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# XO AQUÍN MOREIRA TOMÉ

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## Education

2008-2010 PhD, University of Vigo, Spain  
2006-2007 M.Sc., University of Vigo, Spain  
2001-2005 B.S. in Forestry, University of Santiago de Compostela, Spain

## Academic & Research Appointments

2015-present Ramon y Cajal researcher, Biological Mission of Galicia (CSIC), Pontevedra, Spain  
2014-2015 Postdoctoral researcher, University of Neuchâtel, Dep. Evolutionary Entomology, Switzerland  
2012-2014 Fulbright postdoc, University of California, Dep. Ecology & Evolutionary Biology, Irvine USA  
2010-2012 Postdoctoral researcher, Biological Mission of Galicia-CSIC, Dep. Forestry, Pontevedra, Spain  
2006-2010 Predoctoral researcher, Forestry Research Centre of Lourizán, Dep. Ecology, Pontevedra, Spain

## Publications

### Peer-reviewed papers

- [48] **Moreira X**, Nell CS, Katsanis A, Rasmann S, Mooney KA (in press) Herbivore specificity and the chemical basis of plant-plant communication in *Baccharis salicifolia* (Asteraceae). *New Phytologist*. Impact Factor: 7.33 (9/211 Plant Sciences).
- [47] **Moreira X**, Glauser G, Abdala-Roberts L (2017) Interactive effects of plant neighbourhood and ontogeny on insect herbivory and plant defensive traits. *Scientific Reports* 7:4047. Impact Factor: 4.259 (4/50 Multidisciplinary Sciences).
- [46] **Moreira X**, Pérez-Ramos IM, Abdala-Roberts L, Mooney KA (2017) Functional responses of contrasting seed predator guilds to masting in two Mediterranean oak species. *Oikos* 126:1042-1050. Impact Factor: 4.03 (32/153 Ecology).
- [45] **Moreira X**, Pearse IS (2017) Leaf habit does not determine the investment in both physical and chemical defences and pair-wise correlations between these defensive traits. *Plant Biology* 19:354-359. Impact Factor: 2.106 (65/211 Plant Sciences).
- [44] Abdala-Roberts L, Parra-Tabla V, **Moreira X**, Ramos-Zapata J (2017) Ecological and evolutionary consequences of tri-trophic interactions: spatial variation and effects of plant density. *American Journal of Botany* 104:241-251. Impact Factor: 2.811 (43/209 Plant Sciences).
- [43] Abdala-Roberts L, Rasmann S, Berny-Mier y Terán JC, Covelo F, Glauser G, **Moreira X** (2016) Biotic and abiotic factors associated with altitudinal variation in plant traits and herbivory in a dominant oak species. *American Journal of Botany* 103:2070-2078. Impact Factor: 2.811 (43/209 Plant Sciences).

