



Study of maternal care in some spiders of Satlasana, North Gujarat, India

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Abstract

Adaptation is the most important part of evolution. This Behavioral and evolutionary strategy of female spiders in form of maternal care to raise their offspring in some spiders of various families was studied from 2017 to 2018. Study and observations of spiders were done in the maternal care exhibited by female spiders of families i.e. Araneidae, Eresidae, Lycosidae, Pholcidae, Sparassidae, and Theridiidae. The results of the maternal care study showed that behavioral and caring patterns varied from species to species.

Keywords: Maternal Care, Spider, North Gujarat.

Introduction

Spiders are extremely carnivores, seen in all terrestrial habitats. Worldwide, a total of 49,549 species of 4220 genera and 129 families of spiders were recorded¹. In the Indian subcontinent, 1866 species of 475 genera and 61 families were recorded². In North Gujarat, Satlasana Taluka, a total of 157 species of 88 genera and 27 families of spiders were recorded³.

Due to the diversity of spiders, they are tremendous models to study behavioral and evolutionary adaptations in the animal kingdom. Total 129 families of spiders, so far described all over the world¹; exhibit a wide range of maternal care behavior.

Protracted maternal care is measured a precondition for the evolution of perpetual family grouping and sociality in invertebrates. In spiders, the important evolutionary changes to permanent sociality along this 'sub-social route' include the postponement of care yonder hatching, the persistence of spiderlings to maturation and the exclusion of premating dispersal.

Maternal care is an adaptive strategy by certain animals' creation maternal investment into evolutionary suitability of their offspring^{3,10}. This adaptive strategy means that additional effort is consumed on a relatively less number of offspring to provide each of the higher chances of survival to reproduce. According to this explanation, all spiders express maternal care by investing in eggs and covering their eggs in a shielding silk brood⁴. Additionally, it is common in some families of a spider to protect the egg sac and the anew developed spiderlings for a single instar^{4,5}, which we call 'transient sub social' behavior. For the protection of eggs make a web nest to deposit eggs. Forms, sizes, and designs of web nests vary from species to species in spiders. The type of maternal care also varies from species to species. This study and observations explore the approaches used by spiders to maximize the survival of their offspring.

Methodology

Study area: Satlasana Taluka is located (23.540 N and 72.380 E) in north Gujarat. The total area of the study area is covers 308.38km². A range of average Day temperature is approximately 38°C in the summertime and 20°C in the winter time. Generally, a stony region with barren soil structure and the maximum region of the jungle have free sandy soil⁷. The main two leading rivers are Saraswati and the Sabarmati. The Dharoi dam is on Sabarmati which the chief resource of irrigation in Taluka. This region provides natural habitation of the junglein which many creatures like leopards, sloth bears, and hyenas are found⁷.

Sampling technique: The study of spider diversity was done from 2017 to 2018 using line transects. The line transects were of 1.5kms length and 20m width, with sampling limited to a maximum height of 1.6m. Collections of spiders were using the hand picking method. Important notes of Web pattern, habitat type, and other observations were recorded in the field with every collection. The collected spiders were kept under observation and their maternal care and Behavior were studied.

Identification: After collection of specimens were placed separately in observation for maternal care. For detailed identification of collected specimens use stereo zoom microscope and some for captured photographs were used. Taxonomic references, monographs, and keys^{1, 2, 3} were used for the identification of spiders.

Results and discussion

The results show the observations of the maternal care in some spiders from Satlasana Taluka and discussion mention below:

Araneidae: Cyrtophora (Figure-1): Most diverse family Araneidae was containing 177 genera and 3065 species worldwide¹. In the characters of the family Araneidae:

Small to large-sized, ecribellate, entelegyne spiders. The carapace is frequently flat sometimes engorged; the cephalic part disjointed from the thoracic part by slanting depression. Eight eyes are in two rows; lateral eyes and median eyes. Chelicerae are dominant, with proximal, cheliceral furrow is with two rows of teeth; fang relatively short and stout. The labium is elongated and broad; distal edge puffy. Leg strongly spined, short, and relatively stout; three claws, trichobothria present in all leg segments except tarsi; tarsi furnished apically with thickened serrate bristles. Opisthosoma is larger however variable in form, usually rounded, pendulous carapace. Six spinnerets and Colulus are present. Epigyne partially or completely sclerotized, epigynal plate with transverse furrow; Cyrtophora: Dorsum without transverse bands; usually one shoulder hump present; Lateral eyes separated. The genus Cyrtophora was containing 49 species world-wide¹. Spiders of this genus are also known as tent-web spiders because they built different webs other than orb weaver spiders, found in disturbed or open habitats. Female spider of genus Cyrtophora was expressed maternal care for her spiderlings. After fertilization, the female constructs an egg sac. The egg sac is approx. 10-18 millimeters bluish-green color. These egg sacs are placed in chains of up to 6-10 sacs vertically on the webs. Females with egg sacs will normally rest directly underneath the egg sac with the aim of guard them. Spider lings usually make their webs off the maternal webs after 4-5 days. Spider lings in larger webs are less likely to leave their mother's web. Always, these spiders prefer to select nest sites and make webs in the clefts between branches and leaves of plants.

