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Co-evolution between parthenogenesis-inducing Wolbachia and its hosts.

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References

A

- Alexandrov ID, Alexandrova MV, Goryacheva II, Rochina NV, Shaikevich EV, Zakharov IA (2007). Removing endosymbiotic *Wolbachia* specifically decreases lifespan of females and competitiveness in a laboratory strain of *Drosophila melanogaster*. *Russian Journal of Genetics* **43**: 1147-1152.
- Arakaki N, Noda H, Yamagishi K (2000). *Wolbachia*-induced parthenogenesis in the egg parasitoid *Telenomus nawai*. *Entomologia Experimentalis et Applicata* **96**: 177-184.
- Arakaki N, Miyoshi T, Noda H (2001). *Wolbachia*-mediated parthenogenesis in the predatory thrips *Franklinothrips vespiformis* (Thysanoptera: Insecta). *Proceedings of the Royal Society of London, Series B* **268**: 1011-1016.
- Arnqvist G, Rowe L (2005). *Sexual conflict*. Princeton University Press, Princeton, New Jersey, USA.
- Audas LJ, Heywood V (1981). *Winkler Prins Encyclopedie van het Plantenrijk*, pp. 127. Elsevier, Amsterdam, The Netherlands.

B

- Baldo L, Dunning Hotopp JC, Jolley KA, Bordenstein SR, Biber SA, Choudbury RR, Hayashi C, Maiden MCJ, Tettelin H, Werren JH (2006). Multilocus sequence typing system for the endosymbiont *Wolbachia pipientis*. *Applied and Environmental Microbiology* **72**: 7098-7110.
- Baldo L, Werren JH (2007). Revisiting *Wolbachia* supergroup typing based on *WSP*: spurious lineages and discordance with MLST. *Current Microbiology* **55**: 81-87.
- Bandelt HJ, Forster P, Röhl A (1999). Median-joining networks for inferring intraspecific phylogenies. *Molecular Biology and Evolution* **16**: 37-48.
- Bateman PW, Ferguson JWH, Yetman CA (2006). Courtship and copulation, but not ejaculates, reduce the longevity of female field crickets (*Gryllus bimaculatus*). *Journal of Zoology* **268**: 341-346.
- Becks L, Agrawal AF (2010). Higher rates of sex evolve in spatially heterogeneous environments. *Nature* **468**: 89-92.
- Bell G (1982). *The masterpiece of nature: The evolution and genetics of sexuality*. Croom Helm, London, United Kingdom.

- Bell G (1985). Two theories of sex and variation. *Experientia* **41**: 1235-1245.
- Beukeboom LW, Werren JH (2000). The paternal-sex-ratio (PSR) chromosome in natural populations of *Nasonia* (Hymenoptera: Chalcidoidea). *Journal of Evolutionary Biology* **13**: 967-975.
- Bordenstein SR, Uy JJ, Werren JH (2003). Host genotype determines cytoplasmic incompatibility type in the haplodiploid genus *Nasonia*. *Genetics* **164**: 223-233.
- Bouchon D, Rigaud T, Juchault P (1998). Evidence for widespread *Wolbachia* infection in isopod crustaceans: molecular identification and host feminization. *Proceedings of the Royal Society of London, Series B* **265**: 1081-1090.
- Boutin-Ganache I, Raposo M, Raymond M, Deschepper CF (2001). M13-tailed primers improve the readability and usability of microsatellite analyses performed with two different allele-sizing methods. *BioTechniques* **31**: 24-28.
- Braig HR, Zhou W, Dobson SL, O'Neill SL (1998). Cloning and characterization of a gene encoding the major surface protein of the bacterial endosymbiont *Wolbachia pipientis*. *Journal of Bacteriology* **180**: 2373-2378.
- Brownlie JC, Cass BN, Riegler M, Witsenburg JJ, Iturbe-Ormaetxe I, McGraw EA, O'Neill SL (2009). Evidence for metabolic provisioning by a common invertebrate endosymbiont, *Wolbachia pipientis*, during periods of nutritional stress. *PLoS Pathogens* **5**: e1000368.
- Bürger R (1999). Evolution of genetic variability and the advantage of sex and recombination in changing environments. *Genetics* **153**: 1055-1069.