- [42] **Moreira X**, Abdala-Roberts L, Zas R, Merlo E, Lombardero MJ, Sampedro L, Mooney KA (2016) Masting behaviour in a Mediterranean pine tree alters seed predator selection on reproductive output. *Plant Biology* 18:973-980. Impact Factor: 2.106 (65/211 Plant Sciences).
- [41] Abdala-Roberts L, Hernández-Cumplido J, Chel-Guerrero L, Betancur-Ancona D, Benrey B, **Moreira X** (2016) Effects of plant intra-specific diversity across three trophic levels: underlying mechanisms and plant traits. *American Journal of Botany* 103:1810-1818. Impact Factor: 2.811 (43/209 Plant Sciences).
- [40] **Moreira X**, Sampedro L, Zas R, Pearse IS (2016) Defensive traits in young pine trees cluster into two divergent syndromes related to early growth rate. *PLoS ONE* 11: e0152537. Impact Factor: 2.806 (8/56 Multidisciplinary Sciences).
- [39] Pellissier L\*, **Moreira X\***, Danner H\*, Serrano M\*, Salamin N, van Dam N, Rasmann S (2016) (\*same contribution of these authors) The simultaneous inducibility of phytochemicals related to plant direct and indirect defences against herbivores is stronger at low elevation. *Journal of Ecology* 104:1116–1125. Impact Factor: 5.813 (11/153 Ecology).
- [38] Abdala-Roberts L, **Moreira X**, Rasmann S, Parra-Tabla V, Mooney KA (2016) Test of biotic and abiotic correlates of latitudinal variation in defenses in the perennial herb *Ruellia nudiflora*. *Journal of Ecology* 104:580-590. Impact Factor: 5.813 (11/153 Ecology).
- [37] **Moreira X**, Abdala-Roberts L, Rasmann S, Castagneyrol B, Mooney KA (2016) Plant diversity effects on insect herbivores and their natural enemies: current thinking, recent findings, and future directions. *Current Opinion in Insect Science* 14:1-7. Impact Factor: 3.66 (8/94 Entomology) (20/86 Biology).
- [36] **Moreira X**, Petry WK, Hernández-Cumplido J, Morelon S, Benrey B (2016) Plant defence responses to volatile alert signals are population-specific. *Oikos* 125:950-956. Impact Factor: 4.03 (32/153 Ecology).
- [35] Hernández-Cumplido J, Forter B, **Moreira X**, Heil M, Benrey B (2016) Induced floral and extrafloral nectar production affect ant-pollinator interactions and plant fitness. *Biotropica* 48:342-348. Impact Factor: 1.73 (84/153 Ecology).
- [34] Abdala-Roberts L, González-Moreno A, Mooney KA, **Moreira X**, González-Hernández A, Parra-Tabla V (2016) Effects of tree species and genotypic diversity on leafminer-parasitoid interactions. *Agricultural and Forest Entomology* 18:43-51. Impact Factor: 1.726 (23/91 Entomology).
- [33] Abdala-Roberts L, Berny-Mier y Terán JC, **Moreira X**, Durán-Yañez A, Tut-Pech F (2015) Effects of pepper (*Capsicum chinense*) genotypic diversity on two insect herbivores and mechanisms underlying plant-herbivore interactions. *Agricultural and Forest Entomology* 17:433-438. Impact Factor: 1.805 (19/94 Entomology).
- [32] **Moreira X**, Abdala-Roberts L, Hernández-Cumplido J, Cuny MAC, Glauser G, Benrey B (2015) Specificity of induced defenses, growth, and reproduction in lima bean (*Phaseolus lunatus*, Fabaceae) in response to multispecies herbivory. *American Journal of Botany* 102:1300-1308. Impact Factor: 2.811 (43/209 Plant Sciences).
- [31] **Moreira X**, Abdala-Roberts L, Linhart YB, Mooney KA (2015) Effects of climate on reproductive investment in a masting species: assessment of climatic predictors and underlying mechanisms. *Journal of Ecology* 103:1317-1324. Impact Factor: 6.180 (9/149 Ecology).
- [30] **Moreira X**, Abdala-Roberts L, Hernández-Cumplido J, Rasmann S, Kenyon SG, Benrey B (2015) Plant species variation in bottom-up effects across three trophic levels: A test of traits and mechanisms. *Ecological Entomology* 40:676-686. Impact Factor: 1.687 (23/94 Entomology).
- [29] Zas R, **Moreira X**, Ramos M, Lima MRM, Nunes da Silva M, Solla A, Vasconcelos MW, Sampedro L (2015) Intraspecific variation of anatomical and chemical defensive traits in Maritime pine (*Pinus*

*pinaster*) as factors in susceptibility to the pinewood nematode (*Bursaphelenchus xylophilus*). *Trees, Structure and Function* 29:663-673. Impact Factor: 1.706 (16/68 Forestry).

