

Research Article

Stem Botanical Studies of *Markhamia Platycalyx* (Baker) Sprague

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ABSTRACT

Family Bignoniaceae is one of the richest families in secondary metabolites. It includes many genera of high economic and medicinal values. One of the important plants of this family is *Markhamia platycalyx* (Baker) Sprague. Reviewing the available literature, nothing could be traced concerning the botanical features of *M. platycalyx*. This provoked the authors to carry out both macromorphology and micromorphology investigations of it. These various diagnostic characters could be helpful in authentication and identification of *M. platycalyx* stems.

Keywords: *Markhamia platycalyx*, *Dolichandrone platycalyx*, Bignoniaceae, stem, botanical, macromorphology and micromorphology.

INTRODUCTION

Bignoniaceae family is rich in active secondary metabolites and includes many genera of high economic and medicinal values¹. It is known as the Bignonia family². Its plants are particularly abundant in northern South America, a few genera occur in tropical Africa, Madagascar and Asia². *Markhamia platycalyx* (Baker) Sprague [Syn. *Dolichandrone platycalyx* Baker] is one of Bignoniaceae species³. The recent literature showed a study that investigated the antimicrobial and GC/MS studies for saponifiable and volatile oil of *M. platycalyx* leaves⁴. While, nothing could be found about the botanical study of *M. platycalyx*. The current study was performed to investigate the macromorphological and micromorphological features of *M. platycalyx* stems, which could be helpful in authentication and identification of the plant.

MATERIALS AND METHODS

Plant material

The plant (*M. platycalyx*) was cultivated in El-Zohria botanical garden, Giza, Egypt. The plant material was collected in May 2012. It was recognized by Mr. Mamdouh Shokry, director of El-Zohria botanical garden and confirmed by Prof. Mahmoud A. H. Abdo, Director of Floriculture Nursery (Aromatic and Medicinal plants), Faculty of Agriculture, Minia University. A voucher sample was kept in the Herbarium of Pharmacognosy Department, Faculty of Pharmacy, Minia University. The number of the voucher specimen is (Mn-Ph-Cog-015). The fresh and preserved [in alcohol-glycerin-water (1:1:1)] plant samples were used for the botanical study. Moreover, the stems were air-dried, reduced to fine powder suitable for microscopical examination. All samples were stored in well-closed containers.

Taxonomy

M. platycalyx Sprague belongs to⁵: Kingdom (Plantae), Subkingdom (Viridiplantae), Infrakingdom (Streptophyta), Superdivision (Embryophyta), Division (Tracheophyta), Subdivision (Spermatophytina), Infradivision (Angiospermae), Class (Magnoliopsida), Superorder (Asterales), Order (Lamiales), Family (Bignoniaceae), Genus (*Markhamia* Seem. ex Baill.) and Species (*M. platycalyx* (Baker) Sprague).
Dyes

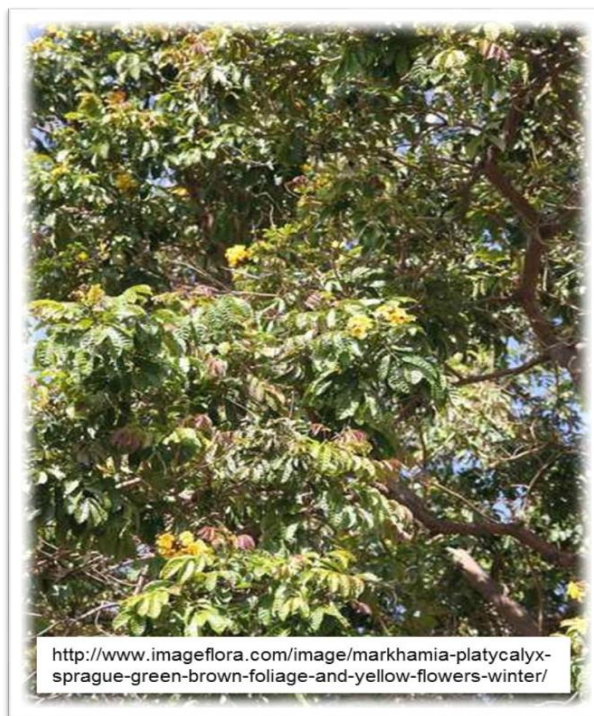


Figure 1: A photo of *M. platycalyx* Sprague.

