Jurnal Entomologi Indonesia
p-ISSN: 1829-7722 e-ISSN: 2089-0257
Terakreditasi Kemenristekdikti: 105/E/KPT/2022

November 2024, Vol. 21 No.3, 177–183
Online version: https://jurnal.pei-pusat.org
DOI: https://doi.org/10.5994/jei.21.3.177

# KOMUNIKASI SINGKAT

# New *Eucalyptus* (Myrtaceae) species host of *Blastopsylla occidentalis* (Hemiptera: Aphalaridae) and its parasitism by *Psyllaephagus blastopsyllae* (Hymenoptera: Encyrtidae) in Indonesia

## Species *Eucalyptus* (Myrtaceae) baru yang menjadi inang *Blastopsylla occidentalis* (Hemiptera: Aphalaridae) dan parasitismenya oleh *Psyllaephagus blastopsylla* (Hymenoptera: Encyrtidae) di Indonesia

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(diterima Februari 2024, direvisi Oktober 2024, disetujui November 2024)

**ABSTRACT**

*Blastopsylla occidentalis* Taylor (Hemiptera: Aphalaridae), native to Australia, causes damage to an increasing number of *Eucalyptus* (Myrtaceae) species and their hybrids in a growing number of countries. This is partly because predatory insects and spiders have low potential to reduce *B. occidentalis* populations. The purpose of this study was to report a new host of *B. occidentalis* and the parasitism of this insect by *Psyllaephagus blastopsyllae* Tamesse, Soufo, Tchanatame, Dzokou, Gumovsky, & Coninck (Hymenoptera: Encyrtidae) in Indonesia. *Blastopsylla occidentalis* nymphs parasitized were collected from five *Eucalyptus pellita* F. Muell. trees on October 3rd, 2023, in Senoni, East Kalimantan, Indonesia, and reared in a laboratory until their adults or *P. blastopsyllae* emerged. The adults recovered from this parasitoid were identified by morphological analysis of their bodies. *Eucalyptus pellita* is a new host for *B. occidentalis*. This is the first time in Asia (Indonesia) that *P. blastopsyllae* has been reported. This new insect-host association alerts the world to the need to develop management strategies for *B. occidentalis* on *E. pellita* plantations. The recovery of *P. blastopsyllae* also opens up new perspectives for the development of biological control programs in Indonesia.

**Key words:** biological control, Encyrtinae, *Eucalyptus*

**ABSTRAK**

*Blastopsylla occidentalis* Taylor (Hemiptera: Aphalaridae), berasal dari Australia, menyebabkan kerusakan pada beberapa spesies *Eucalyptus* (Myrtaceae) dan hibridanya di beberapa negara. Hal

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ini disebabkan oleh rendahnya potensi serangga predator dan laba-laba dalam mengurangi populasi *B. occidentalis*. Tujuan dari penelitian ini adalah melaporkan spesies baru *Eucalyptus* yang menjadi inang *B. occidentalis* dan parasitisme serangga ini oleh *Psyllaephagus blastopsyllae* Tamesse, Soufo, Tchanatame, Dzokou, Gumovsky & Coninck (Hymenoptera: Encyrtidae) di Indonesia. Nimfa yang diparasit *B. occidentalis* dikumpulkan dari lima tanamaan *Eucalyptus pellita* F. Muell. pada tanggal 3 Oktober 2023 di Senoni, Kalimantan Timur, Indonesia dan dipelihara di laboratorium hingga muncul *P. blastopsyllae* dewasa. Parasitoid dewasa yang muncul ini diidentifikasi melalui analisis morfologi dari tubuhnya. *Eucalyptus pellita* terungkap sebagai inang baru *B. occidentalis*. *Psyllaephagus blastopsyllae* pertama kalinya dilaporkan di Asia (Indonesia). Asosiasi inang serangga yang baru ini mengingatkan dunia akan perlunya mengembangkan strategi pengelolaan *B. occidentalis* di perkebunan *E. pellita*. Pengembangan *P. blastopsyllae* juga membuka perspektif bagi pengembangan program pengendalian hayati di Indonesia.

