Biological Activity of the *Mentha spicata* L. and *Salvia officinalis* L. (Lamiaceae) Essential Oil on *Sytophilus granarius* L. and *Tribolium confusum* Jac. Du Val. infested stored wheat.

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Introduction

The Stored foods constitute the basis of the diet of most countries in the world, especially underdeveloped countries such as South African countries and developing countries such as Algeria where their diet is based mainly on legumes as a source. proteins like the bean with all its varieties, the different cereals; and on corn and rice as a source of carbohydrate and long sugars.

According to the most recent estimates of the Food and Agriculture Organization of the United Nations (FAO), 842 million people in the world or 12% of the world population were not able to meet their needs. dietary energy needs between 2011-2013 (FAO, 2013).

To preserve better the original quality of the grains and seeds as much as possible, good storage and conservation will be required. global food production needs to be increased by about 70% by 2050, to feed the ever rising human population (Bruinsma 2009; Cramer et al. 2011).

Each year, nearly 2,000 species of insects threaten world production and destroy a large part of food grains and legumes, which cause significant damage; they degrade the nutritional and organoleptic quality of the stored product and which lead to the total loss of the product and generate significant costs for the food industry; of which we find between harvesting, storage for consumption more than 30% of production is lost (Alzouma, 1995; Bell, Mück & Schneider, 1998; Danho, 2003; Ngamo & Hance, 2007). The losses caused to this type of food during storage are estimated at 100 million tonnes, of which 13 million are caused by insects. In developed countries, these losses are around 3%, while in Africa they reach 30%.

It is necessary to seek effective control and control methods against insect pests in order to limit losses due mainly to Coleoptera which are among the main pests of stored foodstuffs such as Curculionidae (weevils), Bruchidae (Bruches) and Tenebrionidae (triboliums) (Delobel & Tran, 1993; Alzouma, Huignard, Lenga, 1994; Bendifallah, 2002).

Our study aims to find an alternative non-polluting method. Proper crop protection is important to produce higher quality crops with minimal wastage. This is the evaluation of extracts of medicinal and aromatic plants with bioinsecticidal potential.

Given the extent and variability of climatic edapho, and the different ecosystems, Algeria has a great floristic richness estimated at more than 3139 species (Quezel and Santa, 1962).

This work aims to study the insecticidal activity of two essential oils of two plants: mint *Mentha spicata* L. and sage *Salvia officinalis* L. against adults of the grain weevil *Sitophilus granarius* L. and beetle *Tribolium confusum* Jac. du Val.

Material and methods

Plant Material

The plants used in this study are two wild medicinal plants sage *Salvia officinalis* and mint *Mentha spicata* (Fig.1a, b). In our study, 30-cm apical branches were collected from Bir Ghebalou mountain, near Bouira, Easter Algeria (Latitude: 36°15′47″ N, Longitude: 3°35′12″ E, Altitude 632m), in March 2018 (Fig.2). They were dried at room temperature and stored in paper bags.

Animal Material

The two stored product insects grain weevil *Sitophilus granarius* L. (Arthropod: Coleoptera, Curculionidae) and tribolium *Tribolium confusum* Jac. du Val. (Arthropod: Coleoptera, Tenebrionidae) (Fig3, 5)

The mass rearing is maintained on a regular basis for provisioning. It is made in airtight plastic boxes 15 cm high and 20cm wide and 40 cm long. These boxes contain approximately 500g of the healthy soft wheat grains, semolina and flour, once labeled, the boxes are kept in the dark in an oven set at 26 ° C and 40% relative humidity

Method of Extraction of Essential Oil HS from Sage and Mint

The The freshly harvested plant material leaves and flowering tops) of Sage and Mint was dried at room temperature in a ventilated, shady place for 40 days, in shelves covered with wallpaper to prevent mold deposits. After drying, each plant is crushed with an electric mixer.

The EO was extracted by the Hydro-distillation method according to the standard procedure reported in the Sixth edition of the European Pharmacopoeia, using a Clevenger Type apparatus.

Biological test: application of essential oil on insects by contact

After storing the essential oil, we dilute it with agar agar water. We tested 03 different doses of essential oil of sage and mint, each dose of which is repeated three times.

