

Host Records for *Ornithonyssus sylviarum* (Mesostigmata: Macronyssidae) from Birds of North America (Canada, United States, and Mexico)

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ABSTRACT The northern fowl mite, *Ornithonyssus sylviarum* (Canestrini and Fanzago, 1877) (Mesostigmata: Macronyssidae) is a broadly distributed blood-feeding parasite that has been collected from many birds of temperate regions. Previously, the most complete host list was published in 1938, and it included 15 North American (Canada, United States, and Mexico) host species. In the process of a general survey of bird-associated mites in Alberta, Canada, we recovered many *O. sylviarum* specimens. Herein, we update the previous host list with these observations and records published since 1938. We collected mites by washing the bodies of salvaged birds and examining the filtrate. Northern fowl mites were collected from 26 host species, with 16 of these species being the first host records for North America. Including results from the current study, *O. sylviarum* has been reported from 72 species of North American birds from 26 families. This updated host list will be useful to anyone interested in the role of *O. sylviarum* in transmission of avian disease.

KEY WORDS *Ornithonyssus sylviarum*, northern fowl mite, Macronyssidae

Birds are host to a diversity of symbiotic animals. Mites (Arachnida: Acari) are among the most diverse groups of these associates, with at least 40 families and ≈3,000 described species known from avian hosts (Proctor and Owens 2000). Some species are highly detrimental parasites such as the nasal mite *Sternostoma tracheacolum* Lawrence, 1948 (Mesostigmata: Rhinonyssidae), whereas others are relatively benign such as most feather mites (Astigmata: Analgoidea: Pterolichioidea: Freyanoidea) (Proctor and Owens 2000). The northern fowl mite, *Ornithonyssus sylviarum* (Canestrini and Fanzago, 1877) (Mesostigmata: Macronyssidae), is an obligate hematophagous ectoparasite of domestic and wild birds in temperate regions worldwide. *O. sylviarum* spends the majority of its life cycle on the host (Sikes and Chamberlain 1954), but it is often associated with nesting material when young birds are in the nest. With a short generation time of 5–7 d, *O. sylviarum* populations can build up rapidly, reaching upward of 22,000 individuals in a single nest (Sikes and Chamberlain 1954, Masan and Orszaghova 1995). Humans are occasionally attacked by hungry mites when nests associated with artificial structures are abandoned after chicks fledge, and bitten humans may suffer pruritic dermatitis as a result (Orton et al. 2000). Heavy infestations in poultry houses can result in large blood losses and reduced egg production in domestic fowl (DeVaney 1979, DeLoach and DeVaney 1981). Currently, it is not clear whether these mites can act as vectors for disease agents.

Northern fowl mites have been found to harbor and mechanically transmit western equine encephalitis and St. Louis encephalitis viruses (Hammon and Reeves 1948, Mullen and O'Connor 2002), but they are not considered to be an important reservoir for either virus (Chamberlain and Sikes 1955, Reeves et al. 1955). Hofstad (1949) experimentally infected northern fowl mites with Newcastle virus by allowing them to feed on infected chickens, but the disease could not be transmitted by infected mites to uninfected chickens.

The most recent North American (Canada, United States, and Mexico) host list for *O. sylviarum* was published nearly 70 yr ago (Cameron 1938). While surveying the mites associated with birds of Alberta, Canada, we became aware of a need for an updated host list for the northern fowl mite in North America, including our new records from Alberta.

Materials and Methods

We have amassed a collection of ≈700 birds from the contributions of the Alberta Fish and Wildlife Forensic Laboratory, the Royal Alberta Museum, waterfowl hunters, and colleagues at the University of Alberta. Collection data were sparse for many of these specimens; and for some species, we can only say that the birds were collected from somewhere in Alberta. Bird bodies were maintained at –20°C until processing. Frozen birds were first thawed and then washed using the following method. The bird was placed in a suitably sized container, ranging from 4 to 18 liters,

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Table 1. *O. sylviarum* host species records from birds of Alberta, Canada, and the status of these records for North America

