CUTICULAR STUDIES IN *CASSIA*

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INTRODUCTION

THE chief distinguishing characters of the leaf cuticle of six species of *Cassia* have been previously tabulated (Pandey, 1969). A detailed account is here presented of the cuticular characters of 12 species of this genus including the six above mentioned. The leaves of several of these (*C. alata* L., *C. auriculata* L., *C fistula* L., *C. occidentalis* L., *C. sophera* L., and *C. tora* L.) are used for medicinal purposes in the Ayurvedic and Unani systems of medicine.

The material for study was collected from plants growing in the National Botanic Gardens, Lucknow. Where possible the cuticle was stripped off the leaves; in the other cases, the maceration technique with nitric and chromic acids was followed. The cuticles were stained with aqueous safranin and mounted in glycerine.

OBSERVATIONS

General features of the cuticle.—A pharmacognostic study of *C. alata* has been made by Neubern de Toledo (1948–49) and of *C. sophera* by Chauchury (1964). The epidermal cells are either polygonal, with straight or slightly undulate anticlinal walls (*C. occidentalis*, *C. siamea* Lamk.) (Figs. 21, 24), or of an irregular shape with markedly sinuous anticlinal walls [*C. alata* (Fig. 4)]. The epidermal cells may be papillose, with a single prominent papilla in each cell (Fig. 4). In some cases the papillae are not clearly visible in the cuticular preparation but can be easily made out in sectional view (Fig. 8). The stomata may be confined to the lower surface of the leaf (*C glauca* Sieb., *C. siamea*), or may occur on both the surfaces (*C auriculata*, *C. tora*). In the latter case they are more numerous on the lower surface. The stomata are variable; they are generally of the paracytic type but the anomocytic type occasionally occurs and may even be frequent in the same species. The two subsidiary cells are generally indistinguishable from the other epidermal cells, but one of them is usually smaller than the other. Comparing roughly the stomatal area with that of the epidermal/subsidiary cells, the stomata may be divided into two categories: (i) small and (ii) of about the same size as the epidermal/subsidiary cells. Example of the first category is *C. auriculata* (Fig. 2), that of the second *C. siamea* (Fig. 24). The stomata are usually of oval shape with rounded poles. T-shaped thickenings are often seen at the poles. The stomatal ledges are usually seen forming a rim to the pore.

TABLE

Cuticular characters

	EPIDERMAL CELLS		
	Lower Cutiele	*Upper Cuticle*	*Venous areas*
1. *Cassia alata* L. (Figs. 3, 4) ..	Irregular; anticlinal walls sinuous. Cells papillose, papillae prominent 14·4 × 18 μ to 36 × 36 μ	Irregular; anticlinal walls sinuous. Cells papillose but less frequently than in lower cuticle 25 × 39·6 μ to 39·6 × 54 μ	Veinlets clear
2. *C. auriculata* L. (Figs. 1, 2) ..	Polygonal; anticlinal walls generally straight 14·4 × 25·2 μ to 25·4 × 43·2 μ	Polygonal; anticlinal walls straight 18 × 21·6 μ to 28·8 × 46·8 μ	Veinlets clear
3. *C. fistula* L. (Figs. 9, 10) ..	Polygonal; anticlinal walls undulate or straight 14·4 × 14·4 μ to 18 × 25·2 μ	Polygonal; anticlinal walls straight 14·4 × 18 μ to 18 × 36 μ	Veinlets conspicuous
4. *C. glauca* Sieb. (Figs. 11, 12) ..	Polygonal; anticlinal walls straight or slightly undulate 18 × 25·2 μ to 25·2 × 61·2 μ	Polygonal; anticlinal walls straight or slightly undulate 18 × 21·6 μ to 25·2 × 50·4 μ	Veinlets clear
5. *C. grandis* L. (Figs. 5–8) ..	Polygonal or somewhat irregular; anticlinal walls straight or slightly undulate. Cells papillose 14·4 × 18 μ to 18 × 21·6 μ	Polygonal; anticlinal walls straight or slightly undulate 18 × 21·6 μ to 21·6 × 46·8 μ	Veinlets conspicuous
6. *C. nodosa* hybrida (Figs. 18–20) ..	Irregular; anticlinal walls sinuous 10·8 × 14·4 μ to 18 × 39·6 μ	Irregular; anticlinal walls sinuous 25·2 × 28·8 μ to 25·2 × 39·6 μ	Veinlets conspicuous
7. *C. occidentalis* L. (Figs. 21–23) ..	Polygonal; anticlinal walls straight or slightly undulate 21·6 × 39·6 μ to 28·8 × 46·8 μ	Polygonal; anticlinal walls straight or slightly undulate 25·2 × 36 μ to 21·6 × 50·4 μ	Veinlets clear

