PREVALENCE OF LOUSE-FLIES Diptera, Hippoboscidae
PARASITING A CARDUELLINE FINCH AND ITS EFFECT ON
BODY CONDITION

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Increasing evidence indicates that ectoparasites have major effects on many aspects of host behaviour and ecology (e.g. Loye & Zuk 1991). This may be especially true for group-living species. Several contact-transmitted ectoparasites (e.g. fleas, mites, ticks, bugs or lices) have been shown to reduce the fitness of their host (e.g. Brown & Brown 1986, Möller et al. 1990, Loye & Zuk 1991, Möller 1993). This contrasts with the very few data available on the ecology and prevalence of more mobile ectoparasites, such as louse flies (Diptera, Hippoboscidae). These are blood-sucking parasites, and hence can have a debilitating effect either by themselves or because of the transmission of endoparasites (McClure 1984a, 1984b, Baker 1967, Möller pers. comm.).

The aim of the present paper is to describe the phenological appearance of louse flies in the Serin Serinus serinus, to relate it to meteorological variables and host sex and age, and to study to what extent the presence of the parasite may affect the body condition of the host.

The data presented here are based on captures of Serins from 1985 to 1992 at a permanent ringing station in the suburban area of Barcelona (NE Spain). The area is formed by orchards, small pine woods Pinus halepensis and gardens, and has a typical mediterranean climate, with mean minimum temperatures in January (10°), and mean maximum ones in July-August (24°). Precipitation is very variable, from 30 mm in January or July, to 82 mm in September (mean values from 1976 to 1985, Meteorological Center of Barcelona). Birds were trapped at baited feeders using platform traps, clap nets and mist nets (see Senar 1988), and were marked with numbered aluminium rings. For each bird we recorded sex, age, body mass and wing-length. We trapped a total of 6547 Serins (3468 recaptures), although for the analysis we have only used the birds trapped within the period in which louse-flies appeared (May to October, 3728 Serins). Since average recovery period for Serins was longer than a month, so that the bird could get additional parasites, we used first captures and recoveries in the analyses. Louse-flies were collected directly from the birds and were placed individually in small tubes of 70% ethyl alcohol, later being identified in the laboratory by GW. Most of the flies were not captured, but identified by size and action. Multiple regression models were built interactively using the method of Henderson & Velleman (1981).

From 1985 to 1992, 48 birds with flies were observed (1.3% of prevalence). Four of the trapped flies were identified as Ornithoica turdi, and an additional one was identified as Ornithomyia avicularia. All the remaining (observed) louse-flies were of very small size and quick flyers, and they would most probably be Ornithoica turdi specimens. In all cases, except one in which the Serin carried two flies, only one fly per bird was recorded.

Louse-flies appeared from May to October, with peak prevalence in August-September ($X^2_{s} = 12.0$, $df = 5$, $p = 0.035$) (Fig. 1). Prevalence (arcsine transformed) for the months May to October (months with flies positively recorded) was positively correlated with the average minimum temperature of the previous month ($r =$...
Table 1. Multiple regression model and associated statistics for the relationship between monthly louse-flies prevalence (arcsine transformed) (dependent variable), and average minimum temperature of the previous month and average precipitation of the previous month.

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<th>Variable in</th>
<th>Temperature</th>
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<td>Constant</td>
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Table 2. Multiple regression model and associated statistics for the relationship between annual louse-flies prevalence (arcsine transformed) (dependent variable), and the sum of monthly average minimum temperatures from May to August and the sum of monthly average precipitation from May to August.

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Prevalence of louse-flies varied significantly between years ($\chi^2 = 27.1, df = 4, p = 0.0003$). Prevalence (arcsine transformed) per year (May to October) was not correlated to either of the yearly meteorological variables used (sum of monthly (May to August) maximum and minimum average temperatures, average precipitation, and number of days with rain; we excluded September and October because these months showed a very high precipitation rate masking any relationship and because of its a priori small effect on the number of flies in the

0.36, $p < 0.01$). Adding into the model the average precipitation the previous month, significance of the model still hold, although the change in correlation was not significant (Table 1). Neither maximum average temperatures, number of days with rain, nor number of hours of sun, either from the previous or the analysed month, improved the predictability of the model.

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whole season [i.e. they are the last months]). However, plotting of prevalence against these variables, showed a positive relationship between prevalence and the sum of monthly average minimum temperatures (Fig. 2A), two outliers (years 1987 and 1992) being the cause of the lack of significance in the correlation ($r = 0.47, p = 0.24$). Exclusion of these two points raised correlation to $r = 0.996 (p < 0.001)$. In these years, precipitation was very high (they were the first and third year with highest precipitation, respectively; 1991 was the second one but temperature was probably too low) (Fig. 2B). Therefore, we added to the model the index of annual precipitation (sum of monthly average precipitation from May to August), and the predictibility of the regression model improved considerably (Table 2).

In Serins, as in other cardueline finches, females stay longer periods in the nest than males. However, analysis of prevalence by sex (taking only reproductive individuals, i.e. Euring ages 4-6), showed no significant difference ($\chi^2 = 0.08, df = 1, p = 0.77$). Juveniles in streaked plumage (3J Euring age) have in comparison to yearlings (3 Euring age), more recently abandoned the nest. However, comparison of prevalence between these two age classes did not show any significant difference ($\chi^2 = 1.90, df = 1, p = 0.17$). Effect of general age (yearlings -Euring ages 3J, 3 and 5, vs. adults -ages 4 and 6) was not significant either ($\chi^2 = 3.17, df = 1, p = 0.21$).

An index of body condition was calculated as the bird’s mass divided by the cube of wing-length (see Clark 1979, Johnson et al. 1985). The body condition of Serins holding louse-flies was lower (about a 3%) than the mean body condition of Serins of the same sex and age caught on the same day during the same period of the day (±1 h) (Sign test, Fig. 3; Serins without individuals for comparison were excluded from the analysis).

Serins show a low louse-fly prevalence (1.3%), within the ranges for other cardueline finches (McClure 1984b: 0.8 - 1.8%; see how-

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**Fig. 2.** Plot of the different years of the study for prevalence of louse-flies per year and A: the sum of mean minimum temperatures from May to August, and B: the sum of monthly average precipitation from May to August.

**Fig. 3.** Body condition (mass/wing-length$^3$) of louse fly infected and non-infected Serins. Values plotted as means ± SE. Infected birds = 30.711 ± 0.65; non-infected birds = 31.568 ± 0.56, Sign test, $z = 2.028, n = 35, p = 0.043$. 

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ever Bouvier 1973). The occurrence of *Ornithoica turdi* during summer and autumn with a peak at the end of the summer, is also similar to that of other species (McClure 1984b, Walter *et al.* 1990). Variation in prevalence, either among months or years, can be explained by meteorological variation (average minimum temperatures and precipitation) (see also Bequaert 1952). Mobile ectoparasites seem therefore to be more sensitive to external variables not directly related to the host than contact-transmitted parasites (e.g. Burt *et al.* 1991, Dobson & May 1991, Harper *et al.* 1992), a fact that should be taken into account when studying the interaction between louse-flies and bird populations.

Until recently, many ecologists assumed that parasites do not harm their host. However, recent studies reveal a multitude of effects of ectoparasites on hosts (e.g. Loye & Zuk 1991). Reduction in body condition has been reported for bugs and ticks parasitizing nestlings (Chapman & George 1991), and here we show how louse-flies may have a similar effect on adult hosts.

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**REFERENCES**


