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SHORT COMMUNICATION: FIRST RECORD OF *Aleurocanthus camelliae* (Homoptera: aleyrodidae) IN INDONESIA, AN INVASIVE PEST ON VARIOUS MEDICINAL PLANTS

Komunikasi Pendek: Laporan Pertama Keberadaan Aleurocanthus camelliae *(Homoptera: Aleyrodidae) di Indonesia, Hama Invasif Pada Tumbuhan Obat*

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ABSTRACT

Aleurocanthus camelliae was identified as a new species in 2011. The distribution of this species in worldwide is not widely known, including in Indonesia. This finding reported the existence of A. camelliae in Indonesia as a new record based on morphological characters which previously identified as A. spiniferus. The study was carried out in August 2019 using an observation method in three locations with different altitudes around Mount Lawu. The result showed the species parasitized 13 medicinal plant species in two observation location (495 m asl and 1,200 m asl).

Keywords**:** *Aleurocanthus spiniferus, morphology, camellia spiny whitefly, invasive pest, medicinal plant pest.*

ABSTRAK

Aleurocanthus camelliae diidentifikasi sebagai spesies baru telah dilakukan pada tahun 2011. Sebarannya diseluruh dunia belum banyak diketahui, termasuk di Indonesia. Laporan ini menyampaikan hasil pengamatan tentang keberadaan *A. camelliae* di Indonesia sebagai catatan baru berdasarkan karakter morfologi. Penelitian dilakukan pada bulan Agustus 2019 dengan metode observasi di tiga lokasi dengan ketinggian berbeda di sekitar Gunung Lawu. Hasil penelitian menunjukkan bahwa spesies ini telah menjadi parasite pada 13 spesies tumbuhan obat di dua lokasi pengamatan pada ketinggian 495 m dpl dan 1.200 m dpl.

Kata kunci: *Aleurocanthus spiniferus*, morfologi, kutu putih, hama invasif, hama tumbuhan obat.

INTRODUCTION

Aleurocanthus camelliae (Homoptera: Aleyrodidae) published for the first time by Kanmiya et al. (2011). It is a member of the genus *Aleurocanthus* that comprises about 80 species worldwide (Jansen & Porcelli, 2018). They belong to the family Aleyrodidae that referred to as whitefly (Bragard et al., 2018). The living behaviour of *A. camelliae* larvae is sessile and settles on the underside of the leaves. They absorb nutrient from leave and excrete honeydew through the spines that can trigger the growth of fungi and decrease plant resistance (Kasai et al., 2012).

Kanmiya discovered the specific state of an organism similar to *Aleurocanthus spiniferus*, which attacks tea plants (*Camellia sinensis*) in Japan that lead to the discovery of new species. They distinguish based on several characteristics, including forewing maculation, adult aedeagus shape, marginal crenulations number, 4th instar larvae, and genetic differentiation. However, *A.*

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spiniferus also remains a devastating pest to the tea crop in temperate China (Kanmiya et al., 2011). This species reported in Europe, Italy, the Mediterranean Region, China, and Japan (Chen et al., 2016; Jansen & Porcelli, 2018; Yamashita et al., 2016). However, the presence of this species in medicinal plants and others plants host in Indonesia has never been reported. This study will report the existency of *Aleurocanthus camelliae* which are found as parasites in several species of medicinal plants.

METHODS

Observation method of *A. camelliae* infestation was used in this research. This research was conducted during August 2019 in three locations around Mount Lawu (Table 1). Thirteen medicinal plant species were used as observation sample in each location (Table 2). Plants showing symptoms of *A. camelliae* were collected and examined using a Nikon SMZ645 stereomicroscope in the Laboratory of Medicinal Plant Pest and Disease.

