



**Effect of White Champa Leaf Extract (*Plumeria acuminata*)
on White Fly Eclosion (*Aleurolobus barodensis* Maskell, Hemiptera;
Aleyrodidae) under Laboratory Condition**

***Pengaruh Ekstrak Daun Kamboja Putih (*Plumeria acuminata*) terhadap
Eklosi Cabuk Hitam (*Aleurolobus barodensis* Maskell, Hemiptera;
Aleyrodidae) di Laboratorium***

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ABSTRACT

The white fly explosion might be occurred on the flooded fields and lack of nitrogen fertilizer. Some control methods have to be conducted to prevent further losses. The use of biopesticide was known to be easier, cheaper and environmental friendly control methods. Therefore the aim of this experiment was to determine the effect of white champa leaf extract (*Plumeria acuminata*) as a biopesticide on sugarcane white fly eclosion (*Aleurolobus barodensis*). Experiment was conducted in the laboratory, using a complete randomized design with 6 treatments of *P. acuminata* leaf extract concentrations, 0% (control), 10%, 20%, 30%, 40% and 50%, and was replicated 4 times. The results showed that *P. acuminata* leaf extract could be used to control sugarcane white fly. The effective leaf extract concentration was 40%. The results also proved that *P. acuminata* leaf extract killed the white fly pupae instead of delaying their eclosion.

Key words: eclosion, white fly, biopesticide

ABSTRAK

*Eksplosi serangan cabuk hitam biasanya terjadi pada kebun yang terendam banjir dan kahat hara nitrogen. Pengendalian serangan hama harus dilakukan untuk mencegah kerugian lebih lanjut. Pengendalian dengan pestisida nabati diketahui lebih mudah, murah dan aman terhadap lingkungan. Oleh karena itu percobaan ini bertujuan untuk mengetahui pengaruh ekstrak daun kamboja putih (*Plumeria acuminata*) terhadap penetasan (eklosi) imago cabuk hitam (*Aleurolobus barodensis*). Percobaan dilakukan di laboratorium, menggunakan rancangan acak lengkap dengan 6 perlakuan konsentrasi ekstrak daun kamboja putih yaitu 0% (kontrol), 10%, 20%, 30%, 40% dan 50% dan diulang 4 kali. Hasil percobaan menunjukkan ekstrak daun *P. acuminata* dapat digunakan untuk mengendalikan hama cabuk hitam. Konsentrasi ekstrak daun yang efektif adalah 40%. Hasil percobaan juga*

membuktikan bahwa ekstrak daun P. acuminata dapat membunuh pupa cabuk hitam bukan hanya menunda penetasannya.

Kata kunci: eklosi, cabuk hitam, pestisida nabati

INTRODUCTION

The white fly (*Aleurolobus barodensis* Maskell, Hemiptera; Aleyrodidae) is considered a minor pest of sugarcane, however it is widely spread throughout sugarcane plantations in Indonesia (Achadian, et al., 2012) and may sometimes cause heavy infestations during wet season especially in January – March. Severe infestations of *A. barodensis* are usually found in flooded plants or in conditions where crops are insufficiently fertilizer by Nitrogen (Bhavani and Rao, 2013; Bhargava et al., 2020).

The *A. barodensis* life cycle categorized as complete metamorphosis. Its life cycle began from eggs, then nymphs, pupae, and eclosed into adult *A. barodensis*. The nymph phases were divided into 3 instars. First instar nymphs were motile by crawling, while second and third instar nymphs were sessile or immobile. The pupal phase was also called 4 instar nymph (Hamid, 1955). The *A. barodensis* eclosion usually takes place during the morning. They appeared through the T-shaped slit on the dorsal part of the pupae. During eclosion, the head came out first and its process took about 7 to 9 minutes. After the entire adult body of *A. barodensis* left the pupa, a wing straightening process occurred for 10 to 14 minutes (Shandu & Singh, 1964). Then adult *A. barodensis* flew, mated and laid their eggs on the new plants.