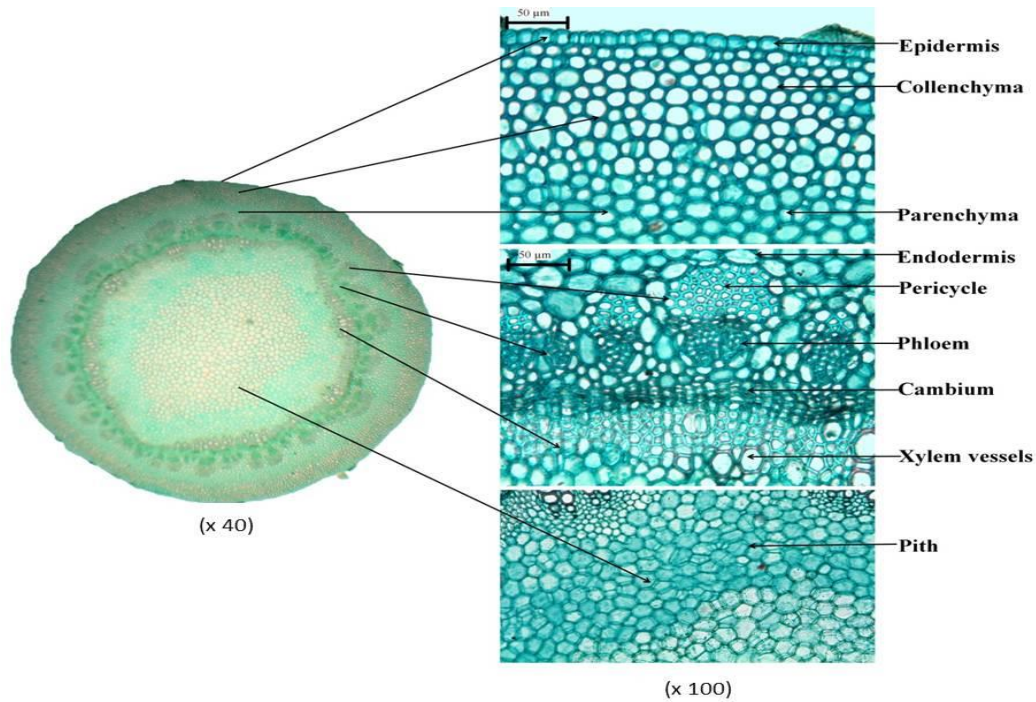


Figure 2: Detailed T.S. in the upper part of the stem.

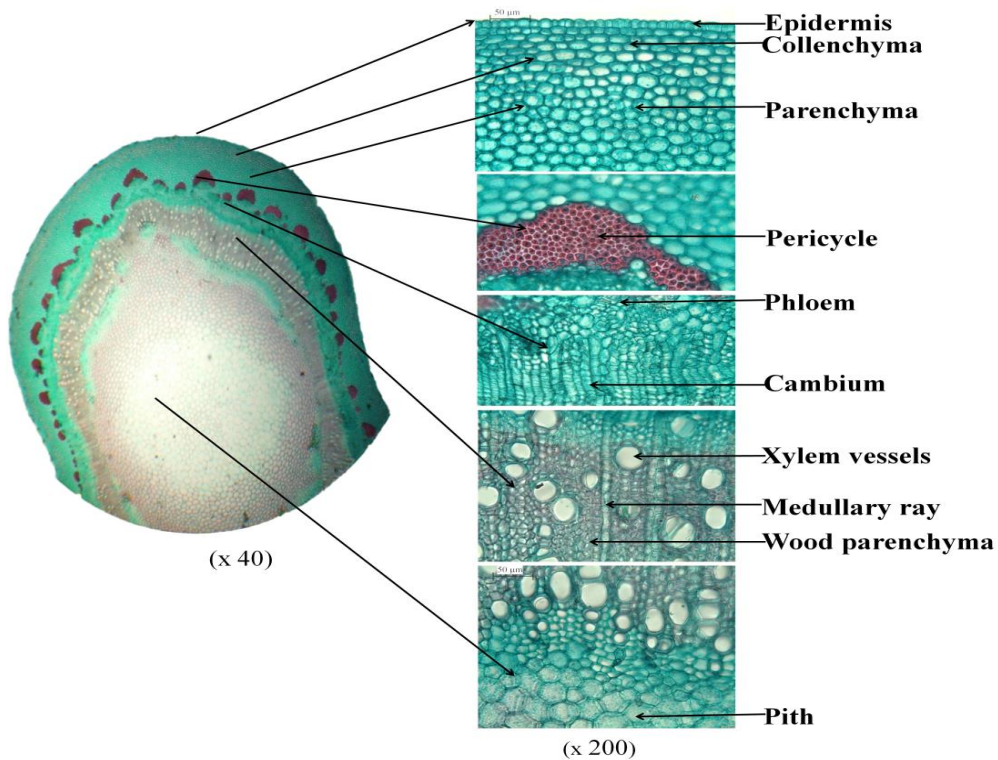


Figure 3: Detailed T.S. in the middle part of the stem.

