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Insect's Visitation on Melastoma malabathricum in UKM Bangi Forest Reserve

Syuhada Ataa[1], Izfa Riza Hazmi[1,2] , Siti Fatimah bt Samsudin[1]

[1] The Centre for Insect Systematics, Faculty of Sciences and Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia. [2] School of Environmental & Natural Resources Science, Faculty of Science & Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia.

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ABSTRACT

The study on insect's visitation on Melastoma malabathricum was carried out at UKM Bangi Forest Reserve, Selangor from February till April 2016. A total of 214 insect individuals comprising of three order, seven families and 15 species were identified. Hymenoptera recorded the highest percentage of 91 % (195 individuals), followed by Coleoptera with 5 % (10 individuals) and Hemiptera with 4 % (9 individuals). Ten species of Hymenoptera namely Trigona itama, T. thoracica, Amegilla zonata, Ceratina perforatrix, Nomia iridescens, Xylocopa confusa, X. latipes, Camponotus japonicus, Lasius fuliginosus and Solenopsis invincta, three species of Coleoptera namely Ischnopterapion virens, Hoplasoma unicolor and Dercetisoma concolor of and two species of Hemiptera Cyrtolobus ovatus and Chlorochroa sp. were successfully identified. The One–way ANOVA showed that there was a significant different ($p < 0.05$) ($P = 0.01$) on the total of insect's sampled on regards to the different sampling's event (month).

1. INTRODUCTION

Plants and insects are living organisms that continuously interacting on their own way. This situation was known as plant-insect interaction. Insects play an important role as pollinators to spread pollen for germination [1]. In addition, they are also important to ensure the reproduction and conservation of flora populations [2]. It was reported that weevil from species Elaeidobius kamerunicus had been proven successfully improve the pollination and increase fruit set of palm oil as being mentioned by Norowi et al. [3]. Therefore, it is very interesting to study the field of insect-plant interaction to gain insights on the co-evolutionary and dependency of two species. One of the interactions that need to be looked into is the interaction of insects with M. malabathricum. More than 4000 species of Melastomataceae plants estimated exist in the world, M. malabathricum has been one of 22 species found in the Southeast Asian region alone [4]. Melastoma malabathricum are well-known herb in Malaysia, particularly, where its leaves, shoots, and roots are prepared in various ways for treatment of different diseases and ailments. Many reviews have appeared in the literature regarding M. malabathricum medicinal uses compare to the ecological studies of this plant. Therefore, this study was carried out to investigate the insects that visited M. malabathricum at UKM Bangi Forest Reserve, Selangor. The study done by Nur Athirah et al. [5] found that, there were 8 insects order consisting of 29 families recorded to visit M. malabathricum on different part of the plant in their study in Rompin Pahang.

2. Material and Methods

The study site is Bangi Forest Reserve that is located within the main campus of Universiti Kebangsaan Malaysia (UKM) in Bangi, Selangor. The samples were collected randomly at the forest edge in 10 days for the consecutive two weeks for each month starting from February 2016 until April 2016. Active sampling by sweeping net was employed. The samples obtained were pinned, oven-dried and labeled in the laboratory. The identification process was done due to their characteristics and morphology by referring to the Triplehorn & Johnson [6] and comparing the samples obtained in repository of Centre of Insects Systematic (CIS), UKM. All the data were analyzed by One – way ANOVA by using PAST software version 2.17c.

3. Results and Discussion

A total of 214 individuals comprising 3 orders consisting 7 families and 15 species were recorded to visit on M. malabathricum in UKM Bangi Forest Reserve (Table 1). Among all the recorded orders, the most encounter order visited to M. malabathricum was Hymenoptera. This result was aligned to the study conducted by Nur Athirah [5] that also reported Hymenoptera as the most insects order to be found visited the Melastoma malabathricum. The order recorded from this study builds up to three major families, namely Apidae, Xylocopidae and Formicidae comprising of 10 species with 195 individuals (91 % from the total number of insects sampled) (Figure 1). Meanwhile, Hemiptera was the least found which only 9 individuals comprise of 2 families sampled namely Membracidae and Pentatomidae. The other order recorded from this study was Coleoptera. This order consists of 2 families namely Curculionidae and Chrysomelidae with 3 species and 10 individuals.

Table 1 Total of insects collected to visit on Melastoma malabathricum in UKM Bangi Forest Reserve per different month.

