



Universiteit  
Leiden  
The Netherlands

## **Systematic, phylogenetic and pollination studies of *Specklinia* (Orchidaceae)**

Karremans, Adam Philip

### **Citation**

Karremans, A. P. (2015, November 25). *Systematic, phylogenetic and pollination studies of Specklinia (Orchidaceae)*. Retrieved from <https://hdl.handle.net/1887/36432>

Version: Corrected Publisher's Version

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/36432>

**Note:** To cite this publication please use the final published version (if applicable).

Cover Page



Universiteit Leiden



The handle <http://hdl.handle.net/1887/36432> holds various files of this Leiden University dissertation

**Author:** Karremans, Adam Philip

**Title:** Systematic, phylogenetic and pollination studies of *Specklinia* (Orchidaceae)

**Issue Date:** 2015-11-25

# References

## References

- Abele AD. 2007. Phylogeny of the genus *Masdevallia* Ruiz & Pav. (Orchidaceae) based on morphological and molecular data. disertación Phd. Hamburg University.
- Ackerman JD. 1986. Mechanisms and evolution of food-deceptive pollination systems in orchids. *Lindleyana* 1: 108–113.
- Ackerman JD. 2014. Orchids flora of the Greater Antilles. The New York Botanical Garden Press, 640 pp.
- Adams PB, Lawson SD. 1993. Pollination in Australian orchids: a critical assessment of the literature 1882–1992. *Australian Journal of Botany* 41: 553–575.
- Albores Ortiz O, Sosa V. 2006. Polinización de dos especies simpátricas de *Stelis* (Pleurothallidinae, Orchidaceae). *Acta Botanica Mexicana* 74: 155–168.
- Ames O. 1923. New or noteworthy orchids. *Schedulae orchidianae* 6: 60–65.
- Ames O, Schweinfurth C. 1925. New or noteworthy species of orchids from the American tropics. *Schedulae orchidianae* 8: 1–84.
- Antoń S, Kamińska M, Stpiczyńska M. 2012. Comparative structure of the osmophores in the flower *Stanhopea graveolens* Lindley and *Cynoches chlorochilon* Klotzsch (Orchidaceae). *Acta Agrobotanica* 65: 11–22.
- Ascensãno L, Francisco A, Cotrim H, Pais MS. 2005. Comparative structure of the labellum in *Ophrys fusca* and *O. lutea* (Orchidaceae). *American Journal of Botany* 92: 1059–1067.
- Ayasse M, Schiestl FP, Paulus HF, Ibarra F, Francke W. 2003. Pollinator attraction in a sexually deceptive orchid by means of unconventional chemicals. *Proceedings of the Royal Society of London Series B - Biological Sciences* 270: 517–522.