C

- Cabello-Garcia T, Vargas-Piqueras P (1985). Temperature as a factor influencing the form of reproduction of *Trichogramma cordubensis* Vargas & Cabello (Hym., Trichogrammatidae). *Zeitschrift für Angewandte Entomologie* **100**: 434-441.
- Capinera JL, Lilly JH (1975a). *Tetrastichus asparagi*, parasitoid of the asparagus beetle: some aspects of host-parasitoid interaction. *Annals of the Entomological Society of America* **68**: 595-596.
- Capinera JL, Lilly JH (1975b). Bionomics and biotic control of the asparagus beetle, *Crioceris asparagi*, in Western Massachusetts. *Environmental Entomology* **4**: 93-96.
- Carson HL, Chang LS, Lyttle TW (1982). Decay of female sexual behavior under parthenogenesis. *Science* **218**: 68-70.
- Casiraghi M, Bordenstein SR, Baldo L, Lo N, Beninati T, Wernegreen JJ, Werren JH, Bandi C (2005). Phylogeny of *Wolbachia pipientis* based on *gltA*, *groEL* and *ftsZ* gene sequences: clustering of arthropod and nematode symbionts in the F supergroup, and evidence for the further diversity in the *Wolbachia* tree. *Microbiology* **151**: 4015-4022.
- Chapman T, Liddle LF, Kalb JM, Wolfner MF, Partridge L (1995). Cost of mating in *Drosophila melanogaster* females is mediated by male accessory gland

products. *Nature* **373**: 241-244.

Chapman T, Arnqvist G, Bangham J, Rowe L (2003). Sexual conflict. *Trends in Ecology and Evolution* **18**: 41-47.

Clancy DJ, Hoffmann AA (1998). Environmental effects on cytoplasmic incompatibility and bacterial load in *Wolbachia*-infected *Drosophila simulans*. *Entomologia experimentalis et Applicata* **86**: 13-24.

Crow JF (1994). Advantages of sexual reproduction. *Developmental Genetics* **15**: 205-213.

D

Dedehne F, Vavre F, Fleury F, Loppin B, Hochberg ME, Boulétreau M (2001). Removing symbiotic *Wolbachia* bacteria specifically inhibits oogenesis in a parasitic wasp. *Proceedings of the National Academy of Science of the USA* **98**: 6247-6252.

Dedehne F, Vavre F, Shoemaker DD, Boulétreau M (2004). Intra-individual coexistence of a *Wolbachia* strain required for host oogenesis with two strains inducing cytoplasmic incompatibility in the wasp *Asobara tabida*. *Evolution* **58**: 2167-2174.

Dyer KA, Jaenike J (2004). Evolutionary stable infection by a male-killing endosymbiont in *Drosophila innubila*: molecular evidence from the host and parasite genomes. *Genetics* **168**: 1443-1455.

E

Ellers J (1996). Fat and eggs: an alternative method to measure the trade-off between survival and reproduction in insect parasitoids. *Netherlands Journal of Zoology* **46**: 227-235.

Ellers J, van Alphen JJM (1997). Life history evolution in *Asobara tabida*: plasticity in allocation of fat reserves to survival and reproduction. *Journal of Evolutionary Biology* **10**: 771-785.

Ellers J, van Alphen JJM, Sevenster JG (1998). A field study of size-fitness relationships in the parasitoid *Asobara tabida*. *Journal of Animal Ecology* **67**: 318-324.

Evanno G, Regnaut S, Goudet J (2005). Detecting the number of clusters of individuals using the software STRUCTURE: a simulation study. *Molecular Ecology* **14**: 2611-2620.

F

Fernald HT (1909). A parasite on the Asparagus beetle. *Journal of Economic Entomology* **2**: 278-279.

- Foucaud J, Orivel J, Fournier D, Delabie JHC, Loiseau A, Le Breton J, Cerdans P, Estoup A (2009). Reproductive system, social organization, human disturbance and ecological dominance in native populations of the little fire ant, *Wasmannia auropunctata*. *Molecular Ecology* **18**: 5059-5073.
- Fowler K, Partridge L (1989). A cost of mating in female fruitflies. *Nature* **338**: 760-761.

G

- Garcia-Gonzalez F, Simmons LW (2010). Male-induced costs of mating for females compensated by offspring viability benefits in an insect. *Journal of Evolutionary Biology* **23**: 2066-2075.
- Gavotte L, Vavre F, Henri H, Ravallec M, Stouthamer R, Boulétreau M (2004). Diversity, distribution and specificity of WO phage infection in *Wolbachia* of four insect species. *Insect Molecular Biology* **13**: 147-153.
- Gilabert A, Simon JC, Mieuze L, Halkett F, Stoeckel S, Plantegenest M, Dedryver CA (2009). Climate and agricultural context shape reproductive mode variation in an aphid crop pest. *Molecular Ecology* **18**: 3050-3061.
- Giron D, Rivero A, Mandon N, Darrouzet E, Casas J (2002). The physiology of host feeding in parasitic wasps: implications for survival. *Functional Ecology* **16**: 750-757.
- Glesener RR, Tilman D (1978). Sexuality and the components of environmental uncertainty: clues from geographic parthenogenesis in terrestrial animals. *The American Naturalist* **112**: 659-673.
- Gottlieb Y, Zchori-Fein E (2001). Irreversible thelytokous reproduction in *Muscidifurax uniraptor*. *Entomologia Experimentalis et Applicata* **100**: 271-278.
- Goudet J (1995). FSTAT (version 1.2): a computer program to calculate *F*-statistics. *Journal of Heredity* **86**: 285-286.
- Grenier S, Pintureau B, Heddi A, Lassablière F, Jager C, Louis C, Khatchadourian C (1998). Successful horizontal transfer of *Wolbachia* symbionts between *Trichogramma* species. *Proceedings of the Royal Society of London, Series B* **265**: 1441-1445.
- Gross R, Vavre F, Heddi A, Hurst GDD, Zchori-Fein E, Bourtzis K (2009). Immunity and symbiosis. *Molecular Microbiology* **73**: 751-759.

