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EFFECT OF INFESTATION BY THE PRIMARY PEST, *RHIZOPERTHA DOMINICA* (F.) ON DIFFERENT WHEAT KERNEL

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ABSTRACT

Rhizopertha dominica (F.) (lesser grain borer), is a serious primary injurious pest of stored wheat grain in vast areas of the world. In Pakistan 5-7% of the food grains are lost due to poor storage situation. The adult of lesser grain borer were recorded on three types of wheat, under laboratory condition for some preliminary studies. The Samples were collected of the different varieties of wheat (Abadgar, TD-1 and Moomal) from the Wheat research institute, Sakrand, Sindh. During the observation four parameter weight loss and insect damaged grain, Insect in damaged grain and weight of frass (gm) with relation to abiotic relation (Temperature and Relative humidity) were seen in the six months January to June-2018. During the six months experimentation of *Rhizopertha dominica*, it was notice that Max: weight loss (14.3±8.42). Insect damaged grains (26.5±6.12) and weight of frass (5.65±0.20) were recorded on wheat variety Abadgar at the average Temp: and R.humidity 35°C, and 63% respectively during the June-2018. There, Min: weight loss (1.12±0.03), Insect damaged grains (4.93±2.67) and weight of frass (1.85±0.21) were recorded on wheat variety Moomal at the average Temp: and R. humidity 20°C, 52% respectively during the January-2018. In contrast to these parameters, Max: Insect undamaged grains (40.4±5.15) was recorded on wheat variety Abadgar during the January-2018. Whereas, Min: was recorded (26.2±6.04) on wheat variety Moomal during the June-2018. Throughout the whole determination it's noticed that lesser grain borer more time feeding inside the wheat kernel that is why its quickly reducing the weight and makes them hollow husks. This is the first time study lesser grain borer and wheat varieties from the Wheat Research Institute, Sakrand, Sindh, Pakistan.

KEYWORDS: *Rhyzopertha dominica*, survey, wheat varieties, Sakrand Sindh.

INTRODUCTION

Lesser grain borer (*R. dominica* F.), is a serious primary pest of whole grain and found in mostly everywhere in the tropical region of the world. They having power full wings with strong flying ability hence it can easily migrate from one place to another of stored grain then create new infestation (Stejskal *et al.*, 2003; Khan and Marwat., 2004). This destructive species is an internal as well as external feeder of whole grain, cereal and various stored raw grains and also good adapted to dry condition (Emekci *et al.*, 2002). Lesser grain borer feeds on maize, barley and breed in wheat, rice corn and other grain substrate including starch molecule (Subramanyam *et al.*, 2007). This insect is extremely harmful because both larva and as an adult feeds exclusively on grain and the developing larva feeds inside the grain, in which mostly damages germ and endosperm part that leading to weight loss of grain. Mostly in different shops and Godowns (warehouses), was stored wheat which also destroyed by *R. dominica* pest and due to this activity its considered primary pest of wheat grain during the storage (Mark *et al.*, 2010). Throughout the storage of stored products up to 5-15% losses can cause due to stored grain pests (Padin *et al.*, 2002). However Mohammad in (2000) obtained average weight loss up to 10.4% during the storage of wheat grain. During the 2016 survey of 150 farm stores in Ethiopia found that about 15% loss observed due to the storage of insects in grains (Kalsa *et al.*, 2018). For the grain storage many researchers recommended various techniques like as use of hermetic begs, metal soils, botanical and inert dust in the replacement of chemical pesticides (Demissie *et al.*, 2008a, 2011; Gitonga *et al.*, 2013; Martin *et al.*, 2015). According to the collectively effect of lesser grain borer, secondary pests and fungi, germination rates of seed grain reduces and also can vigour causes of grains (Bashir, 2002). Lesser grain borer when allowed to

develop in wheat grains from egg to pupal stage, it was noticed that 17% weight loss occurred per kernel Campbell and Sinha (1976). Presence of both live and alive stored grain insect in wheat kernels overall lowers the quality of wheat (Maghirang *et al.*,2003). During the inspection it was noticed that when two or more live insects found in cereal rice and wheat it can be considered as infested grain USDA-GIPSA.,2006). According to the one report it was detected 2.75 kg of 90% wheat grain samples were infested with stored grain insects in rail cars and also no adults were seen in the samples (Perez-Mendoza, Flinn, Campbell, Hagstrum, and Throne, 2004). The main objectives of this study were detection survey of different localities of Sakrand town, District Shaheed Benazirabad, Sindh, Pakistan. To determine the damage and infestation caused by lesser grain borer on different wheat varieties.

