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## High Host Specificity of *Crataerina melbae* (Diptera: Hippoboscidae) in a Mixed Colony of Birds

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**ABSTRACT:** We looked for louse flies (Diptera, Hippoboscidae) in a mixed colony of 9 species of birds from 1991 to 1997. Alpine swifts (*Apus melba*) exhibited an unusually high prevalence (85.9%) by *Crataerina melbae* (Rondani, 1879). No birds from the other 8 breeding bird species were parasitized by this louse fly. We suggest that the number of potential swiftlike hosts as well as the size of hosts may account for the differential prevalence of the louse flies within the colony.

The effects of parasites as deleterious components of their avian host's fitness is well established (Loye and Carroll, 1995). Host sociality favors the infection by contact-transmitted parasites, i.e., through host–host body contact (Hillgarth, 1996; Blanco et al., 1997), frequently constituting 1 of the major costs of coloniality in birds (Loye and Carroll, 1995). However, mobile ectoparasites like louse flies (Diptera, Hippoboscidae) are able to move actively between hosts (Hutson, 1984), and thus they could equally affect solitary and colonial nesting birds, at both interspecific (Poulin, 1991) and intraspecific levels (Tella, 1996).

Although louse flies are common blood-sucking parasites on birds, they have been little studied. Most of the earlier work on these parasites has focused on their abundance (Summers, 1975; Hutson, 1981; McClure, 1984; Young et al., 1993; Lee and Clayton, 1995), and only a few studies have examined the effects of these parasites on their hosts (Senar et al., 1994; Tella, Gortázar, Gajón, and Osácar, 1995; Tompkins et al., 1996), or their role as vectors of avian blood parasites (Baker, 1967). Host specificity is 1 of the poorly known aspects of the louse flies (Summers, 1975; Hutson, 1984), even though it deserves maximum attention in order to understand host–parasite relationships and the broader implications in conservation biology (Loye and Carroll, 1995). Due to their mobility, one should expect louse flies to have a narrow niche specificity, as extensive works have suggested (McClure, 1984). Host specificity could be even more relaxed in mixed colonies of birds, where proximity between species and interchange of nests is facilitated. However, in the present study, we present data showing a high host selection by a louse fly species (*Crataerina melbae*, Rondani, 1879) in a large avian mixed colony.

Fieldwork was carried out in a large cylindrical chasm in Teruel (NE Spain), of about 70 m wide and 100 m depth. At this location, there usually are several hundred breeding birds representing 9 different species. Accurate censuses are not yet available, but our minimum estimates for each species breeding in this colony are shown in Table I. According to our observations, most species breed together inside small cracks and crevices, so the distances between nests of different species are apparently very small (a few cm to a few m). Although *Crataerina* flies mainly are vertically transmitted ectoparasites be-

cause of their vestigial wings (Tompkins et al., 1996), they also have been found to move actively between nests, e.g., 6.25% of 96 marked flies were recaptured in different nests, separated by 0.5–8.5 m (Summers, 1975). Thus, in our colony, louse flies could be vertically transmitted between different host species (through the occupation of a nest hole previously used by other species) as well as horizontally transmitted by active walking or short flights.

Birds were captured in July–August from 1991 to 1997. One to 6 fieldwork days were spent each year, for a total of 20 days. House martins (*Delichon urbica*), crag martins (*Ptyonoprogne rupestris*), European swifts (*Apus apus*), and alpine swifts (*Apus melba*) were trapped by means of a handheld mist net held by 2 persons in a horizontal position close to the ground and raised when a bird attempted to enter or leave the chasm, thus intercepting its flight. Because this method was used to catch alpine swifts selectively (Tella, Gortázar, Gajón, and Osácar, 1995), the other 3 species were captured in lower numbers. Roosting choughs (*Pyrhocorax pyrrhocorax*) and rock doves (*Columba livia*) were hand-captured at night. Other species, i.e., house sparrow (*Passer domesticus*), rock sparrow (*Petronia petronia*), and spotless starling (*Sturnus unicolor*), were captured in mist nets positioned along the edge of the chasm. All birds were kept individually in cloth bags, banded, and systematically searched for ectoparasites by blowing the feathers of the whole body for 5–10 min. Cloth bags were also accurately checked to avoid missing flies or from the contamination of other individuals in the same bags. The louse flies collected were stored in tubes with 70% methanol and identified in the laboratory.