H

- Haack L, Simon JC, Gauthier JP, Plantegenest M, Dedryver CA (2000). Evidence for predominant clones in a cyclically parthenogenetic organism provided by combined demographic and genetic analyses. *Molecular Ecology* **9**: 2055-2066.
- Haag CR, Ebert D (2004). A new hypothesis to explain geographic parthenogenesis. *Annales Zoologici Fennici* **41**: 539-544.

- Haag-Liautard C, Coffey N, Houle D, Lynch M, Charlesworth B, Keightley PD (2008). Direct estimation of the mitochondrial DNA mutation rate in *Drosophila melanogaster*. *PLoS Biology* **6**: 1706-1714.
- Hall TA (1999). BioEdit: a user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT. *Nucleic Acids Symposium Series* **41**: 95-98.
- Hall T (2007). *BioEdit: a biological sequence alignment editor*. Ibis Biosciences, Carlsbad, CA, USA. URL: <http://www.mbio.ncsu.edu/BioEdit/BioEdit.html>
- Hamilton WD, Axelrod R, Tanese R (1990). Sexual reproduction as an adaptation to resist parasites (A Review). *Proceedings of the National Academy of Science of the USA* **87**: 3566-3573.
- Heath BD, Butcher RDJ, Whitfield WGF, Hubbard SF (1999). Horizontal transfer of *Wolbachia* between phylogenetically distant insect species by a naturally occurring mechanism. *Current Biology* **9**: 313-316.
- Heimpel GE, Collier TR (1996). The evolution of host-feeding behaviour in insect parasitoids. *Biological Reviews* **71**: 373-400.
- Hertig M (1936). The rickettsia, *Wolbachia pipientis* (gen. et sp. n.) and associated inclusions of the mosquito, *Culex pipiens*. *Parasitology* **28**: 453-486.
- Hilgenboecker K, Hammerstein P, Schlattmann P, Telschow A, Werren JH (2008). How many species are infected with *Wolbachia*? - a statistical analysis of current data. *FEMS Microbiology Letters* **281**: 215-220.
- Himler AG, Adachi-Hagimori T, Bergen JE, Kozuch A, Kelly SE, Tabashnik BE, Chiel E, Duckworth VE, Dennehy TJ, Zchori-Fein E, Hunter MS (2011). Rapid spread of a bacterial symbiont in an invasive whitefly is driven by fitness benefits and female bias. *Science* **332**: 254-256.
- Hiroki M, Kato Y, Kamito T, Miura K (2002). Feminization of genetic males by a symbiotic bacterium in a butterfly, *Eurema hecabe* (Lepidoptera: Pieridae). *Naturwissenschaften* **89**: 167-170.
- Hoffmann AA, Reynolds KT, Nash MA, Weeks AR (2008). A high incidence of parthenogenesis in agricultural pests. *Proceedings of the Royal Society of London, Series B* **275**: 2473-2481.
- Holden PR, Brookfield JFY, Jones P (1993). Cloning and characterization of an *ftsZ* homologue from a bacterial symbiont of *Drosophila melanogaster*. *Molecular and General Genetics* **240**: 213-220.
- Hornett EA, Duploux AMR, Davies N, Roderick GK, Wedell N, Hurst GDD, Charlat S (2008). You can't keep a good parasite down: evolution of a male-killer suppressor uncovers cytoplasmic incompatibility. *Evolution* **62**: 1258-1263.
- Huigens ME, Luck RF, Klaassen RHG, Maas MFPM, Timmermans MJTN, Stouthamer R (2000). Infectious parthenogenesis. *Nature* **405**: 178-179.
- Huigens ME, Stouthamer R (2003). Parthenogenesis associated with *Wolbachia*. In: Bourtzis K, Miller TA (eds). *Insect symbiosis*, pp. 247-266. CRC Press, Boca

Raton, Florida, USA.

