

Susceptibility of some fresh date palm varieties to infestation by *Rhynchophorus ferrugineus* Olivier (Coleoptera, Curculionidae) in relation physico-chemical composition

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Abstract: The susceptibility of date palm fresh fruit of four cultivars to natural infestation by the *Rhynchophorus ferrugineus* Olivier and the effect of their physico-chemical composition on infestation were studied at Sharkyia Governorate, Egypt in season 2013. Carbohydrate: though the ratio glucose and fructose originates from a one-to-one basis, thus ratio may change during ripening. Usually, glucose remaining the prominent one. Protein and fats: both substances occur in small amounts in the date flesh. Fat is mainly concentrated in the skin and has a more physiological importance in the protection of the fruit than contributing to the nutritional value of the date flesh (0.1-0.4%). Knowledge of the qualitative and quantitative chemical composition of date fruits is of prime important to the user of dates. The consumer interest will mainly focus on the organoleptic and nutritional properties of the product. For practical purposes the relative % of sucrose, glucose and fructose is sometimes propagandized as a more direct, accessible energy source to human body. Generally from the fore mentioned results it can be concluded that in consequence of the high levels of protein, the moderate levels of fats and carbohydrates and the low levels of ash of some date fruits cultivars, certain degrees of effectiveness were manifested towards the date palm weevil infestation.

Keywords: Phoenix dactylifera; Rhynchophorus ferrugineus; physico-chemical compositions, date palm fruits; natural infestation.

1. Introduction

The date palm, *Phoenix dactylifera* Linn (Palmaceae) is the most common and widely cultivated in the arid regions of the Middle East and North Africa. In many areas date palm fruits have provided the stable carbohydrate food of local people since long time ago. Date palm in a multi-purpose tree, being highly regarded as a national heritage in many countries. It provides foods shelter, tumber products and all parts of the palm can be used. For several decades date palm groves have been in decline because of pest and disease problems (Erskine *et al.*, 2004). Worldwide, date production has increased exponentially over the last three decades from 1.8 million tons in 1963 to 6.7 million in 2003 (FAO, 2003).

Recently, date palm insect pests in general and the red palm weevil, *Rhynchophorus ferrugineus* Olivier, (Coleoptera, Curculionidae) in particular are widely accepted as being the most destructive factors of date. The pest was first discovered in Egypt at the end of November 1992 in Sharkyia northeastern governorate (Cox, 1993). Red palm weevil, borers into the leaf bases at the top of the trunk causing the entire crown to wither and die. Major constraints include low quality palm cultivars,

pest's control. Date palm feeding by insects or infest trunk produces unique signatures of chemical compounds that often are exploited by natural enemies (Turling *et al.*, 1990) and then chemical signatures could be used to locate infested in the field (Allen *et al.*, 1999). Knowledge, of the quantitative and qualitative chemical composition of date fruit is of prime importance to the user of dates, in particular the packer, processor or trade, because it effects the possibilities and limitations of the raw materials for the intended end-use. The consumer's interest will mainly focus on the organoleptic and nutritional properties of the product. Very important to know what the date fruit consists of and what are the average quantitative and qualitative values.

Thus, the present studies aims to evaluate the susceptibility degree of date fruits of certain date palm cultivars to the natural infestation by *R. ferrugineus* Olivier, in relation to their physico-chemical compositions (fats, proteins, carbohydrates, ash, weight, diameter, length and approximate yield).

2. Materials and Methods

Experimental materials:

Studies were conducted at El-Hussinia region in El-Sharkyia Governorate in inspection date 2012-2013 to clarify the effect of the infestation by red palm weevil on date fruits. Four cultivars were chosen to carrying these study named by their Arabic denominations: Samani, Hayyani, Zaghlol and Bent-asha. The trees of cultivars were ten years old; ten trees per each cultivar were selected at random and left throughout the experiment time without applying and pest control measures. The four cultivars were similar in each as size and height (4-5m.). They also labeled and received the normal agricultural practices. The samples were taken when the fruits were in the ripening stage, immediately two days before harvesting. A sample of hundred of soft dates from each cultivar (ten date fruits each tree) was selected at random. The study was carried out to determine the relationship between physic-chemical compositions (fats, proteins, carbohydrates, ash, weight, diameter and length) and natural infestation by date palm weevil.

3. Parameters studied:

1- Chemical composition.

Total soluble solids (TSS) were measured directly from the fruit juice using a Kruss hand refractometer (model HRN-32). Thirty grams of pulp of each fruit types of each cultivar were minced and homogenized in 100 ml. of distilled water for one min in an electric blender and centrifuged at 10.000 rpm for ten min in a Gallenkamp portable centrifuge (CF 400). The volume of the supernatant, which constituted the pulp extract, was determined. Total sugars were determined in pulp extracts according to anthrone method of (Yemm and Willis, 1954). Reducing sugars were measured according to technique described by (Somogyi, 1952). Total sugar was expressed in grams per 100g. fresh weight. The protein dye-binding procedure of (Bradford, 1976) was used for total protein determination. Titratable acidity was measured according to the method described by (Ranganna, 1979) and was expressed as percent citric acid.

