Role of The Saw-Toothed Grain Beetle *Oryzaephilus surinamensis* L. Coleoptra : Silvanidae In Date Palm Fruits Decay at Different Temperatures

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Abstract

This research was carried out in the labs of date palm research center to investigate the effect of the saw-toothed grain beetle ***Oryzaephilus surinamensis* L.** in date palm fruits decay at different temperatures of 20, 30, and 40 °C after one and two months for storing period.

Results showed that the highest infection of date palm fruits by date decay and the saw-toothed grain beetle was 38.72% and 74.12% respectively at 30°C.Whera as the lowest rate of infection date palm fruits by date decay and the saw-toothed grain beetle were 4.50% and 22.64% respectively in 40°C. Moreover was recorded the highest decay after two months of storing comparison to one month storing were 31.26% and 21.90% respectively. The role of the saw-toothed grain beetle was noticed in that decay was 46.5,% when the insect is there on the date palm and 6.67% when it was not there. The highest population of the saw-toothed grain beetle was 8.90 insect/date in 30 °C whereas the lowest population was (0.17, 5.78) insect/date in 20°C and 40°C respectively. Moreover, the effect of temperature on the rate of insect mortality varied. The highest rate of mortality was 98.9% in 40°C and the lowest rate was 18.6% in 30°C.

Introduction

The Dates are the most important part of the date palm because of its high nutritional value and its content of sugar, vitamins and proteins(Moter, 1991) After gatherings the dates may be infected by pests such as insects, ferment and fungus which reduce their commercial, nutritional value and quality (Abdul Al-Husin, 1985) The saw-toothed grain beetle *Oryzaephilus surinamensis* L. consider one of these pests in which the insect(adult stage and larvae stages eats the date by digging tunnels between the peel and the content. Date of low wet content and that do not have tops or that have wounds and cracks are the most infected by this insect(Mhameed, 1978; Al-Hafidh *et al.* 1987). Date are also infected by many fungus such as *Alternaria sp*, *Penicillium sp* and *Aspergillus sp.* in addition to ferments. They infect date of high wet and sugar content. Wounds and cracks increase the possibility of decay and fermentation, These fungus secrete many kinds of enzymes and poison that cause decay and loss of the nutritional value of the date and consequently it becomes unsuitable for eating (Berbendi,2000; Ibraheem and Klaef, 2003).

Many chemical and physical methods have been used to control pests that occur after gathering (Al-Azzawi and Mhdi,1983; Emery and Hoffmann, 2007). High and low degrees of temperature are used to prevent infection of the fruit by insects, ferments and fungus during storing whether by use of wet , dry heat or by use of hot water. In this concern, Omamor and Hamza, (2008) studied the effect of relative temperature and humidity in infecting dates with decay. They found that the best temperature for decay ranged between 20°C and 30°C in the humidity level of (90-100)%. Spotts *et al.*(2006) used compressed hot water to get rid of the fungus and

insects that infect apple and pears after gathering and during storing by washing them, and using cooling (low temperature) to protect stored grain from infection of some grain beetles(Mignon *et al.*1996).

This research was carried out because there are no such studies which deal with the role of the saw-toothed grain beetle in date decay we aims to find a kind of relationship between them and to stop the effect of that insect and decay on dates through the use of different degrees of temperature.

2- Materials and methods

This research was carried out in the date palm research center labs. Khidrawi dates were brought from the local market, some of the dates were in a good condition where the others were infected by decay and the saw-toothed grain beetle insects. The species of insect was identify by the Dr. Kadhim Salih Al-hadlak in the dept. of Biology. College of Sciences, University of Basrah.

