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Evaluate the susceptibility of some store rice varieties to the infestation of red flour beetle *Tribolium castaneum*

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Abstract
Study susceptibility of four rice varieties IRRI-06, IRRI-09, Kernel Basmati and Super Basmati by the infestation of red flour beetle and egg fecundity of red flour beetle carried out in laboratory from March 2016 to December 2016 at 15-35±1°C temperature and relative humidly 20-65±5%. Maximum fecundity of eggs 70.45% and weight loss 71.00gm were recorded on IRRI-6 variety. The minimum fecundity 28.84% and weight loss 34gm were observed on IRRI-09 Varity. Highest weight loss and egg fecundity was observed in the month of October while lowest during December and June. IRRI-6 variety was found susceptible while IRRI-09 found resistant. The other two varieties Super basmati and kernel basmati found less susceptible. Temperature below 25°C and humidity below 40% were negatively correlated while temperature between 30-35°C and Humidity 50-65% positively correlated with fecundity and weight loss.

Keywords: *Tribolium castaneum*, store grain pest, rice varieties, fecundity, susceptibility

Introduction
Cereals are important source of food for human population, more than 50% of calories consumed by human, obtain from cereals [1]. Rice is major cultivated crop of Pakistan, India, Srilanka, China, Korea etc. and consumed throughout the world particularly in Bangladesh, Filipinas, Thailand Indonesia etc. In Pakistan paddy crop cultivated on 2.5 million hectors with total production about 6.5 million hectors [2]. Rice grain not only consumed directly but used in many food products [3]. Rice grain facing many a-biotic and biotic problem during pre harvesting and post harvesting. In field fungal and bacterial disease badly effect the rice grain but during storage condition many insect pest caused severe infestation include red flour beetle, rice weevil, kapra bettle, grain moth etc. but maximum infestation noticed by red flour beetle *Tribolium castaneum* [4-6].

Both larvae and adult of red flour beetle caused damage but larvae is more destructive than adult. This infestations lead 10-30% [7]. According to [8] post harvesting losses of store grain rice reached 5-10% through out in world and in tropical environment it reached up to 50% due to humid condition, improper packing and storage. Previous scientist, who worked on store grain pest, reported red flour beetle is the major pest of store comedies in tropical and sub-tropical parts [9-11].

Red flour beetle not only effect directly to the cereals but it also damage its by-products dried fruits, pulses, pasta, cornflake, beans, biscuit, nuts etc [12]. The odor of red flour beetle makes rice grain disagreeable and unfit for human consumption. The high developmental prospective of this insect pest is challengeable for store varieties of rice [13]. Pakistan and other South Asian countries where rice crop is cultivated at large scale are facing problem of store grain pest as compared to advanced countries. Infestation of red flour beetle badly effect the foreign exchange because of bad storing conditions and packing. The main object of present study to estimate susceptibility of four commercial rice genotypes against red flour beetle *Tribolium castaneum*.

Materials and Methods
Rice varieties
Four commercial rice genotypes were selected (Kernel basmati, Super basmati, IRRI-6 and

IRRI-9). These varieties are very common in Pakistan and cultivated throughout in country mostly in Sindh and Punjab. The main reasons to select these varieties for present study are

1. Seemed resistant varieties against sore grain pest
2. Cultivated at large scale in country
3. High Consumption rate

Rearing culture of (*Tribolium castaneum)*

Rearing culture prepared in laboratory for further treatments. Larvae and adult of *Tribolium castaneum* collected from infested grains of local market and was introduced plastic jar capacity of 1 KG for culture.

Method for weight loss and egg fecundity of red flour beetle

100 gm of each rice variety kept in plastic jars measured 14.5 mm in length and 8.00 mm. twenty larvae of *Tribolium castaneum* were introduced in each jar from reared culture. Each Jar enclosed by muslin cloth. The growth and development of adult and larvae observed daily basis while percentage of weight loss was recorded weekly basis and compared with control sample of each variety. For egg hatching percentage, the eggs were collected from each jar on daily basis by the help camel hair burs and kept it separate patri-dishes for observing fecundity percentage.

