

## New Records of the Spider Fauna from Perlis State

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### Abstract

Perlis is endowed with a diverse range of ecosystems supporting a significant flora and fauna biodiversity. Despite its high species richness, few studies have been performed to highlight the diversity of spider species in Perlis. Spider fauna surveys were conducted during Scientific Expeditions at Perlis State Park on 15<sup>th</sup> – 16<sup>th</sup> October 2019 and Eco Park Rimba Bukit Ayer on 4<sup>th</sup> – 6<sup>th</sup> October 2022. Based on the survey, ten spiders from 41 collected specimens were identified, constituting eight families and nine genera. Out of these, eight genera were identified as new records for Perlis including *Nephila*, *Nephilengys*, *Orsinome*, *Pholcus*, *Psechrus*, *Heteropoda*, *Chilobarchys*, and *Damarchus*, with only three being identified at the species level. Overall, the observed spiders are well represented by Araneidae (N = 2), Tetragnathidae (N = 1), Pholcidae (N = 2), Psechridae (N = 1), Liphistidae (N = 1), Sparassidae (N = 1), Theraphosidae (N = 1), and Bemmeridae (N = 1). This baseline data will assist in shedding light on biodiversity and conservation of spider species in Perlis.

## 1. Introduction

Spiders are one of the most successful organisms that have thrived on earth since the late Carboniferous period. They can be found in every corner of the land except in Antarctica. They posed a significantly important role in ecology as a biological control agent [1] and as a bioindicator for environmental conservation [2]. At present, approximately 50,000 of spider species have been identified [3] and the number is increasing exponentially owing to the tremendous efforts by global researchers to discover and document as many unknown species.

Perlis is the smallest state located on the northwest coast of Peninsular Malaysia. Despite geographically small, it is rich in limestone areas that accommodate a high level of biodiversity from lowland and highland dipterocarp forests. These ecosystems are the sanctuary to a diverse range of unique plants and animals that sometimes can rarely be found elsewhere in Malaysia, such as the limestone hill flowering plant, *Microchirita hairulii* [4] and stumped-tailed macaque [5]. Perlis is also blessed with a plethora of spider species, and this information has mainly been obtained from many in situ observations [6,7]. The earliest record of a documented spider in Perlis can be traced back to 1938, with the finding of the primitively segmented spider, *Liphistius yangae* (Liphistidae), in Kaki Bukit [8,9], and a taxonomic study was conducted on *Liphistius* species in Perlis State Park [10].

At present, there are very few published articles related to the spider fauna in Perlis, despite the crucial role spiders play in ecosystems as natural pest controllers, indicators of environmental health, and contributors to biodiversity. The spider survey in this region has been poorly investigated in depth, despite numerous spider

records from other states in Malaysia [11,12,13,14]. Their ecological importance highlights the need for further research and conservation efforts to protect these often-overlooked arthropods. Furthermore, the lack of spider taxonomists in the country has profoundly impeded the identification process, often leading to discouragement in studies aimed at discovering new species. Hence, as an initial effort, this report aims to document the spider species at Perlis State Park and Eco Park Rimba Bukit Ayer during the two scientific expeditions on October 15<sup>th</sup> - 16<sup>th</sup>, 2019, and on October 4<sup>th</sup> - 6<sup>th</sup>, 2022, respectively.

## 2. Materials and Methods

Sampling of spider specimens was conducted at two locations namely, Perlis State Park (6°41'54.8"N 100°11'36.0"E) from 15th October – 16th October 2019 and at Eco Park Rimba Bukit Ayer (6°32'47.69"N, 100°10'4.22"E) from 4th October – 6th October 2022 following the two consecutive scientific expeditions organized by Jabatan Perhutanan Perlis, respectively. Figure 1 shows the map indicating the corresponding sampling sites. The sampling areas were focused at Lapangan Rekreasi and Kolam Lepas Ikan and two separate caves, Gua Wang Burma and Gua Kelam in Perlis State Park (Figure 1a) whereas in Eco Park Rimba Bukit Ayer, spider samples were collected from three selected trails with approximately 500 meters between each trail (Figure 1b).



**Fig. 1** The map indicating the sampling sites (highlighted with red pins) during the two successive scientific expeditions in (a) Perlis State Park; and (b) Eco Park Rimba Bukit Ayer

Sampling in the cave cavity was performed in the dark zone area with the assistance from the park rangers following the three speleobiological zones based on the presence of sunlight [15]. All spiders were randomly collected alive by hand-picking or with sweeping net and forceps and placed temporarily in plastic tubes before transferring to the Tissue Culture and Biomolecular Laboratory (TCBL) at UniCITI Alam Campus, Universiti Malaysia Perlis, Perlis. They were photographed and labelled accordingly. Species identification was performed under Olympus SZ51 stereo microscope (Olympus, Japan) using the following references therein where applicable: Kuntner [16], Jäger [17], Alvarez-Padilla and Hormiga [18], Huber [19], Dzulhelmi and Suriyanti [20], Caleb et al. [21], Koh and Bay [22], Schwendinger et al. [9], and World Spider Catalogue [3].