- Barbosa AR, de Melo MC, Borba EL. 2009. Self-incompatibility and myophily in *Octomeria* (Orchidaceae, Pleurothallidinae) species. *Plant Systematics and Evolution* 283: 1–8.
- Barros F. 2004. Taxonomic and nomenclatural notes on Brazilian Orchidaceae. pp. 7–22. In: Manilal KS, Satish Kumar C. (eds.) Orchid memories: a tribute to Gunnar Seidenfaden. Mentor Books, Kolkata.
- Barros F. 2006. Seis novas combinações para orquídeas brasileiras. *Bradea* 11: 29–32.
- Barros F, Trettel Rodrigues V. 2009. Nomenclatural notes and new combinations on *Acianthera* Scheidw. and *Specklinia* Lindl. (Orchidaceae). *Bradea* 14: 21–26.
- Bartelt RJ, Schaner AM, Jackson LL. 1985. cis-Vaccenyl acetate as an aggregation pheromone in *Drosophila melanogaster*. *Journal of Chemical Ecology* 11: 1747–1756.
- Bartelt RJ, Schaner AM, Jackson LL. 1986. Aggregation pheromones in five taxa of the *Drosophila virilis* species group. *Physiological Entomology* 11: 367–376.
- Bartelt RJ, Schaner AM, Jackson LL. 1988. Aggregation pheromones in *Drosophila borealis* and *Drosophila littoralis*. *Journal of Chemical Ecology* 14: 1319–1328.
- Blanco MA, Barboza G. 2005. Pseudocopulatory pollination in *Lepanthes* (Pleurothallidinae, Orchidaceae) by fungus gnats. *Annals of Botany* 95: 763–772.
- Boerhaave H. 1710. Index Plantarum Horti Lugduno Batavi. Cornelius Boutenstein, Leiden.
- Bogarín D. 2007. A new *Lycaste* (Orchidaceae: Maxillarieae) from Costa Rica. *Lankesteriana* 7(3): 543–549.
- Bogarín D, Pupulin F, Arrocha C, Warner J. 2013a. Orchids without borders: studying the hotspot of Costa Rica and Panama. *Lankesteriana* 13(1–2): 13–26.
- Bogarín D, Karremans AP, Rincón R, Gravendeel B. 2013b. A new *Specklinia* (Orchidaceae: Pleurothallidinae) from Costa Rica and Panama. *Phytotaxa* 115(2): 31–41. <http://dx.doi.org/10.11646/phytotaxa.115.2.1>
- Bogarín D, Serracín Z, Zamudio Z. 2014. Illustrations and studies in Neotropical Orchidaceae. The *Specklinia condylata* group (Orchidaceae) in Costa Rica and Panama. *Lankesteriana* 13(3): 185–206.
- Bolaños R, Watson V, Tosi J. 2005. Mapa ecológico de Costa Rica (Zonas de Vida), según el sistema de clasificación de zonas de vida del mundo de L.R. Holdridge. Scale 1:750 000. Centro Científico Tropical, San José, Costa Rica.
- Borba EL, Semir J. 2001. Pollinator specificity and convergence in fly-pollinated *Pleurothallis* (Orchidaceae) species: a multiple population approach. *Annals of Botany* 88: 75–88.

