Population Fluctuation and Damage Potential of Red Flour Beetle on Different Dry Fruits under Laboratory Conditions

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Abstract: The study was conducted to determine the population fluctuation of red flour beetle *Tribolium castaneum* on different dry fruits under laboratory conditions from 6th March 2015 to 24th July 2015. Four different dry fruits *viz*; T1 (almonds), T2 (walnuts), T3 (peanuts), T4 (cashew nuts) and T5 (wheat as control) were used in the experiment. The standard weight of 50g of every dry fruit was kept in plastic jars and covered with muslin cloth. Ten pairs of beetles were released in each jar. Observations were recorded at fortnight interval and population of the live beetles was counted. Results of the study showed that the population of red flour beetles gradually increased in all the treatments control with respect to time. The highest overall mean population of *T. castaneum* was recorded in wheat (61.61±10.02) followed by cashew nuts (52.90±8.26), almonds (50.01±7.81) and walnuts (43.56±5.89). The lowest population of red flour beetles (27.41±8.26) was recorded in peanut. The highest weight loss was recorded in wheat (18.8 %), followed by cashew nuts (15.6%), almonds (14%), walnuts (11.2%) and peanuts (8%) respectively.

Keywords: Red flour beetle, *Tribolium castaneum,* dry fruits, wheat, population.

INTRODUCTION

The red flour beetle, *Tribolium castaneum* (Herbst) is a major pest of stored foodstuff and has been found in association with a wide range of commodities including grain, flour, peas, nuts, dried fruits and spices [1-3]. Powdered grain products are its preferred food. *Tribolium castaneum* caused extensive loss in stored products because of its high reproductive potential as it can breed throughout the year in tropical regions [4]. The red flour beetle may be present in large numbers in infested grain. The adults are attracted to light but covered themselves when disturbed. Typically, these beetles can be found not only inside infested grain products, but in cracks and crevices where grain may have spilled. They are attracted to grains with high moisture content and can cause a grey tint to the grain [5].

Dried fruits and nuts are relatively high-value commodities when marketed as snack food or confectionery ingredients. Although, they are often considered as luxury foods, they are rarely served as substantial nutritional staples unlike grain, legume or root crops. They are excellent additions to a well-balance diet. Export sales are of particular importance in the marketing of these products, with 30-80% of the production of almonds, walnuts, pistachios, raisins and prunes being sold for foreign export. In the intense competition that exists for world markets, processors who succeed in maintaining product quality have trading advantage [6]. However, dried fruits are attacked by variable numbers of post-harvest insect pests which are directly damage the product and are capable of causing considerable economic damage. These commodities attacked by a number of common stored product moths and beetles. These insect pests having capability of repeated infestation in period of storage, therefore long term protective measures are adopt with necessary for their control [7]. There is a need of effort to save the stored products against deterioration due to stored grain pests especially *T. castaneum.* Therefore, this laboratory study was conducted to evaluate the population fluctuation of *T. castaneum* in different dry fruits and weight loss due to its infestation.

MATERIALS AND METHODS

The study was conducted between 6th March 2015 to 24th July 2015 at Entomology laboratory, Sindh Agriculture University, Tandojam, Pakistan. Four different dry fruits *viz*; T1 (almonds), T2 (walnuts), T3 (peanuts), T4 (cashew nuts) and T5 (wheat as control) were used in the experiment. The standard weight of 50g of every dry fruit was kept in plastic jars which were covered with muslin cloth and banded with rubber strips. The culture of *T. castaneum was* obtained from Grain Storage Research Laboratory, Karachi University. Ten pairs of beetles of mixed sex were released in each jar. Observations were recorded at fortnight intervals and population of the live beetles was

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counted. The data on weight loss in dry fruits due to *T. castaneum* infestation were also determined. Experiment was conducted in a completely randomized design with five replications. The data obtained were statistically analyzed by (ANOVA) and significance differences were compared using Least Square Difference (LSD) test.

