INNSPUB

Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 7, No. 5, p. 190-201, 2015
http://www.innspub.net

RESEARCH PAPER

OPEN ACCESS

Diversity of spiders along an elevational gradient in Mt.Pinukis, Zamboanga del Sur, Philippines

Jeda A. Lalisan[1], Aimee Lynn B. Dupo[2], Olga M. Nuňeza[1*]

[1]*Department of Biological Sciences, Mindanao State University-Iligan Institute of Technology, Philippines*

[2]*Institute of Biological Sciences, University of the Philippines Los Baňos, Laguna, Philippines*

Article published on November 30, 2015

Key words: Assemblages, Guild structure, Fauna, Orb web,Species richness.

Abstract

Spiders play vital ecological service of controlling many insect pest populations. However, there is limited information on the species richness, evenness, relative abundance, and guild structure of spiders in Mt. Pinukis, Zamboanga del Sur. Sampling was conducted for nine field days in three different elevations (low, middle, high) using beat netting, vial tapping, and pitfall trapping techniques. Ninety-nine spider species belonging to 16 families with 261 individuals were collected.*Leucauge decorata* and *Nephila pilipes*were the abundant species in the study area. Spider assemblages were analyzed using PAST software 3.0. Diversity was highest (H'=3.63) at mid-elevation and lowest (H'=3.15) at high elevation. A more or less even distribution was recorded. The spiders were found to belong to six functional groups (guilds) based on their foraging behavior in the field. The orb web was the dominant guild (59%) followed by the foliage runner (18%). Results indicate that elevation affects the abundance and species richness of spiders.The presence of 20 possibly new species in Mt. Pinukis indicatesthe need to further explore the mountain's rich spider fauna.

***Corresponding Author:** Olga M. Nuňeza ✉ olgamnuneza@yahoo.com

Introduction

Spiders belonging to the order Araneae are a special group of invertebrates that utilize a wide variety of niches (Puja, 2014)and play a vital role in the ecosystem. With a variety of sizes, shapes, eye patterns, wonderful colors, behavioral tricks and tactics (Mascord, 1980) and feeding structures they perform numerous ecological services that help in natural suppression of many insect pest population (Barrion *et al.,* 2012). Currently 39,882 species of spiders belonging to 3676 genera and 108 families have been globally described (Bhat *et al.,* 2013). However, 170,000 species of these arachnids are estimated to exist in the world, which reflect the scantiness of studies about this group (Mineo and Claro, 2005). Although the, diversity of spiders in temperate regions has been well studied, tropical areas have received relatively little investigation (Chen and Tso,2004). The Philippines is one of the tropical countries which is represented only by 517 spider species, belonging to 225 genera and 38 families (Barrion, 2001).Recent studies were reportedby Cabili and Nuňeza (2014) and Enriquez and Nuňeza (2014) on diversity of cave dwelling spiders,Garciano *et al.* (2014) on species richness of spiders in Mt. Matutumand, Dacanay *et al.* (2014) on spiders in Pulacan Falls Zamboaga del Sur. However studies on species of spiders according to elevational gradients are meager.

Elevational gradients' effects on species assemblages remain a central theme of biogeography (Willig *et al.,* 2003). They are ideally suited for examining biodiversity drivers, as elevation is correlated with several environmental variables. In general, as identified by Rahbek (1995; 1997), there are three main patterns: a monotonic decline in species richness from low to high elevation, a hump-shaped pattern with a maximum at mid-elevations, or essentially a constant from the lowlands to mid-elevations followed by a strong decline further up. Studies have been conducted on several taxa along elevation gradients that reveal that there is a large variation in diversity patterns. So for this study, Mt. Pinukis which represents one of the least studied environments, especially on arthropods deserves to be studied for better understanding of spider communities' distribution and dynamics according to elevational gradients.

The present study aims to determine species richness and relative abundance of spiders along an elevational gradient, compare habitats at different elevations through computed biodiversity indices, and determine the guild structures along an elevational gradient.

Materials and methods

Study Area

Sampling was conducted in Mt. Pinukis (7°58'31"N and 123°13'43" E) located in Brgy.Lison Valley, Municipality of Pagadian City, Philippines. With a height of 1,562 meters above sea level (masl) the mountain is considered a sacred mountain by the Subanen tribe. The Sugarloaf–Pinukis complex (IBA 109) with most lowland forest may have been degraded through logging, kaingin, farmland and human encroachment (Mallari *et al.,* 2004). The immediately adjacent Mt. Pinukis, covering more than 20,000 ha, seems to retain better forest cover and is therefore included in the Important Bird and Biodiversity Areas (IBAs).

Sampling Sites

Site 1 which is the low elevation site located at 642 masl with coordinates 7°57'44" N 123°13'54" is a flat slope with secondary vegetation type. The area is partly being used for cultivated crops. Cassava (*Manihot esculenta* Crantz), ferns, "gabi" (*Colocasia esculenta*, Schott), gmelina *(Gmelina arborea* Roxb.) and grasses were common in this area. Exposed rocks are rare. About 10 m from the site is a slow-moving stream.

