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Biological Control of Stored Grain Pests

Hansa Singh*, Afreen Kausar*, Shehnaaz Dilkash*, Joyita Das**
*B.Sc. III (2007-10) Department of Zoology, Patna Women's College, Patna University, Patna

**Lecturer, Department of Zoology, Patna Women's College, Patna University, Patna

The present study has been carried out to evaluate the efficacies of some plant products and spices in stemming damages to rice and dal caused by some grain pests. Samples of equally weighed three different grains were taken, namely Usna rice, Arwa rice and Moong dal (Green grams), each containing 20 pests. They were treated with some common herbs– Neem, Tulsi and Curry leaves and spices – Turmeric, Black pepper and Dry ginger (Saunth). They were dried, weighed and used in the grains. The dozes were given and their effects were observed at fixed intervals of 10, 20 and 30 days. Pests in isolated condition were also treated to confirm the efficacy corresponding to the control ones. The three pests were - Sitophilus granarius in Usna rice, Rhizopertha dominica in Moong dal and Tribolium castaneum in Arwa rice. The controls of the three grains showed an increase in the number of pests and a considerable damage and contamination of the grains. In the treated group, the pest population was decreased and damage to the grains was significantly less. Among the herbs, Curry leaves proved to be the most effective followed by Neem and then Tulsi. Among the spices, Black pepper was found to be more efficacious than Turmeric and Ginger. The combined treatments of the selected herbs as well as those of spices were more efficacious than the individual treatments. The order of resistance of the pests to these treatments were as Tribolium > Sitophilus > Rhizopertha.

Key words :- *Pests, stored grains, biological control, plant parts and products (herbs and spices)*

Introduction :

Proper storage of food grains assumes importance as it goes a long way in ensuring a constant supply of food in all seasons and circumstances. Stored grains are subjected to deterioration not only from macro-and micro environment, but also from a variety of organisms ranging from microbes to rodents. They render the food grains nutritionally deficient, pollute them to the extent that they become toxic. Consequently, such food grains become useless for consumption, causing damage to economy (unnakrishnan, 2002)..

A lot of attention has been given to post-harvest management involving prophylactic and curative measures so as to maintain the wholesomeness of stored grains. In this regard, biological control mechanisms have proved to be less detrimental to the grain quality.

The present study is an attempt to determine the efficacy of plant products in containing or thwarting the damage to stored grains caused by the pests that are of common occurrence.

Biological control can be exercised at two different levels-

a) At mass storage level- It can be used at large scale by farmers and whole-salers.

b) At individual storage level- It can be commonly used in households.

The present work was undertaken at the individual storage level. For our present study, we have used plant parts or their products, since these are handy, affordable and easily available, and have minimal side effect to the grains (Bakhru, 2005). Rather, they may add up their medicinal and therapeutic properties, further increasing the food value (Balkrishna , 2008). The suitability of the grains, as food, is not altered even if their residues are cooked accidentally. Furthermore, there is no possibility of having any entomogenous debris in stored grains, which is found when beetles and wasps are employed to control the pests.

Materials and Methods :

The study was conducted in Patna. In the present study, insects causing damage to stored grains were the pests which were selected.

The methodology included two set ups – **Experimental** and **Control**.

In both, samples of three different grains, each containing 20 pests, were taken in uniform containers. The grains were equally weighed and taken. The **Control** set up was kept corresponding to the Experimental set up to observe the impact of the pests and the nature and extent of damage caused by them to the grains. The **Experimental** set up was further divided into two groups – **pests treated in grains** and **pests treated in isolated condition**.

The treatment was first carried out with herbs. The three common herbs taken for this purpose were - Neem *(Azadirachta indica),* Tulsi *(Ocimum tenuifflorum),* and Curry leaves *(Murraya koenigii)*. The leaves of the three herbs were dried, weighed and used separately for both the groups. A combined doze of these three were also given to the pests in grains. The **isolated** set up was carried out to confirm the efficacy of these herbs.

Similarly, the second treatment was done with spices. The three common spices used for this purpose were – Turmeric powder *(Cucuma longa)*, Black pepper *(Piper nigram),* and Dry ginger *(Zingiber officinale* (Saunth). The latter two were grinded and then used. Spices were also used to observe their effects in the similar way as herbs. The three pests identified by us were: - *Sitophilus granarius* were experimented in Usna (Paraboiled) rice, *Rhizopertha dominica* were tested in Moong *(Vigna radiata)* dal and *Tribolium castaneum* were taken in Arwa rice as stated by Ahsan and Sinha (2009. Observations were made over different time periods of uniform time intervals of 10, 20 and 30 days. The observation tables were prepared according to Zar (2008) and Prasad (2005).

Results & Discussion :

The observation tables obtained for the different experimental set-up are as follows:-

Table No 1(a) – Table showing survival of *Sitophilus granarius* when treated with herbs.

In grains (Usna Rice; 80 g)				Isolated			
Name of the Herbs	10 days	20 days	30 Days	Name of the Herbs	10 days	20 days	30 days
Neem (8 g)	18	12	8	Neem (10 mg)	9	3	0
Tulsi (8 g)	20	14	10	Tulsi (10 mg)	10	4	0
Curry leaves (8 g)	14	8	6	Curry leaves (10mg)	7	2	0

Table No 2(a) – Table showing survival of *Rhizopertha dominica* when treated with herbs.