- Brncic D. 1983. Ecology of flower breeding *Drosophila*. In: Ashburner MA, Carson HL, Thompson JN, eds. *The Genetics and Biology of Drosophila* 3b. London: Academic Press, 333–382.
- Carson HL. 1974. Three flies and three islands: Parallel evolution in *Drosophila*. *Proceedings of the National Academy Sciences* 71: 3517–3521.
- Chase MW. 1985. Pollination of *Pleurothallis endotrachys*. *American Orchid Society Bulletin* 54: 431–434.
- Chase MW, Williams NH, de Faria AD, Neubig KM, Amaral MdCE, Whitten WM. 2009. Floral convergence in Oncidiinae (Cymbidieae; Orchidaceae): an expanded concept of *Gomesa* and a new genus *Nohawilliamsia*. *Annals of Botany* 104: 387–402. doi:10.1093/aob/mcp067.
- Chiron GR, Guiard J, van den Berg C. 2012. Phylogenetic relationships in Brazilian *Pleurothallis sensu lato* (Pleurothallidinae, Orchidaceae): evidence from nuclear ITS rDNA sequences. *Phytotaxa* 46: 34–58.
- Christensen DE. 1994. Fly pollination in the Orchidaceae. In: Arditti J, ed. *Orchid Biology: Reviews and Perspectives*, VI. USA: John Wiley & Sons, New York, 415–454.
- Ciotek L, Giorgis P, Benitez-Vieyra S, Cocucci AA. 2006. First confirmed case of pseudocopulation in terrestrial orchids of South America: Pollination of *Geoblasta pennicillata* (Orchidaceae) by *Campsomeris bistrimacula* (Hymenoptera, Scoliidae). *Flora* 201: 365–369.
- Cozzolino S, Widmer A. 2005. Orchid diversity: an evolutionary consequence of deception? *Trends in Ecology & Evolution* 20: 487–494.
- Curry KJ, McDowell LM, Judd WS, Stern WL. 1991. Osmophores, floral features, and systematics of *Stanhopea* (Orchidaceae). *American Journal of Botany* 78: 610–623.
- Darwin CR. 1862. On the various contrivances by which British and foreign orchids are fertilised by insects. London, UK: John Murray.
- Davies KL, Turner MP. 2004. Pseudopollen in *Dendrobium unicum* Seidenf. (Orchidaceae): Reward or Deception? *Annals of Botany* 94: 129–132.
- Davies KL, Stpiczynska M, Rawski M. 2014. Comparative anatomy of floral elaiophores in *Vitekorchis* Romowicz & Szlach., *Cyrtochilum* Kunth and a florally dimorphic species of *Oncidium* Sw. (Orchidaceae: Oncidiinae). *Annals of Botany* 113(7): 1155–1173. doi:10.1093/aob/mcu045.
- de Melo MC, Borba EL, Paiva EAS. 2010. Morphological and histological characterization of the osmophores and nectaries of four species of *Acianthera* (Orchidaceae: Pleurothallidinae). *Plant Systematics and Evolution* 286: 141–151. doi:10.1007/s00606-010-0294-1.
- Den Otter CJ, Behan M, Maes FW. 1980. Single Cell Responses in Female Pieris-Brassicaceae (Lepidoptera, Pieridae) to Plant Volatiles and Conspecific Egg Odors. *Journal of Insect Physiology* 26: 465–472.
- Dressler RL. 1993a. Field guide to the orchids of Costa Rica and Panama. Cornell University Press, Ithaca.
- Dressler RL. 1993b. Phylogeny and classification of the Orchid family. Cambridge: Press Syndicate of the University of Cambridge.
- Drummond AJ, Rambaut A. 2007. BEAST: Bayesian evolutionary analysis by sampling trees. *BMC Evol Biol* 7: 214.
- Dunsterville GCK, Garay LA. 1965. Venezuelan Orchids Illustrated 3. London: Andre Deutsch Ltd.
- Duque O. 1993. Polinización en *Pleurothallis*. *Orquideología* 19: 55–69.
- Duque-Buitrago CA, Alzate-Quintero NF, Otero JT. 2014. Nocturnal pollination by fungus gnats of the Colombian endemic species, *Pleurothallis marthae* (Orchidaceae: Pleurothallidinae). *Lankesteriana* 13: 407–417.
- Edwards, S.V., Liu, L. & Pearl, D.K. 2007. High-resolution species trees without concatenation. *PNAS* 104(14): 5936–5941.
- Endara L, Grimaldi DA, Roy BA. 2010. Lord of the flies: pollination of *Dracula* orchids. *Lankesteriana* 10: 1–11.
- Endara L, Williams NH, Whitten WM. 2011. Filogenia molecular preliminar de *Scaphosepalum* (Orchidaceae: Pleurothallidinae). *Lankesteriana* 11(3): 245–252.
- Fernández M, Bogarín D, Karremans AP, Jiménez D. 2014. New species and records of Orchidaceae from Costa Rica III. *Lankesteriana* 13(3): 259–282.
- Folmer O, Black M, Hoeh W, Lutz R, Vrijenhoek R. 1994. DNA primers for amplification of mitochondrial cytochrome c oxidase subunit I from diverse metazoan invertebrates. *Molecular Marine Biology and Biotechnology* 3: 294–299.
- Garay LA. 1974. *Acostaeta* y los géneros del complejo *Pleurothallis*. *Orquideología* 9: 103–124.

