# CHAPTER 8

## Predatory behavior and Prey preference of *Oxyopes shweta* to insect prey in laboratory arena.

## INTRODUCTION

There are 32 species of Oxyopids spiders described from India (Rajashaker and Rhagavendra, 2001). They are the diurnal dominant foliage hunters found in several agroecosystems (Nyffeler and Sunderland, 2003.). These spiders are seen in the panicles of the plants, leaves of the grasses and on other weeds found along the field margins (Siliwal, 2000). They have long legs which make them fast runners. They attack the prey by jumping like a cat hence their name lynx spiders. These lynx spiders have well developed eyesight which is better than spiders of other families except Salticidae (Wise, 1993). They can see their prey from a distance of up to 10 cms. Oxyopids have 8 eyes which are arranged in an octagonal pattern. All the eyes are of the same size. Lynx spiders can be identified from their eye pattern, presence of long spines on the legs and by their pencil shaped abdomen. Their size ranges between 5 to 10 mm. they feed on a variety of insects and other arthropods (Young and Lockley, 1985; Siliwal, 2000) and are of considerable importance in biological control. Most of the predatory spiders prefer to attack prey whose size is 40 – 60% of their own body size and seldom attack larger prey greater than their own body size (Marc et al, 1999. Nentwig, 1987. Wise, 1993).

Predatory behaviour and prey choice of the spiders is one of the most important aspects in the incorporation of spiders in biological control. As in any agroecosystems once the spider is in a foraging patch, a spider confronted with a choice of potential prey species (insects and other

arthropods). The predatory behaviour and prey choice of the spiders will be of critical importance in incorporating spiders in IPM programs of different crops.

Predatory behaviour of animals is dictated by their cognitive abilities and also dependent on the type of the insect. According to the optimal foraging theory the predatory behaviour is shaped by natural selection (Stephen and Krebs, 1986). To forage in an optimal manner the predator has to differentiate between different prey types. Foraging of any animal is dictated by the relative abundance of the preferred prey, the preferred prey should be nutritionally more profitable to the predator and the prey should be safer to attack.

Much of the work on prey preference and predatory behaviour of the spiders have been done on the jumping spiders by Jackson and Pollard, 1996, Jackson and Willey, (1998). Very little work has been done till date on the Oxyopids apart from the work done by Punzo (1998, 2001) on *Oxyopes salticus* done in New York. No study has been done in the Southeast Asia continent on prey preference and predatory behaviour of Oxyopids. In this present paper we investigated the following aspects.

1. Does the spider employ different predatory methods for attacking the different stages of *Spodoptera litura?*
2. Does the spider employ differential predatory strategy to attack adults and Juveniles of Clavigrella *horrens*?

3. Are there any differences in the hunting strategy of the Males and Females of *Oxyopes shweta*?
4. Does the size of the prey influence the predatory behaviour of the spider?
5. Which prey the spider prefers and is there any sex specific prey choice.
6. Does hunger influence the prey preference by the spiders of either sex?

## RESULTS

### A. Predatory behaviour of *Oxyopes shweta* to 3rd instar *Spodoptera litura*

When the predator is released into the container then the prey is stalked for few minutes and the spider orients itself with the first pair of legs raised prior to the attack, then the predator leaps forward to attack and subdue the prey. On an average a 3rd instar larvae of spodoptera are held for 45 minutes by the male spider while the female spider takes 30 minutes to subdue the prey. If the prey is active and is mobile, the spider waits for the larvae to come near it and with accuracy the spider leaps forward to catch the prey.

### B. Predatory behaviour of *Oxyopes shweta* to Pupa of *Spodoptera litura*

The females of *Oxyopes shweta* attacked the pupa of *Spodoptera litura*, but the frequency of the attack was very less. Of the 12 females tested only 2 fed on the pupa. One peculiar feature was observed in the test arena of the attacked pupa that the spider built draglines which are not the usual mode of attack of the spider. Such draglines crisscrossed the

container. Such draglines were absent from the containers of the females which did not attack the pupa. These draglines were different from the egg case webs which are built by the females. The females attacked the pupa on the anterior side and sucked the pupal fluid leading to the death of the pupa. On closer observation under the binocular microscope we found an aperture made by the spider for siphoning the contents of the pupa. Males did not attack the pupa at all. Thus it is seen that only the females feed on the pupa of Spodoptera litura.

