

resolved, which bore finger-print-like markings on the external surface. Epicuticle dissolved liberating oily droplets when strongly heated in concentrated chlorated nitric acid. Epicuticle stained blue when



FIGS. 4-5. Fig. 4. Diagram of the transverse section of the cuticle of *Uroproctus*. Fig. 5. Diagram of the transverse section of the cuticle of *Galeodes*. (Abbreviations in the diagrams: *derm. gl.*, dermal glands; *epi. ridg.*, epidermal ridges; *soft arthr mem.*, soft arthrodial membrane; *epi.*, epicuticle; *meso.*, mesocuticle; *endo.*, endocuticle; *exo.*, exocuticle; *lam.*, lamellae.)

sections were stained with copper pthalocyanin. Positive Biuret's, Millon's, Xanthoproteic and Argentaffin reactions on the sclerite cuticle of *Uroproctus* and *Galeodes* showed aromatic polyphenols. Bleaching of the cuticle and reversal of Mallory's staining reactions in the exocuticle-1 and

2 and mesocuticle after diaphanol treatment and staining with Malachite green shows phenolic tanning of the cuticle. Negative results with thioglycolate shows absence of -S-S- bonds. Negative chitosan test of the epicuticle also showed its non-chitinous nature, while positive Argentaffin reaction and stainability with copper pthalocyanin confirmed the presence of phospholipids in the epicuticle.

It is evident therefore that (1) The cuticle of *Uroproctus* is unique in being modified into strips of dermal gland islands. (2) The cuticle of both of *Uroproctus* and of *Galeodes*, like those of scorpions, has a definite epicuticle. (3) The epicuticle is a non-chitinous layer and is composed chiefly of phospholipids and proteins containing aromatic groups. (4) The epicuticle of these less-known arachnids is not much different from those of scorpions and the spiders.

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ON IDIOBLASTS IN A FEW TAXA OF PENAEEACEAE

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OCCURRENCE of idioblasts in the form of tracheoids, sclereids and their co-occurrence in the mesophyll at the vein-endings have opened a new interest in seed plants. The co-occurrence of filiform sclereids and wandering tracheidal veins in the mesophyll of a few taxa of this family has already been reported by a few workers¹⁻⁴. Tracheoids, however required special attention because of their diverse size, shape, and positional relationship to the vein-endings. This aspect, studied in detail for a few taxa of this family is presented here.

MATERIALS

Penaea—*P. mucronata* L., Africa, Burchell 394 (LE); Africa, Burchell 623 (LE), Eschscholts s.n.

