CHAPTER 5

ANTIOXIDANT ACTIVITY OF *THAPSIA GARGANICA*

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ABSTRACT: *Thapsia garganica* is a medicinal plant belonging to the Apiaceae family, commonly known in Algeria as Derias. This plant contains several bioactive compounds, some of which may have antioxidant properties. The Antioxidant activity of essential oils of *Thapsia garganica*, using the powder of aerial parts can be evaluated with DPPH (2,2-diphenyl-1-picrylhydrazyl) test. DPPH is a free radical that has a dark purple color in solution.

When it reacts with antioxidants, it loses an electron, and its purple color disappears, indicating its antioxidant power. It was comparing with Ascorbic acid or vitamin C as a reference. The findings from the antioxidant activity analysis revealed that the plant being studied demonstrated a high activity, showing an inhibition percentage (I) of 78.3% when compared to Ascorbic acid as control, which exhibited 82.17% inhibition at the highest concentration, which means a good antioxidant activity of this plant.
KEYWORDS: *Thapsia garganica*, Antioxidant activity, DPPH, Inhibition.

ACTIVITE ANTIOXYDANTE DE *THAPSIA GARGANICA*

RÉSUMÉ: *Thapsia garganica* est une plante médicinale appartenant à la famille des Apiacées, communément connue en Algérie sous le nom de Derias. Cette plante contient plusieurs composés bioactifs, dont certains peuvent avoir des propriétés antioxydantes. L'activité antioxydante des huiles essentielles de *Thapsia garganica*, en utilisant la poudre de parties aériennes, peut être évaluée avec le test du DPPH (2,2-diphényl-1-picrylhydrazyl). Le DPPH est un radical libre qui a une couleur pourpre foncé en solution. Lorsqu'il réagit avec des antioxydants, il perd un électron, et sa couleur pourpre disparaît, indiquant son pouvoir antioxydant. Il a été comparé à l'acide ascorbique ou vitamine C comme référence. Les résultats de l'analyse de l'activité antioxydante ont révélé que la plante étudiée présentait une activité élevée, montrant un pourcentage d'inhibition (I) de 78,3% par rapport à l'acide ascorbique comme témoin, qui a présenté une inhibition de 82,17% à la concentration la plus élevée, ce qui signifie une bonne activité antioxydante de cette plante.
MOTSCLÉS: *Thapsia garganica*, Activité antioxydante, DPPH, Inhibition.

INTRODUCTION

There has been a growing need for natural antioxidants as alternatives to synthetic ones due to the health risks associated with the latter. However, the antioxidant effectiveness may be linked to the concentration of phenolic compounds in a species. Phenolic compounds are recognized for their capacity to neutralize toxic reactive oxygen species owing to their high redox potentials, acting as reducing agents particularly for copper (Ben Haj Koubaier, 2014; Lahmadi et al, 2021).

A considerable array of medicinal plants and their refined components have displayed promising therapeutic potentials. Various herbs and spices have been noted for their antioxidant activity (Khalaf et al, 2008).

The objective of this study is to extract essential oils from the dried aerial parts of *Thapsia garganica* using hydrodistillation. Subsequently, the antioxidant activity is assessed using the DPPH method from the same plant, with ascorbic acid (Vitamin C) as a reference.

MATERIALS AND METHODS

Presentation of the study area

The plant (*T garganica*) was harvested in April from Kheiri, Oued Adjoul in Jijel. A coastal province located in the northeast of Algeria, Its coastline has a length of 121.2 kilometers and with an area of 62.38 square kilometers.

Figure 1: Location of the study area (Jijel, Algeria).

Source: https://fr.wikipedia.org/wiki/Khe%C3%AFri_Oued_Adjoul.

Plant material

The genus Thapsia consists of flowering plants in the Apiaceae family, encompassing many original species from the Mediterranean region with medicinal properties (Ladjel et al, 2011; Athmouni et al, 2015).

Among them, *Thapsia garganica*, stands out, containing a molecule called Thapsigargarine, which acts as a potent non-competitive inhibitor of ubiquitary enzymes (Calcium/ ATPases). By doing so, it increases the calcium concentration in the endoplasmic reticulum and induces cellular apoptosis (Makunga et al, 2006; López et al, 2018).

After harvesting, the aerial parts of the plant were cleaned, washed, dried for 15 days at room temperature, in a dry place protected from sunlight to maintain the integrity of the molecules to the greatest extent possible, then ground into a fine powder using an electric grinder.