60 glass devices of 12X2o Cm. dimensions that were tightly locked when they were used. In each device 50 good dates were put in addition to other three dates decayed ones. In half of the devices, 20 adults of saw-toothed grain beetle insects were put and the others were left free of the insects. The temperature that were used (20, 30, and 40) °C. In cold incubators kind (Gallenhamp type) in humidity arrange of (50±t5)%. In each group 10 devices were put in all the degrees of temperature. Five devices were randomly chosen for each degree of temperature from both groups so as to test them after one and two months of incubation. The infected dates were identified and calculated by noticing the change in color, smell and shape of date so as to assign the rate of decay(Abdul Al-Husin, 1985). Also, the number of good, decayed dates

and the number of living and dead insects were calculated to determine the rate of mortality, the population density of the saw-toothed grain beetle and the rate of infection.

$$\text{Rate of Mortality} = \frac{\text{No. Dead insects}}{\text{Total No. of insects}} \times 100$$

$$\text{Rate of Infection} = \frac{\text{No. of infected Dates}}{\text{Total No. Dates}} \times 100$$

All the experiments were designed according to complete random design (C.R.D) as multi-factored experiments. The means were according to the method of R.L.S.D. with probability 0.01 (Al-Rawi and Khalaf Allah, 1998).

3. The Results

3-1. Effect of temperature, period of storing and availability of the saw-toothed grain beetle on date palm fruits decay

The results of the table (1)revealed significant differences and interaction among all the studied. The highest recorded rat of date decay was 38.72% in 30°C. whereas the lowest was 4.50% in 40 °C. The lowest recorded rate of decay after a month of storing was 21.90% whereas the highest recorded rate of decay after two months of storing was 31.26%.The existence of the saw-toothed grain beetle played a role in increasing the rate of date decay which was 46.50% in comparison with the absence of this insect in which the decay was 6.67%. Decay was high in dates with insects after two months of storing which was 92.26%. in 30°C, the lowest recorded rate of decay was 1.97% in 40°C. after a month of storing without the insect Results of interaction between the method of treatment and the storing showed increase of rate of date decay

with the insect after two months of storing which was 55.01% and the lowest recorded rate of decay after a month of storing without the insect was 5.83%.

Results also showed significant interaction between the effect of degree of temperature and the method treatment in that highest recorded rate of date decay with the insects in 30°C. was 67.97% whereas the date which were not treated with the insect and stored in 40°C. showed the lowest rate of decay 2.86%. Concerning the interaction of storing period and the temperature, the rate of date decay increased in 30°C. after two months of storing and reached to 51.63% whereas it decreased in 40°C. after two months of storing to be 4.13%.

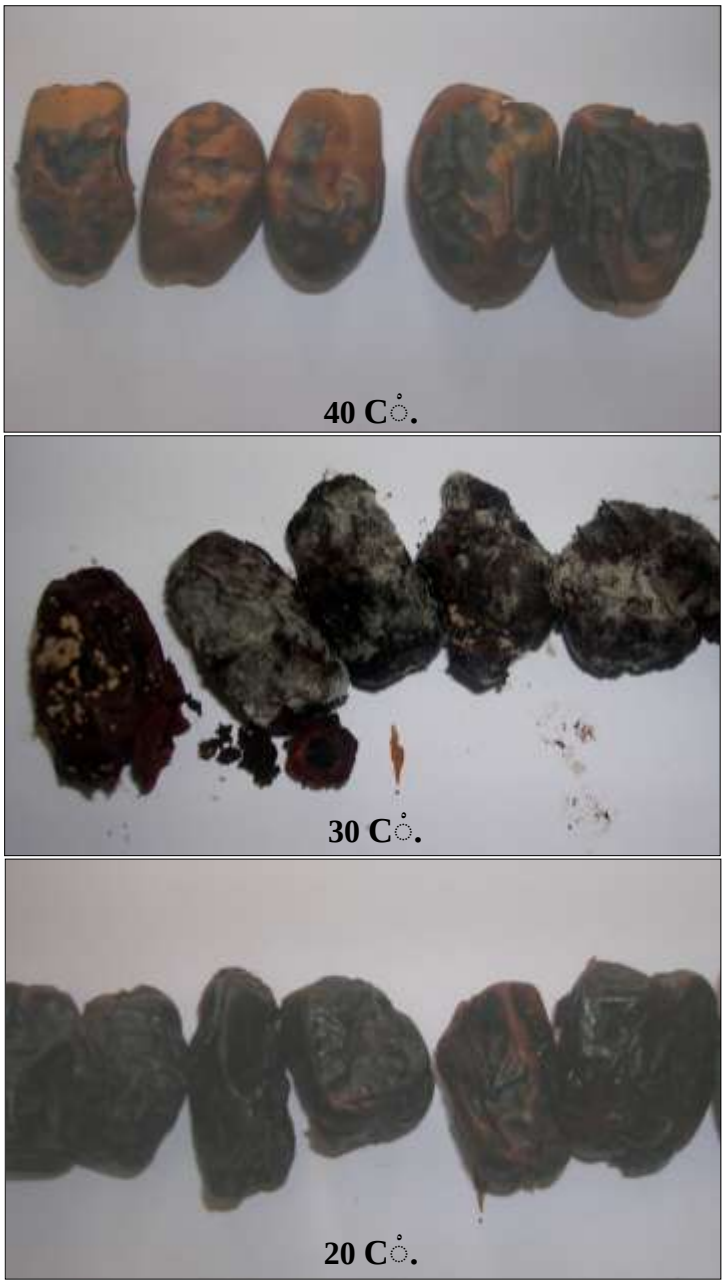
We notice in figure (1) differences in the rate and intensity of decay in dates that were infected by the saw-toothed grain beetle the highest rate of decay was in 30°C whereas the rate looked safe in 40°C and semi-safe of decay in 20°C.

