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INTERESTING OBSERVATION ON MICRO-ADAPTATION AND APPROACH OF RETREAT AGAINST ANY MOVABLE OBJECT BY ONE HERSILIID SPIDER (*HERSILIA SAVIGNYI* LUCAS, 1836) IN DIVERSE ENVIRONMENT OF THE WETLAND ECOSYSTEM OF GANGETIC MARSHLAND OF NORTH 24 PARGANAS, WEST BENGAL

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INTRODUCTION

Studies on feeding behaviour of Araneid spiders from India were available with Tikader (1961, 1982), Kumar *et al.* (1977), published a note on dragonflies caught in spider web. Recently Majumder (2001), Talukdar and Majumder (2006, 2007 and 2008), Majumder and Talukdar (2006) and Talukdar (2008) did some interesting observation on food and feeding behaviour of four Araneid species of the genus *Argiope* and *Neoscona* belong to family Araneidae, genus *Leucauge* belongs to family Tetragnthidae and genus *Pholcus* belongs to family Pholsidae from West Bengal. Information on behavioral observation of Hersilid spider from Gangetic wetlands of North 24 Parganas, West Bengal is not available and also scanty in spider science.

During August,2008 while the authors were carrying out the behavioral studies on a spider named *Hersilia savignyi* Lucas, 1836 came across a male Hersilid displaying its feeding behaviour on a comparatively large cockroach, *Blatella germanica* Linnaeus, 1757 near the undistinguished cocoon built in a concrete shed near a paddy field of North 24 Parganas district, a potential wetland area in the history of Gangatic estuarine system of West Bengal.

The present paper deals with the micro-adaptive predating behaviour of *Hersilia savignyi* Lucas, 1836 along with its short instinctive memorizing

Fig. 1. Study area

capability, the interesting distinguishable pattern of retreat which support their natural history towards the evolution of intelligence in Animalia in-between the heart of very important ecological condition of nature from where the spider predates its prey in the different seasons.

Abbreviation used in the text: c: clockwise rotation; a: anti-clockwise rotation; +: presence of data; –: absence of data; appx.: approximately.

MATERIALS AND METHOD

The Study Area: Ecologically the study area is considered to be the part a large wetland of about 50km. stretch of Gangatic marsh area crept up on several agricultural and fishing villages situated between 22°40´ 09.01˝ to 22°43´ 29.7 ˝ of North and 88°24´ 27.03˝ to 88°22´ 22.6˝- 88°28´ 44.2˝ of East between the altitude of 6.00m -15.00m in several assembly segment of Jagaddal, Panihati, Khordaha, Amdanga, Naihati and Barasat. In bird view the actual study area is situated in and around, a "L" shaped water body, known as Karna Madhabpur Bil area, at the grid between the co-ordinate of 22°40´09.01˝ N and 88°24´27.03˝ E at an altitude of 15.00 m. situated between the Kalyani high way extension and Sealdah-Ranaghat railway route under the jurisdiction of Panihati municipality which is perhaps one of the remnants of the large connected wetland between Vidyadhari and Noai River of the past history Gangatic wetlands (Figure 1).

Climate: Monsoon prevails for about four months from mid of June to mid of October with high humidity. Annual humidity ranges between 85-95%. July–August are the heavy rainfall months with precipitations as high as 400mm., maximum temperature reaches up to 45°C in May while the mean maximum temperature is 30°C. Observed in June. On the other hand the minimum temperature drops up to 8°C in January and the mean minimum temperature 20°C.

Collection: Spiders were collected from the study areas by hand picking method by forceps with soft-tension and small sable brush. Sunca electronic emergency lamp has been used. Taxonomic studies have been made by an Olympus dissecting type binocular microscope with ocular micrometer while behavioral observations were performed by a Sony Mini DV DCR-HC42E, Canon Power Shot SX100IS and an electronic stop watch. Black velvet paper and tabulated data sheets were used. Web threads were collected in black velvet paper pieces. Collected spider specimens were anaesthetized, killed in a killing jar and preserved in Oudman's preservative (90 parts 70% ethanol, 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. Species level identifications was done based on Tikader (1987), Sebastian et al. 2009 and Baehr & Baehr (1987 &1993). The up to date scientific name of the spider by evolutionary sequence have been followed as per the standardized scientific names from the Indian and World catalog of Spiders (Platnick, 2014).

