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A brief diversity of spider fauna from selected area of Pune district, Maharashtra, India

Phirke P, Warlikar R*, Chepe V
Department of Zoology, Fergusson College, Pune. Affiliated to Savitribai Phule Pune University, Pune, Maharashtra, India

Abstract
Arachnids are one of the most diverse groups of terrestrial predators, with over 50,000 described species found in nearly every ecosystem on Earth. Their biodiversity reflects a wide range of adaptations in hunting strategies, habitats, and behaviours. Ecologically, spiders play a crucial role in controlling insect populations, acting as natural pest regulators in both agricultural and natural environments. By maintaining ecological balance and contributing to food webs, spiders are essential for healthy ecosystems. Their presence and diversity also serve as indicators of environmental health and habitat quality. This study aimed to study selected (Khed, Mulshi and Tamhini Ghat) sites of Pune district. Total 34 genera belonging to 13 different families were recorded during the study period.

Keywords: Arachnids, spider diversity, fauna, Pune

Introduction

The number of spider species known from India has steadily increased from 1067 species (Tikader, 1987) [63], 1442 species (Siliwal *et al*., 2005) [61], 1520 species (Sebastian & Peter, 2009) [60] to 1686 species (Keswani *et al*., 2012) [57]. Presently, 1977 species belonging to 514 genera in 63 families are known (Caleb and Sankaran, 2025). In the span of decades, significant contributions were made to Indian spider research. Gajbe (2009) added 147 new species of spiders from varied habitats throughout India and authored 69 research articles dealing with families like *Araneidae*, *Gnaphosidae*, Lycosidae, *Thomisidae*, and Oxyopidae during this time. He also authored several volumes of the State Fauna Series (Gajbe 2007, 2008a, 2009) further adding to Indian arachnid diversity knowledge. Keswani *et al*, (2012) [57] revised the list of Indian spiders. Wankhede *et al*, (2012) [64] documented 32 species of spiders from 7 families in various habitats at the University of Pune. Recent research has stressed the importance of spiders as ecological indicators (Marc *et al*, 1999) [58]. Habitat destruction, alteration, and fragmentation represent some of the most severe threats to biodiversity in many areas (Fahrig, 2003) [3]. Yet, the majority of ecological surveys in these regions have historically been geared towards the conservation of charismatic animal species and ignored invertebrates like spiders, this analysis was carried out in some parts of Pune district with the main aim of evaluating the status and diversity of spider species within the region. The findings of this study are expected to provide a valuable foundation for future ecological and biodiversity research.

Materials and Methods

Pune, in western Maharashtra, India, is at the foot of the Western Ghats is a UNESCO World Heritage site and one of the world's eight hottest biological diversity hotspots. Pune is geographically located at around 185204° N latitude and 738567° E longitude. Varied habitats such as semi-evergreen forests, grasslands, and urban green spaces, it is the most suitable place to study the diversity of spiders. Ecological diversity of the Western Ghats plays a crucial role in the diversity and abundance of arachnid species in and around Pune. Study was conducted from January 2024 to March 2024 from three sites. SS1, SS2 and SS3 i.e., Khed, Mulshi and Tamhini Ghat, respectively.

