Fine Structure of Pollen Surface in Palms*

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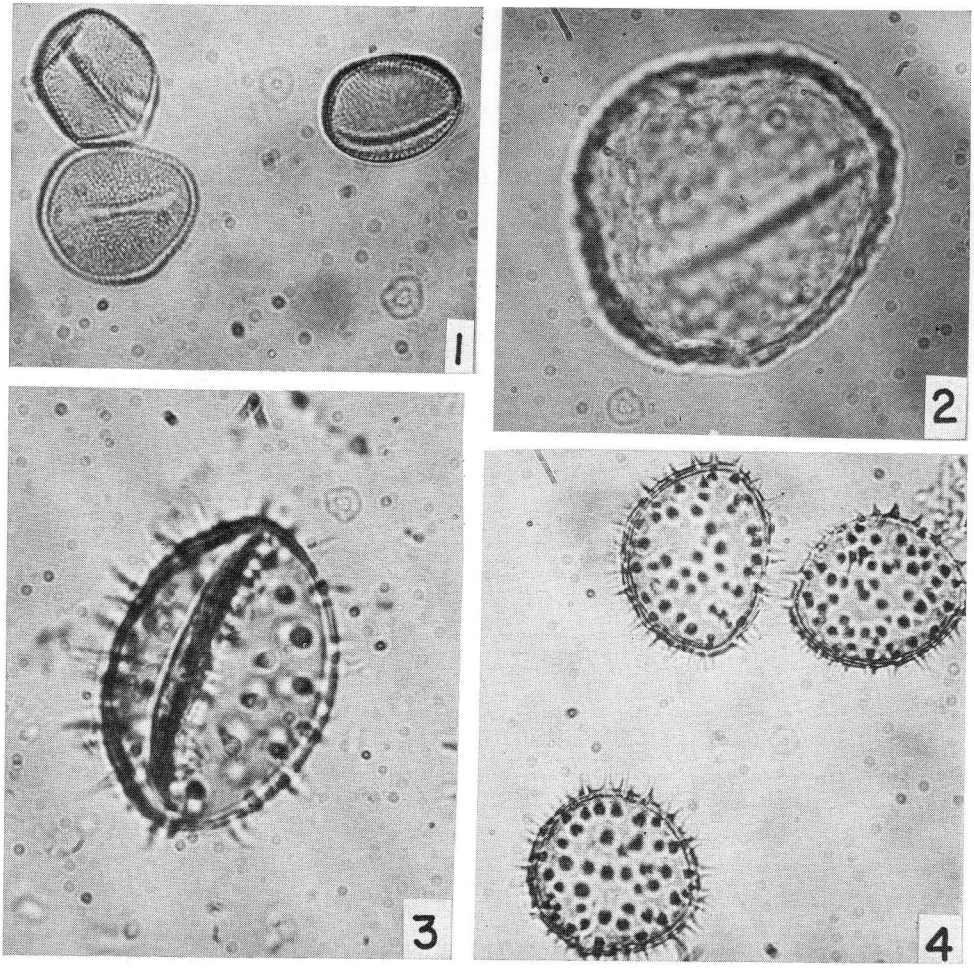
Botanists such as von Mohl (1834) and Fritzsche (1837) recognized the importance of pollen morphology in the last century, and Lindau (1894) used pollen in the classification of the Acanthaceae. It was not until a hundred years later, however, that a truly comprehensive study on pollen was started. The classical works of Wodehouse (1935) and Erdtman (1943, 1952) were the keys that opened the door to a new and exciting field in the biological sciences—palynology—the science of pollen and spores. Palynology (from the Greek verb *palynein*: to spread, to distribute) has since gained tremendous impetus and has been particularly useful to taxonomists and paleobotanists. Several botanists in the past two decades have done brief studies on the pollen morphology of different palms. However the recent contributions of Thanikaimoni (1966) and Sowunmi (1967) are perhaps the most comprehensive of them all.

