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**ACTIVITE ANTIAPETTANTE D'EXTRAITS DE PLANTES DE LA FAMILLE DES LAMIACEAE**

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**RÉSUMÉ**

*Marrubium vulgare* L. et *Origanum glandulosum* Desf. (Lamiaceae) sont deux plantes médicinales de large utilisation. L'extrait acétonique des parties aériennes de ces plantes est obtenu au Soxhlet. Le test d'antiappétance a été conduit avec ces extraits sur trois insectes herbivores *Spodoptora littoralis*, *Myzus persicae* et *Rhopalosiphum padi* au 3<sup>ème</sup> stade larvaire. Un effet antiappétant potentiel a été manifesté par l'extrait de *M. vulgare* contre *S. littoralis* (95,5 %) alors que le taux d'inhibition de colonisation par les insectes (*M. persicae* et *R. padi*) était modéré. A l'opposé, le premier effet évalué pour l'extrait de *O. glandulosum* était modéré (50,33 %) alors que le dernier était important.

Mots-clés : *Marrubium vulgare*, *Origanum glandulosum*, antiappétant, extraits, insectes.

**ABSTRACT**

**ANTIFEEDANT ACTIVITY OF EXTRACTS FROM LAMIACEAE FAMILY PLANTS**

*Marrubium vulgare* L. (Lamiaceae) and *Origanum glandulosum* Desf. are largely used medicinal plants. Acetone extract of the aerial parts of these plants were obtained using a Soxhlet apparatus. The antifeedant assay was assessed on three herbivorous insects *Spodoptora littoralis*, *Myzus persicae* and *Rhopalosiphum padi* third instar larvae using this extract. A potent antifeedant effect was exhibited with *M. vulgare* extract against *S. littoralis* (95,5%) whereas the percent settling inhibition of insects (*M. persicae* and *R. padi*) was moderate. In contrast, when determined for *O. glandulosum* extract, the former effect was moderate (50,33%) and the latter was important.

Keywords: *Marrubium vulgare*, *Origanum glandulosum*, antifeedant, extracts, insects.

## Introduction

Lamiaceae species form one of the largest families in the plantae kingdom with numerous aromatic and culinary species. *Marrubium vulgare* L. and *Origanum glandulosum* Desf. are medicinal plants belonging to this family. They are largely used in folk medicine to cure several pains such digestive disorders, rheumatism and cough. Many works dealt with the chemical composition and biological activities (antimicrobial, antioxidant....etc.) of these species (De Jesus *et al.*, 2000; Belhattab *et al.*, 2004; 2005; 2006; Sari *et al.*, 2006; Belhattab and Larous, 2008; Bendahou *et al.*, 2008; Orhan-Erdogan *et al.*, 2010;). Plants are important sources of natural products with the potential to be developed as commercial active ingredients for pest control (Ballesta –Acosta *et al.*, 2008).

Vegetable crops are often exposed to microbial contamination and insect invasion in the field which cause economic and organoleptic quality losses. Even antifeedant and repellent plants are known since ancient time, limited works focused on the mechanism of defence supported by secondary metabolites. Synthetic insecticides are largely used in pest control but due to their adverse effects, natural antifeedants of plant origin have been proposed as alternatives (Belles *et al.*, 1985). Diterpenoids are well known insect antifeedants isolated from plants of the family Lamiaceae. Furthermore, a few papers document the antifeedant effects of flavones (Sharaby and Ammar, 1997) and other diterpenoids, for example those found in *Plectranthus* leaves (Wellsow *et al.*, 2006). Ballesta –Acosta *et al.* (2008) showed that diterpens and coumarins exhibited significant antifeedant effects against *S. littoralis* whereas all flavones tested were inactive

A variety of insect models such as the army worm, *Spodoptera littoralis*, an important pest of cotton, tobacco and vegetable crops (tomato, pepper, lettuce, broccoli, cauliflower and artichoke) are used to evaluate the antifeedant activity of secondary metabolites. The larvae cause economically important damage since they feed on the leaves, fruits and buds from summer till the end of autumn in the field (or even year-round when warm temperatures prevail during winter and spring) and year-round in greenhouses (Ballesta –Acosta *et al.*, 2008).

