

Isariafumosorosea: a Potential Biocontrol agent for Rugose Spiralling Whitefly on Coconut

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Rugose spiralling whitefly (RSW), *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae) is a highly polyphagous and invasive pest, recorded for the first time in India during 2016 in Tamil Nadu on coconut (Sundararaj and Selvaraj, 2017). Subsequently, it spread to other coconut and oil palm growing tracts in India. Rugose spiralling whitefly nymphs and adults not only feed aggressively on leaf sap resulting in depletion of nutrients and water which leads to premature leaf drop and drying but also produce wax and excrete sticky honeydew on infested areas leading to extreme growth of black sooty mould which results in the reduction of photosynthetic efficiency in palms. It has now become regular pest of coconut and oil palm in India, warranting control measures to avoid crop losses.

Two parasitoids, *Encarsia guadeloupae* and *E. dispersa* (Hymenoptera: Aphelinidae) have been fortuitously introduced into India along with spiralling whitefly *Aleurodicus dispersus* during 1990s. Among these parasitoids, *E. guadeloupaewa*

was found to be most abundant and potential with natural parasitization to the extent of 60-82% on rugose spiralling whitefly on coconut and other crops (Selvaraj et al., 2016). In India, *E. guadeloupaewa* was well established by augmentation, redistribution and various conservation strategies. Moreover, using a single biocontrol agent to suppress the whitefly population may be difficult under severe outbreak conditions especially for an invasive pest like rugose spiralling whitefly.

The entomopathogenic fungus, *Isaria fumosorosea* Wise (formerly *Paecilomyces fumosoroseus*) is distributed world wide and effective against insect pests mainly whiteflies and can initiate epizootics under natural field conditions. This fungus is used as potential biocontrol agent against rugose spiralling whitefly and Bondar's nesting whitefly on coconut in Florida (Ali et al., 2015). This bio control strategy may provide farmers with an alternative and viable option for the management of this invasive whitefly in coconut. Further, it is important to assess the interactions with parasitoid *E. guadeloupaewa*, for their

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simultaneous utilization of both the biocontrol agents for the management of rugose spiralling whitefly.

In vitro evaluation of NBAIR strains of *Isaria fumosorosea*: Two strains of *I. fumosorosea* (Pfu-1 & Pfu-5) were screening against rugose spiralling whitefly. Primary culture was tested against different stages of rugose spiralling whitefly using a leaf-dip method. Fungal culture of (ICAR-NBAIR Pfu-1 & Pfu-5) was produced on 100 gms of sterilized rice grains by inoculating 5ml of 4 days old shaker culture and incubated at $26 \pm 10C$ for 15 days. Spore suspension was prepared by suspending one gram of conidiated rice in sterile distilled water containing 0.01% Tween 80. The suspension was filtrated through three layers of muslin cloth to get hyphal-free spore suspension and the concentration of the spore in the suspension was adjusted to 1×10^8 spores/ml using Neubauer's improved haemocytometer.

The fungus was effective in killing all the life stages of the pest including eggs. These strains showed 35.2 - 80.6% mortality on different stages of rugose spiralling whitefly, respectively at 1×10^4 - 1×10^8 spores/ml) at 5 days of treatment. Myclial growth can be seen with 24 hours after exposure. Among the strains, Pfu-8 is slow growth/mycosis as compared to other strains. Eggs and first instars of these invasive whiteflies were highly susceptible to *I. fumosorosea* as compared to other life stages. Therefore, to get maximum reduction in pest population and sprays should be initiated in early stage of pest.

Development of formulation

Talc and oil formulations were developed with longer shelf life, persistence and higher bio efficacy. The strain can be mass produced using Sabouraud dextrose agar broth and talc/rice grain/oil based formulation as per Central Insecticide Board standards. All these formulations were evaluated in laboratory against rugose spiralling whitefly.

Field evaluation of *Isaria fumosorosea*: Pfu-5 has identified as promising strain and field tested against rugose spiralling whitefly in Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, West Bengal and Maharashtra on coconut. Overall mortality (72.20-73.83%) was observed at Bengaluru, Karnataka and it was 74.26 to 75.83% at Rajahmundry, Andhra Pradesh with two sprays at 15 days interval. This fungus is recommended at 5 g or ml /litre with tween 80 with 5-7 litre water using high volume sprayer during evening hours. Dead stages turn brown, shrink and dry completely. Natural epizootic of this fungus on *A. rugioperculatus* also observed in Andhra Pradesh.

The results of the present study suggest that the application of Pfu-5 was found to be highly pathogenic and seems to be potential biopesticide against *A. rugioperculatus* with very slight negative effects on beneficial parasitoid, *E. guadeloupae*. The compatibility of two different types of biological control agents is very important for sustained and successful pest management. It is evident from present findings that there are positive interactions between the *I. fumosorosea* and *E. guadeloupae* and these interactions could serve as an effective control strategy for *A. rugioperculatus* in coconut and oil palm ecosystem.

Demonstration: About 27 demonstrations were conducted in collaboration with other stakeholders across the pest infested regions such as Karnataka, Tamil Nadu, Andhra Pradesh and West Bengal for field validation. Due to its high field efficacy there is a huge demand for this biocontrol agent from the coconut farming community at farm level.

Training on mass production *Isaria fumosorosea* and their distribution

About 11 trainings were conducted on mass production of this fungus at farm level at Andhra Pradesh and Karnataka and about 45 farmers from



adult parasitoid emerged from nymphs exposed at 1×10^8 spores/mL and 94% at 1×10^4 spores/mL. Since these two biocontrol agents are compatible, they can be utilized together in biointensive pest management programme for the control of *A. rugioperculatus* coconut ecosystem.

References

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different regions were trained on mass production. Different formulation and nucleus culture of this fungus distributed to farmers, state agricultural universities, Horticultural Universities, Krishi Vigyan Kendra, Central Integrated Pest Management Centres, ICAR Research Institutions, Department of Agriculture, Department of Horticulture, All India Coordinated Research Project on Biological Control of Crop Pests Centres and other stakeholders.

Effect of Pfu-5 on Encarsia guadelouape: To test effect of Pfu-5 on parasitized nymphs were treated with different concentrations and observed the emergence and mortality of parasitoid up to 15 days after treatment. Interestingly, about 81%

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