**C. Predatory behaviour of *Oxyopes shweta* to Adult *Spodoptera litura***

Only the females attacked the adult *Spodoptera,* the females attacked the adults along the lateral sides of the abdomen, making an aperture for siphoning; while the males did not attack the adult *Spodoptera.*

**D. Predatory behaviour of *Oxyopes shweta* to *Clavigralla horrens* juveniles**

The juveniles of *Clavigralla* are of comparable size or are smaller than the spider itself (Table 8.1). They are slow moving insects mainly found on the pods of the pigeonpea. In the presence of predator they become stationary. The spider of both the sexes attacks the prey head on and inserts its fangs on the dorsal side of the thorax and along the sides of the thorax. It was rarely seen that the spider attacked the prey from the rear. On an average both the sexes spent 15-20 minutes while subduing the prey.

**E. Predatory behaviour of *Oxyopes shweta* to *Clavigralla horrens* adults**

The adult *Clavigralla* have a more sclerotised exoskeleton and have a tougher look as compared to the juveniles. While attacking the adult *Clavigralla* the spider adopts a different strategy. It attacks the prey with equal frequency from the dorsal side and ventral side of the abdomen. The probable reason is the adult prey is larger in size (Table 8.1) as compared to the predator and the thorax is sclerotised. The chelicerae of the spider may not be strong enough to pierce it.

**F. Prey Preference in *Oxyopes shweta* males**

In the alternate day tests when the prey were presented on alternate days the males of *Oxyopes shweta* in satiated and in hungry condition preferred *Clavigralla horrens* to *Spodoptera litura*. However the preference was not significant (Table 8.2a).

In Simultaneous prey presentation tests, in satiated condition the males preferred *Clavigralla horrens* to *Spodoptera litura* ($P<0.001$). While in hungry condition through *Clavigralla horrens* was attacked more but the results are not significant (Table 8.3a).

In Alternative prey presentation tests, in 42 individuals tested only 2 *Oxyopes shweta* males left *Spodoptera* to attack *Clavigralla horrens* in satiated condition. However there was no spider left each other in hungry condition.

**G. Prey Preference in *Oxyopes shweta* females**

In alternate day tests the female *Oxyopes shweta* showed a significant preference to *Spodoptera litura* in both satiated ($P<0.01$) and in hungry ($P<0.05$) condition (Table 8.2b).

In simultaneous prey presentation test also the females showed a significant preference to *Spodoptera litura* in both satiated ($P<0.001$) and hungry ($P<0.001$) condition. In alternative prey presentation tests no spider left one prey to take the other prey (Table 8.3b).

**Table 8.1: Morphometry and Description of the test animals.**

| Order | Family | Scientific name | Predator \ Pest | Stage / Sex | Body Size (mm) |
|---|---|---|---|---|---|
| Araenae | Oxyopidae | Oxyopes shweta (Tikader) | Predator | Adult Male | 6-8 mm |
| Araenae | Oxyopidae | Oxyopes shweta (Tikader) | Predator | Adult Female | 10-12mm |
| Lepidoptera | Noctuidae | Spodoptera litura | Pest | 3rd Instar larva | 20-25mm |
| Heteroptera | Coreidae | Clavigralla horrens | Pest | Juveniles | 8-10 mm |

**Table 8.2 a: Alternate day prey presentation test -- Male spiders**

| | Prey 1 | Prey 2 | Both | Neither | McNemar test |
|---|---|---|---|---|---|
| Satiated condition | 08 | 10 | 06 | 14 | NS |
| Hungry condition | 15 | 17 | 11 | 3 | NS |

Prey 1 is Spodoptera larvae, prey 2 is Clavigrella juveniles

**Table 8.2 b: Alternate day prey presentation test -- Females spiders**

| | Prey 1 | Prey 2 | Both | Neither | McNemar test |
|---|---|---|---|---|---|
| Satiated condition | 25 | 08 | 15 | 12 | P<0.01 |
| Hungry condition | 21 | 12 | 8 | 5 | P<0.05 |

