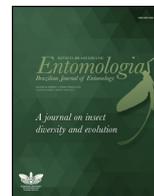




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Short Communication

## Identification and pest status of *Holopothrips fulvus* (Thysanoptera: Phlaeothripidae) on dwarf-cashew crops in northeastern Brazil



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### ABSTRACT

Cashew, *Anacardium occidentale* L. (Anacardiaceae), is one of the most important sources of agricultural income in northeastern Brazil, but many of the arthropods associated with the crop have yet to be identified. We describe here for the first time the damage caused by *Holopothrips fulvus* (Morgan) (Thysanoptera: Phlaeothripidae) to dwarf-cashew trees cultivated in the municipality of Pacajús, Ceará, Brazil. Leaf tissue injuries were caused by the sucking mouthparts of the insect and were characterized by dark necrotic spots on the epidermis that resulted in yellowing, wilting and, ultimately, abscission of the leaves. *H. fulvus* also fed on developing kernels and pseudofruits producing injuries that manifested in the form of chlorotic specks. Additional information is given on the pest status and important aspects of the morphology of the insect, including sexual dimorphism, redescription of the adults and description of the second instar larvae.

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Cashew, *Anacardium occidentale* L. (Anacardiaceae), is native to northeastern Brazil and constitutes one of the most important sources of agricultural income in this region. The edaphoclimatic characteristics of the area favor vigorous growth of the trees and high yields of fruit, thereby facilitating the establishment of productive farming systems. Agroindustrial activity in this sector is concentrated in the semi-arid zones of Ceará, Piauí and Rio Grande do Norte, and these states are responsible for more than 90% of cashew nut production in Brazil (Instituto Brasileiro de Geografia e Estatística, 2016).

The recent expansion of the cultivated area of dwarf-cashew has contributed to the emergence and multiplication of insect pests. However, most of the arthropods associated with cashew have been poorly studied and their taxonomic identification is largely unknown (Mesquita and Braga-Sobrinho, 2013). One important pest that has received attention in Brazil is the red-banded thrips, *Selenothrips rubrocinctus* (Giard), which causes considerable damage to dwarf-cashew at the growing apices, inflorescences, peduncles and fruits (Lima and Zucchi, 2015; Mesquita et al., 2016).

We recently observed the damage caused by attack of another species of thrips, namely *Holopothrips fulvus* (Morgan), on

dwarf-cashew crops in northeastern Brazil, specifically in Pacajús and Fortaleza in Ceará. *Holopothrips* Hood is a Neotropical genus, with the exception of *H. stannardi* Mound & Marullo that was originally described from Florida, USA (Mound and Marullo, 1996), and currently comprises 35 species. Sixteen species were originally reported from Brazil (ThripsWiki, 2016).

*Holopothrips* species are phytophagous, and some species are known to cause leaf roll and deformation (Cavalleri and Kaminski, 2007) or induce galls (Cabrera and Segarra, 2008). Some examples are *H. claritibialis* Cavalleri and Kaminski, that breeds on “pimenteira” [*Mollinedia schottiana* (Spreng) Perkins (Monimiaceae)] in Rio Grande do Sul (Cavalleri and Kaminski, 2007), *H. ananasi* Costa Lima, that attacks pineapple [*Ananas comosus* (L.) Merr. (Bromeliaceae)] in Rio de Janeiro (Costa Lima, 1935), and *H. fulvus*, that develops in “pequiá” [*Caryocar villosum* (Aubl.) Pers. (Caryocaraceae)] in Amazonas (Adis and Kerr, 1979). In addition, there are various reports of association with myrtaceous plants in Brazil, for example “guamirim” [*Myrcia guianensis* (Aubl.) DC] infested by *H. molzi* Lindner, Mendonça Jr. and Cavalleri (Lindner et al., 2016), “guamirim-ferro” [*Myrcia retorta* Cambess.] by *H. striatus* Jorge, Cavalleri, Bedetti and Isaias (Jorge et al., 2016) and “jaboticaba” [*Plinia cauliflora* (Mart.) Kausel] by *H. jaboticabae* (Hood) (Mound and Marullo, 1996). Others are found in “copaiba” [*Copaifera langsdorfii* (Desf.) (Fabaceae)] and “pequi” [*Caryocar brasiliense* Cambess (Caryocaraceae)] in the Brazilian Cerrado (Leite et al., 2012).

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**Fig. 1.** Damage caused by *Holopothrips fulvus* (Morgan, 1929) on dwarf-cashew as shown (A) around the point of insertion of the kernel into the pseudofruit; (B) at various points on the leaf surface, resulting in yellowing, wilting and, ultimately, abscission; and (C) on inflorescences. *H. fulvus* adults and nymphs (D) are present in the field throughout the year, especially during warmer conditions.