4. Physical characters

A- Fruits weight: once in the laboratory, we weighed each fruit (100 fruits each cultivar).

B- Diameter of fruits: once the fruits are weighted using a caliper, we measured the diameter of each fruit. The measurements were made for the 25 fruits of each cultivar.

C- Length of fruits: one the fruit are weighed and measured the diameter, directly the length of each one was made (100 fruits each cultivars).

D- Approximate yield.

5. Statistical analysis:

Analysis of variance (Gomez and Gomez 1984), followed by Fishers protected LSD test with a significant level $P \leq 0.05$ were performed on the data.

6. Results and Discussion

A- Relationship between date fruit contents of different cultivars (fats, protein, carbohydrates and ash) and the infestation by date palm weevil:

1- Fats: mainly concentrated in the skin and has a more physiological importance in the protection of the fruit than

contributing to the nutritional value of the date flesh (Morton, 1987). Data in Table (1) show some insignificant differences among the tested cultivars regarding of infestation by the date palm weevil. The significant difference between Sammani or Bent-asha cultivar and other cultivars were recorded. The insignificant differences observed between Hayyani and Zaghlol.

2- Proteins: protein occurs in the date flesh fruits through their amino acid pattern in favorable to human needs, the amounts are too small. Data in Table (1) show insignificant differences concerning of content of proteins, Hayyani and Zaghlol cultivars had a highest content of protein (3.8% and 3.4%).

3- Carbohydrates: sugars contribute the most prevalent single components, and in the ancient date production countries, the date has been used more as a sugar source than as a fruit. All sugars in date consist of a mixture of sucrose ($C_{12}H_{22}O_{11}$); glucose ($C_6H_{12}O_6$) and fructose ($C_6H_{12}O_6$), (Barrevel 1993). Data in Table (1) revealed that the date fruit cultivars could be arranged in descending order according to their carbohydrate contents as follow: Zaghlol, Hayyani, Bent-asha and Sammani. Table (1) show significant differences concerning of content of carbohydrates, Samani and Zaghlol (74.01% and 93.8%), while the insignificant correlation recorded between Bent asha & Samani (78.3% & 74.01%) and Hayyani & Zaghlol, (87.3% & 93.8%).

Comparing the data obtained from Table (1) show that the date contents in control trees (healthy trees) indicate that the infestation by red palm weevil effect slightly of sugar content and these may be due to feeding of larvae inside trunk make a carrier for flow water and mineral elements to leaves .

4- Ash: Data (Table, 1) show that the differences among the tested date fruits, appertained the ash content, and were only significant between cultivars, Samani and other tested varieties.

B- Relationship between date fruit physical characters of different tested cultivars and the infestation by date palm weevil.

According to cultivar or varieties and growth conditions that fruit vary in shape, size and weight. Usually, they are oblong though certain varieties may reach a near round shape. Length and diameter may vary from respectively 6.1 to 2.5mm and 5.1 to 2.0mm. Average weight per fruit is about 9.5 to 5.3gr.

Fruit weight: The average fruit weight ranged from 5.3gr. to 9.5gr. for the Bent-asha and Zaghlol cultivars (Table 2). The results presented in (Table 2) show that the average of 7.55 gr., the cultivars of Zaghlol and Samani variety is characterized by weight average above the global average, while the cultivars of Bent-asha and Hayyani are determined by lower average weight. On the other hand, the yield can be affected by the date palm weevil infestation. The reduction in yield differs from cultivar to other, the reduction in yield ranged between 6.81 to 3.06%. The reduction observed in Sammani cultivar (6.81%) and the lowest reduction recorded in Zaghlol cultivar (3.06%). Table (2) show significant negative correlation between infestation and yield of Samani variety and other varieties. Thus, this variety more susceptible to the target pest infestation. The variety Samani need to long time more than other varieties to reach the mature stage of fruits (1.5 months).

Fruit diameter and length: We noted that the total average diameter of all cultivars is 3.85mm, while in control is 4.1mm. Data in Table (2) clearly indicate that the difference between the cultivars is significant negative. The significant negative recorded between Bent-asha variety and other cultivars. Samani

variety has a high measure recorded (5.1mm), while the lowest one is Bent-asha (2.0 mm). Statistical analysis indicated that there is no significant between controls for each cultivar and represented one. Concerning the fruit length, Table (2), shows that the variety Zaghlol has the priority for the fruit length, the fruit reach about 6.1mm and in control is 6.3mm. The variety Bent-asha is the lowest one 2.5mm. The statistical analysis revealed that the difference between Zaghlol and Bent-asha is significant negative. The total average of length is 4.25mm, while in control is 4.45mm. From the obvious data, its easy concludes that the relationship between diameter & length and the approximated yield is insignificant.

