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Ovipositional Preference of lesser grain borer, *Rhyzopertha dominica* Fabr. (Coleoptera: Bostrichidae) in certain wheat, *Triticum vulgere* (Linn.) varieties

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Abstract
Rhyzopertha dominica Fabr. (Coleoptera: Bostrichidae) is a highly polyphagousserious insect-pest of stored cereals particularly wheat under tropical conditions and causes extensive damage both in terms of quantity and quality to stored wheat grains.. Study on ovipositional preference in wheat varieties was conducted at Department of Zoology, D.B.S.College, Kanpur, India during 2004 to 2005 Six wheat, *Triticum aestvum* Linn varieties viz., TL 174, K 65, HI 774, UPT 72294, Kalyan Sona and HD1982 were tested under laboratory condition in protected and unprotected condition. In the present investigations six varieties of wheat, *Triticum aestvum* (Linn.) were tested under laboratory trials for their relative food preference to *Rhizopertha Dominica* Fabr. The data revealed significant differences among various wheat varieties for oviposition of *R. dominica.* Fecundity was highest (121.33 eggs) on TL 174 and lowest on K 65 (30.33 eggs) and HI 774 (27.33 eggs) respectively. The second in order to preference for oviposition having 73.33 eggs was HI 774 followed by UPT 72294 and HD1982 in which 67.33 and 54.00 eggs have been laid respectively. K 65 and HI 774 having 30.33 and 27.33 eggs are comparatively less preferred for egg laying. Among the food preference the most preferred variety for the larvae was UPT 72294, and least preferred varieties was HI 7747.

Keywords: *Rhizopertha dominica*, *Triticum aestvum*, oviposition and fecundity

1. Introduction
Wheat, *Triticum vulgere* Linn. (Faimly: Gramineae) is one of the major important rabi cereal crop and staple food throughout the world (Dolinski*et al.*1971 and Buchelos and Katopodis, 1095) [1, 2]. It contains the important elements for an adequate diet (Peter and Hey) [3]. It is extensively grown both in irrigated and rain fed areas in India. It occupies an area of 30.72 million hectare with a production and productivity of 97.44 million tones and 3172kg/ha, respectively (Anonymous. 2017) [4]. A lot of efforts have been made by several agencies to develop high yielding varieties. These new varieties have been replaced by traditional varieties, which have high yield potential.
During storage wheat grains are attacked by more or less than 23 insect's species in world (Sinha, 1971, Horton, 1982, Storey *et al.* 1983 and Thakur, 1999a) [5, 6, 7, 8]. The lesser grain borer, *Rhizopertha dominica* Fabr is a broad-based and serious pest of cereal grains, their products and limiting factor for gainful storage of wheat in Oriental Zoo-geographical regions(Cogburn,1974) [9]. Stored grains are seriously damaged by number of insect pests during storage. Amongst them, lesser grain borer, *Rhizopertha dominica* Fabr. and Angoumois grain moth, *Sitotroga cerealella* Oliv. Are considered to be major under Indian conditions (Pandey and Singh, 1974, Singh and Pandey 1974) [10, 11]. Tiwari (1994) have studied the varietal resistance of some stored grain varieties to *Rhizopertha dominica* Fabr [12]. The lesser grain borer, *Rhizopertha dominica* Fabr. Is primary pest of stored cereals especially wheat under tropical conditions and causes extensive damage both in terms of quantity and quality to stored wheat grains.
The insects infesting barley are similar to those infesting wheat (Atwal, 1976 and Gardner *et al.* 1988) [13, 14]. Secondary pests are the most common insects found in oats stored in the United States, particularly *O. surinamensis*, *Cryptolestes* and *Tribolium* species.

(Ingemansen *et al*. 1986) [15]. However, primary insect pests can also infest oats (Chanbang *et al.* 2008) [16].Triticale is similar to wheat in supporting insect growth (White and Loschiavo 1988) [17] and, thus, 168 is susceptible to many of the same insect pests as wheat (Greening 1983) [17].

The results of present studies are likely to be helpful for stake holders and go downs owners in making effective management decisions to control *R. dominica* thus contributing in sustainable wheat supply. The present investigation is carried out with an object to evaluate the fecundity and ovipositional performance of *Rhizopertha dominica* Fabr on six wheat varieties under laboratory conditions.

