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Functional response of the predators mirid bug and wolf spider against white-backed planthopper, *Sogatella furcifera* (Horvath)

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Abstract

The feeding response of predators on eggs and nymphal densities of white-backed plant hopper (WBPH) was studied. The results indicate that the number of eggs and nymphs of WBPH consumed by the mirid bug greatly increased as prey density increased. It was also concluded that *Cyrtorhinus Lividipennis* is a voracious predator on eggs and nymphs of *Sogatellafurcifera* compared to the predator *Pardosa pseudoannulata.*

Keywords: Feeding response, Predators, Prey

1. Introduction

To check the growth and population of various pests, nature has provided predators. Unfortunately in Pakistan the study of these predators has not been exploited as thoroughly as their utility and economic importance would warrant. Knowledge about the beneficial insects is extremely limited and scattered in the literature. Present study highlights the control of white-backed plant hopper, *Sogatellafurcifera* (Horvath) a serious pest of rice [5,7] through mirid bug, *Cyrtorhinuslividipennis* (Reuter)and wolf spider, *Pardosa pseudoannulata* (Boe.& St.).

The mirid bug, *C.lividipennis* and wolf Spider, *P.pseudoannulata*are probable the best predators. They have the potential to be a bio control agent of the prey. In developing countries particularly in Pakistan, where the use of insecticide is common the introduction of natural enemies would be beneficial. This study aims to determine the functional response of the predators to the white-backed plant hopper at all developmental stages at different densities.

2. Materials and Methods

The functional response of the predators mirid bug, *C. lividipennis* and wolf Spider, *P. pseudoannulata* were examined by a series of experiments at different densities of eggs and nymphal instars of the prey. To determine the influence of density and stage of prey on consumption, the eggs and nymphal instars were offered to the predators. The experiments were carried out at the constant temperature of 30°C and 70% R.H. in an incubator. Each density of the prey (eggs and nymphal instars) was replicated three times. The results were recorded at 24 hours intervals.

2.1 Feeding response of the predator on the eggs of prey

The predators were examined at different densities of prey eggs (3,5,7and 10 eggs/predator/3 days).The eggs were collected from a culture of white-backed plant hopper. The eggs were kept in Petri dishes and counted under a binocular stereomicroscope and transferred to the incubator at 30°C and 70% R.H. The eggs of white-backed plant hopper were offered to predators. The number of eggs consumed by the predators was recorded every 24 hours. The daily average feeding rate was determined from the number of eggs consumed divided by the total number of feeding days and the number of predator. The experiments were terminated after 72 hours.

2.2 Feeding response of the predators on the nymphal instars of the prey

Experiments were performed to determine the feeding performance of predators on each nymphal instars of white-backed plant hopper. The experiments were replicated three times at four densities (5, 10, 15 and 20) of each nymphal instars. Each density of prey was offered to predators kept in 500g jars with rice plant for feeding the nymphs. The consumption rate of the predators was recorded after 24 hours on the each density of white-backed plant hopper for three days.

For statistical analysis, the data obtained from the experiments were submitted to one-way and two-way analysis of variance (ANOVA).

3. Results

The amount of available food (density of prey) has significant effect in determining the effectiveness of the predators. Various densities of the development stages (eggs and nymphs) of WBPH, *S. furcifera* eaten by the predators were tested.

The results indicate that the consumption rate of mirid bug increased as the prey egg density increased. No significant difference was observed for wolf spider. The consumption of eggs of WBPH by the predators *C.lividipennis* and *P.pseudoannulata* at the different densities are shown in Table 1 and Fig 1.

