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ABSTRACT

House Finches in North America are known hosts of ectoparasitic hippoboscid flies and eastern finches are also susceptible to the eye disease mycoplasmal conjunctivitis. I used three years of trapping data from a population in Georgia to ask if birds affected by conjunctivitis had increased rates of hippoboscid fly parasitism. Of 1,531 examinations of 1,287 House Finches, hippoboscid fly prevalence was 0.89% in birds with no conjunctivitis and 0.95% in birds with conjunctivitis. These rates were not significantly different, but the overall low prevalence in this population was considerably lower than that reported in other eastern House Finches. Two individuals with both conjunctivitis and hippoboscid flies appeared to be in poor health.

INTRODUCTION

Bird banders have long known of hippoboscid flies–small, flattened, parasitic flies that live amongst the feathers of birds and often escape when birds are handled. These flies feed on the blood of their host, and often can affect the condition of their host negatively (Senar et al. 1994). Hippoboscid flies were once thought to be facilitators of feather mite transfer between birds (Jovani et al. 2001). Much of what is known about hippoboscids comes from reports by bird banders. Since banders routinely handle large numbers of birds, they have been able to document the general distribution and incidence of hippoboscid fly parasitism on many landbird species (e.g. Wood 1983, McClure 1984, Davis 1998). One species in particular, the House Finch, has been examined in this respect more than most species (Wood 1983, McClure 1984). House Finches are native to western North America but were introduced into the eastern United States in the 1940s and have since spread to most eastern states, so that now two, non-overlapping House Finch populations, eastern and western, exist in North America (Hill 1993). With respect to their hippoboscid fly parasitism, Wood (1983), studying eastern House Finches, found an overall prevalence rate of 13%, and found that hippoboscid flies were present from June to September. McClure (1984) examined 9,973 western House Finches over six years and observed an overall prevalence rate of 1.7%. McClure found hippoboscid flies on House Finches in all months of the year, but by far most occurred from June to October.

In 1994, over a decade after these initial studies of hippoboscid parasitism in House Finches, House Finches in eastern North America began contracting a newly emerged disease, mycoplasmal conjunctivitis (Fischer et al. 1997, Altizer et al. 2004a). This disease, caused by the bacterium *Mycoplasma gallisepticum* (MG), causes infected individuals to develop easily recognizable swellings around their eyes (conjunctivitis) with outbreaks occurring annually during the fall and winter months (Altizer et al. 2004a, Altizer et al. 2004b). Infected House Finches are not able to forage efficiently (Hotchkiss et a1. 2005) and have poor body conditions (Altizer et al. 2004a). Furthermore, based on citizen-science data, Altizer et al. (2004b) showed that prevalence of this disease was highest in the southeastern U.S. This

raises an interesting question: does this high conjunctivitis prevalence make this population particularly susceptible to parasitism by ectoparasites such as hippoboscid flies? This may be the case if conjunctivitis influences the House Finches' ability to preen and successfully rid themselves of external parasites.

