

**BIOLOGY OF METISA PLANA WALKER
(LEPIDOPTERA : PSYCHIDAE) AND EFFICACY
AND ENVIRONMENTAL IMPACT OF CHLORANTRANILIPROLE
FOR ITS CONTROL IN OIL PALM**

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**DOCTOR OF PHILOSOPHY
UNIVERSITI MALAYSIA TERENGGANU
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**EFFICACY AND ENVIRONMENT IMPACT OF CHLORANTRANILIPROLE
FOR CONTROL OF BAGWORM, MESITA PLANA WALKER
(LEPIDOPTERA: PSYCHIDAE) IN OIL PALM**

CHUA CHIN KOK

**Thesis Submitted in Fulfilment of the Requirement for the
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*This manuscript is dedicated to
my parents, Li Ching and Yi Xun.*

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The present study is an investigation of chlorantraniliprole as a chemical control agent for the bagworm *Metisa plana* in oil palm. *Metisa plana* is one of the most serious defoliator pests of oil palm and can result in significant yield loss. The life cycle of *M. plana* from egg to adult under controlled environment averaged 103.5 days. The larvae of *M. plana* in this study underwent six larval instars that lasted approximately 71.5 days. The larva began to develop its case from day 1 of feeding, and by the fourth day it is completely enclosed in the constructed case or bag. The results of this study showed that the crucial period for effective control of *M. plana* using chlorantraniliprole was the first 28 days after hatching, or from the 1st to the 3rd larval instar.

Insecticide bioassays with second instar *M. plana* larvae using the leaf dip technique revealed that the LC₅₀ of chlorantraniliprole was 0.25ppm. Field evaluation of foliar-applied 50.0ppm and 100.0ppm chlorantraniliprole showed that it resulted in 94.1 and 96.6% insect control, respectively, as compared to 82.4% with 1900.0ppm trichlorfon and 52.1% with 75.0ppm cypermethrin. The rain fastness properties of chlorantraniliprole at 25.0ppm and 50.0ppm were able to maintain 100% insect control when subjected to 25mm of artificial rainfall after 3 hours of spraying. The residue level of chlorantraniliprole was found to be very low in crude palm oil (CPO) samples and not detectable in palm kernel oil (PKO) samples. Foliar application in the field of 12.5ppm and 50.0ppm chlorantraniliprole apparently showed less harmful to the oil palm pollinator *Elaeidobius kamerunicus*, causing mortality equivalent to that caused by the application of *Bacillus thuringensis*.

In addition, chlorantraniliprole also showed good potential for control of *M. plana* by soil application. The addition of 1.0% (v/v) MSO to a 200ppm solution of chlorantraniliprole for a drench volume of 4 liters per palm (0.8g ai per palm) provided 75.0% insect control. This soil application experiment also revealed that the optimal residue for insect control was lasted for 21 days after treatment. Further investigation is still needed to refine the rate of chlorantraniliprole application in the soil for effective control of *M. plana* in oil palm.

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**BIOLOGI *METISA PLANA* WALKER (LEPIDOPTERA: PSYCHIDAE)
DAN EFIKASI DAN IMPLIKASI PERSEKITARAN OLEH
CHLORANTRANILIPROLE TERHADAP KAWALANNYA
DI DALAM KELAPA SAWIT**

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Kajian ini adalah bertujuan untuk mengkaji chlorantraniliprole sebagai racun serangga alternatif untuk mengawal *Metisa plana* bagi tanaman kelapa sawit. *Metisa plana* adalah serangga perosak daun yang serius and ia boleh menyebabkan kekurangan hasil yang signifikan jika tidak dapat dikawal. Kitar hidup *M. plana* dari peringkat telur menjadi dewasa di dalam keadaan persekitaran terkawal adalah sebanyak 103.5 hari. Dalam kajian ini juga didapati bahawa *M. plana* mempunyai enam peringkat instar larva dengan selama 71.5 hari. Berdasarkan keputusan kajian didapati bahawa peringkat pengawalan efikasi chlorantraniliprole yang paling berkesan adalah 28 hari yang pertama selepas penetasan iaitu dari peringkat instar pertama sehingga peringkat instar ketiga.

Penggunaan larva peringkat instar kedua di dalam bio-ujikaji racun serangga teknik “leaf dip” menunjukkan bahawa LC_{50} chlorantraniliprole adalah sebanyak 0.25ppm. Kajian applikasi foliar di lapangan menunjukkan bahawa 50.0ppm dan 100.0ppm chlorantraniliprole dapat menghasilkan sebanyak 94.12% and 96.64% hasil kawalan serangga masing-masing, berbanding dengan 82.35% daripada 1900.0ppm trichlorfon dan 52.10% daripada 75.0ppm cypermethrin. Chlorantraniliprole pada kadar 25.0ppm dan 50.0ppm dapat mengekalkan 100% ketahanan hujan (rain fastness) apabila didedahkan kepada 25mm hujan tiruan selepas 3 jam penyeburan dijalankan. Kandungan residue chlorantraniliprole adalah sangat minimum di dalam sampel “crude palm oil (CPO)” dan tidak dapat dikesan di dalam sampel “palm kernel oil (PKO)”. Kajian applikasi foliar di lapangan menunjukkan bahawa 12.5ppm hingga 50.0ppm chlorantraniliprole tidak mendatangkan bahaya kepada serangga debunga kelapa sawit, *Elaeidobius kamerunicus*, dan kesan chlorantraniliprole adalah sama seperti *Bacillus thuringensis*.

Selain itu, chlorantraniliprole juga menunjukkan bahawa ia berpotensi untuk mengawal *M. plana* melalui aplikasi tanah (“soil application”). Penambahan sebanyak 1.0% v/v MSO di dalam larutan 200ppm chlorantraniliprole dengan quantiti siraman sebanyak 4 liter per pokok (0.8g ai per pokok) dapat menghasilkan kawalan serangga sebanyak 75.0%. Eksperimen aplikasi tanah ini juga menunjukkan bahawa residue optimum kawalan serangga adalah selama 21 hari selepas rawatan. Walau bagaimanapun, penjelasan lanjutan adalah perlu untuk memahami kadar penggunaan chlorantraniliprole secara terperinci.