Research Note

Drepanococcus cajani (Maskell 1891) (HEMIPTERA: COCCIDAE) ON RAMBUTAN, *Nephelium lappaceum* L., IN THE PHILIPPINES

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ABSTRACT

The Pigeon Pea Soft Scale, *Drepanococcus cajani* (Maskell 1891) (Hemiptera: Coccomorpha: Coccidae), is reported as a sap-sucking microherbivore on the fruits of rambutan, *Nephelium lappaceum* L. (Sapindaceae), a new host-plant record. Diagnostic characters are presented and briefly discussed vis-à-vis the morphologically close congener *D. chiton* (Green 1909), commonly known as the Longan Scale. Observations on the occurrence of *D. cajani* on different cultivars, as well as attendant ants and associated parasitoids and predators, based upon fruits sold in local markets and roadside stalls, are also included. This work also initiates our effort to document scale insects on rambutan and other local fruit crops.

Key words: Coccomorpha, fruit crops, new host plant record, soft scale insect, Sternorrhyncha

INTRODUCTION

Rambutan (*Nephelium lappaceum* L., Sapindaceae) is native to the Philippines, especially to areas that are part of the Greater Mindanao Pleistocene Aggregate Island Complex (Pelser et al. 2023). Its natural distribution extends to other areas within the Malesian biogeographic region and other peninsular Southeast Asian countries (e.g., Laos). The conservation status of native populations of *N. lappaceum* and the other native wild relatives, namely: *N. cuspidatum* Blume and *N. ramboutan-ake* (Labill.) Leenh., (but not *N. melanomiscum* Radlk.), is vulnerable (DENR 2017). Several cultivars from neighboring countries in Southeast Asia have been introduced to the Philippines, either as planting materials or as parental sources of locally developed hybrids (Tripathi 2021). Excellent locally selected varieties and developed hybrids are

also available, like 'Amarillo' and 'Roja' (Magdalita & Valencia 2009a & b), and five other registered varieties (DA-RFO-02, 2012). The local fruit market has several varieties available, but the four most commonly sold are labeled as 'Corales', 'Maharlika', 'Rongrein' (often referred to as RR), and 'Sejonja' (or 'Seenjoya') (DA-RFO-02, 2012). Local consumers commonly group these fruit varieties into *"supsupin"* (i.e., juice obtained by sucking the fruit pulp) and *"tuklapin"* (i.e., the fruit mesocarp and endocarp easily separable from the seed), with the latter being more popular.

There is increasing popularity in planting rambutan as backyard fruit trees or in plantation orchards (DA-RFO-02 2012; Tripathi 2021). However, only a few local studies are available on herbivorous species that may become problems in rambutan production (Cendaña et al. 1984). Existing checklists of pests like those of Gabriel (1997) listed only a few insect pests on rambutan. Among those listed by Gabriel (1997), there are only two mealybug species, namely: *Exallomochlus hispidus* (Morrison) [as *Cataenococcus hispidus* (Morrison)] and *Planococcus lilacinus* (Cockerell).

This paper reports the occurrence on rambutan fruits of a soft scale insect (Hemiptera: Coccomorpha: Coccidae), long known to be associated with other local crops. With this report, we hope to draw attention to the need to document and/or update lists of potential pests of fruit crops, particularly those that easily escape detection or become introduced unnoticed, like many scale insects and mealybugs (Coccomorpha), which are concealed in crevices and/or other structures on the fruit exocarps.

MATERIALS AND METHODS

Collection and preservation

The soft scale insects were collected with the infested rambutan fruits from different fruit stands or roadside stalls in Batangas (barangays of Tanauan and Santo Tomas Cities) and Laguna (Bay, Los Baños, Calauan). Live specimens and habits were documented using digital cameras (iPhone 14 Plus and Nikon D3100). The collected live specimens, still attached to the fruits, were examined in the laboratory under a dissection stereomicroscope (Olympus SZ61). The scale insects were then gently collected individually using fine-pointed forceps and placed directly into a vial of 95% ethyl alcohol. Each sample vial of collected specimens was labeled using permanent ink or pencil.

