

## ANATOMICAL STUDY TO BRACTS EPIDERMIS OF SOME *BOUGAINVILLEA GLABRA* VARIETY IN IRAQ

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### Abstract

The Anatomical characters of bracts epidermis studied to seven Variety (*Bougainvillea glabra* var. bluish violet, *B. glabra* var. red, *B. glabra* var. yellow, *B. glabra* var. Bold pink, *B. glabra* var. Bold red, *B. glabra* var. white, *B. glabra* var. orange) belong to species *Bougainvillea glabra* from the family Nyctaginaceae and many characters of the bracts epidermis was useful to separate between the Variety, especially the qualitative and quantitative characters of long cells, stomata, microhairs, and macrohairs, besides, crystals Bundles. The mentioned cells varied in length, width, number of stomata, the number of Abaxial epidermises and the Adaxial epidermis, their lengths, the number of hairs, their length, and the number of hair-forming cells, which produced many important characteristics for the identification and diagnosis of the variety of Bougainvillea. So the aim of the study was to a knowledge the anatomical characters of bracts epidermis for the studied variety and use these characters to separate between those variety taxonomically.

Key: *Bougainvillea glabra* Variety, Anatomical characters, epidermis, bracts.

### Introduction

Nyctaginaceae, (the four o'clock family) having about 33 genera and 290 species of [flowering plants](#)(1) ((Chakaravarty, 1976). distributed in tropical ,subtropical regions and temperate regions .there plants are Trees, shrubs, and herbs, or lianas or climbing. Leaves simple, alternate (sometimes), or opposite; petiolate to sessile; non-sheathing;. Lamina entire; pinnately veined; cross - venulate. Leaves exstipulate(2) (Pulawska., 1973). Flowers solitary, or aggregated in inflorescences as cymes, or in panicles, or in spikes, or in umbels. Inflorescences terminal, or axillary; with involucre bracts ,or without involucre bracts

bract is a modified or specialized [leaf](#), especially one associated with a reproductive structure such as a [flower](#), [inflorescence](#)axis or [cone scale](#). Bracts are often different from foliage leaves. They may be smaller, larger, or of a different color, shape, or texture. they look different from the parts of the flower such as the petals or [sepals](#). .( Hernández-Ledesma, et al,2011)(3) .In [Bougainvillea glabra](#) The actual [flower](#) of the plant is small and generally white, but each cluster of three flowers is surrounded by three or six [bracts](#) with the bright colours associated with the plant, including pink, magenta, purple, red, orange, white, or yellow,crimson(4) ( Kobayashi *etal* (2007). [Bougainvillea glabra](#) is sometimes referred to as "paper flower" because the bracts are thin and papery.

Anatomically Nyctaginaceae Plants with 'crystal sand', or without 'crystal sand'. *The leaf lamina* dorsiventral, or bifacial. Hairs present, with eglandular and glandular hairs; mostly Multicellular hairs uniseriate branched or simple. Complex hairs present or absent. The mesophyll usually containing crystals. The crystals raphides, or druses, or solitary-prismatic. First anatomical research has emphasized the occurrence of anomalous secondary growth in stems and roots of *Bougainvillea*. The first researchers who studied the *Bougainvillea* were Esau and Cheadle, they reveal and explain anomalous secondary growth [5]. Following their work, researchers such as Stevenson and Popham studied the ontogeny of the primary thickening meristem in seedlings [6]. So, Zamaski described vascular continuity in the primary and secondary stem tissues [7] and (8) Carlquist reviewed the works in revisiting secondary growth in plants such as *Bougainvillea* in addition to others

[9]. Then Chew, (2010) studied the anatomical features of shoots, petioles, roots, leaves, bracts, spines, and flowers, to try to understand why certain anatomical features exist in this genus and not others. (10) Najmaddin and Saeed, (2020) described the anatomy of the stem, petiole, midrib, lamina, and margin.

