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THE CYTOLOGY OF PHYTOPHTHORA INFESTANS

By

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With 24 Figures in the Text

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A. Introduction

Phytophthora infestans DE BARY is a Phycomyceete fungus, of the order Peronosporales, (FITZPATRICK 1930). Its role as the causal agent of Late Blight in potatoes is familiar enough and a considerable body of information exists on the morphology, physiology, pathogenicity and physiological adaptation of the fungus; little, however, is known about its cytology.

De Bary (1876) in his classical investigation described the microscopic structure of P. infestans and its method of infecting the potato; this work was later supplemented by others, notably Marshall Ward (1887) and Jones, Giddings and Lutman (1912). All these workers described only the vegetative and asexual stages. The sexual phases of P. infestans were only recently known with certainty when they were described by Gallegly and Galindo (1957) and by Smoot, Gough and Gallegly (1958). It is now known that two mating types occur with equal frequency in Mexico where they produce oospores abundantly (Gallegly and Galindo 1958).

The cytology of the sexual stages has not been studied. Some aspects of nuclear behaviour in vegetative mycelium and sporangia were described by Graham (1954) who employed a Feulgen staining technique: unfortunately no detailed results were published.

The purpose of this paper is to describe the cytology of the vegetative and asexual phases of the fungus.

B. Techniques

Four pathogenic races (4, 1.2, 2.4 and 1.3.4. Black et al. 1953), were used. They were grown as follows.

1) Potato slice cultures (McKee 1964) provided mycelium, immature and mature sporangia for counting nuclei and zoospores, using method (A) of the staining schedule below.

2) Pure cultures were grown on chick pea agar slopes at c. 20⁰C (Keay 1953). After 10—14 days' growth sporangia were suspended in sterile water and zoospore liberation was induced by exposing the suspension to a temperature of c. 3⁰C for 1/2—1 hour; liberation was accelerated by re-warming the suspension to room temperature; it was then poured into Petri dishes each containing a sterile micro-
Fig. 1. Conidiophores showing nuclei in swollen nodes. Note attenuated (probably migrating) nuclei.

Fig. 2. Zoospores showing three kinds of nuclei. The "dark ground" effect is due to background stain.

Fig. 3. Immature sporangium showing migrating nucleus. Sporangium multinucleate, cross wall absent.

Fig. 4. Germinating zoospores. Note germ tube opposite "cap", see also Fig. 2.

Fig. 5. Sporangium showing "granular" and "condensed" nuclei.

Fig. 6. Nucleus of zoospore migrating "cap" first into germ tube.

Fig. 7. Later stage in migration of tube nucleus. Note the "cap" and the elongated nucleus.

1 All figures are \( \times 3000 \). Figs. 6, 7 are from preparations stained with Feulgen-Toluidine blue. Figs. 8, 9, 10 are from Acid-Haematin preparations. All other figures are from Propionic-Orcein preparations. Figs. 2, 4, 5, are from temporary preparations, all others are from permanent ones.