Euthanized specimens: To mimic the food item Hymenopteran ants were euthanized for spiders on the distal end of thin twig except otherwise stated. In case of unpalatable food item only thin twig with no ants were used.

OBSERVATION

Territoriality: *Hersilia savignyi* Lucas, 1836 commonly known as "two tailed spider", is generally found to our surroundings. Geological changes have great impact on the adaptive mode of life of this spider.

Fig. 2. *Hersilia savignyi* Lucas, 1836 besides its cocoon case.

They camouflage with their surroundings and remain in one particular position for many days waiting for their prey. They do not make web in hanging condition like many other spiders. Their web extends over their niche substratum made up of very thin silk thread, so unnoticed by many eyes. In case of rearing the spider lings or keeping the prey they also make case like cocoon (Figure 2). They stick themselves with the substratum with their forceps like appendages. Female spider guards the nest. Male-Female pair always lives together. Under an experimental condition if such pair is released to the territory of another adult male spider of same kind, the pair just leaves that place very quickly and search for another suitable place for them. Small spider lings like 4 mm in length can cross maximum 10 cm distance in 1 second at threatening condition.

Food and Feeding habit: While the most spider species generally hunt at night here our observation supports the fact of *H. savignyi* predating behaviour exclusively extends both day and night. In the experimental time period it was observed that a fasting *H. savignyi* predated on *Blattella germanica* Linnaeus, 1757, *Tetraponerarufonigra* Jerdon, 1851, *Camponotus angusticollis sanguinolentus* Forel, 1895, *Camponotus compressus* (Fabricius, 1787), *Camponotus (Orthonotomyrmex sericeus* (Fabricius) and Dipteran flies as food source.

Fig. 3. *Hersilia savignyi*Lucas, 1836 carries *Tetraponerarufonigra* Jerdon, 1851after predation within a silk case.

Hunting technique: *H. savignyi* notably first attacks on any movable palatable object that approaches toward its territory. After immobilizing the prey using poison and silk both male and female carry the item (Figure 3 & 4) to a suitable place, preferably near or into the cocoon, then suck the juice from the food. If movable object is unpalatable or stronger than the spider, it retreats backward. A schematic technique of Pray capturing process of *H. savignyi*drawn as per observation (Figure 5) is partained.

Fig. 4. *Hersilia savignyi*Lucas, 1836 predates on a comparatively large prey *Blattella germanica* Linnaeus, 1757.

In this kind of behaviour, first hersilid spider attacks on that prey and very quickly crawls forward of it and start spinning around it both in clockwise and anti-clockwise direction until the prey is entangled totally. In the present study 15 observations have been carried out for 10 consecutive days on 6 specimens to attain and draw the inferences on the behaviour of *Hersilia savignyi* Lucas, 1836 which is highly significant regarding evolution of memory among the invertebrates. In 29% (appx.) of cases hersilid spiders attack the unpalatable object otherwise avoid. In case of palatable object attack readily happens in 75% (appx.) situations. This was also found from the present study that the hersilid spider made about 55%-70% (61.4% ± 5.5%) clockwise and 30%-45% (38.6% ± 5.5%) anticlockwise rotation to entangle its prey completely. Details of 15 observations are given in Table 1. Out of fifteen observations only eight times spiders attacked and entangled the items which are already shown in Table 1. Activity Budget estimation of this circular movement to entangle the prey is given in Figure 6. In this figure percentage of clockwise and anti-clockwise movements are plotted in 100% stacked column graph with number of observations made with or without feed (prey items) during eight observational accounts are depicted.

