

Leaf and Petiole anatomy of *Acalypha alnifolia* Klein ex Willd.

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Manuscript received: 01 December 2015

Accepted for publication: 20 April 2016

ABSTRACT

Sudhakar P., Kavitha D. & Ramachandra Reddy P. 2016. Leaf and Petiole anatomy of *Acalypha alnifolia* Klein ex Willd. Geophytology 46(1): 51-55.

Acalypha alnifolia Klein ex Willd. is a small shrub belonging to the family Euphorbiaceae that finds its importance as a medicinal plant. Present study is aimed to characterize the macroscopic and microscopic features of the leaf and petiole of *Acalypha alnifolia* Klein ex Willd. The study shows that leaf of *Acalypha alnifolia* Klein ex Willd. is amphistomatic with paracytic and anisocytic stomata. Also, unicellular and uniseriate macroform conical hairs occur on the leaves. In transverse section, the leaf is ribbed on either sides at midvein. Mesophyll is interspersed with sphaerocrystalliferous idioblasts. Palisade extends into midvein. Petiole in transverse section is broadly oval and epidermis is having sphaerocrystaliferous idioblasts. The powder microscopic characters are also presented in this study. Overall, the salient features of the leaf and petiole presented are diagnostic for the plant.

Key-words: *Acalypha alnifolia*, Euphorbiaceae, anatomy, sphaerocrystaliferous idioblasts, leaf, petiole.

INTRODUCTION

Acalypha alnifolia is a pubescent shrub, belonging to the family Euphorbiaceae. The family comprises about 220 genera with about 4,000 species and shows great variety of plants including small annual herbs, shrubs as well as trees (Datta & Mukerji 1952). *Acalypha* is one of the largest genera of the Euphorbiaceae with approximately 450 – 570 species. Leaves of *Acalypha alnifolia* are ovate, acute, rounded or cordate at base and pubescent; petioles long. Flowers usually monoecious, in terminal short spikes; fruit is a small capsule. The plant is found in Deccan Peninsula grows as a wild species in South India (Gamble 1921; Seebaluck et al. 2015). Medicinally, the leaves are used in dysentery (Jain 2012) and are also used as vegetable by the local people of Nilgiris, Tamil Nadu. The leaf juice mixed with boiled cow milk is considered a good

remedy against diabetes (Seebaluck et al. 2015). In the present work, the pharmacognostic studies including epidermal studies, leaf and petiole anatomical studies were undertaken to bring out diagnostic features, that were lacking previously owing to emphasis on the ethnomedicinal importance of the plant.

MATERIAL AND METHODS

Acalypha alnifolia was collected from various locations (provide specifications) of Warangal district, Telangana, India. Collected material was taxonomically identified and deposited in Herbarium Hyderabadense, Department of Botany, Osmania University, Hyderabad. The leaves are boiled, fixed in F.A.A. (Formaldehyde – Acetic acid – Alcohol), dehydrated through xylene – alcohol series embedded in paraffin wax. The sections were cut at 10 – 12 µm on Optica 1090A rotary microtome, stained with crystal violet and basic fuchsin

combination and mounted in canada balsam (Johansen 1940). Epidermal peels were obtained by gently scraping and peeling by razor blade, were stained with saffranine and mounted in glycerine. The powder microscopy characters were studied by boiling the drug in distilled water, stained in saffranine and mounted with glycerine. The photomicrography was done on Olympus BX-53 trinocular microscope attached with digital Sony camera.

OBSERVATION AND RESULTS

Macroscopic characters: Leaves of *Acalypha alnifolia* are ovate, acute, rounded or cordate at base, pubescent; petioles long, pubescent, grooved adaxially (Plate 1, figs. 1-2).

