

A COMPARATIVE MACRO AND MICROMORPHOLOGICAL
STUDY OF CASSIA JAVANICA LINN. AND C. SIAMEA LAM.

PART II: The Fruits

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The macro and micromorphological characters of the fruits and their individual seeds of Cassia javanica Linn. and C. siamea Lam were studied. Thus provided a key for their identification in both entire and powdered forms as well as, differentiation between them.

In a previous paper, we have recorded the macro-and micromorphological characters of the stems and leaves of C. javanica Linn. and C. siamea Lam and provided a scheme for their differentiation¹.

The laboratory investigations revealed the presence of anthraquinones, flavonoids, alkaloids and other constituents in the leaves and terminal branches and also in the fruits of the two plants. These constituents were studied and identified^{2,3,4}. So, It was interesting to fulfil the present investigation in order to throw a light on the different macro- and micromorphological characters of the fruits of the two plants.

Material:

The fruits were collected from trees cultivated at Cairo and Aswan at the end of the summer season. Fresh, as well as preserved samples were used.

MACROMORPHOLOGY

The fruits (Fig. 1 A & B) are shortly-stalked, dry indehiscent pods. They are cylindrical in C. javanica Linn. and flattened in C. siamea Lam and slightly constricted crosswise forming one seeded joints. The surface is smooth or slightly wrinkled, brown; in C. javanica with black blotches. The pods have extended distal ends which are pointed marking the position of the styles and another proximal ones extending to short stalks which widen below towards the remains of the thalamus. Each dorsal suture carries a single vascular strand while the ventral one carries two closely situated strands.

The pods of C. javanica Linn. measure 15 to 30 cm in length and 1 to 1.5 cm in diameter and contain from 6 to 8 seeds only as many segments are empty. On the other hand pods of C. siamea Lam measure from 10 to 32 cm in length and 2.5 to 3.5 cm in width and contain from 8 to 15 seeds.

The fruits are odourless and with a very bitter taste.

The seeds of C. javanica Linn. (Fig. 1 D) are oval to rhomboidal with a narrow pointed end at the apex containing the hilum and micropyle. The surface is smooth, shining and carries a well-marked raphe.

The seeds are buff-yellow in colour, very hard, odourless and with unpleasant bitter taste. They measure from 5 to 8 mm in length and 3 to 7 mm in width.

Those of C. siamea Lam (Fig. 1C) are oval with narrow apex and a broad base, the hilar end. The surface is smooth carrying a raphe running somewhat laterally from base to apex. The seeds are dark-brown, very hard, odorless and with a bitter taste. They measure from 8 to 12 mm in length and 6 to 8 mm in width.

Internally, the seeds show a thick seed coat, followed by a whitish, horny endosperm enclosing a straight, fleshy embryo. The radicle is short, stout cylindrical and pointed towards the micropyle. The two cotyledons are oval and planoconvex.

MICROMORPHOLOGY

The fruit pericarp:

Transverse sections through the pericarps (Fig. 2 A & B) show an outer epicarp followed by a parenchymatous mesocarp which is traversed by several vascular strands. Groups of stone cells are scattered through the mesocarp which in case of C. siamea form generally a complete band accompanied by some other groups. The endocarp is sclerenchymatous formed of stone cells in C. javanica Linn and of fibres in C. siamea Lam.

The epicarp (Fig. 2 C & D, 3 A & B) is formed of one row of cells which appear polygonal, in surface view, either elongated or isodiametric with straight walls and covered with smooth cuticle. Stomata are paracytic and sunken.

The mesocarpal parenchyma is somewhat tangentially elongated and contain prisms and cluster crystals of cal-

cium oxalate. The vascular bundles are collateral showing an upper arc of lignified pericyclic fibres which is large in C. siamea and surrounded by crystal sheath. These pericyclic fibres are usually curved with thick pitted walls, moderately-wide lumina and rounded ends in C. javanica while in C. siamea the walls show slit-like pits. The stone cells are oval, rounded, quadrangular or angular and polygonal, lignified and with narrow lumina and pitted walls.

