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Repellent Effects of Essential Oil from *Simmondasia chinensis* (Link) against *Oryzaephilus surinamensis* Linnaeus and *Callosobruchus maculates* (Fabricius)

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ABSTRACT

Essential oils from seeds of jojoba, *Simmondasia chinensis* (Link) grown in Kerman (South-eastern part of Iran) were obtained by steam distillation, and was used for efficacy on the repellency of two important stored products insects, *Oryzaephilus surinamensis* Linnaeus (Coleoptera: Cucujidae) and *Callosobruchus maculates* (Fabricius) (Coleoptera: Bruchidae). The purity of used essential oil was 0.97 and the experiments were done at 0.2 ml concentration at 30 replications, by using y-shape olfactometer and Loschiavo, (1952) methods. Data processing was conducted by the SAS system. The results indicated that the repellency of jojoba oil was 21.41 ± 3.44 and 11.07± 4.01 for *C. maculates* and 18. 75±0.31 and 12.74±1.28 for *O. surinamensis* by using y-shape olfactometer and Loschiavo methods, respectively. To compare, no significant differences were observed between the effect of seeds oil on two tested pest species and different methods of experiments. These observations confirmed that the essential oils that are extracted from jojoba leaves have more repellency effectiveness.

Key words: *Oryzaephilus surinamensis, Callosobruchus maculates,* Jojoba oil, Repellency

Essential oils have potential for use as insecticides and repellent against stored products insects (Shaaya *et al*., 1991; Liu and Ho, 1999). During the past few decades, application of synthetic pesticides to control agricultural pests has been a standard practice. However, with growing evidence that many conventional pesticides can adversely affect the environmental requirements for safer means of pest management have become crucial (Rozman *et al*., 2007). *Simmondasia chinensis* (Link) (jojoba) is a semi-arid evergreen shrub. The plant is cultivated in some parts of the middle-east and Latin-American countries (Habashy *et al*., 2005). Jojoba seeds are containing of some unique glucoside compounds that can cause food-intake inhibition and repellency effect for the stored products pests (Bellirou *et al*., 2005). The two important stored products pests, *Oryzaephilus surinamensis* Linnaus and *Callosobruchus maculates* (Fabricius) are known as the most harmful pests in storages and the application of chemical pesticides apart from environmental concerns may not be sufficiently effective because of the poison residue and insects resistancy. Therefore, it seems that we need some new safe supplements for their preservation. Therefore, the objective of this investigation was to explore the repellency of the essential oil extract from jojoba seeds against the two mentioned stored grains pests.

MATERIALS AND METHODS

Extraction of essential oils:

Seeds of *S. chinensis* were collected from an experimental farm at university of Kerman (South-western part of Iran) in October 2007. Hydrostillation was carried out for 14 hours in a modified Clevenger apparatus in laboratory of University of Tehran. The extracted essential oil was stored at 5 ºc.

Insects:

Adults of *O. surinamensis* and *C. maculates* were obtained from the same aged cultures, kept on artificial diet of wheat flour and beans at a constant temperature of 30 ºc and darkness (24 hours) in the laboratory of College of Abouraihan, University of Tehran.

Repellency bioassay:

Extracts were mixed with wheat and beans diet at 0.2 ml of jojoba oil. The repellency effect was examined by using a glass Y-tube olfactometere and Loschiavo, (1952) methods, for treated and untreated replications. In order to investigate on oil repellency effect, 30 newly emerged adult beetles of the both tested species were released with a fine brush within the first centimeter of the base tube at 30 replications. After 3 and 24 hours, the number of insects presented at each dishes was counted for the two mentioned methods.

Data analysis:

The data was analyzed using SAS soft ware (SAS institute, 1999). Significant differences were identified by using Duncan's tests.

RESULTS AND DISCUSSION

Table 1: The results of repellency effect of the essential oil with mean and standard error

Species	Repellency values
C. maculates (1)	21.41 ± 3.44 [a]
O. surinamensis (1)	18.75 ± 0.31[a]
C. maculates (2)	11.07± 4.01[a]
O. surinamensis (2)	12.74 ± 1.28 [a]

Means in the same column followed by the same letters are not significantly different ($p< 0.05$)

The insect's repellency effects of jojoba essential oil against *C. maculate* and *O. surinamensis* using y-tube olfactometer (1) and Loschiavo (2) methods are summarized in Table-1 and Figure-1.

The results indicated that the repellency values for the both tested species were not significantly different for none of the experimental methods, that is in accordance with Habashy *et al*., 2005. *C. maculates* and *O. surinamensis* didn't show a high susceptibility to the extracted compound. The percentage of repellency effect for the essential oil was 21.41 and 11.7% for C. maculates, using y- shape olfactometer and Lashiavo methods, respectively.

