IDENTIFICATION OF PARASITOID SPECIES ASSOCIATED WITH WHITEFLY COLONIES IN SELECTED MEDICINAL CROPS

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ABSTRACT

Whitefly is one of the serious pest groups in Sri Lanka, which attacks a numerous crops including medicinal crops. As these insects developed resistance to several groups of insecticides, high cost of insecticides against new bio-types, the elimination of their natural enemies by abuse and misuse of insecticides and their wide host range have make it difficult to control this insect pest. The increasing demand for insecticides free products and self defense of consumers for toxicity of insecticides force the cultivators to take bio-control strategy to control the whitefly outbreaks.

Three medicinal plants Solanum trilobatum, Eucalyptus and Syzygium cumini were identified as the host-plant of whitefly (Genus Trialeurodes) in the Batticaloa district during the study period. Whitefly infested leaves were collected and from which non-parasitized pupae of whitefly were brushed out and parasitized pupae were kept with leaves until the emergence of parasitoids. Morphological characteristics of emerged parasitoids were recorded to identify the species of whitefly associated parasitoids. Three hymenopteran parasitoids belongs to family Aphelinidae namely, Encarsia guadeloupae (Viggiani, 1987), Encarsia pergandiella (Howard, 1907) and Eretmocerus californicus (Howard, 1895) were recorded as the parasitoids of the whitefly colonies, infested the medicinal crops in the Batticaloa district.

Key words: Bio-control, Host plants, Parasitoid, Whitefly

INTRODUCTION

Human beings have been utilizing plants for basic preventive and curative health care since time immemorial. Since the beginning of human civilization, people have used plants as medicine (Anna, 1993). *Syzygium cumini* (jambolan), *Solanum trilobatum (Thuthuvallai), Eucalyptus globules,* etc are commonly taken by human as medicine to cure some disease. Jambolan is of wider interest for its medicinal applications than for its edible fruit. All parts of the Jambolan can be used. Medicinally,

the fruit is stated to be astringent, stomachic, carminative, antiscorbutic and diuretic. In experiments at the Central Drug Research Institute, Lucknow, the dried alcoholic extracts of both, seeds and barks but especially the seeds, are freely given orally, 2 to 3 times a day, to patients with diabetes mellitus or glycosuiria. In many cases, the blood sugar level reportedly is quickly reduced and there are no ill effects (Morton, 1 9 *Solanum trilobatum* is used to treat respiratory diseases, hepatic disorders. And also it is used as antitussive and expectorant.

Demand for medicinal plant is increasing in both developing and developed countries due to growing recognition of natural products, being non-toxic, having no side-effects and easily available at affordable prices. However, it was found that the medicinal crops are severely infested by insect pest especially by whitefly (Bhat, 1995). Whiteflies cause damage to plants by feeding on phloem. It causes three types of damages, direct, indirect damage and virus transmission to their host plants, including medicinal crops (Berlinger, 1986). Many biological characteristics of whiteflies including multivoltinism, and a propensity to develop resistance to wide classes of insecticides have contributed to the difficulty of developing robust and sustainable management systems (Naranjo, 2001). Especially in medicinal plants chemical control of whitefly is not preferable, because mostly fresh or dried forms of plant parts are used as medicines. The residues of chemical can alter the effectiveness of medicinal value of plant parts. There fore the biological control of whitefly is considered as cost effective and environmentally friendly method (Hoddle, 2003).

MATERIALS AND METHODS

After thorough observation of medicinal plants only *Syzium cumini*, *Eucalyptus*, *Solanum trilobatum* were found as the host plants of whiteflies during the study period. Ten whitefly infested leaves from each infested crop were collected in the appropriately labeled polyethylene bags and brought to laboratory for parasitoid rearing. Specimens were collected by weekly interval for one month.

Identification of parasitoid

In this study parasitoids were reared by isolation method. The collected leaf samples were observed under microscope and parasitized and non-parasitized pupae were separated based on their colouration, parasitized pupa had black colour and non-parasitized pupa was in pale colour (Figure 1). Non-parasitized pupae were brushed out and leaf portions

with parasitized pupal instars were cut from the leaf and edges were wrapped with moisten cotton to reduce the water loss from the sample and each leaf portion is placed in a small vial. The vial was sealed with a cotton ball, and kept until the emergence of parasitoids (Figure 2).