Molecular characterization was also integrated using DNA barcoding method to complement the morphological identification. The DNA barcoding was carried out by amplifying the mitochondrial cytochrome c oxidase subunit I (COI) gene, following the protocols outlined by Rowan & Paul [23]. Sequences were compared to reference databases such as GenBank and BOLD (Barcode of Life Data Systems) to confirm species identity. This dual approach, combining morphological and molecular data, provided a robust framework for accurate species identification and ensured the resolution of cryptic species where morphology alone may have been insufficient. Additional records were also made based on the field observation. All specimens were deposited in the Collection Unit of TCBL.

## 3. Result and Discussion

Out of 41 collected specimens, a total of ten spiders from eight families and nine genera were recovered. Eight genera were identified as new records for the state of Perlis including *Nephila*, *Nephilengys*, *Orsinome*, *Pholcus*, *Psechrus*, *Heteropoda*, *Chilobarchys*, and *Damarchus*. Among these, only three genera could be identified at the species level, indicating that further morphological examinations will be necessary in the future to identify the remaining species. Overall, the identified spiders belong to Araneidae (N=2), Tetragnathidae (N=1), Pholcidae (N = 2), Psechridae (N=1), Liphistidae (N=1), Sparassidae (N=1), Theraphosidae (N=1), and Bemmerridae (N=1) as described below, with reference to Figure 2:

### 3.1 Family: Araneidae

### 3.1.1 *Nephila pilipes* (Fabricius, 1793) (Figure 2a)

Material examined: (a) Perlis State Park - Lapangan Rekreasi and Kolam Lepas Ikan, 15.08.2019, ♀ & ♂; Gua Kelam 1, 16.08.2019, ♀, (b) Eco Park Rimba Bukit Ayer - Taman Herba Perlis, 04.10.2022, ♀ & ♂; Eco Park Rimba, 05.10.2022, ♀

Notes: Female spiders weaved large, unsymmetrical golden orb-web with hub nearer the top in space between tree branches or electrical cable. Several male spiders could be observed in close proximity with a single female. Kleptoparasitic spiders, *Argyrodes* sp. were also found on the web. *N. pilipes* has a wide distribution throughout tropical regions of Asia and parts of Australia.

### 3.1.2 *Nephilengys malabarensis* (Walckenaer, 1841) (Figure 2b)

Material examined: Perlis State Park – dormitory area, 14.08.2019, ♀; Gua Kelam 1, 16.08.2019, ♀ & ♂

Notes: In epigeal environment, female spiders built large orb-web with a tubular retreat against wall around the dormitory building. Inside Gua Kelam 1, they constructed extensively overlapping vertical orb webs on the cave wall in the dark zone towards the cave ceiling. Some individuals were close to each other on the same web but territorial. A high proportion of melanic morph over the brown morph was observed in the cave population. The species is commonly found throughout Malaysia and is also distributed across other Southeast Asian countries such as Indonesia, Thailand, and Singapore, extending as far as parts of India, including the Malabar Coast.

## 3.2 Family: Tetragnathidae

### 3.2.1 *Orsinome vethi* (van Hasselt, 1882) (Figure 2c)

Material examined: Perlis State Park – Gua Kelam 1, 16.08.2019, ♀ & ♂

Notes: The specimens were collected from extensive overlapping vertical and horizontal orb webs between the cave wall and bridge railings in the dark zone of Gua Kelam 1. The webs were only abundant in the area with flowing stream and contain individual spiders that tolerate close proximity with each other. They are distributed across Southeast Asia, as well as parts of China and India.

## 3.3 Family: Pholcidae

### 3.3.1 *Pholcus* sp. (Figure 2d)

Material examined: Perlis State Park – Gua Wang Burma, 15.08.2019, ♀

Notes: The specimens identified from the cave cavity belonged to genus *Pholcus* as they displayed elongated (cylindrical) opisthosoma, a common trait for genus *Pholcus* [24]. The individual collected from Gua Wang Burma constructed a domed shape irregular webs with dragline silks attached to the ground.

### 3.3.2 *Pholcus* sp. (Figure 2e)

Material examined: Gua Kelam 1, 16.08.2019, ♀ & ♂

Notes: The specimens identified from the cave cavity belonged to genus *Pholcus* as they displayed elongated (cylindrical) opisthosoma, a common trait for genus *Pholcus* [24]. In Gua Kelam 1, they were collected from irregular sheet webs built in cave crevices on the cave wall and the numbers were scarce. Pholcid spiders have a wide distribution in tropical countries, including Southeast Asia and parts of Australia.

