

## Study of Damage of *Ectomyelois ceratonia* in three Pomegranate Cultivars

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**ABSTRACT:** Carob moth (*Ectomyelois ceratonia* Zell Lepidoptera: pyralidae) is the most important reason of the quantitative and qualitative reduction of pomegranate (*Punica granatum*) yield all over pomegranate cultivation regions of Iran like Isfahan province. Isfahan province with 7620.5 hectare pomegranate orchards is in third place of pomegranate production (after Fars and Markazi provinces) in Iran, and following cultivars are the most important cultivars in Isfahan: Naderi, Ravandi, red aril soursweet, Shahvar sweet, Ameneh Khatooni and Zaagh shirin. The carob moth damage was studied for three cultivars (red aril soursweet, white skin sweet and red skin sour) in five regions (Natanz, Koochpayeh, Shahreza, Rooran and Najafabad) during the 2010 year. In order to determine tolerant cultivars and damage levels of this pest in Isfahan province, primary sampling was conducted to define required sampling number and 60 tree numbers distinguished as required sample. Then 60 trees of each cultivar were selected randomly from orchards of each region which had same aged trees of all three cultivars and larger than five hectares, infected and non-infected fruits were counted and recorded. According to the results, regions and cultivars had highly significant ( $p < 0.01$ ) effect on infection rate and Natanz had the highest infection whereas Najafabad showed the least and also sour cultivar showed the highest infection whereas sour sweet cultivar had the least.

**Keywords:** Carob moth, pomegranate, *Ectomyelois ceratonia*, *Punica granatum*.

### INTRODUCTION

Large parts of our country located in the central desert (Kavir desert and Loot desert) have dry and semitropical weather and pomegranate tree has a specific importance in this region. Then, pomegranate cultivation has had special prosperity in central desert margins from old times and has a considerable cultivation area, cultivar diversity, crop yield and quality (Behzadi shahrehabaki., 1998). The main pomegranate cultivation centers of Iran considering cultivation area are provinces: Fars, Markazi, Isfahan, Khorasan, Yazd, Kerman, Semnan, Kermanshah, Tehran, Bakhtiari, Sistan and Baluchistan, Khouzestan, Lorestan, Mazandaran, Zanjan, Kohgiluyeh Boyer-Ahmad, Azarbaijan Sharghi, Gilan, Hormozgan, Boushehr, Ilam, Azarbaijan Gharbi, Kurdistan. Pomegranate is in third place (after apple and grape) in Isfahan province (Annual Agricultural report., 2002) and Kashan, Ardestan, Natanz, Shahreza, Naein, Najafabad and Isfahan are main regions of pomegranate production. Carob moth is the most important reason of pomegranate qualitative and quantitative reduction all over the country. This pest is polyphage and attacks to fig-tree and pistachio too. This pest eats internal tissues of fruits and makes an entrance of fungi and bacteria easier that will follow by fruit decaying. There are various statistics about damages of this pest which are sometimes exaggerated. Rahmani et al. (1998) estimated it about 50% in Khorasan province whereas Shahrokhi & Zare' (1998) reported that yield loss could be up to 80% in appropriate situations. But the fact is high variation of this moth in different years and cultivars. For example decaying of Gabri cultivar could reach to 90%, whereas infection of Isfahani (black aril) could rarely exceed by 20% (Shakeri., 1992), or Bright cultivar loss was over 50% whereas Atabaki cultivar had 15-30% infection (Kashkoui and Eghtedar., 1975). The results of this study will be a standard to select the best cultivars for decreasing the damage of carob moth.

## MATERIALS AND METHODS

In order to damage evaluation of three important pomegranate cultivars of Isfahan province, sampling was done from July late in September of 2010. cultivars were *sour sweet with red aril*, *white skin sweet*, *red skin sour*, and regions were *Rooran*, *Koohpayeh* (both from Isfahan township), *Najafabad*, *Shahreza*, and *Natanz*.

### Some of cultivars properties

- 1- Red skin sour (summer cultivar): average fruit size, reddish-pink colored thin skin, big arils with bright red to pink color, sour taste and juicy arils, not good for storing.
- 2- Sour sweet with red aril: this cultivar is the most known in Saveh. Not tall, very productive, with large and average sized fruits, red colored aril, thin skin and sour sweet delicious taste, the cultivar is late mature and fruits can be stored for a long time.
- 3- white skin sweet: large fruits, yellow skin, average arils with red to pink color, sweet taste and fairly big seeds. Area selecting was done according to distance from province center and the existence of many orchards, so that Natanz was located in the north, Koohpayeh in east, Najafabad in the west, Shahreza in south and Rooran was almost in the center of the province, and all of them were poles of pomegranate production. Some of geographical specifics of these regions are mentioned in table 1.

