

SAP-SUCKING INSECT RECORDS (HEMIPTERA: STERNORRHYNCHA AND THYSANOPTERA: THIRIPIDAE) FROM INDONESIA

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ABSTRACT

Sap-sucking insects (Hemiptera: Sternorrhyncha and Thysanoptera: Thripidae) collected in Java, Sumatra and Sulawesi were identified. From 28 samples collected on 9 crop and ornamental host-plant species, 21 species of sap-sucking insects were identified, 12 (57%) of which were new island distribution records. This suggests that the Indonesian insect fauna has not been documented for a long time. The new distribution records are: from Java, *Lepidosaphes gloverii* (Packard) (Diaspididae); from Sumatra, *Clavaspidiotus apicalis* Takagi (Diaspididae); and from Sulawesi, *Coccus hesperidum* L. (Coccidae), *Saissetia coffeae* (Walker) (Coccidae), *Aulacaspis yasumatsui* Takagi (Diaspididae), *Hemiberlesia palmae* (Cockerell) (Diaspididae), *Lepidosaphes tokionis* (Kuwana) (Diaspididae), *Microparlatoria fici* (Takahashi) (Diaspididae), *Pseudaulacaspis cockerelli* (Cooley) (Diaspididae), *Icerya aegyptiaca* (Douglas) (Monophlebidae), *I. pulchra* (Leonardi) (Monophlebidae) and *Selenothrips rubrocinctus* (Giard) (Thripidae). *Clavaspidiotus apicalis* could become a potentially invasive pest of citrus.

Key Words: invasive species, potential pest, Aleyrodidae, Coccidae, Diaspididae, Monophlebidae, Pseudococcidae, Thripidae

RESUMEN

Se identificaron insectos chupadores de savia recolectados en Java, Sumatra y Sulawesi (Hemiptera: Sternorrhyncha y Thysanoptera: Thripidae). De las 28 muestras recolectadas sobre 9 especies de plantas hospederas de cultivos y plantas ornamentales, se identificaron 21 especies de chupadores, de estas, 12 (57%) fueron nuevos registros de distribución para las islas. Esto sugiere que la fauna de insectos de Indonesia no ha sido documentada por un largo tiempo. Los nuevos registros de distribución son: de Java, *Lepidosaphes gloverii* (Packard) (Diaspididae); de Sumatra, *Clavaspidiotus apicalis* Takagi (Diaspididae); y de Sulawesi, *Coccus hesperidum* L. (Coccidae), *Saissetia coffeae* (Walker) (Coccidae), *Aulacaspis yasumatsui* Takagi (Diaspididae), *Hemiberlesia palmae* (Cockerell) (Diaspididae), *Lepidosaphes tokionis* (Kuwana) (Diaspididae), *Microparlatoria fici* (Takahashi) (Diaspididae), *Pseudaulacaspis cockerelli* (Cooley) (Diaspididae), *Icerya aegyptiaca* (Douglas) (Monophlebidae), *I. pulchra* (Leonardi) (Monophlebidae) y *Selenothrips rubrocinctus* (Giard) (Thripidae). *Clavaspidiotus apicalis* puede llegar a ser una plaga potencialmente invasora de los cítricos.

Palabras Clave: especies invasoras, plagas potenciales, Aleyrodidae, Coccidae, Diaspididae, Monophlebidae, Pseudococcidae

Sap-sucking insect pests (Hemiptera: Sternorrhyncha and Thysanoptera: Thripidae) in North Sulawesi, Indonesia were collected by R. Muniappan, facilitated by D. T. Sembel during a workshop on "Biodiversity and Integrated Pest Management: Working Together for a Sustainable Future" that the Integrated Pest Management Innovation Laboratory, Virginia Tech University, Blacksburg, Virginia, organized in collaboration with Sam Ratulangi University and the International Association for Plant Protection Sciences in Manado, North Sulawesi, Indonesia, 4 to 7 Jul 2013. Samples were collected also from North Sumatra by B. M. Shepard, G. Carner and E. Benson, and from West Java by A. Rauf and B. M. Shepard, in early Sep 2013. The samples were sent to G. W. Watson for identification at the California Department of Agriculture Plant Pest Diagnostics Center in Sacramento, California, U.S.A. (CDFA-PPDC). This paper reports on new sap-sucking insect distribution records for the islands of Java, Sumatra and Sulawesi.

