Wilson Bull., 107(4), 1995, pp. 734–738

Botfly ectoparasitism of the Brown Cacholote and the Firewood-gatherer.—Flies of the genus *Philornis* (Diptera, Muscidae) are obligate subcutaneous parasites of birds (Pont 1972, Harwood and James 1987). Philornid botflies place their eggs on birds, generally chicks. The larvae burrow into the chick's skin and feed on its blood and body fluids (Uhazy and Arendt 1986). Mature larvae emerge through apertures in the skin producing large cutaneous lesion and posterior scars (Arendt 1985a, Uhazy and Arendt 1986). Pupation occurs on the bottom of the nest (Pont 1972). Lethality of fly parasitism depends on various factors such as age and size of nestlings, implantation sites, intensity of infestation, brood size, the amount of food that adults can bring to the nest, rainfall, and the thermal environment of the nest (Arendt 1985a, b, Mason 1985). Botfly parasitism has been documented in several Neotropical birds (Dinelli 1941; García 1952; Dodge 1968; Smith 1968; Pont 1972; Hector 1982; Fraga 1984; Arendt 1985a,b; Mason 1985; Young 1993). In this note, I report the prevalence and intensity of larvae in nestlings of the Brown Cacholote (*Pseudoseisura lophotes*) and the Firewood-gatherer (*Anumbius annumbi*), their infestation sites, and host mortality. I also report the simultaneous infestation by two species of *Philornis*.

Study area and methods.—I studied botflies in Monte Cristo (31°23′S, 63°53′W), Córdoba, Argentina, over a 4-yr period (1989–1993). Mean annual rainfall at study area is 790 mm, occurring briefly between November and March and the mean annual temperature is 16.5°C. I examined 144 Brown Cacholote nestlings in 67 clutches and 160 Firewood-gatherer nestlings in 50, and 211 and 189 adults, respectively, to determine the presence of botfly larvae. Adult and nestlings were marked individually with leg bands of colored plastic.

I removed 31 larvae from two Cacholote nestlings and 28 from three Firewood-gatherer nestlings, which were not included in the overall analyses. These larvae were reared in separate vials containing some stick as a substrate at ambient temperature. I preserved a sample of three larvae from each host species and the remainder allowed to form pupae, five of which were preserved. Forty-eight adult flies emerged and were preserved. S. Abalos of the Centro de Investigaciones Entomológicas de Córdoba identified philornid flies to species according to descriptions by Shannon and del Ponte (1927) and García (1952) descriptions.

Following Margolis et al. (1982), Fraga (1984), and Arendt (1985b), I measured (1) *prevalence* (percentage infested) among broods and nestlings, (2) *intensity* (number of larvae per infested host), and (3) *mortality* (number of dead nestlings per infested nestlings). I used a Chi-square test to compare fledging success (nestlings surviving from hatching to fledgling) between parasitized and unparasitized nestlings. To correlate annual rainfall with prevalence in nestling I used Spearman correlation. To correlate monthly rainfall with infestation rates I used a regression analysis.

Results.—Two different philornid species were found, *Philornis pici* and *P. seguyi*. The mean density was 11.1 larvae/Brown Cacholote's nestling (range: 3–21) and 8.8 larvae/Firewood-gatherer's nestling (range: 3–17). All of the nestlings of infested brood were parasitized. Hatchlings and young nestlings (one week old) were significantly more infested than older ones ($\bar{x}$ = 12 larvae vs 7.9 larvae; ANOVA, $F_{2,65} = 4.6$, $P < 0.05$).

Botfly parasitism caused the death of eight Brown Cacholote (30.7%) and nine Firewood-gatherer nestlings (31%), corresponding to 5.5% (8/144) and 5.6% (9/160) of total nestlings, respectively (Table 1). No significant difference was found in fledgling success in parasitized cacholotes (69%) and unparasitized ones (74.81%) (Chi-square test = 0.22, df = 1, $P > 0.5$) and in parasitized Firewood-gatherers (69.2%) and unparasitized ones (73.7%) (Chi-square test = 0.4, df = 1, $P > 0.5$).

Both species of botflies simultaneously occurred in nestlings of these two bird species.

TABLE 1

PREVALENCE OF BOTFLY INFESTATIONS IN BROWN CACHOLOTE AND FIREWOOD-GATHERER NESTLINGS IN MONTE CRISTO, 1989–1993

Species	Prevalence in broods (a)	%	Prevalence in nestlings (b)	%	Mortality N	%
Brown Cacholote	11/67	16.4	26/144	18	8	30.7
Firewood-gatherer	9/50	18	29/160	18.1	9	31

[a] Number of parasitized broods/total broods.
[b] Number of parasitized nestlings/total nestlings.