- Huigens ME, de Almeida RP, Boons PAH, Luck RF, Stouthamer R (2004). Natural interspecific and intraspecific horizontal transfer of parthenogenesis-inducing *Wolbachia* in *Trichogramma* wasps. *Proceedings of the Royal Society of London, Series B* **271**: 509-515.
- Hurst GGD, Hurst LD, Majerus MEN (1992). Selfish genes move sideways. *Nature* **356**: 659-660.
- Hurst GDD, Jiggins FM, von der Schulenburg JHG, Bertrand D, West SA, Goriacheva II, Zakharov IA, Werren JH, Stouthamer R, Majerus MEN (1999). Male-killing *Wolbachia* in two species of insect. *Proceedings of the Royal Society of London, Series B* **266**: 735-740.
- Hurst GDD, Johnson AP, von der Schulenburg JHG, Fuyama Y (2000). Male-killing *Wolbachia* in *Drosophila*: a temperature-sensitive trait with a threshold bacterial density. *Genetics* **156**: 699-709.
- Hurst GDD, Jiggins FM, Pomiankowski A (2002). Which way to manipulate host reproduction? *Wolbachia* that cause cytoplasmic incompatibility are easily invaded by sex ratio distorting mutants. *The American Naturalist* **160**: 360-373.

I

- Ideo S, Watada M, Mitsui H, Kimura MT (2008). Host range of *Asobara japonica* (Hymenoptera: Braconidae), a larval parasitoid of drosophilid flies. *Entomological Science* **11**: 1-6.

J

- Jaenike J (2007). Spontaneous emergence of a new *Wolbachia* phenotype. *Evolution* **61**: 2244-2252.
- Jervis MA, Kidd NAC (1986). Host-feeding strategies in hymenopteran parasitoids. *Biological Reviews* **61**: 395-434.
- Jia FX, Yang MS, Yang WJ, Wang JJ (2009). Influence of continuous high temperature conditions on *Wolbachia* infection frequency and the fitness of *Liposcelis tricolor* (Psocoptera: Liposcelididae). *Environmental Entomology* **38**: 1365-1372.
- Johnston FA (1915). Asparagus-beetle egg parasite. *Journal of Agricultural Research* **4**: 303-313.
- Jolley KA, Chan MS, Maiden MCJ (2004). mlstdbNet - distributed multi-locus sequence typing (MLST) databases. *BMC Bioinformatics* **5**: 86.

K

- Kamping A, Katju V, Beukeboom LW, Werren JH (2007). Inheritance of gynandromorphism in the parasitic wasp *Nasonia vitripennis*. *Genetics* **175**: 1321-1333.
- Kimura M, Maruyama T (1966). The mutational load with epistatic gene interactions in fitness. *Genetics* **54**: 1337-1351.
- King KC, Hurst GDD (2010). Losing the desire: selection can promote obligate asexuality. *BMC Biology* **8**: 101.
- Kittayapong P, Jammongluk W, Thipaksorn A, Milne JR, Sindhusake C (2003). *Wolbachia* infection complexity among insects in the tropical rice-field community. *Molecular Ecology* **12**: 1049-1060.
- Kondrashov AS (1988). Deleterious mutations and the evolution of sexual reproduction. *Nature* **336**: 435-440.
- Kraaijeveld AR, van Alphen JJM (1994). Geographical variation in resistance of the parasitoid *Asobara tabida* against encapsulation by *Drosophila melanogaster* larvae: the mechanism explored. *Physiological Entomology* **19**: 9-14.
- Kraaijeveld AR, van der Wel NN (1994). Geographic variation in reproductive success of the parasitoid *Asobara tabida* in larvae of several *Drosophila* species. *Ecological Entomology* **19**: 221-229.
- Kraaijeveld AR, van Alphen JJM (1995). Variation in diapause and sex ratio in the parasitoid *Asobara tabida*. *Entomologia Experimentalis et Applicata* **74**: 259-265.
- Kraaijeveld AR, Godfray HCJ (1999). Geographic patterns in the evolution of resistance and virulence in *Drosophila* and its parasitoids. *The American Naturalist* **153**: S61-S74.
- Kraaijeveld K, Franco P, Reumer BM, van Alphen JJM (2009). Effects of parthenogenesis and geographical isolation on female sexual traits in a parasitoid wasp. *Evolution* **63**: 3085-3096.
- Kraaijeveld K, Franco P, de Knijff P, Stouthamer R, van Alphen JJM (2011a). Clonal genetic variation in a *Wolbachia*-infected asexual wasp: horizontal transmission or historical sex? *Molecular Ecology* **20**: 3644-3652.
- Kraaijeveld K, Reumer BM, Mouton L, Kremer N, Vavre F, van Alphen JJM (2011b). Does a parthenogenesis-inducing *Wolbachia* induce vestigial cytoplasmic incompatibility? *Naturwissenschaften* **98**: 175-180.
- Kremer N, Charif D, Henri H, Bataille M, Prévost G, Kraaijeveld K, Vavre F (2009). A new case of *Wolbachia* dependence in the genus *Asobara*: evidence for parthenogenesis induction in *Asobara japonica*. *Heredity* **103**: 248-256.
- Kremer N, Dedeine F, Charif D, Finet C, Allemand R, Vavre F (2010). Do variable compensatory mechanisms explain the polymorphism of the dependence phenotype in the *Asobara tabida*-*Wolbachia* association? *Evolution* **64**: 2969-2979.
- Kremer N, Huigens ME (2011). Vertical and horizontal transmission drive bacterial invasion. *Molecular Ecology* **20**: 3496-3498.

