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Physical destruction of *Triticum aestivum* By *Trogoderma granarium* (Khapra Beetle) In Sakrand district Shaheed Benazirabad, Sindh, Pakistan

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Abstract

During the present study effect of *Trogoderma granarium* (khapra beetle) were seen on three wheat varieties namely Abadgar, TD-1 and Moomal during the month of January 2018 to June-2018. Material was collected from the different localities (Sakrand) whereas the fresh samples of wheat varieties were collected from the wheat research institute, Sakrand town. During the research only four parameters were seen namely weight loss, insect damaged grain, insect undamaged grain of percentage and weight of frass, it was noticed that max: weight loss (16.9 ± 8.66), Insect damaged grain (34.02 ± 7.28) and weight of frass (6.83 ± 1.02) were recorded on wheat variety Abadgar during the month of June-2018. Their Min: weight loss (2.16 ± 0.60), Insect damaged grain (17.2 ± 3.24) and weight of frass (1.71 ± 0.40) were recorded on wheat variety Moomal during the month of January-2018, In contrast to these parameters, Max: Insect undamaged grain (38.29 ± 6.41) was recorded on wheat variety Abadgar during the month of January-2018. Whereas, Min: was recorded (24.7 ± 2.05) on wheat variety Moomal during the month of June-2018. During the investigation large amount of weighable losses and physical destruction in three wheat varieties were seen. This is the first time study of khapra beetle and wheat varieties from the Wheat research institute, Sakrand, Sindh, Pakistan.

Keywords: *Trogoderma granarium*, wheat, Sakrand and Sindh

1. Introduction

Khapra beetle and besides family of Dermestidae of other pest are considered the world's most serious damaging stored product pest [1, 2]. Mostly many grain insect pests are good flier and move to stored grains masses from field to infest bins with different rate of season and grain temperature [3]. Majority of shopkeeper's store the food material and cereal grains for a long time, due to this storage activity many insect pests and rodents which enter into cereal grain and make it damp by adding the faeces, dust and fraas then it's nutritional and economical value of grain in market losses and do another indirect damage, increasing the temperature of stored grain and make it further liable for the attack of any other forms of pest, moulds, mites and micro-organism [4-7]. Hence on the wheat grain (10 to 20%) damage has been estimated by the cause of different insect pest [8]. Stored cereal grain has been damage not only the insect pest infestation but also the deterioration of micro-organism [3]. Wheat (*Triticum aestivum*) is a crush crop and an important staple food for our Pakistani people. It positions first among cereal crops and covers about 65% of the area devoted to food crops in the country [9]. *T. granarium* not only the feed on whole and ground cereal but also ground rice, barley, pasta, dried fruits, blood, insects and other stored products. The larvae begin to feed from the embryo point and then consume the whole seed/kernel, causing the grain to empty and leaving only the shell. In case of serious infestation, the infested grain is filled with excrement, skins and faeces that seriously deteriorate the quality of the grains [10]. of the storage pests, *T. granarium* larvae, although their adults are harmless [11]. Larvae of A2 quarantine (khapra beetle) consumed 3-12 average mg of food during their development and females eat nearby twice as more as males [12-13]. Under the hot and dry climate, it was observed that Dermestidae family of species *Trogoderma granarium* is a very destructive pest [14]. Due to the abiotic factor (Temperature, moisture, light, season and host species development and survival rates vary considerably [15]. Due to its quick destructive activity it's treated as A2 quarantine organism for EPPO [16].

Khapra beetle plague received status of 100 most invasive species in the world. It's considered as a native of India, from which it disperses to other continent of countries in Asia, Europe, North America and Africa [17]. It was first time detected the destructive *Trogoderma granarium* species in the Indonesia coming through import products from some ports in Sumatera, South Sulawesi, special District Capital of Jakarta, central Java, East Java, East Nusa, Tenggara (NTB) [18]. In Pakistan conducted the first schematic loss survey, which reported a total damage of 15.3% in several after harvest wheat actions in the country [19]. Researcher also reported between 10% and 15% post-harvest losses of wheat grain in Pakistan, mainly due to pest attack [20]. In stored wheat grain due to infestation effect of khapra beetle 6.01 to 22.8% quantitative loss of weight were recorded [21]. Due to the harsh infestations of wheat grain by *T. granarium* can make it unpleasant or unsalable. The committee of World Trade Organization on Sanitary and Phytosanitary (SPS) have banned the import of wheat, flour and meals transported from various countries harbouring, to prevent the introduction and dispersion in this regard well-known khapra beetle pest and also in order to protect domestic production [22].

