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PRELIMINARY STUDY OF SPIDER DIVERSITY IN UITM NEGERI SEMBILAN KUALA PILAH CAMPUS FOREST RESERVE

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Abstract

UiTM Negeri Sembilan Kuala Pilah Campus Forest Reserve was a lowland rainforest canopy located in Kampung Beting, Kuala Pilah, which hold various habitats for a wide range of organisms. Many of the species, however, were poorly known and documented. Therefore, a preliminary study was conducted to record the diversity of spider fauna in UiTM Kuala Pilah Campus Forest Reserve in two separate areas using three different methods: hand picking, net sweeping and pitfall traps. The present study resulted in 85 samples of spiders from seven families (Araneidae, Ctenidae, Eutichuridae. Oxyopidae, Pholcidae, Salticidae, and Sparassidae) and 13 genera. There were 29 individuals from four families collected from Site A, and 56 individuals from seven families collected from Site B. Salticidae spiders had dominated both sites with 62% of total samples collected. The second dominant family was Araneidae, which constituted 15% of the samples, followed by Ctenidae (6%), Oxyopidae (6%), Eutichuridae (5%), Sparassidae (4%), and Pholcidae (2%). This ecosystem's spider fauna was qualitatively rich due to diverse microhabitats that represented the high flora and fauna diversity in UiTM Negeri Sembilan Kuala Pilah Campus Forest Reserve. However, the study did not reflect the full spider inventory as fewer sampling periods and areas were conducted. Therefore, additional sampling activities and study periods are anticipated to submit to the inventory of the organisms.

Keywords:, Diversity, Salticidae. Spider

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Introduction

Spiders were the most prevalent proportion of Arachnids globally, ranking seventh in total species diversity among all orders of the organism (Ezeonyejiaku *et al.*, 2019). These creatures were usually found everywhere, from the forest floors, leaves, tree trunks, water corners, human habitats, and much more. Together with its abundance and significance as a group of predators in nature, the high diversity of the group made an appealing model for studying ecology and biogeography on the global scale (Viera & Gonzaga, 2017). In our country, Malaysia, however, lesser attention had been paid to the research highlighting the diversity of spider groups, resulting in limited published sources (Muhammad Nasir *et al*., 2020). A study by Nyffeler and Birkhofer (2017) stated in the study estimates that the spider community globally kills in the range of 400–800 million metric tons of prey every year. This then further proved through a study by Michalko *et al.* (2019) that increased spider density might significantly reduce agricultural pest insects and improve the quality of the crops produced. This was very necessary to minimize the use of pesticides as part of biological control conservation in the field (Betz & Tscharntke, 2017). Next, with the area of 161.87 + 242.8 hectares, study area's location was chosen for its species richness and evenness, allowing the study of spider species distribution and abundance to be done efficiently. As spiders have established a wide range of foraging methods, habitats, and vegetation strata, few sampling methods

were integrated to provide a comprehensive description of the entire collection. Hence, this study aimed to conduct a preliminary investigation of the UiTM Kuala Pilah Campus Forest Reserve spider's diversity. No data on this organism community was recorded in the area. Therefore, the documented diversity findings were expected to contribute to the inventory and information of the UiTM Kuala Pilah forest reserve.

Methods

Study Area

The study was conducted at Kuala Pilah, Negeri Sembilan, where the specific location was in UiTM Negeri Sembilan, Kuala Pilah Campus Forest Reserve. This forest had been extensively used for students' research but still purely reserved and undisturbed. There were two different sites involved to study the diversity of spiders. Site A was the urbanized area with little shrubs, while Site B was the forest margin and less disturbed by humans than Site A. Both sites also had different structures and vegetation that reflected different habitats. The samplings were done for 4 times at respective locations. Each sampling period was during the day (0700-01100 h) and in the evening (1600-1800 h) to maximize the number collected and the species richness.