L

- Legner EF (1985). Natural and induced sex ratio changes in populations of thelytokous *Muscidifurax uniraptor* (Hymenoptera: Pteromalidae). *Annals of the Entomological Society of America* **78**: 398-402.
- Librado P, Rozas J (2009). DnaSP v5: A software for comprehensive analysis of DNA polymorphism data. *Bioinformatics* **25**: 1451-1452.
- Lively CM, Craddock C, Vrijenhoek RC (1990). Red Queen hypothesis supported by parasitism in sexual and clonal fish. *Nature* **344**: 864-866.
- Lo N, Casiraghi M, Salati E, Bazzocchi C, Bandi C (2002). How many *Wolbachia* supergroups exist? *Molecular Biology and Evolution* **19**: 341-346.

M

- Maynard Smith J (1978). *The evolution of sex*. Cambridge University Press, Cambridge, United Kingdom.
- Mitsui H, van Achterberg K, Nordlander G, Kimura MT (2007). Geographical distributions and host associations of larval parasitoids of frugivorous Drosophilidae in Japan. *Journal of Natural History* **41**: 1731-1738.
- Moiroux J, Le Lann C, Seyahoei MA, Vernon P, Pierre JS, van Baaren J, van Alphen JJM (2010). Local adaptations of life-history traits of a *Drosophila* parasitoid, *Leptopilina boulardi*: does climate drive evolution? *Ecological Entomology* **35**: 727-736.
- Mouton L, Henri H, Boulétreau M, Profizi N, Vavre F (2004). Virulence, multiple infections and regulation of symbiotic population in the *Wolbachia-Asobara tabida* symbiosis. *Genetics* **168**: 181-189.
- Mouton L, Henri H, Boulétreau M, Vavre F (2006). Effect of temperature on *Wolbachia* density and impact on cytoplasmic incompatibility. *Parasitology* **132**: 1-8.
- Mouton L, Henri H, Fleury F (2009). Interactions between coexisting intracellular genomes: mitochondrial density and *Wolbachia* infection. *Applied Environmental Microbiology* **75**: 1916-1921.
- Muller HJ (1964). The relation of recombination to mutational advance. *Mutation Research* **1**: 2-9.
- Murata Y, Ideo S, Watada M, Mitsui H, Kimura MT (2009). Genetic and physiological variation among sexual and parthenogenetic populations of *Asobara japonica* (Hymenoptera: Braconidae), a larval parasitoid of drosophilid flies. *European Journal of Entomology* **106**: 171-178.

N

- Negri I, Pellecchia M, Mazzoglio PJ, Patetta A, Alma A (2006). Feminizing *Wolbachia* in *Zyginidia pullula* (Insecta, Hemiptera), a leafhopper with an XX/X0 sex-determination system. *Proceedings of the Royal Society of London, Series B* **273**: 2409-2416.
- Noda H, Miyoshi T, Zhang Q, Watanabe K, Deng K, Hoshizaki S (2001). *Wolbachia* infection shared among planthoppers (Homoptera: Delphacidae) and their endoparasite (Strepsiptera: Elenchidae): a probable case of interspecies transmission. *Molecular Ecology* **10**: 2101-2106.

O

- O'Neill SL, Giordano R, Colbert AME, Karr TL, Robertson HM (1992). 16S rRNA phylogenetic analysis of the bacterial endosymbionts associated with cytoplasmic incompatibility in insects. *Proceedings of the National Academy of Science of the USA* **89**: 2699-2702.

