CHAPTER 33

SOMMERSTORFFIA Arnaudow
God. Sofiĭ Univ. II. Fiz.–Mat. Fak., Book 1, a 19:183. 1922-23

Mycelium delicate; intramatrical portion holocarpic; irregular and lobed; extramatrical portion functioning as a capturing device, consisting either of slender, rigid hyphae with short, lateral, spiciform branches, the apex of each tapering abruptly and covered in part with a mucilaginous substance, or reduced to fusiform, stalked cells to which host animals adhere. Sporangium tubular, irregular, lobed. Spores monomorphic; encysting on discharge in a cluster at exit pore, then excysting and secondary planonts produced; at germination may produce a pyriform or sicyoid sporeling.

Oogonia ornamented. Oospore single. Antheridial apparatus lacking.

Type species: *Sommerstorffia spinosa* Arnaudow, God. Sofiĭ. Univ. II. Fiz.–Mat. Fak., Book 1, a 19:183, figs. 1-4. 1922-23.

Two species have been described, one an unnamed member of the genus (Karling, 1952). See discussion of *Sommerstorffia spinosa* for remarks on the genus.

The original description of the genus and species (*spinosa*) generally has been cited (Sparrow, 1960, for example) as appearing in volume 116 of *FLORA*, published in 1923. This is in error, since Arnaudow (1923) did not include a formal description in this journal. In his paper of 1922-23, Arnaudow made it clear that the account published in *FLORA* was a preliminary statement only.

Sommerstorffia spinosa Arnaudow
God. Sofiĭ Univ. II. Fiz. –Mat. Fak., Book 1, a 19:183. 1922-23
(Figure 102 D-H)

Extramatrical mycelium delicate, rotifer-capturing; limited in extent, intra- and extramatrical; consisting of one to a few slender, straight, bent, or slightly irregular rigid, spiciform branches 60-200 X 5.6-10.4 μm; apex of each branch tapering abruptly to form a blunt spike or spine; then conspicuously refractive, and frequently provided apically with a hyaline, homogenous substance; 5-10 (-15) μm in diameter. Intramatrical mycelium delicate, usually filling body of host; tubular, lobed and very irregular; functioning as a sporangium, or growing outside host to form the extramatrical, rotifer-capturing mycelium. Sporangium formed by conversion of intramatrical mycelium; producing a long, sinuous, extramatrical exit tube 50-160 (-680) μm long by 8-12 μm in diameter at base. Spores monomorphic; on release from the sporangium encysting in an irregular, dense clump at the exit orifice; at excystment, laterally biflagellate, reniform, secondary spores emerge; primary spore cysts 6-11 μm in diameter; planont encysting, and at germination may produce a pyriform or sicyoid sporeling capable of adhering to host individuals. Oogonia developed on septate branches. Oogonial wall ornamented;

papillate, bullate, or with large, blunt, truncate or faintly bifurcate projections. Oospore single; up to 22 μm in diameter. Antheridial apparatus not observed.

We have not recovered living specimens of *Sommerstorffia spinosa* in any of our collections, but have had available preserved material (on slides) from the F. K. Sparrow collection. The foregoing description is in large measure taken from Karling's (1952) exceptionally fine account, but with the description of the sexual apparatus adapted from Arnaudow (1922-23, 1923).

In its development, *Sommerstorffia spinosa* essentially has two structural phases, namely, the extramatrical, rigid hyphae (Fig. 102 H) adapted for "capturing" host animals, and a tubular, irregular and lobed, Intramatrical thallus that converts into a sporangium (Fig. 102 D-G). The fungus can be recognized readily by the first of these growth phases, but the latter - when occurring alone in animals and not accompanied at least by remnants of the sporelings (Karling, 1952: figs. 16-23) - cannot be distinguished easily (if at all,) from diminutive forms of *Aphanomyces*. Usually (if one may judge from the literature), host animals containing the sporangial thallus also show evidence of the rigid, spiciform, extramatrical hyphae.

The morphology of growth and development in Arnaudow's species was detailed by Karling, in 1952, and his account in brief form is summarized in the following paragraph.

Three thallus types of *Sommerstorffia spinosa* can be recognized: endobiotic, epibiotic, and epiendobiotic. The extramatrical portion of the thallus consists of the rigid hyphal pegs, at the mucilaginous apex of which a host animal may adhere. An endogenous thallus then develops (Fig. 102 F) and converts into a sporangium (holocarpic). Spores are formed endogenously (Fig. 102 E), and upon release (Fig. 102 D) cluster at the sporangium exit orifice. Subsequently, excystment occurs and laterally biflagellate, reniform planonts emerge. The secondary spores encyst, then germinate in a unipolar fashion (Karling, 1952: figs. 16, 17) to become a pyriform or sicyoid sporeling. These sporelings also serve as a capturing device, with host animals being "caught" on the neck of the cell (Karling, 1952: fig. 29A). An intramatrical thallus subsequently develops within the animal after penetration is effected (Karling, 1952: figs. 30, 31). The extramatrical portion of the sporeling functions as the rudiment of the extramatrical, spiciform hyphal system (Karling, 1952: figs. 32-35).

