

IDENTIFICATION OF WHITEFLY SPECIES (Hemiptera: Aleyrodidae) AND THEIR PARASITOIDS ON WILD PLANTS IN THE BATTICALOA DISTRICT

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ABSTRACT

In Sri Lanka, whiteflies infest wide range of host plants including wild plants, fruit crops, vegetable crops and medicinal plants. Whitefly fauna of Sri Lanka include 49 species (David, 1993). However, distribution data of whitefly species are not available. This study was conducted to identify the whitefly species and their parasitoids in the selected farmer's fields in the Batticaloa district. Twenty whitefly infested leaves were sampled from *Manihot* spp. and *Terminalia catappa*. The non parasitized and parasitized pupae were separated and prepared for the identification of whitefly species and their parasitoids respectively. Three species of whiteflies viz. *Trialeurodes vaporariorum*, *Bemisia tabaci* and *Aleurodicus dispersus* and two Hymenopteran parasitoids species, *Encarsia cibcensis* and *Encarsia guadeloupae* were found in the samples. *Encarsia cibcensis* was predominantly found in the sampled area. Both parasitoids parasitized the nymphal instars and emerged from the pupae of whitefly.

Key words: Nymphal instar, Parasitoids, White flies

INTRODUCTION

Whiteflies infest a wide range of host plants which include cultivated crops, ornamental, medicinal and wild plants (Bellotti, 2002). They injure plant by feeding on plant sap, producing honey dew and transmitting viral diseases (Brown, 1994). Therefore, management of whitefly population in agro and natural ecosystems is important. Different management strategies have been practiced to manage whitefly population in Sri Lanka ((Ponnambalam, 1983) and bio-control is one of the important strategies in integrated pest management systems rather than the chemical control measures. Because the conventional insecticide spraying is associated with several limitations such as the chemicals are expensive and not always effective (Hilje *et al.*, 2001). Therefore, nowadays many researches are directed to develop biological control

agents of whiteflies (Gerling, 1986; Gerling and Mayer, 1996; Gerling *et al.*, 2001; Van Lenteren and Martin, 1999).

In order to promote biological control it is important to know the host species and the parasitoids species attacking them. Therefore the objective of this study was identification of the whitefly species and their parasitoid species associated with wild plants in the Batticaloa district.

MATERIALS AND METHODS

This study was conducted in the Batticaloa district during 2007/2008. The work involved two components (a) field sampling of whiteflies and (b) processing of samples in the laboratory and species identification.

(a) Field sampling

Terminalia catappa (Tropical almond) and *Manihot* spp. complex (wild Cassava) were identified as heavily infested wild crops during initial field surveys. Twenty infested leaves with whitefly colonies were randomly collected from each wild plant species wrapped them in a paper towel to avoid excess humidity and subsequent fungal growth and placed the samples in poly-ethylene bags separately. Samples were collected in a weekly interval for one month. The collected samples were taken to laboratory.

(b) Processing of samples

Identification of whiteflies was based on morphological characteristics of pupal cases. Pupal cases were removed from leaf samples using a paint brush and collected into a plastic vials. Pupal cases were processed according to Martin (1987) for the microscopic examination.

These characteristics were compared with the taxonomic key at their species level. Whitefly species in the Batticaloa region were confirmed by using reference collections, catalogues, taxonomic keys and pictorial keys on whitefly species.

Collection and rearing of parasitoids

Upon the examination of whitefly pupae samples, black colour pupae were separated. Black coloration is due to the parasitization (Evans, 1997). The leaf disk which containing parasitized whitefly pupae were selected to rare parasitoids under isolation method (Evans, 1997). After emergence of parasitoids, adults were processed and preserved as wet specimens for identification.

Identification of parasitoid

Emerged parasitoids from the parasitized whitefly pupal cases were collected from parasitoid rearing vials and they were mounted on cleared slides using the guidelines described by Evans, in 2004. Morphological and morphometric characters were observed and the species of each parasitoid were identified by using an identification guide developed by Evans, (1997) and Schmidt *et al.*, (2001). The parasitoids were confirmed by using reference collections, catalogues taxonomic keys and pictorial keys.

RESULTS AND DISCUSSION

Whitefly species attacking the wild plants

Among one hundred and sixty specimens collected from Cassava and *Terminalia*, three whitefly species were identified. All three species were found on Cassava while only one species found on *Terminalia*. The observed characteristics were compared with the taxonomic key prepared by Martin, (1987).

