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EFFICACY OF INERT DUSTS AGAINST LESSER GRAIN BORER, *RHIZOPERTHA DOMINICA* (COLEOPTERA: BOSTRICHIDAE) IN STORED SORGHUM

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ABSTRACT

The efficacy of inert dusts against the lesser grain borer was evaluated under laboratory conditions at the Department of Entomology, RCA, Udaipur during 2013-14. Among different inert materials evaluated for their effectiveness against *R. dominica* upto 120 days, diatomaceous earth at 5 and 10g/kg grains and rice husk ash at 10g/kg grains were found superior with cent per cent adult mortality, no grain damage and weight loss and no progeny development. Flay ash at 5g/kg grains with adult mortality of 52.25 per cent, 11.25 adults emergence, 17.16 per cent grain damage and 5.01 per cent weight loss was least effective.

Key words: Sorghum, *Rhizopertha dominica*, effectiveness, and inert dusts

Inert dusts have various industrial and agricultural uses including that as insecticide dust diluents and carriers (Ebeling, 1971). Watkins and Norton (1947) provide a classification of the inert dusts used as diluents and carriers. Inert dusts have been used to control insect pests of stored products (Mel'zina *et al.*, 1982). Those used for stored-product protection from insect pests can be categorized into 4 groups (Banks and Fields, 1995). The 1st group consists of clays, sand, paddy husk ash and wood ash. (Edwards and Schwartz, 1981); the 2nd group consists of a great number of minerals such as dolomite, magnesite, copper oxychloride, katelsous (rock phosphate and ground sulfur), lime (calcium hydroxide), limestone (calcium carbonate), and common salt (sodium chloride) (Golob, 1997). These minerals have been tested in past, and seem to offer some protection to stored grains from insect attack at rates greater than 10 grams per kilogram of grain (Jenkins, 1940; Parkin, 1944; Gay *et al.*, 1947). The 3rd group consists of dusts that contain synthetic silica (silicon dioxide). The 4th group consists of dusts that contain natural silica, such as diatomaceous earth. An experiment was thus conducted under laboratory conditions to evaluate the efficacy inert dusts.

MATERIALS AND METHODS

A stock culture of the lesser grain borer was reared in laboratory in glass jars of 2 kg capacity containing sorghum grains. The cultures were maintained for use in various investigations undertaken.

The effectiveness of inert dusts *viz*., fly ash, rice husk ash (plant source), cow-dung ash (animal source) and diatomaceous earth at the rate of 5g/kg and 10g/kg grains was evaluated by treating 100g of sorghum grains maintained in plastic jar. Ten pairs of 48 hour-old lesser grain borer adults were released in each jar. The mouth of jars were covered with muslin cloth and secured by rim of lid to disallow the entry or exit of any insect.

Adult mortality (%): The numbers of dead insects in each jar were counted upto 120 days at intervals of 30, 60, 90 and 120 days and the adult mortality was expressed as a percentage.

Progeny development (No. of adults): The observation on progeny development was recorded by sieving the grains and counting the total number of adult beetles at 30, 60, 90, and 120 days of treatment.

Grain damage (%): Before estimating the damaged grains, the grains were thoroughly mixed and samples of 100 grains were drawn for five times from each jar, then damaged grains in 100 grains were counted for each sample.

Weight loss (%): The observation on per cent weight loss was recorded by counting the numbers of uninfested seeds and infested seeds. Weight loss was worked out by the method suggested by Adams and Schulton, (1978).

$$\text{Weight loss (\%)} = \frac{(UND) - (DNU)}{U\,(ND + NU)} \times 100$$

Where,

U = Weight of uninfested seeds (g)

NU = Number of uninfested seeds
D = Weight of infested seeds (g)
ND = Number of infested seeds

RESULT AND DISCUSSION

Application of diatomaceous earth at 5 and 10g/kg grains and rice husk ash at 10g/kg grains caused cent per cent mortality; however, adult mortality varied significantly (p=0.05) within and among days of storage. The mortality of *R. dominica* in control and different treatments with inert dusts ranged from 0.67 to 100.00, 1.67 to 100.00, 7.67 to 100.00 and 10.33 to 100.00 per cent after 30, 60, 90 and 120 days of storage, respectively (Table 1). Significantly higher mortality was recorded in the treatment with diatomaceous earth at 5 and 10g/kg grains and rice husk ash at 10g/kg grains that recorded 100.00 per cent mortality. It was followed by cow dung ash at 10g/kg grains and rice husk ash at 5g/kg grains with 92.83 and 89.92, per cent mortality, respectively. The minimum adult mortality 52.25 per cent was recorded in fly ash at 5g/kg grains. Waqas *et al.* (2006) observed that diatomaceous earth @ 500 and 600 ppm were highly effective resulting in 100 per cent adult mortality of *R. dominica* after three weeks of exposure in treated wheat.

