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Preliminary studies on distribution diversity and physical properties of the nests of social spider fauna in Srivaikundam (Tamil Nadu, India)

Petchidurai G[1*], Velankanny M[2]

[1] Assistant Professor, Department of Zoology, Pope's College (Autonomous), Sawyerpuram, Affiliated to Manonmaniam Sundaranar University, Tirunelveli, Tamil Nadu, India

[2] Assistant Professor, Department of Zoology, Jayaraj Annapackiam College for Women (Autonomous), Periyakulam, Theni, Tamil Nadu, India

Abstract

The present study investigated the distribution, diversity, habitat association, and nest characteristics of social spiders in Srivaikundam. Field surveys were conducted across five habitat types. We recorded 79 social spider nests, with *Stegodyphus sarasinorum* (Eresidae) occurring across all surveyed habitats, while *Cyrtophora cicatrosa* (Araneidae) was recorded only in riverine vegetation. The highest nest abundance was observed in dry scrubland (34.2%), followed by agricultural margins (22.8%), riverine scrub (17.7%), roadside shrubs (13.9%), and open wasteland (11.4%). *Prosopis juliflora* and *Acacia nilotica* were the predominant nesting substrates. Nest dimensions differed significantly among habitats (one-way ANOVA, $p < 0.01$). Nest volume showed a strong positive correlation with colony size (Pearson's $r = 0.91$, $p < 0.001$), indicating its potential as an indicator of colony development. Nests in exposed and disturbed habitats exhibited more compact structures, suggesting adaptation to local environmental conditions. The findings emphasize the ecological importance of natural scrubland and riverine vegetation for maintaining social spider populations and provide baseline information for future studies on their ecology, behavior, and conservation in semi-arid regions of Tamil Nadu.

Keywords: Social spiders, *S. Sarasinorum*, *C. Cicatrosa*, nest characteristics, habitat

Introduction

Spiders (Order: Araneae) are one of the most varied and important ecological groups of arthropods on Earth. With more than 48,000 species identified globally, spiders fill a variety of ecological niches and are essential for controlling insect populations, which helps maintain the equilibrium of terrestrial ecosystems (World Spider Catalogue, 2023) [22]. Nearly 1,700 species from 67 families have been identified in India, and the number is still rising as more research is done in tropical areas (Patel, 1978) [12].

Spiders are significant bioindicators; the quality and health of the surrounding ecosystem can be inferred from their variety, abundance, and presence. Spiders also play a major role in biological management in agricultural ecosystems because they hunt crop pests. Understanding predator-prey relationships, population dynamics, and the general operation of food webs in tropical environments depends on research on spider biology, behaviour, and nest construction (Tikader, 1982) [19].

Spiders that live in long-term cooperative groups and share a nest, food, and care for their young are known as social spiders. In contrast to most solitary and territorial spider species, social spiders engage in cooperative behaviours such as communal feeding, nest upkeep, and prey capturing. At least 25 species of spiders from various families have independently evolved social behaviour, demonstrating a remarkable convergent evolution of sociality (Kullmann, 1972; Cassidy and Avilés, 2026) [5, 9].

A number of essential characteristics set social spiders apart from non-social species. These include community egg sac guarding, tolerance of nestmates, cooperative foraging (when numerous individuals attack and defeat prey larger than any individual could handle alone), and alloparental care (where females tend to the children of other individuals). Depending on the species and resources available, the colonies may consist of a few dozen to several thousand individuals (Bilde & Lubin, 2011) [3].

In addition to having a highly female-biased sex ratio, social spiders are mostly inbred, which means that mating mostly takes place between siblings in the same colony. It is believed that this special reproductive approach will preserve genetic cohesiveness within the colony and improve inclusive fitness. According to Agnarsson *et al*. (2006) [1], colonies typically reproduce by budding, in which a piece of the colony splits off to build a new nest close by.

Social spiders are categorised primarily according to their nest form, family, and degree of sociality. The genus *Stegodyphus* (Family: Eresidae), which displays obligatory cooperative sociality, is the most studied social spider in India (Bradoo, 1967) [4]. Araneidae (*Cyrtophora* spp.) and Theridiidae (*Anelosimus* spp.) are two more families featuring social species. Quasi-social species exhibit less integrated cooperation and may have distinct retreats within a community web, whereas real social spiders (*Eusocial analogues*) share nests permanently and collaborate in all tasks (Bilde & Lubin, 2011) [3].