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of Cassia *spp.*

STOMATA			NON-GLANDULAR HAIRS		
Occurrence size in relation to epidermal subsidiary cells	*Average size of stomata*	*Stomatal index (lower Cuticle)*	*Occurrence*	*Form and size*	*Ornamentation of wall*
Present on both surfaces; small	17·5× 11·2 μ	14·2– 18·3– 23·4	Present mostly in costal areas on both surfaces; sparse	Small; unicellular; 35·7 to 114 μ long, 14·2 μ wide. Hair-base cells distinct	Granular, indistinctly tuberculate
Present on both surfaces; small	18 × 12·5 μ	4·5– 8·4– 12	Present on both surfaces; common	One to several celled, uniseriate; 185–454 μ long, 14·2 wide. Hair-base cells distinct	Tuberculate, tubercles minute
Present on lower surface only; about same size as epid./subs. cells	29·6× 15·4 μ	12– 13·6– 16	Present on both surfaces; numerous	Mostly unicellular; 54 to 144 μ long, 9·4 μ wide. Hair-base cells distinct	Indistinctly granular
Present on lower surface only; small	19·8× 14·4 μ	20– 22·5– 25	Present on lower surface only; sparse	Unicellular; 183 to 367 μ long, 18 μ wide. Hair-base cells distinct	Indistinctly granular
Present on lower surface only; about same size as epid./subs. cells	15·8× 14·7 μ	11·7– 13·1– 16·6	Present on both surfaces; numerous	Several celled; uniseriate; 115 to 360 μ long, 14·4 μ wide. Hair-base cells distinct	Tuberculate, tubercles minute, round or oval
Present on lower surface only; about same size as epid./subs. cells	21·2× 15·4 μ	15·4– 19·3– 21·4	Present on both surfaces; numerous	One to several celled; uniseriate; 47·5 to 198 μ long, 8·3 μ wide. Hair-base cells not distinct	Tuberculate, tubercles minute, round
Present on both surfaces; small	22·2× 11·9 μ	15·1– 16·6– 18·1	Confined usually to leaf margin; scant	One to several celled; 170 to 497 μ long, 35·9 μ wide	Tuberculate, tubercles narrowly elliptic or linear

