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Performance of three vertebrate predators in controlling brown plant hopper

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Abstract: A study was made to measure the performance of three vertebrate predators for management of brown planthopper (BPH), *Nilaparvata lugens* (Stål.) (Homoptera : Delphacidae) in Boro rice season during the period of December 2004 to April 2005 at Bangladesh Institute of Nuclear Agriculture (BINA) Farm, Mymensingh. Four treatments were laid out in a RCBD. The treatments were: (i) Duckling, *Anas boschos* (ii) Bull frog, *Rana tigrina* (iii) Fish (climbing perch), *Anabus testudeneis* and (iv) a control. The comparative evaluation indicated that treatment with ducklings performed better than other predators. The performance of these predators were in the order of ducklings > frogs > fishes. It may be noted that the ducklings are capable to reduce BPH population in a short period of time. The results of this study are discussed for their possible use in integrated management of brown planthopper.
Key **words:** Brown planthopper, Vertebrate predators, Duckling, Bull frog, Fish (Climbing perch).

Introduction

Rice covers about 74.35 per cent of the total cropping area of Bangladesh (Anon. 1996) having maximum cropping intensity with high yielding varieties. Many insect pests have been reported to attack rice crop among which brown planthopper (BPH), *Nilaparvata lugens* (Stål.) has become a serious problem to rice cultivation in Bangladesh. The brown planthopper belongs to the plant-sucking group of insects under the order Hemiptera, suborder Homoptera and family Delphacidae. This insect prefers rain fed and irrigated wetland fields to upland rice and direct sown fields to transplanted fields. Brown planthopper infests the rice crop at all stages of plant growth and causes substantial damage to the rice crop by direct physical damage due to phloem sap removal (Sogawa and Cheng, 1979) and blocking the xylem and phloem by laying egg masses in the midrib of the leaf sheath and leaf blade. Van Driesche and Bellow (1996) reported that releasing domestic ducks for pest control is a common component of IPM in China and Vietnam. Ducks are generalist predators, feeding on stem borers, leaf folders, grasshoppers, planthoppers and leafhoppers etc.

Materials and Methods

The present study was undertaken utilizing three indigenous vertebrate predators against BPH in Boro rice season during the month of December 2004 to April 2005 at BINA Farm, Mymensingh. Four treatments including three vertebrate predators and a control were laid out in a RCBD. The predators were: (i) Duckling, *Anas boschos* (ii) Bull frog, *Rana tigrina* (iii) Fish (climbing perch), *Anabus testudeneis* and (iv) a control.

Each predators had three density levels (3, 5 and 7) and every density level was evaluated against three levels of BPH population density (20, 30 and 40). Each treatment was replicated three times. The plot size was 1m × 1m. Each plot was demarcated earthen wall (ail) of 20 cm in height and 15 cm width surrounding the plot. Each plot was covered separately with nylon net (1m length × 1m breadth × 1m height). In each plot known number of vertebrate predators was released to feed on the known number of BPH. Known number of vertebrate predator and BPH were introduced in a plot covered separately with nylon net. In the control plot only BPH was released. Some artificial diet were supplied for the use of duckling, frog and fish everyday. Data were recorded daily starting after 24 hours of release on the survival of BPH. Recording of data was continued until the number of BPH reaches to zero. The rate survival of the prey was calculated and analyzed statistically.

Results and Discussion

Survival percentage of BPH in presence of vertebrate predators was significantly different with the three different densities of the prey and predator at 1, 3 and 5 days after release. Survival of BPH was 100% at all the intervals in the treatment where no vertebrate predators was released (control). After one day, survival of the pest was the highest (83.33%) when three fishes or bull frog were used against the BPH density of 20, while it was lowest (3.33%) with the duckling at a density of 7 (Table 1). The highest survival (61.67%) of BPH was also found after three days of release in the treatment with three fish utilized against the BPH population of 20. No BPH survived after three days of release of duckling at any level of BPH population density (Table 2). Similar trend of survival of BPH was observed after three days of release of the vertebrate predators. The highest number of BPH survived at all the time intervals when the fish, climbing perch at a density of three was used while the minimum survival of BPH was found with the vertebrate predators ducklings at any levels of prey and predator density. Survival of the pest was almost nil after 1 day of consumption in case of duckling while the frog and fish (climbing perch) required at least 5 days to consume the preys completely (Table 3). There was a quick action of duckling in reducing the pest. Survival of BPH became zero after 1 day with all the three ratios (40:3, 40:5 and 40:7) of BPH and duckling. On the other hand the frog were able to show a complete reduction of the pest in 6 days time with the ratio 40:3. Fish caused a complete reduction of the pest in 9 days time with the ratios 40:3. The minimum survival of BPH with duckling indicates the higher efficiency. Similarly, the maximum survival of BPH with fish indicates the lower efficiency in controlling the pest.

