

Natalia Ivalú Cacho

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INTERESTS

- Interplay between historical and contemporary drivers of diversity.
- Evolutionary ecology of adaptations to harsh environments, plant systematics, speciation, floral evolution.
- Next generation sequencing for phylogenetics and phylogeography.

EDUCATION

- 2009 Ph.D. Botany, University of Wisconsin-Madison (Advisor: David A. Baum)
2003 B.Sc. Biology, National Autonomous University of Mexico (UNAM)

PROFESSIONAL EXPERIENCE (Non-Curatorial)

- 2015–now **Assistant Professor.** National Autonomous University of Mexico (UNAM). Institute of Biology, Department of Botany.
- 2011–2014 **Postdoctoral Fellow.** University of California-Davis. Center for Population Biology, and Genome Center. PIs: Sharon Y. Strauss, Luca Comai
- 2009–2011 **Postdoctoral Researcher.** University of California-Davis. Department of Evolution and Ecology, PI: Sharon Y. Strauss
- 2007 **Research Assistant.** University of Wisconsin-Madison. Botany Department. Project: ‘*EuphORBia*’ PBI. PIs: D.A. Baum and P.E. Berry. Research on cyathium evolution and development (molecular evolution of the leafy gene and immunolocalization of leafy protein in *Euphorbia*).
- 2006 **Research Assistant.** University of Wisconsin-Madison. Botany Department. Project: *Bromeliaceae molecular systematics based on whole plastid genomes*. PIs: P.E. Berry, T.G. Givnish, K.J. Sytsma. Performed extraction of whole chloroplast genomes for rolling-circle amplification and sequencing.
- 2004 **Research Assistant.** University of Wisconsin-Madison. Botany Department. Project: *Using chloroplast gene order to infer phylogenies*. PI: Bret Larget
- 1999-2002 **Managing Editor,** Redacta SA de CV, CEO: Antonio Bolívar Goyanes. Mexico. Oversaw production and proofreading of biology and conservation books. Examples: *El Jaguar En El Nuevo Milenio* (ISBN: 9789681666170), *Regiones Terrestres Prioritarias De México* (Conabio), *Regiones Hidrológicas Prioritarias* (Conabio); *Malezas Arvenses del Valle de México* (Fondo de Cultura Económica).

CURATORIAL EXPERIENCE

- 2012 **Contributor.** Critchfield Herbarium US-Forest Service.
– Digitization of records for firs and pines of California. PI: Dr. Jessica Wright.
- 2010 **Contributor.** Flora of North America, volume 12. Euphorbiaceae.
– Pedilanthus clade of *Euphorbia*.
- 2004-2009 **Co-curator.** Teaching Herbarium. U. Wisconsin-Madison. Botany Department.
– Curated collection of ca. 10,000 records; flora of Wisconsin, and transferred valuable specimens to main state herbarium, WIS. Supervisor: Ken Sytsma
- 2003 **Assistant Herbarium Curator at Wisconsin State Herbarium (WIS)**, University of Wisconsin-Madison. Botany Department.
– Oversaw the successful transfer of specimens accompanying the USDA forest Product Laboratory to WIS (ca. 4,500 records), including repairing historical specimens as needed, organizing, and filing. Supervisor: Paul E. Berry.
- pre-2000 Undergraduate researcher. Ficolgical section of the Faculty of Sciences Herbarium (FCME; UNAM, Mexico)
– Curated liquid collections and database. PI: Dr. Daniel León Alvarez.

PUBLICATIONS (*peer reviewed*)

