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Phytochemical Content, Antioxidant and Antimicrobial Effects of *Thapsia garganica* L. Leaves and Roots Grown Wild in North-west Algeria

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ABSTRACT

Background: Oxygen-centre free radicals and other reactive oxygen species (ROS) are continuously produced *in vivo,* resulting in cell death and tissues damage. Besides, the increasing resistance to existing antimicrobial agents has become a major problem. The present study aims to evaluate the antioxidant and antimicrobial activities of the *Thapsia garganica* L. leaves and roots.

Methods: Broth dilution and single spore methods were developed and seven microorganisms were used. The evaluation was performed by measuring the diameter of the growth inhibition zones around the holes *via* the determination of the inhibition percentage of mycelium growth.

Result: The determination of the polyphenol contents, total flavonoids and condensed tannins of the aqueous extract for both leaves and roots gave respectively (2.21 mg, 2.63 mg/ 100 mg gallic acide equivalents), (2.39 mg, 0.49 mg/100 mg catechin equivalent), (0.12 mg, 0.04 mg/100 mg catechin equivalent) in dry matter. The results of antioxidant activity showed that the methanolic, flavonoids and tannins extracts showed a potent scavenging activity with IC_{50} = 0.41; 0.81; 1.39; 1.80 and 1.90 mg/ml, respectively. As regards for antimicrobial activity, an important inhibition of the proposed extracts has been observed against the tested strains.

Key words: Antimicrobial activity, Antioxidant activity, Essential oils, Polyphenols content, Selective extracts, *Thapsia garganica* L.

INTRODUCTION

For a long time, plants have been subject to extensive research, heightened by the hope of obtaining therapeutically active molecules. More specifically, the therapeutic use of plants is very old and is experiencing a revival (Kabouche *et al.,* 2005). Plants produce a vast array of specialized metabolites, many of which are used as pharmaceuticals, flavors, fragrances and other high-value fine chemicals (Oksman-Caldentey *et al.,* 2004).

Polyphenols are a large family of natural compounds widely distributed in the plant kingdom, which have seen growing interest and recognition for their beneficial health effects (Lrhorfi *et al.,* 2016). Generally, each of these categories contains thousands of known compounds with many more awaiting discovery (Xiao *et al.,* 2013). Among the tens of thousands of plant-specialized metabolites, many display potent biological activities and have been used extensively as pharmaceuticals (Rates *et al.,* 2001). A significant number of studies has focused on the biological activities of phenolic compounds known as antioxidants and free radical scavengers (Saritha *et al.,* 2014). Antioxidants are a large group of compound which is formed of enzymes, vitamins, some metals and they may prevent oxidative damage in the cell due to free radicals (Senel *et al.,* 2018). Oxidative stress arises from malfunctioning internal antioxidant processes leading to range of pathophysiological conditions, primarily neurodegenerative disorders, biological aging and cancer (Kiran *et al.,* 2021).

Recently, the resistance of microorganisms to antibiotics is considered as major problem for public health. Hence, the isolation and development of new antibacterial agents from medicinal plants has gained special interest for researchers. Antimicrobial resistance threatens the prevention and treatment of an ever-increasing range of infections caused by bacteria, parasites, viruses and fungi (Farjana *et al.,* 2014).

The *Thapsia* genus, belonging to the Apiaceae family is widely used in traditional medicine as an anti-inflammatory treatment to cure many diseases such as eczema (Tlili *et al.,* 2015). Members of *Thapsia* family are found around the Mediterranean, extending from the Atlantic coasts of Portugal and Morocco to Crete and other Greek Islands (Pujadas-Salvà *et al.,* 2003). The resin from *Thapsia* spp. has been used in

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traditional medicine and in European pharmacopoeias as a remedy (Weitzel *et al.,* 2014).

The genus *Thapsia* is constituted by ten species distributed in the Western Mediterranean area and extended to the Atlantic coast of the Iberian Peninsula and Morocco. Relatively, a large number of secondary metabolites have been isolated from the genus *Thapsia* such as sesquiterpenoids and phenylpropanoids (Rubal *et al.,* 2007).

For the best of our knowledge, no scientific investigations concerning the antioxidant and antimicrobial properties of the main families of secondary metabolites of *Thapsia garganica* have been conducted so far. In this context, the aim of the present work is: (i) to carry out a primary phytochemical screening of the main secondary metabolites classes and determined the polyphenols content contained in the leaves and roots extracts, (ii) to evaluate the potential of *Thapsia garanica* as a source of natural antioxidants, (iii) to examine the antimicrobial activity of various selective extracts.

