

Is the bacterial genus name *Rhodococcus* Zopf 1891 illegitimate? Request for an Opinion

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Abstract

In 2014, it was reported that the bacterial genus name *Rhodococcus* Zopf 1891 was illegitimate due to the priority of the cyanobacterial genus name *Rhodococcus* Hansgirg 1884. Since that time, the consequences of this conclusion have been largely ignored, whilst changes have been made to relevant Rules of the International Code of Nomenclature of Prokaryotes, including significant changes to the way in which the Code treats the names of members of *Cyanobacteriota*. Given the complexity of the nomenclatural issues, we request the opinion of the Judicial Commission of the International Committee on Systematics of Prokaryotes as to whether the genus name *Rhodococcus* Zopf 1891 (Approved Lists 1980) is illegitimate.

In 2014, Tindall published a characteristically scholarly ‘Note on the genus name *Rhodococcus* Zopf 1891 and its homonyms’ [1], in which he stated that ‘The wording of the 1975 and subsequent revisions of the Code dealing with bacteria/prokaryotes is such that the name *Rhodococcus* Zopf 1891 is illegitimate’, as a consequence of the bacterial genus name being a later homonym of the algal (cyanobacterial) genus name *Rhodococcus* Hansgirg 1884 [2, 3]. This conclusion was based on the wording of the 1975 and 1990 revisions of the International Code of Nomenclature of Prokaryotes (ICNP [4, 5]), in which Principle 2 states that ‘The nomenclature of bacteria is independent of botanical nomenclature, except for algae and fungi, and of zoological nomenclature, except protozoa’ [5]. The illegitimate nature of the name was reinforced by the then wording of Rule 51b(4), which stated that a name is illegitimate ‘If it is a junior homonym of a name of a taxon of bacteria, fungi, algae, protozoa, or viruses’ (‘junior homonym’ meaning the same as the more commonly used term ‘later homonym’, the terminology adopted in the more recent revisions of the ICNP [6, 7]; see below).

Although the illegitimacy of the bacterial genus name *Rhodococcus* Zopf 1891 (Approved Lists 1980) [8, 9] has been noted in several discussions of rhodococcal taxonomy (e.g. [10–13]), no action to address this has been taken either by taxonomists or the wider microbiological community, despite Rule 51 a of the ICNP clearly stating that ‘A name contrary to a Rule is illegitimate and may not be used’ [5–7] and Rule 54 providing clear guidance on the replacement of names [7]. Indeed, a recent reappraisal of the systematics of *Rhodococcus* provided an emended description of the genus and yet made no reference to the apparent illegitimacy of the name itself [14]. Moreover, it is notable that the authoritative LPSN resource [15] lists *Rhodococcus* Zopf 1891 as a correct name and suggests that it is only a ‘Potential later homonym of the algal genus *Rhodococcus* Hansgirg 1884’ (<https://lpsn.dsmz.de/genus/rhodococcus>).

Subsequent to the publication of Tindall [1], in which it is clearly concluded that *Rhodococcus* Zopf 1891 is an illegitimate name, there have been revisions to both Principle 2 and Rule 51b. Principle 2 currently reads ‘The nomenclature of prokaryotes is **not independent** of botanical and zoological nomenclature’ although this is clarified by ‘Note. This principle takes effect with publication of acceptance of this change by the ICSP (from 1 January 2001) and is not retroactive’ [7]. The stipulation that Principle 2 is not retroactive thus, potentially, circumvents the synonymy of *Rhodococcus* Zopf 1891 and *Rhodococcus* Hansgirg 1884. However, following a proposal by Tindall in 2016 [16] and subsequent consideration by the International Committee on Systematics of Prokaryotes [17], Rule 51b(4) of the ICNP was amended and currently states that the reasons which render a name illegitimate include ‘If a new name or combination validly published before 31 December 2000 is a later homonym of a name of a taxon of

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Keywords: *Actinomycetota*; *Cyanobacteriota*; homonym; International Code of Nomenclature of Prokaryotes; Request for an Opinion.

Abbreviations: ICN, International Code of Nomenclature of algae, fungi and plants; ICNP, International Code of Nomenclature of Prokaryotes; ICSP, International Committee on Systematics of Prokaryotes; LPSN, list of prokaryotic names with standing in nomenclature.

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prokaryotes, fungi, algae, protozoa or viruses' [7]. Thus, it would seem clear from this new wording, and the date inserted, that *Rhodococcus* Zopf 1891 remains an illegitimate name, as originally concluded by Tindall [1].

