Whiteflies (Hemiptera-Aleyrodidae) breeding on Teak (Tectona grandis L. f) in India with description of a new species

ABSTRACT
Detailed surveys were conducted to identify the whiteflies breeding on teak in India. The whitefly infested leaves were collected from teak and permanent mounts of the puparia were prepared and their identity was confirmed. The study revealed the presence of seven species of whiteflies breeding on teak in India. They include earlier reported four species viz, Pealius splendens (David, Sundararaj & Regu), Martiniella fletcheri (Sundararaj & David), Aleurolobus sundararaji Regu & David and Aleurodicus dispersus Russell; two new records viz., Aleurolobus moundi David & Subramaniam and Pealius sairandhryensis Meganathan & David and a new species of the genus Aleurocanthus. The new species is described with illustration and other species are listed with their host range. Further, a suitable illustration of the puparium of each species is provided along with a key for identification.

Key-words: Hemiptera, Whiteflies, Tectona grandis, India.
INTRODUCTION

Teak [*Tectona grandis L. f.*] is an undisputed global leader of quality tropical timbers [1-15]. It is a large deciduous tree which occurs in moist and dry deciduous forests below 1000 m elevation and is one of the several species constituting mixed forest stands. It occurs naturally only in India, Myanmar, the Lao People’s Democratic Republic and Thailand, and it is naturalized in Java, Indonesia, where it was probably introduced some 400 to 600 years ago. In addition, it has been established throughout tropical Asia, as well as in tropical Africa and Latin America and the Caribbean [Pandey and Brown, 2000]. Presently among the growing timber plantations of world appreciable portion is represented by teak trees. More than 150 species of insects have been reported on teak but, little information is available on the whiteflies breeding on it. [8] listed teak as host plant of Aleurotrachelus trachoides [Back] in Neotropical region. In India teak was reported to infest by four species of whiteflies viz., Pealius splendens [3] [3], Martiniella fletcheri [3], [14], Aleurolobus sundararajji Regu & David [12], and Aleurodicus dispersus Russell [9]. In the present study, in addition to these four species we found three more species of whiteflies viz., Aleurocanthus icfreae sp. nov., Aleurolobus moudii David & Subramaniam and Pealius sairandhryensis Meganathan & David on teak. The new species is described with illustration and other species are listed with their host range. For easy identification of mounted specimens of whiteflies, a suitable illustration of the puparium of each species is provided. In addition a detailed key for identification of whiteflies infesting teak is given.

MATERIAL & METHODS

The present study was largely based on the whitefly puparium collected from teak in various localities of India during the period 2005-08. The whitefly infested leaves were collected from teak and permanent mounts of the puparia were prepared by adopting the method suggested by David & Subramaniam [2]. The best mounts were obtained from puparium from which adults have emerged. Observations, micro-measurements and camera lucida drawings were made by using Nikon Optiphot T-2 EFD microscope and the identity of the whiteflies were confirmed. The holotype of the newly described species was deposited in National Forest Insect Collection, Division of Forest Entomology, Forest Research Institute, Dehra Dun, India [NFIC] and one paratype each was deposited in National Pusa Collection, Division of Entomology, Indian Agricultural Research Institute, New Delhi, India [IARI] and Zoological Survey of India, Calcutta, India [ZSI]. The other studied specimens are in the collection of Institute of Wood Science & Technology, Bangalore, India [IWST].

RESULTS & DISCUSSION

The survey revealed that in India the teak is infested by whiteflies representing two subfamilies viz., Aleurodicinae Quaintance & Baker and Aleyrodinae Westwood. The subfamily Aleurodicinae is represented by a single species while the subfamily Aleyrodinae is represented by six species including a new species. The details are as follows.

Subfamiliy I: Aleurodicinae Quaintance & Baker, 1913
1. Aleurodicus dispersus Russell [Fig. 1]
2. Aleurocanthus icfreae sp. nov. [Fig. 2]

Puparium. Black, with secretion of wax on surface of leaves. Mainly on under surface and rarely on upper numbers with secretions of fluffy wax and covers margin; elliptical in shape, broadest across the I abdominal segment region, 0.64 - 0.77 mm long, 0.44 - 0.5 mm wide; found singly on the under surface of leaves. Margin serrated, 10 - 11 teeth in 0.1 mm, tooth not modified at thoracic and caudal tracheal openings. Anterior and posterior marginal setae respectively, 12 µm and 22 µm long.

