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CHEMICAL COMPOSITION OF *MYRTUS COMMUNIS* ESSENTIAL OIL AND ITS ANTIFUNGAL ACTIVITY ON *FUSARIUM OXYSPORUM F. SP. ALBEDINIS* AND *FUSARIUM CULMORUM*

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ABSTRACT

The inhibitory effectiveness of basil essential oil "*Myrtus communis*" on growth was assessed in laboratory plant biology of the Faculty of Nature and Life Sciences at Constantine1 University in Algeria. This effectiveness was compared to the control of three concentrations of 5, 10, 15 µl against two types of *Fusarium* fungus; first, *Fusarium oxysporum sp. Albedinis* that causes powdery for date palms, and second, *Fusarium culmorum* causing head scab disease. The laboratory study's results showed that inhibition rate values ranged from 42, 5% up to 85% on fungal growth compared to concentrations. In the experimental group, high levels of disease control were recordedin fungus *Fusarium Culmorum* at 85% at concentration 15 µl and 70, 85- 68, 75% when concentrations are 10-5 µl respectively. Hence, the essential oils can be used as an effective alternative without side effects to combat this fungal disease in the near future.

Keywords : *Myrtus Communis, Fusarium Oxysporum F. Sp. Albedinis, Fusarium culmorum,* Essential Oil.

Introduction

The *Fusarium oxysporum* f. Sp. *albedinis*, and *culmorumis* a huge destructive of food stuff whether as a plant or during its storage, making it unfit for human consumption by delaying their nutritional value and also the ability of fungi to produce mycotoxins (Scherm *et al*., 2013). It is defined as compounds with different chemical structures of low molecular mass, characterized by a wide range of cancerous, mutagenic, generic or estrogenic genetic effects that can cause acute and chronic diseases in the food chain (Zain 2011; da Cruz *et al*., 2013; Assunção *et al*., 2016).

The number of resistant fungi that cause disease and toxins is increasing in the face of the inability of industrial fungicides to curb or eliminate them. Thus, the search for new anti-synthetic treatments is essential as an alternative to synthetic treatments that cause cancers and rupture of the endocrine glands (Misnage *et al*., 2014 Nicolopou-lou-Stamati *et al*., 2016). Moreover, the consequences may go beyond man affecting the whole environment with its living and non-living elements (da Cruz *et al*., 2013). Hence, medicinal plants with their extracts were given way to become a viable alternative, since they were classified as safe and recognized by the Food and Drug Administration (FDA) (Kedia *et al.,* 2014).

Essential oils with their turbocharged and phenolic compounds such as ogenol, thymol and carvacrol attack lipophilicmycotoxin cells with low partial weight leading to structural and functional damage by disrupting membrane permeability and cell osmosis balance. This may also prevent certain enzymes' action, including mitochondrial enzymes that go into the process of ATP synthesis such as lactate and malate enzymes as well as inhibiting H^+ activity –ATPase. In view of that, stopping these processes leads to acidification and cells death (Ahmad *et al*. 2013; Kalagatur *et al.,* 2015; Prakash *et al*., 2015; Grata, 2016).

Accordingly, this research aims to assess the laboratory effectiveness of the basil oil; *Myrtus communis* L as an antifungal agent against fungi isolated from various agricultural crops namely wheat, tomatoes, and palm.

Materials and Methods

Tools

Plant material: the researcher tested the inhibitory efficacy level of *Myrtus communis L* (*Myrtacées*), collected from Tasala Zone in Mila State, Algeria - late March 2021, its geographical coordinates 36 ° 34 "31" "N 5 ° 59" 31 "E (Google Earth).

Fungal isolations: These fungal isolates "*Fusarium oxysporum f. Sp. Albedinis, Fusarium culmorum*" are obtained from the Laboratory of Microbial Systems Biology (LBSM) of the Higher School of Professors in Kouba-Algeria. This is mentioned by Professor Syed Ahmed Sadi.

Methods

Extraction of the essential oil :

Oil extraction and yield determination: the oil is extracted by water distillation method, using a Dean Starck distillery device. On the other hand, the yield is determined by processing 100 g of plant material in a 500 ml beaker, the sample is kept in a tight tube at 4° C away from light.