The size and shape of the pollen grain, the number of furrows, the position, number and types of apertures or openings (colpi, pores) and the structure of the pollen wall are some of the main morphological characters that are used in classifying pollen grains. Detailed studies on the structure of the pollen surface were limited until recently by the resolution of the light microscope (about 1/2000 millimeter). Thus only major structural features of the surface of the pollen wall such as its smoothness, reticulation (Fig. 1), warts (Fig. 2), spines (Fig. 3, 4) and other prominent patterns could be observed with the light microscope. The advent of the scanning electron microscope (also known as scanning reflection electron microscope) has made it possible in recent years to study fine surface structures of biological material, including pollen, in great detail (Echlin 1968). Briefly, the scanning electron microscope differs from the conventional electron microscope in its use of solid or whole specimens instead of ultrathin sections. The image formed by the scanning electron microscope has a great depth of focus, a three dimensional appearance, and a far better resolution (about 1/50,000 millimeter) than the light microscope. The present investigation, which is a preliminary study of the fine structure of the surface of the pollen wall in seven species of palms, was conducted at The Institut für Allgemeine Botanik, Eidgenossische Technische Hochschule, Zürich, and at the Research Laboratory of J. R. Geigy S. A., Basel, both in Switzerland.

Pollen material of *Chamaedorea* sp. (FG 57-755), *Hyphaene Schatan*, *Mascarena lagenicaulis*, *Phoenix* sp. (P-1596) and *Ptychosperma* sp. (FG 60-675F) were collected by Dr. P. B. Tomlinson at the Fairchild Tropical Garden, Miami, Florida, and those of *Chamaedorea brachypoda* and *C. oblongata* were collected by Dr. Harold E. Moore, Jr., at Cornell University, Ithaca, New York. The pollen was air-mailed to Zürich, Switzerland, in gelatin capsules

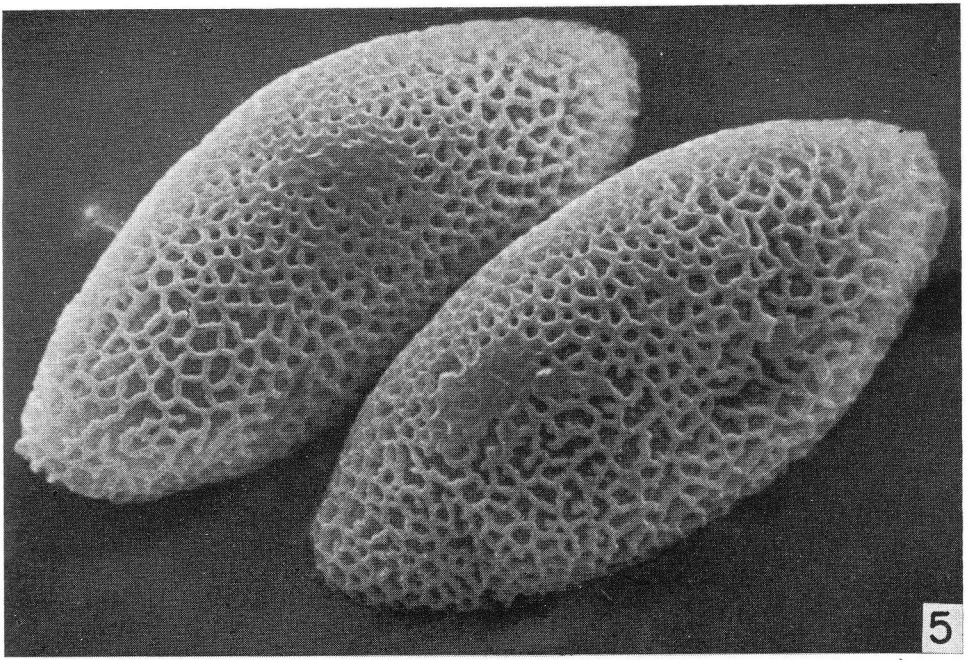
* This investigation was carried out as part of a research program conducted as a Montgomery Fellow of the Fairchild Tropical Garden, Miami, Fla.