Table (1) Effect of the different degrees of temperature, storing period and treatment method on date palm fruit decay.

Treatment method	Storage period(month)	Temperature(°C)			Effect of Interaction between treatment method and storage period
		20	30	40	
Dates with insects	One month	62.96	43.26	7.75	37.99
	Two months	67.86	92.68	4.50	55.01
Dates without insects	One month	7.12	8.38	1.97	5.83
	Two months	8.17	10.59	3.76	7.50
Means of effect the temperature		36.52	38.72	4.50	
R.L.S.D $_{0.05}$	Tertiary Interaction = 1.21	Temperature= 0.61			Interaction between treatment method and storage period= 0.70

Effect of Interaction between temperature and treatment method				Means of effect treatment method
Dates with insect	65.41	67.97	6.13	46.50
Dates without insect	7.64	9.49	2.86	6.67
R.L.S.D $_{0.05}$	Interaction between temperature and treatment method=0.86			Treatment method= 0.49

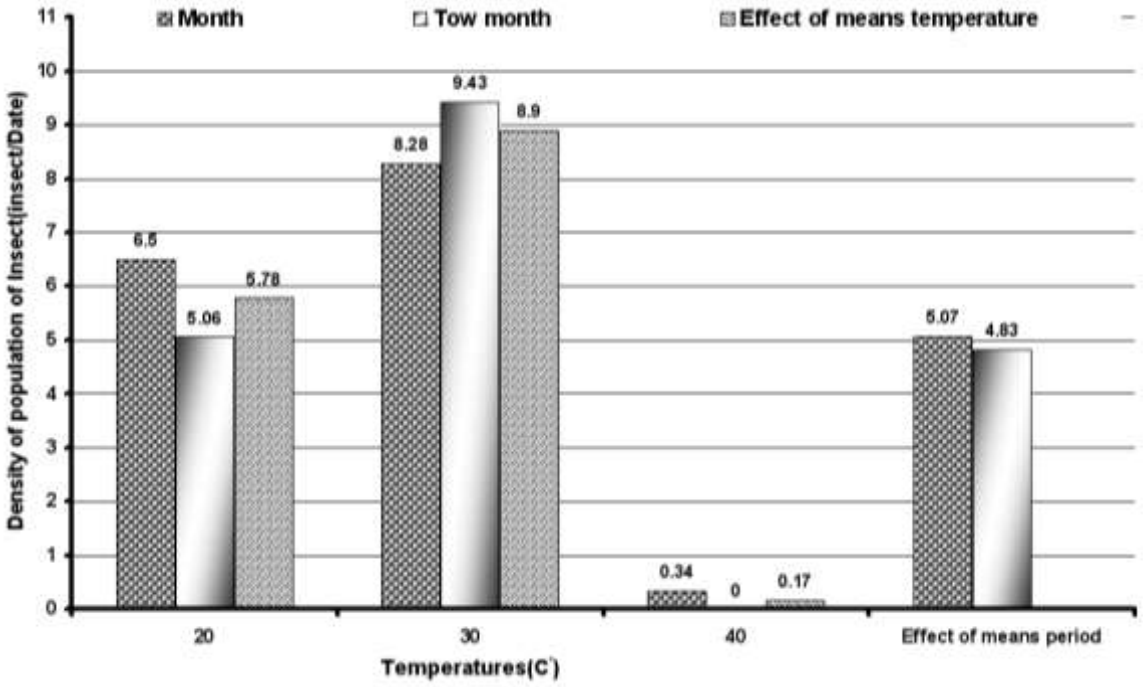
Effect of Interaction between storage period and temperature				Means of effect storage period
One month	35.04	25.82	4.86	21.90
Two months	38.01	51.63	4.13	31.26
R.L.S.D $_{0.05}$	Interaction between storage period and temperature=0.86			Storage period = 0.49



