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Research Article

# EFFECT OF *SALSOLA VERMICULATA* ON FUNGI OF FRENCH SOFT WHEAT AND TEST OF GRAIN STORAGE BY THE COATING METHOD

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## ABSTRACT

Algerian aride zone is rich with medicinal plant, *Salsola vermiculata* is one of the most traditional plant remedies in Bechar region. in this work, we tried to test the inhibitory effect on eight storage soft wheat fungi of various extracts of *Salsola vermiculata in vitro* and *vivo* by using grain storage by the coating method.

The phytochemical screening of plants showed the detection of tannins, saponisides and flavonoids.

The results show a remarkable antifungal effect by most of the extracts tested. The decrease in the level of fungi observed in wheat samples demonstrates the effectiveness of grain storage by the coating method.

**Keywords**: *Salsola vermiculata*; Antifungal activity; Coating method; Fungi; soft wheat; Storage.

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## 1. INTRODUCTION

storage of wheat is necessarily necessary against the damage of natures or wars ... and also for food security (nutrition). Several methods are used for grain storage:

Traditional methods such as open-air storage and underground storage, but these two modes present a high risk of alteration [1].

In modern methods in co-operatives and warehouses, silos which are previously constructed of wood, are now, usually made of reinforced concrete, sometimes made of metal. Wheat inside is protected from cold, heat and humidity. They are divided into smooth-walled, perfectly watertight cells. Many drying systems, by ventilation of hot air, have been developed and can be used to preserve the grain of wheat under good conditions [2].

There are several factors of alteration of common wheat during storage; Mold is the major cause of microbial alterations in stored grains [3].

Our work constitutes the effectiveness of the coating method and the valorization of *Salsola vermiculata* an endemic Algerian Saharian plant.

**Fig.1.** *Salsola vermiculata* (2016)

## 2. MATERIALS AND METHODS

(i) Sampling

Sampling of soft wheat is carried out in accordance with ISO 13690, Official Journal of the European Union, and a practical guide for the quality control of cereals and protein crops.

The areal part of *Salsola vermiculata* was collected during the flowering phase from March to June from kanadssa Bechar Algeria (31°33'15.6"N °25'04.0"W), washed and dried at room temperature. They were identified at Laboratory of Plants' Resources and Food Security in Semi-arid Areas, South-West of Algeria, University of Bechar - BP 417, Bechar (08000), Algeria.

(ii) Isolation and identification of molds

*Aspergillus flavus, Aspergillus ochraceus, Aspergillus niger, Aspergillus fumigatus, Aspergillus parasiticus, Fusarium sp* and *Penicillium sp* eight strains were isolated from french imported soft wheat and purified in Laboratory of Plants' Resources and Food Security in Semi-arid Areas, South-West of Algeria, University of Bechar - BP 417, Bechar (08000), Algeria.

Phytochemical screening

The plant of *S. vermiculata* was phytochemically screened by traditional methods according to the method of Harborne[4] (1973) and Bruneton[5] (1993).

(iii)Extraction

Extraction is carried out by two methods:

1-The extraction under reflux was renewed three times every 2 hours. The extracts were filtered off and evaporated to dryness under reduced pressure. The solvent was chosen according to the polarity gradient: petroleum ether, chloroform, ethyl acetate and methanol.

2- In a monocolar flask, surmounted by a refrigerant, 10 g of plant material is placed in Present of 60 ml of water. The whole is brought to reflux for one hour. Then, the Mixture is filtered

(iv)Evaluation of antifungal effect

The antifungal tests are carried out according to the method reported by Remmal[6] *& al*., (1993), Farah[7] *& al*., (2001), Satrani[8] *& al*., (2001). Percentage inhibition was calculated from the following equation[9]:

Percentage inhibition= **(1-Da/Db)*100**

**Da** : The diameter of the growth zone of the test.

**Db** : The diameter of the growth zone of the control

(v) Storage by the coating method

The plants extracts were used to coat the grains. The wheat is then dried and stored in the flasks; Each flask contains 1 kg of soft wheat. The effectiveness of these methods is evaluated by post-drying and post-storage analyzes after one year of storage with a one-year period from November 2014 to November 2015. And then compare the fungi contamination found according to the method of Mills[10] (1978).

