

STUDIES ON THE CUTICULAR CHARACTERS OF SOME MELIACEAE

Y. N. PANDEY

National Botanic Gardens, Lucknow

ABSTRACT

The cuticular characters of eight species belonging to six genera of Meliaceae, namely: *Azadirachta indica* A. Juss., *Melia azedarach* L., *M. birmanica* Kurz, *Swietenia macrophylla* King, *S. mahagoni* Jacq., *Soymida febrifuga* A. Juss., *Cedrela toona* Roxb. and *Chloroxylon swietenia* DC., are described.

INTRODUCTION

The family Meliaceae is characterised by the presence of anomocytic (ranunculaceous) type of stomata. A noteworthy feature of the stomata, which does not seem to have been previously mentioned, and is seen in all the species investigated here, is that the surrounding epidermal cells more or less overarch the guard cells from below (figs. 9, 27, 28). The guard cells show a prominent poral rim formed by the two ledges (figs. 1, 28) and sometimes conspicuous polar thickenings (fig. 21). The stomatal structure in the eight species examined here is quite uniform. But differences among the species are seen in the shape and size of the epidermal cell and, form of glandular hairs, and presence or absence of trichomes and cuticular striations.

Dutta & Mukerjee (1952) has given the pharmacognostic characters of the leaves of *Azadirachta indica* A. Juss. and *Melia azedarach* L. with figures of the leaf cuticle. In the following description a more detailed account of the cuticle of these two species is given.

DESCRIPTION

***Azadirachta indica* A. Juss. (Figs. 7-12)**

Lower epidermis: Intercostal cells straight-walled, or with walls often curved or slightly undulate; generally polygonal, measuring $10.8 \times 10.8 \mu$ to $21.6 \times 32.4 \mu$ (fig. 12). Costal cells elongated, arranged in rows. Venule reticulation clear. In intercostal areas groups of small-sized cells containing rosette crystals frequently occur (fig. 7). Stomata (fig. 12) oval, measuring 21.6×18 to $32.4 \times 18 \mu$ and occurring very sparsely on venous areas also. Non-glandular hairs (fig. 10) very sparse, occurring on the leaf margin and the veins, 46.8 to 201μ long, 10.8 to 14.4μ wide at the base, unicellular,

thick-walled with vaguely tuberculate surface; foot rounded; hair-base cells polygonal, thick walled. Glandular hairs sparse, multicellular, spherical, measuring 64.8 to 82.8μ in diameter (fig. 11).

Upper epidermis: Intercostal cells straight-walled or with slightly curved walls, polygonal, measuring $10.8 \times 14.4 \mu$ to $32.4 \times 36 \mu$ (fig. 8). Stomata absent. Non-glandular and glandular hairs very sparse, similar to those on the lower epidermis.

