

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

PART I : STEMS AND LEAVES

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The macro and micromorphological characters of the stems and leaves of Cassia javanica Linn. and C.siamea Lam. were studied in order to identify them in both the entire and powdered forms. Moreover, a comparison between their characters established a scheme for their distinct differentiation.

The genus Cassia (Fam. Leguminosae, SubFam. Ceasalpini-
oideae) is widely distributed all over the world comprising
several species. Some of these species have been used med-
icinally, long ago, as purgatives because of their anthra-
quinone content.¹⁻²⁰ Cassia javanica Linn have been
subjected to several studies and the presence of anthraqui-
nones, flavonoids, leucoanthocyanidine and other constituents
were recorded²¹⁻²³. From C.siamea Lam., anthraquinones,
flavonoids and alkaloids were isolated and studied²⁴⁻²⁷.
Both of the two species are now under chemical investigations
and additional constituents were found to be present²⁸⁻³⁰.

The important situation of both C. javanica Linn and C. siamea Lam. among the other Cassia species enhanced the present study.

Material:

Collections were made from trees cultivated at Cairo and Aswan. Fresh stems and leaves as well as preserved in a mixture of alcohol: glycerin water(1: 1: 1) were used.

Habitat:

Both plants are trees attaining up to 15 metres in height. They bear flowers during summer season and are deciduous for a short period(January and February). The flowers are crowded in axillary and terminal erect panicles with a yellow colour in case of C. siamea and pink in C. javanica. Pods are cylindrical (C. javanica) or flattened (C. siamea), shining brown and long in case of C. javanica (up to 25 cm).

MACROMORPHOLOGY

1- The Stems: (Fig. 1 A & B)

The main trunk of both plants is erect, cylindrical woody, monopodially - branched and reaching about 12.5 to 14.5 meters in height and 70 to 90 cm., sometimes 150 cm in width. The outer surface is pale brown and rough, wrinkled and sometimes shows lenticels. The terminal and lateral branches are narrower and carry short internodes (about 5 to 10 cm in length); they are green, hairy and slightly longitudinally striated. The older lower parts are brownish, rough, longitudinally wrinkled and bear the scars of fallen leaves. The stems are odourless and with a disagreeable bitter taste.

The bark is hardly separated from the wood. The outer surface is greenish to reddish-brown with longitudinal wrinkles, transverse fissures and lenticells. The inner

surface is pale brown, smooth and finely longitudinally striated.

2- The leaves: (Fig. 1 A & B)

Both plants carry alternate; exstipulate, compound and paripinnate leaves. The leaflets have a green upper surface and a lower paler one (Those of C. siamea are more darker). The lamina is ovate lanceolate to oblong - ovate with entire margin, coriaceous texture and symmetric base. The leaf rachis is slender, yellowish-green and hairy. Additional information and significant differences in the macromorphological characters of both plants are recorded in Table 1.

MICROMORPHOLOGY

1- The stems:

Transverse sections through the stems (Fig. 2 A & B, 3 A & B) are somewhat rounded in outline. An outer brownish narrow cork formed of thin suberised and tangentially-elongated cells is observed. The cork cells contain yellowish-brown contents and arranged in vertical rows. The narrow cortex is formed of tangentially- elongated parenchyma cells; some of which contain prismatic and cluster crystals of calcium oxalate. C. siamea stems show quadrangular stone cells with wide lumen, thin, pitted and lignified walls in the cortex. The endodermis is non-distinguishable and the pericycle shows bands of sclerenchyma, rarely, interrupted by parenchyma. The pericyclic fibres (Fig. 2 C & D) are long, usually in groups surrounded by a crystal sheath. Their apices are tapering, walls are lignified and lumen are moderate wide. Groups of oval, elongated or rounded stone cells are present accompanying the pericyclic fibres in case of C. siamea stems.

These stone cells have lignified, pitted walls and wide lumen. Phloem is separated from xylem by cambium and is formed of sieve tubes with companion cells and phloem parenchyma. In case of C. siamea, phloem is interrupted by groups of long fibres with tapering apices, thin, lignified walls and wide lumen. It is traversed by uni, bi-, or triseriate medullary rays of cells with thick, pitted and lignified walls. Vessels are mainly solitary, shortly segmented showing lignified pitted walls. Tracheids are narrow with tapering ends and pitted, lignified walls. Pith is comparatively narrow and of pitted, lignified parenchyma.

Young stems have epidermis of polygonal cells covered with smooth cuticle and bear rubiaceous stomata and unicellular, non-glandular hairs with warty cuticle.

2- Leaves:

a- Lamina of leaflets

Transverse sections through the lamina (Fig. 4 A, B, C & D, 5A & B) are somewhat planoconvex with upper palisade of two sometimes three rows of columnar cells. The palisade is interrupted in the midrib region by a mass of hypodermal collenchyma of rounded cells arranged in two to three rows. The main vascular bundle shows upper and lower arcs of pericyclic fibres which are surrounded by crystal sheath. Xylem arc is radiating and the vessels have lignified, annular, spiral, pitted and scalariform walls (Fig. 5, C & D). Medullary rays are uniseriate and parenchyma is non-lignified. The lower phloem arc is soft and composed of sieve tubes, companion cells and phloem parenchyma. The cortical parenchyma and the spongy mesophyll contain prismatic and cluster crystals of

calcium oxalate as well as minute starch granules. The cortical region shows a lower arc of two to three rows of collenchyma abutting on the lower epidermis.

