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ACARINE SYMBIONTS OF LOUSEFLIES (DIPTERA : HIPPOBOSCIDAЕ)

BY J. R. PHILIPS¹ and A. FAIN²

SUMMARY : Approximately 4 000 hippoboscid flies were examined for mites. Four hundred ninety mites were found on 129 flies. The mites belonged to 12 families, 17 genera and 31 species. There are 62 new mite/fly host records, 71 new mite/bird host records, and 55 new mites/country distribution records.

RÉSUMÉ : Des acariens ont été recherchés sur un total d’environ 4 000 mouches hippoboscides. Des acariens, au nombre de 490, furent découverts sur 129 de ces mouches, ils font partie de 12 familles, 17 genres et 31 espèces. On a observé 62 nouvelles associations acariens/mouche-hôte, 71 nouvelles associations acariens/oiseau-hôte et 55 nouvelles localisations géographiques (pays) pour ce groupe d’acariens.

INTRODUCTION

Hippoboscid flies (Diptera : Hippoboscidae), or louseflies, are bloodsucking ectoparasites of birds and mammals. Man is not the normal host of any lousefly, but species such as the sheep ked, Melophagus ovinus (Linnaeus) and the pigeon fly, Pseudolynchia canariensis (Macquart) will bite man and can be very irritating pests to those handling sheep or domestic pigeons. Animals with heavy infestations of louseflies become emaciated and more susceptible to secondary infections. Louseflies also serve as vectors, transmitting endoparasites, and other ectoparasites. Mammalian trypanosomes and filarial worms, and avian trypanosomes and hae-mosporina, are transmitted by louseflies (BAKER, 1967) and ectoparasitic avian lice (Mallophaga) and mites (Acarina) both utilize louseflies in dispersal as well (KEIRANS, 1975; BEQUAERT, 1953, 1957; MAA, 1966, 1969).

Most of the mites which occur on louseflies are avian skin mites (Epidermoptidae) which may burrow into birds’ skin, causing mange lesions that are often extensive, resulting in scuffiness and feather loss. Female mites of the genus Microlichus are phoretic on the flies; fertilized females of the genera Myialges and Promyialges parasitize the flies (FAIN, 1965). Strelkoviacarus is a similar avian skin mite, formerly in the Epidermoptidae, but closer to the Analgidae, whose females are also phoretic on louseflies (MACK-FIRA and CRISTEA, 1966; HILL et al., 1967). Other genera of mites found on louseflies in isolated instances include Acarus (CORBET, 1961), Glycyphagus (BUTTIKER and CERNY, 1974), Proctophyllodes (HILL et al., 1967), Blattisocius (HILL et al., 1967), and Leptus (HILL et al., 1967).

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However, mite family or species determinations have usually been absent from records of mites from louseflies published by entomologists such as Bequaert and Maa. Consequently, host associations between the mites and the flies or the mites and the flies’ avian hosts are not well known. The objectives of this research were to survey the acarine symbionts of louseflies to ascertain what species of parasitic and phoretic mites occur on various species of louseflies, and to determine the specificity of the host-parasite relationships between birds and mites transported by louseflies.

**METHODS**

Most of the specimens of louseflies discussed in the literature on which unidentified mites have been observed are preserved in museum collections. We examined hippoboscid flies in the collections of the Museum of Comparative Zoology (Harvard), the Bernice P. Bishop Museum in Honolulu, the U.S. National Museum, and the British Museum of Natural History. Approximately 4,000 louseflies were examined for mites with a binocular dissecting microscope. We did not record an exact count of number of flies examined, since the data cannot be used for calculation of rates of mites incidence on the flies, because mites have been removed from some of the flies by previous researchers.

Flies were also solicited from members of the Ornithological Societies of North America through a request for assistance published in the Ornithological Newsletter. All mites found were removed and temporarily preserved in 70% isopropyl alcohol. Later mites were mounted on slides using Hoyer’s medium and identified using a phase-contrast microscope. Preserved epidermoptid mites were also examined in the W.T. Attyeo collection of the University of Georgia.

