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# **First report of *Ophiusa disjungens* (Walker, 1858) on *Acacia mangium* Willd. (Fabaceae), and damage and notes of its biology on *Eucalyptus* (Myrtaceae) commercial plantations in Sumatra, Indonesia (Lepidoptera: Erebidiae)**

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## **Abstract**

*Acacia mangium* Willd. (Fabaceae), *Eucalyptus pellita* F. Muell. and *Eucalyptus grandis* W. Hill ex Maiden (Myrtaceae) are largely planted in Sumatra, Indonesia, where they are used as a raw material to produce commodities such as paper, pulp and viscose. *Acacia* and *Eucalyptus* are attacked by several species of defoliating Coleoptera and Lepidoptera in Sumatra. The objectives of this study were to report, for the first time, the guava moth, *Ophiusa disjungens* (Walker, 1858) on *A. mangium*, and damage and notes of its biology on *Eucalyptus* commercial plantations in Sumatra. *Ophiusa disjungens* on six- and seven-month-old *A. mangium* had an average of three larvae per tree in two commercial stands in Peranap Sector, Riau, Sumatra, on April 2018. The incidence of caterpillars and/or fresh damage (defoliation) of this pest on one-, three- to seven-, nine-, and 10-month old *E. pellita* and *E. grandis*  $\infty$  *E. pellita* ranged 4.0–80.2% within 18 commercial stands in Sei Kebaro Sector, Riau, on April 2020. Caterpillars reared in a laboratory had period from pupa to adult (mean  $\pm$  SD) of 25.5  $\pm$  4.5 days. *Ophiusa disjungens* is reported for the first time on *A. mangium*, and incidence of its caterpillars and/or damage (defoliation) on *Eucalyptus* is up to 80.2% in Sumatra.

KEY WORDS: Lepidoptera, Erebidiae, *Ophiusa disjungens*, damage, defoliation, *Acacia mangium*, Fabaceae, *Eucalyptus*, Myrtaceae, Sumatra, Indonesia.

**Primer registro de *Ophiusa disjungens* (Walker, 1858) sobre *Acacia mangium* Willd. (Fabaceae), y daños y notas de su biología sobre plantaciones comerciales de *Eucalyptus* (Myrtaceae) en Sumatra, Indonesia (Lepidoptera: Erebidiae)**

## **Resumen**

*Acacia mangium* Willd. (Fabaceae), *Eucalyptus pellita* F. Muell. y *Eucalyptus grandis* W. Hill ex Maiden (Myrtaceae) están plantadas en gran parte de Sumatra, Indonesia, donde son usadas como materia prima para producir productos primarios como el papel, la pulpa y las fibras textiles. *Acacia* y *Eucalyptus* son atacadas por algunas especies defoliadores de Coleoptera y Lepidoptera en Sumatra. El objetivo de este estudio era informar, por primera vez, de *Ophiusa disjungens* (Walker, 1858) sobre *A. mangium* y notas sobre su biología y daños en

plantaciones comerciales de *Eucalyptus* en Sumatra. *Ophiusa disjungens* sobre *A. mangium* en seis o siete meses, tenía un promedio de tres larvas por árbol en dos puestos comerciales en el sector de Peranap, Riau, Sumatra, en abril de 2018. El índice de orugas y/o de daños recientes (defoliación) de esta plaga sobre uno, tres a siete, nueve y diez meses *E. pellita* y *E. grandis*  $\approx$  *E. pellita* se extendían 4.0-80.2% dentro de 18 puestos de comerciales en el sector en Sei Kebaro, Riau, en abril de 2020. Las orugas criadas en un laboratorio tenían el período de crisálida a adulto (representa  $\pm$  SD) de  $25.5 \pm 4.5$  días. *Ophiusa disjungens* se registra, por primera vez, sobre *A. mangium* y el índice de sus orugas y/o daños (defoliación) sobre *Eucalyptus* es de 80.2% en Sumatra.

PALABRAS CLAVE: Lepidoptera, Erebidae, *Ophiusa disjungens*, daños, defoliación, *Acacia mangium*, Fabaceae, *Eucalyptus*, Myrtaceae, Sumatra, Indonesia.

## Introduction

*Acacia mangium* Willd. (Fabaceae) is endemic to four environmentally-similar regions, northeastern Queensland (Australia), southwestern Papua New Guinea, Papua, and eastern Maluku Islands (SILVA *et al.*, 2020). *Eucalyptus grandis* W. Hill ex Maiden is endemic to coastal areas and sub-coastal ranges from Newcastle in New South Wales northwards to west of Daintree in Queensland, while *Eucalyptus pellita* F. Muell. (Myrtaceae) to northeastern Queensland (LI *et al.*, 2016; MENUCELLI *et al.*, 2019; ARISANDI *et al.*, 2019). *Acacia* and *Eucalyptus* are largely planted in Sumatra, Indonesia where they are used as a raw material to produce commodities such as paper, pulp and viscose (WIBISONO *et al.*, 2015; RONG *et al.*, 2016; NAWAWI *et al.*, 2017).

