DOES THIOSIPHON EXIST?

In his system of *Beggiatoaceae* in Bergey's Manual of Determinative Bacteriology 1948 C. B. van Niel classified the thiobacterium *Thiosiphon adriaticum* Klas 1936 in his Appendix between the insufficiently characterized filamentous sulphur bacteria, which may be related to the *Beggiatoaceae*. Here I would not like to discuss the morphology of *Thiosiphon adriaticum*, but I only wish to analyse the conclusions of C. B. van Niel more precisely. These conclusions lead him to doubts about the validity of the genus *Thiosiphon*.

In the first place van Niel established, that the description (Klas 1936) differs from the published photomicrograph in regard to the size of conidia. From the photomicrograph the size of conidia seems to be about 30 by 200 microns, but in the text proportions 13 to 30 by 30 to 60[1] microns are stated. – But if we compute the breadth of conidia, respectively of filaments, from fig. 2/2,3, 3/4,5, and I./2, we also receive considerably greater values than those stated in diagnosis (40 to 95 microns instead of 30 microns at maximum). These differences probably result from various perceptions of the term magnification. Klas by all means states as magnification (Vergr.) to her figures and photomicrographs the magnifying power of the microscope, by which the objects were drawn or photographed, while van Niel conceives it as the relation between the size of the figure and the size of the object (Abbildungsmasstab[2]). Howeyer, I could convince myself, that the size of several conidia can exceed the length of 60 microns. But there are chiefly the stages of the beginning of the constriction, which can be followed by new intercalar constrictions, because the succession of constrictions can sometimes be disturbed (Klas 1936, p. 212).

Then van Niel is of opinion, that the entire appearence of *Thiosiphon* »is strongly reminiscent of that of *Beggiatoa mirabilis (B. gigantea)* in certain cultures«, and that »the short conidia, described in the text, strikingly resemble the species of *Achromatium*«. – I should not be able to agree with van Niel's reasoning, because the same polar structure itself of *Thiosiphon* is so striking, that it is not possible to confound it with *Beggiatoa*. At least *Beggiatoa* is never fixed on any object.

Van Niel repeats in his conclusions the mentioned meanings:

»Since (a) the internal structure of the large *Beggiatoaceae* is easily damaged, (b) the segmentation in living individuals is difficult to observe when

[1] The upper limit is thus 60 and not 50 microns as cited erroneously by van Niel.

[2] See e. g. Westphal 1941, p. 457.

the filaments are filled with suphur, (c) the presence of *Achromatium* in the locality from which *Thiosiphon* was collected is almost certain, and (d) the developmental cycle is merely a reconstruction of simultaneously observed elements, considerable doubts as to the validity of the genus appears justified«.

To the premises (a) to (d) I would like contradict with the following facts:

Ad (a): The internal structures of the large *Beggiatoaceae* can in reality easily be damaged, but the transversal walls are yet so resisting, that they sometimes remain preserved even when the filaments perish. Damages, which would be so strong, that they would destroy the transversal walls, should be easily recognised.

Ad (b): It is quite correct, that in living *Beggiatoaceae* it is difficult to observe the segmentation, when they are filled with sulphur. But by means of a treatment with certain chemicals, which dissolve sulphur, e. g. absolute alcohol, the transversal walls become clearly visible. In the same manner the transversal walls become visible, when at the presence of oxygen and absence of hydrogen sulphide the sulphur of the bacteria is oxydized i. e. when we let the organism »to starve out of sulphur«. K l a s stated on p. 210, that by the mentioned treatments she had not succeded to prove the existence of transversal walls. D e l a p o r t e, who investigated the cytology of *Thiosiphon adriaticum* stated the absence of transversal walls (D e l a p o r t e 1939, p. 78). In fixed and stained material they should be clearly noticeable.

Ad (c): Conidia of *Thiosiphon* cannot be confounded with *Achromatium* (without the regard of their various shape and structure), because *Achromatium* is motile (one of the characteristics of fam. *Achromatiaceae)*, while for conidia of *Thiosiphon* it was not possible to prove any motility (K l a s 1936, p. 212). Besides that we cannot explain the accordance in thickness of separated conidia with the thickness of non separated conidia and the filaments. This accordance is also very noticeable in photomicrograph V/1 (K l a s 1936).

Ad (d): Continual microscopical obsevations on growing cultures are without doubt necessary, but they represent considerable difficulties, while the physiology and ecology of this rare species are completely unknown. Probably the whole process of the formation of conidia occurs very slowly so that we can expect only possibility to observe the last phases of separation.

The above mentioned facts do not permit us to agree with v a n N i e l's oppinion. Occasional proper observations of several specimens of this rare bacteria only proved,that there is doubtlessly a non motile, a fixed, a polarly built *Beggiatoacea* without any segmentation, which is propagated by fractions to smaller parts, i. e. by formations of so-called conidia. A *Beggiatoacea* with such chraracteristics can neither be classified with the genus *Beggiatoa* nor with the genus *Thiothrix*. If we do not want to enlarge by force the genus *Thiothrix* [as this genus was made by W i n o g r a d s k y (1888) and retained by B a v e n d a m m (1924), E l l i s (1932) as well as by v a n N i e l (1948)], then the formation of a separate genus *Thiosiphon* is by all means the best solution.

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POSTOJI LI THIOSIPHON?

(Sadržaj)

U svojoj obradi begijatoaceja u Bergeyevu manualu determinativne bakteriologije van Niel je posumnjao u valjanost roda *Thiosiphon* (Klas 1936). Kao razlog za to svoje mišljenje navodi: razlike u veličini gonidija, do kojih je došao usporedivši u originalnom opisu podatke u tekstu s mikrofotografijama; upadljivu sličnost, koju pokazuje *Thiosiphon* s vrstom *Beggiatoa mirabilis* u nekim kulturama i sličnost gonidija tiosifona s pripadnicima roda *Achromatium*.

Laka povredljivost poprečnih membrana, poteškoće njihova promatranja u nitima krcatim sumporom, gotovo sigurna prisutnost ahromacija na staništu tisifona i samo rekonstruirani razvojni ciklus opravdavaju po van Nielovu mišljenju znatno sumnjanje u valjanost roda.

Autor se ne slaže s van Nielovim gledištem oslanjajući se na podatke literature, koje van Niel nije uzeo u obzir, kao i na prigodna vlastita opažanja. Razlike u veličini gonidija na mikrofotografijama i u tekstu proizlaze vjerojatno iz različitog shvaćanja pojma »povećanja«. S vrstom *Beggiatoa mirabilis (B. gigantea) Thiosiphon* ne može se zamijeniti, jer *Beggiatoa* niti je polarno građena, niti je pričvršćena na supstrat. Prema autorovu mišljenju bi se oštećenja, koja bi uništila poprečne membrane, morala bez daljeg prepoznati. Osobito se ne može mimoići postojanje poprečnih membrana u fiksiranim i bojenim preparatima (usporedi navode Delaporte-ove 1939), a ni kod primjeraka, u kojih je sumpor bio uklonjen oksidacijom ili otapanjem, što je navedeno i u originalnom opisu (str. 210). Od ahromacija razlikuju se gonidije tiosifona, osim po obliku i strukturi, i time što su negibljive, a promatranje njihova razvoja predstavlja znatne poteškoće.

Autor smatra polaritet i nedostatak poprečnih membrana karakteristikama, koje jasno dokazuju, da se radi o posebnom organizmu, a koje prema tome opravdavaju i postavljanje novoga roda.

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