Sensitivity of Some Date Palm Cultivars to Infestation with Lesser Date Moth *Batrachedra amydraula*

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Abstract: This study was carried out through 2018 to study the food preference of the lesser date moth *B. amydraula*. Four date palm (*Phoenix dactylifera* L.) cultivars (Barhee, Medhjoul, Khalas and Nabbut Seif) in date palm orchards in Sabkhat Al-Mouh, Palmyra, Homs governorate, Syria, through cooperation between the Central Laboratory for Research and Development of Date Palm, ARC, Egypt, the Arab center for the studies of arid zones and dry lands (ACSAD) and the Biological Control Research and Studies Center, Faculty of Agriculture, Damascus University, Syria. Five trees in each sampling date were randomly selected from each studied cultivar tests were monitored on bunches and the number of infected bunches was recorded of each palm cultivar tree and the number of infected trees were recorded. The numerical density of larvae or injury (Number of larvae / 100 strands), percentage of infection and the relationship between the number of fallen fruits as well as infested fruits and the number of larvae were recorded. The obtained results revealed that, the fallen fruits contained a number of larvae in different stages and there was a positive relationship between the number of larvae and the percent of fruits infestation differed according to the cultivar. The percentage of bunches infestation was higher in bunches of Medhjoul cv., (70.5%), followed by Nabbut Seif cv. (53.5%), while the lowest was Barhee cv. (16.6%). Medhjoul cv. recorded the highest infection rate in kimri ripening stage (73.2%) among the studied cultivars, followed by Khalas cv. (52.9%), Nabbut Seif cv. (50.9%) and Barhee cv. (42.1%). In addition, in the rutab ripening stages Medhjoul cv. was with the highest infection rate among the studied cultivars, the average infection was (5.7%); the second was Nabbut Seif (2.8%), Khalas (1.8%) and Barhee (1.7%). Estimation of the lesser date moth infestation was: too much infestation (Medhjoul and Khalas cvs.), much infestation (Nabbut Seif cv.) and mean infestation (Barhee cv.).

Key words: Lesser date palm moth • Bunch and fruits infestation • Date palm • Medhjoul

INTRODUCTION

The date palm, *Phoenix dactylifera* L. (Arecales: Arecaceae) is an important food and cash crop thriving well in hot arid [1]. It is believed to have originated in Mesopotamia (Iraq) where it has been cultivated some 6000 years ago [2]. The date palm has been carried out from Mesopotamia to other parts of the world [3]. Factors such as monoculture of date palm, global warming and unrestricted application of insecticides and global movement of date palm is planting materials have influenced the pest complex and its natural enemies [4]. A good example of this change is the lesser date moth *Batrachedra amydraula* Meyrick (Lepidoptera: Batrachedridae).

The lesser date moth is one of the most important pests that attack date palm trees in several countries [5]. It is a pest that damages fruits in both field sand stores [6]. Injury is inflicted by the larvae that spin a web around the fruits and attaches them to the strands or to other fruits, then it's enter the fruit near its sepals, or less frequently at other sites and feed on the pulp and immature seeds. When small fruits are infested its usually remain attached to the strand by silken threads. In their
first generation, the larvae infest several fruits before completing development, thus increasing the damage. Large fruits usually drop after being attacked. Heavily infested fruit bunches cease to grow and dry. Dates in stores may also be affected [6-9].

In Syria, this pest was recorded as a pest attacks date palm trees in different Oases. Bashher and Metwally [5] recorded that; *B. amydraula* was a frequent pest on the date palm in Homs, Palmyra, Deir Ezzor, Albukamal and Damascus. Infested trees ranged between 51% and 86% with a general mean 63%. There are no studies on the susceptibility of the different date palm cultivars to the infestation with the lesser date moth and the prevalence of this pest in different oases.

Therefore, the aim of this study is to determine the extent of the spread of this pest, the nature of the damage and its percentage of loss in yield for date palms cultivars (Barhee, Medhjoul, Khalas and Nabbit Seif) in Sabkhat Al-Mouh, Palmyra, Homs governorate, Syria.

**MATERIALS AND METHODS**

This study was conducted on four cultivars of date palms (Barhee, Medhjoul, Khalas and Nabbit Seif) in Sabkhat Al-Mouh, Palmyra, Homs governorate, Syria, during seasons (2018) through cooperation between the Central Laboratory for Research and Development of Date Palm, ARC, Egypt, the Arab Center for Studies of Arid Zones and Dry Lands (ACSAD) and the Biological Control Research and Studies Center, Faculty of Agriculture, Damascus University, Syria.

