INSECT COMPOSITION IN SUNGAI CHUKAI, KEMAMAN MANGROVE FOREST OF PENINSULAR MALAYSIA

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Abstract: A study on insect composition was conducted along Sungai Chukai in Kemaman mangrove forest, Terengganu during June 2011, February and July 2012. The Yellow Pan Trap and Malaise Trap were installed in 4 zones, where within each zone, there were selected three plots areas. As a result, 7.772 of individual insects comprising 16 orders and 125 families were identified. The most abundant insect was recorded from the order of Diptera (4.072 individuals), followed by Hymenoptera (1.477 individuals), Coleoptera (726 individuals), Lepidoptera (623 individuals), Hemiptera (510 individuals) and Collembola (219 individuals). Diptera order has shown a significant difference in the number of individuals compared to other orders ($P<0.05$). Furthermore, it was found that Zone 3 (2.888 individuals) has the most abundance of insects, followed by Zone 1 (1.778 individuals), Zone 4 (1.630 individials) and last but not least Zone 2 (1.476 individuals). Also, according to the diversity index, Shannon-Wiener index, Zone 2 has shown the most diverse insects whose H' value is 3.35.

Keywords: abundance, diversity, insect, mangrove, zonation

Introduction:

Insects are one of the most abundant organisms on earth (Sajap et al. 1999) and they are believed to have evolved before mankind. By the successful of development of the wings, their small sizes and short lifecycle, they exist almost everywhere (McGavin 1997; Speight et al. 2008).

Until now, entomologists have been able to identify about 750.000 of insects species (Ragaei and Allam 1997), nevertheless there were probably more than 30 billion of insect species which have not been identified yet (Erwin 1982). Many scientists assumed that there are more insect species inhabiting the tropical forest rather than other types of forest (Stork 1988; Lewis and Basset 2007). Whereas in fact, there is less data on insect species which has been reported from the tropical forest (Samways 1993; Lewis and Basset 2007). Furthermore, the mangrove forest which is located in the tropical climate area is reported to be very important for organisms such as mammals, reptiles, crustaceans and also including the insect, where it provides food sources, suitable breeding places, shaded canopy areas for protection from bad weather and the predator (Nagelkerken et al. 2008). In addition, mangroves are also important to the human in agriculture and aquaculture, economy and other activities.

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The association of insects and mangrove has been well studied worldwide. In Australia, there were about 12 orders of arthropods of which there were recorded 252 of morphospecies in the terrestrial mangrove (Meades et al. 2002). Whereas, Veenakumari et al. (1997) has reported that 276 species of insects were found in the mangroves of Andaman and Nicobar Islands, where 197 species were identified as phytophagous. In India the study in the mangroves of Muthupet has recorded 113 species of insects comprised by 8 orders and 53 families. The dominant order was recorded from the order of Lepidoptera and Coleoptera, followed by Hymenoptera, Hemiptera, Odonata, Diptera, Orthoptera and Isoptera (Rahman 2002). Besides, the study of insects throughout all coastal localities of Aldabra Atoll has shown that the composition of insects was also dominated by moth and butterfly (Order: Lepidoptera), followed by bugs (Order: Hemiptera), beetles (Order: Coleoptera), flies and Hymenoptera (Veenakumari et al. 2007).

The other study conducted in Malaysia has claimed that the colony of fireflies (Family: Lampyridae) were found abundantly on the four mangrove species, *Sonneratia caseolaris*, *Rhizophora apiculata*, *Hibiscus tiliaceus* and *Ficus* sp. in Rembau-Linggi estuary (Wan Jusoh et al. 2010). Besides, there was also other study conducted in the same area of Rembau-Linggi estuary has found that 9 species of ants consist of 4 subfamilies found on *Sonneratia caseolaris* (Berembang) trees (Alang et al. 2010). Regarding all these studies above, only a few were carried out on insects in the mangrove and were as well recorded in Malaysia; also, most of the studies were reported outside Malaysia. In conjunction with that, this one was aimed at identifying the composition and distribution of insects throughout Sungai Chukai mangrove forest in 4 distinct zones.