ORDER	FAMILY	SPECIES	Total of individuals by month			TOTAL
			FEB	MAC	APRIL	
Hymenoptera	Apidae	*Trigona itama*	34	25	68	127
		Trigona thoracica	0	0	4	4
		Amegilla zonata	0	1	0	1
		Ceratina perforatrix	3	6	0	9
		Nomia iridescens	0	2	1	3
	Xylocopidae	*Xylocopa confusa*	1	2	2	5
		Xylocopa latipes	4	5	5	14
	Formicidae	*Camponotus japonicus*	10	4	6	20
		Lasius fuliginosus	2	0	5	7
		Solenopsis invicta	1	2	2	5
Hemiptera	Membracidae	*Cyrtolobus ovatus*	5	1	1	7
	Pentatomidae	*Chlorochroa sp.*	1	0	1	2
Coleoptera	Curculionidae	*Ischnopterapion virens*	4	0	1	5
	Chrysomelidae	*Hoplasoma unicolor*	1	0	0	1
		Dercetisoma concolor	2	1	1	4
Total of individuals			68	49	97	214

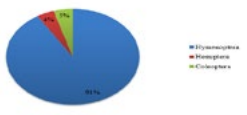

Figure 1 Percentage of insects order (Hymenoptera, Hemiptera and Coleoptera) visited on *M. malabathricum*

Referring to Table 1, Trigona itama was the highest species recorded with a total of 127 individuals (59.34 %). Trigona itama was known as a stingless bee that involved in meliponiculture in Malaysia. The number of stingless bee species in Malaysia varies between 17 to 32 species depending on the study areas [7]. Another species of Trigona that were recorded in this study is T. thoracica. Based on the observation made on the sampling site, species of T. itama was the active visitor to Melastoma malabathricum as well as Xylocopa latipes and X. confusa. By referring to the highest percentage of T. itama with about 59 %, it was thought that based on the field observation, the species acted as pollinator for M. malabathricum where they feed on the pollen of the flowers and the pollen therefore attached on their abdomen and legs. The tropical carpenter bee, X. latipes, is a species of carpenter bee widely dispersed throughout Southeast Asia. This bee inhabits forests in warm tropical climates and constructs nests by burrowing into wood. The finding of Xylocopidae family as one of the pollinators on the plant is

supported by Gonzalvez et al. [8] when their studies in Singapore, found that X. latipes and X. confusa are both the most frequent visitors on M. malabathricum. Moreover, the other species from Hymenoptera order that were found on M. malabathricum was Nomia iridescens. Tropical rainforest is one of the habitats for Nomia sp. that belong to Apidae family [9]. Nomia sp. also recorded as the flower visitor in the Oriental Region particularly tropical and subtropical [10]. It was identified that Nomia sp. pollinated the plant species that were on the forest floor, in the under storey or in forest gaps with relatively long floral tube, and this was exactly like where and what M. malabathricum were found and looks like [11]. Another species from Apidae family that was found on M. malabathricum is Amegilla zonata (L.), also known locally as the Blue-banded bee. It was a medium-large, pubescent, long-tongued and solitary bee [12]. The Amegilla sp. had already been established as well-known pollinators of a wide range of crops [12]. Therefore, a conclusion can be made that A. zonata was actually one of the pollinators for M. malabathricum.

The family of Formicidae has three species that were found associating with M. malabathricum. The first species was Camponotus japonicus normally known under the common name Japanese carpenter ant, is a species of ant native to East Asia. It is black, and one of the largest ants. Camponotus japonicus was found many on the flower part of M. malabathricum and according to Inouye [13], ants were normal visitor to any plants, but they were regards as nectar thief since they were not involving with pollination because of their morphological limit such as smallness, winglessness, smooth integument and frequent grooming but study done by Sugiura, Miyazaki and Nagaishi [14] found that C. japonicus were able to pollinate an orchid species, Epipactis thunbergii. They officially remove the pollen from the anther and brought the pollen to the stigma of the flower and they frequently visited the orchid species up to 40 % compare to the hover flies, the principle pollinators of the E. thunbergii only 10 to 20 % of it visitations frequency on the flower. The second species from Formicidae was Lasius fuliginosus. This species of ant were widely distributed in Europe and Asia [15]. Lasius fuliginosus can be found lived in urban places but at the green areas only such as parks [16]. Therefore, that was the reason for L. fuliginosus can be found on the area where M. malabathricum were lived since the sampling site was near to a developed places that have building and road. Besides that, L. fuliginosus is a strongly competitive species, they are able to successfully compete for area and food sources. Their food sources were honeydew at the trees and aphids [17]. Solenopsis invicta, red imported fire ant was known to be a common urban pest ant in Malaysia [18] feed on the nectar of Passiflora ambigua and it was a study done by Lanza et al. [19]. Furthermore, the study showed that it is an example of plant adaptation to avoid herbivore from eating the plants by attracting ant protectors [20], therefore, it might be the same reason of S. invicta existed on M. malabathricum to serve as protectors from any herbivore attack.

The Hemiptera recorded only two species namely Cyrtolobus ovatus and Chlorochroa sp. The percentage of C. ovatus from Membracidae family that were found visited on M. malabathricum was 78 % (seven individuals) and Chlorochroa sp.,(Pentatomidae) was 22 % (two individuals). Sum up the total individuals of Hemiptera order found on M. malabathricum were only nine individuals and it was indicate that Hemiptera order was the lowest ranking in term of individual's number of total insects captured.