## 3. RESULTS AND DISCUSSIONS

(i) Phytochemical screening

The preliminary evaluation of the phytochemical composition of the plant selected for this study a permit to demonstrate the presence of some chemical groups; flavonoïds, saponins, tannins, sterols and terpenoïds are present in *Salsola vermiculata*[11] (table 01). Four groups of bioactive compounds are present: sterols and triterpenes, flavonoids, tannins and saponins[12-13].That explain the biological activity of a particular chemical family According to Traoré [14], 2006; In the field of ophthalmology, the effects of saponosides relate to antifungal activity. Bruneton[15] (1999) and Kurkin[16] (2003) have shown that simple phenols, phenolic acids and flavonoids possess anti-inflammatory and anti-haemorrhagic properties, antibacterial and antifungal properties, in particular with regard to phytopathogenic organisms.

**Table 1.** Phytochemical screening of *Salsola vermiculata*

| Chemical groups | Alkaloids | Flavonoids | Tanins | Coumarin | Quinon | Steroids and Terpenes | Saponosides |
|---|---|---|---|---|---|---|---|
| Results | + | + | + | + | +/- | + | +/- |
| +: Presence; -: not detected | | | | | | | |

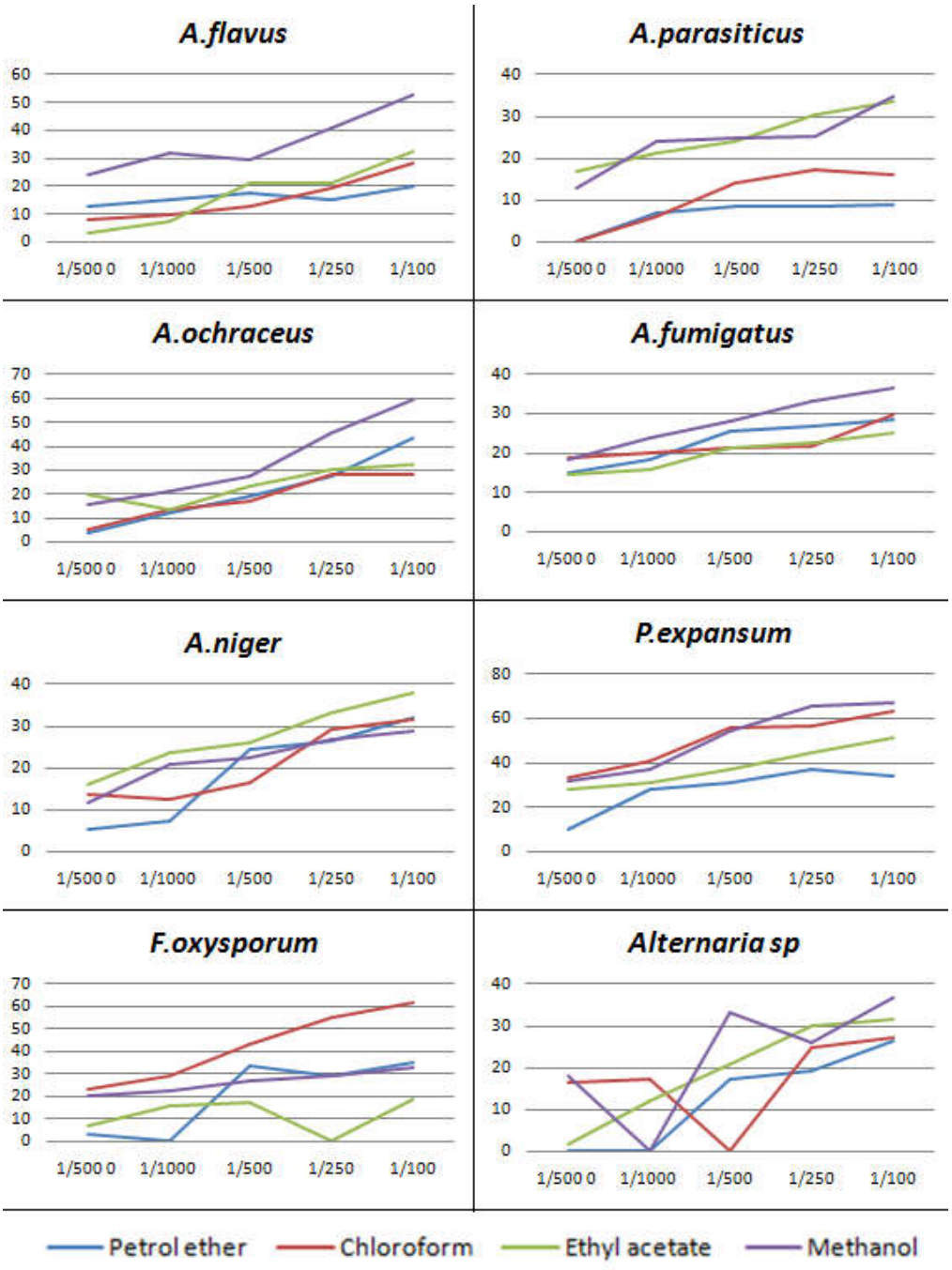


**Fig.2.** The action of the different concentrations of the extracts tested of *Salsola vermiculata* on the growth of molds studied subjected.

