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STUDIES ON HABIT AND HABITAT, EXTERNAL MORPHOLOGY, FEEDING CAPACITY AND PREY PREFERENCE OF TRUE WORB-WEAVING SPIDER *Argiope aemula* (WALEKENAER)

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ABSTRACT

Laboratory studies were carried out to investigate habit and habitat, external morphology, preying capacity and prey preference of true worb-weaving spider *Argiope aemula* (Walekenaer) collected from different places of U.P. India. The spider was found to inhabit bushes and paddy crop fields in its characteristic web. It is beautifully coloured on the dorsal side. It inhabits bushes and paddy crop plants by constructing a net web often suspended between two adjoining bushes and paddy plants. It prey on small and medium sized insects entangled by its net.

KEYWORDS: *Argiope aemula*, Habit And Habitat, Morphology, Preying Capacity, Prey Preference, Bio-Control Agent.

Spiders (order Araneae) are air-breathing arthropods that have eight legs and chelicerae with fangs that inject venom. They are the largest order of arachnids and rank seventh in total species diversity among all other orders of organisms. Spiders are found worldwide on every continent except for Antarctica, and have become established in nearly every habitat with the exceptions of air and sea colonization.

Spiders are of major importance in ecosystems and are recognized as effective natural control agents in agro-ecology. They are classified into 106 families with about 40,000 species, but the actual number of species is expected to be many times higher. These are carnivorous arthropods and are found all over the world in almost every kind of habitat. They mainly prey on insects, although they may also feed on various other kinds of prey. The population densities and species abundance of spider communities in agricultural fields can be as high as in natural ecosystems (Tanaka, 1989).

Spiders play an important role in regulating insect pests in the agricultural ecosystem. There are a large number of species many of them with high population densities, There are 22 families, 99 genera and 175 species of spiders in Korean rice fields. They limit the availability of habitats open to insect pests of rice by occupying various microhabitats. They have a wide range of prey species, catch significant numbers of prey and use various foraging strategies. Most of the spiders in rice fields seem to evacuate the field after the application of insecticides and move back into the field later. Their predatory capacity can have a synergistic effect in suppressing densities of insect pests when they are used to complement the effects of insecticides. They consume a large number of prey, and do not damage plants. They can achieve and equilibrium in pest control, after which their own numbers are suppressed by their territoriality and cannibalism. For some time, spiders have been considered important predators which help regulate the population densities of insect pests (Tanaka, 1989). In particular, spider communities in areas with a temperate climate achieve equilibrium in the control of agricultural pests. In spite of this, they have not usually been treated as an important biological control agent, because there is so little information on the ecological role of spiders in pest control (Riechert and Lockley, 1984).

Spiders use a wide range of strategies to capture prey: trapping it in sticky webs, lassoing it with sticky bolas, mimicking the prey to avoid detection, or running it down. Most detect prey mainly by sensing vibrations, but the active hunters have acute vision, and hunters of the genus *Portia* show signs of intelligence in their choice of tactics and ability to develop new ones. Spiders' guts are too narrow to take solids, and they liquefy their food by flooding it with digestive enzymes. They also grind food with the bases of their pedipalps, as arachnids do not have the mandibles that crustaceans and insects have.

Spiders represent more than 90 % of the natural enemies of brown plant hoppers living in paddy fields in Korea (Lee *et al*., 1997).

Vijayalakshmi and Ahimaz (1993) have given a descriptive account of spiders. Gajbe (2004) has provided a detailed account of spiders of Jabalpur, Madhya Pradesh, Rao *et al*. (2005) have described arachnid fauna of Nallamalai region, Eastern Ghats Andhra Pradesh (India) and Majumder (2004, 2005 and 2007) has given a detailed account of taxonomic studies of some spiders from Mangrove and Semi-Mangrove areas of Sunderban, studies on some spiders from Eastern Coastal region of India and various aspects of

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spiders of Sunderbans, West Bengal (India) respectively. Mishra *et al.* (2012[a] and 2012[b]) have reported *Neoscona nautica* and *Neoscona crucifera* and *N. adianta* from Azamgarh district and Yadav *et al* (2012[a] and 2012[b]) have reported *Leucauge decorata* from Azamgah and *Hippasa holmerae* from Azamgarh and Mau districts of U.P., India. Recently Chaubey and Mishra (2016, 2017[a] and 2017[b]) have reported *Cyrtophora cicatrosa* (Stolockza), *Cyrtophora citricola* (Simon) and Eucta chamberlini (Simon) from U.P. India. They have described habit and habitat, morphology, feeding capacity and prey preference of these spider species and also suggested for use of spiders as bio-control agents in controlling insect pests of crop fields.

