

Comparative Anatomical Study between *Cayratia Mollissima*, *Pterisanthes Caudigera* (Vitaceae) and *Leea Indica* (Leeaceae)

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Abstract: Problem statement: *Leea* species was originally placed in the family Vitaceae but was later placed in the Leeaceae due to the anatomical differences between the two families. **Approach:** A comparative study on the stem and leaf anatomy of *Cayratia mollissima* and *Pterisanthes caudigera* (Vitaceae) and *Leea indica* (Leeaceae) was conducted to investigate anatomical differences which could provide additional differentiating characters for supporting this treatment. **Results:** The Transverse Sections (TS) revealed species differences with respect to the shape of the stems, the leaf margin, midrib and petiole. Druses were present in the leaves and stems of both species, while raphides were present in the lamina. **Conclusion:** Starch grains and trichomes were present only in *Cayratia mollissima* and *Pterisanthes caudigera*.

Key words: Vitaceae family, leeacea family, leeaceae anatomy, *leea indica*, sliding microtome, safranin solution, alcohol concentrations, alcian blue, druses crystals

INTRODUCTION

Vitaceae family contains around 700 species, assigned to 13-15 genera. The evolutionary history of the Vitaceae, the grape family, is of interest because of the wide geographic and ecological range of the family today and because of its apparently basal position within the Rosids. The suborder taxa of Vitaceae are not easily delimited (Lombardi, 2007). Morphologically, Leaf-opposed tendrils and inflorescences and unique seed morphology are the most useful characters to distinguish Vitaceae from other families (Chen and Manchester, 2007). Leeaceae is shrubs, small trees, scramblers, or rarely large perennial herbs. Stems unarmed or with rows of prickles; tendrils absent. *Leea* contains approximately 70 species and has often also been placed in the Vitaceae family. The *Leea* places in the subfamily Leoioideae (Vitaceae). *Leea* is placed in its own family based on morphological differences between Leeaceae and Vitaceae.

MATERIALS AND METHODS

The stem, middle part of petioles, midrib, lamina and margins which have been embedded in polystyrene, were sectioned transversely on a sliding microtome, (model Richard Jung-1972) or Microtome Reichert (model Leica Jung histolide 200). Transverse sections were cut at 20 μm thick, depending on the texture of the

specimen. Transverse sections were presoaked in (Clorox) for 5-15 min to clear the tissues and the sample sections were rinsed in distilled water 2-3 times and were steeped in Safranin solution for approximately 5 min, rinsed with water, then stained for approximately 5-10 min in Alcian blue, dehydrated in a series of alcohol concentrations, one or two drops of concentrated HCl (hydrochloric acid) were added to the 70% treatment to change colour leaves to purplish. Finally, the samples were mounted on microscope slides in Euparal as a permanent medium and then kept in drying oven at 60°C for a week (Johansen, 1940).

RESULTS

This study focuses on taxonomy and anatomy of the two families Vitaceae and Leeaceae, these families are closely associated with each other. This study utilizes the morphological and anatomical characters to show the variations between the families. The anatomy included the stem, petiole, midrib, margin and lamina in Transverse Sections (TS).

The following variations were observed.

General anatomical description:

TS stem: The shape of stem of the species is different, stem outline in *Cayratia mollissima* and *Pterisanthes caudigera* have trichomes. The pith of *Cayratia mollissima* and *Pterisanthes caudigera* contain starch grains which are absent in *Leea indica*, Druses crystals

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are present in *Cayratia mollissima*, *Pterisanthes caudigera* and *Leea indica*, raphid crystals are present only in *Cayratia mollissima* and *Pterisanthes caudigera*. In cortex layer, collenchymas tissue is present, vascular bundle is closed and surrounded by a fiber layer, secretory cells are present (Fig. 1).

TS petiole: They have different shapes according to the species. The outline: In *Cayratia mollissima* and *Pterisanthes caudigera* trichomes exist, collenchyma is present in cortex, vascular bundle is closed, druses crystals present, but raphides exist only in *Cayratia mollissima* and *Pterisanthes caudigera*, secretory cells present, starch grains are present in pith (Fig. 2).

