TRICHOPHRYA DANAE SP. NOV., A SUCTORIAL PROTOZOAN FROM GREENLAND WATERS

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Introduction.

In the summer of 1950 under the leadership of Dr. Å. Vedel Tåning the Danish research-ship "Dana" carried out investigations in Greenland waters during the period $^{29}/_{6}$—$^{26}/_{7}$ (see fig. 18). When off the south-east coast of Greenland on $^{30}/_{6}$ we observed at a distance of some hundred metres from the ship a small number of yellowish flakes floating on the surface. At the distance the colour stood out strongly in the rays of the descending sun. Directing our course to the spot, which we may call St. X in the following, we collected a goodly sample of such a flake, which proved to have a jelly-like consistency. It was found that the main body was formed of a suctorial species and colonies of bacteria; smaller samples were then preserved in formalin and alcohol; a culture was also attempted, but it was not succesful. The investigations to be described was based therefore only on preserved material, which may be acknowledged as a shortcoming; on the other hand, this material has been very rich and it has thus been possible to study the reproduction and a considerable amount of form variation in the species.

In addition to St. X, where special conditions prevailed, the same suctorial species was found as a plankter at several of the stations in Danmarksstrædet and in Davisstrædet, where net samples were collected at the surface. All these stations are noted in the accompanying chart, fig. 18. The total material of phytoplankton which, in addition to these net samples consists of water samples from 0,10, 20 and 50 m in depth will be published later.

In staining the cell nuclei the Feulgen nucleal reaction has been used; I owe my best thanks to dr. phil. O. Hagerup, Inspector of the Botanical Museum, Copenhagen University, for carrying out this staining work for me.

Morphology of *Trichophrya Danae.*

The cells of non-conjugating individuals are elongate with hemispherical ends; the length being on an average 1.5 to 1.9 times the breadth; the breadth is often greatest at the middle, but the cell can be more or less constricted centrally (figs. 1—2); the few cells observed containing swarmers have an oval form (fig. 3); on the conjugation stages the shape of the cell is somewhat irregular (figs. 13—15). The cell content has a yellowish colour. There are two different kinds of tentacles, the one shorter and thicker with a broader basal part and an expansion at the distal end: "Saugtentakeln" (KAHL 1931, p. 450); in most individuals again there are some very long tentacles which may even be considerably longer than the cell body; they are very slender and end in a spherical expansion: "Fangtentakeln" (KAHL l. c.). The latter are more frequent in specimens from St. X than in those collected at the plankton stations. The tentacles are arranged in two bundles, one at each of the hemispherical ends of the body, the number of tentacles in a bundle is very variable; often the prehensile tentacles get so woven in and out between each other, the suctorial tentacles and the slime material, that it is impossible to determine the number with certainty. Some of the cells contain no vacuole, others one or exceptionally two. The size of the cells in solitary individuals from St. X:

Length 86—104 μ, average 96 μ,
Breadth 60— 75 μ, average 69 μ.

and in solitary individuals from the plankton stations:

Length 86—169 μ, average 129 μ,
Breadth 55— 95 μ, average 73 μ.

Fig. 1—6. *Trichophrya Danae.* Fig. 2 from St. 7235; the other figures from St. X. (All figures × 500).

Fig. 1. A frequently occurring form of the cell body, broadest in the middle, and the ends where the tentacles have their origin hemispherical in shape; macronucleus to be seen and a smaller chromatin body (micronucleus?). Stained with saffronin.