The endocarpal stone cells of C. javanica (Fig. 2 C, 3 A) are elongated, oval and with narrow lumina and lignified pitted walls. The endocarpal fibres in C. siamea (Fig. 2 D, 3 B) are long somewhat curved with moderate lumina and thick, pitted, lignified walls. These fibres are surrounded by a crystal sheath from the innermost cells of the endocarp which contain prisms of calcium oxalate.

Other characters which provide significant differences are recorded in the table.

The seeds:

Transverse sections through the seeds (Fig. 4 A & B) show an outer testa of 5 layers and an endosperm which is horny in C. siamea followed by the fleshy embryo.

The epidermis of the testa (Fig. 5 A & B) is formed of elongated, palisade-like cells (Malpighian) which are cellulose and covered with very thick cuticle. The epidermal cells appear in top view (Fig. 4 Cb & Db) polygonal, isodiametric with thick walls and in basal view (Fig. 4 Ca & Da) appear with wider lumina and somewhat less thick walls following the epidermis is the hypodermis (Fig. 4 & 5) which

is formed of basket-like cells with wide intercellular spaces. The middle layer is parenchymatous in C.javanica and contain prismatic and cluster crystals of calcium oxalate.

This layer is traversed by vascular strands. In C. siamea, thick-walled oval elongated or sometimes rounded cells constitute the middle layer. The walls of these cells sometimes show pits and lumina are free from contents (Fig. 4D, & 5D). Another layer (inner layer) of basket-like cell arranged in one row is present accompanied by a layer of collapsed (C.javanica) or parenchyma cells (C.siamea).

The endosperm is fleshy in C. javanica and contain aleurone grains and some oil globules. (Fig. 4 A & 5 A). While, in C.siamea it shows irregular cells with thick, pitted walls horny and hard and contain in addition prismatic crystals of calcium oxalate (Fig. 4 B & 5B).

The embryo cells are quadrangular or rounded containing amorphous aleurone grains and some oil globules (Fig. 4 A, B & 5 A, B).

More information about the histological differences are recorded in the table.

The main micromorphological differences between the fruits of C. javanica Linn. and C. siamea Lam.

Character	<u>C. javanica</u> Linn	<u>C. siamea</u> Lam.
1- Epicarp cells:		
- Dimensions *		
Length	28-60	40-70
Width	20-45	20-40
Height	28-40	20-40
2- Mesocarp		
- Par. Contents	Ca.Ox	Ca.Ox
- Stone cells		
Length	38-70	60-250
Width	35-50	40-80
- Pericyclic fibres	curved, pitted wall	irregular, slit-like pits
Length	600-1000	600-1200
diameter	20-40	20-60
- Vessels (diameter)	25-35	30-62
3- Endocarp		
- Stone cells		
Length	160-450	-
Width	40-100	-
- Fibres	-	irregular, pitted walls
Length	-	720-1100
Width	-	28-55

Part II: The Fruits

Character	<u>C. javanica</u> Linn	<u>C. siamea</u> Lam.
4- Testa, epid.		
Length	100-180	160-280
Width	12-20	12-30
5- Testa, middle layer	Parenchyma	thick-walled cells
Length	150-190	160-300
Width	30-40	40-65
6- Testa, inner layer collapsed		Parenchyma
7- Endosperm	horny, thick-walled cells	fleshy
Length	40-100	68-180
Width	40-60	28-80

* All the measurements are in microns.