To compare the repellency percentage was 18.75 and 12.74% for *O. surinamensis*, using above mentioned methods. Furthermore, according to Duncan's grouping, the differences were not significant for the both species and experimental methods. These type of investigations have been constructed for our tested species and other stored products pests by using another plant's extractions. For example Lee *et al*., 2004 have tested the fumigant toxicity of essential oils from 42 species of Myrtacea on three important storage pests including, *Tribolium castaneum* (Herbst), *Rhyzoperta dominica* Fabrisius *and Sitophilus oryzae* Linnaeus. The efficiency of *Ocimum basilicum* and *O. gratissimum* oils against *C. maculates* was studied by Keita *et al*., 2001. Their results indicated that these two essential oils have a high efficacy on the pest mortality (70%) that is considerably higher than our records. Negahban *et al*., 2007 were reported the high susceptibility of *C. maculates* to *Artemisia sieberi* Besser essential oil, previously.

Studies have not been reported previously concerning the activity of jojoba seeds essential oil as a repellent on these two species. In general according to our data the extracted oil was considerably less efficacious (2-3 times) than that was recorded by Abbasy *et al*., 2007, for its repellency and anti-feeding effect against *Spodoptera littoralis* Boisduval.

Plants essential oils have potential as products for some important stored products pests such as *C. maculates* and *O. surinamensis* control because some of them are selective and have a little or no harmful effects on non- target organisms (Ismen, 2001). The toxic effect of *S. chinensis* could be attributed to major constitutes such as petroleum ether, diethyl ether and ethanol extracts (Bellirou *et al*., 2005). Conclusively, our results indicated that the essential oil extracted from jojoba seeds didn't show potent repellency and anti-feeding toxicity against *C. maculates* and *O. surinamensis* to compare with the essential oil extracted from its leaves that was confirm by Bellirou *et al*., 2005, previously.

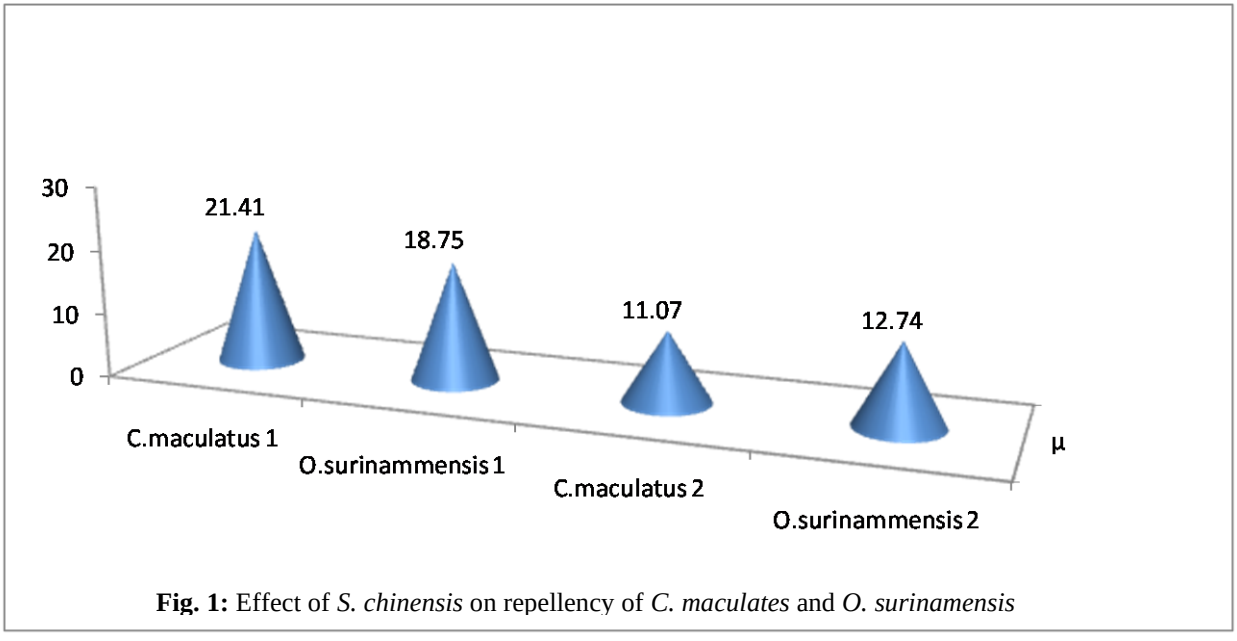

Fig. 1: Effect of *S. chinensis* on repellency of *C. maculates* and *O. surinamensis*

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