Heavy infestations by *A. barodensis* have recently been observed in the fields in Pasuruan. The white fly prefers to attack sugarcane varieties with wide dark green leaves. Studies in India stated that severe

white fly infestation may result in reduction of cane yield up to 24 % and loss in sugar up to 2.9 units (Bhavani and Rao, 2013). A control must be conducted in order to prevent greater losses. Some control methods were used in suppressing white fly population in some countries such as spraying insecticide (Mohammadi et al., 2017; 2018), cultural control (Bhatti et al., 2019), releasing its parasitoid (Nikpay, 2017; Mohammadi et al., 2019; Bhargava et al., 2020) and biopesticide (Djunaedy et al., 2009).

Biopesticide have a role in pest management being environmental friendly and may offer an alternative to pesticide ((Djunaedy et al., 2009). Plant extracts such as neem (*Azadirachta indica*), papaya (*Carica papaya*), lemon grass (*Cymbopogon citratus*), tobacco (*Nicotiana tabacum*), white champa (*Plumeria acuminata*), have been used against a range of agricultural and forestry crop pest species in Indonesia (Sari et al., 2013; Suhartini, et al., 2017; Latumahina, et al., 2021).

P. acuminata is a small tree with sparse thick leaves, and white to purplish-red crown flowers. *P. acuminata* leaves contain stigmast-7-enol, lupeol carboxylic acid, lupeol acetate and ursolic acid. The fulvoplumierin, plumericin along with three new compounds isoplumericin, β -dihydroplumericin and β -dihydroplumericin acid can be isolated from roots. In addition, essential oils in steam distillate contain primary alcohols, geraniol, citronellol, farnesol and phenylethyl alcohol and traces of aldehyde and ketones (Ibanez et al., 2012). *P. acuminata* also contained agoniadins, plumierids, plumeric acid, lipeol, and serotonic acid, saponins, flavonoids,

polyphenols and alkaloids (Wrasiati, et al., 2011).

The previous study by Utami and Cahyati, (2017) reported that *P. acuminata* leaf extract can be used in controlling *Aedes aegypti* mosquito. Yuliana and Kadarusno (2016) used *P. acuminata* leaf extract in controlling house flies (*Musca domestica*).

This work was conducted to study the effect of *P. acuminata* leaf extracts as a biopesticide on eclosion of white fly (*Aleurolobus barodensis*), under laboratory condition.

METHODS

The experiment was conducted at Plant Protection Laboratory of Indonesian Sugar Research Institute, Pasuruan from January to February 2021, with daily temperature $30 \pm 2^\circ\text{C}$ and relative humidity $70 \pm 5\%$. The experiment used a Complete Randomized Design with 6 treatments and 4 replications. The treatments were *P. acuminata* leaf extract with the following concentrations:

- T1 : control (aquadest)
- T2 : *P. acuminata* leaf extract 10 %
- T3 : *P. acuminata* leaf extract 20 %
- T4 : *P. acuminata* leaf extract 30 %
- T5 : *P. acuminata* leaf extract 40 %
- T6 : *P. acuminata* leaf extract 50 %

P. acuminata leaf extract was made by washing and slicing the leaves into small pieces and left to dry. Dried leaves were then crushed to make a powder. To prepare the leaf extract, 200 grams of leaf powder were dissolved in 400 ml aquadest. The solution

was allowed to sit overnight and stirred occasionally. The solution was then filtered and concentrations of 10, 20, 30, 40 and 50% were prepared. Application was conducted by spraying the solution on sugarcane leaves using a hand sprayer.

This experiment used two 5 x 5cm pieces of white fly infested sugarcane leaves of PSJT 941 variety, placed in petri dishes. To maintain leaf moisture, petri dishes were placed in a plastic tray filled with water as high as 0.5 cm.

Observations were conducted at 24 hours intervals. We observed the number of white fly eclosion from each treatment. Emerged white fly adults were put in the freezer for ± 30 minutes to make it inactive so that it was easy to calculate. Statistical analysis was carried out using the SPSS software.

RESULT AND DISCUSSION

The *A. barodensis* eclosion happened in the morning around 7:00 a.m. to 8:30 a.m. They appeared through the T-shaped slit on the dorsal part of the pupae (Figure 1). Sugarcane leaves that were infested by *A. barodensis* appeared yellowing and chlorosis lines along the leaf blade.

