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ANATOMICAL STUDY OF THE PETIOLE AND PULVINUS IN FIVE SPECIES OF *CASSIA* CULTIVATED IN IRAQ

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Abstract

In the current research, anatomical characteristics of petiole and pulvinus sections of five species belong to the genus *Cassia* L. (*Cassia didymobotrya* Fres., *Cassia fistula* L., *Cassia obtusifolia* L., *Cassia occidentalis* L., *Cassia sophera* L.) have been studied.

From the study, some anatomical features, such as outline of petiole cross section, type of collenchyma and number of vascular bundles, were found to be valuable at species Level, while, pith diameter, thickness of cuticle and epidermis of Limited value, outline of pulvinus cross section, number of cortex rows and type of vascular bundles have good taxonomic importance, while pith diameter, Length of vascular bundles showed Little importance.

Key words: Caesalpinoidae, Anatomy, Section, *Cassia*.

Introduction

The genus *Cassia* L. belongs to the family: Fabaceae; subfamily Caesalpinoidae.

The subfamily Caesalpinoidae includes about 166 genera and 400 species distributed in the tropical and subtropical regions (Marazzi *et al*., 2012), in the form of tree or shrubs and may be herbs or lianas (Watsan and Dallwitz, 1992). It has a distinctive characteristics such as, presence of the external floral nectarines, pinnate leaves and globose inflorescence (Marazzi *et al*., 2012).

The genus *Cassia* L. consists of more than 500 species (Chakarvarty, 1976), usually evergreen trees, leaves are paripinnate with pulvinate base (Watsan and Dallwitz, 1992). Many species possess medicinal properties as in *Cassia occidentalis* (Al-Rawi and Chakruvarty, 1964), a few yield tanin used in commerce Chakarvarty (1976), others, are grown for ornamental purposes (Glimn-Lacy and Kufman, 2006). There are eight species of *Cassia* L. cultivated in Iraq, known as SANÂ, SANÂ MAKKI, ISHRIQ (Al-Rawi and Chakruvarty, 1964; Townsend and Guest, 1974; Chakravarty, 1976).

No comerhesive study of the anatomical characteristics of petiole and pulvinus of the genus *Cassia* L. has been presented, although some of the anatomical characteristics of petiole in Legume were studied by Petit, (1886, 1887, 1889); Watari, 1934) also, some anatomical characteristics of the pulvinus were mentioned by (Esue, 1965; Revean *et al*., 2005; Heywood *et al*., 2007). The literature survey showed that petiole and pulvinus of *Cassia* Has not been studied yet. The aim of this investigation was to study the anatomical characteristics of five species of *Cassia* L. cultivated in Iraq.

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Materials & Methods

Samples of *Cassia* selected from fresh materials collected from different localities of Babylon. Specimens were deposited in the herbarium of Babylon University, Department of Biology, College of science. To prepare the slides mature fresh petiole with pulvinus were fixed in FAA solution after, washing with distill water. Cross section were made according to (Sass, 1968). For species identification, flora of Iraq (Townsend and Guest, 1974).

Results

From the study of cross sections of petiole and pulvinus of five species belong to the genus *Cassia*, the presence following of the regions are shown.

1. Epidermis:epidermis of all species studied was covered simple by cuticle in different thickness within species.

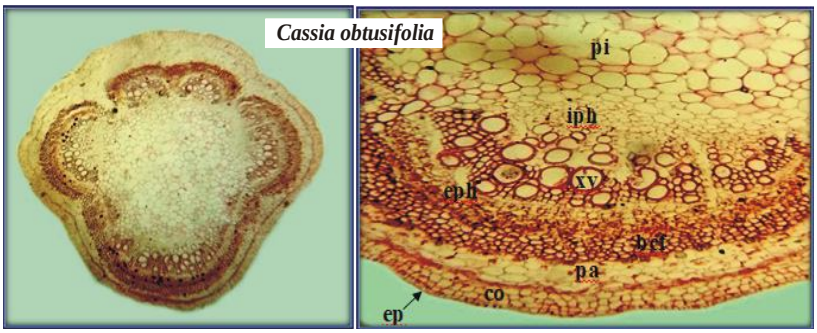

Fig. 1: Showing cross-section of petiole anatomy of *Cassia* species; cu: cuticle; ep: epidermis, co: collenchyma, pa: parenchyma, bcf: bundle cup fiber; eph: external phloem; xy: xylem; iph: internal phloem; pi: pith; (A=40X; B=100X).

2. Cortex: The cortex appeared in the pulvinus consisting of one type of cells, parenchyma cells, while the petiole cortex with two types of cells, collenchyma and parenchyma and showed a differences in the number of rows and thickness among the species.
3. Vascular bundle: vascular bundle are bicollateral, variable in size, addition(accessory) bundles usually present in most species.
4. Pith: composed from a thin wall parenchyma cells with small intercellular space.