Eresidae: Stegodyphus pacificus (Figure-2): Family Eresidae is known as velvet spider. They distributed with 9 genus and 102 species in world¹. The spiders of Genus Stegodyphus are found on scrubs, brushwood of trees; they build a big sheet-like web. They live under natural conditions of web colonies containing up to several hundred spiders. They live on scrubs where they spin either a large sheet-like web conveyed by a tubular retreat or a large saccular nest web in which many spiders live together. Cephalic region-wide and usually high, clypeus low. Four median eyes forming a small quadrangle, narrower in front than behind, ALE situated on the side of the head, PLE far removed from the rest of the eyes and located on the posterior part of the head. Legs are Strong, weakly spined with three claws. In main characters of the genus Stegodyphus are head rather broad, with the cephalic part raised above the thorax. Abdomen stout, elongate, oval. It builds vertical, cribellate web across a gap at the top of the plant or a small shrub at about a meter from the ground. The Female was expressed maternal care and sacrifices for her spiderlings. After two weeks of the mating female is made normally one egg sac contains 200-400 eggs. The brood size was depending upon body mass, the larger the females larger the egg sac. The size of Eggs was small, round, yellowish, and closely attached. The Female was always protecting the egg sac. Approximately after the fifth week of egg-laying, the female brook/crack the egg sac and the spiderlings come out from the egg sac in the same

maternal web. After two to three weeks of hatching the female nourishes the spiderlings with regurgitated material, and finally, gives them with her body as food. After four to five hours, consume body fluid, nearly all webs exoskeleton of the mother spider was recorded. The young ones stay few days in the maternal web after, beginning of the new generation through nourishing on trapped preys in maternal web and finally move away from the maternal web, to build the new own web.

Lycosidae: Lycosa (Figure-3): Spiders of this family is known as the wolf spider. They distributed 125 genus and 2430 species in world¹. They live under natural conditions of funnel-web. Small to large spiders, ecribellate, entelegyne spiders. The carapace is longer than wide; usually covered with short recumbent setae. Eyes eight are all dark in color; the posterior row of the eye recurved strongly; eyes arranged in 3 rows; anterior eyes small other eyes large. Chelicera long, robust, often hairy; with 3 prolateral and 2 to 4 retro lateral marginal teeth. Legs are elongated, with spines; tarsi bearing 3 claws, leg-IV longest. Six spinnerets present; Colulus absent. Epigyne with well sclerotized median septum; females of this family carry the egg sac along with them attached to the spinnerets. The genus Lycosa contains Clypeus slanting; metatarsus IV shorter than tibia and patella Together; Carapace otherwise Female of genus Lycosa was expressed unique care for her spiderlings. After a few days of mating, the female is laying eggs and covering them in a round shape egg sac, which attaches by using to the underneath of her abdomen. Normally one egg sac contains 250-350 eggs. Mother was hatching her young ones for 25- 35 days. After few days of hatching, the mother carries her young ones on her back until they have grown enough. Spider lings are beginning to disperse from the mother's abdomen slowly 6-8 days after hatching. Mother stay with her young ones until they dispersed.

Pholcidae: Crossoprizalyoni (Figure-4): Spider of this family known as Cellar spider or daddy-long-legs spiders. They distributed 95 genera and 1842 species in the world¹. They were building messy and irregular-shaped webs.

Small to medium-sized, ecribellate, haplogyne spiders. Carapace as elongated as broad; vaulted at the thoracic area; rounded narrow in front and back with complex markings; cephalic region normally raised on the sides with deep markings, a thoracic region with deep median longitudinal fovea. Six to eight eyes present. Chelicerae without lateral condyle, fused at the basal part, fang small. Labium as wide as long, fused to the sternum, with slightly concave anterior margin; gnathocoxae converging. Legs long and slender, light covering setae; tarsi usually pseudo segmented, with three claws; spines absent; metatarsi longer than tarsi. Opisthosoma is wide, tubular to rounded; Anterior spinnerets contiguous, slightly larger than other spinnerets; colulus large pointed with numerous setae. Female genitalia usually with a sclerotized plate covering the internal genitalia; vulva paired with multiple spermathecae and scattered glands.

