

## Diversity and Distribution of Spiders (*Araneae*) in the Galunggung Mountain Area

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### ABSTRACT

Spiders are classified as Anthrophoda, Arachnida, and Araneae. Spiders are classified into two types based on their life patterns: web-making and hunting, commonly known as trapdoor spiders. This study aimed to assess the diversity of spider distribution (Ordo Araneae) near Mount Galunggung. This study is quantitative. The VES (Visual Encounter Survey) method was utilized to collect data. 1) Gadobangkong waterfall, 2) Panoongan waterfall, and 3) Cimedang waterfall are the sampling places. This reseach gate 17 spesies *spiders*; *Argiope aemula*, *Argiope anasuja*, *Leucauge celebesiana*, *Nephila pilipes*, *Oxyopes salticus*, *Nephilengys malabarensis*, *Tetragnatha Montana*, *Argiope appensa*, *Argiope catenulate*, *Cyrtophora moluccensis*, *Zotahpeventralis hasel*, and *Dolomedes vittalus* were discovered. *Leucauge celebesiana* was the most frequent species discovered. *Argiope catenulate*, *Tylorida ventralis*, and *Dolomedes vittalus* were the least common. Each of which has only one individual.

### Diversitas dan Distribusi Laba-laba (*Araneae*) di Kawasan Gunung Galunggung

**ABSTRAK:** Laba-laba termasuk ke dalam filum Antrophoda, kelas Arachnida, dan Ordo Araneae. Berdasarkan pola hidupnya laba-laba terbagi menjadi laba-laba pembuat jaring dan laba-laba pemburu atau dikenal juga dengan laba-laba pintu jebakan. Tujuan dari penelitian ini untuk mengetahui diversitas dan distribusi laba-laba (Ordo Araneae) di sekitar Gunung Galunggung. Penelitian ini merupakan penelitian kuantitatif, Metode yang di gunakan dalam pengumpulan data adalah metode VES (Visual Encounter Survey) yang dikombinasikan dengan petak kuadran. Adapun lokasi pengambilan sampel yaitu 1) Curug Gadobangkong, 2) Curug Panoongan, 3) Curug Cimedang. Hasil penelitian di peroleh 17 jenis laba - laba; *Argiope aemula*, *Argiope anasuja*, *Leucauge celebesiana*, *Nephila pilipes*, *Oxyopes salticus*, *Nephilengys malabarensis*, *Tetragnatha Montana*, *Argiope appensa*, *Argiope catenulate*, *Cyrtophora moluccensis*, *Macrachantha hasselti*, *Herennia multipuncata*, *Gasterachantaha kuhli*, *Tylorida ventralis*, *Argiope reinwardti*, *Zoropsis spinimana*, *Dolomedes vittalus*. Jenis yang paling banyak di temukan adalah *Leucauge celebesiana*, dan yang paling sedikit di temukan *Argiope catenulate*, *Tylorida ventralis*, *Dolomedes vittalus*. Yang masing masih hanya ditemukan 1 individu.

## INTRODUCTION

Spiders are classified as Arthropoda, Chelicerata subphylum, Arachnida class, and Araneae order. Today, 43,678 spider species have been found worldwide, organized into 26 families and 111 families (Koneri, 2017);(Baba et al., 2018). Spiders have an extensive distribution in nature, with spiders present practically everywhere on the planet, from the arctic regions to arid desert places. Spiders have the most extraordinary diversity of all their habitats in all world environments in tropical rainforest ecosystems, compared to other ecosystems. Spiders can live on mountain tops, caves, the ground level, underground, and even underwater (Susilo et al., 2021);(Potapov et al., 2020).