P

- Pannebakker BA, Pijnacker LP, Zwaan BJ, Beukeboom LW (2004a). Cytology of *Wolbachia*-induced parthenogenesis in *Leptopilina clavipes* (Hymenoptera: Figitidae). *Genome* **47**: 299-303.
- Pannebakker BA, Zwaan BJ, Beukeboom LW, van Alphen JJM (2004b). Genetic diversity and *Wolbachia* infection of the *Drosophila* parasitoid *Leptopilina clavipes* in western Europe. *Molecular Ecology* **13**: 1119-1128.
- Pannebakker BA, Schidlo NS, Boskamp GJF, Dekker L, Van Dooren TJM, Beukeboom LW, Zwaan BJ, Brakefield PM, van Alphen JJM (2005). Sexual functionality of *Leptopilina clavipes* (Hymenoptera: Figitidae) after reversing *Wolbachia*-induced parthenogenesis. *Journal of Evolutionary Biology* **18**: 1019-1028.
- Peakall R, Smouse PE (2006). GENALEX 6: genetic analysis in Excel. Population genetic software for teaching and research. *Molecular Ecology Notes* **6**: 288-295.
- Perlman SJ, Hunter MS, Zchori-Fein E (2006). The emerging diversity of Rickettsia. *Proceedings of the Royal Society of London, Series B* **273**: 2097-2106.
- Pijls JWAM, van Steenbergen HJ, van Alphen JJM (1996). Asexuality cured: the relations and differences between sexual and asexual *Apoanagyrus diversicornis*. *Heredity* **76**: 506-513.
- Pintureau B, Chapelle L, Delobel B (1999). Effects of repeated thermic and antibiotic treatments on a *Trichogramma* (Hym., Trichogrammatidae) symbiont. *Journal of Applied Entomology* **123**: 473-483.

Pritchard JK, Stephens M, Donnelly P (2000). Inference of population structure using multilocus genotype data. *Genetics* **155**: 945-959.

R

- R Developmental Core Team (2006) *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL: <http://www.R-project.org>
- R Development Core Team (2008). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL: <http://www.R-project.org>
- R Development Core Team (2010). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL: <http://www.R-project.org>
- R Development Core Team (2011). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL: <http://www.R-project.org>
- Raychoudhury R, Baldo L, Oliveira DCSG, Werren JH (2009). Modes of acquisition of *Wolbachia*: horizontal transfer, hybrid introgression, and codivergence in the *Nasonia* species complex. *Evolution* **63**: 165-183.
- Raychoudhury R, Grillenberger BK, Gadau J, Bijlsma R, van de Zande L, Werren JH, Beukeboom LW (2010). Phylogeography of *Nasonia vitripennis* (Hymenoptera) indicates a mitochondrial-*Wolbachia* sweep in North America. *Heredity* **104**: 318-326.
- Raymond M, Rousset F (1995). GENEPOP (Version 1.2): population genetics software for exact tests and ecumenicism. *Journal of Heredity* **86**: 248-249.
- Reumer BM, Kraaijeveld K, van Alphen JJM (2007). Selection in the absence of males does not affect male-female conflict in the parasitoid wasp *Leptopilina clavipes* (Hymenoptera: Figitidae). *Journal of Insect Physiology* **53**: 994-999.
- Reumer BM, van Alphen JJM, Kraaijeveld K (2010). Ecology, *Wolbachia* infection frequency and mode of reproduction in the parasitoid wasp *Tetrastichus coeruleus* (Hymenoptera: Eulophidae). *Molecular Ecology* **19**: 1733-1744.
- Reumer BM, van Alphen JJM, Kraaijeveld K (2012). Occasional males in parthenogenetic populations of *Asobara japonica* (Hymenoptera: Braconidae): low *Wolbachia* titer or incomplete co-adaptation? *Heredity* **108**: 341-346.
- Rice WR (1996). Sexually antagonistic male adaptation triggered by experimental arrest of female evolution. *Nature* **381**: 232-234.
- Rivero A, Casas J (1999). Incorporating physiology into parasitoid behavioral ecology: the allocation of nutritional resources. *Researches in Population Ecology* **41**: 39-45.
- Roff DA (1992). *The evolution of life histories: theory and analysis*. Chapman & Hall, New York, New York, USA.

- Roff DA (2002). *Life history evolution*. Sinauer Associates, Sunderland, Massachusetts, USA.
- Rousset F, Bouchon D, Pintureau B, Juchault P, Solignac M (1992). *Wolbachia* endosymbionts responsible for various alterations of sexuality in arthropods. *Proceedings of the Royal Society of London, Series B* **250**: 91-98.
- Rousset F (2008). GENEPOP'007: a complete re-implementation of the GENEPOP software for Windows and Linux. *Molecular Ecology Resources* **8**: 103-106.
- Russell HM, Johnston FA (1912). The life history of *Tetrastichus asparagi* Crawford. *Journal of Economic Entomology* **5**: 429-433.
- Russell JA, Goldman-Huertas B, Moreau CS, Baldo L, Stahlhut JK, Werren JH, Pierce NE (2009). Specialization and geographic isolation among *Wolbachia* symbionts from ants and lycaenid butterflies. *Evolution* **63**: 624-640.

