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Influence of habitat type and climatic variables on spider assemblages in rainforest and derived Savannah regions of Southwestern Nigeria

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Abstract

Spiders are important ecological indicators and natural predators that play vital roles in terrestrial ecosystems. This study assessed the abundance, diversity, and distribution of spider species across two ecological zones—rainforest and derived savannah—in Ogun State, southwestern Nigeria. Sampling was conducted using systematic random sampling across various habitats: grassland, fallow bush, agro-ecosystem, and residential areas within Ogun State, Nigeria. A total of 60m × 120m plots were demarcated in each habitat, and spiders were collected using three standard techniques: hand picking, sweep netting, and pitfall trapping. Specimens were preserved in 70% ethanol and identified to family and species levels using established taxonomic keys and reference manuals. Results showed that spider species composition was relatively similar across habitats, but species abundance varied significantly. Families such as Lycosidae, Araneidae, and Salticidae were the most dominant across both zones, while families like Hersiliidae, Amblypygi, and Sparassidae were the least represented. Hogna spp., Pardosa injucunda, Hippasa spp., and Ocyale neatalanta exhibited high abundance, particularly in the rainforest zone. Climatic factors influenced spider activity, with a statistically significant positive correlation between species abundance and temperature ($p < 0.01$), and a weak, negative, non-significant correlation with rainfall. Seasonal analysis further revealed that spider abundance, particularly of the family Lycosidae, was higher in both wet and dry seasons, with notable declines in other families during the dry season. Despite ecological and climatic differences, the similarity in spider abundance between the two zones was relatively high (80.5%). However, residential habitats showed distinct patterns, with little similarity to other habitat types. The study concludes that habitat complexity, prey availability, and climatic factors are major determinants of spider distribution and abundance. These findings underscore the need for ongoing biodiversity monitoring and the conservation of habitat heterogeneity to sustain arthropod diversity in tropical landscapes.

1.0 Introduction

Weather refers to the short-term atmospheric conditions experienced at a specific location on the Earth's surface, encompassing daily variations in parameters such as temperature, precipitation, humidity, and wind patterns (Newman, 2010). It is inherently dynamic, fluctuating across days, seasons, and geographic locations (Redd, 2016). In contrast, climate represents the long-term average of weather conditions observed over extended periods, often spanning several decades. Climatic variables commonly analyzed include temperature, rainfall, humidity, wind speed, sunshine duration, and evaporation rates (Zang *et al*., 2017).

Over recent decades, the global climate has undergone noticeable alterations, a phenomenon broadly referred to as climate change. These shifts have far-reaching implications for biodiversity and ecological stability. Specifically, climate change has the potential to influence the distribution, abundance, reproductive patterns, and survival rates of animal populations, thereby altering population dynamics in ways that are often unpredictable and complex (Knape and Valpine, 2010). As climatic patterns become increasingly erratic, many species—especially those with limited adaptive capacity—face heightened ecological stress.

Wildlife, traditionally defined as non-domesticated animal species inhabiting various ecosystems, now broadly encompasses all flora and fauna that thrive in natural habitats without direct human interference (Harris and Brown, 2009). Wildlife resources include a wide range of organisms, such as terrestrial animals, birds, and aquatic species, all of which contribute significantly to ecological balance and offer both consumptive and non-consumptive benefits to humans (Career Guide, 2019). These resources are integral not only to biodiversity but also to ecosystem services that support human livelihoods and environmental resilience.

Biodiversity, the variety of life across all levels of biological organization, plays a crucial role in enhancing ecosystem resilience. According to the National Wildlife Fund (NWF, 2015), ecosystems with high species diversity are better equipped to absorb environmental disturbances such as floods and wildfires. For instance, the extinction of a single reptile species in a biodiverse forest—home to multiple other reptilian species—would likely cause less ecological disruption than in a less diverse system. Similarly, Shah (2014) emphasized that robust ecosystems with healthy biodiversity are more capable of withstanding and recovering from a range of natural disasters.

Despite the growing awareness of the impacts of climate variability on various wildlife species, there remains a notable gap in literature concerning the influence of climatic variables on invertebrates, particularly spiders. Spiders play a vital ecological role as both predators and prey in many terrestrial ecosystems, contributing to pest control and maintaining trophic balance. However, studies exploring the correlation between spider abundance and climatic fluctuations are limited, especially within the Nigerian context.

To address this knowledge gap, the present study aims to investigate the relationship between climatic disturbances and spider abundance in two distinct ecological zones—the rainforest and derived savanna regions—of Ogun State in southwestern Nigeria. By analyzing key climatic variables alongside observed spider populations, this research seeks to enhance understanding of how climate variability may influence the distribution and ecological patterns of spiders across different biogeographic settings.

2. 0 Materials and Methods

2.1 Study Area

This study was conducted within two distinct ecological zones of Ogun State, located in the southwestern region of Nigeria—namely, the rainforest and derived savanna zones. The rainforest site encompassed areas within the Olabisi Onabanjo University (OOU) main campus in Ago-Iwoye, situated between latitudes 3°54′N and 3°55′N and longitudes 6°55′E and 6°56′E. In contrast, the derived savanna site was centered on the OOU College of Agricultural Sciences (CAS), Ayetoro Campus, located at latitude 7°23′N and longitude 3°04′E.

Sampling locations within each ecological zone were selected using a systematic random sampling technique based on the odd-number method as described by Salkind (2012). In the rainforest zone, the specific sites included the OOU main campus, Abobi, and Legumo—all within Ago-Iwoye—and five surrounding villages in Ijebu-North Local Government Area: Mamu, Aba Paanu, Oke Arowa, Laagan, and Okenugbo. For the derived savanna zone, the sampling points comprised the CAS Ayetoro campus and five neighboring locations: Idagba, Igbo Aje, Isa-Ope, Idi-Ori, and Arun (Figure 1).