- Garay LA, Sweet, HR. 1972. Notes on West Indian orchids, III. *Journal of the Arnold Arboretum* 53: 515–530.
- Gravendeel B, Smithson A, Slik FJW, Schuiteman A. 2004. Epiphytism and pollinator specialization: drivers for orchid diversity? *Philosophical Transactions of the Royal Society of London B - Biological Sciences* 359: 1523–1535.
- Greenspan RJ, Ferveur J-F. 2000. Courtship in *Drosophila*. *Annual Review of Genetics* 34: 205–232.
- Grüber CE, Nakagawa S, Laws RJ, Jamieson IG. 2011. Multimodel inference in ecology and evolution: challenges and solutions. *Journal of Evolutionary Biology* 24: 699–711.
- Hamer F. 1974. Las orquídeas de El Salvador. Ministerio de Educación. Dirección de Publicaciones, San Salvador, 374 pp.
- Hamer F. 1981. Las orquídeas de El Salvador, III, suplemento. The Marie Selby Botanical Gardens, Sarasota.
- Hamer F. 1984. *Pleurothallis endotrachys*. Sub pl. 1096. In: Hamer F. Orchids of Nicaragua, Icones plantarum tropicarum 11.
- Harder LD, Johnson SD. 2009. Darwin's beautiful contrivances: evolutionary and functional evidence for floral adaptation. *New Phytologist* 183: 530–545.
- Hebert PDN, Cywinska A, Ball SL. 2003. Biological identifications through DNA barcodes. *Proceedings of the Royal Society of London Series B - Biological Sciences* 270: 313–321.
- Hebert PDN, Penton EH, Burns JM, Janzen DH, Hallwachs W. 2004. Ten species in one: DNA barcoding reveals cryptic species in the neotropical skipper butterfly *Astraptes fulgerator*. *Proceedings of the National Academy of Sciences of the United States of America* 101: 14812–14817.
- Hedlund K, Bartelt RJ, Dicke M, Vet LEM. 1996. Aggregation pheromones of *Drosophila immigrans*, *D. phalerata*, and *D. subobscura*. *Journal of Chemical Ecology* 22: 1835–1844.
- Heller AH, Hawkes AD. 1966. Nicaraguan orchid studies – 1. *Phytologia* 14: 1–35.
- Heneghan C, Thompson M, Billingsley M, Cohen, D. 2011. Data from: Medical-device recalls in the UK and the device-regulation process: retrospective review of safety notices and alerts. Dryad Digital Repository. <http://dx.doi.org/10.5061/dryad.585t4>.
- Holdridge LR. 1987. Ecología basada en zonas de vida. 3ª reimpresión. Instituto Interamericano de Cooperación para la Agricultura (IICA), San José, Costa Rica. 216 pp.
- Hooker JD. 1890. *Pleurothallis platyrachis*. *Curtis' Botanical Magazine* 116: sub pl. 7129.
- Humphreys AM, Linder P. 2009. Concept versus data in delimitation of plant genera. *Taxon* 58(4): 1054–1074.
- Immonen E, Hoikkala A, Kazem AJN, Ritchie MG. 2009. When are vomiting males attractive? Sexual selection on condition-dependent nuptial feeding in *Drosophila subobscura*. *Behavioral Ecology* 20: 289–295.
- Janzen D. 1967. Why mountain passes are higher in the tropics. *American Naturalist* 101: 233–249.
- Janzen D. 1991. Historia Natural de Costa Rica. San José. Editorial de la Universidad de Costa Rica.
- Jersáková J, Johnson SD, Kindman P. 2006. Mechanisms and evolution of deceptive pollination in orchids. *Biological Reviews* 81: 219–235.
- Karremans AP. 2010. Phylogenetics of *Stelis* (Orchidaceae: Pleurothallidinae) and closely related genera, based on molecular data, morphological characteristics and geographical distribution in the Central American and Andean Cordilleras. M.Sc. Thesis, Wageningen University. Available: <http://edepot.wur.nl/146921>. Accessed 22 October 2014.
- Karremans AP. 2014. *Lankesteriana*, a new genus in the Pleurothallidinae (Orchidaceae). *Lankesteriana* 13(3): 319–332.
- Karremans AP, Bogarín D, Fernández M, Smith CM, Blanco, MA. 2012. New species and records of Orchidaceae from Costa Rica. II. *Lankesteriana* 12(1): 19–51.
- Karremans AP, Bogarín D. 2013. Costa Rica, land of endless orchids. *Orchids (West Palm Beach)* 82(7): 408–411.
- Karremans AP, Bakker FT, Pupulin F, Solano-Gómez R, Smulders MJM (2013a). Phylogenetics of *Stelis* and closely related genera (Orchidaceae: Pleurothallidinae). *Plant Systematics and Evolution* 29(1): 69–86.
- Karremans AP, Pupulin F, Gravendeel B. 2013b. Taxonomy, molecular phylogenetics, reproductive isolation, and niche differentiation of the *Specklinia endotrachys* species complex (Orchidaceae: Pleurothallidinae). *Lankesteriana* 13(1–2): 132–133.
- Karremans AP, Bogarín D, Gravendeel B. 2015a. *Specklinia lugduno-batavae* (Pleurothallidinae: Orchidaceae), a new species in the *S. digitalis* group. *Blumea* 59: 180–184. <http://dx.doi.org/10.3767/000651915X687859>
- Karremans AP, Pupulin F, Gravendeel B. 2015b. *Specklinia dunstervillei*, a New Species Long Confused with *Specklinia*

