

MORPHOLOGY AND ANATOMY OF SEEDS OF SOME *CROTALARIA* SPECIES*

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ABSTRACT

Morphology and anatomy of seeds of 12 *Crotalaria* species have been investigated. In all the species, seed-coat shows, more or less, a similar pattern of differentiation. Size of palisade, hour glass and parenchymatous cells varies in different species. In mature seeds, only a few cell-layers of the endosperm persist.

INTRODUCTION

Economic importance of water soluble seed gums is well known because of their diverse uses in pharmaceutical, food, textile and paper industries. FAROOQI (1975) has reported that the seeds of many species of *Crotalaria* are sources of such gums. Considering the importance of this genus as a potential source of gums, it is thought desirable to undertake the morphological studies of available seeds of various species to find out the structural details.

Genus *Crotalaria* belongs to the tribe Genistae, sub-family Papilionoideae of the family Leguminosae. It comprises nearly 300 species distributed in tropical and subtropical regions of the globe (AIRY-SHAW, 1973). Previous literature on the seed structure of the family Leguminosae has been reviewed by NETOLITZKY (1926), SINGH (1964) and CORNER (1976). MILLER (1967) and NARANG AND CHANDRA (1977) have worked out seed coat anatomy of some *Crotalaria* species. The present paper deals with the external morphology and seed-coat anatomy of *Crotalaria albida* Heyne, *C. calycina* Shrank, *C. grahmiana* W. & A., *C. juncea* L., *C. medicagenia* Lamk., *C. mysorensis* Roth., *C. prostrata* Roxb., *C. retusa* L., *C. saltiana* Andr., *C. sericea* Retz., *C. striata* DC., and *C. verrucosa* L.

MATERIAL AND METHODS

Mature seeds of *Crotalaria* species were boiled in water for a few minutes and were dehydrated through tertiary butyl alcohol series and embedded in paraffin wax in usual way. Some of the paraffin blocks containing hard seeds were trimmed and kept in dilute solution of glycerine which improved sectioning. Sections were cut at a thickness of 12-15 μ m and stained in safranin-fast green combination.

EXTERNAL MORPHOLOGY

The seeds of *Crotalaria* species under investigation show to a large extent great similarity in their general appearance but in size they differ considerably (Table-1). The seeds, in general, are compressed, nearly flat and assymetrical, reniform with one end curved and beaked (Figs. 1-12). The surface of the seeds in most of the species is smooth but slight striations do occur in *C. albida* and *C. medicagenia*. The colour also varies in different

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species ranging from light brown, smoky-grey to dark brown and black (Table-1). Seeds of some species have a shining surface where as other species have a dull surface. Just near the notch, formed due to the curving of the beak, there is a depression where the micropyle and hilum are situated.

