Proceedings of the Iowa Academy of Science

Volume 62 | Annual Issue Article 10

1955

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Chroococcus turgidus (Kuetz.) Naegeli occurs in great abundance in the shallow pools of an alkaline fen near Silver Lake, Iowa. Observations over a period of four years have shown a characteristic association in these pools of *C. turgidus, Gomphosphaeria aponina* Kuetzing, a large species of *Oscillatoria,* a species of *Chara,* and the aquatic moss, *Drepanocladus aduncus* (Hedw.) Warnst. The fen has been well descibed by Anderson (1943) and its unique vascular flora has long been a center of botanical interest.

Observations of the *Chroococcus* material, collected for class use, revealed numerous examples of deformed individuals. The normal appearance of this species is indicated by Figure 1. The deformations noted ranged from inequalities in the sizes of daughter cells following division (Figures 2-4) to more or less complete disintegrations of protoplasts within the sheath, (Figure 5). An investigation into the possible causes of such deformations led to the discovery that a parasitic fungus was involved. The fungus, a member of the Chytridiales, is described briefly in this report.

The posteriorly uniflagellated spores of the chytrid come to rest on the surface of the host cell. A penetration tube passes through the sheath and enters the protoplast. The spore cyst swells during the next several hours, (Figure 8), becoming a sporangium having dimensions of approximately 30 microns in length and 20 microns in width. The sporangium is widest at it base. Near the end of the growth phase conspicuous refractive granules appear in the cytoplasm of the sporangium (Figure 9) and these shortly become incorporated into spores (Figure 10). Continuous observation of one sporangium showed a time lapse of approximately five hours between the initial appearance of the granules and spore discharge. The total number of spores in each sporangium was estimated to be less than sixty.

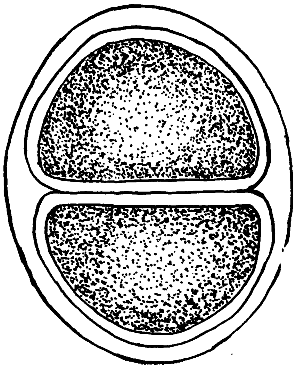
Spore discharge occurs through an inoperculate exit pore which is bordered by four or five irregularly placed, teeth. Although the initial discharge is explosive (Figure 11) not all of the spores are discharged immediately; laggard spores squeeze though the exit pore one at a time and are laterally compressed, temporarily, during this process (Figure 12). There is no external vesicle but the spores are so entangled by their flagellae, which are about 35 microns in length, that they do not disperse immediately. Many of the flagellae are trapped in the exit pore for some time and, thus, several spores may be grouped around the outside of the pore, engaged in violent tugging actions which eventually free the flagellae. At this time they look like a mass of toy ballons on long strings attempting to escape from a street vendor. Each spore contains an eccentric, refractive granule.

The number of infections per cell of the host varies considerably. As many as twenty per cell have been observed in several instances. These might all be in the same general stage of development (Figure 7), indicating a simultaneous invasion by many spores; or, might vary from new infections to old ones with empty sporangia, indicating successive invasions of the same cell (Figure 8).

In cases of heavy infestations the host cell degenerates rapidly. However, the unequal cell divisions of the host shown in Figures 3 and 6 indicate the possibility that a lightly infected cell might divide abnormally with one of the daughter cells recovering subsequently (Figure 4). In many such cases it was not possible to find direct evidence of infection.

A similar surmise is that, if the infection occurred after the onset of a normal cell division by the host, a membrane might form between the invaded periplasm of the infected half and its central portion creating the appearance shown in Figures 3 and 4 of a protoplasmic "plug" being withdrawn from the disintegrating daughter cell.

