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A new species of *Dialeurodes* Cockerell (Hemiptera: Aleyrodidae) on *Schefflera* Forst and Forst in Florida

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Abstract. Descriptions of pupal cases of *Dialeurodes schefflerae*, new species, as well as distribution records are presented. This species is known to occur in Florida, Hawaii and Puerto Rico appearing to feed only on species of *Schefflera* Forst and Forst. This restriction to plant hosts in the Asian genus *Schefflera*, along with its affinities with *Dialeurodes agalmae* Takahashi, *Dialeurodes citri* (Ashmead) and *Dialeurodes kirkaldyi* (Kotinsky), suggests it is an invasive species, probably endemic to the Asian region.

Introduction

Aleyrodid pest species on *Schefflera* Forst and Forst (Aralaceae) have been recorded in the two aleyrodid subfamilies (Aleurodicinae and Aleyrodinae): *Aleurodicus dispersus* Russell in the Aleurodicinae; and the others in the Aleyrodinae: *Dialeurodes agalmae* Takahashi, *Dialeurodes citri* (Ashmead), and unknown species of *Aleurocerus* Bondar and *Bemisia* Quaintance and Baker (courtesy of the online website Whitefly Ecology Database, Evans 2007).

Interceptions of this species have been recorded from federal pre-departure quarantine inspections of baggage at San Juan, Puerto Rico on nine separate occasions from passengers leaving Puerto Rico for Massachusetts, New York, Pennsylvania, and Texas. The passengers were recorded carrying propagative *Schefflera* sp. plants in baggage.

Florida has some of the greatest diversity of flora and fauna in North America with both temperate and subtropical habitats existing within the state. Because of this, both agriculture and ornamental plant industries are among the largest in the United States. One of the most commonly grown and used ornamental plants in Florida is dwarf schefflera, *Schefflera arboricola* (Hayata) Merr. Dwarf schefflera has several pest species of scale insects (Hemiptera: Coccoidea), but there are relatively few reports of whiteflies (Hemiptera: Aleyrodidae) on this host. In Florida, there are 69 described species of whiteflies (59 species of the Aleyrodinae and 10 species of the Aleurodicinae) (Hodges and Evans 2005). Four species of whiteflies have been observed on *S. arboricola* in Florida: among these are two aleurodicines, *A. dispersus* and a species of *Paraleyrodes* Quaintance, and two aleyrodines, *Bemisia* sp. and *D. citri*.

An undescribed species of *Dialeurodes* Cockerell has become established, and is consistently the most prevalent whitefly on dwarf schefflera grown in Florida. *Dialeurodes schefflerae*, new species, is apparently host-specific in Florida, occurring only on *S. arboricola*. *Dialeurodes schefflerae* shares morphological similarities to two other Asian *Dialeurodes* species: *D. citri* and *D. kirkaldyi* (Kotinsky) (Morrill and Back 1911, Woglum 1912, and Husain and Khan 1932), which suggests it may be endemic to Asia. Representative material used for this study indicates it may also occur on *Schefflera venulosa* (Wight and Arn) Harms (an endemic in the Philippines), which further supports the hypothesis that is may be endemic to Asia. *Dialeurodes schefflerae* (listed as *Dialeurodes* sp. n. on Schefflera sp.) was also used in Jensen's cladistic analysis of *Dialeurodes* (Jensen 2001). In his study, *D. schefflerae* placed in the middle of the *Dialeurodes* clade between *D. citri* and *D. kirkaldyi*.

Dialeurodes schefflerae is of economic concern, based on the relative ease of plant movement and with *Schefflera* species being some of the most common ornamental plants. Hawaii first encountered this

whitefly on *S. venulosa* originating from Indonesia in 1960. California intercepted it from Hawaii first in 1988 and on subsequent plant shipments in the early 1990s. This seems to indicate that *D. schefflerae* is most likely established in Hawaii. It is also established in Florida and was first recorded there in 1986. A description is presented here to provide a name for use by quarantine, regulatory, and other agricultural officials.

All measurements in the following description are given in micrometers (μm) and were made using a Leitz Laborlux phase contrast microscope with magnification ranging from 100X to 500X. The measurements in the text show the average length (unless otherwise noted), followed by the ranges in parentheses. Ten slide mounted specimens were measured for this description. Morphological terminology used here can be found in Gill (1990). Abbreviations for the type depositories are as follows: Auburn University Entomological Museum (AUEM); California Department of Food and Agriculture (CDFA); Florida State Collection of Arthropods (FSCA); The Natural History Museum, London (BMNH); Louisiana State University Entomological Collection (LSEM); Natural History Museum, University of Georgia (GNHM), Texas A & M University Entomological Collection (TAMU), and U.S. National Museum of Natural History (USNM).

