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DIVERSIFIED FEEDING BEHAVIOR OF A TRUE WEAVING ARANEID SPIDER FROM TINDHARIA, DARJEELING DISTRICT, WEST BENGAL

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INTRODUCTION

Information on feeding behavior of araneid spiders is lacking from Darjeeling Hills of West Bengal. Tikader (1961) made an observation on spider weavers as a trap hunter in their orb-web. Tikader (1982) in his observation on nest building behavior of araneid spider from India mentioned the prey capturing purpose also. Majumder (2001) recorded some important notes on spider nest by which odonates were caught. Talukdar and Majumder (2006) studied some interesting observations on web-building, food and feeding behavior of four araneid species of the genus *Argiope* and *Neoscona.*

During early monsoon of the year 2006 while carrying out an extensive behavioral studies on spiders of Darjeeling hills the authors came across an araeneid spider *Argiope pulchella* Thoerll was displaying its feeding behavior on its orb web built near a hill stream of Tindharia. The present paper deals with the details of the sites where the spider builds it's web for trapping insects as their prey is also included the food and the diverse pattern of feeding habits of *Argiope,* the places it stays near the web while retract, the morphological structure and measurements of the spider and its prey, the time span it needs to capture the prey and digestive mechanism along with the biological significance regarding the advancement of predatory behaviour.

MATERIALS AND METHOD

Study area : The camp site of Tindharia situated at the grid between 88.00 degree east and 26.38 degree north of West Bengal, a vibrant pteridophytic hill walls steeped in splendour on the western ravine of Darjeeling hills about 856 meters of altitude and is about 32 kms away from

siliguri and about 52 kms from Darjeeling town. The place where we performed our observation is very green, vegitation of this area is remarkable with very dense population of ferns and bryophytes under dense canopy of different varieties of trees. Spiders of almost all group like such habitat. It was a narrow upward path along the hill towards the forest. Beside this path there was a jhora, a sharp hill stream. One of the place left less green may be due to land sliding the settled vegetation was disturbed. We took the area as special interest keeping in mind that "this might be a habitat of clubioneid spiders" But suddenly we saw an Argiope female on its web acting on a lepidopteran victim.

Climate : Monsoon prevails for about four months from early of June to mid of October with high humidity. Annual range of humidity is between 90–95%. July-August are the heavy rainfall months with precipitations as high as 500 mm. Annual rainfall is about 320 cms. Occasional rains are often encountered throughout the rainy season. Pre-monsoon is dry and warm with versatile climatic conditions within a single day. Clouds from mild to most dense accumulation and precipitation thereon following sunny sky wormness are very common Post-monsoon is apparently cold with negligible rainfall. Maximum temperature reaches up to 14.89 degree celcious in May while the mean maximum temperature is 8.59 degree celcious observed in June. On the other hand the minimum temperature drops up to 1.2 degree celcious in January and the mean minimum temperature is about 3 degree celcious observed during early December every year.

Collections : Spiders were collected from the study areas directly from the webs by hand picking method, by the sweeping net and by dusting the nearby bushes in to an inverted umbrella. More we concentrated ourselves in collection of the data about the behaviors of the spiders than we collected the specimens.

Preservation : Collected spider specimens were anaesthetized, killed in a killing jar and finally preserved in Oudman's preservative (90 parts 70% ethanol, 1.5 parts glycerol and 5 parts glacial acetic acid) in glass vials.

Identification : Well-preserved spider specimens were sorted transferred in ethyl alcohol and studied under binocular microscope in a Petri dish. The specimens were identified up to species level.

OBSERVATION

Two different process of feeding observed in same species.

In first case : On 10th July' 06 at 3 p.m. we saw an *Argiope pulchella* female measuring about 12 mm of it's body length is waiting at the hub of its orb-web hanging vertically from the fern and weeds of the slant decorated with the stabilimentum near a hill stream beside our trake. After a while during return from the same way back at about 4.30 p.m. we saw one large lepidopteran

moth is entrapped into the web and trying to escape. But the predator (*A. pulchella)* rushed at the insect which is at least 5 times larger than the spider and pierces it with repeated actions of biting. This process lingers at least 5 minutes till the victim become completely immobilized at about 4.35 p.m. Then the spider approached towards the victim and finally confirmed itself about the immobilization process with 3–4 attempts At about 4.40 p.m the spider pulled out a sheet of silk from its spinnerets with its right hind leg first then the second and thursts the sheet against the moth keeping a distance about 2 cm away from the victim. The silk sheet then fussed with the moth's body by 2–3 trials. At about 4.50 p.m. we saw the spider rolling the insect on to the sheet to swathe it and simultaneously pulling out the same from the spinnerets with the help of the right and left hind legs alternately. This process continued upto 5 p.m. with some intervals and ended when the victim was completely covered with the silk.

