification characteristics of insect pests and their damaging symptoms and management (Hybrid mode), 18-22 March 2024**


**Training on Meliponiculture to ITBP personnel, 25-29 June 2024**


**Coconut Development Board sponsored "Training on recent Advances in Good Agricultural Practices of Management of Emerging Insect pests in Coconut", 29 April 29–03 May 2024**

**Exposure visit of KVK scientists from Karnataka and Kerala to ICAR-NBAIR, Bengaluru, 7 June 2024**

**Christ school students visit to ICAR-NBAIR, Bengaluru, 2 August 2024**


**Visit of farmers practicing Organic farming from Tamil Nadu to ICAR-NBAIR, Bengaluru, 23 October 2024**

**Farmers attending the Training cum Demonstration programme on Biocontrol strategies for management of invasive whiteflies in coconut, Avelappanpatti, Pollachi, Coimbatore district, Tamil Nadu, 14 March 2024**


**Visit of trainees to ICAR NBAIR Yelahanka campus**


**Visit of trainees to ICAR NBAIR Yelahanka campus**

**Student in house training programme on collection, preservation, preliminary sorting and general overview of thrips**

**Student training on Taxonomy of mealybug (Hemiptera: Pseudococcidae)**

## 16. DISTINGUISHED VISITORS

1. Dr S.N. Puri, Former Vice-Chancellor, Central Agricultural University, Imphal, 22 February 2024
2. Dr Himanshu Pathak, Secretary, Department of Agricultural Research and Education and Director General, Indian Council of Agricultural Research, New Delhi, 19 April 2024
3. Dr R.Muniappan, Director, IPM Innovation Lab. Virginia Tech, 30 April 2024
4. Shri Faiz Ahmed Kidwai, Additional Secretary (Plant Protection), Department of Agriculture & Farmers Welfare, 21 June 2024
5. Dr T.R. Sharma, Deputy Director General (Crop Science), Indian Council of Agricultural Research, New Delhi, 3 May 2024 and 19November 2024
6. Dr D.K. Yadava, Assistant Director General (Seeds), Indian Council of Agricultural Research, New Delhi, 3 May 2024.
7. Sh. Faiz Ahmed Kidwai, Additional Secretary (PP), Department of Agriculture & Farmers Welfare, Govt. of India, 21 June 2024.
8. Mr Rana Yudhvir Singh, Deputy Inspector General, SHQ BBSR, Ind Tibetan Border Police, 29 June 2024.
9. Dr J.P. Singh, Plant Protection Advisor, Government of India, 21 June 2024
10. Dr Ashok Dalwai, IAS, Ex-CEO, National Rainfed Area Authority, Ministry of Agriculture and Farmers Welfare, Government of India, 19 October 2024.
11. Dr Poonam Jasrotia, Assistant Director General (Plant Protection), Indian Council of Agricultural Research, New Delhi, 19November 2024.
12. Shri N.S. Govindaraju, IAS, Controller, HSFC, ISRO Bengaluru, 23 December 2024.

**Dr Himanshu Pathak, Honourable Secretary DARE and DG, ICAR inaugurating Live Insect Repository Unit and interacting with scientists**


**Dr T.R. Sharma, DDG, ICAR and Dr Poonam Jasrotia, ADG (Plant Protection) inaugurating Butterfly Garden and Biopesticide Production Unit**

**Visit of DIG ITBP to ICAR NBAIR Yelahanka campus**


**Shri Faiz Ahmed Kidwai, Additional Secretary (Plant Protection), Department of Agriculture & Farmers Welfare, 21 June 2024**

**Visit by Dr S.N. Puri, Former Vice-Chancellor, Central Agricultural University, Imphal to ICAR NBAIR, Bengalur**

**Visit by Dr R.Muniappan, Director, IPM Innovation Lab. Virginia Tech to ICAR NBAIR, Bengaluru**

## 17. OTHER ACTIVITIES

### ICAR–NBAIR organised Input distribution programme at Krishi Vigyan Kendra, Hogalagere arm, Srinivasapura, Kolar

ICAR–NBAIR organised training-cum-input distribution programme for ensuring sustainable livelihood security for the SC farming community under the Scheduled Caste Sub-Plan (SCSP) conducted in association with HRES, Hogalagere farm, Srinivasapura on 15 March 2024. Dr R. K. Ramachandra, Professor and Head of Department, Horticulture Research and Extension Centre, Shri. Srinivasan, Joint Director Social Welfare Department, Srinivaspura and S.A.D.H, Srinivasapura. Mrs Lavanya M, Deputy Director Horticulture, Project Officer, Centre of Excellence Mango, Dr N. Ashwath Narayana Reddy, Assistant Professor and Head of Department All India Coordinated Research Project on Cashew, Shri. Toopalli Narayanaswamy, Former ZP member, Kolar, Dr Venugopal Reddy, District BJP President, Shri. Chandrashekhar Reddy, Taluk BJP President, Shri. Chinnapa Reddy, District Mango Grower Association President, Shri. K. Venugopala Reddy, Taluk Vokkaliga Sangha President, Shri. Byrareddy, President District Raitha Sangha, Shri. C.V Prabhakara Gowda, District President of Raitha Sene and Dr S.N. Sushil, Director, ICAR-NBAIR Bengaluru participated in the programme. In the programme battery operated sprayers, ICAR-NBAIR technologies, seeds were distributed as inputs.