Microscopic characters:

Leaf: In surface view epidermal cells mostly 5-6 sided, few cells up to 7 sided, polygonal, anisodiametric and isodiametric, surface smooth, sides thick, pitted at some places, curved to wavy, few cells wavy to sinuous, sinuses deeply 'U' shaped with slightly dense contents on abaxial side. Costal cells are polygonal linear, few anisodiametric, sides thick, straight to curved, pitted, surface granulate, striate, oriented in parallel and are present on primary and secondary veins. Stomata occur on either sides, mostly Paracytic, rarely anisocytic. Stomatal frequency is 150 per sq.mm. and stomatal index is 5.82 on adaxial; stomatal frequency is 280 per sq.mm. and stomatal index is 16.2 on abaxial surface. Trichomes are of two types: i) unicellular conical and ii) uniseriate macroform conical, present on the adaxial surface while only uniseriate macroform conical hair are present on the abaxial surface (Plate 1, figs. 4-5).

In transverse section, the leaf is ribbed on either sides at midvein, and prominently on abaxial surface; secondary and tertiary veins are also ribbed on both sides; midvein 324 – 486 (411) μm and lamina is dorsoventral, 86 – 205 (135) μm thick. Epidermis is single layered and composed of mostly barrel shaped, oval to circular cells, smaller on adaxial surface of lamina, elongate cells 16 – 52 (30) μm long, 11 – 19 (16) μm wide, isodiametric cells 11 – 22 (17) μm in diameter and larger towards abaxial surface, cells 21 – 57 (35) μm long, 11 – 25 (17) μm wide and isodiametric cells 14 – 33 (22) μm in diameter; cells over midvein

adaxial larger, contents scanty, in few cells with sphaeraphides mostly on midvein; cuticle slightly thick over the surface. Stomata flushed with epidermal cells (Plate 1, fig. 3). Mesophyll differentiated into palisade and spongy tissues. Palisade one layered, occasionally two layered and occupying half of the area of mesophyll; throughout, extending into the midvein and secondary veins; cells columnar, cylindrical, 22 – 63 (36) μm long and 3 – 6 (4.33) μm wide, interspersed with sphaerocrystaliferous idioblasts. Spongy parenchyma 3-4 layered, cells circular, oval and oblong, 16 – 47 (26) μm long, 8 – 19 (13) μm wide and isodiametric cells 11 – 25 (16) μm in diameter loosely arranged with small intercellular spaces, often interspersed with sphaerocrystaliferous idioblasts (Plate 2, figs. 1-2). The ground tissue of midvein consists of a group of hypodermal collenchymatous cells in adaxial ridge and one to two layered throughout on abaxial surface; cells mostly polygonal, spherical, lamellar, 8 – 22 (14) μm in diameter. Parenchyma is four to six layered beneath the palisade on adaxial surface, cells 14 – 36 (21) μm in diameter and five to seven layered on abaxial surface, 11 – 30 (21) μm in diameter, cells mostly polygonal to circular and oval with small intercellular spaces, interspersed with sphaerocrystaliferous idioblasts. Sclerenchyma in patches of two to three layers and cells enclosing the vascular bundle outside the phloem on abaxial surface (Plate 1, fig. 6).

Midvein consists of one large arc shaped vascular bundle at centre with small vascular strand above adaxial surface. Midvein vascular bundle is 162 – 302 (253) μm long and 108 – 151 (127) μm wide. Secondary vascular bundles oval to circular; wing bundles several, enclosed by endodermis. Vascular bundles collateral, conjoint, endarch; xylary elements 36 to 45 in number in midvein, arranged in radial rows. In L.S. tracheary elements show mostly annular and helical thickenings; helices single and double, annular rings free. Xylem parenchyma in between tracheary elements. Phloem consists of sieve tubes, companion cells and phloem parenchyma (Plate 1, fig. 6).