- endotrachys* (Orchidaceae: Pleurothallidinae). *PLoS ONE* 10(7): e0131971. doi:10.1371/journal.pone.0131971
- Karremans AP, Bogarin D, Pupulin F, Luer CA, Gravendeel B. 2015c. The glandulous *Specklinia*: morphological convergence versus phylogenetic divergence. *Phytotaxa* 218(2): 101–127.
- Kowalkowska AK, Kozieradzka-Kiszkurno M, Turzynski S. 2014. Morphological, histological and ultrastructural features of osmophores and nectary of *Bulbophyllum wendlandianum* (Kraenzl.) Dammer (*B.* section *Cirrhopetalum* Lindl., Bulbophyllinae Schltr., Orchidaceae). *Plant Systematics and Evolution* DOI 10.1007/s00606-014-1100-2.
- Kress JW, Wurdack KNJ, Zimmer EA, Weigt LA, Janzen DH. 2005. Use of DNA barcodes to identify flowering plants. *Proceedings of the National Academy of Sciences of the United States of America* 102 (23): 8369–8374.
- Kubatko, L.S. & Degnan, J.H. 2007. Inconsistency of phylogenetic estimates from concatenated data under coalescence. *Systems Biology* 56(1): 17–24.
- Lahaye R, van der Bank M, Bogarin D, Warner J, Pupulin F, et al. (2008) DNA barcoding the floras of biodiversity hotspots. *Proceedings of the National Academy of Sciences of the United States of America* 105: 2923–2928.
- Leopardi C, Carnevali G, Romero-González GA. 2012. *Amoana* (Orchidaceae, Laeliinae), a new genus and a new species from Mexico. *Phytotaxa* 65: 23–35.
- Lindley J. 1830. The genera and species of orchidaceous plants 8. Asher, London. xvii, 554 pp.
- Lindley J. 1836. Notes upon some genera and species of American Orchidaceae. *Companion to the Botanical Magazine* 2: 353-357.
- Lindley J. 1859. *Pleurothallis*. In: Lindley J. (Ed.). *Folia Orchidacea*. J. Matthews, London. pp. 1–46.
- Luer CA. 1986. Systematics of *Pleurothallis* (Orchidaceae). Icones pleurothallidarum III. *Monographs in Systematic Botany from the Missouri Botanical Garden* 20.
- Luer CA. 1988. Icones Pleurothallidarum V. Systematics of *Dresslerella* and *Scaphosepalum*. Addenda to *Porroglossum* (Orchidaceae). *Monographs in Systematic Botany from the Missouri Botanical Garden* 26.
- Luer CA. 1990. Icones Pleurothallidarum VII. Systematics of *Platystele*. *Monographs in Systematic Botany from the Missouri Botanical Garden* 38.
- Luer CA. 1991. Icones Pleurothallidarum VIII. Systematics of *Lepanthopsis*, *Octomeria* subgenus *Pleurothallopsis*, *Restrepia*, *Restrepopsis*, *Salpistele* and *Teagueia*. Addenda to *Platystele*, *Porroglossum* and *Scaphosepalum* (Orchidaceae). *Monographs in Systematic Botany from the Missouri Botanical Garden* 39.
- Luer CA. 1997. Systematics of *Trichosalpinx*. *Monographs in Systematic Botany from the Missouri Botanical Garden* 64.
- Luer CA. 1999. Icones Pleurothallidarum XVIII. Systematics of *Pleurothallis* Subgen. *Pleurothallis* Sect. *Pleurothallis* Subsect. *Antenniferae*, Subsect. *Longiracemosae*, Subsect. *Macrophyllae-Racemosae*, Subsect. *Perplexae*, Subgen. *Pseudostelis*, Subgen. *Acuminatia*. *Monographs in Systematic Botany from the Missouri Botanical Garden* 76.
- Luer CA. 2002. A systematic method of classification of the Pleurothallidinae versus a strictly phylogenetic method. *Selbyana* 23(1): 57–110.
- Luer CA. 2004. *Pleurothallis* subgenus *Acianthera* and three allied subgenera. A second century of new species of *Stelis* of Ecuador. *Epibator*, *Ophidion*, *Zootrophion*. Icones Pleurothallidarum XXVI. *Monographs in Systematic Botany from the Missouri Botanical Garden* 95.
- Luer CA. 2005. *Dryadella* and *Acronia* section *Macrophyllae-Fasciculatae*: addenda to *Acianthera*, *Andinia*, *Dracula*, *Dresslerella*, *Lepanthes* and *Masdevallia* new taxa, validation of taxa, errata. Icones pleurothallidarum XXVII. *Monographs in Systematic Botany from the Missouri Botanical Garden* 103.
- Luer CA. 2006. A Reconsideration of *Masdevallia*. Systematics of *Specklinia* and vegetatively similar taxa (Orchidaceae). Icones Pleurothallidarum XXVIII. *Monographs in Systematic Botany from the Missouri Botanical Garden* 105.
- Luer CA. 2007. A third century of *Stelis* of Ecuador. Systematics of *Apoda-Proropentia*. Systematics of miscellaneous small genera. Addenda: new genera, species and combinations (Orchidaceae). Icones pleurothallidarum XXIX. *Monographs in Systematic Botany from the Missouri Botanical Garden* 112.
- Luer CA. 2009. Icones Pleurothallidarum XXX. *Lepanthes* of Jamaica and Systematics of *Stelis*, *Stelis* of Ecuador, part four and addenda: systematics of *Masdevallia*, new species of *Lepanthes* from Ecuador, and miscellaneous new combinations. *Monographs in Systematic Botany from the Missouri Botanical Garden* 115.

