



EPIDERMAL FEATURES AND PETIOLE ANATOMY OF LEAF OF *GARCINIA DULCIS* (ROXBURGH) KURZ, NEWLY REPORTED SPECIES FROM NORTH EAST INDIA

Ajima Begum

Department of Botany, Tihu College, Tihu - 781371 (Assam), India

Abstract

The genus *Garcinia* Linnaeus of Clusiaceae is pantropic and comprises of over 350 species. The genus is native to South Asia. Out of the estimated 350 species worldwide, in India, Maheswhari (1964) reported 15 species from North-East India. Kanjilal *et al.*, (1934) reported 9 species from erstwhile Assam. However Begum *et al.*, (2013) added one more species of *Garcinia* i.e. *Garcinia dulcis* in the list of species of *Garcinia* of Assam. The present study focuses on the foliar epidermal features and petiole anatomy of *Garcinia dulcis* since the micromorphological attributes are widely used along with macromorphological features to identify different species.

Key words: *Garcinia dulcis*, Anatomy, Leaf, Petiole, Epidermis, Stomata

Introduction

The genus *Garcinia* Linnaeus of Clusiaceae is pantropic and comprises of over 350 species of evergreen, lactiferous, dioecious trees and shrubs of the moist, lowland tropical forests (Stevens 2007; Sweeney 2008). The genus is native to South Asia starting from southern parts of the Thailand and Peninsular Malaysia to Indonesia but distributed throughout South East Asian region (Singh 1993; Mabberley 2005). Out of the estimated 350 species worldwide, in India, Anderson (1874) reported 30 species in *Flora of British India*. Out of the 35 species reported by Maheswhari (1964), 15 species are from North-East India. Kanjilal *et al.*, (1934) reported 9 species from erstwhile Assam. However Begum *et al* (2013) added one more species of *Garcinia* i.e. *Garcinia dulcis* in the list of species of *Garcinia* of Assam. The species was collected from Jokai Reserve Forest, Dibrugarh district, Assam, India. This species is a new record for its distribution in Assam as well as in North East India. However, scrutiny of literatures revealed that the species has neither been reported nor been collected from mainland of India; it has only been reported from the tropical forests of South Andaman and Nicobar islands.

The present study is carried out to explore the foliar epidermal features and petiole anatomy of *Garcinia*

dulcis. Howard (1962) considered that the vascular bundle of the petiole is significant in the identification of vascular plant species. Metcalfe and Chalk (1950) and Schofield (1968) emphasized that the vascular pattern of the petiole is very helpful in identification of species within Clusiaceae and they identified six distinct types of vascular structures. It has been found that the morphological studies along with anatomical features are important for solving taxonomic and evolutionary issues as well as establishing the relationships among *Garcinia* species (Pathirana and Herat 2004).

Taxonomy of *G. dulcis*: Tree 20 m tall, 40 cm in diameter. Wood light yellow with some red marks exuding scanty cream coloured latex which later turns yellow. Leaves 10.6 – 30 cm × 4.3 - 13.3 cm, elliptic, obovate, oblong-lanceolate and broadly lanceolate with acute or obtuse apex and obtuse base, shiny, dark green above and light green underneath, coriaceous; petiole 1.7 – 3 cm long, robust. Female flowers 2.6 – 3.7 cm long (with pedicel); sepals 5 or 6, unequal, quincuncial; petals 5 or 6, free, quincuncial, greenish white,; staminodes few, distributed in 5 fascicles, free or connate at base; truncated porous yellow nectar glands of about 2.5 mm long alternate with the staminode round the base of ovary; ovary globose, smooth, green, 5-celled, one ovule in each; stigma 5-lobed, white, peltate, droop downside, 0.4 mm

in diameter. Mature 3.4 – 5.3 cm × 3.2 – 5.1 cm, globose to oval with straight or oblique pointed apex, yellow when ripe, pulp yellow, seed 1–3.