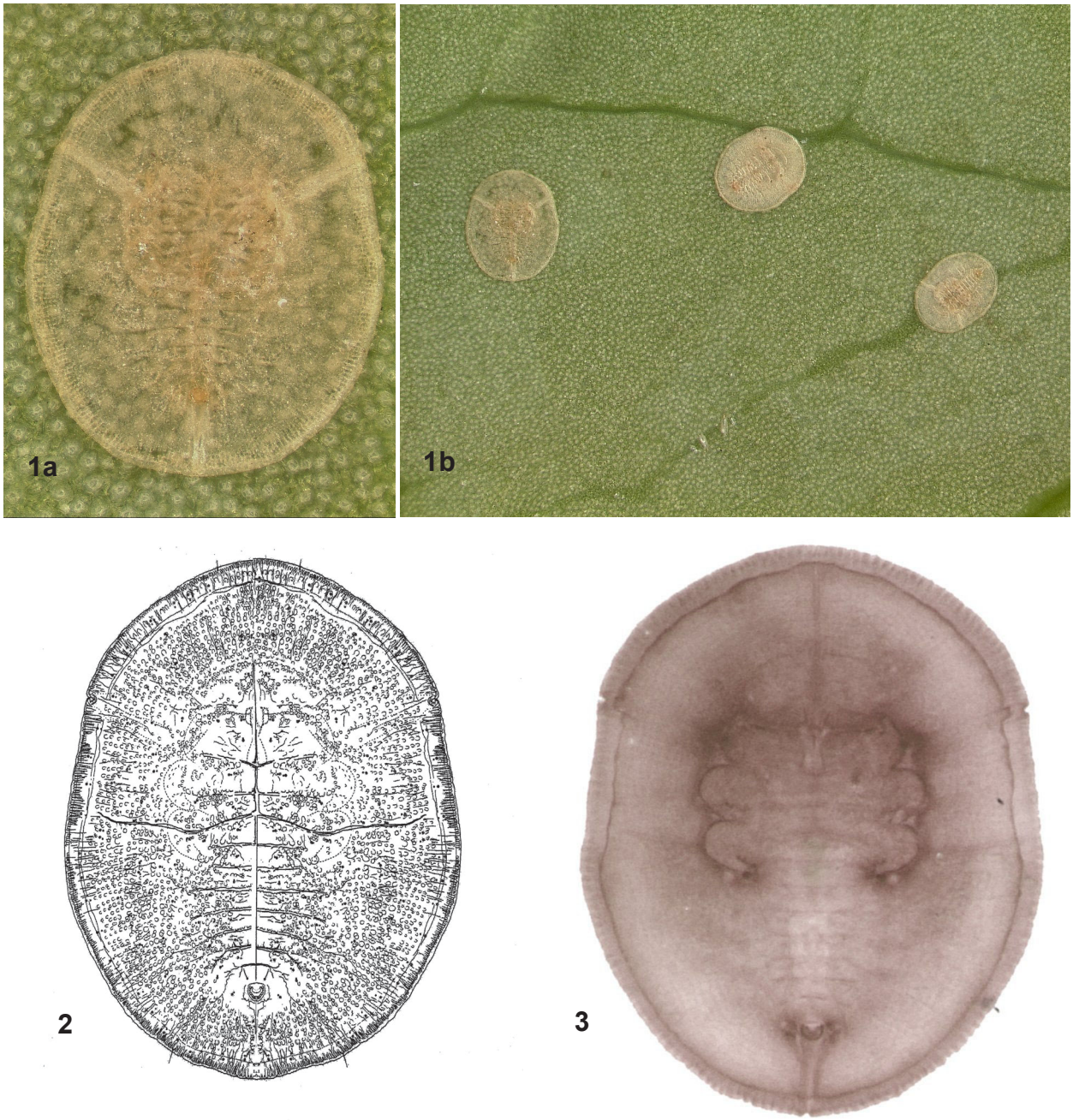
Dialeurodes schefflerae Hodges and Dooley, new species
Figure 1-6

Field Description. (Fig. 1a) Pupae yellowish-green, semi-transparent. Pupal case broadly oval to elliptical, widest opposite first abdominal segment; extremely flat in profile. Pupae occur randomly and generally distributed on the undersides of the host leaflets. No wax rays or other adornment present; pupae are covered only with a thin film of transparent wax. Thoracic and caudal tracheal furrows are visible in several field specimens under a wide field scope (Fig. 1b). Live adults of this species have not been observed by the authors.