Result showed that *P. acuminata* leaf extract application reduced the number of *A. barodensis* eclosion (Tabel 1). Suppression effect could be observed from low to high concentration. But leaf extract concentration of 40% had the better result at all observation time. The significant effect was begun 2 days after application which was the eclosion number of pupa on these treatments quite different to control.



Figure 1. *A. barodensis* eclosion (left) and infested plants (right)
 Gambar 1. Eklosi *A. barodensis* dewasa (kiri), tanaman terserang (kanan)

Tabel 1. The number of white fly eclosion on 1, 2, 3, 4, and 5 days after biopesticide application

Table 1. Jumlah eklosi cabuk hitam pada pengamatan 1, 2, 3, 4, dan 5 hari setelah aplikasi biopestisida di laboratorium

Treatments Perlakuan	White fly eclosion numbers on observation day Jumlah eklosi cabuk hitam pada pengamatan hari ke				
	1	2	3	4	5
0 %	11,5±3,3 ^a	53,25 ±0,4 ^a	95±1,8 ^c	135,75 ±2,9 ^c	155,75±3,3 ^b
10 %	7,5±1,5 ^a	52,25 ±1,5 ^{ab}	52,75±1,5 ^{bc}	52,75±1,5 ^b	52,75±1,5 ^a
20 %	5±1,4 ^a	25,25 ±1,5 ^{ab}	27±1,5 ^{ab}	27,75±1,5 ^{ab}	28,5±1,4 ^a
30 %	6,25 ±3,1 ^a	20,25 ±3,0 ^{ab}	25,75±2,8 ^a	31,75±2,9 ^{ab}	34,5±3,1 ^a
40 %	1±0,8 ^a	8 ±1,5 ^b	9,5±1,1 ^a	12,75 ±0,8 ^a	14,25 ±0,8 ^a
50 %	1,75±1,1 ^a	13,75 ±0,9 ^b	14,25±0,9 ^a	15±1,1 ^a	15±1,1 ^a
p-Value	0,222	0,015	0.000	0,000	0,000

Note: Numbers followed by the same letter in one column indicate there is no significant difference between treatments in the Tamhane test (5%) and DMRT (5%).

Keterangan : Angka yang diikuti oleh huruf yang sama dalam satu kolom menunjukkan tidak ada perbedaan nyata antar perlakuan pada uji Tamhane (5%) dan DMRT (5%).

Table 1 and Table 2 showed that *P.acuminata* leaf extract concentration of 40% had the highest suppression of eclosion, although there were not significantly different to other concentrations. The interesting result was showed that the *P.acuminata* leaf extract concentration of 50% has a lower suppression

percentage than that of 40%. It was supposed that *P.acuminata* leaf extract concentration of 50% was higher concentrate so that the active substances could not diffuse into the pupa's body. According to Syafina et al. (2020) the active compounds in saturate solution cannot be dissolved optimally. Therefore higher

concentrate of *P. acuminata* leaf extract did not provide high pupal mortality as well.

Tabel 2. Suppression level (%) of adult white fly eclosion by *P. acuminata* leaf extracts treatments on day 5

Tabel 1. Tingkat penekanan (%) eklosi cabuk hitam pada perlakuan ekstrak daun *P. acuminata* pada hari ke-5

Leaf extract concentration <i>Konsentrasi ekstrak daun</i>	Suppression level (%) <i>Tingkat penekanan (%)</i>
10 %	66,0
20 %	81,7
30 %	77,8
40 %	90,8
50 %	90,3

Further observations showed that 5 days after leaf extract application there was only a bit number eclosion of white fly. In 7 days after biopesticide application there was no eclosion occurred in the biopesticide treatment but the eclosion still occurred in the control treatment. This showed that *P. acuminata* leaf extract affects eclosion by killing the pupae, not by delaying the eclosion time. However we did not observe which compounds of *P. acuminata* leaf extract caused the death of pupae.

CONCLUSION

The white champa (*P. acuminata*) leaf extract affected the eclosion of white fly (*A. barodensis*) by killing its pupae in the laboratory. The most significant concentration was 40%. Further experiment has to be conducted to examine its effectivity in the fields.

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