Site 2 which is the mid elevation located at 858 masl with coordinates 7°58'13"N 123°14' 28"E is a mountainous slope with primary type of vegetation. Abundance of ferns, palm tree (rattan), some "santol"

(*Sandoricum koetjape* Burm.f.), banana, grasses, and sedges were observed. “Balite” (*Ficus stipulosa* Miq. Linn.) and “gabi” were also found in the area. Fallen logs and exposed rocks are rare in this site.

Site 3 which is at higher elevation with 7°61’15”N 123°16 31”E at 1050 masl is a mountainous slope with primary type of vegetation. Canopy cover decreases penetration of sunlight to the forest floor. Among the flora found in this site are rattan (*Calamus sp*.), ferns, and vines. Ferns, mosses, and orchids were the canopy epiphytes observed. Few of *Pandanussp*. and *Ficussp*. were present and even exposed rocks were found to be abundant in the site. Forest floor is covered with leaf litters and fallen logs, which are common microhabitats of ground-dwelling spiders.

Collection, Processing, and Identification of Samples

Before any sampling was done, necessary collection permits were secured in compliance to RA 9147 or the Wildlife Resource and Conservation Act. Sampling was done every morning from 900 hours to 1200 hours and in late afternoon from 1400 hours to 1800 hours. At each elevation, 2km transect line was established. Bushes, tree trunks, ferns, forest floor, foliage and grass lands were entirelyexplored for spiders and collected by a combination of opportunistic sampling, beat netting, and pitfall trap methods. Samples when captured were placed in large containers, making them easier to contain because they are highly motile. Spiders were temporarily placed in the zip-lock plastic bags for capturing live images. Specimens were then preserved in 70 % alcohol solution in glass vials labeled with date of collection in the field for later identification. All specimens were identified by the second author at the University of the Philippines Los Baňos Museum of Natural History.

Statistical Analysis

Biodiversity indices were computed using Paleontological Statistics Software Package version 3.0. These indices were determined in order to correlate the different sampling sites with collected spider species and to be able to determine if elevation affects species diversity. To translate these indices in the biological sense, the effective species number or ENS was also computed.

Results and discussion

Spiders representing 16 families, 64 genera, and 99 species were collected and identified from three sites of Mt. Pinukis during the study (Table 1). This number is very high compared to other spiders recorded in Mt. Matutum, South Cotabato (Garciano *et al.,* 2014), caves of Siargao Island (Cabili and Nuňeza, 2014), and in the caves of Mindanao (Enriquez and Nuňeza, 2014). The total spider collections formed a mixture of immatures (41.76%) and adults (58.24%) wherein 20 species are probably new to science.

Araneidae with 21 species from 10 genera and Tetragnathidae with 14 species from six genera were the dominant family (Table 2). The observation that Araneidae and Tetragnathidae are abundant is in conformity with the findings of spiders in Sri Lanka (Bambaradeniya and Edirisinghe, 2001).Araneidae and Tetragnathidae prefer locations that are highly influenced by the presence of plants and even near water systems, shaded vegetation, traces of logs, trunks or buttresses of trees and wood debris (Dacanay *et al.,* 2014).According to Barrion *et al.* (2012), Araneidae and Tetragnathidae families are mostly common on the foliage or canopy of the plant vegetation which in turn serves as anchors or stabilizing posts in building their webs.*Leucauge decorata*was the most abundantspecies comprising 13.79% of the total species collected. Most species were collected from sites 1 and 2 where areas with cultivated crops and low shrubs are present. Yadav *et al.*(2012) reported that *Leucaugedecorata*was found in low shrubs and grasses in shaded and moist environments.In the present study, spider species richness peaked at the intermediate elevation and declined at lower and higher elevations.The relationship observed is a hump-shaped which is a well-known pattern in macroecology (Lomolino,

2001) that has been documented in spiders (McCoy 1990; Chatzaki *et al.,* 2005). This may indicate that the mid-elevation provides a good habitat for several spider species. Many species from both lower and higher elevations overlap at mid-elevation, which generally offersarthropodsappropriate environment (Cardel´us *et al.,* 2006).

Table 1. Checklist of spiders collected from the three sampling sites.

