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Ectoparasitic Fly *Carnus hemapterus* (Diptera: Carnidae) in a Nesting Population of Common Barn-Owls (Strigiformes: Tytonidae)

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ABSTRACT As part of a comprehensive study of the common barn-owl (*Tyto alba* Scopoli) in southwestern New Jersey, we captured and examined owls for ectoparasites during the May–July nesting seasons of 1986 and 1987. We examined 179 young (<12 wk old) and 51 adults from 58 nest sites. Male and female adults of *Carnus hemapterus* Nitzsch (Diptera: Carnidae) were found on 91 (88%) of 103 young owls (≤5 wk old), but they were not detected on older nestlings (5.5–11.5 wk old) or adult owls. Other ectoparasites infrequently encountered were the lice, *Strigiphilus aitkeni* Clay (Mallophaga: Philopteridae) and *Kurodata subpachygaster* Piaget (Mallophaga: Menoponidae). Although nestlings (>5 wk old) and adult owls appeared to be relatively free of flies, infestation of downy nestlings by *C. hemapterus* was common.

KEY WORDS Insecta, *Tyto alba*, *Strigiphilus*, *Kurodata*

Carnus hemapterus Nitzsch is a common ectoparasite of nestling birds of various species in the Old World, particularly in Europe (Bequaert 1942, Andersson 1985, Walter & Hudde 1987). The existence of this fly in North America was first recorded by Bequaert in 1942. Since then, *C. hemapterus* has been reported infrequently from North American birds. In summarizing the literature on *C. hemapterus* in this region, Capelle & Whitworth (1973) listed records from nine avian hosts collected from eight states in the United States, two Canadian provinces, and Mexico. Since that review, this ectoparasite has been recorded on five additional avian host species in North America (Main & Wallis 1974, Wilson & Bull 1977, Fitzner & Woodley 1983, Cannings 1986, Schulz 1986). Thus, to date, *C. hemapterus* are known in North America from 15 species of birds from 10 states in the United States, two Canadian provinces, and Mexico. These flies have not been reported previously from New Jersey.

Although *C. hemapterus* has been found on birds in the Old and New World, we are aware of only one study in which more than a few individuals of a host species were examined. In this study 59 infested broods of European starlings (*Sturnus vulgaris* L.) were studied in the Federal Republic of Germany (Walter & Hudde 1987).

As part of a comprehensive study of the ecology and population maintenance of the common barn-owl, (*Tyto alba* Scopoli), we examined a large breeding population of these owls for ectoparasites. This paper describes the epizoötiology of ectoparasitic infections on these birds, with emphasis on *C. hemapterus*.

Materials and Methods

Nestling and adult common barn-owls were captured in Salem and Cumberland Counties, in southwestern New Jersey. Characteristics of the study area and of the owl population are described in Hegdal & Blaskiewicz (1984) and Colvin et al. (1984). Most of the owl nests were found in specially constructed nest boxes (Colvin 1983) placed in farm buildings; other nests were in tree cavities. Ectoparasites were sought by gross examination of plumage and skin in the axillae, inguinal regions, ventral alar surfaces, facial disk margins, and aural openings. The occurrence of ectoparasites was recorded for each owl. After examination, the owls were banded and released. Examinations were made from 24 May to 12 July 1986 and from 24 May to 21 July 1987.

Representative specimens of *C. hemapterus* were collected from some of the infested owls. All of the lice that we found were collected. Ectoparasites were placed in vials containing 70% ethanol. Immediately upon collection, the abdomens of some adult flies were crushed and smeared on glass microscope slides. The smears were air dried, fixed in absolute methanol (60 s), and stained with Giemsa stain. Flies were allowed to defecate onto glass microscope slides placed inside an aspirator. Slides of fly feces were fixed and stained.