Petiole: In transverse section, the petiole is broadly oval in shape; adaxially grooved at centre. Epidermis is single layered, covered by a slightly thick cuticle; cells

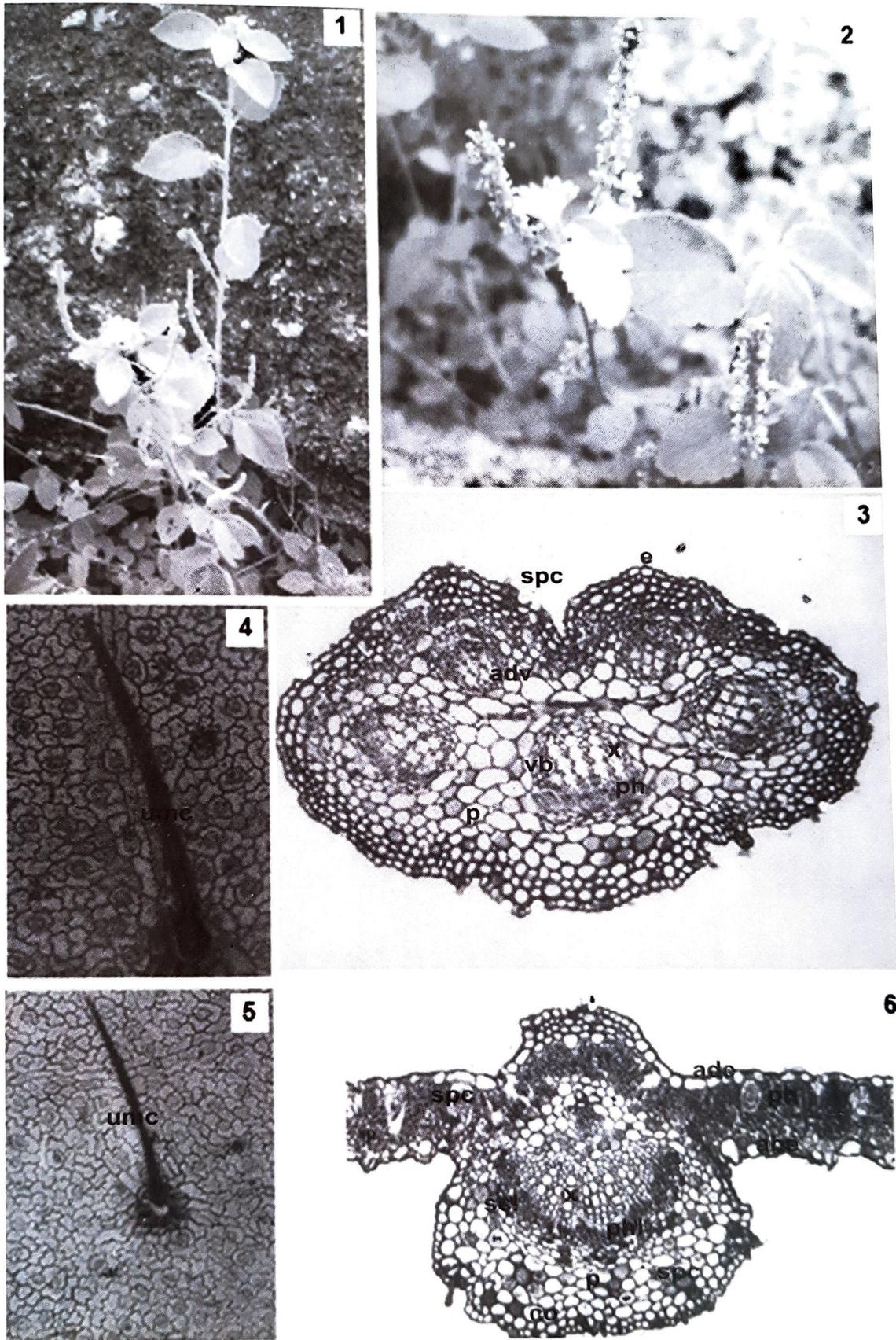


Plate 1

1. General appearance of *Acalypha alnifolia* x 120, 2. General appearance of *Acalypha alnifolia* x 120, 3. Transverse section of Petiole x 130, 4. Leaf adaxial surface x 129, 5. Leaf abaxial surface x 129, 6. Transverse section of leaf at midvein x 80. (Abbreviations: e – epidermis, spc – sphaerocrystaliferous idioblasts, co – collenchyma, p – parenchyma, adv – adaxial vascular bundle, vb – vascular bundle, ph or phl – phloem, x – xylem, umc – uniseriate macroform conical hair, ade – adaxial epidermis, abe – abaxial epidermis, sel – sclerenchyma).