### ICAR-NBAIR organized Tribal sub plan (TSP) programme at ICAR- Krishi Vigyana Kendra, Haradanahalli (Chamrajnagar)

ICAR–NBAIR organized one day training program cum inputs distribution to tribal farmers at KVK, Haradanahalli (Chamarajanagar) under Tribal sub plan on 7 May 2024. Around 50 tribal farmers from Burudarahundi, Kaniyanapura Chaluvarayanpura attended the program. From ICAR-NBAIR Bangalore Dr S.N. Sushil, Director, Dr A.N. Shylesha Principal Scientist, Dr Gundappa, Senior Scientist and Dr D. Sagar Senior Scientist attended the program. Dr S.N. Sushil Director ICAR-NBAIR inaugurated programme, in the inaugural address, emphasized farmers to adopt bio-intensive practices for effective pest management. He also reiterated that hilly areas are best suited for organic farming. Dr A.N. Shylesha addressed the gathering given technical knowledge of pest management using bio-agents. In the program Mr Hiralal Chief Conservator Forest highlighted the pivotal role played by the tribal farmers in the conservation of flora and fauna of the forest, they should adopt the farming practices which will have least effect on the forest ecosystem. Mrs. Hita G Suvarna, District Development Manager, NABARD in her address she appraised that farmers should acquire new skills and knowledge through capacity-building programmes. Dr Gundappa appraised the gathering about the effects of chemical intensive farming led to the imbalance in the environment and ill effects on human health. He emphasized that farmers should adopt bio-intensive practices to curtail insect pests and diseases. Dr Yogesh, G.S. Head, ICAR-KVK Haradanahalli in his presidential address told that farmers should utilize the opportunity and improve their livelihood using the

## ICAR-NBAIR organised TSP programme in KVK, Chintamani, Karnataka

ICAR-National Bureau of Agricultural Insect Resources (NBAIR) has organized one day training cum input distribution programme to the tribal farmers of Chintamani and Kolar Taluks of Chikballapur and Kolar districts on 14-03-2024 under Tribal subplan programme (TSP). Around 50 farmers from Bramhanaradinne in Chintamani Taluk, Thernahalli in Srinivaspur Taluk, Mullahalli village in Kolar Taluk attended the programme. The programme was inaugurated by Dr S.N. Sushil, Director, ICAR-NBAIR and coordinated by Dr M. Papi Reddy, Senior Scientist & Head, Krishi Vigyan Kendra, Chintamani, Karnataka. The use of biopesticides was demonstrated and farmers were given hands on training on utilization and benefits of biopesticides towards adoption of ecofriendly pest management strategies. Later, the inputs comprising entomobacterial and entomofungal biopesticides, multi cut fodder seeds, vegetable seed kits, coconut and mango seedlings were distributed to the farmers. Dr Kolla Sreedevi, ICAR National Fellow, Dr Sagar, D., Senior Scientist, Dr Manjunatha, C., Scientist and Dr N.N. Rajagopal, Scientist from ICAR-NBAIR also participated in the programme.


**Tribal sub plan and Input distribution programme organised by ICAR-NBAIR at KVK Chintamani (Karnataka)**

## 18. EXHIBITIONS

ICAR–NBAIR organised several exhibitions as a part of various events in the institute and also participated in various exhibitions/expo conducted across India to display a range of biological control technologies developed at the Institute to farmers, students, extension & research workers and other stakeholders. Details of the same are provided chronologically as below.

