



A TREE COVERED WITH THE NESTS AND WEBS OF SOCIAL SPIDERS. (PORTRAIT OF MR. JAMBUNATHAN)

THE HABITS AND LIFE HISTORY OF A SOCIAL
SPIDER (STEGODYPIIUS SARASINORUM
KARSCH)

By N. S. JAMBUNATHAN

Of the many creatures that attract attention, one of the most common is the spider. Every hedge-row glistens with the snares so cunningly laid by these little hunters. They are found everywhere, and no place is too sacred for their occupation. The walls you lean against, the corners you look into, the books you begin to dust, the grassy lawns over whose soft beds you delight to walk, and even the flowers whose fragrance you enjoy, contain the spiders peculiar to each of these localities. Some there are that run, that spin, that dive, some that even dig to catch their prey—thus pursuing several of the various crafts and industries of men,—spinning, weaving, diving, and mining. Some spiders seem to be successful aeronauts performing long journeys across mountains, rivers, gulfs, and seas—by means of their slender threads. These facts and many others concerning their extraordinary habits and intelligence have already been noted by man.

Simon, a French arachnologist, first hazarded the statement that some spiders exhibit a form of social living. This assertion I find questioned by that eminent American entomologist, the Reverend Doctor McCook, who maintains "that all spiders are solitary in their habits and that the discovery of a social species, if confirmed, would be most important. Males and females might be seen living amicably together for a considerable period, but this cannot be social living" (vide *Scientific American*, page 186, September 17, 1892).

From this we may easily see that the question as to the existence of communal spiders is a debated one. My study of social insects generally led me to a closer investigation of the habits of the spiders of southern India, and in March, 1898, I discovered at Saidapet, Madras, a group which I believe may properly be termed "social spiders."

These spiders live in a sponge-like nest of ramified net-work of inter-communicative canals with a number of outside openings. The nests, often seen attached to the ends of the branches of trees or to leaves of the prickly pear, are ash-gray in color and made of dried

leaves and refuse matter from their food, and are over-lined with their thick, sticky threads, thus affording an advantageous background for the spiders, for being of the same color as the nests they are thus given necessary protection. Numbers of sheet-like webs radiate from the nest, in one or many directions. At a given spot five or six nests are often found built over the leaves of the prickly pear, with a number of connecting webs—thus establishing means of inter-communication. These hanging webs are peculiarly constructed. A number of strong and non-sticky threads are irregularly laid to form the warp while the woof of sticky threads closely laid in a zig-zag manner, connect the non-sticky threads issuing in all directions, sometimes establishing communication between one nest and another, like bridges to cross the intervening space.

The number of spiders in a nest varies from 40 to 100. Males and females occupy the same nest in the proportion of 7 to 1, though sometimes the females are less numerous.

The creature itself is not less interesting than its nest. It is more or less a compact animal about the size of our ordinary vagrant spider of the family Attidæ.

THE FEMALE

	Millimeters.
Total length cephalic thorax and abdomen.....	8
Abdomen	4
Cephalothorax	4

THE MALE

Total length.....	6
Abdomen	3
Cephalothorax	3

This spider belongs to the family Eresidæ. It is ash-colored, this tint being due to the color of the hairs over its body surface. Three longitudinal white stripes mark the dorsal surface of the abdomen. The limbs are striped gray and brown. A number of dark lines makes the abdomen appear segmented, but closer examination shows them to be only external figurations. There are approximately six pairs of dots arranged on either side of the leaf-like patch on its dorsal surface.

The ventral surface of the abdomen bears two black irregular spaces, the lower one of which contains the spinnerets, which are six in number, with a cribellum. The cephalothorax is ash-colored with an anterior prominence that forms the head. The cephalic groove which is well marked in most spiders is absent here. The eight eyes are arranged in three rows as in Lycosidæ. The first two rows, of

four and two, lie in a black spot in front of the head, while the other rows are a little behind with their faces directed rather towards the sides of the animal. Thus the spider can see objects in front as well as at the sides. The palces are black, pointing downwards, with the curved claws working sidewise.

