INSECTS OF TAMAN NEGARA JOHOR TANJUNG PIAI: A RAMSAR SITE

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ABSTRACT

Tanjung Piai, located in Pontian district, forms the southernmost point of mainland Asia. This wetland area has been classified as one of six RAMSAR sites in Malaysia. This study was performed to record the number of insect fauna that can be found in the area. The focus was on three main insect groups: ants, butterflies, and odonates. The collection was conducted using general collection methods, namely baited traps and sweep netting. Overall, 36 species of insects from the three main groups were recorded. Formicidae recorded the highest number of species (21), followed by Odonata with nine species and butterflies with six. The low number of insects collected was due to the comparatively low diversity of vegetation and poor accessibility. The conditions of the waterlogged area limited the sampling collection process. Nevertheless, this is the first attempt to record insect species at Taman Negara Johor Tanjung Piai.

Keywords: Insects, Odonata, Formicidae, butterfly, mangrove forest, Tanjung Piai

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INTRODUCTION

Malaysia is one of the world's biodiversity hotspots (Myers *et al*., 2000). Nevertheless, the total number of insects in this region is still unknown, except for certain fauna which has been over-studied, such as butterflies, moths, dragonflies, damselflies and ants. Numerous studies have been done on insects in the tropical forest especially; however, the mangrove ecosystem has generally been neglected.

The mangrove ecosystem is very rich in floral diversity. Mangroves such as those from genera *Rhizophora*, *Sonneratia*, and *Bruguiera* have pneumatophore roots, allowing them to perform gaseous exchange and live in the mudflat area. This adaptation is due to the high salt intake and low oxygen composition in the area from the water being very near to the ocean. It is estimated that about 110 species of mangrove have been recorded in the world (Hogarth, 1999).

On the other hand, many animal groups can also be found in this inundated aquatic area, such as birds, fishes, crustaceans and amphibians. Insects are another group that are nearly always visible in mangrove areas due to their abundance and ubiquitous quality (Hills & Abang, 2010). They can live on land, in soil or even in the water (Gullan & Cranston, 2010). Insects are one of the most widespread fauna to have spread across the globe and are found in every niche except the oceanic benthic zone (Grimaldi & Angel, 2005). Although the number of insect species has always been debated, the earth's insect fauna is estimated to number between 5 and 15 million species (Stork, 1993; Gaston, 1991; Hammond, 1992; Grimaldi & Angel, 2005), making it the most dominant group on earth. To date, it is estimated that fewer than 20 per cent of the total number of insect species have been described (Grimaldi & Angel, 2005).

Insects in the mangrove ecosystem in Malaysia are understudied. Numerous insect collections have been carried out by different researchers, such as butterflies (Cheng *et al*., 2015), Odonata (Furtado & Mori, 1982; Norma-Rashid *et al*., 2001; Choong *et al*., 2016) and ants (Noor Izwan & Amirrudin, 2015) in the Tasek Bera RAMSAR site. Thus, this study was conducted to record the insect fauna in the mangrove area of the southern-most tip of mainland Asia, focusing on three main groups of insects that are important as ecological indicators: butterflies, odonates, and ants.

MATERIALS AND METHODS

The survey was carried out at Taman Negara Johor Tanjung Piai (Figure 1), which is in the district of Pontian and is the southernmost tip of mainland Asia. This mangrove area was designated as RAMSAR site on 31st January 2003. According to Johor Parks (2018), the total area of Tanjung Piai is 526 hectares, comprising an 8 km strip of coastal mangroves and mudflats, which makes it the smallest Ramsar site compared to Sungai Pulai (9,126 ha) and Pulau Kukup (647 ha).

Figure 1 Aerial photo of Taman Negara Johor Tanjung Piai using a drone by Mr Fairuzi, (2017). Inset: Topographic map of south Peninsular Malaysia shows the location of Taman Negara Johor Tanjung Piai (in red square) at the southernmost tip of mainland Asia

This study focused on three main groups of insects which are important as ecological indicators: ants (Formicidae: Hymenoptera), butterflies (Rhopalocera: Lepidoptera) and Odonata. Sampling surveys were carried out on three occasions between May and June 2017 at several sampling points in Tanjung Piai (Figure 2). Various sampling methods were employed in this study following the general manual collection method using sweep netting, baited traps and light traps. All samples collected were identified using taxonomic keys for ants (Bolton, 1994), butterflies (Corbet & Pendlebury, 1992) and odonates (Orr, 2005). The samples were deposited at Universiti Tun Hussein Onn Malaysia repository.