Materials and Methods

Both the fresh and preserved leaf samples in 4% Formaldehyde were used to study the foliar epidermal

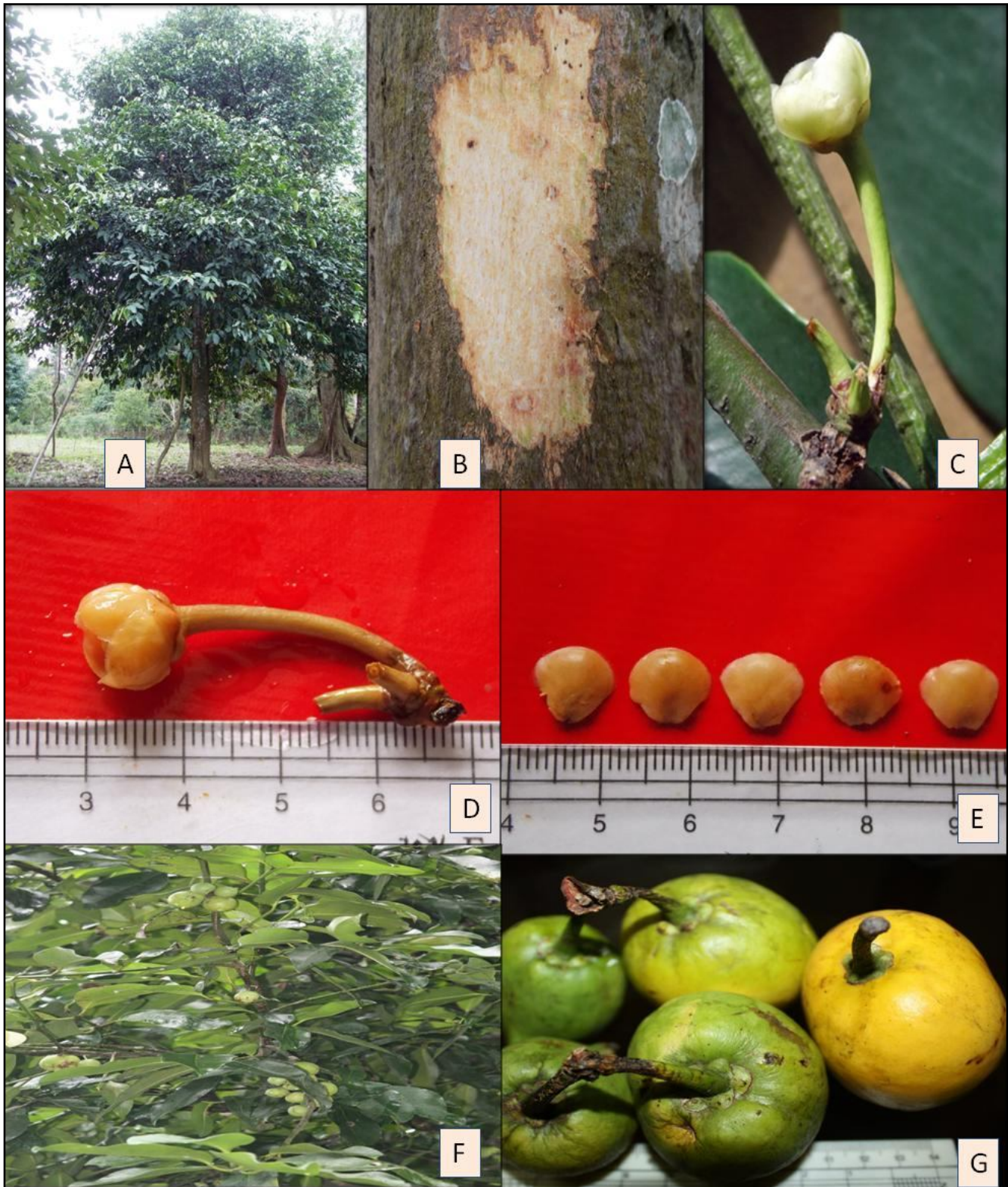


PLATE 1. *Garcinia dulcis* (Roxburgh) Kurz : A. a tree; B. bark; C. inflorescence; D. flower in lateral view; E. petals; F. fruits on a tree; G. mature fruits

