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Distribution of Social Spider *Stegodyphus Sarasinorum* along the Altitudinal Gradient of Nilgiri Biosphere Reserve

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Abstract: ***Stegodyphus sarasinorum is a common social spider found in India. It has the ability to control the pest. It is found in the fencings of the agricultural fields and road sides. The present investigation was carried out to find the distribution of S. sarasinorum population along the attitudinal gradient of Nilgiri Biosphere Reserve (NBR). Twelve different stations were selected for the present study from 918m above msl to 2262 above msl. The results reveals that the S. sarasinorum is absent in altitude above 1441m above msl while in the lower altitude places the number of webs of S. sarasinorum was more. Highest frequency of nests was found in Vazhaithottam (925 above msl). The relationship between the number of nests/ 100 m transect as well as nest size with altitude was derived using Curve expert software and presented. The present study reveals that S. sarasinorum do not exist in higher altitudes.***

1. Introduction

Each and every organism has their specific role in the ecosystem. Spiders are predators which maintain the prey population to balance the nature. Especially the communal spiders are remarkably known for the pest control efficiency as potential biological pest control agent.

Global species diversity patterns are likely to change across spatial gradients in response to changes in climate, area, latitude, altitude, productivity, available resources and habitat complexity (MacArthur, 1972; Rosenzweig, 1995; Trevelyan and Pagel, 1995; Quasin and Uniyal, 2011). There is a monotonic decrease in species richness in the increasing elevations (MacArthur, 1972; Stevens, 1992; Rahbek, 1995 and Nogues-Bravo *et al*., 2008).

Sociality in spider species is very rare. Social spiders live in groups as more numbers *i.e., Stegodyphus lineatus, Stegodyphus mimosarum, Stegodyphus dumicola* and *Stegodyphus sarasinorum.*

S. sarasinorum is a communal spider found in India and its neighborhood countries. *S. sarasinorum* individuals live in large cooperatively built colonies with a nest or retreat constructed of silk woven together with leaves (Jacson and Joseph, 1973; Smith and Engel, 1994).

The social spiders exhibit an extreme form of population structure. They live in closed breeding colonies and new colonies are formed either by fission of an existing colony, by swarming of related females, or by single gravid female (Lubin and Robinson, 1982; Vollrath, 1982; Johannesen and Lubin, 1999).

Stegodyphus sarasinorum, Karsh (1891) is one of three permanent cooperative species in the genus *Stegodyphus* (Karus and Karus, 1988). The ecology and natural history of S.Sarasinorum has been investigated by Jambunathan (1905), Bradoo(1972,1975,1980), Jacson and Joseph (1973), Karus and Karus (1988) and Jeevan Chakravarthy et al., 2015. However no studies are available on the distribution of *S. Sarasinorum* in higher altitude.
In the present study the Distribution and Population *S. sarasinorum* along the altitudinal gradient of Nilgiri Hills and the relationship between altitude and nest size was studied.

2. Materials and Methods

In the present study the sociality spider *Stegodyphus sarasinorum* was selected. The study was conducted for six months from November 2014 to April 2015.

Systematic Position of *S. sarasinorum*
Phylum : Arthropoda
Class : Arachnida
Order : Araneae
Suborder : Araneomorphae
Family : Eresidae
Genus : *Stegodyphus*
Species : *sarasinorum*

Study area
The whole research work was carried out in different locations along the altitudinal gradient (Table- 1). The places were tabulated as follows.

Table 1: Study area along with the Geographical Position

S. No	Location	Latitude	Longtitude	Altitude (Above msl)
1	Mavanalla	11° 32’ 35.55’’ N	76° 40’ 51.23’’ E	918
2	Vazhaithottam	11° 31’ 49.56’’ N	76° 41’ 31.41’’ E	925
3	Masinagudi	11° 34’ 04.87’’ N	76° 38’ 20.54’’ E	948
4	Bokkapuram	11° 32’ 33.62’’ N	76° 38’ 58.29’’ E	968
5	Boison View Point	11° 29’ 52.98’’ N	76° 41’ 23.84’’ E	1128
6	Kalhatty Checkpost	11° 29’ 15.76’’ N	76° 41’ 05.70’’ E	1441
7	Emerald	11° 19’ 20.05’’ N	76° 37’ 33.08’’ E	1951

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8	Avalanche	11° 18' 46.75'' N	76° 37' 25.70'' E	1964
9	Muthorai	11° 22' 48.80'' N	76° 40' 14.44'' E	2085
10	Nanjanad	11° 21' 25.73'' N	76° 38' 56.87'' E	2090
11	Mullikorai	11° 23' 41.70'' N	76° 40' 35.41'' E	2158
12	Ooty	11° 24' 45.15'' N	76° 42' 44.89'' E	2262

Selection of Transect

Transect method of survey was made to study the nests of social spider *S. sarasinorum*. A transect of 100 meters was selected along the roadsides near to the field and fencings.