Mounting on microscope slides

Alcohol-preserved specimens were subsequently macerated by soaking overnight in a small dish of 10% aqueous potassium hydroxide at ambient room

temperature. On the following day, loosened waxy tests were then removed. Cleared specimens were washed twice in distilled water and then soaked in alcoholic acid fuchsin stain for at least one hour. Excess stain and water were removed by soaking the specimens for at least 30 mins each in a graded series of aqueous ethanol solutions, beginning at 50%, then 75%, 85%, 95%, and finally two changes of absolute ethanol. Absolute propanol was used as the last rinse before soaking the specimens for another 30 minutes in xylene. They were then mounted on microscope slides in Eukitt™ quick-hardening mounting medium. Slides were labeled and then dried in a laboratory oven at 30°C for 24 hours.

Examination, identification, and imaging

Slide-mounted adult females were examined under a compound light microscope (Zeiss PrimoStar 3) connected to a screen monitor and computer. Images were captured using the same set-up, incorporating scale bars as indicators of size. Hodgson (1994) and Williams & Watson (1990) proved very useful for the identification of the species. We also benefited from the summary of the features that distinguish between closely related species, given under *Drepanococcus chiton* (Green 1909) in Miller et al. (2014).

Depository of vouchers

Voucher specimens were deposited in the Entomology Section of the Museum of Natural History, University of the Philippines Los Baños, Philippines (UPLB-MNH).

RESULTS AND DISCUSSION

Taxonomy

Order Hemiptera
Suborder Sternorrhyncha
Infraorder Coccomorpha (Fallen) Heslop-Harrison 1952
Superfamily Coccoidea (Fallen) Handlirsch 1903

Family Coccidae Fallen 1814

Genus *Drepanococcus* Williams & Watson 1990

Drepanococcus Williams & Watson 1990: 102. Type species: *Eriochiton cajani* Maskell 1891, by original designation.

Diagnosis

Williams & Watson (1990: 102) established *Drepanococcus* for *Eriochiton cajani* Maskell and three other closely related species. They, as well as Hodgson (1994) and Choi et al. (2018), enumerated the distinguishing characteristics of this genus as having the "anal cleft short, about a ninth of its body length; the anal plates each with conical inner marginal and apical setae; without dorsal setae and tubular ducts" (Williams & Watson 1990). Also, the marginal setae are conical and stigmatic clefts are absent, each being represented by a single stigmatic spine. The venter has multilocular disc-pores, each with 10 loculi; tubular ducts of 1 or 2 types are present over the entire ventral surface; and the antennae are 7- or 8-segmented. The legs do not have tibio-tarsal articulatory scleroses.

Remarks

Live adult females of *Drepanococcus* are completely covered with a test of granular glassy wax. For slide-mounted specimens, the genus is easily recognized by the presence of a single, long stigmatic spine opposite each spiracle and a short anal cleft. At present, six species are included (García Morales et al. 2016); of these, at least four are known from Southeast Asia. Two African species were briefly discussed under *Ceroplastodes* by Hodgson (1971). So far, *D. cajani* is the only species known to occur in the Philippines (Ali 1968), mainly on *Lansium domesticum* fruits intercepted at quarantine inspections in other countries. Choi & Lee (2019) included the genus in the subfamily Cardiococcinae on the basis of their proposed molecular phylogeny.

Species *Drepanococcus cajani* (Maskell 1891) (Figure 1)

Eriochiton cajani Maskell 1891: 61. Type data: INDIA: Madras, on *Cajanus indicus*. Syntypes, female, Type depository: Auckland: New Zealand Arthropod Collection, Landcare Research, New Zealand.
Ceroplastodes cajani (Maskell, 1891): Cockerell 1900: 368.
Drepanococcus cajani (Maskell, 1891): Williams & Watson 1990: 102.