#### Materials and Methods

"The autopsy study included anatomy of seven varieties of *Bougainvillea glabra*, and it was based on samples collected during field trips in Karbala Governorate. The bracts leaves were dissected and their microscopic characteristics were studied, in terms of quantity and quality:

#### 1.1 Preparation of epidermis

##### - Leaf Epidermis

(11) (Al-Garaawi, 2017) the method with some modification in preparing the bract Epidermis of the lower and upper leaf was followed with the following steps:

1. The bracts is taken from the plant at the flowering stage.
2. The middle third of the fully grown bracts is taken so that it includes all areas of the blade from one edge to the other.
3. The bracts was held in the same way for the upper and lower Epidermis, a slit is made that runs from edge to edge across the width of the leaf and in the middle to include all of the blades.
4. The required Epidermis was isolated by the scraping process of the contrasting Epidermis and the tissues between them until clean Epidermis is obtained.
5. The Epidermis was dyed with saffranin, then washed with alcohol.

The clean Epidermis was transferred to a new slide containing a drop of calicirin and covered with a Coverslip gently. The slices were marked and preserved until they were used for examination and diagnosis"

## Results

### 1. Bracts epidermis

Bracts epidermal cells of *Bougainvillea* subspecies have a high degree of diversity, when microscopically dissecting its skin, many characteristics were revealed in distinguishing between subspecies. The cells of these areas varied in the Abaxial epidermis and the Adaxial epidermis, but they were similar in terms of their components and quality. The epidermal tissue consists of long cells, stomata, microhairs, and macrohairs, besides, crystals Bundles were also studied.

The mentioned cells varied in length, width, number of stomata, the number of Abaxial epidermises and the Adaxial epidermis, their lengths, the number of hairs, their length, and the number of hair-forming cells, which produced many important characteristics for the identification and diagnosis of the variety of *Bougainvillea*.

### Abaxial epidermis

Many variations were found in the characteristics of the Abaxial epidermis, despite some overlapping, through a microscopic study of the shapes, dimensions, and nature of the walls of six subspecies belonging to *Bougainvillea*.

It was possible to distinguish between the subspecies by the shape of the long cells and the nature of their walls, where the walls in most of the subspecies medium slightly undulating-moderately and slightly thickened, while the two subspecies *Bougainvillea* var. white, and var. orange were characterized by a greater ripple than the rest of the studied subspecies. The subspecies var. white with slightly thicker walls compared to the studied species. As for the two types, *Bougainvillea* Var Bold pink and *Bougainvillea* Bold red var, they were characterized by lobed walls of a star shape with four lobes. Najmaddin and Saeed (2020) reported that the epidermal cells are polygonal isodiametric, or elongated with thick straight arched or have slightly sinuous walls

In addition, the study also dealt with the lengths and numbers of stomata, their shapes were of the anomocytic type, where the stomata are not surrounded by subsidiary cells but Najmaddin and Saeed (2020) showed that the stomata type were anisocytic, anomocytic, parasitic, hexacytic and hemiparacytic. while Xuan *et al.* (2011) reported that the stomata were anisocytic. As for their lengths, the highest range of stomata cell length was recorded in the subspecies var bluish violet, which reached (30-42.5) Micrometer, followed by the var Orange in the range (27.5-40) Micrometer, and the lowest range in the var red subspecies reached (20-27.5) Micrometer. As for the rest of the subspecies, they overlapped in their ranges, which ranged between (22.5-32.5) micrometers. No study was available on the dimensions of the epidermal cells of the subspecies of the *Bougainvillea* plant.

Table No. (1) shows the highest number of stomata in the genus Var bold pink, ranging between 2-to 7) stomata in the microscopic field. The lowest number was (0-1) in the Bold red var, while the rest of the subspecies overlapped in their numbers between 1-3) No study was available on the stomata of the subspecies of the *Bougainvillea* plant.

The long cell length was useful in distinguishing between the studied subspecies, as the highest range was recorded at (125-62.5) in var red, followed by var bluish violet, which reached (60-87.5), and the ranges of the rest of the studied subspecies overlapped between 32.5 as a minimum in *Bougainvillea* var white and 60 as a maximum in the var orange.

The two subspecies var red and var bluish violet recorded the highest ranges in the long cell width, reaching (42-75) and (25-50), respectively, and the lowest record width of (12.5-25) in var white. The rest of the subspecies overlapped in their ranges that reached (15-45).

The number of crystalline bands for Bold red var was distinguished by having the highest number (between 3-4) bands and the lowest number which reached 0-1 bands in the two subspecies var red and var yellow, the number of which ranged between (1-2) bands in the rest of the studied subspecies.