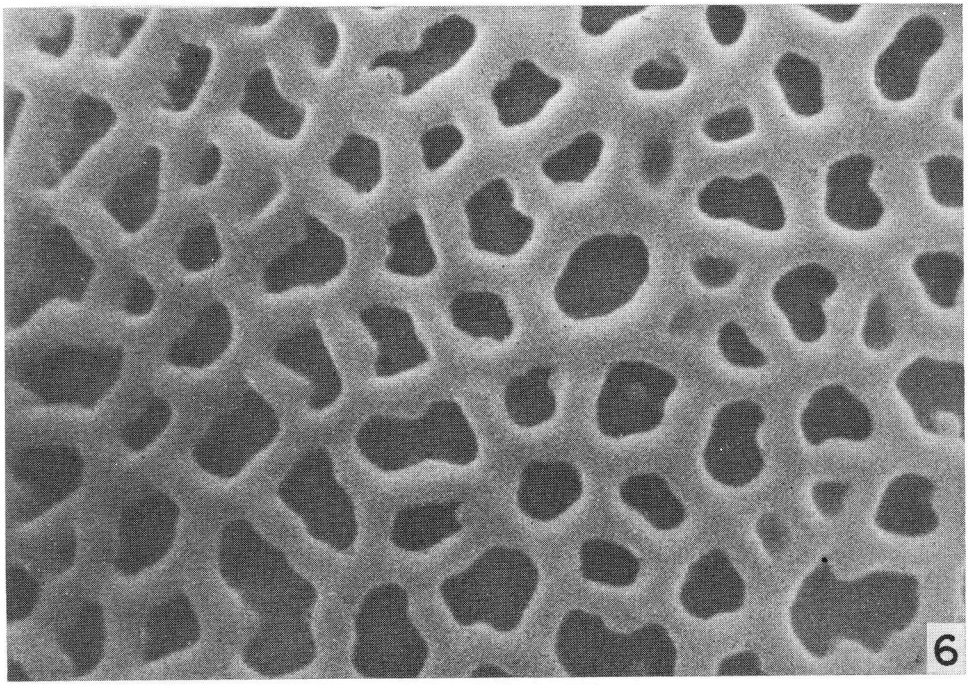


1–4. Photomicrographs of palm pollen grains. Fig. 1, *Chamaedorea oblongata*: pollen with reticulate surface; each grain with a furrow, × 500. Fig. 2, *Hyphaene Schatan*: pollen grain with wartlike ornamentation, × 1500. Fig. 3, *Arenga pinnata*: pollen grain with spiny wall; note the prominent furrow, × 1500. Fig. 4, *Nypa fruticans*: pollen with spiny surface similar to that in *Arenga*, × 500.