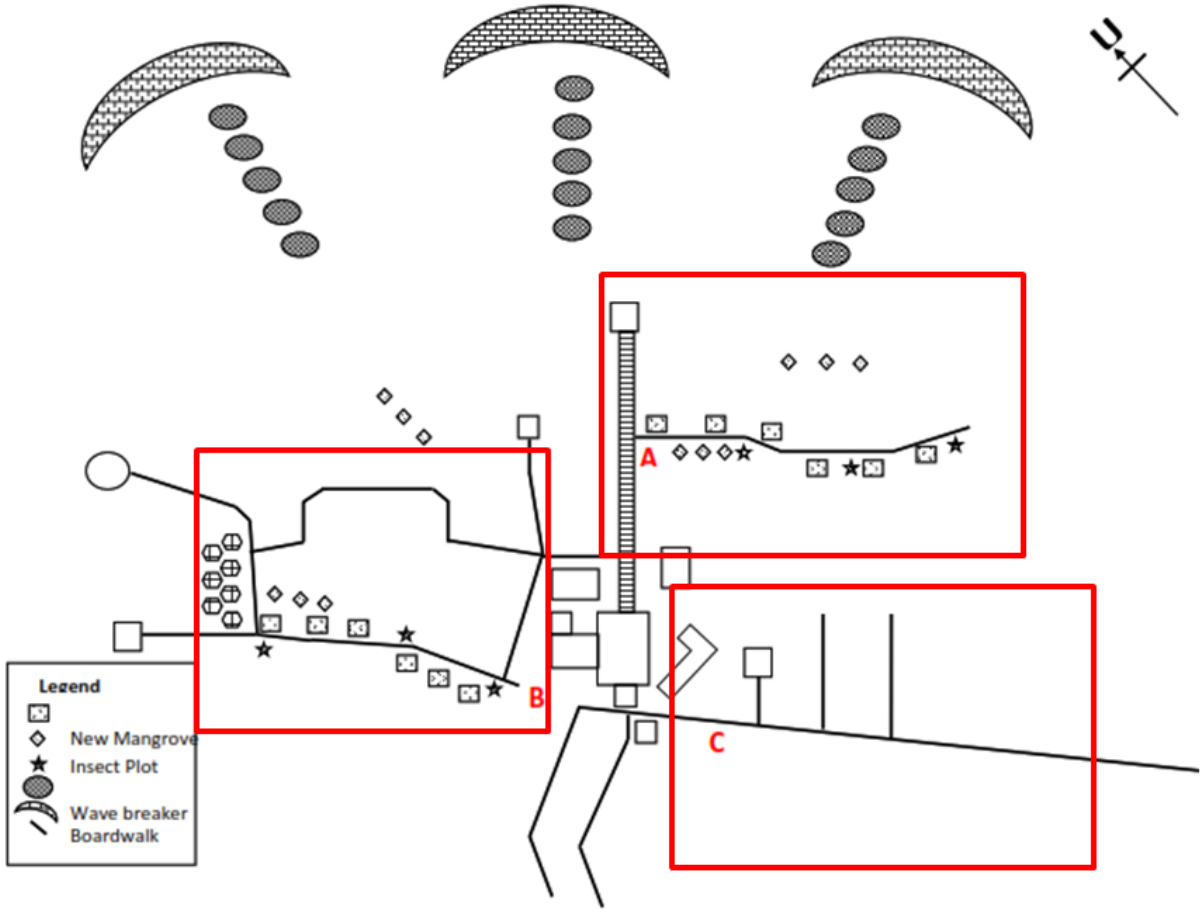

Figure 2 Schematic map showing the location of the sampling area at Tanjung Piai (in red boxes). **(A)** Vegetation in this area is mainly surrounded by growth and a planted plot of mangrove trees (e.g. *Avicennia alba*, *A. rumphiana*, *Bruguiera cylindrica*, *B. parviflora*, *Ceriops tagal*, *Rhizophora apiculata*, *R. mucronata*, *R. stylosa* and *Xylocarpus moluccensis*). This trail was connected to the lowland forest ecosystem. Some lowland forest trees can be found, such as banana trees, coconut and oil palm trees. The soil was partially muddy. **(B)** Most of the sampling was done on the boardwalk because almost all soil was muddy due to the mangrove ecosystem (general collection, sweep net and light trap); baiting traps were installed on the trunks of mangrove trees approximately 5–10 m from the boardwalk. The vegetation was mainly surrounded by mangrove trees such as *B. cylindrica*, *C. tagal*, *R. apiculata* and *R. mucronata*. **(C)** This area was near to the tourist car park, an open area, and connected to the lowland forest ecosystem (e.g. shrubs, oil palm trees, coconut trees). The area partially covered with hard soil and road area.

RESULTS AND DISCUSSION

In total, 36 species of insect comprising three different groups were recorded in Taman Negara Johor Tanjung Piai. Ants dominated the area with 21 species, followed by odonates with nine species and butterflies with six (Figure 3).