Many dyes were used for staining the plant sections and the powder as safranin, light green, phloroglucinol and concentrated hydrochloric acid.

Microscopic studies

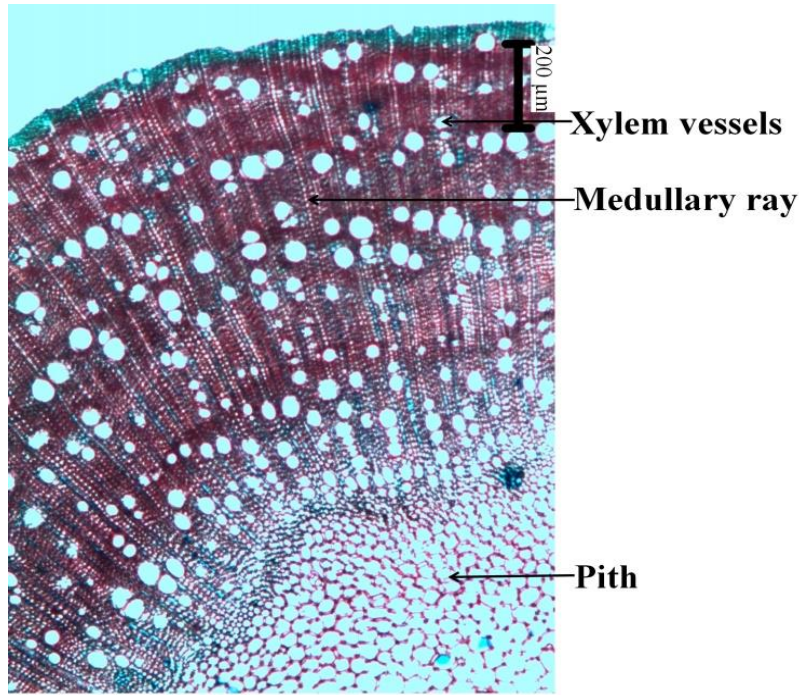
Transverse sections (T.S.), longitudinal sections (L.S.) as well as the powder of the stem were used for investigation of different microscopic characters.

Microscope with camera, Leica® (Germany) and 12.2 megapixels digital camera, Samsung (Korea) were used for the microscopical investigations.

RESULTS AND DISCUSSION

Macromorphology of the stem

M. platycalyx is an evergreen, erect and spineless tree up to 15 m in height; the trunk reaches 20 cm in diameter with



(x 40)

Figure 4: Detailed T.S. in the lower part of the stem.

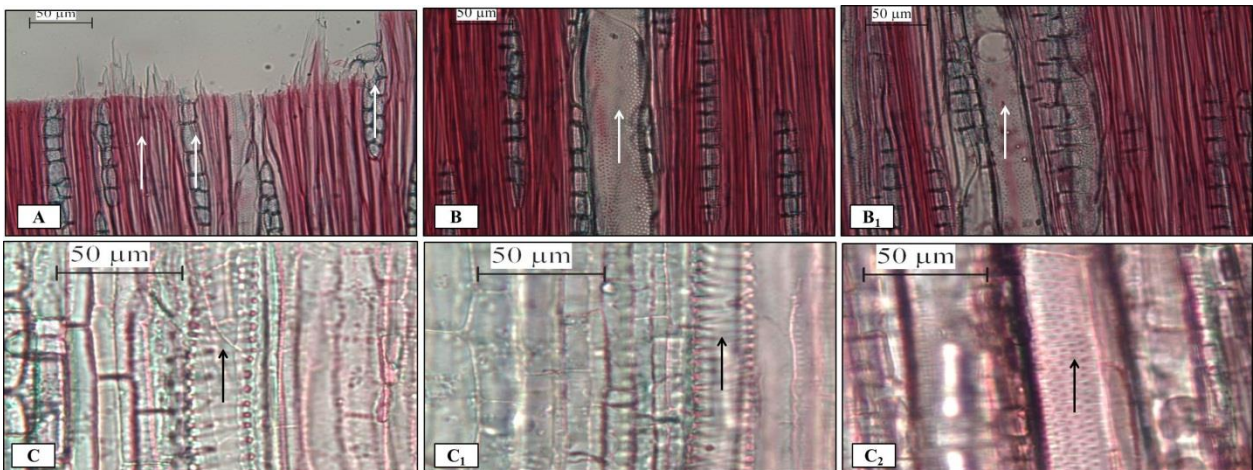


Figure 5: L.S. in lower part of the stem showing: A: Wood fibers, medullary ray cells and wood parenchyma, B, B₁: Tracheids and tracheidal vessel, C, C₁, C₂: Scalariform, spiral and boarded pitted thickenings of xylem vessels. All (x 200).

