

Evaluation of Total Phenolic Contents and in Vitro Antioxidant and Antimicrobial Activities of *Quercus ilex* L.

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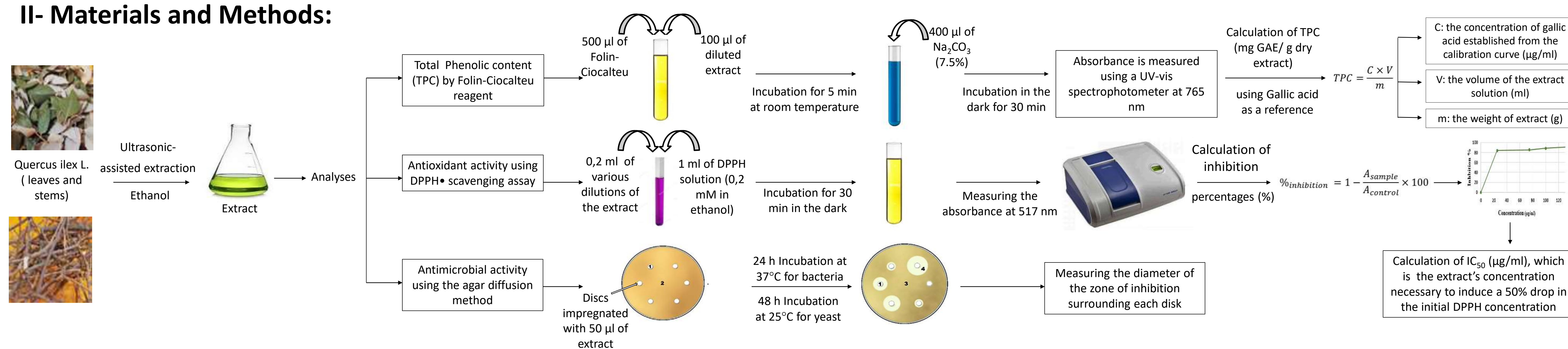
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Abstract : Natural plant extracts include a range of biologically active compounds. In order to investigate this, we conducted a study that evaluated the total polyphenol content, antioxidant, and antimicrobial activities of Algerian *Quercus ilex* L. extracts. According to the results, the stem extract of *Q. ilex* L. showed higher polyphenol content (4.695 mg GAE/g dry extract) than the leaf extract (2.834 mg GAE/g dry extract). Both extracts showed a strong antibacterial activity against some bacteria and yeasts, as well as a strong antioxidant potential towards the DPPH• radical, which was more pronounced in the stems (IC_{50} =9.80 µg/ml) than in the leaves (IC_{50} =25.28 µg/ml). These results suggest that Algerian *Q. ilex* L. can serve as biologically active ingredients in food and pharmaceutical applications.

Keywords: *Quercus ilex* L.; ultrasonic extraction; polyphenols; antioxidant activity; antimicrobial activity

I- Introduction : For centuries, medicinal plants have been considered a major source of products used in alternative medicine. Herbal treatment is known for its ease of use, its effectiveness, and its undeniable benefits. Thus, one can treat oneself with plants and put to use their preventive and curative properties. Nowadays, we understand more and more that the active principles are often linked to the secondary metabolites of medicinal plants, which are widely used in therapeutics as well as preventive agents, anti-inflammatory antimicrobials, antiseptics, diuretics, but mainly as antioxidants to fight against oxidative stress. The first goal of this study was to extract secondary metabolites from the leaves and stems of *Quercus ilex* L. using ultrasound-assisted extraction (UAE), as well as to evaluate their total polyphenol content (TPC) by the Folin-Ciocalteu method and their antioxidant activity by the DPPH free radical scavenging method, while the second part is dedicated to the examination of *Quercus ilex* L.'s antibacterial activity.

II- Materials and Methods:



III- Results and discussion:

Table 1: polyphenol content of *Quercus ilex* L. extracts

Extract	Total polyphenol content (mg GAE/ g dry extract)
Leaves extract	2.834
Stems extract	4.695