The spiders' widespread distribution is owing to a skill known as ballooning, in which the spider uses the threads it makes and the wind to travel long distances. Spiders can be said to have touched all ecological niches and occupied all habitats on the planet because of this ability (Akhyar & Rizali, 2022);(Foti et al., 2017). Muhammad et al., (2020) claim that the diversity of spiders will grow during the rainy season while the evenness of spiders will decrease and increase during the dry season. The key factor influencing spider existence is altitude; an area's altitude directly impacts climatic conditions. Decreasing temperatures as altitude increases will have a direct impact on humidity and rainfall, two of the most essential elements in the spread of diversity, and will limit the dispersal of both animals and plants, including spiders (Dewi et al., 2020);(Ganai et al., 1940);(Hassan et al., 2016). This claim is supported by research conducted by (Wangge & Mago, 2021) which discovered nine species of spiders at an altitude of 1000-1500 meters above sea level, five species of spiders at an altitude of 1500-2400 meters above sea level, and one species of a spider at an altitude of 2400-3142 meters above sea level.

Spiders, as ecosystems, serve as biological control agents (biocontrol) against insect pests and as bioindicators of environmental change (Wulandari & Kamilah, 2021). Spiders live as predators, and their primary food is insects, so they have the potential to control pests. Spiders are polyphagous predators, which means they can control insect pests (Asih et al., 2021);(Rodrigues et al., 2015). Spider diversity can detect environmental changes and describe the state of an ecosystem, whether it is well-kept, moderately maintained, or no longer suited for spider habitat. A high diversity score can indicate that the environment is still well protected and suitable for spider habitat (Lavery, 2019);(Potapov et al., 2020). The researchers conducted a study named "Variety and Distribution of Spiders (Ordo Araneae) in the Mount Galunggung Tasikmalaya Region" based on the literature review to determine their diversity and distribution.

## METHOD

The research was conducted over three weeks, from April 7 to April 27, 2022. This research was carried out at three observation points: Gadobangkong Waterfall, Panoongan Cipanas Galunggung Waterfall, and Cimedang Waterfall. The vegetation at the first observation site was dominated by pine, bamboo, and shrub plants. The vegetation at the second observation site was dominated by bushes and moss, with only a few big trees. The third observation point was different because it was dominated by bamboo trees and had a few abandoned structures.

A quantitative descriptive research method was employed in this research. The VES (Visual Encounter Survey) approach was used with quadrant plots to collect data. A minimum distance of 2 km was made at each spot to explore. The distance was horizontal according to the geographical conditions of the location. The location was established by examining the surrounding

nature and potential sites with several objects to be explored. The collection was carried out by photographing known species and capturing unknown species in specimen bottles that would subsequently be identified in the laboratory. Spiders were caught using nets or instruments created specifically for this purpose.

The collected data was then examined for species diversity, evenness, dominance, resemblance, and distribution pattern. The Shannon-Wiener index was used to calculate the species diversity index (Biodiversity), the Evenness formula was used to calculate species evenness, the Simpson index was used to calculate species dominance, the Similarity index was used to calculate species evenness, and the Morrista index was used to calculate distribution (Jalil, 2019). The researchers employed the following formula:

$$H' = -\sum P_i \ln (P_i)$$

Description:

H' = Species diversity index

P<sub>i</sub> = The number of individuals of a species against all individuals encountered

The distribution was used to determine the distribution or position of an individual in an ecosystem. For distribution calculations, the Morrista index can be used as follows:

$$Id = n = \frac{\sum x^2 - N}{N(N-1)}$$

Description:

Id = Morisita dispersion index

n = Number of sampling plots

N = Number of individuals in all plots

X<sub>2</sub> = Number of individuals in each plot

(Hasyimuddin et al., 2019).

Furthermore, to calculate the evenness index, the researcher employed the Evenness index with the following formula:

$$E = \frac{H'}{\log S}$$

Description:

H' = Shannon-Wiener Diversity Index

S = Number of Species (Inggita, 2020).