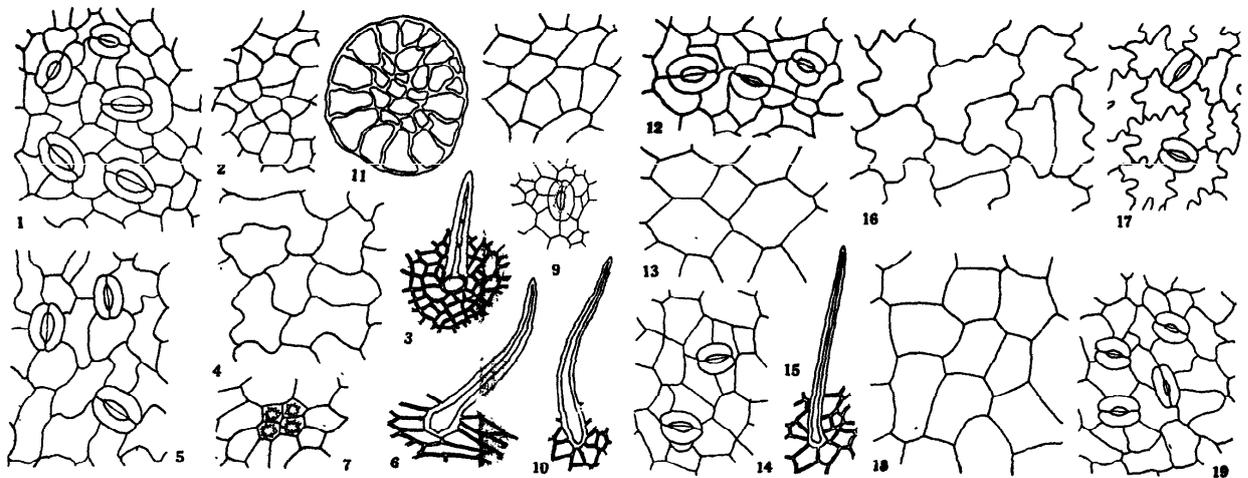
***Melia azedarach* L. (Figs. 4-6)**

Lower epidermis: Intercostal cells sinuous-walled, sometimes only slightly sinuous; irregular in shape, measuring $14.4 \times 14.4 \mu$ to $21.6 \times 36 \mu$ (fig. 5). Costal cells elongated, straight walled, arranged in rows. Stomata (fig. 5) oval, measuring $18 \times 14.4 \mu$ to $21.6 \times 14.4 \mu$. Non-glandular hairs (fig. 6) common on petiole, sparse on margin and veins; 90 to 180μ long, 14.4μ wide at the base, unicellular, thick-walled, without perceptible ornamentation; foot rounded or angular; hair-base cells thick-walled, polygonal. Glandular hairs spherical, short stalked, multi-cellular, measuring from 43.2 to 64.8μ in diameter.

Upper epidermis: Intercostal cells sinuous-walled, irregular in shape, generally larger in size than the cells of the lower epidermis, measuring $14.4 \times 18 \mu$ to $25.2 \times 43.2 \mu$ (fig. 4). Stoma absent. Non-glandular and glandular hairs similar to those on lower epidermis.

***M. birmanica* Kurz (Figs. 1-3)**

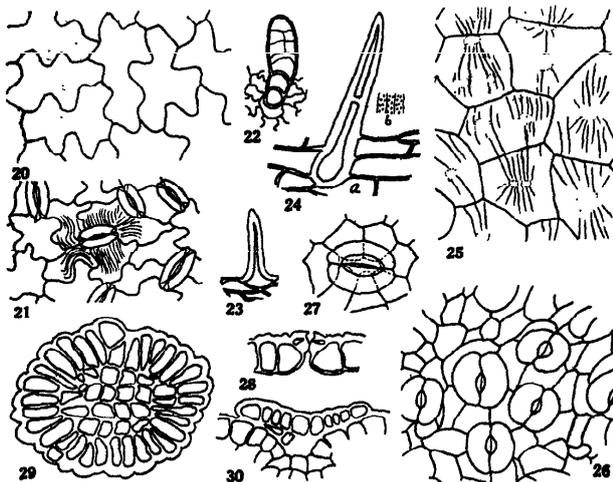
Lower epidermis: Intercostal cells polygonal, straight-walled, or with walls often curved, measuring $10.8 \times 10.8 \mu$ to $18 \times 25.2 \mu$ (fig. 1). Costal cells elongated, arranged in rows. Stomata (fig. 1) oval, measuring $18 \times 14.4 \mu$ to $28.8 \times 18 \mu$. Non-glandular hairs sparse, present on veins and intercostal areas;



Figs. 1-3. *Melia birmanica* Kurz: 1. Lower epidermis $\times 265$. 2. Upper epidermis $\times 265$. 3. Non-glandular hair from upper epidermis $\times 124$. Figs. 4-6. *Melia azedarach* L.: 4. Upper epidermis $\times 265$. 5. Lower epidermis $\times 265$. 6. Non-glandular hair from lower epidermis $\times 124$. Figs. 7-12. *Azadirachta indica* A. Juss.: 7. Rosette crystals in small cells of lower epidermis $\times 265$. 8. Upper epidermis $\times 265$. 9. Stoma showing overarching epidermal cells $\times 152$. 10. Non-glandular hair from lower epidermis $\times 124$. 11. Glandular hair from lower epidermis (surface view) $\times 265$. 12. Lower epidermis $\times 265$. Figs. 13-15. *Chloroxylon swietenia* DC.: 13. Upper epidermis $\times 265$. 14. Lower epidermis $\times 265$. 15. Non-glandular hair from lower epidermis $\times 124$. Figs. 16-17. *Swietenia mahagoni* Jacq.: 16. Upper epidermis $\times 265$. 17. Lower epidermis $\times 265$. Figs. 18-19. *Swietenia macrophylla* King: 18. Upper epidermis $\times 265$. 19. Lower epidermis $\times 265$.

several-celled, 54 to 234μ long, 10.8 to 12.6μ wide at the base; wall thick, faintly tuberculate; foot rounded; hair-base cells polygonal with thickened walls (fig. 3). Glandular hairs spherical, multicellular, measuring 36 to 72μ in diameter.

Upper epidermis: Intercostal cells polygonal, straight-walled, often with curved walls, measuring $10.8 \times 10.8 \mu$ to $18 \times 25.2 \mu$ (fig. 2). Stomata absent. Non-glandular and glandular hairs similar to those on the lower epidermis; non-glandular hairs sparse on veins and very sparse on intercostal areas.