**Kata kunci:** Encyrtinae, *Eucalyptus*, pengendalian biologis

## INTRODUCTION

The eucalyptus shoot psyllid *Blastopsylla occidentalis* Taylor (Hemiptera: Aphalaridae), native to Australia, feeds on *Eucalyptus* L'Hér. (Myrtaceae) (Demetriou et al. 2022). This insect is geographically distributed in all regions of Brazil, on the islands of Kalimantan and Sumatra in Indonesia, and in the states of California and Florida in the United States of America. It has been also reported in Algeria, Burundi, Cameroon, Egypt, Kenya, South Africa (Africa), Argentina, Chile, Mexico, Nicaragua, Uruguay (America), China, Hong Kong, Israel, Philippines, Turkey, Yemen (Asia), Cyprus, Italy, Malta, Portugal, Spain (Europe), and New Zealand (Oceania) (de Queiroz et al. 2018; Saliba et al. 2019). *Blastopsylla occidentalis* is spread through infested *Eucalyptus* spp. materials, but the introduction of this insect into new areas can be prevented through organism identification work in borders, as reported by the identification, at a species level, of several psyllid species in a port of entry in South Korea (Suh & Choi 2020).

*Blastopsylla occidentalis* damages plants of all ages of *Eucalyptus* spp., with a greater number of individuals foraging on new leaves and the tips of younger ones, resulting in physical damage (distortion of leaves and tips) and loss of vigor (Floris et al. 2020). Infestation of *Eucalyptus globulus* Labill. by *B. occidentalis* reduces the growth and causes death of young plants in the nursery and field in African countries, including Cameroon (Soufo & Tamesse 2015; Dzokou et al. 2020) and Rwanda (Ivan & Takatoshi 2019). This insect also makes *Eucalyptus camaldulensis* Dehnh. trees weaker and preferred by other psyllid species with greater damage potential, *Glycaspis brimblecombei* Moore (Hemiptera: Aphalaridae) in Algeria (Kheddar et al. 2020). In addition, *B. occidentalis* reduces the wood productivity of *Eucalyptus urophylla* S.T. Blake and hybrids of *E. urophylla* × *Eucalyptus grandis* W. Hill. in areas with prolonged drought in Brazil due to an increase in the population of this insect (Burckhardt et al. 1999). In contrast, the infestation of *Eucalyptus maidenii* Muell. adult trees by *B. occidentalis* did not cause damage in Uruguay (Martínez et al. 2014), but reduced the production of *Eucalyptus* spp. inflorescences and seeds for genetic improvement programs and honey in the Mediterranean Basin (Floris et al. 2018). The hybrid *E. urophylla* × *E. grandis* and more than 10 *Eucalyptus* species have been reported as hosts of *B. occidentalis*, including *E. camaldulensis*, *Eucalyptus forrestiana* Diels, *E. globulus*, *Eucalyptus gomphocephala* DC., *Eucalyptus microtheca* F. Muell., *Eucalyptus nichelii* Maiden & Blakely, *Eucalyptus oleosa* F. Muell. ex Miq., *Eucalyptus rudis* Endl., and *Eucalyptus spathulata* Hook. (Soufo & Tamesse 2015; Joly et al. 2020). *Blastopsylla occidentalis* is controlled through different practices of integrated management such as the application of insecticides (Künast et al. 2023) and the conservation and/or release of the parasitoid *Psyllaephagus blastopsyllae* Tamesse, Soufo, Tchanatame, Dzokou, Gumovsky, & Coninck (Hymenoptera: Encyrtidae) (Tamesse et al. 2014). This parasitoid lays its eggs on *B. occidentalis* nymphs, which become blackish as the host develops inside

them; a new *P. blastopsyllae* adult emerges per nymph with potential to reduce the *B. occidentalis* population (Tamesse et al. 2014).

*Psyllaephagus blastopsyllae* has been reported in Algeria, Cameroon, Ethiopia, Rwanda, South Africa (Africa), and Brazil (America) (Tamesse et al. 2014; Bush et al. 2016; Adel-Sellami et al. 2020; Künast et al. 2020). Although reports of *P. blastopsyllae* in Ethiopia and Rwanda do not refer to *B. occidentalis* (Ivan & Takatoshi 2019; Wondafrash et al. 2021), its occurrence is likely to occur in these countries. New reports confirming the presence of *P. blastopsyllae* in countries and host plants of *B. occidentalis* provide important information for the development of biological control programs and the selection of tolerant *Eucalyptus* clones, respectively (Joly et al. 2020; Künast et al. 2021). The objective of this study was to report the first incidence of *P. blastopsyllae* in Asia and confirm the species name of its insect host. We also report a new species of *Eucalyptus* as a host for *B. occidentalis*.

## METHODS

This study was conducted on a commercial plantation of *Eucalyptus pellita* F. Muell. and its hybrids in East Kalimantan, Indonesia at 00°16'56.57'' to 00°39'10.78''S, 116°24'59.00'' to 117°00'18.92''E, and an average of 70 m above sea level. *Blastopsylla occidentalis* was reported in this area for the first time in mid-2022, when it reached pest status (Burckhardt et al. 2024).