Results

During the 1986 breeding season, 28 barn-owl nests and 89 young were examined. Nestlings infested with *C. hemapterus* adults were found in 10 nests. Ages of the young ranged from 2 to 11.5

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wk (mean, 5.8 wk), but infested individuals (n = 24) ranged in age from 2 to 4.5 wk. Of the 31 nestlings ≤4 wk old, 65% were infested. Flies were counted on 14 of the infested nestlings (representing 8 of the positive sites), and a mean intensity of 5.4 (range, 1–20) flies per infested owl was obtained. Five nestlings at one site were examined on two occasions; all were infested at 3 wk of age, but were negative 6 wk later. Flies were not detected on the four adult owls that we examined. Based on this preliminary data, we planned a more intensive study for the 1987 breeding season.

Thirty nests were checked in 1987, and 25 contained young that were infested with *C. hemapterus*. In all, we examined 90 young, that ranged in age from 2 to 10 wk. Of these, 73 (81%) harbored flies. Again, infestation was limited to nestlings 2 to 5 wk old (Table 1), with 99% of nestlings ≤4 wk old (n = 72) infested. Ages of noninfested young ranged from 4 to 10 wk, with only 3% of young >4 wk old (n = 74) infested. Flies were counted on all 73 infested nestlings, yielding an overall mean intensity of 17 flies per infested owl (range, 1–73).

Of the 25 positive sites, we rechecked 20 from 2.0 to 4.5 wk later (mean, 3.4 wk), and 56 young owls that had been infested were reexamined. None of the young owls (ages 5 to 10 wk; mean, 6.7 wk) was infested at the time of the second examination.

During May–July 1987, we captured and examined 47 adult barn-owls; four of these were captured and examined a second time 5 to 36 d later. Thirteen (28%) of the adults that we checked were brooding infested young when captured. However, all adult owls were negative for *C. hemapterus*.

In some owls, *Carnus hemapterus* were found on all of the apterial areas of skin. The axillae were infested most frequently followed by the inguinal areas. Winged and dealated forms of adult *C. hemapterus* were collected. Many of the dealated females had abdomens greatly distended with eggs (confirmed by dissection).

The abdomens of some of the flies, male and female, had red tinges, suggesting the presence of a blood meal. Microscopic examination of smeared and stained fly abdominal contents revealed a preponderance of avian blood cells, indicating blood feeding. Flecks of a dark, reddish brown material were observed on host skin in areas of infestation. The flecks could be removed from the skin with moist cotton, indicating that these were not feeding sites.

Flies captured in an aspirator defecated (and females oviposited) promptly on the glass aspirator walls and on glass microscope slides placed inside the aspirator. Because the fly feces resembled the material found on the owls in association with the flies, we concluded that the latter was fly feces. Fixed and stained fly feces were examined microscopically; they revealed many structures similar to nuclei of avian erythrocytes. Within broods that had infested nestlings, fly feces often could be found on nestlings that were not obviously infested. Young owls reexamined weeks after infestation did not have fly feces, and neither did any adult owl, including those brooding infested young.

Table 1. Prevalence and density of *C. hemapterus* adults on common barn owls (*Tyto alba*) in southwestern New Jersey, May–July 1987

Host age class (wk)	No. owls			Density (flies/owl)	
	Examined[a]	Infested	(%)	Mean	(Range)
Nestlings:					
2–3	47	47	(100)	22	(1–73)
>3–4	25	24	(96)	8	(0–23)
>4–5	13	2	(15)	1	(0–1)
>5–6	12	0	(0)	0	—
>6–7	40	0	(0)	0	—
>7–8	8	0	(0)	0	—
>8–10	1	0	(0)	0	—
Subtotal	146	73	(50)	—	
Adults:					
(≥1 yr)	49	0	(0)	0	—
Total	195	73	(37)	—	—

[a] Fifty-six (62%) of the young owls were examined twice, once when <5 wk old and again when ≥5 wk old (interval between examinations, 2.0–4.5 wk).

In addition to *C. hemapterus*, two other species of ectoparasite were found on owls. Three lice, *Strigiphilus aitkeni* Clay, were found on a wing of a 6.5-wk-old nestling; and a single *Kurodata subpachygaster* Piaget louse was found on a wing of a 5.5-wk-old nestling.