Species	Site 1 642 masl	Site 2 858 masl	Site 3 1050 masl	Total	RA (%)
Araneidae (Orb weavers)					
Acusilas sp.	0	3i	0	3	1.15
Cyclosa cf. confuse (Bos et.Str, 1906)	1♀	0	0	1	0.38
Cyclosa insulana (Costa, 1834)	1♀	0	0	1	0.38
Cyclosa cf. oatesi (Thorell, 1892)	1♀	0	0	1	0.38
Cyrtophora sp.	0	1i	0	1	0.38
Cyrtophora cylindroides (Walck, 1841)	0	1♀	0	1	0.38
Eriovixia sp.	0	1i	0	1	0.38
Eriovixia laglaizei (Simon, 1877)	0	1♀	0	1	0.38
Gasteracantha diadesmia (Thorell, 1887)	2♀	2♀	0	4	1.53
Gea sp.	0	1i	0	1	0.38
Gea spinipes (C.L.Koch,1843)	0	1♀	0	1	0.38
Hypsosinga sp.	0	1i	0	1	0.38
Macracantha arcuata (Fabr., 1793)	0	5♀	3(2♀,1i)	8	3.07
Mitonia sp.A	0	0	1i	1	0.38
Mitonia sp. Rhom	0	1i	0	1	0.38
Neoscona sp.1	3(1♀,1♂,1i)	4♀	0	7	2.68
Neoscona sp.2	0	1i	0	1	0.38
Neoscona nautica (C.L.Koch, 1875)	1i	3i	0	4	1.53
Neoscona sp.nr.nautica	1i	1i	0	4	1.53
Neoscona molemensis (Tikader & Bal, 1981)	3(2♀,1i)	8(6♀,2i)	0	11	4.21
Neoscona theisi (Walckenaer, 1841)	0	1i	0	1	0.38
Clubionidae (Sac spiders)					
Cheiracanthium insulanum (Thorell, 1878)	0	2(1♀,1♂)	2(1♀,1♂)	4	1.53
Nusatidia sp.1	0	0	1♀	1	0.38
Nusatidia sp.2	0	0	1♀	1	0.38
Simalio sp.	1♀	0	0	1	0.38
Corinnidae (Antmimic spiders)					0.38
Echinax sp.1	1♂	0	0	1	0.38
Ctenidae (Wandering spiders)					0.38
Ctenidae sp.	1i	0	0	1	0.38
Ctenus sp.	0	2i	0	2	0.77
Hersiliidae (Two tailed/Tree trunk spiders)					
Hersilia sp.	1i	1i	0	2	0.77
Linyphiidae (Sheetweb weavers)					
Linyuphiid cf. Linyphia sp.	1♀	0	0	1	0.38
Neriene sp.	2(1i,1♀)	0	2(1♀,1♂)	4	1.53
Neriene macella (Thorell, 1898)	0	1♀	0	1	0.38
Plectembolus sp.	0	1♀	2♀	3	1.15
Lycosidae (Wolf spiders)					

Trochosa sp.	1♀	0	0	1	0.38
Nephilidae (Golden Silk Orb-weaver)					
Herennia gagamba (Kuntner, 2005)	0	1♀	0	1	0.38
Nephila pilipes (Fabricius, 1793)	8i	8i	10(9i,1♀)	26	9.96
Oxyopidae (Lynx spiders)					
Hamadruas sp.	0	1i	0	1	0.38
Hamataliwa incompta (Thorell,1890)	0	0	1♀	1	0.38
Oxyopes sp.	0	2i	0	2	0.77
Pisauridae (Nursery web spiders/ fishing spiders)					
Hygropoda sp.	2i	0	0	2	0.77
Salticidae (Jumping spiders)					
Bavia sp.	1i	3i	1i	5	1.92
Bavia cf.sexpunctata (Odeschall,1859)	0	0	1♀	1	0.38
Cytaea sp.1	2(1♀,1♂)	0	3(2i,1♂)	5	1.92
Emathis astorgasensis	0	1i	0	1	0.38
Microhasarius sp.1	0	1♂	0	1	0.38
Myrmarachne sp.	0	0	1i	1	0.38
Pancorius sp.1.	0	0	1♂	1	0.38
Palpelius sp.	0	3i	1i	3	1.53
Palpelius sp.A2	0	0	1♀	1	0.38
Palpelius sp.1	1♀	0	0	1	0.38
Palpelius cf. beccarii (Thorell,1881)	0	1♀	0	2	0.38
Parabathippus sp.	0	0	1i	1	0.38
Pancorius sp.1	0	1♂	0	1	0.38
Pluridentata sp.	0	0	1i	1	0.38
Pselcis latifasciatus (Simon, 1877)	1♀	0	0	1	0.38
Salticidae imm	3i	2i	0	5	1.92
Simaetha sp.1	1♀	0	0	1	0.38
Siler sp.	0	1♂	0	1	0.38
Zenodorus sp.1	0	1♀	0	1	0.38
Sparassidae (Giant Crab/Huntsman spiders)					
Pandercetes sp.	1i	1i	1i	3	1.15
Pseudopodasp.1	0	0	2(1♀,1♂)	2	0.77
Tetragnathidae (Long jawed spiders)					
Opadometa fastigata (Simon, 1877)	0	2♀	1♀	3	1.15
Leucauge decorata (Blackwall,1864)	17(15♀,1♂,1i)	18(6♀11i 1♂)	1i	0	13.79
Leucauge sp.1	3♀	4(3♀,1i)	0	7	2.68
Leucauge sp.2	7(6♀,1i)	1i	0	8	3.07
Leucauge tessellata (Thorell, 1887)	0	2♀	0	2	0.77
Mesida sp.	0	1i	0	1	0.38
Orsinome vethi (Hasselt, 1882)	1♀	0	0	1	0.38
Orsinome sp.1	1♀	0	0	1	0.38
Tetragnatha sp.1	0	1i	0	1	0.38
Tetragnatha sp.2	1♀	0	0	1	0.38
Tetragnatha nitens(Audouin, 1826)	0	1i	0	1	0.38
Tylorida sp.1	0	1i	0	1	0.38
Tylorida sp.2	0	0	2♀	2	0.77
Tylorida striata (Thorell, 1887)	2(1♀,1♂)	1♀	0	3	1.15
Theridiidae (Comb footed/Sheet line spiders)					
Achaearanea sp.	0	1♀	0	1	0.38
Anelosimus taiwanicus (Yoshida,1986)	0	1♀	0	1	0.38