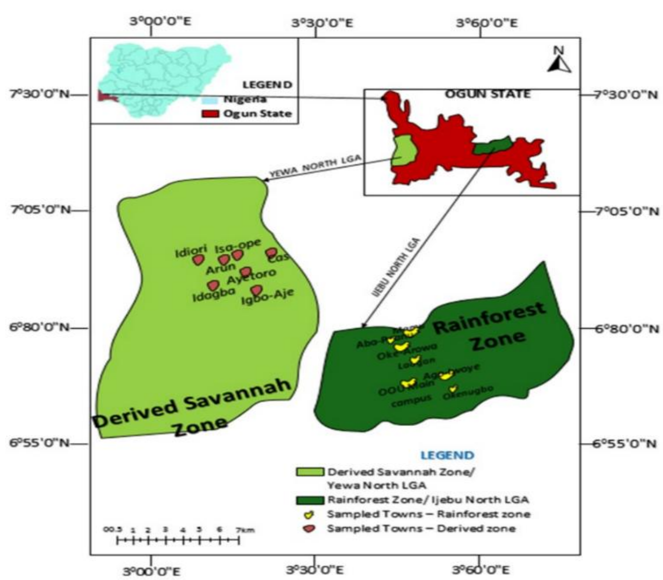

Figure 1: Map of study sites in rainforest and derived savanna zones of Ogun State.

2.2 Sampling Design and Collection Techniques

At each selected site, a standardized land area measuring 60 meters by 120 meters was demarcated for sampling. Spider collection was carried out using three complementary methods widely employed in arachnological research to ensure representative sampling across habitat strata:

1. Hand Picking – Individual spiders were manually collected from visible surfaces such as vegetation, leaf litter, and ground surfaces, following the technique outlined by Tikader (1987).
2. Sweep Netting – A sweep net was employed to capture spiders from grasses, shrubs, and low-lying vegetation, as recommended by Upamanyu (2009).
3. Pitfall Trapping – Ground-dwelling spiders were sampled using pitfall traps, which consist of buried containers left open to trap surface-active arthropods, following the protocol of Churchill and Arthur (1999).

All specimens were counted using a digital counter to ensure accuracy. Immediately after collection, spiders were preserved in 70% ethyl alcohol in well-labeled containers, which included detailed information such as locality, habitat type, and date of collection. The specimens were kept in this solution for a period of five days for proper fixation, as per the guidelines of Tikader (1987). Safety precautions were strictly adhered to during fieldwork, including the use of hand gloves to prevent bites or stings from potentially venomous species.

2.3 Laboratory Identification and Classification

Collected spider specimens were sorted based on their observable morphological features. Immature individuals were classified to the family level, whereas adult specimens were identified to species level. Identification was conducted using two primary resources: *African Spiders: An Identification Manual* and the *World Spider Catalog* (Version 14.0, 2013). Taxonomic verification and identification were completed at the Laboratory of the Department of Zoology, Olabisi Onabanjo University, Ago-Iwoye, in collaboration with Dr. Tony Russell-Smith of the Spider Research Society Laboratory in Kent, England.

2.4 Data Analysis

To assess spider diversity and species composition across the different ecological zones, several statistical and ecological indices were employed:

i. Species Diversity was evaluated using the Simpson Diversity Index (Simpson, 1949), which measures the probability that two individuals randomly selected from a sample belong to the same species.
ii. Species Richness was calculated using the non-parametric Chao-1 estimator, which is effective in predicting total species richness including undetected rare species. This was computed using PAST software, version 2.17c (Hammer et al., 2001).
iii. Comparative Analysis of Species Richness across the vegetation zones and sampled habitats was performed using One-Way Analysis of Variance (ANOVA).
iv. All statistical analyses were conducted using the Statistical Package for Social Sciences (SPSS), version 20.0 (IBM Corp, 2011).
v. Additionally, biodiversity indices were calculated using ComEcoPac software, version 1.0 (Drozd, 2010), to provide a comprehensive view of community ecology and species distribution.

This multi-method approach ensured a robust and systematic evaluation of the relationship between ecological conditions and spider diversity in southwestern Nigeria.

3.0 Results and Discussions

The abundance and distribution of spider species across the two ecological zones—rainforest and derived savannah—are presented in Table 1 and 2 respectively. Overall, *Hogna* species emerged as the most dominant taxon in both locations, demonstrating their adaptability across varied habitats. In the rainforest zone, species such as *Pardosa injucunda*, *Hippasa* spp., and *Ocyale neatalanta* exhibited relatively high population densities, indicating their favorable response to the microclimatic and vegetative conditions of the region. Similarly, in the derived savannah, notable species with high abundance included *Pardosa injucunda*, *Foveosa infuscata*, and *Hippasa lamtoensis*, suggesting a species-specific preference or tolerance to the ecological characteristics of the savannah biome.

When comparing the residential areas of both zones, a relatively consistent pattern of spider abundance was observed. In particular, *Plexippus paykulli* (Rainforest: 858 individuals; Derived Savannah: 512 individuals), *Selenops annulatus* (Rainforest: 709; Derived Savannah: 341), and *Menemerus bivittatus* (Rainforest: 438; Derived Savannah: 322) were among the most commonly encountered species, indicating a wide distribution and possible synanthropic tendencies—thriving in areas closely associated with human habitation. Habitat-specific abundance within the rainforest ecosystem revealed that *Hogna* species, *Hippasa* spp., *Ocyale neatalanta*, and *Pardosa injucunda* were most prevalent in grassland habitats, pointing to the open-canopy and herbaceous vegetation as favorable microhabitats. Meanwhile, the fallow bush habitats supported larger populations of *Hogna* spp., *Pardosa injucunda*, *Gasteracantha curvispina*, *Gasteracantha sanguinolenta*, and *Cyrtophora citricola*, suggesting a preference for less disturbed, regenerating vegetation.