2. Material and Methods

The study regarding to identify the resistant varieties was carried out under field condition during 2012-13 to 2014-15 at Department of Zoology, D.B.S.College, and Kanpur, India during 2008 to 2012.Six wheat varieties were evaluated against *Rhizopertha dominica*.

2.1. Rearing and Culture of the Test Insect

Adults of *Rhyzopertha dominica* Fabr. (Coleoptera: Bostrichidae) collected from local granaries for building up a laboratory culture. The stock culture of *R. dominica* was maintained in glass jars (2litre capacity) containing broken wheat flour +5% dried brewer's yeast, tied with muslin top under the controlled conditions of 30 $\pm$1° C temperature and 75 $\pm$5% relative humidity for mass breeding.

2.2. Experimental Tools Used

The tools like egg laying apparatus, glass jars petridish a 100 mesh sieve, plastic jars with perforated top, Camel hair brush, muslin cloth, chemical balance, complete with weight box, magnifying hand lens and a binocular microscope etc. was used in the present investigation.

2.3. Obtaining Eggs for Different Experiments

The newly emerged male and female of *R. Dominica* Fabr. Distinguished by observing a number of characters mentioned above, was keep into a special egg laying apparatus. It is a special device, consisting of glass chimney at the top, tied with muslin top, kept on the ordinary sieve netting. The sieve and chimney kept over petridish will keep above another petri-dish, which is just reverse in their position as above petri-dish. The whole device kept on large petri-dish filled with water Adults will provide 0.5 percent glucose solution with the help of soaked cotton wool and hanged in the center of the top muslin cloth of the chimney. Just emergence, the adults are sluggish and less active but after a few times they become more active, males are more active than the females. 0-2 and hours old eggs removed from the petri-dish regularly and kept into the specimen tubes labeled with date-wise to find the known aged eggs.

3. Bioassay

All the laboratory experiments were conduct in controlled conditions of 27$\pm$2° C temperature and 75 $\pm$5.0 percent relative humidity. This experiment was performing inside a closed chamber of glass. Twenty seeds of each variety was weight and put in watch glasses and into small muslin bags leveled for each variety in three replications in randomized way. The randomized glace paper was put in the base of the chamber and thus each watch glass will keep according to its proper place. Now 30 pairs of newly emerged moths will release inside the chamber with 1:12 ratio of insects and seeds. To provide them food the cotton wool soak in 0.5 percent glucose solution was keep in the center of top of the chamber. Number of eggs laid in each wheat, variety was count after 3 and 5 days of release. The counting was done with the help of magnifying, hand lens and camel hairbrush and is recorded.

4. Result

In the present investigations, six varieties of wheat were tested for their relative resistance or susceptibility to *Rhyzopertha dominica* Fabr and The relative resistance or susceptibility of wheat was tested by observing the preference for oviposition and the food preference. The experiments were carried out at a constant temperature of 27 $\pm$2° C and 75.00 percent relative humidity. The means of original data have been worked out. These have been statistically analyzed by using the "Analysis of variance" technique (Abbott, 1925) [19], and are presented. The results have been interpreted separately under each character. The analysis furnishes estimates of population variances due to difference of the mean for each variety, and errors of random sampling.

The ratio of these estimated variances in known as the variance ratio or 'F'. This observed value of 'F' is compared with the theoretical value of 'F' given by Fisher and Rates (1938) for testing the significance. The standard error of mean (S. Em.) is calculated as/$\underline{2}$VE. It is a measure of their variation in the means due to sampling errors and gives an indication of the comparative reliability of the estimated mean. The critical difference (C.D.) is the product of (S.E.) Diff. X t 5%, which is the minimum value required in order to make differences between any two means, may be considered significant. The C.D. at 5.0 percent level for the results of each investigation are given under the respective table.

