Spider Diversity in San Francisco, Agusan de Sur, Philippines

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ABSTRACT

Spiders play a vital role in maintaining ecological balance and serve as important ecological indicators. This study aimed to assess spider diversity within the agri-ecosystem of San Francisco, Agusan del Sur, utilizing the transect-quadrat method across two elevation stations (42 and 142 meters above sea level). We recorded abiotic factors, including humidity and temperature, during our survey. A total of 219 spider individuals were identified, representing six families, ten genera, and twelve species, with Tetragnatha montana being the most abundant and ecologically significant species. The dominance index was low, suggesting a lack of a single dominant species, while the diversity index indicated a moderate level of diversity across all stations and pooled data. Statistical analyses using a distance-based linear model (DistLM) revealed a significant correlation between temperature and spider species assemblage, while humidity and elevation exhibited negative correlations with spider diversity. These findings underscore the importance of temperature in shaping spider communities and highlight the relevance of spider diversity in agricultural ecosystems, which may inform future conservation and management practices.

Keywords: Agusan del Sur, diversity, elevation, humidity, spiders, temperature, T. montana

INTRODUCTION

Spiders are among the most widespread and dominant animals, living in every life-supporting continent. They are likely to be found near any place where there is terrestrial life (Dupo, 2014). Spiders live in a wide range of extreme environments, from the coldest northern islands of the Arctic to the hottest and driest arid regions. They exist at some of the highest altitudes reached by living organisms, in the depths of caves, along ocean shore intertidal zones, in swamps and lakes, on high arid moorlands, sandy dunes, and floodplains. Furthermore, spiders also thrive in swarming colonies within shallow-water systems and have even reestablished a presence in aquatic environments (Vogel, 1965).

Spiders can serve as bioindicators for evaluating the impact of human disturbances on natural ecosystems (Maelfait & Hendrickx 1998). Their webs can be used to measure habitat quality as an indicator of environmental chemistry (Rutkowski *et al.,* 2018). Even though their life cycles occur on time periods equivalent to the disturbance, they do not respond to seasonal changes but rather to chronic grazing pressure (Warui, 2004).

Many spider studies are done worldwide, particularly in temperate areas, whereas there has already been much research in tropical areas throughout the years. Currently, the World Spider Catalog announced that there have been 51,064 different species of spider inhabiting the Earth, belonging to 4,314 genera and 132 families (Bern, 2023). However, spider fauna is still less explored. The Philippines, reported to be one of the 17 megadiverse countries, accounting for 70-80% of global biodiversity (Ong, 2002). In addition, being an archipelago with diverse ecosystems, and high endemism rate, the Philippines is indeed an excellent habitat for spider fauna. There are 517 documented spider species in the Philippines, classified under 225 genera and 38 families. Nonetheless, due to scarce information on composition of species and diversity, researchers struggle to precisely estimate spider population densities. Consequently, more faunal studies are needed to document the species

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richness of spiders in the country.

Research on spiders in the Philippines has been minimal, leaving many species yet to be discovered across the different islands of the archipelago. Specifically, in Sitio Managbay, Barangay Alegria, San Francisco, Agusan del Sur, an area classified as an agri-ecosystem, is consequently threatened by anthropogenic activities. The purpose of this study was to determine the diversity of spiders in Sitio Managbay, Barangay Alegria, San Francisco, Agusan del Sur.

The results of this study would contribute preliminary data on species diversity and status of the spiders in the area at different elevations. Since spiders are often disregarded as valuable organisms, this study would raise interest and awareness in them, and promote understanding of their significance in the ecosystem. Thus, the objective of this study is to assess the diversity of spiders in San Franscisco, Agusan del Sur, specifically this aimed to identify the spider species in the area, identify its morphological characteristics and probe the differences in spider diversity among the sampling sites.

MATERIALS AND METHODS

Study area

The study was carried out in an agri-ecosystem of Sitio Managbay, Barangay Alegria, San Francisco Agusan del Sur (8° 30' 59.23" N, 126° 00' 15.72" E) (Fig. 1). Two stations with different elevations, namely, 42 m and 142 m were established in the study area, labeled as Station 1 and Station 2, respectively (Fig. 1C). A 500 m transect line was set up where two sites according to elevation (42 and 142 meters above sea level) were selected (Garciano *et al*., 2014).