TS midrib: The outline of the adaxial surface is slightly humped and the abaxial surface is arc shaped; in *Cayratia mollissima* and *Pterisanthes caudigera* trichome is present, but in *Leea indica* it is absent, collenchyma presents in both epidermal layers, in *Cayratia mollissima* and *Pterisanthes caudigera* raphides and druses crystals are present while in *Leea indica* only druses crystals are present, vascular bundle is closed, in *Cayratia mollissima* and *Pterisanthes caudigera* the vascular bundle surrounded by a fiber layer, secretory cells are present while in *Leea indica* the vascular bundle is opened and not surrounded by fiber (Fig. 3).

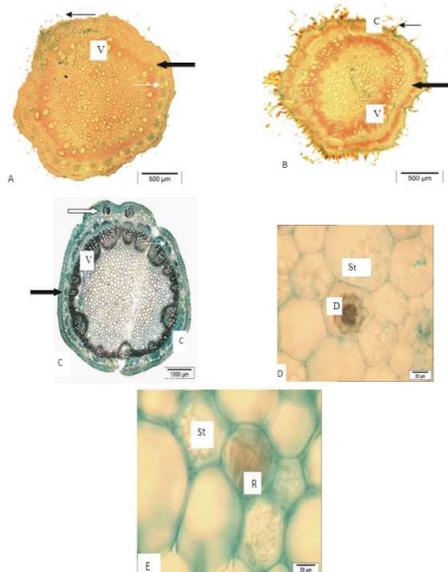


Fig. 1: (A) *Cayratia mollissima* stem, (B) *Pterisanthes caudigera* stem, (C) *Leea indica* stem, (D, E) T.S of stem. Multicellular trichomes (small black arrow), st: Starch grains, d: druses, r: raphid crystals, c: collenchymas tissue, V: vascular bundle, secretory cell (small white arrow), fiber (large black arrow), accessory vascular bundle (large white arrow)

TS lamina: Vitaceae: palisade consists of two layers. Epidermis is uniseriate and its outline is smooth or has trichomes; raphide, druses crystals and secretory cells are present, in *Cayratia mollissima* and *Pterisanthes caudigera* trichomes are present, but in *Leea indica* it is absent (Fig. 4).

TS margin: It is straight with slightly downwards and the tip is rounded or tapering. secretory cells are present, trichomes are present in *Cayratia mollissima*, trichomes are present *Pterisanthes caudigera* trichome while they are absent in *Leea indica* (Fig. 5).

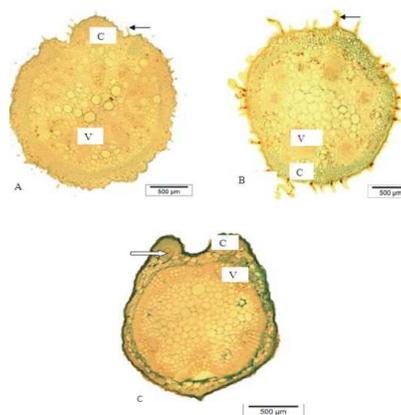


Fig. 2: (A) *Cayratia mollissima* petiole, (B) *Pterisanthes caudigera* stem, (C) *Leea indica* petiole. multicellular trichomes (small black arrow), c: Collenchyma tissue, V: Vascular bundle, accessory vascular bundle (large white arrow)

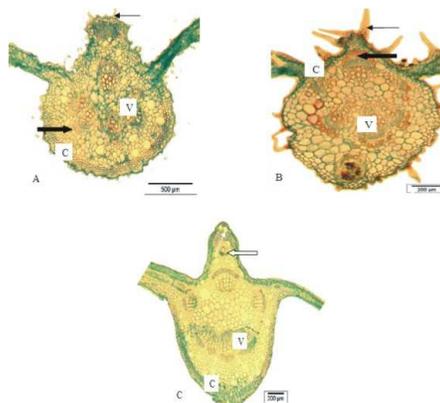


Fig. 3: (A) *Cayratia mollissima* midrib, (B) *Pterisanthes caudigera* midrib, (C) *Leea indica* midrib. multicellular trichomes (small black arrow), c: Collenchyma tissue, V: Vascular bundle, secretory cell (small white arrow), accessory vascular bundle (large white arrow), fiber (large black arrow)

