ORIGINAL ARTICLE

EVALUATION OF THE ANTIBACTERIAL ACTIVITY OF *Carum Carvi L* ESSENTIAL OIL

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ABSTRACT

Background: The common caraway (Carum carvi L), one of the oldest plants known for its pleasant aroma is native to Asia, Europe and North Africa. Its fruits are used in pharmacy, perfumery and human food. Ripe fruits of Carum carvi L are used in the traditional Chinese medicine and other popular medicines. This plant is known for its antispasmodic properties. It is used against stomach irritations, gastrointestinal spasms, and indigestion. It is also advocated against the lack of appetite and dyspepsia in adults. **Methods**: The fruits of Carum carvi L grown in the region of Meknes (Morocco) provided by hydrodistillation a yield of 1.5% essential oil. Six compounds were identified by GC / MS. D-limonene (23.19%), Thymol (1.29%), β Myrcene (0.14%), β-Mentha-1,3, 8-triene (0.13%), dihydrocarbon (0.12%). **Results**: The antibacterial activity of carum carvi L essential oil has been studied on Klebsiella pneumonia, Proteus Vulagaris, Pseudonenas aeruginas, Escherichia coli and Staphylococcus aureus. As a result we recorded a strong antimicrobial activity against five bacterial strains. **Conclusion**: gas chromatography analysis identified six compounds, the major products were the (R)-carbon (74.06%) and the D-limonene (23.19%) These results are consistent with previous work. The essential oil tested showed a non-negligible antimicrobial activity, probably related to the richness of carvone and limonene. These monoterpenes are known for their antiseptic activity. The antimicrobial effect of the essential oil of Carvi fruits against pathogenic germs makes it possible to envisage its use as an antiseptic agent

Key words: *Essential oil, Carum carvi L, chemical composition, antibacterial properties, Morocco.*

1. INTRODUCTION

Among the 29 species of the genus Carum, of the family Apiaceae, only the caraway or cumin, Carum carvi L present an economic importance. Carvi is cultivated in several regions of the world (Northern Europe, Mediterranean region, Russia, Iran, Indonesia, North America, etc.) for its leaves and especially fort its fruits which used as food condiment, traditional medicine, pharmacy and in perfumery, it is used in the composition of food products and cosmetics [1,2]. This plant is known for its antispasmodic properties. It is used to treat inappetence, nerve dyspepsia, gastric spasms, meteorism and intestinal parasites.

Since their discovery, antibiotics have been the primary defense in the treatment of bacterial infections. However, their effects are now under threat. Indeed, their blind use has triggered a phenomenon of resistance to these antibiotics [3,4].

Antibiotic resistance is a natural and predictable mechanism that causes a loss of the efficacy of the antibiotic against pathogenic bacteria [5]. The resistance of germs to antibiotics is becoming more and more worrying, so the search for another molecule possessing effective antibacterial activity. Due to their effectiveness, essential oils (EO) can be a remedy for this phenomenon of resistance. Essential oils are complex products derived from an aromatic and medicinal plants (AMP), containing constituents such as; phenols, alcohols, aldehydes, esters, terpenes, and ketones [6,7]. Fruit essential oil (EO) of Carum carvi L has antibacterial properties [8,9].

The objective of this work is to demonstrate the antibacterial effect of the essential oil extracted from Carum carvi L seeds of the Meknes region on the growth of five pathogenic strains isolated from the chicken pulp.

2. MATERIAL AND METHODS:

2. 1 Plant material:

The present study was carried out on caraway (Carum carvi L). The seeds are taken from a plantation located in the Meknes region. The plant material has been washed in the laboratory and dried in the dark in a well-ventilated place, at an ambient temperature the seeds are kept in clean bags in a ventilated place.

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Extraction of essential oil.

The extraction of the essential oil was carried out by hydro-distillation in a Clevenger-type apparatus [10]. Three distillations were carried out by boiling for 5-6 hours of 300 g of plant material with a volume of 1000 ml of distilled water in a 2-liter flask topped by a column of 60 cm of height connected to a refrigerant. The yield of essential oil was determined according to the dry material. After recovery, the essential oil was stored at 4 ° C. in the dark in the presence of anhydrous sodium sulfate.

2. Chromatographic analysis:

The essential oil was analyzed using gas chromatography (Trace GC ULTRA) coupled to a mass spectrum (Polaris Q MS with ion trap), equipped with a capillary column VB-5 (5% phenyl methylpolysiloxane) the vector gas was helium, the oven temperature was programmed at 200 ° C for 6 min and increased to 300 ° C at a rate of 20 ° C / min for 10 min.

2. Microorganisms studied:

The bacteria used in the trial were isolated from the chicken pulp and then characterized and identified as Staphylococcus Aureus, Escherichia coli, Klebsiella pneumonia, Proteus Vulagaris, pseudomenas aeruginas.

