J. Agrofor. Environ. 2(2): 43-46, 2008 ISSN 1995-6983

Efficacy of different insecticides against brown planthopper and their hazardous effect on beneficial organisms

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Abstract: Efficacy of different insecticides against BPH and their hazardous effect on beneficial organisms were evaluated in Aus rice season during the period of May to August 2004 at BINA Farm, Mymensingh. Seven different treatments assigned in a RCBD were (i) Basudin 10G @ 16.8 kg/ha (ii) Cidan 4G @ 18 kg/ha (iii) Biesteren 5G @ 17.5 kg/ha (iv) Nimbicidine @ 10 Litre/ha (v) Diazinon 60 EC @ 1.68 Litre/ha (vi) Baycarb 500 EC @ 2 Litre/ha and (vii) Control. Basudin 10G was found to be the most effective insecticides followed by Baycarb 500 EC, Cidan 4G, Biesteren 5G, Nimbicidine and Diazinon 60 EC. All the chemical insecticides were found to leave hazardous effect on to fishes and frogs. Nimbicidine, a botanical based insecticides was found as less hazardous to the beneficial organisms. Fingerlings of different fishes were more susceptible to the insecticides than the frogs. The results of this experiment could be used in the development of integrated management of brown planthopper.
Key words: Brown planthopper, insecticides, frog, prawn, pangas, barb and lata

Introduction

Rice is the world's single most important food crop (David, 1992) and contributes more than 20 per cent of all calories consumed by the entire human population. More than 90 percent of the world's rice is produced and consumed in Asia, where more than half of the world population lives (David, 1992; Anon. 1993). Bangladesh is one of the most important rice growing countries of Asia where the crop is grown throughout the year. 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, *N. lugens* 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. The brown planthopper is a threat to rice production in many parts of Bangladesh (Alam *et al.,* 1980) which needs to be controlled in the field. The conventional method of controlling this pest is the use of synthetic insecticides, but insecticides are not effective always due to presence of several development stages of the insect at the same time (Heinrichs, 1979). Misuse of broad spectrum insecticides against other leaf feeding insects at early plant growth stages and often estimation of losses in the field due to insects have led to increase *N. lugens* population (Kenmore *et al.* 1984; Heinrichs and Mochida, 1984; Joshi *et al.,* 1992; Schoenly *et al.,* 1994). The present study was undertaken to evaluate the efficacies of different insecticides against BPH and its harmful effects on beneficial organisms.

Materials and Methods

The experiments were conducted in Aus rice season during the period of May to August 2004 at BINA Farm, Mymensingh. Seven different treatments were assigned in a RCBD. The treatments were (i) Basudin 10G @ - 16.8 kg/ha (ii) Cidan 4G @ - 18 kg/ha (iii) Biesteren 5G @ - 17.5 kg/ha (iv) Nimbicidine @ - 10 Litre/ha (v) Diazinon 60 EC @ - 1.68 Litre/ha (vi) Baycarb 500 EC @ - 2 Litre/ha and (vii) Control. There were 7 plots in each replication and 3 replications were made. The plot size was 3m × 2m and plot to plot distance was one meter. Replication to replication distance was also one meter. Each ail (demarcation line) of the plot was 20 cm in height, 15 cm in width and each plot was supplied with sufficient water. With each of those 21 plots one small pond (30 cm × 30 cm × 30 cm) was dug and covered with nylon net (size 60 cm × 30 cm× 60 cm) (Fig 1). In each pond, the fish's viz., pangas (fingerlings), prawn, barb, lata and some frogs were released. One hill was chosen randomly from each of the plot and covered with mylar film. Ten adult BPH were released in each mylar film. The upper portion of the mylar film was covered with nylon net. Each of the plot was fully filled with water and initially the water level of the pond was at a lower level than the plot. Six different insecticides were applied at usual dose in 18 plots, except the control plots. Insecticides were also applied at the same dose to the hill of rice covered by mylar film. After applying the insecticides each of the plots was connected with the pond with a small canal so that the water of insecticides treated plot can flow to the ponds. Forty eight hours after applying the insecticides the mortality of BPH in mylar film and the number of beneficial organism in the ponds were recorded. The efficacy and the hazardous effect of the insecticides were determined on the basis of the mortality of the pest and the beneficial.