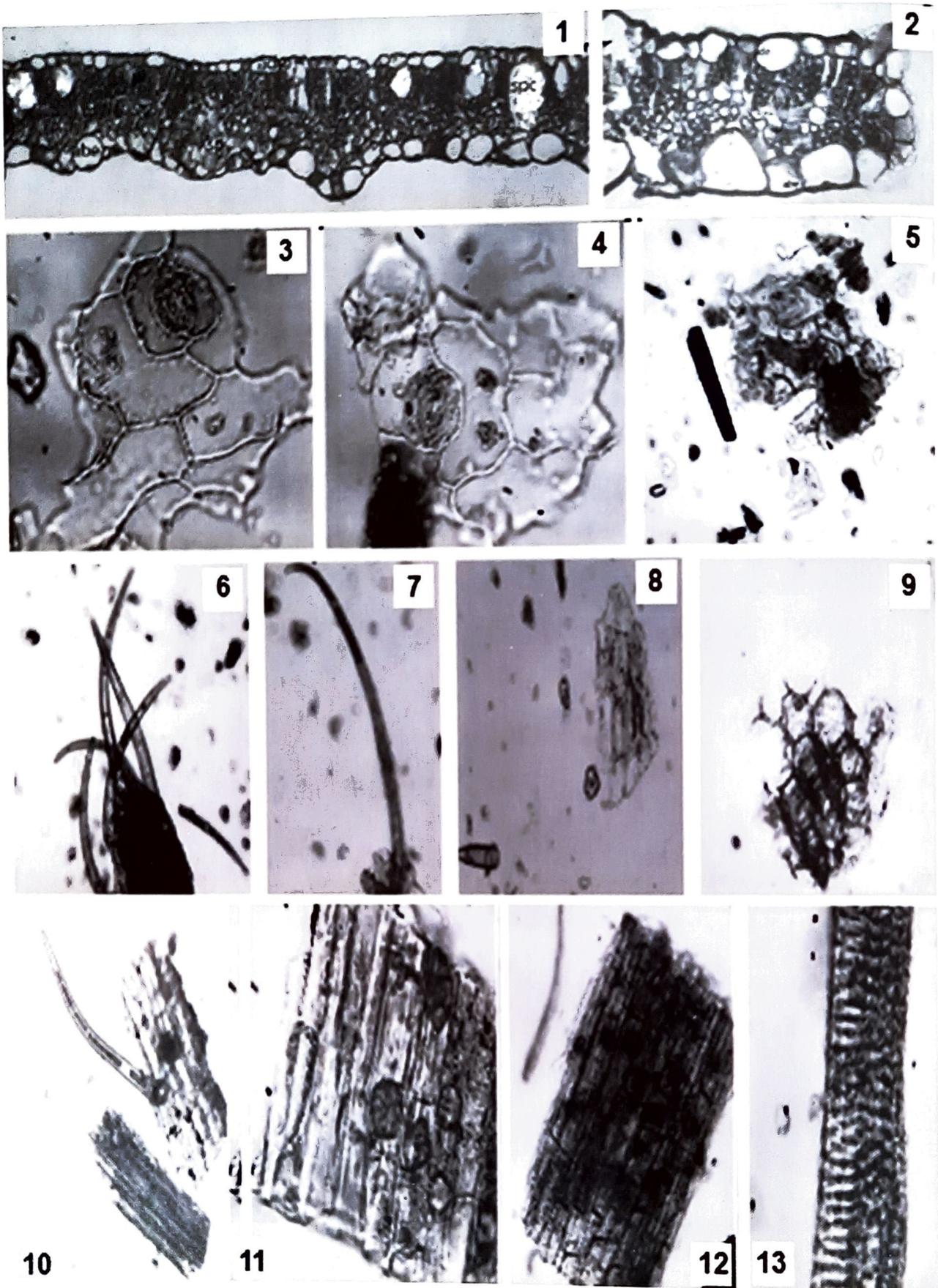


Plate 2

1. Transverse section of leaf at lamina x 60, 2. Transverse section of leaf at margin. x 88, 3. epidermis with paracytic stomata, 4. epidermis with anisocytic stomata, 5. epidermis with stomata, 6. costal cells with trichomes, 7. Uniseriate macroform conical hair, 8. costal cells, 9. parenchymatous tissue, 10. costal cells with trichomes, tracheary elements, 11. petiole epidermis with sphaerocrystaliferous idioblasts, 12. petiole epidermis with sphaerocrystaliferous idioblasts, 13. tracheary elements with helical thickenings (Abbreviations: abe – abaxial epidermis, spc - sphaerocrystaliferous idioblasts).