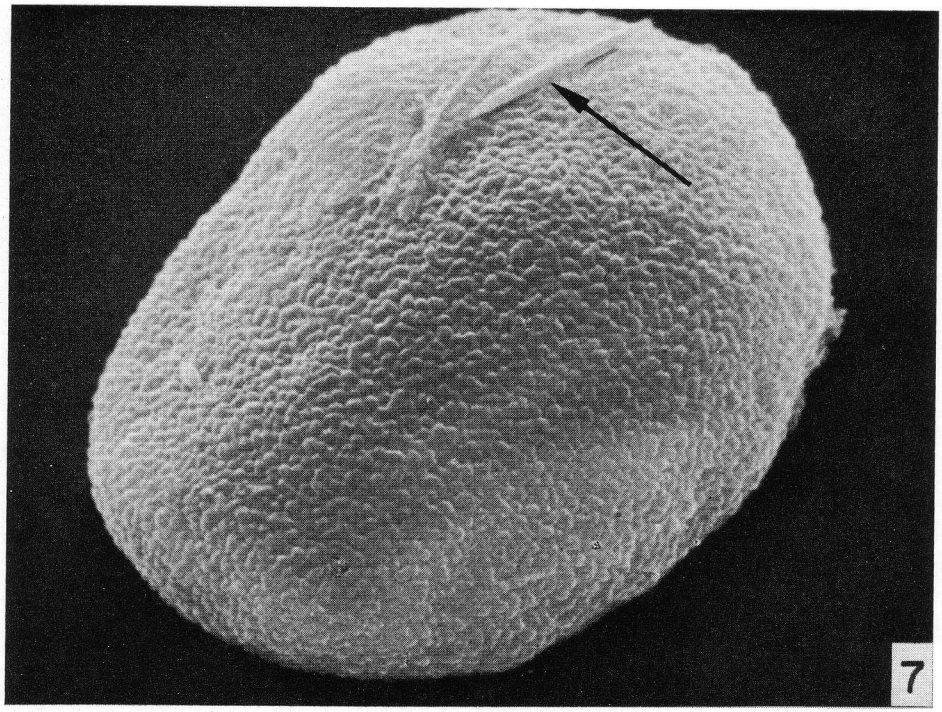
and was kept dry during shipment and subsequent cold storage by packing the capsules in silica-gel. Observations using the light microscope were also made on pollen from *Nypa fruticans*, *Chamaedorea* sp. (FG 57-755), *C. oblongata*, and *Hyphaene Schatan*.

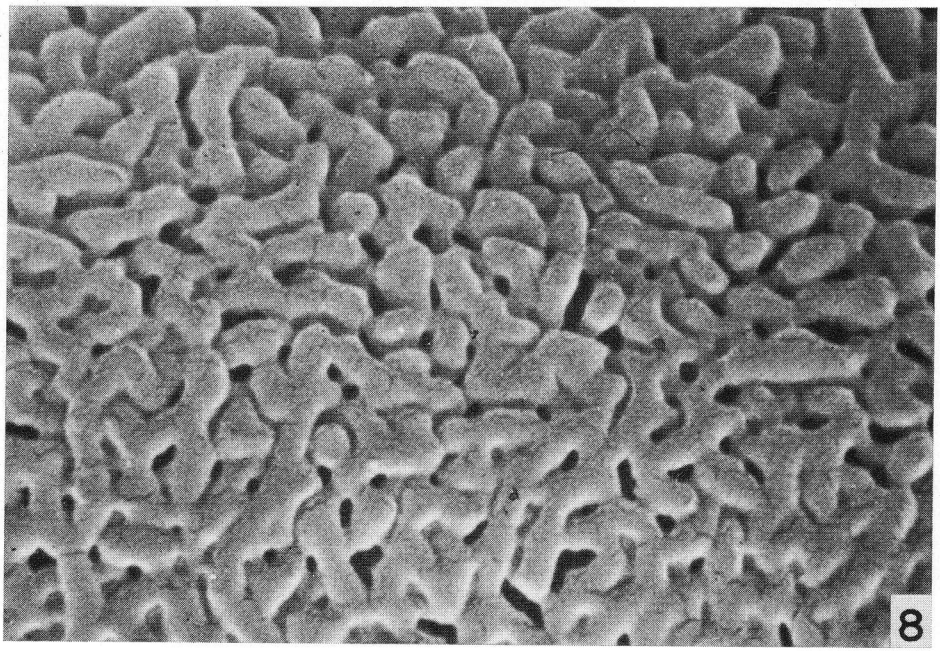
Figures 5–17 demonstrate the tremendous detail and three-dimensional qualities of pictures taken with the scanning electron microscope. The usefulness of scanning electron microscopy can be demonstrated especially well in the pollen of *Mascarena* and *Ptychosperma*. The surface of pollen in these palms appears finely reticulate when examined with a light microscope (Thanikaimoni, 1966; Sowunmi, 1967). Under low magnifications with the scanning electron microscope, the pollen wall of these palms does