In grains (Moong dal; 80 g)				Isolated			
Name of the Herbs	10 days	20 days	30 days	Name of the Herbs	10 days	20 days	30 days
Neem (8 g)	12	8	2	Neem (10 mg)	6	0	0
Tulsi (8 g)	16	10	6	Tulsi (10 mg)	8	0	0
Curry leaves (8 g)	10	4	0	Curry leaves (10mg)	3	0	0

Table No 3(a) – Table showing survival of *Tribolium castaneum* when treated with herbs.

In grains (Arwa Rice; 80 g)				Isolated			
Name of the Herbs	10 days	20 days	30 days	Name of the Herbs	10 days	20 days	30 days
Neem (8 g)	16	11	9	Neem (10 mg)	9	0	0
Tulsi (8 g)	17	13	11	Tulsi (10 mg)	12	0	0
Curry leaves (8 g)	14	10	7	Curry leaves (10mg)	7	0	0

Table No 1 (b) – Table showing survival of *Sitophilus granarius* when treated with Spices.

In grains (Usna Rice; 80 g)				Isolated			
Name of the Spices	10 days	20 days	30 days	Name of the Spices	10 days	20 days	30 days
Turmeric powder(8g)	13	9	5	Turmeric powder(10 mg)	8	2	0
Black pepper (8 g)	11	6	4	Black pepper (10 mg)	5	0	0
Dry Ginger (8 g)	17	12	8	Dry Ginger (10 mg)	12	5	0

Table No 2 (b) – Table showing survival of *Rhizopertha dominica* when treated with Spices.

In grains (Moong dal; 80 g)				Isolated			
Name of the Spices	10 days	20 days	30 days	Name of the Spices	10 Days	20 days	30 days
Turmeric powder(8g)	12	4	0	Turmeric powder (10 mg)	6	0	0
Black pepper (8 g)	10	4	0	Black pepper (10 mg)	2	0	0
Dry Ginger (8 g)	16	8	0	Dry Ginger (10 mg)	12	2	0

Table No 3(b) – Table showing survival of *Tribolium castaneum* when treated with Spices.

In grains (Arwa Rice; 80 g)				Isolated			
Name of the Spices	10 days	20 days	30 days	Name of the Spices	10 days	20 days	30 days
Turmeric powder(8g)	15	11	7	Turmeric powder (10mg)	10	4	0
Black pepper (8 g)	13	8	5	Black pepper (10 mg)	7	0	0
Dry Ginger (8 g)	18	15	11	Dry Ginger (10 mg)	15	7	0

Table 4 (a) Table showing survival of the pests in combination of herbs

Individual weight	Neem (2.5 g)	Tulsi (2.5 g)	Curry leaves (3 g)
Total weight (of combination of herbs)	8 g		
Name of the pest	10 days	20 days	30 days
Sitophilus granarius (in Usna rice; 80 g)	10	4	2
Rhizopertha dominica (in Moong dal; 80 g)	8	2	0
Tribolium castaneum (in Arwa rice ; 80g)	12	10	6

Table 4 (b) Table showing survival of the pests in combination of spices.

Individual weight	Turmeric powder (2.5 g)	Black pepper (2.5 g)	Dry ginger (3g)
Total weight (of combination of spices.)	8 g		
Name of the pest	10 days	20 days	30 days
Sitophilus granarius (in Usna rice; 80 g)	10	4	0
Rhizopertha dominica (in Moong dal; 80 g)	8	2	0
Tribolium castaneum (in Arwa rice ; 80g)	14	8	2

The results of the present work showed that the grains were considerably damaged in the control setup. In the Experimental setup, the effects of Curry leaves on the pests were most pronounced followed by Neem and Tulsi as evident from Table no. 1(a), 2(a) and 3(a) in the category of plant products. Among the spices, Black pepper appeared most efficacious followed by Turmeric and Dry ginger as shown in Table no. 1(b), 2(b) and 3(b). The combination of plant parts as well as the combination of spices had greater effect on the survival of the pest according to the present work as it is clear from Table no. 4(a) and 4(b). Thus, the persent results demonstrate that plant parts (herbs) or spices serve as a useful biological agent for control of stored grain pest.

In the **Control** set up, it was observed that the pests in all the three grains increased in number and damaged the grains in the following way as stated by Vincet, Croettel and Lazaronits (2007).

1. In **Usna rice,** some of the grains were broken and turned from pale yellow to black in colour.
2. In **Arwa rice**, some pale powdery dusts of the grains were observed in between them and some at the bottom of the container.
3. In **Moong dal,** some hollowed grains were seen with a thin shell which was intact and the pests were present within the hollow cavities of the grains.

While in the **Experimental** set up, the pests decreased in number and damage caused to these grains was significantly less. Among the herbs, Curry leaves proved to be the most effective followed by Neem and then Tulsi. Curry plant is a very common household shrub which can be grown even in pots. Even a study by the Reader's Digest Association (2005) suggests that the leaves of Curry plant have phytochemicals which can be very effectively used. In spices, Black pepper was found to be more efficacious than Turmeric and Ginger. Moreover, the combined treatments of these herbs, and spices displayed more efficacy than the individual treatments. Hence, their combinations can also be used to ensure a greater protection. The order of the resistance of the three pests to these treatments was – *Tribolium* > *Sitophilus* > *Rhizopertha*.

Conclusion :

The present work has shown the efficacy of the selected plant products on the pest containing grains and has suggested that these biological agents can be utilized for effective control of stored grain pests. As these plant parts or herbs are easily available, therefore, these can be used at various levels without causing any harmful side effects.

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