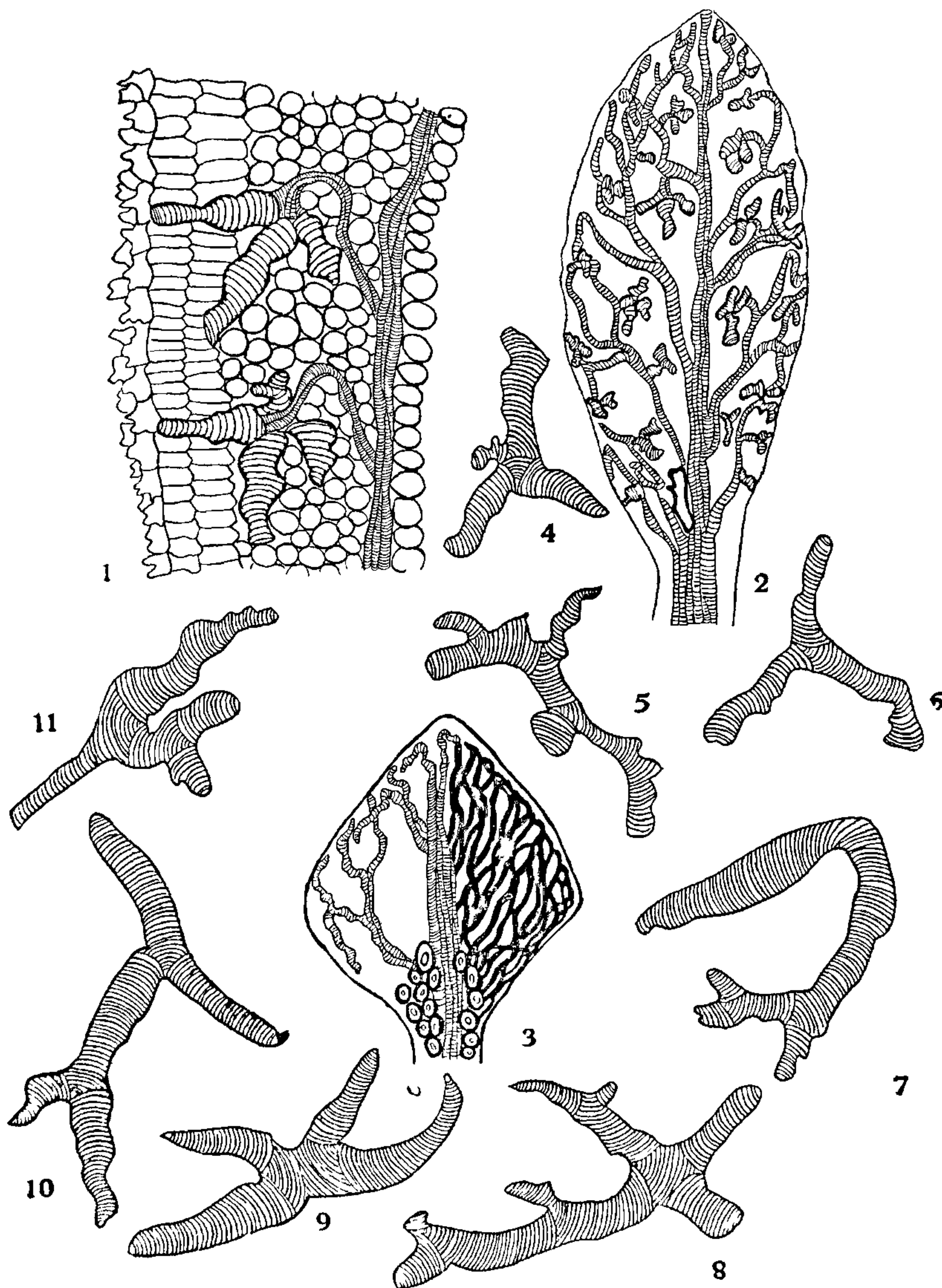
(LE) *P. myrtilloides* L.f., Africa, Drege s.n. (LE); Royal Botanic Garden, Kew. Anon 6069 (LE); Africa, Drege 8155 (LE). *P. fruticulosa* L.f., Africa, Cape of Good Hope, C. Wright s.n. (LE); Echlen 3 (LE); Spec. s.n. (LE). *P. sp.* Herb. Fischer s.n. (LE). *Sarcocolla*—*S. acuta* Kth., Africa, Zeyher 3728 (LE); *S. furcata* Endl. Africa, Zeyher (LE); *S. formosa* Kth., E.E. Spec. 1838 (LE); *S. retzoides* Eckl and Zeyh. Africa, Burchell 7712 (LE); Africa, Zeyher 3724 (LE); *S. speciosa* Eckl. Africa, Zeyher 3725 (LE). *S. ap.*, Africa, Burchell 8141 (LE).

Distributional Pattern

The singularly interesting feature in the laminae of the aforesaid taxa is the co-occurrence of

sclereids and tracheoids of varied forms of exceptional interest. These idioblasts can be classified under two patterns : diffused sclereids and terminal

tracheoids. Sclereids are densely scattered in the mesophyll and frequently exhibit branching at the marginal regions of the lamina. In sections cut



FIGS. 1-11. Figs. 1-3. Semi-Diagrammatic sketches. Fig. 1. Margin of lamina of *Sarcocolla retzoides* showing Lagcniform terminal tracheoids. Fig. 2. Surface view of the cleared lamina of *Sarcocolla retzoides* showing loose clusters of terminal heterotracheoids of the vein-endings. Fig. 3. Surface view of the cleared lamina of *Penaea mucronata* showing filiform sclereids and terminal Loratotracheoids along the margin. Note spheroidal sclereids at base of Lamina. Figs. 4-11. Diverse types of heterotracheoids from the lamina of *Sarcocolla retzoides*, $\times 60$ each.

parallel to midrib and passing through the marginal portion of the lamina they show intra-epidermal orientation inside the mesophyll. Their close disposition obscures the positional relationship to the vein-endings. It is presumed, however, that they are of diffuse pattern.