In this study, calculating the domination index is also very important. The dominance index was calculated using

the Simpson dominance index with the formula:

$$D = I - \sum_{i=1}^S (p - 1)^2$$

Description:

P - 1 = The proportion of species x in the community

S = Number of species

Furthermore, the type similarity index was calculated using the Similarity index with the formula:

$$IS = \frac{2C}{A+B}$$

Description:

A = Number of species in community A

B = Number of species in community B

C = The number of the same species in both communities

S = Number of species

## RESULT AND DISCUSSION

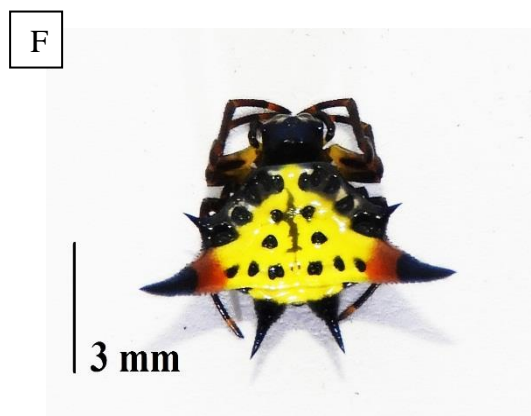
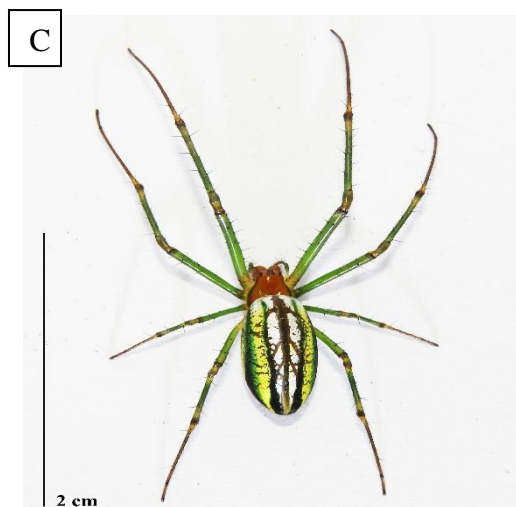
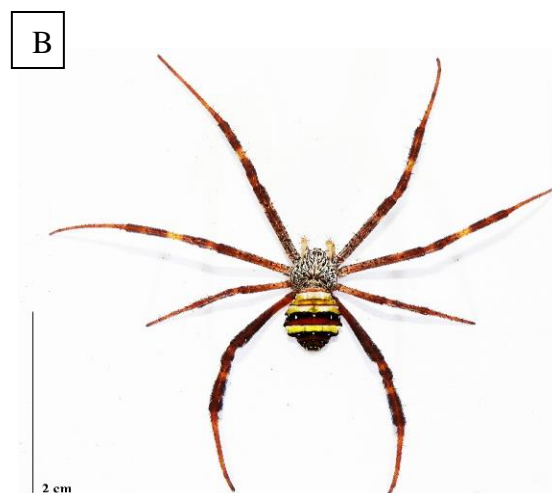
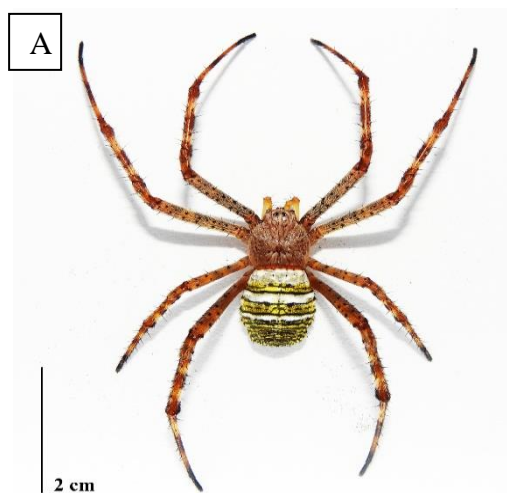
Data for 17 species were acquired based on field study findings. The species found were *Argiope aemula*, *Argiope anasuja*, *Leucauge celebesiana*, *Nephila pilipes*, *Oxyopes salticus*, *Nephilengys malabarensis*, *Tetragnatha Montana*, *Argiope appensa*, *Argiope catenulate*, *Cyrtophora moluccensis*, *Macracantha hasselti*, *Herennia multipunctata*, *Gasterachantaha kuhli*, *Tylorida ventralis*, *Argiope reinwardti*, *Zoropsis spinimana*, and *Dolomedes vittalus*. *Leucauge celebesiana* was the most common species found, owing to their tremendous flexibility and capacity to multiply swiftly and in large numbers. *Argiope catenulate* species and *Dolomedes vittalus* were the most rarely encountered. Each discovered one person, as illustrated in Table 1.

