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Spider Diversity (Arachnida: Araneae) in Suhelwa Wildlife Sanctuary's Different Ecosystems, Terai Region, Uttar Pradesh, India

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ABSTRACT

Spiders are essential parts of all ecosystems in which they exist, and they're recognized to be good markers of the diversity and health of terrestrial populations. However, the Suhelwa Wildlife Sanctuary's spiders are poorly documented, with hardly any information on their systematics, diversity, or ecology. The current study aims to look into the spider faunal richness in a few habitats in the Suhelwa Wildlife Sanctuary in Uttar Pradesh, India. The chosen environments yielded a total of 65 species, divided into 46 genera and 20 families. The maximum species richness was found at Razia Taal (Site C), while the lowest was found at Hathiakunda Naala (Site D). The spiders were divided into seven functional categories based on their guild structure: stalkers, orb-web builders, ambushers, space-web builders, ground runners, foliage runners, and sheet-web builders. Finally, the highest species richness is linked to the flora and fauna of these locations. The findings of this study provide useful and up-to-date information on the diversity of species found in the Suhelwa Wildlife Sanctuary, and the data may be used for future spider research.

Key words: *Spiders, Suhelwa, Forest Habitat; Species richness, Ecosystem*

Introduction

In most ecosystems, arachnids are an important but understudied category of arthropods that play a key role in the management of insect and other invertebrate populations (Russell-Smith, 1999). Spiders are the most diverse and abundant invertebrate predators in terrestrial ecosystems (Wise, 1993). As an ideal biocontrol agent, spiders show tolerance and sometimes even resistance against pesticides in the agricultural field. For some time, spiders were considered important predators which help to regulate the population densities of insect pests (Pickett *et al.,* 1946; Dondale, 1956; Kajak *et al.,* 1968; Fox and Dondale, 1972, Tanaka 1989). Currently, there are approximately 50,000 known species of spider's worldwide belonging to 120 families (World Spider Catalog, 2020). The vast majority of spiders are predatory; however, some species are known to supplement their diet with plant material, including nectar and pollen (Meehan *et al*., 2009; Peterson *et al*., 2016; Taylor and Bradley, 2009). As generalist predators, spiders play an integral role within a wide variety of ecosystems. They inhabit every continent except Antarctica and can be found in some of the most extreme environments on Earth including alpine areas reaching altitudes above 4000 meters (Schmoller, 1970), the high Arctic (Ernst *et al*., 2016; Sikes *et al.,* 2013), the Southern Ocean Islands near Antarctica (Pugh, 2004), within freshwater (Seymour and Hetz, 2011; Bleckmann and Lotz, 1987), as well as the salt flats and deserts of the

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southwestern U.S. (Crews and Gillespie, 2014; Kay *et al*., 1970). Spiders are prolific predators of other forest arthropods, therefore their ecological value is evident despite their small size (Scharff *et al*., 2003). With just 2.4 percent of the world's surface area, India is one of the world's mega diversity countries, home to 7-8 percent of all documented species, with over 45,000 plant species and 91,000 animal species (Pande and Arora, 2014). There are 1686 species of spiders in India, divided into 438 genera and 60 families (Keswani *et al*., 2013). Spiders are an essential, if understudied, type of arthropod that play a vital role in the control of other invertebrate populations in most habitats (Russell-Smith, 1999). Spiders have received little attention from the conservation community, despite their demonstrated ecological relevance in many habitats, enormous diversity, and dangers (Sebastian *et al*., 2005). Conservation of spider variation requires an understanding of regional diversity trends as part of conservation planning projects (Uniyal and Shrivastava, 2012). Spiders are one of the most abundant and diverse species of organisms found in Uttar Pradesh, yet little study has been done on them. The goal of this research is to examine into the spider diversity of a few sites in Uttar Pradesh's Suhelwa Wildlife Sanctuary.

Study Area

Suhelwa is a wildlife sanctuary located in Balrampur, Gonda and Sravasti districts of the state of Uttar Pradesh in India. It covers an area of 452 square kilometers. During this study, the Khairmaan reservoir, Rampur bandha, Razia taal and Pipra range of Suhelwa are the habitats selected for field visit.