Diagnosis

Drepanococcus cajani is morphologically very close to *D. chiton.* Hodgson (1994) enumerated the characters that distinguish *D. cajani* from its closest congener. They were summarized in ScaleNet (García Morales et al. 2016)

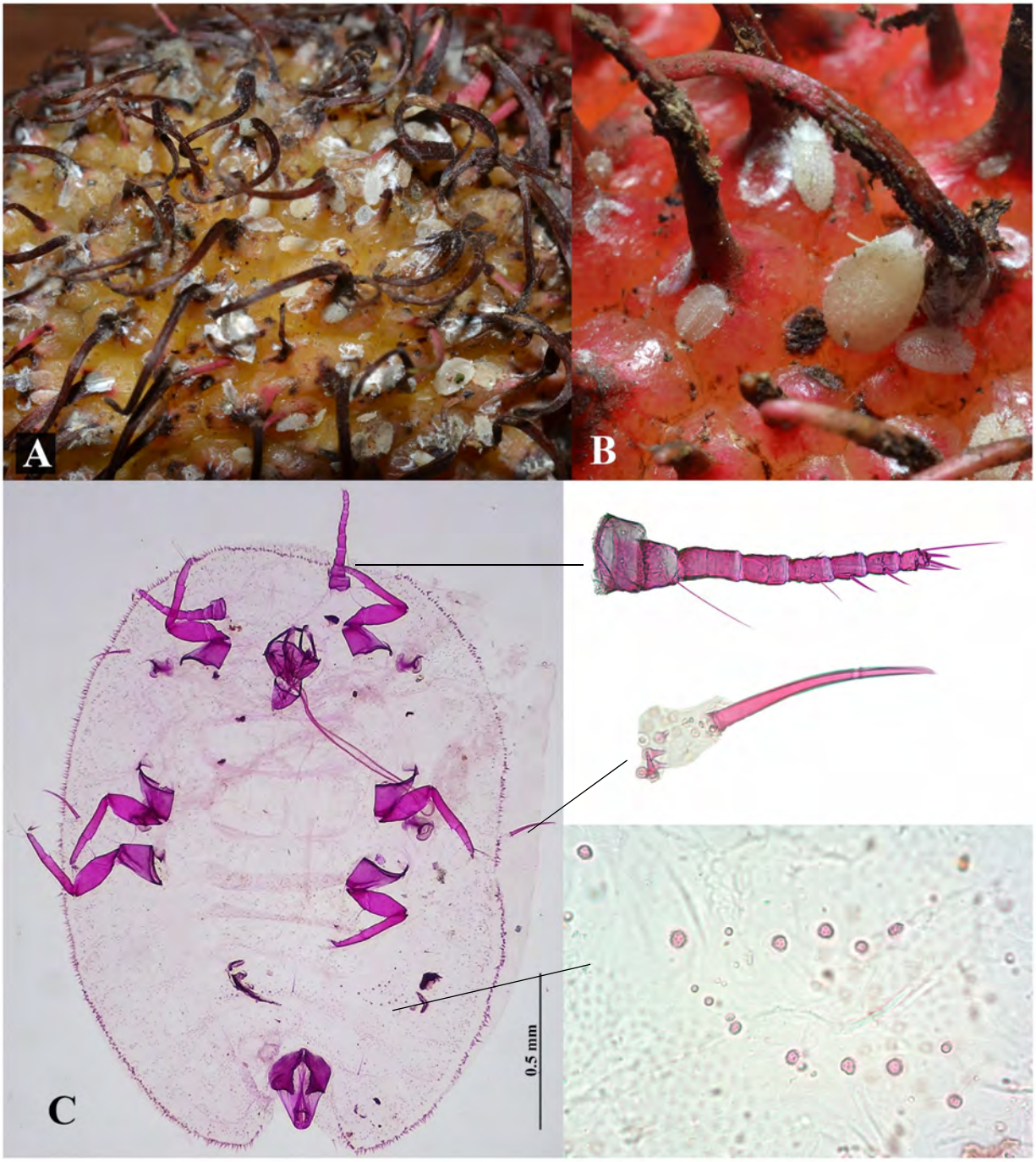

Figure 1. The pigeon pea soft scale, *Drepanococcus cajani* (Maskell 1891). **a.** Live insects on rambutan fruit. **b.** Closer view of the same. **c.** Adult female as mounted on a microscope slide, and details of the antenna, a stigmatic spine, and multilocular disc-pores. The photographs were taken by the authors.