Table 1

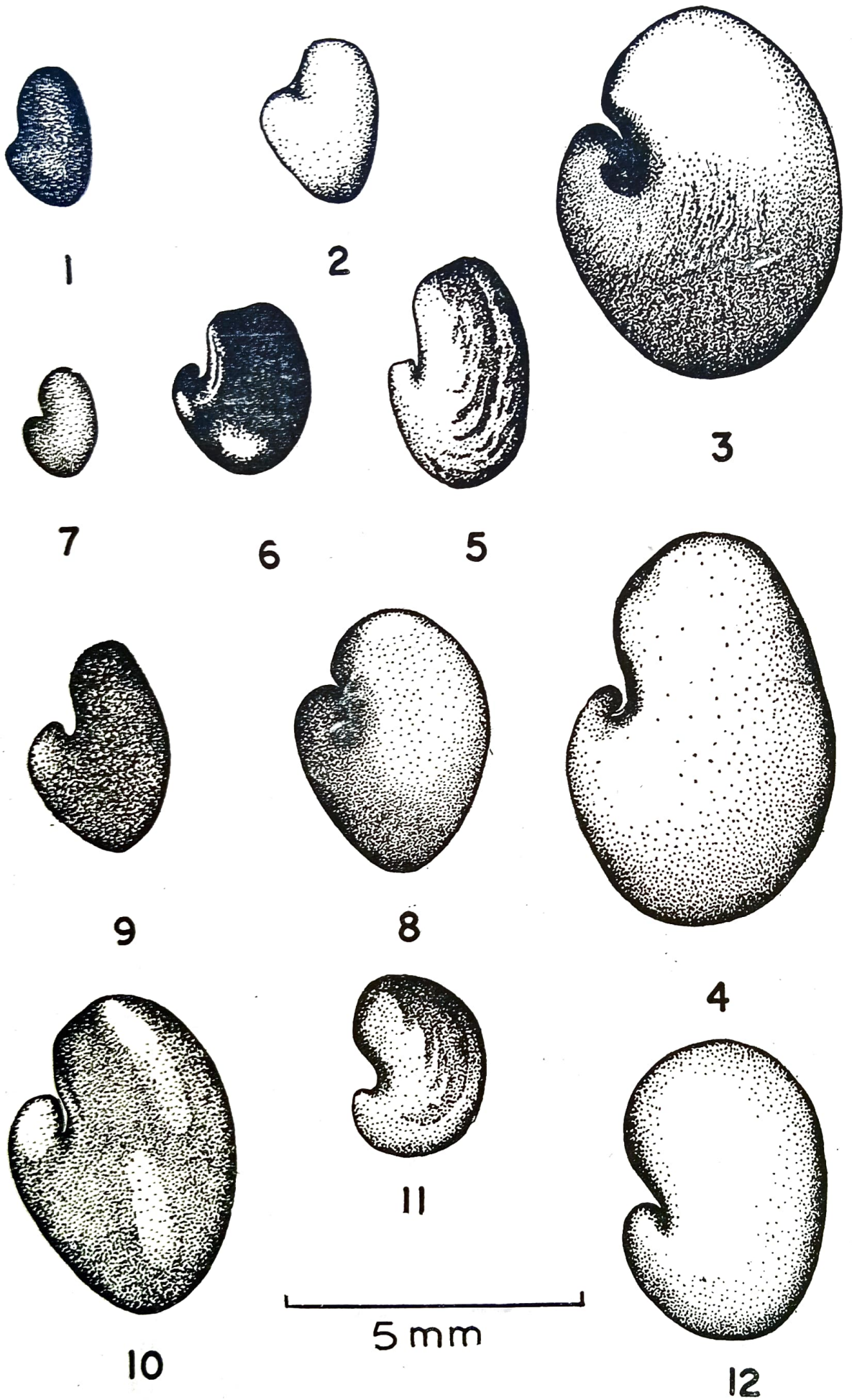
Name of the species	Size l × b × t in mm	Colour	Surface	Weight of 100 seeds in gms.	Percentage of mucilage
1. <i>Crotalaria albida</i> Heyne	2.2 × 1.5 × 1	Light to dark brown	Light granular	0.2	14.0
2. <i>Crotalaria calycina</i> Shrank	2.8 × 2 × 1	Yellow brown to grey	Smooth and shining	0.4	8.0
3. <i>Crotalaria grahmiana</i> W & A	6 × 4.8 × 2	Smoky grey to dull yellow	Smooth	4.0	13.3
4. <i>Crotalaria juncea</i> L.	6.5 × 5.6 × 2.1	Steel grey	„	4.7	20.4
5. <i>Crotalaria medicaginea</i> Lamk.	3.6 × 2.5 × 1.6	Greenish to brown yellow	Striated	0.8	28.5
6. <i>Crotalaria mysorensis</i> Roth.	3 × 2.4 × 0.9	Dark brown to black	Smooth	0.5	8.8
7. <i>Crotalaria prostrata</i> Roxb.	1.7 × 1.3 × 0.8	Dark brown	„	1.5	9.6
8. <i>Crotalaria retusa</i> L.	4.7 × 3.4 × 1.4	Yellowish brown	„	1.8	18.4
9. <i>Crotalaria saltiana</i> Andr.	3.4 × 2.6 × 1.5	Redish yellow to brown	„	0.6	24.0
10. <i>Crotalaria sericea</i> Retz.	5.5 × 4 × 2.4	Dark brown	„	2.7	18.4
11. <i>Crotalaria striata</i> DC.	3.1 × 2.4 × 1.2	Greenish to yellowish brown	„	0.8	20.0
12. <i>Crotalaria verrucosa</i> L.	5 × 3.5 × 2.5	Chocolate brown	„	3.2	17.2