*Acacia* and *Eucalyptus* commercial plantations are attacked by several species of coleopterans and lepidopterans in Riau, Sumatra. *Acacia* species have been recently recorded as attacked by beetles of *Altica* sp., *Aulacophora* spp. (Chrysomelidae), *Aulonogria* sp. (Lagriidae) (TAVARES *et al.*, 2020a), *Glycyphana nicobarica* Janson, 1887 (Scarabaeidae) (SINULINGGA *et al.*, 2020), *Mylocherus scapularis* Roelofs, 1880 (Curculionidae), *Rhytiphora bankii* (Fabricius, 1775) (Cerambycidae) (SIRAIT *et al.*, 2020), and *Scotaeus* sp. (Tenebrionidae) (TAVARES *et al.*, 2020b), and caterpillars of *Parasa pastoralis* Butler, 1885 (Limacodidae) (SUKA *et al.*, 2020) and *Spodoptera* spp. (Noctuidae) (SULISTYONO *et al.*, 2020; KHAN *et al.*, 2020). *Auletobius* sp. (Rhynchitidae) (TAVARES *et al.*, 2020b) and caterpillars of *Polyphagozerra coffeae* Nietner, 1861 (Cossidae) (TAVARES *et al.*, 2020c; TACHI *et al.*, 2020) and *Strepsicrates semicanella* (Walker, 1866) (Tortricidae) (KKADAN *et al.*, 2020) were, at a recent time, recorded as pests of *Eucalyptus* species in Riau.

*Ophiusa disjungens* (Walker, 1858) (Erebidae), known as guava moth, has its caterpillars seen at daytime resting on branches and petioles of its host plants. They camouflage assembling a plant twig leading difficult to be detected, but drop onto the ground as soon as they feel threatened (CHEW, 2020). The caterpillar has two pairs of undeveloped prolegs leading them to move in a looper fashion. The caterpillar pupates in a loose cocoon on ground litter (HERBISON-EVANS & CROSSLEY, 2020). *Ophiusa disjungens* incidence can be assessed by observing its caterpillars as well as damage (defoliation) and frass produced by them. The objectives of this study were to report, for the first time, *O. disjungens* on *A. mangium*, and damage and notes on its biology on *Eucalyptus* commercial plantations in Sumatra.

## Material and methods

### REPORT OF *O. DISJUNGENS* ON *A. MANGIUM*

Monitoring results recorded two commercial stands of *A. mangium* (Table 1) severely infested by caterpillars, along with eggs and damage (defoliation) by *O. disjungens* in Peranap Sector (0°35'N x 102°01'E, 38 m above sea level), Riau on 24 and 25-IV-2018. Fifty trees were randomly selected within each stand and monitored for incidence of living caterpillars and/or fresh damage (defoliation) of *O. disjungens*.

**Table 1.**– Planting date, size and rotation of *Acacia mangium* (Fabaceae) commercial stands recorded as infested by *Ophiusa disjungens* (Wlk.) (Erebidae) in Peranap Sector, Riau, Sumatra, Indonesia on 24-25-IV-2018.

Compartments	Planting date	Size (ha)	Rotation
1	X-2017	27.5	3 <sup>rd</sup>
2	XI-2017	15.7	2 <sup>nd</sup>

MONITORING OF *O. DISJUNGENS* ON *EUCALYPTUS*

Eighteen commercial stands of *Eucalyptus* (Table 2), out of 19 monitored, were recorded as infested by caterpillars of *O. disjungens* in Sei Kebaro Sector (100°10'N x 100°24'E, 178 m above sea level), Riau. Caterpillars were seen along with damage (defoliation) they caused.

**Table 2.**– Planting date, size (ha), rotation, and incidence (%) of *Eucalyptus* (Myrtaceae) commercial stands recorded as infested by *Ophiusa disjungens* (Wlk.) (Erebidae) in Sei Kebaro Sector, Riau, Sumatra, Indonesia on 6-III to 4-IV-2020.