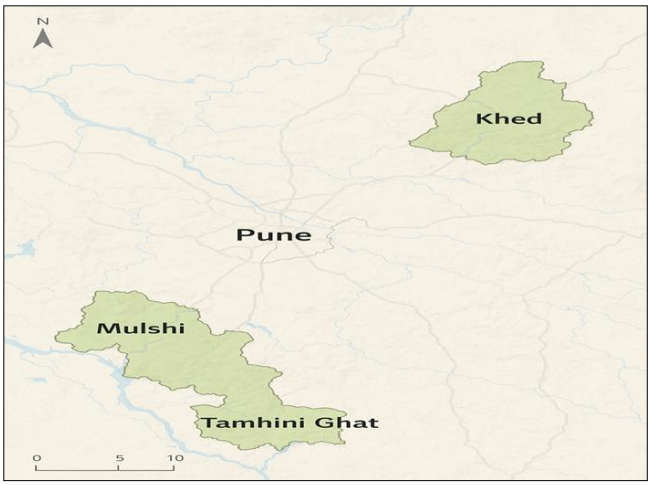

Fig 1: Map highlighted three study sites

Sampling Technique: Specimens were collected during the early hours of the day, specifically between 6:00 AM and 10:00 AM, across three study sites (SS1, SS2, and SS3). Specimens were collected using the methods such as, visual searching and tree beating (Inverted umbrella technique). Collected spiders were transferred to 20 ml clear glass vials, preserved in 80% ethanol and labelled according to their respective sampling locations. The specimens were observed under a Celestron digital pro microscope and were identified using taxonomic keys given by B. K. Tikader.
Biodiversity indices were calculated based on the number of spider species recorded within each family across the three study sites Khed, Tamhini Ghat, and Mulshi in the Pune region. A total of 13 spider families comprising 70 species were used for the analysis. The Shannon–Wiener diversity index (H′) was calculated using the formula $H' = -\Sigma (pi \ln pi)$, where *pi* represents the proportion of species in each family. The Simpson's diversity index (1–D) was determined using $D = \Sigma (pi^2)$. Evenness (E) was computed as $E = H' / \ln(S)$. Species richness was expressed through

Margalef's index, $d = (S–1)/ln(N)$, and Menhinick's index, $DMn = S/\sqrt{N}$, where S is the total number of families and N is the total number of species recorded. All calculations were performed using the family wise species counts as abundance data.

Results

A total of 13 families, representing 35 genera (Table 1) were recorded during the study period in the Pune region. Among these, the family *Araneidae* was the most dominant, comprising 31 species, followed by Salticidae (12 species), Lycosidae (7 species), Oxyopidae (4 species), Tetragnathidae (4 species), Eresidae (2 species), *Philodromidae* (2 species), Uloboridae (2 species), Hersiliidae (2 species), *Gnaphosidae* (2 species), and Theridiidae (2 species). Additionally, single species were recorded from the Sparassidae and *Thomisidae* families. In India, approximately 63 spider families have been documented; thus, the 13 families recorded in this study indicate a considerable level of local arachnid diversity within the Pune biome.

Table 2 represents the distribution of spider families across three different habitats: Khed (SS1), Mulshi (SS2), and Tamhini Ghat (SS3). Each family's presence is indicated by a "+" (present) or "–" (absent). Widely distributed families: *Araneidae*, Salticidae, Oxyopidae, and Lycosidae were found in all three habitats, indicating their adaptability to varied environmental conditions.

Table 1 : Details of spider species collected from all study areas.

No.	Family	Spider fauna genus
1.	*Araneidae*	*Araneus, Cyclosa, Neoscona, Nephila, Argiope, Gasteracantha, Cyrtophora, Gea, Eriovixia, Bijoaraneus*
2.	Eresidae	*Stegodyphus.*
3.	*Gnaphosidae*	*Scotophaeus.*
4.	Hersilidae	*Hersilia.*
5.	Lycosidae	*Hippasa, Lycosa, Pardosa, Wadicosa.*
6.	Oxyopidae	*Oxyopes, Peucetia.*
7.	*Philodromidae*	*Philodromus, Ebo.*
8.	Salticidae	*Plexippus, Menemerus, Carrhotus, Hyllus, Telamonia, Hasarius, Phintella*
9.	Sparassidae	*Heteropoda.*
10.	Tetragnathidae	*Leucauge, Tetragnatha.*
11.	Theridiidae	*Argyrodes, Theridion.*
12.	*Thomisidae*	*Ozyptila.*
13.	Uloboridae	*Uloborus*

Table 2 : Distribution of spider species in different habitats

Sr. No	Family	(SS1) Khed	(SS2) Mulshi	(SS3) Tamhini ghat
1.	*Araneidae*	+	+	+
2.	Salticidae	+	+	+
3.	Oxyopidae	+	+	+
4.	Lycosidae	+	+	+
5.	Theridiidae	-	-	+
6.	*Gnaphosidae*	-	+	-
7.	*Thomisidae*	-	+	-
8.	Hersilidae	+	-	+
9.	Tetragnathidae	+	+	-
10.	Uloboridae	+	-	-
11.	Sparassidae	-	-	+
12.	*Philodromidae*	-	+	-
13.	Eresidae	-	+	-