**Table 1.** The Data of Discovered Spider Species

	Species	Discovery Sites		
		S1	S2	S3
1.	<i>Argiope aemula</i>	√	√	√
2.	<i>Argiope anasuja</i>	√	√	√
3.	<i>Leucauge celebesiana</i>	√	√	√
4.	<i>Nephila pilipes</i>	√	√	√
5.	<i>Oxyopes salticus</i>	√	√	√
6.	<i>Nephilengys malabarensis</i>	√	-	√
7.	<i>Tetragnatha montana</i>	√	√	√
8.	<i>Argiope appensa</i>	√	√	-
9.	<i>Argiope catenulate</i>	√	-	-
10.	<i>Cryptophora mulucensis</i>	√	√	√
11.	<i>Macracantha hasselti</i>	√	-	-

	Species	Discovery Sites		
		S1	S2	S3
12.	<i>Herennia multipunctata</i>	√	-	-
13.	<i>Gasteracantha kuhli</i>	-	√	√
14.	<i>Tylorida ventralis</i>	-	√	-
15.	<i>Argiope reinwardti</i>	-	-	√
16.	<i>Zoropsis spinimana</i>	-	-	√
17.	<i>Dolomedes vittatus</i>	-	-	√

Images represent the findings. Their presentation follows the same guidelines as before: The title or picture name is put one space below and to the left of the image. If there is more than one line, the spaces between them are single-spaced. Figure 1 shows one example of this presentation.