Fig(1)Infection date palm by the decay on different temperatures

3-2. Effect of temperature degree and period of storing on the density of population of the saw-toothed grain beetle on dates.

The results in figure(2) showed significant differences among the degrees of temperature of storing in the population of the saw-toothed grain beetle that which grow on dates. The highest population was 8.90 insect/date in 30°C. whereas the lowest was 0.17 insect/date in 40°C. The storing period did not significantly effect on the density of population of the *O. surinamensis* which was 5.07 and 4.83 insect/date after a one and two months respectively whereas the result of interaction between the degree of temperature and the storing period was significant on the population of *O. surinamensis* where the highest population was in 30°C after two months storing and it was 9.43 insect/date whereas the lowest recorded population of insect in 40°C. after two months of storing was 00 insect/date.

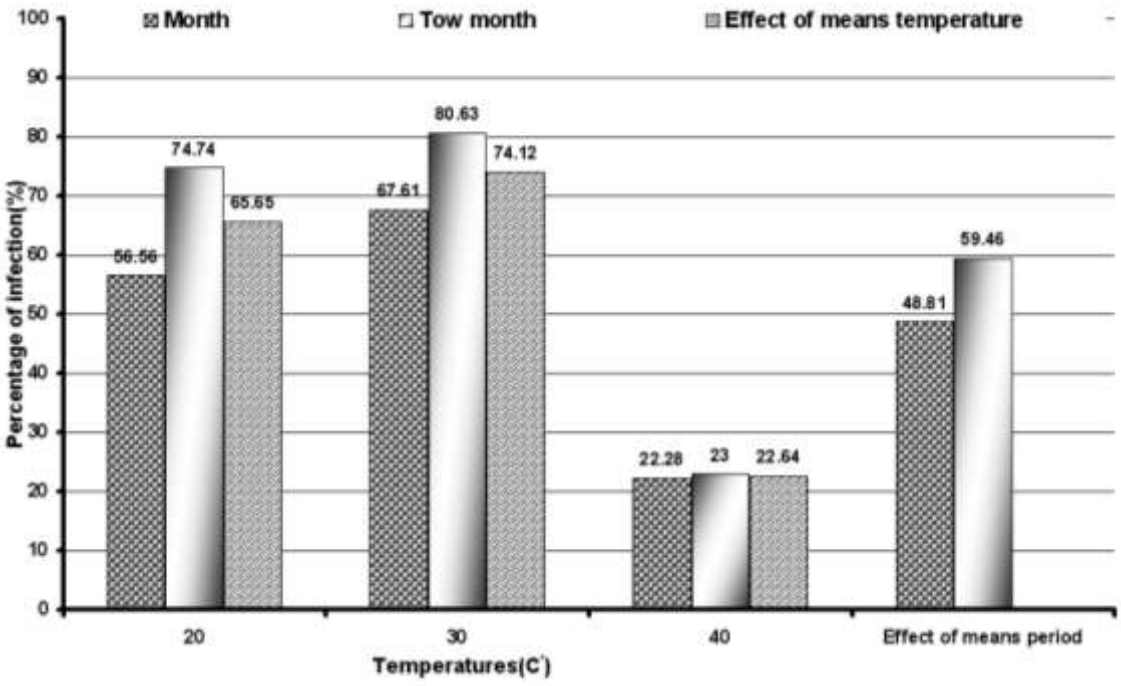


Fig(2)Effect of the different degrees of temperature and storing period on the population density of the saw-toothed grain beetle(insect/date) growing on dates.