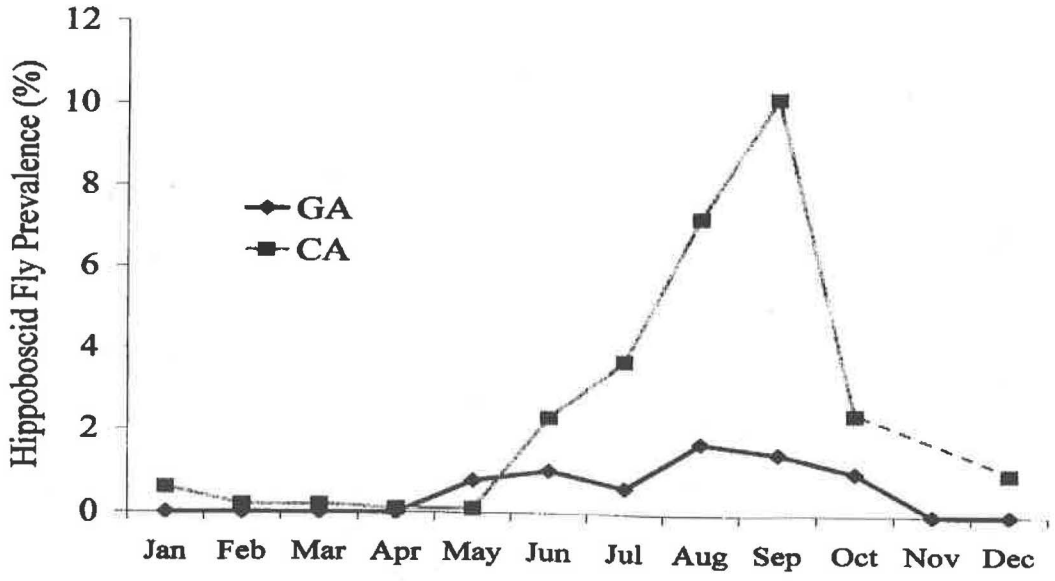
In this paper, I used three years of trapping data from a long-term study of mycoplasmal conjunctivitis in House Finches in Georgia to address the above question. Specifically, I asked: 1) What is the prevalence and seasonal distribution of hippoboscid fly incidence in GA House Finches (and is this different from other populations); 2) are House Finches infected with MG more likely to have hippoboscid flies; and 3) is there any effect of hippoboscid fly parasitism on the body condition (i.e. weight, fat load, pectoral muscle or feather mite load) of House Finches either with or without conjunctivitis?

METHODS

As part of an ongoing, long-term study of the dynamics of mycoplasmal conjunctivitis in Georgia (Altizer et al. 2004a, Davis et al. 2004), I trapped House Finches at three locations within metro Atlanta, conducting trapping sessions at least once a week for at least three hours in the morning. To trap House Finches, I used a combination of mist nets (9 m long, 30 mm mesh) placed around the feeders and walk-in cage traps, following Hill (2002). The cage traps were cylindrical and made of hardware mesh with each containing a standard bird feeder filled with sunflower seed. Two entrances in the hardware mesh near the bottom of the trap allow birds to walk in (via a wooden perch placed outside each entrance).

Upon capture, all House Finches were banded with a numbered USFWS metal band. Where possible, I recorded each bird's age as either after-hatch year (AHY) or hatch-year (HY), based on skull ossification, plumage, or fault bars (Pyle 1997). Similarly, where possible I recorded the sex of each bird based on the dimorphic plumage of the species (Hill 1993). Each bird was weighed with a portable electronic balance, and I recorded its unflattened wing chord, the amount of visible subcutaneous fat (scored from 0 to 3), the shape of its pectoral muscle (body condition index) on a score of 0-3, and the number of feather mites on one outstretched wing (scored from 0 to 3). For recaptured individuals, the same data were collected.

Fig. 1. Temporal distribution of hippoboscid flies on House Finches in Georgia and California. California data taken from (McClure 1984).



Because of the handling and ruffling of feathers required for this processing, it was usually during this time that any hippoboscid flies would either fly off the bird, or I would observe them on the bird. Thus, because all birds were handled in the same manner and for the same length of time, this method allowed me to document the presence or absence of hippoboscid flies on the House Finches I trapped. Although I did not attempt to capture (and thus identify) any flies, I made note of which finches were parasitized. Based on my previous experience with hippoboscid fly identification (Davis 1998), and the size of the flies that I observed, I estimate that most, if not all, hippoboscid flies on the House Finches I trapped were the species *Ornithomya anchineuria*.

RESULTS and DISCUSSION

Over 39 months (Aug 2001 - Oct 2004), I trapped 1,287 House Finches and made 244 subsequent recaptures, for a total of 1,531 examinations. Of this total, 236 (15.4%) examinations were of House Finches with conjunctivitis, and 11 birds (0.7% of the total) were observed with hippoboscid flies. All hippoboscid flies were observed on House Finches between the months of May and October (Fig. 1), which is very similar to that found in other eastern (Wood 1983) and western (McClure 1984) House Finches..

House Finches with conjunctivitis were not parasitized by hippoboscid flies more so than those without conjunctivitis (Table 1). During the period when hippoboscid flies were observed (May through October), parasitism rates of 0.89% (no conjunctivitis) and 0.95% (with conjunctivitis) were observed. These rates were not significantly different from each other ($\chi^2 = 0.006$, df = 1, p = 0.940).