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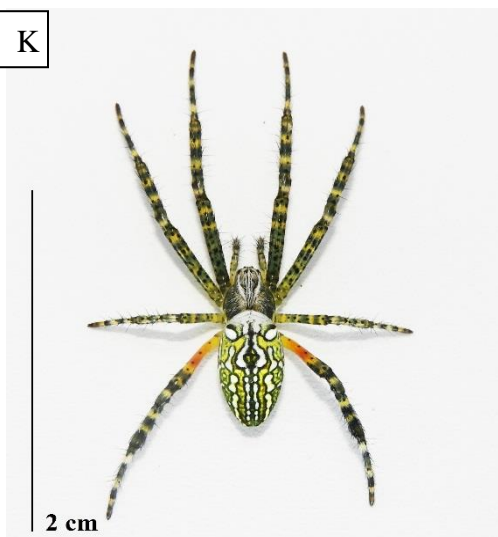
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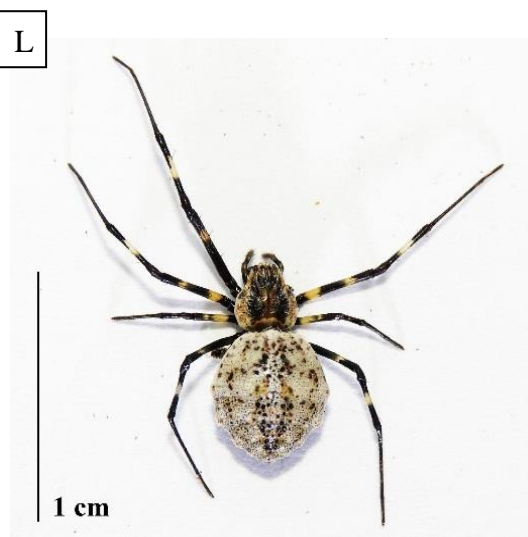
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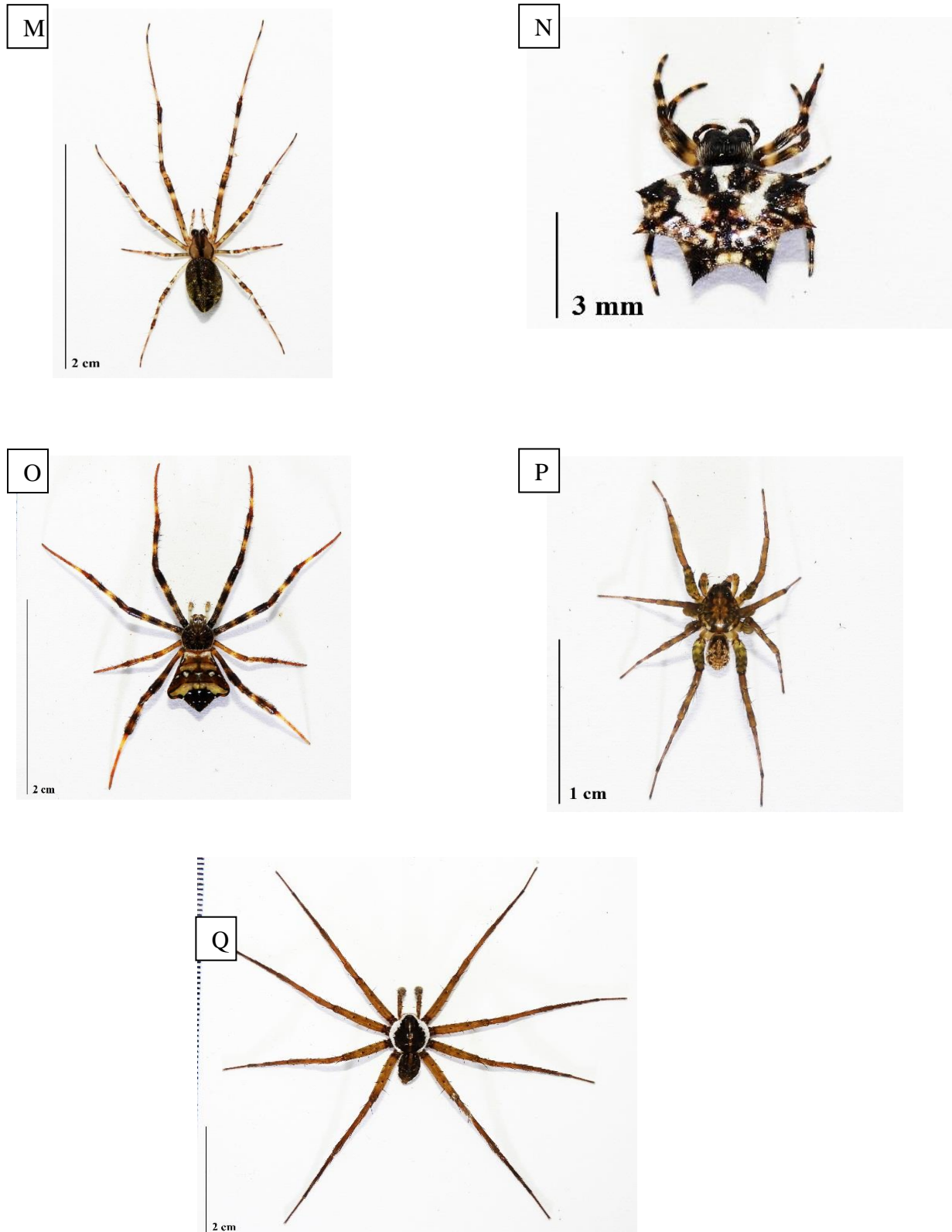


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**Figure 1.** Images of the discovered species (A) *Argiope aemula* (B) *Argiope anasuja* (C) *Leucauge celebesiana* (D) *Nephila pilipes* (E) *Oxyopes salticus* (F) *Nephilengys malabarensis* (G) *Tetragnatha montana* (H) *Argiope appensa* (I) *Argiope catenulate* (J) *Cryptophora molucensis* (K) *Macracantha hasselti* (L) *Herennia multipunctata* (M) *Gateracantha kuhli* (N) *Tylorida ventralis* (O) *Argiope reinwardti* (P) *Zoropsis spinimana* (Q) *Dolomedes vittalus*

Spiders are arthropods that use webs to capture prey. Spider webs have a distinct chemical structure in addition to a mechanical function. Many arthropods are involved in silk synthesis, including spiders, which use silk to create webs as a trap to catch prey. More than 4600 species of web-making spiders are foliage predators in terrestrial environments (Anitha & Vijay, 2016);(Hadole et al., 2015).