## 3.4 Family: Psecridae

### 3.4.1 *Psecrus* sp. (Figure 2f)

Material examined: Perlis State Park – Gua Wang Burma, 15.08.2019, ♀ & ♂

Notes: Numerous spiders in close proximity were observed on horizontal lace webs built on bridge railings in the dark zone region of the cave. Egg cases were also found on the web with spiderlings. Psecrids are long-legged spiders equipped with a cribellum. The family consists of two genera, *Fecenia* and *Psecrus*, which can be distinguished by the patterns on the venter. The species is widely distributed across Southeast Asian countries and extend to Australia and the Pacific Islands.

## 3.5 Family: Liphistidae

### 3.5.1 *Liphistius* sp. (Figure 2g)

Material examined: Eco Park Rimba Bukit Ayer – Eco Park Rimba, 06.10.2022, ♂

Notes: The male specimen was collected alive from its burrow that was constructed on the cliffsides. *Liphistius* species are geographically restricted to parts of Southeast Asia, with confirmed distributions in Thailand, Malaysia (including Peninsular Malaysia and parts of Borneo), Myanmar, Laos, and southern China. They are typically found in forested or humid microhabitats, often in undisturbed environments where they construct silk-lined burrows with a trapdoor.

## 3.6 Family: Sparassidae

### 3.6.1 *Heteropoda* sp. (Figure 2h)

Material examined: Perlis State Park – Gua Wang Burma, 15.08.2019, ♀ & ♂

Notes: The spiders had black stripes and large body size. They were found in high numbers on the cave wall near a small stream full with shrimps inside the cave. Nearby the cave cricket colonies, a number of the spiders was also documented. *Heteropoda* spiders are large, agile hunters known for their flattened bodies and crab-like leg posture. They are primarily nocturnal and do not build webs, relying instead on active hunting. The genus is widely distributed across tropical and subtropical regions of Asia, including Southeast Asia, China, India, and extending to parts of Australia. Some species are also found in indoor environments, particularly in warm climates.

## 3.7 Family: Theraphosidae

### 3.7.1 *Chilobrachys* sp. (Figure 2i)

Material examined: Eco Park Rimba Bukit Ayer – Eco Park Rimba, 05.10.2022, ♀ & three juvenile spiders

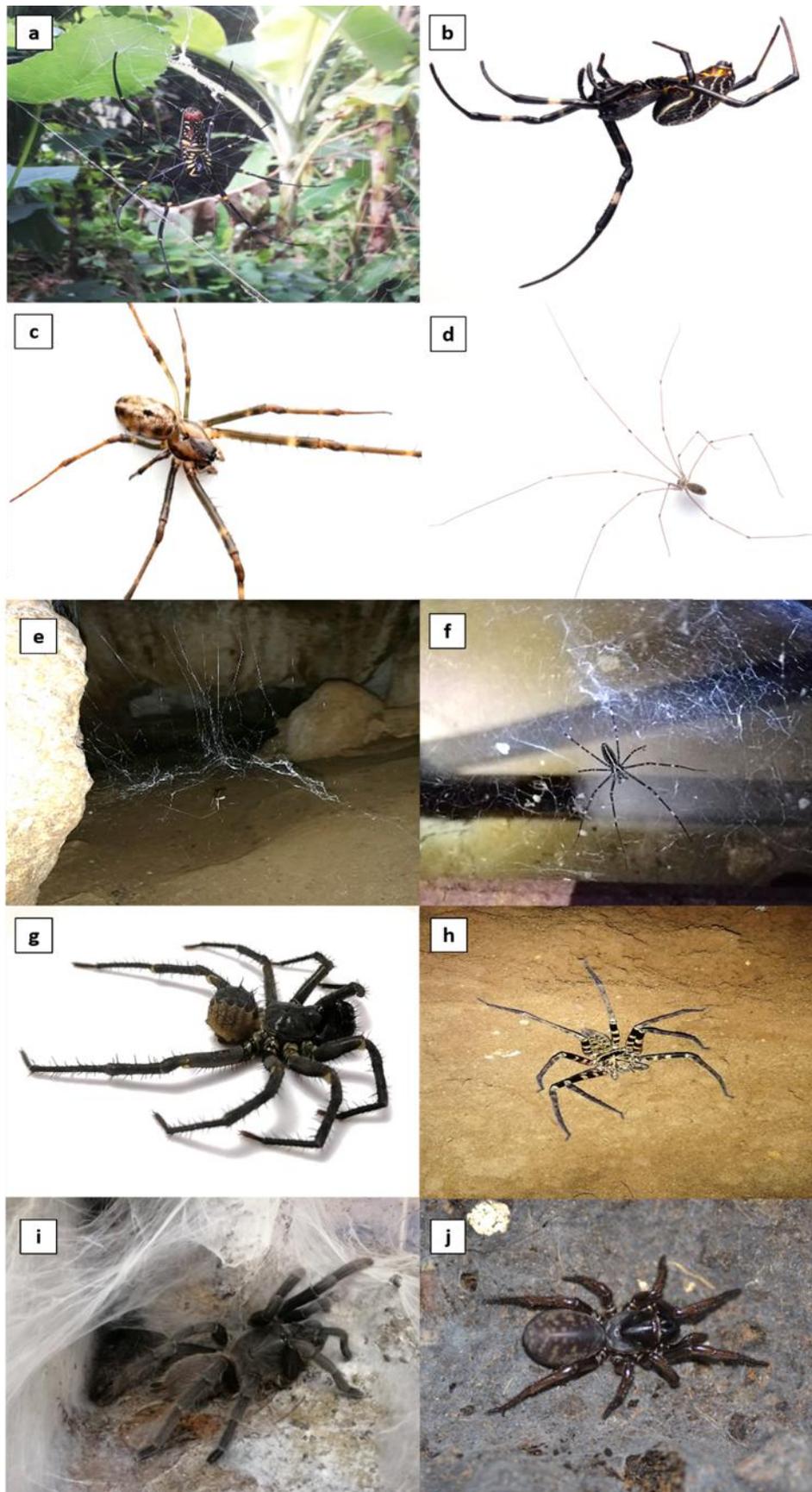
Notes: An adult spider was collected from the rocky area where it was observed to wander around. The three juveniles were collected from cavities on the tree trunk at night when they emerged slightly to the opening of the hole. *Chilobrachys* is a genus of tarantulas that is primarily found in Southeast Asia, classified as an Old World genus. Its distribution is focused on countries like India, Sri Lanka, Thailand, Malaysia, and Myanmar. These spiders typically inhabit forests and are often found in burrows or under rocks and logs in their natural environments. Some species within the *Chilobrachys* genus are known for their striking colors and patterns. As Old World tarantulas, they are more defensive and possess potent venom, which is a characteristic of this group.

