

## Research Article

# First report of *Encarsia dispersa* Polaszek (Hymenoptera: Aphelinidae) as a parasitoid of rugose spiralling whitefly, *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae), a recent invasive pest in India, with notes on its predators

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**ABSTRACT:** *Encarsia dispersa* Polaszek (Hymenoptera: Aphelinidae), an exotic parasitoid fortuitously introduced in India in the late 1990s along with spiralling whitefly, *Aleurodicus dispersus* Russell (Hemiptera: Aleyrodidae), is reported here as a parasitoid of the rugose spiralling whitefly, *Aleurodicus rugioperculatus* Martin, a recent invasive pest in India. This is the first report of this host association for *E. dispersa*, a parasitoid of many species of *Aleurodicus* in its native geographic range. This marks the reappearance of *E. dispersa* in South India more than a decade after its total displacement by *E. guadeloupae*. Predators of the rugose spiralling whitefly observed on banana in Tamil Nadu and Kerala are also listed.

**KEY WORDS:** *Encarsia dispersa*, India, predators, rugose spiralling whitefly

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## INTRODUCTION

The rugose spiralling whitefly, *Aleurodicus rugioperculatus* Martin (Hemiptera: Sternorrhyncha: Aleyrodidae), has been recently reported as an invasive pest of coconut from Tamil Nadu, Kerala and Andhra Pradesh in South India (Selvaraj *et al.*, 2016). It is of Neotropical origin and mainly infests coconut palms and other broad-leaved hosts in its native range (Martin, 2008). During recent surveys carried out in Aliyar Nagar and nearby places in Tamil Nadu and Kerala, severe infestation of this pest was observed on banana besides coconut, which is the major host. Infestation was also observed on other hosts such as guava, bhendi, custard apple, jatropa, hibiscus, citrus, mango, and sapota. All the stages of the whitefly were found on the leaves and fruits of banana and in cases of severe infestation, leaves were covered with heavy sooty mould. Selvaraj *et al.* (2016) also observed 25–40% leaf infestation on banana and total drying of infested leaves in several places in Tamil Nadu and Kerala.

In our surveys for natural enemies of *A. rugioperculatus* in Tamil Nadu, heavy parasitism by *Encarsia guadeloupae* Viggiani (Hymenoptera: Aphelinidae) ranging from 40 to 70% was recorded on banana alone. Selvaraj *et al.* (2016) recorded 20–60% parasitism of *A. rugioperculatus*

by *E. guadeloupae* on coconut in Tamil Nadu and Kerala. In our surveys, we recorded another parasitoid, *Encarsia dispersa* Polaszek on this whitefly (Fig. 1) along with *E. guadeloupae*. Between the two parasitoids, *E. guadeloupae* was more predominant, causing 60–70% overall parasitism. *Encarsia dispersa* was found in much fewer numbers compared to *E. guadeloupae* and the extent of parasitism was <5%. It has never been recorded on *A. rugioperculatus* anywhere in the world so far and this is the first report of this new host association for *E. dispersa*. This also marks the reappearance of *E. dispersa* in south India after more than a decade of its competitive displacement by *E. guadeloupae*. A brief history of introduction and nomenclature and diagnostic details of *E. dispersa* are given in this paper with notes on the predators of the rugose whitefly.

## Brief history of introduction of *Encarsia dispersa* in India and its nomenclature

*Encarsia dispersa* Polaszek, is an exotic parasitoid of New World (Neotropical) origin. This species has been widely and erroneously referred to as *Encarsia ?haitiensis* Dozier, *Encarsia* sp. nr. *haitiensis* and occasionally as *Encarsia* sp. nr. *meritoria* Gahan by different authors from India (Ramani *et al.*, 2002) and elsewhere. It has been both deliberately and fortuitously introduced around the world

for the biological control of spiralling whitefly, *Aleurodicus dispersus* Russell (Polaszek *et al.*, 2004). Polaszek *et al.* (1992) regarded *Encarsia ?haitiensis*, *Encarsia* sp. nr. *haitiensis* and *Encarsia* sp. nr. *meritoria* as distinct, though very closely related. Based on variations in DNA sequence data for the D2 region of 28S nuclear ribosomal genes, Polaszek *et al.* (2004) formally described this species as *Encarsia dispersa* and included it as part of the *luteola* species-group and the *Encarsia meritoria*-species complex and defined the species limits of *E. haitiensis*, *E. meritoria* and other related species. The widely introduced populations of *E. dispersa* probably originated from a single, or a few, original populations brought from Trinidad to Hawaii (Polaszek *et al.*, 2004).

*Encarsia dispersa* was the first of two species of *Encarsia* accidentally introduced in South India along with its host, *A. dispersus*, in the late 1990s, the other one being *E. guadeloupae* (Ramani *et al.*, 2002). In an apparent case of competitive displacement, *E. guadeloupae* completely displaced *E. dispersa* within a short span of 2–3 years in most of the places in South India where it was colonized (Ramani *et al.*, 2002; Mani *et al.*, 2004; Mani, 2010). *Encarsia dispersa* has not been collected in the last decade or so from south India until now.