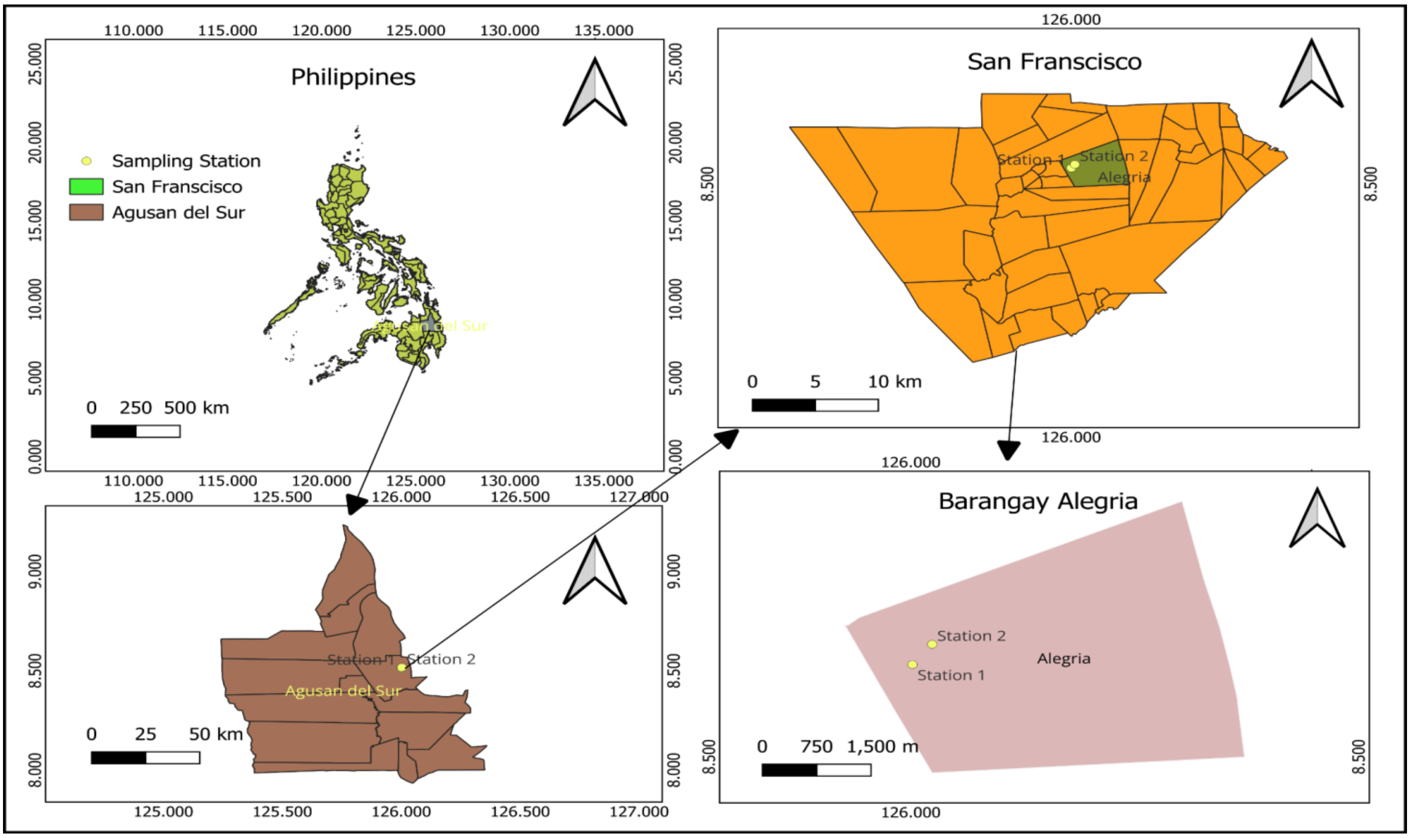

Fig. 1. Location of the study site with inset map of the Philippines, Agusan del Sur, San Francisco and Barangay Alegria (QGIS).

Sampling Methods

Sampling was conducted for one field day for 16 man-hours on November 03, 2023. The collection was done for two hours, from 6 pm-8 pm. At each site, sampling extended 10 meters on both sides perpendicular to the

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transect, allowing for a wider and more in-depth collection area. The 500-meter line transect will be delineated having three 10 m x10 m quadrats laid on either side in each selected station with a distance of 10 meters in between the quadrats. Microhabitats such as fallen logs and crevices were rigorously inspected for ground-dwelling spiders, while tree leaves and visible webs were checked to locate arboreal species of spiders. Collection techniques like hand collection combined with opportunistic sampling will be used. When captured, Representative spider samples will be put in zip-lock plastic bags for acquiring live images and then placed to vials with 80% ethanol.

Identification of Spiders

All spiders were identified using laboratory manuals of Green (1996), Barrion and Litsinger (1995), and Koh (1989, 2000) keys, images, and descriptions (World Spider Catalog, 2023; naturalist, 2023). Taxonomic keys and picture comparisons from different literature will be also used for identification. Morphometric measurements will be checked using a ruler. Body size will be measured from the frontmost of the cephalothorax to the tip of abdomen. The identified spiders will then be verified by Prof. Rodrin A. Rivera.

Abiotic factors

Temperature: Temperature will be measured using a thermometer. The thermometer will be positioned to the air at a height of four feet above the ground. Temperature readings will be recorded randomly at selected points along each established transect line. This procedure will be repeated three times at identified sites within each transect (Mante et al., 2019).