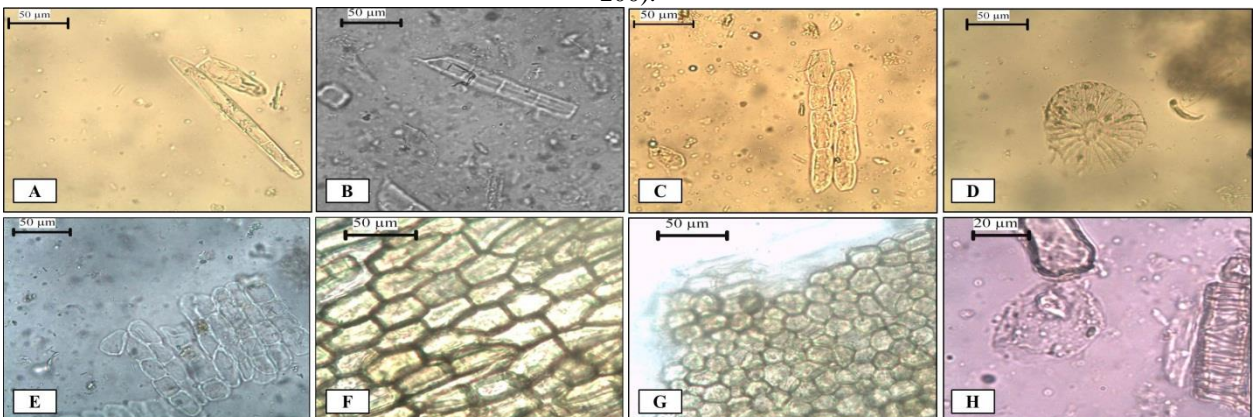


Figure 6: Powder elements of the stem; A: Pericyclic fiber, B: Wood fibers, C: Medullary ray cells, D: Peltate hair, E: Wood parenchyma cells, F: Cork cells, G: Epidermal cells of stem and H: Spiral xylem vessel. All (x 200) except H (x 400).

Table 1: Microscopical dimensions of the stem elements of *M. platycalyx* (μm).

| Item | Length | Width | Height | Diameter |
|--------------------------------|----------------------|-------------------|-------------------|-------------------|
| 1. Peltate hair | ---- | ---- | 10- <u>13</u> -16 | 62- <u>66</u> -80 |
| 2. Epidermal cells | 16- <u>20</u> -24 | 12- <u>18</u> -20 | 8- <u>10</u> -14 | ---- |
| 3. Cork cells | 28- <u>40</u> -60 | 14- <u>20</u> -24 | ---- | ---- |
| 4. Collenchyma cells | ---- | ---- | ---- | 6- <u>8</u> -20 |
| 5. Parenchyma cells | ---- | ---- | ---- | 14- <u>22</u> -30 |
| 6. Pericyclic fibers | 164- <u>200</u> -234 | 14- <u>16</u> -32 | ---- | ---- |
| 7. Xylem vessels | ---- | ---- | ---- | 12- <u>14</u> -22 |
| 8. Medullary ray cells | 28- <u>50</u> -60 | 12- <u>16</u> -22 | ---- | ---- |
| 9. Wood fibers | 150- <u>158</u> -168 | 10- <u>18</u> -20 | ---- | ---- |
| 10. Tracheids | 188- <u>190</u> -192 | 38- <u>50</u> -64 | ---- | ---- |
| 11. Tracheidal vessels | 154- <u>200</u> -216 | 30- <u>40</u> -42 | ---- | ---- |
| 12. Acicular needles of Ca ox. | 12- <u>19</u> -42 | ---- | ---- | ---- |

bright brown bark and fine vertical fissures, while the leafy branches measure 0.5-1 cm in diameter (Fig. 1).

Micromorphology

The upper part of the stem: A transverse section in the upper part of the stem is nearly rounded in outline (Fig. 2). It showed an epidermis followed by a narrow cortex formed of subepidermal masses of collenchyma cells and parenchymatous layer towards the vascular tissue. The pericycle consists of islets of slightly lignified pericyclic fibers alternating with parenchyma cells, surrounding a continuous ring of vascular tissue with wide parenchymatous pith in the center.