Nevertheless, little is known of the biology and host–plant relationships of many members of the genus *Holopothrips*, and no information is available concerning the plant associations of around half of Brazilian *Holopothrips* species (Zamora et al., 2015). The presence of *H. fulvus* on cashew was recorded previously (Hood, 1942), but we describe here for the first time the damage caused by this pest to *A. occidentale* in Brazil and present additional details concerning the identification, morphological characteristics and pest status of *H. fulvus*.

### Collection and identification of insects

Specimens of thrips were collected along with the damaged leaves on which they were found during August and September 2015 at the experimental field of *Embrapa Agroindústria Tropical* located in Pacajús, Ceará (4°10'35" S 38°28'19" W; altitude 79 m). Leaves with thrips were placed in plastic bags and transported to the Entomology Laboratory at *Embrapa Agroindústria Tropical*, where adults and nymphs were transferred to 70% ethanol solution. Thrips were identified following Mound and Marullo (1996). However, since the descriptions provided by the original authors did not take into account some essential features currently used in the identification of thrips, we undertook a detailed examination of a number of individuals, including second instar larvae, and updated the original morphological description of *H. fulvus*, including its synonym *H. anacardii* (Morgan, 1929; Hood, 1942).

### Damage caused by *H. fulvus*

*H. fulvus* feeds on various organs of the cashew, producing dark necrotic spots at the feeding site around the point of insertion of the kernel into the pseudofruit (Fig. 1A), and at various points on the leaf surface, which develop into yellowing, wilting and, ultimately, abscission (Fig. 1B), and senescence of inflorescences

(Fig. 1C). Myrtaceous by *H. fulvus* adults and nymphs (Fig. 1D) can be intense, with pest populations present on 100% of the cashew trees. Moreover, preliminary observations indicate that populations of *H. fulvus* are present in the field throughout the year in Pacajús, although insect density is higher under warmer conditions.

### Recognition data

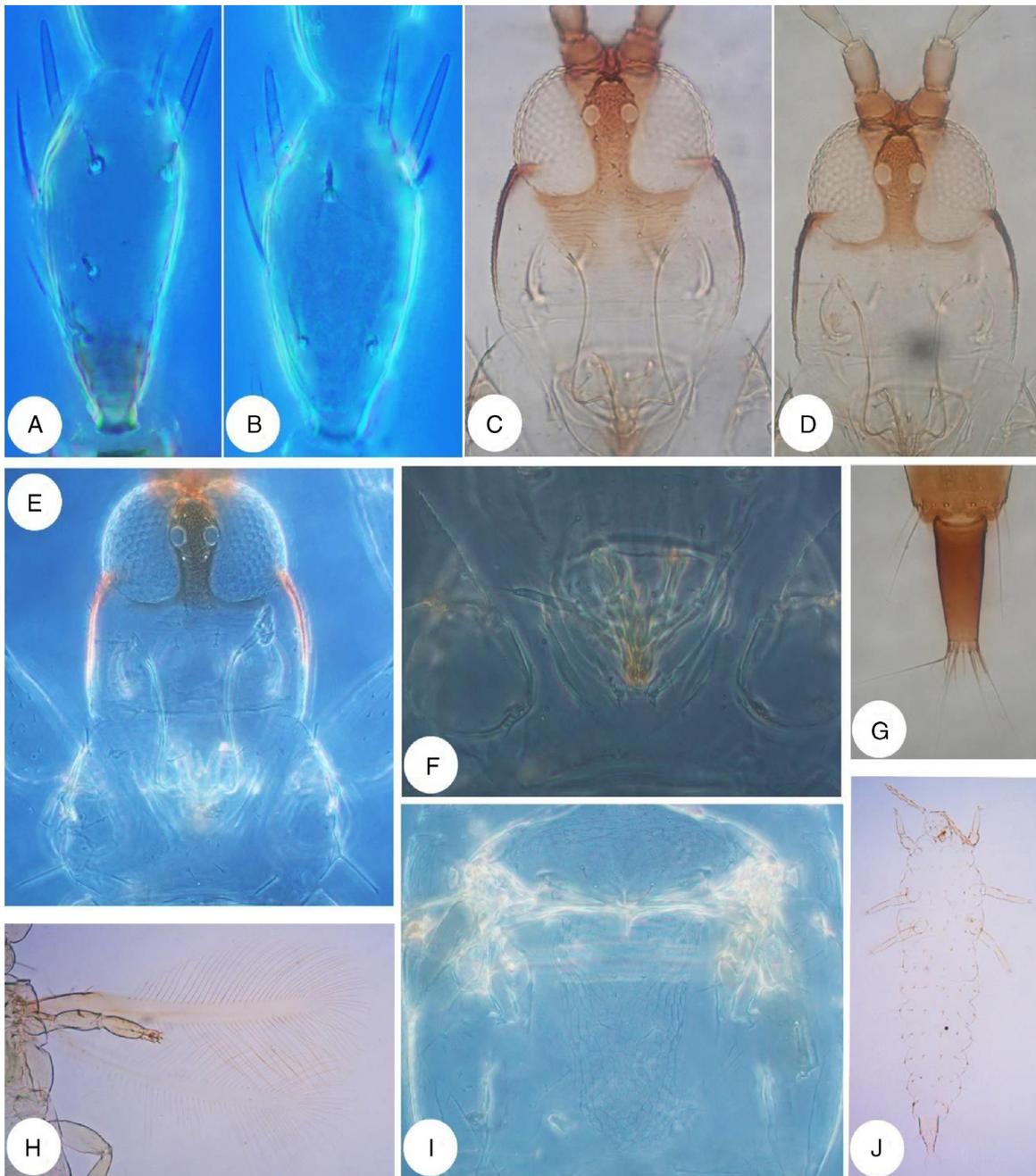
In common with other *Holopothrips* species, *H. fulvus* has three sense cones on antennal segments III and IV of the antenna, but in several individuals one sense cone was absent or reduced (Fig. 2). Furthermore, sutures on the pronotum of *H. fulvus* are reduced or absent and the postocular setae are small in comparison with other congeneric species. Interestingly, the color of the head seems to be subject to sexual dimorphism, since in males the brown area does not extend posterior to the compound eyes.