From the review of literature, it appears that role of spiders as bio-control agents in agriculture, poultry as well as in controlling house-hold insects is being studied in various parts of the world, but unfortunately, no proper investigation, regarding role of these efficient bio-control agents in India is scanty.

In the present investigation, therefore, it has been to find out habit and habitat, external morphology, preying capacity and prey preference of *Argiope aemula*, a true orb weaving spider collected from various places of U.P. (India).

MATERIALS AND METHOD

Collection of Spiders

Individuals of *Argiope aemula* were collected from crop fields, orchards, ornamental and wild plants.

Mehods of Collection

Following techniques were used for collection of spiders:

Jarring

The foliage spider fauna was collected by jerking the plants on a cloth sheet, from which the specimens were transferred alive in to plastic containers having pores in their corks for aeration and brought to the laboratory for studies.

Direct Hand Picking

Collection of most web building spiders was made by direct hand picking with the help of test tubes.

Inverted Umbrella

In this method an inverted umbrella was placed below flowering shoots and bushes and when the tree or branch was thoroughly shaken, spiders along with insects fallen to the inverted umbrella. After removing leaves, spiders were transferred into collecting tubes.

Preservation

Before the spiders were permanently preserved they were arranged properly. For this, collected specimens were transferred into petridish containing Isopropyl alcohol. It was kept covered undisturbed for about 2 or 3 hours in order to allow the relaxation of body muscles. The body parts like legs, abdomen, and palps were then arranged in a life like manner with the help of forceps and brush. Spiders were then kept in alcohol in a closed pair of petridish overnight before transferring to tubes for permanent preservation. The glass vial containing preserved specimens were stoppered by a rubber cork to prevent evaporation of alcohol. Alternatively, glass vials were plugged by cotton and group of these tubes were then placed in large bottle containing alcohol. This was the method used for preserving most specimens. Each collecting tube enclosed a label indicating the collection data. Collection data includes the name of the collector, place of collection, date of collection and habitat of collection.

Photography

Live photographs of all important spiders were taken with the help of Web Cam of 12 mega pixel attached to computer. For taking alive photographs, the spiders were anesthetized with mild doses of chloroform in specimen tubes. Generally, major diagnostic features such as dorsal view, ventral view, ocular area and side view were taken for the study. Natural photographs of spiders were taken while they were feeding on insects.

Identification

It was done on the basis of morphometric characters of various body parts. The help was mainly taken from the keys and catalogues provided by Biswas and Biswas (2003), Nentwig *et al.* (2003) and Plantik (2004), information and photographs available on internet and other relevant literature.

Study of Prey Choice

To study the prey choice of the collected spiders, adult house flies, rice moth, mosquitoes and their larvae and small insects were supplied to spiders which were kept under rearing chambers.

Each rearing chamber (9.5 cm height, 6.0 cm length and width) was consisted of transparent plastic

containers. The lid of each container was provided with small holes for aeration. Since, spiders are highly cannibalistic, individual spiders were kept in separate chambers.

To study prey choice, spiders were kept starved for 24 h, then each spider was supplied with larvae and adults of moths, house flies and mosquitoes along with small insects collected from houses and surroundings (five individuals of each kind of prey in each rearing chamber). After 12h number of fed and live prey individuals were counted to find out preference of their prey. Attempts were also made to take live photographs while spiders were preying.

Study of Preying Potential

For this purpose spiders were kept starved for 24h and then each spider was supplied with various kinds of insect pests like adult moths, house flies and mosquitoes (ten individuals of each type) separately in their individual rearing chambers. After 12h, dead, fed and live prey were counted.

Statistical Analyses

Each experiment was repeated ten times and student's t-test was applied for comparison between two sample means.

RESULTS

Classification

Phylum: Arthropoda, Class: Arachnida, Order:Araneae, Family: Araneidae, Genus: *Argiope*, Species: *aemula*

Habit and Habitat

This species is the true orb–weaving spider. These are beautifully coloured on the dorsal side (Fig. 01). These inhabit bushes and paddy crop plants by constructing a net web often suspended between two adjoining bushes and paddy plants. These catch small and medium sized insects entangled by their nets (Fig.02 and Fig. 03).