Most of the pomegranate orchards of mentioned regions have various cultivars which are planted disorderly. Orchards larger than five hectares with all three cultivars were selected to uniformity and possibility of sampling generalization.

### Primary sampling

In order to determine required samples for study, we did primary sampling and five trees of each cultivar were selected, then infected and non-infected fruits of each tree were counted and required sample number was calculated using following formula (required sample calculating formula for one difference in ratios and groups with the same size) (Whitley and Ball., 2002):

Which  $P_1$  and  $P_2$  are proportions in two groups, and  $C_p$  power constant is:

$$C_p, power = (Z_{\alpha} + Z_{1-\beta})^2 = 7.84888$$

$$\alpha = 0.05$$

$$\beta = 0.2$$

Number 58.21 was obtained for  $t_1$  in this study, and then 60 samples for each cultivar were studied. After selecting the orchard, sampling was done in garden diameters (every five meters) because of the disorder cultivation of trees and we tried to cover all orchards for sampling. 60 trees for each cultivar were defined and their fruits (infected and non-infected) were counted and recorded in a table. Data analysis

Infection percentage data was converted by *Arc sin* formula:

$$\text{Arc sin} = \sin^{-1} \sqrt{0.01 * p}$$

$p$  = Infection percentage

Analysis of data was performed using M stat-c program and where f-value was found to be significant, Duncan's multiple range test was used to compare treatment means at  $p=0.01$ . Excel program was used to graph drawing.

Table 1. geographical specifics of study regions

Regions	Latitude	Longitude	Elevation
Isfahan	32-38	32-39	1570
Koohpayeh	42	52	1778
Najafabad	35	51	1655
Shahreza	42	51	1570
Natanz	33	51	1778

**RESULTS AND DISCUSSION**

Variance analysis results are shown in table1. According to the results, regions had highly significant ( $p < 0.01$ ) effect on infection rate (table2).

Then various regions of study didn't have equal infection and showed significant difference. Mean comparisons showed that the high infection (9.34%) was belonged to Natanz whereas Najafabad had the lowest infection (5.44%), although there was no significant difference between Koohpayeh (5.56%) and this region. (Table3 and Figure1).

The reason may be ecological and climatic specifics of regions. Natanz is warmer than regions like Najafabad (Agricultural report., 2008), that causes relatively temperate winters too. Probably, weather of this township increased pest generations and caused significant difference but regions with dry and cold winters like Koohpayeh, had less infection because the bad climate of winter has affected overwintering of pest and decreased pest population (Annual agricultural reports., 2008). On the other hand, not considering sanitation of orchards helped the infection apparently and because there isn't enough in manpower Natanz and similar townships for collecting all fruits from trees and the ground, pests find a good place for overwintering and reproduction, (Shojaei et al., 1987). Allzi (1985) reported also that the highest rate of damage was observed in orchards with low sanitation and cleaning. There was highly ( $p < 0.01$ ) significant difference between infection of cultivars (table1) and mean comparison showed that cultivar with sour taste had the highest infection (9.83%), whereas the least infection (5.2%) was observed in sour sweet cultivar (Table2 & Figure2), although there was no significant difference between sweet cultivar and this cultivar. The reason of differences between pomegranate cultivars may be variety in their internal properties. Apparently, skin of sour cultivar's fruit cracks in ripening time more than the others, and then insect can enter easier and lay its eggs inside the fruit. On the other hand, sour sweet cultivar reaches for maturity later than the other cultivars that can be the reason of its less infection and being healthier. In conducted researches on cultivars of various regions, the sour sweet pomegranate of Saveh has known as the best cultivar which is recommendable from shape, taste and storing ability aspects. So, this cultivar has been the luckiest cultivar in the home market and worldwide markets (Shakeri., 2007).

Interaction of regions and cultivars was significant (table1) and mean comparison showed that the highest infection was belonged to Rooran and sour taste cultivar whereas sour sweet cultivar in Koohpayeh had the least infection (table4).

