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Phytochemical analysis of *Capparis spinosa L* in Palestine

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Abstract
This study aims to shed light on the plant (*Capparis spinosa L.*), belonging to the family (*Capparidaceae*) found in Palestine, in terms of the chemical composition of its leaves, flowers, buds, fruits, and roots.
The chemical study of various extracts of leaves, flowers, buds, fruits and roots (*Capparis spinosa L.*) for biologically active compounds was carried out using several types of specific chemical reactions and based on the color change of the dye before and after treatment with special reagents, the identity of the active substance was determined.
As a result of the chemical study of the various extracts, the presence of the following active substances was proven for the first time.
Anthraquinones derivatives, alkaloids, saponins, tannins, phenols, flavonoids, terpenoids, amino acids and coumarins in the leaves, flowers, buds, fruits and roots of the plant (*Capparis spinosa L.*), widespread in Palestine.

Keywords: Phytochemical analysis, *Capparis spinosa L.*, plants of Palestine.

Introduction
Mediterranean shrubs called capers are prized for their salt and vinegar-pickled fruits and delicious flower buds. This species is a good candidate for domestication to sustain and improve agriculture in places susceptible to significant climate change and severely affected by drought since it possesses great adaptations to regions experiencing climate swings [1, 2].
Utilizing these drought-tolerant species has several benefits, such as their moderate water needs, great genetic improvement potential, local expertise and information of this plant material, and the current global plant product commerce network. Perennial caper plantings have the potential to preserve agricultural ecosystems and assist retain water in the soil for extended periods of time [2, 3].
The Capparis genus, often known as capers, is not widely grown. These plants have high tolerance to challenging climatic circumstances and are found growing widely in many locations of the world, particularly in the Mediterranean basin [4].
One of the most significant commercial species in the *Capparidaceae* family is *Capparis spinosa L.* [5]. Apart from its application in the Mediterranean diet, *Capparis spinosa L.* has long been recognized for its diuretic, antihypertensive, and tonic qualities as a traditional herbal remedy [6]. It has been demonstrated that numerous *Capparis spinosa L.* extracts have positive effects on human disorders, including anti-diabetic and anti-hypolipidemia properties [7]. For instance, *Capparis spinosa L.* methanol extract has been suggested as a therapy for pathological disorders brought on by oxidative stress [8].
It has demonstrated outstanding efficiency in scavenging antioxidants/free radicals in several settings [9, 10]. In traditional medicine in Arab countries, the *Capparis spinosa L.* plant is used to prevent or treat a number of illnesses, including diabetes, prostate, hepatitis, obesity, and eye infection [11, 12] Table 1.
There have been several reports of the pharmacological actions of the different components of the *Capparis spinosa L.* plant. Antibacterial, cytotoxic, antiviral, anthelminthic, antifungal, antioxidant, anti-inflammatory, anti-arthritic, chondroprotective, cardiovascular, respiratory, antidiabetic, anti-allergic, and anti-histaminic properties, as well as immunomodulatory, diuretic, hypolipidemic, antipyretic, anticarcinogenic, hepatoprotective, and hypoglycemic properties are among these actions [11, 12, 18-22].

Table 1: Traditional uses of *Capparis spinosa L.* in some Arab countries

Arab country	Traditional uses of *Capparis spinosa L.*	References
Palestine	Breast cancer	[13]
Jordan	Purgative, Rheumatic pain and anthelmintic	[14]
Saudi Arabia	Skin rash, dry skin and Swollen joints	[3]
Morocco	Eye infection, cataracts, diabetes and hypertension,	[3, 15]
Algeria	Prostate, breast, and bone cancers	[16]
Libya	Hemorrhoids, splenomegaly, stomach ailments and vomiting	[17]

Prior research on the chemical makeup of several *Capparis spinosa L.* extracts revealed the existence of numerous advantageous substances, including vitamins, flavonoids, and polyphenols, which are well-known for their antioxidant capabilities [3, 11, 12, 22].

In Palestine, one of the recognized medicinal herbs is *Capparis spinosa L.*, sometimes known as "caper." This perennial subshrub grows to a height of one meter. It grows haphazardly in the clefts and fissures of stone walls and rooks. Orbicular leaves and white, fading pinkish purple blooms are features of the plant [23], Figure.1.

Fig 1: *Capparis spinosa L.*

Materials and Methods

Collection of plant material

Plant parts of *Capparis spinosa L.* were collected from a natural habitat

In the village of Izbet Shoofa in Tulkarm Governorate in the West Bank-Palestine, see the Table 2.

Table 2: Plant part of *Capparis spinosa L.* and time harvest

Plant parts	Buds	Flowers	Fruits	Leaves	Roots
Harvest time	May	June	July	June-July	August

All parts of *Capparis spinosa L.* cleansed with cold distilled water, let to air dry, crushed into a powder using an electric grinder to make them ready for extract preparation, and stored in opaque plastic containers until needed.