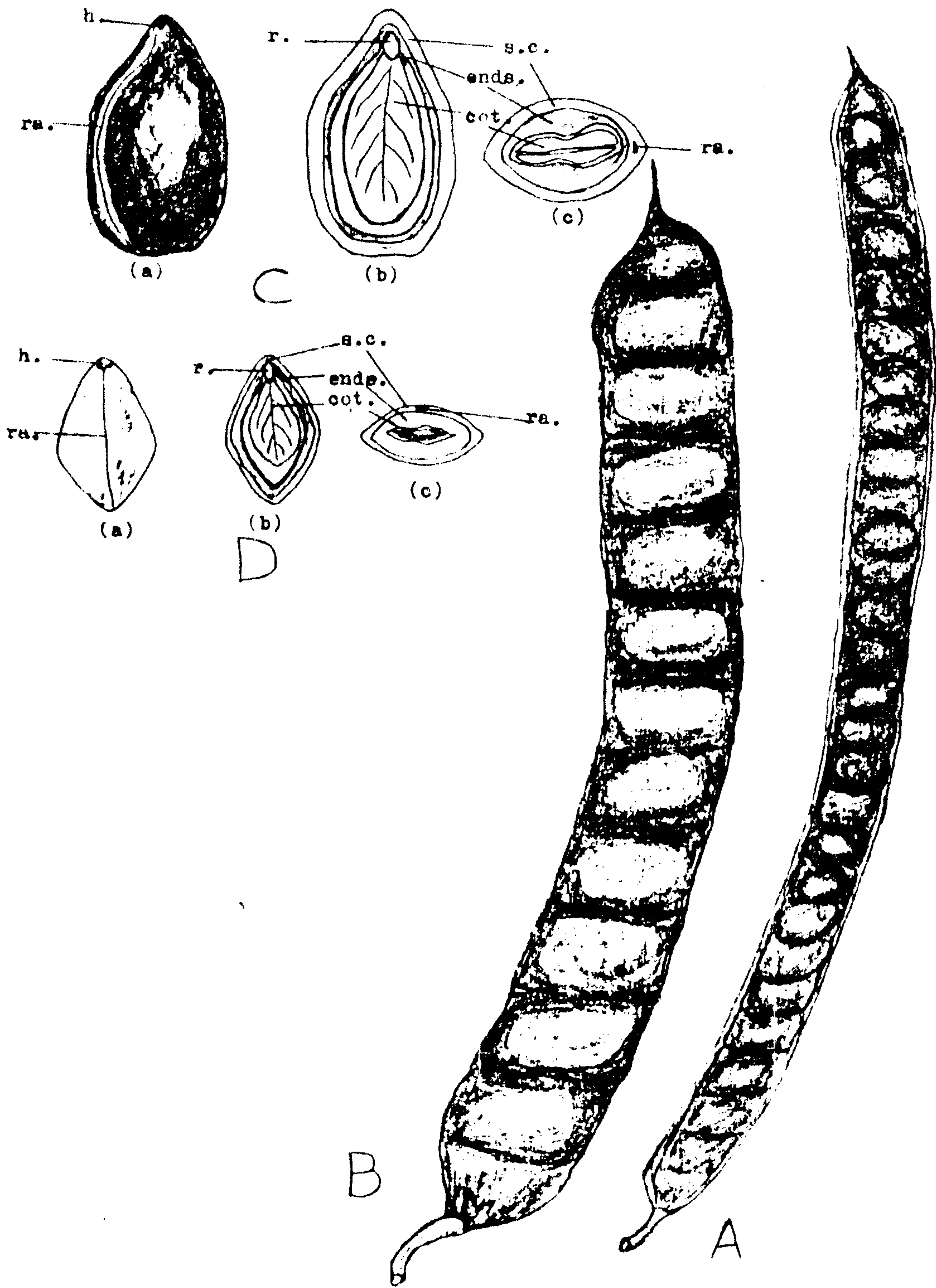


Fig. 1- Macromorphology

- A. *C. javanica* fruit x 1
- B. *C. siamea* fruit X 1
- C. *C. siamea* seed X 4
 - a. The seed
 - b. L.S. in the seed
 - c. T.S. in the seed
- D. *C. javanica* seed X 4
 - a. The seed
 - b. L.S. in the seed.
 - c. T.S. in the seed.

cot., cotyledon; ends., endosperm; h., hilum; r., radicle; ra., raphe; s.c., seed coat.

