Pharmacognostical and preliminary investigation of Iraqi cultivated Bougainvillea spectabilis

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Abstract

Objective: The goal of this study was to examine the morphological characteristics such as shapes, colors, and sizes of different parts of the plant, as well as microscopical analysis of both fresh and dried leaves, and to identify several phytoconstituents through preliminary phytochemical screening. Methods: The plant was collected from Baghdad, Iraq. Morphological features such as shape, color, and size, were examined in fresh B.spectabilis leaves, flowers, bracts, and stems; while for microscopical examination, both fresh and dried leaves were employed. Furthermore, different secondary metabolites were investigated by general preliminary tests. Results: In this study, the plant's morphological characteristics were estimated as well as the types of stomata and trichomes of both fresh and dried leaves were identified microscopically. Furthermore, general phytochemical screening on different parts of the plant revealed that it contains alkaloids, tannins, saponins, steroids, terpinoids, and carbohydrates, but it loses both flavonoids and coumarins. Conclusion: The morphological characteristics of *Bougainvillea spectabilis* grown in Iraq were found to be similar to those grown in other countries, with the exception that the petaloid bracts, which are modified leaves that surround the flower, are only available in purple or rusty-red, whereas those grown in other countries are available in a variety of colors ranging from white to red. In preliminary tests, all the tested parts of the plant were found to contain similar phytochemicals, however the quantities may differ, and more quantitative researches are needed to validate this. Many phytochemicals are abundant in this plant, with the exception of coumarins and flavonoids, which are missing.

Keywords: *Bougainvillea spectabilis*, Human health, medical plants

Introduction

Human health is extremely interested in medicinal plants. For thousands of years, plant-based medicines have been a part of traditional healthcare in most parts of the world. Ayurvedic practitioners employ a variety of therapeutic herbs on a regular basis. The Pharmaceutical, cosmetic, agricultural, and food industries all use therapeutic plants [(1)]. The genus *Bougainvillea* is native to South America and derived its name from Louis Antione de Bougainville (1729–1811), an admiral in the French Navy who encountered the plant in Brazil in 1768, and it was introduced to the rest of the world. The genus *Bougainvillea* in the Nyctaginaceae (4 O'clock) family of plants has 18 species, with three that are horticulturally

important (in an ornamental sense): *B. spectabilis*, *B. glabra*, and *B. peruviana*. *Bougainvillea* species have been shown to possess alkaloids, flavonoids, cardiac glycosides, saponines, and beta-cyanins [(2)]. According to ethnomedical information, Bougainvillea is used to treat helminthiasis, diabetes, respiratory disorders, cough, cold, bronchitis, ulcers, and diarrhea in numerous parts of the world. Analgesic, antipyretic, and anti-inflammatory properties are among the pharmacological functions of Bougainvillea [(3)]. The antibacterial activity was discovered in *B.spectabilis*, hinting that it could be utilized to replace commercially available antibiotics [(4,5)].

The disinfecting effect of an ethanolic extract of fresh green *B.spectabilis* leaves was examined. The maximum antibacterial activity was identified in leaves, followed by flowers, and stems. Gram-negative E.coli and gram-positive Micrococcus aureus can both be slowed by it [(6)]. In albino rats, B. spectabilis stem bark extract had 22.2 percent more anti-hyperglycemic efficacy than 0.2mg/kg glibenclamide, an oral hypoglycemic medication [(7)]. Pinitol, a component of *B.spectabilis*, a traditional anti-diabetic herb, has been demonstrated to have insulin-like effects. The findings support the hypothesis that D-pinnitol (3-O-methyl-chiroinositol) can improve glycemic control in STZ (streptozocin)-diabetic mice by acting as insulin. D-pinitol may affect glucose absorption via influencing insulin action at the post-receptor level [(8)].

Materials and methods

B.spectabilis plant materials were collected from Baghdad, Iraq. The plant was recognized and certified by the national herbarium at the University of Baghdad's biology department.

Macroscopical examination

Morphological features such as shape, color, and size were examined in fresh B.spectabilis leaves, flowers, bracts, and stems.

Microscopical study of B.spectabilis

For microscopical examination, both fresh and dried leaf powder were examined. On a slide, fresh and dried leaf was applied separately, followed by the addition of two drops of chloral hydrate solution to bleach the color and obtain a clear section. Then it was examined under a microscope. The photographs containing various cell components were obtained by using a digital camera [(9)].

Phytochemical studies [(10)]

Test for tannins

0.5 g of powdered plant material was boiled in 20ml of distilled water and filtered in a test tube. The filtered material was then treated with 0.1 percent FeCl3. The presence of tannins is indicated by a brownish-green or blue-black tint.