### Material examined

Brazil, Ceará State, Pacajús, on *A. occidentale*, 13 females, 10 males and 7 second instar larvae (N.S. Dias-Pini), 15.xi.2015 (Universidade Federal do Piauí, Universidade Estadual do Ceará and EMBRAPA).

### Morphological traits

*Female macroptera.* Body bicolored; head with brown on anterior half, laterally and mid-laterally on cheeks; antennal segment I brown, II brown with apex light brown, III yellow with basal quarter suffused brown, IV–VI yellow, VII light brown with basal quarter yellow, VIII light brown; fore wing brown on basal third and clearing toward apex; abdominal segments I–VIII pale, IX–X brown. Antennae 8-segmented, III–IV with three simple sense cones (one sense sometimes absent or reduced on III). Head constricted behind



**Fig. 2.** Morphology of *Holopothrips fulvus* (Morgan, 1929): (A) antennal segment III; (B) antennal segment IV; (C) female head; (D) male head; (E) male head and pronotum; (F) prosternum; (G) male tube; (H) fore wing; (I) mesonotum and metanotum; and (J) second instar larva.

compound eyes; ocellar area with irregular striation, compound eyes with internal margin recurved close to hind ocelli; three pairs of ocellar setae, one pair of postocellar setae behind hind ocelli, three pairs of minor postocular setae behind eyes, median pair longer than laterals; maxillary bridge present. Pronotum surface smooth, epimeral sutures not developed; five pairs of major setae present: am, aa, ml, pa1 and pa2 setae with capitate apex; pm setae with acute apex; basantra absent. Mesonotum surface reticulate, with sparse microtrichia-like structures on anterior third. Metanotum surface reticulate. Fore wing with six duplicated cilia on posterior margin at apex. Pelta broad, surface reticulate, bearing one pair of campaniform sensilla. Tergites II–VII with two pairs of wing-retaining setae in addition to one auxiliary pair; marginal

pairs of setae 2 and 3 with apex expanded; tergite IX setae S1 with apex capitate, 0.7 times as long as setae S3 with apex acute; longest anal setae roughly as long as tube.

*Male macroptera.* Similar to female but smaller and with head pale mid-laterally; tergite VIII with paired transverse pore plates posteriorly.

*Larva II.* Body bicolored, mainly pale with light brown area between bases of antennae, legs suffused brown medially and abdominal segments IX–X brown; antennal segments I pale, II light brown on basal half and pale on apical half, III–VII brown; body setae light brown; setae on abdominal tergites emerging from brown rings. Antennae 7-segmented. Dorsal setae with expanded apex; ventral setae acute. Mesothoracic spiracle granulated.

## Conflicts of interest

The authors declare that they have no conflicts of interest.

## Acknowledgements

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