Methods

In this study, three main methods were implied to collect the specimens of spiders successfully. The first method was the handpicking method. Specimens were collected randomly where all the spiders from the ground up to three meters are collected by hand, done by sweeping plants while picking up any spiders falling, carefully observing any trees and decayed logs, and lastly, turning over stones or leaf litters. Next, the second method was net sweeping. The net was swept on the trees with visible spider webs at approximately three to four meters above the ground. Lastly, the third method was pitfall traps used to efficiently capture spiders wandering, jumping and ground-dwelling. The traps were made up of polystyrene cups dug in the soil, making them ground. The cups were filled with a solution with a proportion of 50% water and 50% alcohol. The cups were also covered with a wire grid elevated few centimeters from the cup opening to prevent any leaf litters from interrupting. The collected specimens then preserved in ethanol 70% before deposited in the lab. Collected specimens were identified up to the genera level using morphospecies characteristics following Nasir and Su (2015).

Result and Discussion

The Composition of Spiders in UiTM Negeri Sembilan Kuala Pilah Campus Forest Reserve

A total of 85 samples of spiders from seven families (Araneidae, Ctenidae, Eutichuridae. Oxyopidae, Pholcidae, Salticidae, and Sparassidae) and 13 genera were recorded in UiTM Kuala Pilah Campus Forest Reserve. Among them, 29 individuals were collected in Site A, made up 34% of total samples, and 56 individuals were collected from Site B, made up of 66% of total samples. Generally, Site B had more abundance of spiders. The forest reserve was a tropical lowland rainforest canopy consisting of large and complex habitat, home to many organisms, including spiders. The most dominant families recorded were Salticidae, comprising more than half of the total samples (62%). Next, Araneidae constituted 15% of the samples, followed by Ctenidae (6%), Oxyopidae (6%), Eutichuridae (5%), and Sparassidae (4%). Lastly, the least dominant family was Pholcidae constituting only 2% of total samples from the study areas (Figure 1).

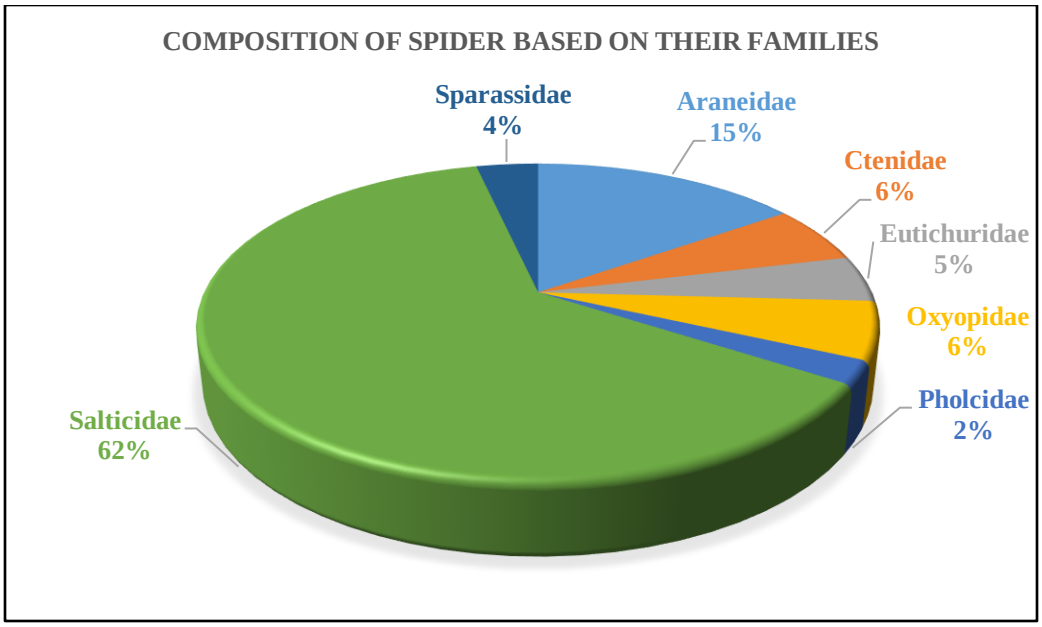

Figure 1. Composition of spiders based on their families.