| Sl. No | Exhibition | Date | Venue |
|---|---|---|---|
| 1 | Entomology Student Conclave – 2024 | 21–23 February 2024 | University of Agricultural Sciences, Bengaluru |
| 2 | National Horticulture Fair 2024 | 05–07 March 2024 | ICAR- Indian Institute of Horticultural Research, Bengaluru |
| 3 | National Conference on Expanding the Horizons of Microbial Research in Agriculture | 10–11 June 2024 | ICAR- National Bureau of Agriculturally Important Microorganisms, Mau |
| 4 | ICAR Foundation and Technology Day Expo | 15–16 July 2024 | NASC complex New Delhi |
| 5 | Press and media conference | 30 September 2024 | ICAR- National Bureau of Agricultural Insect Resources, Bengaluru |
| 6 | Second Biocontrol Expo- 2024 | 19 October 2024 | ICAR- National Bureau of Agricultural Insect Resources, Bengaluru |
| 7 | Krishi mela-2024 | 14–17 November 2024 | University of Agricultural Sciences, Bengaluru |
| 8 | COCO Festival-2024 | 19–22 November 2024 | Krishi Vigyan Kendra, Lakshadweep |
| 9 | Kisan Diwas -2024 | 23 December 2024 | ICAR- National Bureau of Agricultural Insect Resources, Bengaluru |

## ICAR–NBAIR participated in ICAR Foundation and Technology Day Expo, New Delhi

ICAR–NBAIR participated in ICAR Foundation and Technology Day Expo on 15th July 2024, at NAS Complex, New Delhi to showcase various technologies developed at the Institute to farmers, students, extension & research workers. Union Minister for Agriculture and Farmers Welfare, Sri. Shivraj Singh Chouhan, Dr Poonam Jasrotia, ADG (Plant Protection), New Delhi, Dr Subash Chander, Director, ICAR–National Centre for Integrated Pest Management, New Delhi and other dignitaries visited our stall. Nearly 2000 farmers, students, extension & research workers visited to NBAIR stall and were exposed to biological control activities in NBAIR.

## ICAR–NBAIR participated in National Horticulture Fair, ICAR–Indian Institute of Horticultural Research, Bengaluru

ICAR–NBAIR participated in National Horticulture Fair at ICAR–IIHR, Bengaluru during March 5−7, 2024 and displayed various technologies developed at the Institute to farmers, students, extension & research workers. ICAR-NBAIR won Best exhibition stall under ICAR category. More than 3000 farmers, students, extension & research workers visited to NBAIR stall and learnt biological control activities in NBAIR.

**ICAR-NBAIR bagged Best exhibition stall at National Horticulture Fair, ICAR–Indian Institute of Horticultural Research, Bengaluru, March 5−7, 2024**

## ICAR–NBAIR participated in COCO Festival, Lakshadweep

ICAR–NBAIR participated in COCO Festival by KVK, Lakshadweep during during 19–22 November 2024 and displayed various technologies developed at the Institute to farmers, students, extension & research workers, particularly for major pests of coconut. More than 1000 farmers, extension & research workers, and students visited the stall and were shown biological control activities in NBAIR.

ICAR–NBAIR stall in COCO Festival at Lakshadweep

ICAR–NBAIR stall at Krishi Mela 2024, Bengaluru

### ICAR-NBAIR participated in Krishi Mela 2024, Bangalore

ICAR–NBAIR participated in "Krishi Mela-2023" from 14−17 November 2024 held at UAS, Bengaluru, Karnataka. NBAIR organized an exhibition stall to showcase various biological control technologies developed at the Institute to students, extension & research workers and other dignitaries. About 3,000 farmers, students, extension & research workers and other dignitaries visited ICAR NBAIR stall and learned biological control activities

ICAR-NBAIR stall at ICAR National Institute of Biotic Stress Management, 28 February 2024