In agro-ecosystems within the rainforest zone, a different assemblage pattern emerged, with high representation from *Hogna* spp., *Pardosa injucunda*, *Cyrtophora citricola*, *Neoscona penicilipes*, and *Isoxya semiflava*. These species appeared to be well-adapted to agricultural landscapes, possibly benefiting from habitat complexity, edge effects, or prey availability. In the derived savannah, *Hogna* spp. and *Hippasa lamtoensis* dominated the grassland habitats, consistent with their open-habitat preference. In fallow bush areas, species such as *Hogna* spp., *Cyrtophora citricola*, *Isoxya semiflava*, and *Pardosa injucunda* recorded high abundance, reflecting similarities with the rainforest zone in terms of species-habitat relationships. Conversely, agro-ecosystem habitats in the derived savannah were chiefly inhabited by *Hogna* spp., *Pardosa injucunda*, and *Ocyale pilosa*, indicating their ability to exploit disturbed and cultivated landscapes. These findings highlight the influence of both ecological zone and habitat type on spider species composition and abundance, with certain species displaying broad ecological plasticity, while others exhibit more habitat-specific patterns of occurrence.

Table 1: Species abundance of spiders in the rainforest ecological zone of Ogun State, Nigeria

Family	Species	GRLA		FABU		AGEC		RES	
		AB	%	AB	%	AB	%	AB	%
Amblypygi	Damos species	0	0	0	0	0	0	43	1.5
Araneidae	Acrosomoides linnaei	11	0.1	29	0.4	37	0.4	0	0
	Aetrocantha falkensteini	41	0.5	2	0	15	0.2	0	0
	Afracantha camerunensis	0	0	0	0	27	0.3	0	0
	Araneidae indet	64	0.8	0	0	39	0.5	0	0
	Araneus apricorum	15	0.2	0	0	120	1.4	0	0
	Araneus species	0	0	0	0	0	0	0	0
	Argiope flavipalpis	4	0.1	33	0.5	6	0.1	0	0
	Argiope species	1	0	0	0	0	0	0	0
	Cyclosa species	22	0.3	14	0.2	78	0.9	0	0
	Cyrtophora citricola	272	3.5	487	7.5	497	5.9	0	0
	Gansteracanthinae	1	0	0	0	0	0	0	0
	Gasteracantha curvispina	162	2.1	576	8.9	327	3.9	0	0
	Gasteracantha sanguinolenta	102	1.3	498	7.7	143	1.7	0	0
	Gasteracantha species	84	1.1	55	0.8	87	1	0	0
	Gasteracanthinae indet	0	0	0	0	0	0	0	0
	Isoxya semiflava	43	0.6	0	0	326	3.9	0	0
	Isoxya testudinaria	143	1.9	33	0.5	249	3	0	0
	Lycosidae neatalanta	0	0	0	0	0	0	0	0
	Neoscona moreli	0	0	85	1.3	185	2.2	0	0
	Neoscona penicilipes	77	1	237	3.7	380	4.5	0	0
	Neoscona rapta	1	0	13	0.2	80	0.9	0	0
	Neoscona species	53	0.7	38	0.6	242	2.9	0	0
	Neoscona triangular	28	0.4	37	0.6	114	1.4	0	0
	Neoscona vigilans	0	0	14	0.2	88	1	0	0
Hersiliidae	Hersiliidae indet	17	0.2	0	0	14	0.2	0	0
	Hersilia savignyi	0	0	2	0	76	0.9	0	0
	Hersilia species	0	0	0	0	1	0	0	0
Lycosidae	Foveosa infuscate	129	1.7	126	1.9	213	2.5	0	0
	Hippasa lamtoensis	211	2.7	109	1.7	309	3.7	0	0
	Hippasa species	699	9.1	74	1.1	290	3.4	0	0
	Hogna species	3514	46	2189	34	1969	23.4	0	0
	Immature	253	3.3	0	0	0	0	0	0
	Ocyale neatalanta	535	6.9	302	4.7	199	2.4	0	0
	Ocyale pilosa	191	2.5	0	0	0	0	0	0
	Ocyale species	157	2	0	0	65	0.8	0	0
	Pardosa injucunda	316	4.1	886	14	539	6.4	0	0
	Pardosa species	155	2	0	0	0	0	0	0
Miturgidae	Cheiracanthium aculeatum	65	0.8	39	0.6	101	1.2	0	0
	Cheiracanthium afracanum	0	0	1	0	84	1	0	0
	Miturgidae indet	0	0	0	0	0	0	0	0
Nephilidae	Nephila species	0	0	11	0.2	69	0.8	0	0
	Nephilengys cruentata	0	0	23	0.4	48	0.6	0	0
Opiliones	Opiliones species	0	0	77	1.2	230	2.7	0	0
Oxyopidae	Hamataliwa species	0	0	5	0.1	26	0.3	0	0
	Oxyopes elongates	0	0	10	0.2	0	0	0	0
	Oxyopes species	31	0.4	21	0.3	92	1.1	0	0
	Peucetia longipes	0	0	60	0.9	107	1.3	0	0
	Peucetia species	2	0	0	0	0	0	0	0
Pholcidae	Pholcidae indet	0	0	0	0	0	0	238	8.5
	Pholcus species	0	0	0	0	0	0	62	2.2
	Pholcidae species	0	0	0	0	0	0	355	12.6
Pisauridae	Perenethis species	0	0	0	0	18	0.2	0	0
	Pisaura species	0	0	3	0	0	0	0	0
	Pisuaridae indet	0	0	15	0.2	0	0	0	0
Salticidae	Evarcha dotata	0	0	20	0.3	80	0.9	0	0
	Evarcha species	0	0	0	0	0	0	0	0
	Menemerus bivittatus	0	0	0	0	0	0	438	15.6
	Menemerus species	0	0	0	0	0	0	90	3.2