• 03 solutions of essential oils (1ml, 2ml, 10ml of essential oil / 10ml of agar agar water), are prepared by diluting known quantities of essential oil in agar agar water (Obeng-Ofori et al. 1997). Three repetitions were performed for each dose, plus the control treated only with water agar agar. • A batch of 10 adult insect individuals was introduced into each petri dish and placed in their respective oven. Evaluation of the effectiveness of the product tested: this involves counting the dead individuals daily from the first hours after the launch of the tests.

Figure 2: Geographical location of Bir Ghebalou (Bouira region)

Mentha spicata L.

Salvia officinalis L.

Fig.1. Plants collected

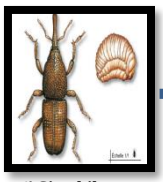

***Fig.3. Weevil Sitophilus granarius L.* (Sojam, 2017)**

Fig.4. wheat weevil damage. (Original photo)

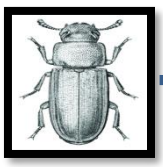

Fig.5. Tribolium confusum Jac. du Val (Jan, 2013)

Fig.6. damage of the beetle on flour. (Original photo)

Results

***1*-The essential oil yield of Spearmint=:Rh = 0.84%**

• The yield of essential oil for the officinal sage:Rh = 0.68%

2- Variation of weevil and Tribolium mortality according to the different doses of sage

***Table 1.* Analysis the mortality variance of Weevils and Tribolium according to the different doses of officinal sage by the ANOVA test**

Factors	sum of squares	d.d.l	mean of squares	F-ratio	P
Doses	5802.222	2	2901.111	15.333	0.000
Insects	3484.444	1	3484.444	18.416	0.000
Dose-insects	2802.222	2	1401.111	7.405	0.001

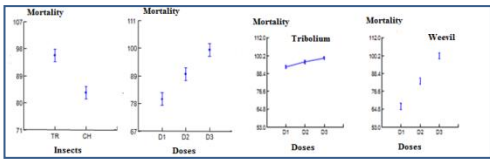

***Figure 6*. Variation of weevil and Tribolium mortality according to the different doses of sage.**

Table 2. Analysis the mortality variance of Weevils and Tribolium according to the different doses of Spearmint by the ANOVA test

Factors	sum of squares	d.d.l	Mean of squares	F-ratio	P
Doses	4775.556	2	2387.778	4.300	0.017
Insects	8410.000	1	8410.000	15.147	0.000
Dose-insects	1820.000	2	910.000	0.200	1.639

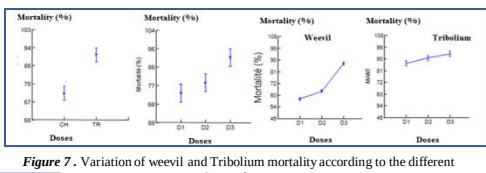

***Figure 7*.** Variation of weevil and Tribolium mortality according to the different doses of mint

3- Determination of the LD50 and LD90 of Sage and Spearmint

The values of the LD50 of Weevil under the effect of the toxicity of Spearmint in the 1st day is 10.75µl / ml, 16.34 µl / ml in the 2nd day and 2.86 µl / ml in the 3rd day, its LD90 in the 1 st day 154.73 µl / ml, in the 2 nd day 124.64 µl / ml and in the 3 rd day 7.03 µl / ml. For Tribolium under the effect of Spearmint the LD50 in the 1 st day is 10.75 µl / ml, in the 2 nd day is 0.03 µl / ml and in the 3 rd day 0.29 µl / ml, its LD90 in the 1 st day is 154.73 µl / ml, in the 2 nd day 3.03 µl / ml and in the 3 rd day is 1.48 µl / ml.)

Conclusion & perspectives

The two plants used can be used in biological control as a contact bioinsecticide for the control of stored food insects *Sitophilus granarius* and *Tribolium confusum*. This insecticidal power attributed to *Salvia officinalis* and *Mentha spicata* is due to the richness of these two plant species in active compounds with an insecticidal or repellent effect.

References

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