- [28] **Moreira X**, Abdala-Roberts L, Parra-Tabla V, Mooney KA (2015) Latitudinal variation in herbivory: Influences of climatic drivers, herbivore identity, and natural enemies. *Oikos* 124:1444-1452. Impact Factor: 3.586 (34/149 Ecology).
- [27] **Moreira X**, Zas R, Solla A, Sampedro L (2015) Differentiation of persistent anatomical defensive structures is costly and determined by nutrient availability and genetic growth-defence constraints. *Tree Physiology* 35:112-123. Impact Factor: 3.587 (2/68 Forestry).
- [26] Carrillo-Gavilán A\*, **Moreira X\***, Zas R, González-Voyer A, Vila M, Sampedro L (2015) (\*same contribution both authors) Phylogenetic and biogeographical patterns in the allocation to chemical defence and defensive strategies in Palearctic and Nearctic pine trees (Subgenus *Pinus*). *Journal of Biogeography* 42:684-693. Impact Factor: 3.997 (26/149 Ecology) (5/49 Geography Physical).
- [25] **Moreira X**, Abdala-Roberts L, Parra-Tabla V, Mooney KA (2014) Positive effects of plant genotypic and species diversity on anti-herbivore defences in a tropical tree species. *PLoS ONE* 9:e105438. Impact Factor: 3.234 (8/56 Multidisciplinary Sciences).
- [24] Abdala-Roberts L, **Moreira X**, Cervera JC, Parra-Tabla V (2014) Light availability influences growth-defense trade-offs in big-leaf mahogany (*Swietenia macrophylla* King). *Biotropica* 46:591-597. Impact Factor: 2.084 (65/144 Ecology).
- [23] **Moreira X**, Mooney KA, Rasmann S, Petry WK, Carrillo-Gavilán A, Zas R, Sampedro L (2014) Trade-offs between constitutive and induced defences drive geographical and climatic clines in pine chemical defences. *Ecology Letters* 17:537-546. Impact Factor: 10.689 (2/144 Ecology).
- [22] Linhart YB, **Moreira X**, Snyder MA, Mooney KA (2014) Variability in seed cone production and functional response of seed predators to seed cone availability: support for the predator satiation hypothesis. *Journal of Ecology* 102:576-583. Impact Factor: 5.521 (12/144 Ecology).
- [21] **Moreira X**, Abdala-Roberts L, Linhart YB, Mooney KA (2014) Masting promotes individual- and population-level reproduction by increasing pollination efficiency. *Ecology* 95:801-807. Impact Factor: 4.656 (17/144 Ecology).
- [20] **Moreira X**, Lundborg L, Zas R, Carrillo-Gavilán A, Borg-Karlsson AK, Sampedro L (2013) Tissue-specific induction of pine defences: herbivore feeding guild influences differentially phloem and needle induced terpenoids. *Phytochemistry* 94:113-122. Impact Factor: 3.35 (32/195 Plant Sciences).
- [19] **Moreira X**, Mooney KA (2013) Influence of plant genetic diversity on interactions between higher trophic levels. *Biology Letters* 9:20130133. Impact Factor: 3.425 (15/83 Biology).
- [18] **Moreira X**, Zas R, Sampedro L (2013) Additive genetic variation in resistance traits of an exotic pine species: little evidence for constraints on evolution of resistance against native herbivores. *Heredity* 110:449-456. Impact Factor: 3.804 (28/140 Ecology).
- [17] **Moreira X**, Mooney KA, Zas R, Sampedro L (2012) Bottom-up effects of host-plant species diversity and top-down effects of ants interactively increase plant performance. *Proceedings of the Royal Society B* 279:4464-4472. Impact Factor: 5.683 (8/83 Biology).
- [16] **Moreira X**, Zas R, Sampedro L (2012) Differential allocation of constitutive and induced chemical defences in pine tree juveniles: a test of the optimal defence theory. *PLoS ONE* 7:e34006. Impact Factor: 3.73 (7/56 Multidisciplinary Sciences).