MATERIALS AND METHODS

Experimental conditions

The study was carried out during the 2014 season in the Laboratory of Chemistry, University Tahri Mohammed, Bechar- Algeria.

Plant collection and authentication

Fresh leaves and roots of *T. garganica* were collected in November 2014 from Ain Lahdjer village- Saida Province, North West of Algeria. The plant was taxonomically identified and authenticated by the Laboratory of Botanics at Tlemcen University- Algeria.

Processing of plant material

The leaves and roots were chopped into small pieces that were shade dried over a period of 3 weeks. The dried leaves and roots were milled into fine powder by means of a mixer (IKA WERKE MILL M20). The powder was stored in clean polythene bags in a cool, dry place until further use.

Preparation of crude methanolic extract

The leaves and roots of *T. garganica* (1 g) were powdered and extracted for 24 h with 20 mL of methanol at room temperature. After filtration through Whatman No 0.45 µm, the resulting solution was evaporated under vacuum at 60°C by Buchi Rotavapor R-200 to dryness. The residues were dried, weighed (8.1 g; 5.02 g) and stored at 4°C in storage vials for experimental use as in (Benhammou *et al.,* 2013).

Preparation of flavonoids extract

The sample of stem or root was directly extracted with methanol at room temperature (20 mL/24 hours). Then, the suspension was filtered and the solvent was evaporated under vacuum. The residue was dissolved in 10 mL of boiling water and then successively partitioned with 10 mL of diethyl ether, 10 ml of ethyl acetate and 10 mL of n-butanol, respectively. After separation and evaporation, the organic phases were weighed (0.33g; 1.82g; 1.08g) and stored before use following the method in (Bekkara *et al.* 1998).

Preparation of tannins extract

The extraction of tannins from *T. garganica* L. was carried out according to the method described by Zhang *et al.* (2008). The powder (5 g) of each part (leaves, roots) was extracted with 50 mL acetone-water (35/15, v/v) and stirred continuously for 72 h at room temperature. Then, the mixture was filtrated and evaporated under vacuum at 40°C to remove acetone. The remaining solution was washed with 15 mL of dichlomethane to remove lipid soluble substances. After that, the solution was further extracted with ethyl acetate at a ratio of 15/15 (v/v). The water layer was separated and extracted twice more similarly. Then the resulting water layer was evaporated to dryness and tannins residues were weighed (0.45g; 0.61g) and dissolved in methanol.

Preparation of saponosides extract

The dry seeds (200 g) were pulverized in a grinder. Powdered seeds were submitted to saponosides extraction according to protocol described by Bruneton (Bruneton 1999). A mixture of powdered material (105 g), distilled water (280 ml) and ethanol 96% (120 ml) was refluxed for 8 h. After filtration of the marc, the filtrate was extracted three times with 50 ml of n-butanol. After evaporation of ethanol and water, the title extract was obtained by precipitation with diethyl ether (m=0.94 g, yield = 0.89%, mp = 210°C). Then, the residue was dissolved in ethanol and kept in brine.

Extraction of essential oil

Samples of leaves were dried in shade at room temperature. Leaves were subjected to a steam distillation for 6 hours in a montage developed with a pressure cooker to increase the quantity of extracted oil. The distillation system consists of a source heat, a distiller, a condenser and a collection tank. The oil was dried over anhydrous sodium sulphate. After filtration, the residue was weighed (18.1g) and stored at 4°C until analysis (Lim *et al.,* 2017).

Phytochemical screening

All the prepared plant leaves and roots extracts were subjected to preliminary phytochemical screening for the presence of tannins, flavanoids, alkaloids, anthocyanins, saponins, coumarines, quinones, anthraquinones, reducing compounds, starch, sterols, fixed oils, fats and terpenoids using standard experimental procedures of analysis (Kokate 1994; Harborne 1998). This qualitative chemical characterization of the extracted constituents has been performed by means of colourful specific reactions and the formation of precipitations using suitable chemical reagents.