Laboratory environment

The all experiments were completed in laboratory from March 2016 to December 2016 on room temperature range between 15-35±1°C and RH 20-65±5%. Data of Temperature and humidity collected daily basis by the help of Fahrenheit thermometer and hygrometer.

Data analysis

Data analyzed by using computer programs statistics 8.1 and Microsoft office. T Test and ANOVA are applied for analysis.

Results and Discussion

Feeding preference and egg fecundity of red flour beetle (*Tribolium castaneum*) observed on four rice varieties IRRI-06, IRRI-09, Kernel basmati and Super basmati. Both wait lass and egg fecundity observed significantly varied ($P<0.05$). Maximum beetles attracted to IRRI-6 followed by Kernel Basmati, Super basmati, while on IRRI-09 Varity very low attractiveness observed. Significantly high weight loss recorded on IRRI-6 71(gm) followed by Kernel basmati 51(gm), Super basmati 44.46(gm) and only 35(gm) on IRRI-09. (Table 1-4). Quite similar result reported by previous researchers, [14] Maximum number of Larvae observed on Basmati followed by DM-25, NIAB and IRR-9 and Maximum weight loss recorded on IRRI-6. [15] Reported high weight loss and larval development on Basmati 70 then super basmati.

Month wise weight loss observed significantly different, mmaximum weight loss was recorded in October 11.99(gm) on IRR-6, 9.98(gm) on Kernel Basmati, 7.77(gm) on Super basmati and 6.46(gm) on IRR-9. Minimum weight loss observed in the month of December, that was 3.00(gm) on IRRI-6, 1.88(gram) on Super basmati, 1.88(gm) on Kernel basmati only 0.50(gm) weight reduction observed on IRR-9 verity. Variability in month wise weight loss observed because of humidity and temperature. All the experiments were observed on 27-35±1°C from March to October while 15-25±1 °C temperature during November and December. Relative humidity observed 50-65±5% from March to October while 20-40±5% during the month of November and December. Temperature ranged 30-35±1 °C and humidity above 50% observed favorable for growth and feeding of *Tribolium castaneum,* while temperature bellow 25±1 °C and humidity less than 30% was negatively correlated with growth and development. According [16-18], moisture is favorable for *Tribolium castaneum* feeding and development. They reported humidity ranged 60-70±5% and 35 °C Temperatures is ideal for red flour beetle growth and development.

Egg fecundity ratio of *Tribolium castaneum* observed varied on all four varieties, maximum fecundity observed on IRR-6 (310) 70.45%, followed by Kernel basmati (207), 47%, Super basmati (188) 42% and on IRR-9 (127) 28.86% (Table 5-8). Maximum egg hatching ratio reported in October while lowest reported in June and December. The temperature and humidity recorded in October 35±1 °C and 65±5%, while in December 10±1 °C temperature and Humidity 20±5% observed. Almost same finding reported by [19, 20], eggs not incubated below 15 °C and Humidity below 20%, they further reported temperature 35 °C and moisture 70% are ideal for egg hatching of red flour beetle. [21], reported 30 °C is favorable for eggs incubation.

Present study revealed that development of insect resistant and increase of store grain pest burden in rice is alarming for rice manufacturing and also for consumers. Still there is no any proper packing and storing mechanism is available which protect rice maximum from store grain pest. The rice and their by products are packed in plastic and jute bags. It is a serious challenge to manufacture that packed rice should stay insect free until consumed [22].