4. Antimicrobial testing

Being immiscible with water and therefore with the cultures, the essential oil was emulsified according to the method described by Remmal et al. [11] with a 0.2% of aqueous agar solution to promote seed and compound contact [12].
The minimum inhibitory concentrations (MIC) of the essential oil were determined according to the method described by Remmal et al. [11] and Satrani et al. [13]. Dilutions were prepared at 1/10, 1/25, 1/50, 1/100, 1/200, 1/300 and 1/500 in the agar solution. In the test tubes containing 13.5 ml of the nutrient agar autoclaved for 20 min at 121 ° C and cooled to 45 ° C, 1.5 ml of each of the dilutions was added to obtain final concentrations of 1 / 100 to 1/5000 (v/v). The tubes are then agitated by the vortex before being poured into Petri dishes. The cultures of the various bacterial strains were carried out by striation. Control tubes containing only the culture were seeded. The cultures are then incubated at 37 ° C. for 24 hours. Each test is repeated three times in order to minimize the experimental error.

3. RESULTS AND DISCUSSION

The Carvi is a biennial plant of the Apiaceae family (Umbelliferae) of 30-60 cm., Glabrous, with fleshy root, long swivel in spindle, naked at the top, fragrant. The stem is furrowed and angular, the root often from the base; The oblong leaves, with short linear strips, appearing crosswise on the petiole, the superior ones furnished at the base of the sheath with 2 finely cut segments, the umbels with very unequal 6-12 rays, erect after flowering; Involucre and involucal null or with 1-4 leaflets; Styles 1 times longer than the stylopode; Ovoid, aromatic fruit, carried out by the extraction method described in material and method allows the extraction of the EO with a yield of 1.5% for 5-6 hours.

Chemical composition

Analysis of the essential oil of Carum carvi L by gas chromatography coupled with a mass spectrum allowed us to identified six constituents (Table 1). (R) -carbon and D-limonene dominate with respective percentages of (74.06%) and (23.19%). Other compounds are present at lower levels: Dihydrocarvone (0.12%), β-Myrcene (0.14%), β-Mentha-1,3,8-triene (0.13%), Thymol (1.29%).

Table I: Chemical composition of the essential oil of fruits of Carum carvi L of Agourai in Morocco.

Compound	Percentage (%)
(R)-carvone	**74.06**
D-limonène	**23 .19**
Thymol	1.29
β-Myrcene	0.14
β-Mentha-1. 3.8-triene	0.13
Dihydrocarvone	0.12
Total	**98.93**
Error	**1.07**

Antibacterial Activity

The results obtained by the serial dilution method (Table 2) showed that the antibacterial effect of the essential oil was obtained at a dilution of 1:50 for Klebsiella pneumonia, Proteus Vulagaris, Pseudonenas aeruginas, whereas dilution 1 / 25 for Escherichia coli and 1/100 for Staphylococcus aureus.
This method shows that the essential oil of the caraway fruits has an important antibacterial activity on the strains tested. However, the microorganisms studied did not exhibit the same sensitivity towards the essential oil used.

With Staphylococcus aureus, Klebsiella pneumonia, Pseudonenas aeruginas and Proteus Vulagaris, we found a high sensitivity compared to Escherichia coli for essential oil studied. Escherichia coli is inhibited from the 1/25 concentration.

Table 2: Antibacterial activities of the essential oil of the fruits of Carum carvi L (Agourai in Morocco).

Concentration Mg/ml / **bacteria**	**1/10**	**1/25**	**1/50**	**1/100**	**1/200**	**1/300**	**1/500**	**T**
Staphylococcus aureus	-	-	-	-	+	+	+	+++
Escherichia coli	-	-	+	+	+	+	+	+++
Proteus Vulagaris	-	-	-	+	+	+	+	+++
Klebsiella pneumonia	-	-	-	+	+	+	+	+++
Pseudomeneas	-	-	-	+	+	+	+	+++

4. CONCLUSION

The present work aimed at determining the yield, the chemical composition and the antibacterial properties of the essential oil of the fruits of Carum carvi L from Agourai in Morocco. Gas chromatography analysis identified six compounds, the major products were the (R)-carbon (74.06%) and the D-limonene (23.19%) These results are consistent with previous work. The essential oil tested showed a non-negligible antimicrobial activity, probably related to the richness of carvone and limonene. These monoterpenes are known for their antiseptic activity. The antimicrobial effect of the essential oil of Carvi fruits against pathogenic germs makes it possible to envisage its use as an antiseptic agent. Other studies have shown that the carvone extracted from the essential oil could find various industrial applications, in particular the conservation of seeds by its insecticidal properties as a fungicide for the conservation of tubers and for its capacity to inhibit the germination of Potatoes We conferred these properties by our results in realization.