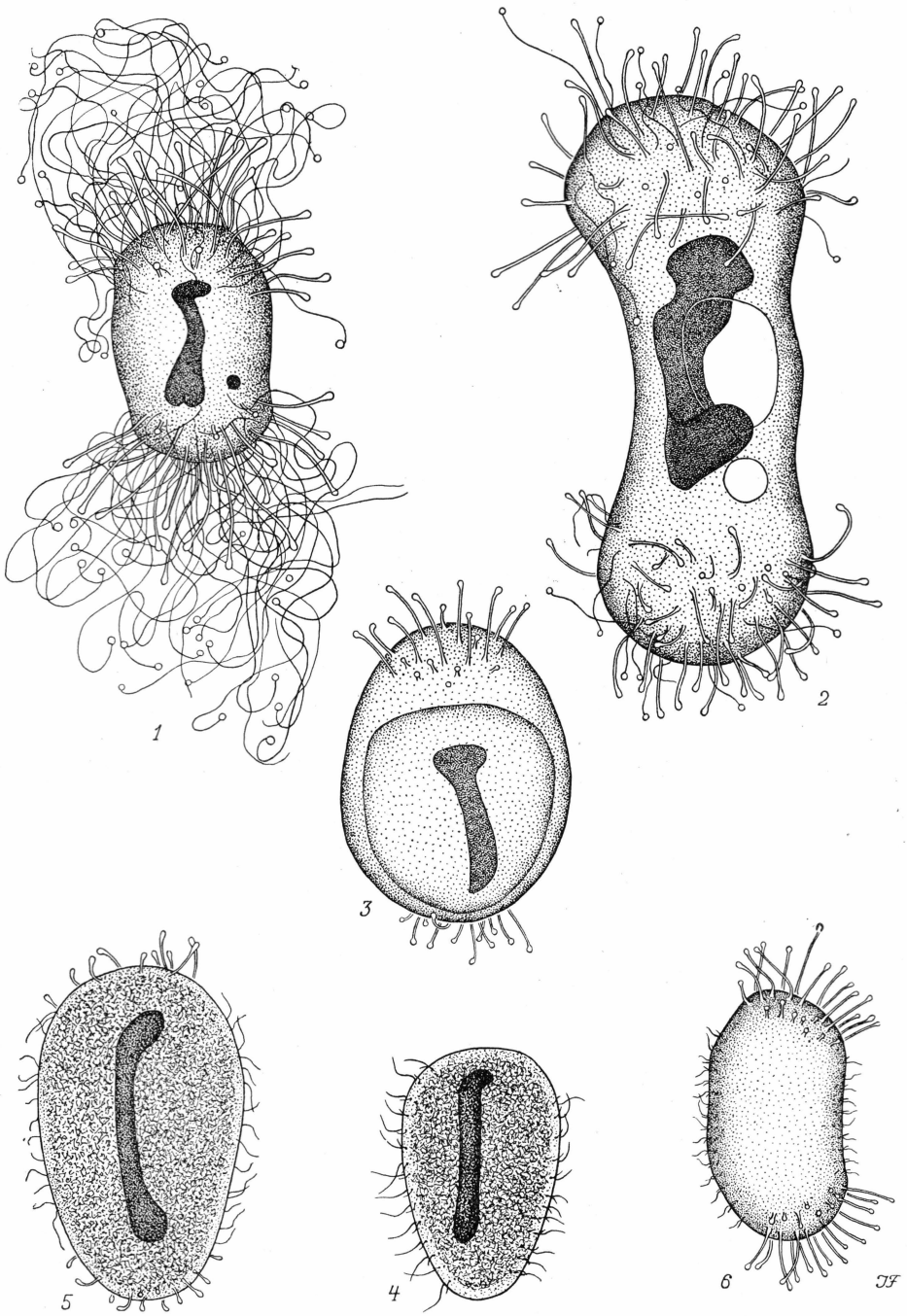
Fig. 2. Such a dumpbell shaped cell is seldom found in the material and the size is unusually large. The suctorial tentacles are short and there are only few prehensile tentacles; 2 vacuoles, macronucleus in the shape of a horse-shoe. Unstained.

Fig. 3. Oval mother-individual with a nearly developed bud; macronucleus of the latter can be seen, but not that of the mother-cell. Unstained.

Fig. 4. Egg-shaped swarmer with many cross-rows of cilia; cylindrical macronucleus. Unstained.

Fig. 5. Swarmer which has formed some few tentacles. Unstained.