as follows: (a) antennal segments 4 and 5 are each shorter than wide or as long as wide; (b) multilocular disc-pores are present as far forward as the metathorax; and (c) preopercular pores are confined to the abdominal segments. In contrast, in *D. chiton,* antennal segments 4 and 5 are each longer than wide, multilocular disc-pores are restricted to the abdominal segments, and the preopercular pores extend as far forward as the thorax.

Material examined

Eighteen adult females mounted on four slides, plus others preserved in vials of ethanol: all ex fruits of *Nephelium lappaceum* (less hairy form of 'Maharlika'): PHILIPPINES: Luzon: Batangas Province: Talaga, Tanauan City, 16.ix.2023. M.C. Lit & I.L. Lit, Jr.; Santor, Tanauan City, 07.x.2023. M.C. Lit; San Roque, Santo Tomas City, 07.x.2023. M.C. Lit. Laguna Province: Barangays Puypuy, Masaya, Tranca & Bitin, Bay, 14.x.2023. M.C. Lit; Balayhangin, Calauan & San Mateo, San Pablo City, 21.x.2023. M.C. Lit.

Distribution

China, India, Pakistan, Sri Lanka, Laos, Malaysia, Philippines, and Taiwan. This distribution list is consolidated from the data enumerated in García Morales (2016) and Choi et al. (2018).

Remarks

Our specimens agree with the morphological features enumerated in the diagnosis of *D. cajani* above, particularly on the distribution of multilocular and preopercular pores. However, we note that the antennal segments are longer than wide. Williams & Watson (1990) remarked that compared to *D. chiton*, which has all but the basal segments longer than wide, those in *D. cajani* have the segments all as long as, or shorter than, wide. With such a combination of characters, our specimens seem to be intermediate between *D. chiton* and *D. cajani* as discussed in Williams & Watson (1990). We therefore sought the valuable opinion of Dr. Gillian W. Watson of The Natural History Museum, London. She kindly confirmed that "*Hodgson's (2021: 71) key expresses the antennal difference between the species in a different (better) way, and his key clearly places [y]our material as* D. cajani." (G.W. Watson, personal communication). Hodgson (2021: 71) characterizes *D. cajani* as having antennal segment 5 subequal in length to segment 6, whereas *D. chiton* has antennal segment 5 about 2x longer than segment 6.

García Morales (2016) cites Ali (1968 & 1971) for the record of this species in the Philippines. According to Miller et al. (2014), *D. chiton* is the species commonly intercepted (i.e., 22 times at U.S. ports-of-entry between 1995 and 2012, from Colombia, South Korea, Thailand, and Vietnam), with specimens

from Thailand on *Nephelium*. On the other hand, *D. cajani* is often encountered on lanzones (*Lansium domesticum*) fruits from the Philippines. With greater and more open fruit trade in the ASEAN region, and bearing in mind the polyphagous nature of these two *Drepanococcus* species, we postulate that it is likely that *D. chiton* will also be found in the Philippines, among the commonly sold fruits in the local markets.

Ecological Notes

Associated ants

We observed several species of ants (Hymenoptera: Formicidae) attending to both *D. cajani* and other honeydew-producing scale insects on rambutan; they are listed in Table 1. Among them, the most commonly encountered species (even among fruits being sold in roadside fruit stands) is the common black ant, *Dolichoderus thoracicus* (Smith, F.). The smaller black tree ant, *Technomyrmex* sp. and ghost ant, *Tapinoma melanocephalum* (Fabricius), apparently are attracted only to older fruits, which suggests that they may be consuming both the dispersing crawlers and dead or dying adults as well as honeydew.