Chromatographic analysis of the studied oil sample:

Core oil is extracted from *Myrtus communis* L (*Myrtus communis* L) whose chemical pattern was determined in previous work (results not yet published).

Effect of oil on fungus growth (direct contact method):

In petri dishes with 5 Cm diameter, agar is erected with a quantity of pure aromatic oil with specific concentrations (5, 10, 15µl). Besides, the solution was swished in all directions to cover the entire surface of the agar dish and ensure its homogenization.

In the same vein, the transshipment method is applied where a 5 mm tablet in diameter is taken from the farm "Active Growth Zone" and placed in the center of the dish, the incubation is done out of light for 7 days at 30° C by using a control group, and then we calculate:

- Fungal Growth X_{mm} = D1 + D2 where D1 means the length of the diameter longitudinal, D2 means the length of the diameter incidentally (Nawara Ali Mohammed *et al.*, 2016).
- Rapid fungal growth (VC) depends on the diameter of each farm; the experimental group or the control group, registered during the incubation period:

VC = (D1/T1) + (D2/T2) + (D3/T3) +........ + (DN/TN)

D: Length of diameter measured daily.

T: Reading time (Cahagnier *et al.*, 1998).

-Inhibition rate (I%) = (fungal diameter in control group - fungal diameter in experimental group /fungal diameter in control group) (Kordali *et al.*, 2003).

Results and Discussion

Results

Oil Yield

Essential oil yield in Table 1

Table 1: Extract yield and color of essential oils *Myrtus communis L*

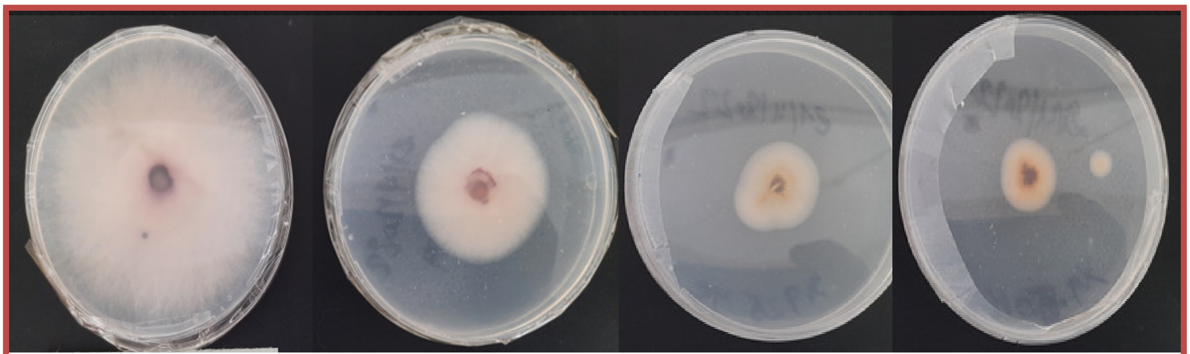
Gender	Odor	Color	Famille	Yield (%)
M. communis L	referees	pale yellow	*Myrtacées*	1.71

Chromatographic analysis of the sample

The chemical pattern of *Myrtus communis* L is characterized by the presence of a high percentage of core oxygenated mono-terpenes that its core compounds are 1-8cinéole (31.29%),´α-terpinol (4.21%), linalool (3.90%), and the α-Pinene compound.

Antifungal activity of *Myrtus communis* essential oils :