The epidermis: The epidermal layer is formed of one row of square to subrectangular cells as seen in the transverse section (Fig. 2). In surface view, the epidermal cells appear polygonal isodiametric in shape with straight anticlinal walls covered with smooth cuticle (Fig. 6G). Glandular hairs of peltate type are present, similar to those of the leaf, but more abundant and larger in size; formed of an unicellular stalk and a multicellular head of 16-28 radiating cells (Fig. 6D).

The cortex: The cortical tissue is formed of an outer subepidermal collenchymatous zone followed by an inner parenchymatous one. The collenchyma layer is formed of 6-7 rows of rounded to oval cells having thick cellulose walls with no intercellular spaces, while the parenchymatous layer consists of 5-8 rows of rounded cells having thin cellulose walls with large intercellular spaces and containing few acicular needles of calcium oxalate (Fig. 2). The endodermis is parenchymatous and nearly indistinguishable.

The vascular tissue: The pericycle is formed of islets of slightly lignified pericyclic fibers, separated by parenchymatous cells (Fig. 2). Each islet composed of 14-50 fibers. The pericyclic fibers are fusiform in shape,

septated with thick lignified walls, narrow lumina and rounded ends as shown in the powder (Fig. 6A). The phloem is formed of islets of thin walled, soft cellulosic elements; sieve tubes, companion cells interrupted by phloem parenchyma. The phloem region is free of any lignified elements (Fig. 2). The cambium is formed of 4-5 rows of radially arranged, tangentially elongated, thin-walled, cellulosic, meristematic and rectangular cells (Fig. 2). The xylem is formed a continuous narrow ring, consisting of slightly lignified scalariform and spiral thickened xylem vessels, wood parenchyma and wood fibers. The medullary rays traverse the xylem zone (Fig. 2, 5C and 5C₁).

The pith represents approximately 3/4 of the whole section. It is formed of a wide zone of rounded and thin walled pitted parenchymatous cells (Fig. 2).

The middle part of the stem: A transverse section in the middle part of the stem is oval and slightly compressed in the center in outline (Fig. 3). It is larger in size compared to the upper part. It is quite similar in structure to the upper part with a few differences. The epidermis is similar to that of the upper part. The cortical tissue occupies a bit larger area. The collenchyma layer is formed of 4-5 rows of rounded to oval cells, while the parenchymatous layer consists of 10-12 rows of rounded cells.

The pericycle is more lignified, formed of islets, each one composed of 40-80 fibers. The region of phloem is wider than the upper part. The cambium is wider, formed of 8-9 rows of rectangular cells. The xylem is larger in area and consists of highly lignified xylem vessels. The medullary rays of 1-2 rows traverse the phloem, cambium and xylem regions. Finally, the pith is narrower than the upper part. It is formed of rounded and thin walled pitted parenchyma cells.

The lower part of the stem: A transverse section of the lower part (Fig. 4) was decorticated and rounded in outline,

showing a wide area of wood region composed of lignified xylem vessels of scalariform, spiral and boarded pitted thickenings, wood parenchyma, wood fibers, tracheids and tracheidal vessels (Fig. 5). The wood fibers are long, septated, lignified with wide lumina and very sharp tapered ends as shown in the L.S. (Fig. 5A). The medullary ray formed of 1-2 cells wide of elongated and pitted cells (Fig. 5A). The pith is a narrow zone of pitted parenchyma cells enclosed into the wood region. The powder of the stem is greenish white in color with a faint characteristic odor and a disagreeable taste. The micromorphology examination showed the following fragments (Fig. 6):

- xFragments of fusiform lignified pericyclic fibers with thick walls, narrow lumina and rounded ends (Fig. 6A).
- Fragments of fusiform lignified wood fibers with thick walls, narrow lumina and narrow very sharp ends (Fig. 6B).
- Fragments of medullary rays formed of pitted, polygonal, radially elongated cells (Fig. 6C).
- Peltate hair, glandular hair with an unicellular stalk and a multicellular head of 16-28 thin walled cells and covered by thin and smooth cuticle (Fig. 6D).
- Fragments of wood parenchyma (Fig. 6E).
- Fragments of cork cells, brown polygonal cells with isodiametric walls (Fig. 6F).
- Fragments of epidermal cells of stem with polygonal isodiametric cells covered with a smooth cuticle (Fig. 6G).
- Fragments of lignified xylem vessels with spiral thickenings (Fig. 6H)

CONCLUSION

The botanical examination of the stem of *M. platycalyx* (Baker) Sprague represents a worthy tool in the identification of the plant. Moreover, these features will be useful in the investigation of the plant in any pharmacognostical and pharmacological studies.

CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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