As an addendum to his central argument, Tindall [1] also addressed the potential significance of the observation that *Rhodococcus* Hansgirg 1884 may itself be a later heterotypic synonym of the cyanobacterial genus name *Chroococcus* Nägeli 1849. However, Tindall highlighted that 'It should be noted that Principle 2 and Rule 51b(4) make no reference to the status of names under the [botanical and zoological codes]' meaning the wording of ICNP does not require 'that only legitimate/acceptable or validly published/available names be taken into consideration with regards establishing whether names are homonyms' [1]. The current wording [7] of ICNP Principle 2 and Rule 51b(4) are the same in this regard and this interpretation does not seem to be affected by subsequent changes to the ICNP that ensure that cyanobacterial names validly published under the International Code of Nomenclature of algae, fungi and plants (ICN, botanical code [18]) are now recognized as valid under the ICNP [19, 20], again with no caveats regarding the status of cyanobacterial names as synonyms or otherwise. Also of note is that Tindall [1] refers to an AlgaeBase entry as the source of 'the information that *Rhodococcus* Hansgirg 1884 is regarded as a synonym of the cyanobacterial/cyanophyte genus name *Chroococcus* Nägeli 1849'. However, a version of the AlgaeBase entry on *Rhodococcus* Hansgirg 1884 (www.algaebase.org/search/genus/detail/?genus_id=42893, updated by M.D. Guiry on 31 October 2023) made no reference to the apparent synonymy of those two algal genera, and stated 'This name is of an entity that is currently accepted taxonomically' and that the genus is a member of the family *Chroococcaceae*; subsequently this entry was updated on 19 December 2023 to note that the currently accepted name for the type species *Rhodococcus caldiariorum* Hansgirg is *Gloeocapsa bituminosa* (Bory) Kützing 1849 [21]. The Index Nominum Genericorum also lists *Rhodococcus* Hansgirg 1884 as a name in current use [22]. In contrast, the CyanoDB 2.0 database of cyanobacterial genera [23] lists *Rhodococcus* Hansgirg in Wittrock et Nordstedt 1884 as a synonym of *Chroococcus* Nägeli 1849. The synonymy, or otherwise, of *Rhodococcus* Hansgirg 1884 and *Chroococcus* Nägeli 1849 (or *Gloeocapsa* Kützing 1843) evidently requires further study, ideally using contemporary molecular methods. Nevertheless, it appears that *Rhodococcus* Hansgirg 1884, *Chroococcus* Nägeli 1849 and *Gloeocapsa* Kützing 1843 are cyanobacterial genus names that are validly published under the ICN and so should be recognized as validly published under the reciprocation now embedded in the ICNP. The recognition of cyanobacterial *Rhodococcus* Hansgirg 1884 as validly published under the ICN would thus appear to confirm that *Rhodococcus* Zopf 1891 is indeed an illegitimate name.

In considering Judicial Opinion 106, the Judicial Commission of the ICSP deemed the 'potential issue with the genus name *Rhodococcus*' as 'beyond the scope of this Judicial Opinion' [24]. In view of the complexity of the above summarized nomenclatural issues, and the potential significance if the names of multiple *Rhodococcus* species names are deemed illegitimate and so need to be replaced, we request here the opinion of the Judicial Commission as to whether the genus name *Rhodococcus* Zopf 1891 (Approved Lists 1980) is illegitimate.

Funding information

The authors have not received any support for this work from funding agencies.

Acknowledgements

We thank Mike Guiry (National University of Ireland, Galway) for his advice concerning the AlgaeBase entries and Dr. Jan Mareš (České Budějovice, Czech Republic) for helpful comments.

Conflicts of interest

The authors declare that there are no conflicts of interest.