The upper and lower epidermis (Fig. 4, E, F, G, & H) are polygonal, covered with smooth cuticle and show rubiaceous stomata. Unicellular; non-glandular hairs are present having a cicatrix between 6 to 8 radiating epidermal cells. The hairs are covered with warty cuticle and present in a much larger number on the lower surfaces.

b- The leaf rachis:

Transverse sections through the leaf rachis (Fig. 6A B, 7 A & B) are circular to subcircular in outline with a slight depression on the upper side. The outer hairy epidermis is followed by a hypodermal collenchyma of two to three rows. The cortex is narrow, parenchymatous and the cells contain prismatic and cluster crystals of calcium oxalate. The vascular tissue is represented by four to six bundles of upper soft phloem and a lower lignified radiating xylem. These bundles show upper arcs of pericyclic fibres which are separated by wide medullary rays in case of C. siamea; while they form arms of sclerenchyma between the bundles in case of C. javanica. Two accessory collateral bundles are present on the dorsal side is crowned by an arc of pericyclic fibres.

(Fig. 6 E & F)

The epidermal cells of both plants (Fig. 6 C & D) are polygonal, with straight walls, covered with smooth cuticle and bear hairs as those of the lamina. Stomata are rare.

Table 2 shows the significant differences between both species concerning their micromorphological characters.

Table 1: Significant macromorphological differences between Cassia javanica Linn. and C. siamea Lam. stems and leaves.

<i>Aspect</i>	<u><i>C. javanica</i></u>	<u><i>C. siamea</i></u>
1- Diameter of the middle portion of the main trunk(cm.)	15 to 20	15 to 35
2- Length of internodes of the terminal branches (cm.)	2 - 5	5 - 7
3- No. of pairs of leaflets	9 - 19	8 - 10
4- Size of leaflets length (cm)	3 - 5	2.5 - 4.5
width (mm)	15 - 20	15 - 24
5- Apex	mucronate	round with spine

Table 2: Significant micromorphological differences
 between C. javanica Linn. and C. siamea Lam.
 stems and leaves.

Aspect	<u>C. javanica</u>	<u>C. siamea</u>
A- Stem		
1- Outline of transverse section	irregular rounded	rounded
2- Cortex	Parenchyma	parenchyma & stone cells
3- Pericycle	Fibres	Fibre & stone cells
4- Phloem	Soft	Soft & hard with fibres
5- Measurements*		
.Cork cells		
Length	48-72	40-60
Width	28-40	28-48
.Pericyclic fibres		
Length	700-1300	600-1100
.Phloem fibres		
Length	-----	640-1400
.Xylem		
Fibres, length	640-900	600-800
Vessels, diameter	60-120	80-150
Tracheids, length	200-300	280-400
B- Leaves		
a- Leaflet:		
1- Palisade	mainly 2 rows, the lower is irregular	2-3 rows, one row on the lamina
2- Epidermal cells		
Walls	wavey or irregular	straight
measurements*		
.Upper:		
length	28-60	28-45
width	16-40	20-45
height	24-36	16-25
.Lower		
length	28-48	32-45
width	20-35	12-25
height	22-30	14-21
.Hairs (length)	240-320	120-200
.Stomata		
length	20-30	12-20
width	19-20	12-18

Table 2: Cont.

Aspect	<u>C. javanica</u>	<u>C. siamea</u>
3- Numerical values		
. Stomatal index	8.8-10.2	13.0-15.2
. Palisade ratio	2.8-5.2	4.9 -7.0
. Vein-islet no.	3.0-4.0	4.1-6.3
b- Leaf rachis		
1- Pericyclic schlerenchyma	complets circle with arms between the bundles	dissected circle.
2- Measurements*		
- Epidermal Cells		
length	28-60	24-40
width	12-20	24-32
- Hairs(Length)	200-320	160-240
- Pericyclic fibres		
(length)	600-900	500-700
- Vascular tissue		
- vessels(diameter)	48-75	60-100
- Fibres(length)	560-720	480-640
- Tracheids(length)	160-240	140-220

* = All measurements are in microns.

