

University of Dundee

Symbioses with nitrogen-fixing bacteria

Afkhami, Michelle E.; Mahler, D. Luke; Burns, Jean H.; Weber, Marjorie G.; Wojciechowski, Martin F.; Sprent, Janet

Published in:
Ecology

DOI:
[10.1002/ecy.2110](https://doi.org/10.1002/ecy.2110)

Publication date:
2018

Document Version
Peer reviewed version

[Link to publication in Discovery Research Portal](#)

Citation for published version (APA):

Afkhami, M. E., Mahler, D. L., Burns, J. H., Weber, M. G., Wojciechowski, M. F., Sprent, J., & Strauss, S. Y. (2018). Symbioses with nitrogen-fixing bacteria: nodulation and phylogenetic data across legume genera. *Ecology*, 99(2), 502. <https://doi.org/10.1002/ecy.2110>

General rights

Copyright and moral rights for the publications made accessible in Discovery Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from Discovery Research Portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain.
- You may freely distribute the URL identifying the publication in the public portal.

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Symbioses with nitrogen-fixing bacteria: nodulation and phylogenetic data across legume genera

Authors: Michelle E. Afkhami^{1,8}, D. Luke Mahler², Jean H. Burns³, Marjorie G. Weber⁴, Martin F. Wojciechowski⁵, Janet Sprent⁶ and Sharon Y. Strauss⁷

Institutions:

¹Department of Biology, University of Miami, 1301 Memorial Dr, #215, Coral Gables, FL 33146

²Department of Ecology and Evolutionary Biology, University of Toronto, 25 Willcocks Street, Toronto, ON, Canada M5S 3B2

³Department of Biology, Case Western Reserve University, 307 DeGrace Hall, Cleveland, Ohio 4410

⁴Department of Plant Biology, Michigan State University, East Lansing, MI 48824

⁵School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287

⁶College of Life Sciences, University of Dundee at JHI, Dundee DD2 5DA Scotland, UK

⁷Department of Evolution and Ecology, University of California, Davis, One Shields Avenue, 2320 Storer Hall, Davis, CA 95616

Abstract: How species interactions shape global biodiversity and influence diversification is a central – *but also data-hungry* – question in evolutionary ecology. Microbially-based mutualisms are widespread and could cause diversification by ameliorating stress and thus allowing organisms to colonize and adapt to otherwise unsuitable habitats. Yet the role of these interactions in generating species diversity has received limited attention, especially across large taxonomic groups. In the massive angiosperm family Leguminosae, plants often associate with root-nodulating bacteria that ameliorate nutrient stress by fixing atmospheric nitrogen. These symbioses are ecologically-important interactions, influencing community

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1002/ecy.2110

assembly, diversity, and succession, contributing ~100-290 million tons of N annually to natural ecosystems, and enhancing growth of agronomically-important forage and crop plants worldwide. In recent work attempting to determine whether mutualism with N-fixing bacteria led to increased diversification across legumes, we were unable to definitively resolve the relationship between diversification and nodulation. We did, however, succeed in compiling a very large searchable, analysis-ready database of nodulation data for 749 legume genera (98% of Leguminosae genera; LPWG 2017), which, along with associated phylogenetic information, will provide a valuable resource for future work addressing this question and others. For each legume genus, we provide information about the species richness, frequency of nodulation, subfamily association, and topological correspondence with an additional data set of 100 phylogenetic trees curated for database compatibility. We found 386 legume genera were confirmed nodulators (*i.e.*, all species examined for nodulation nodulated), 116 were non-nodulating, 4 were variable (*i.e.*, containing both confirmed nodulators and confirmed non-nodulators), and 243 had not been examined for nodulation in published studies. Interestingly, data exploration revealed that nodulating legume genera are ~3× more species-rich than non-nodulating genera, but we did not find evidence that this difference in diversity was due to differences in net diversification rate. Our metadata file describes in more detail the structure of these data that provide a foundational resource for future work as more nodulation data become available, and as greater phylogenetic resolution of this ca. 19,500-species family comes into focus. We release this data set under the Creative Commons 4.0 Attribution-ShareAlike License (<https://creativecommons.org/licenses/by-sa/4.0/>). The data may be used, distributed, and reproduced with proper citation of this article.

Keywords: bacteria, biodiversity, database, diversification, Leguminosae, mutualism, nitrogen fixation, nodulation, phylogeny, rhizobia, species interactions, tree

The complete data set is available online at: [*to be completed at proof stage*].

Corresponding Editor: William K. Michener.

⁸E-mail: afkhami@bio.miami.edu