Fig. 6. A specimen almost completely developed, still with cilia. Macronucleus not seen. Unstained.



Figs. 1—6.

The macronucleus lies near the longer axis of the cell; in rare cases it is roundish-oval; usually it is cylindrical, sausage- or ribbon-shaped; the ends are often thickened and more or less deeply incised or forked; they are often bent, even horseshoe-shaped macronuclei have been observed (see fig. 2). In many individuals we find one to many, larger or smaller roundish chromatin bodies scattered in the plasma outside

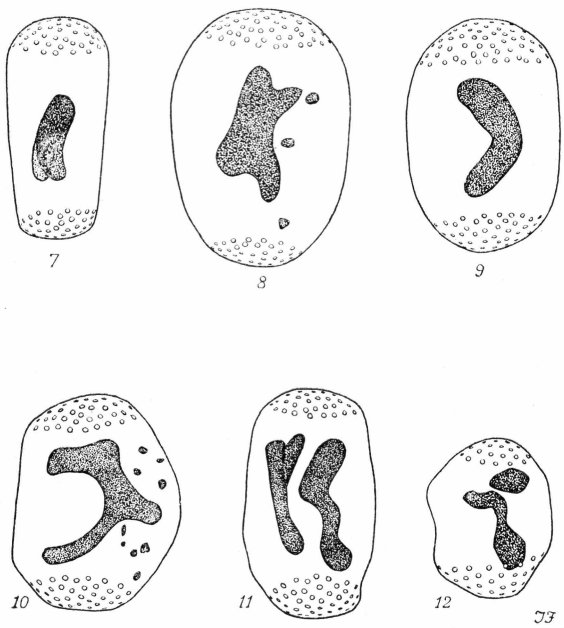


Fig. 7—12. *Trichophrya Danae.* Macronuclei of different shapes in non-conjugating individuals; fig. 11 has 2 macronuclei; in some of the cells chromatin bodies can be seen in the plasma outside the macronucleus. The material has been stained with FEULGEN's process; no vacuoles can be seen in these preparations. The contours of the cells are outlined and the areas marked where the tentacles arise. (× 500).

the macronucleus; some of these may be supposed to be micronuclei; a closer study of these bodies has not been undertaken however, as the preservation of the material in formalin or alcohol is not suited to a deeper cytological study. The macronucleus in the swarmers is cylindrical with a thicker often slightly bent end-piece in the broadest part of the cell (figs. 3—5). In the conjugation stages the cells assume shapes different from the common kind found in the solitary individuals; the macronucleus changes correspondingly (figs. 13—15).

Swarmers were fairly frequently observed in the material from St. X; they have a rather constant shape: subconical—egg-shaped; cilia are present in many, but not very distinct, crossrows (figs. 4—6); the length varies from 55 to 83 μ with an average of 73 μ; greatest breadth 35—52 μ,

average 42 μ; in a few cases the formation of swarmers was observed, they are formed by simple endogenous budding (fig. 3).

Conjugation is very common in the individuals from the St. X patch samples; whereas it was only once observed in the material from the plankton stations; usually there are only two conjugants, but there can be three or four cells connected in the conjugation. Specimens of conjugating cells are shown in figs. 13—15. The macronucleus is more or less bent, so that its ends as in the solitary individuals are near to the tentacle bundles. The majority of the conjugating cells are considerably smaller than the sizes given above for the solitary individuals (cf. fig. 16).

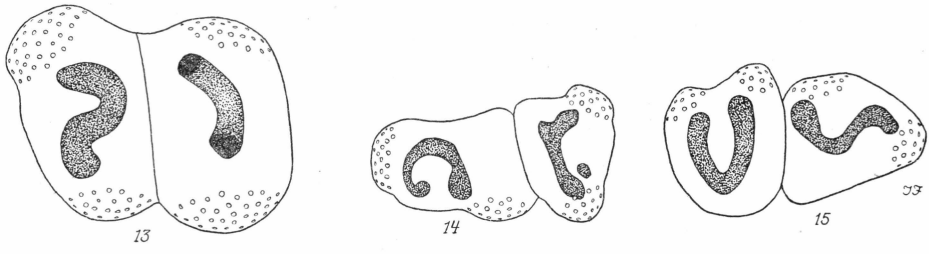


Fig. 13—15. Conjugating individuals of *Trichophrya Danae*. The shape of the cell becomes irregular during this process; the ends of the macronuclei turn here each towards its tentacle bundle as in solitary individuals. Stained with FEULGEN's reaction. (× 500).