**RESULTS**

In the museum collections we visited, we were able to locate most of the specimens mentioned in the literature as harboring unidentified mites, except for those flies listed in publications by T.C. Maa. Dr. Maa still had those flies in his possession, and was unwilling to loan them to anyone since he had them on loan himself. We did find some museum specimens with mites not previously listed in the literature. Four hundred ninety mites were found on 129 flies. The mites belonged to 12 families, 17 genera and 31 species. There are 62 new mite/fly host records, 71 new mite/bird host records, and 55 new mite/country geographic distribution records. In the collection data, the fly host is given first, then the avian host.

*Strelkoviacaenus critesi* Spory, 1965

3 females ex *Ornithomya bequaerti* Maa, ex *Zonotrichia leucophrys gambeli* (Nuttall), Totem Park, Juneau, Alaska, 9-VI-73, R.B. Williams; 4 females, same data; 2 females, 2 tritonymphs, 1 protonymph, same data except 9-x-73.

*Strelkoviacarus quadratus* (Haller, 1882)

1 female ex *Ornithoica turdi* (Latreille), ex *Melanornis fischeri* toruenesis (Hartert), Kwagimba, Toro, Uganda.


9 females ex *Ornithomya* “fringillina Curtis”, ex *Dumetella carolinensis* (Linnaeus), Middletown, Rhode Island, 5-ix-57, J. Baird; 6 females, same fly host, no avian data, same locality, 1957, J. Baird.

10 females ex *Ornithomya “fringillina Curtis”, ex Catharus ustulatus Swainson* (Tschudi), Rhode Island.

45 females ex *Ornithomya “fringillina Curtis”, ex Quiscalus quiscula* (Linnaeus), Milton, Massachusetts.

1 female ex *Ornithomya “fringillina Curtis”, ex Spizella pusilla* (Wilson), Block Island, Rhode Island.
Remarks: These are all specimens of the "small americanus" described by FAI (1965). Males are needed to distinguish whether this is an americanus variant or a different species. North American louseflies labeled O. fringillina or O. chloropus Bergroth in museums were identified before Maa revised the genus. The North American species of Ornithomyia are anchineuria Speiser and bequaerti Maa; fringillina and chloropus are Palaearctic species.

Myialges anchora Trouessart, 1906.

5 females ex Pseudolynchia canariensis (Macquart), Limasol, Cyprus.
3 females ex Pseudolynchia canariensis (Macquart), art gallery, Durban, Natal, 3-x-1933.
31 females ex Ornithoctona erythrocephala (Leach), Balzampra, Ecuador.
1 female ex Ornithoctona erythrocephala (Leach), Sa. Maria, Colombia.

Myialges bombycillae Fain, 1965.

5 females ex Icosta chalcolampra (Speiser), Solomon Islands.
5 females ex Icosta hirsuta (Ferris), ex Callipepla californica (Shaw).
1 female ex Icosta mecorrhina (Maa), ex Bycanistes bucinator (Temminck), Zululand, 15-xi-34.
9 females ex Icosta rufiventris (Bigot), ex Buteo magnirostris (Gmelin), Brazil.
23 females ex Ornithoctona erythrocephala (Leach), Chippewa County, Michigan.
1 female ex Ornithoctona curvata Maa, ex Centropus sinensis (Stephens), Myitkina, Burma, 7-tv-45.
3 females ex Ornithoica exilis (Walker), ex Dacelo novaeguineae, (Hermann), N. Queensland, 3-vii-64.
1 female ex Ornithoica exilis (Walker), ex Halcyon chloris pealei Finsch and Hartlaub, Tutuila, Samoa.
20 females ex Ornithoica exilis (Walker), ex Halcyon cinnamominia reichenbachi (Hartlaub), Ponape.
1 female ex Ornithoica stipituri (Schiner), ex Pitta erythrogaster gazellae Neumann, New Britain.
1 female ex Ornithoica tridens Maa, Taiwan.