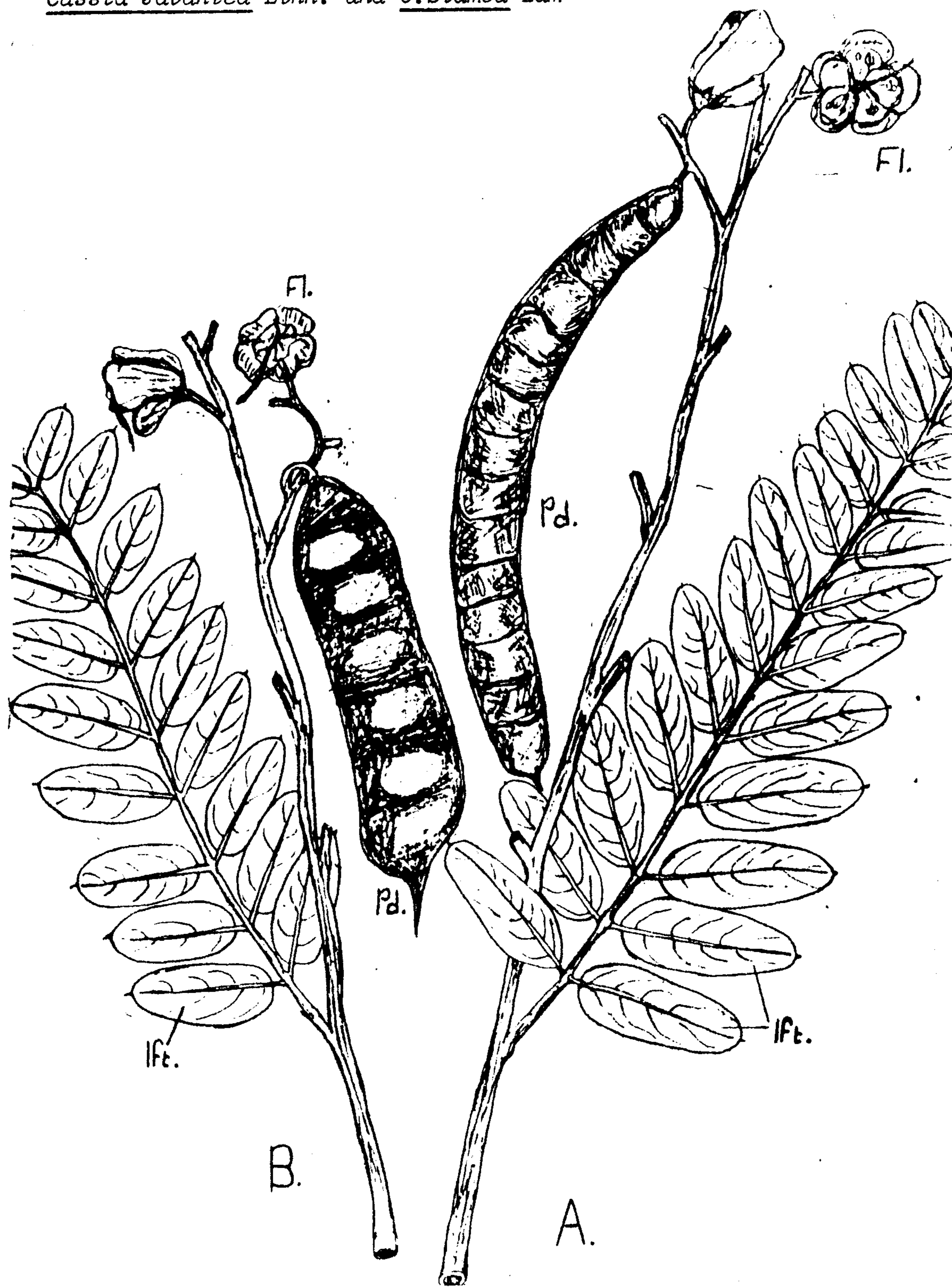


Fig. 1- Flowering and fruiting branches,
A.C. javanica X 1
B.C. siamea X 1
Fl., floret; lft., leaflet; pd., pod.