From earlier investigations (GÖNNERT 1935, p. 132) it is known that "conjugation epidemies" may occur in Suctorians when unfavourable conditions for their thriving set in; something of this kind may have happened in the case of the material from St. X.

The author has been unable to identify the above-described form with any known hitherto, and venture therefore to set it up as a new species under the name of *Trichophrya Danae*.

It has to be admitted, that our fig. 2 shows a great resemblance to *Sphaerophrya pelagica* DADAY (DADAY 1888, Taf. III, fig. 16), later referred by KAHL (1934) to the genus *Trichophrya*. The species *Sph. pelagica* is however very constant in shape and size. DADAY who has seen masses of it, gives the length of the cells as 90—92 μ and the greatest breadth 50—52 μ, whereas our fig. 2 is an extreme case in a rich variation in form and size (cf. figs. 1—3, 7—12, 16—17). The reproduction in *Sphaerophrya pelagica* is not known and hence a very important character is lacking for the identification with our species. DADAY (l. c.) considers it not unlikely, that *Sph. pelagica* is a larva—for the time free-living—or a young stage, probably identical with *Trichophrya salparum*, which lives in the gill-space of pelagic Salps. *Tr. Danae* reproduces in the pelagic condition, which therefore can hardly be a young stage, in any

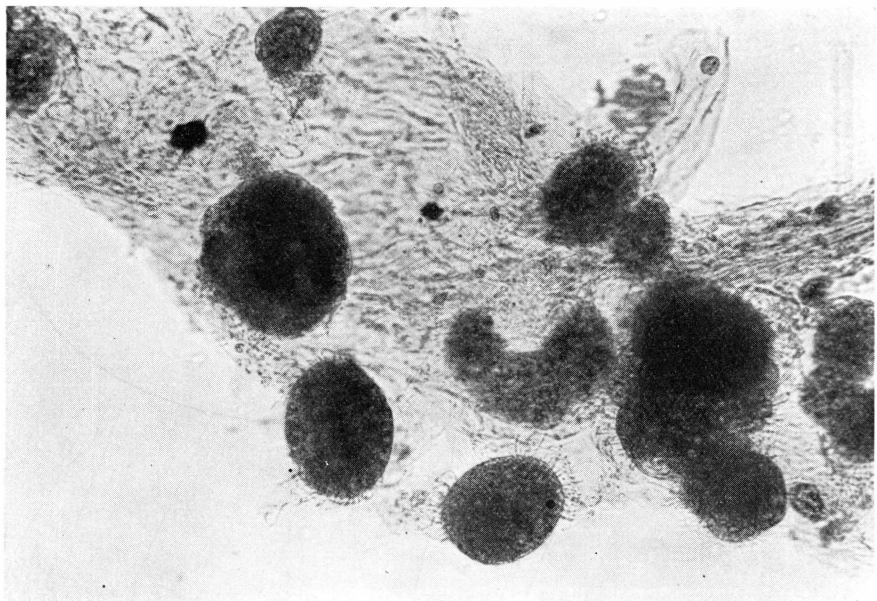


Fig. 16. Individuals of *Trichophrya Danae* clinging by means of their tentacles to a bacterial patch; small clumps of bacteria are seen scattered in threaded but otherwise structurless substance which makes the patch coherent. The bent object in the middle of the figure shows the conjugation of 3 small individuals; a very small solitary individual is seen low down in the figure. Stained with saffronin. (× 190). Material from St. X.

case not of *Tr. salparum*, which has endogenous multiple budding, whereas *Tr. Danae* has endogenous simple budding.

