PLASMODIOPHORA LEWISII, NOV. SP.

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In the spring of 1926, I found mycetozoa living on some tomato and tobacco plants in the University of Chicago greenhouse. I picked up some of these organisms with a Barber pipette and transferred them to six 500 c.c. flasks containing 100 c.c. of serile Knop's solution. Bacteria were put in the flasks for the mycetozoa for food. Knop's solution was used for the organisms instead of wheat or hay infusion because th ph. in the former remains more constant.

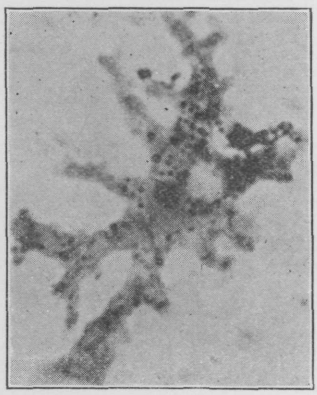

FIG. 1. Preplasmodium of *P. brassicæ* showing its nucleus and the karyosome lying against the nuclear membrane. The black dots filling the cytoplasm are oil globules. ×1000.

When first studying the mycetozoan, I noticed that it had but a single nucleus, which divided by promitosis, (Figs. 2, 3, 11). I also noticed that it moved by a rhythmic flow, which was quite different from the method employed by other mycetozoans. Though this method of movement resembled more that used by the myxomycetes, yet the contents did not flow through the vein-like structure which is so evident in the latter. Since the pseudopodia in this new organism were of typical myxopodia type, (Figs. 2, 3) the organism may be assumed to feed as others with pseudopodia of this kind.

In moving, one pseudopodium would contract with a rapid flowing movement into a lobe-like structure, (Figs. 2, 3). The contents of this lobe would then flow into another pseudopodium as if the lobe had been squeezed. The contraction of the pseudopodium into a lobe followed by the apparent squeezing of this lobe, which caused the contents to go elsewhere, gave the organism the rhythmic movement. The plasmodium in its extended form averaged 76 u. in length.

This new mycetozoan reminded me very much of the pre-plasmodium I have reported for *Plasmodiophora brassicæ*, (b) (Text Fig. 1). Oil globules, however, which were found in the latter, were missing in this organism. The method of movement also was very different from that found in *P. brassicæ*.

PRE-CYST.

In unfavorable conditions the whole plasmodium would round itself into a ball (Fig. 1). A thin wall was first secreted about the organism (pre-cyst) and then if conditions were again favorable, the plasmodium would flow out of the pre-cystic condition leaving the pre-cyst wall behind and move and feed as before, (Fig. 8). The pre-cyst averaged 20 u. in diameter. If, however, favorable conditions did not return after the pre-cyst was formed, another wall, much thicker than the first would be formed and a true cyst was the result, (Fig. 6). The cyst averaged 14 u. in diameter.

NUCLEUS.

The nucleus was a spherical structure, and appeared very small for the amount of cytoplasm. It had a karyosome which did not lie in the center of the nucleus but to one side, touching the nuclear membrane, (Fig. 10). During nuclear division this karyosome divided first, which the spindle occurring between the two polar masses, within the nuclear membrane, (Fig. 11). The organism then divided forming two new individuals, I have often found the plasmodium with two nuclei before the cytoplasm divided. Only twice have I found a plasmodium with four nuclei.

AMOEBA AND FLAGELLATE STAGES.

When favorable conditions such as food and temperature returned, the nucleus of the plasmodia cyst gave off chromidia

into the cytoplasm. Small flagellates were developed from these chromidia. The cyst and pre-cyst walls soon ruptured (Fig. 4), and the flagellates were liberated, (Fig. 5). These flagellates had a single flagellum, but showed no signs of conjugation. After swimming around in a dancing movement for a time these organisms developed pseudopodia at the posterior end. The pseudopodia were used in obtaining bacteria for food.

The flagellates later changed into amoebæ (Fig. 7). This change occurred under certain conditions as described in *P. tabaci* (a). In the amoeba stage the ectosarc could not be differentiated from the endosarc although the food material inside the organism might at first sight give one the impression that the two layers could be distinguished. I also noticed that the two cell layers could not be differentiated in the plasmodium stage.

If unfavorable conditions arose during the amoeba stage, the organism developed into a pre-cyst and cyst. Under normal conditions, however, the amoeba continued in this stage until a certain period of growth was reached and then was transformed into a pre-cyst. During this pre-cyst stage the nucleus gave off chromidia (Fig. 4), as was done in the cyst stage. I have not observed any gametes formed from these chromidia but judging from such an occurrence in *P. brassicæ* (b), *P. tabaci* (a), and *Amoeba proteus* (c), I firmly believe that gametes are produced following the pre-cyst stage in this organism. I also believe that the sexual stage takes place following the pre-cyst condition before the plasmodium is produced.

CLASSIFICATION.

SUB-PHYLUM—Sarcondia, Calkins.
CLASS—Rhizopoda, Calkins.
SUB-CLASS—Mycetozoa, Debary.
ORDER—Phytomyxidia, Schroter.
FAMILY—Plasmodiophoraceæ, Gaumann.
GENUS—Plasmodiophora, Woronin.
SPECIES—Lewisii.*

*Named for Doctor I. F. Lewis, of the University of Virginia.

BIBLIOGRAPHY.

(a) **Jones, Philip M.** Structure and cultural history of a mycetozoan found in tobacco plants with mosaic-like symptoms. Bot. Gaz. LXXXI: 446–459. 1926.

(b) **Jones, Philip M.** Morphology and cultural history of P. brassicae. Archiv. f. Protestenkunde. Bd. 63, 213; 331–327. 1928.

(c) **Jones, Philip M.** Life cycle of Amoeba proteus with special reference to the sexual stage. Archiv. f. Protestenkunde. Bd. 63, 3: 322–332. 1928.

EXPLANATION OF PLATE I.

(All photographs are ×960.)

Fig. 1. Pre-cyst just before the wall is formed.

Figs. 2, 3. Two plasmodia which have just formed lobes. Each lobe was formed by a contraction of a single pseudopodium.

Fig. 4. Pre-cyst of mature amoeba. The nucleus is giving off chromidia.

Fig. 5. Flagellate Stage.

Fig. 6. Cyst of a plasmodium.

Fig. 7. Amoeba which was formed from a flagellate.

Fig. 8. Plasmodium flowing out of a pre-cyst.

Fig. 9. Pre-cyst of young amoeba.

Fig. 10. Plasmodium in extended form. The karyosome lying against the nuclear membrane.

Fig. 11. Nucleus of the plasmodium undergoing division by promitosis.

Plasmodiophora Lewisii
Philip M. Jones

PLATE I.