INTERNAL MORPHOLOGY

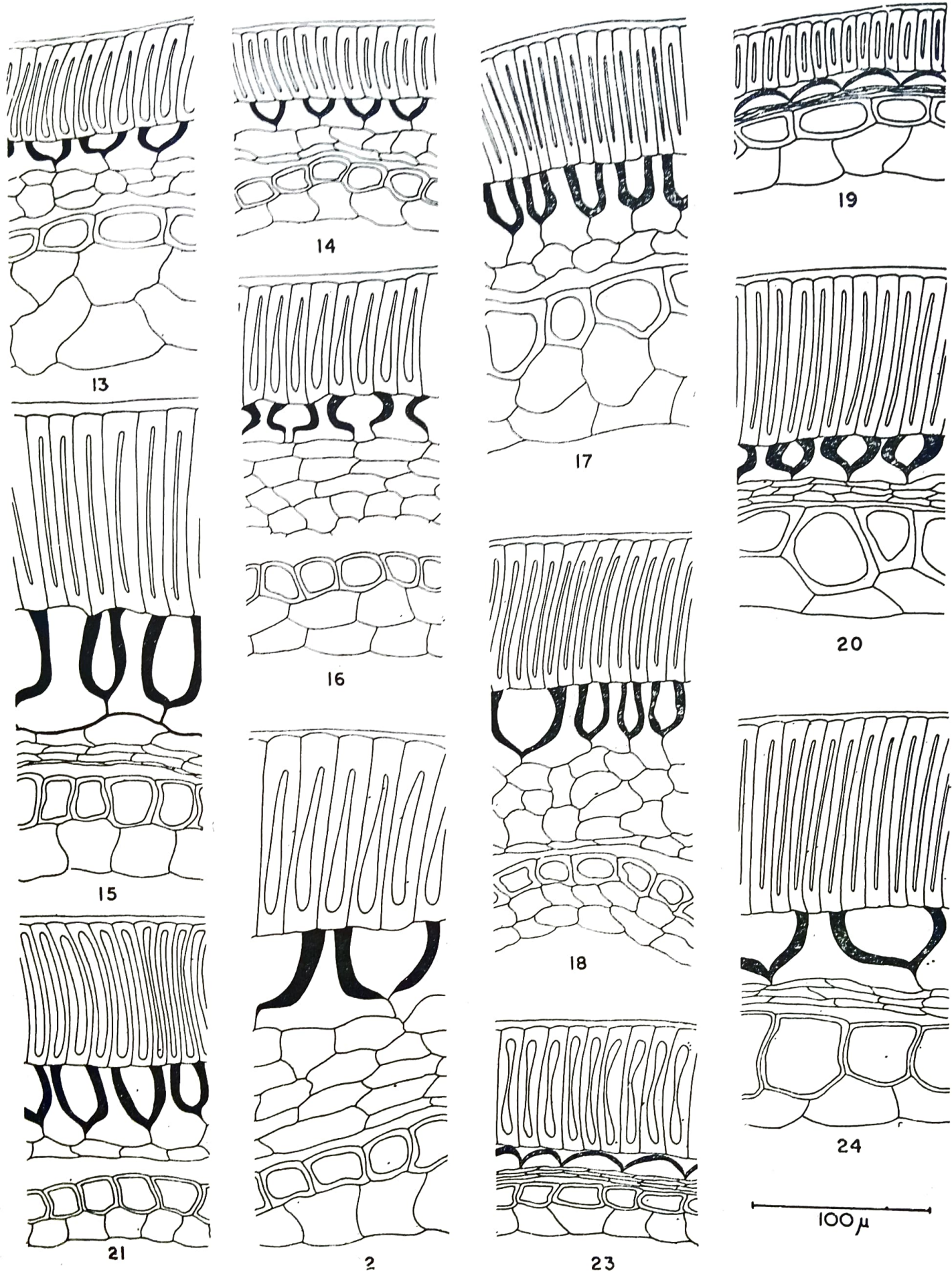
Anatomically, the seed-coat of all the 12 *Crotalaria* species follows a similar pattern of differentiation. The seed-coat in a mature seed, can easily be distinguished into the following four regions : (a) Cuticle, (b) Palisade cells, (c) Hour glass cells and (d) Parenchymatous cells.