Estate	Stand	Planting date	Size	Rotation	Plant species	Monitoring date	Incidence
A	1	I-2020	29.4	4 <sup>th</sup>	<i>pellita</i>	24-III	22.8
	2	II-2020	11.7		<i>grandis</i> x <i>pellita</i>	2-IV	15.2
	3		46.7				58.1
B	1	XII-2019	38.8		<i>pellita</i>	6-III	4.0
	2		32.8		<i>grandis</i> x <i>pellita</i>	2-IV	8.3
	3		18.5		<i>pellita</i>		18.0
C	1	X-2019	21.2	5 <sup>th</sup>	<i>grandis</i> x <i>pellita</i>	4-IV	16.9
	2	VII-2019	30.0		<i>pellita</i>	9-III	13.6
	3	X-2019	12.0			30-III	13.7
	4		15.0			16-III	16.2
	5	VII-2019	34.9		<i>pellita</i>	20-III	43.3
	6	X-2019	30.5		<i>grandis</i> x <i>pellita</i>	27-III	7.6
	7	VII-2019	41.3		<i>pellita</i>	31-III	73.6
	8		20.0		<i>grandis</i> x <i>pellita</i>	2-IV	60.3
	9	IX-2019	23.2			23-III	65.9
	10	X-2019	37.8		<i>pellita</i>	18-III	31.9
	11	VII-2019	25.4		<i>grandis</i> x <i>pellita</i>	13-III	4.2
	12	X-2019	34.1			24-III	80.2

Stands were assessed once for severity (S) and incidence (I). Severity of the damage (defoliation) on *Eucalyptus* trees by caterpillars was calculated based on scoring: 0= healthy branches (no injury or living caterpillars), 1= 1-25% of branches with living caterpillars or injury, 2= 26-50% of braches with living caterpillars or injury, and 3= >50% of branches with living caterpillars or injury. Four lateral branches, from the middle third *Eucalyptus* crown, were examined per tree. The following formula was utilized:  $S = [(0 \times \text{number of trees in a plot with caterpillars or injury equal to 0}) + (1 \times \text{number of trees in a plot with caterpillars or injury equal to 1}) + (2 \times \text{number of trees in a plot with caterpillars or injury equal to 2}) + (3 \times \text{number of trees in a plot with caterpillars or injury equal to 3})] \div (3 \times \text{total number of living trees in the plot}) \times 100$ . Result of S in a plot was obtained with the average number of S from the trees sampled in this plot. Severity data were used to calculate the I of caterpillars on *Eucalyptus* using the following formula:  $I = [(\text{number of infested trees}) \div (\text{total number of living trees in the plot})] \times 100$ . Infested trees were those scored as 1, 2 or 3 according to S results. A total of 1.5% of the trees per stand was monitored.

IDENTIFICATION OF *O. DISJUNGENS*

One, 10 and three caterpillars, without realizing their age, were collected manually from Logas

South (01°59'N x 98°59'E, 70 m above sea level), Peranap and Sei Kebaro Sectors, respectively, placed in 1-Kg plastic bags and taken to the Entomology Laboratory of the PT. Riau Andalan Pulp and Paper (RAPP) in Pangkalan Kerinci, Riau. They were transferred to 2-Kg plastic containers as soon as they reached the laboratory and reared on the foliage of *E. grandis* x *E. pellita* as a food until turned into adults in an environmentally-controlled room at  $26 \pm 2^\circ$  C,  $75 \pm 15\%$  RH and 14:10 (L:D) h photoperiod. Moths obtained from the reared caterpillars were killed, pinned and identified by comparing their external morphology with descriptions provided by HAMPSON (1894), CHEW (2020), HERBISON-EVANS & CROSSLEY (2020), and HOLLOWAY (2005).

#### MORPHOMETRY AND NOTES ON BIOLOGY

Morphometry and parameter on the biology of *O. disjungens* were evaluated with individuals obtained from Logas South and Sei Kebaro Sectors. The length and width (cm) of pupae and adults were measured using a ruler.

### Results

#### REPORT OF *O. DISJUNGENS* ON *A. MANGIUM*

An average of three caterpillars per tree was found in Peranap Sector (figs 1-2). *Ophiusa disjungens* caterpillars were recorded along with its eggs as well as caterpillars of tussock moth (Lepidoptera), adults and nymphs of *Helopeltis theivora* Waterhouse, 1886 (Hemiptera: Miridae), adults of pintail beetle (Mordellidae: Mordellinae), and adults of comb-clawed beetle (Tenebrionidae: Alleculinae).

#### MONITORING OF *O. DISJUNGENS* ON *EUCALYPTUS*

Incidence of *O. disjungens* on *Eucalyptus*, in Sei Kebaro Sector, varied from 15.2 to 58.1%, 4.0 to 18.0% and 4.2 to 80.2% in the Estates A, B and C, respectively. *Ophiusa disjungens* attacked *E. pellita* and *E. grandis* x *E. pellita* (fig. 3) and its caterpillars occurred along with adults and nymphs of *H. theivora*.