MATERIALS AND METHODS

Samples of infested plant material were collected into Ziploc bags in the field for later sorting and preservation. Collection data was noted at the time of collection. Infested plant fragments were preserved in 70% ethanol in labeled Eppendorf tubes, and were stood in freshly boiled water for about 15 minutes to ensure optimal fixation of insect body contents. At CDFa-PPDC, archival-quality slide mounts of specimens were prepared using the method described by Watson & Chandler (2000) and refined by Sirisena et al. (2013).

Slide-mounted specimens were examined under a Zeiss compound light microscope with phase contrast illumination at x20-x800 magnifications, and identified using keys available in the literature (Reyne 1948; Takagi 1974; Martin 1987; Williams & Watson 1988a, 1988b, 1990; Watson 2002; Williams 2004; Unruh & Gullan 2008; Suh & Ji 2009; Hoddle et al. 2012) and with reference to specimens in the California State Collection of Arthropods, Plant Pest Diagnostic Center, Sacramento, California, U.S.A. Representative slide mounts of all the species are deposited in the collection at Museum Zoologicum Bogoriense, Bogor, West Java, Indonesia, and duplicate slides are in the California State Collection of Arthropods.

RESULTS

A total of 21 taxa were identified from 28 samples collected on 2 crop and 7 ornamental host-plant species:

From West Java, Bogor, on *Citrus* sp., coll. A. Rauf and B. M. Shepard: Hemiptera: Diaspididae: *Lepidosaphes gloverii* (Packard), 5-IX-2013.

Pseudococcidae: *Rastrococcus* sp. immatures, 5.ix.2013.

From North Sumatra, Pakpak Bharat District, Siengat Robe, Traju, on *Citrus* sp., coll. B. M. Shepard, G. Carner and E. Benson, 2-IX-2013: Hemiptera: Aleyrodidae: *Aleurocanthus citriperdus* Quaintance & Baker, 3 samples. Coccidae: *Saissetia coffeae* (Walker), 2 samples. Diaspididae: *Clavaspidotus apicalis* Takagi, 3 samples; *Lepidosaphes beckii* (Newman), 2 samples.

From North Sulawesi, Manado, coll. R. Muniappan: Hemiptera: Coccidae: *Coccus hesperidum* L., on *Mangifera indica*, 26-VI-2013; *Saissetia coffeae* (Walker), on *Cycas* sp., 29-VI- and 7-VII-2013; on ornamental Acanthaceae, 27-VI-2013. Diaspididae: *Aspidiotus rigidus* Reyne, on ornamental palm, 26-VI-2013; *Aulacaspis yasumatsui* Takagi, on *Cycas* sp., 7-VII-2013; *Hemiberlesia palmae* (Cockerell), on *Cycas* sp., 26-VI-2013; *Lepidosaphes tokionis* (Kuwana), on *Codiaeum variegatum*, 27-VI-2013; *Microparlatoria fici* (Takahashi), on *Ficus* sp., 26-VI-2013, *Pseudaulacaspis cockerelli* (Cooley), on *Cycas* sp., 29-VI-2013. Monophlebidae: *Icerya aegyptiaca* (Douglas), on *Mimosa pigra*, 7-VII-2013; *Icerya pulchra* (Leonardi), on *Mangifera indica*, 30-VI-2013; *Icerya samaraia* (Morrison), on *Mimosa pigra*, 7-VII-2013. Pseudococcidae: *Maconellicoccus hirsutus* (Green), on *Hibiscus* sp., 27-VI-2013; *Planococcus minor* (Maskell), on *Codiaeum variegatum*, 28-VI-2013; *Pseudococcus cryptus* Hempel, on *Citrus* sp., 30-VI-2013; *Pseudococcus longispinus* (Targioni Tozzetti), on *Codiaeum variegatum*, 2 samples, 27-VI-2013. Thysanoptera: Terebrantia: Thripidae: *Selenothrips rubrocinctus* (Giard), on *Codiaeum variegatum*, coll. R. Muniappan, 30-VI-2013.