Antioxidant activity

The obtained powder of the cited plant was placed in a distillation container (Hydrodistillation by Clevenger) to obtain the essential oils (Clevenger, 1928). The antioxidant activity of the essential oils of *Thapsia garganica*, with different concentrations

(2, 4, 6 and 8 μg/ml) and also vitamin C (Ascorbic acid) as control can be evaluated by the DPPH test (2,2-diphényl-1-picrylhydrazyl) (Athmouni et al, 2015). It is a free radical that appears dark violet in solution; due to scavenging of stable free DPPH radicals, its violet color changes to yellow, indicating its antioxidant capacity (Khadri et al, 2020), which is representing by inhibition percentage as follows (Chibani et al, 2014):

Inhibition I= (Ao-Ae/Ao)*100

Ao: Absorbance of DPPH in solution

Ae: Absorbance of the studied sample

The change in color is measured by the decrease in absorbance values at a wavelength of 517 nanometers. A decrease in absorbance indicates an increase in free radical scavenging activity, and vice versa.

RESULTS

The first graph (Figure 2) represents the inhibition activity of *Thapsia garganica* against the DPPH radical at different concentrations. It can be observed that as the concentration increases, the inhibition activity against the DPPH radical becomes stronger. It was 71.94% with the lowest concentration and 78.3% with the highest concentration.

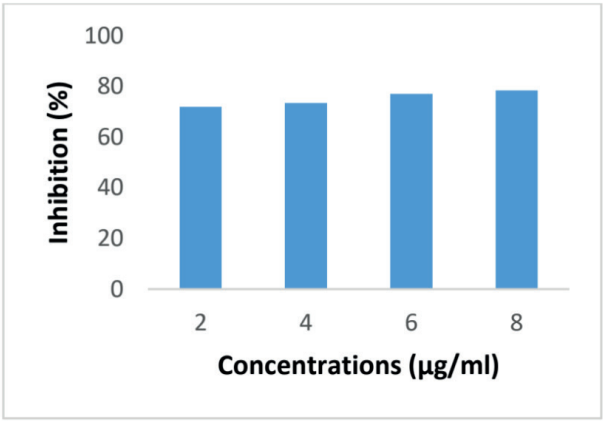

Figure 2: Inhibition (%) of *T. garganica* essential oils.

The second graph (Figure 3) represents the inhibition activitiy of vitamin C (Ascorbic acid) against the DPPH radical at different concentrations. It can be observed that as the concentration increases, the inhibition activity against the DPPH radical becomes stronger. It was 75.08% with the lowest concentration and 82.17% with the highest concentration.

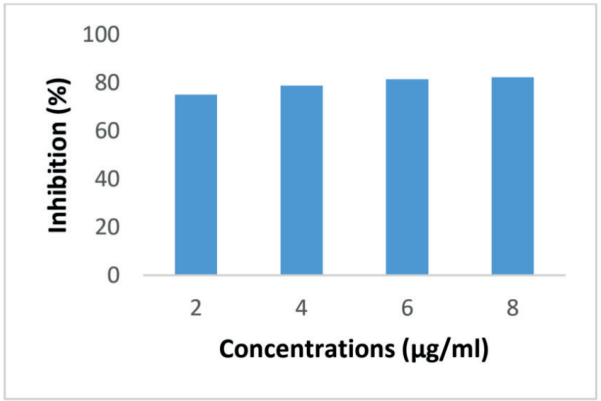

Figure 3: Inhibition (%) of Vitamin C.

The antioxidant activity against Ascorbic acid is greater than the antioxidant activity against *Thapsia garganica* oils. However, despite this, the oils of this plant is considered to have high antioxidant activity.

DISCUSSION

Based on the findings of the study on the antioxidant activity of *T. garganica* oils, the inhibition percentage at the different concentrations was high which indicates a good level of inhibition. These results are consistent with what was found by (Chibani et al, 2014) using the same plant and the same method (DPPH) with an inhibition of 28.3 to 68.7% and 28.5 to 73.2% the lowest and highest concentration (1 and 200 µg/ml) for leaves and flowers respectively.

This difference between the cited studies can be attributed to variations in environmental conditions such as soil pH, light, geographical location, prevailing climate, as well as the extent of exposure to different stresses, which play a significant role in altering their physiology. This leads to changes in the nature, type, and quantity of compounds produced, as well as the plant's age stage.

The antioxidant activity of *Thapsia garganica* essential oils is attributed to the presence of flavonoid compounds (Chibani et al, 2014; Aici and Benmehdi, 2021; Meratate et al, 2022) that act by inhibiting enzymes that produce free radicals, neutralizing them, or regenerating antioxidant systems. This has been confirmed by several studies on the same plant. In addition to its antioxidant activity, the essential oils from various parts of *Thapsia garganica* exhibits other notable biological properties like antiacetylcholinesterase, antimicrobial, anticancer and insecticidal (Casiglia et al, 2016; Khadri et al, 2020; Aici and Benmehdi, 2021; Khemis et al, 2023; Cao et al, 2024), suggesting promising therapeutic prospects.

CONCLUSION

We can conclude that the studied plant has a satisfactory antioxidant activity, although it is lower than that of Vitamin C and this is what gives it a significant therapeutic importance.

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