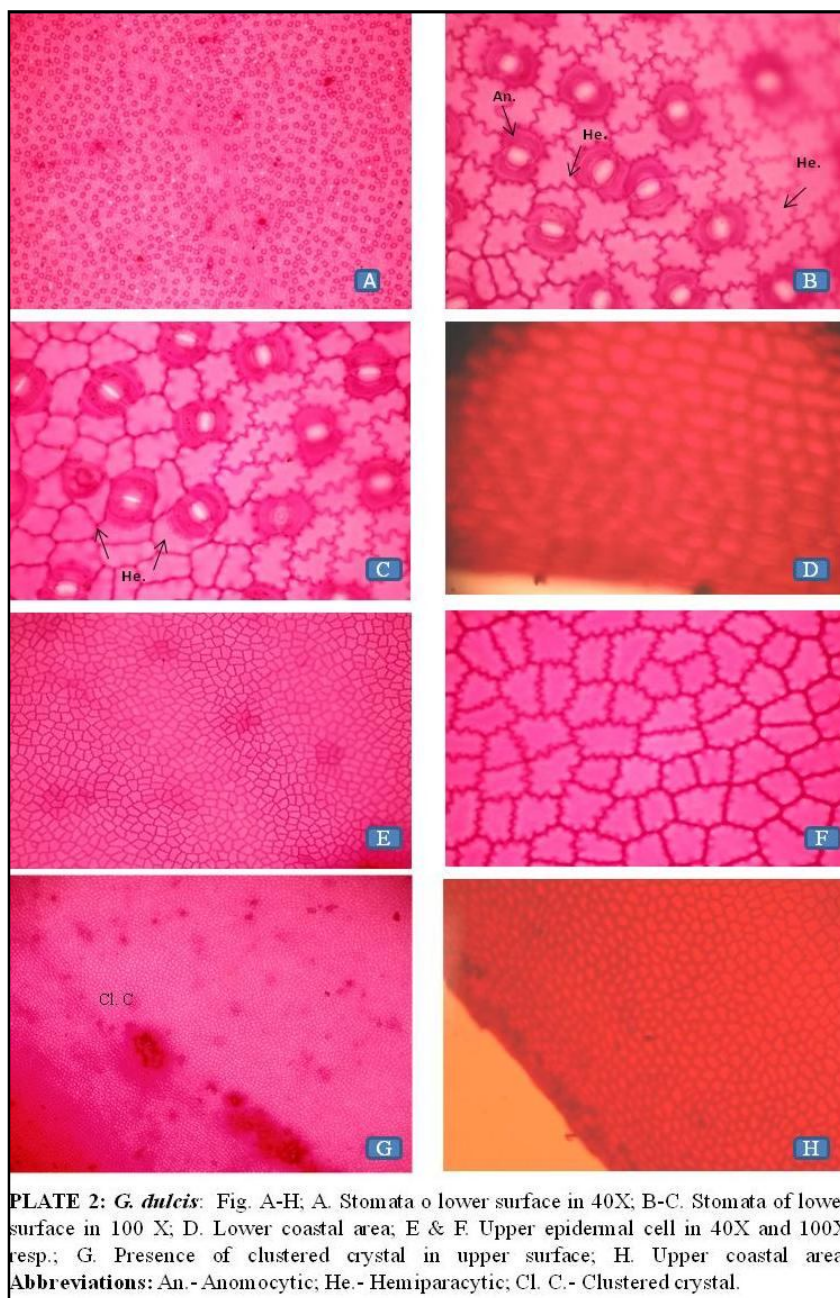


PLATE 2: *G. dulcis*: Fig. A-H: A. Stomata of lower surface in 40X; B-C. Stomata of lower surface in 100 X; D. Lower coastal area; E & F. Upper epidermal cell in 40X and 100X resp.; G. Presence of clustered crystal in upper surface; H. Upper coastal area. **Abbreviations:** An. - Anomocytic; He. - Hemiparacytic; Cl. C. - Clustered crystal.