In almost everything except in size and palpal organs, the male resembles the female, and although the male is the smaller, the measurements of the two do not show him to be the dwarfed individual found in many species of spiders. In place of the black streaks and stripes of the female, we meet with brown ones in the male.

As already mentioned, the prickly pear bushes appear to be the favorite resort of these spiders, though sometimes the branches of some other thorny plants are preferred. A whole tree may be so covered with the nests, that the leaves are hardly visible. I have also found these nests on tops of hills. If built on the prickly pear, the leaves serve as bases or floorings. If on the ends of branches of trees, the leaves serve as partition walls or roofs for their silken dwelling, which is plastered and cemented by means of woven threads. In every case the refuse of their food serves as a convenient substance for thickening the walls of their nest.

The web is arranged in longitudinal and zig-zag lines. If it is to be a horizontal sheet, a main line is made of the finest, strongest, yellowish silk-like threads with a lustre all their own. This main line is laid by the joint labor of six or seven spiders moving over the line a number of times, thus thickening it, and making it not one thread but a bundle of threads. Other lines are laid, connecting with this main line in all directions. These may be of fewer threads, yet strong enough for their purpose. Having now finished the warp lines of the web, the process of regular weaving is begun. The spiders settling at different places begin to spin out their thick, smoke-like, sticky threads and to lay them as connecting lines for their web. The method of drawing out the thread is unique in the spider world. In almost all the web-builders the sticky threads as well as the non-sticky ones come out as the spider moves from one line to another, a method which may not be possible here, these spiders using their hind pair of legs, which are then seen moving in quick succession rubbing against the spinnerets. The threads so taken are laid without any regard to either precision or symmetry, the only object being somehow to fill the space and make a net. These transverse sticky lines, being eminently elastic, can be drawn out to ten times their ordinary length. While there is work to be

done, there is no standing still, no idleness; each individual appears to recognize its own responsibility in assisting to complete the web. As soon as a spider finishes work in one spot, it hastens on to where the web is still incomplete, so that within two or three hours the whole task is finished. This done, the spiders retire to the nest to enjoy a well-merited rest. Like some other spiders, these are also nocturnal in their habits and begin web-building between the hours of six and seven in the evening, finishing their toil before eight or nine.

The manner of repairing the nest is also very interesting. The first spider that comes out of the nest after sunset sets to work to repair any damaged portion it may discover. It thus never becomes necessary to completely rebuild their webs. The burden of building and repairing the webs falls heavily upon the females of this spider colony. They are the active workers. The males appear to do very little, though not wanting in apparatus necessary for web-building, since they may be observed, while young, actively participating in such a task. When they attain maturity, they think of nothing but courtship and love, and can then be seen moving about in the web, disturbing the females that are patiently engaged in their work.

With their nests and webs in shady places our spiders never suffer from want of food. Bees and mosquitoes, crickets and beetles, butterflies and moths in their pleasant flights entangle themselves in the waiting snares. The struggle of the victims sounds the signal that prey is available and the spiders hurry to the spot to pull and drag the victim to the nest. In this effort part of the web may be damaged. Spiders there are, in the family of *Epeiridæ*, that can skillfully disentangle a prisoner and carry it away without damage to their webs, but social spiders do not possess this skill.

The arrival of the victim is eagerly awaited by the spiders in the nest, ready to catch hold of some portion of the prey. Those carrying the precious booty never appear to resent the actions of others that pull the victim in all directions, before they finally settle down to partake of the food thus secured. Sometimes the spiders do not bring the victim to the nest but begin eating it where caught. On one occasion an extreme case of selfishness came under my notice. A spider pulled hard at a victim, got a good piece of its leg, and ran away to a corner to feed unobserved by the others. But as a general rule they are seen partaking of the meal at a common table and nothing can be more curious than the sight of these spiders, almost one over another sitting at dinner, some feasting at the head,

some at the body, some near the tail-end, others sucking their repast from the limbs of the victim. To test their intelligence I once threw a big ant into a web. As the ant struggled a spider issued from the nest in the direction of the prey but found the creature too defiant to be easily pulled home. The spider caught one leg many a time, and many a time it ran for life, fearing the ant's bite. In a moment, another spider came to its aid, but, curiously enough, instead of catching hold of the ant, began to pull the first spider by its abdomen, until other spiders came to the rescue and the victim was carried away by their joint labor, to the common nest.