S. sarasinorum (Karsch, 1891) [15], commonly known as the Indian social spider, is the most extensively studied social spider species in India. It belongs to the family Eresidae and is widely distributed across arid and semi-arid regions of India, Sri Lanka, and neighboring countries. In Tamil Nadu, this species is commonly encountered in scrublands, coastal plains, and agricultural margins where thorny shrubs such as Acacia, Prosopis, and Ziziphus provide ideal support for nest construction (Bradoo, 1967 [4]; Sharada *et al*., 2024).

S. sarasinorum is a medium-sized spider with a body length of approximately 10–15 mm in females and 7–10 mm in males. The females are significantly larger than the males, reflecting a pattern of female-biased sexual dimorphism common in social spiders. The body is covered with dense, pale yellowish-brown setae, providing camouflage within the nest structure (Tikader, 1987) [20].

Colonies of *S. sarasinorum* may contain a few dozen to several thousand individuals sharing a common silk nest. Cooperative behaviours exhibited by this species include group prey capture, communal feeding, brood care, and collective silk production for nest maintenance. The species is considered an excellent model organism for the study of the evolution of social behaviour in arthropods (Lubin & Bilde, 2007; Drisya-Mohan *et al*., 2019) [6, 10].

Nest Architecture in Social Spiders

The nest of social spiders is a complex, multi-functional structure that serves simultaneously as a shelter, a brood chamber, and a prey-capture device. The nest of *S. sarasinorum* is constructed using silk produced by the spinnerets of colony members. The nest structure consists of three main components: (1) the retreat, an enclosed silk chamber where spiders reside and brood is raised; (2) the capture sheet, a horizontal or sloped sheet of silk extending from the retreat to ensnare prey; and (3) guy threads or signal lines, which radiate outward from the nest to detect and intercept flying or walking prey (Bradoo, 1967 [4]; Jani *et al*., 2023).

The retreat is a dense, opaque mass of silk, debris, and prey remains that gives the nest its characteristic fluffy and layered appearance. The outer surface of the retreat often incorporates plant material, sand particles, and insect cuticles, which provide both camouflage and structural reinforcement. The interior of the retreat contains multiple chambers or cells, each occupied by one or more adult females along with their egg sacs and spiderlings (Lubin & Bilde, 2007) [10].

As the colony grows, the nest is continuously expanded by the addition of new silk layers and extensions of the capture sheet. Nest size is therefore a reliable indicator of colony age and population size. Large, well-established nests may span over a meter in diameter and be easily visible in the vegetation from a considerable distance. The physical properties of the nest, such as its length, width, height, weight, and porosity, vary depending on colony size, habitat type, and seasonal conditions (Srinivasulu & Srinivasulu, 2005) [17].

Distribution of Social Spiders in Tamil Nadu

Tamil Nadu, with its diverse landscape ranging from coastal plains and river basins to dry scrubland and forest margins, supports a variety of social spider populations. *S. sarasinorum* has been widely reported from districts including Thoothukudi, Tirunelveli, Ramanathapuram, Virudhunagar, and Madurai. The coastal and semi-arid zones of southern Tamil Nadu, characterized by Acacia-dominated scrublands and Prosopis-invaded wastelands, are particularly favourable for the establishment and growth of social spider colonies (Tikader, 1987; John *et al*., 2026) [5, 20].

Several studies conducted in the Gulf of Mannar region have documented the occurrence of social spider nests on *Acacia nilotica*, *Prosopis juliflora*, *Ziziphus mauritiana*, and other thorny shrubs commonly found in the dry zone coastal belt. The abundance and distribution of social spider nests in a given area are strongly influenced by the availability of suitable nesting substrates, prey availability, and microclimatic conditions such as temperature and humidity (Patel, 1978) [12].

Ecology and Habitat Preference

Social spiders preferentially occupy habitats that offer a combination of suitable vegetation for nest support, abundant insect prey, and protection from excessive wind and rain. In the Srivaikundam region, thorny shrubs and medium-sized trees along field margins, roadsides, and degraded land provide the primary nesting substrate for social spider colonies. Open habitats with scattered shrubs are particularly favourable because they allow for effective prey capture while still providing shelter (Agnarsson *et al*., 2006) [1].