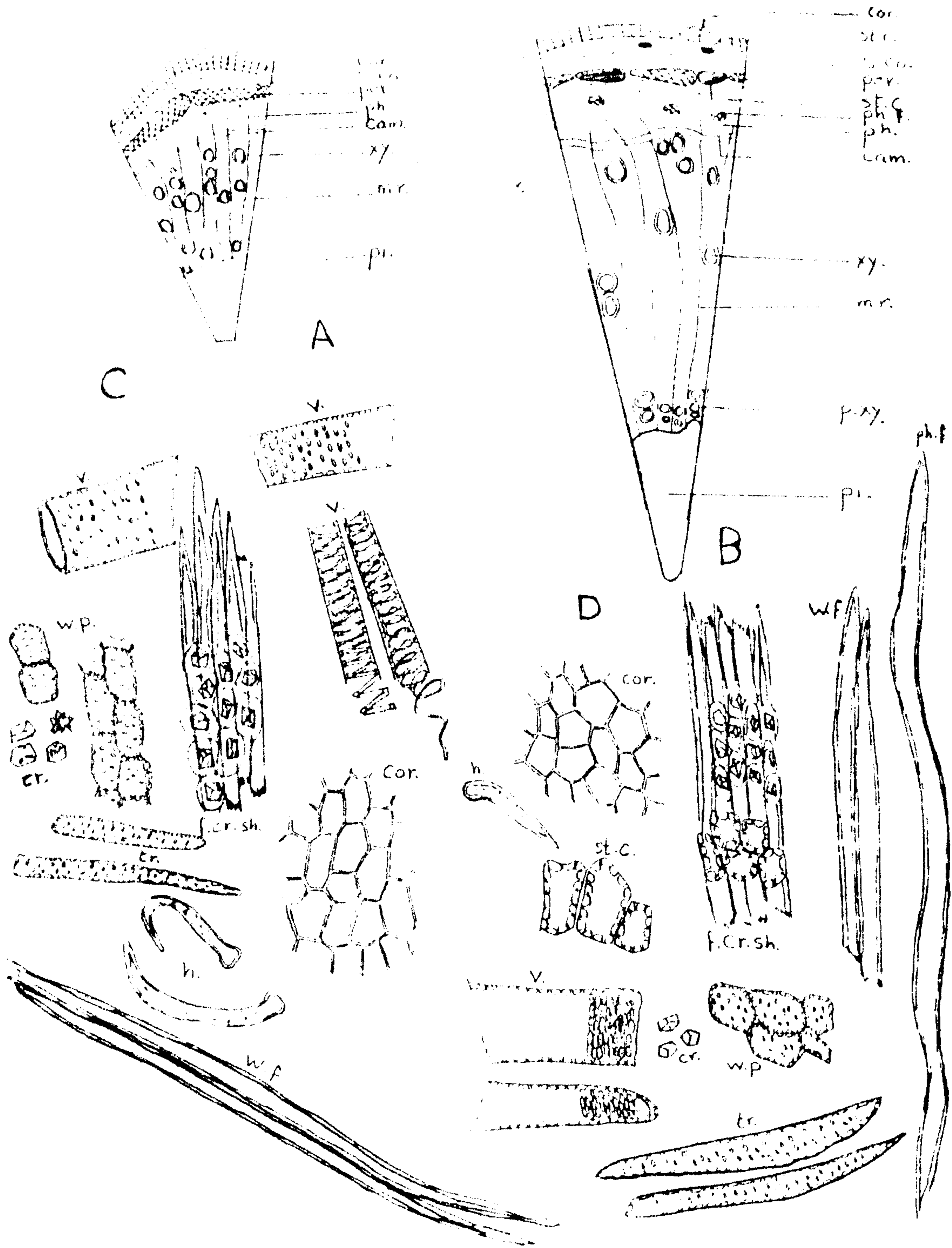


Fig. 2- The stems, micromorphology

- A. Diagrammatic T.S. of *C.javanica* X 27
- B. " " " *C.siamea* X 27
- C. Isolated elements of *C.javanica* X 200
- D. " " " *C.siamea* X 200

cam., cambium; cor., cork; cr., crystal; f.cr.sh., fibres with crystal sheath; h., hair; m.r., medullaryrdy; per., pericycle; ph., phloem; ph.f., phloem fibre; pi., pith; s.co., secondary cortex; st.c., stonecell; tr., tracheid; v., vessel; w.f., wood fibre; w.p., wood parenchyma; xy., xylem.