Dorsum. Dorsum with 29 pairs of pointed spines with distinct bases- 14 pairs on cephalothorax and 15 pairs on abdomen. Of the 14 pairs on cephalothorax, 3 on submedian 40 - 100 µm long, 6 on subdorsum 32.5 - 150 µm long and 5 on submargin 150 - 162.5 µm long and of the 15 pairs on abdomen, 3 on inner submedian area 12.5 - 72.5 µm long, 7 on outer submedian area 45 - 150 µm long and 5 on submargin 150 - 162.5 µm long. Subdorsum granulated. Longitudinal moulting suture reaching margin. Transverse moulting sutures curved caudad from its midpoint,
recurred and terminating at submargin nearly opposed to its midpoint.

Chaetotaxy. Cephalic setae 50 µm long, eighth abdominal setae 54 - 60 µm long and caudal setae 112 µm long. First abdominal setae absent. Thoracic and caudal tracheal furrows absent. Pores and porettes absent.

Vasiform orifice. Subcordate, elevated, 32 - 38 µm long, 44 - 50 µm wide, postero-lateral inner wall of vasiform orifice with finger-like processes; operculum similarly shaped, 26 - 30 µm long, 34 - 40 µm wide, filling half of orifice. Lingula concealed.


Etymology. The name of this species refers to the acronym for Indian Council of Forest Research and Education [ICFRE], Dehra Dun, India.

Comments. This species resembles Aleurocanthus bangalorensis Dubey & Sundararaj in shape and by the presence of 29 pairs of dorsal spines, but differs in the nature of transverse moulding suture, serrated margin, and presence of granules on subdorsum and by the absence of row of irregular markings in venter of submargin.

Pest status. 1 to 2 puparia per leaf were found without any wax secretion on the under surface of leaves in young teak plantations.

4. Aleurolobus sundararaji Regu & David [Fig. 4]
Aleurolobus sundararaji Regu and David, 1993. FIPPAT Entomology Series, 4, 47.

Material examined. India: Tamil Nadu: Ulakkai falls, 9 puparia, on Tectona grandis, 20.iii.07, R. Sundararaj [IWST].

Hosts. Tectona grandis [12].

Pest status. Black puparium with fringe of wax around margin and little powdery wax on dorsum, 0 to 1 per leaf on the under surface of leaves in natural plantations.

5. Martiniella fletcheri [14] [Fig. 5]


Material examined. India: Tamil Nadu: Unnamalaikadai, 4 puparia on Tectona grandis, 11.xi.06, R. Pushpa [IWST].

Hosts. Mallotus sp., Tectona grandis, Hemidesmus indicus [14]; Lanorea cornomandelica, Litsea bourdilloni [4].

Pest status. Small white puparium with little wax on dorsum, 1 to 2 per leaf on the under surface of leaves of young plantations.

6. Pealius sairandhryensis Meganathan & David [Fig. 6]
Pealius sairandhryensis: Meganathan and David, 1994. FIPPAT Entomology Series, 5, 47.

Material examined. India: Tamil Nadu: Unnamalaikadai, 10 puparia, on Tectona grandis, 11.xi.06, R. Pushpa [IWST].

Hosts. Oreocnida integrifolia [Meganathan & David, 1994]; Tectona grandis [new host record].

Pest status. Pale white puparium with little wax only on margin, 1 or 2 per leaf, found on the under surface of leaves in natural strands of teak.

7. Pealius splendens [12] [Fig. 7]


Material examined. India: Tamil Nadu: Unnamalaikadai, 10 puparia, on Tectona grandis, 11.xi.06, R. Pushpa [IWST].

Hosts. Oreocnida integrifolia [Meganathan & David, 1994]; Tectona grandis [new host record].

Pest status. White puparium with little wax only on margin, 1 or 2 per leaf, found on the under surface of leaves in natural plantations of teak.

8. Aleurolobus moudii David & Subramaniam [Fig. 3]

Material examined. India: Karnataka Chikbalapur, 5 puparia on Tectona grandis, 3.i.2007, R. Pushpa [IWST].

Hosts. Madhuca indica, M. longifolia, Madhuca sp., [David and Subramaniam, 1976]; Michelia champaca, Tectoma stans [Dubey and Sundararaj, 2006]; Tectona grandis [new host record].

Pest status. 28 to 32 black puparia per leaf with a marginal fringe of wax and white powdery meal on dorsum were found in groups on the under surface of leaves of young plantations.

9. Aleurolobus moudii Regu & David [Fig. 4]
Aleurolobus moudii Regu and David, 1993. FIPPAT Entomology Series, 4, 47.

Material examined. India: Tamil Nadu: Ulakkai falls, 9 puparia, on Tectona grandis, 20.iii.07, R. Sundararaj [IWST].

Hosts. Tectona grandis [12].

Pest status. Black puparium with fringe of wax around margin and little powdery wax on dorsum, 0 to 1 per leaf on the under surface of leaves in natural plantations.