These larvae were at various stages in each nestling. In both species, the botfly larvae infested most body surfaces, especially on the head, throat, wings, legs and near the cloaca. There were no significant differences in some specific sites and the distribution of larvae did no vary with the nestling development.

The Brown Cacholote's reproductive period is longer (late September–February) (Nores and Nores 1994) than that of the Firewood-gatherer (September–December) (Nores and Nores unpubl. data). The rate of infestation by botfly larvae on nestling Cacholotes varied over the breeding season, peaking during November and decreasing during December. There were a few cases in October and January, and none in February (Fig. 1A). Infestation rates on nestling Firewood-gatherers did not vary over the breeding season (Fig. 1B). Botfly infestation varied among years in Brown Cacholote and Firewood-gatherer nestlings (Fig. 2), and was related to annual rainfall (Spearman rank $r^s = 0.97$, $P < 0.05$, and $r^s = 0.95$, $P < 0.05$, respectively). During the third (1991–1992) breeding season only one cacholote's brood was lightly parasitized (three to five larvae per nestling). During the study this was the driest year (670 mm). The most intense infestation in both species occurred in 1989–1990. During this wetter period (900 mm), mean intensity was 15 larvae/Brown Cacholote nestling (N = 11) and 13 larvae/Firewood-gatherer nestling (N = 13). I found no correlation between monthly rainfall and botfly infestation in Brown Cacholote nestlings ($r^2 = 0.55$, N = 24, $P > 0.05$) and in Firewood-gatherers ($r^2 = 0.35$, N = 16, $P > 0.05$.) None of the

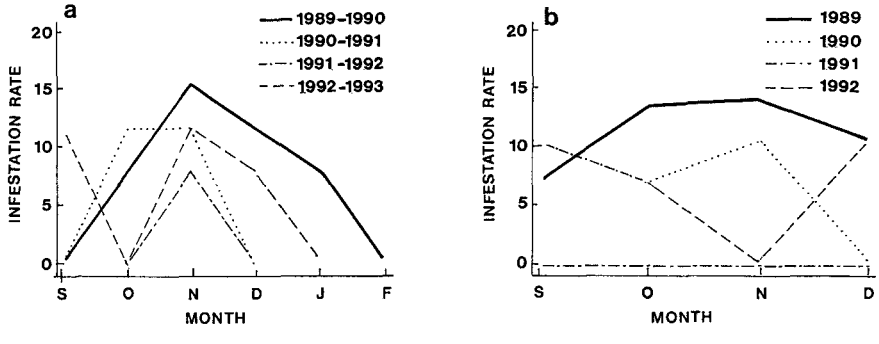

FIG. 1. Infestation rate during four breeding periods in Monte Cristo, (a) Brown Cacholote nestlings, (b) Firewood-gatherer nestlings.

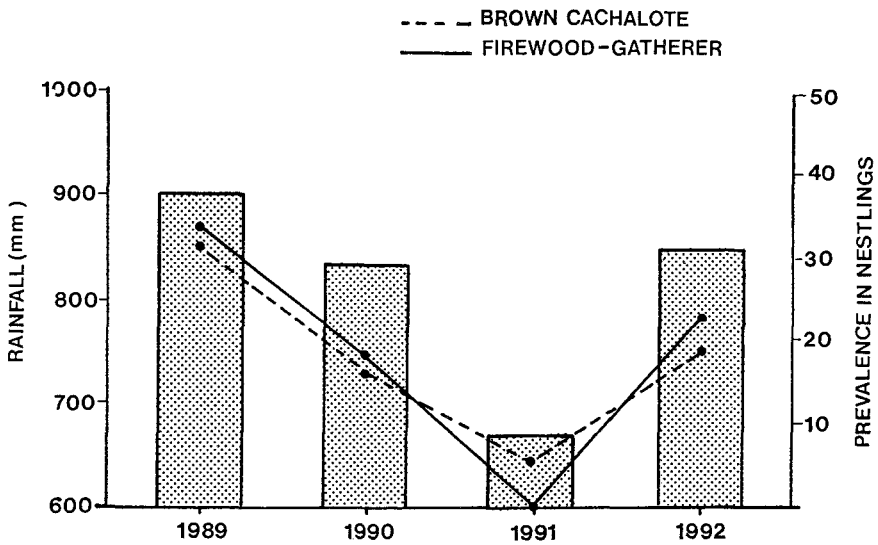

FIG. 2. Relationship between infestation of nestlings in Brown Cacholote and Firewood-gatherer and annual rainfall in Monte Cristo (1989–1993).

sampled adult birds of either species (211 Brown Cacholotes and 189 Firewood-gatherers) was infested during the study period.

