



Motivation

Many pathogens can be transmitted between hosts through several routes (i.e. different “inoculation sites”, different infective hosts), but little is known about the impacts to the host of becoming infected by each of several routes. We are studying the implications of multiple disease-transmission routes in the House Finch (*Carpodacus mexicanus*) – *Mycoplasma gallisepticum* bacteria system.

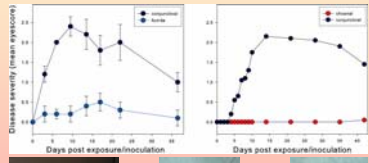
Implications

- Different routes of infection can lead to differences in disease expression (leading to differences in infectivity) and in different rates of disease-induced mortality of hosts, and thus different proportions of partially immune hosts in a population.
- Population-level host – disease dynamics can “evolve” through time, even without any alteration in the genetic structure of either host or pathogen, due to changing average host mortality and disease transmission rates associated with the presence of partially immune hosts.

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The Specific Route of Infection Affects Transition From Susceptible to Infected State

Route of infection determines severity and duration of disease in experimental infections.



Conjunctiva Indirect (blue) vs. Conjunctiva Direct (black) vs. Choana Direct (red)

Severity of clinical signs may affect probability of mortality in the wild



Survival following experimental infection in captivity is high, yet *M. gallisepticum* caused severe declines in House Finch populations in the wild, suggesting that impaired vision due to conjunctival inflammation may mediate higher mortality in nature. Shown are different grades of severity in inflammation (“eyescores”).

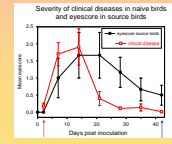
Therefore, route of infection likely affects host survival probability through variation in severity and duration of clinical signs of disease.

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Mode of Infection Affects Rapidity of Recovery and Duration of Infectivity

Different routes of infection lead to different times to disappearance of clinical signs of disease (see above)

Infectivity and severity of transmitted disease are linked with severity of infective host’s disease.



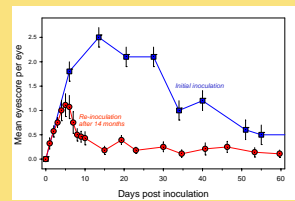
Day 2 PI: Source bird: no clinical disease BUT infectious; Day 42 PI: Source bird: clinical disease BUT: not infectious

Therefore, because of relationship between conjunctival inflammation and infectivity, the route of infection affects transmissibility (R₀) of *M. gallisepticum*.

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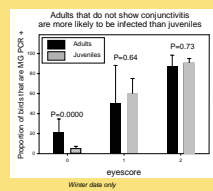
House Finches that Survive Infection Re-enter the Susceptible Pool in a Different State due to Partial Immunity

Captive birds maintain long-term partial immunity



Sydenstricker et al. 2005, Journal of Wildlife Diseases 41: 326-333

In the wild, partial immunity appears to allow adult House Finches to carry *M. gallisepticum* infections without displaying conjunctival inflammation.



Adults that do not show conjunctivitis are more likely to be infected than juveniles

Therefore, increased proportions of previously exposed and partially immune birds through time will cause changes in both mortality rate of exposed birds, and rate of disease transmission (R₀).

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