As a part of ongoing study of Lamiaceae species from North Africa (Algeria), here we report on the antifeedant activities of *M. vulgare* and *O. glandulosum* since to the best of our knowledge no data is available on antifeedant properties of these species.

## Material and methods

### Plant material

*Marrubium vulgare* and *Origanum glandulosum* Desf. aerial parts were collected in Setif area (Algeria) and stored in the shade till use.

*Capsicum annuum* (bell pepper) used to test insects *Myzus persicae* and *Spodoptera littoralis* and wheat leaves to test *Rhopalosiphum padi*.

### Insects

*Spodoptera littoralis* Boisd. (Lep: Noctuidae), *Myzus persicae*, and *Rhopalosiphum padi* were reared on artificial diet, bell pepper (*Capsicum annuum*) and potato foliage plants, respectively, and maintained at 24±1°C, 60-70% relative humidity, with a 16 :8h (l: d) photoperiod in a growth chamber.

## Methods

### Preparation of extract

20 g of grinded leaves were extracted with acetone using a Soxhlet apparatus for 6 h. The volume was completed to 100 ml in a volumetric flask (Belhattab *et al.*, 2004; 2006).

### Feeding assays

Dried acetone extract was dissolved in methanol (10mg/ml). The assays were conducted according to methods developed by Poitout and Bues (1974) and Reina *et al.*, (2001).

### Test 1: Feeding inhibition

Bell pepper leaves (*Capsicum annuum*) cut into small pieces (10 mm diameter) were put into wells punched in agar medium (2%). The plant sheets previously soaked with 10 µl of the extract (test) or methanol (control) are filed onto the surface of Petri dishes (10 plates) containing agar then incubated for 24 h at 25°C in the presence of the chewing insects newly emerged *S. littoralis* L6 larvae. The experiment is stopped as soon as the ¾ of the leaves are consumed (test or control). The remaining leaf pieces are taken off the Petri dishes and bonded to a sheet of paper using scotch tape. Then, results are recorded.

Percent feeding reduction (%FR) was determined for each plate by the following equation:

$$\%FR = [1 - (\text{treatment consumption} / \text{control consumption})] \times 100.$$

### Test 2: Settling inhibition

This test was conducted with two aphids, *Myzus persicae* (polyphagous) and *Rhopalosiphum padi*. The former insects used usually settle on the inferior side of the leaves of crops (pepper) to avoid UV light whereas the latter fed on cereals (wheat leaves). For this purpose, leaves from pepper are cut to form half circles (10mm diameter) and those from wheat to form 1cm long sheets, then soaked with *M. vulgare* or *O. glandulosum* dried acetone extract (test) dissolved in methanol (100%) or methanol (100%) (control) and put into Petri dishes containing agar. Afterwards, ten aphids (*M. persicae* and *R. padi*) are introduced into the Petri dishes (5 to 10 plates) and 24h later the number of aphids settled on each leaf is determined and a settling inhibition index (%SI) was calculated for each aphid:

$$\%SI = 1 - (\%T / \%C) \times 100$$

## RESULTS

Acetone was chosen as less polar solvent, often used to extract active phenolic constituents from plants (Exarchou *et al.* 2002; Belhattab *et al.*, 2004).

### Insect bioassay

The acetone extract (10µl) of aerial parts inhibited the feeding activity of *S. littoralis* larvae. Percent feeding reduction (%FR) was determined for each plate. According to the above equation, % FR was determined for *M. vulgare* (Tab.I) and *O. glandulosum* (Tab.II) to be 95,5% and 50,33 % respectively.