This study was conducted on four cultivars of date palms (Barhee, Medhjoul, Khalas and Nabbit Seif) to study the food preference of the lesser date moth *B. amydraula*.

To study the food preference of the lesser date moth *B. amydraula*, three variables were studied:

**Numerical Density of Larvae or Injury:** Five trees were randomly selected from each cultivar, three bunches were selected from each tree, of which ten strands were selected, randomly, followed by the selection of ten fruits from each strand and placed in special containers recorded the location, variety, fruit ripening stages, the date of collection, temperature, relative humidity and others. Samples were taken to the laboratory and was explained and examined by a (Binocular) and the severity of the injury was determined according to the following equation:

\[
\text{Severity of the injury} = \frac{\text{Number of larvae}}{100 \text{ strands}}
\]

**Percentage of Infection Fruits:** The percentage of infection fruits was determined according to fruit ripening stages {hababouk, kimri, khalal (sometimes named bisr), rutab and tamar}. Samples were randomly selected from five date palm trees of each studied cultivars. The samples were taken from beginning of each fruit ripening stage, where 10 fruits were taken from each tree for each cultivar and placed in special packages on which recorded the - cultivar - fruit ripening stage, the date of collection - temperature - relative humidity and others. The samples were taken to the insect laboratory, explained and examined by the Binocular.

The injury ratio was calculated by the following formula:

\[
\text{Injury ratio} = \frac{\text{Number of infected fruits in the sample}}{\text{Number of fruits in the sample}} \times 100
\]

**Larval Rate in Fallen Fruits and Percentage of Infection:** This study was conducted with the aim of finding a relationship between the fallen fruits on the ground, the percentage of infected fruits and the number of larvae in them for the purpose of use as a guide to the percentage of infection on the palm.

100 fallen fruits were taken on the ground from each palm (replicate) with five replicates and each was placed in a paper bag and brought to the laboratory where the infected fruits and that fallen for other reason were examined. The infected fruits were carefully dissected to determine the number of larvae in them. Samples were taken every ten days starting from the end of April until the end of July when the insect disappeared. All the falling fruits on the ground and around the trunk were cleaned to avoid overlapping with the falling for the subsequent period of sampling.

The relationship between the falling fruits on the ground, the percentage of infected fruits and the number of larvae in them was calculated using the straight line equation:

\[
Y = bx + a
\]

Y: Number of larvae / 100 infected fruit X: Percentage of infection a: Fixed coefficient, the value of the cut-off portion of the. DR axisb: Regression coefficient.

**Estimation of the Lesser Date Moth Infestation:** Lesser date moth infestation was estimated according to Machacek [10] as shown in Table (1).
Table 1: Estimation of the lesser date moth infestations

<table>
<thead>
<tr>
<th>Infestation quality</th>
<th>Selective code</th>
<th>Infestation amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>No infestation</td>
<td>0</td>
<td>0 percentage</td>
</tr>
<tr>
<td>Little infestation</td>
<td>1</td>
<td>0-25 percentage</td>
</tr>
<tr>
<td>Mean infestation</td>
<td>2</td>
<td>25-50 percentage</td>
</tr>
<tr>
<td>Much infestation</td>
<td>3</td>
<td>50-75 percentage</td>
</tr>
<tr>
<td>Too much infestation</td>
<td>4</td>
<td>Up to 75 percentage</td>
</tr>
</tbody>
</table>

Data Analysis: The Complete randomized design with three replicates was followed. Statistical analysis of the obtained data was carried according to Snedecor and Cochran [11]. L.S.D. test was used for comparing the data at the 5% level of probability.

RESULTS AND DISCUSSION

Numerical Density of Infested Bunches or Percentage of Injury: As shown in Table (2), the highest percentage of bunches infestation (70.5%) recorded with Medhjoul cv., followed by Nabbut Seif cv. (53.5%), while the lowest percentage (16.6%) found in Barhee cv. The results showed that the damage by this pest is differ from one cultivar to another, this agreed with the results obtained by El–Haidari [12].