Host order	Host family	Host genus	Host species	Location and date of host collection	Status
Falconiformes	Accipitridae	<i>Accipiter</i>	<i>striatus</i> Vieillot	Barrhead, 24 Sept. 1993	New record
		<i>Pandion</i>	<i>haliaetus</i> (L.)	No location, no date	New record
Passeriformes	Falconidae	<i>Falco</i>	<i>columbarius</i> L.	No location, 22 Aug.	New record
		<i>Corvus</i>	<i>brachyrhynchus</i> Brehm	Edmonton, Oct. 2006	Previous record
	Corvidae	<i>Cyanocitta</i>	<i>cristata</i> (L.)	Edmonton, 19 Sept. 2000	Previous record
		<i>Perisoreus</i>	<i>canadensis</i> (L.)	Slave Lake, 10 Oct. 2003	New record
		<i>Pheucticus</i>	<i>ludovicianus</i> (L.)	Barrhead, 21 July 1999	New record
		<i>Spizella</i>	<i>passerina</i> (Bechstein)	No location, 1 July 2003	Previous record
		<i>Zonotrichia</i>	<i>leucophrys</i> (Forster)	Barrhead, 6 Sept. 1992, 1 Oct. 1991, 21 July 1999	New record
	Fringillidae	<i>Carpodacus</i>	<i>purpureus</i> (Gmelin)	Barrhead, 22 June 1993	New record
	Icteridae	<i>Euphagus</i>	<i>cyancephalus</i> (Wagler)	No location, no date	New record
		<i>Icterus</i>	<i>galbula</i> (L.)	Ministik Hills, no date	Previous record
		<i>Molothrus</i>	<i>ater</i> (Boddaert)	Standard, 15 July 2002	Previous record
		<i>Quiscalus</i>	<i>quiscula</i> (L.)	Devon, 10 July 2002	Previous record
		<i>Sturnella</i>	<i>neglecta</i> Audubon	No location, no date	New record
	Parulidae	<i>Vermivora</i>	<i>peregrina</i> (Wilson)	University of Alberta, 11 Aug. 2004	New record
	Turdidae	<i>Catharus</i>	<i>ustulatus</i> (Nuttall)	Ministik Hills, no date	New record
		<i>Sialia</i>	<i>currucoides</i> (Bechstein)	St. Paul, 5 Aug. 2003	New record
		<i>Turdus</i>	<i>migratorius</i> Linnaeus	Ministik Hills, 2 Sept. 1993; Millet, 18 July 1999	Previous record
Pictiformes	Tyrannidae	<i>Empidonax</i>	<i>alnorum</i> Brewster	Barrhead, 9 June 1993	New record
		<i>Tyrannus</i>	<i>tyrannus</i> (L.)	Cardston, 9 Sept. 2003	Previous record
	Picidae	<i>Colaptes</i>	<i>auratus</i> (L.)	Barrhead, no date	Previous record
		<i>Picoides</i>	<i>pubescens</i> (L.)	St. Albert, July 2004	New record
		<i>P.</i>	<i>villosus</i> (L.)	Edmonton, 15 Oct. 2002	Previous record
Strigiformes	Strigidae	<i>Sphyrapicus</i>	<i>varius</i> (L.)	Edmonton, 3 Oct. 2002	New record
		<i>Asio</i>	<i>otus</i> (L.)	No location, 20 Aug. 2005	New record

with a drop of dish detergent, enough 95% ethanol to soak the plumage of the bird, and enough water to submerge it. The sealed container was then shaken vigorously for 5 min. Particularly large birds were washed in a basin and thoroughly massaged while in the solution. Each bird was then removed from the container and rinsed thoroughly over a Fisher 53- μ m mesh filter; large birds were rinsed over the washing basin. The washing liquid was filtered and the container and lid were rinsed thoroughly over the same 53- μ m filter. The filtrate was stored in 30-ml scintillation and snap cap vials. Washings were examined using Leica MZ16 and MZ6 dissection microscopes at 20–25 $\times$ magnification. Mites were removed and cleared in 85% lactic acid for 1–24 h depending on the degree of original opacity. Mites were mounted in a polyvinyl alcohol medium (6371A, BioQuip Products, Rancho Dominguez, CA). Slides were cured on a slide warmer at $\approx$ 40 $^{\circ}$ C for 3 to 4 d. We examined slide mounted specimens on a Leica DMLB compound microscope, with differential interference contrast microscopy at 400 $\times$ magnification and identified *O. sylviarum* specimens by using Baker (1999). Female *O. sylviarum* can be distinguished from female *O. bursa* (Berlese, 1888) by the absence of the Z5 dorsal opisthosomal setal pair in *O. sylviarum*. Although the extent of the sternal shield and placement of the third pair of sternal setae on or off the shield are often presented as diagnostic characters in keys, they are not sufficiently reliable to separate these two species; moreover, we have examined some *O. sylviarum* individuals in which one seta is on the shield and the other is off. *O. sylviarum* protonymphs and males also

lack the Z5 setal pair. Male northern fowl mites can also be identified by the presence of a transversal line approximately where the ventral and anal shields meet (Cameron 1938). Literature searches were performed in Zoological Record (1978–2006) and Journal Storage (JSTOR) (from the earliest records, in the 1800s for some journals, to 2003) databases. We did not confirm the identification for any of the mites recorded in the literature. Host taxonomy and authorities follow Clements (1991) provided by Andrew and McAllan (1998), selecting the “Clements 1991–1996” taxonomy option. Voucher specimens have been deposited in the E. H. Strickland Entomological Museum at the University of Alberta (UASM 80530–80556).

