NOTE.

NOTE ON A SPORELING OF PHYLLOGLOSSUM ATTACHED TO A PROTHALLUS.—All attempts to raise prothalli of *Phylloglossum* from spores having so far failed, we are dependent upon material collected in the field. In 1901 a preliminary account of some New Zealand specimens was given by Professor Thomas, but his paper contained no figures.¹ Since that date no further observations have been published, and the occurrence of a prothallus among some recent Australian material seems worth recording. The prothallus in question was attached to a young sporeling, which possessed a single leaf 8 mm. long, a slender root, and a small storage tuber (Fig. A).² The plant was embedded in a mass of peat, which contained other small plants, but these were all developed from storage tubers formed in the previous season.

The prothallus is a small tuberous body, about 2 mm. in diameter, the upper end being slightly extended to form a crown. In form and size it recalled the 'shorter thick-set prothalli' described by Professor Thomas. The preservation of the tissues was poor, but it was clear that the prothallus was of a relatively unspecialized type. It consisted mainly of large thin-walled cells, some of which had grown out to form rhizoids.

A notable feature of the prothallus was its association with fungal hyphae. Among the outer layers of cells, and occasionally among the rhizoids, relatively coarse, non-septate hyphae were found. These hyphae were probably the mycelium of some saprophytic fungus, which had helped to bring about the decay of the prothallus. Slender hyphae, septate and frequently coiled, occurred in abundance in the central region of the prothallus, and in sections through the crown (Fig. B, r). Occasionally they showed a tendency to fragment, and in some sections they were associated with groups of deeply staining bodies. Thick-coated resting spores, formed either singly or in pairs at the ends of slender hyphae, occurred towards the edge of the prothallus. It was impossible to observe the relation between the fungal hyphae and the individual cells of the prothallus, but there seems little doubt that the thin septate type belonged to an endophytic fungus such as Professor Thomas described.

Professor Thomas found the sexual organs of *Phylloglossum* on the crown of the prothallus. In the specimen here described, the upper part of the prothallus was decayed and crushed, and its structure was difficult to determine, but in two consecutive sections a rounded mass of small cells was observed on the edge of the crown (Fig. B, A). The specimen had been embedded, cut transversely,

¹ Thomas, A. P. W.: Preliminary Account of the Prothallus of *Phylloglossum*. Proc. Roy. Soc., vol. lxi, 1901-2, p. 285.

² Thomas states that he has seen no formation of root during the first year of growth. Loc. cit., p. 288.

and stained with aniline safranin and light green. The safranin had collected in the corners of these cells, a fact which helped to distinguish them from those of the surrounding tissue. Though nothing can be definitely stated, it is possible that they were the cells of an immature antheridium.

FIG. A. Diagram constructed from serial transverse sections, to show the sporeling and the prothallus in vertical longitudinal section. $\times 23$.

FIG. B. Transverse section through the sporeling and part of the prothallus, drawn from two consecutive sections at the level marked $\times \times$ in diagram A. $\times 53$.

L=leaf; R=root; T=storage tuber; *b*=bud; E.S=embryonic swelling; P=prothallus; C=crown of prothallus; F=fungal hyphae; A=antheridium; *rh*=rhizoids; D=débris. The sections which were lost occurred just above the level marked $\times \times$.

Besides the leaf, root, and storage tuber already referred to, the sporeling possessed a tuberous mass of tissue, which was partly immersed in the prothallus and partly free. This body consisted of parenchymatous cells, which differed from those of the gametophyte in that they contained no fungal hyphae, and were in a better state

of preservation (Figs. A and B, E.S). The morphology of this part of the sporeling presents some difficulty. Having only a single specimen we are without data of development, and not even could the position of the archegonium neck be discovered, since one or two sections of the microtomed series were unfortunately lost. Two alternative views are possible. The tuberos body may be either a local swelling in the hypobasal region of the embryo, comparable with the foot found in an embryo of the *L. clavatum* type, or it may have arisen in the epibasal part of the embryo, and therefore correspond with the protocorm of *L. cernuum*. In the specimen examined there is nothing against regarding the swollen part of the sporeling as a foot, except the fact that it is partly extraprothallial, and even this might be due to decay and shrinkage in the gametophyte. On the other hand, the account given by Professor Thomas seems to support the second alternative. This observer states that the early stages of embryogeny in *Phylloglossum* are much like those in *L. cernuum*, and he describes a condition in which the embryo, 'a short cylindrical body, bluntly pointed at both ends', is attached to the prothallus by a foot which is lateral in position. It is possible, therefore, that in the specimen described above, a foot, relatively small and lateral to the sporeling, was present in the sections which were lost. If this be so the bulky mass of tissue half buried in the prothallus must correspond, not with the foot of *L. clavatum*, but with the protocorm of *L. cernuum*. It differs from this organ, however, in possessing no rhizoids and no endophytic fungus, and in being only partially free from the prothallus.¹

Although the morphology of the embryonic swelling must be left an open question until further observations can be made, the specimen seemed worthy of record because the sporeling is found to possess both an embryonic swelling and a characteristic storage tuber. Thus it demonstrates (a) that *Phylloglossum* falls into line with one or other of the Lycopodian series with an embryonic swelling, and (b) that the annual storage tuber is of entirely independent origin.

¹ For discussion of the problem see Bower, Origin of a Land Flora, chap. xxvi, where also further references to the literature on the subject are given. I regret that all reference to Professor Bower's treatise was omitted by mistake in my paper on the Morphology of *Phylloglossum*, Ann. of Bot., vol. xxx, p. 315.

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