Social spiders are important components of the arthropod food web. As sit-and-wait predators, they capture a wide range of insects, including flies, beetles, grasshoppers, moths, and even small wasps. The large communal web and cooperative capture strategy allow social spider colonies to subdue prey far larger than any individual spider could manage alone. This makes them particularly effective at removing large-bodied insects from the local ecosystem (Nentwig, 1985) [11].

Importance of Social Spiders

Social spiders are significant from multiple perspectives. Ecologically, they are important predators that help regulate insect populations, particularly in agricultural and semi-natural habitats. Economically, social spider colonies that are established in crop fields and orchards can contribute to the biological control of pest insects, reducing the need for chemical pesticides (Bilde & Lubin, 2011) [3].

Scientifically, social spiders are fascinating models for studying the evolution of sociality, cooperation, and altruism in arthropods. Understanding how and why solitary animals evolve into social ones is a central question in evolutionary biology, and social spiders offer a tractable system for addressing such questions experimentally. The relatively simple social structure of social spiders compared to social insects such as bees and ants makes them more amenable to controlled experimental manipulation (Lubin & Bilde, 2007) [10].

Additionally, the silk produced by social spiders has been studied for its unique mechanical properties. Social spider silk is known to be highly elastic and tough, with potential applications in material science and biotechnology (Vollrath & Knight, 2001) [21].

Prey Capture and Foraging Behaviour

Social spiders are ambush predators. When an insect contacts the capture sheet of the nest, the vibrations produced by the struggling prey are detected by the spiders through sensory hair arrays on their legs. The alarm signal spreads rapidly through the colony via substrate-borne vibrations, triggering a cooperative attack response. Multiple spiders emerge from the retreat simultaneously and converge on the prey item (Nentwig, 1985) [11].

Cooperative prey capture in *S. sarasinorum* has been extensively documented. Colonies are capable of capturing and consuming prey several times the body weight of individual spiders. Large prey items such as grasshoppers, cicadas, and moths are collectively immobilized by repeated biting and silk wrapping before being transported to the retreat for communal feeding. This cooperative strategy gives social spiders a significant advantage over solitary species in terms of prey diversity and size range (Bradoo, 1967) [4].

Physical Properties of Nests
The physical properties of social spider nests reflect both the age and size of the colony and the ecological conditions of the habitat. Key physical parameters that are measured in nest studies include nest length (the longest horizontal dimension), nest width, nest height, nest volume (estimated as an ellipsoid), nest weight (dry weight of silk and debris), and the degree of attachment to the substrate. Other parameters include the height of the nest from the ground, the substrate type (plant species) on which the nest is built, and the orientation of the capture sheet (Srinivasulu & Srinivasulu, 2005) [17].

Physical nest properties are closely correlated with colony size. Larger colonies produce larger nests with more complex architecture and greater silk investment. Environmental factors such as wind exposure, humidity, and prey availability also influence nest structure. In arid habitats, nests tend to have a more compact, tightly sealed retreat compared to nests in humid areas, where a more open structure may facilitate ventilation (Rao & Poyyamoli, 2000) [13]. The present study was undertaken with the following objectives: To survey the distribution of social spider nests across different habitats in Srivaikundam. To identify the species of social spiders present in the study area; to record the diversity of social spider nests with respect to habitat type, substrate, and height; to measure the physical properties of the nests, including length, width, height, volume, and colony size. To assess the relationship between nest physical properties and colony size; to compare nest characteristics across different habitat types in Srivaikundam and to contribute to the baseline data on social spider ecology in the coastal semi-arid zones of Tamil Nadu.

Materials and Methods
Study Area – Srivaikundam
Srivaikundam is a historic town and taluk headquarters located in Thoothukudi (Tuticorin) District, Tamil Nadu, India. It lies on the southern bank of the Thamirabarani River, one of the most perennial rivers of Tamil Nadu. The region is characterized by a semi-arid tropical climate with distinct wet and dry seasons, which strongly influence the local biodiversity. The landscape of Srivaikundam encompasses diverse habitat types including agricultural fields, scrub forests, riverine vegetation, thorny shrublands, and human settlements with open courtyards and garden areas. These varied ecological conditions make Srivaikundam a suitable habitat for a wide range of invertebrate fauna, including spiders. Studies on spider diversity and behaviour in southern Tamil Nadu have been limited, making the present investigation particularly relevant for enriching our understanding of spider ecology in this region.

