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Scanning Electron Microscope Study of Brachysclereids of Pear (Pyrus communis L.)

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A Scanning Electron Microscope Study of Brachysclereids of Pear (*Pyrus communis* L.)

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ABSTRACT

The external surfaces of pear sclereids commonly are illustrated as covered with apertures. This SEM investigation of the surface features has shown the surface to have few or no apertures. When the primary wall layer was removed the typical ramiform canal system was obvious. This observation confirms the often-ignored fact that the pit apertures of the secondary wall are not continuous with the primary wall. Hence, they do not show on the surfaces of the intact cell.

INTRODUCTION

The pulp of pear (*Pyrus communis* L.) long has been used in botany and general biology laboratory courses as a source of sclereids for student observation. These sclereids generally are classified in the literature as brachysclereids. The term "brachysclereids," as first designated by Tschirch (1889, p. 301-302), has continued to be recognized by many anatomists including Esau (1965), Cutter (1969), Foster (1949), Fahn (1974), and Eames and MacDaniels (1947). Authors such as Rao (1957) suggested that modifications to this classification system would be advisable to bring it up to date. Singly occurring sclereids have been termed "idioblasts" and they pose numerous problems in plant development (Foster 1955).

Descriptions of these sclereids or "stone cells" are very uniform in the literature (Cutter 1969, Eames and MacDaniels 1947, Esau 1961, 1965, Fahn 1974). Anatomical descriptions denote the sclereids as short, compact, isodiametric cells with extremely thick laminated walls, often with ramiform canal-like cavities in the secondary wall. Eames and MacDaniels (1947) indicated that two or even several pits fused to form one structure which had only one aperture in each cell. Ledbetter and Porter (1970) produced a TEM illustration of the laminated cell walls and the restricted lacuna of the pear sclereid. Parameswaran (1975) illustrated the same thing in sclereids of various tree bark. Sterling (1954) presented a description of pear sclereid development. All data indicate these descriptions of the sclereid to be accurate.

Illustrations of several authors (Cutter 1969, Eames and MacDaniels 1947, Esau 1961, 1965) made by use of light, polarized, and/or nonpolarized microscopy show the ramiform pit structure. However, in these illustrations cells also are shown with surface views bearing small circular areas labeled as pits. Thus, either correctly or incorrectly, the impression is given that the exterior faces of the sclereid cells are covered with obvious apertures. Such observations in some cases are transferred to general botany texts without correction (for example, Weier et al. 1974). Observations of sclereids with the scanning electron microscope help clarify the external appearance and pit structure of these cells.

METHODS AND MATERIALS

A pear fruit was cut into half-inch pieces, placed into a blender with FAA fixative (Jensen 1962), and homogenized for 10 minutes. The homogenate was mixed with a large volume of FAA and allowed to stand overnight. A large number of sclereids settled to the bottom of the container, and thus unwanted material could be decanted away. The sclereids were dehydrated in an ethyl alcohol series to absolute alcohol. Some of the sclereids were placed on a small section of glass slide which was glued to an SEM stub. Another slide was placed on top of it, and pressure was applied carefully to break up some of the larger masses of sclereids. The specimens were air dried in a dessicator, coated with approximately 50 Å carbon, and coated with about 200 Å of 60% gold - 40% palladium in a vacuum evaporator. The stubs were examined and photographed in a Cambridge S-600 microscope.

RESULTS

Under low-power magnifications the sclereids were seen in large clumps and smaller groups (Figs. 1, 2, 3). Most of the cell faces appeared smooth and without apertures. A few cells were seen with obvious apertures on one or more of the surfaces (Figs. 4, 5). On more isolated cell clusters, the many faces of the cells could be seen easily and most of them were without apertures (Figs. 4, 5). The thick-layered secondary walls and evidence of the ramiform canal cavities can be seen in Figure 5. Figure 6 shows a cell with part of the primary wall layer peeled back to reveal the pits ending blindly against the primary wall. Figure 5 shows sclereids with sections of outer primary wall broken away and the rest of the wall intact. In many observations the presence of the ramiform canal system (pit aperture) in the secondary wall was obvious. But in the great majority of sclereids these "apertures" were hidden beneath the primary wall or the outer surface of the cell.

DISCUSSION

From this short investigation it was seen that the literature describing the internal makeup of brachysclereids of pear is correct, but that some of the illustrations generally used can convey an erroneous impression of their external appearance. The cell surfaces of a majority of the cells observed in this study were without apertures. The ramiform pit aperture system was confined to the secondary wall and was not generally continuous with the primary wall.