## 3.8 Family: Bemmeridae

### 3.8.1 *Damarchus* sp. (Figure 2j)

Material examined: Eco Park Rimba Bukit Ayer, 06.10.2022, 3 adults ♀; Gua Semadong, 07.10.2022, 2 adults ♀

Notes: The adult females were collected from Bukit Ayer waterfall, where they constructed their nest by the river embankment closely to *Chilobrachys* sp. The specimens from Gua Semadong were found outside the cave area, at the rocky part uphill approximately 70 m elevation. *Chilobrachys* spp. were also found living in close proximity with *Damarchus* sp. *Damarchus* is a genus of mygalomorph spiders in the family Bemmeridae. They are primarily found in tropical and subtropical regions of Southeast Asia, including Malaysia, Indonesia, Thailand and Vietnam. They prefer environments where they can construct hidden, silk-lined burrows and are known for their solitary and defensive behaviour.



**Fig. 2** The spider samples collected during the 2019 and 2022 expeditions. (a) *N. pilipes*; (b) *N. malabarensis* melanic morph; (c) *O. vethi*; (d) *Pholcus* sp. from Gua Kelam 1; (e) *Pholcus* sp. from Gua Wang Burma; (f) *Psecchus* sp.; (g) *Liphistius* sp.; (h) *Heteropoda* sp.; (i) *Chilobracys* sp.; and (j) *Damarchus* sp. from Gua Semadong

## 4. Conclusion

Following two consecutive scientific expeditions, eight genera of spider specimens have been identified as new records for Perlis. However, only three of these genera could be identified at the species level. While these spider species are commonly found in other states of Malaysia and parts of Southeast Asia, documenting their presence in Perlis is of utmost importance. This information serves as a crucial baseline for future reference. It is anticipated that the findings from these surveys will contribute to long-term monitoring of spider conservation programs and inspire future researchers to explore spider studies in Malaysia.

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## Conflict of Interest

Authors declare that there is no conflict of interest regarding the publication of the paper.

## Author Contribution

The authors confirm contribution to the paper as follows: **study conception and design:** Johan Ariff Mohtar, Ahmad Mukhlis Abdul Rahman; **data collection:** Johan Ariff Mohtar; **analysis and interpretation of results:** Johan Ariff Mohtar, Khadijah Hanim Abdul Rahman, Fadhilah Mohamad; **draft manuscript preparation:** Johan Ariff Mohtar, Ahmad Mukhlis Abdul Rahman. All authors reviewed the results and approved the final version of the manuscript.

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