2. Materials and Methods

The current Experimental study was held at Advanced Entomology laboratory, Department of Zoology, University of Sindh, Jamshoro to observe the physical damage and infestation of khapra beetle on three different wheat varieties monthly wise from January to June-2018. Three wheat varieties namely Abadgar-93, TD-1 and Moomal-2002 were collected from wheat Research Institute Sakrand, Sindh. Before starting the experimental work, wheat varieties were cleaned with sieve set to remove the dust particles, kernel pieces and broken wheat which were adding threshing time. Collection of Insects (*Trogoderma granarium*): Mixed age culture of khapra beetles was collected from different shops, wheat granaries and of the Wheat Research Institute, Sakrand, Sindh. For the Experimental purpose larvae of *T. granarium* was used.

2.1 Experimental Procedure

Healthy Wheat grains without any Infestation or Broken Weighing 100grams from each wheat variety and Ten Non uniform larvae of *T. granarium* were put in 400 grams capacity plastic Jars as triplicate. The jars were covered with muslin cloths with the help of rubber bands and placed in the Laboratory at natural room temperature and R. Humidity for conditioning. During the present work four different parameters Weight loss, Insect damaged grain, Insect undamaged grain and weight of frass were seen repeatedly monthly wise.

(1) Weight loss: After 30 days of each monthly wise time period, infested grains from each jar were cleaned with the help of sieve to separate grain dirt, sloughed insect skin and other excretory waste which were added by khapra beetle

infestation. To determine the % of weight loss, weighing 30 grams which were taken from cleaned wheat. For this work number and weight of damaged and undamaged (Healthy) grains were recorded drawn from 30grams cleaned wheat and put in the following equation [23].

$$\text{Percent weight loss} = \frac{(W_{\mu} \times N_d) - (W_d \times N_{\mu})}{W_{\mu} \times (N_d + N_{\mu})} \times 100$$

W_{μ} = weight of undamaged grains

N_{μ} = number of undamaged grains

W_d = weight of damaged grains

N_d = number of damaged grains

(2) Weight of Frass: During the infestation of khapra beetle, weight loss, exuviae weight, flour dirt, alive along with dead larvae and adult of this specie were measured and collectively called weight of Frass of each sample of the variety.

(3) Percentage of Insect damaged and Healthy (undamaged) grain count: After the frass removing, 30 grams was drawn from each replication of cleaned grain of wheat variety. From this weight age, Number of Insect damaged and undamaged grain were classified and counted to find the percentage of Insect damaged and Healthy (Undamaged) grain by using the following equations.

$$\text{Percent Insect damaged grains} = \frac{\text{No. Of insect damaged grain}}{\text{Total number of grains in the sample}} \times 100$$

$$\text{Percent healthy grains} = \frac{\text{No. Of healthy grains}}{\text{Total number of grains in the sample}} \times 100$$

Statistical Analysis

All the analysis were done with the help of Statistix © version 8.1, in which data were tabulated with the use of Analysis of variance (ANOVA) and Fishers Least Significant Difference (LSD) test.

3. Results and Discussion

It's evident from (Table-1) that maximum weight loss (%) in wheat variety Abadgar was recorded (16.9±8.66) in the month of June-2018 at average 35 °C and 63% Relative Humidity but the minimum (5.50±1.56) was recorded in the month of February-2018 at average 23 °C and 53% Relative Humidity. Similarly maximum insect damaged (%) and weight of frass (gm) were recorded in wheat variety Abadgar (34±7.28) and 6.83±1.02) in the month of June-2018 whereas minimum were (22.79±4.38) and (3.05±0.62) in the month January at average 20 °C and 52% Relative Humidity, then the insect undamaged grain was seen Maximum (38.29 ±6.41) in the month of June-2018.

Table 1: showing monthly wise Effect of *Trogoderma granarium* 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	5.77±3.09 bc	22.79±4.38 b	38.29±6.41 a	3.05±0.62 e	20 °C	52%
February, 2018	5.50±1.56 b	26.48±4.96 ab	36.83±7.18 ab	3.77±0.32 de	23 °C	53%
March, 2018	9.74±3.63 ab	29.01±5.54 ab	34.15±6.40 ab	4.54±0.20 cd	29 °C	45%
April, 2018	12.23±4.76 ab	30.80±6.12 ab	31.11±6.62 ab	5.25±0.51 bc	33 °C	50%
May, 2018	14.27±7.69 ab	32.02±6.71 ab	27.36±3.55 b	6.24±0.58 ab	34 °C	55%
June, 2018	16.9±8.66 a	34.02±7.28 a	26.73±3.75 b	6.83±1.02 a	35 °C	63%

It's evident from presented result in the (Table-2) that greater weight loss (%), weight of frass (gm) and insect damaged grain (%) were (15±7.27), (6.72±0.78) and (31.81±6.09) obtained at average 35 °C and 63% Relative Humidity in the month of June-2018 but the lesser percentage were obtained (4.71±2.01), (2.96±0.74) and (21.27±3.82) in the month of

January at average 20 °C and 52% Relative Humidity whereas the (37.54±4.39) was greater obtained Insect undamaged grain in the month of January and lesser percentage was (25.35±2.03) obtained at 63% r.h and 35 °C Temperature in the month of June-2018.