After a while the spider readjusted the swathed victim on to the hub of it's web and set itself very close to the body in search of a soft area in it from which juices can be sucked. It took about 5–10 minutes. Finally the predator sat on a grand dinner and keeping a half an hour watch further we left the spot for evening tea at about 5.40 p.m. We returned there again after 45 minutes and saw no new thing other than the direction of the prey-predator composition is rotated just 180 degree. The spider is now sucking juice keeping it's head vertically upward which is just opposite to the previous position. We had to return to the camp for other activities and for arrangement of light at about 7.10 p.m. in between we saw the spider rotated another 180 degree and changed its position in continuation of its dinner.

After finishing dinner we came back along with our camp host at about 9 p.m. and saw that the spider is also about to finish it's dinner and very actively moving with the prey composition but never sucking more. Switching off the light we awaited there for about half an hour and observed no new thing other than the detachment of prey-predator complex. After more 30 minutes while we departed the study area we saw the spider started repairing its web which was torn during feeding.

In second case : On 11th July, 06 the day was very dark but no rain, with extra interest we visited the same spider in same web and the observation was really very interesting. At 9 a.m. we reached the spot and saw a complete different picture. That time the spider was feeding upon a jet black coleopteran beetle most probably a species of the genus *Apogonia* measuring about 9 mm in length. The feeding process was almost direct unlike yesterday's pattern, the spider first immobilized the prey by repeated biting from different angles by injecting venom which took about 15 minutes and no silk swathing to the victim. During this process, the spider was using the first two legs little folded keeping the body away with a keen watch on the victim. After confirmation of the immobilization process the predator started feeding by piercing its sucking instrument through a soft area near the joint of head and thorax of the prey. Searching a soft area took about 15 minutes, in between stray sucking was done by the spider during search through the joining areas of the

hard crust of the insect. Like yesterday whole the feeding process occurred at the hub where the predator dragged down the prey for nourishment. After completion of the sucking the spider detached from the residue of the victim's body within 5 minutes. The total process took about 3.5 hours and before we left the place at 12.45 noon the spider started repairing its web.

DISCUSSION AND SIGNIFICANCE

It is revealed from this study that *Argiope pulchalla* of Tindharia have a two dimensional food capturing behavior in one of which it displayed a similar type of prey-predator interaction like the wandering spiders by direct attack for immobilization and then suck the juice. The only difference is that they perform their feeding like all biological activities on the web. Here *Argiope* displayed it's feeding behavior on a coleopteran beetle by sucking it's body fluid directly just after immobilizing it while in other case it swathed the prey (a lepidopteran moth) after immobilization and then sucked the body fluid.

Thus it can be concluded that in the way of evolution the majority of sedentary spiders develop the art of building orb-webs as traps to capture the prey to satisfy their carnivorous and predatory habit. Unlike all other web-building spider species *Argiope pulchella* Thorell simultaneously display the method of capturing prey like the wandering spiders and like the true web hunters both by the primitive attack procedure of using the chelicerae to immobilize prey while in other case first immobilize the victim by using a silk swath following an injection of venom after the prey has been encountered. Prey caught by the Argiope differs in size, from large grass hopper, beetle, moths, butterflies to small insects such as leaf hopper, gall wasps, fruit flies and small moths. According to the post captured behavior and the external morphology of the prey particularly the size and active repercussion which might have been cause of fear to the predator.

The diverse mechanism regarding feeding habit in light of evolutionary significance is note worthy. This might have happen due to the diversity of the morphology of the prey insects. Here the lepidopteran prey was larger in size and about 5 times volume of the spider thus needed extra security and protection for defense and conveniences during feeding (during the sucking action). On the other hand the coleopteran prey was smaller in size and easy manageable thus might not need swathing but more venom injection was also needed three fold time to immobilize than the swathed prey. The development of swathing before feeding is definitely an advancement in feeding behavior by conservation of bimolecule (Less use of venom) towards the savings of biological energy and highly significant.

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