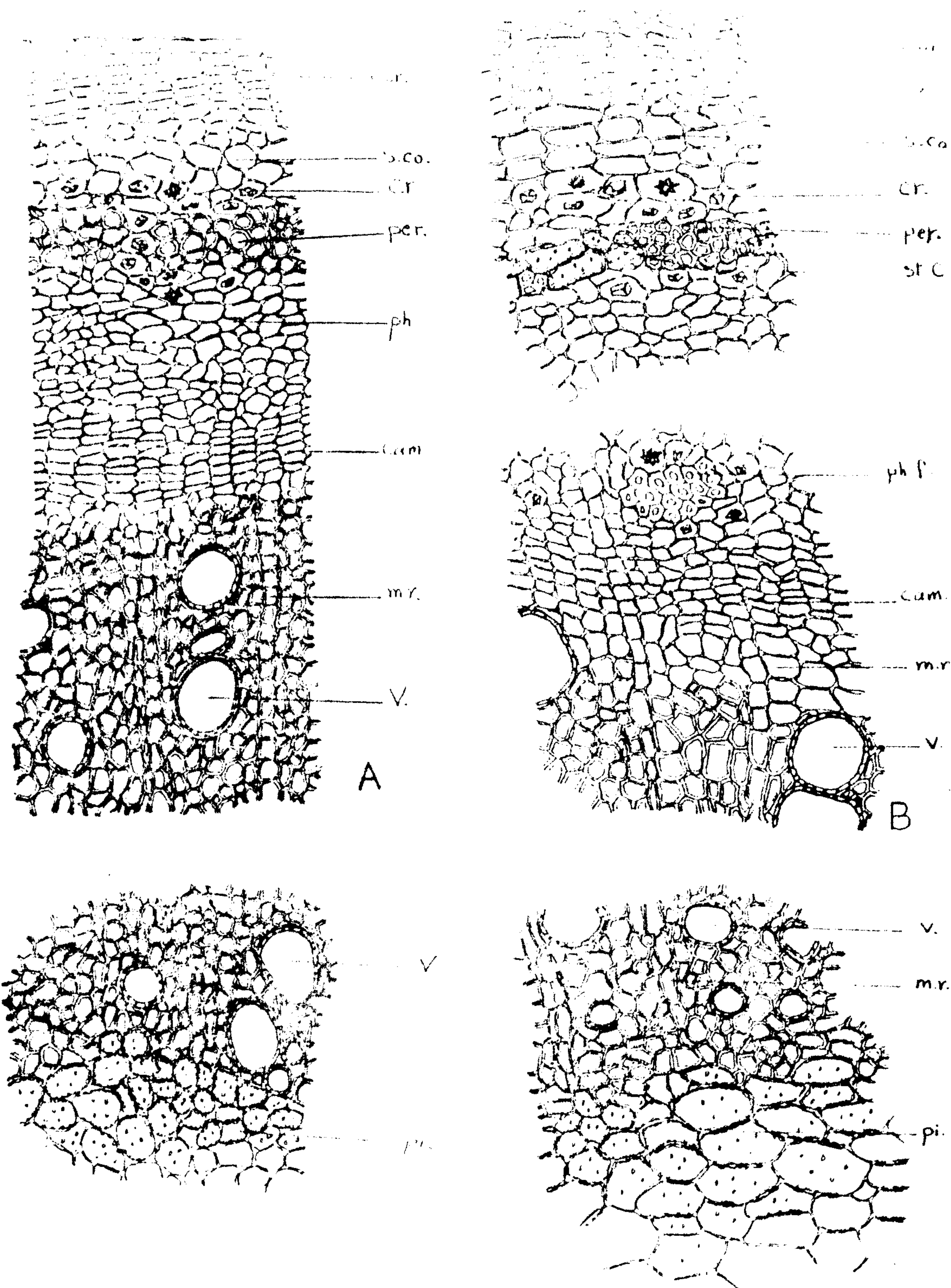


Fig. 3- The stems, micromorphology

- | | | |
|----|-------------------------------------|-------|
| A. | Detailed T.S. of <i>C. javanica</i> | X 200 |
| B. | „ „ „ <i>C. siamea</i> | X 200 |

cam., cambium; cor., cork; cr., crystal; m.r., medullary ray;
 per., pericycle; ph., phloem; ph.f., phloem fibre; pi., pith;
 s.co., secondary cortex; st.c., stone cell; v., vessel.

