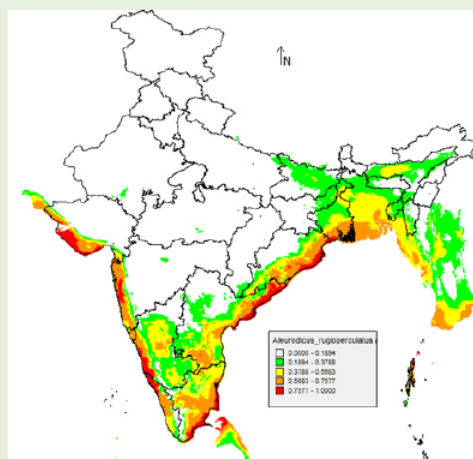


## ***Isaria fumosorosea*: a Potential Biocontrol Agent for Invasive Rugose Spiralling Whitefly in Coconut and Oil Palm**

Rugose spiralling whitefly (RSW) *Aleurodicus rugioperculatus* Martin is an invasive pest, native of the Central America and attack more than 120 host plants. In India, occurrence of *A. rugioperculatus* was reported on coconut in Coimbatore district of Tamil Nadu during August, 2016. Subsequently, its occurrence was reported from Kerala, Karnataka, Andhra Pradesh, Assam, Goa, West Bengal, Maharashtra, Meghalaya, Lakshadweep and Gujarat on more than 45 host plants.

Nymphs and adults feed aggressively on leaf sap, results in depletion of nutrients and water which leads to premature drying and leaf drop & produces wax and sticky honeydew on infested plant surface leading to extreme growth and development of black sooty mould which may interfere with photosynthetic efficiency of the palms. Besides coconut, this pest has also become a serious pest on oil palm in certain states.

Two nymphal parasitoids, *Encarsia guadeloupeae* and *E. dispersa* (Hymenoptera: Aphelinidae) have been parasitizing RSW. Among these, *E. guadeloupeae* was found to be most abundant & potential parasitoid with the natural parasitization to the extent of 60-82% on coconut and 42-54% in oil palm.



**Distribution of RSW in India**

Though, *E. guadeloupeae* was well established through augmentation and conservation strategies, there is a need for repeated release due to various factors. In most of the case, pest disperses during egg stage so parasitoid is detached from host insect as it prefer to parasitize on nymphal stages.

***Isaria fumosorosea* (ICAR-NBAIR Pfu-5):** The entomopathogenic fungus, *Isaria fumosorosea* Wize (formerly *Paecilomyces fumosoroseus*) is used as a myco-insecticide in many countries both in greenhouses as well as in an open field conditions against many insect pests mainly whiteflies. This fungus is being used as potential biocontrol agent against RSW and Bondar's nesting whitefly *Paraleyrodes bondari* on coconut in Florida.

Natural epizootics of this fungus on RSW under the field conditions was also observed in Andhra Pradesh. Further many research workers also demonstrated their compatibility with many beneficial arthropods which include predators and parasitoids.

***In vitro* evaluation of NBAIR Pfu-5 & Pfu-1:** Initial screening with two strains of *I. fumosorosea* (Pfu-1 & Pfu-5) were done against RSW. Primary culture was tested against different stages of *A. rugioperculatus* using a leaf-dip method. Among these two, Pfu-5 showed high virulence and pathogenicity against the RSW and further re-isolated twice before conducting bioassays.

Fungal culture of *I. fumosorosea* was produced on sterilized rice grains by inoculating 5 ml of 8 days old shaker culture and incubated at  $26 \pm 1^\circ\text{C}$  for 15 days. Spore suspension was prepared by suspending one gram of conidiated rice in sterile water containing 0.01% Tween 80.

The spore suspension was filtrated through three layers of muslin cloth to get hyphal-free spores and the concentrations adjusted to  $1 \times 10^8$  spores/ml using Neubauer's improved haemocytometer.

**Effectiveness:** The fungus was effective in killing all the life stages of the pest including eggs.



***Isaria fumosorosea* infection on RSW eggs**

The Pfu-5 strain showed 35.2 to 99.6, 48.8 to 91.8, 36.9 to 86.1 and 28.6 to 80.6% mortality on the eggs, first, third and fourth instars of RSW, respectively at  $1 \times 10^4$  -  $1 \times 10^8$  spores/ml) at 5 days of treatment. Myclial growth can be seen after 48 hours after exposure.

The eggs and first instars of *A. rugioperculatus* are highly susceptible to *I. fumosorosea*. Therefore, to get maximum reduction in pest population and sprays to be initiated during early life stage of pest.



***Isaria fumosorosea* infection on RSW nymphs and adult**

**Field evaluation of *Isaria fumosorosea*:** Pfu-5 was identified as promising strain and field tested against RSW in Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, West Bengal, Lakshadweep, Gujarat and Maharashtra on coconut and oil palm. Overall reduction (72.20-73.83%) in RSW population was observed in Karnataka while it was 74.26-75.83% in Andhra Pradesh with two sprays at 15 days interval.





### *Isaria fumosorosea* infection on RSW nymphs

**Formulations:** Talc, rice grain and oil based formulations were developed with longer shelf life, persistence and higher bio efficacy. The strain can be mass produced using Sabouraud dextrose agar broth.



**Formulations of *Isaria fumosorosea***

**Dosage:** Recommended dose is at 5 g or ml /litre with tween 80 and require 5-8 litre spray suspension / palm based on age of palms. The spraying should be done with high volume sprayer during evening hours. Spray fluid should cover entire lower surface of infested leaves and spray droplets to be medium in size instead of aerosol.

Infection and effectiveness of Pfu-5 is visualized by RSW life stages turning into brown, shrunk and dry completely.

### Demonstration and training on mass production

Twenty demonstrations were conducted across the pest infested regions for field validation with excellent results, necessitating huge demand from the farming community.

Seven training were conducted on mass production of this fungus at farm level in Andhra Pradesh and Karnataka. Many progressive farmers from different locations were trained and benefitted from these mass production training.

**Effect of Pfu-5 on *Encarsia guadeloupae*:** The Pfu-5 is safe to *E. guadeloupae* about 81% of adult parasitoid emerged from parasitized nymphs when exposed at  $1 \times 10^8$  spores/mL and 94% at  $1 \times 10^4$  spores/mL.

Since these parasitoid, *E. guadeloupae* and *Isaria fumosorosea* are compatible, they can be utilized together for the control of *A. rugioperculatus* in coconut and oil palm ecosystem.

**Effect of Pfu-5 on Non-target insects:** Safety of this fungus also evaluated on mulberry silkworm (mulberry common intercrop with coconut), *P. astur* (common predator on whiteflies) and *Goniozus nephantidis* (potential parasitoid of coconut black headed caterpillar). No infectivity was observed on different stages of *B. mori*, *P. astur* and *G. nephantidis*.

**Effectiveness of Pfu-5 against other invasive whiteflies:** Pfu-5 is also effective against nesting whiteflies and palm infesting whiteflies.

## *Isaria fumosorosea*: a Potential Biocontrol Agent for Management of Invasive Rugose Spiralling Whitefly in Coconut and Oil Palm



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**2020**



*Published by :*

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