If such an ant were thrown into the web of an Epeiridæ, the victim, however big and ferocious, would be carefully bound by threads and thus secured. The social spiders know how to drag, pull and bite, but have never learned the finer and safer method of binding and securing their prey. Perhaps the extremely sticky character of the webs lessens the necessity for them to develop these finer methods.

In the foregoing paragraphs, two facts have been clearly recorded about the habits of this group of spiders, (1) the joint action and willing coöperation of a number of them to achieve a definite end, (2) the partaking by any and every spider that happens to get near it of the meal brought by one or more, the captors showing apparently no resentment. These two facts together with what has been noted in connection with web-building point to the conclusion that the spiders we are considering, certainly exhibit a form of social living which is, so far as I am aware, rarely met with in the spider world.

It has been noted by every arachnologist that the relation between the sexes in this group is something unique in spider communities. The male is generally a dwarfed individual, and is able to carry on his life's task only by agility and cunning. Such antagonism exists between the sexes, that a male seldom returns from courtship without losing a leg or two. It is a struggle which often imperils even his life. In some families, as in the Epeiridæ, this struggle has been so severe and lengthened that there have come to be certain profound modifications in the mental as well as the bodily structure of the males, they being often dirty colored and dwarfed individuals, and hardly recognizable as spiders at all. In addition to this the male is sometimes caught and devoured by his savage consort.

But the picture is not all dark—all tragic. There are some families that exhibit a more genial relationship. In the Attidæ, Lycosidæ, Thomisidæ, Phalangidæ, Tetragnathidæ, and Mygalidæ, the

males are nearly as bright colored and attain to almost the same size as the females. Here there is no danger to life, all the risk that a male runs being, perhaps, the loss of a limb or two. In everyone of the groups of spiders mentioned, the female and male may be seen near each other only during the pairing season and even then the male has to make its own arrangement for food.

Here the absence of much disparity in size and color between the sexes, the friendly and communal living of the males and females in the same nest, and lastly, the happy and almost affectionate relation that subsists between the sexes, indicate a high order of development. The savage nature of the female in other groups is never displayed by the female spiders of this group.

The female gladly welcomes her lover and the male may be seen rubbing its pedipalps alternately against the genital pore of the female, sometimes for over three or five minutes. At other times one may find the male running after the other sex, in fact, hunting it through all the winding passages in the nest. The female may step aside, or run, and thus avoid the approach of the male, if she has no liking for such a meeting; but never does she exhibit the rancor and resentment with extended forelegs and well-drawn falces, found among the females of the family *Epeiridæ*.

The eggs when laid are packed in silk in a lenticular cocoon, which is white in color, and about six millimeters in diameter. Unlike the other spiders that carry the cocoon, either by means of their falces or spinnerets, the female in the group we are considering, attaches it to the side walls of the nest.

After a period varying from thirteen to fifteen days, the young ones try to emerge from the cocoon by tearing out portions of its walls. These little spiders, the size of an Indian mustard seed, move about and some of them settle over the back of the mother, after the manner of *Lycosidæ*. The abdomen of the young ones is globular and pink-colored. Until they pass through two or three moults, they do not appear to take any food. As they grow older, they partake of the food brought by the mother. I have often noted instances in which the females quietly retired, leaving the food they were eating to the young ones that clustered round it. After a few moults, the young spiders begin to participate, in their own little way, in the grand task of web-building. Small patch-works of webs, a few lines here and there, mark their juvenile efforts. At this stage no difference of size, color or sex is visible. The time required by the young spiderling to reach the adult condition, after issuing out of the egg, is almost three months.

While the development of the young is in progress, the adult

members of the nest either desert it, one by one, to found, perhaps, new colonies elsewhere, or voluntarily starve themselves, or are starved to death by the rapacity and greed of the younger generation. In the nest at this stage I have found the young ones very active, while the members of the older generation were scarcely able to move. Later, I found only the dried remains of a few old ones to mark their former presence in the nest. Closer examination makes me strongly affirm that the dried remains are not the skins generally cast away after moulting, but the real bodies of the spiders shrunken and shrivelled up. In some nest I have also found one or two members of the older generation living with those of the younger generation.