Pupa. (Fig. 2-3) Measurements based on ten specimens from type material. Measurements of slide mounted specimens 1555 (1500-1625) μm long by 1315 (1200-1375) μm wide. Marginal areas: Margin tooth-like or smooth with inset lobe-like crenulations, with 21.6 (19-26) crenulations per 100 μm. Tracheal pore areas roughly c-shaped with the inner margins scalloped (Fig. 4), typical of the *Dialeurodes citri* group. Submargin with a thin ventral line inward of margin by about 70.45 (60-75) μm. Anterior marginal setae 28.4 (20.3-37.3) μm long, posterior marginal setae 32.8 (25.3-37.0) μm long. Submarginal setae well in from margin, up to 104 (75-112) μm depending on body position, with 5 on cephalothorax starting about 4 (16-28) marginal crenulations from midline, and with 5 on abdomen starting from a position about marginal 48 (42-64) crenulations from midline and ending on abdominal segment IV.

Dorsal Disk. Derm uniformly rugulose (Fig. 5), except becoming smooth toward the midline. Rugosities composed of raised oval areas approximately 12-16 μm across, arranged linearly at right angles to margin. Dorsal disk pores 3 μm wide, with an associated smaller porette, surrounded by a more lightly sclerotized area of the derm. Dorsal disk pores uniformly distributed but with no particular pattern except for a row on each side of midline on abdominal segments I-VII, and a row submarginally in a position roughly over or just distad of the ventral submarginal lines. Pores and associated porettes are aligned usually with porette distal to pore; individual pore and porette combinations usually adjacent medially but becoming separated nearer the margins. Transverse molting suture reaching nearly to margin, stopping just short of the ventral submarginal line. Thoracic segmental lines faintly indicated. Only dorsal setae other than submarginals include a cephalic (length approximately 12.5 (10.5-14.3) μm), 8th abdominal (length approximately 22.1 (16.8-25.0) μm), and caudal (length approximately 8.6 (8.3-12.8) μm).

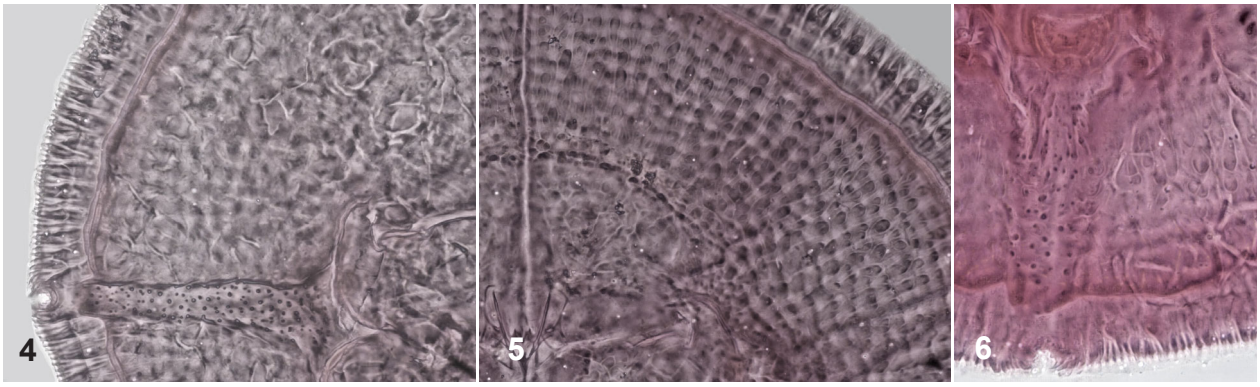
Cephalic setae just anterolaterad of the mouthparts position; 8th abdominal setae located anterolaterad of anterior corners of the vasiform orifice (257.5 μm) distant from orifice to setal base); caudal setae short, mesad of margin at about the ventral submarginal line. With 8 abdominal segments apparent between transverse molting suture and vasiform orifice, all subequal in width. Vasiform orifice 44.2 (37.5-50.0) μm long by 54 (32.5-63.5) μm wide; broadly rounded to nearly circular except for anterior margin which is almost straight; more than 5 times its median length from the posterior pupal margin. Orifice with a



Figures 1-3. *Dialeurodes schefflerae*. **1a-1b)** Habitus (Photo credit: Greg Evans, USDA-APHIS). **2)** Puparia (modified from Gill 1990). **3)** Slide mounted puparium ex Puerto Rico (Photo credit: John Dooley, USDA-APHIS-PPQ).

broad, sclerotized rim, inner lateral and posterior edges with scallop-like thickenings. Operculum roughly triangular but truncated posteriorly and weakly indented laterally; nearly filling entire vasiform opening. Lingula slender, linear, totally covered by operculum.

