

PYTHIUM INFECTION OF CABBAGE HEADS

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WITH ONE FIGURE IN THE TEXT

In a previous paper¹ dealing with the cottony leak of cucumbers were enumerated some recorded instances in which members of the genus *Pythium* have been found responsible for destruction to plant products. Such cases are deserving of special note, inasmuch as they differ from the instances of damage from damping off and rootlet injury more usually associated with the genus, in that they involve tissues of relatively mature parts. Moreover in certain cases where destruction may be initiated or continued after harvesting, the control problem presented is a different one, consisting, as it does, in the conservation of plant structures under conditions more or less subject to control, rather than in maintenance of the life of the plant or its efficiency as a productive unit by the somewhat indirect and not always effectual means of soil management.

To the instances enumerated may be added a type of decay of cabbage not hitherto described. In July, 1924, the writer received for identification a portion of a cabbage head found on the Washington market by Miss L. McCulloch. Some of the compactly arranged inner leaves were conspicuously water-soaked in appearance, the discolored regions extending somewhat farther along the fleshy midribs than over the thinner lamellae, and evidently proceeding from the base where the modified foliar organs were attached to the affected core. When the affected leaves were separated out, the diseased portions were found to be nearly as firm to the touch as the healthy portions. That this firmness was due mainly to the surface tissues became apparent on dissection, by which means the deeper tissues were revealed as a softened pulpy mass from which water could be freely expressed.

When examined under the microscope the pulpy material was found to consist very largely of abundantly branching, continuous mycelium of the type characteristic of *Pythium* when developing in culture media rich in organic matter, or, for example, in living cucumber or watermelon fruits. And as in these substrata the tissue structures of the host were reduced to disorganized cell walls small in quantity when compared to the abundance of mycelial development. Portions of the material planted on cornmeal agar yielded cultures of a species of *Pythium*, which subsequently were freed of contaminating bacteria.

¹ Drechsler, Charles. The cottony leak of cucumbers caused by *Pythium aphanidermatum*. In press; to appear in the Journal of Agricultural Research.

A fuller treatment of the morphology and taxonomy of the fungus is reserved for inclusion in a comparative account of the genus *Pythium* now under preparation. It would appear to be a species of the type usually dealt with in the literature as *Pythium debaryanum* Hesse producing sub-spherical "conidia," smooth oogonia, and oospores, and on suitable artificial media an abundance of cottony aerial mycelium. Hesse's binomial, however, cannot appropriately be applied to it as the sexual apparatus shows marked departures from that distinctive of *Pythium debaryanum*, particularly in the relationship of antheridium to oogonium. When the oogonium is intercalary and borne on the larger hyphae, fertilization is generally accomplished by cylindrical stalked antheridia, of which one or two are usually present, communication being established by a tube entering directly from the septum originally delimiting the two organs. When more delicate hyphae are involved, more frequently a sessile pouch-like outgrowth develops immediately adjacent to the oogonium, and this together with a variable but usually small portion of the hypha is delimited by a septum and functions as an antheridium, communication being established by a tube originating from the pouch-like part and traversing the oogonial wall a short distance from its juncture with the parent filament. Not infrequently antheridia developing from a hypha other than the one bearing the oogonium are encountered, these being either of the "branch" type with the septum at the base of an inflated part, or of a modified "intercalary" type consisting of an intercalary portion of hypha bearing a sessile inflated protuberance from which the fertilization tube is produced, the delimiting septa then being two in number and inserted directly in the hypha. The condition figured by Hesse, and made familiar by numerous text-book illustrations, of fertilization being accomplished by an approximately cylindrical or slightly swollen antheridium terminating a branch arising some distance below the oogonium from the same hypha as the latter, has not been observed.

The pathogenicity of the fungus to cabbage was established by inoculating healthy heads through incisions at the base of the stalk. Extensive water soaking in the region surrounding the inoculum became evident within 24 hours, the tissues of the core simultaneously becoming softened to a narrow-like consistency. Eight days after inoculation, on cutting the specimens, the condition shown in figure 1 was found: the core entirely softened, and the infection extending into all the foliar elements that make up the head for distances up to 60 millimeters. Although some mycelium was present in the spaces between the leaves, the fungus appeared to progress largely within the individual leaves, attaining its greatest development, as in the original specimen, in the tissues of the thickened fleshy