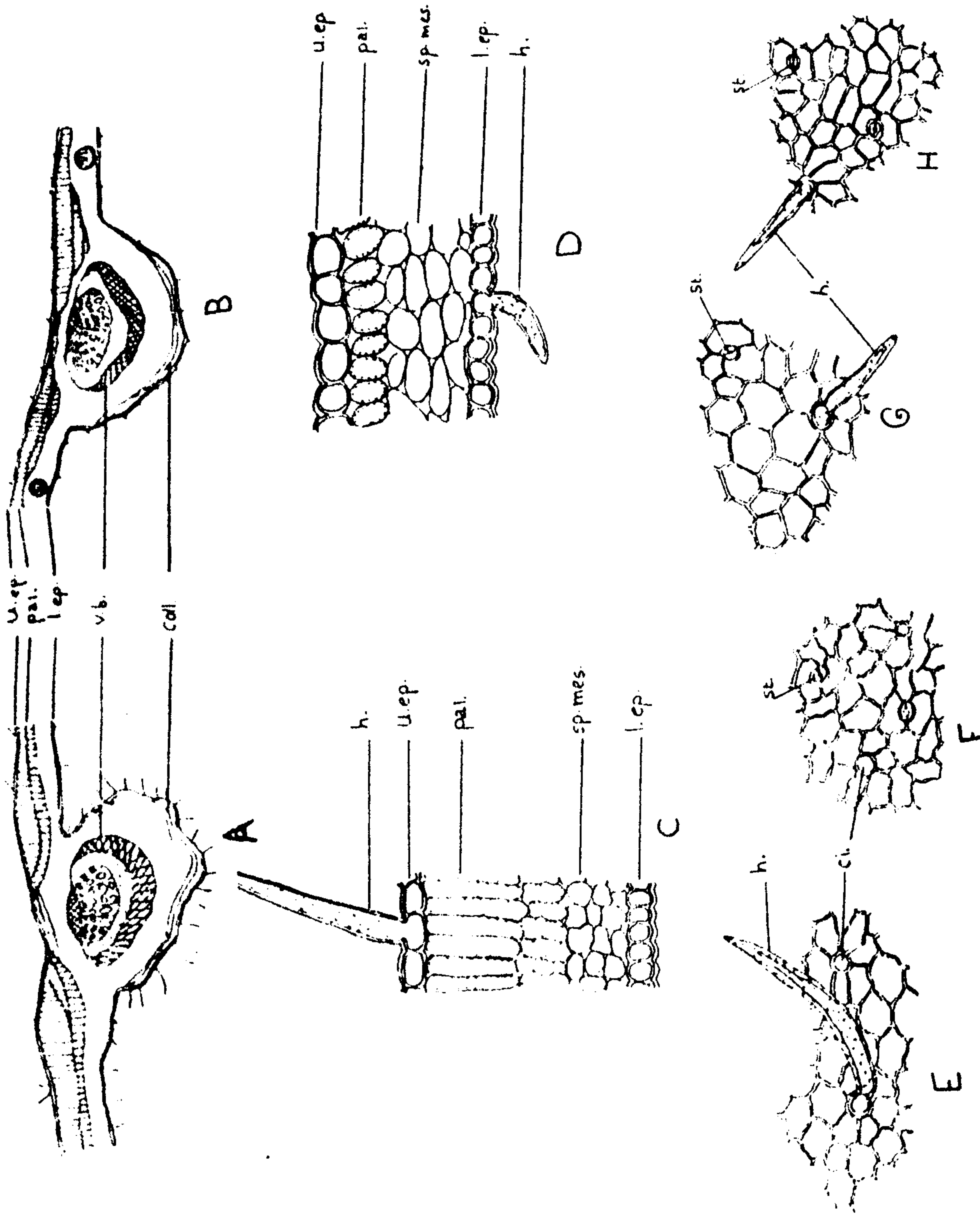


Fig. 4- The leaflets, micromorphology

A.	Diagrammatic T.S. of lamina of	<i>C. javanica</i>	X 18
B.	" " " " " "	<i>C. siamea</i>	X 18
C.	Detailed T.S. of arm of	<i>C. javanica</i>	X 200
D.	" " " " " "	<i>C. siamea</i>	X 200
E & F.	Upper & lower epidermis of	<i>C. javanica</i>	X 200
G & H.	" " " " " "	<i>C. siamea</i>	X 200

coll., collenchyma; ci., cicatrix; h., hair; l.ep., lower epidermis; pal., palisade; sp. mes., spongy mesophyll; st., stomata; u.ep., upper epidermis; v.b., vascular bundle.

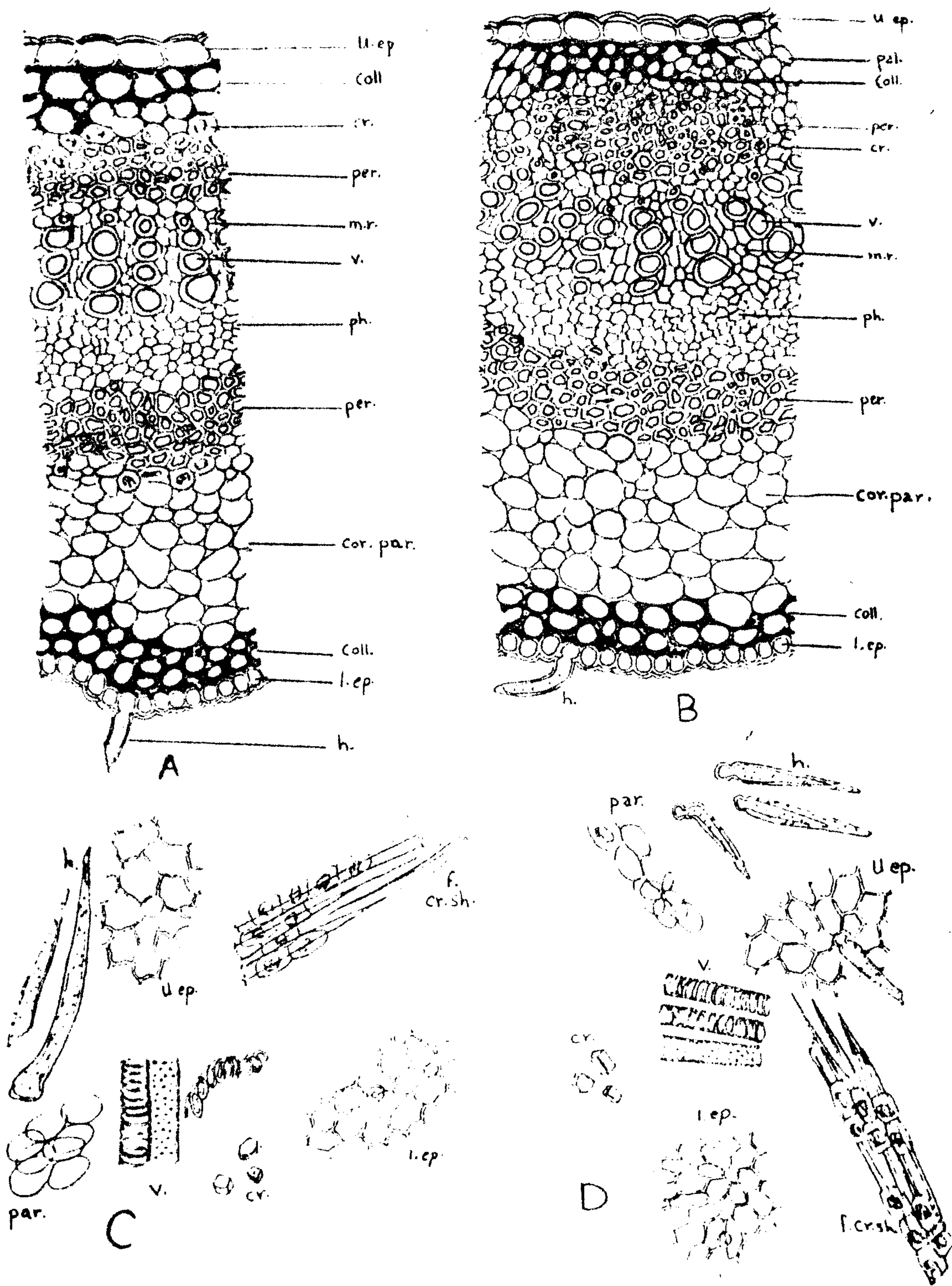


Fig. 5- The leaflets, micromorphology

A.	Detailed T.S. of the midrib of	<i>C. javanica</i>	X 200
B.	" " " " " "	<i>C. siamea</i>	X 200
C.	Isolated elements of	<i>C. javanica</i>	X 200
D.	" " " " " "	<i>C. siamea</i>	X 200

coll., collenchyma; cor. par., cortical parenchyma; cr., crystal; f.cr. sh., fibres with crystal sheath; h., hair; l.ep., lower epidermis; m.r., medullary ray; pal., palisade; per., pericycle; ph., phloem; u.ep., upper epidermis; v., vessel.

