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Use of indegenous plant products and byproduct as low cost methods in management of rice pests during storage

K.R. Das, K.S. Ahmed, M.A. Haque and M. Ahmad
Department of Entomology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Abstract

An investigation was carried out in the laboratory to study the efficacy of leaf dust of neem (*Azadirachta indica*), biskatali (*Polygonum hydropiper*) and a byproduct eg. ash @ 5g/500g grain for the control of stored grain pests of rice. The efficacy were assessed on the basis of insect pest abundance, insect infestation, seed weight loss and germination capacity of the treated seeds. The results revealed that all the treatments were effective against stored grain pests regarding insect abundance and insect pest infestation. In case of seed weight loss neem dust showed best result followed by ash and biskatali. The dust form of neem leaf, biskatali leaf and ash did not show any adverse effect on germination capacity of seeds even after 6 months of storage. It is concluded that leaf dusts of neem and biskatali and the byproduct ash can be used as safe and low cost methods for management of rice pests in storage.

Keywords: Plant products, Byproduct, Storage pest management

Introduction

Bangladesh is basically an agricultural country. Here, rice is the most important cereal crop and staple food. Each year insect pests cause heavy damage in storage and losses due to insect infestation are the most serious problem in grain storage, particularly in developing countries like Bangladesh. The climate and storage conditions are often highly favourable for insect growth and development. There are over 200 major species of insects and mites infesting important crops and stored products. Among these species rice weevil, rice meal moth, red flour beetle are common and most destructive. In tropical countries outbreak of these pests may make the stored rice unfit for human consumption within 8 months of storage. The stored product insects not only feed on the stored food but also cause organoleptic changes in food grains as a result the nutritional value of the food grains. The efficient control and removal of stored grain pests from food commodities have long been the goals of entomologists throughout the world.

Synthetic insecticides which have been in use for a long time for controlling insect pests have got many limitations and undesirable side effects. Thus, there is an urgent need for safe but effective, biodegradable pesticides with no toxic effects on non-target organisms. Botanical insecticides are now conveniently described as first generation pesticides (Parmar and Dureja, 1998). Botanical products and byproducts are environmentally safe, less hazardous and less expensive. So the use of botanicals and byproducts are suited for grain protection in developing countries like Bangladesh. But a very few scientific research works have been done in Bangladesh to explore our locally available plant materials which are effective for the control of harmful insect pests in storage and at field level. Therefore, the present study was undertaken to evaluate the effects of some indigenous plants (neem, biskatali) and byproduct (ash) in the management of storage pests.

Materials and Methods

Experiments on the evaluation of two plant products viz. neem (*Azadirachta indica*), biskatali (*Polygonum hydropiper*) and byproduct ash for their effects against stored grain pests of rice were carried out in the laboratory of the Department of Entomology, Bangladesh Agricultural University (BAU), Mymensingh. To compare the efficacy two control treatments, no insecticide and ash + insecticide (sevin dust), were included in the experiment.

Fresh leaves of neem and biskatali were washed in running tap water in the laboratory and then dried in shade. Afterwords, these were dried in oven till constant weight. Then dusts were prepared by pulverizing the dried leaves in a mortar and sieve by 25-mesh diameter sieve to obtain fine dust. Ash was dried in the oven and then 25 mesh diameter sieve was used to obtain fine ash. Then fine ash was divided into two parts and sevin was mixed with a part of fine ash @ 2%.

Seeds of rice used in the present study were collected from local market, whose initial moisture content was 15-16%. Five hundred gram rice seeds were kept separately in each earthen pot. Then these were mixed with neem leaf dust, biskatali leaf dust and ash @5g separately. The experiment was replicated thrice with two controls (no insecticide and ash + sevin) and kept undisturbed for 6 months. All pots were kept open for invasion of insects. Some pots with infested grains of rice, wheat and pulse were kept near to the experimental pots to ensure infestation.

After six months of storage, each seed sample was checked for insect infestation. Different storage insect species were identified based on their individual characters and their population was determined species wise.

The intensity of damage caused by insects in the stored seeds was considered with the presence of hole(s) number in the seeds and expressed as percent infestation.

The seed weight losses were calculated by subtracting the final weight from the initial weight of each storage container. The seed weight losses were converted into percentage.

Germination test was done by petridish method using filter paper as medium. Wet filter papers were put in the petridish. Then 25 seeds were arranged in them and kept in the laboratory having the temperature 25 ± 2^{0}C. Germination was recorded after 8 days of seed setting. The percentage of all the seeds was calculated for each seed sample and then the average was obtained for all three replications (ISTA, 1985).