Occurrence of *Trichophrya Danae* in Greenland Waters.

At St. X *Trichophrya Danae* was found in very strong concentration in patches of about 100 m square, rich in bacteria; the flakes were fairly coherent, as they contained a threaded, jelly-like substance (cf. fig. 16). Owing to the small amount of nourishment to be found in seawater these patches have probably not developed in the pelagic condition where they were found; they may have been formed on a solid substratum and here we must think of the sea-bottom near the coast or the ice floes, where other microorganisms or birds' excrements may have served the bacteria as nutriment. To obtain possibly an indication of the original home of the patches, the material was examined for the presence of foreign bodies. The following species of plankton were found:

Chaetoceros decipiens
Fragilaria oceanica
Navicula sp.
Nitzschia seriata
Rhizosolenia alata
— *hebetata f. semispina*
Thalassiosira gravida
Thalassiosira Nordenskjöldi
Ceratium lineatum
Peridinium pellucidum
— sp.
Trochiscia Vanhöffeni
Parafavella denticulata

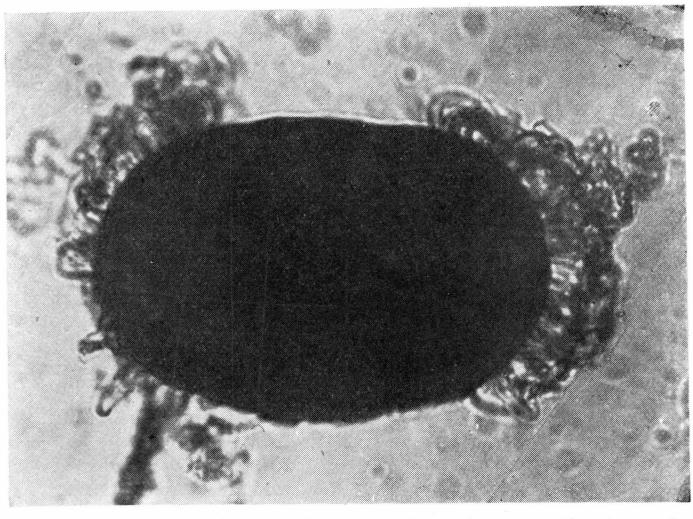


Fig. 17. A specimen of *Tr. Danae* with, as is often the case, the tentacles strongly entangled. Stained with saffronin. (× 700). Material from St. X.

Of these species *Rhizosolenia hebetata* f. *semispina* was very common, the others more or less rare; also found were remains of Crustacean skeletons and excrements and—on glowing the material—a small quantity of mineral particles.

The organisms belong to species commonly found in the plankton from this part of Danmarksstrædet, and it may be supposed that they were trapped in the patches after these had broken loose. Thus they afford no light on the place of origin. The relatively many empty skeletons indicate that the plankters have contributed to the nourishment of the bacteria. Probably these have served the Suctorians as nutrient and we may suppose there has been a certain biocoenotic equilibrium at these peculiar biotopes.

At 7 of the 10 stations where *Tr. Danae* was found in the plankton the surface temperature varied between 1.5° and 3° C; at the 3 other stations the temperature was over 6° (at St. X where we had the mass occurence of *Tr. Danae* under extreme conditions, no hydrographical observations were made, as this station lay outside the planned route