Diatomaceous earth at 5 and 10g/kg grains and rice husk at 10g/kg grains recorded no progeny development; however, the progeny development varied significantly (p=0.05) within and among storage periods evaluated. The progeny development of *R. dominica* in different inert dust treatments and control ranged from 0.00 to 18.67, 0.00 to 38.00, 0.00 to 58.67 and 0.00 to 65.33 after 30, 60, 90 and 120 days of storage, respectively. Significantly higher progeny development with 11.25 adults was recorded in fly ash at 5g/kg grains followed by cow dung ash at 5g/kg grains with 7.58 adults among treatments. No progeny development was recorded in case of diatomaceous earth at 5 and 10g/kg grains and rice husk ash at 10g/kg grains. Shaheen and Abdul Khaliq (2005) also reported that fly ash at 1.0 g/50g of grains showed the lowest number (3.14) of F1 adult emergence.

Treatment with diatomaceous earth at 5 and 10g/kg grain and rice husk ash at 10g/kg grains caused grains to be completely free from lesser grain borer damage though grain damage varied significantly (p=0.05). The mean grain damage by *R. dominica* in case of application of different inert dusts ranged from 0.00 to 30.65, 0.00 to 37.54, 0.00 to 44.21 and 0.00 to 47.01 after 30, 60, 90 and 120 days of storage, respectively (Table 2). Significantly higher grain damage was recorded in fly ash at 5g and 10g/kg grains, followed by cow dung ash at 5g/kg grains and rice husk ash at 5g/kg grains with 17.16, 15.97, 2.31 and 1.91 per cent damage, respectively. No grain damage was recorded in diatomaceous earth at 5g and 10g/kg gains and rice husk as at 10g/kg grains. Swain and Baral (2005) reported the effect of different ashes for controlling rice weevil and pulse beetle. Rice husk ash was considered as the best in controlling the insects in comparison to other ashes tested.

Application of diatomaceous earth at 5 and 10g/kg grains and rice husk ash at 10g/kg grains resulted in no weight loss; however, weight loss varied significantly (p=0.05) within and among different days of storage. The mean weight loss by *R. dominica* in different inert dusts ranged from 0.00 to 23.78, 0.00 to 25.45, 0.00 to 29.46 and 0.00 to 35.15 after 30, 60, 90 and 120 days of storage, respectively. Significantly higher weight loss was recorded in fly ash, rice husk ash and cow dung ash. No grain damage was recorded in diatomaceous earth at 5 and 10g/kg grains and rice husk ash at 10g/kg grains. Shaheen and Abdul Khaliq (2005) reported that fly ash at 1.0g/50g of grains showed the minimum weight loss (9.63%) and minimum holes (0.41 per grain).

On the basis of results and reviews, diatomaceous earth, rice husk ash, cow dung ash and fly ash happen to be good grain protectants against *R. dominica* in storage.

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Table 1. Effect of different inert dusts on mortality and Progeny development of lesser grain borer