Results and Discussion

Three insect species were identified in rice seeds after 6 months of storage with different treatments, viz. rice meal moth, *Corcyra cephalonica* (Lepidoptera: Galleriidae); Rice weevil, *Sitophilus oryzae* (Coleoptera: Curculionidae) and Red flour beetle, *Tribolium castaneum* (Coleoptera: Tenebrionidae). The abundance of these pests were statistically significant ($P < 0.01$) (Table 1). After 6 months of storage the lowest number of rice meal moth (87.00) and red flour beetle (35.78) were found in case of ash while the lowest number of rice weevil (7.56) was found in ash+insecticide treated seeds followed by biskatali (8.67), ash (10.22) and neem (10.89).

Table 1. Effects of neem, biskatali, ash and ash+insecticide on the abundance of different insects

Treatments	Number of insects found		
	Rice meal moth (mean ± SE)	Rice weevil (mean ± SE)	Red flour beetle (mean ± SE)
Neem	133.56 ± 6.75 b (2.12)	10.89 ± 1.94 b (1.03)	41.44 ± 4.58 bc (1.59)
Biskatali	133.78 ± 11.35 b (2.11)	8.67 ± 0.76 b (0.97)	45.33 ± 4.94 bc (1.64)
Ash	87.00 ± 5.31 c (1.93)	10.22 ± 1.2 b (1.03)	35.78 ± 2.34 c (1.55)
Ash+Insecticide	91.89 ± 8.63 c (1.94)	7.56 ± 0.88 b (0.91)	48.44 ± 3.19 b (1.68)
Control (no insecticide)	226.78 ± 11 a (2.35)	65.56 ± 4.60 a (1.82)	80.78 ± 6.47 a (1.89)

Within columns means followed by same letter(s) are not significantly different at the 1% level by DMRT
Logarithmic transformed values are given within parentheses.

The effects of neem, biskatali, ash and ash+insecticide on insect infestation was found significant ($P<0.01$) (Fig. 1). Lowest (5.89) infestation was found in ash and ash with insecticide but in control (no insecticide) it was found highest (15.44).

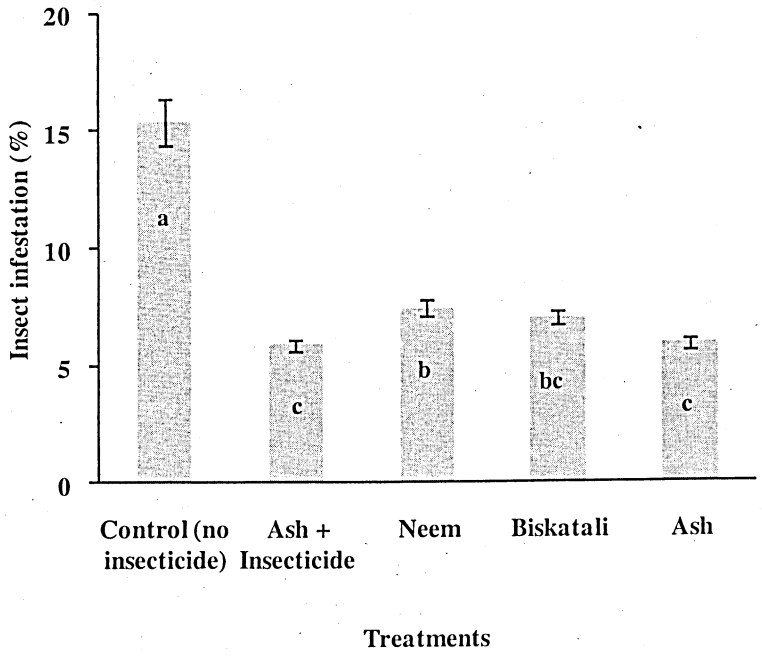

Fig. 1. Effects of neem, biskatali, ash and ash+insecticide on insect infestation

The effect of neem, biskatali, ash and ash+insecticide on seed weight loss was also found significant (P<0.01) (Fig. 2). It was observed that the percentage of seed weight loss ranged from 5.36 to 8.13. The lowest seed weight loss (5.36%) was found in seeds treated with ash+ insecticide and highest seed weight loss (8.13%) was observed in seeds treated with biskatali. The best result was found in case of ash+insecticide and the order of effect was ash+insecticide> neem> ash> biskatali (Fig. 2).