The study was carried out in and around Srivaikundam town in Thoothukudi District, Tamil Nadu, India. Srivaikundam is situated at approximately 8°38'N latitude and 77°55'E longitude (Figure 01), at an elevation of about 20 meters above mean sea level. The region experiences a typical semi-arid tropical climate, with a hot dry season from March to June, followed by the northeast monsoon from October to December. Annual rainfall averages approximately 650–750 mm. The vegetation is dominated by thorny scrub comprising *Acacia nilotica*, *Prosopis juliflora*, *Ziziphus mauritiana*, *Lantana camara*, and various grasses, with scattered patches of agricultural land, riverine vegetation along the Thamirabarani River, and human habitation.

A total of five survey sites were selected to represent the range of habitats present in the study area. The sites were chosen to include: (1) agricultural field margins, (2) thorny scrubland, (3) riverine vegetation near the Thamirabarani River, (4) roadside vegetation, and (5) open wasteland with scattered Prosopis shrubs. GPS coordinates were recorded for each site using a handheld GPS device.

Field Survey
Field surveys were conducted from November 2025 to April - 2026, covering the dry and wet seasons to account for seasonal variation. Surveys were carried out during the early morning hours and late afternoon hours to avoid the hottest part of the day, as spider activity is reduced during peak afternoon temperatures. A total of 4 site field visits were made to the five survey sites over the study period.

At each survey site, a belt transect method was employed for nest enumeration. Transects of 100 m × 5 m were laid at each site, and all social spider nests within the transect

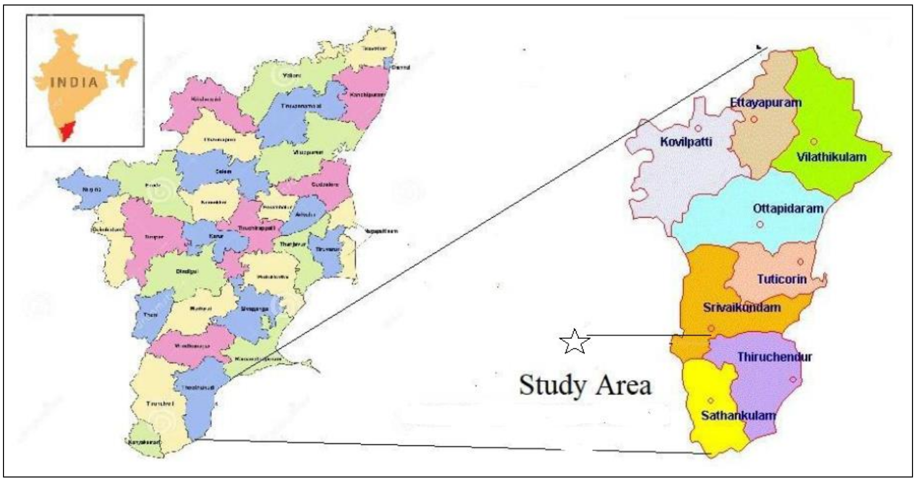

Fig 1: Map showing the social spider distribution Study area

Were recorded. For each nest, the following information was recorded: the GPS coordinates of the nest, the plant species on which the nest was constructed, the height of the nest from the ground (in cm), and the approximate colony size estimated by counting visible adult spiders and juveniles.

Identification of Social Spider Species

Social spider species were identified in the field based on morphological characteristics including body size, coloration, and nest type, using standard identification keys and reference works (Tikader, 1987; Patel, 1978) [12, 20]. Representative specimens were collected from nests at each site, preserved in 70% ethanol, and brought to the laboratory for confirmation of identification using a stereomicroscope with a standard manual. The species *S. sarasinorum* was identified based on the presence of dense yellowish-brown setae on the dorsal surface, the characteristic eresid eye arrangement (four pairs in two transverse rows), and the distinctive communal retreat and sheet-web nest structure. *Cyrtophora cicatrosa* (quasi-social) was identified based on its orb web structure with a characteristic tent-shaped retreat and clustered nest arrangement.