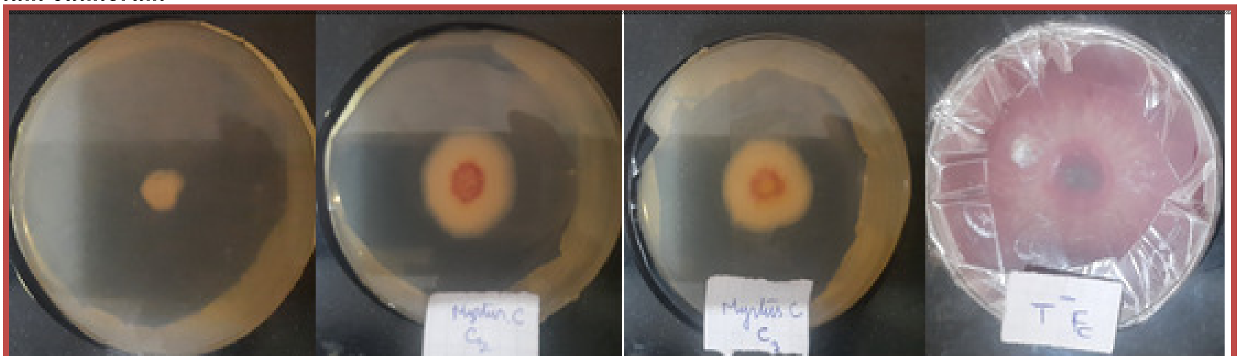
Fusarium oxysporum f. Sp. albedinis



Control 15 µl 10 µl 5µl

Fig. 1 : Colonies of the *Fusarium oxysporum* f. strain. Sp. *albedinis* under the influence of different concentrations of *Myrtus communis* oil

Fusarium culmorum



Control 15 µl 10 µl 5 µ

Fig. 2: Colonies of the *Fusarium culmorum* under the influence of different concentrations of *Myrtus communis* oil

Table 2 : The growth rate of the fungus, the speed of mycelium growth, and the rate of inhibition under the influence of three different concentrations of *Myrtus communis* L oil during the incubation period (7 days).

treatment	the sample	Dosage(µl)	Fungal Growth (Xmm)	Rapid fungal growth (VC)	Inhibition (I%)
Myrtus communis L oils	Foa	15	0,71	0,133	80
		10	1,79	0,351	53,3
		5	2,181	0,433	42,5
	FC	15	0,38	0,063	85
		10	0,915	0,169	70,87
		5	1,157	0,223	68,75

Comparing the effect of the oil according to the concentration on the studied treatments (growth rate, growth rate and inhibition):

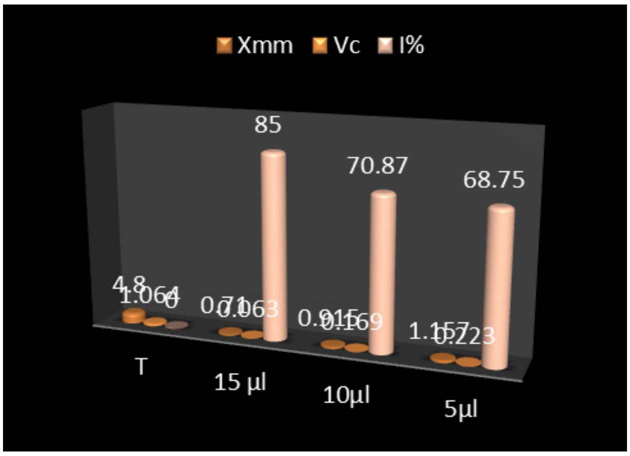


Fig. 3: Effectiveness of basil essential oil on the growth of *Fusarium culmorum* in terms of concentrations

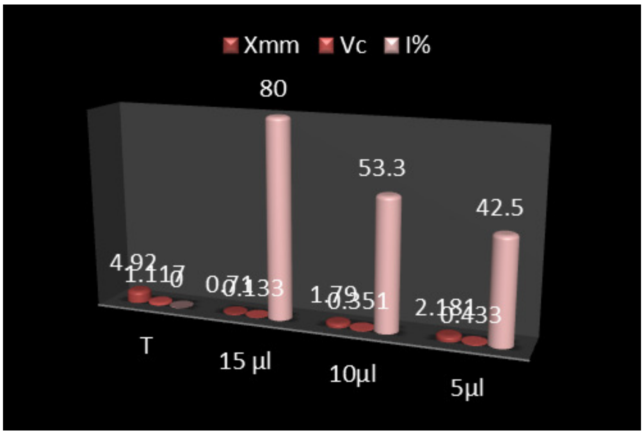


Fig. 4: Effectiveness of basil essential oil on the growth of *Fusarium oxysporum* f. Sp. *albedinis* in terms of concentrations