Whitefly species 1

It was collected from wild *Manihot* sp. Pupal case was elliptical, elongated and broadly rounded posteriorly. The cuticle was pale and the margin was uniformly crenulated. Subdorsum had five pairs of evenly spaced large simple pores. A smaller number of minute submarginal setae and were irregularly distributed along the submargin. The submarginal papillae were very closely set and distally acute.

Large and elongated vasiform orifice was inserted from posterior margin of pupal case by its own length. It was rounded and triangular in shape and slightly longer than wide. More than half of total length and area of vasiform orifice was occupied by operaculum and head of the lingual together. Lingula was small, tongue shaped and had a caudal furrow.

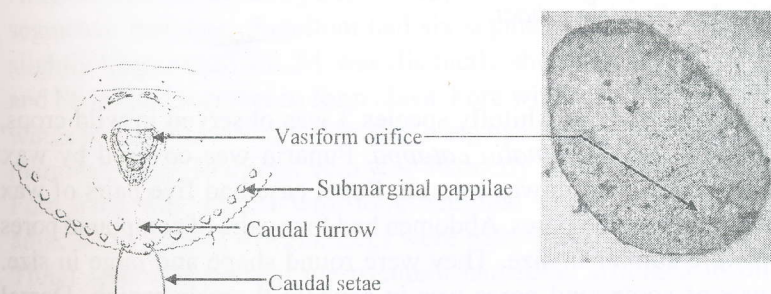


Figure 1: Pupal case of *Trialeurodes vaporariorum* ($\times 100$)

Based on these morphological characters, this whitefly species was identified as *Trialeurodes vaporariorum* with the help of taxonomic key.

Whitefly species 2

It was also collected from wild *Manihot* sp. Pupal case was elliptical, less elongated and was pointed posteriorly. The margin was irregularly crenulated. Cuticle was pale in colour. Compound pores and submarginal papillae were absent in subdorsum.

Triangular vasiform orifice was inserted from posterior margin of pupal case. It was much longer than wide at base and sides were straight to concave. The sides of orifice were almost straight. Caudal furrow was smaller than vasiform orifice in length and has one pair of well developed, stout and long caudal setae. The lingula was pointed but the head was not lobed.

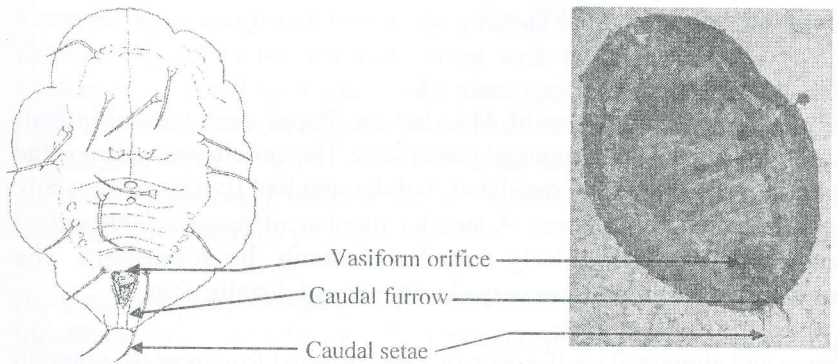


Figure 2: Pupal case of *Bemisia tabaci* ($\times 100$)

The above mentioned morphological characters of whitefly species 2 were compared with the identification guidelines and the species was identified as *Bemisia tabaci*.

Whitefly species 3

The emergence of the whitefly species 3 was observed in wild crops, *Manihot* sp. and *Terminalia catappa*. Puparia was covered by wax strands. Lateral margin was smooth. Pupal case had five pairs of wax producing compound pores. Abdomen had four pairs of compound pores which were similar in size. They were round shape and large in size. One pair of compound pores was in cephalo thoracic region. Dorsal disc with a pattern of conspicuous septate pores was in submedian area

and much of subdorsal area with a dense pattern of wide rimmed pores. Vasiform orifice was subcordate and wider than long. Lingula with four setae was large, tongue shaped and extended beyond posterior margin of vasiform orifice.

