



EFFICACY OF DIFFERENT BOTANICALS FOR THE MANAGEMENT OF *RHYZOPERTHA DOMINICA* (FABRICIUS) IN STORED SORGHUM

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ABSTRACT

An experiment was conducted to investigate the insecticidal activity of different grain protectants viz., red chilli fruit powder, *Capsicum annum* L. 5.0, black pepper seed powder, *Piper nigrum* L. 0.5, neem seed kernel powder, *Azadirachta indica* A. Juss 5.0, neem leaf powder, *A. indica* 5.0, turmeric rhizome powder, *Curcuma longa* L. 5.0, tulsi leaf powder, *Oscimum basilicum* L. 5.0 per cent (w/w) and Untreated (control) against *Rhyzopertha dominica* (Fabricius) in stored sorghum. The result revealed that black pepper seed powder 0.5 per cent exhibited maximum adult mortality 65.00 and 29.75 per cent after 48 hrs release of adults at 4 and 60 DAT, respectively. The next effective treatment was red chilli fruit 5.0 and neem seed 5.0 per cent. The germination of sorghum grains was found to be above 80 per cent with neem leaf, tulsi leaf and turmeric rhizome powder while neem seed kernel, red chilli fruit and black pepper seed powder showed somewhat detrimental to the germination up to 60 days of storage.

KEYWORDS: *Rhyzopertha dominica*, Botanicals powders, sorghum storage, adult mortality, germination

INTRODUCTION

Sorghum, *Sorghum bicolor* (L.) Moench is one of the most widely adopted staple food crop for the mankind specially in semi-arid tropics and it occupies fifth position among the cereal crops in terms of production following rice, wheat, maize and barley in the world. Grain should be stored to meet home consumption as well as for sale. About 80 per cent of all grain produced is estimated to be stored at farm or village level. Heavy losses are inflicted to grain in storage. Insects, micro-organisms and vertebrates (birds and rodents) are the major agents causing losses to food grain in storage. The losses of stored grains as seed were accounting 7 to 8 per cent and to the major share of economic loss of worth Rs. 600 to 700 crore (Jadhav, 2006). Sorghum is attacked by many insect pests in field as well as in storage condition. Among the different stored grain pest, the lesser grain borer, *R. dominica*, is an important internal and primary feeder of various stored sorghum grains. Females laid eggs singly or in a row on the exterior part of the grain. Eggs hatch and the active larvae bore inside a grain, where it completes its development up to the adult stage. Upon reaching to the adult stage, the insect emerges from the grain and creates a large exit hole. Therefore, the best method to manage this pest is to control adults before they colonize and reproduce in the stored grain, or control larvae before they enter into the grains. Applying a grain protectant may offer long-term protection against adults and larvae of *R. dominica* in stored grain. Control of insects by insecticide has serious drawbacks, such as the development of resistance, toxic residues, workers safety and increasing

costs. Among various grain protectants, some plants have been found to possess the most effective and most acceptable active ingredients. There is an urgent need to develop pest management strategies which will be commercial and safer in small and large scale storage. These strategies could be achieved by exploiting the plants of insecticidal property, which are also easily available to farmers. The plant materials are inevitable favourites by virtue of lesser impact on the environment. During the investigation, the insecticidal activity of powder of different plant parts were evaluated in order to determine their effect on the mortality and progeny production of *R. dominica* in sorghum grains under laboratory condition.

MATERIALS & METHODS

The test insect was obtained from local market through infested sorghum grain and maintained under the laboratory condition. The mass multiplication of stock culture was done on stored sorghum grains. The grains of sorghum were disinfested at 55°C temperature in an oven for 4 hrs before use. Leaves of neem (*Azadirachta indica* A. Juss) and tulsi (*Oscimum basilicum* L.) were collected from College farm, Block-E, NAU field, Navsari and dry fruits of chilli (*Capsicum annum* L.), seeds of neem, black pepper (*Piper nigrum* L.) and rhizomes of turmeric (*Curcuma longa* L.) were collected from local market and shade dried for a week and ground into powder with the help of mixer. As far as seeds of neem, first decoated in the laboratory and obtained kernels. The kernels were dried and ground. The powders were stored in airtight plastic containers at room temperature before use.

The sorghum grains, variety GJ-42 (100 gm) were kept in glass jar (9.5 × 7.0 cm) and test materials (seed protectant in powder form) were mixed at respective dose thoroughly and properly mixed by manual agitation until the materials were evenly distributed among the grains and ensure a homogeneous mixture, which was considered as one repetition. Four repetitions were maintained in each case. Ten pairs of adults of *R. dominica* (2 to 3 days old) were released in each jar at an interval of 4, 7, 15, 30 and 60 days of treatment. The jars were covered with two-fold muslin cloth and tied with rubber band to ensure ventilation and escape of adults. The per cent adult mortality was calculated on the basis of the number of dead insects. Insects showing movement of legs and antennae were considered as alive. The mortality counts were recorded after 48 hours of release of adults at each interval. The percentage mortality of the adults was corrected by using following formula given by Abbott's (1925) and then subjected to ANOVA after transforming them to arc sine.

$$\text{Per cent weight loss} = \frac{U_{Nd} - D_{Nu}}{U(N_d + N_u)} \times 100$$

Where,

$$\text{Germination percentage} = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds kept}} \times 100$$

The data thus, obtained was statistically analysed by employing arc sine transformation.