S

- Scheffer SJ, Grissell EE (2003). Tracing the geographical origin of *Megastigmus transvaalensis* (Hymenoptera: Torymidae): an African wasp feeding on a South American plant in North America. *Molecular Ecology* **12**: 415-421.
- Scheu S, Drossel B (2007). Sexual reproduction prevails in a world of structured resources in short supply. *Proceedings of the Royal Society of London, Series B* **274**: 1225-1231.
- Schilthuizen M, Stouthamer R (1997). Horizontal transmission of parthenogenesis-inducing microbes in *Trichogramma* wasps. *Proceedings of the Royal Society of London, Series B* **264**: 361-366.
- Seyahooei MA (2010). *Life-history evolution in hymenopteran parasitoids: the roles of host and climate*. PhD thesis, Leiden University, The Netherlands.
- Sinkins SP, Braig HR, O'Neill SL (1995). *Wolbachia* superinfections and the expression of cytoplasmic incompatibility. *Proceedings of the Royal Society of London, Series B* **261**: 325-330.
- Sintupachee S, Milne JR, Poonchaisri S, Baimai V, Kittayapong P (2006). Closely related *Wolbachia* strains within the pumpkin arthropod community and the potential for horizontal transmission via the plant. *Microbial Ecology* **51**: 294-301.
- Smith PT, Kambhampati S (1999). Status of the *Cotesia flavipes* species complex (Braconidae: Microgasterinae) based on mitochondrial *16S* rRNA and *NADH 1 dehydrogenase* gene sequence. *Journal of the Kansas Entomological Society* **72**: 306-314.
- Smith PT, Kambhampati S, Völkl W, Mackauer M (1999). A phylogeny of aphid parasitoids (Hymenoptera: Braconidae: Aphidiinae) inferred from mitochondrial *NADH 1 dehydrogenase* gene sequence. *Molecular Phylogenetics and Evolution* **11**: 236-245.

- South A, Lewis SM (2011). The influence of male ejaculate quantity on female fitness: a meta-analysis. *Biological Reviews* **86**: 299-309.
- Stearns SC (1992). *The evolution of life histories*. Oxford University Press, Oxford, United Kingdom.
- Stouthamer R, Luck RF, Hamilton WD (1990a). Antibiotics cause parthenogenetic *Trichogramma* (Hymenoptera/Trichogrammatidae) to revert to sex. *Proceedings of the National Academy of Sciences of the United States of America* **87**: 2424-2427.
- Stouthamer R, Pinto JD, Platner GR, Luck RF (1990b). Taxonomic status of thelytokous forms of *Trichogramma* (Hymenoptera: Trichogrammatidae). *Annals of the Entomological Society of America* **83**: 475-481.
- Stouthamer R, Kazmer DJ (1994). Cytogenetics of microbe-associated parthenogenesis and its consequences for gene flow in *Trichogramma* wasps. *Heredity* **73**: 317-327.
- Stouthamer R, Breeuwer JAJ, Hurst GDD (1999). *Wolbachia pipientis*: microbial manipulator of arthropod reproduction. *Annual Review of Microbiology* **53**: 71-102.
- Stouthamer R, van Tilborg M, de Jong JH, Nunney L, Luck RF (2001). Selfish element maintains sex in natural populations of a parasitoid wasp. *Proceedings of the Royal Society of London, Series B* **268**: 617-622.
- Stouthamer R, Russell JE, Vavre F, Nunney L (2010). Intragenomic conflict in populations infected by parthenogenesis inducing *Wolbachia* ends with irreversible loss of sexual reproduction. *BMC Evolutionary Biology* **10**: 229.

T

- Tamura K, Peterson D, Peterson N, Stecher G, Nei M, Kumar S (2011). MEGA5: Molecular Evolutionary Genetics Analysis using maximum likelihood, evolutionary distance, and maximum parsimony methods. *Molecular Biology and Evolution* **28**: 2731-2739.
- Turelli M, Hoffmann AA (1991). Rapid spread of an inherited incompatibility factor in California *Drosophila*. *Nature* **353**: 440-442.

V

- van Alphen JJM (1980). Aspects of the foraging behaviour of *Tetrastichus asparagi* Crawford and *Tetrastichus* spec. (Eulophidae), gregarious egg parasitoids of the asparagus beetles *Crioceris asparagi* L. and *C. duodecimpunctata* L. (Chrysomelidae). 1. Host-species selection, host-stage selection and host discrimination. *Netherlands Journal of Zoology* **30**: 307-325.
- Van Handel E (1985a). Rapid determination of glycogen and sugars in mosquitoes. *Journal of the American Mosquito Control Association* **1**: 299-301.