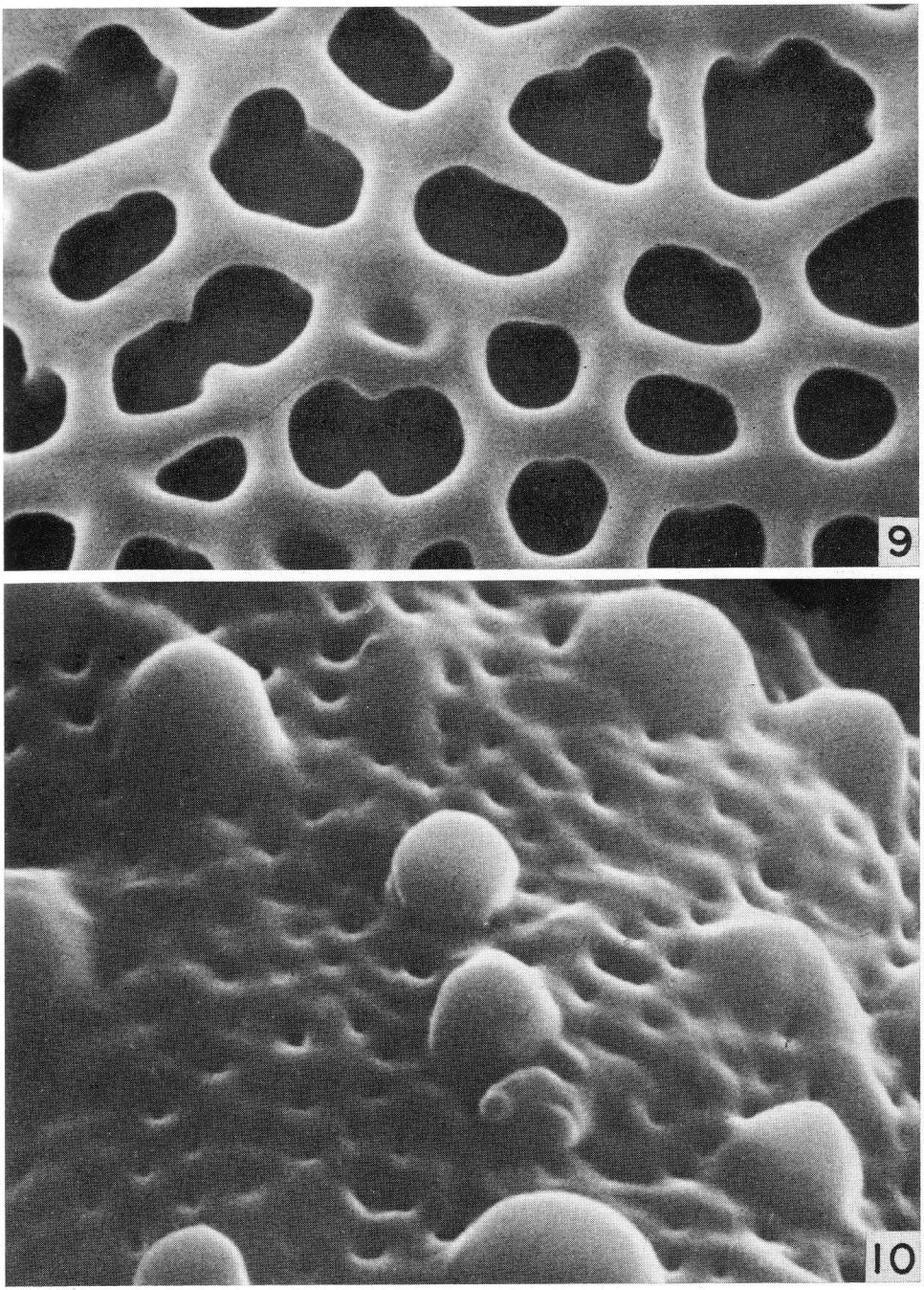


5–6. *Chamaedorea brachypoda.* Scanning electron micrographs. Fig. 5, two pollen grains showing prominent reticulate surface structure, × 5400. Fig. 6, magnified view of the reticulate surface, × 19000.