	Natta horizontalis	0	0	31	0.5	7	0.1	0	0
	Plexippus paykulli	0	0	0	0	0	0	858	30.6
	Plexippus species	0	0	0	0	0	0	14	0.5
	Thiratoscirtus mirabilis	0	0	0	0	12	0.1	0	0
	Thyene bucculenta	0	0	89	1.4	154	1.8	0	0
	Thyene coccineovittata	0	0	0	0	47	0.6	0	0
	Thyene inflate	57	0.7	0	0	217	2.6	0	0
	Thyene species	67	0.9	0	0	8	0.1	0	0
Selenopidae	Selenops annulatus	0	0	0	0	0	0	709	25.3
Sparassidae	Rhitumna species	0	0	25	0.4	36	0.4	0	0
Tetragnathidae	Leucauge decorate	0	0	34	0.5	19	0.2	0	0
	Leucauge species	1	0	0	0	20	0.2	0	0
Thomisidae	Runcinia depressa	0	0	40	0.6	197	2.3	0	0
	Runcinia species	0	0	0	0	0	0	0	0
	Synema species	41	0.5	36	0.6	71	0.8	0	0
	Thomisidae indet	43	0.6	66	1	3	0	0	0
	Thomisus spinulosus	67	0.9	21	0.3	46	0.5	0	0
	Thomisus species	34	0.4	25	0.4	21	0.2	0	0

NB: GRLA: Grass land; FABU: Fallow bush; AGEC: Agro-ecosystem; RES: Residential

Table 2: Species abundance of spiders in the derived savannah ecological zone of Ogun State, Nigeria

Family	Species	GRLA		FABU		AGEC		RES	
		Abundance	%	Abundance	%	Abundance	%	Abundance	%
Amblypygi	Damos species	0	0	0	0	0	0	28	2
Araneidae	Acrosomoides linnaei	0	0	22	0.4	0	0	0	0
	Aetrocantha falkensteini	0	0	34	0.6	24	0.4	0	0
	Afracantha camerunensis	1	0.1	18	0.3	0	0	0	0
	Araneidae indet	19	1	57	1	60	0.9	0	0
	Araneus apricorum	0	0	82	1.5	105	1.7	0	0
	Araneus species	0	0	0	0	12	0.2	0	0
	Argiope flavipalpis	8	0.4	102	1.8	49	0.8	0	0
	Argiope species	55	2.8	9	0.2	0	0	0	0
	Cyclosa species	0	0	0	0	41	0.6	0	0
	Cyrtophora citricola	18	0.9	327	5.9	237	3.7	0	0
	Gansteracanthinae	0	0	0	0	0	0	0	0
	Gasteracantha curvispina	96	4.9	15	0.3	149	2.4	0	0
	Gasteracantha sanguinolenta	15	0.8	196	3.5	102	1.6	0	0
	Gasteracantha species	10	0.5	41	0.7	91	1.4	0	0
	Gasteracanthinae indet	0	0	1	0	75	1.2	0	0
	Isoxya semiflava	0	0	322	5.8	316	5	0	0
	Isoxya testudinaria	11	0.6	127	2.3	108	1.7	0	0
	Lycosidae neatalanta	0	0	12	0.2	0	0	0	0
	Neoscona moreli	0	0	10	0.2	0	0	0	0
	Neoscona penicilipes	0	0	73	1.3	105	1.7	0	0
	Neoscona rapta	0	0	51	0.9	138	2.2	0	0
	Neoscona species	3	0.2	27	0.5	110	1.7	0	0

	Neoscona triangular	42	2.1	0	0	119	1.9	0	0
	Neoscona vigilans	0	0	0	0	21	0.3	0	0
Hersiliidae	Hersiliidae indet	0	0	0	0	3	0	0	0
	Hersilia savignyi	0	0	0	0	0	0	0	0
	Hersilia species	0	0	0	0	0	0	0	0
Lycosidae	Foveosa infuscate	0	0	513	9.3	266	4.2	0	0
	Hippasa lamtoensis	250	13	126	2.3	297	4.7	0	0
	Hippasa species	0	0	88	1.6	93	1.5	0	0
	Hogna species	1052	54	###	41	1258	20	0	0
	Immature	0	0	0	0	0	0	0	0
	Ocyale neatalanta	0	0	0	0	172	2.7	14	1
	Ocyale pilosa	110	5.6	0	0	369	5.8	0	0
	Ocyale species	76	3.9	21	0.4	12	0.2	0	0
	Pardosa injucunda	84	4.3	318	5.7	1114	18	0	0
	Pardosa species	0	0	0	0	0	0	0	0
Miturgidae	Cheiracanthium aculeatum	0	0	4	0.1	0	0	0	0
	Cheiracanthium afracanum	0	0	0	0	8	0.1	0	0
	Miturgidae indet	0	0	2	0	0	0	0	0
Nephilidae	Nephila species	0	0	0	0	138	2.2	0	0
	Nephilengys cruenta	0	0	0	0	162	2.6	0	0
Opiliones	Opiliones species	0	0	64	1.2	0	0	0	0
Oxyopidae	Hamataliwa species	2	0.1	0	0	4	0.1	0	0
	Oxyopes elongates	0	0	22	0.4	7	0.1	0	0
	Oxyopes species	4	0.2	16	0.3	64	1	0	0
	Peucetia longipes	0	0	0	0	19	0.3	0	0
	Peucetia species	0	0	0	0	0	0	0	0
Pholcidae	Pholcidae indet	0	0	0	0	0	0	280	17
	Pholcus species	0	0	0	0	0	0	189	11
	Pholcidae species	0	0	0	0	0	0	0	0
Pisauridae	Perenethis species	0	0	4	0.1	2	0	0	0
	Pisaura species	4	0.2	0	0	0	0	0	0
	Pisuaridae indet	4	0.2	25	0.5	2	0	0	0
Salticidae	Evarcha dotata	0	0	0	0	0	0	0	0
	Evarcha species	0	0	21	0.4	0	0	0	0
	Menemerus bivittatus	0	0	0	0	0	0	322	19