Like other creatures, these spiders are subject to the varying influences of heat and cold, and show in some instances remarkable powers of adjustment. Living, as they do, in the tropics, they have learned a method of protecting themselves from heat by building their nests mostly under the shade of trees. If ever they happen to be exposed to the direct rays of the sun, as was a nest which I purposely tied to a hedge in my garden, the inmates are seen outside the nest resting on the threads proceeding downwards, the spiders being shaded by the nest. Evidently the heat between 11 a. m. and 4 p. m. in the interior of the nest must have been unbearable. Even when disturbed and driven within they would not remain inside the nest.

In winter the walls of the nest are thickened, especially in the upper part, which is exposed to the rainfall. The holes leading to the nest are to be found in the under surface, and those which might catch the wind are carefully closed. In spite of all these precautions, these creatures suffer like other animals during this season. They are able to protect themselves completely from neither wind nor rain, nor are they able to procure their food easily.

The area under my observation is limited to South India. So far as I have seen, and I have visited some of the typical districts—such as South and North Arcot, Salem, Coimbatore, Malabar, Chingleput, Madura, Trichinopoly and Tanjore—this species is more or less universally distributed throughout these districts. On the top of the Tripati hills, in North Arcot, at an elevation of some five hundred feet above the sea, I saw their nests. Considering the facilities these spiders have for safe and speedy dispersal, one need not wonder at their wide distribution. The young ones may sometimes be detected while on their aerial voyages to near or distant places as the winds permit. At other times one solitary spider, more or less in the adult condition, ventures out and settles near the mother

colony. At times a female, while in the act of web-building, may be carried away by the wind and thus plant a new colony.

Before concluding this description let me rehearse the points which lead me to designate this group of spiders as social. We note the common nest for a number of spiders—males and females; the manner in which they build and repair their nests; their feeding together, and the absence of ill-feeling amongst them—these are characteristics not commonly met with among animals of the solitary kind. Other points in their habits go to strengthen my conclusion. The relation between the sexes is found to be one of affection, and the maternal feeling for the offspring verges almost on self-sacrifice.

While it must be conceded that these spiders have nothing of that differentiation and organization found in the communities of ants and bees, it still seems that the amicable existence led by them in the common which has been built by united effort, the friendly sharing of their meals, the more than toleration, the affection shown for each other by the male and female, and the self-denial of the mother on behalf of her young entitle this group of spiders to be called social.

APPENDIX.

The author, who has given such an interesting account of one social spider seems unaware of records of various other species. Probably all the species of *Stegodyphus* are social. The Rev. O. P. Cambridge was the first to record this habit in this genus, when describing *S. gregalis* from South Africa. A nest of this species was kept for some time in the London Zoölogical Garden. Mr. Marshall has written an account of this species which agrees very closely with that of Mr. Jambunathan. He notes that several feed upon the same insect, and that the old ones die in the early winter. He also speaks of a mouse that nests in the midst of a communal nest to feed on the insects, and of a Tineid moth that breeds in the débris of dead insects. Simon has described several social spiders from Venezuela, notable among them being *Uloborus republicanus*. Mr. Schwarz has found this species in Cuba, and notes that the males keep to one corner of the connected mass of webs.

References to the social spiders are as follows:

- E. Holmberg—Anales di Agricultura, II, 1874, p. 156.
- C. Berg—Bol. Acad. Cordova, I, pp. 279-283, 1879.
- O. P. Cambridge—Proc. Zoöl. Soc. London, 1889, pp. 42-44.
- J. Bolivar—Bol. Soc. Espagn., XXI, p. 22, 1892.
- E. Simon—Ann. Soc. Ent. France, 1891, pp. 1-14, 4 pls.
- G. A. K. Marshall—Zoölogist (IV), vol. II, pp. 417-422, 1898.
- L. Kathariner—Biol. Centrabl., XXI, pp. 72-74, 1901.
- E. A. Schwarz—Proc. Ent. Soc. Wash., VI, pp. 147-148, 1904.

[N. BANKS.]