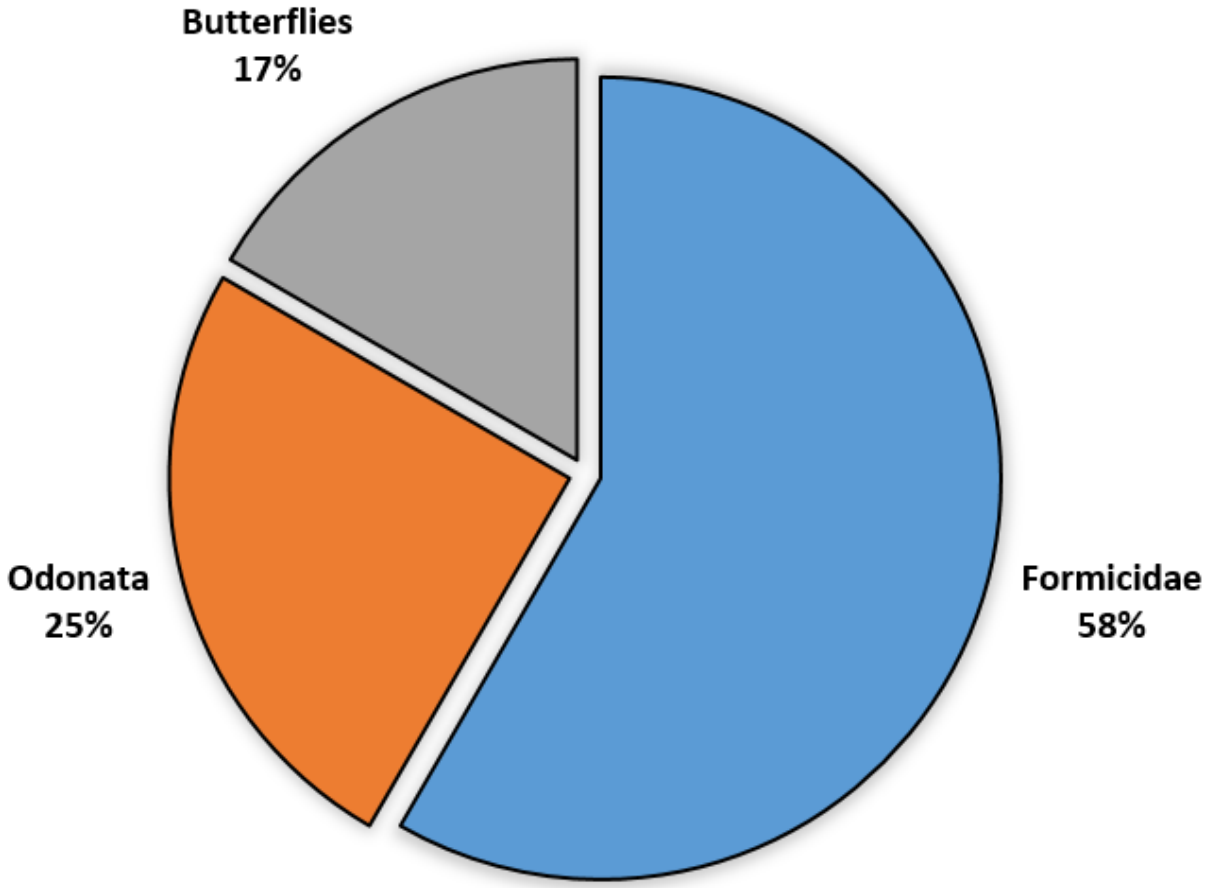

Figure 3 Percentage of insect species according to specific groups found at Tanjung Piai

In the Family Formicidae, the genus *Crematogaster* dominated the area with eight species, followed by *Camponotus* with three, and *Tetraponera* and *Dorylus* with two species each. The composition of ants in this area (Figure 4) shows a distinct lack of decomposer groups such as *Pheidole*, *Carebara, Strumigenys* and *Dacetine*. This indicates that decomposition in this mangrove ecosystem may not be carried out by ants. As a mangrove is a waterlogged habitat (Hutchings & Saenger, 1987), decomposition is performed by water processes such as maceration and leaching of plant tissues.