Relative Humidity: Relative humidity will be measured using a sling psychrometer, which will be rotated at a height of six feet above the ground for three minutes. The difference between the wet and dry bulb readings will be calculated, and values will be referenced against the Brower and Zar (1977) table. The intersection of the two readings on the table will indicate the relative humidity. This process will also be conducted three times at selected sites along each transect line.

Data Analysis

All data that were obtained (actual count, morphometric measurements such as abdomen length, width and total body length) will be recorded, consolidated and processed to obtain ecological indices.

Ecological Indices

The following formula were used for ecological measurement (as suggested by Odum 1971 Fundamentals of Ecology 3rd Edition p. 144):

1. Density (D) – the total number of individuals per species in relation to sampling.

$$D = \frac{No. of\ individuals\ (N)}{Area\ sampled\ (A)}$$

2. Relative Density (RD) – the proportion of the density of the species to the density of all species.

$$RD = \frac{Density\ of\ species\ A}{Tot\ al\ density\ of\ all\ species}\ x\ 100$$

3. Frequency (F) – the proportion of the numbers of quadrats which the species A occurs to the number of quadrats examined.

$$F = \frac{No. of\ quadrats\ in\ which\ species\ A\ occurs}{Total\ number\ of\ quadrats\ examined}$$

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4. Relative Frequency (RF) – the proportion of the frequency of the species A to the total frequency of all species

$$RF = \left(\frac{Frequency\ of\ species\ A}{Total\ frequency\ value\ for\ all\ the\ species}\right) x\ 100$$

5. Dominance (Dom) – the area covered by species A in each quadrat

$$Dom = \frac{Species\ Basal\ Area\ Coverage\ Value}{Area\ Sampled\ (A)}$$

6. Relative Dominance (RDom) – the proportion of the dominance of the species A to the total dominance of all species

$$RDom = \left(\frac{Dominance\ of\ Species\ A}{Total\ Dominance\ of\ all\ species}\right) x\ 100$$

7. Species Important Value (SIV)

$$SIV = RD + RF + Rdom$$

8. Index of Dominance (C)

$$C = \sum \left(\frac{n_i}{N}\right)^2$$

Where: n_i = important values of each species

N = total important values of species

9. Shannon's Index of Diversity (H^1) as detailed by Margalef (1957) is computed as

$$H^1 = -\sum_{i=1}^{s} p_i\ ln\ ln\ p_i$$

Where: p^i= relative proportion of the species *i* in the community

ln = the proportion of the entire community made up of species *i*

Using Primer V6 software, the distance-based linear model (DistLM) was used to correlate the elevation and spider species.

The spatial distribution of the spiders was also checked using nMDS (non-metric multi-dimensional scaling).

Documentation

To document the anatomical description, photographs were prepared using a DSLR Canon camera phone to

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accompany the systematic account.

RESULTS AND DISCUSSION

Spiders Species Collected

There were 219 spiders accounted for in this study conducted in Sitio Managbay, Brgy. Alegria, San Francisco, Agusan del Sur. These spiders we identified and classified into 6 families, 10 genera, and 12 species (Table 1). Table 2 shows the summary of the composition of spider species from the (2) sampling stations. Family Araneidae, collectively known as orb-weaver spiders, recorded the highest number of genera (4 genera) and species (6 species). The orb weavers have a cosmopolitan distribution and are known to build spiral wheel-shaped webs (naturalist, 2022). Family Salticidae, commonly called jumping spiders, recorded 2 genera and 2 species. The jumping spiders are among the largest family distinguishable by their very alert jumps when hunting and sometimes in response to danger (naturalist, 2022).

Table 1. Composition of spider species in San Francisco, Agusan del Sur.

Family		Common Name	Number of Genera	Number of Species
1	Agelenidae	Funnel weavers	1	1
2	Araneidae	Orb-weaver spiders	4	6
3	Oxyopidae	Lynx spiders	1	1
4	Salticidae	Jumping spiders	2	2
5	Sparassidae	Huntsman spiders	1	1
6	Tetragnathidae	Long-jawed orb-weavers	1	1
Total			**10**	**12**

Table 2. List of species of spiders with their calculated Pooled Density (***D***), Relative Density (RD), Frequency (F), Relative Frequency (RF), Dominance (Dom), Relative Dominance (Rdom), and Species Important Value.