The spider's body is divided into two sections: the Cephalotorax and the Abdomen, which are joined by a thin connector called a pedicle or pedicellus. Spiders have four pairs of legs, palps, no wings, and four or two pairs of simple ossicular-type eyes (Singh & Singh, 2020);(Kamarudin & Arshad, 2016). The size of a spider's body varies considerably. The *Erigoninae* subfamily has the smallest spiders, with body lengths of less than one millimeter, and the *tarantula* subfamily has the largest spiders, with body lengths of up to 90 mm. Spiders have incredible tenacity; they may go three weeks without eating and can survive in various environmental situations. The data was collected in the Galunggung Mountain area, namely at three primary locations: Gadobangkong Waterfall, Panoongan Waterfall, and Cimendang Waterfall, which has an average elevation of 700 meters above sea level to 800 meters above sea level. The viewing points are in areas frequently utilized for excursions but not overcrowded. The vegetation is still in good shape and diversified, with sceneries ranging from rice fields to pine woods.

The data from the field revealed that *Leucauge celebesiana* was the most prevalent of the 17 species discovered. This is owing to the three sites of the observation stations based on their habitat, as well as the extremely high adaptability of these spiders, which is the factor that this type is most usually found. Because of its ability to reproduce swiftly and its resistance to environmental changes, this variety of spiders can be found anywhere it travels. *Leucauge celebesiana*, like most of its

relatives, is a colorful and unique spider. The body length, excluding the legs, is around 13 mm. This spider spins webs at a 45° angle, and multiple individuals normally construct these webs close together. Brunei, Malaysia, Laos, Indonesia, Singapore, the Philippines, Papua New Guinea, India, China, and Japan are all home to this species (Singh & Singh, 2020). (Das et al., 2018).

*Argiope catenulate*, *Dolomedes vittalus*, *Zoropsis spinimana*, and *Tylorida ventralis* were the fewest spider species discovered. The influence of habitat location and habitat circumstances is the most important aspect for the few species identified in this spider. *Argiope catenulate* is commonly found in areas with homogeneous vegetation and little variation in height, such as rice fields and plantations. Grasshoppers, butterflies, and other small insects are the primary prey of this species. The other three species are influenced by habitat circumstances, with this species' primary habitat being under the litter of leaves or rotting wood with high humidity. The state of the habitat at the observation station is deteriorating as the rainy season approaches, and floods are common, destroying the majority of this species habitat. This condition demonstrates the importance of the microhabitat element, as spiders are extremely sensitive to alterations or disturbances in the habitat structure (Hadole et al., 2015);(Lami et al., 2016).

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Based on the statistics, the diversity index falls into the medium category, with an index value of 2.29. With an index value of 0.92, the evenness index of species falls into the high category. With an index value of 0.12, the domination index falls into the low category. The similarity index is in the middle range, with a value of 55%, and the distribution index has a value of 0.84, indicating a uniform distribution.

## CONCLUSIONS AND SUGGESTIONS

The data revealed 17 species from 5 families and 13 genera. The total number of individuals discovered was 104, with the species *Leucauge celebesiana* having the most with 21 individuals, and the species *Argiope catenulate*, *Tylorida ventralis*, *Zoropsis spinimana*, and *Dolomedes vittalus* each having only one species discovered. With an index value of 2.29, the species diversity index belongs to the moderate category. With an index value of 0.92, the evenness index of species belongs to the high category. With an index value of 0.12, the domination index belongs to the medium group. The similarity index is in the medium range, with a value of 55%, and the distribution index has a value of 0.84, indicating a uniform distribution.

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