and anatomical features of petiole. The protocol suggested by Radford *et al.*, (1974) was used with slight modification for separating epidermal layer from the leaf blade. The leaves were placed in fresh 5% NaOH (Sodium hydroxide) solution, which was replaced daily or at the interval of two days for 10-15 days. Leaves were then washed properly with water and dipped in 3% H₂O₂ (Hydrogen peroxide) solution for 12 hours. When the epidermal layers got completely separate from the rest of the tissues, the separated layer was then taken out with the help of forceps. The epidermal layer was then stained with 1% safranin and mounted in glycerine and sealed with DPX. To make the slide of petiole, thin

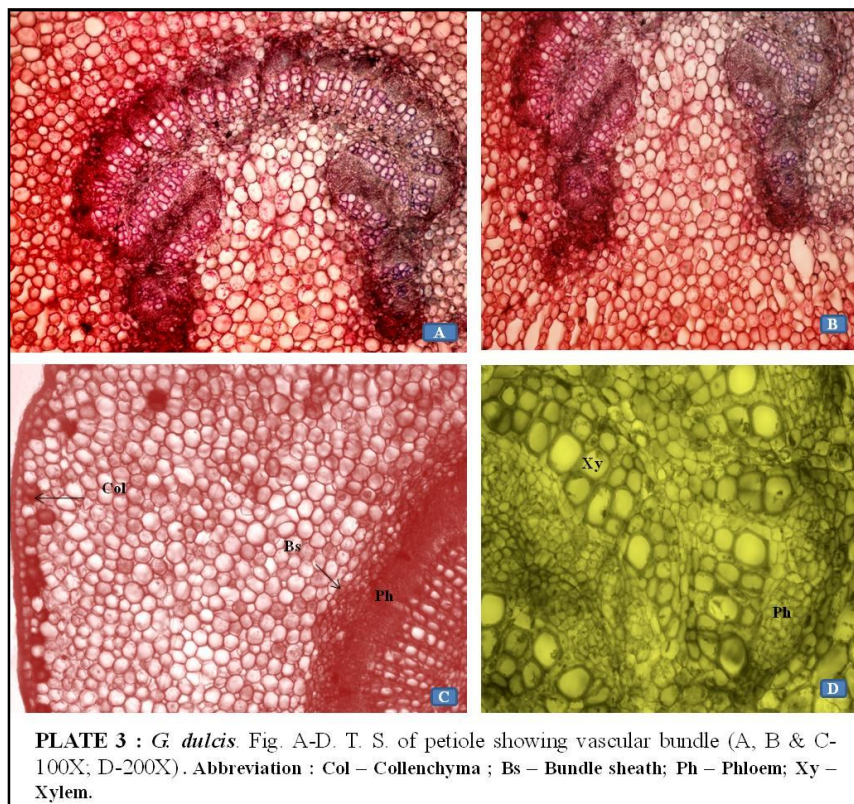
sections were made and permanent slides were prepared by following the methods suggested by Radford *et al.* (1974) and Gerlach (1977). The sections were stained with safranin and fast green and subsequently dehydrated through an ethanol gradient (70% to 100%). The sections were then treated with xylol and mounted on slides using DPX. The slides were then studied under Leica microscope using 40X, 100X and 200X magnifications and photographs were taken.

Results and Discussion

The outline of petiole is blunt at the adaxial side with no lateral outgrowth and convex at the abaxial side. The epidermis is uniseriate. Cortex is made up of 2-3 layered polygonal collenchymas cells and 13-14 layered isodiametric parenchyma cells. The vascular bundle is arc shaped with two distal ends incurved which in turn emerges outside just like two protuberances. The entire vascular bundle is well surrounded by 4 - 6 layered bundle sheaths. Secretory canals are not observed.