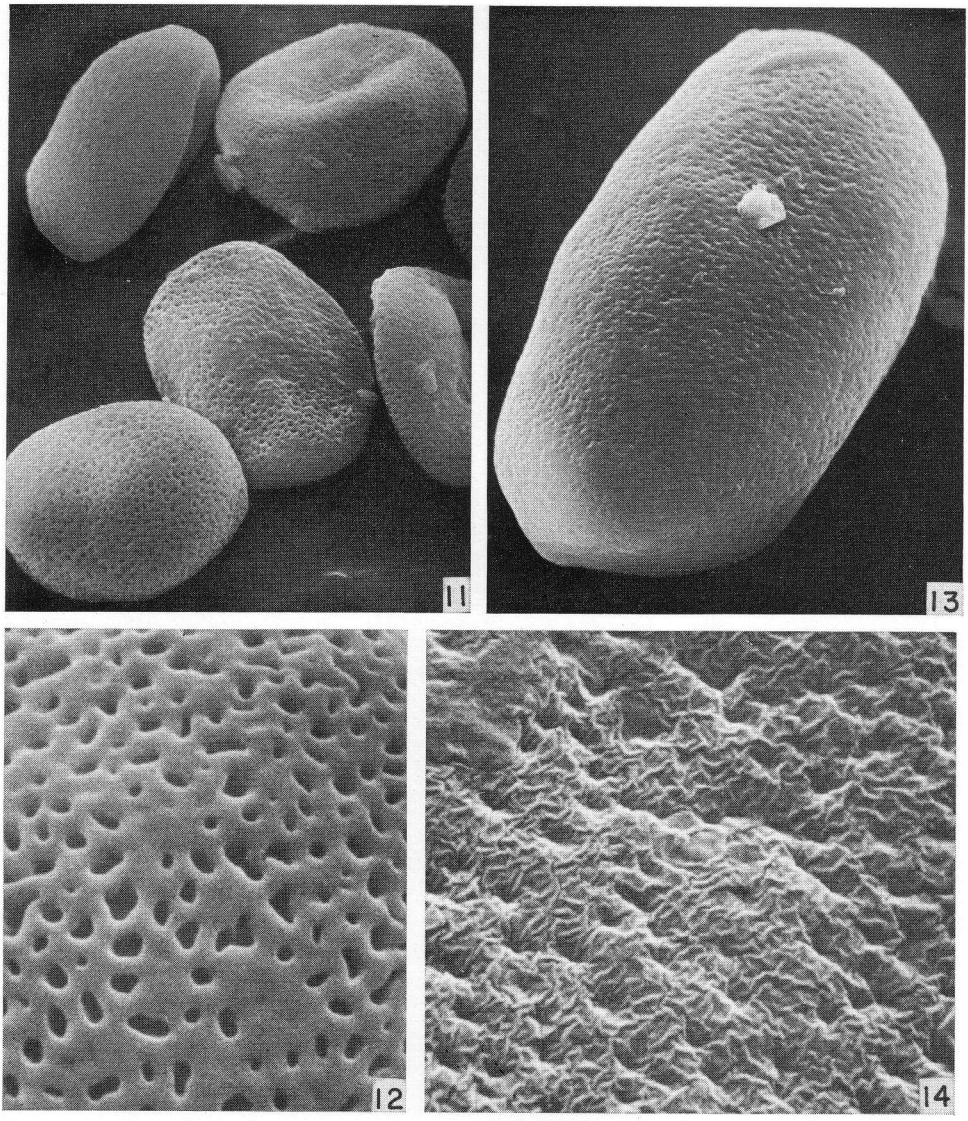




7–8. *Chamaedorea* sp. (FG 57-755). Scanning electron micrographs. Fig. 7, pollen grain with finely reticulate surface; a calcium oxalate crystal (arrow) can be seen on the top of the pollen grain (such crystals are commonly found in the anthers of this species), × 4800. Fig. 8, magnified view of the pollen surface showing the fine structure; note the difference between this pattern and pollen surfaces of the other two species of this genus (Fig. 6, 9), × 19000.

