

## Comparative Infestation of Some Date Fruit Varieties by Red Flour Beetle *Tribolium castaneum* (Coleoptera: Tenebrionidae) as a Storage Pest

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**Abstract:** Present study investigated comparative infestation of different date fruit varieties by red flour beetle *Tribolium castaneum* (Coleoptera: Tenebrionidae) as a storage pest. The study was conducted at the laboratory of stored grain insect pests, Department of Entomology, University College of Agriculture & Environmental Sciences, The Islamia University of Bahawalpur, Pakistan. Date varieties viz., Ajwa, Iran-I (Dry dates), Iran-II (Black variety) and Pak-I (variety from Pakistan) were obtained from market. The infestation was checked in a square shaped glass box. It was divided into four equal chambers and a central plastic pipe giving an inlet for beetles release. Results revealed that number of beetles entering in to chambers of different varieties were not significantly different from each other. Maximum mean number of beetles (11.75) entered in to chamber of Pak-I variety and the minimum number of beetles (5.50) entered in to chamber of Iran-II. Beetles invasion in to date fruit was significant for different varieties. Maximum mean no of beetles invaded in to Iran-II (8.75) followed by Pak-I (8.00) which were non-significantly different from each other. Higher invasion of beetles in to Iran-II and Pak-I was significantly different from the mean invasion in Ajwa (0.75) and the no beetle invasion at all in Iran-I (0.00). These data give useful information regarding red flour beetles and other stored grain insects' infestation of date fruit and can be used for managing stored grain insect pests like red flour beetles on date fruit.

**Key words:** Date Palm • *Phoenix dactylifera* • Fruit storage pests • Red flour beetles

### INTRODUCTION

Date palm tree bears high quality fruit rich in nutrition and has got enormous value in the heart of people. It generates high energy and many products are derived from the fruit. An important characteristic of date fruit is about its invert sugar that is in form of glucose or fructose unlike sucrose which can be immediately absorbed by the human beings in the alimentary canal. Dates are also very good source of vitamins and proteins. Date palm tree as well as fruit is attacked by a variety of insect pests. El-Shafie [1] reported about 22 insect species that can infest date fruit during harvesting and storage. Among them majority of the species belong to order coleopteran and Lepidoptera. Hussain [2] reported that dry dates are attacked by moth and beetle insect pests.

High quality for fresh dates is attributed to adequate size and color, small pit, thick flesh, free from dirt, sand and leaves particles, birds, insects and rodents damages, fungi and molds infestation, sugar crystals formation and free from any other apparent alterations [3].

Insect infestation is one of the main causes of post harvest losses in dates. Dates can be infested with saw toothed grain beetle, red flour beetles, Indian meal moth, rusty grain beetle, almond moth etc. When dates become infested with any stored grain insect pests fumigation is recommended with methyl bromide or phosphine. Alternatives to fumigation include low and high temperature treatment and ionizing radiation. Integrated control of insect pests include proper harvesting time before getting fully mature and proper packaging of date fruit to avoid insect attack and also after fumigation, low

or high temperature treatment to avoid re-infestation by the stored grain insect pests [4]. According of U.S. standard of quality and grades the score of date fruit is dependent on factors like color, uniformity of size, free from spots and mechanical injury, properly ripened, cleaned and insect free [5]. There should be many other factors as well while considering date fruit for import and earning foreign exchange from date fruit.

Red flour beetle has been described as one of the storage pests of date fruit [6]. They are usually the insect pests of broken grains and farinaceous compounds or their infestation demands an early attack by primary insect pests. In usual commodities left unattended become conducive for insect pest attack like red flour beetles. In the present study we evaluated four date fruit types for infestation by red flour beetles.