Table 1: Weight loss by the infestation of *Tribolium castaneum* on irri-6 variety

Month	Weight loss (Grams)	Control (Grams)
March	9.67	0.24
April	9.87	0.35
May	5.34	0.41
June	4.10	0.66
July	5.78	0.72
August	7.66	0.33
September	9.68	0.21
October	11.99	0.11
November	4.00	0.15
December	3.00	0.20
Total	71.00	3.38
Mean	7.00	0.664

$P > 0.05$

Table 2: Weight loss by the infestation of *Tribolium castaneum* on kernel basmat variety

Month	Weight loss (Grams)	Control (Grams
March	7.85	0.50
April	5.91	0.20
May	3.33	0.40
June	1.77	0.70
July	4.91	0.50
August	5.71	0.30
September	7.15	0.40
October	9.98	0.33
November	3.00	0.22
December	1.5	0.10
Total	51	4.1
Mean	5.10	0.41

$P > 0.05$

Table 3: Weight loss by the infestation of *Tribolium Castaneum* on super basmati variety

Month	Weight loss (Grams)	Control(Grams)
March	4.33	0.20
April	4.12	0.15
May	3.66	0.30
June	2.33	0.40
July	4.22	0.20
August	6.11	0.30
September	6.91	0.40
October	7.77	0.20
November	3.13	0.40
December	1.88	0.30
Total	44.46	2.85
Mean	4.44	0.285

P >0.05

Table 4: Weight loss by the infestation of *Tribolium castaneum* on irri-09 variety

Month	Weight loss (Grams)	Control (Grams)
March	2.75	0.11
April	5.00	0.15
May	3.00	0.20
June	2.00	0.15
July	3.50	0.25
August	4.00	0.15
September	5.71	0.20
October	6.67	0.30
November	2.00	0.20
December	0.50	0.30
Total	35	2.01
Mean	3.5	0.20

P>0,05

Table 5: Eggs fecundity of *Tribolium Castaneum* on irr-6 variety

Month	No. of Eggs	No. of Hatched Eggs	Percentage
March	50	40	80
April	50	41	82
May	50	28	56
June	50	24	48
July	50	29	58
August	50	38	76
September	50	45	91
October	50	46	92
November	20	11	55
December	20	8	40
Total	440	310	70.45

Table 6: Eggs fecundity of *Tribolium Castaneum* on kernel basmati variety

Month	No. of Eggs	No. of Hatched eggs	Percentage
March	50	25	50
April	50	28	56
May	50	20	40
June	50	15	30
July	50	19	38
August	50	28	56
September	50	29	58
October	50	35	70
November	20	5	25
December	20	3	15
Total	440	207	47

Table 7: Eggs fecundity of *Tribolium Castaneum* on super basmati variety

Month	No. of Eggs	No. of Hatched Eggs	Percentage
March	50	22	44
April	50	24	48
May	50	17	34
June	50	13	26
July	50	15	30
August	50	24	48
September	50	27	54
October	50	31	62
November	20	9	45
December	20	6	30
December	440	188	42.7

Table 8: Eggs fecundity of *Tribolium Castaneum* on irri-09 variety

Month	No. of Eggs	No. of Hatched Eggs	Percentage
March	50	17	34
April	50	19	38
May	50	13	26
June	50	11	22
July	50	9	18
August	50	13	26
September	50	15	30
October	50	19	38
November	20	7	35
December	20	4	20
Total	440	127	28.86

Conclusion

Study of fecundity of red flour beetle and susceptibly of four rice verities against *Tribolium castaneum* was observed from March 2016- December 2016 on room temperature ranged 15-35 °C and Relative Humidity 20-65 °C. The Fecundity ratio observed significantly different in all four varieties maximum mean of fecundity observed on IRR-6 and lowest mean were observed on IRR-9. The fecundity percentage of other two verities found very same with little difference. Weight loss was observed significantly different. Maximum weight loss observed on IRRI-6 and minimum observed on IRR-9. On other two varieties the weight loss observed similar with little variation. IRR-6 variety of rice found most susceptible verity of rice against red flour beetle because of high fecundity rate and maximum potential weight loss. The Super Basmati and Kernel Basmati found lest susceptible verities while IRRI-09 found resistant verity against red flour beetle. It was observed that humidity less than 40% and Temperature below 25°C were negatively correlated with fecundity ratio and weight loss.

