



RESEARCH PAPER

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Effect of fresh gum of assafoetida on the damage reduction of pomegranate fruit moth, *Ectomyelois ceratoniae* (Lep., Pyralidae) in Shahreza City

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Abstract

The *Ectomyelois ceratoniae*, Carob moth is one of the key pests of pomegranates in Iran. Pomegranate orchards in Shahreza city (Isfahan province) are the host of this pest. Synthetic insecticides can not be used for the control of carob moth because they have biological and behavioral traits. The fresh gum of *Ferula assafoetida*, a medicinal plant, was examined in two pomegranate orchards to control of this pest. In each orchard 30 trees were treated by fresh gum of *Ferula assafoetida*. The number of rotten fruites were counted and eliminated every 10 days. The percentage of carious fruites were calculated in the whole of farming season. Independent sample t-test showed significant differences between treatment and control plots. Percentage of rotten pomegranates of treatments was lower than control. Comparison of control and treatment plots data showed lower damage in treatment. Asafoetida fresh gum offers a nonchemical means of pest management.

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Introduction

The carob moth, *Ectomyelois ceratoniae* Zeller (Lepidoptera: Pyralidae) is a major fruit pest in the Mediterranean basin and Near East regions (Al-Izzy *et al.*, 1985; Gothilf, 1969, 1970, 1984; Al-Maliky and Al-Izzy, 1986). It has been reported on many crops (Farzaneh, 1987; Mehrnejad, 1992). In Iran it is the key pest of pomegranate and it spoils great damages to this crop annually (Peyrovi *et al.*, 2011; Goldansaz *et al.*, 2012; Kishani Farahani and Goldansaz, 2013; Soufbaf *et al.*, 2013). The damage can at times reach up to 80% (Ahmadian, 1997). The chemical control against carob moth is not effective because its larvae feed and develop inside fruit (Mediouni *et al.*, 2004). In the other hand Insecticides are not used against the insect in Iran because: 1) Spraying with insecticides kills the natural enemies. 2) The population of *Tenuipalpus* species increases after using insecticides. 3) Pomegranate trees are very sensitive to poisons (Karami *et al.*, 2011). So, nonchemical methods recommended.

There are some nonchemical methods to control of this pest that are used in Iran. One of these ways is the mechanical methods that are important and researchers focus on this subject. According to Shojai, Esmaili and Najafi (1955), Kashkooli and Eghtedar (1975), Shakeri (1992) and Shahrokhi and Zare (1994) collecting infected pomegranates on and under the trees is the best mechanical way to control of this pest. Filling the crown of the pomegranate with mud is an economic and safe method that is recommended (Mirkarimi, 1999). Stamens elimination (Sheikhali *et al.*, 2009) and using of net cover (Taki *et al.*, 2014) are suggested too.

The other way is the biological methods such as using of egg parasitoids for control of this pest (Noori *et al.*, 1993; Nasrollahi, 1998). Due to the fact that the aforementioned methods to control this pest are not enough only as well as these methods are not able to control this pest thoroughly, without a doubt, using efficient non-chemical methods that have the necessary functionality to the integrated control of this pest are needed. Moreover, with regard to the fact

that few studies have been done on the use of biorational products to control this pest so far, the need for the present study seems to be necessary in order to enlighten existing ambiguities.

Asafoetida, is an oleo-gum-resin obtained from the exudates of the roots of the Iranian endemic medicinal plant, *Ferula assafoetida* L. (Apiaceae). *F. assafoetida* grows wildly in the central and southern mountains of Iran. The oleo-gum-resin asafoetida is called "Anghouzeh", "Khorakoma" and "Anguzakoma" in Iran (Kajimoto *et al.*, 1989; Sefidkon *et al.*, 1998; khajeh *et al.*, 2005; Iranshahi and Iranshahi, 2011).