	Menemerus species	0	0	0	0	0	0	0	0
	Natta horizontalis	0	0	0	0	119	1.9	0	0
	Plexippus paykulli	0	0	0	0	0	0	512	30
	Plexippus species	0	0	0	0	0	0	12	0
	Thiratoscirtus mirabilis	0	0	11	0.2	38	0.6	0	0
	Thyene bucculenta	0	0	13	0.2	0	0	0	0
	Thyene coccineovittata	0	0	0	0	22	0.3	0	0
	Thyene inflate	14	0.7	172	3.1	76	1.2	0	0
	Thyene species	0	0	37	0.7	85	1.3	0	0
Selenopidae	Selenops annulatus	0	0	0	0	0	0	341	20
Sparassidae	Rhitumna species	0	0	0	0	34	0.5	0	0
Tetragnathidae	Leucauge decorate	7	0.4	18	0.3	0	0	0	0
	Leucauge species	1	0.1	35	0.6	1	0	0	0
Thomisidae	Runcinia depressa	13	0.7	8	0.1	0	0	0	0
	Runcinia species	0	0	0	0	17	0.3	0	0
	Synema species	10	0.5	68	1.2	38	0.6	0	0
	Thomisidae indet	0	0	0	0	6	0.1	0	0
	Thomisus spinulosus	26	1.3	117	2.1	34	0.5	0	0
	Thomisus species	32	1.6	26	0.5	0	0	0	0

NB: GRLA: Grass land; FABU: Fallow bush; AGEC: Agro-ecosystem; RES: Residential

Table 3: Jaccard's similarity index of spider abundance in the different study locations

	RGL	RFB	RAE	RRD	DGL	DFB	DAE	DRD	RF	DS
RGL	1	0.44	0.56	0	0.47	0.55	0.56	0.02	0.49	0.55
RFB		1	0.71	0	0.4	0.48	0.55	0.02	0.59	0.61
RAE			1	0	0.4	0.6	0.69	0.02	0.7	0.75
RRD				1	0	0	0	0.7	0.1	0.13
DGL					1	0.49	0.4	0	0.4	0.38
DFB						1	0.5	0	0.63	0.52
DAE							1	0.02	0.69	0.59
DRD								1	0.12	0.11
RF									1	0.81
DS										1

NB: GL (Grassland), FB (Fallow bush), AE (Agro-ecosystem) & RD (Residential habitats)

3.2 Similarity in Spider Abundance between the Rainforest and Derived Savannah Regions

Comparative analysis of spider species abundance across the different habitat types within the two ecological zones revealed a high degree of similarity. Overall, there was an 80.5% similarity in spider abundance between the rainforest and derived savannah regions, indicating that both ecosystems support a broadly overlapping assemblage of spider species despite differences in vegetation structure and microclimatic conditions (Table 3).

Within the rainforest zone, a closer examination showed that fallow bush and agro-ecosystem habitats exhibited the strongest similarity in species abundance patterns, with a similarity index of 71.4%, suggesting shared habitat features such as vegetative cover, prey availability, and moderate disturbance levels. In contrast, grassland habitats within the rainforest region showed less similarity to both the fallow bush and agro-ecosystem in terms of spider abundance, indicating differing ecological conditions or structural habitat differences that may influence species composition.

Importantly, residential areas in the rainforest zone exhibited no significant similarity in species abundance with the grassland, fallow bush, or agro-ecosystem habitats. This lack of similarity suggests that residential environments may host a distinct assemblage of spiders, potentially influenced by anthropogenic factors such as buildings, reduced vegetation cover, and altered microclimates.

A similar pattern was observed in the derived savannah region, where residential areas again showed no measurable similarity in spider abundance with the other habitat types—grassland, fallow bush, and agro-ecosystem. However, the non-residential habitats within the derived savannah were more closely aligned, showing moderate similarities ranging from 39.6% to 50.0%. This trend implies that natural and semi-natural habitats within the derived savannah share more structural and ecological attributes than residential zones, which may explain their overlapping species compositions.

These findings underscore the influence of habitat type on spider assemblages and highlight that human-dominated landscapes tend to support distinct species communities compared to more natural or semi-natural environments.

3.3 Mean Species Abundance of Spiders in the Study Areas

Analysis of the mean abundance of spider species across the various habitat types—grassland, fallow bush, agro-ecosystem, and residential areas—in both ecological zones revealed no statistically significant differences (p > 0.05). This suggests a relatively uniform distribution of spiders among the habitat categories within each region, despite variations in vegetation structure, land use, and human disturbance levels. Furthermore, when the overall mean abundance of spider species was compared between the rainforest and derived savannah zones, no significant difference was detected (p > 0.05) (Table 4). This indicates that the two ecological regions supported comparable levels of spider population densities, despite inherent differences in their climatic conditions and vegetative compositions.

These findings imply that, while species composition and individual species abundance may vary between habitats and zones, the overall spider population is resilient and widely distributed across diverse ecological landscapes. The lack of significant variation may also suggest that spiders in these areas are generalist species capable of exploiting a range of environmental conditions, or that microhabitat conditions across the zones are sufficiently similar to support similar population sizes.

Table 4: Mean species abundance of spider abundance in the study areas

Ecological zones	Locations	Mean Species Abundance
Rainforest	Grassland	197.67±90.31a
	Fallow bush	150.95±55.90a
	Agro-ecosystem	159.02±38.89a
	Residential	311.89±102.19a
Derived savannah	Grassland	72.85±39.01a
	Fallow bush	128.88±53.97a
	Agro-ecosystem	134.51±35.21a
	Residential	212.25±65.05a
Rainforest		358.24±111.95a
Derived savannah		228.37±71.46a

[a]Mean species abundance (±Standard error) having similar superscript in the same column were not significantly different (P > 0.05; Duncan Multiple Range Test).

3.4 Relationship between Spider Abundance and Climatic Variables

The Pearson correlation analysis conducted to evaluate the relationship between climatic variables (temperature and rainfall), spider species diversity, and species abundance is presented in Table 5. A significant positive correlation was observed between temperature and spider species abundance ($R = 0.095$, $p < 0.01$). This indicates that an increase in ambient temperature corresponded with higher levels of spider activity and abundance. The findings suggest that spiders are more active and tend to thrive under warmer conditions, which may enhance prey availability and metabolic efficiency, thereby increasing their detectability during sampling.