Variations in the number of long cells were diagnosed in the microscopic field of the studied subspecies (Table 1). The subspecies var white achieved the highest rate (412 cells) in the microscopic field, while the lowest rate was recorded (125) cells in the subspecies var bluish violet, while their numbers converged in the two subspecies var red and var yellow, reaching 192 and 197, respectively. However, they were isolated from the rest of the studied subspecies, and they also converged in the two subspecies Var Bold pink and Bold red var, reaching 228 and 235 cells, respectively, but they were also isolated from the rest of the studied species. No study was available on the dimensions of the epidermal cells of the subspecies of the *Bougainvillea* plant.

### **Adaxial epidermis**

The variations in the quantitative characteristics of the Adaxial epidermis components of *Bougainvillea* were useful in isolating the studied subspecies as shown in Table (2). The highest average length of long cells was recorded in the red Bracts, which amounted to 60.5, followed by var Bold pink, which reached 52.5  $\mu\text{m}$ , whose average was close to the yellow subspecies, which recorded 51.5  $\mu\text{m}$ , isolated from the rest of the studied subspecies based on this trait, while the lowest length of the long cells in the orange subspecies was 37.5, which distinguished and isolated it from the rest of the studied species, while their lengths were equal in the two subspecies white and bold red, which amounted to 45.25, and the trait isolated them from the rest of the subspecies. As for the width of the long cells, the highest rate was recorded in the white subspecies, which reached 40 micrometers, which was characterized by the convergence of the lengths of its cells with their width resembling a square. Its cell walls were sparse, and this isolated it and distinguished it from the rest of the subspecies. The lowest width was seen in the two subspecies Bold red and Bold pink, reaching 27.25, and the rates of the rest of the subspecies were close between these two rates.

As for the stomata cells, they were absent in most of the studied subspecies, except for the white var subspecies. In some microscopic fields, two stomata cells were seen as a maximum, their lengths ranged between 22.5-30, and thus isolated from the rest of the studied subspecies, and this is contrary to what Chew, (2010) mentioned that the Adaxial epidermis of the bracts is devoid of

stomata. So he mentioned that the type of stomata in the family as a whole was of the anomocytic type. The characteristics of stomata were considered important taxonomically to separate the taxonomic ranks, as in the study (Al-Garaawi, 2020).

The crystalline bands of the studied subspecies were isolated. The highest limit was recorded in the subspecies Bold pink, reaching 5 bands, followed by Bold red and yellow subspecies, reaching (4) bands, while the two subspecies var red and orange, only one crystalline band was seen in the microscopic field, which is useful in isolating the studied subspecies from each other. Concerning the number of long cells in the microscopic field, the highest number was recorded in var white, which reached 356 cells, which distinguished it and isolated it from the rest of the subspecies. It is followed by the two subspecies red and Bold pink, which reached 236,216 respectively, which contributed to their taxonomic isolation from the rest of the subspecies, and the lowest number was 157 cells in var yellow. No study was available on the characters of crystalline bands of the subspecies of the *Bougainvillea* plant.

### Indumentum

The indumentum was distinguished by hairs in the studied genera in terms of variation in their number, length, and number of cells that make up a single hair. The papillae were also found in very few numbers in all the studied species except for orange, which was distinguished by a large number of papillae in addition to the hairs (Table 3).

In all studied species, hairs consisting of (2) cells to 11 cells were found, and the percentage of the number of cells forming hairs varied. The hairs consisting of (6-7) cells were found more in the subspecies var bluish violet, white, var, orange. As for the subspecies var yellow, Bold red, and Bold pink, a large number of hairs consisting of (4-5) cells were observed, while the hairs whose number ranged from (2-3) found the highest percentage in var red, while the hairs formed by the number of cells were observed (10-11) in var bluish violet white, var. In general, the number of hair cells that ranged between (2-3) was found in small percentages in all species, except for the type var red, which was distinguished by the highest percentage from the rest of the other types, followed by var yellow.

As for the number of hairs, their numbers were large in the microscopic field, especially in the areas close to the veins in the two types, white, and var orange. It ranged between (3-10) overlapping with its numbers in var bluish violet, as it ranged between (2-7), and its numbers were similar in the rest of the species, ranging between (1-4) hairs in the microscopic field.