Attempts to identify the organism have been indecisive. The facts that this is a monocentric, eucarpic chytrid having the spore cyst enlarging to form an inoperculate sporangium indicate the possibility that it might belong to such genera as *Rhizophydium* or *Phlyctochytrium,* in both which an external vesicle is lacking at the time of spore discharge. The distinguishing feature between these genera is the development of an apophysis in the latter genus and its absence in the former. The point has been surprisingly difficult to settle. Professor Karling, from observation of Kodachrome photomicrographs in the author's possession, suggested that an apophysis might be present. However, the author is of the opinion that simulation of the appearance of an apophysis might be accounted for by the shrinkage of the host protoplasm, some of which is caught on mycelial branches just below the point of entrance of the penetration tube: thus, it stands out as a bulge on the surface of the host cell. The mycelium is of such a delicate nature that its outline is lost in the coarsely granular protoplasm of the host cell. For this reason, an absolute decision on the matter of the apophysis has not been reached. Mycelial branches have been observed extending between pairs of infected cells and, in one chance observation, the penetration tube was seen to branch in the clear area of the slime sheath. In this instance



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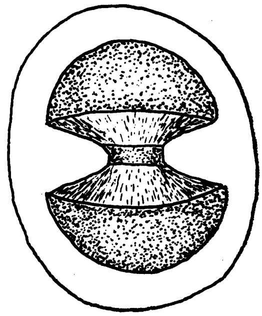

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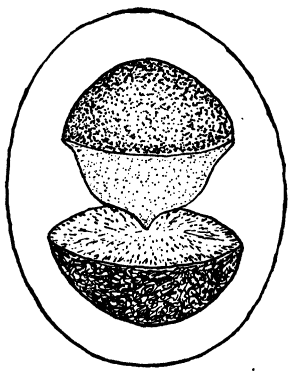

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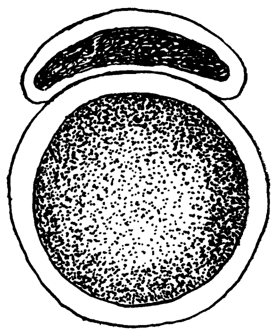

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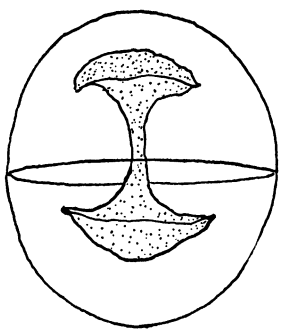

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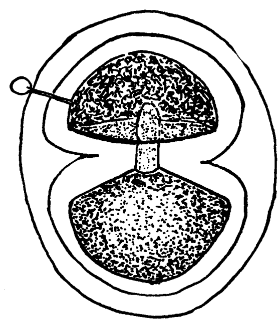

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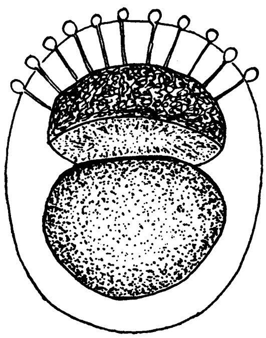
Explanation of figures.

Figure 1. Normal appearance of *Chroococcus turgidus* shortly after the completion of cell division. Figures 2.-5. Samples of the types of deformations in this species which led to the present investigation. Figures 6.-7. Early stages of infection by the parasite. Figure 8. Several stages on one host. The early growth of the spore cyst into a sporangium is indicated. Resting spores are also present.



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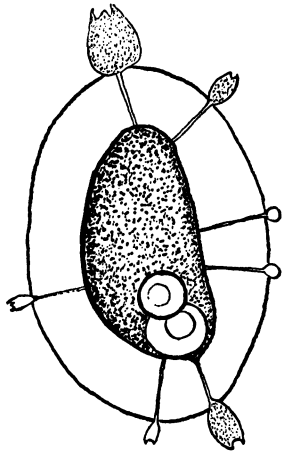

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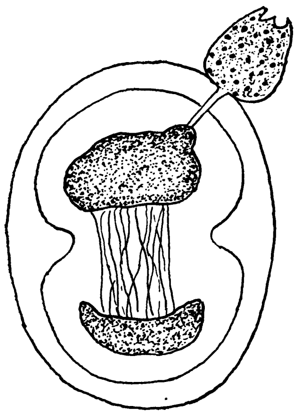
For explanation, see page 100.

it was evident that no apophysis was present.