Test for saponins

1 gram of powdered plant material was boiled in 10 ml of distilled water and then filtered. The filtered material was then combined with 5ml of distilled water in a test tube and violently shaken. The presence of saponins is indicated by the creation of a stable froth of about 1cm in height

Test for flavonoids

1ml of ethanolic extract of the plant was mixed with 2ml of ethanolic KOH. The presence of flavonoids is indicated by the production of a yellow color.

Test for terpinoids

5 ml of aqueous plant extract and 2 ml of CHCl3 were combined in a test tube. After that, 3ml of concentrated H2SO4 was carefully added. The presence of terpinoids is indicated by the formation of a layer with a reddish-brown precipitate.

Test for alkaloids

After acidifying 2 ml of plant ethanolic extract with a few drops of dilute HCl, 1 ml of Dragendorff's reagent was added. The presence of alkaloids is indicated by the presence of an orange- to- crimson precipitate.

Test for steroids.

1 ml of CHCl3 and 2 ml of acetic anhydrous were added to 1 ml of ethanolic plant extract, followed by 1-2 drops of concentrated H2SO4 carefully applied. The upper layer of the test tube will be colored red, while the acid layer will turn yellow with green fluorescence, showing that steroids are present.

Test for carbohydrates

The test solution was mixed with a small amount of Molisch's reagent (α-naphthol dissolved in ethanol) in a test tube. A small amount of concentrated sulfuric acid was then gently added down the sides of the slanting test tube without mixing to form a layer. A purple-red ring forming at the interface between the acid and test layers indicates a successful reaction.

Test for coumarins

On filter paper, a few drops of ethanolic extract were applied, followed by one to three drops of NAOH (1N) solution. The filter paper is then exposed to UV light to check for yellow to blue fluorescence.

Results and discussion

Macroscopical examination

The plant's morphological characterization was part of the macroscopic examination; the plant is a woody vine or shrub that grows to a height of 5 to 12 meters, (figure 1), (table 1).

Figure (1): *B.spectabilis* cultivated in Iraq

The flowers are white, with hairy tubes and a short, slender form. Each flower is surrounded by three vivid, egg-shaped petaloid bracts that are purple or rusty-red in color (table 2). Simple, alternating, ovate to rounded leaves with a deep green color, leathery texture, and hairy underneath. The leaves ranged in length from 5 to 10 cm, (table 3). The stem was thorny, pubescent, and covered in numerous hairs. Growing stems range in color from light green to dark green, (table 4), (figure 2).

(a)

(b) (c) (d)

Figure (2): Arial parts of B.spectabilis, (a) leaves and bracts (b) stem (c) leaves and stems (d) bracts and flowers.

Plant type	Woody plant characteristics	Growth rate	Texture	Hight	Habit/form
Annual	Brood life evergreen	rapid	medium	Up to 12m	Ascending
perennial					climbing
shrub					Multi-stems
vine					spreading

Table (1): whole traits of *B.spectabilis*

Flower color	Cream tan/white
Blooming time of flower	Fall/spring/summer
Flower Shape	Tubular
Flower petals	Bracts
Flower size	<1 inch

Table (2): flower description of *B.spectabilis*

Leaf color	Green
Leaf feel	Leathery/papery
Leaf type	simple
Leaf shape	Elliptical/ovate
Hairs present:	yes
Leaf length	5-10 cm
Leaf width	3-5 cm

Table (3): leaf description of B.spectabilis

Stem color	Copper/brown
Thorns present:	Yes
type	Woody perennial vine
Length	Spread up to 2-4 m
Hairs present:	yes

Table (4): stem description of B.spectabilis

Microscopical examination

A close-up of the stomatal guard cells (GC) and epidermis subsidary cells on the abaxial surface of the leaf's epidermal peel (SC) revealed that the stomata are anomocytic, with guard cells surrounded by cells that are the same size, shape, and organization as epidermal cells. Furthermore, a clean section of the leaves revealed multicellular, glandular, and unbranched trichomes. In addition, microscopical examination of powdered leaves revealed the presence of fibers and calcium oxalate crystals, (figure 3).