**Diagnosis:** Both *Encarsia dispersa* and *E. guadeloupae* have a tarsal formula of 5–4–5 and belong to the *luteola* species-group (Hayat, 2011), with *E. dispersa* being a part of the *Encarsia meritoria* species-complex, a subgroup of the *luteola*-group (Polaszek *et al.*, 2004). Females of *Encarsia dispersa* can be distinguished from *E. guadeloupae* by the following combination of characters: body more or less uniform orange-yellow except mesoscutal-scutellar transverse suture distinctly pigmented dark brown-black (Fig. 2a) in live and recently mounted specimens; antennal scape pale yellow to white, pedicel yellow, flagellum pale yellowish brown to brown, F6 usually darker than rest of flagellar segments. Wings hyaline. Legs, including coxae, yellowish except tarsal apices pale brown. Antennal formula 1133 (Fig. 2d, e), F1 shorter than pedicel and F2, F2 subequal to or only slightly longer than F3, rest of flagellum more or less subequal in length. Midlobe of mesoscutum with 12–15 setae (Fig. 2b); each side lobe with 3 setae; scutellar sensillae widely separated; distance between anterior pair of scutellar setae slightly greater than between posterior pair. Fore wing (Fig. 2c) about 2.3x as long as broad with marginal fringe less than one-fifth of wing width (modified from Hayat (2011) and Polaszek *et al.* (2004)). Hayat (2011) provided detailed descriptions of *E. dispersa* and *E. guadeloupae* with illustrations.



Fig. 1. Adult of *Encarsia dispersa* Polaszek on rugose whitefly infested banana.

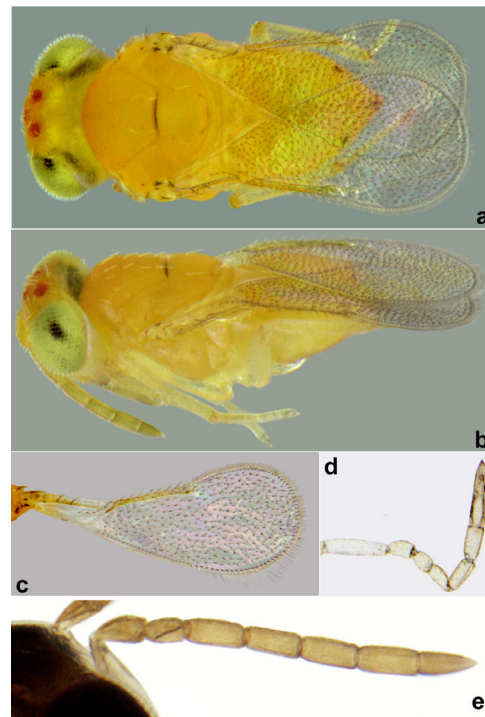


Fig. 2. Diagnostic characters of *Encarsia dispersa*: (a). Female, dorsal view; (b). Female in profile; (c). Forewing; (d, e). Antenna.

**Hosts:** The known hosts of *E. dispersa* are *Aleurodicus dispersus*, *A. maritimus* Hempel, *A. pulvinatus* (Maskell), *Aleurothrixus floccosus* (Maskell), *Paraleyrodes urichii* Quaintance, and *Tetraleurodes acaciae* (Quaintance) (Polaszek *et al.*, 2004; Noyes, 2017); *Aleurodicus rugioperculatus* (new record).

**Specimens examined:** INDIA: Tamil Nadu: CRS, Aliyar Nagar, N10°29'26.47" E076°58'50.92", 10.i.2017, Ex. *Aleurodicus rugioperculatus* on banana, R. Thanigairaj, 7 females; with same data, 21.xii.16, R. Thanigairaj, 3 females (National Research Centre for Banana, Trichy).

### Predators of *Aleurodicus rugioperculatus*

Many indigenous predators have been observed feeding on *A. rugioperculatus* (Fig. 3) as in the case of *A. dispersus* (Ramani *et al.*, 2002). Natural enemies of the rugose whitefly collected on coconut by field workers in Kerala, and Coconut Research Station (TNAU), Aliyar Nagar, were also brought to our attention. Among these, *Pseudomallada* sp. (Neuroptera: Chrysopidae) (Fig. 3f), *Cybocephalus* sp. (Coleoptera: Cybocephalidae) (Figs. 3a, b), *Diadiplosis* sp. (Diptera: Cecidomyiidae) (Figs d, e) and *Jauravia pallidula* Motschulsky (Coleoptera: Coccinellidae) (Fig. 3c) were the most predominant predators and actual feeding by these predators was observed. Besides these, whitefly infested leaves of coconut and banana had a heavy incidence of indeterminate psocids (Fig. 3g). Few larvae of *Chrysoperla zastrowi sillemi* (Esben-Petersen) (Neuroptera: Chrysopidae), released by farmers for controlling the whitefly following the pest advisories issued by Tamil Nadu Agricultural University and the state department of agriculture, were also recovered.



**Fig. 3.** Predators of *Aleurodicus rugioperculatus*: a, b. *Cybocephalus* sp.; c. *Jauravia pallidula* (Motschulsky); d. Larva of *Diadiplosis* sp.; e. Adult of *Diadiplosis* sp.; f. Larva of *Pseudomallada* sp.; g. Indet. psocid feeding on whitefly.

Many coccinellid predators such as *Chilocorus nigrita* (F.), *Cryptolaemus montrouzieri* Mulsant, *Scymnus saciformis* Motschulsky, *Sasajiscymnus dwipakalpa* (Ghorpade), and *Scymnus nubilus* Mulsant were also observed on whitefly infested banana and coconut, but these were not confirmed to feed on the whitefly. In the case of coconut, mixed infestations of *A. rugioperculatus*, mealybugs and other species of whiteflies were observed, from which host associations could not be definitively recorded. There

are obvious and interesting parallels between the cases of introductions of spiralling whitefly and the rugose spiralling whitefly in India, their subsequent spread and natural enemy complex. In the case of *A. rugioperculatus*, heavy parasitism by *E. guadeloupae* coupled with predation by indigenous predators seems to be bringing its population levels below economic threshold levels.

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