2. MATERIALS AND METHODS

Material of Insect (lesser grain borer) and wheat varieties were brought into Advanced Entomology laboratory, Department of Zoology, University of Sindh, Jamshoro to noticed the visual damage and infestation on collected different wheat varieties.

Steps of study

First step: The detection survey

The different localities of Sakrand town, District Shaheed Benazirabad, Sindh, Pakistan. During the first step of this study, different localities of Sakrand were visited like shops Zahid khanzada pedhi, Jholy lal pedhi and Jamali kiryana shop Different Granaries such as Mehran colony, Majid keerio and Sakrand wheat Godowns, adjacent villages like Hamal faqeer Meer khan laghari and Shah Muhammad Jamali and also wheat research, institute, Sindh, Sakrand. During the detection survey mostly lesser grain borer and also other stored grain pest were detected. Culture of lesser grain borer were captured through hand picking method and put into the jars for experimental use.

Second step: Experimental procedure of insect Rearing on wheat varieties

Fresh Samples of three wheat varieties without any infestation, Abadgar-93, TD-1 and Moomal-2002 were obtained from wheat Research Institute, Sindh, Sakrand. 100 grams grain of each wheat and ten randomly adult specimen of lesser grain borer were put in 400 grams capacity plastic jars with triplicate replication. Muslin cloths and rubber bands were used to cover plastic jars and placed in laboratory conditioning temperature and Relative humidity as shown in (Fig 1). Four different parameter, weight loss, Insect damaged grain, Insect undamaged grain and weight of frass were recorded at monthly wise intervals.

Fig. 1: Showing the experimental culture of beetle in plastic jars.

Third step: Using different equation for collecting the result

During the whole six monthly work of each month, Jars were taken out for the analysis of wheat varieties which were infested by lesser grain borer shown in Fig 2.

Fig. 2: Showing the effect of beetle on wheat grain.

At the time of collecting result, from each jar infested grains were subjected to sieving and separate the unwanted grain dirt, broken grains and other excretory material. For the % analysis of weight loss, Insect damaged grain, Insect undamaged (Healthy) grain and weight of frass, 30 grams of grain was drawn from the cleaned wheat. Number and weight of damaged and undamaged grains were recorded and put in the weight loss equation for the determination. During the infestation of lesser grain borer, weight loss, flour dirt, both dead as well as alive larvae, adult and other excretion produced which were measured and collectively called Frass which was the respective sample of each wheat variety. From the drawn 30 grams of each replication of the respective wheat variety, percentage of Insect damaged, Insect undamaged (Healthy) grain were calculated through classifying and counting of grains after removing the frass. For this purpose following equations were used. All the data were subjected to analysis of variance (ANOVA) using Statistix ® version 8.1. the means were compared by Fisher's protected Least Significant Difference Test at 5%.

$$\text{Weight loss (\%)} = \frac{(W\mu \times Nd) - (Wd \times N\mu)}{W\mu \times (Nd + N\mu)} \times 100$$

$W\mu$ = Weight of undamaged grains
$N\mu$ = Number of undamaged grains
W_d = Weight of damaged grains
N_d = Number of damaged grains

$$\text{Insect damaged grains (\%)} = \frac{\text{No. of insect damaged grains}}{\text{Total number of grains in the sample}} \times 100$$

$$\text{Healthy grains (\%)} = \frac{\text{No. of healthy grains}}{\text{Total number of grains in the sample}} \times 100$$

RESULTS AND DISCUSSION

According to (LSD) test, values with the same letters in the tables are not significantly different due to ($P > 0.05$). The Result presented in the Table. 1 indicates that highest weight loss (%), Insect damaged (%) and weight of frass (gm) in the wheat variety Abadgar caused by artificial infestation of lesser grain borer were (14.3±8.42), (26.5±6.12) and (5.65±0.20) in the month of June-2018 at average 35°C and 63% R.humidity. Whereas, the lowest was recorded (2.16±0.60), (17.2±3.24) and (3.64±0.14) in the month of January-2018 at average temperature 20°C and 52% R. humidity. Then the Insect undamaged grain was noticed highest (40.4±5.15) in the month of January-2018 and (28.4±1.12) was recorded minimum in the month of June-2018.(Fig. 3)

Table 1: Showing monthly wise Effect of *Rhyzopertha dominica* on wheat variety Abadgar.