- Van Handel E (1985b). Rapid determination of total lipids in mosquitoes. *Journal of the American Mosquito Control Association* **1**: 302-304.
- Van Handel E, Day JF (1988). Assay of lipids, glycogen and sugars in individual mosquitoes: correlations with wing length in field-collected *Aedes vexans*. *Journal of the American Mosquito Control Association* **4**: 549-550.
- Van Valen L (1973). A new evolutionary law. *Evolutionary Theory* **1**: 1-30.
- van Vugt JFA, Salverda M, de Jong JH, Stouthamer R (2003). The paternal sex ratio chromosome in the parasitic wasp *Trichogramma kaykai* condenses the paternal chromosomes into a dense chromatin mass. *Genome* **46**: 580-587.
- Varaldi J, Fouillet P, Ravallec M, López-Ferber M, Boulétreau M, Fleury F (2003). Infectious behavior in a parasitoid. *Science* **302**: 1930.
- Vavre F, Fleury F, Lepetit D, Fouillet P, Boulétreau M (1999). Phylogenetic evidence for horizontal transmission of *Wolbachia* in host-parasitoid associations. *Molecular Biology and Evolution* **16**: 1711-1723.
- Vavre F, Dedeine F, Quillon M, Fouillet P, Fleury F, Boulétreau M (2001). Within-species diversity of *Wolbachia*-induced cytoplasmic incompatibility in haplodiploid insects. *Evolution* **55**: 1710-1714.
- Vavre F, Fleury F, Varaldi J, Fouillet P, Boulétreau M (2002). Infection polymorphism and cytoplasmic incompatibility in Hymenoptera-*Wolbachia* associations. *Heredity* **88**: 361-365.
- Visser B, Ellers J (2008). Lack of lipogenesis in parasitoids: a review of physiological mechanisms and evolutionary implications. *Journal of Insect Physiology* **54**: 1315-1322.
- Visser B, Le Lann C, den Blanken FJ, Harvey JA, van Alphen JJM, Ellers J (2010). Loss of lipid synthesis as an evolutionary consequence of a parasitic lifestyle. *Proceedings of the National Academy of Sciences* **107**: 8677-8682.

W

- Weeda EJ, Westra R, Westra C, Westra T (1991). *Nederlandse Oecologische Flora; wilde planten en hun relaties 4*, pp. 304-305. IVN, Amsterdam, The Netherlands.
- Weeks AR, Breeuwer JAJ (2001). *Wolbachia*-induced parthenogenesis in a genus of phytophagous mites. *Proceedings of the Royal Society of London, Series B* **268**: 2245-2251.
- Weir BS, Cockerham CC (1984). Estimating *F*-statistics for the analysis of population structure. *Evolution* **38**: 1358-1370.
- Werren JH (1991). The paternal-sex-ratio chromosome of *Nasonia*. *The American Naturalist* **137**: 392-402.
- Werren JH, Zhang W, Guo LR (1995). Evolution and phylogeny of *Wolbachia* - reproductive parasites of arthropods. *Proceedings of the Royal Society of London, Series B* **261**: 55-63.

- Werren JH (1997). Biology of *Wolbachia*. *Annual Review of Entomology* **42**: 587-609.
- Werren JH, Windsor DM (2000). *Wolbachia* infection frequencies in insects: evidence of a global equilibrium? *Proceedings of the Royal Society of London, Series B* **267**: 1277-1285.
- Werren JH, Stouthamer R (2003). PSR (paternal sex ratio) chromosomes: the ultimate selfish genetic elements. *Genetica* **117**: 85-101.
- Werren JH, Baldo L, Clark ME (2008). *Wolbachia*: master manipulators of invertebrate biology. *Nature Reviews: Microbiology* **6**: 741-751.
- Wigby S, Chapman T (2005). Sex peptide causes mating costs in female *Drosophila melanogaster*. *Current Biology* **15**: 316-321.

X

- Xu J, Wang Q (2011). Seminal fluid reduces female longevity and stimulates egg production and sperm trigger oviposition in a moth. *Journal of Insect Physiology* **57**: 385-390.

Z

- Zchori-Fein A, Perlman SJ (2004). Distribution of the bacterial symbiont *Cardinium* in arthropods. *Molecular Ecology* **13**: 2009-2016.
- Zeh DW, Zeh JA, Bonilla MM (2005). *Wolbachia*, sex ratio bias and apparent male killing in the harlequin beetle riding pseudoscorpion. *Heredity* **95**: 41-49.
- Zhou W, Rousset F, O'Neill S (1998). Phylogeny and PCR-based classification of *Wolbachia* strains using *wsp* gene sequences. *Proceedings of the Royal Society of London, Series B* **265**: 509-515.