



**UNIVERSITI PUTRA MALAYSIA**

**THE IMPORTANCE OF MEALYBUGS AND COLONY  
COMPATIBILITY IN AUGMENTATION OF *Dolichoderus thoracicus*  
(SMITH) (HYMENOPTERA: FORMICIDAE) POPULATIONS IN COCOA**

**HO CHENG TUCK**

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**THE IMPORTANCE OF MEALYBUGS AND COLONY COMPATIBILITY  
IN AUGMENTATION OF Dolichoderus thoracicus (SMITH)  
(HYMENOPTERA: FORMICIDAE) POPULATIONS IN COCOA**

By

**HO CHENG TUCK**

Thesis Submitted in Fulfilment of the  
Requirements for the Degree of Master of Agricultural  
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To

**Keng See**

with gratefulness for your support

indeed,

"Two are better than one  
for they have a good return  
for their work."

Ecclesiastes 4: 9



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"I never thought, when I used to read books,  
what work it was to write them"

Betsy Trotwood

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**THE IMPORTANCE OF MEALYBUGS AND COLONY COMPATIBILITY  
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By

**HO CHENG TUCK**

**July 1991**

Supervisor : Associate Professor Dr. Khoo Khay Chong

Faculty : Agriculture

In the artificial introduction of the black cocoa ant Dolichoderus thoracicus (Smith) for controlling mirid damage in cocoa in Malaysia, initial establishment of introduced ants were often good but the effect was frequently not sustained. This underscored the need for augmentation of populations of both the ant and its mutualistic mealybug Cataenococcus hispidus (Morrison).



Honeydew of C. hispidus was demonstrated to be the main and preferred source of food of D. thoracicus. This emphasises the need for mealybug establishment prior to ant introduction for success in establishment of the latter.

Transport of C. hispidus by D. thoracicus was established. Transport was the cumulative effect of random occasions of nymphs being carried in the mandibles of worker ants in the general direction of the ant's trails.

Direct spread of C. hispidus was effected by crawlers. Crawlers were most stimulated to do this when mother colonies were stressed, particularly through the dessication of host substrate.

The first instar crawler has the potential to be readily transported by wind, terminal velocity being  $42.2 \text{ cm s}^{-1}$ . However, they are not readily directly removed by wind, mean wind speed of 18 to  $20 \text{ m s}^{-1}$  being needed for complete removal of crawlers from cherelle and peduncle surfaces.

Importance of ants, crawlers and wind in the spread of C. hispidus were: ants  $\equiv$  crawlers  $>$  wind. When combined, the effect of these factors was additive. This resulted in a radial pattern of spread with the edge advancing in amoeboid fashion.



Foreign C. hispidus was established to be readily accepted by host ants. Mealybugs could thus be collected from any locality for augmentation purpose.

A mealybug augmentation strategy of three introductions of mealybugs at fortnightly intervals into concentric arrangement of trees was found to consistently result in highest establishment of both ants and mealybugs. Based on this, an augmentation strategy that emphasise frequent re-introductions in an increasing radial pattern from a central ant colony is proposed.

Unlike mealybugs, there was clear incompatibility between different D. thoracicus populations. In strong indigenous populations of ants, safe direct augmentation of the ant was limited to within a 100 m radius area. In introduced ant populations, kin populations separated in time and space became antagonistic. Direct augmentation in such situations would be problematic.



Abstrak tesis yang dikemukakan kepada Senat Universiti Pertanian Malaysia sebagai memenuhi syarat untuk Ijazah Master Sains Pertanian.

**KEPENTINGAN KOYA DAN KESERASIAN KOLONI  
DALAM PENGIMBUHAN POPULASI Dolichoderus thoracicus (SMITH)  
(HYMENOPTERA: FORMICIDAE) PADA KOKO**

Oleh

**HO CHENG TUCK**

**Julai 1991**

Penyelia : Profesor Madya Dr. Khoo Khay Chong

Fakulti : Pertanian

Dalam usaha kemasukan secara artifisial semut hitam koko Dolichoderus thoracicus (Smith) untuk pengawalan kerosakan oleh kepinding nyamuk dalam kawasan koko di Malaysia, pertapakan awal semut yang dimasukkan didapati baik, tetapi seringkali tidak berkekalan. Oleh itu, pengimbuhan populasi kedua-dua semut dan mutualisnya, iaitu koya Cataenococcus hispidus (Morrison) perlu dititikberatkan.





Madu rembesan C. hispidus telah didapati menjadi sumber makanan yang utama dan dipilih oleh semut. Oleh yang demikian pertapakan koya perlu diutamakan sebelum pelepasan semut dilakukan demi kejayaan pertapakan semut tersebut.

Pengangkutan C. hispidus oleh D. thoracicus telah dapat dipastikan. Namun, pengangkutannya cuma berlaku hasil daripada kesan kumulatif pembawaan rambang nimfa-nimfa dengan mandibel semut-semut pekerja di sepanjang tapak jalan mereka.

Penyebaran secara langsung C. hispidus berlaku terutamanya melalui peringkat nimfa. Nimfa-nimfa ini paling kuat terangsang untuk berbuat demikian apabila koloni-koloni induk mengalami kesukaran, terutamanya apabila terjadi pengontangan substrat perumah.

Nimfa instar pertama mempunyai keupayaan yang tinggi untuk disebar oleh angin, dengan halaju terminal  $42.2 \text{ cm s}^{-1}$ . Bagaimanapun, mereka tidak mudah ditanggalkan oleh angin daripada substrat perumah, di mana kelajuan 18 hingga  $20 \text{ m s}^{-1}$  diperlukan untuk penanggalan yang sempurna daripada permukaan cherelle dan tangkai lenggai.

Kepentingan semut, nimfa dan angin dalam penyebaran C. hispidus ialah: semut  $\equiv$  nimfa  $>$  angin. Apabila digabungkan, kesan