Nest Measurement Parameters

The physical properties of each nest were measured carefully to avoid disturbing the colony. The following parameters were recorded for each nest: Nest Length (cm), Nest Width (cm): Nest Height (cm): Nest Volume (cm^3), estimated using the formula for an ellipsoid: $V = (4/3)\ \pi abc$, where a, b, and c are the semi-axes corresponding to half of the length, width, and height respectively. Height from Ground (cm): Nest Weight (g): Substrate Attachment: Colony Size: Number of adult spiders and juveniles counted by carefully parting the retreat silk with a blunt probe.

Habitat Assessment

For each survey site, basic habitat parameters were recorded, including dominant plant species, vegetation density (open, semi-open, dense), land use type, and proximity to human habitation. These data were used to characterize the habitat types and to assess the influence of habitat conditions on nest distribution and physical properties.

Prey availability at each site was assessed qualitatively by recording the diversity of arthropod prey items visible in or around the nests. The substrate specificity of nesting was assessed by recording the frequency of nest occurrence on different plant species relative to their availability within the transect.

Statistical Analysis

Data were compiled and analyzed using Microsoft Excel and SPSS software. Descriptive statistics (Mean ± SD) were calculated for all nest physical parameters. One-way ANOVA was used to compare nest physical parameters across the five survey sites and between habitat types. Pearson’s correlation coefficient was calculated to assess the relationship between colony size and nest volume. A significance level of $p < 0.05$ was used for all statistical tests.

Results

Species Distribution and Site-wise Occurrence

A total of 79 social spider nests were recorded across the five survey sites in Srivaikundam during the study period. *S. sarasinorum* (Eresidae) was the dominant social spider encountered at all five study sites, confirming its widespread distribution across the habitat types surveyed. *C. cicatrosa* (Araneidae), a quasi-social species, was recorded only at Site 3 (Riverine Vegetation), where it formed loose aggregations of individual orb webs on *Ziziphus branches*.

Table 1: Site-wise Distribution of Social Spider Nests in Srivaikundam

Site No.	Site Name	Habitat Type	No. of Nests Recorded	Dominant Substrate	Species Present
1	Agricultural Fields, East Zone	Agricultural margin	18 ^{b}	*Acacia nilotica*	*S. sarasinorum*
2	Thorny Scrubland, North Zone	Dry scrubland	27 ^{a}	*Prosopis juliflora*	*S. sarasinorum*
3	Riverine Vegetation, Thamirabarani Bank	Riverine scrub	14 ^{c}	*Ziziphus mauritiana*	*S. sarasinorum, C. cicatrosa*
4	Roadside Vegetation, Highway Margin	Roadside shrubs	11 ^{d}	*Lantana camara*	*S. sarasinorum*
5	Open Wasteland, South Zone	Wasteland / degraded	09 ^{e}	*Prosopis juliflora*	*S. sarasinorum*
Total			79		

The highest number of nests was recorded at Site 2 (Thorny Scrubland), with 27 nests, accounting for 34.2% of the total nests observed. Site 1 (Agricultural Margin) yielded 18 nests (22.8%), followed by Site 3 (Riverine Vegetation) with 14 nests (17.7%), Site 4 (Roadside Vegetation) with 11 nests (13.9%), and Site 5 (Open Wasteland) with 9 nests (11.4%). The results indicate that dry scrubland with dense Prosopis and Acacia vegetation supports the highest density of social spider nests in Srivaikundam (Table 1).

The habitat-wise analysis revealed that dry scrubland nests showed the largest mean nest dimensions and the highest mean colony sizes, followed by riverine scrub, agricultural margin, roadside shrubs, and open wasteland habitats (Table 2). These differences in nest size and colony abundance between habitat types were statistically significant (one-way ANOVA, $p < 0.01$).

Table 2: Habitat-wise Abundance of Social Spider Nests and Nest Dimensions

Habitat Type	No. of Nests	Mean Nest Length (cm)	Mean Nest Width (cm)	Mean Nest Height (cm)	Mean Colony Size
Agricultural Margin	18	38.4 ± 5.2^{d}	27.6 ± 4.1^{cd}	14.2 ± 2.3^{cd}	84 ± 22^{d}
Dry Scrubland	27	52.7 ± 8.6^{a}	38.4 ± 6.3^{a}	19.8 ± 3.7^{a}	147 ± 38^{a}
Riverine Scrub	14	44.3 ± 6.7^{b}	32.1 ± 5.0^{b}	17.4 ± 3.1^{ab}	112 ± 29^{b}
Roadside Shrubs	11	31.8 ± 4.8^{e}	23.4 ± 3.6^{e}	11.6 ± 2.0^{e}	68 ± 17^{e}
Open Wasteland	09	28.5 ± 4.1^{f}	21.2 ± 3.2^{f}	10.3 ± 1.8^{e}	54 ± 14^{f}
Overall Mean	79	42.6 ± 9.8^{bc}	30.7 ± 7.5^{bc}	15.9 ± 4.2^{bc}	108 ± 42^{c}