Among the treatments, efficiency of duckling was highest. Possible reasons of such findings may be due to food habit of duckling, more food requirement for quick body growth and capability of frequent movement in the paddy field, particularly in the early to mid tillering stage.

Ducks feed on almost all the insects available in the field. It can consume more than 100 insects per hour due to its big appetites (Van Driesche and Bellow, 1996). In China and Vietnam, ducks are released for pest control as a common component of IPM (Van Driesche and Bellow, 1996). It was suggested from large scale investigation that 400-500 ducklings may be sufficient for controlling pests of one hectare rice field (BRRI, 2002).

Bull frog another generalist predator was found to take few days longer time than duckling to control the BPH. Although frog requires little higher time to control the pest than duckling but it has some extra advantages as it is naturally available and can continue its activities for long period of time until the maturity of rice crop. The activities of ducklings would be limited during the vegetative stages of the rice crop.

A higher density of the fish climbing perch (7 number per sq meter) was found to consume all the BPH within nine days, while the frog consumed in six days. Control of insects by fish is a common component of IPM (Mackay, 1995). He reported that different types of carp, tilapia and catfish feed on plant hopper and leafhopper, stem borers or other insects that fall into the water, mosquito larvae and other aquatic insects. Some fishes also feed on the outer leaf of the leaf sheath, which contains plant hopper and leaf hopper eggs.

Considering the result of vertebrate predators duckling, frog and fish may be used to control BPH as a alternative methods of insecticides in the framework of IPM. All the three vertebrate predators were found to provide control of BPH and their performance can be graded as duckling>forg>fish in reducing the pest. However, as the duckling and fishes can contribute for extra farm income, their release and maintenance in the pest infested field would have high value in integrated management of the pest BPH. The performance of duckling was very promising in controlling BPH short period of time. As it is found as a rapid action bio-control agent, its use can be compared with the application of insecticides.

Table 1. Survival of BPH at three levels of three vertebrate predators used against three population levels of BPH after one day of release

Vertebrate predators	Predator density	20 BPH	30 BPH	40 BPH
Duckling	3	41.67e	36.66e	24.17f
	5	23.33f	31.11e	22.50f
	7	3.33g	7.77f	6.66g
Bull frog	3	83.33b	80.00b	80.83b
	5	55.00d	57.77c	51.67d
	7	45.00e	38.88e	43.33e
Fish (Climbing perch)	3	83.33b	81.11b	56.67c
	5	63.33c	61.11c	57.50c
	7	55.00d	48.89d	50.83d
No vertebrate predators (Control)		100.00a	100.00a	100.00a
LSD at 5%		6.14	7.44	4.91

Means followed by different letters in a column are significantly different at 5% level.

Table 2. Survival of BPH at three levels of three vertebrate predators utilized against three population levels of host (BPH) after three days of release

Vertebrate predators	Predator density	20 BPH	30 BPH	40 BPH
Duckling	3	0.00f	0.00f	0.00e
	5	0.00f	0.00f	0.00e
	7	0.00f	0.00f	0.00e
Bull frog	3	51.67c	46.66c	44.17b
	5	6.66ef	11.11e	4.16e
	7	1.66f	1.11f	4.16e
Fish (Climbing perch)	3	61.67b	57.77b	30.83c
	5	33.33d	25.55d	29.17c
	7	11.67e	14.44e	19.17d
No vertebrate predators (Control)		100.00a	100.00a	100.00a
LSD at 5%		7.45	6.28	7.65

Means followed by different letters in a column are significantly different at 5% level

Table 3. Survival of BPH at three levels of three vertebrate predators used against three population levels of host (BPH) after five days of release

Vertebrate predators	Predator density	20 BPH	30 BPH	40 BPH
Duckling	3	0.00e	0.00d	0.00d
	5	0.00e	0.00d	0.00d
	7	0.00e	0.00d	0.00d
Bull frog	3	23.33c	15.55c	19.17b
	5	0.00e	0.00d	0.00d
	7	0.00e	0.00d	0.00d
Fish (Climbing perch)	3	30.00d	34.44b	20.00b
	5	11.67d	0.00d	5.00c
	7	0.00e	0.00d	0.83d
No vertebrate predators (Control)		100.00a	100.00a	100.00a
LSD at 5%		4.17	2.61	2.73

Means followed by different letters in a column are significantly different at 5% level

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