(i) Antifungal effect and Storage by the coating method

The results show a remarkable antifungal effect by most of the extracts tested. Comparing the effects of the extracts shows a difference; the tests carried out showed that strains were more or less resistant to the effects of acetyl ethyl extracts than the others. On the other hand, the highest antifungal activity was obtained with the methanolic extracts of the plant, Figure 2.

The aqueous extracts of the plants are tested under technique conservation by coating showed a reduction of numbers of individual species isolated and the percentage of grain contaminated during a storage period. The decrease in the level of fungi observed in wheat samples demonstrates the effectiveness of this method of conservation, Figure 3.

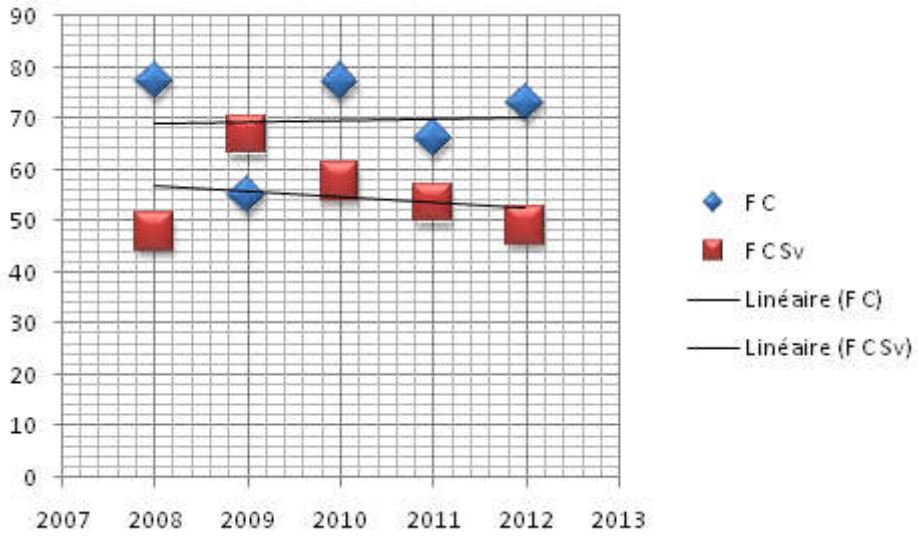


**Fig.3.** Test results of Storage by the coating method relating to the frequency of contamination of the molds (FC: frequency of contamination without the addition of extract, FCCs: frequency of contamination with l Addition of *Salsola vermiculata* extract.

Indeed through the composition that is highly diversified plant extracts can be act at several levels on sensible mold. The mechanism of action of extracts on fungal flora is unclear, but the majority of reports indicate that their activity is on the one hand by:

Morphological modifications of hyphae[17];

Direct perturbation of the fungal cell membrane[18];

Modification on genetic cells[19];

The antifungal activity of the extracts of *Salsola vermiculata* remains very limited compared to the other plants studied. However, another work was done on the antifungal activity of some plants in southern Tunisia by Bouaziz [20] *et al*. In 2009 concluded that the methanolic extract of *S.vermiculata* did not inhibit the growth of *A. niger*. While Mughal [21] in his works in 2008 showed that the methanolic extract of *Salsola kali* showed an important activity against *A.flavus*. However, Jin (2011)[22] showed that the extracts of *Salsola kali* have positive antifungal activity. The richness of this plant in saponins gives it very variable biological activities, for example the antimicrobial effect.

The type and level of biological activity exhibited by any plant material depends on many factors, including the plant part, geographical source, soil conditions, harvest time, moisture content, drying method, storage conditions, and post-harvest processing [23].

## 4. CONCLUSION

According to these results, we can predict that the extracts of *Salsola vermiculata* are very effective natural antifungals and can be a very important source of plant protection due to its antifungal activity.

A significant decrease in percentage of grain contaminated during twelve months of storage demonstrates the effectiveness of of grain storage by the coating method.

Further studies on these wild plants are necessary and should seek to determine toxicity of active constituents.

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