Month and Year	Weight loss (%)	Insect damaged grains (%)	Insect undamaged grains (%)	Weight of frass (gm)	Average: Temp./month	Average R.H./month
January,2018	2.16±0.60 c	17.2±3.24 b	40.4±5.15 a	3.64±0.14d	20°C	52%
February,2018	3.20±0.62 bc	21.5±3.83 ab	38±4.59 ab	3.84±0.31d	23°C	53%
March,2018	7.85±3.79 abc	22.2±4.38 ab	36.6±3.82 ab	4.25±0.16c	29°C	45%
April,2018	10.2±6.13 abc	24±4.98 ab	33.5±3.55 bc	4.65±0.13b	33°C	50%
May,2018	12.5±7.97 ab	26.1±5.54 b	29.1±3.10 c	5.61±0.19a	34°C	55%
June,2018	14.3±8.42 a	26.5±6.12 b	28.4±1.12 c	5.65±0.20a	35°C	63%

There are three homogenous group (A, B and C) in which means are not significantly One another.

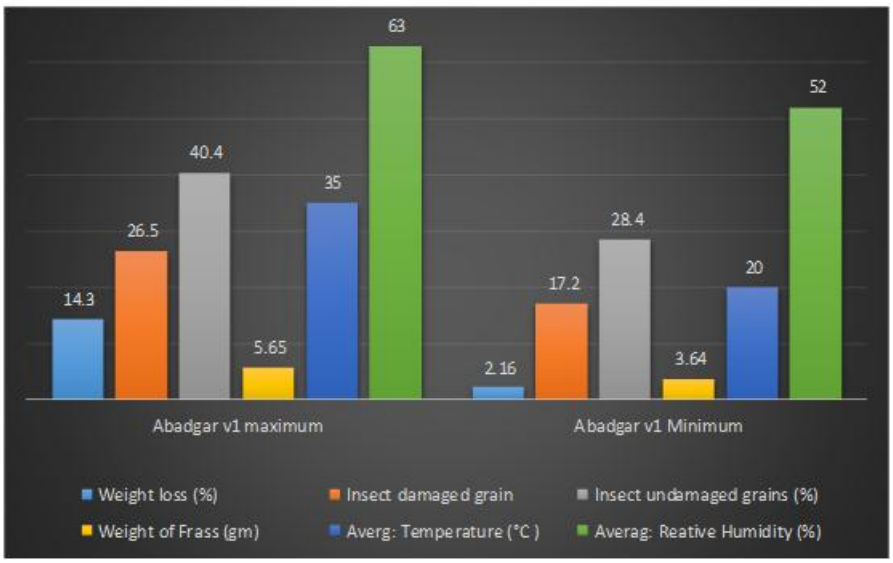

Fig. 3: Showing the monthly wise Infestation rate of *Rhizopertha dominica* on wheat variety Abadgar.

According to (LSD) test, values with the same letters in the tables are not significantly different due to (P > 0.05). From Table 2 clearly evident that in the month of June-2018 at average 35°C and 63% R. humidity, maximum insect damaged grain (%) and weight loss(%) were (21.4±6.12) and (13.2±5.54) recorded whereas the minimum in the month of January-2018 at Average temperature 20°C and 52% R. Humidity were (9.60±3.25) and (1.65±0.54) respectively, But the Maximum weight of frass (gm) was (4.75±0.13) in the month of May-2018 at Average 34°C and 55% R. humidity, then the instead of Insect damaged grain and weight loss (%), maximum insect undamaged was recorded (39.3±1.18) in the month of January-2018 and the minimum was (27.6±2.27) recorded in the month of June-2018.(Fig. 4)

Table 2: Showing monthly wise Effect of *Rhyzopertha dominica* on wheat variety TD-1.

Month and Year	Weight loss (%)	Insect damaged grains (%)	Insect undamaged grains (%)	Weight of frass (gm)	Average: Temp./month	Average R.H./month
January,2018	1.65±0.54 c	9.60±3.25 b	39.3±1.18 a	2.78±0.59 d	20°C	52%
February,2018	2.66±0.54 c	12.1±3.82 b	37.6±2.12 ab	3.66±0.36 cd	23°C	53%
March,2018	6.19±1.54 bc	14.8±4.38 ab	35.2±1.75 bc	3.94±0.26 bc	29°C	45%
April,2018	9.33±3.27 ab	16.3±4.99 ab	32.3±1.98 c	3.68±0.15 cd	33°C	50%
May,2018	11.7±4.98 ab	17.6±5.55 ab	28.5±2.64 d	4.75±0.13 ab	34°C	55%
June,2018	13.2±5.54 a	21.4±6.12 a	27.6±2.27 d	4.47±1.0 a	35°C	63%