Part II: The Fruits

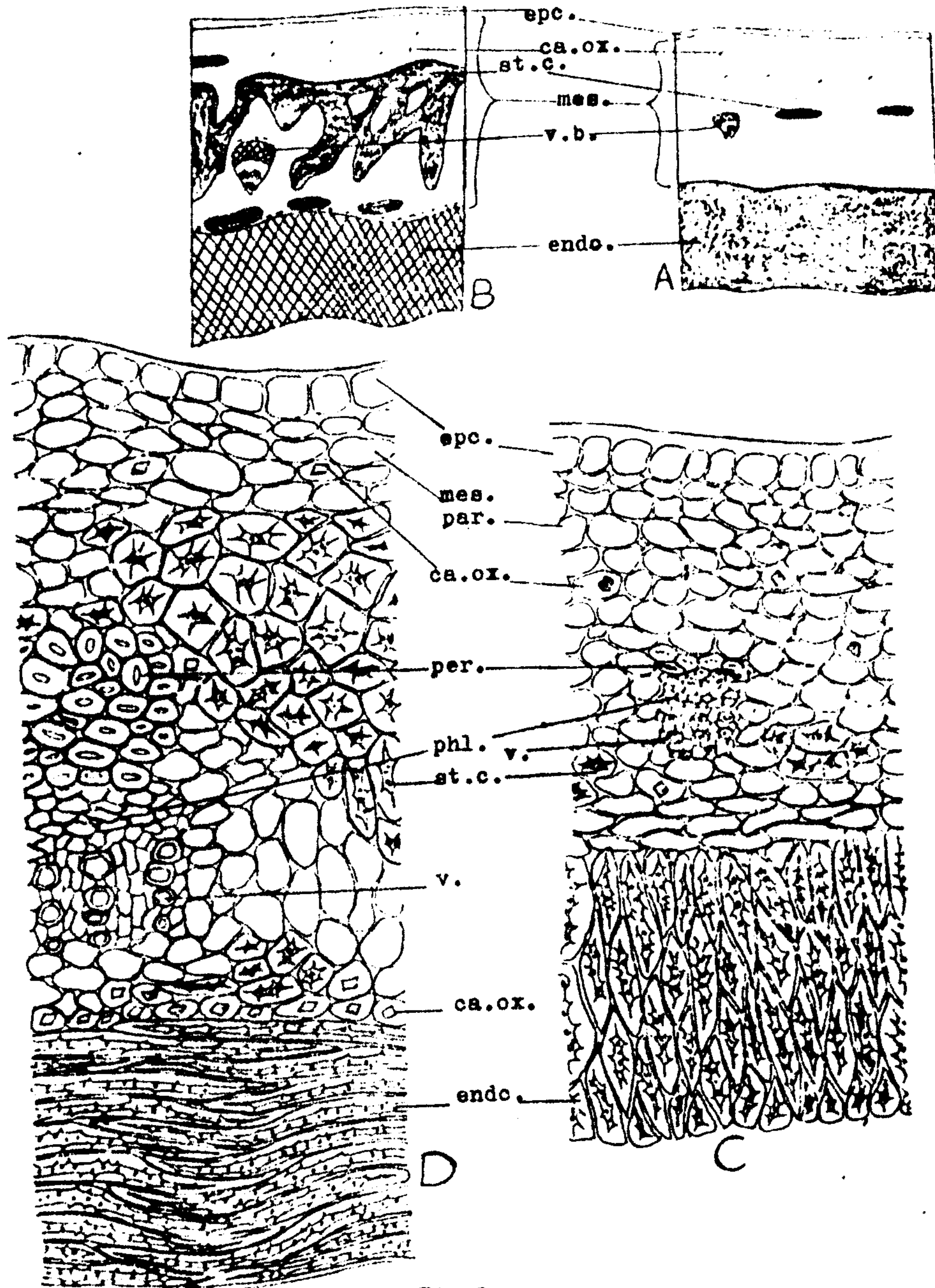


Fig.2

Fig. 2- Micromorphology of the fruits

- | | | | |
|----|--------------------------------------|--------------------|-------|
| A. | Diagrammatic T.S. in the pericarp of | <i>C. javanica</i> | X 90 |
| B. | " " " " " " | <i>C. siamea</i> | X 90 |
| C. | Detailed T.S. in the pericarp of | <i>C. javanica</i> | X 200 |
| D. | " " " " " " | <i>C. siamea</i> | X 200 |

ca. ox., calcium oxalate; endc., endocarp; epc., epicarp; mes., mesocarp; mes. par., mesocarpal parenchyma; per., pericycle; phl., phloem; st.c., stonecells; v., vessels; v.b., vascular bundles.