Materials and methods:

Study area

This study was conducted along 22 km of the Sungai Chukai area (Fig. 1), located in Kemaman mangrove forest, Terengganu, comprising 938 hectares. Sungai Chukai, which is situated in Kemaman district, features a wet equatorial climate, all year round high temperature and seasonally heavy rainfalls, from November to January.

Methods

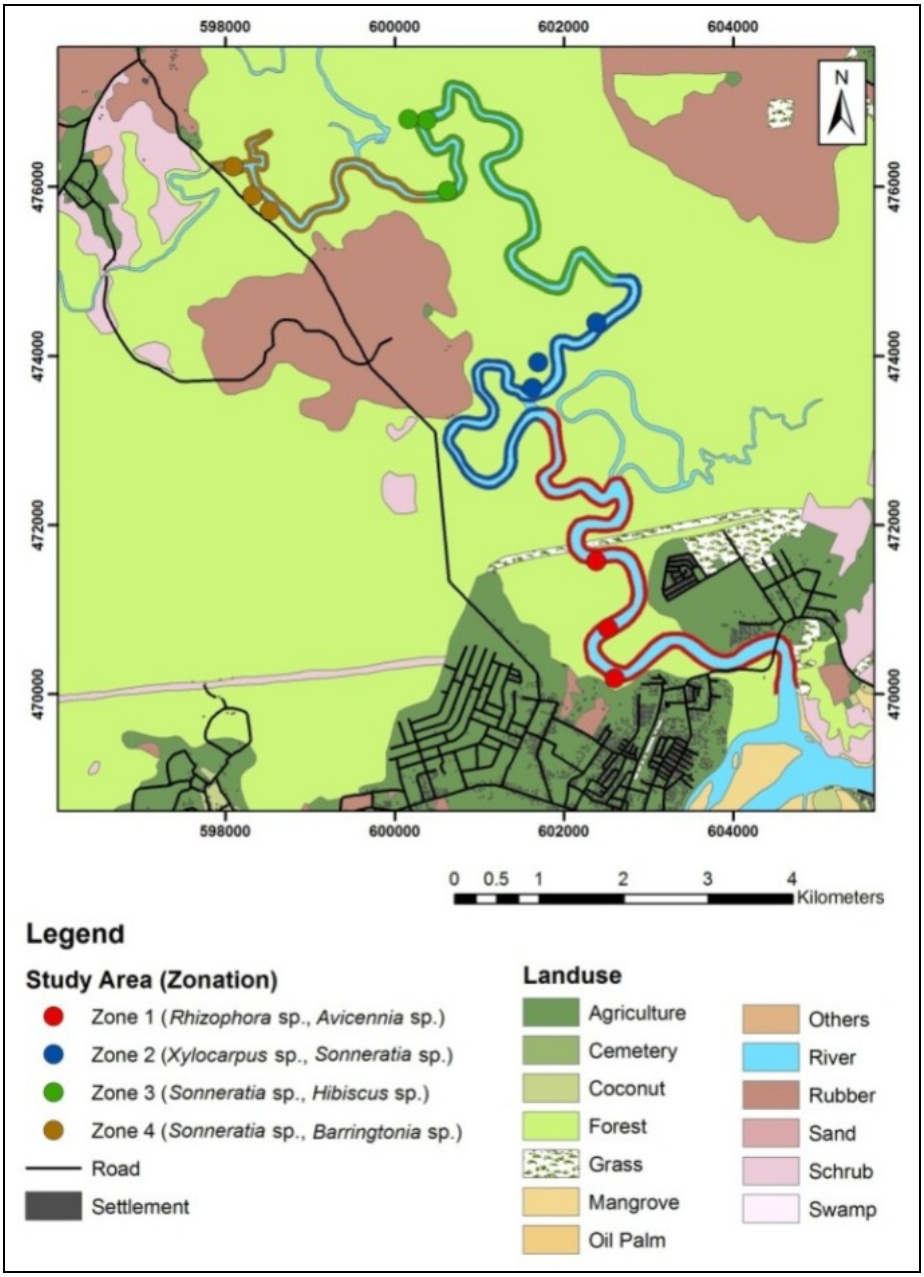
Prior to sampling activities, the areas along Sungai Chukai have been surveyed and observed to distinguish the zonation. The establishments of the zonation were made based on the salinity of water and the dominant vegetation within the area. The sampling activities were conducted during June 2011, February and July 2012. In total, there were 12 plots altogether represent by 4 zones. The traps used which are the Malaise traps and Yellow Pan traps were installed on each plot for up to three days. On the fourth day, all the samples were collected and preserved in the white bottles containing 75% Ethanol. The samples were further taken to the laboratory for the sorting and identification processes.