The collection of *P. blastopsyllae* to confirm its species identity was carried out as previously described. The three uppermost branches (around 50 cm long) of *E. pellita* were collected from five trees (around 1.70 m high) at 00°23'25.12''S and 116°50'11.14''E (tree 1), 00°23'25.24''S and 116°50'11.52''E (tree 2), 00°23'25.49''S and 116°50'11.92''E (tree 3), 00°23'25.75''S and 116°51'52.27''E (tree 4), and 00°23'25.91''S × 116°52'11.01''E (tree 5) within a 20-hectare stand on October 3rd, 2023, in Senoni, East Kalimantan. This stand was planted for four days starting on May 17th, 2023. Only plants with branches infested with at least one blackened (potentially parasitized) *B. occidentalis* nymph were selected. These branches collected were placed in 3 l capacity plastic bags filled with air and taken to a laboratory, where they were kept under incubation at 26.6 ± 4.0 °C and a 12:12 (L:D) h photoperiod until the emergence of *B. occidentalis* or parasitoids. Emerging parasitoids were collected from plastic bags using a brush and stored in 80% ethanol in Eppendorf® plastic vials (Hamburg, Germany).

*Psyllaephagus blastopsyllae* was identified through a morphological analysis of its adult body, followed by a comparison with a description by Tamesse et al. (2014), and deposited at the National Collection of Insects, Biosystematics Division, Agricultural Research Council in Pretoria, South Africa (accession number: HYMT07333).

The number of *B. occidentalis* nymphs (blackish color) parasitized per branch in each plant and emergence rate (%) were assessed. Non-parasitized and parasitized nymphs (blackish color), another with the exit hole of the adult parasitoid, and adult females of *P. blastopsyllae* (pinned and foraging on *E. pellita* branches) were photographed with an HDL camera attached to an Olympus SZ2-ILST stereomicroscope manufactured by Olympus Corporation, Tokyo, Japan. To provide a compiled list of *B. occidentalis* natural enemies, a literature review was performed to identify all species reported per region in different countries.

## RESULTS AND DISCUSSION

The present study reports the first occurrence of *P. blastopsyllae* in Asia (Indonesia), and its host species (*B. occidentalis*) was confirmed through two analyses: first, previous information on the existence of two psyllid species in Senoni, *B. occidentalis* and *Platyobria drepanoides* Burckhardt (Hemiptera: Aphalaridae); second, the possibility of differentiating the nymphs of these two species by analyzing their antenna features (Burckhardt et al. 2024). The psyllid species whose mummies presented an exit hole from parasitoid emergence was confirmed as *B. occidentalis* after analysis of its antenna features (*B. occidentalis* antenna is longer than that of *P. drepanoides*) (Figures 1A–1C). *Psyllaephagus blastopsyllae*, recovered in Indonesia in the current study, has

been reported as an endoparasitoid (Künast et al. 2020) of fourth- and fifth-instar nymphs of *B. occidentalis* (Soufo & Tamesse 2015). The adults of this insect emerge from the hosts through an exit hole in the upper part of the second half of the abdomen, as first illustrated and described in Cameroon (Tamesse et al. 2014). The origin of both *P. blastopsyllae* and its host *B. occidentalis* is likely to be the same in Australia (Künast et al. 2020).

*Psyllaephagus blastopsyllae* is easily identified by the naked eye when foraging on *E. pellita* branches infested by *B. occidentalis* in the field due to its high body mobility, wing movement, and characteristic dark color body (Figures 1D−1E). The parasitized nymphs and mummies of this psyllid were also easily observed (Figures 1B−1C) facilitating the determination of parasitism rate percentages in plantations. The current report on *P. blastopsyllae* adds Indonesia as the sixth country with confirmed occurrence of this insect (Table 1). The identification of *P. blastopsyllae* from a collection in Indonesia opens up possibilities for its release into this country in areas with *B. occidentalis* with a low number or absence of natural enemies. The first report of *B. occidentalis* parasitized by *P. blastopsyllae* was in Cameroon (Tamesse et al. 2014), followed by a study reporting the presence of this parasitoid in South Africa, with populations high enough to keep those of its host under the control level (Bush et al. 2016). *Psyllaephagus blastopsyllae* and *Psyllaephagus viridis* Prinsloo are similar, differing in that the former has a scutellum more densely covered in pubescence (covered with 55 to 60 setae or more), the position of the toruli being below the lower eye margins, females with a shorter antennal scape (only 3.5 to 4.0 times longer than broad), and males with a shorter antennal scape (close by twice as long as broad) (Tamesse et al. 2014).