Materials and Methods

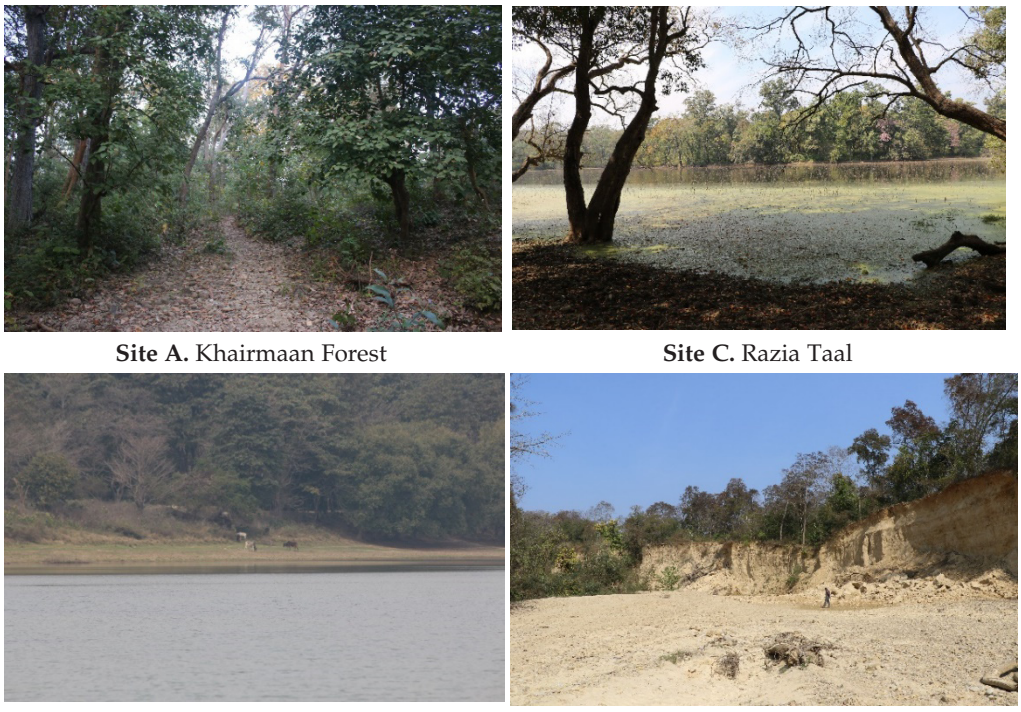
The current research focused at the variety of spiders in the Suhelwa Wildlife Sanctuary's various environments. The study took place between March 2022 and July 2022.

Collection

During the study period, spiders were collected from four different habitats at Suhelwa Wildlife Sanctuary. Samples were collected using the visual search method, Kerchief method and inverted umbrella method.

Preservation

The specimens were preserved in 75% ethyl alcohol



Site A. Khairmaan Forest **Site C.** Razia Taal

Site B. Rampur Bandha **Site D.** Hathiakunda Naala

Fig. 1. Study Area

in glass specimen tubes with water-tight stoppers.

Identification

The specimens were identified with the help of experts in spider taxonomy and taxonomic keys of spiders (Tikader, 1987; Murphy and Murphy, 2000; Dippenaar, 2002).

Guild Classification

Guild classification was used to classify ecological traits such as foraging behaviour, web structure, prey type, microhabitat utilisation, and daily activity. The spider guild classification was created based on the families that were gathered during the research. The ecological characteristic of the family was used to determine the spider guild. (Young and Edwards, 1990; Cardoso *et al*., 2011)

Results

The present study focused on the spider diversity of four different habitats of the Suhelwa Wildlife Sanctuary, Uttar Pradesh, India. A total of 65 species belonging to 46 genera under 20 families were recorded from the selected habitats. Salticidae was the dominant family constituting 15 species under 10 genera, followed by Araneidae (9 species), Lycosidae (6 species), Tetragnathidae (5 species), Sparassidae (4 species), Oxyopidae (3 species), Thomisidae (3 species), Theridiidae (3 species), Nephilidae (3 species), Pisauridae (2 species), Uloboridae (2 species), Hersiliidae (2 species), Corrinnidae (1 species), Eutichuridae (1 species), , Linyphiidae (1 species), Clubionidae (1 species), Ctenidae (1 species), Mimetidae (1 species), Pholcidae (1 species) and Theraphosidae (1 species).

