



# The Confusion in Renaming Species: *Penicillium chrysogenum* and *Penicillium rubens*

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Houbraken et al. (1) mention our genome sequencing work on strain P2niaD18 and claim that we have incorrectly identified this strain. We previously published data (2, 3) on strain Q176, the ancestor strain of P2niaD18, and referred to the 2011 paper by Houbraken et al. (4), which discussed the renaming of *Penicillium chrysogenum* to *Penicillium rubens*. However, the Seventeenth International Botanical Congress (Vienna, Austria; July 2005) (5) suggested that traditional taxonomic identifications should be retained for simplification and clarity. Indeed, *P. rubens*, the renamed *P. chrysogenum*, has often appeared in recent publications by diverse groups, but all of them used the traditional name *P. chrysogenum* (6–9). We expect that species name changes attached to taxonomic names will get updated over time, thus reflecting the ever-changing nature of taxonomic nomenclature.

We ourselves have shown very recently that based on beta-tubulin sequences, P2niaD18 and Pc3 are *P. rubens* species (10). But when we used the sequence of the sex-determining mating type loci, *P. rubens* and *P. chrysogenum* strains were not distinguishable, thus suggesting that both species are only distinguishable by minor morphological and/or molecular differences.

In summary, we appreciate the careful survey conducted by Houbraken and co-workers, all of whom are excellent taxonomists of moldy ascomycetes. However, we would like to ask them to amend their statement of “incorrect identification,” with one that simply mentions that the species were “renamed.”

We foresee that in the international literature, penicillin-producing strains will continue to be called *Penicillium chrysogenum*, since all industrial strains can be traced back to a common ancestor, the wild-type strain NRRL 1951 (CBS 307.48), as was outlined in previous papers (8, 11).

We do not want to start a major dispute about the taxonomy of penicillin production strains such as *P. rubens* but would rather like to close with a Shakespearean quote from the tragedy *Romeo and Juliet*: “That which we call a rose, by any other name would smell as sweet.”

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This is a response to a letter by Houbraken et al. (<https://doi.org/10.1128/MRA.01074-20>).

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## REFERENCES

1. Houbraeken J, Visagie CM, Frisvad JC. 2021. Recommendations to prevent taxonomic misidentification of genome-sequenced fungal strains. *Microbiol Resour Announc* 10:e01074-20. <https://doi.org/10.1128/MRA.01074-20>.
2. Specht T, Dahlmann TA, Zadra I, Kürnsteiner H, Kück U. 2014. Complete sequencing and chromosome-scale genome assembly of the industrial progenitor strain P2niaD18 from the penicillin producer *Penicillium chrysogenum*. *Genome Announc* 2:e00577-14. <https://doi.org/10.1128/genomeA.00577-14>.
3. Böhm J, Hoff B, O'Gorman CM, Wolfers S, Klux V, Binger D, Zadra I, Kürnsteiner H, Pöggeler S, Dyer PS, Kück U. 2013. Sexual reproduction and mating-type-mediated strain development in the penicillin-producing fungus *Penicillium chrysogenum*. *Proc Natl Acad Sci U S A* 110:1476–1481. <https://doi.org/10.1073/pnas.1217943110>.
4. Houbraeken J, Frisvad JC, Samson RA. 2011. Fleming's penicillin producing strain is not *Penicillium chrysogenum* but *P. rubens*. *IMA Fungus* 2:87–95. <https://doi.org/10.5598/ima fungus.2011.02.01.12>.
5. McNeill J, Barrie FR, Burdet HM, Demoulin V, Hawksworth DL, Marhold K, Nicolson DH, Prado J, Silva PC, Skog JE, Wiersema JH, Turland NJ. 2006. International code of botanical nomenclature (Vienna code). *Regnum vegetabile* 146. A.R.G. Gantner Verlag, Königstein, Germany.
6. Guzmán-Chávez F, Zwahlen RD, Bovenberg R, Driessen A. 2018. Engineering of the filamentous fungus *Penicillium chrysogenum* as cell factory for natural products. *Front Microbiol* 9:2768. <https://doi.org/10.3389/fmicb.2018.02768>.
7. Mózsik L, Büttel Z, Bovenberg R, Driessen A, Nygård Y. 2019. Synthetic control devices for gene regulation in *Penicillium chrysogenum*. *Microb Cell Fact* 18:203. <https://doi.org/10.1186/s12934-019-1253-3>.
8. Martín JF. 2020. Insight into the genome of diverse *Penicillium chrysogenum* strains: specific genes, cluster duplications and DNA fragment translocations. *Int J Mol Sci* 21:3936. <https://doi.org/10.3390/ijms21113936>.
9. García-Estrada C, Martín JF, Cueto L, Barreiro C. 2020. Omics approaches applied to *Penicillium chrysogenum* and penicillin production: revealing the secrets of improved productivity. *Genes* 11:712. <https://doi.org/10.3390/genes11060712>.
10. Mahmoudjanlou Y, Dahlmann TA, Kück U. 2020. Molecular analysis of mating type loci from the mycophenolic acid producer *Penicillium brevicompactum*: phylogeny and MAT protein characterization suggest a cryptic sexual life cycle. *Fungal Biol* 124:821–833. <https://doi.org/10.1016/j.funbio.2020.07.006>.
11. Dahlmann TA, Böhm J, Becker K, Kück U. 2015. Sexual recombination as a tool for engineering industrial *Penicillium chrysogenum* strains. *Curr Genet* 61:679–683. <https://doi.org/10.1007/s00294-015-0497-7>.