- In Press.** Hanan-Alipi, A., H. Vibrans, N.I. Cacho, J.L. Villaseñor, E. Ortiz, V. Gómez-G. *Use of herbarium data to evaluate weediness in five congeners.* **AoB Plants.**
2015. Cacho, N.I., D.J. Kliebenstein and S.Y. Strauss. *Macroevolutionary patterns of glucosinolate defense and tests of defense–escalation and resource availability hypotheses.* **New Phytologist** 208 (3):915-927, doi: 10.1111/nph.13561
** *Featured and Commentary:* <http://onlinelibrary.wiley.com/doi/10.1111/nph.13624/full>
2015. S.Y. Strauss, N.I. Cacho, M.W. Schwartz, A.C. Schwartz, K.C. Burns. *Apparency Revisited.* **Entomologia Experimentalis et Applicata** 157: 74-85.
2014. Cacho, N.I. and S.Y. Strauss. *Occupation of bare habitats, an evolutionary precursor to soil specialization in plants.* **Proceedings of the National Academy of Sciences** 111 (42): 15132–15137 **
** *Featured on Cover, and Commentary:* <http://www.pnas.org/content/111/42/14968.full>
2014. Cacho, N.I., A.M. Burrell, A. Pepper, and S.Y. Strauss. *Novel markers inform the systematics and the evolution of serpentine use in *Streptanthus* and allies (*Thelypodieae*, *Brassicaceae*).* **Molecular Phylogenetics and Evolution** 72: 72-81.
2014. Drew, B.T., N.I. Cacho, and K.J. Sytsma. *The transfer of monotypic narrow endemics *Neoeplingia* and *Chaunostoma* to *Lepechinia* with notes on their conservation.* **Taxon** 63(4): 831-842.
2013. Strauss, S.Y. and N.I. Cacho. *Nowhere to run, nowhere to hide: The role of enemies in edaphic adaptation in California Jewelflowers (*Streptanthus*).* **American Naturalist** 128: E1-14.
2013. Cacho, N.I. and S.Y. Strauss. *Single copy nuclear gene primers for *Streptanthus* and other *Brassicaceae* from genomic scans, published resources, and ESTs.* **Applications in Plant Sciences** 1(7): 1200002.
2013. Olson, M., C. León, S. Zamora, A. Weeks, L. AlvCárdenas, N.I. Cacho, and J. Grant. *Convergent vessel diameter–stem diameter scaling across five clades of new and old world eudicots from desert to rain forest.* **International Journal of Plant Sciences** 174(7):1062-1078.
2012. Cacho, N.I. and D.A. Baum. *The Caribbean slipper spurge *Euphorbia tithymaloides*, the first example of a ring species in plants.* **Proceedings of the Royal Society B** 279: 3377-3383.**

****Featured in Nature:** <http://www.nature.com/nature/journal/v486/n7404/full/486442c.html>

2011. Prenner, G., **N.I. Cacho**, D. Baum, and P.J. Rudall. *Is LEAFY a useful marker gene for the flower-inflorescence boundary in the Euphorbia cyathium?* **Journal of Experimental Botany** 62(1): 345-350.
2010. **Cacho, N.I.**, D.A. Baum, and P.E. Berry. *Are spurred cyathia a key innovation? Molecular systematics and trait evolution in the Slipper-Sparges (Pedilanthus clade - Euphorbia, Euphorbiaceae).* **American Journal of Botany** 97(3): 493-510.
2005. Olson M.E., J.A. Lomeli, and **N.I. Cacho**. *Extinction threat in the Pedilanthus clade (Euphorbia, Euphorbiaceae), with special reference to the recently rediscovered E. conzattii (P. pulchellus).* **American Journal of Botany** 92: 634-641.

MANUSCRIPTS (in press and in preparation; available upon request)

- Cacho, N.I.**, P.J. McIntyre, and S.Y. Strauss. *Macroevolution and ecological correlates of genome size in Streptanthus (s.l.).* To be submitted.
- Cacho, N.I.**, I.M. Henry, and L. Comai. *Towards next-generation species phylogenies: a reduced target genome approach.* In Preparation.

NON PEER-REVIEWED AND SCIENCE COMMUNICATION

- Berry, P.E., J.A. Peirson, W.W. Steinmann, J.J. Morawetz, R. Riina, Y. Yang, D. Geltman, and N.I. Cacho. (In Press). *Euphorbia. Flora of North America, vol 12.* Editorial Committee, eds. Flora of North America and North of Mexico. New York and Oxford.
- Olson M.E. and N.I. Cacho. 2002. *Our hidden biological treasures.* **Gaceta UNAM.** In Spanish.
- Olson M.E. and N.I. Cacho. 2002. *Hallazgo botánico: localización de una especie endémica a México después de 86 años de no ser vista.* **El Faro** 29: 7. In Spanish.
- Proofreader**, *Revista Ciencias*, Faculty of Sciences, UNAM, spring 2000
Proofread communications for publication at the science communication magazine (<http://www.revistaciencias.unam.mx/>)