There are four homogenous group (A, B, C and D) in which means are not significantly from one another

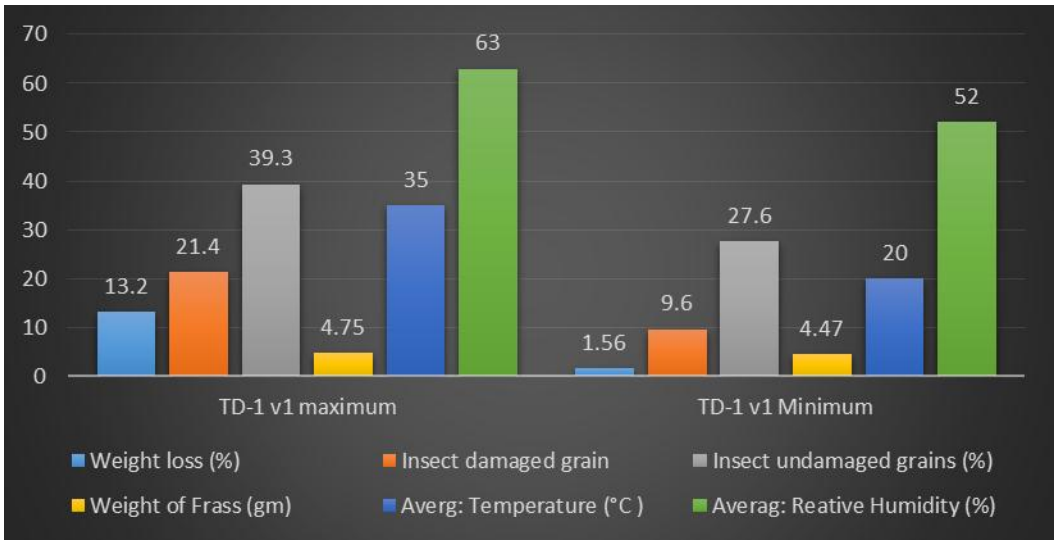

Fig. 4: Showing the monthly wise Infestation rate of *Rhizopertha dominica* on wheat variety TD-1.

According to (LSD) test, values with the same letters in the tables are not significantly different due to (P > 0.05). The result presented in Table 3 express that percent insect undamaged grain caused by lesser grain borer on wheat variety Moomal, maximum obtained (38.1.2±1.98) and minimum (26.2±6.04) with similar abiotic (Temp and r.h) pattern, which were recorded in TD-1 wheat variety whereas the greater weight loss (%), insect damaged grain(%) and weight of frass(gm) were recorded (12.1±7.03), (12.4±5.54) and (2.48±0.56) in the month of June-2018, but the lesser (1.12±0.03), (4.93±2.67) and (1.85±0.21) were recorded in the month of January-2018.(Fig. 5)

Table 3: Showing monthly wise Effect of *Rhyzopertha dominica* on wheat variety Moomal.

Month and Year	Weight loss (%)	Insect damaged grains (%)	Insect undamaged grains (%)	Weight of frass (gm)	Average: Temp./month	Average R.H./month
January,2018	1.12±0.03 b	4.93±2.67 b	38.8±1.98 a	1.85±0.21 b	20°C	52%
February,2018	2.02±0.54 b	7.51±3.26 ab	36.6±4.31 a	1.94±0.13 ab	23°C	53%
March,2018	5.10±2.01 ab	8.91±3.81 ab	34.6±5.00 ab	1.90±0.45 ab	29°C	45%
April,2018	8.25±4.67 ab	10.8±4.41 ab	31.7±4.47 ab	2.17±0.66 ab	33°C	50%
May,2018	10.1±6.59 a	11.1±4.97 a	27.4±5.73 b	2.47±0.54 a	34°C	55%
June,2018	12.1±7.03 a	12.4±5.54 ab	26.2±6.04 b	2.48±0.56 a	35°C	63%

There are two homogenous group (A and B) in which means are not significantly from one another.