- [15] **Moreira X**, Zas R, Sampedro L (2012) Genetic variation and phenotypic plasticity of nutrient re-allocation and increased fine root production as putative tolerance mechanisms inducible by methyl-jasmonate in pine trees. *Journal of Ecology* 100:810-820. Impact Factor: 5.431 (14/136 Ecology).
- [14] **Moreira X**, Zas R, Sampedro L (2012) Quantitative comparison of chemical, biological and mechanical induction of secondary compounds in *Pinus pinaster* seedlings. *Trees, Structure and Function* 26:677-683. Impact Factor: 1.925 (10/62 Forestry).
- [13] **Moreira X**, Alfaro RI, King JN (2012) Constitutive defenses and damage in Sitka spruce progeny obtained from crosses between white pine weevil resistant and susceptible parents. *Forestry* 85:87-97. Impact Factor: 1.677 (12/62 Forestry).
- [12] Blanch JS, Sampedro L, Llusà J, **Moreira X**, Zas R, Peñuelas J (2012) Effects of phosphorus availability and genetic variation of leaf terpene contents and emission rates in *Pinus pinaster* seedlings susceptible and resistant to the pine weevil *Hylobius abietis*. *Plant Biology* 25:66-72. Impact Factor: 2.32 (56/195 Plant Sciences).
- [11] Carrillo-Gavilán A, **Moreira X**, Zas R, Vila M, Sampedro L (2012) Early resistance of alien and native pines against two native generalist insect herbivores: no support for the Natural Enemy Hypothesis. *Functional Ecology* 26:283-293. Impact Factor: 4.861 (19/136 Ecology).
- [10] Zas R, **Moreira X**, Sampedro L (2011) Tolerance and induced resistance in a native and an exotic pine species: relevant traits for invasion ecology. *Journal of Ecology* 99:1316-1326. Impact Factor: 5.044 (17/134 Ecology).
- [9] Sampedro L\*, **Moreira X\***, Zas R (2011) \*same contribution of both authors. Costs of constitutive and herbivore-induced chemical defenses in pine trees emerge only under low resources availability. *Journal of Ecology* 99:818-827. Impact Factor: 5.044 (17/134 Ecology).
- [8] Sampedro L, **Moreira X**, Zas R (2011) Resistance and response of *Pinus pinaster* seedlings to *Hylobius abietis* after induction with methyl jasmonate. *Plant Ecology* 212:397-401. Impact Factor: 1.829 (8/59 Forestry).
- [7] Sampedro L\*, **Moreira X\***, Llusà J, Peñuelas J, Zas R (2010) \*same contribution of both authors. Genetics, phosphorus availability and herbivore-derived induction as sources of phenotypic variation of leaf volatile terpenes in a pine species. *Journal of Experimental Botany* 61:4437-4447. Impact Factor: 4.818 (12/188 Plant Sciences).
- [6] Martíns P, Sampedro L, **Moreira X**, Zas R (2009) Nutritional status and genetic control of phenotypic plasticity to nutrient availability in *Pinus pinaster*. A multisite field study in NW Spain. *Forest Ecology and Management* 258:1429-1436. Impact Factor: 1.95 (5/46 Forestry).
- [5] Sampedro L\*, **Moreira X\***, Martíns P, Zas R (2009) \* same contribution of both authors. Growth and nutritional response of *Pinus pinaster* after a large pine weevil (*Hylobius abietis*) attack. *Trees, Structure and Function* 23:1189-1197. Impact Factor: 1.603 (9/46 Forestry).
- [4] **Moreira X**, Sampedro L, Zas R (2009) Defensive responses of *Pinus pinaster* seedlings to exogenous application of methyl-jasmonate: Concentration effect and systemic response. *Environmental and Experimental Botany* 67:94-100. Impact Factor: 3.164 (22/173 Plant Sciences).
- [3] **Moreira X**, Costas R, Sampedro L, Zas R (2008) A simple method for trapping *Hylobius abietis* (L.) alive in northern Spain. *Investigación Agraria. Sistemas y Recursos Forestales* 17:188-192. Impact Factor: 0.56 (32/46 Forestry)