Using a Soxhlet system at 60-80 °C, the resultant powder was extracted using a range of solvents, including hexane, chloroform, acetone, and alcohol in different concentrations. After being concentrated in a rotating vacuum evaporator, these extracts were kept for later use at 4 °C.

Chemicals and reagents

All liquids, chemicals, and reagents used in the phytochemical study were of analytical grade.

The reagents used for detecting various phytochemical groups included Modified Borntragers for anthraquinones, Wagner's, Dragendorff's, Hager's reagents for Alkaloid detection, Foam Froth for saponinsLead acetate, $FeCl_3$ reagents for Tannins/ Phenols, Wilson's and Alkaline regents for Flavonoids, Libermann-Burchard, Salkowski's for Terpenoids/Steroids and Biuret regent for amino acides.

Preparation of plant extract

Coarse powder from the shade dried leaf part of (50 g) was extracted to exhaustion successively with ethanol extract using a soxhlet apparatus.

Phytochemical analysis

Phytochemical analysis different qualitative chemical tests for all previously prepared extracts of leaves, flowers, buds, fruits and roots (*Capparis spinosa L.*) were performed using standard procedures to identify the presence of major constituents to identify biologically active compounds (24-26).

Results and Discussion

Qualitative phytochemical screening

The biochemical activity of many medicinal plants, like *Capparis spinosa L.*, in treating a wide range of ailments is the reason for their significance. These plants include a large number of active chemical compounds that are chemically formed from secondary metabolic components.

These substances, which are referred to as naturally occurring secondary metabolites, are produced by a number of metabolic processes in the presence of several enzymes in medicinal plants.

The components of the *Capparis spinosa L.* plant produce active chemical compounds by biochemical synthesis caused by these enzymes. These chemicals include coumarins, alkaloids, tannins, phenols, flavonoids, and terpenoids. These chemical substances that are active have a wide range of physiological impacts.

This study employed multiple types of specific chemical reactions to chemically study extracts of leaves, flowers, buds, fruits, and roots from (*Capparis spinosa L.*), in order to identify biologically active compounds. The active substance was identified based on the dye's color change before and after treatment with special reagents Table 3.

Screening of anthraquinones

Modified Borntragers Test: 10 ml of benzene was added to 20 ml of aqueous-alcoholic extract from the leaves, flowers, buds, fruits and roots (*Capparis spinosa L.*) and shaken for 3-4 minutes. In this case, the benzene layer turned yellow-orange. 5 ml of benzene extract was mixed with 5 ml of 10% ammonia solution. The ammonia layer acquired a red or cherry-red color, indicating the presence of anthraquinone glycosides in the raw material.

10 ml of the extract from the leaves, flowers, buds, fruits and roots (*Capparis spinosa L.*) obtained with 10% sodium hydroxide solution was acidified with diluted hydrochloric acid to a slightly acidic reaction and 10 ml of diethyl ether was added. The ethereal layer turned yellow. 5 ml of ether extract was shaken with 5 ml of ammonia solution. The ammonia layer was colored red, and the ether layer was yellow, which indicates the presence of anthraquinones in the

raw material.

Table 3: Initial qualitative analysis of active substances from *Capparis spinosa L.* parts

No	Chemical composition	Qualitative interaction
1	Anthraquinones	Modified Borntrager's Test
2	Terpenoids	Libermann-Burchard test Salkowski's test
3	Flavonoids	Alkaline reagent Wilson‟s Test
4	Saponins	Foam (Froth) Test
5	Tannins	Ferric chloride Test
6	Alkaloids	Dragendorff‟s Test Wagner‟s Test Hager's Test
7	Amino acids	Biuret test
8	Phenols	Lead acetate test
9	Coumarins	With 10% solution NaOH

Screening of alkaloids

- **Dragendorffs test:** 1ml of the extract from the leaves, flowers, buds, fruits and roots (*Capparis spinosa L.*) was measured and put in a test tube. After that, 1 mL of Dragendorff's reagent was added and well mixed. Alkaloids were indicated by the formation of an orange-red deposit.
- **Wagners test:** Equal volumes of the extracts and Wagner's reagent were put in a clean dry test tube and agitated. The appearance of a reddish-brown precipitate revealed the presence of alkaloids.
- **Hagers test:** Extracts was treated with a saturated picric acid solution. The presence of alkaloids was evidenced by the production of a yellow precipitate.