(a) *Cuticle*—This layer in all the species is smooth but thickness varies to some extent. Cuticle covers the outer tangential wall of the palisade cells (Figs. 13—24) and prevent the passage of water and air as long as it is undamaged (FAHN, 1974).

(b) *Palisade Cells*—The palisade cells are radially elongated and characteristically thickened. Radial elongation of the palisade cells varies not only from species to species



Crotalaria species. Mature seeds. Text-figs. 1-12: 1. *Crotalaria albida*, 2. *C. calycina*, 3. *C. grahmanniana*, 4. *C. juincea*, 5. *C. medicaginea*, 6. *C. mysorensis*, 7. *C. prostrata*, 8. *C. retusa*, 9. *C. saltiana*, 10. *C. sericea*, 11. *C. striata*, 12. *C. verrucosa*.



Crotalaria species. Anatomy of mature seeds: Text-figs. 13-24. I.. s. part of mature seeds of *Crotalaria* *albida*, *C. calycina*, *C. grahmlana*, *C. juncea*, *C. medicaginea*, *C. mysorensis*, *C. prostrata*, *C. retusa*, *C. saltiana*, *C. sericea*, *C. striata* and *C. verrucosa* respectively.

but also in the same species on two opposite sides—hilar and antihilar—of the mature seeds. Palisade cells are more elongated radially in *C. grahamiana*, *C. sericea* and *C. verrucosa* (Figs. 15, 22, 24) while they are of medium length in *C. albida*, *C. juncea*, *C. medicagena*, *C. mysorensis*, *C. retusa*, *C. saltiana* and *C. striata* (Figs. 13, 16-18, 20, 21, 23). The palisade cells are less radially elongated in *C. calycina* and *C. prostrata* (Figs. 14, 19). The palisade cells are thickened to varying extent in different species.

(c) *Hour Glass Cells*—These cells form the hypodermal layer and lie below the palisade (Figs. 13-24). The cells are columnar; they are narrow on the palisade side and broad towards the other end. Between two hour glass cells wide air spaces are present. Usually these cells are in a single row. In *C. albida*, *C. calycina*, *C. juncea* and *C. retusa* the hour glass cells are small (Figs. 13, 14, 16, 20) while they are large in *C. grahamiana*, *C. sericea*, *C. mysorensis* and *C. verrucosa* (Figs. 15, 18, 21, 22, 24). In *C. prostrata* and *C. striata* hour glass cells of the type described in other species are, however, not formed (Figs. 19, 23).

(d) *Parenchymatous Zone*—Only a few layers of the parenchymatous cells remain in the mature seeds (Figs. 13—24). In many cases the cells of this zone are discernible.

ENDOSPERM

Only a few layers of the endosperm persist in the mature seeds (Figs. 13—24). The outermost layer of the endosperm, in all the cases is thickened. Endosperm is the main source of mucilage in the seeds and it takes green stain with fast green. The percentage of mucilage in different species of *Crotalaria* is given in Table 1.

DISCUSSION

In broad features, the seed-coat of all the 12 *Crotalaria* species studied closely compares with the observations of previous authors (CORNER, 1951; MILLER, 1967; CHAUDHURY & BUTH, 1970; DESHPANDE & UNTAWALE, 1971; NARANG & CHANDRA, 1977). The outermost cell-layer of the seed-coat is the cuticularised palisade and the extent of the radial elongation and thickening of these cells varies from species to species. Variation in the shape, size and thickening in hour glass cells are seen. This layer is followed by a zone of parenchymatous cells.

NARANG AND CHANDRA (1977) report that in *C. medicagenea* hour glass cells are not well-organized but during present investigation of the same species, well-organised hour glass cells have been recorded. In *C. prostrata* and *C. striata*, however, a well differentiated zone of hour glass cells has not been observed.

The dimensions of cells of various zones vary enormously in seeds of *Crotalaria* species. They are longer towards the hilum and shorter towards the opposite side. Even if fairly average-sized cells are chosen from a selected part of the seed, the variation shown between species of *Crotalaria*, as also illustrated by MILLER (1967), will be of taxonomic significance but needs further detailed study involving more species.

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