Figure 2: Zones of inhibition of microbial growth of *Pseudomonas aeruginosa*

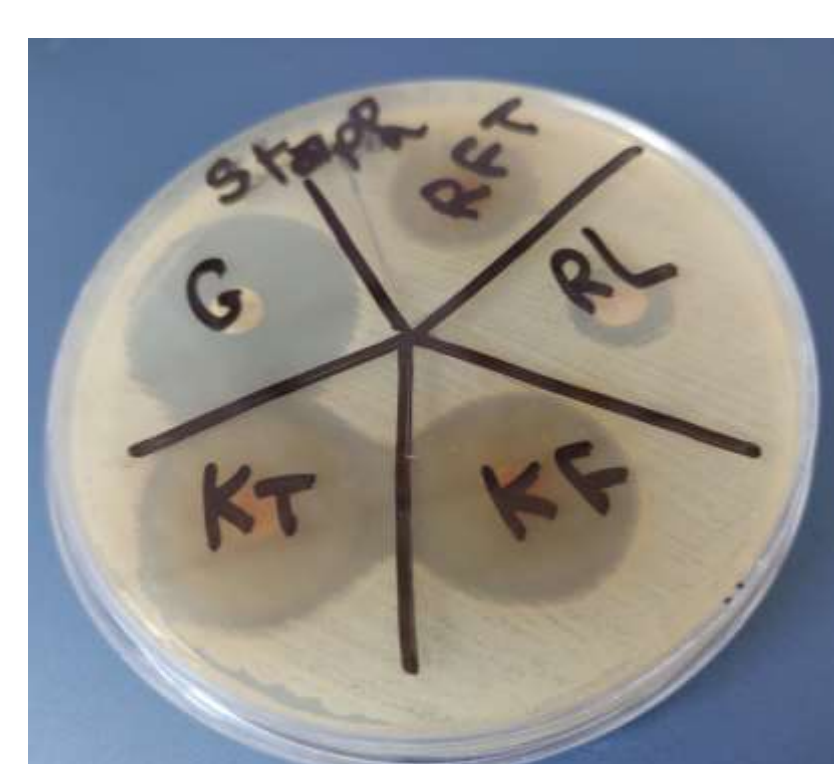


Figure 3: Zones of inhibition of microbial growth of *Staphylococcus aureus*



Figure 4: Zones of inhibition of microbial growth of *Escherichia coli*



Figure 5: Zones of inhibition of microbial growth of *Candida albicans*

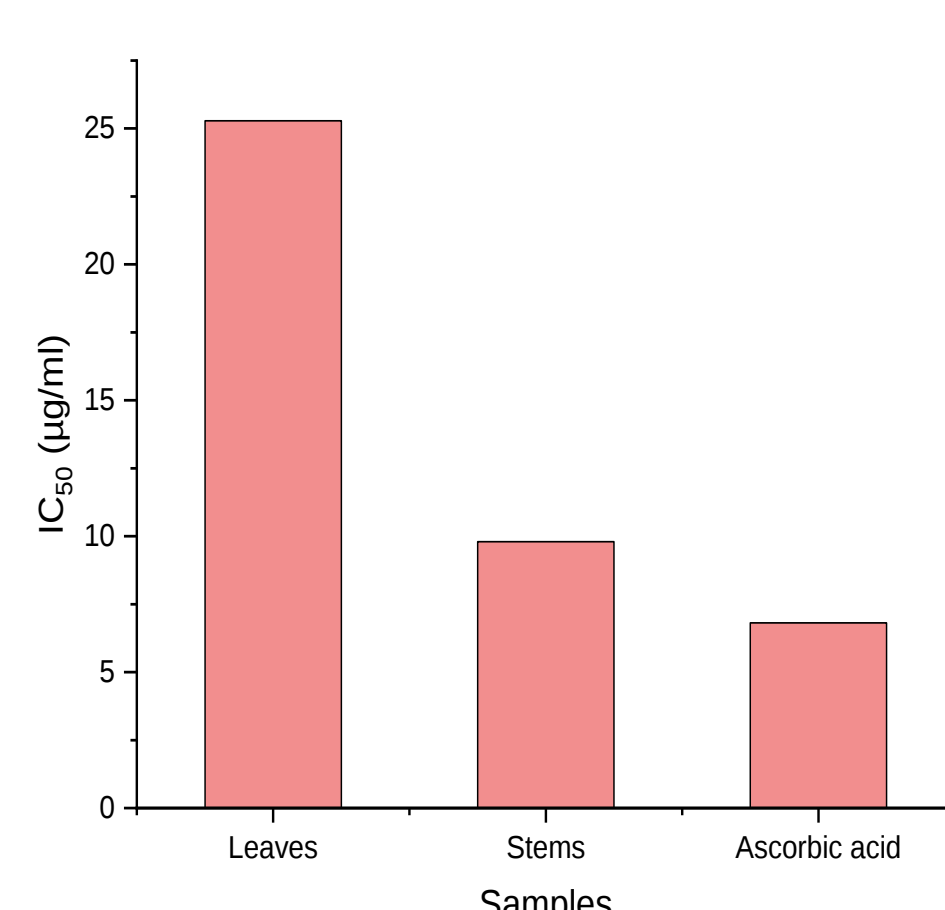


Figure 1: IC_{50} values of DPPH radical scavenging activity for extracts of *Quercus ilex* L. and ascorbic acid

Table 2: Antibacterial activity of *Quercus ilex* L. extracts, against bacteria and yeast strains, in vitro

Strains	Diameter of inhibition (mm) $\pm$ SD			
	Leaves	Stems	Gentamicin	Ketoconazole
<i>Staphylococcus aureus</i>	27.6 $\pm$ 2.6	27.3 $\pm$ 1.0	30.3 $\pm$ 0.6	—
<i>Pseudomonas aeruginosa</i>	23.3 $\pm$ 2.0	19.6 $\pm$ 1.1	27.3 $\pm$ 0.6	—
<i>Escherichia coli</i>	17.6 $\pm$ 2.0	17 $\pm$ 0.5	27.0 $\pm$ 1.0	—
<i>Candida albicans</i>	26.3 $\pm$ 1.1	18.6 $\pm$ 0.0	—	26.0 $\pm$ 0.9

Data are the mean of the three trials $\pm$ Standard deviation.

Conclusion: The phytochemical study of the *Quercus ilex* L. extracts obtained showed that they present a considerable content of phenolic compounds, more important in the stems than in the leaves. The results obtained showed a strong antioxidant potential, more pronounced in the stems than in the leaves. Moreover, the extracts of the two parts of the plant exert a very remarkable antibacterial and antifungal activity. These results suggest that extracts derived from the leaves and stems of *Quercus ilex* L. possess biological properties that make them suitable as active ingredients in the food and pharmaceutical industries. It is, however, suggested that they be analyzed qualitatively and quantitatively using more powerful methods like HPLC and GC-MS, as well as other complementary in vivo tests.