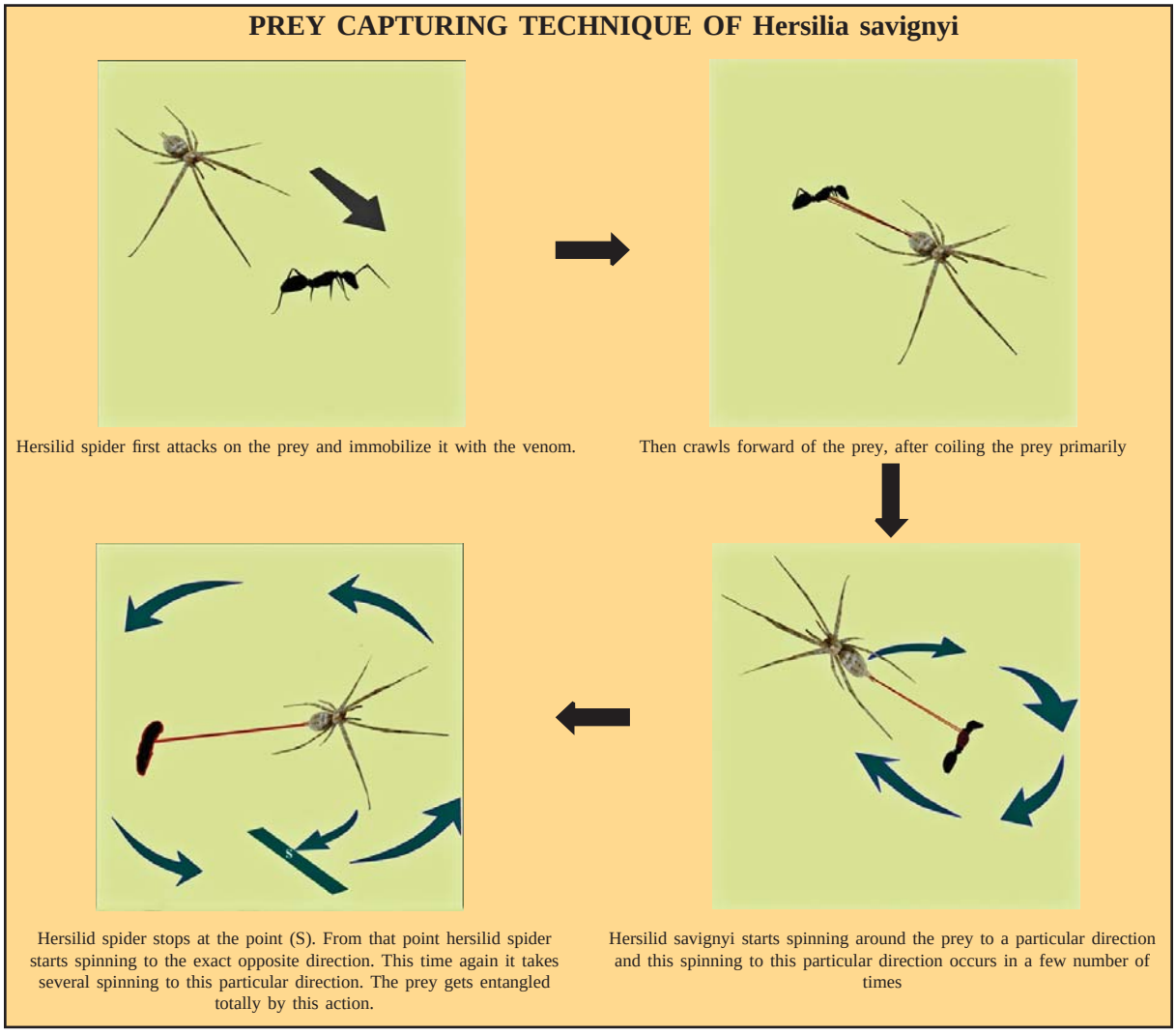

Fig. 5. Scheme showing Prey capturing process of *H. savignyi.*

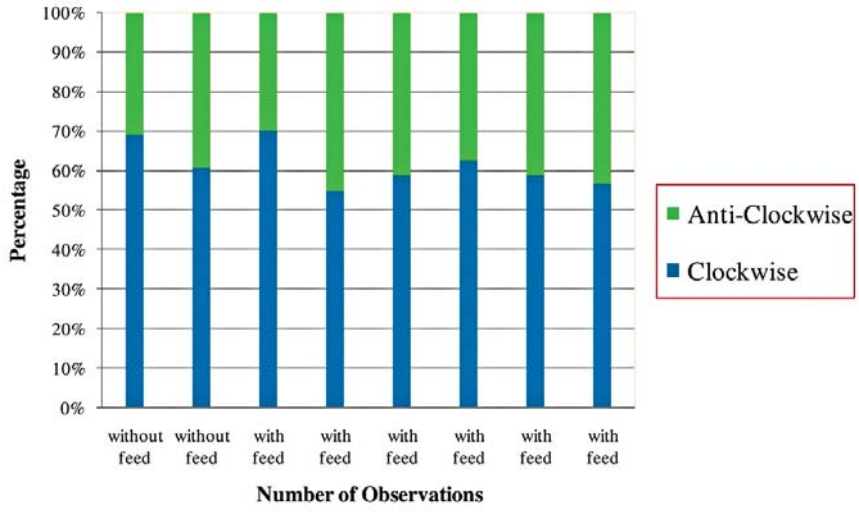

Fig. 6. Clockwise and anti-clockwise activity budget estimation during focal sampling in different observational cases at the time of capturing prey items for *Hersilia savignyi* Lucas, 1836.