Chrysso sp.1	0	1♀	0	1	0.38
Chrysso sp.2	1♀	1♀	1♂	3	1.15
Phoroncidia sp.1 nr.lygeana	3♀	0	0	3	1.15
Phoroncidia sp.2	0	2♀	0	2	0.77
Rhomphaea labiate (Zhu&Song, 1991)	0	1♂	0	1	0.38
Theridion sp.1 like *Coleosoma*	2(1♀)	0	0	2	0.77
Theridion cf. zebrinum (Zhu, 1998)	1♀	1♀	0	2	0.77
Theridion zebrinusum (Zhu, 1998)	2(1♀,1i)	1i	0	3	1.15
Theridion sp.2	0	1♀	0	1	0.38
Theridion sp.3	0	1♀	1♀	2	0.77
Thomisidae (Crab spiders)					
Cebrenninus rugosus (Simon, 1887)	0	1♂	1♂	2	0.77
Ebrechtella sp.B1	0	0	1♀	1	0.38
Ebrechtella sp.	0	0	1♀	1	0.38
Ebrechtella tricuspidata (Fabricius, 1775)	2(1♀,1i)	0	6(2♀,2♂,2i)	8	3.07
Loxobates sp.	1♂	0	0	1	0.38
Lycopus sp.	1♂	0	0	1	0.38
Lycopus rubropictus (Workman, 1896)	1♂	0	1♀	2	0.77
Massuria sp. imm	0	1i	0	1	0.38
Massuria angulata (Thorell, 1887)	1♀	0	0	1	0.38
Thomisus sp.	1i	0	0	1	0.38
Uloboridae (Safe spiders)					
Uloborus sp.	0	0	1♀	1	0.38
Philoponella sp.	0	0	1♀	1	0.38
Total no. of individuals	91	115	55	261	
Total no. of species	42	58	32	99	
Total no. of families	14	12	11	16	

Legend: ♀- Male, ♂-Female, i-immature,*-possibly new species, Site 1-Low, Site 2-Mid, Site 3-High.

The lower level elevation is disturbed due to human activities and some agricultural plantations which caused less spider species. Previous study of Whitmore *et al.*(2002) reported that increasing disturbance level lead to decreasing spider richness. While in high elevation the high rate of transpiration by plants makes the atmosphere very humid and cool.Since spiders normally have preferenceson humidity and temperature (Riechert and Gillespie, 1986)these factors limit them to areas within the range of their "physiological tolerances"and it could be the reason for low species richness in this elevation. But, enough forest canopy and litter in mid-elevation offergreater survival opportunities in the form of ecological niches than those higher and lower elevations (Ramanathan and Alagesan, 2013). This elevation is occupied by all species of spiders in fairly equal proportion, and this explains high species occurrence observed in mid-elevation.

Sixteen families were recorded to be present in the study area. The major families were Tetragnathidae (59%), Araneidae (45%) and Salticidae (29%). Analysis of guild structurerevealed six feeding guilds (Quasin and Uniyal, 2011). These are the (1)orb web weavers-Araneidae, Nephilidae,Tetragnathidae, Uloboridae; (2)ground runners-Corinnidae, Ctenidae, Lycosidae, Sparassidae; (3) foliage runner-Clubionidae, Hersiliidae, Oxyopidae, Salticidae; (4)sheet web builder- Linyphiidae, (5) ambushers-Pisauridae, Thomisidae and (6) scattered line weavers- Theridiidae(Fig. 1).Results showed that spider guilds vary abundantly. Comparison of guild structure can provide understanding into the effects of disturbances and habitat modificationon biodiversity of spiders (Stork, 1987). Sites 1 and 2 were dominated by the orb web builders representing 59% of the total collection. The same observation was obtained on spider fauna of Pulacan falls, Zamboanga del Sur (Dacanay *et al.,* 2014). Occurrence of high number of orb web spiders might be due to forest vegetationthat provides sufficient space for building webs of different sizes. Araneidae and Tetragnathidae favor habitats near water, in shaded vegetation, or buttresses of trees or logs, or trunks (Ward, 2007). Foliage runners formed the next dominant guild (18%) in sites 1 and 2 and the dominant guild in site 3. The foliage running and web building spiders depend on vegetation for some part of their lives, either for food searching, constructing retreats or for building of web (Sudhikumar *et al.,* 2005). Thus, vegetation structure is likely to influence the spider diversity found in the habitat. Ground runners (4%) and sheet web builders (3%) were found less common in the study area. These groups favor disturbed habitats that are subjected to mowing, plowing, harvesting, and high turnover of crop types (Schochat *et al.,* 2004).