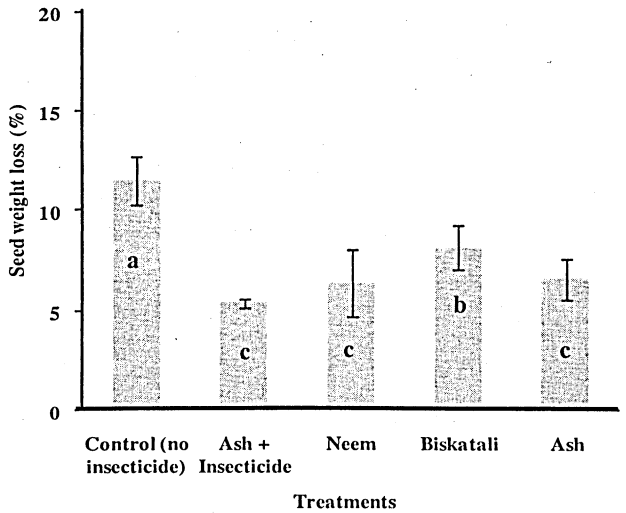

Fig. 2. Effects of neem, biskatali, ash and ash+insecticide on seed weight loss

Neem, biskatali, ash and ash+insecticide had significant effect on seed germination. In case of these treatments, the range of seed germination was found 83.22 to 86.44%. The highest seed germination (86.44%) was found in seeds treated with ash followed by neem (85.22%), biskatali (84.56%) and ash+insecticide (83.22%) whereas, in control (no insecticide) seed germination percentage was 57.00 (Fig. 3).

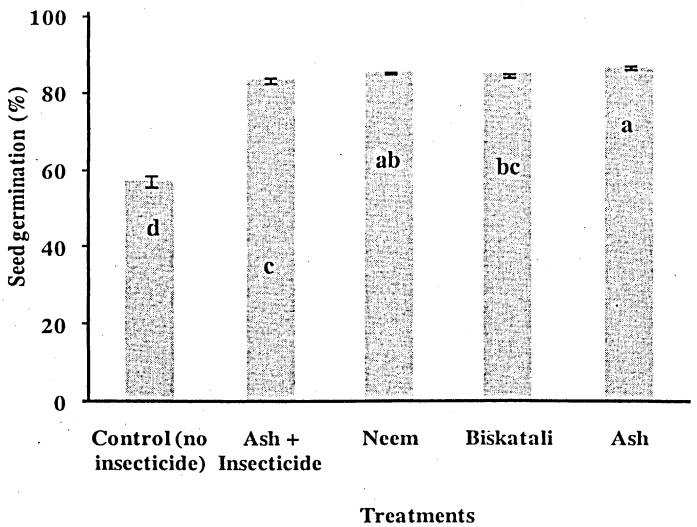

Fig. 3. Effects of neem, biskatali, ash and ash+insecticide on seed germination

In compare to control the effect of neem, biskatali, ash, and ash+insecticide on the abundance of insect pests in rice seeds during storage was found significant. In all cases it was found that the population of stored grain pests (rice, meal moth, rice weevil and red flour beetle) decreases by using botanicals and byproduct. These results supported the findings of Makanjuola (1989), El-Kashlan (1999) and Latif (1999).

In case of infestation of seeds by insect pests, the effects of neem, biskatali, ash, and ash with insecticide were also found significant. These were effective against infestation and best result was found in case of ash and ash with insecticide. These results are in agreement with those of El-Lakwah *et al.* (2000), Parwar and Yadav (2004) and Rajendran (2006), where they reported that leaf dust and extracts of neem, leaf dust of biskatali and ash reduced insect infestation.

Seed weight loss occurred due to the consumption of seeds by the insect pests. Compared to control (no insecticide), all the treatments showed significantly lower seed weight losses because of the lower seed damage by insects. From the results it was found that neem, biskatali, ash, and ash with insecticide had pronounced effect to reduce seed weight loss. The lowest seed weight loss was recorded with ash + insecticide treatment which was statistically identical with neem leaf powder and ash treatments. This result supported the findings of Misra (2000), Tripathy *et al.* (2001), Singh (2003) and Umoetok (2004). They found that oils and powders of different plants effectively reduced the seed weight loss.

From the results it was observed that neem, biskatali, ash and ash+insecticide had significant effect on seed germination after 6 months of storage condition. In controlled condition (no insecticide) it was found that seed germination was low because of highest insect infestation. These results supported the findings of Islam (2001), Sujatha *et al.* (2005) and Hampanna *et al.* (2006). They reported that indigenous plant products and byproduct had no adverse effect on seed germination.

From the foregoing discussion, it could be concluded that use of indigenous plant products (neem, biskatali), and byproduct (ash) are very effective, safe and economic compared to the use of synthetic insecticide. From these results it can be suggested that use of indigenous plant products and byproduct for the safe storage of rice seeds can be an alternate method from which our farmers may become benefited.

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