Results and discussion:

According to Figure 2 there was a number of 7.772 insect individuals found in Kemaman mangrove forest of Sungai Chukai. Out of these, 16 orders and 123 families of insects were recorded. The dominant orders were recorded from the order of Diptera (52%), Hymenoptera (19%), Coleoptera (9%), Lepidoptera (8%), Hemiptera (7%) and Collembola (3%). Furthermore, there were three insects order which recorded with the least number of individuals found. As well from the order of Dermaptera, Microcoryphia and Neuroptera, whose percentage is less than 1% respectively.

Besides, all the dominant orders can be found in all 4 zones. While the least order can only be recorded in Zone 3 and 4.

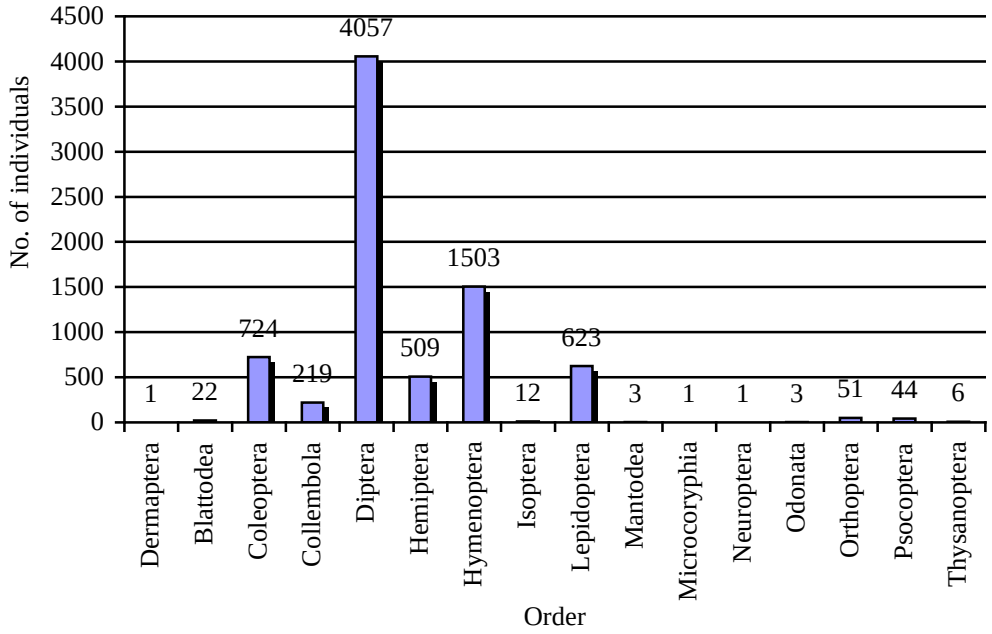
Figure no. 1 The zonation area in Sungai Chukai, Kemaman, Terengganu



Based on the result, the order of Diptera has shown significant differences between the number of individuals and the other orders ($P < 0.05$). More than half of the insects found were dominated by the flies and this finding is also in conjunction with the study conducted in the terrestrial mangrove of Southern New South Wales in

Australia, where out of 12 orders, the order of Diptera was recorded as the most abundant in insects found (Meades et al. 2002). Besides, the abundance of flies in the mangrove habitat may be due to the availability of food and breeding places (Meades et al. 2002) and they have more influence and are more noticeable in the mangrove habitat compared to the other insect's order (Prayoonrat 2004). On the other hand, the occurences of Dermaptera, Microcoryphia and Neuroptera in low numbers was due to the tidal condition and the natural behavior of the insects themselves, where they prefer to forage and hiding on the ground and on the slit of rock rather than under the canopy (Meyer 2009). Whereas, during high tides, some of these insects may be washed out by the water.