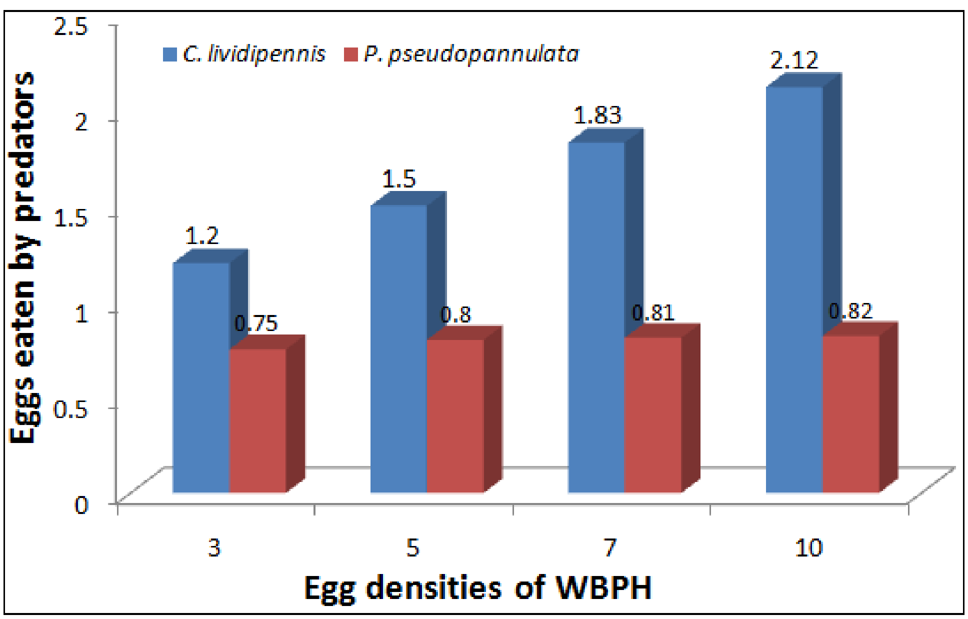

Fig 1: Different densities of eggs of WBPH eaten by predators (Numbers over bars indicate mean number eaten over 72 hours.)

Table 1: Analysis of variance for the predators feeding on the eggs of WBPH.

Source	DF	SS	MS	F value	P value
Egg densities of WBPH	3	975.74	195.15	26.32	< 0.001
Predators	1	417.17	16.19	02.25	< 0.001
Error	576	4271.00	007.42		
Total	719	77.13			

