

marked pith, figure 61 *m*. The pith communicates with the external fundamental tissue through a gap caused by the exit of the cotyledonary trace, as has been described by Van Tieghem<sup>28</sup>. The internal endodermis discovered in the younger portion of the stem of *Botrychium Lunaria* and others of the *Ophioglossaceæ* by Van Tieghem<sup>29</sup> and Poirault<sup>30</sup>, is not present in this species, although the external endodermis is well-marked, only disappearing opposite the foliar gaps. The bast-tissue originates first in the young central cylinder and seems never to have any secondary additions from the activity of the *cambium*. Graf zu Solms<sup>31</sup> has thrown doubt on the existence of secondary wood in the *Ophioglossaceæ*, but in this species there can be no uncertainty as to its presence; in fact, the wood is practically all secondary, as may be learned from the radial arrangement of its matured elements and by following the course of its development, figure 63 *x*, and figure 64 *x*. The first-formed wood-elements are reticulately sculptured and are never of the ringed or spiral type. In this respect they resemble those of the stem of the *Marattiaceæ*, and, in fact, also those of the *Osmundaceæ*; for the groups of typical protoxylem elements found in the upper region of the bundles of the latter, really belong to the leaf-traces. It is more than probable that the absence of typical primitive tracheary tissue in all these cases, is due to the very slow growth of the stem, a phenomenon which renders their presence unnecessary. The writer has noticed the absence of these elements in the slowly growing stems of species of so-called polystelic *Primulæ*, viz:—*P. Auricula* and *P. farinosa*.

During this investigation, the rather interesting observation has been made, that the periderm-tissue first described in the *Ophioglossaceæ* by Russow<sup>32</sup> and Holle<sup>33</sup>, is formed in *Botrychium virginianum* at the bases of defunct leaves, and thus is merely an absciss-layer. Figure 65, from a photomicrograph, shows a young sporophyte still attached to its prothallium; *r* is the first root and *x* the base of the cotyledon; *l*<sup>2</sup> and *l*<sup>3</sup> are developing leaves. As may be seen from the figure, the course of the cotyledonary bundle *x*, has been interrupted by the intercalation of a layer of periderm. Figure 66 shows the tissues in question under a sufficiently high magnification to make clear the details of periderm formation. By the continued growth of the latter the distal part of the

28. Remarques sur la structure de la tige des Ophioglossées. Journal de Botanique, iv., Année; p. 407

29. Op. Cit.

30. Recherches sur les Cryptogames vasculaires. Annales de Sci. Nat. Bot. Tome xviii.; p. 170.

31. Fossil Botany, p. 223.

32. Mém de l'Acad. Imp. des Sciences de St. Petersburg. vii. Serie. Tome xix., No. 1, p. 117.

33. Bot. Zeit. 1875. Ueber Bau u. Entwicklung der Ophioglossen, p. 12.