Table 2. Spider families recorded from the study area.

Family	Site 1 642 masl	Site 2 858 masl	Site 3 1050 masl	No. of Individuals	RA (%)	Species	GUILD
Araneidae	13	36	3	52	44.83	21	Orb web weavers
Clubionidae	1	2	4	7	6.034	4	Foliage runner
Corinnidae	1	0	0	1	0.862	1	Ground runner
Ctenidae	1	2	0	3	2.586	2	Ground runner
Hersiliidae	1	1	0	2	0.179	1	Foliage runner
Linyphiidae	3	2	4	9	7.759	4	Sheet web builder
Lycosidae	1	0	0	1	0.862	1	Ground runner
Nephilidae	8	9	6	23	19.83	2	Orb web weavers
Oxyopidae	0	3	1	4	3.448	3	Foliage runner
Pisauridae	2	0	0	2	1.724	1	Ambushers
Salticidae	9	14	11	34	29.31	19	Foliage runner
Sparassidae	1	1	3	5	4.31	2	Ground runner
Tetragnathidae	32	32	4	68	58.62	14	Orb web weavers
Theridiidae	9	11	2	22	18.97	12	Scattered line weaver
Thomisidae	7	2	10	19	16.38	10	Ambushers
Uloboridae	0	0	2	2	1.724	2	Orb web weavers

Considering the significance of spiders in controlling several insect pests and as bio indicators, serious efforts are required to understand their diversity (Umarani and Umamaheswari,2013). The diversity and evenness indices were calculated for the collected spiders (Table 3). A more or less even distribution of spiders was recorded in all the sites. Species diversity increases as individuals become more evenly distributed (Price, 1975). The effective species numbers for the collection sites are arranged as follows: Site 3(23) > Site 1 (27) > Site 2 (38). Site 2 had the highest number of equally-common species. This means that Site 2 had the highest spider diversity.

The less count of spider species in site 1 (642 masl) may be due to the close disturbance or threat since humans and other animals have more direct exposure to the area and nearby agricultural system. Site 2(858masl) had the most abundant spiders with 115 individuals and the most diverse with 58 species belonging to 12 families. Diversity normally increases when a greater variety of habitat types are present (Reid and Miller, 1989) and the physical structure and species composition of vegetation define diversity of species and abundance through habitat availability

(Malumbres-Olarte *et al.*,2013). This indicates that Site 2 vegetation type is favorable to spiders and may have more diverse flora than other sites. Site 3 with 1050 masl has the lowest diversity. It may be possible that site 3 with higher elevation resource gets limited and only the tolerant species are able to handle with the changes (Malumbres-Olarte *et al.*,2013).

Table 3. Biodiversity indices of the three sampling sites.

Indices	Site 1 642 masl	Site 2 858 masl	Site 3 1050 masl
Species	42	58	32
Shannon	3.31	3.626	3.147
ENS	27	38	23
Simpson	0.938	0.953	0.934
Evenness	0.652	0.6474	0.7273

Since altitude is associated with factors such as humidity, temperature, and distinctive plant growth (Koponen, 1991), it is expected that spider populations would similarly fluctuate as increases or decreases in these variables became more intense.As was observed from the results (Fig. 2) altitude, habitat type, temperature and relative humidity play asignificantpart in composition and distribution of spider families. Salticidae, Clubionidae, Sparassidae and Nephilidae were notably affected by elevation. However,relative humidity and air temperatureaffected the distribution of Theridiidae, Tetragnathidae, Hersiliidae and Corinnidae. Since temperature affects the growth, development, and activity of arthropods (Hodkinson, 2005). The rest of the eight families were not affected by environmental factors because some families like Lycosidae are more tolerant and overcome harsh conditions (Quasin and Uniyal, 2011). Araneidae and Thomisidae are, after Linyphiidae, the two most numerous families of ballooning spiders (Dean and Sterling, 1985). They are both species with broad environmental tolerance but with great dependence on the physical structure of the environment because of their life histories.