R.L.S.D. $_{0.05}$ Temperature=0.47 Periods=N.S Interaction=0.71

3-3. Influence of temperature degree and period of storing on the rate dates of infected by the saw-toothed grain beetle .

The results in figure (3) showed significant differences among all the variables of the study and their interaction. The highest infection of *O. surinamensis* was 74.12% in 30°C. whereas the lowest rate of infection by this insect was 22.64% in 40°C. Also it was noticed that as the storing period increased, the rate of infection increased to 48.81% and 59.46% after a month and two months of storing respectively. The highest rate of infection of the saw-toothed grain beetle in 30°C. after two months of storing was 80.63% whereas the lowest rate was 23.00% in 40°C. after two months of storing .

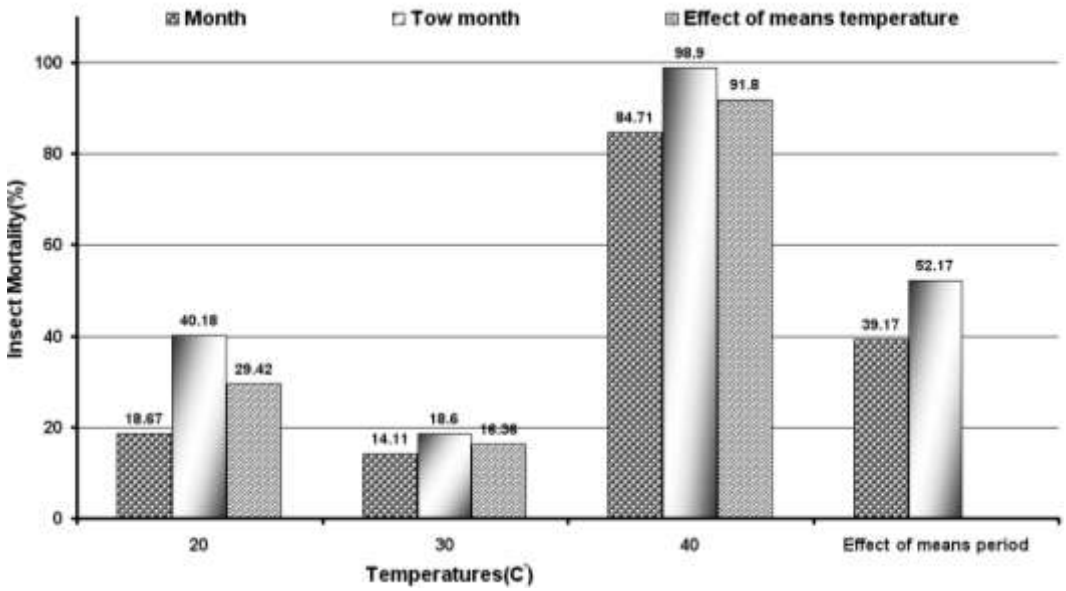


Fig(3)Effect of the different degrees of temperature and storing period on the rate infection dates by the saw-toothed grain beetle(insect/date) growing on dates.

R.L.S.D. $_{0.05}$ Temperature=0.83 Periods=0.68 Interaction=1.18

3-4. Influence of Degree Temperature and Period of storing on The rate Mortality of the saw-toothed grain beetle Growing on Date.

Figure(4) showed significant differences between the degree of temperature and the storing period concerning with the rate of mortality of *O. surinamensis.* The highest rate of mortality was 91.80% in 40°C. whereas the lowest rate was 16.36%. in 30°C. Also, the highest rate of mortality of *O. surinamensis* after two month of storing was 52.17% in comparison to one month storing which was 39.17%. Concerning interaction of degree of temperature and storing period, the highest rate of mortality was 98.90% in 40°C. after two months of storing whereas lowest rate was 14.11%. in 30°C. and after one month of storing



Fig(4)Effect of the different degrees of temperature and storing period on the rate mortality of the saw-toothed grain beetle(insect/date) growing on dates.

