

First report of *Encarsia cubensis* Gahan (Hymenoptera: Aphelinidae) an exotic parasitoid on the Neotropical Whitefly *Aleurotrachelus atratus* Hempel in India

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The invasive palm infesting whitefly, also known as the coconut whitefly, *Aleurotrachelus atratus* Hempel (Hemiptera: Aleyrodidae), entered India during 2019 and was reported to feed on coconut and areca palm (Selvaraj *et al.*, 2019). Subsequently, it spread rapidly to other coconut growing districts in Karnataka and Tamil Nadu, Kerala and Andhra Pradesh on coconut and oil palm as well. This pest host ranges include coconut, areca nut, oil palm, areca palm, foxtail palm and lipstick palm. The whitefly is highly polyphagous and prefers to colonize on palm plants often resulting in moderate to severe infestations. Nymphs and adult colonise on the under surface of leaflets and in severe cases covers more than 90% of the leaflets resulting in loss of vigour and drying of the leaflets. Colonies of *A. atratus* often coexist with other invasive and native whiteflies.

The use of natural enemies is considered an important and effective sustainable strategy in pest management, particularly of exotic and invasive pests which have been used effectively through classical, augmentation or conservation biological control to manage the pest population. Therefore, since its invasion to India, intensive and continuous surveys were conducted to document the potential natural enemies of this pest in the country. Only four species of generalist predators were recorded on this pest in India and no parasitism from native or established species observed. During the recent survey, the immature stages of *A. atratus* were found parasitized by an aphelinid parasitoid, *Encarsia cubensis* Gahan (Hymenoptera: Aphelinidae).

These parasitoids were identified by their morphological characteristics and also characterized by DNA barcoding of adult parasitoids using partial (658 bp) mitochondrial cytochrome oxidase 1 (CO1) gene (GenBank accession number ON881119). This is the first report on occurrence of *Encarsia cubensis* as primary parasitoids on *A. atratus* in India and its natural parasitism ranged from (46-68%) on coconut across the different locations in Karnataka.

Encarsia cubensis is minute, solitary and develops as primary endoparasitoid on the puparium (4th nymphal instar) (Fig. 1). Therefore, it is believed that the parasitoid likely entered India either along with *A. atratus* or other recently invaded whiteflies viz., solanum whitefly, *Aleurotrachelus trachoides* during 2015 and woolly whitefly, *Aleurothrixus floccosus* during 2019. This parasitoid well established in Brazil, Costa Rica, Cuba, Dominican Republic, Guadeloupe, Haiti, Mexico, Puerto Rico, USA.

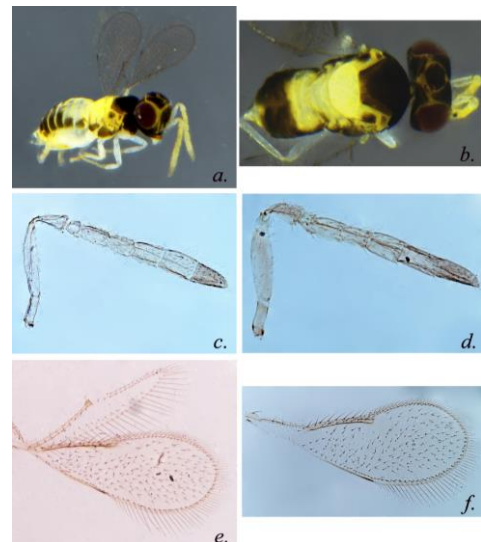


Fig.1. *Encarsia cubensis*. a). female, habitus; b). dorsal view of head, meso and metasoma; c). female antenna; d). male antenna; e). female fore wing; f). male fore wing

Encarsia cubensis was described by Gahan (1931) from Cuba based on a female reared from the woolly whitefly, *Aleurothrixus howardi*, a junior synonym of *Aleurothrixus floccosus*. *Encarsia cubensis* group is characterized by having the tarsus of the middle leg 4 segmented and the fore wing broad with a

large asetose area under the stigma vein. The adult female of *E. cubensis* differs from other species in the group by having 2 pairs of setae on the midlobe of the mesoscutum, the body mostly dark colored except for the scutellum, the lateral margins of the mid-lobe of the mesoscutum and central portion of metasomal tergites I and II which are yellow and the 2nd funicle segment of the antenna longer than the 3rd funicle segment (Fig.1). The parasitized nymphs having circular exit hole on the thoracic region whereas whitefly adults emerge by splitting the “T” shape structure formed by longitudinal and transverse moulting sutures on the cephalothorax of the whitefly puparium (Fig.2).

The infestation of *Aleurotrachelus atratus* is very high on coconut and oil palm and spreading rapidly in other coconut and oil palm growing areas in India. The parasitoid species recovered in the present study is one of the most promising biological control agents of *A. atratus* and has been reported, reared and/or released in other African countries where *A. atratus* populations are now under control due to the activities of *E. cubensis*. Although the parasitoid population is known to reduce pest density, it is only possible when the parasitoid is well established and the rate of parasitism is sufficiently high enough to exert a significant impact on the *A. atratus* population in India. Therefore, efforts should be made to increase the rate of parasitism through conservation of native natural enemies and inundative releases of classical biological control agents.

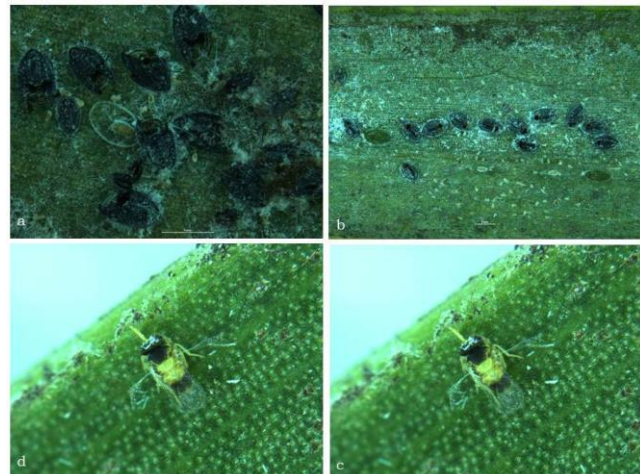


Fig. 2. a). *Aleurotrachelus atratus* adult emerged, b). *E. cubensis* emerged puparium; c-d) *Encarsia cubensis* adults

Furthermore, the scope of this effort should be broadened to include the utilization of this parasitoid for the management of *A. floccosus* on guava and *A. trachoides* on many Solanaceae plants which invaded India, respectively. *Encarsia cubensis* has not yet been reported on these other invasive pest species in India. Therefore, further extensive surveys need to be conducted on the occurrence of *E. cubensis* on these invasive species for the implementation of effective biological control strategies.

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