The data presented in Table 1a and figure 1a revealed that fecundity was highest 121.33 eggs on TL 174 and lowest on K 65 (30.33 eggs) and HI 774 (27.33 eggs) respectively. The second in order to preference for oviposition, having 73.33 eggs was HI 774 followed by UPT 72294 and HD1982 in which 67.33 and 54.00 eggs have been laid, respectively. Wheat varieties K 65 and HI 774 having 30.33 and 27.33 eggs are comparatively less preferred for egg laying. The data presented in Table 1b and figure 1brevealed that fecundity was highest 152 eggs on TL 174 in replication three followed by 122 eggs in R2and 90 in R1, respectively. Similarly, lowest on variety K 65 in replication- 3(21 eggs) followed by replication- 2(27 eggs) and replication-1 (43 eggs), respectively. The second in order to preference for oviposition in replication three having 92 eggs was UPT 72294 followed by HI 7747and HD 1982 in which 66.00 and 62.00 eggs have been laid, respectively. Wheat variety K 65 and Kalyan Sona having 21.00 and 36 eggs in replication three are comparatively less preferred for egg laying. The data presented in Table 1c and figure 1crevealed that number of eggs laid was highest 364 eggs and mean eggs laid 121.33 on TL 174 all replications followed by 220number of eggs and mean eggs laid 73.33 in all replication whereas lowest number of eggs 82.00and 27.33mean eggs laid in case of variety Kalyan Sona.

Based on the combined effect on ovipositional preference for food, food value for its development and losses done in

weight the varieties can be distinguished with regard to their highest susceptible on TL 174to the attack of *R. dominica*. Wheat varieties HI 7747, K. Sona and K 65 are least susceptible to *R. dominica* (Fabr.) whereas, UPT 72294 are intermediate in position. It may thus be concluded from the present study that no variety of wheat was immuned to the attack of *Rhyzopertha dominica (*Fabr.) but only exhibited varying degrees of susceptibility, which depends upon a number of factors like hardness and softness, size and shape and varying chemical constituents of the grains, etc.

Table 1a: Fecundity of *R. Dominica*on different varieties of wheat after 72 hours of release

Treatments	Replications after 72 hours			Total Number of egg /Mean Percentage of Eggs	
Varieties	Repication-1	Repication-2	Repication-3	Number of eggs	Mean Eggs
HI 7747	82	72	66	220	73.33
HD 1982	42	58	62	162	54.00
K 65	43	27	21	91	30.33
KalyanSona	25	21	36	82	27.33
TL 174	90	122	152	364	121.33
UPT 72294	60	50	92	202	67.33

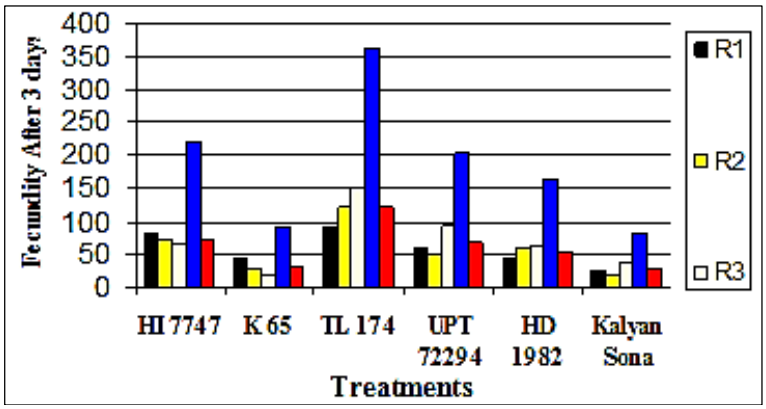

Fig 1a: Fecundity of *Rhyzopertha dominica* Fabr. on different varieties of wheat after 3 Days of release

Table 1b: Fecundity of *R. dominica* with three replications on wheat varieties after 72 hours of release

Treatments	No. of Egg laying after 3 days of release		
Varieties	Replication- 1Day-1	Replication-2Day-2	Replication-3Day-3
HI7747	82	72	66
HD 1982	42	58	62
K 65	43	27	21
KalyanSona	25	21	36
TL 174	90	122	152
UPT 72294	60	50	92

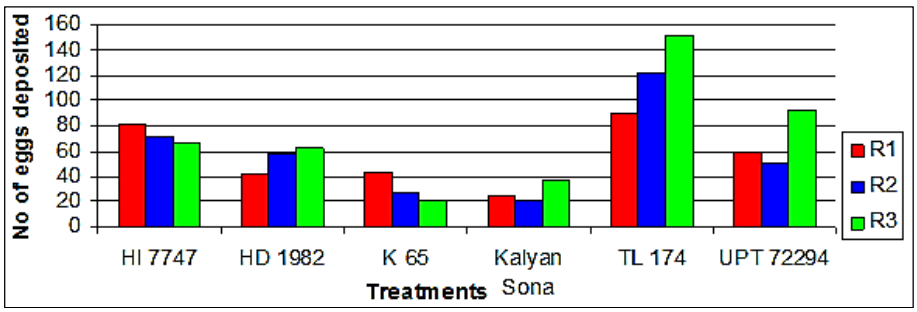

Fig 1b: Fecundity of *R. dominica* with three replications on wheat varieties after 3 days of release