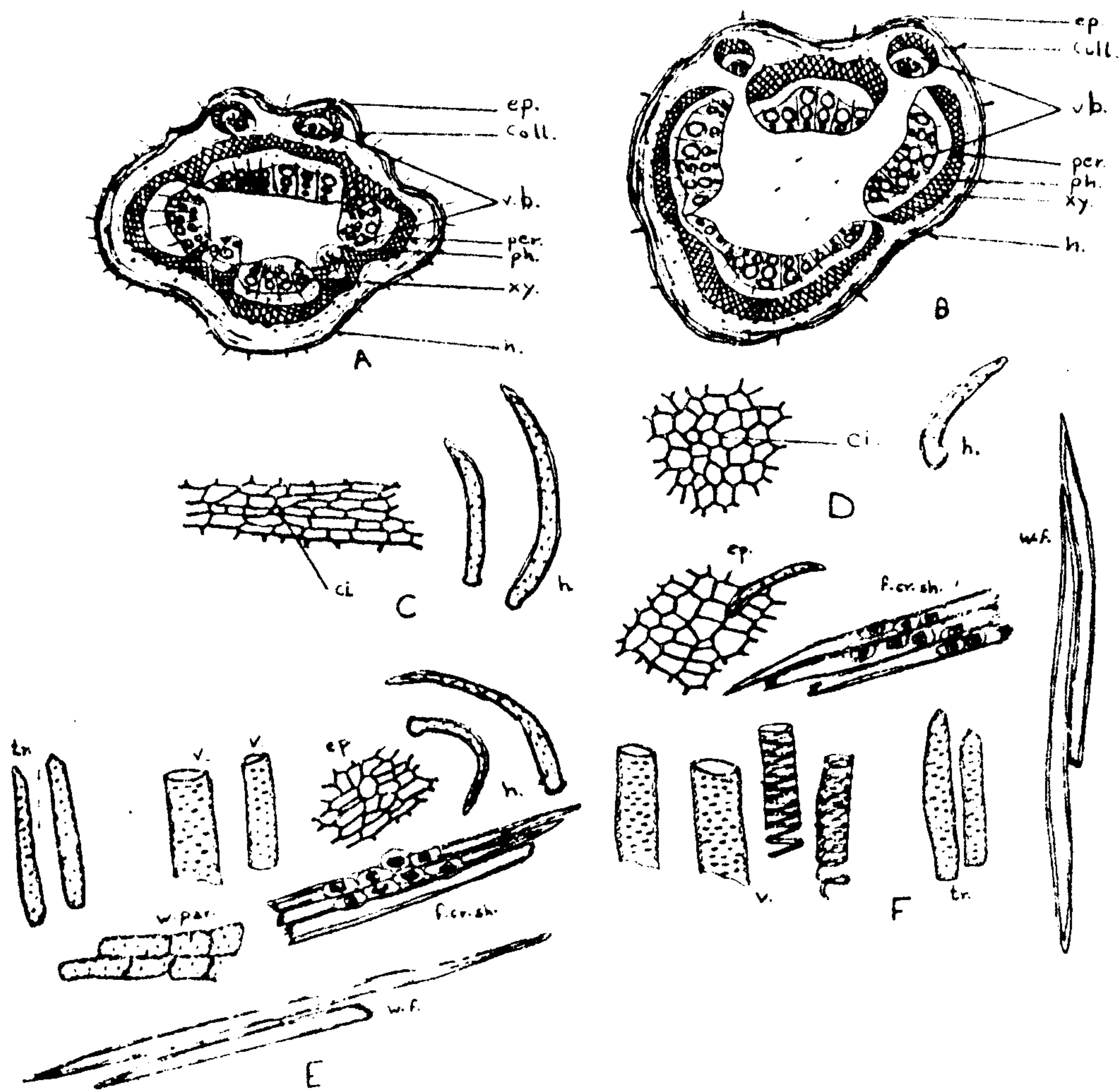


Fig. 6- The leaf rachis, micromorphology

A.	Diagrammatic T.S. of	<i>C. javanica</i>	X 28
B.	"	<i>C. siamea</i>	X 28
C.	Surface preparation of	<i>C. javanica</i>	X 165
D.	"	<i>C. siamea</i>	X 165
E.	Isolated elements of	<i>C. javanica</i>	X 165
F.	"	<i>C. siamea</i>	X 165

ci., cicatrix; coll., collenchyma; ep., epidermis; f.cr.sh., fibres with crystal sheath; h., hair; per, pericycle; ph., phloem; pi., pith; tr., tracheid; v., vessel; v.b. vascular bundle; w.f., wood fibre ; w. par., wood parenchyma; xy., xylem.