Venter. With a submarginal line or weak groove approximately 50 (35.0-67.5) µm in from the margin; each thoracic tracheal fold 327.5 (300-350) µm long with spinules (Fig. 4); abdominal tracheal fold 225 (200-250) µm long with spinules (Fig. 6). Legs and antennae typical of Aleyrodinae; antenna subequal in length to prothoracic legs. Ventral setae few, on legs, mouthparts and just anterior to vasiform orifice



Figures 4-6. *Dialeurodes schefflerae*. **4)** Thoracic furrow of slide mounted puparium ex Puerto Rico, seen with phase contrast (Photo credit: John Dooley, USDA-APHIS-PPQ). **5)** Cranial area of slide mounded puparium ex Puerto Rico, seen with phase contrast (Photo credit: John Dooley, USDA-APHIS-PPQ). **6)** Caudal furrow of slide mounted puparium ex Puerto Rico, seen with phase contrast (Photo credit: John Dooley, USDA-APHIS-PPQ).

position. With a very weak cranial suture or ridge above the level of where mouth parts are located (Fig. 5).

Hosts. The species is presently restricted to the plant genus *Schefflera* (Araliaceae). No injury has been noted to the host thus far.

Type Material. The holotype is designated as 1 slide from the CDFA (Calfiornia Department of Food and Agriculture) (Slide # 25245) collected July 20, 1960 by J. Fine in Hawaii on plant material originating from Bangor, Indonesia. Paratype series includes the following: 1 additional slide, same data; 2 slides (#1022529 CDFA), December 12, 1992, J. Gibbs on material originating from Hawaii; 3 slides (#743119 CDFA), May 24, 1988, L. Buerer on material originating from Hawaii; 8 slides (FDACS-DPI), March 9, 1995, D. C. Clinton in Boca Raton, Florida; 8 slides (FDACS-DPI), October 23, 1986, I. Phillips in Plantation, Florida; 8 slides (FDACS-DPI), September 16, 1995, K. Vanyo, Hollywood, Florida; and 3 slides (FDACS-DPI), January 1990, A. Capitano in Apopka, Florida. The Holotype specimen along with 5 paratype slides will be deposited at the USNM; 8 paratype slides deposited at the CDFA collection; 10 paratype slides at the FSCA; 4 paratype slides deposited at the BNHM; 2 paratype slides deposited at the Natural History Museum at the University of Georgia; 2 paratype slides deposited at the AUEM; 2 paratype slides deposited at the TAMU; 2 paratype slides deposited at LSUEM.

Etymology. The species name (*schefflerae*) is derived from the host plant generic name *Schefflera*.

Comments. Although *D. schefflerae* is similar in form of the pupal case to *D. citrifolii* (Morgan), that species lacks spinules in the tracheal folds of the pupa. *Dialeurodes schefflerae* differs from *D. citri* in size and distance of the vasiform orifice from the posterior margin. In *D. schefflerae* the distance from the posterior edge of the vasiform orifice is more than 5 times the median length of the vasiform orifice itself, whereas in *D. citri* this distance is less than 3 times the median length. These pupal measurements also separate *D. schefflerae* from *D. kirkaldyi*.

The field pupal form for *D. agalmae* is unkown since the specimen was not available. *Dialeurodes schefflerae* is similar taxonomically to the pupal cases of *D. agalmae*, *D. citri*, and *D. kirkaldyi*. According to Jensen's (1999) cladistic study: *D. schefflerae* and *D. kirkaldyi* have the caudal fold ventrally marked with scattered spinules not in rows to or approximate the margin and lacking these spinules near the vasiform orifice; whereas *D. agalmae* and *D. citri* have small spinules in rows near the vasiform orifice and larger spinules not in rows extending to or near the margin. *Dialeurodes agalmae, D. schefflerae* and *D. kirkaldyi* have a strong tracheal pore invagination whereas it is slightly indented in *D. citri*. *Dialeurodes agalmae* is the least similar to *D. schefflerae* by the presence of many dorsal papillae that are low and directed to the margin, dorsal pores mounted on tubercles or papillae with the pore and porette pairs are closely appressed.

Dialeurodes citri is polyphagous including *S. arboricola*, while *D. agalmae* is only recorded from *Schefflera* (*Agalma*) *taiwanianum* (Nakai) Kan. (Araliaceae). *Dialeurodes kirkaldyi* is also polyphagous, but it is not recorded on *Schefflera* spp.

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