Discussion.—Prevalence of botfly larvae in brood and nestlings was similar in both host species. Comparable values in nestlings on the Firewood-gatherer were observed by Fraga (1984) who found 33.3% and 18.2%, respectively. Mason (1985) recorded a brood prevalence of 32.5%. Their areas were slightly wetter (annual rainfall was about 1000 mm) than mine. Arendt (1985b) found that 96 percent of 448 nestling Pearly-eyed Thrashers (*Margarops fuscatus*) examined were infested and overall mean intensity was 37 larvae/nestling (range 0–220). In his study area the annual rainfall varies from 3000 mm to more than 5000 mm. I agree with him that infestation by botflies is associated with rainfall.

Hatchlings and young nestlings were more susceptible to infestation than older ones, because they were naked and less active. Philornid larvae were observed on all body surfaces of the nestling and no significant difference was found in any specific site and with the nestling's ontogeny.

Lethal infestation was more than 14 larvae per nestling in both species, but there were two exceptions. Two recently hatched Firewood-gatherer nestlings with four and six larvae, respectively, died, while a Brown Cacholote nestling fledged with 15 larvae.

Other birds species died with fewer larvae. Smith (1968) suggested that seven larvae were sufficient to kill nestlings of the Giant Cowbird (*Scaphidura oryzivora*) three species of oropendolas, *Zarrhinchus wagleri, Psarocolius decumanus, Gymnostinops montezuma* and one species of cacique, *Cacicus cela.* Mason (1985) reported a lethal intensity of six botfly larvae in eight species of passerine birds. Arendt (1985b) reported mortality in hatchling Pearly-eyed Thrashers infested with 1-5 larvae.

Thirty-one percent of the infested Firewood-gatherer nestlings and 30.7% of Brown Cacholote nestlings died. Fraga (1984) and Mason (1985) observed higher mortality rates (50%) in the Firewood-gatherer.

Some adult birds remove botfly larvae. Bay-winged Cowbirds (*Molothrus badius*) remove larvae from their nestlings and those of their brood parasite, the Screaming Cowbirds (*M. rufoaxillaris*) (Fraga 1984). Giant Cowbirds (*Scaphidura oryzivora*) remove botfly eggs and larvae from their own bodies and those from their host (Smith 1968). This behavior was not observed in the Brown Cacholote or the Firewood-gatherer.

Botfly ectoparasitism in adult birds has been documented for several species (García 1952, Dodge 1968, Arendt 1985b), but in this study, no adult Brown Cacholotes or Firewood-gatherers were parasitized by botfly larvae. *Philornis* ectoparasitism occurred fairly commonly at the nestlings, but it contributed slightly to total mortality (5.5% and 5.6%). It does not appear to be severe enough to affect population levels of these species.

Acknowledgments.—I sincerely thank my thesis advisor, M. Nores for his continued help and encouragement throughout my study. I thank W. Arendt and D. Forrester for helpful comments on the manuscript. I also thank J. Navarro for helping during data analysis. The Consejo de Investigaciones Científicas y Tecnológicas de la Provincia de Córdoba and the Consejo Nacional de Investigaciones Científicas y Técnicas provided founds through post-graduate scholarships.

LITERATURE CITED

ARENDT, W. J. 1985a. *Philornis* ectoparasitism of Pearly-eyed Thrashers. I. Impact on growth and development of nestlings. Auk 102:270–280.

———. 1985b. *Philornis* ectoparasitism of Pearly-eyed Thrashers. II. Effect on adults and reproduction. Auk 102:281–292.

DINELLI, L. M. 1941. Causas que merman las aves. Hornero 8:60–62.

DODGE, H. R. 1968. Some new and little-known species of *Philornis* (Diptera, Muscidae). J. Kansas Entomol. Soc. 41:155–164.

FRAGA, R. M. 1984. Bay-winged Cowbirds (*Molothrus badius*) remove ectoparasites from their brood parasites, the Screaming Cowbirds (*Molothrus rufoaxillaris*). Biotrópica 16: 223–226.

GARCÍA, M. 1952. Las especies argentinas del género *Philornis* Mein., con descripción de especies nuevas. Rev. Soc. Entomol. Arg. 15:277–293.

HARWOOD, R. F. AND M. T. JAMES. 1987. Entomología médica y veterinaria. Noriega Ed. Limusa, México.

HECTOR, D. P. 1982. Botfly (Diptera, Muscidae) parasitism of nestling Aplomado Falcons. Condor 84:442–444.

MARGOLIS, L., G. W. ESCH, J. C. HOLMES, A. M. KURIS, AND G. A. SCHAD. 1982. The use of ecological terms in parasitology (report of and ad hoc committee of the Amer. Soc. of Parasitologists). J. Parasitol. 68:131–133.