- Luer CA. 2010. *Lepanthes* of Bolivia. Systematics of *Octomeria* species north and west of Brazil. Addenda: new species of *Brachionidium*, *Lepanthes*, *Masdevallia*, *Octomeria*, *Playstele*, *Pleurothallopsis* and *Porroglossum*. Corrigenda. Icones pleurothallidarum 31. *Monographs in Systematic Botany from the Missouri Botanical Garden* 120.
- Luer CA. 2011. Miscellaneous new species in the Pleurothallidinae excluding species from Brazil. *Harvard Papers in Botany* 16: 311–360.
- Maddison WP, Maddison DR. 2007. Mesquite: a modular system for evolutionary analysis. Mesquite v. 2.72. Available: <http://mesquiteproject.org>. Accessed 13 January 2013.
- Markow TA. 1988. Reproductive behavior of *Drosophila* in the laboratory and in the field. *Journal of Comparative Psychology* 102: 169–174.
- Markow TA, O’Grady PM. 2005. Evolutionary genetics of reproductive behavior in *Drosophila*: Connecting the Dots. *Annual Review of Genetics* 39: 263–291.
- Markow TA, O’Grady PM. 2008. Reproductive ecology of *Drosophila*. *Functional Ecology* 22: 747–759.
- Meyer GE, Basquero L, Cameron KM. 2012. A new Ecuadorian species of *Dracula*: Pleurothallidinae (Orchidaceae). *OrchideenJournal* 19: 107–113.
- Meyer CP, Paulay G. 2005. DNA Barcoding: Error Rates Based on Comprehensive Sampling. *PLoS Biology* 3(12): e422.
- Mickelionas L, Pansarin ER, Sazima M. 2006. Biologia floral, melitofilia e influência de besouros Curculionidae no sucesso reprodutivo de *Grobya amherstiae* Lindl. (Orchidaceae: Cyrtopodiinae). *Revista Brasileira de Botânica* 29: 251–258.
- Miller, M.A., Pfeiffer, W. & Schwartz, T. 2010. Creating the CIPRES Science Gateway for inference of large phylogenetic trees. Pp. 1–8. New Orleans: Proceedings of the Gateway Computing Environments Workshop (GCE).
- Misas Urreta G. 2006. Orquídeas de la Serranía del Baudó, Chocó, Colombia. Corporación Capitalina de Orquideología y Concreto. Medellín.
- Moats RA, Bartelt RJ, Jackson LL. 1987. Ester and ketone components of the aggregation pheromone of *Drosophila hydei*. *Journal of Chemical Ecology* 13: 451–462.
- Montes C, Cardona A, Jaramillo C, Pardo A, Sliva JC, Valencia V, Ayala C, Pérez-Angel LC, Rodríguez-Parra LA, Ramírez V, Niño H. 2015. Middle Miocene closure of the Central American Seaway. *Science* 348 (6231): 226–229.
- Neyland R, Urbatsch LE, and Pridgeon, AM. 1995. A phylogenetic analysis of subtribe Pleurothallidinae (Orchidaceae). *Botanical Journal of the Linnean Society* 117: 13–28.
- Oliveira DCSG, Almeida FC, O’Grady PM, Armella MA, DeSalle R, Etges WJ. 2012. Monophyly, divergence times, and evolution of host plant use inferred from a revised phylogeny of the *Drosophila* repleta species group. *Molecular Phylogenetics and Evolution* 64: 533–544.
- Ortiz P, Uribe C. 2007. Galería de Orquídeas de Colombia (CD edition). Asociación Bogotana de Orquideología, Bogotá.
- Ossenbach C. 2002. Breve historia de la orquideología en Costa Rica. Editorial de la Universidad de Costa Rica, 41 pp.
- Pansarin ER, Amaral MCE. 2006. Biologia reprodutiva e polinização de duas espécies de *Polystachya* no sudeste do Brasil: evidência de pseudocleistogamia em Polystachyaeae (Orchidaceae). *Revista Brasileira de Botânica* 29: 423–432.
- Pansarin LM, Pansarin ER, Sazima M. 2008. Reproductive biology of *Cyrtopodium polyphyllum* (Orchidaceae): a Cyrtopodiinae pollinated by deceit. *Plant Biology (Stuttgart)* 10: 650–659.
- Pansarin ER, Pansarin LM. 2011. Reproductive biology of *Trichocentrum pumilum*: an orchid pollinated by oil-collecting bees. *Plant Biology (Stuttgart)* 13: 576–581.
- Pansarin ER, Aguiar JMRBV, Pansarin LM. 2013. Floral biology and histochemical analysis of *Vanilla edwallii* Hoehne (Orchidaceae: Vanilloideae): an orchid pollinated by *Epicharis* (Apidae: Centridini). *Plant Species Biology* 29(3): 242–252. doi: 10.1111/1442-1984.12014
- Papadopoulos AST, Powell MP, Pupulin F, Warner J, Hawkins JA, Salamin N, Chittka L, Williams NH, Whitten WM, Loader D, Valente LM, Chase MW, Savolainen V. 2013. Convergent evolution of floral signals underlies the success of Neotropical orchids. *Proceedings of the Royal Society of London Series B - Biological Sciences* 280: 20130960.
- Peakall R, Ebert D, Poldy J, Barrow RA, Francke W, Bower CC, Schiestl FP. 2010. Pollinator specificity, floral odour chemistry and the phylogeny of Australian sexually deceptive *Chiloglottis* orchids: implications for pollinator-driven speciation. *New Phytologist* 188: 437–450.

