Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 5 [3] February 2016: 85-88

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.533
Universal Impact Factor 0.9804

ORIGINAL ARTICLE **OPEN ACCESS**

Feeding Efficacy of *Pardosa pseudoannulata* (Bosenberg & Strand, 1906) And *Neoscona mukerjei* Tikader, 1980, Predominant Spiders of Rajasthan

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ABSTRACT

Spiders keep the pest population under check in the cultivated crops, therefore they can be used as biological control agent. Knowledge of actual diet for a particular species of spider is a primary requisite before the impact of spider predation on arthropod communities can be correctly assessed. So, the present study was conducted on two prominent predatory spider species of Rajasthan, Pardosa pseudoannulata (Bosenberg & Strand, 1906) and Neoscona mukerjei Tikader, 1980, which were recorded throughout the data collection. Their feeding potential against Pyrilla perpusilla and Drosophilla melanogaster was observed under the laboratory conditions at Department of Zoology, University of Rajasthan, Jaipur, Rajasthan, India. The overall consumption of P. perpusilla within 24 hours was found to be 5.21±0.38 and 3.97±0.42 by P. psuedoannulata and N. mukerjei, respectively. Whereas the average number of D. melanogaster larvae consumed by P. psuedoannulata and N. mukerjei was recorded to be 4.32±0.28 and 5.10±0.35, respectively in 24 hours. The results of the present study, therefore revealed that P. psuedoannulata and N. mukerjei, both were voracious feeders and prefer soft bodied and less active larvae than the adults.

KEY WORDS: *Pardosa pseudoannulata (Bosenberg & Strand, 1906), Neoscona mukerjei Tikader, 1980, Pyrilla perpusilla, Drosophilla melanogaster, Rajasthan, feeding efficacy.*

Received 12.12.2015 Revised 26.12.2015 Accepted 10.01.2016

INTRODUCTION

The indiscriminate and injudicious use of chemical pesticides leads to development of resistance in pests and cause many health hazards and environmental pollution. In order to minimize the use of chemial pesticides, a useful alternative method is biological control. For the past several years, there has been increased interest in the utilization of natural enemies, particularly the predators as biocontrol agent for the regulation of insect pests of crops. Predators are sometimes equally important as control agents as they attack more than can prey, devouring them or suckng their body fluid. In nature, amongst the biotic agents, spiders play a major role in keeping the pest population under check in the cultivated crops [1]. In this respect, spiders attract our attention, because of being the dominant predator of terrestrial community and major component of the predatory arthropod trophic level in many ecosystems.

Spiders though important, are poorly studied and understood creature on every land marsh. Inspite of polyphagous and carnivorous nature of spiders, very little efforts have been made to evaluate their potential as pest control agent. There is a dire need of information regarding biology and feeding efficacy of a predominant spiders so that their role in controlling insect pests could be ascertained. The increasing interest on the high feeding potential of the spider and the significant role they play in the natural suppression of the insect pest, have necessitated detailed studies on their biology. Hence, an attempt has been made to study the feeding potential and influence of temperature on biology of predominant spider, *Pardosa psuedoannulata* (Bosenberg & Strand, 1906) and *Neoscona mukerjei* Tikader, 1980.

METHODOLOGY

To observe biology and feeding potential of *P. psuedoannulata* and *N. mukerjei*, spiders were collected and reared in simulated laboratory conditions and culture was maintained at 25˚±2ºC and 50-65% relative humidity (R.H) in BOD incubator. Spiders collected from study area were kept individually in separate glass containers to prevent cannibalism (2). *Pyrilla perpusilla* and *Drosophila melanogaster* were also cultured in laboratory condition as the diet source for rearing spider species. To provide and maintain the proper feeding for spiders, collected specimens were kept in separate glass cages, each of which was marked and numbered. Each glass cage consisted of a lantern chimney fixed over a petridish containing sterilized and moist sand. The chimney was covered by a piece of muslin cloth and the sand was to be kept moist by putting a few drops of distilled water over it daily in order to provide humidity as the spiders do not thrive under dry conditions. Marked male and female individuals were placed together in the same glass cage in order to provide them mating opportunity. During this period, the larvae of prey insects were provided them as food in adequate number to prevent cannibalism. After three days males and females were separated as they had been mated and kept in another glass cages separately. The newly hatched spiderlings were separated in small containers, the lid of which had a few small holes for aeration and one moderately big hole for feeding. A small strip of paper was inserted into the container to provide additional support to the spiderlings.