Determination of total phenolic content

The amount of total phenols in plant extracts was determined by the Folin-Ciocalteu reagent method (Waterman *et al.* 1994; Singleton *et al.,* 1999). About 20 µl of plant extract were mixed with Ciocalteu reagent (100 µl, (1:10; v/v) and

300 µl of sodium carbonate, Na_2CO_3, 7.5% (w/v). The mixture was stirred and incubated in dark at room temperature for two hours. The total phenols were determined spectro photometrically at 750 nm. All determination was performed in triplicate. The results were expressed in equivalent mg gallic acid/g dry plant material with reference to the calibration curve of gallic acid. The studied concentrations of gallic acid are: (0; 0.01; 0.02; 0.05; 0.08; 0.1; 0.13; 0.15; 0.17 mg/ml).

Determination of flavonoids content

The aluminum chloride colorometric method was used to determine flavonoid content (Lamaison *et al.* 1991; Bahorun 1998). Plant extract (1 ml) in methanol was mixed with 4 ml of distillated water and 0.3 ml of sodium nitrate solution (5%). As a next step, 0.3 ml of a solution of $AlCl_3$ 10% was added. After 10 min of incubation at room temperature in the dark, absorbance was measured at 510 nm. The results were expressed in equivalent milligrams of catechin per g dry plant material. The studied concentrations of catechin are: (2.5; 5; 10; 15; 20; 25; 30; 35; 40 mg/ml).

Determination of condensed tannins

The method described by Porter (1986) was followed for the determination of condensed tannins present in the extracts. Briefly, Butanol-HCl reagent (butanol-HCl 95:5 v/v) Ferric reagent (2% ferric ammonium sulfate in 2N HCl) were mixed. The mixture was stored in a boiling water pool protected against light. After 1 h of incubation, absorbance was measured by spectrophotometer UV-Vis at 550 nm. Results were expressed in mg catechin equivalents by g of dry *Thapsia garganica* powder (mg PE/g) (Porter 1986). The studied concentrations of catechin were: 0.06; 0.16; 0.18; 0.24 and 0.30 mg/ml.

DPPH scavenging activity

In order to evaluate the antioxidant potential through free radical scavenging by the test samples, the change in optical density of DPPH radicals is monitored. Using the method described by Manzocco (1998), the sample extract (0.2 mL) is diluted with methanol and 2 mL of DPPH solution (0.5 mM) was added. After 30 min, the absorbance was measured at 517 nm (Manzocco *et al.,* 1998). The percentage of the DPPH radical scavenging was calculated using the equation given below:

$$\text{Inhibition } (\%) = \frac{A_C - A_S}{A_C} \times 100$$

Where

A_c is the control reaction (containing all reagents expect the test compound) and A_s is the absorbance of the test compound. The commercially known antioxidant, ascorbic acid was used for comparison as a positive control. The tests were performed in triplicate. The extract concentration providing 50% inhibition (IC_{50}) was calculated based on the graph of inhibition percentage plotted against extract concentration.

Iron reducing power

The reducing power of *Thapsia garganica* extract and ascorbic acid was determined according to the method of Oyaizu (Oyaizu *et al.,* 1986). Different concentrations of *Thapsia garganica* extract (1 ; 2 ; 3 ; 4 et 5 mg/ml) in 1 ml of distilled water were mixed with 2.5 mL phosphate buffer (0.2 M, pH 6.6) and 2.5 mL of 1% potassium ferricyanide [$K_3Fe(CN)_6$] and underwent vortex. The mixture was made homogeneous and incubated at 50°C for 20 min; aliquots of trichloroacetic acid (2.5 ml, 10%) were added to the mixture, which was then centrifuged at 3000 rpm for 10 min. The upper layer of the solution (2.5 ml) was mixed with distilled water (2.5 ml) and $FeCl_3$ (0.5 ml. 0.1%) and the absorbance was measured at 700 nm. Increased absorbance of the reaction mixture indicated better power reduction. Ascorbic acid was used as the standard. Phosphate buffer (pH 6.6) was used as blank solution. The absorbance of the final reaction mixture of three parallel experiments was taken and is expressed as mean ± standard deviation.

Antimicrobial assay

Microbial strains

The antibacterial and antifungal activities of different extracts were tested against a panel which included five bacteria, selected as representative species: *Staphylococcus aureus* (ATCC25923), *Pseudomonas aeruginosa* (ATCC27853), *Escherichia coli* (ATCC25922), *Enterococus feacalis* (ATCC 29212), *Bacillus cereus* (ATCC 11778), obtained from the laboratory of Microbiology, Tahri Mohamed University, Bechar, Algeria. Two fungal strains: *Aspergillus flavus* and *Penicillium Purpurogenum* were isolated from coffee. The strains were grown on nutrient agar for the bacteria and on potato dextrose agar (PDA) for yeasts. For the antimicrobial tests, agar mueller hinton for bacteria and potato dextrose agar for fungal strains were used (Casiglia *et al.,* 2016).