SPIDERS	D (600)	RD	F	RF	Dom	Rdom	SIV
Agelenopsis potteri	0.015	4.11	0.17	3.2	3E-06	2.747	10.1
Argiope keyserlingi	0.008	2.28	0.33	6.5	5E-06	5.495	14.2
Gasteracantha fornicata	0.002	0.46	0.17	3.2	1E-05	11.9	15.6
Gasteracantha kuhli	0.017	4.57	0.5	9.7	5E-06	5.495	19.7
Heteropda venatoria	0.033	9.13	0.5	9.7	1E-05	14.65	33.5
Neoscona molemensis	0.032	8.68	0.83	16	5E-06	5.128	29.9
Neoscona punctigera	0.018	5.02	1	19	7E-06	7.326	31.7
Nephila pilipes	0.005	1.37	0.17	3.2	3E-05	36.63	41.2
Oxyopes Javanus	0.032	8.68	0.5	9.7	2E-06	2.564	20.9
Plexippus paykulli	0.008	2.28	0.33	6.5	2E-06	2.564	11.3
Telamonia dimidiata	0.015	4.11	0.17	3.2	1E-06	1.099	8.43

Tetragnatha montana	0.18	49.3	0.5	9.7	4E-06	4.396	63.4
TOTAL	0.365	100	5.17	100	9E-05	100	300

Distribution and Diversity

In the pooled data (Table 1), *Tetragnatha montan*a had the greatest relative density with the value of 49.3, followed by *Heteropoda venatoria* with a value of 9.13, and the least was *Gasteracantha fornicata* with the value of 0.46. The *Neoscona punctigera* had the greatest relative frequency with a value of 19, and the *Agelepnosis potteri*, *Gasteracantha fornicata*, *Nephila pilipes* and *Telamonia dimidiata* had the least value of 0.17. *N. pilipes* recorded the highest relative dominance with a value of 36.63, followed by *G. fornicata* with a value of 11.9, and the least was *T. dimidiata* with a value of 1.09. The *T. montana* had the highest species important value (SIV) with value of 63.4; followed by *N. pilipes* with a value of 41.2, and the least was *T. dimidiata* with a value of 8.43. A high species importance value indicates that *T. montana* is the dominant species in the area. This may contribute to the presence of rivers wherein it can hunt for mosquitoes which are abundant in moist areas. *T. montana,* grows from May to September, with the earliest appearing as soon as February. Flies and mosquitoes are their primary prey. These are captured in the spider's web, which is an erect web composed of threads projecting from a central point and intersected by radial links spiraling in from the edges, among the branches and stems of trees, shrubs, and low vegetation. (British Arachnological Society, 2016). The study of Dabrowska (1968) showed that 60% of the food *T. montana* consumed are mosquitoes thru its web. Furthermore, it was shown that there is a relation found between the seasonal variation in the occurrence, population density, and behaviors of spiders and mosquitoes.

T. montana is found throughout much of the Palearctic, from Western Europe to East Asia, and is the most common Tetragnatha species in many parts of Europe. As far north as southern Norway and as far south as Iran are concerned. It is widespread in the south of the United Kingdom but becomes more localized in the north. In a variety of predominantly lowland environments, T. montana webs can be seen on trees, bushes, and low vegetation. Although the webs are found near water, Tetragnatha extensa is more closely connected with wetland ecosystems. (British Arachnological Society, 2016).

Table 3. Abiotic factors determined during data collection last at San Francisco, Agusan del Sur.

Abiotic factors	**Station 1**	**Station 2**
Relative Humidity (%)	53.6	55.6
Temperature (°C)	21	20
Elevation (m)	42	142

The abiotic factors recorded in the study included temperature, relative humidity, and altitude. Data collected from both sampling stations are summarized in Table 3. According to the results, temperatures ranged between 20°C and 21°C, with Station 2 obtaining the highest value and Station 1 the lowest. These temperature readings fall within the ideal range for spider growth, which is between 21°C and 26°C (70°F–80°F), as indicated by Tansley (2003). This range also avoids the extremes that could inhibit spider growth, typically below 15°C (60°F) or above 32°C (90°F). Herberstein (2003) emphasized that temperature plays a role in affecting spiders' web-building behavior. Furthermore, the existence of water sources contributes to the environmental suitability of these stations, supporting both the survival of spiders and the availability of potential prey, as noted by Gillespie (1987). Therefore, both locations appear to provide favorable conditions for sustaining spider populations.

Relative humidity measurements from the two stations revealed that Station 2 had the highest level at 55%, which can be influenced by its higher elevation. Interestingly, Station 1, situated at a lower elevation of 42 meters, recorded a slightly higher average temperature of 21°C. In contrast, Station 2, located at 142 meters above sea level, had a lower mean temperature of 20°C. This pattern indicates a possible inverse relationship

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between elevation and temperature across the sampling sites.

Table 4. Pooled Index of Dominance and Shannon's Index of Diversity.

Indices	Station 1 (42 m)	Station 2 (142 m)	Pooled data
Index of Dominance C'	0.209	0.068	0.0513
Shannon's Index of Diversity H'	1.18	2.02	1.80

The indices of dominance of different elevations are shown in Table 4. Station 1 had an index of dominance of 0.209, Station 2 had 0.068, and the pooled data had 0.0513, implying that dominance was shared among the species in the area. The computed index of diversity in this study was 2.02 implying that the diversity was moderate (Fernando et al., 1986). This is the same to the results of the studies of Alviola and Disomimba (2017) in Impasug-ong Protected Area, Bukidnon; Garciano (2014) in Mt. Matutum, South Cotabato; and Achacoso (2016) in Sinaloc, El Salvador City which all recorded low diversity.