Asafoetida is used for repelling insects (Kajimoto *et al.*, 1989; Sefidkon *et al.* 1998; Peyrovi *et al.*, 2011,) because of having disulfide compounds (Kajimoto *et al.*, 1989). In Iran Barkhordar (2006), Peyrovi *et al.*, 2011 and Goldansaz *et al.*, 2012, studied the essential oil of Asafoetida as adult carob moth repellent. Pomegranate is an ancient fruit originated in South-west Asia, probably in Iran and some adjoining countries (De Candolle, 1967). One of the most pomegranate cultivation centers of Iran is Shahreza, Isfahan province (Hashemi Fesharaki *et al.*, 2011).

In this survey, we investigate the effect of *F. assafoetida* fresh gum on inhibition of carob moth damage in the pomegranate orchards of Shahreza city, Isfahan province, Iran.

Materials and methods

Select of orchards for experimental application

In the summer of 2013, two pomegranate orchards, as treatment and control were considered in vicinity of Shahreza city, Isfahan province, Iran. Each orchard had about 1000 meters area and they were approximately two kilometers far from each other. The orchards had same conditions such as irrigation period and system, variety of pomegranate, distance of culturing rows and etc.

Choose the treatments and collecting the data

In both orchards, trees of first and second culturing rows were left as marginal area. From third to last

row, the selected trees were numbered from 1 - 30 with ribbon bars. In the early summer that fruits were the size of walnuts, 2 gr of the fresh gum of asafoetida were placed in the net pockets with 5×10 centimeters dimension (Fig.1).

The pockets were hanged with a thread in the among zone of labeled trees with about 1.5 m height. All the processes were the same in control orchard, but only asafoetida was not used. During the growing season, in treatment and control orchards, the number of rotten fruits that fell to the ground were counted and removed every 10 days. Moreover the percentage of rotten fruits at the harvested time was calculated.

Softwar uses for statistical analyze

To determine the statistical significance for the experiments, data were analyzed by independent sample t-test with SPSS 16.0 software.

Results and discussion

Infection analyze

Results of t-test expressed that there are significant differences ($T=2.951$, $df=358$, $P=0.003$) in data, between treatment and control orchards. During the season average of rotten pomegranates in treatment orchard was significantly fewer than control (Fig 2). The average number of rotten fruits in control orchard, on 17 August was the largest number and on 26 September and 6 October were the lowest number. The largest number of rotten fruits in treatment orchard was on 16 September and the lowest number was on 7 August. Similarly, the percentage of rotten fruits on trees was counted at the end of season; amount of damage in treatment plot was significantly less than the control (Fig 3). The highest level of infection was observed in control with 9.01%. While the percentage of rotten fruites in treatment was 3.70%. Obviously, these values indicate that fresh gum of asafoetida has decreased the damage of carob moth approximately up to 2.5-fold.

Discussion

Based on these results fresh gum of asafoetida reduced effectivly fruit infestation by carob moth,

Ectomyelois ceratoniae. Some studies on effects of asafoetida essential oil on carob moth was performed by Barkhordar (2006), Peyrovi *et al.* 2011 and Goldansaz *et al.* 2012. Barkhordar (2006) clarified the repellency and mating disruption of asafoetida essential oil on the carob moth under laboratory conditions. Survey of Peyrovi *et al.* 2011, showed decrease in carob moth contamination in treatment plot under field conditions. They stated that disruption in pest reproduction behavior and repellency effects of asafoetida essential oil led to reduction of damage of this pest. In according to Goldansaz *et al.* 2012, essential oil of *F. assafoetida* significantly reduced the rotten fruits in treated plots during the growing season under field conditions. They counted reasons similar to Peyrovi *et al.* 2011 for the reduction of damage to pomegranates by asafoetida. These results agree with our findings and prove that *F. assafoetida* has some compounds with repellent effect that decrease attack of carob moth to pomegranate fruits. Also disruption in pest reproduction behavior by asafoetida is undeniable. A study on insecticidal effect of *F. assafoetida* extracts on *Ephestia kuehniella* L. and *Tribolium castaneum* Herbst was performed by Nazemi (2002). Results of that research showed high repellent activity of Asafoetida extract on *E. kuehniella* and *T. castaneum*. These results are compatible with our conclusions.