There have been two reports of a sexual apparatus for *Sommerstorffia spinosa* but the accounts are basically in conflict. Arnaudow (*loc. cit*.) described small, papillate or roughened oogonia (containing one oospore) for *S. spinosa* but unaccompanied by antheridial structures. Prowse (1954b:137) found a single, pluriovulate oogonium in his material of this species, but wrote that it was "... just possible that there [was] more than one fungus involved..." Arnaudow's figure illustrating oogonia of *S. spinosa* looks suspiciously like the sexual apparatus of *Aphanomyces scaber*, but the oogonium reported by Prowse cannot be related to any recognizable watermold.

Karling (1952), who examined more generous material of Arnaudow's species than either Prowse (1954b) or Sparrow (1929), saw no sexual apparatus. We are dubious

of the accuracy of Arnaudow's report since it apparently was not based on unifungal cultures.

The behavior of the spores of *Sommerstorffia spinosa* at discharge -- emerging and encysting as in *Aphanomyces* and subsequently excysting to release secondary planonts - constitutes the only character on which to retain the species (and the genus) in the Saprolegniaceae. In conformity with Sparrow's (1929) and Karling's (1952) decision, we are keeping *S. spinosa* in the family to which it was assigned by Arnaudow, recognizing at the same time that the thallus is not typically saprolegniaceous. Until the sexual apparatus of *S. spinosa* has been characterized and evaluated for taxonomic characters, the best repository for the taxon seems to be in the Saprolegniaceae.

Sommerstorffia spinosa has been found in rotifers of the genera *Colurus* and *Distyla* (synonymous with *Colurella*), *Lepadella*, and *Monostyla (=Lecane*) and in the flagellated protozoan *Entosiphon ovatum*. *See* distribution records following.

CONFIRMED RECORDS: -- BRITISH ISLES: Prowse (1954b:134 *et sqq*., figs. 1, 2). BULGARIA: Arnaudow (*loc. cit*.). CZECHOSLOVAKIA: Cejp (1959a:85, fig. 17). INDIA: Karling (1966a:107). POLAND: Czeczuga and Próba (1980:705, fig. 1A, B). UNITED STATES: Karling (1952:390 *et sqq*., figs. 1-59); Sparrow (1929:90 *et sqq*., fig. 1).

RECORDED COLLECTIONS: -- NEW ZEALAND: Karling (1966f). UNITED STATES: C. E. Miller (1965); Sparrow (1933). WEST INDIES: Sparrow (1952a).

SPECIMENS EXAMINED: -- UNITED STATES, F. K. Sparrow, preserved specimens.

Sommerstorffia sp. Karling
Mycologia 44:406 *et sqq*., figs. 60-76. 1952

Intramatrical thallus delicate, usually filling body of host; tubular, lobed and very irregular, functioning as a sporangium. Sporangium produced by conversion of intramatrical thallus; producing 1-3 short, broad, tapering, exit papillae. Spores monomorphic; on release from the sporangium encysting in a well-defined clump at the exit orifice; at excystment, laterally biflagellate, reniform, secondary spores emerge; germination of secondary spores not observed. Extramatrical thallus consisting of broadly to narrowly fusiform, stalked cells, subtended by a small, oval to circular holdfast; 15-24 x 5-10 μm; lacking specialized sites of attachment for capture of host animals; at germination, producing the intramatrical thallus. (Adapted from Karling, *loc. cit*.)

In contrast to *Sommerstorffia spinosa*, this unnamed fungus does not have a hyphal system morphologically adapted for the capture of prey. In *Sommerstorffia* sp. the epibiotic phase in the plant's development is limited to stalked, fusiform cells (Karling, *loc. cit*., figs. 60-62). These cells function in the inoculation of host animals - just as do the sporelings of *S. spinosa*. The epibiotic elements of *S. spinosa*, however, are not provided with a holdfast apparatus. It is assumed (Karling, *loc. cit*.) that the fusiform

thalli of *Sommerstorffia* sp. adhere to the lorica of the host, but the mechanism by which this is accomplished is not known. A narrow penetration tube develops from the free end of the fusiform thallus in contact with the lorica, and a tubular, holocarpic thallus eventually is formed endogenously.

Karling found the unnamed fungus only in the same cultures of rotifers with *Sommerstorffia spinosa*. He suggested that *Sommerstorffia* sp. might be a new species, but recognized also that because of its association solely with *S. spinosa* cultures, it might in some way relate to the development of that species.

CONFIRMED RECORD: -- UNITED STATES: Karling (*loc. cit.*).