Results and Discussion

Efficacy of different insecticides against BPH

There was a significant difference in the mortality of BPH with different types of insecticides. Mortality percentage of BPH was highest (86.67%) in the treatment Basudin 10G and this was followed by Baycarb 500EC (83.33%) (Fig. 2). Mortality percentage of the pest in the treatment with Cidan 4G, Biesteren 5G and Nimbicidine were 76.67, 76.67 and 73.33%, respectively. Lowest (23.33%) mortality was found with the insecticide Diazinon 60EC. Mortality percentage of beneficial organism showed significant difference with different types of insecticides (Table 1). Highest mortality (53.33%) was found in prawn when Basudin 10G was used and lowest mortality (13.33%) was in frog. Cidan 4G caused highest mortality (50.00%) in prawn and lowest 16.67% in frog. Mortality percentage of pangas, barb and lata were 23.33, 26.67 and 23.33% respectively when Cidan 4G was used.

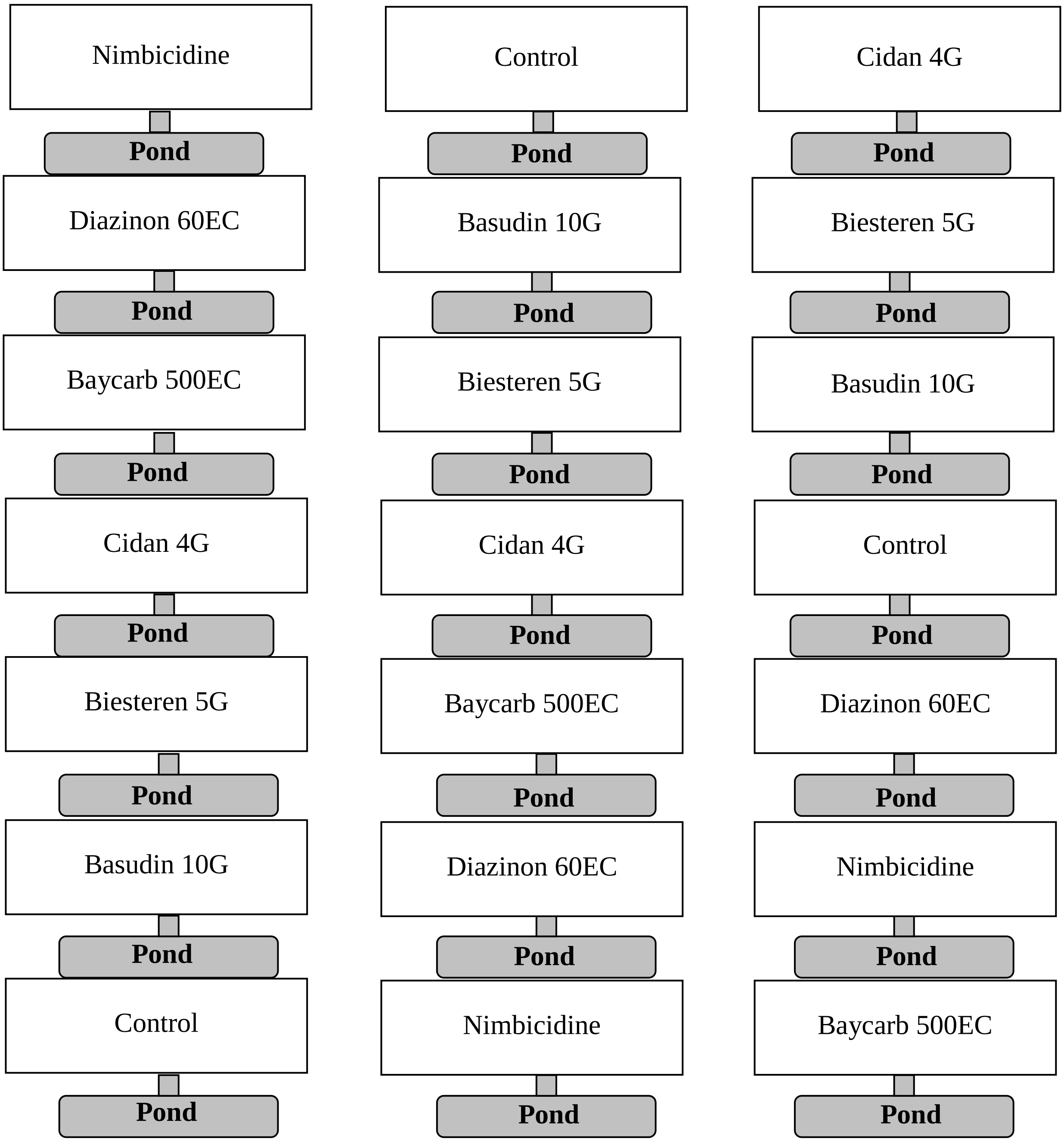
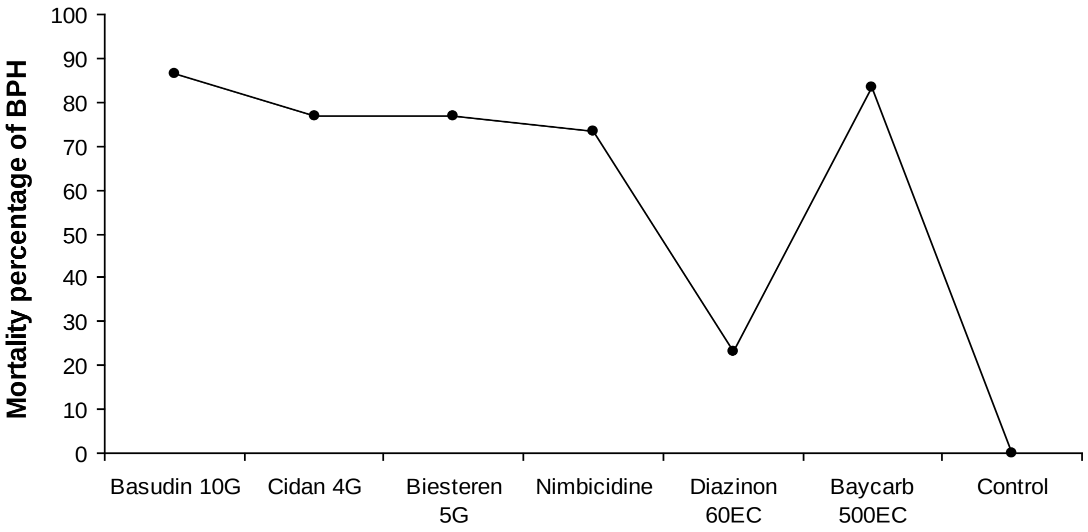


Fig. 1 Different insecticides against BPH and their hazardous effect on beneficial organisms



Different insecticides

Fig. 2 Efficacy of different liquid and granular insecticides against brown plant hopper.

Hazardous effect of insecticides

Table 1 Mortality of beneficial organisms by different liquid and granular insecticides during BPH control in rice field.