Table 2: showing monthly wise Effect of *Trogoderma granarium* 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	4.71±2.01 b	21.27±3.82 b	37.54±4.39 a	2.96±0.74 d	20 °C	52%
February,2018	4.77±1.56 c	25.53±4.39 ab	35.58±5.55 a	3.35±0.65 d	23 °C	53%
March,2018	8.76±3.08a bc	27.99±4.96 ab	33.91±7.55 ab	4.36±0.16 c	29 °C	45%
April,2018	11.5±4.78 abc	29.20±5.56 ab	30.13±5.55 ab	5.20±0.34 bc	33 °C	50%
May,2018	13.2±5.82 ab	30.85±6.13 a	26.45±3.23 b	6.17±0.42 ab	34 °C	55%
June,2018	15±7.27 a	31.81±6.69 a	25.35±2.03 b	6.72±0.78 a	35 °C	63%

The result shown in (Table-3) denoted that greater weight of frass(gm), Insect damaged grain(%) weight loss (%) were noticed (2.68±0.28), (26.5±6.12) and (14.3±8.42) at 63% R. humidity and 35 °C Temperature in the month of June-2018, while the lesser (1.71±0.40), (17.2±3.24) and (2.16±0.60)

were recorded at average 20 °C and 52% Relative Humidity, although greater (36.1±5.48) was insect undamaged grain(%) noticed in the month of January-2018 and lesser (24.7±2.05) was recorded in the month of June-2018 at average 35 °C and 63% R. humidity in the month of June-2018.

Table 3: showing monthly wise Effect of *Trogoderma granarium* 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	2.16±0.60 c	17.2±3.24 b	36.1±5.48 a	1.71±0.40 c	20 °C	52%
February,2018	3.20±0.62 bc	21.5±3.83 ab	34.7±6.63 a	1.95±0.41 bc	23 °C	53%
March,2018	7.85±3.79 abc	22.2±4.38 ab	32±5.48 ab	2.21±0.61 abc	29 °C	45%
April,2018	10.2±6.13 abc	24±4.98 ab	29.7±6.37 ab	2.27±0.25 abc	33 °C	50%
May,2018	12.5±7.97 bc	26.1±5.54 a	25.2±2.97 b	2.49±0.36 ab	34 °C	55%
June,2018	14.3±8.42 c	26.5±6.12 a	24.7±2.05 b	2.68±0.28 a	35 °C	63%

It had been investigated in stored wheat 6.01 to 22.8% weight loss due to infestation of *T. granarium* [23]. And also noticed that larvae of khapra beetle when reared on crushed wheat or whole wheat flour at 30 °C, about 89.91% completed larval to adult developmental stage and larval survival significantly varied depending upon type of food (Ismail *et al.*, 1988/89). During the infestation on twelve rainfed wheat lines, it was noticed positive and highly significant ($P<0.01$) [9]. Larvae of the khapra beetle mostly feed on grains of both germ as well as endosperm part and in case of this specie mostly whole grain was consumed and husk part partially eaten which was the only remains of the grain. Further was investigated that with the increase of khapra beetle infestation level, weight loss, progeny development, number of broken grain, insect damaged grain and weight of frass was significantly increased and It was proved that most susceptible wheat variety BWP-97 with 20.25% weight loss and Insect damaged grain (43.37%) statistically which seem like to Manthar with (42.87%) loss while Wafaq-2001 behaved most resistant wheat variety with lowest (6.22%) weight loss and (19.9%) Insect damaged grains were recorded and massive quantity of exuviae, flour dirt, dead as well as alive larvae and adults that was the sign of infestation severity caused by the Khapra beetle effect on wheat varieties [10]. In India, the average damage situation varied from 6 to 33% of the cereal grain in a

Storage single season while with extreme 73% recorded [24]. Furthermore scientists were worked on post-harvest loss of wheat in Pakistan; they were recorded 22.7% out of which 9% observed storage time and 13.2% remaining due to harvesting and threshing time [25]. Throughout the whole country wide basis, 3.5 to 25% storage losses of wheat were recorded [26].

4. Conclusion

During present study it's concluded that greatest infestation of *T. granarium* were observed on wheat variety namely Abadgar which proved to be the Susceptible while wheat variety namely Moomal have been least effected then considered as most resistant wheat variety. Frequently Insect undamaged grains have been maximally seen in a resistant variety after a monthly maintained experiment while minimum in susceptible variety and the presence of more impurities exuviae, flour dust and other inclusion in each experimental variety indicate the deterioration of grain. This research will present base data and perception among local working class peoples as well as farmers about the *Trogoderma granarium* (khapra beetle), which will be helpful to begin and estimate the prospect management implement for guava this research in the sakrand town, district Shaheed benazirabad. This project will also good class result in the scientific literature of Pakistan.

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