Petiole

The anatomical features of the petioles of the species studied are in the fig. 1 and 2 show cross sectioning:

1. *Cassia didymobotrya* Fres:

The outline of petiole cross section is ovate. Epidermis consist of a single row of quadrate-rectangle parenchyma cells (11.25-17.5)µm in thickness, Cuticle (1.5-5)µm. The cortex consists of collenchymas cells (lacunar), (40-65) µm and parenchyma cells (37.5-175). Vascular bundles variable in size, bicollateral (8-9) bundle per section, rows of xylem (6-13) row. Pith composed from a thin wall parenchyma cells (650-887.5)µm.

2. *Cassia fistula* L.:

The outline of petiole cross section is circle. Epidermis consist of a single row of quadrate-rectangle parenchyma cells (10-12.5)µm in thickness, Cuticle (3.25-6)µm. The cortex consists of collenchymas cells (angular), (100-125)µm and parenchyma cells (200-250). Vascular bundles bicollateral, continuous, rows of xylem (4-7) row. Pith composed from a thin wall parenchyma cells (600-750)µm.

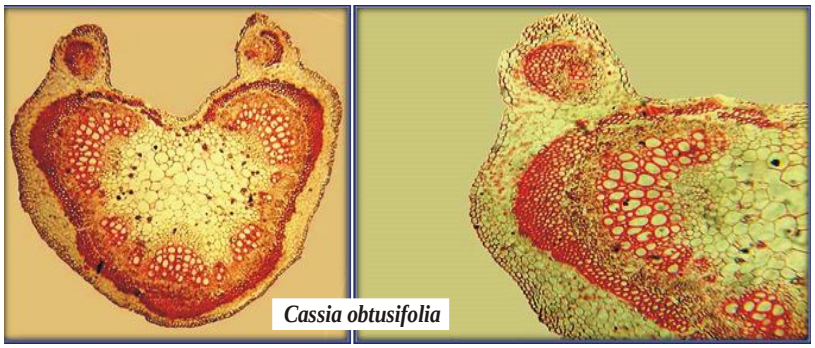

Fig. 2: Showing cross-section of petiole anatomy of *Cassia* species; cu: cuticle; ep: epidermis, co: collenchyma, pa: parenchyma, bcf: bundle cup fiber; eph: external phloem; xy: xylem; iph: internal phloem; pi: pith; ab: accessory bundle (A=40X; B=100X).

3. *Cassia obtusifolia* L.:

The outline of petiole cross section is cordate. Epidermis consist of a single row of quadrate-rectangle parenchyma cells (10-16.25)µm in thickness, Cuticle (1.75-3.75)µm. The cortex consists of collenchymas cells (lacunar), (40-57.5)µm and parenchyma cells (125-200). Vascular bundles variable in size, bicollateral (11-12) bundle per section, rows of xylem (3-12) row. Pith composed from a thin wall parenchyma cells (1050-1100)µm.

4. *Cassia occidentalis* L.

The outline of petiole cross section is cordate. Epidermis consist of a single row of quadrate-rectangle parenchyma cells (8.75-15)µm in thickness, Cuticle (2.25-4.75)µm. The cortex consists of collenchymas cells (lacunar), (20-50)µm and parenchyma cells (25-100). Vascular bundles variable in size, bicollateral (11-12) bundle per section, rows of xylem (2-13) row. Pith composed from a thin wall parenchyma cells (700-800)µm.

5. *Cassia sophera* L.:

The outline of petiole cross section is cordate. Epidermis consist of a single row of quadrate-rectangle parenchyma cells (12.5-14)µm in thickness, Cuticle (1-1.25)µm. The cortex consists of collenchymas cells (lacunar), (25-40)µm and parenchyma cells (45-57.5). Vascular bundles variable in size, bicollateral (5-6) bundle per section, rows of xylem (3-19) row. Pith composed from a thin wall parenchyma cells (525-750)µm.

Pulvinus

The anatomical features of the pulvinus of the species studied are in the fig. 3 and 4 show cross sectioning:

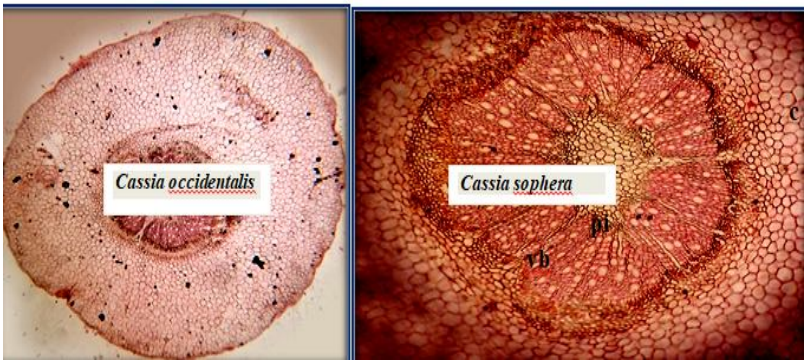

Fig. 4: Showing cross-section of pulvinus anatomy of *Cassia* species (40X).