**Table I:**

Pourcentage de consommation des feuilles de poivron cloche traitées par l'extrait acétonique de *M. vulgare* (test) et le méthanol (témoin) par *S. littoralis*

Percent of consumption of bell pepper leaves treated with *M. vulgare* acetone extract (test) and methanol (control) by *S. littoralis*

| % consumption | Plates |      |       |      |      |      |     |      |
|---------------|--------|------|-------|------|------|------|-----|------|
|               | 01     | 02   | 03    | 04   | 05   | 06   | 07  | 08   |
| Test          | 00     | 25   | 00    | 00   | 00   | 00   | 00  | 6,25 |
| Control       | 100    | 87,5 | 93,75 | 87,5 | 87,5 | 87,5 | 75  | 75   |
| T/C           | 0      | 0,28 | 00    | 00   | 00   | 00   | 0   | 0,08 |
| % FR          | 100    | 72   | 100   | 100  | 100  | 100  | 100 | 92   |

**Table II:**

Pourcentage de consommation des feuilles de poivron cloche traitées par l'extrait acétonique de *O. glandulosum* (test) et le méthanol (témoin) par *S. littoralis*  
 Percent of consumption of bell pepper leaves treated with *O. glandulosum* acetone extract (test) and methanol (control) by *S. littoralis*

|               | Plates |     |      |      |      |     |    |     |    |
|---------------|--------|-----|------|------|------|-----|----|-----|----|
| % Consumption | 01     | 02  | 03   | 04   | 05   | 06  | 07 | 08  | 09 |
| Test          | 0      | 50  | 50   | 25   | 50   | 0   | 75 | 0   | 50 |
| Control       | 75     | 100 | 87,5 | 62,5 | 75   | 75  | 75 | 75  | 50 |
| T/C           | 0      | 0,5 | 0,57 | 0,4  | 0,66 | 0,0 | 1  | 0   | 1  |
| %FR           | 100    | 50  | 43   | 60   | 34   | 100 | 00 | 100 | 00 |

A difference between the behavior of the sucking insects, *M. persicae* and *R. padi*, when subjected to the settlement inhibitory test in the presence or absence of *M. vulgare* acetone extract, was observed. The mean number of *M. persicae* larvae settled on the treated and control leaves was 0,7 and 2,1 respectively which correspond to a settling inhibition index of 67%, whereas that of *R. padi* was 2,35 and 4,5 respectively which correspond to a settling inhibition index equal to 48%. The settlement inhibitory effect of *O. glandulosum* acetone extract on the sucking insect *M. persicae* and *R. padi* was similar. The mean number of *M. persicae* larvae settled on the treated and control leaves was 0,3 and 1,85 respectively which correspond to a settling inhibition index of 83,8%, whereas that of *R. padi* was 6,05 and 1 respectively which correspond to a settling inhibition index equal to 83,5%.

#### DISCUSSION:

The antifeedant activity of *M. vulgare* and *O. glandulosum* extracts obtained in this study suggest a plant defensive role played by the secondary metabolites beside other effects such as their antimicrobial and cholinesterase actions (Belhattab *et al.*, 2004; Orhan-Erdogan *et al.*, 2010). In addition, antifeedant effect of acetone extract against *S. littoralis* was too strong. Furthermore, the main works dealing with insecticidal effects focus on diterpene alkaloids as potent insecticidal and antifeedant compounds (Reina and Gonzalez-Coloma, 2007). These findings suggest a possible role of the main component of *M. vulgare*, marrubiin, a labdane diterpene. Phenolic content was also determined (Belhattab *et al.*, 2006; Boskou, 2006) since several works have shown the effective role of these compounds on microorganisms (Belhattab *et al.*, 2004). Tannins known to possess the ability to precipitate proteins can reduce the nutritional value of several tissues. They affect the insect digestion by binding to mucoproteins of their oral cavity. It has been reported that plant tannins content affect the consumption of plants by the *S. latifascia* larvae (Harborne, 1988).

#### Conclusion

The results obtained here reveal that species belonging to the Lamiaceae family make a promising alternative source of natural compounds for crop protection, however further studies are needed to assess safety and efficacy of this plant extracts.

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