Table 5. Classification scheme for the Shannon Diversity Index (Fernando *et al*., 1998).

Relative values	Shannon-Wiener diversity Index (H')
Very High	3.50 and above
High	3.00-3.49
Moderate	2.50-2.99
Low	2.0-2.49
Very Low	1.99 and below

The spatial distribution of the spiders was also checked using nMDS (non-metric multi-dimensional scaling) revealing a significant difference in spider species assemblage between sites (Fig.2). In addition, the non-metric multidimensional scaling analysis highlighted the distinctiveness of a particular spider species found only at Station 1—the long-jawed orb-weaver (*T. montana*).

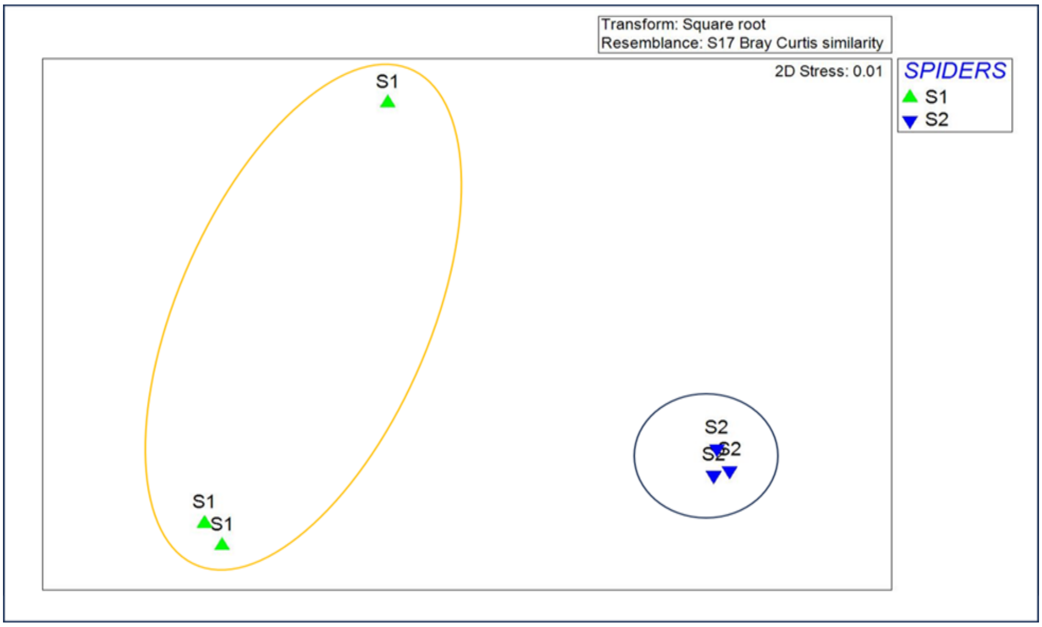

Fig. 2. A non-metric multi-dimensional scaling (nMDS) of the spider assemblage distribution in the sampling stations in Barangay Alegria, San Francisco, Agusan del Sur. Separate circles indicate similarities across sampling stations.

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The principal coordinate analysis of spider species assemblages in two different elevations (Station 1= 42 masl and Station 2 = 142 masl), temperature and humidity (Fig.3). *A. keyserlingi*, *G. kuhli*, *G. fornicata*, *N. punctigera*, *N. molemensis*, *O. javanus* and *P. paykulli* are the spider species that are closely associated with temperature, which means that a change in temperature would affect the spider species assemblage. *T. montana* is the only spider species closely associated with elevation which is consistent with the data of *T. montana* being present only in Station 1. *A. potteri, H. venatoria* and *T. dimidiata* are the only spider species that are closely associated with humidity, which means that varying humidity would likely affect the presence of spider species.