Diagnostic Characters

Cephalothorax longer than wide, yellowish brown in colour, narrowing in front. Anterior and posterior median eyes sub-equal in size, lateral eyes are close, both situated on a prominent tubercle. Chelicerae small and weak provided with rudimentary boss. Abdomen is broadly oval, longer than wide, overlapping anteriorly on the cephalothorax. Dorsum is provided with black transverse stripes and forming a network on the posterior half (Fig. 01).

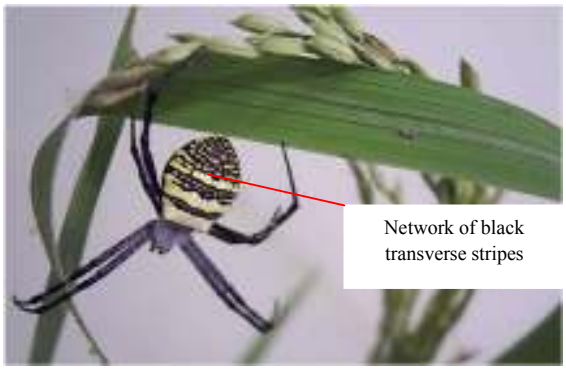

Figure 1: Dorsal view, sitting on paddy plant

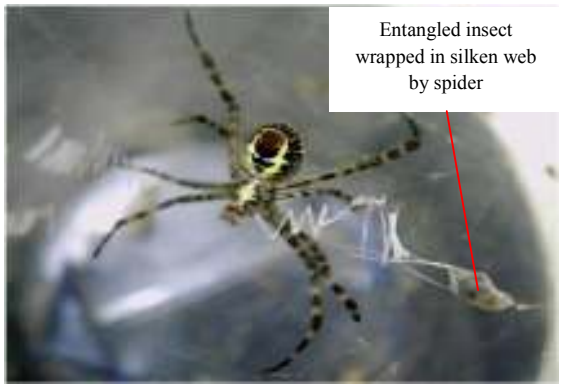

Figure 2: An entangled insect wrapped in silken web by spider

Figure 3: Feeding on insect wrapped in silken web

Economic Importance

Acts as an efficient controlling agent for various kinds of insect pest in the crop fields (Fig. 02 and Fig. 03 and Table -01).

DISCUSSION

Argiope aemula Walckenaer (Orb weaving spider) is the true orb weaving spider (Majumder, 2007). These are beautifully coloured spiders inhabiting the bushes and paddy field crops constructing a net web often suspended between two adjoining bushes or paddy plants. Similar description has also been made by Majumder (2007) he has reported this spider from mangrove bushes.

Table 1: Feeding potential/ prey preference of *Argiope aemula*.

Type/ Number of prey consumed/ 24h/ Spider (Mean ± S.D.)						
S.No.	**Lepidoptera**	**Diptera**	**Homoptera**	**Orthoptera**	**Coleoptera**	**Total**
1	5	6	3	6	1	21
2	4	5	5	5	0	19
3	5	7	4	6	1	23
4	6	5	3	7	0	21
5	5	6	5	5	1	22
6	5	8	5	6	0	24
7	4	5	6	6	0	21
8	8	4	4	7	0	23
9	6	7	3	5	1	22
10	5	4	5	6	1	21
Mean±S.D.	05.30±1.16	05.70±1.34[*]	04.30±1.06[b]	05.9±0.74[b]	0.50±0.52[a]	21.70±1.42[a]

Significance level [a]0.001, [b]0.01, [c]0.05, [d]0.10 and [*] not significant when compared with adjacent means.

Distribution

It has also been reported from India (West Bengal, Darjeeling, Gujarat, Tamilnadu, Maharashtra, Andaman and Nicobar Island). It has also been reported from Myanmar, Shri Lanka, Austro-Malaysia (Majumder, 2007).

Economic Importance

It was observed to feed on paddy crop insect pests by entangling them in net, as also reported by Gajbe (2004) and Majumder (2007). Thus, it can be used as a bio-control agent in paddy crop fields like other spider species as suggested by Song and Lee (1994); Kim and Kim (1995); Kim (1995a & 1995b) and Im and Kim (1999).

Remark

This spider species is being reported here for the first time from Uttar Pradesh (India).

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