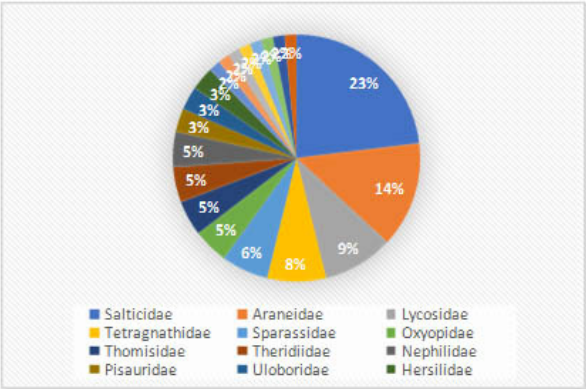


Fig. 2. Species distribution in different families found in Suhelwa Wildlife Sanctuary, Uttar Pradesh.

Highest species richness was recorded at Razia Taal (Site C) with 30 species belonging to 10 families. Khairmaan Forest (Site A) exhibited the second highest species richness with 15 species belonging to 8 families. Rampur Bandha (Site B) depicted third highest level of species richness with 12 species belonging to 5 families. About 8 species belonging to 3 families were recorded from Hathiakunda (Site D). So, in the present investigation, the highest species richness was observed at Khairmaan Forest as compared to other habitats.

Table 1. Systematic list of recorded spiders from ecosystems

Family	Species	Guild
Araneidae	*Arachnuraangura*	Orb Web Builders
	Araneus sp. 1	Orb Web Builders
	Argiope anasiya	Orb Web Builders
	Argiope pulchella	Orb Web Builders
	Argiope sp. 1	Orb Web Builders
	Cyrtophoracicatrosa	Orb Web Builders
	Neoscona adianta	Orb Web Builders
	Neoscona bengalensis	Orb Web Builders
	Neoscona mukerjei	Orb Web Builders
Clubionidae	*Clubiona sp. 1*	Foliage Runners
Corinnidae	*Castianeirazetes*	Ground Runners
Ctenidae	*Ctenuscochinensis*	Ground Runners
Eutichuridae	*Cheiraeanthium-melanostomum*	Foliage Runners
Hersilidae	*Hersiliasriata*	Foliage Runners
	Hersilia sp. 1	Foliage Runners
Lycosidae	*Hippasaagelenoides*	Ground Runners
	Hippasa sp. 1	Ground Runners
	Lycosa tista	Ground Runners
	Lycosa sp. 1	Ground Runners
	Lycosa sp. 2	Ground Runners
	Pardosamysorensis	Ground Runners
Lyniphidae	*Lyniphia sp. 1*	Sheet Web Builders
Mimetidae	*Mimetus sp. 1*	Ambushers
Nephilidae	*Herenniamultipuncta*	Orb Web Builder
	Hamadruas sp. 1	Stalkers
	Hamadruas sp. 2	Stalkers
Oxyopidae	*Oxyopesjavanus*	Stalkers
	Oxyopessunandae	Stalkers
	Oxyopes sp. 1	Stalkers
Pholsidae	*Pholcus sp. 1*	Space Web Builder
Pisauridae	*Perenthis venusta*	Ambushers
	Pisaura sp. 1	Ambushers
Salticidae	*Asemoneatenuipes*	Stalkers
	Carrhotus viduus	Stalkers
	Epeusflavobilineatus	Stalkers
	Epeus indicus	Stalkers
	Epeus sp. 1	Stalkers
	Hasarius adansoni	Stalkers
	Myrmarachnecornuta	Stalkers
	Myrmarachnemaxillosa	Stalkers
	Myrmarachne sp. 1	Stalkers
	Myrmarachne sp. 2	Stalkers