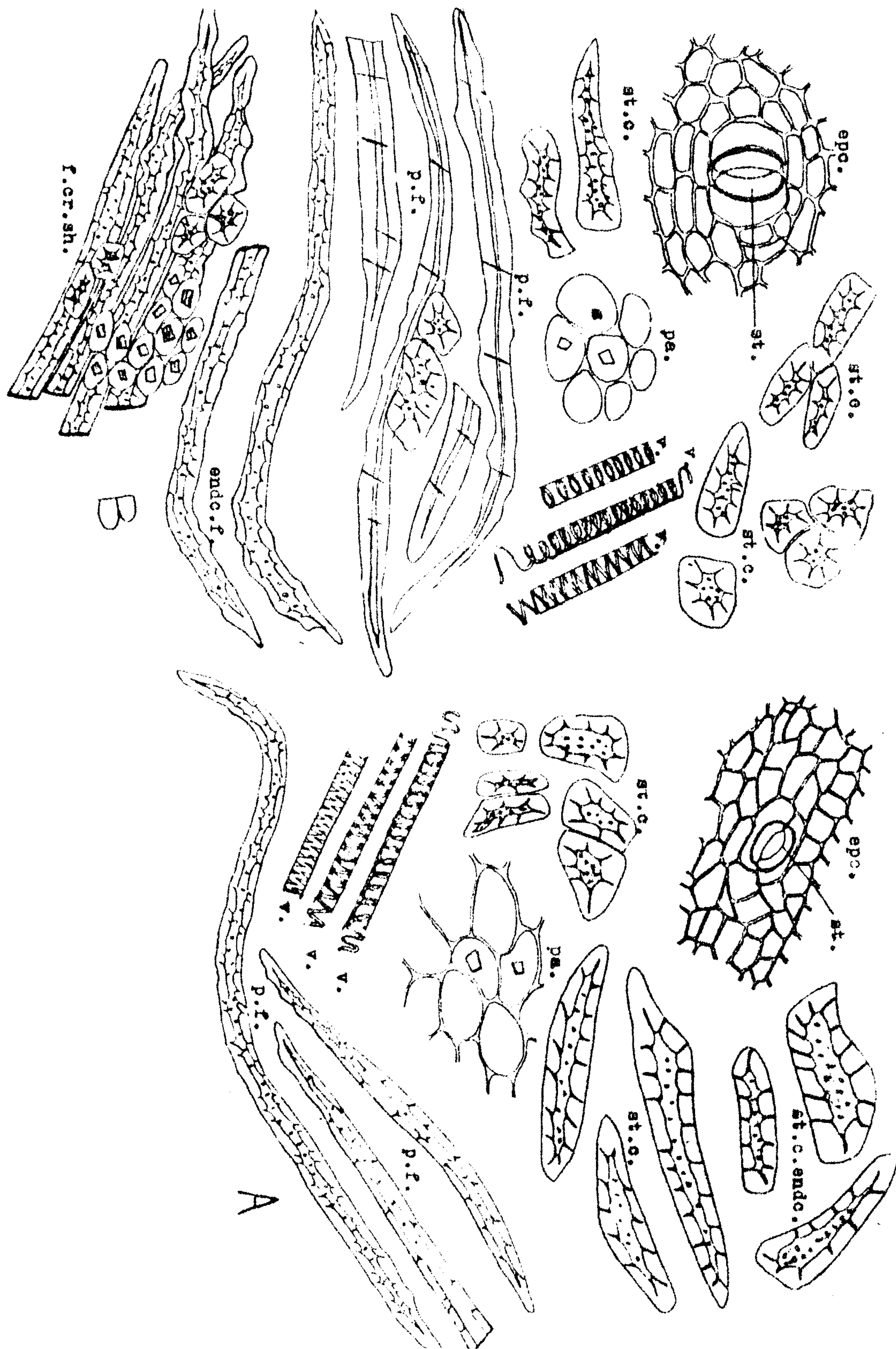


Fig. 3- Isolated elements of the fruits
 A. Isolated elements of *C. javanica* X 200
 B. " " " *C. siamea* X 200

endc. f., endocarp fibres; epc., epicarp; f.cr.sh., fibres with crystal sheath; par., parenchyma; p.f., precyclic fibres; st., stomata; st.c., stone cells; v., vessels.

