What ever happened to *Thermomicrobium fosteri* Phillips and Perry 1976?

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*Thermomicrobium fosteri* Phillips and Perry 1976 was included on the Approved List of Bacterial Names with the type strain designated ATCC 29033. However, this strain is no longer directly listed in the ATCC online catalogue and the only reference to ATCC 29033 is under ATCC 35268, a strain of *Thermoleophilum minutum* Zarilla and Perry 1986. There currently appears to be no formal documentation in the pages of the International Journal of Systematic and Evolutionary Microbiology with regards either the current status of the name *Thermomicrobium fosteri* Phillips and Perry 1976 or its type strain ATCC 29033.

In 1976, Phillips and Perry (Phillips & Perry 1976) published a proposal for the creation of a novel species, *Thermomicrobium fosteri* based on the type strain PTA-1 that was also deposited in the ATCC as ATCC 29033. This strain was isolated from a 'mud sample from littoral area (near Beaufort) on coast of North Carolina' (Phillips & Perry, 1976). The name *Thermomicrobium fosteri* was included on the Approved lists of Bacterial Names (Skerman *et al.*, 1980, 1989) with reference to the description being that of Phillips & Perry (1976) and the type strain ATCC 29033. A search of the current ATCC online catalogue (www.atcc.org on 25.11.2013) produced no results for the name ‘Thermomicrobium fosteri’, but a single result for ATCC 29033. The reference to ATCC 29033 is, however, as part of the strain designations of strain PTA-1=ATCC 35268, a strain of *Thermoleophilum minutum* Zarilla and Perry 1986 (Zarilla & Perry 1986), isolated from ‘mud, Beaufort, NC (=North Carolina’). The explanation as to the link between ATCC 29033 and ATCC 35268 is a note under the entry for *Thermomicrobium fosteri* Phillips and Perry 1976 in the List of Prokaryotic Names with Standing in Nomenclature (www.bacterio.net) to the effect:

‘Strain ATCC 29033 was deposited as *Thermomicrobium fosteri*. Later correspondence with the depositor indicated that it was a mixed culture and the purified strain was re-deposited as ATCC 35268.

Reference: TANG (J.): Personal communication (to J.P. Euzéby) (December 20, 2001)’

While this explains the link between the ATCC numbers, also confirmed by the location where these two ATCC deposits were isolated, it does not explain what has happened to the species *Thermomicrobium fosteri* Phillips and Perry 1976 (Approved Lists) and raises a number of questions.

1. If the original description was not based on a mixed culture and only the strain deposited in the ATCC as ATCC 29033 was a mixed culture, then with the deposit of a pure culture, ATCC 35268, that strain could serve as the type strain. It should be remembered that the Judicial Commission has ruled in Opinion 74 (Trüper, 2003) that any strain deposited in a culture collection knowingly derived from the original strain (i.e. strain PTA-1 of Phillips & Perry, 1976) may serve as the type strain.

2. In the publication proposing the name *Thermoleophilum minutum* Zarilla and Perry 1986 (Zarilla & Perry, 1986) the authors clearly refer to strain PTA-1=ATCC 35268, although they do not identify it as the type strain of *Thermomicrobium fosteri* Phillips and Perry 1976 (Approved Lists). Based on all available evidence PTA-1=ATCC 35268 can be considered to be the type strain of *Thermomicrobium fosteri* Phillips and Perry 1976 (Approved Lists).

3. Technically placing strain PTA-1=ATCC 35268 (the type strain of *Thermomicrobium fosteri* Phillips and Perry 1976 (Approved Lists)) in the same species as YS-4= ATCC 35265 (the type strain of *Thermoleophilum minutum* Zarilla and Perry 1986 (Zarilla & Perry, 1986)) makes these two names heterotypic synonyms and under normal circumstances the choice of the correct epithet is governed by Rule 23a (Lapage *et al.*, 1992). However, placing strain PTA-1=ATCC 35268 in a novel species without recognizing it as the type strain of an existing species or without creating a new combination based on the basonym *Thermomicrobium fosteri* Phillips and Perry 1976 (Approved Lists) is contrary to Rule 51b:

‘Among the reasons for which a name may be illegitimate are the following.

1. If the taxon to which the name was applied, as circumscribed by the author, included the nomenclatural type of a name which the author ought to have adopted under one or more of the Rules.

2. If the author did not adopt for a binary or ternary combination the earliest legitimate generic name, specific
epithet, or subspecific epithet available for the taxon with its particular **circumscription, position** and **rank**.