Physical Properties of Nests

The physical measurements of social spider nests across all five survey sites revealed considerable variation in nest dimensions and colony sizes. The data showed a consistent pattern in which larger nests were associated with denser and taller vegetation, greater substrate stability, and higher colony populations (Table 3).

Table 3: Physical Measurements of Nests Recorded from Different Study Sites

Site	Mean Nest Length (cm)	Mean Nest Width (cm)	Mean Nest Height (cm)	Mean Nest Volume (cm^3)	Mean Colony Size
Site 1	38.4 ± 5.2^{c}	27.6 ± 4.1^{c}	14.2 ± 2.3^{c}	784.2 ± 16.2^{b}	84 ± 2.5^{c}
Site 2	52.7 ± 8.6^{a}	38.4 ± 6.3^{a}	19.8 ± 3.7^{a}	811.4 ± 54.2^{a}	147 ± 3.8^{a}
Site 3	44.3 ± 6.7^{b}	32.1 ± 5.0^{b}	17.4 ± 3.1^{ab}	130.4 ± 29.2^{e}	112 ± 2.9^{b}
Site 4	31.8 ± 4.8^{d}	23.4 ± 3.6^{d}	11.6 ± 2.0^{d}	458.2 ± 10.7^{c}	68 ± 1.7^{d}
Site 5	28.5 ± 4.1^{e}	21.2 ± 3.2^{de}	10.3 ± 1.8^{e}	324.9 ± 81.2^{d}	54 ± 1.4^{e}

Table 4: Nest Attachment Substrate, Height from Ground, and Substrate Frequency

Site	Substrate Plant Species	Nest Height from Ground (cm)	Part of Plant Used	Frequency (%)
Site 1	*Acacia nilotica*	115.4 ± 18.3	Branch / twig	62
Site 2	*Prosopis juliflora*	134.7 ± 22.6	Branch / main stem	74a
Site 3	*Ziziphus mauritiana*	122.8 ± 19.1	Branch / twig	56
Site 4	*Lantana camara*	87.3 ± 14.2	Stem cluster	47
Site 5	*Prosopis juliflora*	98.5 ± 16.8	Main stem / branch	68

The nest attachment substrate analysis showed that *Prosopis juliflora* was the most frequently used plant species for nest construction, accounting for 74% of nests at Site 2 and 68% of nests at Site 5. *Acacia nilotica* was the preferred substrate at Site 1 (62% frequency) (Table 4). Nests on Prosopis branches were found at a significantly greater mean height from the ground (134.7 cm) compared to nests on *Lantana camara* shrubs (87.3 cm), reflecting differences in the structural height and architecture of the different substrate plants.