2 females ex Ornithoica turdi (Latreille), ex Tchagra senegala (Linnaeus), Kenya, MEINERTZ-HAGEN.
3 females ex Ornithoica vicina (Walker), Cyanocitta cristata (Linnaeus), Groton, Massachusetts.
1 female ex Ornithoica vicina (Walker), ex Pipilo erythropthalmus erythropthalmus (Linnaeus), New Brunswick.
4 females ex Ornithoica vicina (Walker), ex Pipilo fuscus mesoleucus, Baird, Colorado Springs, Colorado.
1 female ex Ornithoica vicina (Walker), ex Quiscalus quiscula (Linnaeus), Oak Bluffs, Massachusetts.
2 females ex Ornithoica vicina (Walker), ex Zonotrichia albicollis (Gmelin), Middletown, Rhode Island, 6-x-58; 9 females, same hosts, Londonderry, Vermont.
13 females ex Ornithomya avicularia (Linnaeus), ex Turdus merula Linnaeus, Spanca, Turkey, 2-ix-53.
20 females ex Ornithomya avicularia (Linnaeus), ex Otus sp., Italy.
1 female ex Ornithomya "fringillina Curtis", ex Coccothraustes vespertinus (Cooper), Londonderry, Vermont, 14-vt-59, P. REED.
1 female ex Ornithomya "fringillina Curtis", ex Cyanocitta cristata (Linnaeus), New Brunswick.
1 female ex Ornithomya "fringillina Curtis", ex Dumeletella carolinensis (Linnaeus), Middletown, Rhode Island, 1957, J. BAIRD.
2 females ex Ornithomya "fringillina Curtis", ex Melospiza melodia (Wilson), Groton, Massachusetts.
9 females ex Ornithomya "fringillina Curtis", ex Spizella passerina (Beckstein), Groton, Massachusetts.
3 females ex Ornithomya "fringillina Curtis", ex Zonotrichia albicollis (Gmelin), Elmhurst, New York.
1 female ex Ornithophila metallica (Schiner), ex Euryestomus orientalis (Linnaeus), Myitkina, Burma.
13 females ex Ornithophila metallica (Schiner), ex Halcyon albonotata Ramsay, New Britain.
3 females ex Ornithophila metallica (Schiner), ex Halcyon chloris (Boddaert), Boang Island, Bismarck Archipelago.
1 female ex Ornithophila metallica (Schiner), ex
1 female ex Ornithophila metallica (Schiner), ex Malacconotus blanchoti approximans (Cabanis), Uganda.
1 female ex Ornithophila metallica (Schiner), ex Strix ocellata (Lesson), Deccan, India.

Myialges caulotoon Speiser, 1907.
3 females ex Icosta ardea botaurinorum (Swenk), ex Botaurus lentiginosus (Rackett); 10 females, same hosts, St Paul, Minnesota.
1 female ex Icosta chalcolampra (Speiser), Solomon Islands.
1 female ex Icosta ducet (Austen), ex Urotoriorchis macrourus (Hartlaub) Bantanga, Congo; 1 female, same fly host, Kwamouth, Africa, 6-vi-13.
2 females ex Icosta nigrar (Perty), Indefatigable Island, Galapagos; 1 female, same fly host, Tucson, Arizona, 8-v-16.
3 females ex Olfersia fossulata Macquart, Peru.
2 females ex Olfersia fumipennis (Sahlberg), ex Pandion haliaetus (Linnaeus), British Honduras.
2 females ex Olfersia spinifera (Leach), ex Freagata magnificens Mathews, Jamaica.

Promyialges falconis Fain, 1965.
5 females ex Icosta nigrar (Perty), ex Buteo jamaicensis (Gmelin), Montana.
2 females ex Pseudolychnia canariensis (Macquart), Manila, Philippines.
4 females ex Stilbometopa fulvifrons (Walker), ex Quiscalus niger (Boddart), Rio Ojo del Toro, Cuba, 30-viii-30.

Promyialges lophortyx (Furman and Tarshis, 1953)
4 females ex Ornithomyia chloropus Bergroth, ex Zonotrichia albicollis (Gmelin), California.

Promyialges macdonalldi Evans, Fain and Bafort, 1963.
17 females ex Ornithoctona laticornis (Macquart), ex Passer griseus (Vieillot), Kivu, Zaire.
5 females ex *Ornithophila metallic* (Schiner), ex *Falco tinnunculus* Linnaeus, Cyprus.

1 female ex *Ornithophila metallic* (Schiner), ex *Halcyon chloris tristrami* Layard, New Britain.