Figure no. 2 Insects abundance (according to order) in Sungai Chukai, Kemaman mangroves forest



Furthermore, analyses on the diversity by Shannon-Wiener index have shown that Zone 2 (H'= 3.35) is more diverse compared to the other zones (Tab. 1). Zone 1 was recorded with the least diverse zone where the H' value is 2.34. While, for the evenness, Zone 2 and 4 share the same values of 0.76 and Zone 1 was recorded with the low evenness in comparison with other zones and the value is 0.56. The diversity of insects was higher in Zones 2, 3 and 4 and these may be due to the type and distribution of vegetation in the zonation. Furthermore, the forest within the same Zones 2, 3 and 4 were widely distributed into terrestrial strips and the structure of the forest was also more compact compared to Zone 1. However, in Zone 1 the forest patches are restricted and provided more compartments. Besides, the areas were also already disturbed within the local settlement and regarding other human activities. According to Barkati and Rahman (2005), the disturbance and pollution in certain areas might influence the diversity of insects and the diversity would be higher in the areas with fewer disturbances.

Furthermore, a low diversity of insects might also be affected by the destruction of their natural habitat and conversion into other purposes. All of these issues pose a major threat to the insect communities in the forest (Sajap et al. 1999).

Table no. 1 The diversity and evenness of insects in 4 zones of Sungai Chukai mangrove forest

Indices	Zone			
	1	2	3	4
Diversity Shannon-Wiener (H')	2.34	3.35	3.24	3.28
Evenness Shannon-Wiener (E)	0.56	0.76	0.71	0.76

Conclusions:

In conclusion, the composition of insects in Kemaman mangrove forest is diverse. The database on insects abundance and species richness is vital and must be documented before this being lost due to anthropogenic activities. The area surrounding the Chukai town is being rapidly developed, which may become the major threat to insects' habitat in the mangrove forest. Last but not least, this preliminary study could as well be the baseline for further study on insect conservation and bioindicator approaches.

Rezumat:

INSECTELE DIN SUNGAI CHUKAI, PĂDUREA DE MANGROVE KEMAMAN DIN PENINSULA MALAEZIA

Studiul privind compoziția insectelor de-a lungul pădurii de mangrove Sungai Chukai din Hemaman, Terengganu, s-a desfășurat în luna iunie 2011, februarie și iulie 2012. Capcanele de tip Vas Galben și Malaise au fost instalate în 4 zone, iar în cadrul fiecărei zone au fost selectate trei parcele. Au fost identificate un număr de 7.772 de exemplare, aparținând la 16 ordine și 125 de familii. Cele mai numeroase insecte au fost din ordinul Diptera (4.072), urmate apoi de Hymenoptera (1.477), Coleoptera (726), Lepidoptera (623), Hemiptera (510) și Collembola (219). Potrivit cu testul Kruskal-Wallis, nu există diferențe semnificative între numărul de insecte în cele 4 zone ($P < 0,05$), în timp ce între ordine s-a constatat că numărul de insecte din ordinul Diptera diferă semnificativ față de cele din celelalte ordine ($P < 0,05$). De asemenea, s-a constatat că în Zona 3 abundența insectelor este mare (2.888 de exemplare), urmată de Zona 1 (1.778 exemplare), Zona 4 (1.630 exemplare) și ultima, Zona 2 (1.476 exemplare). Pe de altă parte, potrivit cu indicele de diversitate (Shannon-Wiener), în Zona 2 s-a semnalat cea mai mare diversitate a insectelor, cu o valoare H'=3.35.

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