Name of insecticides	Mortality (%)				
	Frog	Prawn	Pangas	Barb	Lata
Basudin 10G	13.33 ab	53.33 a	30.00 a	23.33 b	23.33 a
Cidan 4G	16.67 a	50.00 a	23.33 b	26.67 ab	23.33 a
Biesteren 5G	10.00 b	43.33 b	33.33 a	23.33 b	20.00 a
Nimbicidine	0.00 c	23.33 c	6.66 c	16.67 c	6.66 b
Diazinon 60EC	13.33 ab	50.00 a	30.00 a	26.67 ab	23.33 a
Baycarb 500EC	16.67 a	43.33 b	33.33 a	30.00 a	23.33 a
Control	0.00 c	0.00 d	0.00 d	0.00 d	0.00 b

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

In case of the insecticide Biesteren 5G, mortality percentage was highest (43.33%) in prawn and was lowest (10.00%) in frog and 33.33, 23.33 and 20.00% in pangas, barb and lata, respectively. Nimbicidine caused highest mortality (23.33%) in prawn and lowest (6.66%) in lata, while percentage of mortality in pangas and barb were 6.66 and 16.67%, respectively. In case of Diazinon 60EC mortality percentage was highest (50.00%) in prawn and was lowest (13.33%) in frog and 30.00, 26.67 and 23.33% in pangas, barb and lata, respectively. Baycarb 500EC showed a mortality percentage 43.33% in prawn and lowest (16.67%) in frog while percentage of mortality in pangas, barb and lata were 33.33, 30.00 and 23.33%, respectively.

The result of the experiment showed that the maximum mortality of BPH occurred when Basudin 10G was used @ 16.8kg/hectare and minimum mortality occurred when Diazinon 60EC was used @ 1.68 litres/hectare. This indicates that among the six insecticides Basudin 10G was most effective for controlling BPH.

Considering the results of the experiments the efficacy of Basudin 10G, Baycarb 500 EC, Cidan 4G, Biesteren 5G, Nimbicidine and Diazinon 60 EC were as follows: Basudin 10G>Baycarb 500 EC>Cidan 4G>Biesteren 5G>Nimbicidine> Diazinon 60 EC.

Application of all the insecticides caused hazardous effect on the fish and frog population. Prawn was found as most susceptible to almost all the insecticide, indicating that the insecticide has maximum hazardous effect on it. The insecticides have also been found to leave hazardous effect on the other fishes. Less mortality in frogs in all the insecticide treatment indicates that the frogs are completely less susceptible to the insecticides. Application of insecticides may not always provide good control of the pest rather it may cause out break of pests as was reported by Barbosa, 1998. He reported that in a pesticide free environment, many beneficial organisms including spider, insects, frog etc are present, which keep the BPH population under control. Destruction of the beneficial may cause quick build up of BPH population leading to the development of “hopper burn” symptom in rice field.

Insecticide application has been reported by several authors to cause negative effect on the beneficial in the environment. Shailaja and Sen (1989) reported that the residues of DDT and its metabolites in 4 species of fish from coastal waters in the Arabian Sea and 4 species from the open ocean. Atallah *et al.* (1989) reported that after 24h exposure the order become Nurelle = Meothrin = Sevin> Cybolt> Decis. Meothrin lost its persistence after 6 days while Nurelle was still hazardous after 6 days but the decrease in toxicity for all the insecticides was slow for the first 5 days after spraying. In the present study, although insecticides caused high mortality of BPH but they were also found to be the cause of mortality of beneficial organisms like fishes and frogs.

Not only this, now are a days farmer in Bangladesh encouraged to culture fish in rice field. From the present result it can be clearly stated that use of insecticides will not be compatible for the practice of rice cum fish. Moreover, as it is reported by several authors that in a pesticide free environment naturally occurring beneficial can reduce the BPH population, the result of the present study on the use of fishes in the same field could cause further reduction of it and contribute the integrated management of the pest. Therefore, it could be suggested here to use the insecticides as judicious as possible for providing better environment for natural regulatory forces and other beneficial organism in rice ecosystem.

It is therefore often said that BPH is a man made pest due to the indiscriminate use of pesticides. In most cases, the out break of BPH could be minimized by judicious use of insecticides for encouraging the activities of beneficials. Another reason to discourage the use of insecticides is their toxicity for causing hazard to the users, consumers and the environment (fish, bird, honey bees etc.).

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