To evaluate the feeding efficacy, the different stages of spiders were fed on *Drosophila* larvae to satiation level and then starved for five days to standardize the hunger levels. Prior to the use in experiment kept starved for 24 hours and then 10 larvae of *P. perpusilla* and *D. melanogaster* were introduced into each cage as food. Observations were made 24 hours after experimentation to record the number of larvae consumed by the spider. The remaining food was taken out. The same experiments were repeated ten times. On the basis of the total number of larvae consumed by a single spider within 24 hours, the feeding efficacy of *P. psuedoannulata* and *N. mukerjei* were recorded in the laboratory conditions for *P. perpusilla* and *D. melanogaster,* separately.

RESULT

In the present study, the feeding efficacy of *P. pseudoannulata* and *N. mukerjei* against *P. perpusilla* and *D. melanogaster* was studied under laboratory conditions to understand their prey and predator relationship. The data on feeding efficacy revealed that the average number of *P. perpusilla* larvae consumed by an individual of *P. pseudoannulata* within 24 hours was found to be 5.21±0.38 while for the larvae of *D. melanogaster* this number was recorded as 4.32±0.28 (Table 1). The average number of *P. perpusilla* larvae consumed by an individual of *N. mukerjei* within 24 hours was found to be 3.97±0.42 while for the larvae of *D. melanogaster* this number was 5.10±0.35 (Table 2). During the present study, it was also observed that *P. pseudoannulata* and *N. mukerjei* preferred soft bodied and less active insects such as larvae of *P. perpusilla* and *D. melanogaster*, than hard bodied adults. Consumption rate of prey of all the spiders increased slowly as the stages of the spider advanced. This was proved by devouring more number of insect preys by later instar spiderlings than the earlier ones. The predatory potential of adult spider was more than its developing stages.

Table 1. Feeding efficacy of *Pardosa pseudoannulata* on larvae of *Pyrilla perpusilla* and *Drosophilla melanogaster*

S.No.	Date	No.of Larvae provided	Avg.no.of Larvae of *Pyrilla* consumed by a spider daily	Avg.no.of Larvae of *Drosophila* consumed by a spider daily
1	27/10/2015	10	5.5±0.38	4.1± 0.30
2	28/10/2015	10	5.2±0.40	4.1± 0.36
3	29/10/2015	10	4.9±0.36	4.2± 0.44
4	30/10/2015	10	5.3±0.47	4.1± 0.44
5	31/10/2015	10	5.3±0.35	4± 0.40
6	1/11/2015	10	6±0.68	4.5± 0.26
7	2/11/2015	10	4.8±0.28	4.5± 0.38
8	3/11/2015	10	5.4±0.40	4.6± 0.35
9	4/11/2015	10	5±0.40	4.9± 0.39
10	5/11/2015	10	4.7±0.49	4.2± 0.28
Mean±S.E			5.21±0.38	4.32±0.28

Table.2 Feeding efficacy of *Neoscona mukerjei* on larvae of *Pyrilla perpusilla* and *Drosophilla melanogaster*

S.No.	Date	No.of Larvae provided	Avg.no.of Larvae of *Pyrilla* consumed by a spider	Avg.no.of Larvae of *Drosophila* consumed by a spider
1	10/9/2015	10	3.4±0.32	4.9± 0.29
2	12/9/2015	10	3.7±0.45	5.5± 0.35
3	14/9/2015	10	4.1±0.33	5.5± 0.29
4	16/9/2015	10	4.2±0.40	4.5± 0.35
5	18/9/2015	10	3.5±0.43	5.1± 0.28
6	20/9/2015	10	4.6±0.35	5± 0.39
7	22/9/2015	10	4.3±0.5	5.5± 0.25
8	24/9/2015	10	3.6±0.39	4.7± 0.24
9	26/9/2015	10	4.2±0.44	5± 0.41
10	28/9/2015	10	4.1±0.36	5.3± 0.28
Mean±S.E			3.97±0.42	5.10±0.35