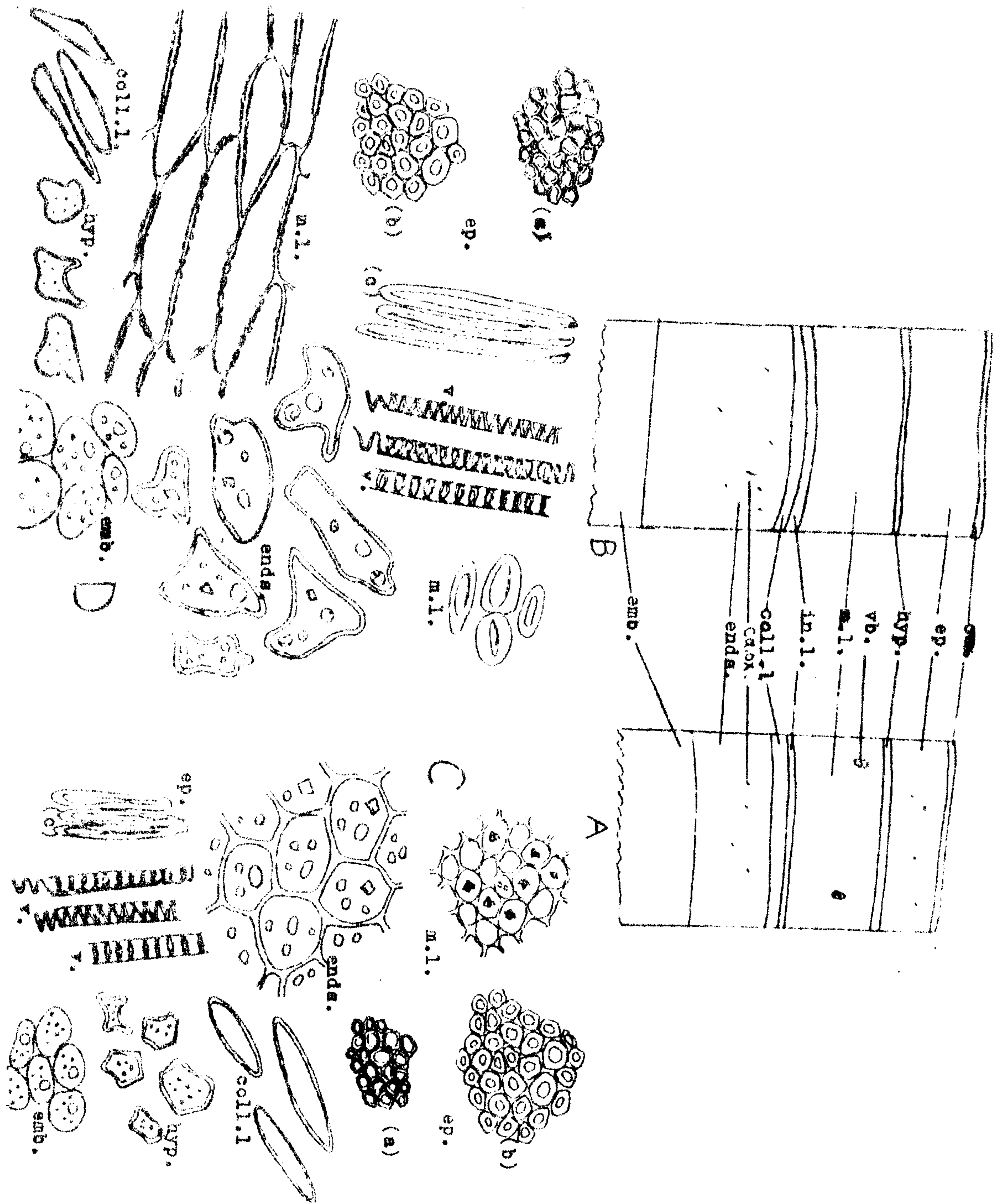


Fig. 4- Micromorphology of the seeds

- | | | |
|----|---|-------|
| A. | Diagrammatic T.S. in the seed of <i>C. javanica</i> | X 90 |
| B. | " " " " " " " " " " " " <i>C. siamea</i> | X 90 |
| C. | Isolated elements of the seed of <i>C. javanica</i> | X 200 |
| D. | " " " " " " " " " " " " <i>C. siamea</i> | X 200 |

ca.ox., calcium oxalate; coll.l., collapsed layer; cu., cuticle; emb., embryo; ends., endosperm; ep., epidermis; hyp., hypodermis; in.l., inner layer; m.l., middle layer; v.b., vascular bundles.

