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STUDIES ON HABIT, HABITAT, EXTERNAL MORPHOLOGY, FEEDING CAPACITY AND PREY PREFERENCE OF WORB-WEAVING SPIDER, *ZYGEILLA MELANO CRANIA*

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ABSTRACT

Studies were carried out to investigate habit, habitat, external morphology, preying capacity and prey preference of worb-weaving spider, *Zygeilla* collected from different places of Uttar Pradesh, India. The spider was found to inhabit bushes and crop fields in its characteristic web. It bears cephalothorax \ larger than wide, narrowing in front. Occular quadrate slightly longer than wide. Legs moderately long and strong. Abdomen oval, longer than wide. Dorsum provided with distinct folium composed of white and black patches. In laboratory conditions it was found to prey actively/ preferably on soft bodied insects entangled in its web.

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KEY WORDS : Bio-control agent, Habit and habitat, Morphology, Preying capacity, Prey preference, *Zygeilla*.

Introduction

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[16].

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

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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 an equilibrium in pest control, after which their own numbers are suppressed by their territoriality and cannibalism. Sometimes, spiders have been considered important predators which help in regulating the population densities of insect pests[1]. 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[15].

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[6].

Spiders are an important group of predators in various ecosystems. However, their role in pest control and crop protection has not been utilized properly in India. Various living organisms lived in perfect harmony and balance with each other in different ecosystems before chemical agriculture and chemical pest control came into the picture. Today, we see a kind of agricultural development which is based on monoculture and extensive use of chemicals. This has led to the emergence of several pests which has in turn led to the failure of crops. The number of pests developing resistance

TABLE-1: Feeding potential/ prey preference of *Zygeilla melanocrania*.

Type/ Number of prey consumed/ 24h/ Spider (Mean ± S.D.)						
S.No.	**Lepidoptera**	**Diptera**	**Homoptera**	**Orthoptera**	**Coleoptera**	**Total**
1	10	9	8	8	1	36
2	10	8	8	6	0	32
3	9	9	10	7	1	36
4	5	9	10	5	0	29
5	10	10	9	6	1	36
6	12	7	6	4	0	29
7	8	9	5	7	0	29
8	9	5	5	6	0	25
9	7	11	6	7	1	32
10	6	6	7	5	1	25
Mean±S.D.	08.60±2.12	08.30±1.83*	07.40±1.90^{d}	06.10±1.20^{c}	0.50±0.52^{a}	30.90±4.23^{a}

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

to pesticides over the years has been increasing at a very alarming rate. The pesticides have proven to be extremely toxic and have led to a number of side effects: impact on public health, toxic residues in food and disturbance of local ecosystems. Use of such chemicals has also led to the eradication of natural predators such as spiders which normally keep pest populations in balance.

Descriptive account of spiders from various regions of India have been given[5,7,8,9,14,17]. *Neoscona nautica* and *Neoscona crucifera* and *N. adianta* from Azamgarh district[10,11]. *Leucauge decorata* from Azamgah and *Hippasa holmerae* from Azamgarh and Mau districts of U.P., India[18,19]. Recently habit and habitat, morphology, feeding capacity and prey preference of *Cyrtophora cicatrosa*, *Cyrtophora citricola* and *Eucta chamberlini* have also been reported from U.P. (India)[2,3,4].

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 *Zygeilla*, an orb weaving spider collected from various places of U.P. (India).

Materials and Method

Collection of spiders: *Zygeilla* spiders were collected from crops, orchards, ornamental and wild plants of Uttar Pradesh, India.

Methods 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 into plastic containers having pores in their corks for aeration and brought to the laboratory for studies.

Direct hand picking: Collection of most web building and surface dwelling spiders was made by direct hand picking with the help of test tubes.

Sweep net: This is an old method usually used for collecting insects and butterflies. An insect net was swept through tall grass and weeds and the spiders caught in it were collected in a small glass vial containing some spirit.

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.

Kerchief method: This method was used for collecting running and wandering spiders, especially those belonging to the families Lycosidae and Salticidae. An open kerchief was thrown over the running spider, which was then carefully caught in the folds of kerchief.

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[2,12,13].

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

Fig.1

Fig.2

Fig.3

Fig.4

Zygeilla melanocrania

Fig.1: Dorsal view, Fig.2: Ventral view, Fig. 3: Postero-dorsal view, Fig. 4: Antero-dorsal view

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 and Discussion

Habit and habitat: These are smaller to medium sized found on the bushes and crop plants. Basically *Zygeilla* spp. builds orb-weav in which characteristically one sector remains free of viscid spiral threads. There is one radius leaving through this open sector to the retreat of the spider as the trap line. The webs are renewed almost every day. They catch their prey entangled by web.

Diagnostic characters: Cephalothorax longer than wide narrowing in front. Occular quadrate slightly longer than wide. Both rows of eyes are recurved but posterior row very narrowly recurved. Anterior median eyes larger than the posterior medians. Chelicerae moderately strong, provided with distinct boss. Legs moderately long and strong. Abdomen oval, longer than wide. Dorsum provided with distinct folium composed of white and black patches (Figs. 01-04). ***Zygeilla*** F.O.P. Cembridge spiders are smaller to medium sized also found on the mangrove and semi-mangrove area of Sunderban. They are also found on the bark of the large trees of mangrove forest. Basically *Zygeilla* spp. builds orb-weav in which characteristically one sector remains free of viscid spiral threads. There is one radius leaving through this open sector to the retreat of the spider as the trap line. The webs are renewed almost every day. They catch their prey entangled by web[9].

Distribution: It has also been reported from West Bengal, Bardwan and Orissa (India), Myanmar and Pakistan[9].

Economic importance: Acts as a predator of insect pests in the fruit garden and paddy crop fields[9].

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