MASON, P. 1985. The nesting biology of some passerines of Buenos Aires, Argentina. Pp. 954–972 *in* Neotropical Ornithology (P. A. Buckley, M. S. Foster, E. S. Morton, R. S. Ridgely and R. G. Buckley, eds.). Amer. Ornithologist's Union. Washington, D.C.

NORES, A. I. AND M. NORES. 1994. Nest building and nesting behavior of the Brown Cacholotes. Wilson Bull. 106:106–120.

PONT, A. C. 1972. A Catalogue of the Diptera of the Americas south of the United States: Family Muscidae, Genus *Neomusca*. Pp. 55–57. Museo Zoología Universidade de Sao Paulo, Brazil.

SHANNON, R. C. AND E. F. DEL PONTE. 1927. Sinopsis parcial de los Muscoideos argentinos. Rev. Inst. Bact. 4:1–48.

SMITH, N. G. 1968. The advantage of being parasitized. Nature 219:690–694.

UHAZY, L. S. AND W. J. ARENDT. 1986. Pathogenesis associated with philornid myiasis

(Diptera: Muscidae) on nestling Pearly-eyed Thrashers (Aves: Mimidae) in the Luquillo rain forest, Puerto Rico. J. Wildl. Diseases 22:224–237.

YOUNG B. E. 1993. Effects of the parasitic botfly *Philornis carinatus* on nestling house wrens, *Troglodytes aedon,* in Costa Rica. Oecologia 93:256–262.

ANA I. NORES, *Consejo Nacional de Investigaciones Científicas y Técnicas. Centro de Zoología Aplicada. Casilla de correo 122, 5000 Córdoba, Argentina.* *Received 12 May 1994, accepted 20 Jan. 1995.*

Wilson Bull., 107(4), 1995, pp. 738–741

Seasonal response of Wood Thrushes to taped-playback songs.—Broadcast vocalizations are a useful technique to detect various bird species (see review by Johnson et al. 1981), such as raptors (e.g., Lynch and Smith 1984, Kimmel and Yahner 1990, Morrell et al. 1991), marsh birds (e.g., Marion et al. 1981, Johnson and Dinsmore 1986, Kaufmann 1988), and songbirds (e.g., Falls 1981, Richards 1981). As part of a study focusing on nest-site selection and nesting success of Wood Thrushes (*Hylocichla mustelina*) in a forest managed for Ruffed Grouse (*Bonasa umbellus*) habitat in central Pennsylvania, we developed a survey protocol using taped-playback songs as a means of increasing the number of contacts of Wood Thrushes during the breeding season. Our objective in this study was to test the response of Wood Thrushes to taped-playback songs among three trials (I–III) during the 1992 and 1993 breeding seasons.

Study area and methods.—We conducted our study at the 1166-ha Barrens Grouse Habitat Management Area (HMA), State Game Lands 176, Centre County, Pennsylvania, from June–July in 1992 and 1993 (details of the Barrens Grouse HMA were given in Yahner 1993). The study area has been managed for Ruffed Grouse habitat since 1975 by the Pennsylvania Game Commission (PGC) using an even-aged system of forest clearcutting. The Barrens Grouse HMA consisted of a reference (control) and a treated (clearcut) sector of similar size. The PGC established four parallel transects on each of the two sectors to survey Ruffed Grouse populations at the Barrens Grouse HMA (Yahner 1984). Each transect was 3.2 km long and was oriented in an approximate N-S direction; distance between transects was 0.4 km.

We established 128 stations (N = 64/sector) at 200-m intervals along the eight transects. In both 1992 and 1993, each station was visited once per trial (early to mid-June, mid- to late June, and early to mid-July; trials I–III, respectively) between sunrise and 11:00 hr; the order of visits to transects was alternated between the two sectors. At each station, the observer recorded unsolicited contacts (sightings, call notes, songs) of Wood Thrushes during a 1-min equilibrium period (protocol modified from Morrell et al. 1991). A series of taped-playback songs (Cornell Laboratory of Ornithology, Cornell Univ.) of a Wood Thrush then was broadcasted, using a Johnny Stewart Bird and Animal Caller (Model MS512, Johnny Stewart, Waco, Texas). The series consisted of six songs, each separated by 10-sec pauses; the speaker was rotated to a different direction for each song. After the equilibrium and broadcast periods, the observer noted solicited contacts of Wood Thrushes during a 4-min post-broadcast period. Because of possible difficulty in an observer hearing Wood Thrushes during the playbacks, contacts noted only between the end of the pre-broadcast and before the post-broadcast period were not recorded. To minimize counting the same individual bird twice, contacts of birds recorded in the post-broadcast period included only