Leaves hypostomatic, the stomata are confined only to the abaxial surface of leaf; they are hemiparacytic and anomocytic. However the most common type of stomata in *Garcinia* is paracytic (Pathirana and Heart, 2004). The stomata are surrounded by 1 - 8 subsidiary cells; stomatal size: 13.8 μ \times 15.0 μ ; stomatal frequency: 98.3 mm² and stomatal index: 36.65. On the abaxial

surface intercoastal epidermal cells are irregular with highly sinuous anticlinal wall, a few cells are polygonal with straight anticlinal wall. Coastal cells are polygonal with straight anticlinal wall, 10 - 15 layered in both surfaces. On the adaxial surface intercoastal epidermal cells polygonal with straight anticlinal wall. Clustered crystal of calcium oxalate is present in between the epidermal cells in the adaxial surface. Some rudimentary inward projection like structure arises from the wall of epidermal cell of both the surfaces. Contiguous stomata present.



Conclusion

The present study reveals that the foliar epidermal features and petiole anatomy along with morphological attributes facilitates to delimit the taxa in the genus *Garcinia*. In this study, it has been found that the vascular bundle of *G. dulcis* is arc shaped with two distal ends incurved which in turn emerges outside just like two protuberances and it is a very peculiar type which is not observed in the species of *Garcinia* of Assam. In case of stomata it is hemiparacytic and anomocytic. However the most common type of stomata in the genus *Garcinia* is paracytic (Pathirana and Heart, 2004).

References

Anderson, T. (1874). Guttiferae. In: *Flora of British India*. J.D. Hooker (Ed.). L. Reeve, London. **1**: 258 – 278.

Begum, A., S.K. Barthakur and J. Sarma (2013). *Garcinia dulcis* (Roxburgh) Kurz (Clusiaceae): a new distributional record

for Assam, India. *Pleione*, **7(2)**: 545 – 548.

Gerlach, D. (1977) *Botanische Mikrotechnik* (Edn. 2.). Thieme, Stuttgart.

Howard, R.A. (1962). The vascular structure of the petiole as a taxonomic character. Reprint from “Advances in Horticultural science and their Applications”. Pergamone press, Oxford, **3**: 87 – 92.

Kanjilal, U.N., P.C. Kanjilal and A. Das (1934). *Flora of Assam*. Periodical Expert Book Agency, Delhi, **1**: 103–110.

Mabberly, D.J. (2005). *The Plant Book- A portable Dictionary of the Vascular Plants* (Edn. 2). Cambridge University Press. p. 293.

Maheshwari, J.K. (1964). Taxonomic Studies on Indian Guttiferae III. The genus *Garcinia* Linn. *Bulletin of Botanical Survey of India*, **6(2-4)**: 107 - 135.

Pathirana, P.S.K. and T.R. Herat (2004). Comparative Vegetative Anatomical study of the genus *Garcinia* L. (Clusiaceae/ Guttiferae) in Sri Lanka. *Ceylon Journal of Sciences (Biological Science)*, **32**: 39–66.

Radford, A.E., W.C. Dickison, J.R. Massey and C.L. Bell (1974). *Vascular Plant Systematic*. Harper and Raw Publishers, New York.

Schofield, E.K. (1968). Petiole Anatomy of the Guttiferae and Related Families. *Memoirs of the New York Botanical Garden*, **18**: 1–55.

Singh, N.P. (1993). Clusiaceae (Guttiferae nom. alt.) In: *Flora of India*. B.D. Sharma and N.P. Balakrishnan (Ed.). Botanical Survey of India, Kolkatta, **3**: 86-151.

Stevens, P.F. (2007). Clusiaceae. The families and genera of vascular plants. 9, Kubitzki K(ed.), Berlin, Springer, pp. 48-66.

Sweeney, P.W. and Z.S. Rogers (2008). Nomenclatural notes on *Garcinia* (Clusiaceae) from Madagascar and the Comoros. *Novon*, **18**: 524 - 537.