10. Aleurolobus sundararaji Regu & David [Fig. 4]
Aleurolobus sundararaji Regu and David, 1993. FIPPAT Entomology Series, 4, 47.

Material examined. India: Tamil Nadu: Ulakkai falls, 9 puparia, on Tectona grandis, 20.iii.07, R. Sundararaj [IWST].

Hosts. Tectona grandis [12].

Pest status. Black puparium with fringe of wax around margin and little powdery wax on dorsum, 0 to 1 per leaf on the under surface of leaves in natural plantations.

11. Aleurolobus sundararaji Regu & David [Fig. 4]
Aleurolobus sundararaji Regu and David, 1993. FIPPAT Entomology Series, 4, 47.

Material examined. India: Tamil Nadu: Ulakkai falls, 9 puparia, on Tectona grandis, 20.iii.07, R. Sundararaj [IWST].

Hosts. Tectona grandis [12].

Pest status. Black puparium with fringe of wax around margin and little powdery wax on dorsum, 0 to 1 per leaf on the under surface of leaves in natural plantations.

12. Aleurolobus sundararaji Regu & David [Fig. 4]
Aleurolobus sundararaji Regu and David, 1993. FIPPAT Entomology Series, 4, 47.

Material examined. India: Tamil Nadu: Ulakkai falls, 9 puparia, on Tectona grandis, 20.iii.07, R. Sundararaj [IWST].

Hosts. Tectona grandis [12].

Pest status. Black puparium with fringe of wax around margin and little powdery wax on dorsum, 0 to 1 per leaf on the under surface of leaves in natural plantations.
CONCLUSION
1. Puparium white or pale white. ..................................................2
- - Puparium black................................................. 5
2. Puparium not surrounded with cottony and fluffy waxy and without compound or agglomerate pores. .......................... 3
- - Puparium surrounded with cottony, fluffy waxy and in compound and compound or agglomerate pores. ........ Aleurodicus dispersus Russell
3. Dorsum without two pairs of long two-segmented setae on cephalic and first abdominal segments; vasiform orifice situated in a pyriform pit .............................................Martiniella fletcheri [Sundararaj & David]
4. Puparium with setae on mesothorax and metathorax; submargin with 14 pairs of setae .........................Pealius sairandhryensis Meganathan & David
- - Puparium without setae on mesothorax and metathorax; submargin with 15 pairs of setae . ......................Pealius splendens [David, Sundararaj & Regu]
5. Puparium with a marginal fringe of wax and white powdery meal on dorsum; out prominent spines on the dorsum; vasiform orifice triangular and not elevated; caudal and thoracic tracheal openings at margin indicated in the form of modified marginal teeth... 6
- - Puparium with prominent spines on the dorsum; vasiform orifice subcordate and elevated; caudal and thoracic tracheal openings at margin not indicated ................. . Aleurocanthus icfreae sp. nov.
6. Puparium broadly oval; submargin with 7 pairs of setae; subdorsum with setae; median area of abdominal and thoracic segments without brown patches ................. Aleurolobus moudi David & Subramaniam
- - Puparium elongately oval; submargin with 10 pairs of setae; subdorsum without setae; median area of abdominal and thoracic segments with brown patches ................. Aleurolobus sundararaji Regu & David

In the present study seven species of whiteflies have been recorded on teak which includes a new species A. icfreae and two new records viz, A. moudi and P. sairandhryensis. Among these the spiralling whitefly A. disperus is more economically important as they infest severely both in nurseries and plantations of teak. The world has now started growing about more than 50 million hectares of timber plantations and the appreciable portion of this is represented by teak trees. Although not specifically targeted, teak plantations have been included in general anti-plantation campaigns which are based on the premise that plantations – especially single-species plantations [forest monocultures] – tend to have lower levels of biodiversity than natural forests and may also be more susceptible to catastrophic damage, especially from pests and diseases [10]. In this context to meet the challenges in pest management in future, the wholesome data on whiteflies infesting teak for any outbreak of whitefly pests is inevitable to avoid.

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REFERENCE
Fig 1. Puparium of *Aleurodius*.

Fig 2. *Aleurocanthus iccreae* sp. nov.
A. puparium, B. margin, C. dorsal spine, D. vasiform orifice
Fig 3. Puparium of *Aleurolobus moundi*
David & Subramaniam

Fig 4. Puparium of *Aleurolobus sundararaji*
Regu & David
Fig 5. Puparium of Martiniella fletcheri (Sundararaj & David)

Fig 6. Puparium of Pealius sairandhryensis Meganathan & David

Fig 7. Puparium of Pealius splendidus (David, Sundararaj & David)