There were too few birds parasitized with hippoboscid flies to statistically compare morphological and physiological host traits with non-parasitized birds. However, general trends can be discerned in Table 2, where these parameters are

Table 1. Prevalence of mycoplasmal conjunctivitis and hippoboscid flies on House Finches during the seasonal period of hippoboscid fly presence (May to Oct) . Parasitism rates of birds with and without conjunctivitis were not statistically different.

	No Hippoboscids	Hippoboscids	Total
No conjunctivitis	998	9 **(0.89%)**	1007
Conjunctivitis	209	2 **(0.95%)**	211
Total	**1207**	**11**	**1218**

Table 2. Summary of effects of hippoboscid flies and mycoplasmal conjunctivitis on House Finches from May to October (period of Hippoboscid fly presence). Mean values for all parameters are shown.

Variable	No Hippo, No Conj.	No Hippo, Conj.	Hippo, No Conj.	Hippo, Conj.	Overall
N	784	171	9	2	966
Wing chord (mm)	75.3	75.6	74.6	76.0	75.4
Weight (g)	20.3	20.2	20.1	18.4	20.3
Fat Score[a]	1.5	1.6	1.3	1.0	1.5
Body Condition index[b]	2.7	2.6	2.9	2.5	2.7
Feather mite score[c]	1.2	1.6	1.6	2.0	1.3

[a] Fat was scored on a 0-3 scale.
[b] Score of pectoral muscle shape, from 0-3.
[c] Feather mite loads were scored on a 0-3 scale.

given across all infection and parasitism categories. For example, average weights of House Finches with conjunctivitis and hippoboscid flies were lower than uninfected birds. Fat scores tended to decrease with conjunctivitis infection and hippoboscid fly parasitism. Finally, feather mite scores of birds with conjunctivitis and hippoboscid flies were higher than all other categories.

While the seasonal distribution of hippoboscid flies I observed is consistent with previous studies, my estimate of overall prevalence (0.7%), whether or not they had conjunctivitis, is similar to that found in a western population of House Finches (1.7%) (McClure 1984). Unexpectedly though, it is much lower than that found in a population in Pennsylvania (13%) (Wood 1983). In both cases, the authors trapped large numbers of House Finches–McClure nearly 10,000 and Wood over 2,000 (extrapolated from results shown), and each over many years. However, while their prevalence estimates are likely to be accurate, the hippoboscid fly species did differ in each House Finch population. McClure reported the species *Ornithoica vicina* and *Microlynchia pusilla* on western House Finches, while Wood reported *Ornithomya anchineuria* (previously *O. fringilla*). The latter is most likely what I observed on the House Finches in this study, based on the size of the flies I observed (*O. vicina* is very small).

Why then, did I find the large discrepancy between Wood's results and the present study, since both (eastern) House Finch populations are presumably parasitized by the same fly? Could the introduction of *M. gallisepticum* since Wood's paper was published have somehow lowered the overall susceptibility of House Finches to other ailments? Or could the prevalence of hippoboscid flies on House Finches have naturally lowered over the 20 years since the first study? Or could my method of estimating hippoboscid fly incidence substantially underestimate the true prevalence? Although some hippoboscid flies could have escaped before I reached the bird while in the mist net or trap, this bias must have also been true for Wood. Furthermore, if 13% of House Finches in my study population had been parasitized, I should have seen approximately 200 parasitized individuals, which I clearly did not. I can offer no other explanations for this result, but I believe it to be one of the more interesting findings of this study, even though it was not the intended focus of the research.

Conclusions: I conclude that mycoplasmal conjunctivitis does not increase the rate of parasitism by hippoboscid flies, either at the population level or at the level of the individual. Furthermore, although more data would be needed to test this idea, I did find limited evidence that individuals infected with both conjunctivitis and hippoboscid flies may be affected more severely than those with only one infection. Finally, the hippoboscid fly parasitism rate I observed was much lower than that of another eastern House Finch population, the reason for which is unknown.

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House Finch
by D. L. Bordner