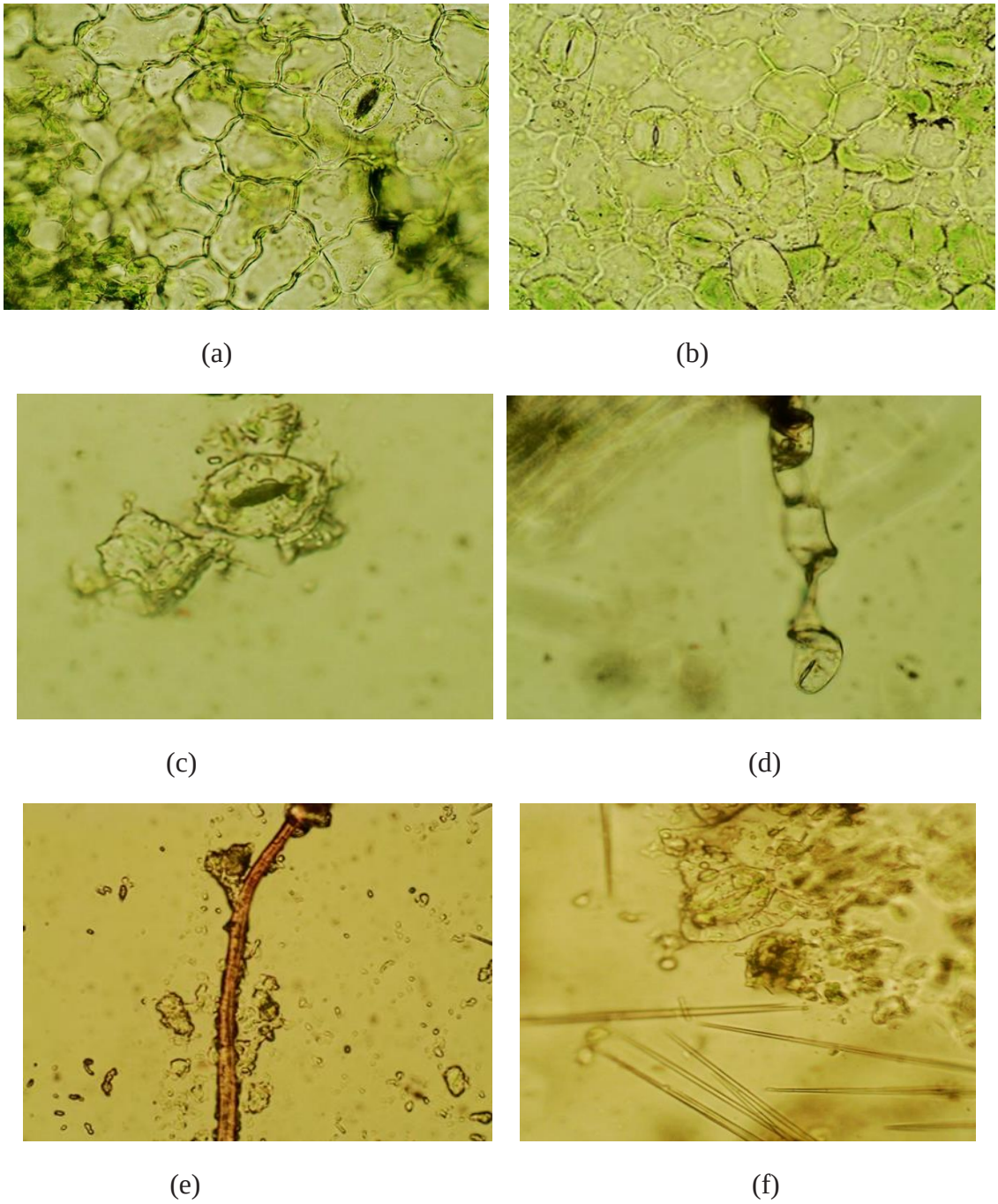

Figure (3): Micrograph of *B.spectabilis* fresh and powdered leaves (a) fresh leaf anomocytic stomata 40x (b) fresh leaf anomocytic stomata 10x (c) powdered leaf anomocytic stomata 40x (d) fresh leaf trichomes 40x (e) fibers 10x (f) calcium oxalate crystals 40 x.

Phytochemical screening

In the present study, the phytochemicals occurring in the various parts of *Bougainvillea spectabilis* (leaves, stems, and bracts) were analyzed qualitatively by phytochemical screening. The results revealed the presence of various secondary metabolites of therapeutical importance. Alkaloids, saponins, terpinoids, carbohydrates, and steroids were found in all the investigated parts of plants. Flavonoids and coumarin, on the other hand, are not found in any part of the plant, (table 5).

Tests	Leaves	Stems	Purple Bracts
Tannis	+	+	+
Saponins	+	+	+
Flavonoids	_	_	_
Terpinoids	+	+	+
Alkaloids	+	+	+
Steroids	+	+	+
carbohydrates	+	+	+
Coumarin	_	_	_

Table (5): results of preliminary general screening of *B.spectabilis*

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