

Hippoboscid flies on raptors in the Upper Midwest

Shalini Latchman^{a, b} and Roger D. Moon^a

^aDepartment of Entomology, University of Minnesota, St. Paul, MN; ^bcurrent address: College of Veterinary Medicine, Cornell University, Ithaca, NY

Introduction

Louse flies (Diptera: Hippoboscidae) are known as “flat flies” to wildlife rehabilitators. The University of Minnesota operates a Raptor Center in St. Paul, where staff rehabilitate large numbers of injured raptors submitted by citizens throughout the region. Staff at the center have noticed louse flies on many of their patients in previous years. The louse fly fauna of birds and mammals in the Upper Midwest was summarized in the 1940s,¹ where museum records contained 9 species of louse flies from diurnal and nocturnal raptors. Arrival of West Nile virus in North America has increased interest in louse flies as potential vectors.² The present descriptive study was undertaken to characterize the louse fly fauna on raptors admitted to the St. Paul Raptor Center.

Procedures

All patients admitted to the center between 1 April to 30 November, 2007, were examined for louse flies. This period spanned months when resident and migratory species were present. Specimens were collected manually and placed in vials labeled with date, species of host, and host case number to trace geographic origin. Specimens were frozen until they could be pinned or pointed and keyed to species.^{1, 3-5} Labeled specimens and associated puparia have been deposited in the University of Minnesota’s Insect Museum.

Counts of hosts and associated louse flies were compiled to characterize host-parasite associations. Frequencies of different fly-raptor associations were examined for independence by chi-square test. Prevalence of *Icosta americana* (Leach) by month on chosen host species were analyzed with binomial regression.



Figure 1. Three species of louse flies from raptors admitted to the University of Minnesota Raptor Center, Apr-Nov, 2007. Left, *Icosta americana* (Leach); center, *Ornithoica vicina* (Walker); right, *Ornithoictona erythrocephala* (Leach). Vertical scale bar at center = 2 mm.

Results

Three species of louse fly (Figure 1) were obtained from 650 patients during the 8-mo study period. Patients came from Minnesota (86%), Wisconsin (10%), and surrounding states. Eleven of 26 raptor species were infested (Table 1). Overall prevalence was 19% (n = 650). The most abundant louse fly was *Icosta americana*. It was most prevalent on great horned owls (45% of 75 patients). Infested owls yielded 1–41 louse fly specimens, and averaged 6.3 per infested bird. Species less frequently infested were 10 other owls, hawks, and eagles. Infested great horned owls, broad-winged hawks and red-tailed hawks were more frequent than expected from random associations (19%). Infested sharp-shinned hawks, American kestrels, ospreys and peregrine falcons were underrepresented ($\chi^2 = 63.9$, df = 11, $P < 0.001$). Bald eagle, turkey vulture and Swainson’s hawk were new host records for *I. americana*.

One specimen of *Ornithoica vicina* (Walker), the smallest of the three species (Figure 1), was from a barred owl, and a second specimen was captured at large in the clinic, so its host was unknown. A single specimen of the largest species, *Ornithoictona erythrocephala* (Leach), was obtained from a Cooper’s hawk. Both of these species were previously recorded from their respective hosts in the Upper Midwest,¹ and at least 75 other bird species in 25 families and 14 orders.^{3, 4} Rarity on the present raptors suggests the two species were contaminants from prey rather than established parasites of the raptors themselves.

Table 1. Numbers of raptor patients, by species, and frequencies of infestation by *Icosta americana* Leach at UM Raptor Center, 2007.

Raptor species	No. Total	No. infested	%	No. expected	Total <i>Icosta</i>	No. per infested bird
Great horned owl	75	34	45 ^e	14	214	6.3
Broad-winged hawk	38	12	32 ^e	7	38	3.2
Red-tailed hawk	135	40	30 ^e	26	95	2.4
Barred owl ^c	33	7	21	6	18	2.6
Cooper’s hawk ^d	126	18	14	24	55	3.1
Eastern screech-owl	15	2	13	3	2	1.0
Bald eagle	66	5	8 ^f	13	7	1.4
Sharp-shinned hawk	16	1	6	3	1	1.0
American kestrel	32	0	0 ^f	6	0	–
Osprey	24	0	0 ^f	5	0	–
Peregrin falcon	19	0	0 ^f	4	0	–
Others	(71)	(6)	(8 ^f)	(14)	(7)	(1.2)
Turkey vulture	11	1	9	–	1	1.0
Northern saw-whet owl	10	0	0	–	0	–
Short-eared owl	10	0	0	–	0	–
Red-shouldered Hawk	8	4	50	–	5	1.3
Merlin	6	0	0	–	0	–
Hybrid falcon	5	0	0	–	0	–
Northern goshawk	5	0	0	–	0	–
Long-eared owl	3	0	0	–	0	–
Northern harrier	3	0	0	–	0	–
Swainson’s hawk	2	1	50	–	1	1.0
Gyr falcon	2	0	0	–	0	–
Harris’s hawk	2	0	0	–	0	–
Rough-legged hawk	2	0	0	–	0	–
Golden eagle	1	0	0	–	0	–
Snowy owl	1	0	0	–	0	–
Combined	650	125	19	–	437	3.5