- [2] **Moreira X**, Sampedro L, Zas R, Solla A (2008) Alterations of the resin canal system of *Pinus pinaster* seedlings after fertilization of a healthy and of a *Hylobius abietis* attacked stand. *Trees, Structure and Function* 22:771-777. Impact Factor: 1.629 (8/39 Forestry).
- [1] Zas R, Sampedro L, **Moreira X**, Martins P (2008) Effect of fertilization and genetic variation on susceptibility of *Pinus radiata* seedlings to *Hylobius abietis* damage. *Canadian Journal of Forest Research* 38:63–72. Impact Factor: 1.43 (13/39 Forestry).

### Book chapters

- [1] **Moreira X**, Zas R, Sampedro L (2012) Methyl jasmonate as chemical elicitor of induced responses and anti-herbivory resistance in young conifer trees. In: Merillon JM, Ramawat KG (eds) *Plant defence: Biological control*. Progress in Biological Control, Volume 12, Part 4, 345-362. Springer Netherlands.

## Research Grants

2016-2020 Galician Innovation Agency: “Factors influencing the direction and magnitude of altitudinal gradients in oak defensive strategies and herbivory”. (PI: Xoaquín Moreira €100,000).

2016-2018 Spanish Ministry of Economy and Competition: “Factors determining the existence of defense syndromes in *Quercus* sps. in the Iberian Peninsula: consequences for the conservation of endangered species” (PI: Xoaquín Moreira €42,350).

2016-2017 i-COOP+ (CSIC): “Mechanisms explaining tree species diversity effects on associated arthropod communities: patterns of insect herbivore dispersal and expression of plant chemical defenses” (PI: Xoaquín Moreira, Luis Abdala-Roberts; €7,250).

2015-2020 Ramon y Cajal Research Program: “Unravelling the relative importance of biotic and abiotic factors on driving latitudinal and altitudinal gradients in leaf defences” (PI: Xoaquín Moreira €40,000).

2013-2014 UC-MEXUS-CONACyT: “Integrating predators to current theory of plant anti-herbivore defenses” (PI: Kailen Mooney, Víctor Parra-Tabla, Xoaquín Moreira, Luis Abdala-Roberts; \$25,000).

2013 UC-MEXUS-CONACyT: “Plant genotype diversity effects on anti-herbivore defenses” (PI: Xoaquín Moreira; \$1,500).

2013-2015 Spanish Ministry of Economy and Competition: “Tolerance and resistance against herbivores as driver of life history traits in Mediterranean pine species” (PI: Rafael Zas; €150,000).

2012 Spanish Association of Terrestrial Ecology: “Consequences of host-plant specific diversity on the ant-aphid mutualism and the structure of arthropod community” (PI: Xoaquín Moreira; €2,000).

2012-2013 European Union-Spanish Ministry of Education and Science (Integrative Action Spain-Portugal): “Exploring new aspects of pine resistance to the Pine Nematode Wilt Disease (*Bursaphelenchus xylophilus*): intra-specific genetic variation and role of induced defences” (PI: Rafael Zas; €5,990).

2011-2012 Spanish Ministry of Education and Science: “Tradeoffs between growth and constitutive and induced resistance in the genus *Pinus*: Within and across species variation and implications for breeding programs” (PI: Rafael Zas; €131,890).

2011 Spanish National Research Council (CSIC): “Interspecific variation (Genus *Pinus*) of constitutive and induced terpene profiles in response to real herbivory” (PI: Xoaquín Moreira; €2,900).