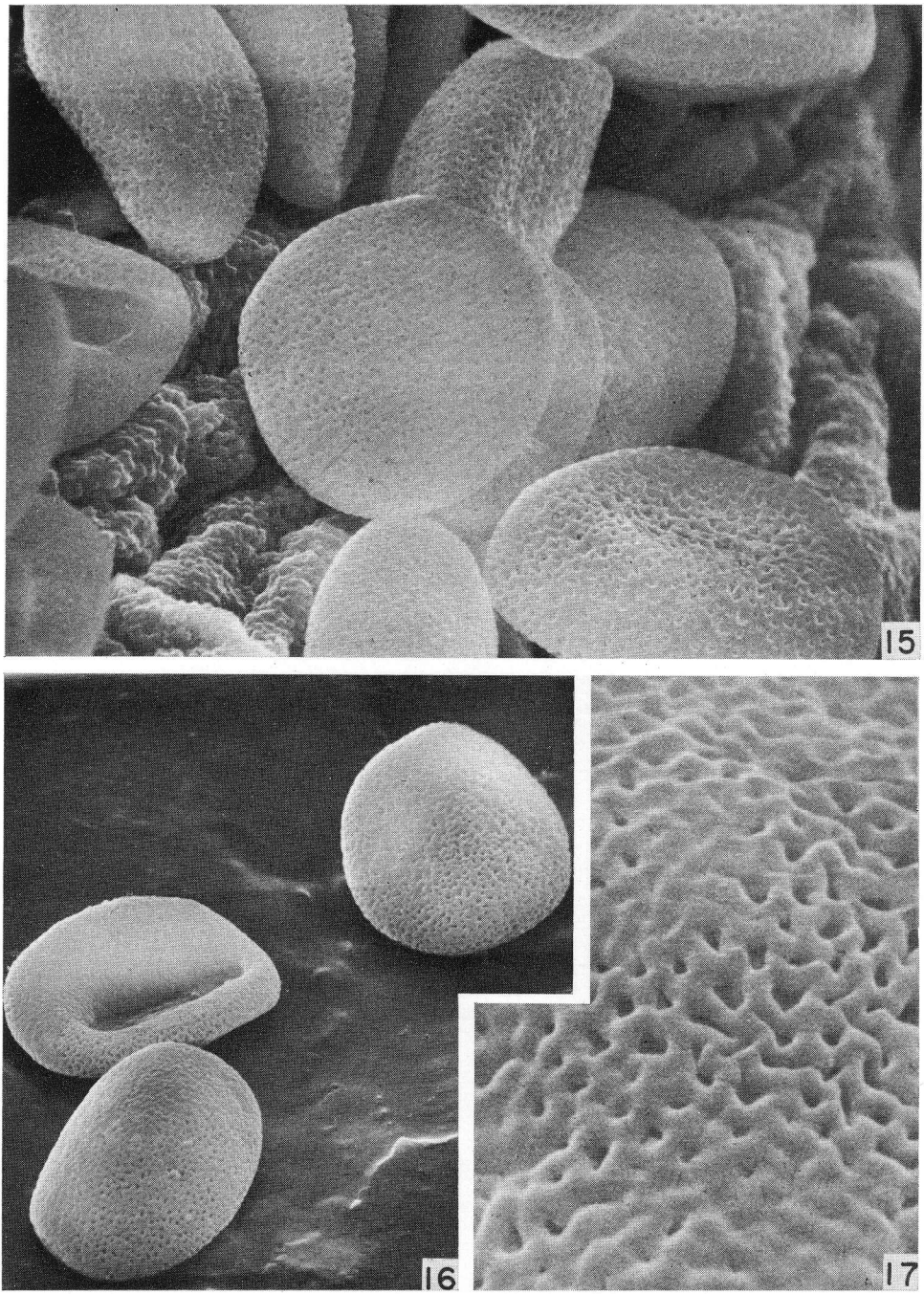


9–10. Scanning electron micrographs. Fig. 9, *Chamaedorea oblongata*: magnified view of the reticulate pollen surface (see cover picture), × 19000. Fig. 10, *Hyphaene Schatan*: magnified view of the pollen surface showing bumps and "warts" in addition to the reticulate structure of the wall; compare details of this with the photomicrograph in Fig. 2, × 19000.



11–14. Scanning electron micrographs. Fig. 11–12, *Ptychosperma* sp. (FG 60-675F). Fig 11, A cluster of pollen grains, × 2500. Fig. 12, magnified view of the pollen surface showing the reticulate wall; note the smooth exterior of the reticulate structure, × 12700. Fig. 13, 14, *Mascarena lagenicaulis*. Fig. 13, pollen grains with a finely reticulate surface, × 2500. Fig. 14, magnified view of the pollen surface; note the crinkled exterior in addition to the reticulate pattern of the pollen surface, × 12700.

not show any obvious difference in surface architecture (Fig. 11, 13). However, higher magnifications with the scanning electron microscope reveal that the finely reticulate pollen surface of *Mascarena* has a crinkled appearance (Fig. 14) while that of *Ptychosperma* appears smooth (Fig. 12). Among the three species of *Chamaedorea* examined, the pollen of one of the species has a



15–17. *Phoenix* sp. (P-1596). Scanning electron micrographs. Fig. 15, pollen grains within the anther, × 3000. Fig. 16, three isolated pollen grains, one of them showing a deep furrow, × 1950. Fig. 17, magnified view of the pollen surface showing the reticulate pattern, × 12700.

different surface structure (Fig. 7, 8) from that of the other two (cover, Fig. 5, 6, 9). More samples of pollen from different groups of this horticulturally important genus need to be examined before one can determine whether there are any correlated variations in the fine structure of the pollen surface in different species.

