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Effect of Neem oil on the population dynamics of *Rhizopertha dominica F*

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Abstract
The present investigation reports the effect of natural pesticide, the neem oil, on the population of R. dominica. The beetle although attacks many legume seeds but in the present investigation it has been specifically grown and studied on maize. It was found that the neem oil has insecticidal properties which can reduce the population growth of this beetle in storage. Among the different doses of neem oil taken, 1.0 m/50 gm maize was considered the most effective dose in all cases. This is followed by 0.75 ml, 0.5 ml, and 0.25 ml/50 g of maize seed.

Keywords: *Rhizopertha dominica* F, Maize seed, neem oil, containers

1. Introduction
Maize is one of the three major cereal crops produced worldwide (Anon, 1987) [2]. It is attacked by several insect pests of which the lesser grain borer (*R. dominica* F) is a primary pest of maize in storage (Mark *et al.*, 2010) [9]. It is a strong flier (Barrer *et al.*, 1993) [6]. Young beetles tend to have a greater flight activity than older beetles (Aslam and Dover, 1994) [4].
Maize, under storage conditions, is subjected to severe damage by pests and thus necessitates to develop strategies for grain protection. Although some work has been done on the evaluation of maize varieties and some suitable grain protectants have been determined still further work on these aspects need to be carried out to facilitate export of good quantity maize, as and when required.
Today's usual practices for the control of store grain insect pest of maize in the world include application of synthetic insecticides and phosphine gas during the storage (Anwar *et al.*, 2003) [3]. The research for environmentally safe alternatives is the focus of research in several laboratories around the world (Silhacek and Murphy, 2006) [13]. Resistance to phosphine is so high in Australia, India and other countries, that it would cause control failure (Mau *et al.*, 2012; Ahmad *et al.*, 2013) [10, 1]. Although the chemical insecticides are effective but their repeated use has led to several problems (Lu and Wu, 2010) [8] besides increasing costs of their application.
In view of the above facts the present investigations were carried out to reduce the huge storage losses in maize by *R. dominica* (L) through the neem oil.

Materials & Methods
The present investigation on the effectiveness of neem oil on the population dynamics of *R. dominica* (F) in stored maize was carried out in the P. G. Deptt. of Zoology, College of Commerce, Patna during 2017-18. The materials used and methods employed during the course of investigation are described below:
1. Zea mays of maize
2. R. donimica F or lesser grain borer
3. Containers
4. Neem oil.

Maize grains were washed and dried under sunlight to ensure that seeds are free from pesticides prior to study.
R. dominica (F) were collected from maize traders and farmers. A healthy culture of *R. donimica* was maintained in containers containing maize at 28oC ± 2oC temperature and 70-75% relative humidity.
Ten pairs of insects were first introduced in the rearing pots and were allowed to lay eggs. One pair of freshly emerged adults was isolated from the stock culture and was separately liberated into separate pots containing maize seeds. The test insect and maize seeds were regularly changed in order to keep a healthy culture. During winter, the pots were transferred to incubator at a constant temperature of 30oC.
Constant quality 50 g of maize grain were taken and treated with 4 doses of pure neem oil (Procured from neem mission, Pune, India online) viz. 0.25 ml, 0.50 ml, 0.75 ml and 1.0 ml. These four doses were used each in four replicates. Each set of four experiments was conducted at room temp. 30oC ± 2oC and 70 ± 5 R.H.
Except the control replicates all the containers were shaken vigorously for optimum coverage of the grain surface by neem oil.

Results & Discussion
The population growth of *R. donimica* (F) on maize seed was found low as compared to the control during the summer season. The mortality percentage was observed to be relatively high. During rainy season, the population of *R. dominica* (F) was significantly high and mortality was relatively low. It was also observed that the population growth of weevils during winter was significantly low and mortality high.
The percentage of damaged seeds in each replication of the different treatment of neem oil was calculated. The average percentage damage observed at different intervals after various treatments, is given in Tables 1-3.
From the result obtained, it may be concluded that maize seeds can be effectively protected from the damage of *R. dominica* (F) by mixing the neem oil at the rate of 0.25 ml to 1.0 ml per 50 g of seed. It may be observed that in general mixing the seed with neem oil has given effective

control of the pest infestation.

Narayan *et al.*, (1980) [11] reported that one of the different fractions from neem oil at 0.25% concentration provided as high as 92%, protection from feeding by desert locust Schistocerca gregaria on leaves of corn. Attri and Prasad (1980) [5] observed that neem oil at a concentration of as low as 0.5% caused complete mortality of the larvae of C. fatigans. Pierre *et al.*, (2015) [14] reported that use of neem product control maize weevil on three maize varieties in cameroon. Goektepe *et al.*, (2004) [7] studied ecological risk assessment of neem based pesticides. Stark (2001) [15] studied population level effects of neem insecticide. Okumu and Bart (2007) [12] reported the larvicidal effects of neem oil formulation on the A. gambiae. Sujarwo *et al.*, (2016) reported ethnobotanical uses of neem product in Bali (Indonesia).

The results of this study indicate that there was an increase in maize weevil population with the progress in storage time. This could be related to the increase in moisture content of the grain during storage. The untreated control recorded highest moisture gain and highest population.

Concluding the discussion on the effect of neem oil on the control of the population of *R. dominia* (F) in stored maize, it may be said that different doses gave better protection o the grain.

Table 1: Effect of treatment with neem oil (ml/50 g maize) on weight loss of maize in 40 days due to infestation with R. dominica (F) is summer season.

Observation	Control	0.25	0.50	0.75	1.00
1	8.00	7.70	7.00	6.90	6.75
2	9.00	8.60	8.00	7.60	6.80
3	10.00	9.80	9.20	8.80	6.70
4	11.00	10.50	10.00	9.60	6.67
Mean	9.50	9.15	8.55	8.23	6.73

Table 2: Effect of treatment with neem oil (ml/50 g maize) on weight loss of maize in 40 days due to infestation with R. Dominica (F) is rainy season.

Observation	Control	0.25	0.50	0.75	1.00
1	11.00	8.95	8.70	7.95	6.35
2	10.00	8.70	8.50	7.70	6.00
3	9.00	8.50	8.00	7.30	6.10
4	10.00	8.20	8.10	7.10	6.20
Mean	10.00	8.59	8.33	7.51	6.16

Table 3: Effect of treatment with neem oil (ml/50 g maize) on weight loss of maize in 40 days due to infestation with R. dominica (F) is winter season.

Observation	Control	0.25	0.50	0.75	1.00
1	14.00	9.80	8.70	7.80	7.25
2	13.90	9.70	8.60	7.60	7.40
3	12.90	9.50	8.00	7.40	7.35
4	13.50	9.10	8.10	7.20	7.20
Mean	13.58	9.53	8.35	7.50	7.30A

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