

NOTES ON THE HISTOLOGY OF AN ILLINOIS PSARONIUS

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The specimens studied were collected by Schopf and Carroll in 1938.² The material was well preserved and the peel method was used for sectioning. In addition to a microscopic study of the whole nitrocellulose peels, portions of these films were mounted in balsam and examined at high magnification.

Figure 1 shows that the character of the stem is in general similar to other species of polystichous *Psaroniaceae* that have been described from American³ and European collections. The vascular system is polycyclic; i. e., the meristemes are arranged in a more or less concentric pattern, as in certain modern tree ferns of the Cyatheaceae. The central meristemes are smaller and are much more irregular in their relations. The vascular strands are surrounded by ground tissue which includes irregular sclerenchymatous bands. Large mucilage ducts, apparently lysigenous in origin, are also present in the ground parenchyma. In the peripheral region the mucilage ducts are larger, more frequent and more regularly arranged. Often there are two ducts present on the concave adaxial side of the leaf trace meristeme. The stem is bordered by a mass of adventitious cortical roots.

Narrow bands of secondary growth are irregularly present on as many as ten of the meristemes. Secondary tracheids are laid down in quite regular rows. Fig. 2 shows a camera lucida drawing of a section through a secondary growth band with ground parenchyma at the right and primary xylem at left. Secondary xylem may be centrifugal or centripetal or both in its direction of growth. In longitudinal section these secondary tracheids show scalariform pitting as in fig. 3. The

presence of secondary meristellar growth in *Psaronius* is an anomalous feature which seems previously unreported. Among modern ferns, the Ophioglossaceae are commonly known to produce secondary xylem. Farmer and Hill (1902)⁴ have pointed out that in *Angiopteris evecta* and in some species of *Marrattia* certain cells situated next the meristeme may undergo division forming secondary tracheids. The meristematic cells may occur singly or in groups. Secondary xylem in both *Marrattiaceae* and *Psaronius* is another point which may indicate their relationship.

It seems likely that phloem entirely surrounded individuals meristemes. Groups of parenchyma cells are scattered among the tracheids in the meristeme as shown in figs. 4 and 5.

The free roots associated with this *Psaronius* may become quite large (2 to 3 cm. in diameter). The thick outer sclerenchyma is lost when they leave the peridermous cortex of the stem. Most of the cortex is lacunar as shown in Fig. 6. This is a character common to roots of modern hydrophytes and it probably indicates a similar environment for *Psaronius*. The stele is not precisely delineated from the cortex since no layer of cells can be definitely identified as endodermis. Phloem tissue is not definitely distinguishable though some of these small parenchymatous cells between the xylem rays must have assumed this function. The stellate xylem body is generally well preserved. It may be pentarch, or hexarch as shown in fig. 7, and probably varies within the same species. The protoxylem cells all appear scalariform in longitudinal sections and lack the char-

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² Schopf, James M. A significant collection of American coal balls. *Chronica Botanica* IV; 384-385, 1938.

³ See Gillette, N. J., Morphology of Some American Species of *Psaronius*, *Bot. Gaz.* 99:80-102, 1937.

⁴ Farmer, J. B. and Hill, I. G. On the arrangement and structure of the vascular strands in *Angiopteris evecta* and some other *Marrattiaceae*. *Annals of Bot.* XVI; 371-402, 1902.

acteristic annual or spiral thickenings. This is unusual since the position of the protoxylem is very definitely indicated by the small size of the tracheids.

There are other unusual features associated with this *Psaronius* stem, so that it will probably be necessary later

to describe it as new species.⁵ The presence of secondary growth in stem meristemes and the absence of spiral or annular tracheids in protoxylem areas of the free roots seem to be new features hitherto unreported from American *Psaronius* material.

⁵ Description of the genus *Psaronius* and several previously described species are treated by Hirmer, M. Handbuch der Paläobotanik I. München und Berlin, 1927, pp. 545-566.

Explanation of Plate.—Histology of *Psaronius*

Fig. 1.—Segment of stem: Scale indicated. This, and other figures except fig. 7, from I. G. S. Coal Ball 137.

Fig. 2.—Meristeme with secondary growth.

Fig. 3.—Longitudinal section through secondary xylem showing scalariform pitting.

Fig. 4.—Segment of meristeme. Small xylem cells top center and below at left may represent protoxylem. Some of the thin walled tissue above and below may be phloem.

Fig. 5.—Longitudinal section through meristeme. Note included parenchyma (see also fig. 4) and scalariform pitting.

Fig. 6.—Lacunar cortex of free growing *Psaronius* root.

Fig. 7.—Central tissues of free growing *Psaronius* root. Dark cells between stelar rays have secretory contents. From I. G. S. Coal Ball 203A (T 1).