oval to circular and barrel shaped, elongated cells 14 – 25 (20) μm long, 8 – 19 (13) μm wide and isodiametric cells 11 – 22 (16) μm diameter, few cells with dark contents, interspersed with sphaerocrystaliferous idioblasts. Ground tissue heterogenous, consisting of collenchyma and parenchyma tissues. Hypodermal collenchyma two to five layered, throughout; cells oval to circular, 8 – 27 (18) μm in diameter, lamellar or angular, contents dense in some with tanniniferous idioblasts. Rest of the ground tissue parenchymatous, beneath the collenchyma, cells oval to circular, 19 – 52 (36) μm in diameter, often interspersed with sphaerocrystaliferous idioblasts. Vascular bundles five in number, oval to spherical, arranged in a ring (3 on abaxial and 2 adaxial), 77 – 151 (110) μm diameter. Tracheary elements arranged in radial rows with thick walls. In L.S tracheary elements are made of helical, annular and scalariform pitted thickenings (Plate 1, fig. 3).

Powder microscopy: Pieces of epidermal cells with curved to wavy and sinuous walls showing paracytic and anisocytic stomata; pieces of epidermal cells with uniseriate macroform conical hair, numerous, broken; pieces of leaf epidermal costal cells with uniseriate macroform conical hair; pieces of petiole epidermis with sphaerocrystaliferous idioblasts; pieces of ground tissue with parenchymatous cells; pieces of tracheary elements showing helical, scalariform pits (Plate 2, figs. 3-13).

DISCUSSION AND CONCLUSION

Literature pertaining to the leaf and petiole anatomy of *A. alnifolia* Klein ex Willd. is lacking. The morphological description of this plant is reported in Flora of the Presidency of Madras (Gamble 1921). Paracytic stomata has been earlier recorded in *Acalypha* spp. (Metcalf & Chalk 1950). The present anatomical study of leaf of *A. alnifolia* Klein ex Willd shows that epidermal cells are curved to wavy and sinuous on adaxial surface while sinuses deeply 'U' shaped on abaxial surface. Besides these features, few anisocytic stomata have also been observed. Presence of simple, unicellular or uniseriate trichomes recorded

in members of the Acalypheae (Metcalf & Chalk 1950) is also confirmed in the present study. Mesophyll is made up of single layered palisade and four to six layered spongy parenchyma, interspersed with clustered form of crystals, have been recorded in *Acalypha indica* (Datta & Mukerji 1952) and sphaerites in *Acalypha* spp. (Metcalf & Chalk 1950). In the presently studied species, palisade is one to two layered, extending into midvein and secondary veins; spongy parenchyma is three to four layered, interspersed with sphaerocrystaliferous idioblasts. Hypodermal collenchyma as a group of cells is present in adaxial ridge and one to two layered on abaxial surface. Parenchyma is interspersed with sphaerocrystaliferous idioblasts. Vascular bundles were reported conjoint, collateral, surrounded by sclerenchyma in species of *Acalypha* (Metcalf & Chalk 1950), which is also confirmed in the species studied here. In transverse section, the petiole epidermis is single layered, interspersed with sphaerocrystaliferous idioblasts. Overall, the salient features of the leaf and petiole presented are diagnostic for the plant.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. P. Padma Rao (Drug Standardisation Unit, Central Council for Research in Homoeopathy, Hyderabad) for suggestions and encouragement. We also thank Head, Department of Botany, Osmania University, Hyderabad for providing necessary facilities.

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