Habitat study

Number of webs in 100 m transects in the selected locations were recorded. The location of nest above ground level was also recorded and categorized. The length and width of the nests were carefully measured and recorded to the nearest mm.

Statistical Analysis

The data on number of nests/ transects in different altitude was correlated using Curve Expert software. The non linear relationship was derived. Likewise the length and width of nest was also correlated with altitude.

3. Results and Discussion

The distribution of *S. sarasinorum* was found to be depending upon the altitudinal gradient. A total no. of 12 localities was studied to examine the distribution of *S. sarasinorum*. Table 1 shows the localities and their Geographical position. The distribution of *S. sarasinorum* was observed up to 1441 m above msl (Kalhatty). The results reveals that *S. sarasinorum* were absent in the higher elevations.

Table 2: Distribution of *S. sarasinorum* along with Altitudinal gradient

S. No	Locality	Altitude (Above msl)	Frequency	Range	Average no. of webs/ transects*
1.	Mavanalla	918	70	20-60	4.2 ± 5.45
2.	Vazhaithottam	925	90	20-90	5.2 ± 3.36
3	Masinagudi	948	40	10-40	3.5 ± 5.10
4	Bokkapuram	968	30	7-30	2.9 ± 3.75
5	Boison View Point	1128	20	1-5	0.5 ± 0.84
6	Kalhatty Checkpost	1441	10	0-2	0.2 ± 0.63
7	Emerald	1951	0	0	0
8	Avalanche	1964	0	0	0
9	Muthorai	2085	0	0	0
10	Nanjanad	2090	0	0	0
11	Mullikorai	2158	0	0	0
12	Ooty	2262	0	0	0

(* Each value is a mean of 10 transects)

Table 3: Distribution of *S. sarasinorum* in different elevations from ground level Altitudinal gradient

S. No	Locality	Altitude (Above msl)	Position of nest from Ground level		
			>5 ft	**5 to 10 ft**	**< 10 ft**
1	Mavanalla	918	1.2 ± 2.82	0.4 ± 0.84	2.6 ± 4.90
2	Vazhaithottam	925	0.4 ± 0.69	1.9 ± 2.23	2.9 ± 2.88
3	Masinagudi	948	0.1 ± 0.32	1 ± 2.10	2.4 ± 5.15
4	Bokkapuram	968	0.7 ± 1.06	1.2 ± 1.69	1 ± 0.32
5	Bison View Point	1128	0	0.1 ± 0.32	0.4 ± 1.26
6	Kalhatty Checkpost	1441	0	0.2 ± 0.63	0

Table 4: Length and Width of webline of *S. sarasinorum* in different Altitudes

S.No	Locality	Altitude (Above msl)	Web Length (cm)	Web Width (cm)
1	Mavanalla	918	14.95 ± 7.39	5.6 ± 2.61
2	Vazhaithottam	925	19.36 ± 4.76	11.2 ± 4.27
3	Masinagudi	948	7.1 ± 6.88	5.4 ± 5.22
4	Bokkapuram	968	10.4 ± 6.83	8.29 ± 5.73
5	Boison View Point	1128	1.05 ± 3.32	0.78 ± 2.46

The frequency of websize was maximum in transects Vazhaithottam (90%) at the altitude of 925 above msl.

The frequency was correlated with altitude and the best correlation model was rational function (Fig:1). The r value is 0.964 and the relationship can be expressed as,
y=a+bx+cx^2+dx^3...
Where x = Frequency
y = Altitude

The lowest (10 %) was recorded in Kalhatty check post with the elevation of 1441 above msl. Above this elevation the *S. sarasinorum* was absent (Table 2).

Highest number of webs/ transects were recorded (5.2±3.35) in Vazhaithottam (925 above msl). This was followed by 918msl > 948msl > 968msl > 1128msl > 1441msl as 4.2 ± 5.45 > 3.5 ± 5.10 > 2.9 ± 3.75 > 0.5 ± 0.84 > 0.2 ± 0.63.

The Length was correlated with Altitude, the best fit was Rational Function (Fig-2). The r value is 0.828, S value is 4.282 and the relationship can be expressed as,
y=(a+bx)/(1+cx+dx^2).
Where x = Web Length
y = Altitude

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The best fit for Width and Altitude is Harris Model (Fig-3). The r value is 0.762, S value is 3.102 and the relationship can be expressed as,
y=1/(a+bx^c).
Where x = Web Width
y = Altitude

The patterns of species diversity of invertebrates along the elevation gradient it cause a monotonic decrease in species richness with increasing elevation (Macarthus, 1972: Stevens, 1992). However, the two most commonly observed patterns of species richness along altitudinal gradients are a steady decline in diversity with increasing elevation (Noques-Bravo *et al.*, 2008). In insects, there is an evidence that the species richness is low in higher altitude while in lower altitude the richness of species is high (Brown and Kodric- Brown, 1977; Lawton *et al.*, 1987; Fleishman *et al.*, 1988; Holloway *et al.*, 1990; Stevens 1992; Kearns, 1992; Olson, 1994; Sparrow, 1994; Brown *et al.*, 1996; Sanders, 2002).