GRANTS, AWARDS AND FELLOWSHIPS

- 2015 PAPIIT-UNAM, México. *Systematics and biogeography of Thelypodieae (Brassicaceae)* (\$12,000).
- 2015 Awarded level 1 at National System of Investigators, Conacyt, México.
- 2015 NSF, DEB: *Replicated evolution of leaf form in a neotropical radiation of Viburnum (Adoxaceae).* Senior Personnel (not eligible for Co-PI status). Involved in proposal preparation in collaboration with: Michael Donoghue, Deren Eaton & Patrick Sweeney (Yale U.), and Erika J. Edwards (Brown U.). (Combined budget \$898,000)
- 2013 Smithsonian Institution Postdoctoral Fellowship – *From morphometrics to genomics: Revisiting the only known example of a ring species in plants.* (\$ 48,000) – declined
- 2012 CONACYT Postdoctoral Fellow at UC-Davis. *Adaptive radiation and edaphic specialization in Streptanthus: a comparative analysis in a phylogenomic framework.* (\$25,000)
- 2011 CONACYT Postdoctoral Fellow at UC-Davis. *Phylogenomics in Streptanthus: using next-generation sequencing for species phylogenies in non-model organisms.* (\$25,000)
- 2009 CONACYT Postdoctoral Fellowship at Harvard University (with Elena Kramer and Charles Davis). *Comparative evo-devo in the cyathium of Euphorbia.* (\$25,000) – declined
- 2009 Judy Croxdale Award for Women in Science (\$1,000)

- 2008 O.H. Allen Fellow, Department of Botany UW-Madison (plus \$4,000 award)
- 2007 Vilas Grant for International Research (\$600)
- 2006 NSF, Doctoral Dissertation Improvement Grant (# 0608428; \$12,000)
- 2006 American Society of Plant Taxonomists Graduate Student Research Grants (\$1,000)
- 2006 Garden Club of America, Award in Tropical Botany (\$5,000)
- 2005 Latin American, Caribbean and Iberian Studies (\$1,500)
- 2004 Davis Research Grant, UW-Madison (\$1,500)
- 2003 Young Botanist, Botanical Society of America

INVITED TALKS AND LECTURES

- 2015 Evolutionary Ecology of Jewelflowers (*Streptanthus*), Rancho Santa Ana Botanic Garden, CA, USA
- 2014 From true islands to habitat islands: systematics and ecology in the Caribbean and in California, University of California–Berkeley, CA, USA
- 2014 The integration of systematics and ecology to understand drivers of plant diversity. University of North Carolina–Wilmington, NC, USA
- 2014 Merging phylogeny and ecology to study drivers of plant diversity. Fresno State University, CA, USA
- 2013 Combining systematics and ecology to understand drivers of plant diversity. California State University –Dominguez Hills, CA, USA
- 2013 Using systematics to address evolutionarily and ecological promoters of plant diversity. University of Puerto Rico –Mayagüez, PR
- 2010 Tales of Diversification in the Slipper Spurges. Rancho Santa Ana Botanic Garden, CA, USA.
- 2009 Patterns and processes of diversification in the Pedilanthus clade of *Euphorbia*. University of California-Davis. Center for Population Biology Seminar Series.
- 2006 Monocots: Diversity and Systematics. Plant Systematics Course, Kenneth Sytsma. Madison, WI, USA
- 2002 Field biology: challenging, exciting, and sometimes sad. UNIVERSUM: Museum of Sciences, UNAM, Mexico. In Spanish.

CONFERENCE PRESENTATIONS

- 2015 **Cacho N.I.** & S.Y. Strauss. 2015. Untangling the evolutionary ecology of soil specialization in *Streptanthus* and allies through a combined phylogenetic and ecological approach. In Symposium: Recent advances in phylogeny and systematics of Brassicaceae. Botanical Society of America, Edmonton, Canada. **INVITED
- 2014 **Cacho N.I.** & S.Y. Strauss. Merging ecology and phylogeny: soil endemism, soil chemistry, and plant chemical defense in Californian mustards. Ecological Society of America. Sacramento, CA, USA.
- 2013 **Cacho N.I.**, M.A. Burrell, A. Pepper, & S.Y. Strauss. Systematics and serpentine endemism in Californian Jewelflowers (*Streptanthus*). Botanical Society of America. New Orleans, LA, USA.
- 2013 **Cacho N.I.** & S.Y. Strauss. Reconstructing the paths of edaphic specialization in a Californian clade of mustards (*Streptanthus*). Evolution. Snowbird, UT, USA.
- 2012 **Cacho N.I.** & S.Y. Strauss. The roles of competition and enemies in edaphic specialization in a Californian clade of mustards (*Streptanthus*). Evolution. Ottawa, Canada.
- 2011 **Cacho N.I.** Towards next-generation species phylogenies: a reduced target genome approach. American Genetics Association Symposium. Irapuato, México. POSTER