1 female ex *Ornithophila metallic* (Schiner), ex *Lonchura cucullata* (Swainson), Temvo, Congo, 1922.

1 female ex *Ornithophila metallic* (Schiner), ex *Halcyon chloris tristrami* Layard, New Britain.

1 female ex *Ornithophila metallic* (Schiner), ex *Lonchura cucullata* (Swainson), Temvo, Congo, 1922.

1 female ex *Ornithophila metallic* (Schiner), ex *Motacilla alba* Linnaeus, Doab, Afghanistan.

1 female ex *Ornithophila metallic* (Schiner), ex *Malaconotus blanchoti approximans* (Cabanis), Uganda.

Remarks: These individuals may be a new species or a subspecies of *pari*. Males are needed for more exact determination. Another specimen of the African variety found on *O. metallic* was examined in the University of GA mite collection, ex *Erythropygia paena* Smith, Kukong, Bechuanaland, 20-XII-57, F. Zumpt.

*Promyialges uncus* (Vitzthum, 1934)

5 females ex *Ornithomya bequaerti* Maa, ex *Bombycylla cedrorum* Vieillot, Rector, Pennsylvania, 4-VI-82, Leberman.

6 females ex *Ornithomya bequaerti* Maa, ex *Picoides pubescens* (Linnaeus), Rector, Pennsylvania, 4-VI-82, Leberman.

1 female ex *Ornithomya bequaerti* Maa, ex *Zonotrichia Leucophrys gambelii* (Nuttall), Totem Park, Juneau, Alaska, R. B. Williams.

3 females ex *Ornithomya "chloropus" Bergroth", ex *Catharus guttatus* (Pallas), Mt. Desert Island, Maine, 29-VII-32.

1 female ex *Ornithomya "chloropus" Bergroth", ex *Geothlypis trichas* Linnaeus, E. Westmoreland, New Hampshire.


3 females ex *Ornithomya "fringillina Curtis", ex Colaptes auratus* (Linnaeus), New York.

1 female ex *Ornithomya "fringillina Curtis", ex Dumerella carolinensis* (Linnaeus), Middletown, Rhode Island, 5-IX-57; 4 females, same hosts and locality, 1957.

7 females ex *Ornithomyya "fringillina Curtis, ex Ixoreus naevis naevis* (Gmelin), Vernon, British Colombia.

1 female ex *Ornithomya "fringillina Curtis", ex Zonotrichia lincolni* (Audubon), Fargo, North Dakota.

2 females ex *Ornithomya "fringillina Curtis", ex Melospiza melodia* (Wilson), Groton, Massachusetts.

2 females ex *Ornithomya "fringillina Curtis", ex Spizella passerina* (Beckstein), Groton, Massachusetts.

1 female ex *Ornithomya "fringillina Curtis", ex Spizella sp. (passerina or pallida* (Swainson)), Fargo, North Dakota.

3 females ex *Ornithomya "fringillina Curtis", ex Turdus migratori* Linnaeus, Demarest, New Jersey; 1 female, same hosts, Middletown, Rhode Island.

Remarks: The Brazilian species has bilobed pulvilli and an undivided hysterosomal shield. The Australian and Liberian specimens appear to be the same species, with small hysterosomal shields (80 × 40 µm) far apart from each other (40-65 µm).

Promyialges n. spp.

1 female ex *Microlychnia crypturelli* Bequaert, ex *Columba rufina sylvestris* Vieillot, Brazil, 1940.

3 females ex *Ornithoica exilis* (Walker), ex *Dacelo novaeguineae* (Hermann), North Queensland, 3-VIII-64.

1 female ex *Ornithoica turdi* (Latreille), ex *Gypohierax angolensis* (Gmelin), Kakatowm, Liberia, 24-VIII-26.

Remarks: The Brazilian species has bilobed pulvilli and an undivided hysterosomal shield. The Australian and Liberian specimens appear to be the same species, with small hysterosomal shields (80 × 40 µm) far apart from each other (40-65 µm).