In other words rather than designating YS-4 (=ATCC 35265) as the type strain of *Thermoleophilum minutum* Zarilla and Perry 1986, Zarilla & Perry (1986) should have created a **new combination** ‘Thermoleophilum fosterii’ (Phillips & Perry, 1976) Zarilla and Perry 1986. Based on current information it would appear that one interpretation is that the name *Thermoleophilum minutum* Zarilla and Perry 1986 is illegitimate and may not be used.

An alternative explanation for the actions of Zarilla & Perry (1986) is that the properties of *Thermomicrobium fosterii* Phillips and Perry 1976 (Approved Lists) given by Phillips & Perry (1976) is based on that of a mixed culture, a situation covered by Rule 31a. In the search for such evidence it is noteworthy that Phillips & Perry (1976) indicate in the description of *Thermomicrobium fosterii* that ‘cells contain a pink carotenoid pigment(s), especially when grown on acetate at lower temperatures’. However, there is no explicit mention of pigmentation in the description of *Thermoleophilum minutum* (Zarilla & Perry, 1986). A closer examination of the article by Perry (2006) provides a number of additional clues when referring to either properties of members of the genus *Thermoleophilum* or the species *Thermoleophilum minutum* in that ‘... the colonies were small, white, dry and flat’ (page 844), ‘... the organisms are nonmotile and have no pigmentation’ (page 845) and ‘... colonies were small, round, and white and generally dry and flaky. They were often closely associated with pink-pigmented thermophilic strains on original isolation, and separating the slow-growing *Thermoleophilum* species was a tedious process’ (page 845). Perry (2012) also indicates that members of the genus *Thermoleophilum* are ‘unpigmented’ (page 2011) and that *Thermoleophilum minutum* is ‘nonpigmented’ and ‘forms small translucent to white colonies on agar surfaces’ (page 2013). There, therefore appears to be evidence that the properties listed for *Thermomicrobium fosterii* Phillips and Perry 1976 (Approved Lists) in Phillips & Perry (1976) may not be solely those attributable to a pure culture of strain PTA-1. If this is the case then enforcement of Rule 31a, either in the wording given by Lapage et al. (1975, 1992) or the modified version accepted by the International Committee on Systematics of Prokaryotes (Sadder, 2005) and its Judicial Commission (De Vos et al., 2005) would mean that the name *Thermomicrobium fosterii* Phillips and Perry 1976 (Approved Lists) is not validly published. Strain PTA-1 = ATCC 35268 would then not serve as the **nomenclatural type** of a species and *Thermoleophilum minutum* Zarilla and Perry 1986 would not be (at the time of writing) a **heterotypic synonym** of another species name.

The wording of the Code does not appear to be ambiguous, nor are the consequences of that wording in any doubt, so a ‘Request for an Opinion’ would not be appropriate. However, it is clear that there is uncertainty whether the name *Thermomicrobium fosterii* Phillips and Perry 1976 (Approved Lists) is associated with properties that are derived from a mixed culture, which would make the name not validly published. Alternatively the name *Thermomicrobium fosterii* Phillips and Perry 1976 (Approved Lists) is validly published and ATCC 35268 is to be accepted as the **type strain**, which has an influence on the legitimacy of the name *Thermoleophilum minutum* Zarilla and Perry 1986. When the **circumscription** of *Thermoleophilum minutum* Zarilla and Perry 1986 includes the **type strain** of *Thermomicrobium fosterii* Phillips and Perry 1976 (Approved Lists) then this taxon is, according to Zarilla & Perry (1986) to be transferred to the genus *Thermoleophilum*, which would result in the creation of a **new combination**. ‘Thermoleophilum fosterii’ (Phillips & Perry, 1976) Zarilla and Perry 1986. As a consequence *Thermoleophilum minutum* Zarilla and Perry 1986 is illegitimate. If this is the case then the replacement name ‘Thermoleophilum fosterii’ would need to be created in accordance with Rule 54 (Lapage et al., 1992).

Given the evidence presented, one of two courses of action may be followed. A clear statement is required as to which one of these two solutions is to be endorsed, since the current **status quo** cannot continue. This matter must be addressed as soon as possible by the International Committee on Systematics of Prokaryotes and its Judicial Commission.

### Declaration of a potential conflict of interest

The author is employed by an organization that commercially offers both taxonomic services as well as biological material to the scientific community. This may be perceived as a potential conflict of interest.

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### REFERENCES