No study was available on the dimensions and numbers of the indumentum of the subspecies of the *Bougainvillea* bracts. but a study by Najmaddin and Saeed (2020) to Some *Bougainvillea Glabra* Cultivars it appears that the trichomes are multicellular glandular, unicellular non-glandular, multicellular non-glandular and unicellular glandular. and the characteristics of the indumentum are taxonomically important to separate the taxonomic ranks as in the study (Al-Garaawi, 2017).

Table(1) Show Quantitative adjectives to Abaxial epidermis of Bracts to variety *Bougainvillea*

Number of Ordinary cells in microscope field	Number of Bundles crystals	Length of ordinary cells (µm)	Width of ordinary cells (µm)	Number of Stomata	Length of Stomata (µm)	Adjectives variety
137 (125 ) 115	1-2	87.5( 70 )60	50 (42.5) 25	1-2	37.5) 30 (42.5	<i>Bougainvillea</i> var bluish violet
210(192)170	0-1	125(84.5)62.5	75(60.5)42	1-3	27.5(25)20	<i>Bougainvillea</i> var red
197)180 (217	0-1	51)42.5 (60	32.75) 22.5 (45	1-2	35. 5) 27.5 (40	<i>Bougainvillea</i> var yellow
228)220 (235	1-2	41.75)35(50	27. 5 ) 15(32.5	2-7	(27.5) 22.5 30	<i>Bougainvillea</i> var Bold pink
235)225(240	3-5	41.75)35(50	23)15 (30	0-1	27.5)22.5(30	<i>Bougainvillea</i> Bold red var
412)380 (440	1-2	40)32.5 (45	20.5) 12.5 (25	1-3	31.75)25 (32.5	<i>Bougainvillea</i> var white
151)135 (162	0-3	53.75) 50 (65	36.25)15 (42.5	1-3	28.75)25 (32.5	<i>Bougainvillea</i> var orange

Notice: The number on the right means that (Less) the value ,in the middle means(The average),in the Left means (higher

Pulawska, Z. (1973) The parenchyma-vascular cambium and its derivated tissues in stems and roots of *Bougainvillea glabra* Choisy (Nyctaginaceae). Acta Soc Bot Pol 42:41–61

Table (2) Show Quantitative adjectives to Adaxial epidermis of Bracts to variety *Bougainvillea*

Number of Ordinary cells in microscope field	Number of Bundles crystals	Length of ordinary cells (µm)	Width of ordinary cells (µm)	Number of Stomata	Length of Stomata )µm(	Adjectives variety
196)180( 220	1-3	44.5)37.5( 52.5	36.25)25.5 ( 50	-	-	<i>Bougainvillea</i> var bluish violet
236)200(250	0-1	60.5)42.5 (75	47.5(33. 5)25	-	-	<i>Bougainvillea</i> var red
157)150 (165	1-4	51.5) 45 (60.5	27.25)20(32.5	-	-	<i>Bougainvillea</i> var yellow
216)190(230	1-5	52. 5)45(57.5	27.25)17.5(37.5	-	-	<i>Bougainvillea</i> var Bold pink
168)158 (175	1-4	45.25)35(55	(27.25)17.5 37.5	-	-	<i>Bougainvillea</i> Bold red var
356)370 (420	0-4	45.25)30 (55	40)30 (50	0-1	27.5)22.5(30	<i>Bougainvillea</i> var white
176)170 (182	0-1	37. 5)32.0 (55	32. 5)15(42.5			<i>Bougainvillea</i> var orange

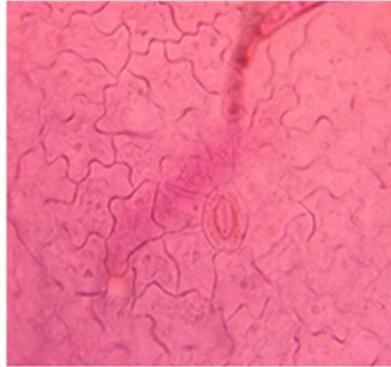
Notice: The number on the right means that (Less) the value ,in the middle means(The average),in the Left means (higher)value

Table (3) Show Difference Density between the *Bougainvillea* variety on leaves epidermis Hairs