- 2011 **Cacho N. I.**, & S.Y. Strauss. The role of competition in serpentine specialization in a Californian mustard. *Ecological Society of America*. Austin, TX, USA.
- 2011 S.Y. Strauss & **N.I. Cacho**. The role of enemies and conspicuousness in edaphic adaptation Californian mustard. *Ecological Society of America*. Austin, TX, USA.
- 2011 S.Y. Strauss & **N.I. Cacho**. The role of enemies in edaphic adaptation. *VII International Conference on Serpentine Ecology*. Coimbra, Portugal.
- 2009 **Cacho N.I.** & D.A. Baum. Will *Euphorbia tithymaloides* species-complex persist as a ring-species in the Caribbean? *Botanical Society of America*. Snowbird, UT, USA.
- 2009 **Cacho N.I.** & D.A. Baum. Is the *Euphorbia tithymaloides* species-complex a ring-species in the Caribbean? *Evolution*. Moscow, ID, USA.
- 2009 Givnish, T.J., J.H. Leebens-Mack, J.R. McNeal, M. Ames, **N.I. Cacho**, P.E. Berry, & K.J. Sytsma. A phylogenomic approach to bromeliad phylogeny. *Botanical Society of America*. Snowbird, UT, USA.
- 2008 **Cacho N.I.** & D.A. Baum. Testing a ring-species hypothesis in a Caribbean *Euphorbia* species-complex (*E. tithymaloides*). *Evolution*. Minneapolis, MN, USA.
- 2007 **Cacho N. I.**, D.A. Baum, & P.E. Berry. Systematics and biogeography of the *Pedilanthus* clade (Euphorbiaceae). *Botanical Society of America*. Chicago, IL, USA.
- 2007 Prenner G., **N.I. Cacho**, D.A. Baum & P. J. Rudall. Exploring the organ-flower-inflorescence boundary in Euphorbia and its allies (Malpighiales: Euphorbiaceae). *Botanical Society of America*. Chicago, IL, USA.
- 2006 **Cacho N.I.** Sistemática y biogeografía del clado *Pedilanthus* (*Euphorbia*, Euphorbiaceae), con énfasis en *E. tithymaloides*, una posible ‘especie-anillo’ en el Caribe. *IX Congreso Latinoamericano de Botánica*. Dominican Republic. POSTER
- 2005 **Cacho N. I.**, B.R. Larget, & D.A. Baum. 2005. Chloroplast genome data suggests *Anthoceros* as sister to the vascular plants. *Evolution*. Fairbanks, AK, USA. POSTER

TEACHING EXPERIENCE

(** Main professor; * Teaching Assistant)

Graduate and other advanced courses

- 2015, fall Phylogenetic Inference: Theory and Practice. In Spanish.**
- 2012, winter The New Generation in Molecular Sequencing: Advances, Applications and Perspectives. Graduate Course. Biological Sciences Graduate Program, Biology Institute (Instituto de Biología) - UNAM. In Spanish. **
- Organized, developed all course materials and taught all lectures; 40 participants, including faculty members.
- 2009, spring Phylogenetic Analysis of Molecular Data (Bot563, with David Baum), UW-Madison*
- Led hands-on laboratory component; developed computer-lab guides, including analysis pipelines and datasets.
- 2008, summer The Tree of Life: Using phylogenies in the teaching of high school biology (Co-led with David A. Baum), UW-Madison.
- Course for high school teachers centered on activities using phylogenies to teach diversity of life.
- 2007, spring Phylogenetic Analysis of Molecular Data (Bot563, D. Baum), UW-Madison, as above*
- 2004-2006, fall Plant Systematics (Bot 400, Kenneth J. Sytsma), UW-Madison*
- Led laboratory component; developed all activities and evaluations. Curated student herbarium (> 10,000 specimens and liquid collections) for teaching plant morphology.