^cOne barred owl coinfecting by *Icosta* and *Ornithoica*, ^done Cooper’s hawk by *Ornithoictona* alone ^eSignificantly more or ^fless than random expectations (19%)

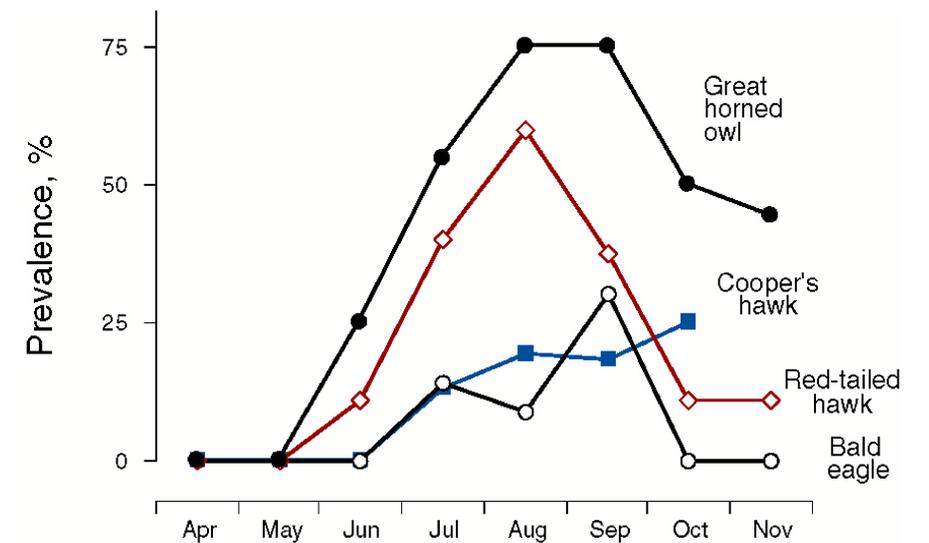


Figure 2. Seasonal prevalence of *I. americana* on the four most abundant raptors.

None of 86 patients of 16 species admitted in April and May were infested by *I. americana*. Thereafter, prevalence on the four most abundant raptors increased to peak levels in August or September, depending on host species (Figure 2). These patterns indicate the subject raptors became infested by *I. americana* from other sources in spring, and then fly populations increased during their hosts’ breeding season. Founders may have overwintered as pupae in host nests from previous years, or they could have been acquired from prey. Overall prevalence on great horned owls was greater than on red tailed hawks, but Cooper’s hawks and bald eagles were the same. Reasons for species differences are not clear. Further study is needed to assess the amount of exchange of louse flies among individual birds, different raptor host species, and their prey.

Conclusions

- *Icosta americana* was the main louse fly on 650 raptors representing 11 of 26 species obtained from the Upper Midwest. Two other species were rare.
- New records for *I. americana* were bald eagle, turkey vulture and Swainson’s hawk.
- Great horned owls, broad-winged hawks and red-tailed hawks were more likely to be infested than other raptor species.
- Prevalence of *I. americana* was zero in spring, and then increased into late summer. This pattern is consistent with colonization and population increase on the infested raptors during their breeding seasons.

References:

- MacArthur, K. 1948. The louse flies of Wisconsin and adjacent states (Diptera, Hippoboscidae). Bull. Publ. Mus. Milwaukee. 8: 373-440.
- Farajollahi A, W. J. Crans, D. Nickerson, et al. 2005. Detection of West Nile virus RNA from the louse fly *Icosta americana* (Diptera : Hippoboscidae). J. Am. Mosq. Control Assoc. 21: 474-476.
- Bequaert, J. C. 1955. The Hippoboscidae or louse flies (Diptera) of mammals and birds. Part II. Taxonomy, evolution and revision of American genera and species. Entomologica Americana 34/35/36: 1-611.
- Maa, T. C. 1969. Notes on the Hippoboscidae (Diptera). Pacific Ins. Monograph 6. 260 pp.
- Maa, T. C and B. V. Peterson. 1987. Hippoboscidae, Chapter 11 in J. F. McAlpine et al (eds), *Manual of Nearctic Diptera*, Vol. 2. Monograph 28, Research Branch, Agriculture Canada.

Acknowledgements: We thank the clinic staff of the University of Minnesota Raptor Center for collecting flies and providing access to patient data, and Ralph Holzenthal for help in photographing specimens. This project was funded by the University of Minnesota Undergraduate Research Opportunity Program