S.	Inert dust	Dose (g/kg grains)	*Mortality (%) at					**Progeny development (No. of adults) at				
			30 DAS	60 DAS	90 DAS	120 DAS	Mean	30 DAS	60 DAS	90 DAS	120 DAS	Mean
1.	Fly ash	5	(55.33) 48.06	(55.67) 48.26	(50.00) 45.00	(48.00) 43.85	(52.25) 46.26	(5.33) 2.41	(8.33) 2.97	(13.00) 3.67	(18.33) 4.34	(11.25) 3.35
2.	Fly ash	10	(89.00) 70.99	(90.33) 72.34	(90.67) 72.70	(72.00) 58.10	(85.50) 68.53	(2.33) 1.68	(5.67) 2.48	(9.33) 3.14	(13.0) 3.67	(7.58) 2.74
3.	Rice husk ash	5	(92.00) 73.87	(93.33) 75.45	(94.33) 76.78	(80.00) 63.48	(89.92) 72.40	(1.33) 1.35	(2.67) 1.78	(4.33) 2.20	(9.67) 3.19	(4.50) 2.13
4.	Rice husk ash	10	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(0.00) 0.71	(0.00) 0.71	(0.00) 0.71	(0.00) 0.71	(0.00) 0.71
5.	Cow dung ash	5	(82.33) 65.18	(80.33) 63.70	(80.67) 63.95	(75.67) 60.46	(79.75) 63.32	(3.67) 2.04	(6.67) 2.68	(8.33) 2.97	(12.33) 3.58	(7.75) 2.82
6.	Cow dung ash	10	(97.67) 81.84	(94.33) 76.78	(90.00) 71.76	(89.33) 71.11	(92.83) 75.37	(1.00) 1.22	(2.33) 1.68	(5.00) 2.34	(7.33) 2.80	(3.92) 2.01
7.	Diatomaceous earth	5	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(0.00) 0.71	(0.00) 0.71	(0.00) 0.71	(0.00) 0.71	(0.00) 0.71
8.	Diatomaceous earth	10	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(0.00) 0.71	(0.00) 0.71	(0.00) 0.71	(0.00) 0.71	(0.00) 0.71
9.	Control		(0.67) 4.68	(1.67) 7.42	(7.67) 16.08	(10.33) 18.75	(50.9) 11.73	(18.67) 4.38	(38.00) 6.20	(58.67) 7.69	(65.33) 8.11	(45.17) 6.60
SEm±		1.54	1.71	1.64	1.06	1.49	0.04	0.04	0.05	0.04	0.04	
CD (p=0.05)		4.58	5.09	4.88	3.15	4.43	0.11	0.12	0.16	0.13	0.13	

* Figures in the parentheses are retransformed percent values, DAS – Days after storage; ** Figures in the parentheses are square root transformed values

Table 2. Effect of different inert dusts on grain damage and weight loss caused by lesser grain borer

S.	Inert dust	Dose (g/kg grains)	Grain damage (%) at					Weight loss (%) at				
			30 DAS	60 DAS	90 DAS	120 DAS	Mean	30 DAS	60 DAS	90 DAS	120 DAS	Mean
1.	Fly ash	5	(13.50) 21.55	(16.25) 23.77	(18.87) 25.74	(20.00) 26.56	(17.16) 24.41	(2.50) 9.10	(3.24) 10.37	(5.65) 13.75	(8.64) 17.09	(5.01) 12.58
2.	Fly ash	10	(10.45) 18.86	(14.61) 22.47	(18.68) 25.60	(20.15) 26.67	(15.97) 23.40	(1.50) 7.03	(2.01) 8.15	(5.61) 13.70	(7.25) 15.62	(4.09) 11.13
3.	Rice husk ash	5	(1.00) 5.74	(1.50) 7.03	(2.15) 8.43	(3.00) 9.97	(1.91) 7.79	(0.25) 2.87	(0.75) 4.97	(2.00) 8.13	(2.15) 8.43	(1.29) 6.10
4.	Rice husk ash	10	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00
5.	Cow dung ash	5	(1.00) 5.74	(1.75) 7.60	(2.50) 9.09	(4.00) 11.53	(2.31) 8.49	(0.30) 3.14	(0.50) 4.05	(0.56) 4.29	(0.76) 5.00	(0.53) 4.12
6.	Cow dung ash	10	(0.86) 5.32	(1.10) 6.02	(1.76) 7.62	(2.45) 9.00	(1.54) 6.99	(0.20) 2.56	(0.40) 3.62	(0.45) 3.84	(0.60) 4.44	(0.41) 3.62
7.	Diatomaceous earth	5	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00
8.	Diatomaceous earth	10	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00	(0.00) 0.00
9.	Control		(30.65) 33.61	(37.54) 37.78	(44.21) 41.67	(47.01) 43.28	(39.85) 39.09	(23.78) 29.18	(25.45) 30.29	(29.46) 32.87	(35.15) 36.36	(28.46) 32.18
	SEm±		0.25	0.29	0.33	0.35	0.30	0.14	0.19	0.22	0.25	0.20
	CD (p=0.05)		0.74	0.86	0.98	1.04	0.90	0.41	0.55	0.64	0.74	0.59

Figures in the parentheses are retransformed percent values, DAS – Days after storage

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