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A Systematic Histological Study of Palm Fruits. I. The *Ptychosperma* Alliance[1]

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Abstract. *The fruit of the eight genera of the* Ptychosperma *alliance have complex sclerenchymatous endocarps that typically consist of a palisade layer derived from the locular epidermis, some sclerified ground tissue, and vascular bundles with thick fibrous sheaths. Highly integrated endocarps appear to have evolved in at least six different lines in the alliance, and unspecialized forms can be found in several genera. The exocarp consists of fibrous bundles and brachysclereids, and also shows varying degrees of integration. Although it is difficult to separate the large genera from one another upon pericarp characters alone, small genera, subgenera, and groups of species often separate readily, suggesting that the major taxonomic application of data from the pericarp will be at the infrageneric level in this alliance.*

In this paper, the first in a series presenting histological investigations into the structure of the pericarp in the palm family (Palmae or Arecaceae), the informal groups of Moore's (1973) classification will be followed, beginning with the *Ptychosperma* alliance of the arecoid group. The present research grew out of a taxonomic study of *Ptychosperma* (Essig, 1975) in which certain histological features of the pericarp were found to be of taxonomic significance. Earlier studies (Guérin, 1949; Murray, 1971, 1973) indicated that pericarp histology might provide important systematic information in many groups of palms.

Guérin (1949) made a broad, descriptive survey of palm fruits with representatives from most of the major groups in the family. Though he provided much useful information, he did not analyze his data in a taxonomic framework and did not discuss the phylogenetic or ontogenetic implications of the data. Murray (1971) covered in depth the ontogeny and structure of a relatively few examples from six of the major groups of palms—the coryphoid, chamaedoreoid, pseudophoenicoid, caryotoid, arecoid, and cocosoid groups. Later she published a special analysis of the formation of the endocarp (Murray, 1973), a work providing valuable information on the origin and ontogeny of the various tissues in palm fruits, adding another dimension to Guérin's data. In the work of both authors it is evident that there is great structural diversity in palm fruits that might be exploited in taxonomic and evolutionary studies, as has long been recognized by taxonomists such as Moore (1957). The purpose of the present series of investigations is to augment the base of data established by Guérin, Murray, and others, to synthesize

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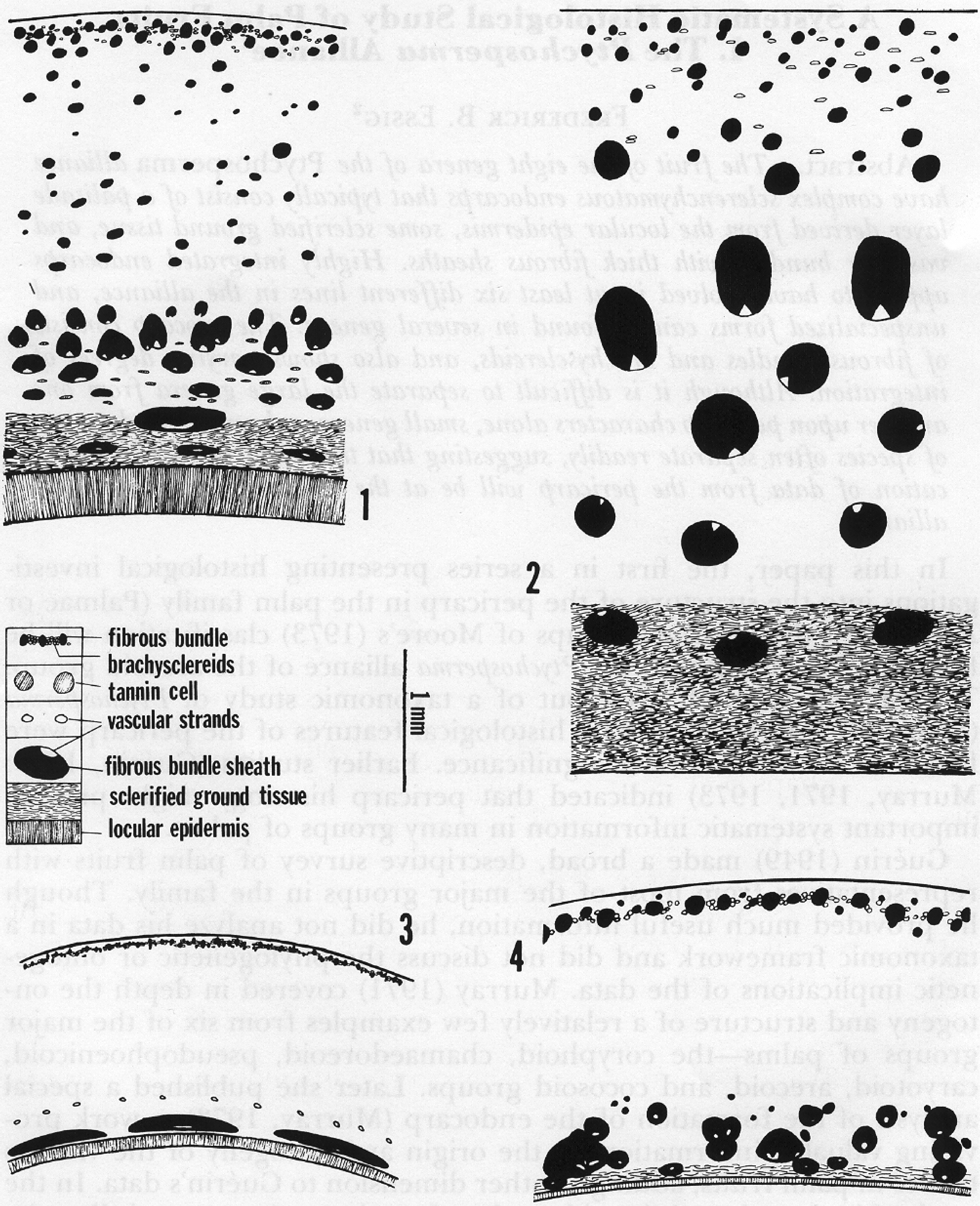

FIG. 1–4. Diagrams of portions of the pericarp in cross section. 1. *Veitchia joannis*. 2. *Normanbya normanbyi*. 3. *Carpentaria acuminata*. Note ring of naked vascular strands in inner mesocarp. 4. *Drymophloeus subdistichus*.

the information systematically, and to discuss the taxonomic and phylogenetic implictions. An effort will be made to study at least one representative of every genus in the family.