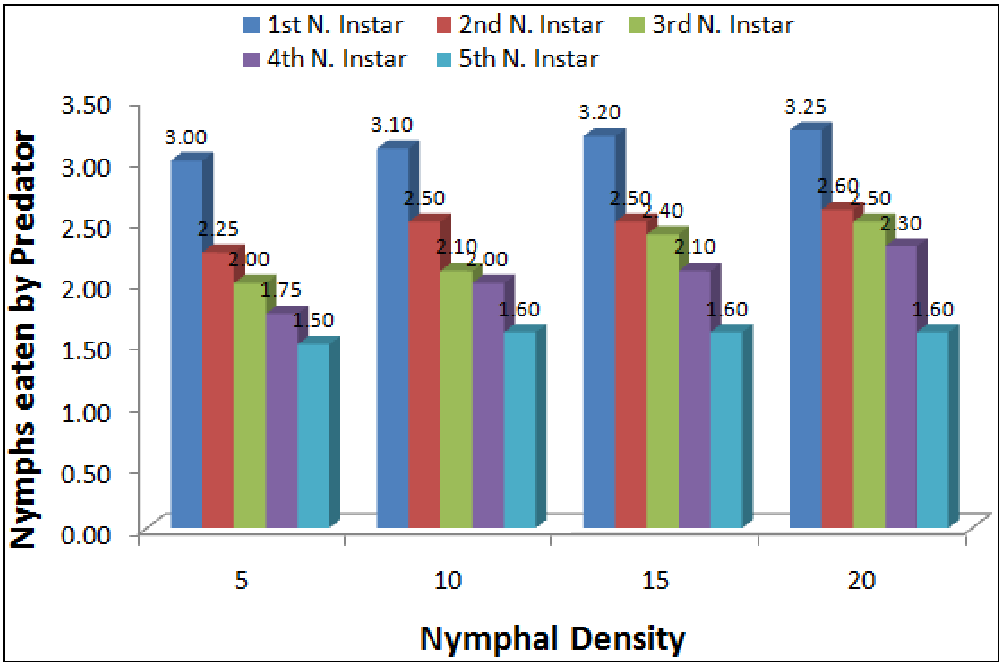

Fig 2: Different densities of nymphal instars of WBPH eaten by *C. Lividipennis* (Numbers over bars indicate mean number eaten over 72 hours.)

Table 2: Analysis of variance for the predators feeding on the first nymphal instar of WBPH.

Source	DF	SS	MS	F. value	P. value
Nymphal densities of WBPH	3	801.658	89.073	78.45	< 0.001
Predators	1	39.19	49.19	8.96	< 0.001
Error	17.6	230.00	131.0		
Total	183				

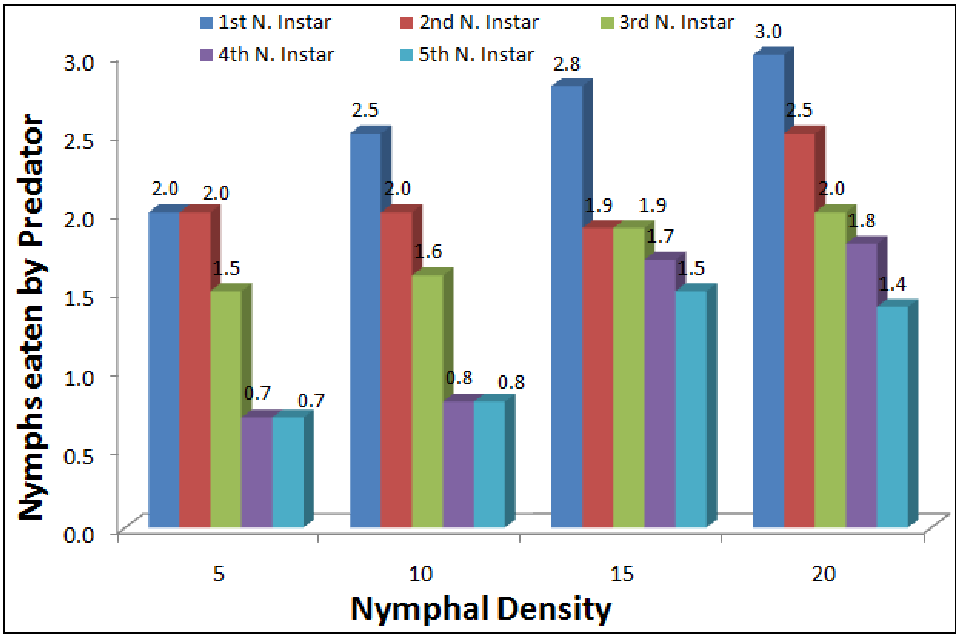

Fig 3: Different densities of nymphal instars of WBPH eaten by *P. pseudoannulata* (Numbers over bars indicate mean number eaten over 72 hours.)

Table 3: Analysis of variance for the predators feeding on the second nymphal instar of WBPH

Source	DF	SS	MS	F- value	P- value
Nymphal densities of WBPH	3	221.73	55.43	271.78	< 0.001
Predators	1	731.120	182.780	217.60	< 0.001
Error	50.00	42.00	0.840		
Total	74	1080.72			