### MATERIALS AND METHODS

Experiment was conducted in stored grain insect laboratory situated in Entomology Department, University College of Agriculture & Environmental Sciences, The Islamia University of Bahawalpur, Pakistan. A device made of glass (16 × 16 × 6 cubic inches) was used for testing the comparative entrance and invasion by the beetles in to date fruit (Fig 1). It was divided in to four chambers by means of standing glass walls on floor of glass and meeting in the centre to a plastic pipe. Glass was glued together with the help of silica and the chambers were made air-tight. Each chamber contained ten date fruit belonging to Ajwa, Iran-I (Dry variety), Iran-II (Black variety) and Pak-I (from Pakistan) placed in a homogenous pattern. 100 adults starved for 12 hours were released through central pipe and beetles' entrance in to chambers was recorded 24 hours following release. Number of beetles entering in to each chamber was counted and beetles invading date fruit if any were also counted. There were four replications in total. Data was analyzed statistically by completely randomized design (CRD) using the Statistix software version 8.1.

### RESULTS AND DISCUSSION

Beetles entrance in to chambers containing date fruit was non-significantly different for different varieties (Table 1 P > 0.05). Maximum mean number of beetles (11.75) entered in to chamber containing Pak-I date variety and minimum mean number (5.50) entered in to the chamber containing Iran-II (Table 3). Beetles invasion in to different fruit varieties was significantly different for

Table 1: Completely Randomized AOV for beetle entrance in to chambers

Source	DF	SS	MS	F	P
Variety	3	83.688	27.8958	0.37	0.7785
Error	12	913.250	76.1042		
Total	15	996.938			

Grand Mean 8.0625 CV 108.20

Table 2: Completely Randomized AOV for beetle invasion in to date fruit

Source	DF	SS	MS	F	P
Variety	3	258.250	86.0833	5.28	0.0149
Error	12	195.500	16.2917		
Total	15	453.750			

Grand Mean 4.3750 CV 92.26

Table 3: All-Pair wise comparisons test of beetle entrance in to chambers

Variety	Mean ± S.E	Homogeneous Groups
Pak-I	11.75±1.24	A
Iran-I	7.75±0.62	A
Ajwa	7.25±0.62	A
Iran- II	5.50±0.85	A

P > 0.05 Critical T Value 2.179

Means sharing same letters are non-significantly different from each

Table 4: All-Pair wise comparisons test of beetle invasion in to dates

Variety	Mean ± S.E	Homogeneous Groups
Iran-II	8.75±0.49	A
Pak-I	8.00±0.64	A
Ajwa	0.75±0.10	B
Iran-I	0.00±0.00	B

P < 0.05 Critical T Value 2.179

Means sharing same letters are non-significantly different from each other

the tested varieties (Table 2 P < 0.05). Maximum mean number (8.75) of beetles invaded Iran- II and minimum mean number of beetles (0.00) invaded in Iran- I (Table 4). Beetles entrance in to chambers was non-significantly different. However more beetles entering in to one chamber than the other might be due to two factors i.e. odors emitted by the certain dates should be greater than the others or it could be random movement by the beetles in to any chamber. Beetles had equal chance of going in to four chambers containing four types of dates viz., Ajwa, Iran-I or dry dates, Iran-II or black variety and Pak-I a Pakistan variety (Figure 1). When hundred adult red flour beetles were dropped by central pipe these fell on glass floor and had four routes to go in to any chamber containing a particular date fruit. It may be also important to note that we observed that even after 24 hours after release of beetles not all of the hundred beetles reached in chambers containing date fruit. Out of the released beetles some were found still on the glass floor under the pipe area. Of the hypothesized factors involved in beetles' entrance relative to the chambers containing different date fruit it



Air tight glass box with four chambers and  $16 \times 16 \times 6$  cubic inches volume capacity  
N = 100 adults red flour beetles released by central pipe for every replication