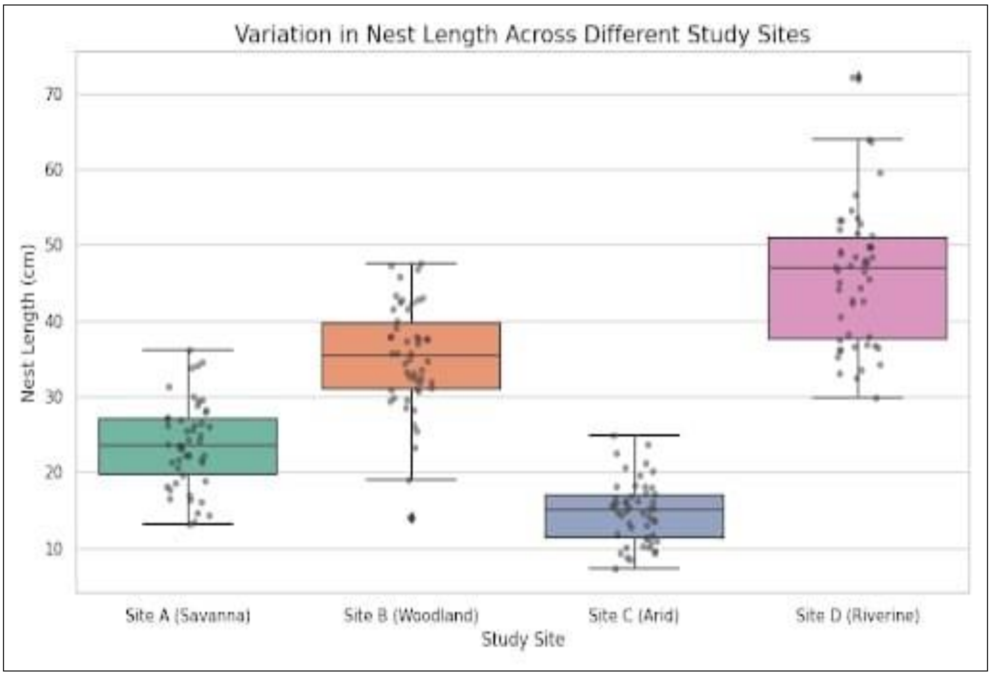

Fig 2: Variation in nest length of the social spider in the study area.

The largest nests were recorded at Site 2 (Dry Scrubland), with a mean nest length of 52.7 ± 8.6 cm, mean width of 38.4 ± 6.3 cm, mean height of 19.8 ± 3.7 cm, and a mean estimated nest volume of 21,154 ± 5,473 cm^3 (Figure 2). The smallest nests were found at Site 5 (Open Wasteland), with mean dimensions considerably below those of all other sites. Pearson's correlation analysis revealed a strong positive correlation between colony size and nest volume ($r = 0.91$, $p < 0.001$), confirming that larger colonies build and inhabit larger nests.

Nest texture and silk density varied visibly across sites. Nests at exposed sites (Sites 4 and 5) showed a tighter, more compact retreat with denser outer silk layers, which is likely an adaptive response to greater wind and heat exposure. In contrast, nests at Site 3 (Riverine Scrub) were larger and more loosely structured, possibly reflecting the greater prey availability and higher humidity in the riverine habitat.

Fig 3: Nesting site and nest habitat of social spiders

Discussion

The present study investigated the distribution, diversity, and physical properties of social spider nests in Srivaikundam, providing comprehensive baseline data on the ecology of social spiders in the coastal semi-arid zone of Thoothukudi District, Tamil Nadu. The findings confirm that *S. sarasinorum* is the dominant social spider in the study area and that nest physical properties are significantly influenced by habitat type and colony size.

The highest density of social spider nests was recorded in the dry scrubland habitat at Site 2, where dense *Prosopis juliflora* and *Acacia nilotica* vegetation provided abundant nesting substrates and structural support for large nests. This result is consistent with the findings of Srinivasulu and Srinivasulu (2005) and Sangavi *et al*. (2023) [14, 17]. who reported that dry thorny scrublands in semi-arid zones of peninsular India support the highest densities of *S. sarasinorum* populations. The preference for *Prosopis juliflora* as a nesting substrate, observed in the present study, aligns with the observations of Rao and Poyyamoli (2000) [13] from Thoothukudi District, who noted that the dense, multi-stemmed architecture of Prosopis shrubs provides ideal support for the heavy silk nests of *S. sarasinorum*.

The lowest nest densities were observed at the open wasteland site (Site 5) and roadside shrubs site (Site 4), which are characterized by sparse, low-growing vegetation and greater exposure to wind and human disturbance. These conditions limit the availability of stable nesting substrates and may result in higher rates of nest destruction by wind and physical disturbance. The reduced nest densities in disturbed habitats are consistent with the observations of Bilde and Lubin (2011) [3], who emphasized the importance of vegetation structure and habitat stability for the persistence of social spider colonies.

The significantly larger nest dimensions and colony sizes observed in the dry scrubland and riverine habitats compared to disturbed habitats suggest that resource availability plays a critical role in colony growth and nest expansion. The abundance of large-bodied insect prey in relatively undisturbed scrubland and riverine habitats likely supports faster colony growth, leading to the accumulation of larger silk structures over time. This interpretation is supported by Nentwig (1985) [11], who demonstrated a direct relationship between prey availability and colony growth rate in tropical social spiders.