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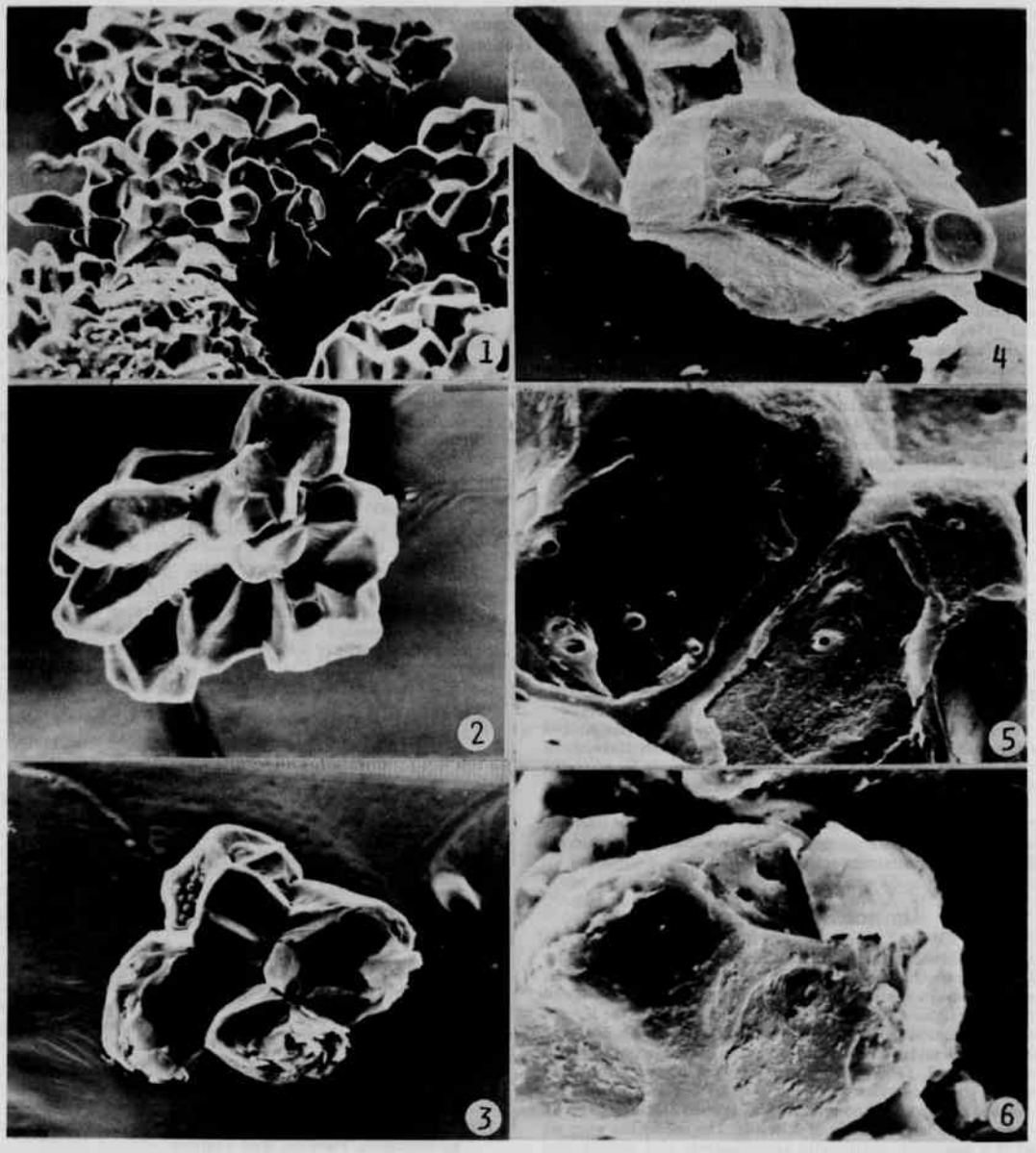

Figures 1-6. Scanning electron micrographs of schlereids of pear. 1. Large group showing smooth surfaces. X200. 2. Small cluster with smooth surfaces. X500. 3. Small cluster, one surface with apertures. X500. 4. Isolated cells with few apertures. X1000. 5. Cells with outer wall layer torn away to show ramiform canals. X2000. 6. Sclereid with outer wall pulled back showing canals and blind ending. X2000.