In contrast, the correlation between rainfall and spider species abundance was negative and statistically non-significant ($R = -0.062$, $p > 0.05$). This suggests that higher levels of precipitation may not favor increased spider activity or abundance. Possible explanations include direct mortality due to heavy rains, displacement from webs, or behavioral adaptations such as retreat into shelters, which reduce their visibility and accessibility during field surveys.

Similarly, the relationship between species diversity and temperature ($R = -0.003$, $p > 0.05$) and between species diversity and rainfall ($R = -0.025$, $p > 0.05$) were both weak, negative, and statistically non-significant. These results imply that neither temperature nor rainfall had a meaningful effect on the diversity of spider species across the study sites. It is plausible that other environmental or ecological factors—such as vegetation structure, habitat complexity, or prey diversity—play a more dominant role in shaping spider diversity patterns than the measured climatic parameters.

Lastly, a weak and non-significant positive correlation was found between species abundance and diversity ($R = 0.023$, $p > 0.05$), indicating that variations in the number of individuals recorded did not strongly correspond to variations in the number of different species observed. This decoupling between abundance and diversity may reflect the dominance of a few highly abundant species in some habitats, overshadowing the presence of rarer taxa.

These findings highlight the nuanced ways in which climatic variables interact with ecological parameters to influence spider communities, and underscore the importance of temperature as a key environmental driver of spider activity in tropical ecosystems.

Table 5: Relationship between abundance, temperature, rainfall, and species diversity

	Abundance	Temperature	Rainfall	Diversity
Abundance	1	0.095**	-0.06	0.023
Temperature		1	-0.592**	-0
Rainfall			1	-0.03
Diversity				1

3.5 Seasonal Distribution of Spider Families across Collection Periods

The seasonal distribution of spider families collected across the two major climatic seasons—wet and dry are presented in Table 6 and 7 respectively. Likewise, the seasonal abundance and distribution of spiders across different location were illustrated with figures 2 – 5. The results revealed marked variations in the abundance of individual spider families between the seasons. Notably, the family Lycosidae was the most dominant group in both seasons, with a slightly higher number of individuals recorded during the dry season (6,645) compared to the wet season (6,516). This consistency in high abundance across seasons underscores the ecological resilience and adaptability of Lycosidae species to seasonal environmental changes.

Following Lycosidae, the Araneidae family recorded the second highest number of individuals, with 2,242 specimens collected during the wet season and 2,016 during the dry season. This suggests that Araneidae, like Lycosidae, is relatively stable across climatic fluctuations, although slightly more prevalent during periods of higher humidity.

Conversely, Amblypygi exhibited the lowest seasonal abundance, particularly during the later collection periods, with notably sparse representation in the dry season. This reduced visibility may be attributed to their cryptic habits, preference for moist microhabitats, or lower reproductive activity during drier conditions.

Interestingly, no individuals belonging to the Hersilidae and Sparassidae families were recorded during the dry season, indicating a possible strong seasonal dependency for these groups, which may be more active or detectable during the wetter months. Opiliones were found to occur in both the wet and dry seasons during the first two rounds of sampling, although in limited numbers, highlighting their relatively even but low-level distribution throughout the study period. Overall, the findings indicate a clear pattern of seasonal variability in family-level spider abundance, with some taxa, such as Lycosidae and Araneidae, displaying broad ecological tolerance, while others, like Hersilidae and Sparassidae, appear to be more sensitive to seasonal changes, particularly to the drier conditions.

Table 6: Wet season collection of spiders by families

Family	RGL	DGL	RFB	DFB	RAE	DAE	RRD	DRD	Total
Amblypygi	0	0	0	0	0	0	0	0	0
Araneidae	359	235	831	623	639	1007	0	0	3694
Hersiliidae	17	0	0	0	10	5	0	0	32
Lycosidae	2046	474	969	805	472	835	0	0	5601
Miturgidae	0	0	5	0	0	2	0	0	7
Nephilidae	0	0	22	0	4	241	0	0	267
Opiliones	0	0	0	0	0	0	0	0	0
Oxyopidae	33	2	52	19	78	45	0	0	229
Pholcidae	0	0	0	0	0	0	44	66	110
Pisauridae	0	0	12	0	2	2	0	0	16
Salticidae	121	0	15	124	90	118	453	95	1016
Selenopidae	0	0	0	0	0	0	216	136	352
Sparassidae	0	0	7	0	7	28	0	0	42
Tetragnathidae	100	0	0	22	0	0	0	0	122
Thomisidae	74	2	41	141	94	32	0	0	384
Total	2750	713	1954	1734	1396	2315	713	297	11872

NB: **RGL:** Rainforest grassland; **DGL**: Derived savannah grassland; **RFB**: Rainforest Fallowbush; **DFB**: Derived savannah Fallowbush; **RAE**: Rainforest agro-ecosystem; **DAE**: Derived savannah Agroecosyetm; **RRD**: Rainforest Residential; **DRD**: Derived savannah Residential