In the event that later work might establish the presence of an apophysis this organism might well be referred to *Phlyctochytrium planicorne,* as described by Atkinson (1909). His illustration shows clearly that both the apophysis and the teeth around the exit pore are present.

On the assumption that an apophysis is absent the organism might be referred to one originally described by Zopf (1888) as *Rhizophyton agile* and later transferred to the genus *Rhizophydium* by Fischer (1892). A summary of this description has been included by Sparrow (1943). Zopf noted that this species caused a heavy infestation in *Chroococcus turgidus,* heavy enough, in fact, to almost eliminate the host from the culture medium. His excellent drawings show that his organism did not form teeth around the exit pore of the sporangium. Such teeth are so characteristic of the organism described here that the difference could be considered to be of a specific nature. His drawings, which are reproduced in color, also portray the marked discoloration of the infected host cells which become dark and show an intensification of the blue pigment.

The formation of endobiotic resting spores by the organism under discussion might negate the assumption that it belongs to either one of the genera suggested. A characteristic of both genera (Sparrow, 1943) would seem to be the formation of epibiotic resting spores. The resting spores are illustrated in Figure 8 and



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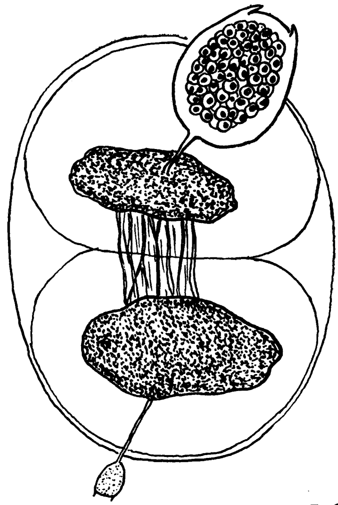

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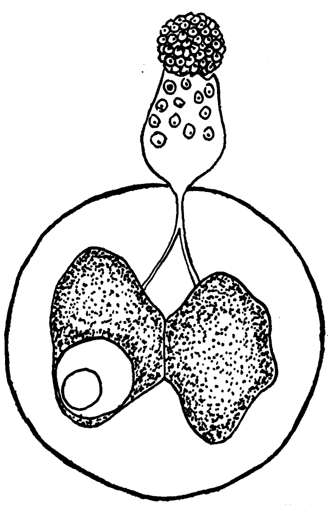

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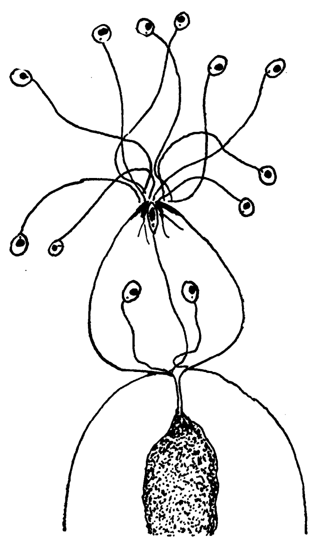

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Explanation of figures.
Figures 9-12. Stages in spore formation and spore discharge are shown.

11. They have been observed on serveral occasions and always contain a large refractive globule. Germination has not been observed and it is not known whether they are formed as the result of a sexual process.

Chroococcus turgidus maintains itself reasonably well in gross cultures left in the original water samples from the Silver Lake fen. Casual observations during a period of serveral months have shown the parasite to be always present in some stage of development. This suggests that cultural experiments might lead to a more clear-cut nomenclatural decision than the author feels qualified to make. Moreover, a study of the relationship between a parasite and a large, single-celled plant such as this particular species of *Chroococcus* might well contribute valuable information on the general subject of parasitism.

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