Table 1. Observation location of *A. camelliae* larvae

No	Location	Location Coordinates	Altitude (m asl)	Total area (m^2)
1	Karangpandan	7°36'39.4"S 111°03'14.6"E	495	5,900
2	Kalisoro	7°39'47.0"S 111°08'05.6"E	1,200	3,500
3	Tlogodlingo	7°40'04.1"S 111°10'42.2"E	1,800	2,700

Previous observations in Kalisoro showed *A. camelliae* infestation on medicinal plant which initially identified as *A. spiniferus*. Research results by Kanmiya (2011) revealed morphological characters differences between *A. camelliae* and *A. spiniferus*. Morphololological characteristics such as eggs, first to fourth-instar larvae and *A. camelliae* were used for identification (Figure 1). Identification process was carried out using morphological descriptions by Kanmiya (Kanmiya et al., 2011).

The genus *Aleurocanthus* can identify from the glandular spines in the dorsal disc and submarginal in the puparium, the typical pile of the exuviae carriage on the dorsum from the preceding instars and white wax edges. Determination of *A. camelliae*: Puparium. Metallic black surrounded by waxy marginal white with a width of 90–160 μm (female) and 66–150 μm (male). Previous instar exuviae (usually 2nd and 3rd) often remain stacked. Female pupae length: 1084.8 ± 51.1 μm, width: 751.5 ± 45.9 μm, male pupae length: 796.3 ± 23.2 μm, width: 491.3 ± 29.5 μm. Chaetotaxy. Dorsal surface with 11 (female) or 10 (male) submarginal gland spines 90–110 μm in length, 3 pairs of submedian abdominal spines, 7 pairs of abdominal subdorsal spines, Sockets of 2nd to 5th spines lined up roughly linearly. Adult. Female body length: 1.25–1.40 mm, male: 0.90–1.10 mm; Antenna total length 260–320 μm, two gray-brown basal segments, 5 yellowish-white distal segments, two thickened basal segments, the second segment is almost 3 times longer than the first, the 3rd segment is the longest; Female forewings: 1.1–1.2 mm long, 413–550 μm wide at the widest part and 320–450 μm wide at the center of wing; The hind wings of the female are 0.95–1.02 mm long, 0.41–0.4 mm wide, evenly grayish-white, or with multiple opaque macules depending on age; In Males, the forewings are 0.84–0.9 mm long and about 0.37 mm wide. Identical male and female forewing macules bearing 9 white macules; hind wings pale brown or grayish with no protruding macules. The female abdomen with two ventral wax plates and the male with four distinct ventral abdominal wax plates (Kanmiya et al., 2011).

The attack rate of *A. camelliae* larvae was calculated using the Kilmaskossu &Nerokouw formula (Kilmaskossu & Nerokouw, 1993)by the following equation:

$$I = \frac{ni.Vi}{N.V} \times 100\%$$

Notes:
I = attack rate per plant
ni = number of plants with the ith score
Vi = The value of the attack score
N = Number of plants observed
V = Highest score
The attack rate scores are as follows:
0 = healthy
1 = Very light (1-20%)
2 = Mild (21-40%)
3 = Medium (41-60%)
4 = Weight (61-80%)
5 = Very heavy (81-100%).

Figure 1. *A. camelliae*: a. Eggs; b. 1st instar larvae; c. 2nd instar larvae; d. 3rd instar larvae; e. 4th instar larvae; f. Puparium; g. Imago top view; h. Imago side view.

RESULT AND DISCUSSION

. Larvae and adults of *A.spiniferus* were morphologically different from *A. camelliae*, mainly in its wings characters (Figure 2). An adult of *A. camelliae* has nine white maculae, whereas *A. spiniferus* has only seven. In the larval stage, the submedian abdominal spines of *A. camelliae* are linear. The marginal wax secretion of *A. camelliae* is narrower than that of *A. spiniferus* (Kanmiya et al., 2011).

Figure 2. Characteristics of adults and pupae, (a, c) *A. camelliae*, (b, d) *A. spiniferus.* Courtesy: Porcelli (2008)

Aleurocanthus camelliae infested thirteen medicinal plants species from 4 plant families in Kalisoro and Karangpandan (Table 2). The infestation of this species was found in leaves (Figure 3). In Japan, this invasive insect makes the tea plant a host and causes losses (Uesugi & Sato, 2013; Yara et al., 2018), while around Mount Lawu, we found this species infesting several plants species (Table 2).