In Site A, only four families were recorded from 29 samples collected, while 56 samples from seven families were collected from Site B (Table 1). Site A was dominated by Salticidae spiders that constituted up to 24.7% of total spiders in the study, followed by Araneidae (4.7%), Oxyopidae (3.5%), and Eutichuridae (1.2%). Meanwhile, another three families, Ctenidae, Pholcidae, and Sparassidae, were not found in Site A but were available during the study period in Site B (Table 1). Salticidae was also monopolizing Site B with 37.6% of the total collected samples. This was then followed by Araneidae (10.6%), Ctendiae (5.9%), while Eutichuridae and Sparassidae shared the same percentage (3.5%). The least families recorded in Site B were Oxyopidae and Pholcidae (2.4%) (Table 1).

Table 1. Records spiders collected in UiTM Kuala Pilah Forest Reserve.

Family	Genera	Site A	Site B	Total Individual
Araneidae	*Anepsion*	1	3	4
	Araneus	2	4	6
	Gasteracantha	1	2	3
Ctenidae	*Ctenus*	0	5	5
Eutichuridae	*Cheiracanthium*	1	3	4
Oxyopidae	*Oxyopes*	3	2	5
Pholcidae	*Belisana*	0	1	1
	Hypochilidae	0	1	1
Salticidae	*Epocilla*	0	1	1
	Phintella	6	10	16
	Plexippus	15	19	34
	Viciria	0	2	2
Sparassidae	*Pandercetes*	0	3	3
Total Individual		**29**	**56**	**85**

Families of Spiders Recorded in UiTM Negeri Sembilan Kuala Pilah Campus Forest Reserve

Family Araneidae

The first spider family noted was Araneidae, the second largest family recorded in this study, making up 15% of total samples. Three genera found were *Anepsion*, *Araneus*, and *Gasteracantha*, where the spiders were small to medium-sized. The genus was commonly found in Malaysia, as reported by Muhammad Nasir *et al*. (2020). The guild structure was orb weavers as they built vertical webs between trees. The webs were built among overlapping leaves that provided shade and protection from predators. The Araneidae spiders were collected from various plants in both study sites, as noted by Sarkowi and Hong (2020). Many web patterns were observed, such as orb-web with the open hub, sheet web, and tubular retreat. Hence, since the spiders were abundant in both study sites, it was proven that they favoured a wide array of microhabitats despite the difference in architectural design of the study sites.

Family Ctenidae

In the family Ctenidae, Ctenus is the only genus that was captured during the survey. The specimen was found in site B. It is known as the tropical wolf spider, and roamed on the ground and wandered without building webs. Hence the guild identified was ground wanderers. Jimenez *et al*. (2017) described spiders of Ctenidae as nocturnal creatures visible on the ground and lower vegetation. They have also been spied on collapsed logs, leaf litters and grasses in the area. This was also consistent with what had been found in a previous study by Salas *et al*. (2019), where *Ctenus villasboasi* was observed ingesting frogs on leaves. The Ctenidae spiders were abundant in Site B. It was characterized with more trees and leaf litter that shaded the lower vegetation, enabling these spiders to move silently on the ground. Compared with Site A, Site B had a compact forest floor with thick leaf litters and more diverse microhabitats hence the preferred habitat for Ctenidae spiders.

Family Eutichuridae

Only the spider of the genus *Cheiracanthium* was captured during sampling for the Eutichuridae. Commonly known as sac spiders, they covered up and hid within a sac made on the surface of leaves and barks to rest and molt. However, the Eutichuridae spiders were active hunters at night hence classified as foliage runners as their guild characteristic. Thus, the spiders were sampled in the morning on leaves at both sites, as noted by Nasir and Su (2015) that most of the species roamed on land and rocks at night but built webs in rolled leaves in the next morning. Additionally, both Sites A and B were equipped with low canopy level trees, although Site A had very few trees, hence collecting Eutichuridae spiders easier and visibly. The spiders were observed to be more readily found on shrubby trees (Site B) instead of sparse ones (Site A).