Table 1. Common ants found attending *Drepanococcus cajani* on infested rambutan fruits.

Scientific Name	Common Name
Anoplolepis gracilipes (F. Smith)	yellow crazy ant
Dolichoderus thoracicus (Smith, F.)	common black ant
Oecophylla smaragdina (Fabricius)	weaver ant
Paratrechina longicornis (Latreille)	black crazy ant; longhorn crazy ant
Tapinoma melanocephalum (Fabricius)	ghost ant
Technomyrmex sp.	smaller black tree ant

Parasitoids and predators

Pupae of an undetermined parasitoid wasp species, probably an encyrtid, have been found in a few adult *D. cajani* individuals upon maceration.

Two kinds of lepidopterous larvae prey on scales of *D. cajani*; these include *Spalgis epius* (Westwood) (Lycaenidae), the caterpillar of which appears like a giant mealybug, while the pupa is dog-faced or monkey-faced. The other species is an undetermined predatory noctuid(?) larva. At night, workers of the largely nocturnal carpenter ant, *Camponotus irritans pallidus* (Smith, F.), may raid rambutan fruits and possibly snatch and consume scale insects in addition to sipping their honeydew. This ant species, being mainly predatory rather than mutualistic with the scale insects, is mentioned here but not included in Table 1.

The unidentified parasitoids and the predators listed above may contribute to the regulation of the soft scale insect population, which may not be economically injurious at present.

Host range

For *D. cajani*, García Morales (2016) enumerates eight plant families, 14 genera, and at least 18 species of hosts, suggesting a tendency toward polyphagy. Rambutan, *Nephelium lappaceum* (Sapindaceae), is a new host-plant record at the family, genus, and species levels. The earliest record of *D. cajani* in the Philippines was by Ali (1968), who did not cite examined materials. Among the host plants enumerated by Ali (1968) under *D. cajani,* the most common locally are *"kadios"* or pigeon pea, *Cajanus cajan* L. (Fabaceae) and guava, *Psidium guajava* L. (Myrtaceae). Miller et al. (2014) mentioned that it is commonly intercepted abroad (USA) on Philippine lanzones fruits, *Lansium domesticum* Corrêa (Meliaceae).

Varietal responses

Some rambutan cultivars have two or more forms mainly characterized by color, exocarp thickness, and/or "hairiness." Seven cultivars, namely: 'Geron', hirsute 'Maharlika', less hairy 'Maharlika', green 'Rongrein', yellow green 'Rongrein', 'Sakay', and an unnamed dark maroon cultivar, were the ones being sold among roadside stalls and fruit stands in the areas surveyed in Laguna and Batangas. Our preliminary qualitative observations indicate that among the seven, those cultivars with red- or orange-colored fruits, especially the less hairy form of 'Maharlika', seemed to have more mature scale insects. This form is sometimes referred to as 'Maharlikang kalbo' ["bald Maharlika"] by fruit sellers. Heavily infested fruits may become discolored on the parts where the insects have fed. The occurrence of more scale insects on this variety suggests that it might be preferred by this insect compared to those with maroon fruits, and that the less-hairy form may be preferred to the more-hairy ones. However, this needs to be verified with better sampling and, if possible, with replicated laboratory trials utilizing properly identified cultivars. In addition, a few fruit vendors sometimes interpret the presence of ants, especially common black ants, *D.*

thoracicus, as indicators of fruit sweetness rather than of a mutualistic association with honeydew-producing scale insects on the fruits.

Recommendations

The book of Cendaña et al. (1984) on insect pests of fruit crops in the Philippines is basically introductory and needs upgrading. Gabriel's (1997) list is still useful, but it also needs to incorporate recent developments in pest complexes and newly introduced species. The nomenclature of included species also needs to be updated for both crop plants and arthropods, as well as for all references on arthropods associated with Philippine fruit crops. In the course of writing this brief research note, we realize these needs and recommend that work be started to achieve these gargantuan tasks. We begin with this work, which also initiates our effort to document scale insects on rambutan and other local fruit crops.

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