The *Ptychosperma* alliance consists of eight genera native to the southwestern Pacific region. *Ptychosperma* and *Veitchia* are large, diverse genera,

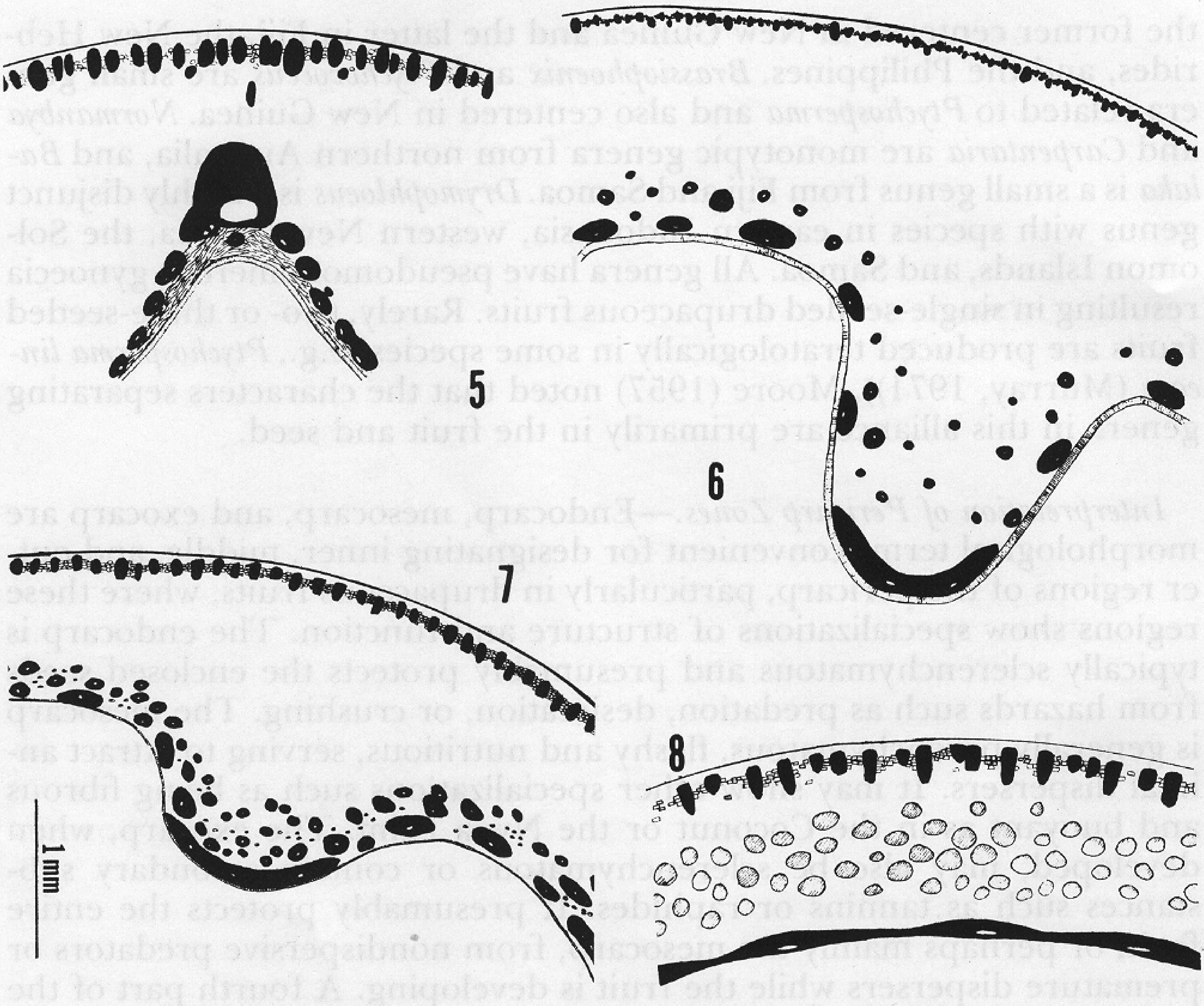

FIG. 5–8. Diagrams of portions of the pericarp in cross section. 5. *Balaka burretiana*. 6. *Ptychosperma schefferi*. 7. *Ptychosperma lauterbachii*. 8. *Ptychosperma salomonense*.

has not been used, largely because the epidermis in the *Ptychosperma* alliance is quite unspecialized.

Materials and Methods

Specimens were obtained primarily from the preserved fruit collection at the L. H. Bailey Hortorium, Cornell University, and from my own collections in New Guinea. Some materials were obtained from correspondents and a few were taken from herbarium specimens. Materials were limited, and often only a single fruit could be examined for each species.

Hand sections, rotary microtome sections, and cleared material were used to elucidate structures. Specimens for rotary microtome sectioning were prepared in the conventional manner, though very protracted dehydration and infiltration times were necessary for this material (one to four weeks for each step). Some fruits with very hard tissues (e.g., *Ptychococcus*) have not yet been satisfactorily sectioned despite application of a variety of softening techniques. Sections were secured to slides that