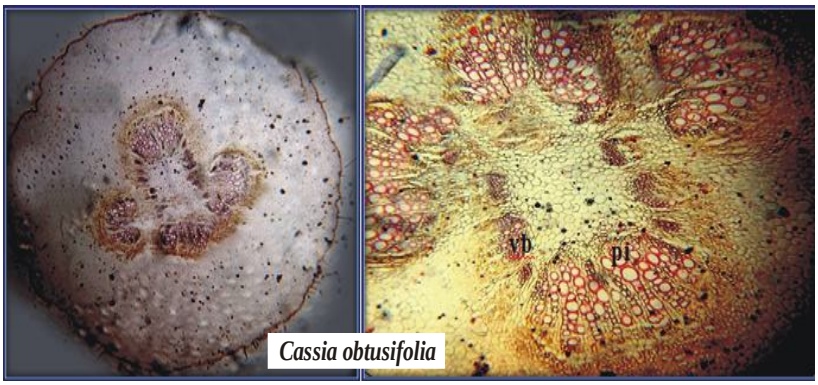

Fig. 3: Showing cross-section of pulvinus anatomy of *Cassia* species; pi: pith; sd: secretory duct; vb: vascular bundle (A=40X; B=100X).

1. *Cassia didymobotrya* Fres:

The outline of pulvinus cross section is circular. Epidermis consist of a single row of quadrate-rectangle parenchyma cells (12.5-17.5)µm in thickness, Cuticle (1.75-5)µm. The cortex consists of parenchyma cells (750-1000)µm. Vascular bundles variable in size, bicollateral (6-7) bundle per section, Length (275-450)µm. Pith composed from a thin wall parenchyma cells (275-625)µm.

2. *Cassia fistula* L.:

The outline of pulvinus cross section is circle. Epidermis consist of a single row of quadrate-rectangle parenchyma cells (15-20)µm in thickness, Cuticle (2.5-5.25)µm. The cortex consists of parenchyma cells (425-925). Vascular bundles bicollateral, continuous, Length (462.5-700)µm. Pith composed from a thin wall parenchyma cells (800-900)µm.

3. *Cassia obtusifolia* L.:

The outline of pulvinus cross section is circular. Epidermis consist of a single row of quadrate-rectangle parenchyma cells (12.5-20)µm in thickness, Cuticle (2.5-7)µm. The cortex consists of parenchyma cells (775-1000)µm. Vascular bundles bicollateral continuous. Length (337.5-400)µm. Pith composed from a thin wall parenchyma cells (250-375)µm.

4. *Cassia occidentalis* L.:

The outline of pulvinus cross section is ovate. Epidermis consist of a single row of quadrate-rectangle parenchyma cells (12.5-18)µm in thickness, Cuticle (2.5-3.75)µm. The cortex consists of parenchyma cells (222.5-875)µm. Vascular bundles bicollateral continuous. Length (237.5-450)µm. Pith composed from a thin wall parenchyma cells (525-550)µm.

5. *Cassia sophera* L.:

The outline of pulvinus cross section is circular. Epidermis consist of a single row of quadrate-rectangle parenchyma cells (12.5-22.5)µm in thickness, Cuticle (2-3)µm. The cortex consists of parenchyma cells (587.5-775)µm. Vascular bundles variable in size, bicollateral (5-6) bundle. Length (150-487.5)µm. Pith composed from a thin wall parenchyma cells (550-625)µm.

Discussion

Anatomical characteristics of petiole considered as diagnostic characters at different taxonomic level (Metcalfe and Chalk, 1950; Olowokudejo, 1987; Shaheen, 2007; Amirabadizadeh *et al*., 2015). Our study showed that the outline shape of petiole cross section varied among species, this result has previously been successfully in the species of *Onobrychis* (Fabaceae), Amirabadizadeh *et al*., 2015) and other plants (Ozdemir *et al*., 2016). Epidermis is of uniserriate with quadrate to rectangle cells in all species studies, thus, epidermis has limited taxonomic importance. Cortex has a good taxonomic value especially type of collenchyma cells which was angular collenchymas in *Cassia fistula*, but it was lacunar in others. This result acceptance with (Metcalfe and Chalk, 1950). According to (Coutinho *et al*., 2016) features of vascular bundles have good taxonomic importance, especially number of vascular bundles and characters of xylem this is compatible with the results of this study pith cells have limited taxonomic value, usually thin walled in all species studied. Anatomy of pulvinus differ from that of petiole (Arslan, 1954), from current study, anatomical characteristic of pulvinus found to be useful in separation of species, such as the general shape of cross section which was oval in *Cassia occidentalis*, while it was circular in others. This acceptance with (Chen *et al*., 2013). Cortex has limited taxonomic importance, it consist of parenchyma cells in all species as mentioned by (Esue,1965). Vascular bundles appeared

in continuous cylinder except in *Cassia didymobotrya* and which was discontinuous cylinder..

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