Results and Discussion

We examined 444 individual birds, representing 149 species from 16 orders. Our sample represents 37% of Alberta’s 402 species of birds (based on list from the Royal Alberta Museum 2005). *O. sylviarum* specimens were collected from 34 host individuals representing four orders, 11 families, 25 genera, and 26 species (Table 1). Sixteen of the 26 host species records from Alberta are new records for North America (Table 1). The northern fowl mites were primarily collected from passerines, which represented 18 of the 26 host species records. We observed an average of three to four mites per host individual, with the highest number being 20 mites on an American robin, *Turdus migratorius*.

Our literature search recovered 27 publications with records of northern fowl mites from North Amer-

Table 2. Known host species records for *O. sylviarum* collected from birds of North America

Host order	Host family	Host genus	Host species and authority	Reference(s)
Apodiformes	Apodidae	<i>Chaetura</i>	<i>pelagica</i> (L.)	1, 2
Columbiformes	Columbidae	<i>Columba</i>	<i>livia</i> Gmelin	5
		<i>Zenaida</i>	<i>macroura</i> (L.)	8
Coraciiformes	Alcedinidae	<i>Megasceryle</i>	<i>alcyon</i> (L.)	2, 9
Falconiformes	Accipitridae	<i>Accipiter</i>	<i>striatus</i> Vieillot	Present study
		<i>Pandion</i>	<i>haliaetus</i> (L.)	Present study
	Falconidae	<i>Falco</i>	<i>columbarius</i> L.	Present study
Galliformes	Odontophoridae	<i>Colinus</i>	<i>virginianus</i> (L.)	13
	Phasianidae	<i>Gallus</i>	<i>gallus</i> (L.)	1
		<i>Tympanuchus</i>	<i>phasianellus</i> (L.)	2, 15
Passeriformes	Cinclidae	<i>Cinclus</i>	<i>mexicanus</i> Swainson	17
	Corvidae	<i>Corvus</i>	<i>brachyrhynchos</i> Brehm	24, present study
		<i>Cyanocitta</i>	<i>cristata</i> (L.)	7, 20, 24, present study
		<i>Perisoreus</i>	<i>canadensis</i> (L.)	Present study
	Emberizidae	<i>Cardinalis</i>	<i>cardinalis</i> (L.)	2
		<i>Melospiza</i>	<i>melodia</i> (Wilson)	23, 24
		<i>Passerculus</i>	<i>sandwichensis</i> (Gmelin)	24
		<i>Passerella</i>	<i>iliaca</i> (Merrem)	24
		<i>Pheucticus</i>	<i>ludovicianus</i> (L.)	Present study
		<i>P.</i>	<i>melanocephalus</i> (Swainson)	25
		<i>Pipilo</i>	<i>erythrophthalmus</i> (L.)	24
		<i>Spizella</i>	<i>passerina</i> (Bechstein)	5, 23, 24, present study
		<i>Zonotrichia</i>	<i>albicollis</i> (Gmelin)	23, 24
		<i>Z.</i>	<i>leucophrys</i> (Forster)	Present study
	Fringillidae	<i>Carpodacus</i>	<i>purpureus</i> (Gmelin)	Present study
	Hirundinidae	<i>Hirundo</i>	<i>rustica</i> L.	1, 2, 23, 24, 25
		<i>Progne</i>	<i>subis</i> (L.)	1, 2
		<i>Riparia</i>	<i>riparia</i> (L.)	24
	Hirundinidae	<i>Stelgidopteryx</i>	<i>rufigollis</i> (Vieillot)	24
		<i>Tachycineta</i>	<i>bicolor</i> (Vieillot)	11, 26
	Icteridae	<i>Agelaius</i>	<i>phoeniceus</i> (L.)	24
		<i>Euphagus</i>	<i>cyanocephalus</i> (Wagler)	Present study
		<i>E.</i>	<i>carolinus</i> (Mller)	1, 2
		<i>Icterus</i>	<i>galbula</i> (L.)	5, present study
		<i>Molothrus</i>	<i>ater</i> (Boddaert)	1, 2, 23, 24, present study
		<i>Quiscalus</i>	<i>quiscula</i> (L.)	1, 2, 23, 24, present study
		<i>Sturnella</i>	<i>neglecta</i> Audubon	Present study
		<i>S.</i>	<i>magna</i> (L.)	2
		<i>Xanthocephalus</i>	<i>xanthocephalus</i> (Bonaparte)	6, 22
	Mimidae	<i>Dumetella</i>	<i>carolinensis</i> (L.)	1, 2, 3, 5, 24
		<i>Mimus</i>	<i>polyglottos</i> (L.)	7
		<i>Toxostoma</i>	<i>rufum</i> (L.)	7, 23, 24, 27
	Parulidae	<i>Dendroica</i>	<i>petechia</i> (L.)	1, 2
		<i>Sciurus</i>	<i>aurocapillus</i> (L.)	24
		<i>Vermicora</i>	<i>peregrina</i> (Wilson)	Present study
	Passeridae	<i>Passer</i>	<i>domesticus</i> (L.)	1, 2, 4, 5, 18, 19
	Poliopitidae	<i>Poliopitila</i>	<i>caerulea</i> (L.)	12
	Sittidae	<i>Sitta</i>	<i>carolinensis</i> Latham	2
	Sturnidae	<i>Sturnus</i>	<i>vulgaris</i> L.	1, 2, 5, 21, 24
	Troglodytidae	<i>Troglodytes</i>	<i>aedon</i> Vieillot	5, 23, 24
	Turdidae	<i>Catharus</i>	<i>occidentalis</i> Sclater	25
		<i>C.</i>	<i>ustulatus</i> (Nuttall)	Present study
		<i>Sialia</i>	<i>currucoides</i> (Bechstein)	Present study
		<i>Turdus</i>	<i>migratorius</i> L.	1, 2, 23, 24, 25, 27, present study
	Tyrannidae	<i>Contopus</i>	<i>virens</i> (L.)	2
		<i>Empidonax</i>	<i>alorum</i> (Brewster)	Present study
		<i>E.</i>	<i>minimus</i> (W. M. Baird & S. F. Baird)	10
		<i>Myiarchus</i>	<i>crinitus</i> (L.)	5, 23, 24
		<i>Sayornis</i>	<i>phoebe</i> (Latham)	5, 23, 24
		<i>Tyrannus</i>	<i>tyrannus</i> (L.)	1, 2, present study
		<i>T.</i>	<i>verticalis</i> Say	2
	Vireonidae	<i>Vireo</i>	<i>bellii</i> Audubon	14
		<i>V.</i>	<i>olivaceus</i> (L.)	2, 24
Piciformes	Picidae	<i>Colaptes</i>	<i>auratus</i> (L.)	1, 2, present study
		<i>Picoides</i>	<i>pubescens</i> (L.)	Present study
		<i>P.</i>	<i>villosus</i> (L.)	1, 2, present study
		<i>Sphyrapicus</i>	<i>varius</i> (L.)	Present study
Psittaciformes	Psittacidae	<i>Amazona</i>	<i>autumnalis</i> (L.)	16
		<i>A.</i>	<i>oratrix</i> Ridgway	16
		<i>A.</i>	<i>viridigenalis</i> (Cassin)	16
Strigiformes	Strigidae	<i>Asio</i>	<i>otus</i> (L.)	Present study
		<i>Strix</i>	<i>varia</i> Barton	27

