EvoLunch

Why is Wolbachia-induced cytoplasmic incompatibility so common?

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Cytoplasmic incompatibility (CI) is the most common reproductive manipulation produced by Wolbachia, obligately intracellular alphaproteobacteria that infect roughly half of all insect species. Once infection frequencies within host populations approach 10%, intense CI can drive Wolbachia to near fixation within 10 generations. However, natural selection among Wolbachia variants within individual host species does not favor enhanced CI. Indeed, variants that eliminate CI, but increase host fitness, are expected to spread (Turelli 1994). Nevertheless, roughly half of Wolbachia infections cause detectable CI. What selects for and maintains this phenotype? CI-causing Wolbachia variants preferentially spread into new host species because, as simple models show, CI increases equilibrium population frequencies and CI-causing variants can be maintained at high frequencies even if conditions fluctuate so that initially beneficial Wolbachia infections become deleterious to their hosts. In contrast, CI does little to help establish beneficial Wolbachia in new host species. An epidemiological model that describes Wolbachia gain and loss by host species and the loss of CI within Wolbachia lineages yields simple expressions for the frequency of Wolbachia-infected species and the fraction of those infections that cause CI. CI exemplifies a common phenotype whose frequency and persistence is more plausibly explained by enhancing spread to new host lineages rather than enhancing spread within host lineages (i.e., classical natural selection). Data documenting recent Wolbachia acquisitions by many hosts species, suggesting ongoing spatial spread within host species, and rapid evolution (especially degradation) of CI-causing loci support a determinative role for interspecific transmission in maintaining CI.

Wednesday, September 29, 2021 12:30pm - 01:30pm
I22 Lakeside View (I22.O1.006)

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