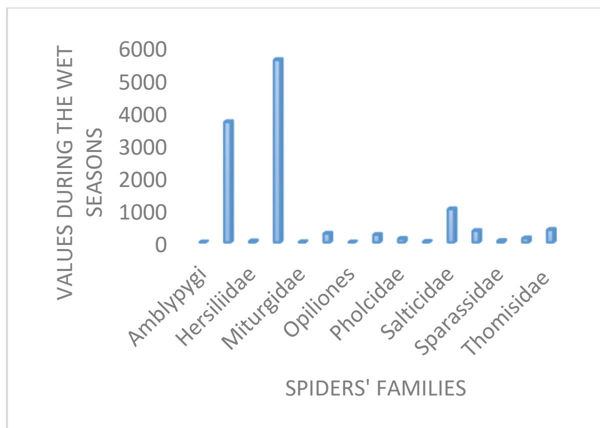

Figure 2: Wet season abundance of spiders' families in Ogun State

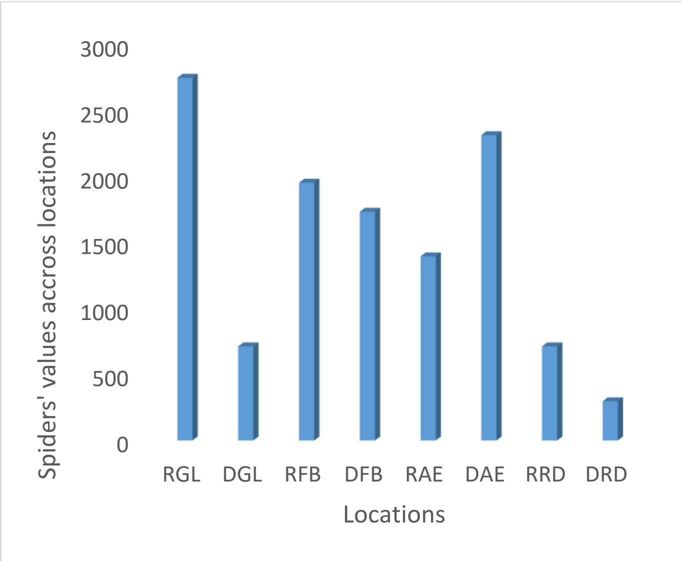

Figure 3: Wet season distribution of spiders in different location of Ogun State

NB: **RGL:** Rainforest grassland; **DGL**: Derived savannah grassland; **RFB**: Rainforest Fallowbush; **DFB**: Derived savannah Fallowbush; **RAE**: Rainforest agro-ecosystem; **DAE**: Derived savannah Agroecosyetm; **RRD**: Rainforest Residential; **DRD**: Derived savannah Residential

Table 7: Dry season collection of spiders by families

Family	RGL	DGL	RFB	DFB	RAE	DAE	RRD	DRD	Total
Amblypygi	0	0	0	0	0	0	0	10	10
Araneidae	202	26	278	300	943	235	0	0	1984
Hersiliidae	0	0	0	0	0	0	0	0	0
Lycosidae	610	79	391	755	722	559	0	0	3116
Miturgidae	12	0	0	38	0	19	0	0	69
Nephilidae	0	0	0	19	0	81	0	0	100
Opiliones	0	0	0	0	0	0	0	0	0
Oxyopidae	0	0	8	3	62	37	0	0	110
Pholcidae	0	0	0	0	0	0	65	32	97
Pisauridae	0	0	4	0	7	0	0	0	11
Salticidae	0	0	0	0	65	50	210	143	468
Selenopidae	0	0	0	0	0	0	119	62	181
Sparassidae	0	0	0	0	0	0	0	0	0
Tetragnathidae	0	0	0	0	32	0	0	0	32
Thomisidae	4	1	0	7	115	32	0	0	159
Total	828	106	681	1122	1946	1013	394	247	6337

NB: **RGL:** Rainforest grassland; **DGL**: Derived savannah grassland; **RFB**: Rainforest Fallowbush; **DFB**: Derived savannah Fallowbush; **RAE**: Rainforest agro-ecosystem; **DAE**: Derived savannah Agroecosyetm; **RRD**: Rainforest Residential; **DRD**: Derived savannah Residential

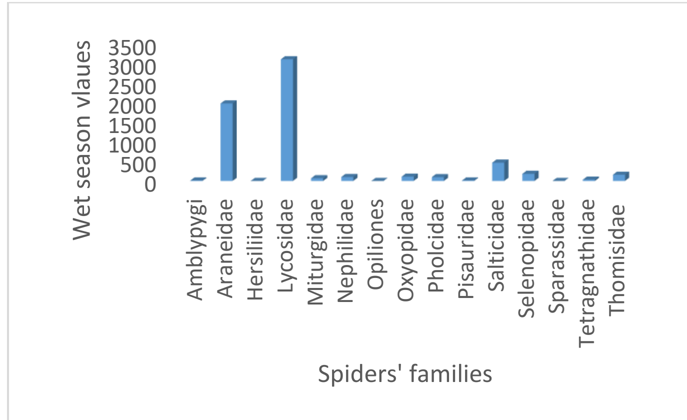

Figure 4: Dry season abundance of spiders' families in Ogun State

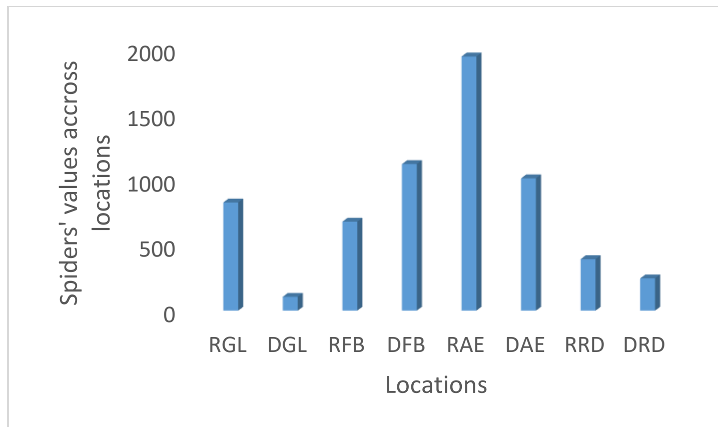

Figure 5: Dry season distribution of spiders in different location of Ogun State

NB: **RGL:** Rainforest grassland; **DGL**: Derived savannah grassland; **RFB**: Rainforest Fallowbush; **DFB**: Derived savannah Fallowbush; **RAE**: Rainforest agro-ecosystem; **DAE**: Derived savannah Agroecosyetm; **RRD**: Rainforest Residential; **DRD**: Derived savannah Residential

4.0 Discussion

The distribution and abundance of spider species across the various habitats surveyed in southwestern Nigeria revealed minimal differences in species presence, indicating a relatively uniform species composition across habitat types. However, variations in species abundance were evident, both at the family and species levels. Among the dominant families encountered, Araneidae, Salticidae, Lycosidae, Oxyopidae, and Thomisidae were consistently the most abundant and widely distributed across all sampling locations. In contrast, families such as Hersiliidae, Amblypygi, Miturgidae, Nephilidae, Opiliones, Pisauridae, Selenopidae, Sparassidae, and Tetragnathidae were less frequently encountered, with lower abundance across both ecological zones.

