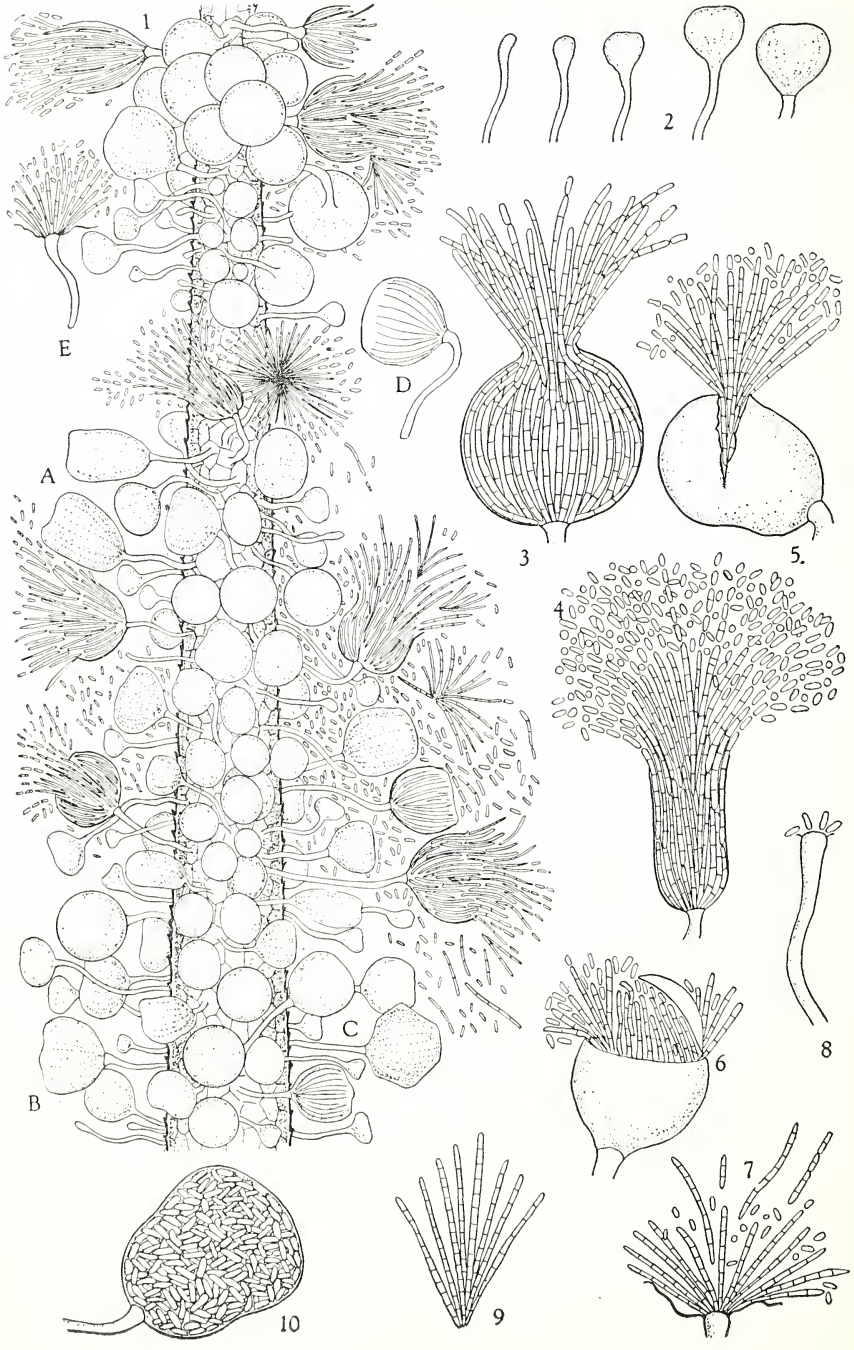
An Unusual Keratinophilic Microorganism

John S. Karling, Purdue University

In the course of my studies on keratinophilic chytrids in the United States and Brazil an unusual microorganism was isolated from various keratinic substrata such as hair, snake skin, feathers, etc. This organism was discovered first in baited soil cultures from Van Cortlandt Park, New York City, in 1938 and later it was found in several cultures from various parts of the Amazon Valley in Brazil. Since then it has been found in soil from New Jersey, Virginia, Louisiana, Indiana and Iowa. Apparently, it is a widely distributed and common soil inhabitant. A description of this organism was given in connection with a paper on Brazilian chytrids which I presented at the annual meeting of the Mycological Society of America at St. Louis, Mo., in 1946 with the hope that microbiologists present might offer a clue to its identity and relationships. None were offered, and since that time a description of it has been presented at several meetings of bacteriologists. In the meantime, Couch's (1949, 1950) excellent studies on *Actinoplanes* have brought to light information on a group of organisms which combine what may be called fungal and bacterial characteristics, and the present organism appears to be related to this group. Accordingly, for the present it is being assigned provisionally to the family Actinoplanaceae. Studies are now being made on its cultural characteristics, nutrient requirements, life cycle and cytology for the purposes of determining its exact identity and relationships.