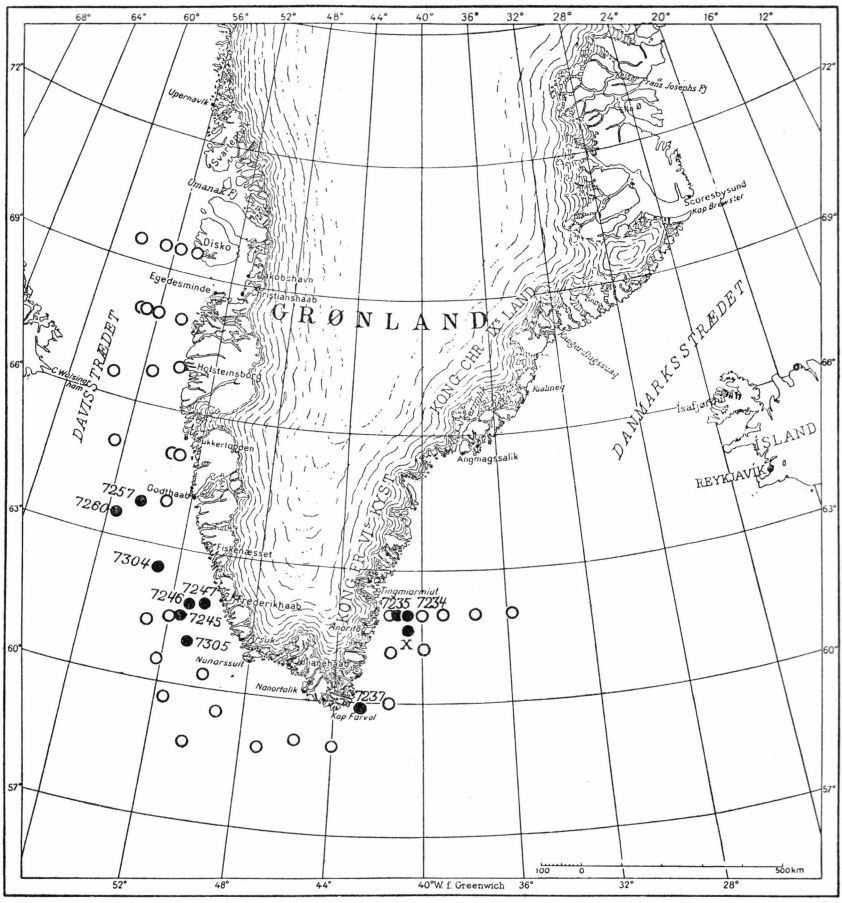


Fig. 18. Chart showing the occurrence of *Trichophrya Danae* in Greenland waters; the empty circles indicate plankton stations where the species was not found; the filled circles positive stations, alongside are the figures showing the Nos. of the stations in the ship's journal. The station marked X is the locality where *Tr. Danae* was found in masses in the patches of bacteria.

of "DANA"). As *Tr. Danae* shows but little difference in frequency at these stations, the hydrographical data give no information with regard to the species' temperature requirements. If we consider the plankton communities at the stations mentioned, paying attention only to the dominant species, we obtain the following series, arranged according to declining frequency:

Chaetoceros decipiens
Rhizosolenia hebetata f. *semispina*
Peridinium pallidum
Thalassiosira gravida
Peridinium depressum
— *pellucidum*

These are all more or less eurythermal species, widely distributed in arctic and temperate waters and thus give no information about, whether *Tr. Danae* must be considered a cold-water species or not; only on 2 of the 10 plankton stations it was found in company with a distinctly arctic species *(Ceratium arcticum)* in somewhat dense concentration. At the northernmost stations west of Greenland (cf. fig. 18) where the decidedly arctic-neritic species: *Achnanthes taeniata*, *Chaetoceros furcellatus*, *Fragilaria oceanica* and *Nitzschia frigida* occurred in large numbers, *Tr. Danae* was not found; according to what we know at present *Tr. Danae* may be called a boreal species.[1])

As far as I am aware, hitherto only 3 marine suctorial species were noted from Greenland waters: the sessile *Ophryodendron trinacrium* GRUBER and *Acineta* sp. and a plankton species: [?] *Podophrya patula* CLAP. & LACHM.; these finds all come from the Little Karajakfjord (VANHÖFFEN 1897, pp. 249, 291).

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[1]) After the printing of this paper I have found a single individual of *Trichophrya Danae* in the surface net sample from the „DANA"-Station 6607 (56°30′ N. Lat.; 7°28′ E. Long.) in the North Sea. This sample was collected 22nd May, 1947. The find indicates, that the species has a fairly wide regional distribution.