Results of this study showed that using of fresh gum of asafoetida remarkably reduced the damage of carob moth in the pomegranate orchard. On the other hand, preparation of fresh gum of asafoetida is easier than its' essential oil. Using of fresh gum of asafoetida next to the other ways of control of carob moth that mentioned in this paper is very effective.

Of course this is the first study on effect of fresh gum of asafoetida on carob moth in pomegranate orchards of Shahreza city. Reducing the risks associated with pest management tactics like pesticides in plant protection is the challenge of pest control for the twenty-first century. In this way, using of biorational control methods in integrated pest management are consequential. Fresh gum of *F. assafoetida* is a safe

botanical matter for human health that has not adverse effects of synthetic pesticides. Although effects of fresh gum or essential oil of *F. assafoetida* on insect natural enemies have not been studied completely, till now. Supplementary studies on effects of fresh gum and essential oil of *F. assafoetida* on biological characteristics of insect natural enemies especially parasitoids of carob moth are suggested. As a result we offer using of fresh gum of *F. assafoetida* as a part of integrated pest management programs to control of carob moth.



Fig. 1. Fresh gum of asafoetida in the net pockets with 5×10 centimeters.

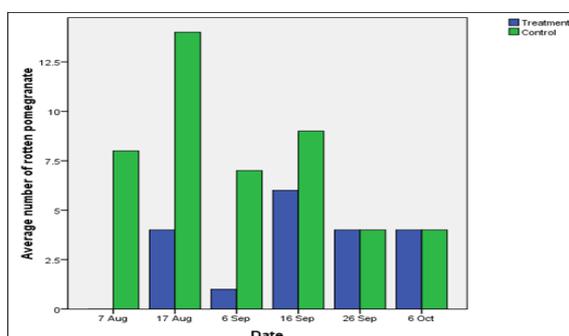


Fig. 2. Average numbers of rotten pomegranates in treatment and control orchards during the season (2013).

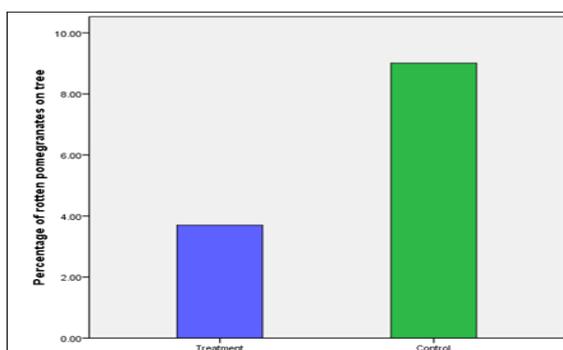


Fig. 3. Percentage of rotten pomegranates on trees in treatment and control orchards at the end of the season (2013).

Conclusion

The carob moth, *Ectomyelois ceratoniae* recognized as the most economically damaging pest of pomegranate in Iran. The damage by this pest can at times reach up to 80%. In many regions around the world it also damages many other high value nut and fruit commodities such as almonds, pistachios and dates. Fresh gum of *Ferula assafoetida*, a medicinal plant, was utilized to control of this pest. To achieve this objective, two pomegranate orchards were chosen for treatments. The results of research showed that there was a significant difference between the treatment and control. Percentage of rotten pomegranates of treatments was lower than control. Comparison of control and treatment plots data showed lower damage in treatment. The reduction in pomegranate damage may be through the repellent effect of fresh gum on the adult carob moth, or a disruption of reproductive behavior of the adult by fresh gum was happened. Finally using of fresh gum of *F. assafoetida* can be proposed in the integrated pest management programs to control of this pest.

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