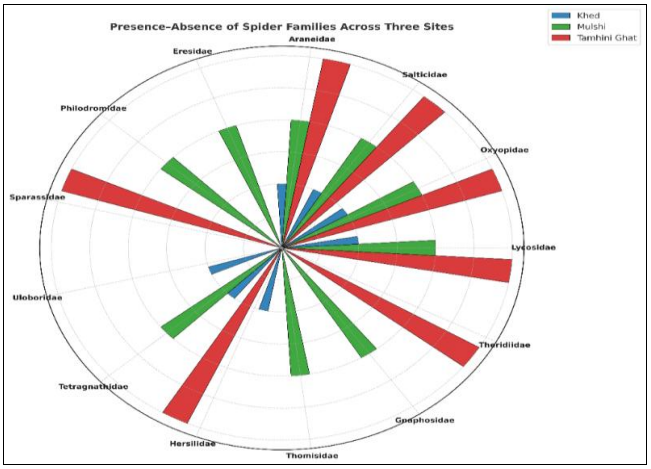

Fig 2: Showing the distribution of the families across study sites

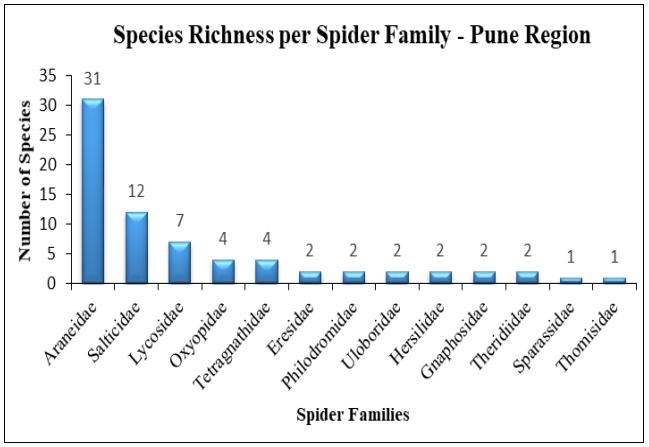

Fig 3: Species richness per spider family – Pune region

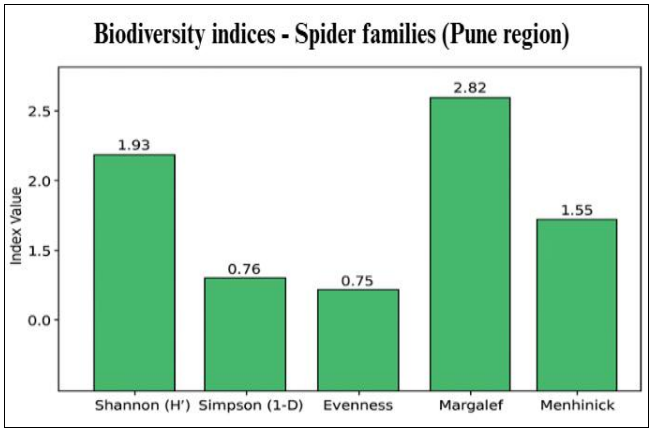

Fig 4: Biodiversity indices – Spider families (Pune region)