RESULTS & DISCUSSION

Perusal of the data presented on 4DAT in Table-1, revealed that the significantly higher mortality (65.00 %) was observed in black pepper fruit powder 0.5 percent and the lower corrected per cent mortality was observed in turmeric rhizome powder 5.0 per cent (10.00 %). It is evident from the data presented on 7 DAT in Table-1 that the maximum per cent mortality (40.00 %) was noted in the treatment of black pepper fruit powder 0.5 per cent which was significantly differed from other treatments. Whereas, the minimum corrected per cent mortality was recorded in neem leaf powder 5.0 per cent (6.25 %) and turmeric rhizome powder 5.0 per cent (7.50 %). The data given on 15 DAT in Table-1 revealed that the treatment of black pepper seed powder 0.5 per cent and red chilli fruit powder 5.0 percent exhibited the maximum adult mortality (20.00 %). The minimum per cent adult mortality (6.25 %) recorded in treatment of neem leaf powder 5.0 percent and turmeric rhizome powder 5.0 per cent. It can be seen from the data presented on 30 DAT in Table-1 indicated that the maximum corrected per cent adult mortality (20.00 %) was noted in treatment of red chilli fruit powder 5.0 percent while black pepper seed powder 0.5 percent exhibited 17.50 per cent adult mortality. The minimum

U = Weight of undamaged grains,
D = Weight of insect damaged grains,
Nu = Number of undamaged grains
Nd = Number of insect damaged grains

The data thus, obtained was statistically analysed by employing arc sine transformation.

Effect of various seed protectant on germination

The effect of various seed protectant on viability of seeds, germination test was conducted at 60 days after treatment in P.G. Research Laboratory Dept. of Agril. Entomology, NMCA, N.A.U., Navsari. For the purpose, 100 seeds of untreated (control) and treated with different seed protectant were taken for each repetition. Three repetitions each having 100 seeds was maintained for germination test. The seeds were soaked in distilled water and then transferred into sterilized petri plate (1.5 × 9cm) consisting a piece of wetted blotting paper at the bottom. One piece of wetted blotting paper was placed on seeds then after petri dish was covered. Blotting papers were moistened by applying distilled water. Germination counts were made after 72 hours and calculated germination percentage (Patel, 2001).

corrected per cent mortality of adults were found in treatment tulsi leaf powder (5.00 %), neem leaf powder (5.00 %) and turmeric rhizome powder (5.00 %) with 5 percent. The corrected per cent mortality of adults of *R. dominica* at 60 days after treatment (Table-1) indicated that neem seed kernel powder and red chilli fruit powder 5.0 per cent gave the maximum protection i.e. 10.00 and 8.75 per cent, respectively. None of the adult mortality was found in treatment of turmeric rhizome powder 5.0 per cent. Overall mean adult mortality of *R. dominica* at 48 hours after adult released with different interval i.e. 4, 7, 15, 30 and 60 DAT presented in Table-1 and depicted in Figure-1. Black pepper seed powder 0.5 per cent was found to be effective up to 60 days and gave significantly higher mortality (29.75 %) over rest of the treatments. The minimum per cent adult mortality was found in treatment of turmeric rhizome powder (5.75 %) and neem leaf powder (8.00 %). Red chilli fruit powder and neem seed kernel powder 5.0 per cent recorded 21.25 and 17.00 percent adult mortality, respectively which was at par with each other. Ashouri and Shayesteh (2009) reported that the red pepper fruit powder did not showed complete adult mortality as compared to black pepper seed powder against *R. dominica*.

TABLE 1: Impact of various plant products against *R. dominica*

Treat. No.	Particulars	Dosage (%) w/w	4 DAT	7 DAT	15 DAT	30 DAT	60 DAT	Mean corrected percentage mortality
T ₁	Red chilli fruit powder	5.0	36.27 (35.00) *	28.28 (22.50) *	26.55 (20.00) *	26.57 (20.00) *	17.20 (8.75) *	26.97 (21.25) *
T ₂	Black pepper seed powder	0.5	53.76 (65.00)	39.23 (40.00)	26.57 (20.00)	24.73 (17.50)	14.47 (6.25)	31.75 (29.75)
T ₃	Neem seed kernel powder	5.0	29.99 (25.00)	28.24 (22.50)	22.78 (15.00)	20.61 (12.50)	18.43 (10.00)	24.01 (17.00)
T ₄	Neem leaf powder	5.0	26.55 (20.00)	14.40 (6.25)	14.30 (6.25)	12.92 (5.00)	9.06 (2.51)	15.45 (8.00)
T ₅	Turmeric rhizome powder	5.0	18.39 (10.00)	15.85 (7.50)	14.37 (6.25)	12.92 (5.00)	0.57 (0.01)	12.42 (5.75)
T ₆	Tulsi leaf powder	5.0	22.76 (15.00)	22.78 (15.00)	18.34 (10.00)	12.89 (5.00)	11.04 (3.75)	17.57 (9.75)
S.Em.±		-	0.75	0.84	0.83	0.66	0.48	1.20
C.D. at 5%		-	2.21	2.48	2.46	1.94	1.40	3.47
C.V. (%)		-	5.59	7.90	9.48	8.33	9.37	20.39