Figs. 20-24. *Cedrela toona* Roxb.: 20. Upper epidermis $\times 265$. 21. Lower epidermis $\times 265$. 22. Glandular hair from lower epidermis $\times 152$. 23. Non-glandular hair $\times 124$. 24(a). Non-glandular hair from lower epidermis $\times 265$; (b). A portion of hair showing minute tubercles $\times 265$. Figs. 25-30. *Soyimida febrifuga* A. Juss.: 25. Upper epidermis $\times 265$. 26. Lower epidermis $\times 265$. 27. Stomata showing overarching epidermal cells $\times 300$. 28. T. S. of leaf showing stoma $\times 152$. 29. Glandular hair from lower epidermis (surface view) $\times 265$. 30. T. S. of leaf showing glandular hair in side view $\times 152$.

Swietenia macrophylla King (Figs. 18-19)

Lower epidermis: Intercostal cells slightly sinuous-walled, polygonal or of irregular shapes, measuring $14.4 \times 25.2 \mu$ to $18 \times 32.4 \mu$ (fig. 19). Costal cells elongated, straight-walled, arranged in rows. Stomata (fig. 19) oval, measuring $18 \times 18 \mu$ to $21.6 \times 18 \mu$. Glandular and non-glandular hairs absent.

Upper epidermis: Intercostal cells straight-walled or with slightly curved walls, larger than the lower epidermal cells, measuring $21.6 \times 46.8 \mu$ to $28.8 \times 54 \mu$ (fig. 18). Stomata, non-glandular and glandular hairs absent.

S. mahagoni Jacq. (Figs. 16-17)

Lower epidermis: Intercostal cells deeply sinuous-walled, irregular in shape, measuring $14.4 \times 14.4 \mu$ to $25.2 \times 39.6 \mu$ (fig. 17). Costal cells elongated, straight to slightly sinuous-walled, arranged in rows. Stomata (fig. 17) oval, measuring $14.4 \times 7.2 \mu$ to $14.4 \times 10.8 \mu$. Glandular and non-glandular hairs

TABLE I

Comparison of the cuticular characters of *Melia azedarach* and *M. birmanica*

| Species | Epidermal cells shape | | Epidermal cell size (microns) | | Size of stomata (microns) | Size of non-glandular hairs (microns) | Diameter of glandular hairs (microns) |
|------------------------|--------------------------------------|--------------------------------------|-------------------------------|--------------|---------------------------|---------------------------------------|---------------------------------------|
| | Upper | Lower | Upper | Lower | | | |
| <i>Melia azedarach</i> | Irregular, sinuous-walled | Irregular, sinuous-walled | 14.4 × 18 | 14.4 × 14.4 | 18 × 14.4 | 90 to 180 long, 14.4 wide | 43.2 to 64.8 |
| | | | to 25.2 × 43.2 | to 21.6 × 36 | | | |
| <i>M. birmanica</i> | Polygonal, generally straight-walled | Polygonal, generally straight-walled | 10.8 × 10.8 | 10.8 × 10.8 | 18 × 14.4 | 54 to 234 long, 10.8 to 12.6 wide | 36 to 72 |
| | | | to 18 × 25.2 | to 18 × 25.2 | | | |

absent. A few hair-base like structures have, however, been observed on the veins.

Upper epidermis: Intercostal cells irregular in shape, sinuous-walled, larger than the cells of the lower epidermis, measuring $21.6 \times 25.2 \mu$ to $43.2 \times 46.8 \mu$ (fig. 16). Stomata, non-glandular, and glandular hairs absent.

Soymida febrifuga A. Juss. (Fig. 25-30)

Lower epidermis: Intercostal cells with straight or curved walls, polygonal, measuring $7.2 \times 10.8 \mu$ to $14.4 \times 18 \mu$ (fig. 26); often showing linear striations on the surface. Costal cells elongated, straight-walled arranged in rows. Stomata (fig. 26) almost round, measuring $18 \times 18 \mu$ to $25.2 \times 21.6 \mu$. Non-

TABLE II

Comparison of the cuticular characters of *Swietenia macrophylla* and *S. mahagoni*

| Species | Epidermal cell shape | | Epidermal cell size (microns) | | Size of the stomata (microns) |
|---------------------------------|--------------------------------------|-----------------------------------|-------------------------------|----------------------------|-------------------------------|
| | Upper | Lower | Upper | Lower | |
| 1. <i>Swietenia macrophylla</i> | Polygonal, generally straight-walled | Polygonal or irregular. | 12.6 × 46.8 to 28.8 × 54 | 14.4 × 25.2 to 18 × 32.4 | 18 × 18 to 21.6 × 18 |
| 2. <i>S. mahagoni</i> | Irregular, sinuous-walled. | Irregular, deeply sinuous-walled. | 21.6 × 25.2 to 43.2 × 46.8 | 14.4 × 14.4 to 25.2 × 39.6 | 14.4 × 7.2 to 14.4 × 10.8 |

glandular hairs absent. Glandular hairs disc-shaped, peltate, multicellular, $72-108 \mu$ in diameter (figs. 29, 30).