Table 1c: Mean Fecundity of *R. dominica* on wheat varieties after 72 hours of release

Treatments	No. of eggs laid	Mean Eggs laid
HI 7747	220	73.33
HD 1982	162	54.00
K 65	91	30.33
KalyanSona	82	27.33
TL 174	364	121.33
UPT 72294	202	67.33

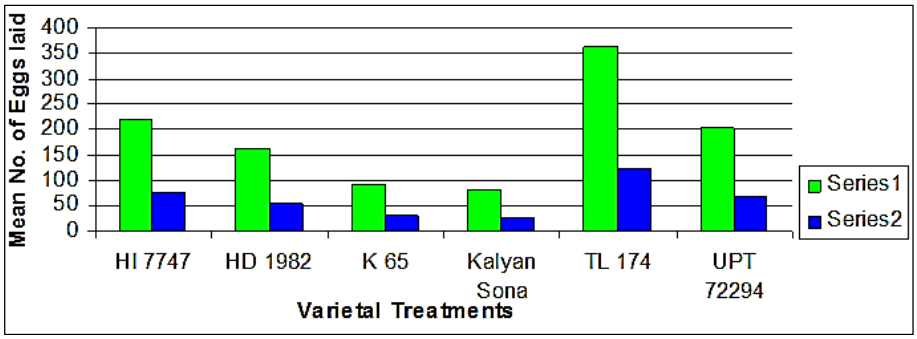

Fig 1c: Mean Fecundity of *R. dominica* on wheat varieties after 3 days of release

5. Discussion

Presented study is in harmony to the finding of previous workers where it was concluded that each wheat variety act in a different way to the stored grain insect pests. During the test varietal preference it was found that the maximum number of eggs laid towards TL 174 the variety HI 774 preferred the least number of egg laying. There may be various physical and chemical factors responsible for this larval attraction.

In the support of above findings Tiwari *et al.* (1989) conducted an experiments to test the effect of storage period and interspecific competition on the population build-upof three stored pests, among them *Sitophilus* oryzae Linn., *Rhyzopertha dominica* Fabr. and *Tribolium castaneum* (Herbst.) caused loss to 6 varieties of wheat. Birch and Snowball (1945) observed that eggs of *Rhyzopertha dominica* (Fab.) are developed at constant temperature. Pant *et al.* 1964. Conducted an experiment to test the relative resistance of certain maize varieties against *Sitophilus oryzae* (L.) and found considerable resistant. Sharma *et al.*2001 showed the relative susceptibility and development of *Rhyzopertha dominica* (Fab.) on promising varieties of wheat and reported positive response of egg laying.

Some workers like Singh *et al.* (1972) were also studied the oviositional preference of *Sitophilus oryzae* on major wheat varieties and their suitability for its subsequent development, was studied at 30 $\pm$1º C temperature and 70.0 per cent RH. The for oviositional preference as determined by the average number of eggs laid on different varieties [24]. Baker *et al.* (1991a) evaluated 30 Eastern soft wheat cultivars by allowing 5 female S. *oryzae* to oviposit for 3 days on 25-gram samples of each cultivar. Under these conditions, progeny production was 7.2 weevils per female per day, a near optimum response [25].

The literature is being compiled on varietal susceptibility and mechanism of resistance for oviposition reducing or multiplication of lesser grain borer, *Rhyzopertha dominica* Fabr. and other stored grains pests are described by various workers (Dobie and Kilminster, 2002) [26, 27, 28, 29, 30, 31, 32]. During the test varietal preference it was found that the maximum number of egg laying 364.00 on $_{TL}$ 174 whereas the variety Kalyan Sona (82 eggs), the least numb of egg laying.

6. Conclusion

On the basis of results, it was concluded that there was variability in different wheat cultivars and none of them found to be completely resistant. Although complete immunity was not possible, yet some of the genetic traits could be incorporated for evolving varieties which possess resistant characters. The susceptible variety is highly preferable, so it can be used as a quick and mass laboratory culture of lesser grain borer, *Rhyzopertha dominica* Fabr, which may be needed in further other scientific experiments.

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