In the end, we can conclude whether there is growth or not, depending on the percentage of inhibition compared to the rate of growth, shown in Table 3

Table 3: Antifungal activity of *Myrtus communis* essential oils

essential oil *Myrtus communis* L	control	Essential oil *Myrtus communis* L		
	C0	5 µl	10 µl	15 µl
Fusarium oxysporum f. Sp. Albedinis	-	+	+	++
Fusarium culmorum	-	++	++	+++

+the presence of inhibition, ++high inhibition, -No inhibition

Discussion

100 g of basil dry weight *Myrtus communis L* gave a base oil yield of (1,71%). Compared to previous results, this yield is somewhat higher than the yield of basil leaf oil. Similarly in a later study of (Sabri *et al*., 2016), the results showed a yield of (1.6%) in an oil sample extracted from 250 g weight of dried and ground ace leaves (Ali Muyayyed Najem, 2018).

The chemical pattern showed a high ratio of mono-terpentherpenate oxygenated compounds 1-8cinéole (31,29%),α-terpinol (4,21%) and linalool (3,90%), as well as the α-Pinene compound (36,10%). These results are consistent with some previous studies, as chromatographic analysis of a sample of ace oil showed its main compounds; α-Pinene (32,65%), -8cinéole (25%), Linalool (16,37%) with a consistent ratio of its core composition (Sabri *et al*., 2016). Previously, a results' study revealed the chemical core composition of ace oil extract; α-Pinene (13.22%), 1-8cinéole (48.41%), with the absence of Linalool (Ennouri *et al*., 2020), this difference may be due to the geographical location and harvesting season of the leaves of this plant.

The antifungal effectiveness of different ace oil concentrations was tested on the growth of the two laboratory-isolated species; "*Fusarium oxysporum f. Sp. albedinis*, and *Fusarium culmorum*", where the highest antifungal activity of oil at 15 µl concentration was recorded for both types at 85% against *Fusarium culmorum* and 80% against *Fusarium oxysporum f. Sp. Albedinis* respectively.

The results shown in table (3) and figures (1, 2, 3 and 4) also indicate that the effectiveness of ace oil against the fungus *Fusarium culmorum* was higher. The inhibition rate exceeds 60% at the lowest concentration of 5 µl. Additionally, previous studies have shown that ace oil has the potency of inhibiting it on many fungal species including the fusarium type "*Fusarium solani*" although it recorded a minimum effectiveness compared to the current study (Ali Muyayyed Najem, 2018).

In another study, the potency of basil water extract was tested against a group of fungi that cause the death of okra seeds, including the *Fusarium* species, it recorded a significant decrease in the growth of pathogenic fungus where it reached a total inhibition in the highest concentration (Najwa Bashir Elshi *et al*., 2002).

Moreover, this difference in inhibition rate can be explained by the different concentrations applied in this study as well as the fact that this type of fungus *Fusariumsolani* is less ferocious than the species used in the present study i.e., low aggressive capacity (Houda Bouraghda *et al.,* 2014).

In the same vein, many scientists also attribute the inhibitory potency of ace oil to Linalool's chemical core composition (Wenzhang *et al*., 2009). On the other hand, some scholars add α-pinene and 1-8cinéole besides Linalool (Curini *et al.,* 2003). While some others consider that the substances can be substituted by antifungal chemotherapies (Aleksandra Barac, 2017). The latter is believed to be adopting procedures that may impair cell membranes by weakening the enzymatic system, particularly the enzymes involved in the production of energy and the installation of its structural components (Salhi *et al*., 2015).

Conclusion

This study was conducted to identify the impact of *Myrtus communis* crude oil on two types of mildew fungi, where different concentrations showed different inhibitory effects, the highest fungicidal effect causing 85% inhibition against *Fusarium culmorum* fungus, while the lowest level against *Fusarium oxysporum* f. Sp. *albedinis* recorded 42,5%. Besides, chemical analysis of its base oil showed dominance of 1-8cinéole and α-Pinene compounds by 67, 39%. These results are encouraging and stimulating for further research using these essential oils or their compounds in the formulation of biological products that may be adopted as alternatives to chemical fungicides without any toxic effect on plants and on the seeds germination or preservation.

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