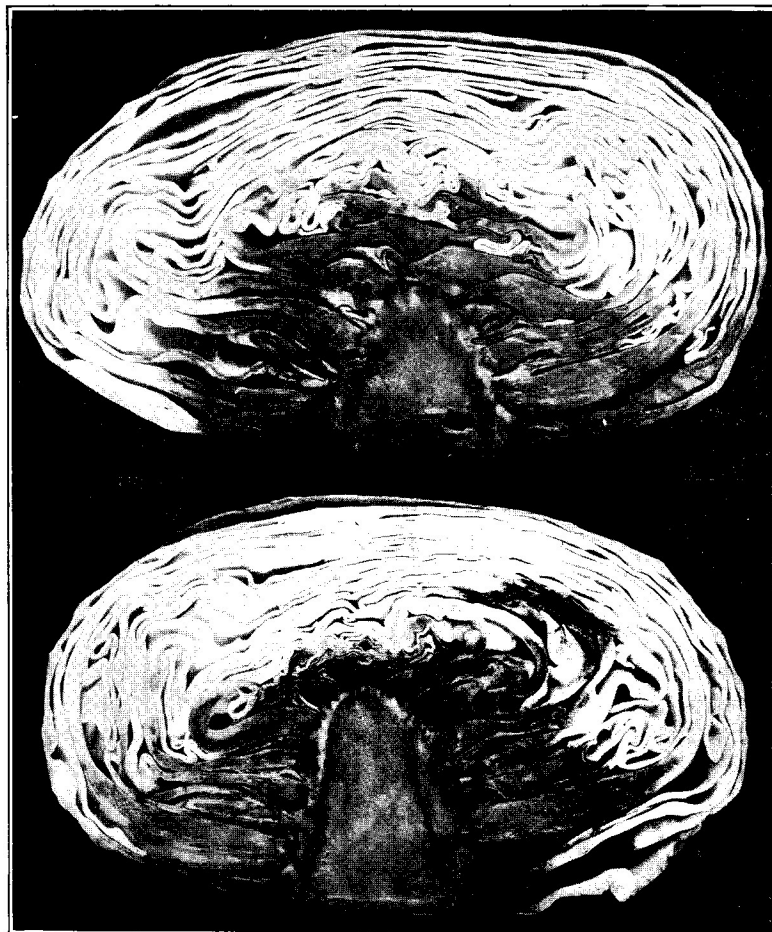


FIGURE 1. Two cabbage heads 8 days after inoculation at the base of the stump with a pure culture of the *Pythium* species isolated from a naturally infected head. Enlarged $\times \frac{1}{2}$.

midrib. Here a watery condition obtained not greatly unlike that which suggested the terms "leak" and "cottony leak" for diseases caused by congeneric forms in potatoes and cucumbers respectively, although, owing to preservation of the outer layers of tissue, the liquid is usually retained, so that the head, as a whole, does not become markedly wet. A mild, not unpleasant odor, as of stewing cabbage, appears to be produced by the activity of the parasite.

Concerning the prevalence of the disease in question nothing definite is known. The writer is informed that a type of damage quite similar to

that resulting from artificial inoculations has been observed on cabbage in the New York market, where it is usually known among the trade as "stump-rot" and generally assumed to be a form of bacterial soft rot. It should be mentioned that as in other cases of *Pythium* infection, after the cabbage tissues have been killed, bacteria multiply, so that the parts take on the texture and emit the disagreeable odor of putrifying material. It is hoped that further observation may yield information concerning the prevalence of *Pythium* infection and its possible relation to stump-rot.

Inoculation experiments carried out on cabbage heads, using various species of *Pythium*, indicate, as might be expected from experience in parallel cases, that pathogenicity is not confined to the form isolated from the host in question. A number of species of the "debaryanum" type derived from various sources, as, for example, from potatoes affected with leak, from diseased pea roots, from diseased sweet-potato rootlets, from sweet-potato roots affected with mottle necrosis, and from watermelon fruit affected with blossom-end rot, produced similar pathological effects, in some instances more rapidly, in other instances less rapidly than the cabbage form. Strains of *P. aphanidermatum* (Edson) Fitz. isolated from diseased watermelon fruit and from cucumbers affected with cottony leak, also gave positive results. On the other hand, certain forms of the "debaryanum" type gave only negative results. None of the species with spiny oogonia appear to be capable of infecting cabbage, nor have any of the forms with a similar intramatrix habit but with smooth oogonia, among which *P. monospermum* Pringsheim could be definitely identified, shown any indication of pathogenicity.

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