DISCUSSION

Of the 21 species of sap-sucking insects collected, 12 (57%) represented new island records within Indonesia.

New Record from Java

Lepidosaphes gloverii (Diaspididae) is a well-known pest of *Citrus* species and is fairly widespread in southern Asia, but in Indonesia it has been recorded before only from the province of Papua (Reyne 1961; Williams & Watson 1988a). A single specimen was collected from Java in this study.

New Record from Sumatra

Clavaspidotus apicalis (Diaspididae) was described from Java, where it is probably native. It has likely been spread by human activity, and has been intercepted at U.S. plant quarantine inspec-

tion from the Philippines, Malaysia, Singapore and Egypt (Takagi 1974). It feeds on *Citrus* species but has also been found on Flacourtiaceae, Lauraceae and Rutaceae. In Sumatra it was found forming dense colonies on citrus fruit, was only sparsely present on the leaves; no sign of any predator or parasitoid activity was apparent. This species has the potential to become a pest of commercial citrus in the absence of its natural enemies.

New Records from Sulawesi

Coccus hesperidum (Coccidae) is a cosmopolitan, polyphagous pest species. In Indonesia, the scale was recorded from Papua and Sumatra by Ali (1971) but Kalshoven (1981) made no mention of it being a crop pest in Indonesia.

Saissetia coffeae (Coccidae) is a tropicopolitan, polyphagous species that is often found on ferns. It was recorded previously from Java and Papua (Green 1904) and Sumatra (Ali 1971). In addition to our samples from North Sulawesi, there are specimens of *S. coffeae* (from North Sulawesi, Utara, Dumoga-Bone National Park, Torut base camp, on epiphytic orchid, coll. J. H. Martin, 26.iii.1985) in the Natural History Museum collection in London, U.K. Kalshoven (1981) mentioned this species but regarded it as a minor pest of coffee, cinchona, tea, cotton, citrus and the palm *Livistona* sp. in Indonesia.

Aulacaspis yasumatsui (Diaspididae), a native of Thailand that has become a serious pest of Cycadaceae in many countries, was first recorded from Indonesia (Java) by Muniappan et al. (2012). Its discovery in Sulawesi indicates that this pest is spreading in Indonesia. Judging by the impact it has had on endemic cycad species in Guam and Taiwan, *A. yasumatsui* may present a threat of extinction to endemic cycads in Indonesia (Cave et al. 2013). The presence of this species in Singapore was discussed by Hodgson & Martin (2001).

Hemiberlesia palmae (Diaspididae) has a preference for palms; it is probably of Neotropical origin, but is now tropicopolitan. It has been present in Java and Sumatra for many years (Green 1930; Kuwana & Muramatsu 1931). The new record from Sulawesi is possible evidence of inter-island movement.

Lepidosaphes tokionis (Diaspididae) is an oligophagous species that has become relatively tropicopolitan; it was recorded from Java by Ali (1969). The material from Sulawesi indicates that the species is more widely distributed in Indonesia than has been documented.

Microparlatoria fici (Diaspididae) is specific to *Ficus* sp.; it was described from Thailand and has been intercepted at Korean plant quarantine inspection from Indonesia and Taiwan (Suh & Ji 2009). Unfortunately Suh & Ji (2009) gave no information on what part of Indonesia the shipment

originated from. Our material indicates that *M. fici* is present in Sulawesi.

Pseudaulacaspis cockerelli (Diaspididae) is a tropicopolitan, highly polyphagous pest of ornamental plants and fruit trees that has been present in Java for many years (Green 1905). The find in Sulawesi indicates that the species is more widespread in Indonesia than has been documented.