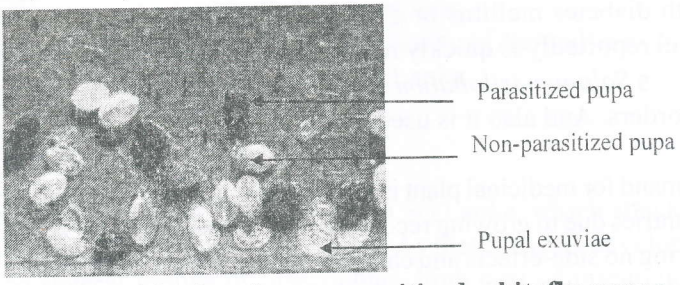

Figure 1: Parasitized and non-parasitized whitefly pupae

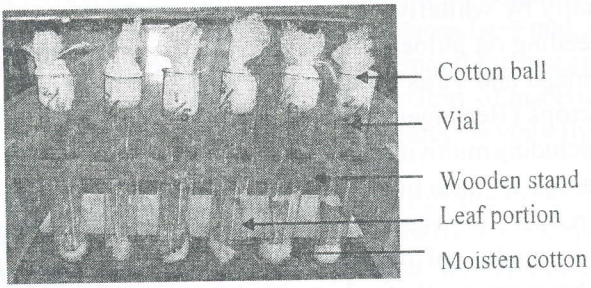

Figure 2: Parasitoid rearing setup

Emerged parasitoids were collected and each was mounted on a slide. Specimens were carefully observed under light microscope (×100) and the morphological characteristic features were recorded. Parasitoids were identified up to Genus level with the help of the pictorial guide provided by Schauff *et al.,* (1996) and the taxonomic keys of Evans, (1996) and Polaszek *et al., (*1992). Guidelines of Schmidt *et al., (*2001) was used to identify the specimens up to their species level.

RESULTS AND DISCUSSION

Parasitoids

Three species of Hymenopteran pupal parasitoids were collected during the study period. They parasitized the nymphal instars of whitefly species. Ten samples of each parasitoid were observed and their morphological and morphometric descriptions were recorded during the study, are listed below.

Parasitoid 1

This dark colour tiny parasitoid was collected from *Solanum trilobatum.* The adult female was mostly brown in colour, 0.4mm in size.

Head was mostly in brown; black coloured compound eyes; three black ocelli; a pair of clavate antennae and a biting and chewing type of mouth-parts were found in brown coloured head.

Clavate antenna was yellow in colour except scape,which was brownish colour. Antenna had three segments, scape, pedicel and flagellum. Flagellum was six segmented; three apical flagellomers fused together and formed a clava and funicle was formed by three basal flagellomers. Pedicel was slightly longer than first funicle segment. First funicle segment was slightly shorter than second and third funicle segments, both were sub equal in length.

Pronotum, axillae and mesoscutal mid lobe were brown in colour and other parts of thorax were yellow in colour. Bilateral symmetrically arranged 16 setae were found in mesoscutal mid lobe. Scutellum was oval shape distinctly wider than long. Scutellar sensilla were widely separated. Distance between anterior pair of scutellar setae was sub equal to distance between posterior pair of scutellar setae. Axillae were short and separated from each other by length of axilla.

Transparent wings were found in meso and meta-thorax respectively. Fore wing was broader than hind wing and the bare area was absent in fore wing. Wing venation was reduced; submarginal vein (smv), marginal vein (mv) and stigmal vein (sv) were found. Marginal vein was long, distinctly longer than stigmal vein. Forewing was hyaline with slightly infuscate band behind basal half of marginal vein. Fore wing was longer than wide. Marginal fringe was relatively shorter than wing width.

Legs were yellow in colour except hind coax and femur, they were brown. Tarsal formula was 5-4-5. Apical spur of middle tibia was longer than half of the length of the basal tarsal segment. There were two claws in pre-tarsi.

Abdomen was brown except the last tergum which was yellow in colour. Last abdominal tergum was wider than long. Three and four abdominal lateral setae were found on third and fourth abdominal segments respectively. Apex of ovipositor was brown in colour. Ovipositor was longer than middle tibia. Terminal valvulae of ovipositor were dark brown in color.

Based on these characteristics this parasitoid was identified as *Encarsia guadeloupae* belong to the family Aphelinidae (Viggiani, 1987).