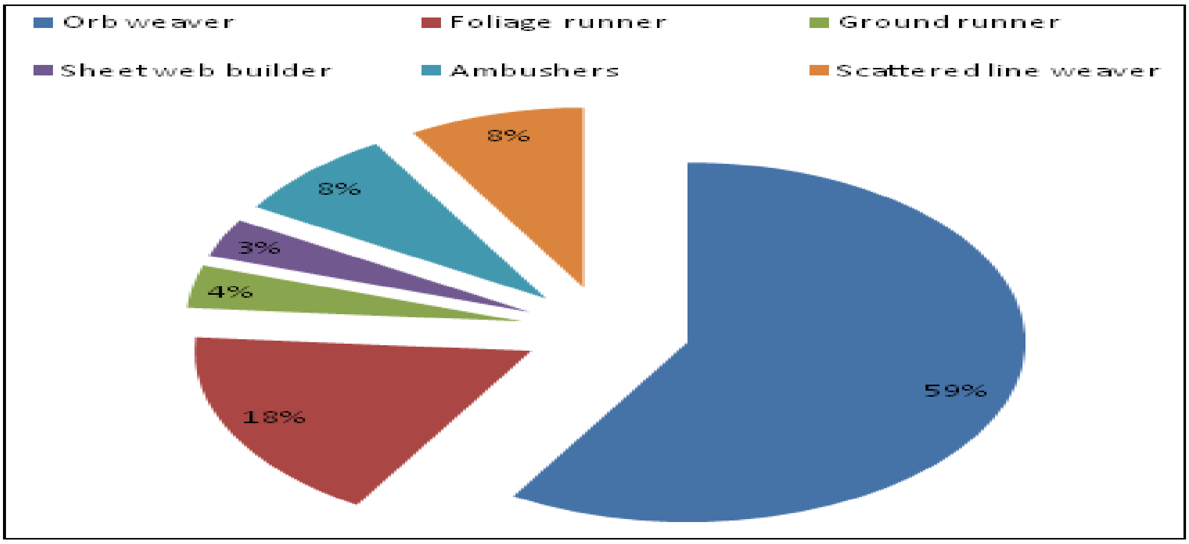

Fig. 1. Percentage distribution of the different spider guilds at Mt. Pinukis.

Fig. 3 shows the linear bivariate model of the three sites using Paleontological Statistics Software Package. It showed that species diversity decreased as elevation increased. Linear correlation coefficient, denoted "r" measures the strength of a linear relationship between the paired values. If r is positive but close to zero, there is a weak positive linear correlation. With r value of 0.3813 and p value of

0.7509, it showed that species richness was negatively correlated with the elevation of sampling sites for spiders and also showed that the decrease in diversity with elevation is insignificant in this study. Same findings were observed that diversity has a negative correlation with elevation in the Nanda Biosphere Reserve in India species Quasin and Uniyal (2011) and that elevation is significantly and, negatively correlated with species richness of spiders (Grill *et al.,* 2005).

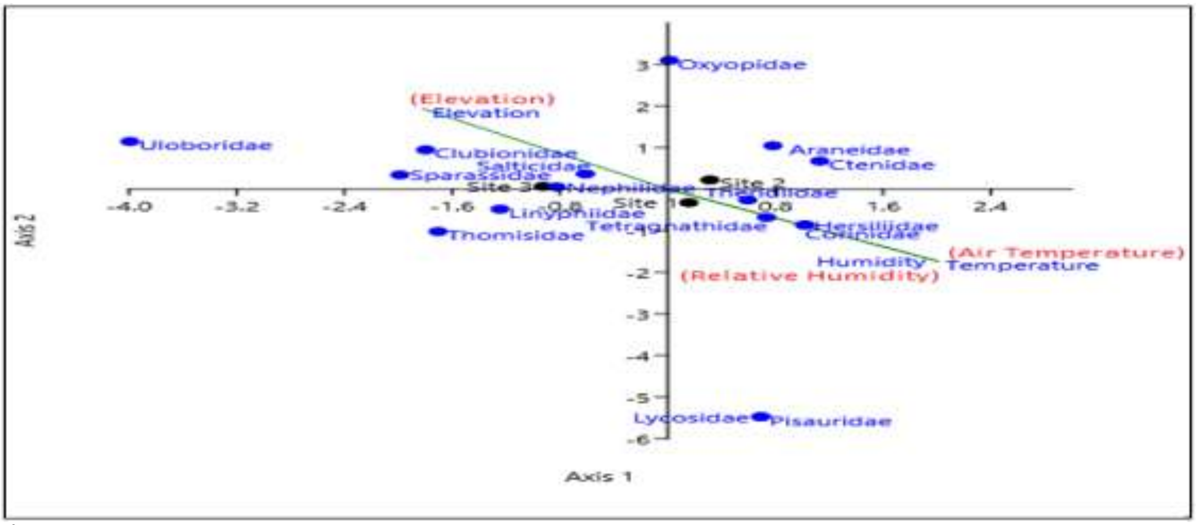

Fig. 2. Canonical Correspondence Analysis (CCA) showing relationship between spider families assemblages and environmental variables.