Family Oxyopidae

Oxyopes is the only genus recorded for the family Oxyopidae during the survey. Commonly known as lynx spider, this family's guild characteristic was stalker as they were found on leaves of shrubs and grassy understorey and prey for food from there, in line with the previous study (Mullen and Vetter 2019). They did not build webs but rather jumped from one branch to another. Unlike all the other families, the spider from this family recorded an almost similar number of samples collected from both study sites. Hence, this proved that Oxyopidae spiders were not affected by the difference between microhabitats and forest architecture. This further demonstrated that the spiders were abundant throughout the study areas of UiTM Kuala Pilah Forest Reserve.

Family Pholcidae

Two genera of family Pholcidae namely *Belisana* and *Hypochilidae* were recorded in Site B. This family recorded the least number of samples in this study, with only 2% of total abundance. Upon observation, the spiders vibrated when distributed, where the finding was similar to a study by Nasir and Su (2015). The guild characteristic of the Pholcidae spider was the space web builders, as they vibrated vigorously to smash

the web, creating spots to alert predators when disturbed. The two genera were collected on different microhabitats, in which one was collected on the ground floor while the other was retrieved from a bamboo tree. The Hypochilidae spider collected, black was found wandering around leaf litters on forest floors in the early morning during the sampling time. Meanwhile, the Belisana spider, green in colour was collected at the trunk of old bamboo trees in the evening. This result tied well with previous studies by Nuñeza and Mndejar (2016), wherein Pholcidae spiders represented various microhabitats for which tiny and dark coloured spiders dwelled on leaf litters and ground. However, large and green spiders favoured tree leaves. This could be why this family was only found in Site B, as Site A had lesser microhabitats.

Family Salticidae

This family constituted majority of the total samples with 62% of abundance. The family also dominating both Site A and Site B with 24.7% and 37.6% respectively. Four genera of Salticidae were recorded throughout the sampling period namely *Epocilla, Phintella, Plexippus,* and *Viciria.* The guild was characterized as stalkers since they waited to attack the prey from the bushes or litter instead of building webs to trap them. From observation, Salticidae spiders were incredibly active during the day, especially during morning sampling time. This finding was supported by Abdullah *et al.* (2019). Salticidae spiders were active in the daytime while utilizing optic signals to hunt for prey. Although Site A and Site B had clear distinctions in their vegetation and architectural design, Salticidae spiders were easily spotted from both sites. Moreover, the spiders were collected on various microhabitats such as shrubs, leaf litters, decaying logs, stones, and others described by Sarkowi and Hong (2020). Thus, the diversification of the microhabitats became an advantage for the families as they could survive and prospers in most areas. This was the ultimate factor in the abundance of Salticidae spiders in Site A and Site B.

Family Sparassidae

In the family Sparassidae, only the genus Pandercetes that was captured during entire survey. With white spots scattered on the prosoma and opisthosoma, they camouflaged as lichen on trees upon observation, hence commonly called lichen huntsman spiders (Nasir and Su, 2015). All Sparassidae spiders' samples were found on the same tree trunk on Site B, where the type of tree was tall, with sparse leaves and soft trunk. The tree was also the only one of a kind present in that area. However, the scientific name was not identified as no inventories of trees studied in the area were recorded. Next, the spiders rarely run around when they were disturbed upon our observation, similar to Chooi *et al.* (2014) finding. However, the finding contradicted a study by Sarkowi and Hong (2020) that stated the Sparassidae spiders were very responsive to disturbances and immediately sprinted away when they encountered some motion. Furthermore, the Sparassidae spiders were not found on Site A due to the forest's architectural difference.The spiders were discovered on a mature tree trunk of Site B, the compacted forest, while Site A was absent with mature trees and only had few young trees.

Conclusion

In summary, a total of 7 families were obtained from the study. The study also demonstrated that different architectural design and vegetation sites strongly influenced the abundance and diversity of spiders collected. Nevertheless, this study is relatively preliminary and did not reflect the spider's whole in the forest reserve. The study of spider diversity is vital for establishing complete information on this species and the conservation of the species' ecosystem. Thus, it is viable that further sampling efforts and additional study periods can contribute to exploring more samples in this area.

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