



Metabarcoding of Parasitic Wasp, *Dolichogenidea metesae* (Nixon) (Hymenoptera: Braconidae) That Parasitizing Bagworm, *Metisa plana* Walker (Lepidoptera: Psychidae)

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Highlights

- First inventory of microbiome presents in the gut of parasitic wasp from three different populations in Peninsular Malaysia.
- Dominant phylum, families and genera were recorded from the three populations.
- The diversity and richness of microbial communities in the gut of *D. metesae* were hypothesised to be affected by the direct and indirect usage of insecticides.

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Abstract: Microbiome studies of the parasitoid wasp, *Dolichogenidea metesae* (Nixon) (Hymenoptera, Braconidae) are important because *D. metesae* has potential as a biological control agent to suppress the pest, *Metisa plana* Walker (Lepidoptera, Psychidae). Three field populations of parasitic wasps with different Integrated Pest Management (IPM) practices to control *M. plana* collected from Perak state (Tapah) and Johor state (Yong Peng and Batu Pahat districts) in Peninsular Malaysia were studied. Bacterial community composition and structure were analysed using α and β diversity metrics. Proteobacteria (83.31%) and Bacteroidetes (6.80%) were the most dominant phyla, whereas unknown family from order Rhizobiales was the most abundant family found in all populations followed by Pseudomonadaceae. Family Micrococcaceae was absent in Tapah. Rhizobiales gen. sp. and *Pseudomonas* sp. were abundant in all populations. Pearson's correlation analysis showed the strongest correlation between individuals of Batu Pahat and Yong Peng ($r = 0.89827$, $p < 0.05$), followed by Tapah and Yong Peng with $r = 0.75358$, $p < 0.05$ and Batu Pahat and Tapah ($r = 0.69552$, $p < 0.05$). We hypothesise that low diversity and richness in Tapah might be due to direct and

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indirect effect of insecticides application. This preliminary data was the first study to do inventory of the microbiomes in the gut of the *D. metesae*.

Keywords: Endoparasitoids, Endosymbiont, Microbiome, Parasitic Wasp, Malaysia

Abstrak: Kajian mikrobiom ke atas spesies penyengat parasitoid, *Dolichogenidea metesae* (Nixon) (Hymenoptera, Braconidae) adalah penting kerana spesies ini berpotensi sebagai agen kawalan biologi untuk mengawal spesies perosak, *Metisa plana* Walker (Lepidoptera, Psychidae). Tiga populasi penyengat parasitoid yang mengaplikasikan Pengurusan Perosak Bersepadu (IPM) yang berbeza untuk mengawal *M. plana* iaitu daripada negeri Perak (Tapah) dan negeri Johor (Yong Peng dan Batu Pahat) di Semenanjung Malaysia telah dikaji. Komposisi dan struktur komuniti bakteria telah dianalisis menggunakan metrik kepelbagaian α dan β . Proteobacteria (83.31%) dan Bacteroidetes (6.80%) merupakan filum yang paling dominan, manakala famili yang tidak diketahui daripada order Rhizobiales ialah famili yang paling melimpah ditemui dalam kesemua populasi diikuti oleh Pseudomonadaceae. Famili Micrococcaceae didapati tidak hadir di populasi Tapah. *Rhizobiales* gen. sp. dan *Pseudomonas* sp. adalah paling melimpah di dalam semua populasi. Analisis korelasi Pearson menunjukkan korelasi yang paling tinggi di antara individu daripada Batu Pahat dan Yong Peng ($r = 0.89827$, $p < 0.05$) diikuti oleh Tapah dan Yong Peng dengan nilai $r = 0.75358$, $p < 0.05$ dan Batu Pahat dan Tapah ($r = 0.69552$, $p < 0.05$). Kami menghipotesis bahawa kepelbagaian dan kelimpahan yang rendah di Tapah mungkin disebabkan oleh kesan langsung dan tidak langsung penggunaan racun serangga. Data awalan ini merupakan kajian pertama yang melakukan inventori mikrobiom ke atas usus *D. metesae*.

Kata kunci: Endoparasitoid, Endosimbion, Mikrobiom, Penyengat Parasitoid, Malaysia

INTRODUCTION

Parasitoids are those natural enemies that are multicellular (in contrast to pathogens) and directly cause death of their host (in contrast to parasites) (Haelewaters *et al.* 2017). Parasitoids play an important role as biological control agents in suppressing populations of bagworm (Lepidoptera, Psychidae) (Cheong *et al.* 2010; Hanysyam *et al.* 2013; Kamarudin *et al.* 2017). The bagworm species *Metisa plana* Walker is the dominant pest infesting palm oil plantations in Peninsular Malaysia (Kamarudin *et al.* 2019). Consequences of infestations are becoming increasingly serious (Kamarudin & Arshad 2016). Hence, chemical insecticides (Kok *et al.* 2012), biopesticides (Kamarudin *et al.* 2010; Mazmira *et al.* 2011), and pheromone applications (Kamarudin *et al.* 2019) have been used in controlling *M. plana*. In addition, natural enemies have been used to reduce populations of bagworm (Basri *et al.* 1995; Ali *et al.* 2007).

Several studies have been conducted on the diversity, ecology and insecticides resistance of the parasitoids that use *M. plana* Walker as their host (Kamarudin *et al.* 1996; Hanysyam *et al.* 2013; Potineni & Saravanan 2013; Halim, Aman-Zuki, *et al.* 2018; Halim, Din, *et al.* 2018). The wasp *Dolichogenidea metesae* (Nixon) (Hymenoptera, Braconidae) is known as the most effective