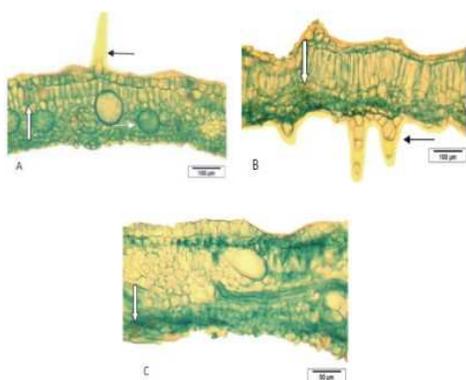


Fig.4: (A) *Cayratia mollissima* lamina, (B) *Pterisanthes caudigera* lamina, (C) *Leea indica* lamina. multicellular trichomes (small black arrow), secretory cell (small white arrow), druses (large white arrow)

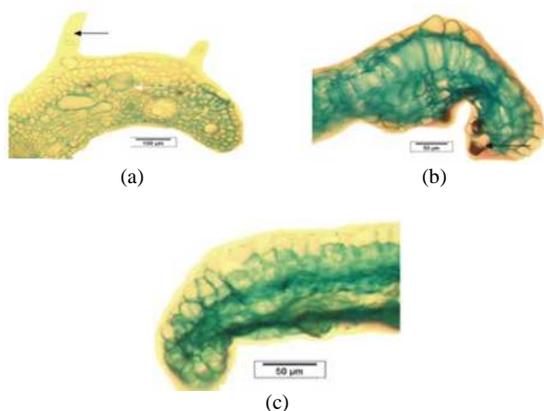


Fig. 5: (A) *Cayratia mollissima* margin, (B) *Pterisanthes caudigera* margin, (C) *Leea indica* margin. multicellular trichomes (small black arrow), secretory cell (small white arrow)

DISCUSSION

The present study has shown morphological and anatomical differences between the two families, Vitaceae and Leeaceae. Leeaceae are most closely related to Vitaceae but most workers have now separated them (Kubitzki *et al.*, 2007). In contrary to Vitaceae, Leeaceae are characterized by the highly distinctive flowers, the absence of tendrils, the terminal inflorescence position, distinct wood anatomical characters usual stipular structure and the erect habit (Kubitzki *et al.*, 2007).

Vitaceae are usually woody climber or herbaceous vines, or small succulent trees, stems unarmed; tendrils simple; usually leaf opposite, leaves simple, lobed or

unlobed, digitately or pedately compound to pinnately compound, or alternate (Kubitzki *et al.*, 2007; Lombardi, 2007), but Leeaceae are usually shrubs, herbs or small trees, sometimes with armed stems, unlike Vitaceae, tendrils absent, leaf from varies greatly; from simple to once to thrice pinnately compound (Kubitzki *et al.*, 2007; Chen and Wen, 2007; Watson and Dallwitz, 1994).

As revealed by the present work, Vitaceae and Leeaceae mesophyll layer contains calcium oxalate (druses) crystals and mucilage cells or secretory cells with raphides in bundle (Metcalf and Chalk, 1950), druses idioblasts and raphide idioblasts are present in the inner layer of bioseriate epidermis (Kannabiran and Pragasam, 1994).

The present investigation revealed starch grains in pith and beside xylem tissue in Vitaceae family, while in Leeaceae family the starch grains were not observed. Starch grains were observed in xylem fibers and most ray parenchyma cells, but not in axial parenchyma cells or ray parenchyma cells with direct lateral wall contact with vessels (Sun *et al.*, 2008).

CONCLUSION

The results conclude that druses were present in the leaves and stems of both species, while raphides were present in the lamina. Starch grains and trichomes were present only in *Cayratia mollissima* and *Pterisanthes caudigera*.

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