Representative specimens of *C. hemapterus* have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Discussion

In our study area, the ectoparasitic fauna of the common barn-owl does not appear to be diverse during the principal nesting season (May–July), nor, with the exception of *C. hemapterus*, are ectoparasites prevalent on this host. Other reports of *C. hemapterus* on common barn-owls have come from Egypt (Mohammed 1958), Switzerland (Büttiker 1975), Austria (Kutzer et al. 1982), Germany (Bequaert 1942, Walter & Hudde 1987), and California (Schulz 1986). In all cases, the workers found flies on nestling owls or reared them from nest material. We are not aware of any reports of *C. hemapterus* infestation of adult barn-owls. Taken together, the results of these studies suggest that *C. hemapterus* is a widespread and common ectoparasite of nestlings of the common barn-owl.

Our results indicate that these ectoparasites are adapted to live on young, downy nestlings. Because human disturbance of barn-owl nests is not desirable before the young are 2 wk old, we could not determine when nestlings initially become infested. However, the heavy infestation rates observed for nestlings 2–3 wk old appeared to end by about

4 wk of age. All of the owls examined at 5 wk and later were free of *C. hemapterus*, including those nestlings found infested at younger ages. Within a single brood of young 4–5 wk old, older siblings typically were free of flies, while younger ones still might be harboring them (or frequently were stained with fly feces). These observations indicated a strongly age-dependent relationship between host and *C. hemapterus* infestation.

The time during which the flies left the nestlings corresponded with the molt from down to flight feathers. The increasing plumage density and layering on the nestlings at that time may result in an environment less hospitable to the flies. However, the axillae and inguinal areas of adult owls remain largely unfeathered, yet no flies were found on these owls. In other studies, observations of *C. hemapterus* have been limited to nestling birds, so it is not clear if the adults of other avian host species also are incapable of harboring these flies.

Little is known of the life history of *C. hemapterus*, including where they go when nestling birds are unavailable (Bequaert 1942, Lloyd & Philip 1966, Capelle & Whitworth 1973, Walter & Hudde 1987). Cannings (1986) found *C. hemapterus* most frequently in nests of raptors or cavity-nesting birds. Capelle & Whitworth (1973) found pupae of these flies in birds' nests, and Walter & Hudde (1987) have suggested that this is how they overwinter. Although all nest boxes in our study area are scraped clean of debris following nesting each year, it is possible that some fly eggs remain in crevices on the interior of the wooden nest boxes. However, we observed infested nestling owls in nest boxes that were being used for the first time. This finding, along with the observation that brooding adults apparently do not harbor flies, suggests that at least some winged adult *C. hemapterus* must seek actively new birds' nests. However, what attracting cues the flies respond to are unknown.

The diet of *C. hemapterus* has been hypothesized to be either blood or cutaneous secretions (Bequaert 1942). Our results indicate that adult flies are blood feeders.

There has been some speculation on a role for *C. hemapterus* in transmitting avian hemotropic protozoan parasites (Bequaert 1942, Lloyd & Philip 1966, Fitzner & Woodley 1983). During the May–July 1985 breeding season, we tested adult and nestling owls for these endoparasites by examining stained blood smears and blood cultures (the latter for trypanosomes). An unidentified haemoproteid was found on a blood smear of only one (a nestling) of 81 owls tested, and trypanosomes were cultured from the blood of only three (all adults) of these same owls. This low prevalence of blood protozoan infections, coupled with the much higher prevalence of *C. hemapterus* infection, appears to argue against an important vectoral role for these flies at this site. In order to be a vector, *C. hemapterus* adults either must fly from nest to nest during the breeding season or harbor parasites capable of vertical transmission. No evidence exists for either of these possibilities.

The two species of lice found on barn-owls during our study, *S. aitkeni* and *K. subpachygaster*, have been reported on this host from other localities around the world (Price & Beer 1963; Clay 1966a,b). Our findings indicate that, at least during the nesting season, common barn-owls appear to be neither heavily nor frequently parasitized by lice. However, it should be noted that lice are inconspicuous and that owls were not examined at other times of the year.