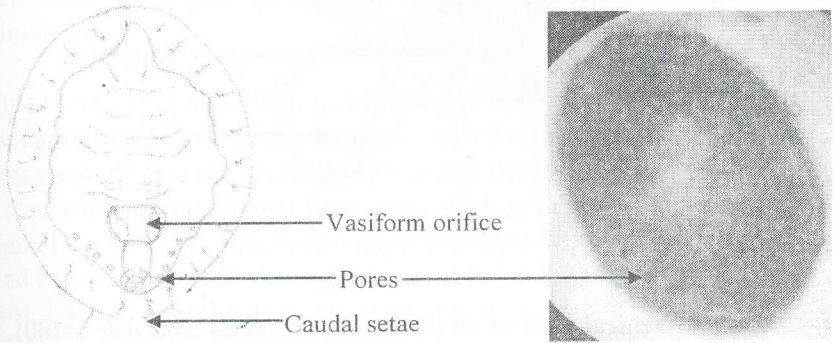


Figure 3: Pupal case of *Aleurodicus disperses* (×100)

Based on these morphological characters, the whitefly species was identified as *Aleurodicus dispersus*.

Whitefly parasitoids

Fifty six adult parasitoids consisting two different parasitoids species were collected during the study. All insects had two pairs of membranous wings and distinct 'waist' in between thorax and abdomen. Therefore these insects were grouped into the order Hymenoptera. The morphological descriptions of each parasitoid are listed below.

Parasitoid 1

Forty eight adult parasitoids out of fifty six showed same characteristic features and were collected from wild *Manihot* sp. plants. Head and body were yellow. Compound eyes and ocelli were black in colour. Antenna was clavate and yellow in colour with slightly darkened apical segments. Antennal flagellum had six segments (F1-F6). Pedicel was slightly longer than F1. F1 was distinctly shorter than F2 and F3. F5 and F6 jointed together to form clava. Fore wings were larger than hind wings in length and width. The fore wing had stigmal, marginal and sub marginal veins. Marginal vein was distinctly longer than stigmal vein. Fore wing was narrow with long marginal fringe and had bare area adjacent to leading margin. Legs were pale. Tarsal formula was 5-5-5. Tibial spur was present mesoscutum had setae arranged in bilateral symmetry. Scutellum was oval in shape and distinctly wider than long. Scutellar sensilla were widely distributed. Axillae were short and separated from each other.

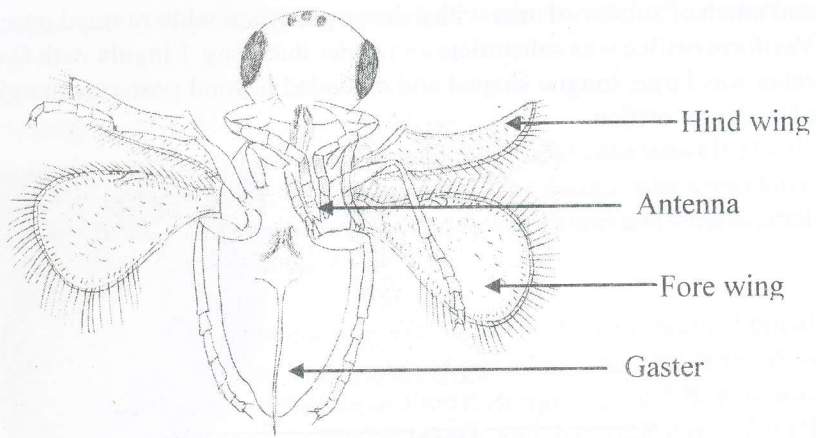


Figure 4: Ventral view of adult female, *Encarsia cibcensis* ($\times 100$)

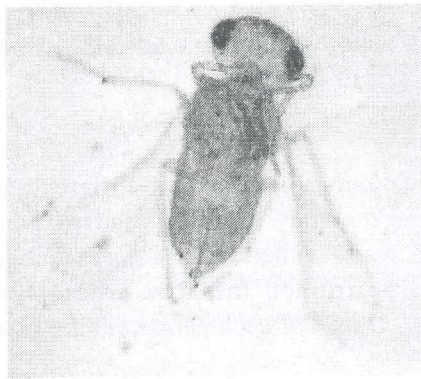


Figure 5: Adult female, *Encarsia cibcensis* ($\times 100$)

Based on these morphological characters, this parasitoid was identified as *Encarsia cibcensis* belongs to the family Aphelinidae.

Parasitoid 2

There were eight adult parasitoids were collected from wild *manihot* sp. and *Terminalia catappa*. The head of the parasitoid was brown and the compound eyes were yellow. It had three ocelli arranged in triangular shape and one pair of antennae. A pair of yellow coloured geniculate antennae, each with six segmented flagellum was observed. Pedicel was slightly longer than first flagellomere. First flagellomere (F1) was slightly shorter than second (F2) and third (F3). F2 and F3 were sub equal in length and other segments were jointed together to form three segmented clava. There was ridge-like, longitudinal sensilla also observed on the flagellum.