Determination of the Percentage of Infested Date Palm with Lesser Date Moth *B. Amydraula* in Sabkhat Al-Mouh, Palmyra: Through the study of infection rate of lesser date moth on the studied varieties during five fruit recognized ripening stages, the result showed that the infection of *B. amydraula* starting during Hababok stage, Medhjoul cv. recorded the highest infection rate in kimri ripening stage (73.2%), followed by Khalas cv. (52.9%) with significant differences between them. While, no significant differences recorded among Khalas cv. (52.9%), Nabbut Seif cv. (50.9%) and Barhee cv. (42.1%). These results are harmony with Khalaf [13], which indicated that the infection of *B. amydraula* starting during Hababok stage and the highest infection rate was in kimri ripening stage.

Data in Table (3) obtained that, infection rate of lesser date moth on the studied varieties during kimri ripening stage.

In khalal ripening stage the results were different; Khalas cv. obtained the highest infection rate among the studied cultivars (22.8%), the second was Nabbut Seif cv. by average infection rate (14.2%) with significant differences between them, followed by Medhjoul cv. (14.2%) and Barhee cv. (3.7%) as shown in Table (4).

Data in Table (5) revealed that, in the rutab ripening stage, Medhjoul cv. was the highest infection rate (5.7%) among the studied cultivars, followed by Nabbut Seif (2.8%), Khalas (1.8%) and Barhee (1.7%).

Table (6) showed that, total infection percentage (%) of the lesser date moth *B. amydraula* on the studied cultivars during fruits ripening stage arranged descending from Medhjoul cv. (89%), Khalas cv. (77.5%), Nabbut Seif cv. (67.9%) to Barhee cv. (47.5%).

These results are harmony with Aziz [14], which indicated the difference in fruit infection percentage of insect according to fruit ripening stages and the highest infection rate was in kimri ripening stage. The same researcher pointed out a correlation between the weight and size of the fruit and the infection of the *B. amydraula*, where the weight and size of the fruit in the kimri ripening stage are less than in khalal ripening stage and rutab ripening stage.

Data in Table (7) cleared that, the highest percentage of infection date palm trees (92.2%) found in Medhjoul cv. in Sabkhat Al-Mouh followed by (81%) with no significant differences in between. While, the lowest percentage (55%) found in Barhee cv. followed by Nabbut Seif cv. (63.3%) with no significant differences in between. In this regard, Aljirradi and Bamiftah [15] pointed out that the infection rate of lesser date moth Batrachedra amydraula on the Hajri cultivar reached 100%. Also, Harhash et al. [16] who found that, in Egypt there were different rates of insect infestation for three date palm cultivars (Samani, Halani and Halawi), Samani cv. was the least affected (22.68%), followed by Hailani cv. (37.42%) and Halawi cv. (53.1%).

Larval Rate in Fallen Fruits and Percentage of Infection: The results showed that the fallen infected fruits contain a number of larvae of different ages. There was an increase in the number of fallen fruits compared with the total number of fruits. In addition, there was positive correlation between the total number of fallen fruits and the number of fallen fruits and the highest number of infested fallen fruits was in fruit ripening stage.

Concerning Medhjoul cv., the percentage of fallen fruits reached 58.64% of the total number of falling fruits. The results of the statistical analysis showed that, the correlation among the number of larvae, the percentage of infection and the correlation coefficient was $r = 0.982$ this means that 98% of the fall of the fruits is due to the infection of lesser date moth *B. amydraula* and the equation of the straight line is: $y = 1.309x + 43.166$. (Fig. 1).
Table 2: Percentage of bunches infestation for some date palm cultivars in Sabkhat Al-Mouh, Palmyra

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Number of tested trees</th>
<th>Percentage of bunches infestation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medjoul</td>
<td>100</td>
<td>70.5%a</td>
</tr>
<tr>
<td>Nabbut Seif</td>
<td>100</td>
<td>53.5%a</td>
</tr>
<tr>
<td>Khalas</td>
<td>100</td>
<td>23.5%b</td>
</tr>
<tr>
<td>Barhee</td>
<td>100</td>
<td>16.6%b</td>
</tr>
</tbody>
</table>

Means followed by the same are no significantly different (P ≤ 0.05)

Table 3: Percentage of infested date palm cultivars with lesser date moth *B. amydraula* at Kimri ripening stage in Sabkhat Al-Mouh, Palmyra.