The characters of genus *Crossopriza*: *Opisthosoma* short, oval, pointed dorsoventrally; with posterior prominence above the spinnerets.

The Female was expressed unique maternal care for her young ones. After mating, the female lays the eggs and wraps their eggs roughly in silk to form an egg sac which carries in her chelicera (jaws), situated on the underneath of her body. The egg sac contains 40-70 eggs. Female was protecting and hatching for nine days to developing into spiders. After the spiderlings hatching, they crawl against the mother's body and stay there for a short period. Spider lings are starting to leave the mother web slowly after few days. Spider lings look like tiny adults, after molt their skin as they grow into adults.

Sparassidae: Olios (Figure-5): Spider of this family known as Huntsman spiders or giant crab spiders. They distributed 89 genus and 1290 species in world¹. Sparassids are free-living, nocturnal, wandering spiders with diverse lifestyles. Most of the species are large. Their legs are often positioned outwards as well as forwards, and this feature allows them to move under loose bark, stones, and crevices in rocks with great ease to escape predation or to retreat after hunting. Most genera are enclosed with a fine mass of light straw-grey to brown hairs. The carapace is broader and elongated. The cypleus displays a white strait (mustache) and the eye design is in two rows, with the anterior laterals often the largest. They have elongated legs, turned on wards in a crab-like fashion. They are usually found on or under the bark of trees and amongst the foliage. Some *Olios* species construct a silken retreat amongst dead leaves in trees. The Female was expressed unique maternal care in her web nest. After fertilization, the female constructs an egg sac. The egg sac is silky, rough fibrous tissue, white or off-white. The female lay a groundsheet of silk underside of the single leaf or sometimes 2 leaves combined and deposits eggs over it, and complete the egg which would be globular in shape. The female spider hides in retreat and incubates eggs inside for 3 to 4 weeks. When the eggs are fully grown tears open the egg sac

and come out along with spiderlings. The female guards the eggs and also spiderlings when they hatch. When disturbed or sensing danger mother jumps on grounds and act still and camouflage to escape from danger. The spiderlings after around 3 weeks of the ballooning process will disperse in the environment.

Theridiidae: Argyrodes (Figure-6): Spider of this family known as tangle-web spiders, cobweb spiders, and comb-footed spiders. They distributed 124 genus and 2526 species in world¹. Very small to medium, sized ecribellate, entelegyne spiders. Eight eyes are in two rackets typically bordered by brownish rings. Chelicerae are weakly sclerotized, usually without retro marginal teeth. Anterior margin of labium not thickened, gnathocoxae are longer than wide and converging distally. Legs are variable elongated; tarsi bear three-clawed, normally tapering at the tip. They are widely distributed, constituting a diverse group of spiders occurring in a variety of habitats, building space-webs radiating in a different direction. Aggregate silk glands are present in Theridiids. Sticky silk is used to wrap prey. The characters of genus *Argyrodes* are carapace contains a deep and transverse groove in the thoracic area; *opisthosoma* prolonged above and posterior to spinnerets, placing spinnerets almost midway between pedicel and the distal end of the *opisthosoma*. Carapace without transverse groove in the thoracic area The Female was expressed unique maternal care. After fertilization, the female constructs a small of the egg sac and carries the package in her legs to touch the egg sac. Females that grown unique control of prey usually took it again beside the egg sac earlier than feeding, and there have been solely events in which maternal females have been viewed feeding with others away from their egg sacs. When eggs hatched, generally pale reddish juveniles merged from the egg sac and remained clustered at their hatching site till they molted (and grew to become black) 10 days later. After this, the spiderlings started to go out into the web to feed. Slowly, the assemblage of spiderlings dispersed from the leaf, in the end dispersing to different leaves as they grow to be bigger.



Figure-1: Image showing a female spider of Araneidae: *Cyrtophora* and egg sacs.



Figure-2: Image showing a female spider of Eresidae: *Stegodyphus pacificus*.



Figure-3: Image showing a female spider of Lycosidae: *Lycosa* and spiderlings on Abdomen.



Figure-4: Image showing a female spider of Pholcidae: *Crossopriza lyoni* and egg sac in her chelicerae.



Figure-5: Image showing a female spider of Sparassidae: Olios and opened egg sac with spiderlings.



Figure-6: Image showing a female spider of Theridiidae: Argyrodes with egg sac.

Conclusion

This study is the first documentation on observation of maternal care in some spiders. This observation displayed that the main reason and requirement for spider species to prefer maternal care to eggs and spiderlings, form a predatory defense, and build different types of web-nest were natural characters of an individual spider to the survival of species.

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