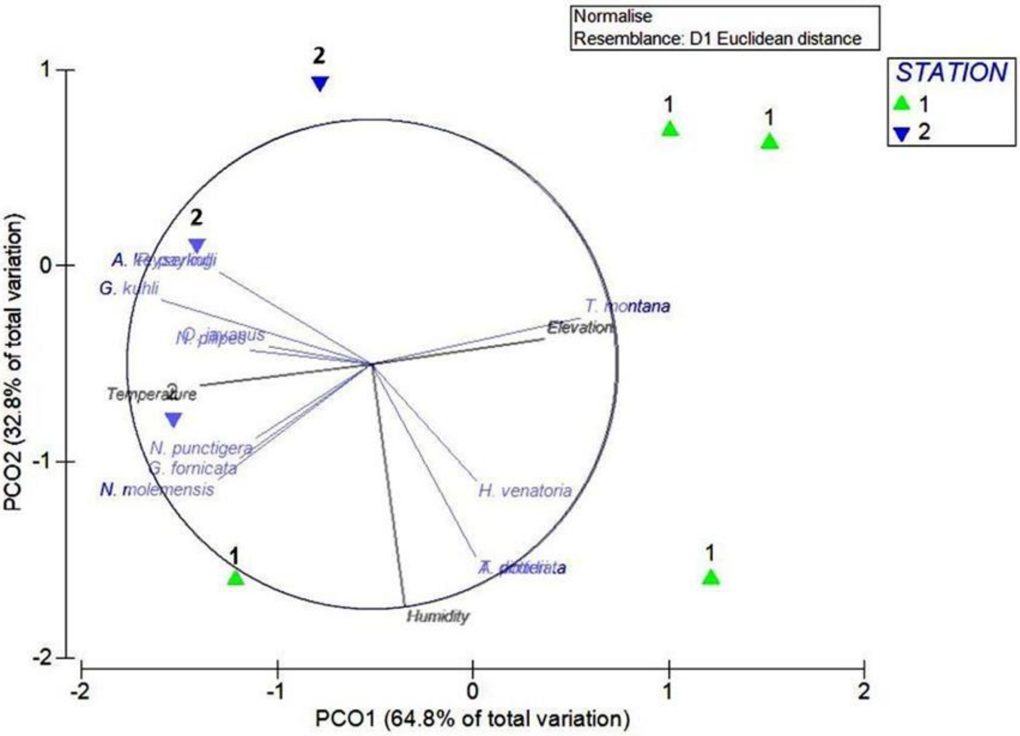

Fig. 3. Principal coordinate analysis of spider species assemblages in different elevations (Station 1= 42 masl; Station 2 = 142 masl), temperatures and humidity in San Francisco, Agusan del Sur.

However, considering the result of the marginal test using a distance-based linear model (Table 6), temperature significantly affects (P < 0.05) the spider assemblage. Since temperature and spider species have a significant correlation, a temperature change would affect the spider species assemblage in the area. No significant correlation (P > 0.05) was observed in elevation and humidity. However, r^2 recorded a computed value of 0.94, which means that 94% of the data accounts of the variation in the spider species. This also means that 6% of the variation may be caused by other factors such as soil type, type of plant and tree in the area, and species of arthropods.

Table 6. Results of the marginal tests using a distance-based linear model showing a negative correlation between elevation and species assemblage based on P value= 0.5.

Variable	r^2	ss (trace)	Pseudo-F	P	Prop.
elevation	0.94	6370	5.6	0.08	0.59
humidity	0.94	1193	0.49	0.07	0.10
temperature	0.94	6257	5.41	0.03	0.57

DISCUSSION

Spiders from six families, ten genera, and twelve species were collected and identified at two locations in Sitio Managbay, San Francisco, Agusan del Sur (Table 1). This figure is considerably smaller than the number of spider species documented in Mt. Matutum, South Cotabato, as reported by Garciano and colleagues in 2014. Mt. Pinukis, Zamboanga del Sur (Lalisan *et al.* 2015), caves of Siargao Island (Cabili and Nuneza, 2014), caves of Mindanao (Enriquez and Nuneza, 2014), Sinaloc, El Salvador City (Achacoso *et al*., 2016), Impasug-ong Bukidnon (Alviola *et al*., 2017), Tangub City (Rivera *et al*., 2024).

This study found a moderate level of spider diversity at various elevations in San Francisco, Agusan del Sur. Station 2 (142 masl) had the highest species diversity. This implied that the area's habitat structures were typically altered, resulting in fewer areas for spider prey and spider microhabitats, increasing trophic interactions. Station 1 (42 masl) had the lowest species diversity and richness, as bushes dominated the area. This most likely influenced the quantity of insects that spiders rely on for sustenance (Rivera, 2024). The substantial agricultural development in the area may have negatively influenced both spider and prey habitat availability (Lawrence and Wise, 1999). The physical characteristics of the area, as well as its vegetation cover, have a substantial association with the species composition of spiders in a given location (Olarto *et al*., 2012). Station 2 (142 masl) had the greatest number of individual spiders since the area was dominated by bushes and crops. Complex forests provide more diversified conditions than homogeneous forests due to a wider range of microhabitats and trees (Khanaposhtani *et al*., 2012), which is similar to the area in Station 2.

The Araneidae family appeared as the most dominant, with six identified species spanning four different genera. This high representation aligns with previous records from Mt. Pinukis (Lalisa et al., 2015) and also parallels observations made in Sri Lanka (Bambaradeniya & Edirisinghe, 2001). Members of the Araneidae family are known to prefer vegetation-rich habitats, particularly those near water bodies or areas with shaded plant growth, decaying wood, tree trunks, and buttress roots (Dacany et al., 2014). As noted by Barrion et al. (2012), both Araneidae and Tetragnathidae are commonly located within plant canopies or foliage, which provide stable points for web construction. Among the species recorded, *T. montana* was the most prevalent, comprising 49% of the total population collected.