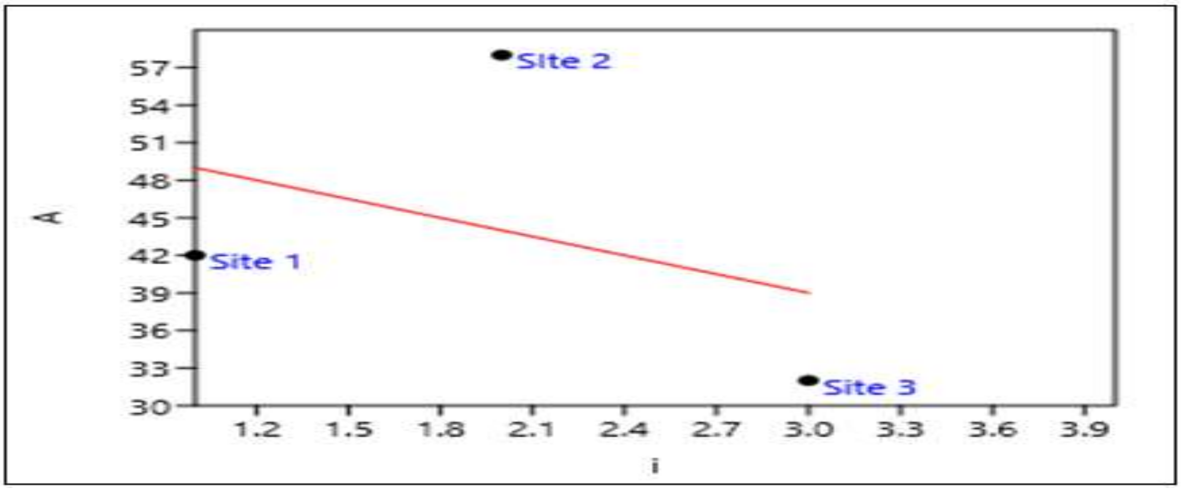

Fig. 3. The trend of decreasing species diversity (red line) with respect to the elevation of the 5 sites (Site 1 = 600, Site 2 = 800, Site 3 = 1050masl).

Conclusion

From the present study, distinct variations in the diversity of spiders at threedifferent elevations were recorded. Species richness and diversity peak at mid-level elevations which indicate that vegetation type in this site is favourable to spiders and have more diverse flora than other sites.*Leucauge decorata* and *Nephila pilipes*were the most abundant species recorded which belong to the large group of web builders.Analysis of guild structure revealed six feeding guilds and dominated by the orb web builders. Mt. Pinukis with 20 possibly new species is a species-rich area. These observations further warrant the need to do additional studies on the seasonal distribution and ecology of spiders in the area.

Acknowledgment

We acknowledge the DOST-SEI (ASTHRDP) for the research funding, the National Research Council of the Philippines for the budget in making processing and identification of the spiders possible, and the DENR Region IX for the gratuitous permit.

References

Bambaradeniya CNB, Edirisinghe JP. 2001. The ecological role of spiders in rice fields of Sri Lanka. Biodiversity **2(4),** 3-10.

Barrion AT. 2001. Spiders: natural biological control agents against insect pests in Philippine rice fields. Transactions of the National Academy Science and Technology, Philippines **23**, 121-130.

Barrion AT, Villareal SS, Catindig JLA, Cai D, Yuan QH, Heong KL. 2012. The spider fauna in the rice agricultural landscape of Hainan Island, China: Composition, abundance and feeding structure. Asia Life Sciences **21(2),** 625-651.

Bhat PS, Srikumar KK, Raviprasad TN. 2013. Seasonal Diversity and Status of Spiders (Arachnida: Araneae) in Cashew Ecosystem. World Applied Sciences Journal **22(6),** 763-770.

CabiliMHD, Nuñeza OM. 2014. Species Diversity of cave-dwelling spiders on Siargao Island, Philippines.International Journal of Plant, Animal and Environmental Sciences **4(2),** 392-399.

Cardel´us CL, Colwell RK, Watkins JE. 2006. Vascular epiphyte distribution patterns: explaining the mid elevation richness peak. Journal of Ecology **94(1),** 144-156.

Chatzaki M, Lymberakis P, Markakis G, Mylonas M. 2005. The distribution of ground spiders (Araneae, Gnaphosidae) along the altitudinal gradient of Crete, Greece: species richness, activity and altitudinal range. Journal of Biogeography **32,** 813-831.

Chen KC, Tso IM. 2004. Spider Diversity on Orchid Island, Taiwan: A Comparison between Habitats Receiving Different Degrees of Human Disturbance. Zoological Studies **43(3),** 598-611.

Dacanay CC, Barrion-Dupo AL, Nuñeza OM. 2014. Rapid assessment of spider fauna of Pulacan falls, Zamboanga Del Sur, Philippines. Journal of Biodiversity and Environmental Sciences **5(1),** 455-464.

Dean DA, Sterling WL. 1985. Size and phenology of ballooning spiders in two locations in Eastern Texas. Journal of Arachnology **13,** 111-120.