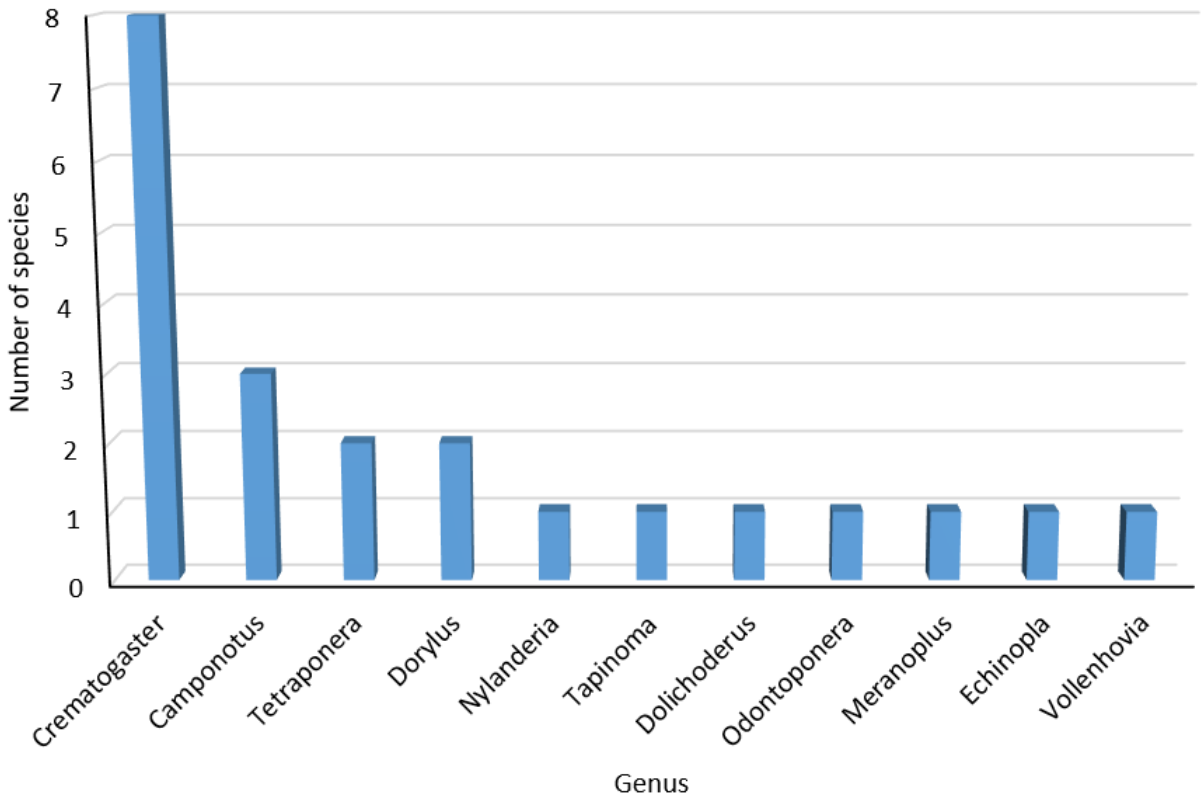

Figure 4 Composition of family Formicidae according to genera

Butterflies are very well known as excellent pollinators (Gullan & Cranston, 2014). The composition of species sampled from the Tanjung Piai area did not indicate the presence of mangrove-associated species such as *Danaus affinis, Rapala cowani* and *Idea leuconoe*. Instead, there were species associated with oil palms such as *Hypolimnas bolina bolina* and *Amathusia ochraceofusca ochraceofusca*, and common lowland forest species such as *Polyura athamas athamas, Parantica agleoides agleoides* and *Euploea radamanthus radamanthus* (Table 1). This may be due to Tanjung Piai being surrounded by large oil palm plantations. Another factor that might have contributed to the poor collection was the requirement to catch along boardwalks, which is not easy. This explains the paucity of butterfly fauna associated with the mangrove area. However, several authors have agreed that pollination in mangroves is generally by insects, birds, bats and the wind (Clifford & Specht, 1979; Saenger, 1982).

Odonates are strong fliers (Gratton & Zanden, 2009) and vicious predators, feeding on small flying insects such as flies and mosquitoes (Fincke *et al*., 1997). Being primitive (Orr, 2003), they are associated with water bodies to furnish a habitat for their young. Their habit of surviving in the water of a certain quality makes them good indicators (Corbet, 1993; Clark & Samways, 1996). The present assemblage of odonate species sampled from Tanjung Piai shows common flowing stream species; they could be using freshwater bodies around the park as their breeding and foraging ground, as no species are known to live in salty or brackish water. As Tanjung Piai is open to the sea, with relatively few freshwater bodies, the diversity among odonates was also poor. The most common species found in this area were *Orthetrum sabina* and *Orthetrum chrysis*, while there were no signs of damselflies in the area during the survey.