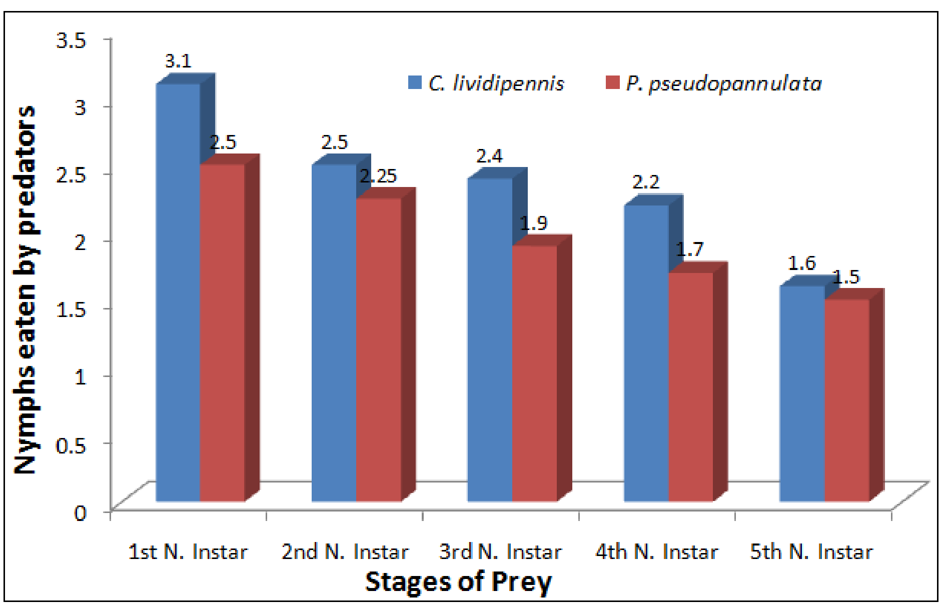

Fig 4: Overall No. of different nymphal instars eaten by the predators

Table 4: Analysis of variance for the predators feeding on the third nymphal instar of WBPH.

Source	DF	SS	MS	F- value	P- value
Nymphal densities of WBPH	3	437.4	609.3	63.86	< 0.001
Predators	1	41.9	42.1	116.18	< 0.001
Error	923	629.6	61	690	
Total	959				

Table 5: Analysis of variance for the predators feeding on the fourth nymphal instar of WBPH.

Source	DF	SS	MS	F- value	P- value
Nymphal densities of WBPH	3	41.547	2.597	3.09	< 0.001
Predators	1	39.19	39.20	63.00	< 0.001
Error	17.6	3053.00	131.00		
Total	183	348.00			

Table 6: Analysis of variance for the predators feeding on the fifth nymphal instar of WBPH.

Source	DF	SS	MS	F- value	P- value
Nymphal densities of WBPH	3	10.882	1.209	5.20	< 0.001
Predators	1	828.13	609.12	12.29	< 0.001
Error	200	526.14	513.36		
Total	160	412.15			

The results also indicate that the feeding capacity of the predators greatly increased as nymphal densities of WBPH increased (Fig.2 and Fig.3) Significant feeding rate of the predators was noted and F-value was observed 78.45 (Table 2). Overall the predator *C.lividipennis* consumed more nymphal instars of WBPH than did the predator *P.pseudoannulata* (Fig.4). Highly significant difference of consumption was recorded between the predators and shown in from Table 2 to 6.

4. Discussion

The findings on the functional response of the predators *C.lividipennis* and *P.pseudoannulata* to WBPH showed that feeding capacity of the predators greatly increased as nymphal densities of WBPH increased. Predator *Cyrtorhinuslividipennis* is voracious predator of both stages (eggs and nymphal instars) of WBPH than the predator *Pardosa pseudoannulata*. It is noted that the predator fed more at a high density. This may be above the economic threshold level (ETL), and consequently the economic effectiveness of predator might be lower. However, Luff [4] pointed out that with the rise in prey density, voracious predator may become more effective leading to an overall density dependent response. The same finding was reported by several other authors [6, 1, 2]. Joon and Seung [3] suggested in their report that in agricultural ecosystem the predators are favorable bio agents to control insect pest.

It is therefore concluded that mirid bug being a voracious predator may be effectively introduced into the field.

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