In the present study the decreasing in population with increase in altitude was recorded. This may be due to intolerance of *S. sarasinorum* to lower temperature ranges.

The mean temperature of station 1 to 4 ranging from 15◦C to 32◦C and station 5 & 6 is 11◦C to 22◦C. While the temperature of station 6 alone is 15◦C. Hence it can be inferred that *S.sarasinorum* can colonize well in temperature upto 15◦C.

Eventhough, the *S. sarasinorum* builds nest as protection, it is unable to tolerate low temperature.

Colonies of *S. sarasinorum* often occupy nearly continuous stretches of vegetation along forest edge or roadsides, on fences or bridges and along streams or rivers; in such instances, local prey abundance at ecotones or near water is a likely cause of this distribution.

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(Araneae, Eresidae) – why attack first? Can. *J. Zool.*, 71: 2220–2223.

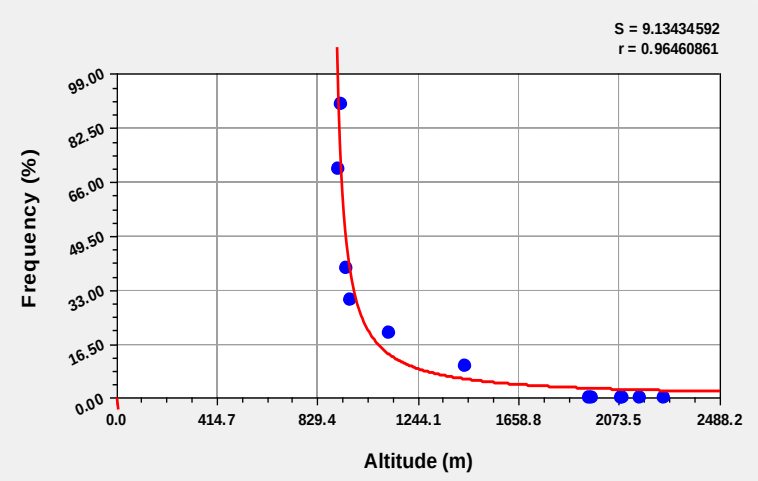

Figure 1: 4th Degree Polynominal fit correlating Altitude with Frequency of *Stegodyphus sarasinorum*

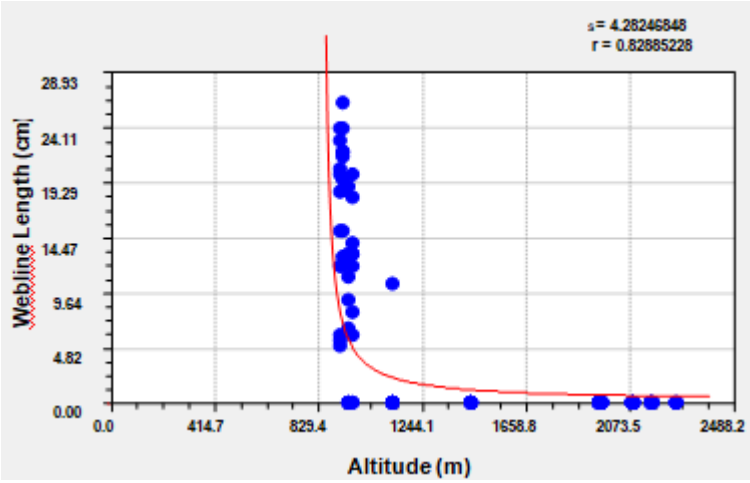

Figure 2: Rational Function correlating Altitude with Webline Length of *Stegodyphus sarasinorum*

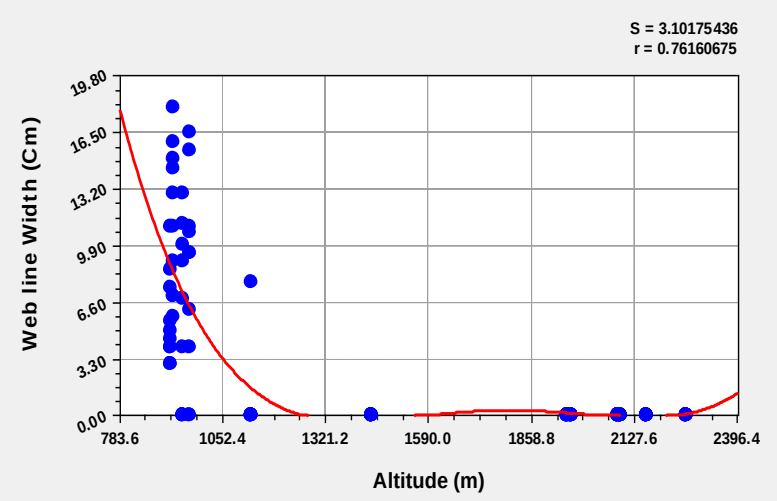

Figure 3: Harris Model Correlating Altitude with Webline Width of *Stegodyphus sarasinorum*

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