2011-2013 Galician Ministry of Education: “Patterns of *Pinus pinaster* and *P. radiata* resistance against forest pests: Insights from forest management in a changeable climate” (PI: María José Lombardero; €68,000).

2008-2010 Spanish Ministry of Science and Innovation: “Maternal effects in *Pinus pinaster*: effect of nutritional and sanitary status of mother trees in the vigour and herbivore resistance of progeny. Insights from tree breeding programs” (PI: Rafael Zas; €88,228).

2008-2009 Spanish Council for Scientific Research (CSIC): “Evolutionary trade-off between defensive strategies in *Pinus* sp.” (PI: Rafael Zas; €30,000).

2005-2007 Spanish Ministry of Science and Innovation: “Phosphorus use efficiency in fast-growing conifers as alternative to fertilization: Genetic variation, tree breeding and phytosanitary repercussions” (PI: Rafael Zas; €69,350).

## **Honors, Awards & Fellowships**

2012 PhD Thesis. Awarded by the Regional Government of Pontevedra as the best PhD Thesis in Science and Technology (€2,000)

2012-2013 University of California-Irvine, Department Ecology & Evolutionary Biology, Fulbright/Ministry of Education and Science postdoc (\$98,553)

2011 PhD Thesis. Awarded by the University of Vigo as Extraordinary Prize of Doctorate

2011 PhD Thesis. Awarded by the Spanish Society of Forest Science as the best Forest Science PhD Thesis (€3,000)

2008-2012 Forestry Research Centre of Lourizán, Department Ecology, Graduate Fellowship, Ministry of Education and Science (€48,000)

2006-2007 Forestry Research Centre of Lourizán, Department Ecology, Graduate Fellowship, Xunta de Galicia (€13,800)

## **Reviewer**

Peer-reviewed papers:

2017 – New Phytologist, Ecology (2), Functional Ecology, Proceedings of the Royal Society B (2), Frontiers in Plant Science, Ecology and Evolution, Journal of Applied Ecology, Tree Physiology

2016 – Ecology Letters, Oikos, Journal of Chemical Ecology, PLoS ONE (2), Trends in Ecology and Evolution, Scientific Reports, Oecologia (3), Ecosphere, Ecology and Evolution

2015 - New Phytologist, Functional Ecology, Global Ecology and Biogeography, Oecologia, PLoS ONE (2), Tree Physiology, Acta Oecologica, Forestry, Annals of Forest Science, Current Opinion in Insect Science

2014 – Ecology Letters, Global Change Biology, Functional Ecology, Oikos (2), PLoS ONE (2), Entomologia Experimentalis et Applicata (2), Plant Biology, BMC Ecology, Agricultural and Forest Entomology, Forest Ecology and Management, Silva Fennica

2013 - New Phytologist, Ecology, Journal of Ecology, Oecologia, Ecological Entomology

2012 - Scientia Agricola, Forest Systems

Projects:

2016 – New Zealand's Marsden Fund Council, Czech Science Foundation

2015 – CONICYT-Chile, FONDECYT Regular grant competition

2013 – Netherlands Organization for Scientific Research

## **Mentoring**

### Graduate students

Andrea Cortegoso Galmán (2017-2020). PhD dissertation at University of Santiago de Compostela (Spain): “Factors influencing the direction and magnitude of altitudinal gradients in oak defensive strategies and herbivory”

Teresa Quijano-Medina (2014). Minor Thesis at University of Neuchâtel (Switzerland): “Exploring the effect of domestication of Lima bean seeds: Is there an increase in attractiveness of bruchids and their parasitoids?”

### Undergraduate students

Undergraduate students 2007-present (4 Degree Dissertations supervised at University of Santiago and mentoring of 10 undergraduate students at University of California-Irvine)

## **Teaching**

### Undergraduate courses

“Vers une agriculture durable” (APP, M203, Bachelor in Biology, University of Neuchâtel, 120 hours in total)  
2014-2015