Since the outer wall (exine) of most pollen is made up of a very tough substance called sapropollenin, the pollen wall remains intact under very harsh conditions. Consequently pollen grain surfaces are probably one of the materials best suited for scanning electron microscopy where objects are subjected to high vacuum and temperature. Detailed investigations on the fine structure of pollen surface in different groups of palms could yield information that might be helpful in resolving problems in taxonomically difficult genera and species when the data are used in conjunction with other morphological characters.

The author wishes to acknowledge his indebtedness to Professor A. Frey-Wyssling, Institut für Allgemeine Botanik, Eidgenossische Technische Hochschule, Zürich, Switzerland for his advice and encouragement, and to Dr. R. Gasser, Research Department, J. R. Geigy S. A., Basel, for the use of a scanning electron microscope (Stereoscan, Cambridge Instrument Company). The author is also very grateful to Miss Christel Brücher for her skillful technical help.

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PALM BRIEFS

Some Palms in Jamaica

These days, I spend much of my time in the splendid Caribbean island nation of Jamaica. My interest in palms, of long standing, continues, and scarcely a week passes but that I discover some fascinating cultivated or indigenous specimen which I have not previously seen.

Visitors to this island are never disappointed in its exuberant and rich flora. Though with a rather small indigenous representation of palms, there are excellent examples of mature cultivated species in several places which are indeed rewarding.

Just now (May 1969) an especially impressive talipot palm (*Corypha um-*