TABLE

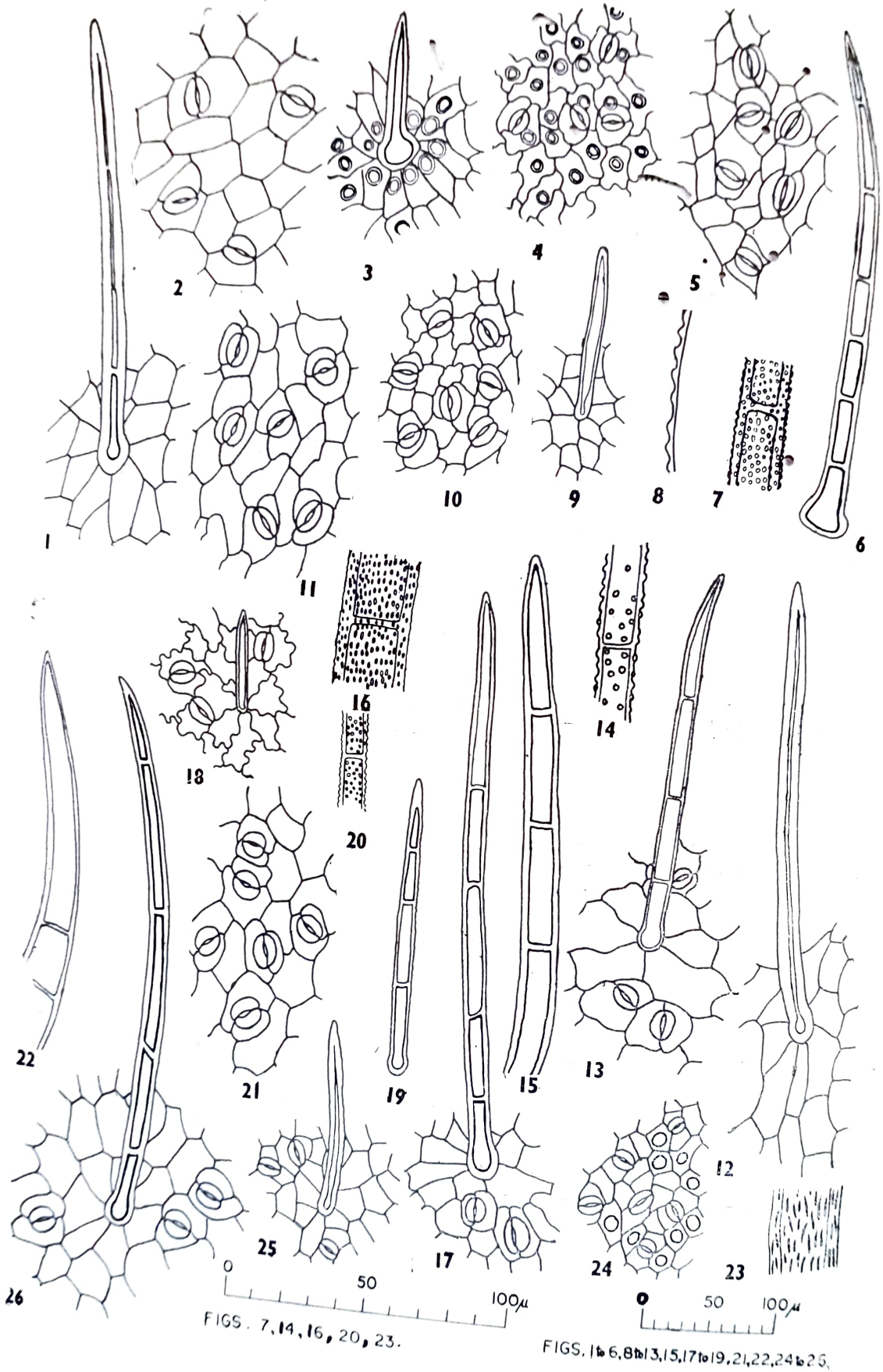
Cuticular Characters

	EPIDERMAL CELLS		
	Lower Cuticle	*Upper Cuticle*	*Venous area*
8. *C. podocarpa* Guill. . . (Fig. 17)	Polygonal; anticlinal walls straight or slightly undulate 21·6 × 25·2 μ to 25·2 × 46·8 μ	Polygonal; anticlinal walls straight or slightly undulate 21·6 × 32·4 μ to 39·6 × 54 μ	Veinlets clear
9. *C. siamea* Lamk. .. (Figs. 24, 25)	Polygonal; anticlinal walls straight. Cells papillate 10·8 × 10·8 μ to 18 × 18 μ	Polygonal or rectangular; anticlinal walls straight 14·4 × 21·6 μ to 21·6 × 46·8 μ	Veinlets clear
10. *C. sophera* L. .. (Figs. 15, 16)	Polygonal; anticlinal walls slightly undulate 25·2 × 32·4 μ to 25·4 × 50·4 μ	Polygonal; anticlinal walls straight or slightly undulate 25·4 × 36 μ to 28·8 × 57·6 μ	Veinlets clear
11. *C. surattensis* Burm... (Fig. 26)	Polygonal; anticlinal walls straight or slightly undulate 25·2 × 28·8 μ to 32·4 × 54 μ	Polygonal; anticlinal walls straight or slightly undulate 25·2 × 36 μ to 39·6 × 61·2 μ	Veinlets clear
12. *C. tora* L. .. (Figs. 13, 14)	Polygonal; anticlinal walls slightly undulate 21·6 × 25·2 μ to 43·2 × 79·2 μ	Polygonal; anticlinal walls straight or slightly undulate 25·2 × 28·8 μ to 46·8 × 54 μ	Veinlets clear

I—(Contd.)

of Cassia spp.