¹Cameron (1938); ²Wheeler and Threlfall (1989); ³Garvin et al. (2004); ⁴McGroarty and Dobson (1974); ⁵Fouk and Matthyse (1965); ⁶Reeves et al. (1947); ⁷Phillis et al. (1976); ⁸Hanson et al. (1957); ⁹Boyd and Fry (1971); ¹⁰Briskie and Sealy (1989); ¹¹Rendell and Verbeek (1996a); ¹²Root (1969); ¹³Kellogg and Calpin (1971); ¹⁴Nolan (1960); ¹⁵Dick (1981); ¹⁶Stone et al. (2005); ¹⁷Halstead (1988); ¹⁸Wilson (1958); ¹⁹Brown and Wilson (1975); ²⁰Boyd et al. (1956); ²¹Boyd (1951); ²²Willson (1966); ²³Peters (1933); ²⁴Peters (1936); ²⁵Estenanes-Gonzalez (1997); ²⁶Rendell and Verbeek (1996b); ²⁷Nelder and Reeves (2005).

ican hosts. Including our new host records from Alberta, *O. sylviarum* has been recorded from nine orders, 26 families, 61 genera, and 72 species of North American birds (Table 2). The most novel additions to the list are our observations of northern fowl mites from raptors. One of the two North American strigiform species records, and all three of the falconiform species records were from the current study (Table 2). Given that there are several observations of northern fowl mites from raptor species in the Old World (Philips 2000), we feel that further examination of strigiform and falconiform birds in North America will result in more host records. This updated host list will be of use to workers in a broad range of fields such as ornithology, wildlife biology, and acarology.

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