- Phillips RD, Faast R, Bower CC, Brown GR, Peakall R. 2009. Implications of pollination by food and sexual deception for pollinator specificity, fruit set, population genetics and conservation of *Caladenia* (Orchidaceae). *Australian Journal of Botany* 57: 287–306.
- van der Pijl L, Dodson CH. 1966. Orchid flowers: their pollination and evolution. Coral Gables, FL: University of Miami Press.
- Posada D, Crandall KA. 1998. Modeltest: testing the model of DNA substitution. *Bioinformatics* 14: 817–818.
- Pridgeon AM. 2005. Subtribe Pleurothallidinae. In: Pridgeon AM, Cribb PJ, Chase MW, Rasmussen FN, editors, Genera Orchidacearum. Volume 4 Epidendroideae (Part One). Oxford: Oxford University Press. pp. 319–422.
- Pridgeon AM, Chase MW. 2001. A phylogenetic reclassification of Pleurothallidinae (Orchidaceae). *Lindleyana* 16: 235–271.
- Pridgeon AM, Solano R, Chase MW. 2001. Phylogenetic relationships in Pleurothallidinae (Orchidaceae): combined evidence from nuclear and plastid DNA sequences. *American Journal of Botany* 88: 2286–2308.
- Pridgeon AM, Chase MW. 2002. Nomenclatural notes on Pleurothallidinae (Orchidaceae). *Lindleyana* 17: 98–101.
- Pupulin F. 2010. Orchidaceae werckleanae: typification of Costa Rican orchid species described from collections by K. Werckle. *Botanical Journal of the Linnean Society* 163: 111–154.
- Pupulin F, Ossenbach C, Jenny R, Vitek E. 2011. Typi Orchidacearum ab Augusto R. Endresio in Costa Rica lecti. *Annalen Naturhistorisches Museums Wien, Ser. B, Botanik. Zoologie* 112: 265–313.
- Pupulin F, Karremans AP, Gravendeel B. 2012. A reconsideration of the empusellous species of *Specklinia* (Orchidaceae: Pleurothallidinae) in Costa Rica. *Phytotaxa* 63: 1–20.
- Pupulin F, Karremans AP, Strigari S. 2013. Taxonomie in Aquarell: die *Specklinia-endotrachys*-Gruppe, Teil 1. Taxonomy in watercolor: the *Specklinia endotrachys* group, part 1. *Die Orchidee (Hamburg)* 64(5): 392–399.
- Pupulin F, Karremans AP, Strigari S. 2013. Taxonomie in Aquarell: die *Specklinia-endotrachys*-Gruppe, Teil 2. Taxonomy in watercolor: the *Specklinia endotrachys* group, part 2. *Die Orchidee (Hamburg)* 64(6): 475–485.
- Pupulin F, Ossenbach C, Jenny R. 2014. Mr. Auguste R. Endrés: not so mysterious, after all. *Orchids (West Palm Beach)* 83(10): 604–617.
- R Core Team. 2013. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Available at <http://www.R-project.org/>
- Rambaut A. 2009. FigTree v1.3.1. Available: <http://tree.bio.ed.ac.uk/software/>. Accessed 13 January 2013.
- Ramírez SR, Eltz T, Fujiwara MK, Gerlach G, Goldman-Huertas B, Tsutsui ND, Pierce NE. 2011. Asynchronous diversification in a specialized plant-pollinator mutualism. *Science* 333: 1742–1746.
- Ramos-Castro SE, Castañeda-Zárata M, Solano-Gómez R, Salazar GA (2012) *Stelis zootrophionoides* (Orchidaceae: Pleurothallidinae), a new species from Mexico. *PLoS One* 7(11): e48822. doi: 10.1371/journal.pone.0048822
- Reichenbach HG. 1876. Orchidographische Beiträge. *Linnaea* 41: 17–98.
- Reichenbach HG. 1878. Zu Tafel 210. *Pleurothallis endotrachys* Rehb. *fil. Xenia Orchidacea* 3(1): 16–17.
- Renner SS. 2005. Rewardless flowers in the angiosperms and the role of insect cognition in their evolution. In: Waser NM, Ollerton J, eds. *Plant-Pollinator Interactions: from specialization to generalization*. Chicago: University of Chicago Press, 123–144.
- Reynolds ES. 1963. The use of lead citrate at high pH as an electron-opaque stain in electron microscopy. *Journal of Cell Biology* 17: 208–212.
- Rolfe RA. 1888. New or noteworthy plants. *Gardeners' Chronicle* 4: 178–179 [18 August 1888].
- Rolfe RA. 1890. The genus *Scaphosepalum* Pfitzer. *Journal of Botany, British and Foreign* 28: 135–137.
- Schlechter FRR. 1910. Orchidaceae novae et criticae. Decas XIV–XV. *Repertorium Specierum Novarum Regni Vegetabilis* 8: 561.
- Scopecce G, Cozzolino S, Johnson SD, Schiestl FP. 2010. Pollination efficiency and the evolution of specialized deceptive pollination systems. *The American Naturalist* 175: 98–105.
- Singer RB. 2002. The pollination mechanism in *Trigonidium obtusum* Lindl. (Orchidaceae: Maxillariinae): sexual mimicry and trap-flowers. *Annals of Botany* 89: 157–163.
- Singer RB, Flach A, Koehler S, Marsaioli AJ, Do Carmo E, Amaral M. 2004. Sexual mimicry in *Mormolyca ringens* (Lindl.) Schltr. (Orchidaceae: Maxillariinae). *Annals of Botany* 93: 755–762.