Table 1. Details of observation for the predatory behaviour of *Hersilia savignyi* Lucas, 1836.Circular movement around the object by hersilid spider are represented within brackets.

Observation no.	Day no.	Specimen No.	With Feed		Without Feed	
			Attack	Retreat	Attack	Retreat
O1	1	1	–	–	–	+
O2	1	1	–	–	–	+
O3	2	1	–	–	+ (9c; 4a)	–
O4	2	1	–	–	–	+
O5	3	1	–	–	+ (17c; 12a)	–
O6	3	1	–	–	–	+
O7	4	2	–	–	–	+
O8	4	3	+ (7c; 3a)	–	–	–
O9	5	4	+ (11c; 9a)	–	–	–
O10	6	4	+ (37c; 26a)	–	–	–
O11	7	4	–	+	–	–
O12	8	5	+ (5c; 3a)	–	–	–
O13	8	6	+ (27c; 19a)	–	–	–
O14	9	6	–	+	–	–
O15	10	6	+ (17c; 13a)	–	–	–

This image of action for unpalatable object may remain in its mind for 24 hrs. (approximate). Within this time period if that unpalatable moving object is placed in front of it again, it retreats backward rather attacking that object. With time this activity gets gloomy. After one day period if the same object is placed in front of that spider again, it repeats the same behaviour as it did at the first time when that object was placed in front of it.

DISCUSSION

Animals receive floods of information from the environment through their sense organs, much more than their brains can process at a given moment (Dukas 2004). Small animals such as spiders, behavioral decisions are sometimes influenced by multiple cues. Orb webs constitute exquisitely precise records of the stimuli the spider experienced and the decisions that it made while building its web (Ederhard and Hesselberg, 2012). It is thus reasonable to expect that animals may bias which subsets are processed and acted upon at any given moment. If an animal can bias input and processing of information appropriately ('pay attention'), it can respond more consistently and more efficiently to the particular subsets of stimuli that are most relevant to its current behavioral context (Shettleworth 2010). Attention is a well-established phenomenon in vertebrates, and there are indications that insects and spiders also present 'attention-like' phenomena (Shettleworth 2010). Study of attention, and of possible behavioral errors that are associated with changes in attention, has important implications. Orb webs constitute exquisitely precise records of the stimuli the spider experienced and the decisions that it made while building its web. In addition, because spiders appear to sense their webs largely by touch, direct behavioral observations can determine which stimuli they probably sense (Ederhard and Hesselberg, 2012).

From the experiment it can be drawn that

Hersilia savignyi Lucas, 1836 generally makes more clockwise rotation than anti-clockwise rotation to entangle its prey. In both cases of web building and predation animals learn either by the process of cultural transmission invested by parents or by instinct in the process of natural selection. The recognition of an object and memorization can only be achieved by multiple exposures of that very object or object-like things. The interesting action pattern of *Hersilia savignyi* for unpalatable object recognition can be considered as "Short Term Memory" (STM), a memory don't last in mind for all time. Cognitive psychology distinguishes short term memory and long term memory. Short term memory (STM) or Working Memory (WM) refers to the memory trace that is maintained during the psychological present, and long term memory (LTM) is the storage of past experiences (Sougné, 2002). During predation, hersilid spider literally takes many behavioral decisions and gets attention to multiple cues from the environmental cues. From this context it can readily be concluded that STM plays a significant role in the predating behaviour of hersilid spider. It can also be concluded that in its small niche by this adaptive predating activity (micro-adaption) hersilid spiders also regulate the population of insects in the house and surroundings. So it can be considered as a potentially bio-controlling natural agent in the related environment of agriculture and domestic fields. Further study on this spider may open many unknown windows in the science of neurology.

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