Icerya aegyptiaca (Monophlebidae) is a pest on many plants in Micronesia (Beardsley 1966); in Kiribati it particularly damages *Artocarpus altii* (O'Connor 1969). In Indonesia, *I. aegyptiaca* was recorded from Kalimantan by Williams & Miller (2010).

Icerya pulchra (Monophlebidae) is oligophagous on tree, shrub and palm hosts but has not been recorded causing crop damage. It was described from Java, and Rao (1951) recorded it from Sumatra. In addition to our sample from North Sulawesi, there are specimens of *I. pulchra* from near Manado (Pulau Bunaken, on breadfruit, coll. C. Salaki 1988) in the Natural History Museum collection in London, U.K.

Selenothrips rubrocinctus (Thripidae) is possibly of African or South American origin but is now present in many tropical countries. It feeds on the mature leaves of numerous tree crops and can be damaging (Hoddle & Mound 2012). *Selenothrips rubrocinctus* was first recorded from Java by Sartiani & Mound (2013).

From 21 species in 28 samples collected from 2 crop and 7 ornamental host-plant species, 12 (57%) were new island distribution records. This suggests that the Indonesian insect fauna has not been documented in the last 30-40 years, during which time a number of economically important species have been accidentally introduced to the country or have spread between the islands. Most of the introductions are well-known, polyphagous pest species whose distributions and economic and ecological impacts in Indonesia have not been documented.

CONCLUSIONS

Our findings suggest that more collection, and development of in-country expertise, is needed to document the current sap-sucking insect fauna of the Indonesian islands. *Clavaspidiotus apicalis* could become a potentially invasive pest of citrus.