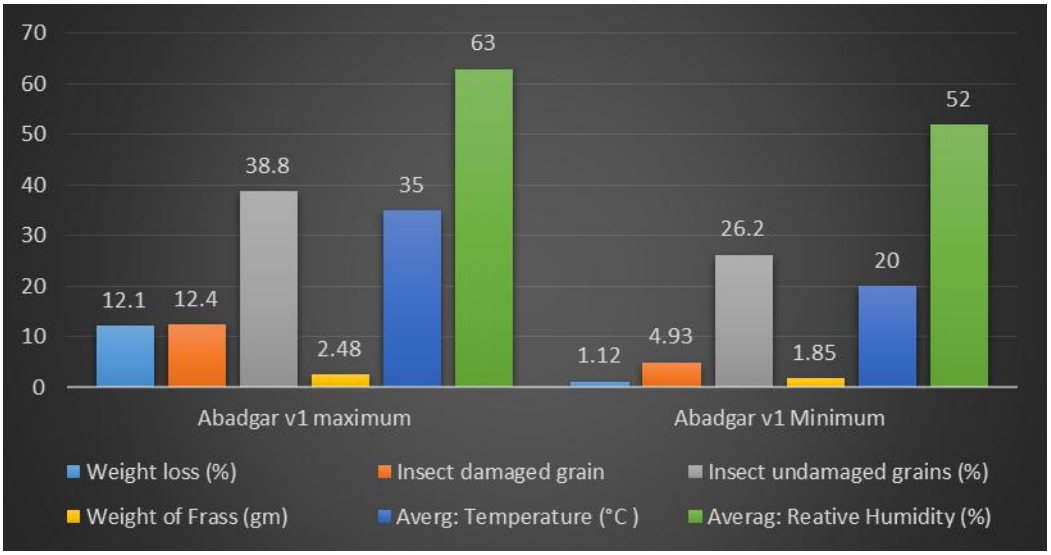

Fig. 5: Showing the monthly wise Infestation rate of *Rhizopertha dominica* on wheat variety Moomal.

It was mostly observed that softness of germplasm and high carbohydrate content in grain considered to be the most suspectibility wheat variety (Bains *et al.*, 1971). During the long time storage of wheat grain in different places (granaries, shops, houses) 3.6 to 22.5% loss recorded (Irshad and Baloch, 1985). Grains of different wheat varieties having different physico-chemical properties and with respect to Insect progeny, Damage and losses have be considered most important parameters for varied resistance against storage insect pests (Khattak, *et al.*, 2000).

In the year 2006, T.S Sayed and his followers have been worked on twelve different wheat varieties by the rearing of *T. granarium* and *R. dominica*, in which they obtained maximum weight loss (2.78%) caused by *T. granarium* in the wheat variety TJ-0787 and in compare to (12.42%) maximum weight loss recorded in Sarsabz wheat variety by the infestation of *R. dominica*, while minimum weight loss of both species were recorded (12.42%) and (0.43%) on the similar variety Mehran-89, with respect to grain damage(%) they were recorded (30.60%) and (45.75%) on the wheat varieties TJ-0787 and Sonalika by the cause of *T. granarium* and *R. dominica*, Although Minimum were noted on similar wheat variety Mehran-89, was (4.33%) and 17.91%) by the infestation of both species. (Sayed *et al.*, 2006).

CONCLUSION

When studied different sites in the town of Sakrand, it was observed that the third most detected pest species was *R.dominica* compared to *Tribolium castaneum* and *Trogoderma granarium*, Further it was noticed during the survey most of shops, Godowns and other storing cereal places were infested by the attack of these notorious pests. Throughout the experimental finding, it was remarked that maximum weight loss, Insect damaged grain and weight of frass were seen in wheat variety Abadgar (Susceptible) and minimum on Moomal variety (Resistant). In the addition, more quantity of flour dust were obtained in the experimental jars of wheat variety Abadgar, respectively.

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AUTHORS' CONTRIBUTION

First Author: Shamsher ali unar Contribution: This is main author, who select this topic under the guidance of Supervisor Naheed Baloch because no proper work has been not done this area so I main author select this topic. Every year with the poor maintenance or storage of wheat grain of former, lot of wheat infested with Rhyzopertha *dominica* pest so this article will be helpful to the area of Sakrand people to properly or carefully maintain the storage places to reduce the losses of this pest. **Second Author:** Naheed baloch Contribution: She is Supervisor of main Author, in the M.Phil Research Work 2018, after completion of this Article, this worked reviewed and suggestion given by this Professor. **Third Author:** Ali Murad Rahoo Contribution: All the collection of wheat varieties without this person it was impossible because main author brought the fresh different wheat genotypes from his wheat Research Institute Sakrand. Also he is the Senior Scientist of wheat as well as Entomology. **Fourth Author:** Tooba Khan contribution: she is a pharmacist by educational profession which helped to remove grammatical mistakes as well as awareness about insect infection. **Fifth Author:** Abro zain-ul-aabdin Contribution: This author remain helpful to solve the all the data analysis statistically. **Sixth Author:** Jaweria shaikh Contribution: This Author remain helpful to remove the minor mistakes in English translation also in write the authors citation in well manner.

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