Antibacterial activity test

The antimicrobial activity was evaluated by determining the minimum inhibitory concentration (MIC) that includes minimum bactericidal concentrations as previously described by Rigano (2011) (Rigano *et al.,* 2011) using the broth dilution method (Barry 1976). Extracts samples were tested in triplicate.

Antifungal activity test

The antifungal activity of different extracts of *T. garganica* was determined by the method of single spore. Antifungal potency was evaluated as the percentage inhibition of mycelium growth according to the formula by Philippe (2012):

$$\%\ I = \frac{C - E}{C} \times 100$$

Where

C and E are the mean growth or sporulation (mm) of controls and extracts, respectively. All tests were performed in triplicate (Philippe *et al.,* 2012).

Statistical analysis

The results were presented as the means ± SEM. Correlation analysis of antioxidant activity versus the total phenolic content were carried out using the correlation and regression programmer in the EXCEL software.

Anti-oxidant activities measured by DPPH and FRAP assays were done in triplicates to test their reproducibility. All results are presented as mean ± S.E. Correlations among data obtained were calculated using Pearson's correlation coefficient (r).

RESULTS AND DISCUSSION

Quinones, reducing compounds, saponosids, flavonoids and tannins were revealed to be present in *T. garganica*. However, basic alkaloids, Anthracenosides and Anthocyanosides were not detected in any of the tested fractions. Results demonstrated that leaves and roots of TG are either rich or of moderate content of alkaloids and flavonoids, which is the case in most of the families to which these plants belong. Leaves and roots of *T. garganica* revealed the presence of slight levels of anthracenosides and anthocyanosides.

The percentage yield of methanolic and saponosid extracts for both leaves and roots were dominated in comparison with other solvents extracted where, the lowest yielding was obtained for the etheric fraction of flavonoids extract and tannins extract. Hence, the leaves part gave 18% of essential oils.

The total phenolic content of the methanolic leaves and roots extracts is calculated from the calibration curve ($R^2 = 1$), were 2.211±0.77 mg gallic acid / 100ml and 1.631±0.56 mg gallic acid / 100 ml for the leaves and roots, respectively. The total flavonoid content of the methanolic leaves and roots extracts, calculated from the calibration curve ($R^2 = 1$), in terms of catechin equivalent ranged between 2.39±0.83 mg/ml and 0.49±0.17 mg/ml for leaves and roots, respectively. Condensed tannins content was determined by Butanol-HCl method using the calibration curve ($R^2 = 1$). The amount of condensed tannins has been reported in milligram equivalents of catechin per milligram dry weight of the extract (mg CE/mg Dw).

The condensed tannins content of the extracts in terms of catechin equivalent were between 0.12 ± 0.04 mg/ml and 0.04 ± 0.01 mg/ml for leaves and roots, respectively.

The scavenging capacity of 1 mg doses of flavonoids, tannins, saponosids extracts and methanolic crude extract of *Thapsia garganica* leaves found to be 0.81, 1.39, 7.24 and 0.41 mg, respectively (Fig 1). On the other side, 1 mg doses of TG roots were founds to be 1.80, 5.79 and 1.90 mg for tannins, saponosids extracts and methanolic crude extract, respectively and these values were greater than that of 1 mg dose of ascorbic acid.

As shown in Fig 2, the reducing power of all secondary metabolites in leaves is stronger than that in roots extract, except for the saponosides extract in roots which exhibited a good reducing effect.

The graph below (Fig 2) shows that the crude methanolic extract and the tannins extract of the leaves have an interesting iron reducing power with concentrations 5, 4, 3, 2 and 1 mg/ml noticed with the decrease in absorbance of (1.8 to 0.4) and (2.5 to 0.8) respectively.

Previously, different studies mentioned that the antioxidant activity of plant extracts is positively correlated with bioactives compounds (Beniwal and Jood 2014).