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REFERENCES CITED

- ALI, S. M. 1969. A catalogue of the oriental Coccoidea. Part II. (Insecta: Coccoidea: Diaspididae). Indian Mus. B. 4: 38-73.
- ALI, S. M. 1971. A catalogue of the Oriental Coccoidea (Part V) (Insecta: Homoptera: Coccoidea) (with an index). Indian Mus. B. 6: 7-82.
- BEARDSLEY, J. W. 1966. Insects of Micronesia. Homoptera: Coccoidea. Insects of Micronesia 6: 377-562.
- BEN-DOV, Y. 2014. ScaleNet, *Clavaspidotus apicalis*. <http://www.sel.barc.usda.gov/catalogs/diaspidi/Clavaspidotusapicalis.htm>
- CAVE, R. D., CHAO, J-T., KUMASHIRO, B., MARLER, T., MILES, J., MOORE, A., MUNIAPPAN, R., AND WATSON, G. W. 2013. Status and biological control of cycad aulacaspis scale. Biocontrol News Inform. 34(1): 1N-4N.
- GREEN, E. E. 1904. On some Javanese Coccidae: with descriptions of new species. Entomol. Mon. Mag. 40: 204-210.
- GREEN, E. E. 1905. On some Javanese Coccidae: with descriptions of new species. Entomol. Mon. Mag. 41: 28-33.
- GREEN, E. E. 1930. Fauna Sumatrensis (Bijdrag Nr. 65). Coccidae. Tijdschr. Entomol. 73: 279-297.
- HODDLE, M. S., MOUND, L. A., AND PARIS, D. L. 2012. Thrips of California 2012. CD-ROM published by CBIT, Brisbane, Queensland, Australia. http://www.lucidcentral.org/keys/v3/thrips_of_california/Thrips_of_California.html
- HODGSON, C. J., AND MARTIN, J. H. 2001. Three noteworthy scale insects (Hemiptera : Coccoidea) from Hong Kong and Singapore, including *Cribropulvinaria tailungensis*, new genus and species (Coccidae), and the status of the cycad-feeding *Aulacaspis yasumatsui* (Diaspididae). Raffles B. Zool. 49(2): 227-250.
- KALSHOVEN, L. G. E. 1981. 160-193 Pests of crops in Indonesia. Ichtar Baru, Jakarta, Indonesia. 701 pp.
- KUWANA, S. I., AND MURAMATSU, K. 1931. New scale insects and white fly found upon plants entering Japanese ports. (In Japanese). Dobutsugaku Zasshi (J. Zool. Soc. Japan) Tokyo 43: 647-660.
- MARTIN, J. H. 1987. An identification guide to common whitefly pest species of the world (Homoptera, Aleyrodidae). Trop. Pest Mgt. 33: 298-322.
- MUNIAPPAN, R., WATSON, G. W., EVANS, G. A., RAUF, A., AND VON ELLENRIEDER, N. 2012. Cycad aulacaspis scale, a newly introduced insect pest in Indonesia. HAYATI J. Biosci. 19(3): 110-114.
- O'CONNOR, B. A. 1969. Exotic plant pests and diseases. A handbook of plant pests and diseases to be excluded from or prevented from spreading within the area of the South Pacific Commission. South Pacific Commission, Noumea, New Caledonia. viii, 23 pp.
- RAO, V. P. 1951. Iceryine scale insects recorded from the Orient II. Indian J. Entomol. 12: 127-158.
- REYNE, A. 1948. Studies on a serious outbreak of *Aspidiotus destructor rigidus* in the coconut-palms of Sangi (North Celebes). Tijdschr. Entomol., Amsterdam 89: 83-123.
- REYNE, A. 1961. Scale insects from Dutch New Guinea. Beaufortia, Amsterdam 8: 121-167.
- SARTIAMI, D., AND MOUND, L. A. 2013. Identification of the terebrantian thrips (Insecta, Thysanoptera) associated with cultivated plants in Java, Indonesia. ZooKeys 306: 1-21.
- SIRISENA, U. G. A. I., WATSON, G. W., HEMACHANDRA, K. S., AND WIJAYAGUNASEKARA, H. N. P. 2013. A modified technique for the preparation of specimens of Sternorrhyncha for taxonomic studies. Trop. Agric. Res. J. 24(2): 139-149.
- SUH, S. J., AND JI, J. 2009. Intercepted armored scales (Hemiptera: Diaspididae) on imported plants at the port of entry in the Republic of Korea. Acta Entomol. Sinica 52(9): 1039-1054.
- TAKAGI, S. 1974. An approach to the *Hemiberlesia* problem (Homoptera: Coccoidea). Insecta Matsumurana (NS) 3: 1-33.
- UNRUH, C. M., AND GULLAN, P. J. 2008. Identification guide to species in the scale insect tribe Iceryini (Coccoidea: Monophlebidae). Zootaxa 1803: 1-106.
- WATSON, G. W. 2002. Arthropods of economic importance: Diaspididae of the world. An illustrated identification guide and information source. CD-ROM. Expert Center for Taxonomic Identification (ETI), University of Amsterdam, The Netherlands. ISBN No. 90-75000-48-0. <http://wbd.etibioinformatics.nl/bis/diaspididae.php>
- WATSON, G. W., AND CHANDLER, L. R. 2000. Identification of mealybugs important in the Caribbean region, 2nd edn. Egham, Surrey, U.K.: CABI Bioscience. 40 pp.
- WILLIAMS, D. J. 2004. Mealybugs of southern Asia. The Natural History Museum. Southdene SDN. BHD., Kuala Lumpur, Malaysia. 896 pp.
- WILLIAMS, D. J., AND MILLER, D. R. 2010. Scale insects (Hemiptera: Sternorrhyncha: Coccoidea) of the Krakatau Islands including species from adjacent Java. Zootaxa 2451: 43-52.
- WILLIAMS, D. J., AND WATSON, G. W. 1988a. The scale insects of the tropical South Pacific region. Part 1. The armoured scales (Diaspididae). CAB International, Wallingford, U.K. 290 pp.
- WILLIAMS, D. J., AND WATSON, G. W. 1988b. The scale insects of the tropical South Pacific region. Part 2. The mealybugs (Pseudococcidae). CAB International, Wallingford, U.K. 260 pp.
- WILLIAMS, D. J., AND WATSON, G. W. 1990. The scale insects of the tropical South Pacific region. Part 3. The soft scales (Coccidae) and other families. CAB International, Wallingford, U.K. 267 pp.