DISCUSSION

The results of the present study have shown similar trend as noticed by Chiu *et al.*, Nyffeler *et al*., Sahito *et al*. [3,4,5]. Rao *et al* for the first time observed that *Pardosa annandalei* feeding on brown plant hopper at the rate of 18 adults per day [6]). Nyffeler *et al.* evaluated the potential of *Oxyopes salticus* as predator of insect pests in cotton fields in Texas and observed that the natural diet of *O. salticus* consisted (by number) mainly of leafhoppers (17.2%), dipterans (15.6%), aphids (14.1%) and spiders (14.1%). During the present study, the average number of larvae consumed by a single *P. pseudoannulata* per day was reported to be 4.32. Similar results were obtained by Dhaliwal and Bhathal who studied the feeding efficacy of six spider species namely, *Salticus senicus* Clerk, *Oxyopes pandae, Pardosa birmanica* Simon*, Thomisus sp., Neoscona nautica* Koch and *Ganoidea indica* Thunberg, under green house conditions. All these species were predaceous on white backed plant hopper of rice namely, *Sogatella furcifera* [7].

Data collected on feeding efficacy, during the present study also have quite similarity with findings of Mathirajan and Regupathy who studied prey-preference and predatory potential of various spider species viz. *Peucetia viridana, Argiope catenulate, Oxyopes javanus* and *Neoscona theisis* under simulated laboratory conditions. The order of preference shown by spider was aphid, whitefly, leafhopper and caterpillar. The predatory potential was maximum for *N. mukerjei* followed by *P. birmanica* (3.67), *Thomisus sp*. (3.45) and *N. nautica* (2.55) [8]. Predatory potential of *N. mukerjei* increased with advancing stages of the spider. However, predation rate of IV and V instars was statistically at par [9]. Khichi *et al* found that all the tested species of the genus *Pardosa* consumed major pests in laboratory conditions which support our present findings (10). *P. pseudoannulata*, a wolf spider were also recorded as most abundant natural enemies which actively contribute to brown planthopper population control in rice field by Preap *et al* [11].

Li investigated the combined effects of temperature and diet on development and survival of a crab spider, *Misumenops tricuspidatus* (Fabricius) (Araneae: Thomisidae) in laboratory conditions. They carried out the experiments at five constant temperatures ranging from 15.8˚C to 35.8˚C on two kinds of diets, fruit flies (*D. melanogaster*) and a mixed diet of fruit flies and dung flies. It was found that no eggs survived to hatching when the spiders were fed on single diet [12]. Kuhro et al during their study revealed that aranied fauna as an efficient predator of jassid could be used for the suppression of insect pests of cotton [13]. The results are also supported by findings of Prasad, Sadana & Kaur and Cloarec, who studied feeding intensity and food preference of different spider species. They observed that spiders preferred small and medium sized insects with soft body than the hard cuticular insects. Small insects with hard body and large insects with soft body were mostly rejected by spiders [1, 14, 15].

These results are not in consonance with findings of Sadana and Kaur who found that out of twenty-three spider species, which inhabited citrus orchards, two predated heavily on *Diaphorina citri,* a serious pest of citrus, whereas other species were moderate feeders. However, Sadana and Kaur and Chauhan *et al*. concluded that non-web spiders were more effective predators as compared to web spinners, but spiders of genus *Neoscona* are web building spiders and also effective predators which provide strong support to our present findings [14, 16].

CONCLUSION

It is clear from the above discussion that *P. pseudoannulata* and *N. mukerjei* found within Rajasthan Agro-ecosystem are competent of feeding on larvae of *P. perpusilla* and *D. melanogaster* in the laboratory and may show such behavior in the field. These observations suggested that *P. pseudoannulata* and *N. mukerjei* both were voracious feeders of insect pests and can be used as a component for a suitable module for IPM.

ACKNOWLEDGEMENT

We are thankful to UGC, New Delhi for financial support and Head, Department of Zoology, University of Rajasthan, Jaipur for providing necessary facilities.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this paper.

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CITATION OF THIS ARTICLE

Vinod Kumari, Kailash Saini and N P Singh. Feeding Efficacy of *Pardosa pseudoannulata* (Bosenberg & Strand, 1906) And *Neoscona mukerjei* Tikader, 1980, Predominant Spiders of Rajasthan . Bull. Env. Pharmacol. Life Sci., Vol 5 [3] February 2016: 85-88