References

1. Gnanamanickam SS. Overview progress in biological control. Biological Control of Rice Diseases Netherlands. 2009; 8:43-52.
2. Anonymous. Agricultural statistics. Economic survey of Pakistan government of Pakistan, 2016-17.
3. Prasanna BM, Vasal SK, Kassahun B, Singh NN. Quality protein maize. Current Sci. 2001; 10:1308-1319.
4. Hall DW. Handling and storage of food grains in tropical and subtropical areas. FAQ, Rome. 1970, 350.
5. Howe RW. Losses caused by insects and mites in stored food and feeding stuffs. Nature Abstract. 1965; 35:285-293.

6. Shafique M, Chaudry MA. Susceptibility of maize grain to storage insects. Pak. J. Zool. 2007; 39:77-81
7. Ahmed M, Ahmed T, Soomro AM, Baloch AW. New insight into physiochemical cooking eating characteristics in Pakistani rice. In: New Genetical Approaches to crop improvement. Pakistan Atomic energy commission Nuclear institute of Agriculture Tandajam. 1997; 197:213
8. Maqsood, Khattak SU, Khalil SK, Hussain, Hamed M. Combined infestation and losses caused by three storage insects in Pak-81 wheat variety. The Nucleus. 1988; 25:23-26.
9. Dubey NK, Srivastava B, Kumar A. Current status of plant products as botanical pesticides instorage pest management, J. Biopesticide. 2008; 2:182-186.
10. Talukder FA. Plant products as potential stored product insect management agents: a mini review, Emirates J. Agric. Sci. 2006; 18:17-32.
11. Shafique M, Ahmed M. Susceptibility of milled rice genotypes to Angoumois grain moth, *Sitotroga cerealella* (Oliv.) (Lepidoptera: Gelechiidae). SAARC J. Agric. 2003; 1:193-197. Biopesticide, 2:182-186.
12. Karunakaran C, Jayas DS, White NDG. Identification of wheat kernels damaged by the red flour beetle using x-ray image biosys. Engin. 2004; 87(3):267-274.
13. Prakash AJ, Rao IC, Pasalu, Mathur KC. Rice storage and insect pests management. Br Publishing Corporation, New Delhi. 1987, 337.
14. Nadeem S, Hameed M, Shafique M. Feeding preference and developmental period of some storage insect's species in rice products. Pak. J Zool. 2011; 43(1):79-83
15. Khaliq A, Sagheer M, Javed M. Estimation of quality deterioration in different Rice Genotypes infested by *Tribolium castaneum* (Herbst) under a biotic stress. Cercetări Agronomice in Moldova. 2014; 159(3):47-57
16. Khalil AR. Pests of stored products in the Sudan. Department of Crop Protection. Ministry of Agriculture, 1970.
17. Robert EP. Fundamentals of Applied Entomology. Macmillan Publishing Company, USA, 1985.
18. Shazali MEH, Smith RH. The growth of single and mixed laboratory populations of three insect's pests in stored sorghum. Bull. Of Grain Technology. 1990; 28(2):107-112.
19. Howe RW. The effect of temperature and humidity on the oviposition rate of *Tribolium castaneum* (Herbst) (Coleopteran: Tehebrionidae). Bull. ent. res. 1962; 53:301-310.
20. Shazali MEH. The biology and population ecology of four insect pests of stored sorghum with particular reference to competition and succession PHD Thesis, university of reading, UK, 1982.
21. Hassan M, Khan AR. Growth and development of the red flour beetle, *Tribolium Castaneum* Herbst. On red lentil flour, *Lens esculenta*. Bangladesh Journal of zoology. 1988; 16(2):177-180.
22. Mullen MA, Vardeman JM, Bagwell J. Insect Resistant Packaging, in stored product protection. Kansas State University, Manhattan, Kansas. 2012; 11:135-141.