<table>
<thead>
<tr>
<th>Temperature °C</th>
<th>Cultivars</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Relative humidity RH%</th>
<th>Percentage of infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Medjoul</td>
<td>25</td>
<td>40</td>
<td>34</td>
<td>73.2%a</td>
</tr>
<tr>
<td></td>
<td>Khalas</td>
<td>25</td>
<td>40</td>
<td>34</td>
<td>52.9%b</td>
</tr>
<tr>
<td></td>
<td>Nabbut Seif</td>
<td>25</td>
<td>40</td>
<td>34</td>
<td>50.9%b</td>
</tr>
<tr>
<td></td>
<td>Barhee</td>
<td>25</td>
<td>40</td>
<td>34</td>
<td>42.1%b</td>
</tr>
</tbody>
</table>

Means followed by the same are no significantly different (P ≤ 0.05)

Table 4: Percentage of infested date palm cultivars with lesser date moth *B. amydraula* at Khalal ripening stage in Sabkhat Al-Mouh, Palmyra.

<table>
<thead>
<tr>
<th>Temperature °C</th>
<th>Cultivars</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Relative humidity RH%</th>
<th>Percentage of infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.5</td>
<td>Medjoul</td>
<td>17</td>
<td>34</td>
<td>45</td>
<td>5.7%a</td>
</tr>
<tr>
<td></td>
<td>Khalas</td>
<td>17</td>
<td>34</td>
<td>45</td>
<td>1.8%b</td>
</tr>
<tr>
<td></td>
<td>Nabbut Seif</td>
<td>17</td>
<td>34</td>
<td>45</td>
<td>2.8%b</td>
</tr>
<tr>
<td></td>
<td>Barhee</td>
<td>17</td>
<td>34</td>
<td>45</td>
<td>1.7%b</td>
</tr>
</tbody>
</table>

Means followed by the same are no significantly different (P ≤ 0.05)

Table 5: Percentage of infested date palm cultivars with lesser date moth *B. amydraula* at rutab ripening stage in Sabkhat Al-Mouh, Palmyra.

<table>
<thead>
<tr>
<th>Temperature °C</th>
<th>Cultivars</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Relative humidity RH%</th>
<th>Percentage of infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Medjoul</td>
<td>17</td>
<td>34</td>
<td>45</td>
<td>92.2%</td>
</tr>
<tr>
<td></td>
<td>Khalas</td>
<td>17</td>
<td>34</td>
<td>45</td>
<td>81%</td>
</tr>
<tr>
<td></td>
<td>Nabbut Seif</td>
<td>17</td>
<td>34</td>
<td>45</td>
<td>63.3%</td>
</tr>
<tr>
<td></td>
<td>Barhee</td>
<td>17</td>
<td>34</td>
<td>45</td>
<td>55%</td>
</tr>
</tbody>
</table>

Means followed by the same are no significantly different (P ≤ 0.05)

Table 6: Infection percentage of the lesser date moth *B. amydraula* on date palm cultivars in Sabkhat Al-Mouh, Palmyra, during fruits ripening stages

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Infection percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medjoul</td>
<td>89%</td>
</tr>
<tr>
<td>Khalas</td>
<td>77.5%</td>
</tr>
<tr>
<td>Nabbut Seif</td>
<td>67.9%</td>
</tr>
<tr>
<td>Barhee</td>
<td>47.5%</td>
</tr>
</tbody>
</table>

Means followed by the same are no significantly different (P ≤ 0.05)

Table 7: Percentage of infection date palm trees in some date palm cultivars in Sabkhat Al-Mouh, Palmyra

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Total number of trees</th>
<th>Number of infested trees</th>
<th>Percentage of infested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medjoul</td>
<td>90</td>
<td>83</td>
<td>92.2%</td>
</tr>
<tr>
<td>Nabbut Seif</td>
<td>90</td>
<td>73</td>
<td>81%</td>
</tr>
<tr>
<td>Khalas</td>
<td>90</td>
<td>57</td>
<td>63.3%</td>
</tr>
<tr>
<td>Barhee</td>
<td>90</td>
<td>49</td>
<td>55%</td>
</tr>
</tbody>
</table>

Means followed by the same are no significantly different (P ≤ 0.05)
Fig. 1: The relationship between the total number of deciduous fruits and the number of fallen fruits infected with the lesser date moth *Batrachedra amydraula* of the Medhjoul cultivar

![Graph showing the relationship between total number of deciduous fruits and number of fallen fruits infected with lesser date moth](image1)

**Equation of the straight line:**

\[ y = 1.0309x + 43.166 \]

**R²:** 0.9656

Fig. 2: The relationship between the total number of deciduous fruits and the number of fallen fruits infected with the lesser date moth *Batrachedra amydraula* of the Nabbut Seif cultivar