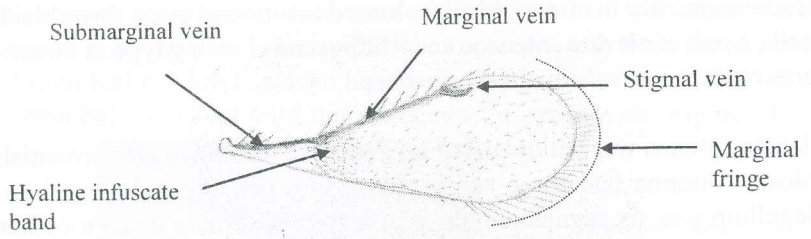

Figure 3: Fore wing of Parasitoid 1

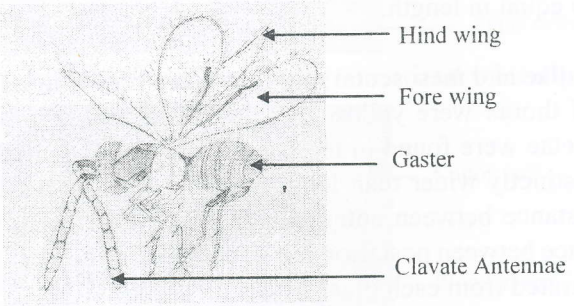

Figure 4: Adult, *Encarsia guadeloupe* (X100)

Parasitoid 2

This parasitoid was collected from *Eucalyptus*. The adult, tiny female parasitoid was 0.4mm in size and largely yellow in colour.

There was a yellow head except the posterior part, it was in brown colour. Yellow colour compound eyes, a pair of clavate antenna, three red colour ocelli and a biting and chewing type of mouth-part were found in head.

Clavate antenna was in yellow colour with slightly darken apex, it consist scape, pedicel and flagellum. Antenna was slender with two segmented clava. Pedicel was longer than first funicle segment. First funicle segment was slightly shorter than second and third funicle segments.

Pronotum and axiilae were brown in colour and other parts of thorax were yellow in colour. Scutellum was oval shape distinctly wider than long. Scutellar sensilla were widely separated. The distance between anterior pair of scutellar setae was sub equal to the distance between posterior pair.

Transparent wings were found in meso and meta-thorax. Fore wing was larger than hind wing. It was 3.5 times as long as wide and found with an asetose area near to stigmal vein. There was long marginal fringe. Wing venation was gradely reduced; submarginal vein (smv), marginal vein (mv) and stigmal vein (sv) were found. Marginal vein was long; distinctly longer than stigmal vein. Wing membrane was light infuscate beneath the venation.

Three pairs of yellow colour legs were found in thoracic region. Tarsal formulation was 5-5-5. Apical spur of middle tibia was shorter than half of the length of basal tarsal segment which was relatively long and slender. There were two claws in pre-tarsi.

Abdomen was brown in colour. Last abdominal tergum was wider than long. A pair of long cercal setae was found in the middle of abdominal cercus. Apex of ovipositor was brown in colour. Ovipositor was longer than the length of the middle tibia.

The characteristics of this parasitoid were compared with the identification guidelines developed by Howard, 1907 and it was identified as *Encarsia pergandiella* belong to the family Aphelinidae

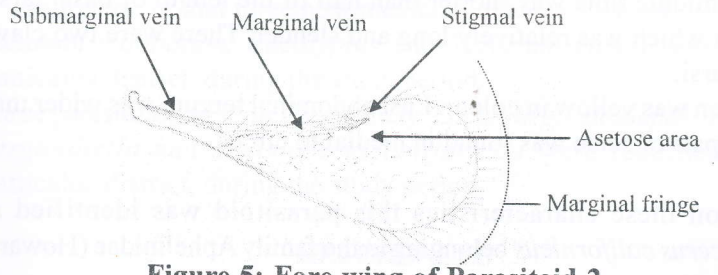

Figure 5: Fore wing of Parasitoid 2

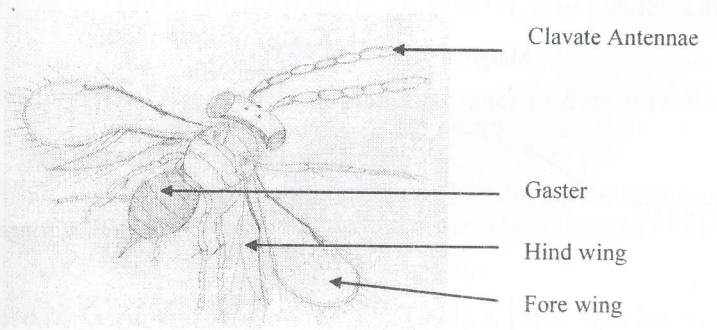

Figure 6 : Adult, *Encarsia pergandiella* (X100)

Parasitoid 3

This pupal parasitoid was collected from *Syzyjium cumini* plant. The adult, tiny female parasitoid was 0.4mm in size and largely lemon yellow in colour. The characteristics of each component of the insect body are listed below.