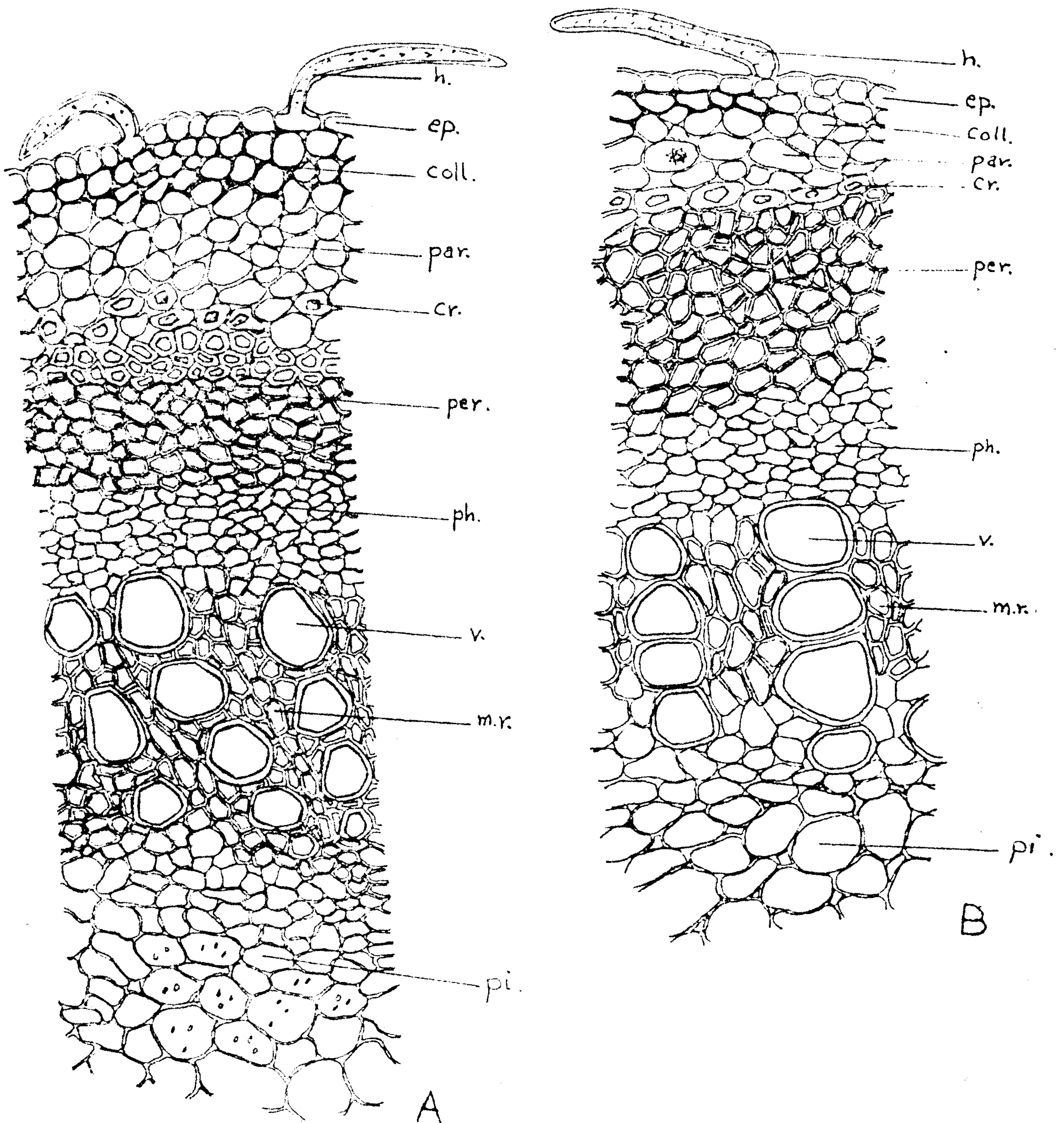


Fig. 7- The leaf rachis, micromorphology

- | | | | |
|----|------------------|--------------------|-------|
| A. | Detailed T.S. of | <i>C. javanica</i> | X 200 |
| B. | " " " | <i>C. siamea</i> | X 200 |

coll., collenchyma; cr., crystal; ep., epidermis; h., haie;
 m.r., medullary ray; par., parenchyma; per., pericycle; ph.,
 phloem; pi., pith; v., vessel.

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دراسة مقارنة للصفات العيانية والمجهرية لنباتى
الكاسيا جافانيكالن والكاسيا سياميلام .

الجزء الاول - السيقان والاوراق

سامية محمد الصياد و هناء محمد سيد
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تمت دراسة الصفات العيانية والمجهرية لسيقان وأوراق نباتى
الكاسيا جافانيكالن والكاسيا سياميلام وأمكن التعرف عليها سواء صحيحة
أو على هيئة مسحوق ، وبمقارنة صفات النباتين العيانية والمجهرية وجد
أن هناك عدة فروق يمكن بها التفريق بين النباتين تفريقا تاما.

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