Accidentals

Acaridida

Acaridae: *Histioaster* n. sp.; 1 hypopus, ex *Ornithoctona erythrocephala* (Leach), Brazil; *Sancassania* spp., 1 hypopus each, ex *Ornithomya fringillina Curtis*, ex *Bonasa umbellus* (Linnaeus), Montana; ex *Ornithophila metallic* (Schiner), ex *Halcyon chloris* (Boddart), Boang Island, Bis-
marck Archipelago, and ex Olfersia bisulcata Macquart, ex Coragyps atratus (Bechstein), Venezuela; 1 acarid sp. hypopus ex Ornithomya bequaerti Maa, ex Zonotrichia leucophrys gambelii (Nuttall), Totem Park, Juneau, Alaska, 9-V-73, R. B. WILLIAMS; 1 acarid tritonymph, ex Ornithomya "fringillina Curtis", ex Zonotrichia albicollis (Gmelin), Elmhurst, New York.

Analgidae : Radfordalges sp., 1 male, 1 tritonymph, 1 larva ex Ornithomya exilis (Walker), ex Dicrurus hottentottus laemostictus Sclater, New Britain, March 1932; 1 male, same fly host, ex Halcyon cinnaomina reichenbachi (Hartlaub), Ponape; 1 male and 1 tritonymph, same fly host, ex Alcedinidae, Irian Jaya. 1 male, 1 female ex Ornithoica stipituri (Schiner), ex Ptiloris magnifica alberti Elliot, Queensland; 1 analgid larva, ex Ornithoica stipituri (Schiner), ex Ninox odiosa Sclater, New Britain.

Histiostomatidae : Histiostoma sp., 1 hypopus, ex Ornithomya "fringillina Curtis", ex Dumetella carolinensis (Linnaeus), Middletwon, Rhode Island, 1957, J. BAIRD; new genus, 3 hypopi, ex Ornithoctona erythrocephala (Leach), Brazil.

Glycyphagidae : Dermacarus sp., 1 hypopus ex Ornithoica turdi (Latreille), ex Melaenornis fischeri toruensis (Hartert), Kwagimba, Toro, Uganda.

Kramerellidae : Pseudogabucinia sp., 1 female ex Icosta dukai (Austen), ex Urottiorchis macrourus (Hartlaub), Batanga, Cameroon; 2 females, 5 tritonymphs, 10 protonymphs and 1 larva ex Icosta pilosa (Macquart), ex Choriotis kori (Burchell), Kenya.

Psoroptoididae : Temnalges sp., 5 females ex Icosta rufiventris (Bigot), ex Leucopternis albicollis (Latham), Panama; 5 females, same fly host, ex Harpyhaliaetus solitarius solitarius (Tschudi), Venezuela.

Winterschmidtiidae : Procalvolia? sp., 1 female ex Ornithoica curvata Maa, ex Centropus sinensis sinensis (Stephens), Myitkina, Burma, 18-IV-45.

Xolalgidae : Ingrassiinae spp., 3 larvae ex Icosta coalescens Maa, Congo, 1 female ex Icosta rufiventris (Bigot), ex Micrastur ruficolus (Vieillot), Brazil; 1 tritonymph, ex Ornithoctona erythrocephala (Leach), ex Circus cinereus Vieillot, Brazil, 1955.

Mesostigmata

Ascidae : Blattisocius keegani Fox, 1 female ex Ornithoica vicina (Walker), ex Bubo virginianus (Gmelin), Eureka, Missouri, 1988, W. CRAWFORD.

Uropodina : 2 deutonymphs ex Ornithoctona erythrocephala (Leach), Brazil.

Prostigmata

Erythraeidae : Leptus sp., 2 larvae ex Ornithoica stipituri (Schiner).

Remarks : The new genus of Histiostomatidae is similar to Ameranoetus and Hormosianoetus in having dark pigment dorsolateral to the palposoma, but has claws on leg IV.

Discussion

There are now a total of 14 epidermoptid mite species known from 32 species of hippoboscid flies and 101 species of birds (FAIN, 1965; MACK-FIRA et al., 1966; HILL et al., 1967; MAIN and ANDERSON, 1970; BUTTIKER and CERNY, 1974; CHIROV, 1979; WILSON and HAAS, 1980; HUTSON, 1981; FAIN, GAUD and PHILIPS, 1987). The classification of these mites remains tentative for those species known only from females found on the flies, and it is likely further species will become apparent when more birds are directly examined and males are found. Since epidermoptid mites are so far known only from 32 of the 153 species of hippoboscid flies, it is also likely that many females of new species remain to be discovered.