Red coloured compound eyes, a pair of antenna, three red coloured ocelli and a biting and chewing type of mouth-part were found on head. There was a pair of long, yellow coloured and elbowed antennae which was three segmented; scape, short pedicel and long flagellum.

Three pairs of setae were found on mesoscutal midlobe. Scutellum was oval in shape distinctly wider than long. Axillae were separated from each other. Wings were transparent and found in meso and meta-thorax. Forewings were larger than hind wings. Wing venation was reduced however marginal, sub-marginal and stigmal veins were found. Marginal vein was longer than stigmal vein. A bare area was found near the stigmal vein. Short marginal fringe was also found.

Legs were yellow in coloured in thoracic region. Tarsal formulation was 4-4-4. A part of the coax was found out of the metathorax. Apical spur of middle tibia was shorter than half of the length of basal tarsal segment which was relatively long and slender. There were two claws in pre-tarsi.
Abdomen was yellow in colour. Last abdominal tergum was wider than long. A pair of setae was found in medial to circus.

Based on these characteristics this parasitoid was identified as *Eretmocerus californicus* belonging to the family Aphelinidae (Howard, 1895).

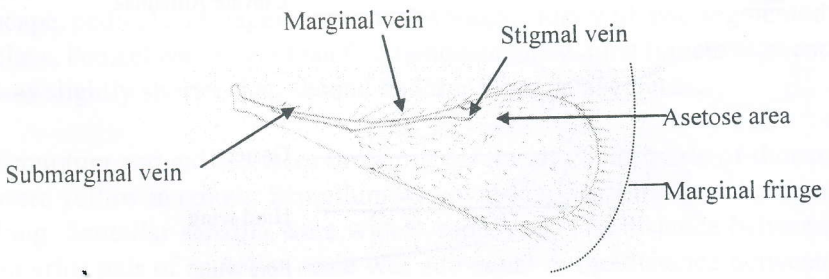

Figure 7: Fore wing of Parasitoid 3

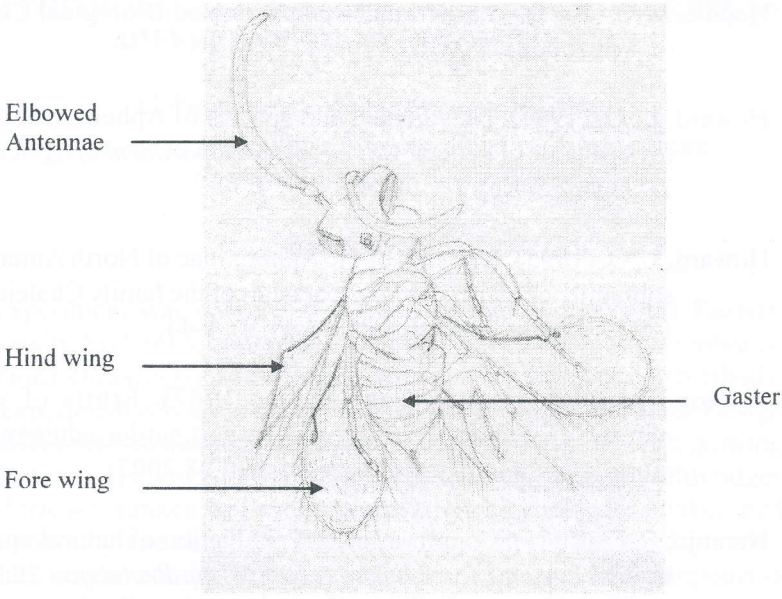

Figure 8: Adult, *Eretmocerus californicus* (X100)

CONCLUSIONS

It was found out that three host-medicinal plants of whiteflies namely, *Solanum trilobatum, Eucalyptus* and *Syzygium cumini* were in the Batticaloa district, during the study period.

Three parasitoids of whiteflies namely, *Encarsia guadeloupae*, *Encarsia pergandiella* and *Eretmocerus californicu* were recorded in the Batticaloa district, during the study period.

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