Upper epidermis: Intercostal cells polygonal, straight-walled, much larger than the lower epidermal cells, measuring $25.2 \times 32.4 \mu$ to $32.4 \times 64.4 \mu$; surface showing striations which generally form radiating patterns (fig. 25). Stomata and non-glandular hairs absent. Glandular hairs as on the lower epidermis.

Cedrela toona Roxb. (Figs. 20-24)

Lower epidermis: Intercostal cells sinuous-walled, irregular in shape, measuring $18 \times 21.6 \mu$ to $21.6 \times 43.2 \mu$, generally with striations on the surface

(fig. 21). Costal cells elongated, sinuous walled, arranged in rows. Stomata (fig. 21) oblong, measuring $14.4 \times 10.8 \mu$ to $25.2 \times 10.8 \mu$; polar thickening conspicuous. Non-glandular hairs (figs. 23, 24) common on petiole; margin and veins but sparse on intercostal areas; one to several-celled, uniseriate, 54 to 144μ long, 14.4μ wide at the base; wall thick, tuberculate (fig. 24b); foot rounded or angular; hair-base cells polygonal, thick walled. Glandular hairs sparse, consisting of a short (1- or more celled) stalk and an oblong, multicellular head; cells surrounding the foot of glandular hair thin and sinuous-walled (fig. 22).

Upper epidermis: Intercostal cells sinuous-walled, irregular in shape, much larger than the cells of the

lower epidermis, measuring $25.2 \times 28.8 \mu$ to $28.8 \times 57.6 \mu$ (fig. 20). Stomata absent. Glandular and non-glandular hairs similar to those on the lower epidermis.

Chloroxylon swietenia DC. (Figs. 13-15)

Lower epidermis: Intercostal cells straight-walled, sometimes with curved walls, polygonal, measuring $14.4 \times 14.4 \mu$ to $21.6 \times 36 \mu$ (fig. 14). Costal cells elongated, arranged in rows. Stomata (fig. 14) oval, measuring $21.6 \times 14.4 \mu$ to $21.6 \times 18 \mu$. Non-glandular hairs (fig. 15) common on petiole, very sparse on veins and intercostal areas, 93.6 to 151.2μ long, 7.2 to 14μ wide at the base, unicellular, thick-walled without perceptible ornamentation; foot rounded; hair-base cells polygonal, thick-walled. Glandular hairs absent.

Upper epidermis: Intercostal cells polygonal, straight walled, generally larger than the lower epidermal cells measuring $10.8 \times 10.8 \mu$ to $32.4 \times 43.2 \mu$ (fig. 13). Stomata absent. Non-glandular hairs very sparse, similar to those on the lower cuticle. Glandular hairs absent.

DISCUSSION

Brandis (1911) mentions that *Swietenia macrophylla* was raised at the Calcutta Botanic Gardens from Honduras seed in 1872. He thought that it might be a variety of *S. mahagoni*. It has much

larger leaves than *S. mahagoni* and according to Bor (1953) grows much more rapidly. The cuticular characters indicate that the two are distinct species. Differences are seen in the shape and to lesser extent, in the size of the epidermal cells. Similar differences in shape and size of the epidermal cells are shown by the two species of *Melia*.

The monotypic genus *Chloroxylon* was placed in Rutaceae by Engler and is now placed in Flindersiaceae, a family somewhat intermediate between Rutaceae and Meliaceae (Willis, 1966). The epidermal characters of the species resemble the other Meliaceae.

ACKNOWLEDGEMENTS

The author remains deeply indebted to Dr. R. V. Sitholey, Director, National Botanic Gardens, Lucknow for his keen interest, guidance and supervision in this work. He is thankful to his colleagues especially Shri D. B. Shukla for help and cooperation.

REFERENCES

- BOR, N. L. *Manual of Indian Forest Botany*. Oxford, 1953.
 BRANDIS, D. *Indian Trees*. Constable, London, 1911.
 DUTTA S. C AND B. MUKERJEE, *Pharmacognosy of Indian leaf drugs*. Government of India Press, Calcutta. Bull. No. 2, 1952.
 WILLIS, J. C. *A Dictionary of the Flowering Plants and Ferns*. Cambridge, 7th Ed., 1966.