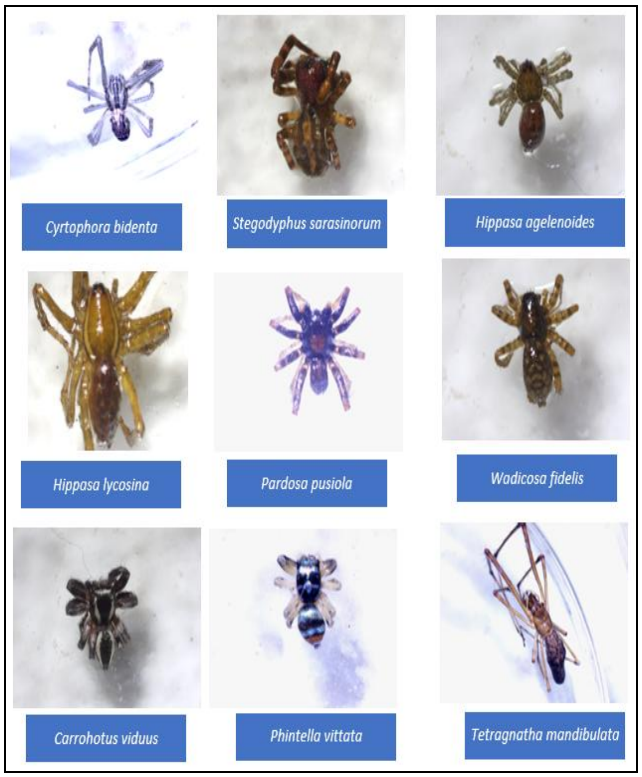

Photo plate 1: Spider Species

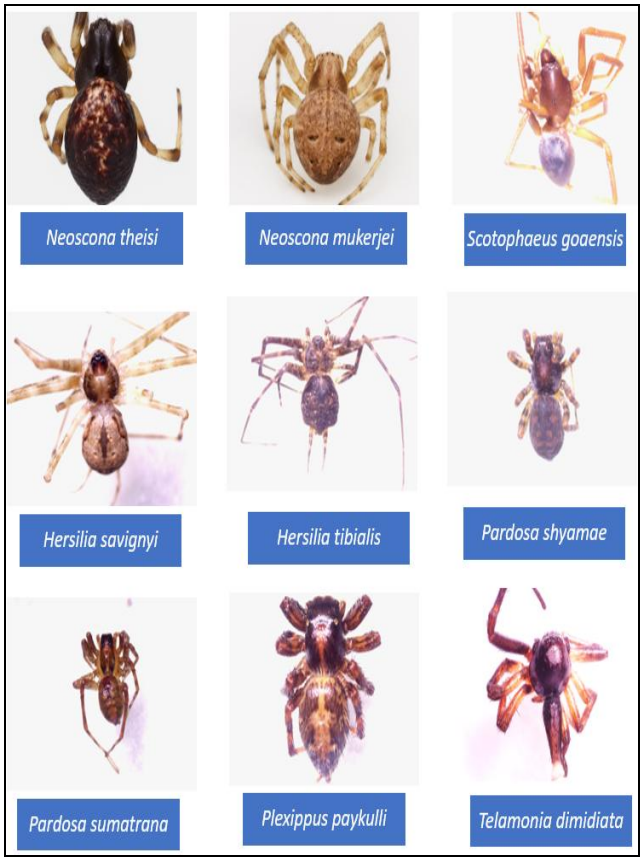

Fig 5: Spider Species

Discussion

Thirteen spider families, including a variety of genera like Araneus, Oxyopes, Plexippus, Lycosa, and Neoscona, were identified. Amongst all the families reported during this study, *Araneidae* and Salticidae (Fig. 3) showed greatest species richness in the surveyed areas of Pune district. Since they can adapt to a variety of habitats and foraging strategies, orb-weaving spiders (*Araneidae*) and jumping spiders (Salticidae) are abundant, according to previous studies conducted in India (Sebastian & Peter, 2009 [60]; Keswani *et al*., 2012) [57]. The Tamhinighat region supports the highest diversity, followed by Khed and Mulshi, according to the distribution across habitats (Table 2; Fig. 2). The Western Ghats region in Tamhinighat is well known biodiversity hotspot supporting great number of spider diversity due to its microhabitat heterogeneity, vegetation cover, and comparatively undisturbed forest conditions (Myers *et al*., 2000) [59]. Mulshi, on the other hand, displayed reduced family richness, which may be the result of human pressures and habitat changes (Basu, 2014) [1].

Biodiversity indices (Fig. 4) calculated from data collected across three sites a Khed, Tamhini Ghat, and Mulshi reveal moderate to high spider diversity in the Pune region. The family *Araneidae* is dominant, but several other families contribute notably to overall species richness and community evenness, indicating a well-balanced arachnid assemblage across the study sites. Shannon index value (1.93) and richness of Margalef (2.49) suggest a moderate level of diversity, indicating that the Pune district has a relatively rich spider fauna but with dominance limited to a small number of families. The Simpson index (0.59) reveals moderate dominance, wherein *Araneidae* and Salticidae contribute the maximum to the community structure. Similar diversity levels were recorded in Maharashtra and Kerala surveys wherein *Araneidae* run the show systemically owing to their status as generalist web-spinners (Chetia & Kalita, 2012 [3]; Sudhikumar *et al*., 2005) [62]. Presence of families such as Oxyopidae, *Thomisidae*, and Lycosidae in particular habitats reflects their status as a bioindicator of health in ecosystems due to their susceptibility to habitat disturbance and working as an insect abundance regulator (Cardoso *et al*., 2011) [2]. The occurrence of rarer families such as Uloboridae and Hersiliidae suggests that even Pune's small forest patches possess specialized taxa, and therefore the conservation of fragmented habitats is required.

Conclusion

The results obtained from this study strengthen that spider diversity within Pune is influenced by habitat type, vegetation complexity, and anthropogenic pressure. As natural predators and ecological indicators, the research highlights the importance of maintaining spider-laden habitats within the Pune district, particularly within ecologically sensitive regions such as Tamhinighat.

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