A total of 364 birds of 10 species was captured, including all the species that usually breed in the chasm (Table I) as well as 1 Bonelli's warbler *Phylloscopus bonelli* that was fortuitously trapped. This species probably forages in the chasm but does not nest there. Of 241 sampled alpine swifts, we found at least 1 *C. melbae* in 207 (85.9%). No other bird species was parasitized by *C. melbae*, demonstrating the host specificity by *C. melbae* to be highly significant ( $\chi^2$  with Yates correction = 241.4,  $P < 0.00001$ ).

Our results confirm a previous study on the effects of *C. melbae* on alpine swifts (Tella, Gortázar, Gajón, and Osácar, 1995), showing the highest louse-fly parasitization rate ever reported in birds. Furthermore, the intensity of parasitization was also high ( $4.14 \pm 4.58$  SD flies, with a range of 1–32 flies per infected bird) (Tella, Gortázar, Gajón, and Osácar, 1995). However, no birds of the other, and more abundant (Table I), 8 species breeding in close contact with alpine swifts were parasitized. This finding contrasts with the low specificity of most louse-fly species, some of them infesting dozens of bird species

TABLE I. Species breeding in the colony, estimates of the minimum number of adult birds present each year, and number of sampled birds between 1991 and 1997.

Species	Abundance	Sampled birds	Infected birds
Rock dove	*	4	0
European swift	†	6	0
Alpine swift	‡	241	207
Crag martin	†	4	0
House martin	*	18	0
House sparrow	*	3	0
Rock sparrow	§	66	0
Spotless starling	†	4	0
Chough	‡	18	0

\* >50 birds.

† >20 birds.

‡ 200–300 birds.

§ >100 birds.

belonging to different avian orders (Bequaert, 1955; McClure, 1984; Llinas and Jiménez, 1996).

Several explanations can be advanced for the high host specificity we observed. Between-year changes in host specificity due to possible shifts in our captures of bird species can be discarded, because the prevalence of louse flies did not vary between years (Tella, Gortázar, Gajón, and Osácar, 1995). Adamson and Caira (1994) suggested that different phenologies may select for different parasite species when 2 hosts are equivalent from a physiological point of view. However, all sampled bird species, except the chough, breed simultaneously in the chasm, and all of them were captured at the same time (choughs breed in April–June, and from then on they roost in the chasm). Poiani (1992) found that sedentary host genera of birds tended to harbor a smaller hippoboscoid fly diversity than migratory host genera. Again, our data do not support this hypothesis. Alpine swifts, European swifts, and house martins are migratory trans-Saharan species, so they offer the same opportunities to parasites regarding their annual movements.

Considering that preening activity and its efficiency in birds is related to their morphological characteristics (Clayton and Cotgreave, 1994), we related the high prevalence of louse flies in alpine swifts to their low preening and scratching capability because of their extremely short necks and tarsi (Tella et al., 1995a). This could explain why sparrows, choughs, rock doves, and starlings are free of *C. melbae*. However, European swifts and both species of martins are morphologically and ecologically similar to alpine swifts. It is possible that these swiftlike species are not parasitized because of their relative smaller numbers in the colony (Table I) that could reduce the chance to become infected.

Another possibility is that louse flies exhibit the positive correlation known between body size of other parasites and the size of their hosts (Morand et al., 1996). House martins and European swifts are parasitized by congeneric louse flies (*Crataerina hirundinis* and *Crataerina pallida*, respectively) and also show a relative high host specificity (Summers, 1975; Hutson, 1981). The smaller louse-fly species (*C. hirundinis* and *C. pallida*; Theodor and Oldroyd, 1964) parasitize the smaller bird species, i.e., house martins and European swifts respectively (Cramp, 1985, 1988), whereas the larger *C. melbae* (Theodor

and Oldroyd, 1964) parasitizes the larger bird species, i.e., alpine swifts (Tella, Gortázar, López, and Osácar, 1995). *Crataerina melbae* may avoid house martins and European swifts because of their smaller body, or feather size, or both (louse flies hide between the feathers). Nevertheless, further experimental studies are needed to test the 2 more likely explanations, i.e., the number of available potential hosts and the size of hosts.

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