Prey 1 is Spodoptera larvae, prey 2 is Clavigrella juveniles

**Table 8. 3 a: Simultaneous prey presentation test -- Male spiders**

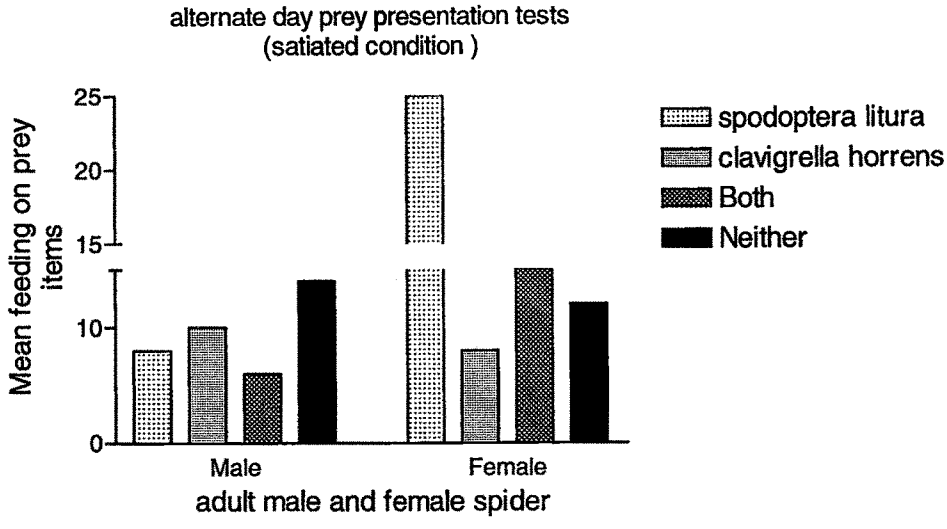
| | Prey 1 | Prey 2 | Neither | Goodness of fit |
|---|---|---|---|---|
| Satiated condition | 14 | 26 | 10 | P<0.001 |
| Hungry condition | 12 | 14 | 3 | NS |

Prey 1 is Spodoptera larvae, prey 2 is Clavigrella juveniles

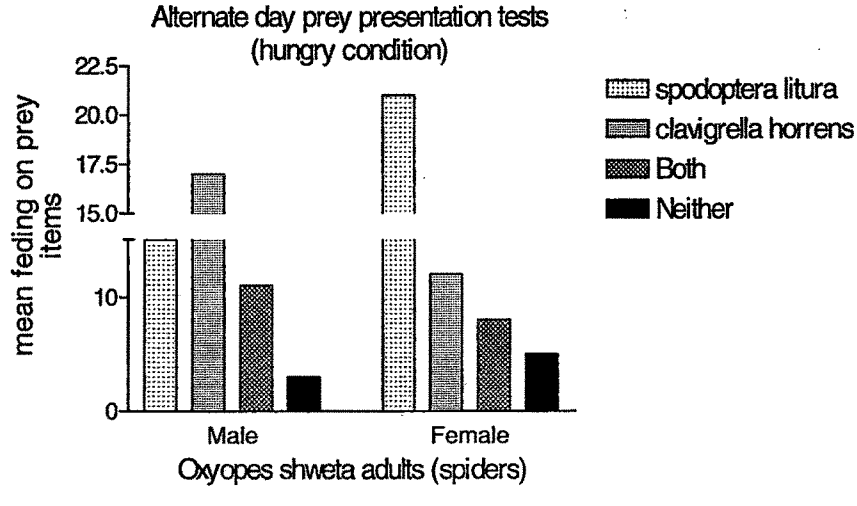
**Table 8.3 b: Simultaneous Prey Presentation test -- Female spiders**

| | Prey 1 | Prey 2 | Neither | Goodness of fit |
|---|---|---|---|---|
| Satiated condition | 19 | 10 | 11 | P< 0.001 |
| Hungry condition | 15 | 7 | 2 | P<0.001 |

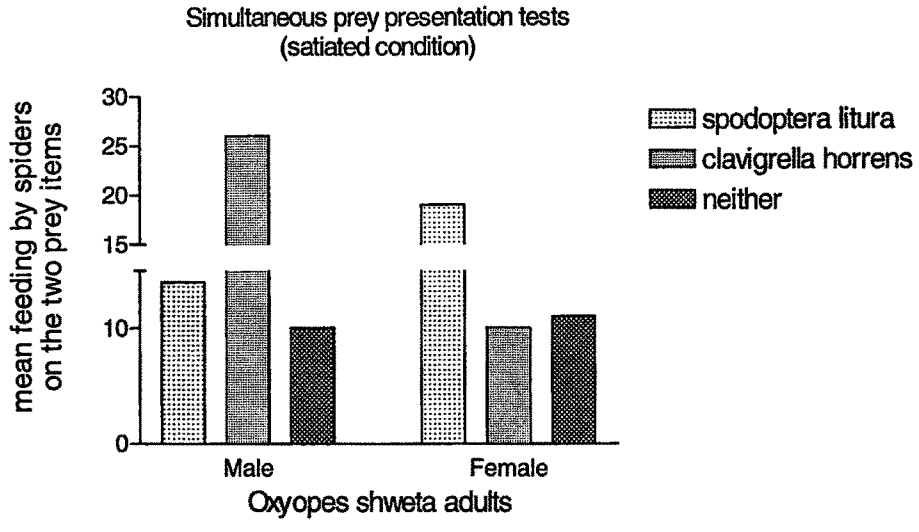
**Graph 8.1: No Choice Tests: Satiated condition**