The synthesis of antibacterial activity results revealed variation in bacteria inhibition zone of plant extracts. *Pseudomonas aeruginosa* and *Bacillus cereus* was found to be the most inhibited bacteria by the saponosids and butanolic leaves extracts with inhibition halos of 20 mm and 13 mm for ethyl acetate leaves extracts. The methanolic extract of leaves and roots was also active against *Enterococcus faecalis* (09 mm). The flavonoids fractions exerted also potential effects of antibacterial activity against *Enterococcus faecalis*, *Bacillus cereus*, *Enterococcus faecalis* and *Staphylococcus aureus* with an inhibition diameter from 10 to 13 mm. However, *E. coli* shows a large

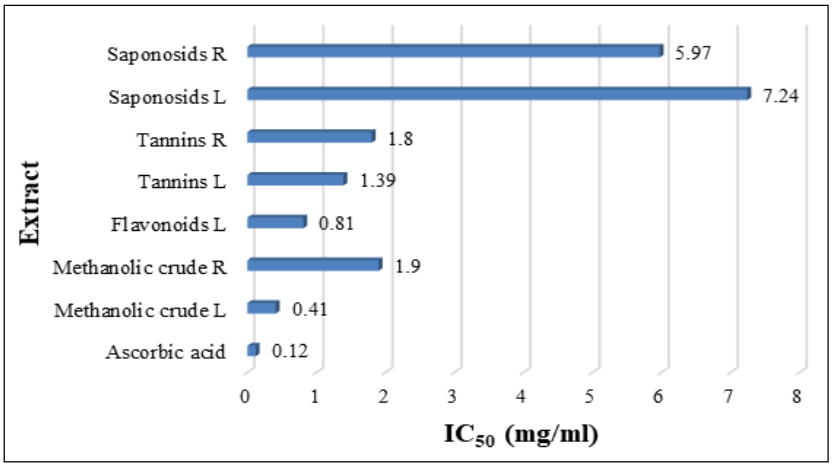

Fig 1: IC_{50} (mg/ml) values of different extracts for free radical scavenging activity by DPPH radical (A lower IC_{50} value indicates higher antioxidant activity; ascorbic acid was used as positive control; L: Leaves; R: Roots).

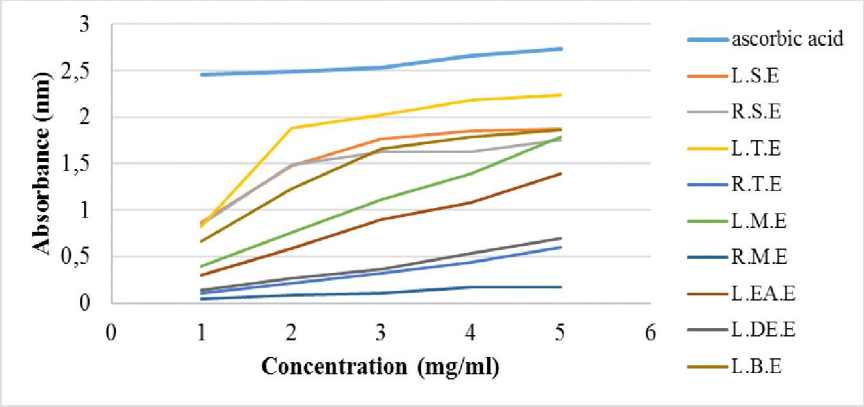

Fig 2: Ferrous reducing capacity of differents extracts of the leaves and root of *Thapsia garganica*. Ascorbic acid was included as a positive control. Each value is the mean ± standard deviation (L: Leaves, R: Roots, E: Extract, S: Saponosids, T: Tannins, M: Methanolic, EA: Ethyl acetat; DE: Diethyl ether, B: Butanolic).

resistance against all extracts for the four concentrations tested.

Antifungal activity of *Thapsia garganica* extracts was assayed by means of agar full diffusion method. The result revealed that the different extracts of *Thapsia garganica* showed significant reduction in the growth of *Aspargillus flavus* and *Penicilline purpnrogenum*.

The noncytotoxic concentrations of plant extracts (0.5; 0.25; 0.125; 0.0625 mg/mL) were used for antifungal activity tests. All results are illustrated in Fig 3.

Phytochemical analysis is very useful in the evaluation of the active biological components of some vegetables and medicinal plants. We noticed that the phytochemical screening findings in this work are in harmony with those reported by Alghazeer (2012) where *Thapsia garganica* L. showed to be rich in alkaloids, flavonoids, tannins, terpenoids, coumarin, saponosids and anthraquinons (Alghazeer *et al.,* 2012). Some of these active components have been demonstrated to possess a wide variety of biological activities such as antimicrobial, antioxidant, antitumor and antiophidic.