R.L.S.D. $_{0.05}$ Temperature=1.12 Periods=0.98 Interaction=1.59

4- Discussion

Results showed that existence of the saw-toothed grain beetle in dates helped to increase infection of decay and spoiling in dates because of two reasons: firstly, this insect when feed on the date, makes wounds and cracks that facilitated penetration of the microorganisms that were responsible of decay and fermentation. These wounds and cracks play an important role in decay (Berbandi, 2000; Al-Asadi *et al.*,2007). It is known that most decay fungus are need wounds and cracks on the fruit to infected it (Aal –Abdual Alslam & Rizq, 1991). Secondly the insect causes transfering infection through the attachment of these microorganisms to the body of the insect (Trdan ***et. al.*** **2005**), That is why, as the population of the saw-toothed grain beetle increases, rate of decay in all degree of temperature increases as well. Also, the length of storing period increased the rate of decay because of the increasing in number of the insects and in growth and activity of the microorganisms that cause decay. Results also showed that 20°C. and 40°C. are the degrees of temperature where decay and prevailing of the saw-toothed grain beetle occur. In this concern, many researchers indicate that fungus, are generally active in the range of temperature 25-30°C. and that decay of fruit decreases in the degrees of temperature that are higher or lower than this rang (Al-Rubai *et al,*1986; Maheshwari, 2005), Jacob(1981) and Al-Dosary (2008) see that the best degree of temperature for the growth and development of *O. surinamensis* is 30-35°C., The variation mortality of this insect is a result of the negative influence of the temperature degree (Klys, 2008), or that the microorganisms that are responsible for decay and fermentation, themselves kill the insect(Mignon et al.,1995,1996).

The present study recommends to conduct a study that isolates the fungi involved with *O. surinamensis* to test their pathogenicity abilities in both the date palm fruits and the saw-toothed grain beetle.

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دور خنفساء الثمار ذات الصدر المنشاري

Oryzaephilus surinamensis (L.) Silvanidae :Coleoptra

في تعفن ثمار نخيل التمر تحت درجات حرارية مختلفة

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البصرة–العراق

الخلاصة

أجري هذا البحث في مختبرات مركز أبحاث النخيل لمعرفة تأثير إصابة ثمار نخيل التمر بخنفساء الثمار ذات الصدر المنشاري ***Oryzaephilus surinamensis*(L.)** في حدوث تعفن الثمار عند درجات حرارة مختلفة هي(20، 30، 40) ْم بعد شهر وشهرين من الحفظ، أظهرت النتائج أن أعلى نسبة إصابة لثمار نخيل التمر بالتعفن وخنفساء الثمار ذات الصدر المنشاري كانت في درجة حرارة 30 ْم وبلغتا(74.12،38.72)% على التوالي في حين سجلت أقل نسبة تعفن ونسبة إصابة بالخنفساء بدرجة حرارة 40 ْم وكانتا(4.50، 22.64)% وسجلت أعلى نسبة تعفن للثمار بعد شهرين من الحفظ مقارنة بعد شهر من الحفظ وبلغتا(21.90،31.26)% على التوالي وكان لوجود حشرات الخنفساء ذات الصدر المنشاري دور في زيادة نسبة التعفن ثمار نخيل التمر من 6.67% في حالة عدم وجود الحشرات على الثمار إلى 46.50% في حالة وجود الحشرات مع ثمار نخيل التمر، وسجلت أعلى كثافة سكانية لخنفساء الثمار ذات الصدر المنشاري في درجة حرارة 30 ْم وبلغت 8.90 حشرة/ثمرة بينما كانت منخفضة في درجتي الحرارة (20 و40) ْم وبلغتا(5.78، 0.17) حشرة/ثمرة على التوالي، وتفاوت تأثير درجات الحرارة على نسبة القتل لخنفساء الثمار ذات الصدر المنشاري إذ كانت أعلى نسبة قتل في درجة 40 ْم وبلغت 98.9% بينما سجلت أقل نسبة قتل في درجة حرارة 30 ْم وكانت 18.6%.