Abbreviation

EO: Essential oil
GC: Gas chromatography
AMP: aromatic and medicinal plants
MIC: minimum inhibitory concentrations

5. REFERENCES

[1]. Bellakhdar (J.) - La pharmacopée marocaine traditionnelle. Médecine arabe ancienne et savoirs populaires. - Paris : Ibis Press., 1997, p. 163-164 (764 p.).
http://www.citeulike.org/group/15400/article/13699767
[2]. Teuscher (E.), Anton (R.), Lobstein (A.), Bauermann (U.), Werner (M.), Rohner (C.), Bernard (M.) - Plantes aromatiques : épices, aromates, condiments et huiles essentielles. -Éditions Tec et Doc Lavoisier, 2005, 171-175 (xvii, 522 p.).
[3]. Lozniewski A., Rabaud C., Résistance aux antibiotiques, juillet 2010 CCLIN Sud-Est
https://www.researchgate.net/profile/Abeer_Esmail2/publication/274252778_Evaluation_de_l'activite_bacteriostatique_d'huile_essentielle_de_la_Lavandula_Officinalis_vis-a-vis_des_souches_d'origine_clinique_resistantes_aux_antibiotiques_Evaluation_of_the_bacteriostatic_activi/links/5519b2aa0cf26cbb81a2b066.pdf
[4]. Zoubair hafed, Rachid Benguedour, Youssef Aboussaleh, Lotfi zeghari, Mahjoub Aouane, Nabyl Berrid, Nabil Abouchouaib, Rachid Sbaibi. profil d'antibioresistance d'escherichia coli d'origine aviaire : cas de poulet de chair dans la région de grande casablanca –maroc. Am. J. innov. res. appl. sci. 2015; 2(2):50-54.
https://www.researchgate.net/profile/Lotfi_Zeghari2/publication/295907429_PROFIL_D'ANTIBIORESISTANCE_D'ESCHERICHIA_COLI_D'ORIGINE_AVIAIRE_CAS_DE_POULET_DE_CHAIR_DANS_LA_REGION_DE_GRANDE_CASABLANCA_-MAROC/links/56eb57a908ae9dcdd82aaabf.pdf
[5]. Acar J.F., Moulin G., Rev. Sci. Tech. Off. Int. Epiz. 25 (2006) 775-792.
https://pdfs.semanticscholar.org/4a78/aaafa2bb8ef894772baca274542a8d67344f.pdf
[6]. Maihebiau P. La nouvelle aromathérapie: biochimie aromatique et influence psychosensorielle des odeurs. JAKIN. Lausanne. (1994).
[7]. Thell., Ksouri A., Dob T., Belkebir A., Krimat S., Chelghoum C., J. Mater. Environ. Sci. 6 (3) (2015) 784-791.
http://www.jmaterenvironsci.com/Document/vol6/vol6_N3/92-JMES-1235a-2014-Ksouri.pdf
[8]. Begum (J.), Bhuiyan (M.N.I.), Chowdhury (J.U.), Hoque (M.N.), Anwar (M.N.) Antimicrobial activity of essential oil from seeds of Carum carvi and its composition. -Bangladesh J. Microbiol., 2008, 25(2), 85-89. http://www.banglajol.info/index.php/BJM/article/view/4867/3879
[9]. Upadhyay (R.K.) Dwivedi (P.), Ahmad (S.) - Screening of antibacterial activity of six plant essential oils against pathogenic bacterial strains. - Asian J. Med. Sci., 2010, 2(3), 152 158.
http://www.researchgate.net/publication/45087782_Screening_of_Antibacterial_Activity_of_Six_Plant_Essential_Oils_Against_Pathogenic_Bacterial_Strains/file/3deec5185c1625d37f.pdf
[10]. Simard S., M. Hachey J., Colin G.J. J. Mill. Wood Techn. 8 (1988) 561-573.

https://www.researchgate.net/profile/Abeer_Esmail2/publication/274252778_Evaluation_de_l'activite_bacteriostatique_d'huile_essentielle_de_la_Lavandula_Officinalis_vis-a-vis_des_souches_d'origine_clinique_resistantes_aux_antibiotiques_Evaluation_of_the_bacteriostatic_activi/links/5519b2aa0cf26cbb81a2b066.pdf
[11]. Remmal (A.), Bouchikhi. (T.), Rhayour (K.), Ettayebi (M.), Tantaoui- Elaraki (A.) - Improved method for the determination of antimicrobial activity of essential oils in agar medium. - J. Essent. Oil Res., 1993, 5(2), 179-184.
http://www.tandfonline.com/doi/abs/10.1080/10412905.1993.9698197
[12]. Satrani B., Farah A., Fechtal M., Talbi M., Blaghen M., Chaouch A. Ann. Fals. Exp. Chim. 956 (2001) 241-250.
https://www.ajol.info/index.php/afsci/article/view/61267
[13]. Satrani (B.), Farah (A.), Fechtal (M.), Talbi (M.), Blaghen (M.), Chaouch (A.) -Composition chimique et activité antimicrobienne des huiles essentielles de Satureja calamintha et Satureja alpina du Maroc. - Ann. Falsif. Expert. Chim. Toxicol., 2001, 94(956), 241-250.

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