Table2. Variance analysis of experimental data

Source of Variation	P	F	SS	Df	Mean of squares
					Infection
Region	< 0.001	4.9	0.27	4	0.067**
Cultivar	< 0.001	53.7	1.46	2	0.730**
Region * Cultivar	< 0.001	13.2	1.43	8	0.179*
Error			12.04	885	0.014
Total				89	

\* and \*\* are significant at 5% and 1% probability levels, respectively

Table3. Mean comparison of infection rate for various treatments

NO		Infection(Percent)
Region(A)		
1	Shahreza(A1)	6.27 <sup>c</sup>
2	Najafabad(A2)	5.44 <sup>d</sup>
3	Rooran(A3)	7.59 <sup>b</sup>
4	Koohpayeh(A4)	5.56 <sup>d</sup>
5	Natanz(A5)	9.34 <sup>a</sup>
Region(B)		
1	Sour(B1)	9.83 <sup>a</sup>
2	Sweet(B2)	5.28 <sup>b</sup>
3	Soursweet(B3)	5.20 <sup>b</sup>
Interaction(A*B)		
1	A1B1	8.94 <sup>cd</sup>
2	A1B2	3.72 <sup>de</sup>
3	A1B3	6.22 <sup>ef</sup>
4	A2B1	6.94 <sup>gh</sup>
5	A2B2	4.66 <sup>gh</sup>
6	A2B3	5.67 <sup>h</sup>
7	A3B1	13.50 <sup>b</sup>
8	A3B2	4.49 <sup>bc</sup>
9	A3B3	4.42 <sup>cd</sup>

10	A4B1	8.93 <sup>efg</sup>
11	A4B2	5.14 <sup>efg</sup>
12	A4B3	2.69 <sup>gh</sup>
13	A5B1	9.67 <sup>a</sup>
14	A5B2	9.85 <sup>ab</sup>
15	A5B3	8.22 <sup>ab</sup>

There is no significant difference between means which have one common letter at least

Table4. Mean of infection percentage in various regions and cultivars of Isfahan

Regions Cultivar	Najafabad (A2)	Koohpayeh (A4)	Shahreza (A1)	Rooran (A3)	Natanz (A5)	Mean
Sour sweet (B3)	5.67 ↘	2.69 ↗	6.22 ↘	4.42 ↗	8.22	5.20
Sweet (B2)	4.66 ↗	5.14 ↘	3.72 ↗	4.49 ↗	9.85	5.28
Sour(B1)	6.96 ↗	8.93 ↗	8.94 ↗	13.50 ↘	9.67	9.83
Mean	5.44	5.56	6.27	7.59	9.34	

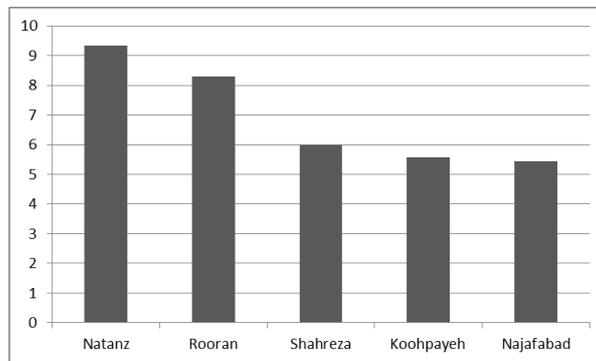


Figure1. Difference between infections of studied regions

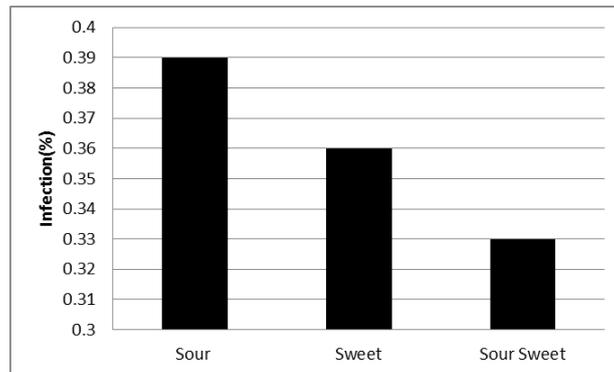


Figure 2. Infection percentage of various pomegranate cultivars

### CONCLUSION

Considering the results of this study, Natanz Township showed the highest infection to carob moth which was because of its appropriate weather for producing more generations of this pest. Plus that, not observing sanitation by farmers is the other reason. But, in other regions like Koohpayeh, because orchards are not large, farmers can check them better and spray pesticide if is necessary, then infection will be less. On the other hand, Sour cultivar is sensitive to fruit skin cracking too, which makes pest entrance and infection prevalence easier. Therefore, considering the results of this study, appropriate weather condition for producing more pest generations and also fruit properties like early maturity and sensitivity to skin cracking can be two main reasons for infection increase.

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