RESULTS & DISCUSSION

Effect of Various Dry Fruits on Population of Red Flour Beetle

Table **1** shows the population of red flour beetle on various dry fruits. The results of the study revealed that population of red flour beetles gradually increased in all treatments and controls with respective time. The analysis of variance demonstrated that there was a significant difference in population dynamics of red flour beetle within treatments (DF=4; F=936.4; P-value=0.0000). On almonds, the initial population of red flour beetles observed on 6th March was 17.00±0.70). Thereafter, the population increased gradually and the maximum population was recorded (89.60±0.81) on 24th July. On almonds, the overall mean population of beetles was recorded at 50.01±7.81. On walnuts, the population of red flour beetles recorded on 6th March was 17.80±0.58, whereas the maximum population (74.80±1.24) was observed on 24th July. The overall mean population of red flour beetles on walnuts was recorded at 43.56±5.89. The result also revealed that the population of *T. castaneum* on peanuts observed on 6th March was 16.40±0.50, whereas maximum mean population was recorded on 24th of July (39.40±2.08). As compared to other dry fruits, peanuts were less attacked as mean population on peanuts was 27.41±2.31**.** Moreover, among all the dry fruits studied, the maximum population of beetles was recorded on cashew nuts. The maximum population of beetles (94.40±1.20) on cashew nuts was recorded on 24th July, whereas the overall mean population was recorded at 52.90±8.26. As compared to all treatments, control (wheat) showed the higher population of *T. castaneum* on first observation on 6th March 19.00±0.58. Afterwards, beetle population gradually increased with maximum population of 114.40±2.58 recorded on 24th July. The mean population of beetle on control (wheat) was recorded at 61.61±10.02.

Weight Loss in Different Dry Fruits by Red Flour Beetle

Average weight loss among different treatments due to *T. castaneum* infestation was recorded at the end of experiment and the results are presented in Table **2**. The results indicated that weight loss of 14%, 11.2%, 8%, 15.6% and 18.8% was recorded in almonds, walnuts, peanuts, cashew nuts and wheat, respectively. Accordingly, the maximum weight loss was recorded in control (wheat), followed by cashew nuts, almonds and walnuts. The minimum weight loss among was noted for peanuts.

The results on the present investigation conducted that none of the dry fruit including wheat (control) tested was immune to this pest, however, susceptibility

Table 1: Mean Population Fluctuation of Red Flour Beetle on Different Dry Fruits

Dates	Treatments				
	T1=Almonds	T2=Walnuts	T3=Peanuts	T4=Cashew nuts	T5=Wheat
06-03-2015	17.00±0.70	17.80±0.58	16.40±0.50	17.80±0.58	19.00±0.58
20-03-2015	23.00±0.70	22.60±0.50	19.80±0.58	23.60±1.02	25.60±0.67
03-04-2015	27.00±0.83	27.00±1.30	21.40±0.92	28.40±0.60	31.20±0.37
17-04-2015	31.50±0.91	31.00±1.00	23.40±1.35	33.40±0.60	36.50±0.86
01-05-2015	36.50±0.97	35.40±1.35	25.20±1.18	37.00±0.86	44.70±1.02
15-05-2015	42.20±1.85	35.60±3.44	29.40±4.82	48.00±1.51	57.80±1.28
29-05-2015	55.40±0.81	47.40±0.74	26.40±1.24	58.20±1.85	68.60±0.92
12-06-2015	66.40±1.16	55.20±1.01	30.40±1.12	71.40±2.11	78.80±0.83
26-06-2015	76.40±1.02	63.00±0.94	32.80±1.65	81.00±1.30	94.40±0.92
10-07-2015	85.20±0.73	69.40±1.36	37.00±2.19	88.80±1.71	107.80±1.56
24-07-2015	89.60±0.81	74.80±1.24	39.40±2.08	94.40±1.20	114.40±2.58
Mean	50.01±7.81 c	43.56±5.89 d	27.41±2.31 e	52.90±8.26 b	61.61±10.02 a

LSD = 2.002; P < 0.05.

Table 2: Mean Weight Loss (%) in Different Dry Fruits by Red Flour Beetle

Particulars	Treatments				
	Initial T1=Almonds	T2=Walnuts	T3=Peanuts	T4=Cashew nuts	T5=Wheat
Weight loss in percentage	14%	11.2 %	8 %	15.6 %	18.8 %
Weight loss	35g	28g	20g	39g	47g
Standard Weight	250g	250g	250g	250g	250g

of these diets were varied significantly. The highest damage observed in wheat may be due to the fact that wheat consists of refined flour, bran, and shorts [8]. Therefore, it could be inferred that wheat was comparatively more susceptible to red flour beetle followed by peanuts and walnuts. The findings of this study are in agreement with [9] who also reported that wheat is the most preferred food for *T. castaneum* as compared to semolina, corn flakes and biscuits. Ajayi and Rahman [10] also recorded higher preference of *T. castaneum* towards wheat, millet, sorghum and maize flours in comparison to semovita grits, cassava and yam flour. Considering the variable susceptibility of various dry fruits against red flour beetle, proper and adequate management practices should be implied in the stored houses to keep the dry fruits safe from pests [11].

CONCLUSION

Results of the present study confirmed that among dry fruits used, *T. castaneum* showed more preference to cashew nuts followed by almonds and walnuts, whereas peanuts were least preferred. Accordingly, the highest weight loss was also recorded in cashew nuts. However, among all materials used in the study, wheat suffered the highest damage and weight loss from *T. castaneum*.

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