The C. ovatus, the common name was treehoppers and also known as thorn bugs are members of the family Membracidae, a group of insects related to the cicadas and the leafhoppers. There were about 3,100 species of treehoppers in nine subfamilies are known [21]. During field observation, C. ovatus were mostly found at the leaves part of M. malabathricum and it was told that the treehoppers are recorded making many plants such as from the type of herbaceous and woody to be their hosts and it was estimated that the hosts were up to 100 plant families. They secrete a sugary substance called "honeydew". The various other insects such as ants, bees and wasps taking advantages from the sugary substance by reserve the substance as their food. Therefore, the presence of treehoppers at M. malabathricum providing a mutualistic interaction with other insects as treehoppers provided food and other insects such as ants protect them from predators [22].

Meanwhile, the other genus from Hemiptera order was Chlorochroa sp. (family Pentatomidae). Distribution of Pentatomidae family are worldwide in approximately 760 genera and 4100 species known [23], therefore it was quite difficult to identify the species. Chlorochroa sp. also known as stink bugs, they were named after their unique characteristic which was the production of large quantities of strong-smelling and irritating defensive chemicals, which are released when the bugs are threatened [24]. Based on the morphology characteristics of captured Chlorochroa sp., they were oval and broad shaped, brownish colour with whitish spots on top of the flat abdomen and on the head. The stink bugs was phytophagous meaning that they feed directly on the plants [25] and it was witnessed during sampling period, there were damaged on the leaves part of M. malabathricum and this damaged might be because of stink bugs that feed on the part.

Coleoptera order that were found on M. malabathricum in this study comprised of 2 families and 3 species which were Curculionidae (Ischnopterapion virens) and Chrysomelidae (Hoplasoma unicolor and Dercetisoma concolor). Percentage of Curculionidae visited on M. malabathricum were 50 % (five individuals), meanwhile the percentage of Chrysomelidae visited on M. malabathricum were 50 % as well (five individuals).

Curculionidae were commonly known as the family of the "true" weevils (or "snout beetles"). Ischnopterapion virens is a species from this family that had been captured during sampling period. This weevil is a pest of clover (Trifolium spp.). The adults I. virens injuring the foliage, meanwhile, the larvae of the species colonized in the petioles, stems (stolons), root-crowns, and roots [26]. Since that, it was believed that I. virens doing the same things towards M. malabathricum which were feed on the leaves part and the larvae of I. virens colonized the petioles, stems, root-crowns and roots of M. malabathricum.

Hoplasoma unicolor from Chrysomelidae family were actually a leaf-beetle with shining yellow brown colour and normally distributed in Asean including Malaysia, India, Burma, Philipines, Vietnam and China [27]. According to Mathew et al. [28], H. unicolor feed on the foliages of plants. Therefore, the existence of H. unicolor on M. malabathricum was believed to have the same role which was feed on the foliages of M. malabathricum. Meanwhile, Dercetisoma concolor were also from the same family and same type as H. unicolor which were a leaf-beetle. There were no much different in term of distribution of these two species of beetles. D. concolor widely distributed Sarawak, Myanmar, Thailand, Cambodia, Vietnam, China and Indonesia [29]. There were no much different between D. concolor and H. unicolor on their role to the plants as they were both leaf-beetle species that feed on the foliages of plants. When the sampling was conducted, it had been spotted that D. concolor were found exactly on the leaves part of M. malabathricum, therefore it can be assumed that the species were also feed on the leaves part of M. malabathricum.

It was witnessed that during the sampling activities, the flower of M. malabathricum was in low number and estimated to have liked less than 8 flowers per plants. According to Molina & Yap [30], the yellow stamen that present at the center of the flower were the main visual attraction for the insects, besides the bright purple colour of the petals. This probably was the reason of low total number of insects individual and the captured during sampling activities.

The families that were low in number of insects which were Membracidae, Pentatomidae, Curculionidae and Chrysomelidae were believed to come from the surrounding plants. This is related to the status of M. malabathricum as weedy plants that can grow well together with other plant species in many conditions [31].

In order to determine the significant different between each order that were found on M. malabathricum within three months sampling, One – way ANOVA were perfomed and results showed that there was significant different for the three months based on the p value obtained ($P = 0.01$) that was lower than α value, 0.05 ($p < 0.05$).

8. Conclusion

A total of 214 individuals comprising from 3 order and 7 families with identification up to genus-species level for 15 species have been collected in this study. It was resulted that the most frequent visitor for Melastoma malabathricum was order Hymenoptera, from the species; Trigona itama. It was stated that the percentages of Hymenoptera captured were 91 % compared to the other order; Coleoptera (5 %) and Hemiptera (4 %). Also, this study was compared to the research by Nur Athirah et al. [5] and project done by Min & Wayne [32]. Last but not least, there was significant different for total insects visited on M. malabathricum for three months based on the p value obtained ($P = 0.01$).

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