Screening of saponins

- **Foam (Froth) test:** A tiny quantity of the extracts was combined with a few drops of distilled water, and the mixture was shaken hard. Saponins were detected by the formation of a persistent foam layer one centimeter thick. The foam was then stirred and a few drops of olive oil added. The production of emulsion validates the outcome.
- **Screening of tannins:** In a test tube containing 10 ml of pure water, 2 ml of the extracts is first added, heated, and then filtered. The presence of tannin is shown by a color shift to blue-black and brownish green after adding 0.1% of $Fecl_3$.

Screening of phenols

Lead acetate test: 2ml of 10% lead acetate were filtered, and then mixed with 2ml of the extracts. The presence of phenolic and tannin chemicals is indicated by a thick, bulky white precipitate.

Screening of flavonoids

- **Wilson's test:** If any flavonoids are present in the extract of the leaves, flowers, buds, fruits and roots (*Capparis spinosa L.*), they turn a bright yellow with yellowish-green fluorescence when treated with Wilson's reagent.
- **Alkaline reagent test:** After treating 2ml of the extract of leaves, flowers, buds, fruits and roots (*Capparis spinosa L.*) with a 10% ammonium hydroxide solution, the presence of flavonoids is denoted by yellow fluorescence.

Screening of terpenoids/steroids

- **Salkowski's test:** After processing the extracts in chloroform, apply a few drops of strong sulfuric acid to the test tube wall, shake well, and let to stand for a little period. A reddish hue at the bottom layer indicates the presence of steroids, whereas the production of a golden-yellow precipitate indicated triterpenoids.
- **Libermann-Burchard test:** The extracts are heated, cooled, and then a few drops of acetic anhydride are added. Next, conc. sulfuric acid is poured from the sides of the test tube. The extracts have a brown ring where two layers meet, and the top layer becomes green to show the presence of steroids. The presence of terpenoids is indicated by the formation of a deep red color.

Screening of amino acids:

The extracts were subjected to tests for free amino acids, which included: Biuret test: A 2 mL filtrate was mixed with a little quantity of Biuret reagent. The hue changed from pale blue to violet/mauve, indicating the presence of peptide linkages or proteins.

Screening of coumarins

Chloroform was combined with a little quantity of each extract from the fraction and crude sample separately. After that, a few drops of 10% NaOH were added. A yellow color develops after a time, signifying the presence of coumarins on the Test-Tube.

The presence of the following active ingredients was established as a consequence of the chemical analysis of the different extracts:

The plant (*Capparis spinosa L.*), which is widely distributed in Palestine, contains anthraquinone derivatives, alkaloids, saponins, tannins, phenols, flavonoids, terpenoids, amino acids, and coumarins in its leaves, flowers, buds, fruits, and roots.

The data obtained in the preliminary phytochemical screening were given in Table. 4.

There are studies conducted on the plant (*Capparis spinosa L.*), which is widespread in Palestine [27, 28], but our current study differs from previous studies in the following:

1. For the first time, the chemical composition of the *Capparis spinosa* L. plant that grows in Palestine is under study.
2. A chemical study was carried out on various extracts from the leaves, flowers, buds, fruits and roots of the *Capparis spinosa* L. plant.
3. For the first time, the existence of the following active substances has been proven:
4. Anthraquinone derivatives, alkaloids, saponins, tannins, phenols, flavonoids, terpenoids, amino acids, and coumarins in the leaves, flowers, buds, fruits, and roots of the plant (*Capparis spinosa* L.), widespread in Palestine.

Conclusions

The current study identified the Phytochemical Analysis of *Capparis spinosa L.*, a traditional medicinal herb which is widely distributed and used in Palestine.

Using a variety of specific chemical reactions, the chemical analysis of different extracts of leaves, flowers, buds, fruits, and roots (*Capparis spinosa* L.) was conducted in order to identify biologically active compounds. The active substance was identified based on the dye's color change before and

after treatment with specific reagents.

For the first time, the presence of the following active components was confirmed as a result of chemical analysis of various extracts from leaves, flowers, buds, fruits, and roots (*Capparis spinosa* L.). It contains anthraquinone derivatives, alkaloids, saponins, tannins, phenols, flavonoids, terpenoids, amino acids, and coumarins.

Table 4: Chemical composition of the extracts from different organs of *Capparis spinosa L.* and method identification

Organs and Chemical composition	Roots	Leaves	Flowers	Buds	Fruits	Identification method
Anthraquinones				+		Modified Borntrager's Test
Terpenoids				+		Libermann-Burchard test, Salkowski's test
Flavonoids		+	+	+	+	Alkaline reagent Wilson‟s Test
Saponins				+		Foa (Froth) Test
Tannins				+		Ferric chloride Test
Alkaloids	+			+	+	Dragendorffs Testm, Wagners Testm, Hager's Test
Amino acids						Biuret test
Phenols		+	+	+	+	Lead acetate test
Coumarins					+	With 10% solution NaOH

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