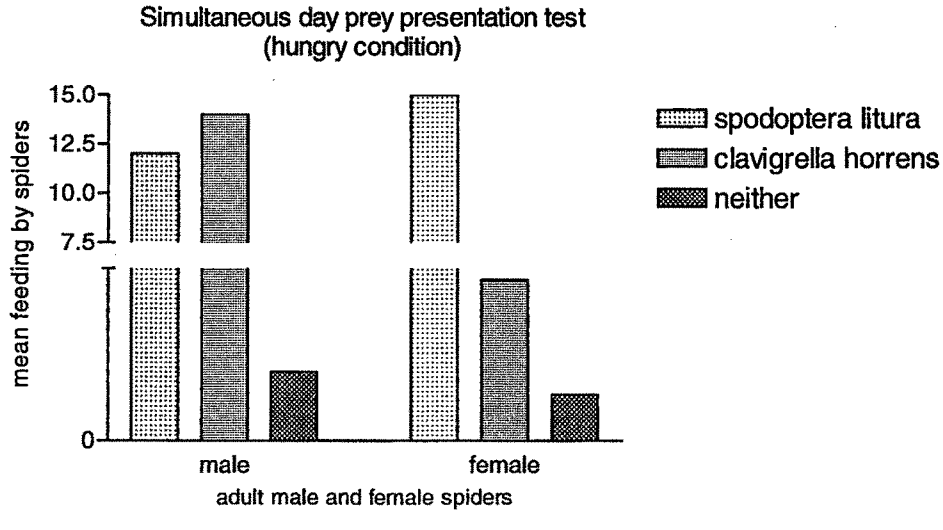

**Graph 8.2: No Choice Tests: Hungry condition**



**Graph 8.3: Choice Tests: Satiated condition**




**Graph 8.4: Choice Tests: Hungry condition**



## DISCUSSION

The predatory behaviour of the spiders shows that the spider adopts different tactics for attacking different types and stages of prey. From the predatory behaviour of *Oxyopes shweta* to the 3 prey items showed that in satiated condition ( experiment done 7 days after giving food) when given a choice between larvae of *Spodoptera* and the juveniles of *Clavigralla*; there was a differential response by either sexes of *Oxyopes shweta.* While the male prefer *Clavigralla* juveniles which were smaller in size than the spiders; female spiders prefer *Spodoptera* larvae which are about twice the body size of the spider. The reasons for the differential preference by either sexes might be because the male's nutritional requirement is less as compared to the females and also the males look for a safer prey ( prey on which it can feed without much struggle and without much harm to itself). The female's nutritional requirement is much more as compared to male spider and it stems from the fact that the fecundity rate of the females has been found to be influenced by the nutritional quality of the prey. Thus the female risks itself for taking a high quality prey which is twice its body size. The physiological requirement of the female dictates its predatory behaviour and thus it takes more risk to forage on a larger prey (Lima, 1998). The female spiders have evolved a lifestyle that emphasizes the consumption of large quantities of food as an adaptation for adding yolk to eggs and nutritional requirement of male spider is small as compared to the females, thus a preference for smaller prey is expected as compared to females (Li and Jackson; 1996). When given a choice between adult *Clavigralla* and 3$^{rd}$ instar *Spodoptera*,

spiders of both the sexes preferred larvae of *Spodoptera* to adult *Clavigralla*. One of the reasons for this is the body of the adult *Clavigralla* is sclerotised and the chelicerae are not strong enough to penetrate It.; while the integument of larvae is delicate and can be easily penetrated.

In hungry condition both the sexes attack *Spodoptera* and *Clavigralla* with equal frequency. The frequency of male spiders attacking *Spodoptera* is greater in hungry condition than in satiated condition (Graph 8.2 and 8.4). The reason is attributed to the fact that hungry animals assume more risk to acquire high quality food than satiated animals and also the choice diminishes in hunger condition (Orians ,2000), While the frequency of attack by females on *Spodoptera* is like that in satiated condition. Thus it seems that the hunger condition in males diminishes the prey preference (Graph 8.1 and 8.3). From the study it shows that *Spodoptera* is a more profitable prey as compared to *Clavigralla.*

The results obtained from this study will provide useful data to understand better the role of spiders in the management of *Spodoptera litura* and *Clavigralla horrens.* Detailed observations show that the spiders of either sex uses specialized predatory behaviour to attack different stages of *Spodoptera* which are morphologically different and also the adults and juveniles of *Clavigralla horrens.* The prey preference shows that the females and the males are equally potent in reducing the number of both pests and show differential preference to the prey. Thus they can be considered in the natural enemy complex of these insect pests. Their potential can be realized only when more ecofriendly practices of pest management are taken into account.