Table 1 List of ants, butterfly and Odonata recorded at Taman Negara Johor Tanjung Piai

Order	**Family**	**Species**
Hymenoptera	Formicidae	*Camponotus reticulatus*
		Camponotus sp. 1
		Camponotus sp. 2
		Crematogaster sp. 1
		Crematogaster sp. 2
		Crematogaster sp. 3
		Crematogaster sp. 4
		Crematogaster sp. 5
		Crematogaster sp. 6
		Crematogaster sp. 7
		Dolichoderus thoracicus
		Dorylus orientalis
		Dorylus sp.
		Echinopla lineata
		Meranoplus bicolor
		Nylanderia sp.
		Odontoponera transversa
		Tapinoma melanocephalum
		Tetraponera cf. pilosa
		Tetraponera difficilis
		Vollenhovia sp.
Lepidoptera	Pieridae	*Delias hyparete metarete*
	Nymphalidae	*Hypolimnas bolina bolina*
		Polyura athamas athamas
		Amathusia ochraceofusca ochraceofusca
		Parantica agleoides agleoides
		Euploea radamanthus radamanthus
Odonata	Aeshnidae	*Anax guttatus*
	Libellulidae	*Lathrecista asiatica*
		Orthetrum chrysis
		Orthetrum sabina
		Orthetrum testaceum
		Pantala flavescens
		Potamarcha congener
		Rhyothemis phyllis
		Tramea transmarina

CONCLUSION

The results indicate that the number of species of insects at Tanjung Piai is quite sparse. However, this may be due to the accessibility problems, as the sampling process was restricted to a boardwalk, common walking trail and entrance area. This may have led to an underestimation of the total number of insects in the area. No mangrove insect pests were

recorded in this study. Nevertheless, this is the first attempt to record insect species at Taman Negara Johor Tanjung Piai. The study should be continued to monitor for the possibility of insect pests or exotic species in this area that may affect its delicate ecosystem.

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