- Silva MF, Silva JF. 1997. Novas ocorrências de orchidaceae para o Brasil. *Boletim do Museu Paraense emílio Goeldi, série Botanica* 13: 69–79.
- Smets EF, Cresens E. 1988. Types of floral nectaries and the concepts “character” and “character-state” - a reconsideration. *Acta Botanica Neerlandica* 37: 121–128.
- Smets EF, Ronse Decraene LP, Caris P, Rudall PJ. 2000. Floral nectaries in monocotyledons: distribution and evolution. In: Wilson KL, Morrison DA, eds. *Monocots – Systematics and Evolution*. Vol. 1 of Proceedings of the Second International Conference on the Comparative Biology of the Monocots, Sydney. CSIRO, Melbourne, 230–240.
- Smith SD. 2010. Using phylogenetics to detect pollinator-mediated floral evolution. *New Phytologist* 188: 354–363.
- Smithson A. 2006. Pollinator limitation and inbreeding depression in orchid species with and without nectar rewards. *New Phytologist* 169: 419–430.
- Solano R, Soto M. 2008. *Specklinia endotrachys*. Sub pl. 1092. In: Hágsater, E. & Soto, M. (eds.). *Orchids of Mexico*, part 4. *Icones orchidacearum* 10: pl. 1001–1100.
- Staden R, Judge DP, Bonfield JK. 2003. Analysing Sequences Using the Staden Package and EMBOSS. In: Krawetz SA, Womble DD. (eds.) *Introduction to Bioinformatics. A Theoretical and Practical Approach*. Human Press Inc., Totawa, NJ 07512. pp. 393–410.
- Stamatakis, A. 2006. RAxML-VI-HPC: Maximum Likelihood-based Phylogenetic Analyses with Thousands of Taxa and Mixed Models. *Bioinformatics* 22(21): 2688–2690.
- Stamatakis, A. 2014. RAxML Version 8: A tool for Phylogenetic Analysis and Post-Analysis of Large Phylogenies. *Bioinformatics* 10.1093/bioinformatics/btu033.
- Steele RH. 1986. Courtship feeding in *Drosophila subobscura*. II. Courtship feeding by males influences female mate choice. *Animal Behaviour* 34: 1099–1108.
- Stenzel, H. 2004. Systematics and evolution of the genus *Pleurothallis* R.Br. (Orchidaceae) in the Greater Antilles. Dissertation Thesis. Mathematisch-Naturwissenschaftlichen Fakultät I der Humboldt- Universität zu Berlin.
- Stpiczyńska M. 1993. Anatomy and ultrastructure of osmophores of *Cymbidium tracyanum* Rolfe (Orchidaceae). *Acta Societatis Botanicorum Poloniae* 62: 5–9.
- Stpiczyńska M, Matusiewicz J. 2001. Anatomy and ultrastructure of spur nectary of *Gymnadenia conopsea* (L.) Orchidaceae. *Acta Societatis Botanicorum Poloniae* 4: 267–272.
- Stpiczyńska M, Davies KL. 2008. Elaiophore structure and oil secretion in flowers of *Oncidium trulliferum* Lindl. and *Ornithophora radicans* (Rchb.f.) Garay & Pabst (Oncidiinae: Orchidaceae). *Annals of Botany* 101: 375–384.
- Sun Y, Skinner DZ, Liang GH, Hulbert H. 1994. Phylogenetic analysis of *Sorghum* and related taxa using internal transcribed spacers of nuclear ribosomal DNA. *Theoretical and Applied Genetics* 89: 26–32.
- Symonds MRE, Wertheim B. 2005. The mode of evolution of aggregation pheromones in *Drosophila* species. *Journal of Evolutionary Biology* 18: 1253–1263.
- Szentesi Á. 2002. Insect-plant relationships – chance and necessity. *Acta Zoologica Academiae Scientiarum Hungaricae* 48: 55–71.
- Teixeira SDP, Borba EL, Semir J. 2004. Lip anatomy and its implications for the pollination mechanisms of *Bulbophyllum* species (Orchidaceae). *Annals of Botany* 93: 499–505.
- Tremblay RL, Ackerman JD, Zimmerman JK, Calvo RN. 2005. Variation in sexual reproduction in orchids and its evolutionary consequences: a spasmodic journey to diversification. *Biological Journal of the Linnean Society* 84: 1–54.
- Villella A, Hall JC. 2008. Neurogenetics of courtship and mating in *Drosophila*. *Advances in Genetics* 62: 67–184.
- Vogel S. 1990. *The role of scent glands in pollination* (transl. by Bhatti JS). Washington, DC: Smithsonian Institute.
- Whitten WM, Blanco MA, Williams NH, Koehler S, Carnveli G, Singer RB, Endara L, Neubig KM. 2007. Molecular phylogenetics of *Maxillaria* and related genera (Orchidaceae: Cymbidieae) based on combined molecular data sets. *American Journal of Botany* 94: 1860–1889.
- Wiens JJ. 2006. Missing data and the design of phylogenetic analyses. *Journal of Biomedical Informatics* 39: 34–42.
- Williams NH. 1982. The biology of orchids and euglossine bees. In: Arditti J, ed. *Orchid Biology: Reviews and Perspectives*. II. Ithaca, NY: Cornell University Press, 119–171.