

ON THE CONTINUED GROWTH OF CERTAIN FERN PROTHALLIA.¹

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Prothallia of *Osmunda claytoniana* and *Matteuccia nodulosa* have been grown upon soil for three and one-half and four years, respectively, under cultural conditions which prevented the production of sporophytes. When an occasional sporophyte appeared it was amputated in such a manner as not to injure the gametophyte.

Prothallia thus grown branched both dichotomously and by the production of lateral shoots or proliferations. Proliferations, large and small, develop from the margins, from both surfaces of the midrib, and from the older proximal tissues, as well as from the growing point or apical sinus.

In older prothallia archegonia may be developed from both upper and under surfaces. In such prothallia antheridia are produced chiefly upon small marginal proliferations, or upon small granular protuberances on older parts. In some cases small protuberances are produced along the midrib on the upper side. Such protuberances bear many archegonia.

The cell walls in older parts of the midrib are relatively thick. They are marked by numerous pits varying in size.

Spine-like processes developed from near the growing point in a few prothallia of *Matteuccia nodulosa*. These outgrowths dried up as the prothallia became older. Apogamous sporophytes did not develop in any case.

If sporophytes are not produced, the continuation shoots of the prothallia of the two species in question seem to be able to continue growth indefinitely.

ON THE OCCURRENCE OF AN ENDOPHYTIC FUNGUS
IN THE PROTHALLIA OF *OSMUNDA*
CLAYTONIANA L.

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The presence of endophytic fungi in the non-chlorophyll-bearing, subterranean parts of the gametophytes of certain Ophioglossaceae and Lycopodiaceae is a well-known and expected phenomenon. In ferns with green prothallia, however, the phenomenon is much less common. Of these Campbell (Am. Nat. 62:154-165. 1908) has enumerated the

¹ Summary. The paper in full will appear in the Botanical Gazette.

"Proc. Ind. Acad. Sci., vol. 36, 1926 (1927)."

following: *Marattia Douglasii* Baker, *Kaulfussia aesculifolia* Bl., *Angiopteris evecta* Hoffm., *Gleichenia polypodioides* Sm., *G. dichotoma* Willd., *G. laevigata* Hooker, *G. pectinata* Presl., and *Osmunda cinnamomea* L.

A brief histological study of the continuation shoots of three and one-half year old prothallia of *Osmunda claytoniana* L. has enabled the writer to add this species to the list. A large number of specimens have not been examined up to the present, and the writer is not able to say whether the presence of the endophyte is general or only occasional in the prothallia of this species. Campbell states that the endophyte appeared commonly in *O. cinnamomea*, but it could not always be found. In the limited number of prothallia of *O. claytoniana* subjected to histological study the endophyte was found in all but one. As stated in the foregoing, the endophyte occurred in prothallia of unusual age, grown under controlled experimental conditions, which, however, were as nearly like those out of doors in summer as it was possible to maintain.

Similar prothallia of *Matteuccia nodulosa* Fernald (*Onoclea Struthiopteris*), though some months older, did not reveal the presence of an endophyte, but it is possible that an endophyte may be present also in this species. In *Osmunda claytoniana* the fungus seemed to occupy circumscribed areas much as do colonies of *Nostoc* in the gametophyte of *Anthoceros*. The region containing the fungus may be midway between lower and upper surfaces of the prothallium, or nearer the lower surface. Whether the infected areas were in any way united into a continuous layer cannot be stated at present.

The fungus seems to belong to the Phycomycetes. The structure and appearance of the fungus agrees closely with that figured by Campbell (1. c., p. 162, fig. 3 B) for the endophyte in *O. cinnamomea*. It consists of rather large, tubular, branched, and multinucleate filaments that pass from cell to cell, apparently through the pits in the cell walls. The cell walls of the midrib in older parts of the prothallia of *O. claytoniana* in question are marked by numerous rounded or elongated pits that vary considerably in size. It is through the larger of these pits that the hyphae pass from cell to cell.

Conidia were not found in the preparations. In cells containing the fungus the plastids differed in appearance from those in non-infected cells. They seemed to be densely granular, and stained uniformly. No starch inclusions were present in them, and in this respect the plastids contrasted noticeably in appearance with those of non-infected cells. The infected cells were much poorer in cytoplasm. In some cases the nuclei seemed to be normal, but in many cells near the center of the infected region, some of the nuclei were ameboid in form, and appeared abnormal in structure.

The fungus was found in some of the rhizoids, so that it is probable that it gained entrance through them.

The prothallium does not seem to suffer in any appreciable degree from the presence of the endophyte, while there can be no doubt that the fungus receives nourishment from the prothallium. Whether there is a symbiotic relation existing between the two, further study must determine.