Most species were obtained from Station 2 (142 masl), mainly cultivated crops. In the present research, spider species richness is maximized at lower elevations due to the abundance of *T. montana*. According to the British Arachnological Society, *T. montana* webs can be found on trees, bushes, and low vegetation in a range of settings, especially in the lowlands. This is consistent with the findings from the study that *T. Montana* is abundant at Station 1 (42 masl). Human activities and some agricultural plants have changed the elevation of the lower elevations, resulting in fewer spider species. Whitmore *et al.* (2002) found that increased disturbance levels resulted in decreased spider richness. The high rate of transpiration by plants in high elevations creates a damp and cold atmosphere. Spiders have preferences for humidity and temperature (Riechert and Gillespie, 1986), which confine them to locations within their "physiological tolerances" and may explain the limited species richness in this elevation. However, sufficient forest canopy and litter at station 2 (142 masl) provide more survival options in the form of biological niches than at higher and lower elevations (Ramanathan and Alagesan, 2013). This height is occupied by all spider species in roughly equal proportions, which explains the high species occurrence at station 2 (142 masl).

Given the significance of spiders in insect pest control and as bioindicators, significant efforts are needed to apprehend their diversity (Umarani and Umamaheswari, 2013). The collected spiders' diversity and dominance indexes were calculated (Table 3). Spiders were distributed very evenly across all of the stations. Individuals become more uniformly dispersed, resulting in increased species diversity. The number of species contributing meaningfully to diversity for the locations collected are ordered as follows: Station 1 (0.2) > Station 2 (0.06). Site 2 had the lowest index of dominance, implying that it contained the most spider diversity. The lower count of spider species in station 1 (42 masl). This could be attributed to nearby disruptions or perceived threats, as both humans and other animals are more frequently present in the area and surrounding agricultural zones.

In this study, ecological parameters such as air temperature, relative humidity, and temperatures were measured and were expected to cover the large percentage of factors affecting spider species assemblage but, in this study, only the temperature was proven to have a significant correlation to spider species assemblage in the area. This proves that other factors would explain in detail this 94% variation. According to Koponen (1991), elevation is correlated with factors such as humidity, temperature, and distinctive plant growth which can influence spider populations. For future studies, it is therefore suggested that ecological parameters be considered such as type of soil and notable plant growth to accurately define spider diversity and distribution. Furthermore, in monitoring ecosystem health, such as forests, it is important to effectively assess the biotic components altogether with the ecological (physicochemical) properties to show the bioindication responses of spiders (for instance) to ecosystem changes within a desired timescale.

CONCLUSION

This study was conducted to assess the diversity of spiders in the Agri-ecosystem of San Francisco, Agusan del Sur using the transect quadrat method. There were three hundred sixty- five (219) individuals were accounted for belonging to six (6) families, ten (10) genera, and twelve (12) species. *Tetragnatha montana* was the most important species. The index of dominance was very low indicating that there were no dominating species in the area. The index of diversity of all stations including the pooled data was moderate. Marginal test using a distance-based linear model suggested that among the abiotic factors included (temperature, humidity, and elevation) only elevation had a positive correlation to spider species assemblage.

The researcher recommends that studies on spider diversity in San Francisco, Agusan del Sur be thoroughly investigated. It also suggested that physicochemical parameters such as acidity of the soil and distinctive plant growth should be considered while studying diversity. It is further recommended that the elevation gap between station should be above 500 meters and to establish more sampling stations. Furthermore, additional sampling methods in collecting spiders should be applied such as pitfall trapping and sticky plaster methods to collect non-web-making spiders. Related studies should be conducted in different areas in Mindanao or the Philippines as a whole.

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Supplemental Data

Figures

Family: Araneidae

Scientific name: Argiope keyserlingi Karsch, 1878

Kingdom: Animalia
Phylum: Arthropoda
Class: Arachnida
Order: Araneae

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Family: Araneidae
Genus: *Argiope*
Species: *Argiope keyserlingi*
Common name: St Andrew's Cross Spider

Figure 3. Actual photo of representative *Argiope keyserlingi* (taxonomic classification source: Global Biodiversity Information Facility, 2023, available from https:// www.gbif.org/species/5171006; original photo of the author).

Scientific name: Gasteracantha fornicata Fabricius, 1775

Kingdom: Animalia
Phylum: Arthropoda
Class: Arachnida
Order: Araneae
Family: Araneidae
Genus: *Gasteracantha* Sundevall
Species: Gasteracantha fornicata
Common name: Laglaise’s garden spider

Figure 4. Actual photo of representative: Gasteracantha fornicata (taxonomic classification source: World Spider Catalog, 2023, available from https:// www.gbif.org/species/2158562; original photo of the author).