*Figures are in parenthesis are retransformed values, those outside are arc sine transformed values.

TABLE 2: Influence of various botanicals on germination of sorghum (Variety GJ-42)

Treat. No.	Particulars	Dosage (%) w/w	60 DAT
T ₁	Red chilli fruit powder	5.0	56.17 (69.00) *
T ₂	Black pepper seed powder	0.5	60.01 (75.00)
T ₃	Neem seed kernel powder	5.0	61.13 (76.67)
T ₄	Neem leaf powder	5.0	72.95 (91.33)
T ₅	Turmeric rhizome powder	5.0	70.35 (88.67)
T ₆	Tulsi leaf powder	5.0	70.64 (89.00)
T ₇	Control (Untreated)	-	64.92 (82.00)
S.Em.±		-	0.80
C.D. at 5%		-	2.43
C.V. (%)		-	2.13

*Figures are in parenthesis are retransformed values, those outside are arc sine transformed values.

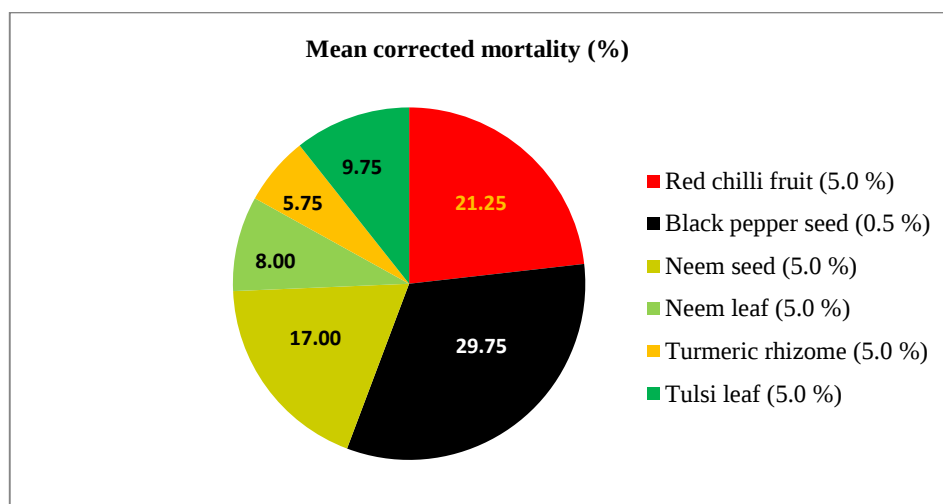


FIGURE 1: Influence of various plant products against adult of *R. dominica* in stored sorghum

Capsicum annum L. fruit powder @ 5.00 gm exhibited 10.40 per cent adult mortality of *Sitophilus zeamais* (Mostch) after 48 hours (Oni, 2011), while *Piper guineense* L. applied @ 0.50 gm per 20 gm of wheat exhibited 33.30 per cent adult mortality of *R. dominica* after 48 hours (Kayode and Daniel, 2012). The present findings are corroborated with Oni (2011) and Kayode and Daniel (2012) and disagreed with Ashouri and Shayesteh (2009). The discrepancy in the adult mortality might be due to variation in methodology opted and prevailing climate condition. From the data presented in Table-2 on per cent germination revealed that the higher germination was found in treatment of neem leaf powder (91.33 %) and tulsi leaf powder (89.00 %). Significantly the lower germination (69.00 %) was found in red chilli fruit powder. A more or less similar findings were also reported by Savitri *et al.* (1994) and Singh and Singh (2005). The black pepper seed powder 0.5 per cent was found to be effective in controlling the *R. dominica* up to 60 days. Neem leaf powder, tulsi leaf powder, turmeric rhizome powder and control (untreated) maintained more than 80 per cent germination. Red chilli fruit powder, black pepper seed powder and neem seed kernel powder were comparatively detrimental in respect to per cent germination of stored sorghum.

ACKNOWLEDGEMENT

The authors are thankful to Director of Research and Dean P.G. Studies, Navsari Agricultural University, Navsari, Gujarat, India for providing the facilities during the present investigation. The help render by Principal and Dean, N.M. College of Agriculture, N.A.U., Navsari is also duly acknowledged.

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