

Government of India, and within a short span of two years, developed a biocontrol strategy using predators and parasitoids for sustainable management of the woolly aphid.

### Collaborative efforts lead to success

ICAR-NBAIR in collaboration with the entomologists of Vasantdada Sugar Institute and Mahatma Phule Krishi Vidyapeeth (Pune); University of Agricultural Sciences (Dharwad); and Tamil Nadu Agricultural University and Sugarcane Breeding Institute (Coimbatore) popularised the biocontrol strategy through demonstrations and training of farmers, extension officers of the Department of Agriculture and representatives of sugar mills. These concerted efforts resulted in the successful management of the woolly aphid especially in Maharashtra, Karnataka and Tamil Nadu, where the pest is under total control now.

### Present status

Continuous surveys and surveillance of woolly aphid in sugarcane-growing areas of Telangana, Tamil Nadu, Maharashtra and Karnataka revealed the scanty presence of woolly aphid (up to 5% incidence), indicating the effectiveness of the biocontrol strategy. In all the surveyed areas, it was found that the natural enemies *D. aphidivora*, *M. igorotus* and *E. flavoscutellum* were well established in fields, thus effectively managing the pest.



Natural occurrence of *E. flavoscutellum*

### Recommended biocontrol strategy for woolly aphid management

1. Application of the recommended doses of chemical fertilisers as excessive application of nitrogenous fertilisers will result in outbreak of the woolly aphid.
2. Monitoring of the sugarcane crop for early detection of the pest and release of biocontrol agents from the areas of abundance to woolly aphid infested areas.
3. If the predators are present, conserve them by avoiding spraying of chemical pesticides.
4. Since *Micromus* pupates in the leaf sheaths of lower leaves, the detashed leaves should not be burnt but left behind in the field to allow the adults to emerge.
5. If predators are not seen, release *D. aphidivora* (@ 1,000/ha) or *M. igorotus* (@ 2,500/ha) 2-3 times depending on the incidence of the pest. (The pest population will come down within 60 days).

### Outcome

During 2003-04, the woolly aphid was observed in 3.13 lakh ha of sugarcane growing areas in Maharashtra and Karnataka. It was brought down to 0.82 lakh ha, only through the natural enemies, viz. *D. aphidivora*, *M. igorotus* and *E. flavoscutellum*. An estimated benefit of approximately ₹ 398.23 crores was realised through this biocontrol intervention.

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## Success is Sweet: Biocontrol Saves Sugarcane from Woolly Aphid



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An outbreak of the sugarcane woolly aphid (*Ceratovacuna lanigera*) was noticed in Maharashtra and Karnataka during 2002. By 2003–04, this became a serious pest affecting large areas in these two states. In Maharashtra, 2,67,000 ha of sugarcane was heavily infested by this pest and especially parts of Pune and Solapur, which were affected the most. In Karnataka, 61,000 ha were affected during the same year. The pest spread to Andhra Pradesh, Tamil Nadu, Kerala, Uttarakhand and Bihar in no time. The aphids colonize on the leaves and young canes and suck the sap leading to stunted plant growth and shrivelled canes. Apart from draining the plant by sucking the sap, this pest also leaves sooty mould behind that affects photosynthesis of the plant, thereby resulting in drastic reduction of yield and sugar recovery.



Sugarcane woolly aphid



Sooty mould

### Failure of chemical pesticides

Sugarcane growers resorted to spraying chemical pesticides to control the pest, but in vain. The chemicals gave only temporary relief and often farmers had to spray repeatedly. There was cause for alarm due to indiscriminate use of chemicals that resulted in environmental pollution, mortality of natural enemies as well as health hazards to those involved in spraying operations, apart from being uneconomical.

### Biological control - The most viable solution to the problem

Biological control through insect predators and parasitoids, which is economically feasible, ecologically compatible and environmentally benign, was explored.

#### Identification of natural enemies

Thirty-one species of predators and seven parasitoids were found to naturally suppress the woolly aphid. Out of all, *Micromus igorotus*, a neuropteran predator, and *Dipha aphidivora*, a lepidopteran predator, were found to rapidly colonise the woolly aphid-infested sugarcane fields and reduce the pest population.

The syrphid, *Eupeodes confrater*, and a few species of ladybird beetles were also observed to feed on the woolly aphid. In addition, a parasitoid, *Encarsia flavoscutellum*, was brought from Assam in 2014 and released in aphid-infested areas. It has established well in all places of its release and brought down the pest population drastically.



*Micromus igorotus*



*Dipha aphidivora*



*Eupeodes confrater*



*Encarsia flavoscutellum*

### Conservation

Since natural enemies were found to control the woolly aphid effectively, farmers were advised not to apply chemical pesticides and encourage natural build-up of parasitoid and predators. In areas where chemicals were not applied, the natural enemies multiplied rapidly and devoured the woolly aphid, thus preventing outbreaks.

### Augmentation

Early colonisation by predators resulted in successful control of the pest, as the pest population began to build up in sugarcane crop. Frequent monitoring of the pest occurrence was done for its early detection and releases of natural enemies were done for early suppression of the pest in the crop.

### Mass production of predators

A simple method of mass production of both *Dipha* and *Micromus* was simultaneously developed. The method involves erecting field cages with shade-net on a six-month-old sugarcane crop colonised by the aphid. After the aphid has multiplied and covered the plant to an extent of 60–70%, around 50 mature larvae or pupae of *Dipha/Micromus* are released. The predators multiplied on the aphid population and 1,500–2,500 predators could be harvested from a single cage in about 60 days. The cages can be relocated to fresh locations for further production of the predators. During periods of pest abundance, the predators can also be multiplied on the woolly aphid in the laboratory.

### Support from ICAR and DBT

ICAR–NBAIR (then Project Directorate of Biological Control or PDBC) took up research on biocontrol of the pest on a priority basis under its core programme as well as under a project funded by the Department of Biotechnology (DBT),