Table 2. The existence of *A. camelliae* in the plants

Medicinal plant species	Karangpandan (495 m asl)			Kalisoro (1,200 m asl)			Tlogodlingo (1,800 m asl)		
	Plant Observed	Larvae	Attack Rate (%)	Plant Observed	Larvae	Attack Rate (%)	Plant Observed	Larvae	Attack Rate (%)
Rutaceae									
Atalantia missionis	-	-	0	2	++	40	2	-	0
Citrus aurantium	-	-	0	4	++	40	-	-	0
Citrus hystrix	-	-	0	3	++	40	-	-	0
Citrus medica	3	++	40	3	+++	60	2	-	0
Glycosmis pentaphylla	-	-	0	2	+	40	-	-	0
Phyllanthaceae									
Glochidion sp.	-	-	0	19	+	7	12	-	0
Lauraceae									
Litsea cubeba	-	-	0	2	++	20	50	-	0
Piperaceae									
Piper betle	3	++	40	4	++	40	2	-	0
Piper betle var. *nigra*	2	++	20	3	++	20	-	-	0
Piper retrofractum	1	++	20	4	++	20	-	-	0
Piper lolot	-	-	0	2	++	20	-	-	0
Piper sp. 1 *(sirih kuning)*	-	-	0	3	+++	60	-	-	0
Piper sp. 2 *(sirih manado)*	-	-	0	2	++	40	-	-	0
Theaceae									
*Camellia sinensis**	3	-	0	14	-	0	100	-	0

Note: Larvae = larvae population; (-) = Not found; (+) = 1-10; (++)= 11-50; (+++)= >100

The table shows that the highest pest population and attack rate (60%) were in *C. medica* and *Piper* sp.1. Infested medicinal plant species data also show that the preference of the host for this pest was rutaceous and piperaceous plant. It is possible that there are other plant species as a host of *A. camelliae*, considering that several species of the genus *Aleurocanthus* are polyphagous, such as *A. spiniferus* which can live in 38 plant families and *A. woglumi* in 300 host species, including rutaceous plant (Bragard et al., 2018). The tea plant that became the basis of naming *A. camelliae* did not show infestation throughout the observation location. Observations at Tlogodlingo found that although it was close to *C. aurantium* and *C. hystrix* that had been infested by *A. camelliae*, *C. sinensis* had no infestation at all. These conditions indicate that the primary preference of this pest is not *C. sinensis*, but species from the genus *Citrus*. It is necessary for further research of the feeding preferences *A. camelliae* larvae to determine the behavior of these pests in finding their hosts.

Based on altitude, the attack rates in Karangpandan and Kalisoro do not show any differences. Environmental conditions of Tlogodlingo (1,800 m asl) is a possible factor that may cause the absence of an infestation by *A. camellia*. We need further research to determine the factors that cause *A. camelliae* was undiscovered infestation at this altitude.