Dense of hair glandular and non glandular depending on number of cells					Number of cell hair	Length of hairs	variety
10-11 cells	8-9 cells	7 cells- 6	4-5 cells	3-2 cells			
+	++_	+++	++	+	2-7	136.25)87.5 (175	<i>Bougainvillea</i> var bluish violet
	+	+	++	+++	1-4	65) 25 100 (	<i>Bougainvillea</i> var red
	+	+	+++	++	1-4	122.5) 50 (162.5	<i>Bougainvillea</i> var yellow
	+	++	_+++	+	1-3	116.5) 62.5(137.5	<i>Bougainvillea</i> var Bold pink
	+	++	+++	+	1-4	106.25)26.5 (150	<i>Bougainvillea</i> Bold red var
+	++	+++	+	+	3-10	116.5)62.5 (175	<i>Bougainvillea</i> var white
	++	+++	++	+	3-10	97.5) 25( 175	<i>Bougainvillea</i> var orange



*B.glabra* var. *red*



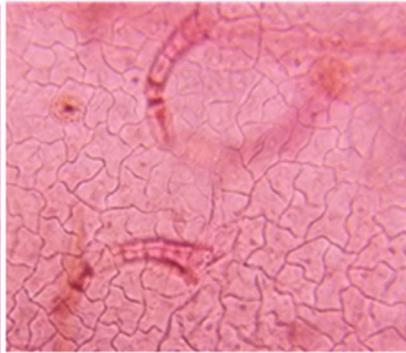
*B.g.* var. *bluish violet*



*B.g.* var *yellow*



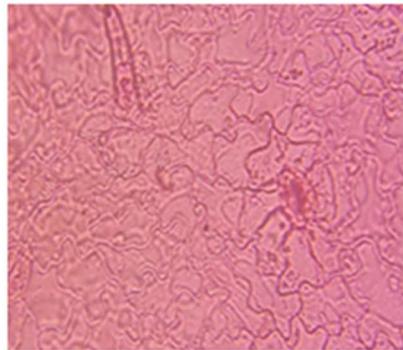
*B.glabra* Var. *Bold pink*



*B.glabra* Var. *Bold red*



*B.glabra* Var. *Wight*

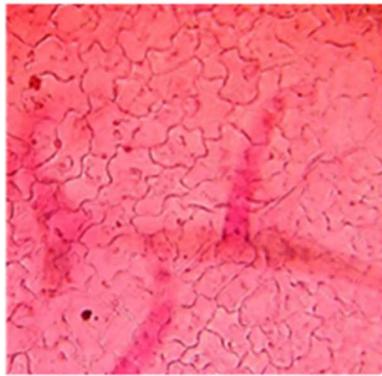


*B.glabra* Var. *Orang*

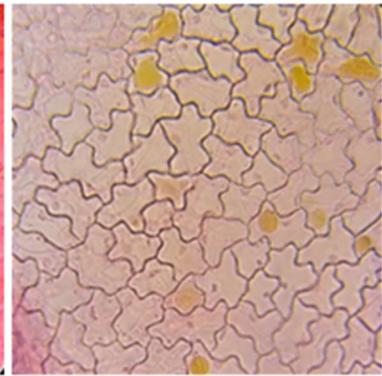
Plate (1) lower epidermis of bracts in *Bougainvillea* variety .



*B.glabra* var. red



*B.g.* var. bluish violet



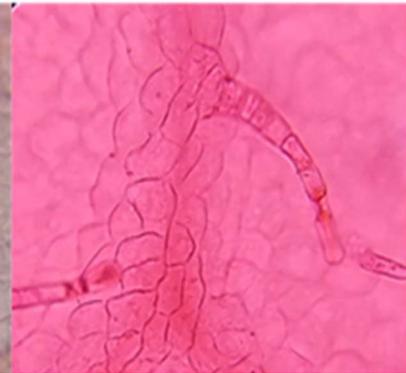
*B.g.* var yellow



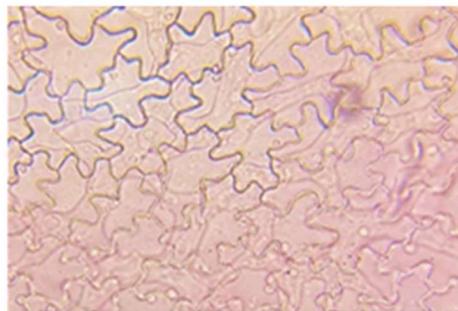
*B.glabra* Var. Bold pink



*B.glabra* Var. Bold red



*B.glabra* Var. Wight



*B.glabra* Var. Orang

Plate (1) upper epidermis of bracts in *Bougainvillea* variety .

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