STOMATA			NON-GLANDULAR HAIRS		
Occurrence: size in relation to epidermal subsidiary cells	*Average size of stomata*	*Stomatal index (lower Cuticle)*	*Occurrence*	*Form and size*	*Ornamentation of wall*
Present on lower surface; only; small	19 × 15·4 μ	12·5–14 – 16·6	Present on lower surface only; common	Slender, several celled; uniseriate; 216 to 353 μ long, 13·7 μ wide. Hair-base cells distinct	Tuberculate, tubercles minute
Present on lower surface only; about same size as epid./subs. cells	8·2 × 4·4 μ	13·5–16·4–20·9	Present on both surfaces; common	Short, somewhat spindle-shaped, unicellular; 46·8 to 137 μ long, 10·8 μ wide. Hair-base cells distinct	Indistinct, rough
Present on both surfaces; small	28·8 × 21·6 μ	12–17·8–22·5	Confined to leaf margin and midrib; scant	One to several celled; uniseriate; 298 to 412 μ long, 14·2 μ wide	Tuberculate, tubercles minute, oval
Present on both surfaces; small	23 × 21·6 μ	10–15·4–22·2	Present on lower surface only; sparse	Slender, one to several celled; uniseriate; 61·2 to 355 μ long, 7·2 μ wide. Hair-base cells distinct	Granular or indistinctly tuberculate
Present on both surfaces; small	23·4 × 15·7 μ	15·7–18–20·8	Present on lower surface only; common	Two to six celled; uniseriate; 170 to 497 μ long, 14·2 μ wide. Hair-base cells not distinct	Tuberculate; tubercles minute, round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FIGS. 7, 14, 16, 20, 23.
FIGS. 1 to 6, 8 to 13, 15, 17 to 19, 21, 22, 24 to 26.

FIGS. 1–26

The non-glandular hairs are variable, one to several cells high, uniseriate, thick-walled, the wall often ornamented with small tubercles. The hairs may be long and slender as in *C. podocarpa* Guill. (Fig. 17), horn-shaped (*C. occidentalis*) (Fig. 22), or small and somewhat spindle-shaped (*C. fistula*, *C. siamea*) (Figs. 9, 25). The foot is generally rounded and swollen and is inserted in a thick-rimmed pore. The hair-base cells are usually distinct, but in some species they are not much different from the other epidermal cells. The hairs vary in the species in their distribution; in some they are quite scant, being confined chiefly to the veins and the leaf-margin, while in the others they occur all over the leaf surface fairly densely.

Summary and Conclusion

The specific characters differ in (i) the form and size of the epidermal cells, (ii) the nature of the anticlinal walls, (iii) the conspicuousness or otherwise of the venule reticulation, (iv) form and ornamentation of the non-glandular hairs, and (v) the occurrence of the stomata on one or both surfaces of the leaf. The stomata themselves are fairly uniform in character in the species examined.

The details of the cuticular characters of the 12 species are given in Table I.

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Explanation of Figures

Figs. 1–26. *Cassia* spp. Figs. 1, 2. *Cassia auriculata* L. Fig. 1. Hair. Fig. 2. Lower cuticle. Figs. 3, 4. *C. alata* L. Fig. 3. Hair. Fig. 4. Lower cuticle. Figs. 5–8. *C. grandis* L. Fig. 5. Lower cuticle. Fig. 6. Hair. Fig. 7. Portion of hair to show wall ornamentation. Fig. 8. Papillae in sectional view. Figs. 9, 10. *C. fistula* L. Fig. 9. Hair. Fig. 10. Lower cuticle. Figs. 11, 12. *C. glauca* Sieb. Fig. 11. Lower cuticle. Fig. 12. Hair. Figs. 13, 14. *C. tora* L. Fig. 13. Hair and stomata from lower cuticle. Fig. 14. Portion of hair to show wall ornamentation. Figs. 15, 16. *C. sophera* L. Fig. 15. Hair. Fig. 16. Portion of hair to show wall ornamentation. Fig. 17. *C. podocarpa* Guill. Hair and stomata from lower cuticle. Figs. 18–20. *C. nodosa* hybrida. Fig. 18. Hair and stomata from lower cuticle. Fig. 19. Hair. Fig. 20. Portion of hair to show wall ornamentation. Figs. 21–23. *C. occidentalis* L. Fig. 21. Lower cuticle. Fig. 22. Hair. Fig. 23. Portion of hair to show wall ornamentation. Fig. 24. Lower cuticle. Fig. 25. Hair. Fig. 26. *C. surattensis* Burm. Hair and stomata from lower cuticle.
Figs. 24, 25. *C. siamea* Lamk.