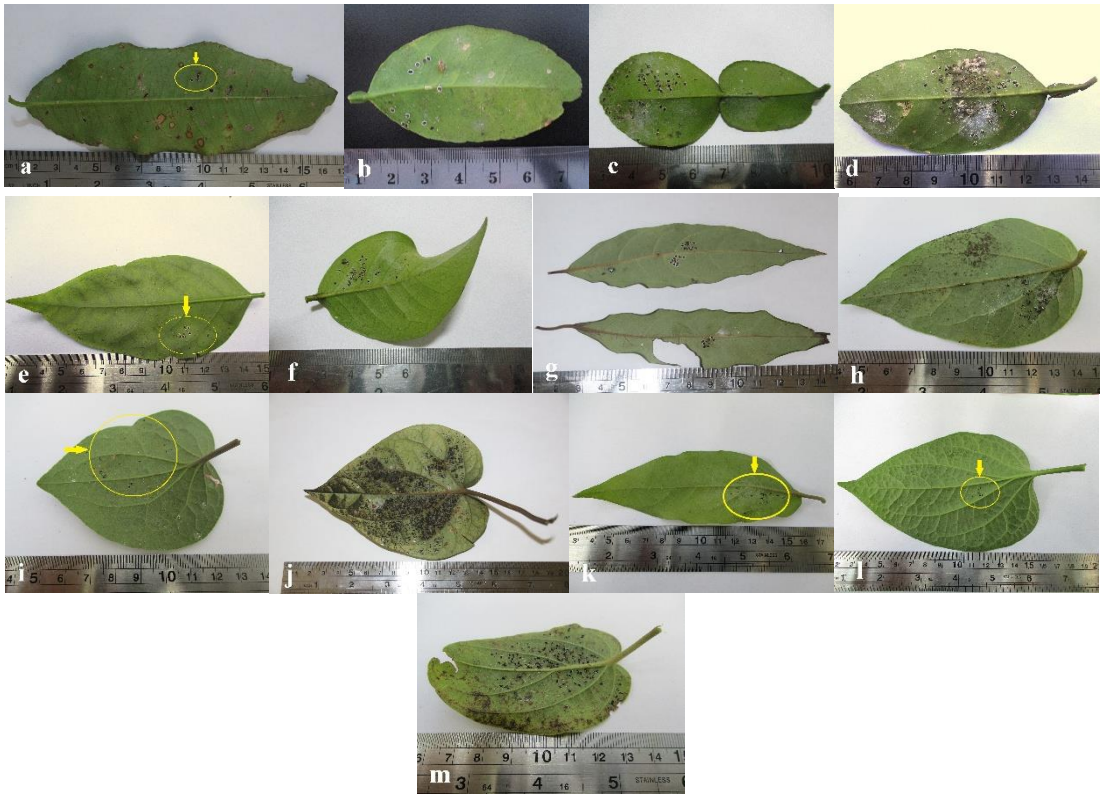

Figure 3. Leaf samples infested with *A. camelliae* from Kalisoro (the smallest scale of the ruler is millimeters): a. *Atalantia mission olive*; b. *Citrus aurantium*; c. *Citrus hystrix*; d. *Citrus medica*; e. *Glochidion* sp.; f. *Glycosmis pentaphylla*; g. *Litsea cubeba*; h. *Piper betle*; i. *Piper betle* var. *nigra*; j. *Piper* sp.1; k. *Piper retrofractum*; l. *Piper lolot*; m. *Piper* sp.2.

The attack of *A. camelliae* has caused damage to the host leaf, as shown in the betel leaf (*Piper* sp.1) in Figure 4. Symptoms of chlorosis was found in the the leaves, showing pale and turning to yellow due to loss of chlorophyll. Other symptoms is the presence of brownish spots over the leaf surface area which indicate necrosis (death of cells or tissues). Heavy infestations in tea plants, according to Saito et al. (2012) causing the plant become weak and sooty mold

grow on it. In addition, the presence of sooty fungi and the sessil behaviour of the larvae will certainly reduce the quality of the leaves because they are contaminated with other unwanted organic materials.

Figure 4. The symptom of *A. camelliae* attack on betel leaf: a. the underside of the leaves; b. the top of the leaf.

Based on a previous study in China and Japan, this insect species have harmed tea plantations. Related to this condition, need for oversight *A. camelliae*-related attacks against medicinal plants, for example, *P. retrofratum* as plant material of anti-gout Jamu Saintifik (Fitriani et al., 2018). Further research is needed to study the distribution and population of *A. camelliae* in Indonesia which will be able to summarize the threats of medicinal plant that used as traditional medicine materials.

CONCLUSION

A. camelliae may have existed for a long time in Indonesia. However, until we prepared this report, there were no records that reported its existence. This report is the first record regarding *A. camelliae*, which also exists in Indonesia. *A. camelliae* infestation level in all affected plant types is very light to medium. The highest population found in *Piper* sp.1 and *C. medica* plants. The presence of *A. camelliae* in Indonesia requires special attention because it has a potential threat for its invasive nature.

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