#### IDENTIFICATION OF *O. DISJUNGENS*

Moths obtained from caterpillars, recovered from Logas South ( $N= 1$ ), Peranap ( $N= 10$ ) and Sei Kebaro ( $N= 2$ ) Sectors, were all *O. disjungens* (fig. 4). *Ophiusa disjungens* differs, slightly, from its most similar species, *Ophiusa discriminans* (Walker, 1858), based on the external morphology analysis. The first lacks a black patch at the end of the abdomen and has a much larger black sub-terminal patch on the hindwing.

#### MORPHOMETRY AND NOTES ON BIOLOGY

The length and width (mean  $\pm$  SD) of pupa ( $N= 3$ ) were  $3.13 \pm 0.04$  and  $0.88 \pm 0.01$  cm, respectively. The forewing and hindwing length were  $6.5 \pm 0.5$  and  $4.5 \pm 0.1$  cm ( $N= 2$ ), respectively. The period from pupa to adult was  $25.5 \pm 4.5$  days ( $N= 2$ ).

### Discussion

*Ophiusa disjungens* reported to low altitudes ranging 38-178 m in the current study differs from its collection to a mountain peak at 1,618 m in Bukit Retak, Brunei (HOLLOWAY, 2005).

*Acacia crassicarpa* as a host plant of *O. disjungens* increases the number of known plant genus

recorded to this insect to five. Common guava, *Psidium guajava* L. (Myrtaceae), native to the Caribbean, Central America and South America (GEORGE *et al.*, 2017), is recorded as an *O. disjungens* host in Japan (SUGI, 1987). *Eucalyptus* and possibly other Myrtaceae were added by COMMON (1990) to Australia and ROBINSON *et al.* (2001) to Asia. There is also a record of *Styphelia* (Ericaceae), a genus endemic to Australia and Pacific Islands (PUENTE-LELIÈVRE *et al.*, 2016), from Guam (SWEZEY, 1946; HOLLOWAY, 1979). The caterpillar also feeds on the turpentine tree, *Syncarpia glomulifera* (Sm.) Nied. in/endemic to Australia (HERBISON-EVANS & CROSSLEY, 2020). The adult *O. disjungens* was recorded as a fruit-piercing moth of soft-skinned fruits in China (WU, 1981) and as *O. indiscriminata* in Thailand (BÄNZIGER, 1982).

*Ophiusa disjungens* recorded in Riau in the actual study has its typical form found in Australia (New South Wales and Queensland States), Lesser Sundas, New Caledonia, and Norfolk. The subspecies *indiscriminata* is found in the Oriental tropics and *tongaensis* in Fiji, Samoa, Tonga, and Vanuatu. The species also occurs in Southeast Asia and the south Pacific, including Borneo, Sri Lanka (HERBISON-EVANS & CROSSLEY, 2020), Guam (HOLLOWAY, 2005), Japan and Thailand (CHEW, 2020).

The forewing length of *O. disjungens* from Logas South and Sei Kebaro Sectors was slightly longer than of specimens from Brisbane, Queensland, 5.0 cm. The period from pupa to adult was within the range reported from Brisbane as being three to four weeks (CHEW, 2020).

The severe damage (defoliation) of *Eucalyptus* by *O. disjungens* in Sei Kebaro Sector is opposite to the minor damage of oilseed crops caused by the castor caterpillars, *Ophiusa melicerta* (Drury, 1773) in Bangladesh (BISWAS & DAS, 2011). *Ophiusa* moths were sporadic fruit-piercing pests of citrus, *Citrus* (Rutaceae) in South Africa during the 2013-2015 growing seasons (GODDARD *et al.*, 2019).

*Ophiusa disjungens* is reported for the first time on *A. mangium*, and incidence of its caterpillars and/or damage (defoliation) on *Eucalyptus* commercial plantations is up to 80.2% in Sumatra. The period from pupa to adult (mean  $\pm$  SD) is recorded as  $25.5 \pm 4.5$  days.

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**Figs 1-4.**— Caterpillar of *Ophiusa disjungens* (Wlk.) (Erebidae). **1.** Damage (defoliation) caused by this species on *Acacia mangium* (Fabaceae). **2.** In Peranap Sector, Riau, Sumatra, Indonesia. **3-4.** Caterpillar of *Ophiusa disjungens* (Erebidae) on *Eucalyptus* (Myrtaceae). **3.** In Sei Kebaro Sector, Riau, Sumatra, Indonesia. **4.** Adult female.