	Plexipuspetersi	Stalkers
	Rhenedanieli	Stalkers
	Menemerus bivittatus	Stalkers
	Phintellavittata	Stalkers
	Salticid sp. 1	Stalkers
Sparassidae	*Heteropodavenatoria*	Ambushers
	Olios sp. 1	Ambushers
	Sparassid sp. 1	Ambushers
	Sparassid sp. 2	Ambushers
Tetragnathidae	*Leucaugedecorata*	Orb Web Builders
	Leucaugetessellata	Orb Web Builders
	Tetragnathamandibullata	Orb Web Builders
	Tetragnatha sp. 1	Orb Web Builders
	Tyloridaventralis	Orb Web Builders
Theraphosidae	*Theraphosid sp. 1*	Ambushers
Theridiidae	*Argyrode sp. 1*	Space Web Builders
	Nihonhimeamundula	Space Web Builders
	Theridiid sp. 1	Space Web Builders
Thomisidae	*Thomisuslobosus*	Ambushers
	Thomisusprojectus	Ambushers
	Oxylate virens	Ambushers
Uloboridae	*Zosisgeniculata*	Orb Web Builders
	Uloboruskrishnae	Orb Web Builders

Based on their foraging method, the spiders were classified into seven functional groups. Stalkers were the most common feeding guild, accounting for 30%, followed by orb-web builders (27%), ambushers (17%), space-web builders (6%), ground runners (12%), foliage runners (6.0%), and sheet-web builders (2%). The dominant guild (Stalkers) included 20 species from the Salticidae and Oxyopidae families. There were 18 species of orb-web builders belonging to the families Araneidae, Tetragnathidae, Uloboridae, and Nephilidae.

The habitat preferences of numerous spider species were also examined in this study. Spiders love to live in many environments. Tetragnathidae, Oxyopidae, Theridiidae, and Araneidae family species were mostly found in vegetation. Tetragnathids are long-legged, thin-bodied spiders that live in webs near riverbanks. Oxyopids were found mostly in grasses. Theridiids are most commonly seen at the base of leaves. Thomisid spiders, on the other

Fig. 5. Species diversity in different families found in Suhelwa Wildlife Sanctuary

hand, were discovered on flowering plants. *Arachnura angura* is a scorpion-tailed, extremely unusual species that lives on the leaves and imitates the appearance of colourful petals. *Hersilia striata* was discovered on tree barks and displayed excellent concealment. *Hippa saagelenoides* lives in funnel-shaped webs and re-treats over holes in the ground at the base of shrubs, and is most active in the morning.

Discussion and Conclusion

In the current study, a total of 65 species belonging to 46 genera under 20 families were recorded from the selected habitats of Suhelwa Wildlife Sanctuary, Uttar Pradesh. Highest species richness was recorded at Razia Taal (Site C) with 30 species belonging to 10 families. This habitat showed rich floral (trees and shrubs) and faunal (butterflies, moths, beetles, dragon flies and ants) diversity which is a key factor to build microhabitats for a wide variety of spider species. With 15 species belonging to 8 families, Khairmaan Forest (Site A) has the second highest species diversity. A diverse assortment of plants and animals can be found in this area. These diverse habitats offer spiders a wider range of microhabitats, microclimatic features, alternate food sources, retreat places, and web attachment sites. Rampur Bandha (Site B) depicted third highest level of species richness with 12 species belonging to 5 families.The poor species richness of the region, which is dominated by bushy trees and bushes, can be linked to human activity that has disturbed the landscape. Hathiakunda naala (Site D) had about 8 species belonging to three families, with minimal plant cover. As a result, Khairmaan Forest (Site A) had the highest species richness in the current study. This could be due to increasing vegetation in these locations, which leads to higher biodiversity and, in turn, more cover and food supplies for these amazing creatures.

Based on their foraging mode, seven functional groupings were identified in the current study. With 36 percent of the vote, stalkers were the most popular feeding guild, followed by orb-web makers (24.66 percent). In our study, spiders from the families Tetragnathidae, Oxyopidae, Theridiidae, and Araneidae were mostly found on trees, shrubs, and herbs. The findings of this study, combined with previous discoveries, lead to the conclusion that habitat structure and environmental conditions may have a significant role in defining the composition of the local spider community. As a result, recording spider diversity trends can be useful in demonstrating the ecosystem's conservation importance.

Conflict of Interest: None

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