Tracheoids unlike the sclereids, show distinct terminal relationship with the vein-endings. As an ontogenic study is yet not carried out, the term terminal is based purely on positional relationship to the vein-endings. Both the types of idioblasts are found to occur in a few taxa but in some only tracheoids unaccompanied by any sclereids have been observed.

TYPES OF SCLEREIDS

Diffused sclereids are classified following the classification outlined by Rao and Bhupal⁵.

Filiform sclereids: These thread-like cell forms are densely scattered in the mesophyll. They are quite long or curiously bent and often show branching leading to Y-shape or T-shaped cell forms. This type is seen in the lamina of *Penaea mucronata* L. (= *P. myrtiodes* L.f.), *Sarcocolla acuta* Kth., *S. formosa* Kth., *S. furcata* Endl and *S. speciosa* Eckl (Fig. 3).

Fusoid sclereids: They are observed within the vicinity of the midrib region in the leaves of *Penaea encorum* Meerb (= *P. fruticulosa* L.f. = *Stylapteris fruticulosus* L.f.) A. Juss. and also in *Sarcocolla retzoides* Eckl and Keyh.

Spheroidal sclereids: They are present at the basal and also in the vicinity of the midrib region in the leaves of *Sarcocolla formosa* Kth. and *S. furcata* Endl. accompanied by filiform sclereids (Fig. 3).

TYPES OF TRACHEOIDS

They are distinct base forms of exceptional interest. In a few taxa they exhibit varied shape and size like the polyramous sclereids *sensu* Rao and Bhupal⁵ (Figs. 1-11). A perusal of the literature shows that such a diversity of foliar tracheoids has not been recorded for seed plants. In view of this they are grouped under idiotracheoids and under this category the following two sub-types are recognised based mainly on base forms: Lorotracheoids and Heterotracheoids.

(i) Lorotracheoids (Fig. 3)

They are nothing but a continuation of the tracheidal veinlet often found traversing the spongy or palisade region of the mesophyll especially near the marginal areas of the lamina of *Penaea mucronata*, *Sarcocolla acuta* and *S. furcata*. They are strap-shaped relatively thin walled, helically thickened and possess uneven width and rounded ends. The unique feature of these wandering tracheiodal veins is their independent disposition

in the palisade region often found abutting the epidermal layer with more or less rounded ends.

(ii) Heterotracheoids

As a contrast to the relatively uniform tracheoids as reported in a few taxa of *Salicornia*⁶ (Chenopodiaceae), *Vochysia*⁷ (Vochysiaceae), *Xanthophyllum*⁸ (Rutaceae), *Pogonophora*⁹ (Euphorbiaceae) the tracheoids of diverse size and form closely disposed in association with veinlet endings in the laminae of *Sarcocolla retzoides* Eckl and Keyh (Burchell 7712, Zeyher 3724) and *Penaea encorum* Meerb (*P. fruticulosa* L.f. = *Stylapteris fruticulosa* A. Juss. C. Wright, s.n.) deserve special attention. These tracheoids are found in loose clusters at the veinlet endings and resemble Macrotracheoids *sensu* Rao and Bhattacharya¹⁰ but differ from them in having uneven wider diameter leading to diverse shape and size in different species and in the same species (Figs. 4-11). Usually they are thin walled with spiral thickenings and protrude into the adjacent tissue prominently near the veinlet endings. In transections they are found in the mid-mesophyll around the vasculature. Along the margin of the lamina the Laganiform tracheoids were observed in *Sarcocolla retzoides* (Fig. 1).

Regarding the function of tracheoids, Van Tieghem¹¹ considered them as an irrigation tissue comparable to *Podocarpus* and *Cycas* and also to *Cansjera* and other members of Opiliaceae. Rao³ considered them to be parts of 'the tracheidal veins' and Dahlgreen⁴ has confirmed their connection with the veins. Thus it is clear that their close connection with the veins and veinlet endings and other structural details makes us to believe that they are probably a part of the tracheidal whole connected with conduction or storage of water.

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