Methanolic, saponosides, flavonoids and tannins extracts were obtained in different yields. For instance, that of essential oils leaves yielded (18.1%) and this result correlates with Tlili, N. and al who mentioned that seeds of *Thapsia garganica* contain 30.46% of oil. Solvent polarity plays a key role in increasing phenolic solubility (Naczk *et al.* 2006). The results show that using methanol as an extraction solvent works is the best method for the extraction of various active phytochemicals, especially polar antioxidants (Alothman *et al.,* 2009). Accordingly, Michiels had suggested that selection of the most efficient solvent for phenolic compounds extraction must depend on the used food matrices (Michiels *et al.,* 2012).

As for the comparison of total phenolic content andreotti mentioned that the average amounts of total phenolics were about 25 mg / g dry matter within 60 days after full bloom and decreased to 3 mg / g dry matter when maturing in the pulpy tissue (Andreotti *et al.,* 2008). While *T. garganica* collected from different regions of Libya between spring and early summer of 2009 had the lowest value (28.53 ± 3.82 mg GAE/g DW) (Alghazeer *et al.,* 2012). Tlili *et al.* (2015) found that the total polyphenol contents of seed oil obtained from *T. garganica* are 24.65 mg GAE / g DR. It is well known that phenolic compounds play a crucial role on the free radical scavenging and reduction of oxygen concentration, or protection and regeneration of other antioxidant molecules (Zhang *et al.,* 2010). While the total flavonoid contents seed oil obtained from *T. garganica* varied from 4.98 mg QE g^{-1} DR. As mentioned in literature, the condensed tannins values of seed oil obtained from *T. garganica* varied between 0.64 mg and CE g^{-1} DR (Tlili *et al.,* 2015). The production of tannins seems to depend to a considerable extent on extrinsic factors, most notably soil conditions and light intensity. The impact of light can be quite extraordinary at the intraplant level so that the foliage in different parts of a shrub or tree can vary by several percentage points in its tannin content (Waterman *et al.,* 1994). The underlying mechanisms by which extrinsic factors, notably light, influence tannin levels has been speculated upon but remains in need of hard experimental data collection performed under conditions where as many of the potential variables as possible are controlled (Iqbal *et al.,* 2011).

The scavenging capacity of 1 mg doses of flavonoids, tannins, saponosids extracts and methanolic crude extract of *Thapsia garganica* leaves were found to be 0.81, 1.39, 7.24 and 0.41 mg, respectively. On the other hand, 1 mg doses of *Thapsia garganica* roots were founds to be 1.80, 5.79 and 1.90 mg for tannins, saponosids extracts and methanolic crude extract, respectively and these values were greater than that of 1 mg dose of ascorbic acid.

The results obtained for the free radical scavenging activity suggest that all the extracts of *Thapsia garganica* possessed the ability to quench free radical from reaching biomolecules (polyunsaturated fatty acids, sugars and amino acids *etc*.) in susceptible biological and food systems (Halliwell *et al.,* 1995).

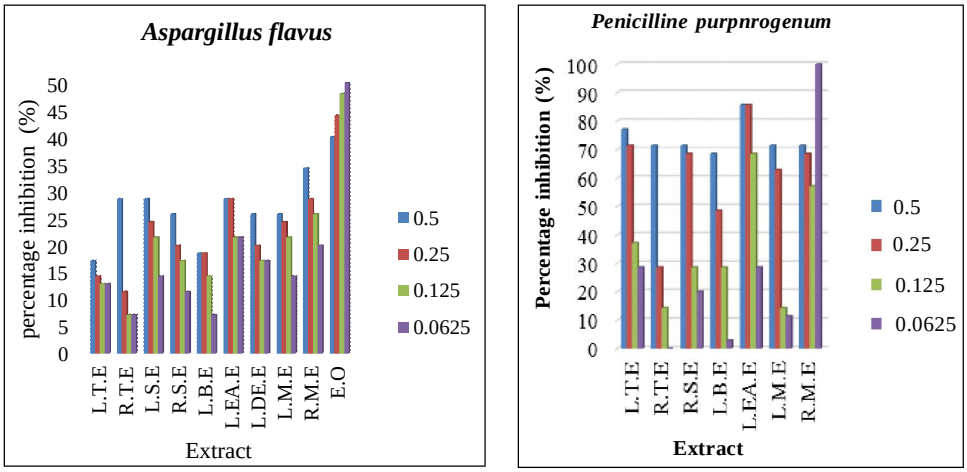

Fig 3: Antifungal activity of different extracts of *T. garganica* (leaves and roots).