This study also reports the first case of *B. occidentalis* hosted in *E. pellita*. All *B. occidentalis* stages (eggs, instar nymphs, and adults) and feeding were clearly observed on the plants. *Psyllaephagus blastopsyllae* is the only parasitoid

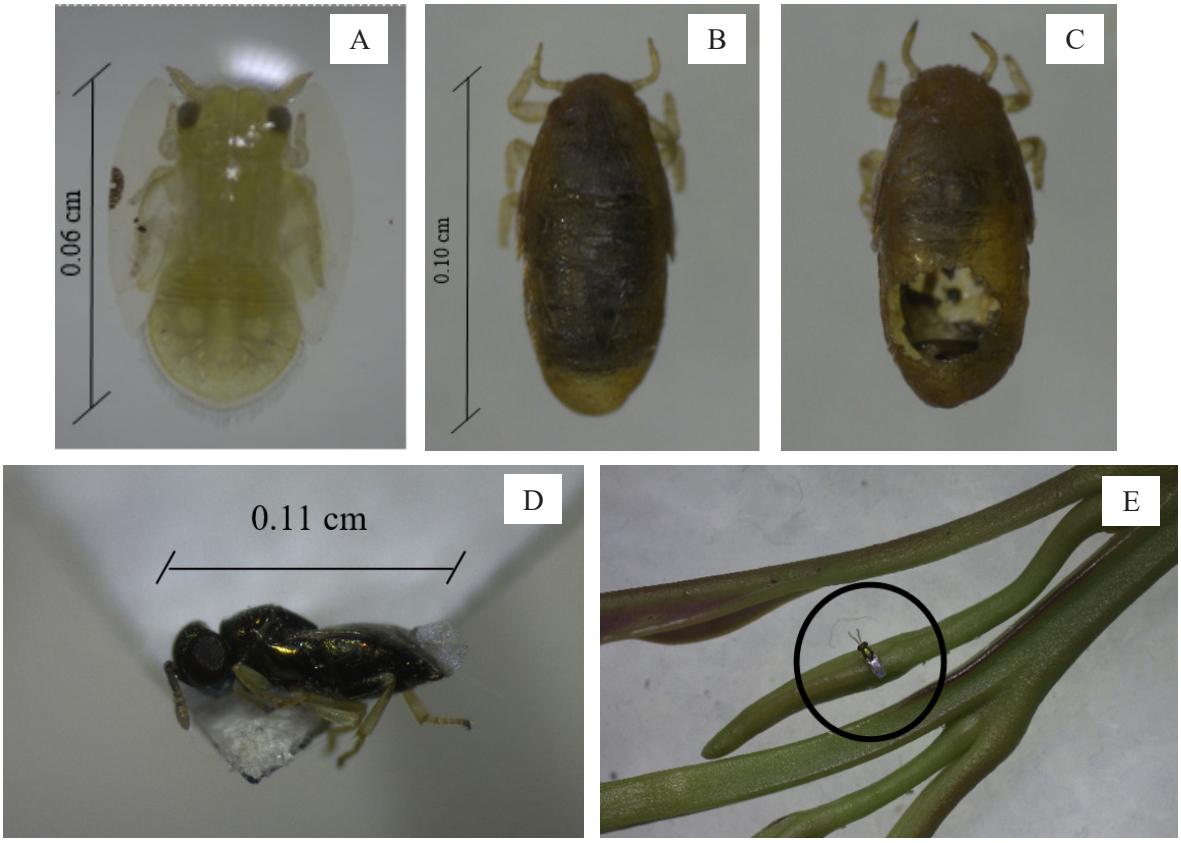


**Figure 1.** Nymphs of *Blastopsylla occidentalis* (Hemiptera: Aphalaridae) non-parasitized (A) and parasitized (B), parasitoid exit hole (C), and adult females of *Psyllaephagus blastopsyllae* (Hymenoptera: Encyrtidae), mounted (D) and foraging on *Eucalyptus pellita* (Myrtaceae) branches in the field (E).