7. References

- [1] ALLEN J. C., KOPP D. D., BREWSTER C. C., FIEISCHER S. J., 1999- An agricultural Odyssey. Am. Entomol. 45(2): 96-104.
- [2] BARREVELD W. H., 1993- Date palm products. **FAO Agricultural Services Bulletin No. 101**, Rome.
- [3] BRADFORD M. M., 1976- A rapid and sensitive method for quantitation of microgram quantities of protein utilizing the principal of protein dye-binding. Analytical Biochemistry, 72: 248-254.
- [4] COX M. L., 1993- Red palm weevil, *Rhynchophorus ferrugineus* in Egypt. FAO Plant Protection Bulletin 41(1): 30-3.
- [5] ERSKINE W., MOUSTAFA A.T., OSMAN A. E., LASHINE Z., NEJATIAN A., BADAWI T., RAGY S. M., 2004- Date palm in the GCC countries of the Arabian Peninsula, International Centre for Agricultural Research in the Dry Areas (ICARDA).
- [6] FAO., 2003- Agro-Statistics Database. FAO: Roma.
- [7] GOMEZ K.W., GOMEZ A. A., 1984- Statistical procedures for Agricultural Research. 2nd edition. John Wiley and Sons. Inc. New York.
- [8] MORTON J., 1987- Date, In: Fruit of warm climates. Julia F. Morton, Miami, FL.p. 5-11.
- [9] RANGANNA S., 1979- Titratable acidity. In: Ranganna, S.(ED). Manual of Analysis of fruit and Vegetable Products. Pp.7-8.Tata McGraw Hill Publishing Company Ltd., New Delhi, India.
- [10] SOMOGYI M., 1952- Notes on sugar determination. Journal of Biological Chemistry, 195: 19-23.
- [11] TURLING T. C. J., TUMLINSON J. H., LEWIS W. J., 1990.- Exploitation of herbivore-induced plant odors by host-seeking parasitic wasps. *Science (Washington DC)* 250:1251-1253.
- [12] YEMM E. W., WILLIS A. J., 1954.- The estimation of carbohydrates in plant extracts by anthrone. *Biochemical Journal*, 57: 508-513.

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Table (1): The effect of *Rhynchophorus ferrugineus* on different cultivars of date palm fresh fruit in relation to fats, proteins, carbohydrates and ash.

Cultivars	%Contents			
	Fats	Proteins	Carbohydrates	Ash
Sammani	0.056±0.01 ^a	3.2±0.013 ^a	74.01±0.41 ^d	2.51±0.05 ^{ab}
Control	0.075±0.02	3.4±0.013	77.2±0.33	2.0±0.04
Hayyani	0.105±0.02 ^b	3.8±0.19 ^b	87.3±0.85 ^c	1.87±0.14 ^{abc}
Control	0.121±0.03	4.1±0.13	93.1±0.81	1.99±0.11
Zaghlol	0.120±0.01 ^b	3.4±0.01 ^b	93.8±0.52 ^a	1.94±0.11 ^{abc}
Control	0.143±0.01	3.9±0.01	98.9±0.41	1.42±0.21
Bent-asha	0.085±0.02 ^c	3.3±0.4 ^a	78.3±0.07 ^b	1.66±0.01 ^c
Control	0.099±0.02	3.8±0.3	82.4±0.03	1.21±0.04

* Means in a column followed with the same letter (s) are not significantly different at 5% level probability.

*(r) between fats, proteins, carbohydrate and ash -0.23, -0.69,-0.32,-0.11

Table (2) Physic-parameters of fresh fruits weight, diameters, length and approximate yield in relation to red palm weevil *Rhynchophorus ferrugineus* infestation (100 fruits used).

Cultivars	Physic-parameters			
	Weight "gr."	Diameter "mm"	Length "mm"	%Reduction in yield
Sammani	8.2±0.4 ^a	5.1±0.2 ^a	4.0±0.4 ^a	6.81 ^a
Control	8.8±0.3	5.4±0.4	4.3±0.3	
Hayyani	7.1±0.2 ^b	4.0±0.3 ^a	4.4±0.3 ^a	2.73 ^b
Control	7.3±0.1	4.2±0.1	4.6±0.3	
Zaghlol	9.5±0.2 ^b	4.3±0.3 ^a	6.1±0.3 ^a	3.06 ^b
Control	9.8±0.2	4.6±0.1	6.3±0.2	
Bent-asha	5.3±0.2 ^b	2.0±0.2 ^a	2.5±0.3 ^b	3.63 ^c
Control	5.5±0.1	2.2±0.1	2.6±0.3	
Total average	7.55	3.85	4.25	
Main control	7.85	4.1	4.45	

* Means in a column followed with the same letter (s) are not significantly different at 5% level probability.