L.T.E: Leaf tannins extract; R.T.E: Root tannins extract; L.S.E: Leaf saponosides extract; R.S.E: Root saponosides extract; L.B.E: Leaf buthanolic extract; L.EA.E: Leaf ethyl acetate extract; L.D.E.E: Leaf diethyl ether extract; L.M.E: Leaf methanolic extract; R.M.E: Root methanolic extract.

Fe (III) reduction is often used as an indicator of electron-donating activity. As described above, the crude methanolic extract and the tannins extract of the leaves have an interesting iron reducing power which has been confirmed by the work of Wannes (2010) and concerning methanolic fractions (Wannes *et al.* 2010) also adopted by the results of Kanoun (2011) concerning the butanol and ethyl acetate fractions of flavonoids (Kanoun 2011).

These results prove that the crude extract in leaves is rich in reductones such as phenolic compounds that produce the total antioxidant activity. Therefore, the reducing power is a very important aspect for the estimation of the antioxidant activity (Ksouri *et al.,* 2008).

In vitro preliminary screening of the antibacterial activity of different extracts of leaves and roots was studied against five microorganisms using the filter paper disc agar diffusion technique. The disc diffusion assay was only used as an indication of anti-microbial activity since the amount of extract or fractions that adhered to the disc was not quantitatively determined. The analysis of the antibacterial potency showed that among the studied bacteria, the most sensitive to be applied are saponosids and butanolic leaves extracts: *Pseudomonas aeruginosa* (ø 20 mm) and *Bacillus cereus* (ø 13 mm). The methanolic extract of leaves and roots was also active against *Enterococcus faecalis* (ø 09 mm). The flavonoids fractions exerted also potential effects of antibacterial activity against *Enterococcus faecalis*, *Bacillus cereus*, *Enterococcus faecalis* and *Staphylococcus aureus* with inhibition halos from 10 to 13 mm. However, *E. coli* shows a large resistance against all extracts for the four concentrations tested. Our results are in good agreement with the findings of Alghazeer *et al*. (2012) who found an antibacterial effect of the leaves of *Thapsia garganica* against *Staphylococcus aureus*, *E. coli* and *Pseudomonas aeruginosa* with diameters of inhibition zones equal to 16, 16 and 10 mm, respectively (Alghazeer *et al.,* 2012).

For the antifungal activity, it was found that the fungi inhibition zone ranged from 0 to 46 mm. The highest values were recorded with the roots methanolic extract against *Penicilline purpnrogenum*. As shown in Fig 3 above, the saponosids and flavonoids extracts of both leaves and roots showed a singnificative antifungal activity with a percentage inhibition of 28 to 80%. Essential oils also indicated a strong antifungal activity against *Aspargillus flavus* (p.i 50%). In contrast, leaves tannins and butanolic extracts did not show any antifungal effect against *Aspargillus flavus*.

CONCLUSION

In this study, the quantitative determination of phenolic compounds, the antioxidant and the antimicrbial properties of *Thapsia garganica* (leaves and roots) were evaluated. Phytochemical analysis showed that the major chemical constituents of the extract were flavonoids, tannins, volatil oils and saponosides. The results obtained may suggest that methanolic extract possesses compounds with antioxidant properties which can be used as natural preservative. These activities were correlated with high level of total phenolic content, flavonoids and condensed tannins. Likewise, these compounds may have potential use as antioxidative preservatives in emulsion-type systems because they are able to scavenge free radicals. However high level antibacterial activity was shown by saponosides extract against *Pseudomonas aeruginosa* and *Bacillus cereus*. Also, a moderate antibacterial activity was shown by flavonoids fractions against *Enterococcus faecalis*, *Bacillus cereus*, *Enterococcus faecalis* and *Staphylococcus aureus*. On the other hand, *E. coli* was found to be the most resistant pathogen against most of the extracts tested. Furthermore, the majority of extracts showed a good antifungal activity against the tested microorganisms. It was interesting to note that *in-vivo* studies are needed to further confirm the advantageous quality of these extracts.

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Authors' contributions

All the authors have contributed equally to this research work.

Conflicts of interest

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