Some of the mites found are cosmopolitan in occurrence, but most have restricted geographic distributions. Fly host specificity varies among the mite genera. Each species of Myalges and Promyialges is less fly-specific, typically occurring on 1-5 fly genera. Mites found on polyxenous flies can occur on monoxenous flies as well — for example, Ornithomya rupes Hutson, from the crag martin.
*Ptyonoprogne reipestris* (Scopoli), is parasitized by *Myialges bombycillae* (HUTSON, 1981), and *Ornithomya biloba* Dufour, from the barn swallow *Hirundo rustica* Linnaeus, is parasitized by *Promyialges uncus*.

Most of the epidermoptid mites so far found on hippoboscid flies occur on polyxenous flies from many avian hosts, and the mites apparently exhibit a lack of avian host specificity corresponding to that of their dipteran hosts. Thus the mites can take advantage of whatever avian their fly host brings them to. This assumes that the mites on flies from birds were actually parasitizing that bird. It is possible that mite on a stray fly may not be able to parasitize an improper new hosts bird. However, direct bird collections have shown that at least some of these epidermoptid species can parasitize several bird orders or families. *Microlichus avus* is known from hummingbirds and passerines, including finches, parrotbills and weavers; *Promyialges macdonaldi* is known from babblers, titmice and warblers (FAIN, 1965; CHIROV, 1979).

In this study, we found mites on three monoxenous flies: *Microlynchia crypturelli*, *Olfersia fumipennis* and *Olfersia spinifera*. *M. crypturelli* had a new species of *Promyialges*, while the *Olfersia* species each had slightly different mites very close to *Myialges caulotoon*. Males are needed to confirm their identity with *M. caulotoon*, but the unique discovery on *M. crypturelli* suggests other undiscovered epidermoptid species may exist, monoxenous for both fly an bird hosts.

Two species have been described in the genus *Strelkoviacarus*. *S. quadratus* has been found on *Ornithomya chloropus* from European passerines (MACK-FIRA and CRISTEA, 1966; HILL et al., 1967), and *S. criitesi* was described from *Agelaius phoeniceus* (Linnaeus) in Ohio (SPORY, 1965), then found on *Ornithomya fringillina* in Europe (HILL et al., 1967). Our records represent new avian hosts, a new fly host genus, and new continental distributions for these mites. Epidermoptid mites are much more common on louseflies than *Strelkoviacarus* is.

The accidental mites found in this study included avian feather mites, phoretic entomophilic astigmat, and mesostigmatic deutonymphs and adults, and one insect parasite — *Leptus* sp. Others have reported similar finds (CORBET, 1961; HILL et al., 1967; BUTTIKER and CERNY, 1974). Since feather mites are generally highly host specific while louseflies are not, a phoretic feather mite does not stand a very high chance of a polyxenous fly happening to pick the same host again. Soil and bark mites will similarly not find louseflies optimal transportation vehicles. Erythraeid larvae have previously been found on louseflies by HILL et al. (1967) and BUTTIKER and CERNY (1974). The latter illustrated their mite on the fly's leg — which is also where our specimens occurred. While *Leptus* parasites flies, such as tse-tse flies (FAIN and ELSEN, 1972), there was no evidence our specimens had penetrated the cuticle anywhere. Since records of *Leptus* on houseflies are so scarce, and are observations of phoresy but not parasitism, we cannot conclude it is a deliberate lousefly parasite.

Considerably more field collecting of mites and flies is needed. We need both sexes of the mites for proper classification, and there are species of *Microlichus* which have been found on birds but not yet on louseflies (FAIN and GAUD). There is also little available information on the frequency of occurrence of these skin mites on birds, or what an average infestation means as far as numbers and pathological effects. Infestation rates of flies with mites have been shown to vary from 1-93 % (HILL et al., 1967) so the incidence of mites and the importance of flies in spreading them may be quite variable and is currently unpredictable for most bird species and geographical areas.

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