Scientific name: Gasteracantha kuhli C.L. Koch, 1837

Kingdom: Animalia
Phylum: Arthropoda
Class: Arachnida
Order: Araneae
Family: Araneidae
Genus: *Gasteracantha*
Species: *Gasteracantha kuhli*
Common name: Laglaise’s garden spider

Figure 5. Actual photo of representative Gasteracantha kuhli (taxonomic classification source: World Spider Catalog, 2023, available from https://www.gbif.org/specie s/2158561; original photo of the author).

Scientific name: Neoscona molemensis Tikader & Bal, 1981

Kingdom: Animalia
Phylum: Arthropoda
Class: Arachnida
Order: Araneae
Family: Araneidae

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Genus: *Neoscona*

Species: *Neoscona molemensis*

Common name: Spotted orb-weavers

Figure 6. Actual photo of representative Neoscona punctigera (taxonomic classification source: World Spider Catalog, 2023, available from https://www.gbif.org/speci es/2158866; original photo of the author).

Scientific name: Neoscona punctigera Dolechall, 1857

Kingdom: Animalia

Phylum: Arthropoda

Class: Arachnida

Order: Araneae

Family: Araneidae

Genus: *Neoscona* Simon, 1864

Species: *Neoscona punctigera*

Common name: Orb-weaver spider

Figure 7. Actual photo of representative Neoscona punctigera (taxonomic classification source: World Spider Catalog, 2023, available from https://www.gbif.org/speci es/2158866; original photo of the author).

Scientific name: Nephila pilipes Fabricius, 1793

Kingdom: Animalia

Phylum: Arthropoda

Class: Arachnida

Order: Araneae

Family: Araneidae

Genus: *Nephila*

Species: *Nephila pilipes*

Common name: Giant Wood Spider

Figure 8. Actual photo of representative *Nephila pilipes* (taxonomic classification source: World Spider Catalog, 2023, available from https://www.gbif.org/species/214 9490; original photo of the author).

Family: Oxyopidae

Scientific name: *Oxyopes javanus* Thorell, 1887

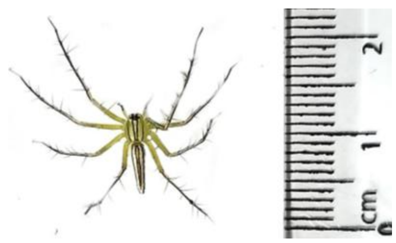
Kingdom: Animalia

Phylum: Arthropoda

Class: Arachnida

Order: Araneae

Family: Oxyopidae



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Genus: *Oxyopes*

Species: *Oxyopes javanus*

Common name: Lynx spider

Figure 9. Actual photo of representative *Oxyopes javanus* (taxonomic classification source: World Spider Catalog, 2023, available from https://www.gbif.org/spe cies/2178948; original photo of the author).

Family: Salticidae

Scientific name: *Plexippus paykulli* Audouin, 1826

Kingdom: Animalia

Phylum: Arthropoda

Class: Arachnida

Order: Araneae

Family: Salticidae

Genus: *Plexippus*

Species: *Plexippus paykulli*

Common name: Jumping spider

Figure 10. Actual photo of representative *Plexippus paykulli* (taxonomic classification source: World Spider Catalog, 2023, available from https://www.gbif.org/speci es/217121; original photo of the author).

Family: Sparassidae

Scientific name: Heteropoda venatoria Linnaeus, 1767

Kingdom: Animalia

Phylum: Arthropoda

Class: Arachnida

Order: Araneae

Family: Sparassidae

Genus: *Heteropoda*

Species: *Heteropoda venatoria*

Common name: Huntsman spider

Figure 11. Actual photo of representative *Heteropoda venatoria* (taxonomic classification source: World Spider Catalog, 2023, available from https://www.gbif.org/species/2161 605; original photo of the author).

Family: Tetragnathidae

Scientific name: *Tetragnatha montana* Simon, 1874

Kingdom: Animalia

Phylum: Arthropoda

Class: Arachnida

Order: Araneae

Family: Tetragnathidae

Genus: *Tetragnatha*

Species: *Tetragnatha montana*

Common name: Long jawed orb weaver

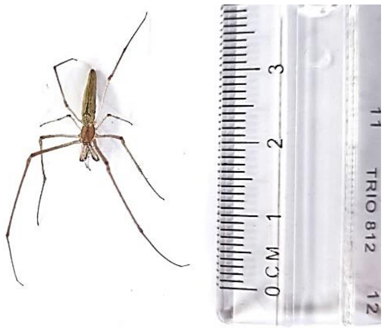

Figure 12. Actual photo of representative *Tetragnatha montana* (taxonomic classification source: World Spider Catalog, 2023, available from https://www.inaturalist.org/taxa/319829-Tetragnatha-montana; original photo of the author).

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