Enriquez CMD, Nuñeza OM. 2014. Cave spiders in Mindanao, Philippines. Extreme Life, Biospeology & Astrobiology International Journal of the Bioflux Society **6(1)**, 46-55.

Garciano DN, Nuñeza OM, Barrion-Dupo AL. 2014. Species richness of spiders in Mt. Matutum, South Cotabato, Philippines. Journal of Biodiversity and Environmental Sciences **4(6),** 214-224

Grill A, Knoflach B, Cleary DFR, Kati V. 2005. Butterfly, spider, and plant communities in different land-use types in Sardinia, Italy. Biodiversity and Conservation **14,** 1281-1300.

Hodkinson ID. 2005. Terrestrial insects along elevation gradients: species and community responses to altitude. Biological Review **80(3),** 489-513.

Koponen S. 1991. On the biogeography and faunistics of European spiders: latitude, altitude and insularity. European society of Arachnology **16,** 2-6.

Lomolino MV. 2001. Elevation gradients of species-density: historical and prospective views. Global Ecology and Biogeography **10**, 3-13.

Mallari NAD, Crosby MJ, Collar NJ. 2004.

Unexplored Philippine forests as revealed by point-locality mapping. Forktail **20,** 124–128.

Malumbres-Olarte J, Vink CJ, Ross JG, Cruickshank RH, Paterson AM. 2013. The Role of Habitat Complexity on Spider Communities in Native Alpine Grasslands of New Zealand. Insect Conservation and Diversity **6,** 124–134.

Mascord R. 1980. Australian Spiders in Color. Tokyo, Japan: Charles E. Tuttle Co., Ruthland, p.1-112.

McCoy ED. 1990. The distribution of insects along elevationalgradients. Oikos **58,** 313-322.

Mineo MF, Claro KD. 2005. Diversity of Tropical Spiders-Ground dwelling species of Brazilian Savannas. Tropical Diversity and Conservation Management **11,** 1-4.

Price PW. 1975. Insect Ecology. John Wiley & Sons, New York, p. 514.

Puja K. 2014. Diversity of Spiders fauna from Sarangpuri Lake, Arvi, Vidarbha Region.International Journal of Life Sciences **2(2),** 165-167.

Quasin S, Uniyal VP. 2011. Spider diversity along altitudinal gradient and associated changes in microclimate attributes in Nansa Devi Biosphere Reserve, Uttarakhand, India. ENVIS Bulletin: Arthropods and their Conservation in India (Insects & Spiders) **14(1),** 219 – 232.

Rahbek C. 1995. The elevation gradient of species richness: A uniform pattern?. Ecography **18(2),** 200-205.

Rahbek C. 1997. The relationship among area, elevation and regional species richness in neotropical birds. American Naturalist **149,** 875-902.

Ramanathan B, Alagesan P. 2013. Diversity of Millipedes in Alagar Hills Reserve Forest in Tamil Nadu, India. International Journal of Biodiversity **2013,** 1-5

Riechert SE, Gillespie RG. 1986. Habitat choice and utilization in the web spinners. In:Shear WA, Ed. Spiders-Webs, Behavior, and Evolution. Stanford University Press, Stanford, p. 23- 48.

Reid WV, Miller KR. 1989. Keeping options alive: Thescientific basis for conserving biodiversity. Washington D.C., World Resources Institute.

Schochat E, Stefanov WL, Whitehouse MEA, Faeth SH. 2004. Urbanization and Spider Diversity: Influences of Human Modification of Habitat Structure and Productivity. Ecological Applications **14(1),** 268-280.

Stork NE. 1987. Guild structure of arthropods from Bornean rain forest trees. Ecological Entomology **12,** 69-80.

Sudhikumar AV, Mathew MJ, Sunish E, Murugesan S, Sebastian PA. 2005. Preliminary studies on the spider fauna in Mannavan shola forest, Kerala, India (Araneae). Acta zoologica bulgarica **1,** 319-327.

Umarani S, Umamaheswari S. 2013. Diversity of spider fauna at different sites in Palani Hills Dindigul District, Tamil, Nadu, South India. International Journal of Advance Biological Research **3(4),** 535-539.

Ward L. 2007. Habitat Specificity of Selected Spiders of Dominica. Texas A&M University, Study Abroad Dominica Program, 1-16 p.

Whitmore C, Slotow R, Crouch TE, Dippenaar-Schoeman AS. 2002. Diversity of spiders (Araneae) in a savanna reserve, Northern Province, South Africa. Journal of Arachnology **30(2),** 344-356.

Willig MR, Kaufman DM, Stevens RD. 2003. Latitudinal gradients of biodiversity: Pattern, process, scale, and synthesis. Annual Review of Ecology, Evolution, and Systematics **34,** 273–309.

Yadav A, Chaubey SN, Beg MA. 2012. Morphology, prey preference, and feeding capacity of decorative spider, *Leucauge decorata* (Blackwall) from Azamgarh, India. Journal of Applie.