So far, human hair cut into short segments and bits of snake skin have proven to be the best bait for trapping this organism. When such substrata are floated on top of soil samples which have been flooded with animal charcoal water they usually become infected within two weeks if the organism is present in the soil. Fig 1 shows the extent to which a piece of human hair may become infected. Such fragments may disintegrate completely in the course of several weeks, which indicates that the organism is a fairly rapid decomposer of keratinophilic tissues.

This organism's most prominent characteristics are variously-shaped stalked sporangia which bear motile bacteria-like cells arranged in elongate filaments or rods as is shown in figs. 1 to 10. Its hyphae or stalks are quite slender and may vary from .8 to 2μ in diameter. The sporangia vary from spherical, 10-35μ, to urceolate, 8-20 x 12-30μ, oval, broadly obpyriform and angular in shape and have a hyaline, relatively thin wall. Under low magnifications they have a glistening appearance which makes them readily recognizable. As shown in fig. 2 they begin as knobs at the apex of projecting hyphae or stalks which may be 15 to 60μ in length. As they increase in size they assume the various shapes noted above and finally become delimited from the stalk by a cross septum. At the same time their content assumes a linear arrangement with lines oriented on the base of the sporangium and running to the apex as is clearly visible at A, B, C, and other places in fig. 1. The nature of this linear arrangement becomes quite clear as the sporangia mature and dehisce. It is the


1
2
E
D
A
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5.
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C
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result of the development of long filaments or rods of bacteria-like cells from the contents of the sporangia.

Dehiscence of mature sporangia may be accelerated by placing them or the infected substrata in fresh animal charcoal water. Under such conditions they may dehisce within half an hour, and emit masses of individual cells or spores, filaments or rods of spores, or brush-like clumps of filaments. This is well-illustrated at various places in fig. 1. The sporangia may dehisce by deliquescence of the apex as in figs. 3 and 4, crack open as in fig. 5, or at times the apex may be lifted up like an operculum or lid as in fig. 6. Oftentimes, the entire apex may deliquesce and the spores and filaments are discharged in plume-like masses (fig. 4). Frequently most of the sporangial wall may disappear leaving only a remanent and a few filaments and spores attached to the stalk (figs. 7, 8). Fairly often the sporangia and stalks may break off from the substratum in mounting (figs. 1 D, 1 E), but these dehisce in the normal manner.

As noted earlier the cells or spores are arranged in long filaments or rods in the sporangia. During dehiscence the individual cells of a rod may separate and emerge singly, but usually entire rods or brush-like clumps of rods (fig. 10) may emerge or project out of the orifice of the sporangia as shown in figs. 3 and 5. The individuals at the projecting tip of the rods then separate in succession (figs. 4, 5) and swim away. Frequently, long filament of cells or bunches of them emerge and go swimming and whirling away in the surrounding medium (fig. 1) by the action of flagella on the individual cells. Eventually most if not all of the filaments or rods break up into individual cells, and the number of motile cells surrounding an infected piece of substrata may be so great that the water becomes markedly clouded. If the sporangia do not dehisce for a long time the individual cells of the filaments may separate and fill the sporangium with a seething mass of motile spores as shown in fig. 10. Occasionally, the lower part of a sporangium may be filled with separate motile cells while in the upper part the cells may still be connected in filaments.

The filaments or rods which emerge intact from the sporangium and can be measured accurately vary from 6 to 18μ in length, depending on

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Explanation of Figures

Fig. 1. Heavily infected segment of human hair showing immature, mature and dehiscing stalked sporangia.

Fig. 2. Stages in the development of a sporangium.

Fig. 3. Large globular dehiscing sporangium with filaments or rods of cells emerging at the apex.

Fig. 4. Large elongate sporangium whose entire apex has deliquesced. Filaments and individual cells emerging in a plume-like manner.

Fig. 5. Oval sporangium with a lateral tear or opening through which filaments are emerging.

Fig. 6. Small dehiscing sporangium with apical lid.

Figs. 7, 8. Remanents of sporangia and stalks with a few filaments and cells.

Fig. 9. Brush-like clump of filaments of cells.

Fig. 10. Undehisced sporangium filled with individual motile cells.

the number of cells of which they are composed, and are .8 to 1.5μ in diameter. The individual cells or spores are short rods, 2 to 3μ long by .8 to 1.5μ in diameter. Their movement or motility is typical of bacterial cells and quite unlike that of fungus zoaspores. So far the number lengths and position of the flagella have not been definitely determined.

So far no other type of fructification has been found in this organism, and it is not certain that it produces occasional conidia as in *Actinoplanes* or *Myceliochytrium* (Johnson, 1945). However, the evidence at hand suggests that it may be a member of the Actinoplanaceae and representative of a new genus.

Summary

An unusual saprophitic fungus- and bacterium-like organism was isolated from soil samples which had been baited with keratinophilic substrata such as human hair, snake skin, feather, etc.

So far as is known it is characterized primarily by spherical, oval, urceolate, elongate, and angular stalked sporangia which bear motile bacterium-like spores or cells arranged end to end in long filaments or rods.

Its identity and relationships are not certain yet, but it appears to be related to the Actinoplanaceae and is assigned provisionally to this family.

Literature Cited

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