Although Cannings (1986) suggested that *C. hemapterus* infestation had adverse effects on nestling saw-whet owls (*Aegolius acadicus* Gmelin), we have no evidence that such infestation decreased barn-owl nestling survival. However, heavy *C. hemapterus* infestations, combined with limited prey resources and inadequate parental care, might reduce nestling survival. This might be true especially for smaller young of large broods with considerable size and age gradations and sibling competition.

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References Cited

Andersson, H. 1985. Flies (Diptera: Brachycera) living on birds or in birds' nests. Anser 24: 115–124 (in Swedish).

Bequaert, J. 1942. *Carnus hemapterus* Nitzsch, an ectoparasitic fly of birds, new to America (Diptera). Bull. Brooklyn Entomol. Soc. 37: 140–149.

Büttiker, W. 1975. Die Gefiederfliege *Carnus hemapterus* Nitzsch (Milichiidae, Dipt.) in der Schweiz. Mitt. Schweiz. Entomol. Ges. 48: 311–314 (in German).

Cannings, R. J. 1986. Infestations of *Carnus hemapterus* Nitzsch (Diptera: Carnidae) in northern saw-whet owl nests. Murrelet 67: 83–84.

Capelle, K. J. & T. L. Whitworth. 1973. The distribution and avian hosts of *Carnus hemapterus* (Diptera: Milichiidae) in North America. J. Med. Entomol. 10: 525–526.

Clay, T. 1966a. The species of *Strigiphilus* (Mallophaga: Philopteridae) parasitic on the barn owls, *Tyto* (Tytonidae). J. Entomol. Soc. Queensland 5: 10–17.

1966b. A new species of *Strigiphilus* (Philopteridae: Mallophaga). Pac. Insects 8: 835–847.

Colvin, B. A. 1983. Nest boxes for barn owls. Publication 346 (183), Ohio Department of Natural Resources, Columbus.

Colvin, B. A., P. L. Hegdal & W. B. Jackson. 1984. A comprehensive approach to research and management of common barn-owl populations, pp. 270–282. *In* W. McComb [ed.], Proceedings, workshop on man-

agement of nongame species and ecological communities. University of Kentucky, Lexington.

Fitzner, R. E. & N. E. Woodley. 1983. *Carnus hemapterus* Nitzsch from Swainson's Hawk. Raptor Res. 17: 28–29.

Hegdal, P. L. & R. W. Blaskiewicz. 1984. Evaluation of potential hazard to barn owls of Talon (brodifacoum bait) used to control rats and house mice. Environ. Toxicol. Chem. 3: 167–179.

Kutzer, E., H. Frey & H. Nöbauer. 1982. Zur Parasitenfauna österreichischer Eulenvögel (Strigiformes). Angew. Parasitol. 23: 190–197 (in German).

Lloyd, G. D. & C. B. Philip. 1966. The "wingless" fly, *Carnus hemapterus* Nitzsch (Milichiidae), on hawk fledglings in northern Utah. J. Parasitol. 52: 414.

Main, A. J. & R. C. Wallis. 1974. Primary records of two vertebrate ectoparasites in New England (Acarina: Argasidae and Diptera: Milichiidae). Proc. Entomol. Soc. Wash. 76: 427.

Mohammed, A. H. 1958. Systematic and experimental studies on protozoal blood parasites of Egyptian birds, vol. 1. Cairo University Press, Cairo, Egypt.

Price, R. D. & J. R. Beer. 1963. The *Kurodaia* (Mallophaga: Menoponidae) parasitic on the strigiformes, with a key to the species of the genus. Ann. Entomol. Soc. Am. 56: 849–857.

Schulz, T. A. 1986. Conservation and rehabilitation of the common barn owl, pp. 146–166. *In* P. Beaver & D. J. Mackey [eds.], Wildlife rehabilitation, vol. 5. National Wildlife Rehabilitators' Assoc., Boston.

Walter, G. & H. Hudde. 1987. Die Gefiederfliege *Carnus hemapterus* (Milichiidae, Diptera), ein Ektoparasit der Nestlinge. J. Ornithol. 128: 251–255 (in German).

Wilson, N. & E. L. Bull. 1977. Ectoparasites found in the nest cavities of pileated woodpeckers in Oregon. Bird-Banding 48: 171–172.

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