#### Date fruit types

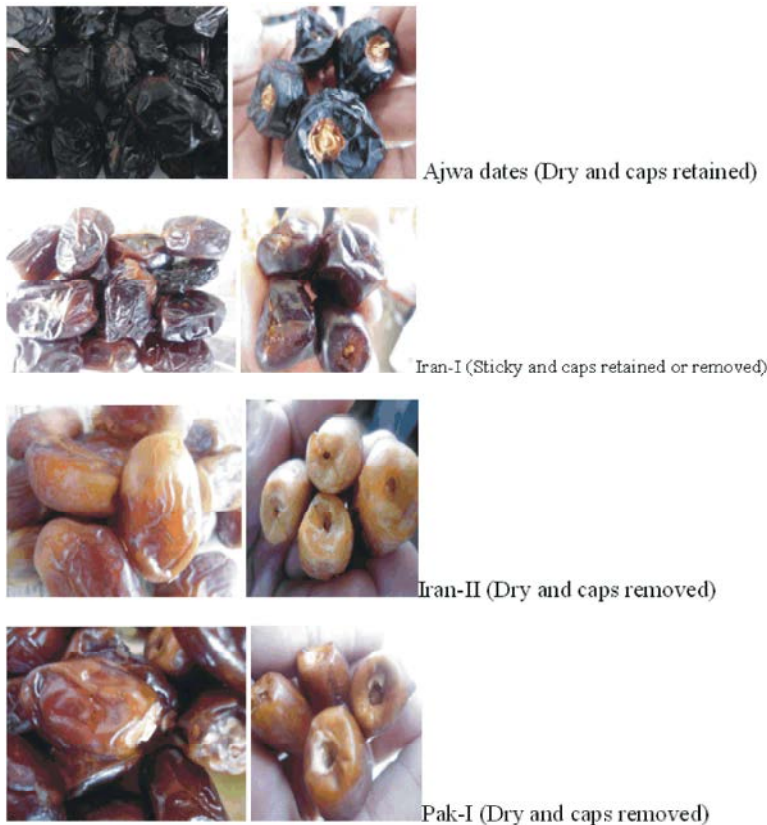


Fig. 1: Experimental device and date fruit

is required that beetles' preference for dates be checked if any based on odors emitted by the fruit and the rest of the factors should be excluded.

Beetles invasion in to different fruit varieties was significantly different for different varieties. This is concluded that it was due to two prominent factors. One of them is the physical condition of the dates like dry dates versus sticky dates. In our results we found that most number of beetles invaded Iran-1 a dry variety (Figure 1). It was followed by Pak- I also a dry variety where mean number of beetles invaded were 8.00 but these were non-significantly different from each other.

We observed that both of above varieties i.e. Iran- I and Pak- I were dry varieties. Further an important character was caps on date fruit. The date varieties Iran-II (dry variety, Figure 1) and Pak-I (dry variety) contained most fruit that did not have caps retained on them. On the other hand the varieties like Iran-I (Black variety) and Ajwa had least number of beetles entered in to fruit (0.00 and 0.75 respectively). We observed that Iran-II was a sticky variety and we also noticed occasionally beetles got stuck to the fruit due to their adhesive character. These date fruit had caps intact as well as without caps (Figure 1). Ajwa variety though dry in nature but some of

the fruit did not have caps on them and only few beetles managed to invade Ajwa fruit (Figure 1 & Table 4). It has been reported that compactness in diets can limit the movement of insects and amount of resource available to insects for feeding and reproduction [7]. Our results are in agreement to this research because we found that no beetles were found infesting date fruit which were sticky like Iran-II and also in Ajwa which was dry but has least number of routes for entry. In Ajwa most or all caps were intact on fruit. Above results show that in all date fruit types dryness and removed caps led to infestation of fruit by the beetles.

Despite extensive reports and books on date production, little research has been carried out on the postharvest physiology, biochemistry and handling of dates and few reviews have been written [8, 9]. Oubahou and Yahia [10] reported that adequate harvest and postharvest techniques need to be implemented to maintain the highest and safest fruit quality possible. Therefore it is demanded that further research should be done extensively on harvesting, handling and storages of date fruit in relation to insect pests of date fruit in storage like red flour beetles and other pests to maximize the profit generated from this valuable fruit.

### CONCLUSION

It is concluded that there is a need for investigation for the cap retaining capacity of all date varieties and dates without caps should have no place among export quality fruit. Dates with removed caps are more likely to harbor red flour beetles and other stored grain insect pests. Such date fruit are expected to get minimum or least score according to grading criteria for dates.

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