Within the Araneidae family, *Cyrtophora* emerged as the most dominant genus in the rainforest sites, closely followed by *Gasteracantha*. Both genera were widely distributed across multiple rainforest habitats. In the derived savannah, however, *Isoxya* exhibited the highest abundance, followed by *Cyrtophora*. These observed differences in distribution and abundance may be attributed to the structural complexity of vegetation in the respective zones. The rainforest's multilayered canopy and dense understory provide a diverse range of microhabitats suitable for web-building and prey capture, likely supporting higher spider densities. This observation aligns with the findings of Uetz (1991), who asserted that structurally complex habitats, such as shrub-dense forests, tend to support more diverse spider communities.

Among the Lycosidae, *Hogna* species showed the highest abundance in both ecological zones, followed by *Pardosa injucunda*. These species were recorded in all habitat types except residential areas, indicating a strong preference for less disturbed, vegetated environments. Interestingly, *Ocyale neatalanta* was the only species observed in every habitat type, including residential zones, suggesting a high level of ecological tolerance and adaptability. The overall abundance of these species is closely linked to prey availability, as spiders are obligate predators. An increase in insect density often leads to a corresponding rise in spider populations, as noted by Henschell and Lubin (1997), who emphasized that prey availability remains a primary factor influencing spider abundance.

Environmental conditions, particularly temperature and rainfall, were found to significantly influence spider abundance. The positive and statistically significant correlation between temperature and spider abundance suggests that warmer conditions enhance spider activity and reproduction. During periods of elevated temperature, spiders tend to be more active in foraging, web construction, and mating, leading to higher capture rates. This pattern supports the findings of Kato et al. (1995), who noted that seasonal climatic variations have a direct impact on arthropod abundance, including spiders.

Conversely, a negative and non-significant correlation was found between rainfall and both species abundance and richness. This implies that heavy precipitation may have a detrimental effect on spider populations, particularly in more exposed environments. Torrential rains can destroy webs, drown immature spiders, and drive adults into hiding beneath leaves, rocks, or soil crevices. In some cases, even adult spiders may succumb to prolonged exposure to intense rainfall. These adverse effects were more pronounced in the derived savannah, where the absence of a dense canopy exposes the ground-level fauna to direct rainfall. In contrast, the rainforest, with its multilayered canopy structure, provides natural shelter that mitigates the destructive impact of rain, offering spiders protection and contributing to their relatively higher abundance and survival. This finding is consistent with Pragya et al. (2015), who reported a decrease in insect populations following increased rainfall in their study area in India.

The abundance and distribution patterns of spiders in the study area are governed by a complex interplay of habitat structure, prey availability, and climatic variables. Rainforest habitats, due to their structural complexity and protective canopy, support higher spider diversity and abundance. The derived savannah, while still hosting a wide range of species, appears more vulnerable to environmental stressors such as rainfall. These findings underscore the importance of habitat heterogeneity and climatic stability in maintaining spider biodiversity and population resilience in tropical ecosystems.

5.0 Conclusion

This study provides valuable insights into the abundance, distribution, and ecological dynamics of spider species across rainforest and derived savannah ecosystems in southwestern Nigeria. The findings reveal that while spider species composition remains relatively consistent across different habitat types, their abundance varies significantly depending on environmental conditions, habitat structure, and ecological interactions. Families such as Lycosidae, Araneidae, and Salticidae emerged as the most dominant across all habitats, indicating their adaptability and ecological significance within these ecosystems. Species like *Hogna* spp., *Pardosa injucunda*, and *Ocyale neatalanta* were particularly abundant and widespread, suggesting their potential as bioindicators of habitat quality. The presence of certain spider species in both natural and human-modified habitats, including residential areas, underscores the resilience of some taxa and highlights the complex ecological roles spiders play in diverse environments.

Environmental factors, especially temperature and rainfall, were shown to influence spider abundance significantly. The positive correlation between temperature and spider activity affirms the role of favorable thermal conditions in enhancing arthropod survival and reproduction. In contrast, the negative effects of heavy rainfall—particularly in more exposed savannah habitats—emphasize the vulnerability of spider populations to extreme weather events and the importance of habitat features such as canopy cover in buffering these impacts. Moreover, habitat similarities and differences in species abundance patterns across the two ecological zones reflect the intricate relationships between vegetation structure, microclimatic conditions, and species ecology. The rainforest, with its structural complexity and higher humidity, supports more stable and diverse spider communities, while the derived savannah presents a more fluctuating environment that limits spider distribution and survival during unfavorable seasons. Overall, this research highlights the ecological importance of spiders as both predators and indicators of environmental health. It reinforces the need for habitat conservation, particularly in transitional zones such as the derived savannah, which are increasingly threatened by anthropogenic activities. Continued monitoring and biodiversity assessments of spider communities will be essential in understanding broader ecological responses to climate change and land-use alterations in tropical ecosystems.

Declaration of Competing Interest

The authors declare that they have no known competing interests.

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Declaration of conflict of interest

The authors have collectively contributed to the conceptualization, design, and execution of this journal. They have worked on drafting and critically revising the article to include significant intellectual content. This manuscript has not been previously submitted or reviewed by any other journal or publishing platform. Additionally, the authors do not have any affiliation with any organization that has a direct or indirect financial stake in the subject matter discussed in this manuscript.