References

- Tindall BJ. A note on the genus name *Rhodococcus* Zopf 1891 and its homonyms. *Int J Syst Evol Microbiol* 2014;64:1062–1064.
- Hansgirg A. Bemerkungen zur Systematik einiger Süßwasser-algen. *Österr botan Zeitschrift* 1884;34:313–318.
- Wittrock VB, Nordstedt CFO. Algae aquae dulcis exsiccatae. *Bot Not* 1884:121–128.
- Lapage SP, Sneath PHA, Lessel EF, Skerman VBD, Seeliger HPR. (eds). *International Code of Nomenclature of Bacteria (1975 Revision)*. Washington, DC: American Society for Microbiology, 1975.
- Lapage SP, Sneath PHA, Lessel EF, Skerman VBD, Seeliger HPR. (eds). *International Code of Nomenclature of Bacteria (1990 Revision)*. *Bacteriological Code*. Washington, DC: American Society for Microbiology, 1992.
- Parker CT, Tindall BJ, Garrity GM. International Code of Nomenclature of Prokaryotes. *Int J Syst Evol Microbiol* 2019;69:S1–S111.
- Oren A, Arahal DR, Göker M, Moore ERB, Rossello-Mora R, et al. International Code of Nomenclature of Prokaryotes. Prokaryotic Code (2022 Revision). *Int J Syst Evol Microbiol* 2023;73:005585.
- Zopf W. Ueber Ausscheidung von Fettfarbstoffen (Lipochromen) seitens gewisser Spaltpilze. *Ber Deutsch Bot Ges* 1891;9:22–28.
- Sneath PHA, McGowan V, Skerman VBD. Approved lists of bacterial names. *Int J Syst Bacteriol* 1980;30:225–420.
- Li S-H, Yu X-Y, Park D-J, Hozzein WN, Kim C-J, et al. *Rhodococcus soli* sp. nov., an actinobacterium isolated from soil using a resuscitative technique. *Antonie van Leeuwenhoek* 2015;107:357–366.
- Goodfellow M, Sangal V, Jones AL, Sutcliffe IC. Charting stormy waters: a commentary on the nomenclature of the equine pathogen variously named *Prescottella equi*, *Rhodococcus equi* and *Rhodococcus hoagii*. *Equine Vet J* 2015;47:508–509.
- Sangal V, Goodfellow M, Jones AL, Seviour RJ, Sutcliffe IC. Refined systematics of the genus *Rhodococcus* based on whole genome analyses. In: Alvarez H (eds). *Biology of Rhodococcus*. *Microbiology Monographs*, vol. 16. Springer, Cham; 2019.
- Vázquez-Boland JA, Scortti M, Meijer WG. Conservation of *Rhodococcus equi* (Magnusson 1923) Goodfellow and Alderson 1977 and rejection of *Rhodococcus hoagii* (Morse 1912) Kämpfer et al. 2014. *Int J Syst Evol Microbiol* 2020;70:3572–3576.

14. Val-Calvo J, Vázquez-Boland JA. *Mycobacteriales* taxonomy using network analysis-aided, context-uniform phylogenomic approach for non-subjective genus demarcation. *mBio* 2023;14:e0220723.
15. Parte AC, Sardà Carbasse J, Meier-Kolthoff JP, Reimer LC, Göker M. List of Prokaryotic names with Standing in Nomenclature (LPSN) moves to the DSMZ. *Int J Syst Evol Microbiol* 2020;70:5607–5612.
16. Tindall BJ. Redefining homonyms under Rule 51b (4) of the International Code of Nomenclature of Prokaryotes. *Int J Syst Evol Microbiol* 2016;66:5618–5619.
17. Oren A, Arahal DR, Rosselló-Móra R, Sutcliffe IC, Moore ERB. Public discussion on a proposed revision of the International Code of Nomenclature of Prokaryotes. *Int J Syst Evol Microbiol* 2021;71:004918.
18. Turland N, Wiersema J, Barrie F, Greuter W, Hawksworth D. *International Code of Nomenclature for Algae, Fungi, and Plants (Shenzhen Code) Adopted by the Nineteenth International Botanical Congress Shenzhen*. China: Koeltz Botanical Books; 2018.
19. Oren A. Three alternative proposals to emend the Rules of the International Code of Nomenclature of Prokaryotes to resolve the status of the *Cyanobacteria* in the prokaryotic nomenclature. *Int J Syst Evol Microbiol* 2020;70:4406–4408.
20. Oren A, Arahal DR, Rosselló-Móra R, Sutcliffe IC, Moore ERB. Emendation of General Consideration 5 and Rules 18a, 24a and 30 of the International Code of Nomenclature of Prokaryotes to resolve the status of the *Cyanobacteria* in the prokaryotic nomenclature. *Int J Syst Evol Microbiol* 2021;71:004939.
21. Molinari Novoa EA, Guiry MD, Guiry GM. AlgaeBase. World-wide electronic publication, National University of Ireland, Galway; 2023. <https://www.algaebase.org> [accessed 6 November 2023].
22. Farr ER, Zijlstra G. (eds). *Index Nominum Genericorum (Plantarum)*. World-Wide Electronic Publication, 1996.
23. Hauer T, Komárek J. *CyanoDB 2.0 - On-Line Database of Cyanobacterial Genera*. World-wide electronic publication, University of South Bohemia & Institute of Botany AS CR, 2022.
24. Arahal DR, Busse H-J, Bull CT, Christensen H, Chuvochina M, et al. Judicial Opinions 103-111. *Int J Syst Evol Microbiol* 2022;72:005197.

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