of *B. occidentalis* reported to date. However, six groups of predators of this insect have been reported in Brazil, and one in Cameroon (Table 2). The first report of *B. occidentalis* on *E. pellita* raises an alert for *Eucalyptus* spp. forest growers, as this plant species is one of the most planted in Indonesia, in addition to being used as a pollen source in genetic selection programs (Sinulingga et al. 2021). *Psyllaephagus blastopsyllae* recovered from *B. occidentalis* in seven countries was the main natural enemy of this psyllid because other natural enemies are generalist predators with a low potential to keep this psyllid population under control levels. These predators prefer to attack soft-bodied insects (aphids, mealybugs, thrips, whiteflies, etc.) rather than *B. occidentalis* when

**Table 1.** Reports of the natural parasitism of *Blastopsylla occidentalis* (Hemiptera: Aphalaridae) by *Psyllaephagus blastopsyllae* (Hymenoptera: Encyrtidae) per region in different countries

| Country | Region | References |
|---|---|---|
| Algeria | Oued Smar, Algiers | Adel-Sellami et al. (2020) |
| Brazil | Três Lagoas, Mato Grosso<br>Mato Grosso do Sul<br>Minas Gerais<br>São Paulo | Künast et al. (2020) |
| Cameroon | Yaounde | Tamesse et al. (2014) |
| Ethiopia | - | Wondafrash et al. (2021) |
| Indonesia | East Kalimantan | Present study |
| Rwanda | Bugesera, Gasabo and Rubavu Districts | Ivan & Takatoshi (2019), Wondafrash et al. (2021) |
| South Africa | Buffelspoort, West of Pretoria | Bush et al. (2016) |

**Table 2.** Organisms reported as predators of *Blastopsylla occidentalis* (Hemiptera: Aphalaridae) per country

| Predatory organisms | Order, Family | Country | References |
|---|---|---|---|
| Hover flies, including *Allograpta exotica*, *Pseudodorus clavatus* and *Syrphus phaeostigma* | Diptera, Syrphidae | Brazil | Santana & Burckhardt (2007) |
| Lacewings, including *Chrysoperla* spp. | Neuroptera, Chrysopidae | Brazil | Santana & Burckhardt (2007) |
| Ladybugs, including *Cycloneda sanguinea*, *Eriopis connexa*, *Harmonia axyridis*, *Hippodamia convergens*, and *Olla v-nigrum* | Coleoptera, Coccinellidae | Brazil, Cameroon | Santana & Burckhardt (2007); Soufo & Tamesse (2015) |
| Long-legged flies | Diptera, Dolichopodidae | Brazil | Santana & Burckhardt (2007) |
| Minute pirate bugs, including *Anthocoris* sp. | Hemiptera, Anthocoridae | Brazil | Santana & Burckhardt (2007) |
| Spiders | Araneae | Brazil | Santana & Burckhardt (2007) |

**Table 3.** Mean (M) and total (T) of *Blastopsylla occidentalis* (Hemiptera: Aphalaridae) nymphs (N) parasitized by *Psyllaephagus blastopsyllae* (Hymenoptera: Encyrtidae) per branch (B) in a commercial stand of *Eucalyptus pellita* (Myrtaceae) in East Kalimantan, Indonesia

| | Tree 1 | | | Tree 2 | | | Tree 3 | | | Tree 4 | | | Tree 5 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B 1 | B 1 | B 3 | B 1 | B 2 | B 3 | B 1 | B 2 | B 3 | B 1 | B 2 | B 3 | B 1 | B 2 | B 3 |
| N | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 3 | 1 | 2 | 2 | 1 | 1 |
| M | 2.3 | | | 1.7 | | | 1.7 | | | 2.0 | | | 1.3 | | |
| T | 7 | | | 5 | | | 5 | | | 6 | | | 4 | | |

they occur simultaneously on the same *Eucalyptus* plant (Santana & Burckhardt 2007; Saliba et al. 2019).

The number of *B. occidentalis* nymphs parasitized per tree was low at the collection time (Table 3) but sufficient to obtain *P. blastopsyllae* parasitoid adults for species identity confirmation. The emergence rate was 100%, with 40% and 60% of the parasitoid individuals emerging within one or two days after field collection, respectively.

The occurrence of *B. occidentalis* in *E. pellita* alerts planted forest growers to implement integrated programs to control this insect. The report of nymphs of this insect parasitized by *P. blastopsyllae* in Indonesia opens up new perspectives for developing biological control activity initiatives.

## ACKNOWLEDGEMENTS

We thank Gerhard Prinsloo (South Africa) for confirming the parasitoid species name. Adam Batten, from Get It Right in Jakarta, Indonesia, proofread the final version of the manuscript. To PT. ITCI Hutani Manunggal (IHM) from Indonesia for financial support.

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