The strong positive correlation between colony size and nest volume ($r = 0.91$) recorded in the present study (Figure 04) is in agreement with the findings of Patel (1978) [12], who documented a similar relationship in *S. sarasinorum* populations in Gujarat. This correlation reflects the cumulative nature of nest building in social spiders, where each successive cohort of spiders adds silk to the existing structure, resulting in a progressive increase in nest volume over successive generations. The measurement of nest volume therefore provides a useful proxy for colony age and relative population size in field studies where direct counting of all spiders is not feasible.

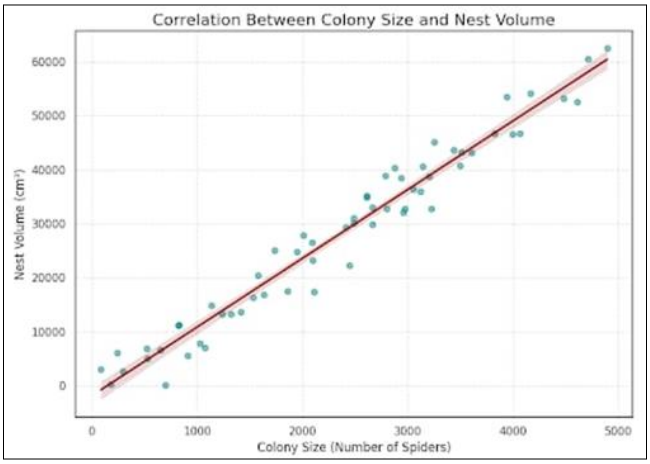

Fig 4: Correlation study of Colony size and Nest volume of the social spider in the study area.

The variation in nest texture and compactness across habitats observed in the present study is ecologically significant. The denser, more tightly sealed retreat structures observed at exposed sites (Sites 4 and 5) likely serve as a thermoregulatory and protective adaptation against heat, desiccation, and physical disturbance. This is consistent with the observations of Lubin and Bilde (2007) [10], who noted that social spider nests in more exposed and arid habitats tend to have thicker retreat walls compared to nests in sheltered or humid locations. The layering of plant debris, insect remains, and silk in the outer walls of nests at exposed sites may also provide additional insulation and camouflage.

The occurrence of the quasi-social species *C. cicatrosa* at the riverine vegetation site (Site 3) adds to the diversity of social spider fauna recorded in the study area. While *C. cicatrosa* does not form the tightly integrated colonies typical of *S. sarasinorum*, its tendency to build aggregated orb webs in the same vegetation is well documented in tropical Asia (Tikader, 1987) [20]. The presence of this species in the riverine habitat reflects the greater structural complexity and biodiversity of this habitat type compared to the drier scrubland sites.

Overall, the results of this study highlight the importance of natural, undisturbed habitats for the conservation of social spider populations in Srivaikundam. The progressive degradation and conversion of scrubland habitats due to agricultural expansion, urbanization, and invasive plant management poses a significant threat to social spider colonies in this region. Conservation of Acacia and native scrubland vegetation, particularly in areas adjacent to agricultural fields and riverine zones, would be beneficial for maintaining social spider populations and the ecological services they provide.

Conclusion

The present study confirmed that Srivaikundam and its surrounding areas in Thoothukudi District support viable and diverse populations of social spiders, predominantly *S. sarasinorum*. A total of 79 nests were recorded across five habitat types, with the highest density observed in dry scrubland characterized by *Prosopis juliflora* and *Acacia nilotica* vegetation. The physical properties of the nests, including length, width, height, and volume, were significantly greater in scrubland and riverine habitats compared to disturbed roadside and wasteland habitats.

The strong positive correlation between colony size and nest volume ($r = 0.91$) confirms that nest physical parameters are reliable indicators of colony age and population size in field studies. The observed variation in nest texture and architecture across habitats suggests that social spiders adapt their nest construction to local environmental conditions, particularly wind exposure and temperature.

The findings of this study contribute to the growing body of knowledge on social spider ecology in Tamil Nadu and provide valuable baseline data for future comparative studies and population monitoring. The presence of diverse social spider habitats in Srivaikundam underscores the importance of conserving natural scrubland and riverine vegetation in the region. Further studies employing quantitative ecological methods and molecular tools are recommended to investigate the population genetics, behavioural ecology, and long-term dynamics of social spider colonies in this area.

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