## 19. PERSONNEL

| S. No. | Name | Designation |
|---|---|---|
| **Director** | | |
| 1. | Dr S.N. Sushil | Director |
| **Scientists** | | |
| **Division of Germplasm Collection and Characterisation** | | |
| 2. | Dr Sunil Joshi | Principal Scientist (Agricultural Entomology) & Head of Division |
| 3. | Dr Kolla Sreedevi | Principal Scientist (Agricultural Entomology) |
| 4. | Dr G. Mahendiran | Senior Scientist (Agricultural Entomology) |
| 5. | Dr Ankita Gupta | Senior Scientist (Agricultural Entomology) |
| 6. | Dr S. Salini | Senior Scientist (Agricultural Entomology) |
| 7. | Dr K. J. David | Senior Scientist (Agricultural Entomology) |
| 8. | Dr Jagadeesh Patil | Senior Scientist (Agricultural Nematology) |
| 9. | Dr M. Sampath Kumar | Senior Scientist (Agricultural Entomology) |
| 10 | Dr R.R. Rachana | Scientist (Agricultural Entomology) |
| 11. | Dr Navik Omprakash Samodhi | Scientist (Agricultural Entomology) |
| **Division of Germplasm Conservation and Utilisation** | | |
| 12. | Dr Kesavan Subaharan | Principal Scientist (Agricultural Entomology) & Head of Division |
| 13. | Dr A.N. Shylesha | Principal Scientist (Agricultural Entomology) |
| 14. | Dr Prakya Sreerama Kumar | Principal Scientist (Plant Pathology) |
| 15. | Dr G. Sivakumar | Principal Scientist (Microbiology) |
| 16. | Dr Deepa Bhagat | Principal Scientist (Organic Chemistry) |
| 17. | Dr A. Kandan | Principal Scientist (Plant Pathology) |
| 18. | Dr K. Selvaraj | Senior Scientist (Agricultural Entomology) |
| 19. | Dr U. Amala | Senior Scientist (Agricultural Entomology) |
| 20. | Dr Richa Varshney | Scientist (Agricultural Entomology) |
| 21. | Dr Gundappa | Scientist (Agricultural Entomology) |
| 22. | Dr Prabhulinga, T. | Scientist (Agricultural Entomology) |
| **Division of Genomic Resources** | | |
| 23. | Dr T. Venkatesan | Principal Scientist (Agricultural Entomology) & Head of Division |
| 24. | Dr M. Mohan | Principal Scientist (Agricultural Entomology) |
| 25. | Dr M. Pratheepa | Principal Scientist (Computer Applications) |
| 26. | Dr Mahesh Yandigeri | Principal Scientist (Microbiology) |
| 27. | Dr R. Gandhi Gracy | Principal Scientist (Agricultural Entomology) |
| 28. | Dr B.S.Gotyal | Senior Scientist (Agricultural Entomology) |
| 29. | Dr Sagar, D. | Senior Scientist (Agricultural Entomology) |
| 30. | Dr C. Manjunatha | Scientist (Plant Pathology) |
| 31. | Dr B.S.Manjunatha | Scientist (Agricultural Microbiology) |
| 32. | Dr R.S. Ramya | Scientist (Agricultural Entomology) |
| 33. | Mr K.T. Shivakumara | Scientist (Agricultural Entomology) |

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|---|---|---|
| **Technical Officers / Assistants** | | |
| 34. | Dr B.K. Chaubey | Chief Technical Officer |
| 35. | Mr Satendra Kumar | Chief Technical Officer |
| 36. | Ms L. Lakshmi | Chief Technical Officer |
| 37. | Mr H. Jayaram | Assistant Chief Technical Officer |
| 38. | Dr A. Raghavendra | Technical Officer (Laboratory Technician) |
| 39. | Mr M. Chandrappa | Technical Officer (Driver) |
| 40. | Mr R. Narayanappa | Technical Officer (General Operator) |
| 41. | Mr P. Madanathan | Technical Officer (Driver) |
| 42. | Mr Umesh Kumar Sanjeev | Senior Technical Assistant (Laboratory Technician) |
| 43. | Mr R. Maruti Mehanth | Senior Technical Assistant (Laboratory Technician) |
| 44. | Mr K.M. Venugopala | Senior Technical Assistant (Laboratory Technician) |
| 45. | Mr Ramakrishnaiah | Technician |
| **Administrative Staff** | | |
| 46. | Mr J. Mathew | Senior Administrative Officer |
| 47. | Ms S. Kusuma | Senior Finance & Accounts Officer |
| 48. | Ms S. Kaveriamma | Private Secretary to Director |
| 49. | Ms Dipanwita Deb | Assistant Administrative Officer |
| 50. | Ms M.S. Uma | Personal Assistant |
| 51. | Ms Naziya Anjum | Assistant |
| 52. | Ms P. Anitha | Upper Division Clerk |
| 53. | Ms Sanjeevini Desai | Lower Division Clerk & Cashier |
| **Supporting Staff** | | |
| 54. | Mr P. Nagaiah | Skilled Supporting Staff |
| | **Retired Personnels** | |
| 55. | Dr. T.M. Shivalingaswamy | Principal Scientist (Agricultural Entomology) (Superannuated on 31.08.2024) |
| 56. | Dr M. Nagesh | Principal Scientist (Agricultural Nematology) (Superannuated on 30.11.2024) |
| 57. | Mr P. Raveendran | Technical Officer (T5) (Superannuated on 30.09.2024) |
| | **Newly Joined Personnel** | |
| 60. | Dr N.N. Rajgopal | Scientist (Agricultural Entomology) (Joined NBAIR on 01.01.2024) |
| 61 | Mr Yogesh Kaswan | Assistant (Joined NBAIR on 26 August 2024) |
| 62. | Mr Utkarsh Sinha | Assistant (Joined NBAIR on 28 August 2024) |
| 63. | Ms Shefali Seth | Assistant (Joined NBAIR on 30 August 2024) |
| 64. | Mr Shah Akik Amitkumar | Assistant (Joined NBAIR on 9 October 2024) (Left NBAIR on 29 December 2024) |
| 65. | Mr Yogesh Kaswan | Assistant (Joined NBAIR on 26 August 2024) |