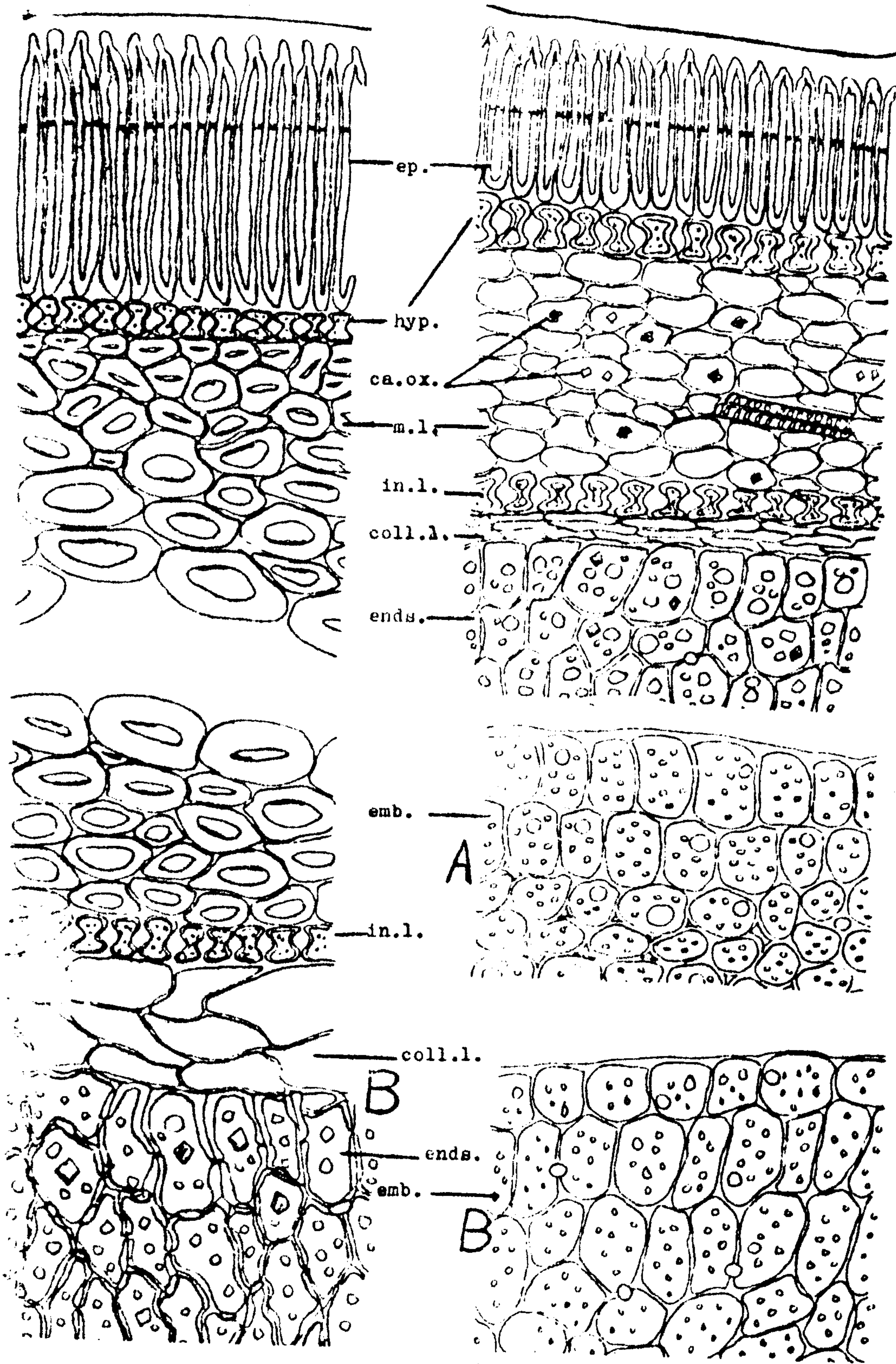


Fig. 5-
 A. Detailed T.S. in *C. javanica* seed X 270
 B. " " " *C. siamea* seed X 270

ca.ox., calcium oxalate; coll.l., collapsed layer; ends., endo-
 sperm; ep., epidermis; hyp., hypodermis; in.l., inner layer;
 m.l., middle layer.

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