![Graph showing the relationship between total number of deciduous fruits and number of fallen fruits infected with lesser date moth](image2)

**Equation of the straight line:**

\[ y = 0.8605x - 24.524 \]

**R²:** 0.9647

Fig. 3: The relationship between the total number of deciduous fruits and the number of fallen fruits infected with the lesser date moth *Batrachedra amydraula* of the Khalas cultivar

![Graph showing the relationship between total number of deciduous fruits and number of fallen fruits infected with lesser date moth](image3)

**Equation of the straight line:**

\[ y = 0.6536x - 19.076 \]

**R²:** 0.9405

Regarding to Nabbut Seif cv., the percentage of fallen fruits reached (54.14%) of the total number of falling fruits. The results of the statistical analysis showed that, the correlation among the number of larvae, the percentage of infection and the correlation coefficient was \( r = 0.982 \) this means that (98%) of the fall of the fruits were due to the infection of lesser date moth *B. amydraula* and the equation of the straight line is: \( y = 0.8605-24.524 \) (Fig. 2).
Fig. 4: The relationship between the total number of deciduous fruits and the number of fallen fruits infected with the lesser date moth *Batrachedra amydraula* of the Barhee cultivar

Concerning Khalas cv., the percentage of fallen fruits reached 41.89% of the total number of falling fruits. Results of the statistical analysis showed that, the correlation among the number of larvae and the percentage of infection and the correlation coefficient was $r = 0.969$ this means that 96.9% of the fall of the fruit is due to the infection of lesser date moth *B. amydraula* and the equation of the straight line is: $y = 0.6536x - 19.076$ (Fig. 3).

Concerning Barhee cv., the percentage of fallen fruits reached 24.285% of the total number of falling fruits. The results cleared that the correlation between the number of larvae and the percentage of infection and the correlation coefficient was $r = 0.986$ this means that (98.6%) of the fall of the fruit is due to the infection of lesser date moth *B. amydraula* and the equation of the straight line is: $y = 0.3473x - 6.3962$ (Fig. 4).

This results were agree with El-Haidari [12, 17] stated that there were positive correlation between the fallen fruits and infection with lesser date moth *B. amydraula* and the percentage of fallen infected fruits is differed according to the variety, with note that there is a natural physiological fall occurs to the fruits of palm Particularly in kimri ripening stage. In this regard, Al-Jorany and Al-Delamy [18], pointed out the relationship between the fallen fruits and the number of insect larvae on the Zahidi and Khastawi cvs. They found that, the fallen fruits contains a number of larva with different stages and there was a positive relationship between the number of larvae and the percent of fruits infestation and that the infection appeared at the beginning of May.

These results are agreement with Aziz [14] who found that, there are significant differences in thedegree of infestation of different palm varieties in Iraq with this insect, ranging from Too much infestation in Khistawi and Zahidi cultivars and to the resistance in Sayer and Al-Buraim cultivars. On the other hand, results showed that, there was no relationship between water content. There was a direct correlation between the low sugars in the cultivars in general and the percentage of infection. In addition, Al-gorabii and Ba-Angood [19] determined the sensitivity of nine Omani palm cultivars to infection with lesser date moth *B. amydraula*, they found that the Medhjoul cv. was the most sensitive species to infest by the insect and the percentage of infested was 80%. Algebraic cv. was the least susceptible to infection with *B. amydraula*, where the infection rate did not exceed 7%. The cultivars of Bernie, Abu Naranja, the Khalas Oman and the Khalas Al-Zahera were moderate sensitivity to infection varieties ranged from 35 to 50%.

**CONCLUSION**

Estimation of the lesser date moth infestation divided to:

- Too much infestation: Medhjoul and Khalas cvs.
- Much infestation: Nabbut Seif cv.
- Mean infestation: Barhee cv.

So, Barhee had the lowest value numerical density of infested bunches or percentage of injury (16.6%) as compared with Khalas cv. (23.5%), Nabbut Seif cv. (53%) and Medhjoul (70.5%).

- Through five fruit recognized ripening stages, it found that the studied date palm cultivars at Kimiri, Khalal and Rutab ripening stages differed in the infestation percentages of the lesser date moth;
Barhee cv. had the lowest than Nabbut seif, Khalas and Medhjoul cvs. Therefore, Barhee cv. was more tolerable to the infestation than the other three cultivars.

REFERENCES