Thorax was brown except scutellum. Midlobe of mesoscutum had sixteen setae arranged in bilateral symmetry. Yellow coloured scutellum was distinctly wider than long. Scutellar sensilla were widely separated. Distance between anterior pair of scutellar setae was sub equal to distance between posterior pair. Two pairs of wings and three pairs of legs arose from thorax.

It had two pairs of membranous wings arose from meso and meta thorax respectively. Fore wing was larger than hind wing. Sub marginal vein (Smv), marginal vein (Mv) and stigmal vein (Sv) were observed clearly in fore wing. It was longer than wide. Asetose area was absent under stigmal vein of forewing. Fore wing was hyaline with slightly infuscate band behind basal half of marginal vein. Marginal fringe was relatively short. Lack of venation was observed in both wings.

Three pairs of legs except the hind coxa and femur appeared in yellow. The tarsal formula was 5-4-5. Long tibial spur was observed.

Abdomen was mostly brown. Metasomal terga with three and four lateral setae were observed in third and fourth tergite respectively. It has a long ovipositor.

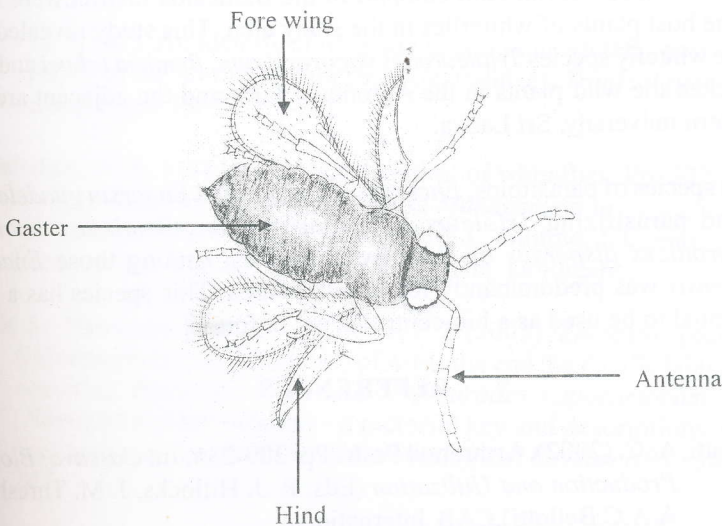


Figure 6: Adult female, *Encarsia guadeloupeae* (×100)

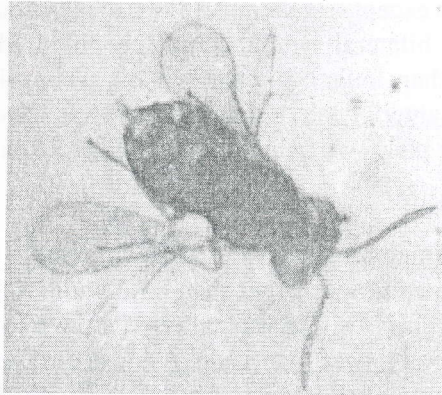


Figure7: Dorsal view of adult female, *Encarsia guadeloupae* (×100)

The above mentioned characteristic features of parasitoids were compared with the identification guidelines described by Evans (1997) and Schmidt *et al.*, (2001). Based on these guidelines, the parasitoid was identified as *Encarsia guadeloupae* Viggiani, 1993.

CONCLUSIONS

Three whitefly species, *Trialeurodes vaporariorum*, *Bemisia tabaci* and *Aleurodicus dispersus* infest *Manihot spp* while only the *Aleurodicus dispersus* infest *Terminalia catappa* in the Batticaloa district. were found as the host plants of whiteflies in the study area. This study revealed that, three whitefly species *Trialeurodes vaporariorum*, *Bemisia tabaci* and were attacked the wild plants in the Agronomy farm and the adjacent areas of Eastern university, Sri Lanka.

Two species of parasitoids, *Encarsia cibcensis*, and *Encarsia guadeloupae* found parasitizing *Trialeurodes vaporariorum*, *Bemisia tabaci* and *Aleurodicus dispersus* on these wild species. Among those *Encarsia cibcensis* was predominantly found in this area. This species has a great potential to be used as a bio-control agent in future.

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