Undergraduate courses

- 2015, fall Phylogenetic Systematics. In Spanish. **
- 2009, summer General Botany (Bot100, Jerry Davis), UW-Madison, Botany*
- Developed lab discussions, activities and evaluations for laboratory section.
- 2008, fall Organismal Biology (Biocore 323, Janet Branchaw), UW-Madison*
- Led discussions, activities and review sessions; coordinated with other TAs.
- 2005-2007, summer General Botany (Bot100, Jerry Davis), UW-Madison, as above*
- 2005, spring General Botany (Bot130, Donna Fernandez), UW-Madison*
- Discussions, activities and review sessions in coordination with other TAs.
- 2002, fall Mathematics for biologists I (Co-taught with Vinicio Gómez), Faculty of Sciences, UNAM, Mexico**
- 2002, spring Mathematics for biologists II (Co-taught with Vinicio Gómez), Faculty of Sciences, UNAM, Mexico**
- 2001, fall Mathematics for biologists I (Co-taught with Gerardo Rivas), Faculty of Sciences, UNAM, Mexico**

Mentoring (*undergraduate, **technician, graduate status indicated)

- 2015-present UNAM: Andrea Cerón (honors thesis committee); María José Monteverde (undergraduate researcher in my lab).
- 2009-2014 UC-Davis: Kyle Christie (PhD), Chandler Purity***, Nia Johnson***, Ken Zillig**, Caprice Lee**, Emily Bergman**, Jessee Hu*, Nicole Silva*, Connie Tan Tong-Ree*, Kyle Garrone*, Han Nguyen*, Kendra Chan*, Ian Kimball**, John Bryan Curtis**, Amanda Bartell*, Jenny Huynh*.
*** through Howard University-UC-Davis minority mentorship program
- 2008 UW-Madison: **Mentor, REU** program, Botany Department.
Undergraduates Raman Kutty* and Brittany Otta* mentored in laboratory and analysis techniques working on phylogenetics of *Euphorbia*.
- 2005-2009 Mentoring incoming and visiting graduate students and post-docs in research skills and methodologies, UW-Madison, Botany Department.

ASSOCIATIONS

Ecological Society of America (**ESA**), Society for the Study for Evolution (**SSE**), Botanical Society of America (**BSA**), American Society of Plant Taxonomists (**ASPT**), Society of Systematic Biologists (**SSB**), Society of Herbarium Curators (**SHC**).

SERVICE

Ad-hoc Reviewer: New Phytologist, Proceedings B, American Journal of Botany, Systematic Botany, Molecular Phylogenetics and Evolution, Molecular Ecology.

Committees served:

- 2008 Vilas Graduate School Grants Review Committee, UW-Madison
- 2007 Botany Department Social Committee, UW-Madison

- 2006 Botany Department Teaching Assistants Evaluation committee, UW-Madison
- 2005 Botany Department Teaching Assistants Training, UW-Madison
- 2004 Botany Department Incoming Graduate Students Orientation, UW-Madison

Outreach and promoting conservation:

- 2008 Biocore Ambassador of Science: Bringing science to middle and high schools
- 2007-2009 Darwin Day, UW-Madison: preparation of materials and delivery.
- 2002, 2005 Formal **conservation assessment** to promote the inclusion of endangered species in the official Mexican Endangered Species List. Based on my undergraduate research.

RELEVANT FIELDWORK

2015: Mexico, USA; 2009-2014: California (USA); 2008: Barbados, Guadeloupe (France), St. Vincent and the Grenadines, St. Eustatius (Netherlands), Puerto Rico, Mexico, US (Florida); 2007: Venezuela, Costa Rica, Guatemala, Mexico; 2006: Jamaica, Dominican Republic, Virgin Islands (USA), Puerto Rico; 2005 and before: Costa Rica, Mexico.

LANGUAGES AND EXTRA-CURRICULAR TRAINING

Languages: English (fluent); Spanish (native); French (working knowledge).

- 2012 Multidisciplinary Teaching. Graduate Teaching Community, UC-Davis.
- 2011 Evolutionary Genomics of Non-Model Species: Next Generation Sequencing, Data Management, and Hypothesis Testing. AGA-Langebio. Irapuato, Mexico.
- 2008 Phyloinformatics. Comparative methods and data analysis with R. NESCent, NC.
- 2005 Tropical Plant Systematics. Organization for Tropical Studies. Costa Rica.