Ectoparasites and Food Habits of the Opossum, *Didelphis virginiana*, in Indiana

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Abstract

The major ectoparasites found on 66 opossums in Indiana were four kinds of mites, *Marsupialichus brasiliensis*, *Archemyobia inexpectatus*, *Ornithonyssus wernecki* and *Didelphilicus serrifer*, a chigger mite, *Neotrombieula whartoni*, and the cat flea, *Ctenocephalides felis*. A number of other invertebrates, some parasitic, were found in the fur in low numbers. A large number of kinds of food was found, indicating that *D. virginiana* is opportunistic and will eat many kinds of foods as available. A total of 71 food categories was listed, but mammals, collectively, formed 22.2% of the total volume, followed by birds 21.3%, other vertebrates 9.0%, insects 11.7%, other invertebrates 13.6%, vegetation 19.0% and garbage 3.1%.

Introduction

Hock (7) remarked that the opossum appears to be one of the most heavily parasitized of North American mammals, while Hamilton (6) stated that the opossum is relatively free of arthropod parasites. The most abundant ectoparasite found by Hamilton on over 200 opossums from New York was the tick, *Ixodes cookei*. However, this species occurred on only seven hosts which harbored from 1 to 18 individuals each. Other ectoparasites taken in low numbers were the fleas, *Oropsylla arctomys*, *Chaetopsylla lotoris*, *Ctenocephalides felis*, *Ctenopthalmus pseudagyrtes*, *Orchopeas wickhami* and *Rhopalopsyllus gwyni*. Mites found were *Liponyssus* sp. (identification unclear) and the chigger, *Neotrombicula microti*.

All opossums taken in summer and early fall during a study in Kansas were infested with ticks, *Dermacentor variabilis* (5). The same tick and also a flea, *Opisodasys* sp. were found on the opossum in Missouri (11).

The most comprehensive study of the ectoparasites of *D. virginiana* is that of Morlan (9) who examined 349 opossums and found (Numbers after each parasite represent the number of hosts infested and the total number found):

ANOPLURA: *Hoplopleura sciuricola* (1, 2); *Polyplax spinulosa* (5, 7).

SIPHONAPTERA: *Echidnophaga gallinacea* (33, 322); *Cediopsylla simplex* (9, 12); *Ctenocephalides felis* (133, 615); *Pulex irritans* (1, 2); *Xenopsylla cheopis* (16, 27); *Odontopsyllus multispinosus* (3, 3); *Orchopeas howardi* (31, 80); *Polygenis gwyni* (114, 501); *Leptopsylla segnis* (3, 3).

ACARINA (MITES): *Hypoaspis lubrica* (2, 4); *Haemogamasus liponyssoides* (1, 4); *Androlaelaps fahrenholzi* (31, 222); *A. casalis* (2, 3); *Eulaelaps stabularis* (9, 15); *Echinolaelaps echidninus* (1, 1); *Ornithonyssus bacoti* (24, 206); *O. wernecki* (34, 195); *Cheyletus eruditus* (1, 52).

ACARINA (TICKS): *Ixodes cookei* (5, 8); *I. scapularis* (5, 7); *Amblyomma americanum* (2, 16); *Dermacentor variabilis* (71, 411); *Haemaphysalis leporis-palustris* (2, 2).

ACARINA (CHIGGERS): *Eutrombicula alfreddugesi* (6, 23); *E. splendens* (15, 196).

Other reports of mites on North American opossums are summarized by Whitaker and Wilson (14). These include, in addition to some of the species mentioned above, *Marsupialichus brasiliensis, Haemogamasus hirsutus* and *Archemyobia inexpectatus.*

There are few reports of ectoparasites from opossums from Indiana, but 21 individuals and 4 separate collections of opossum parasites from that state were examined for sucking lice, fleas and ticks by Wilson (15). No lice were found, but fleas included *Cediopsylla simplex* (1 individual), *Ctenocephalides felis* (7), and *Orchopeas howardi* (1). Ticks consisted of 11 specimens of *Dermacentor variabilis,* and 2 of *Ixodes cookei. Marsupialichus brasiliensis* has also been recorded from *Didelphis* from Indiana (4).

Most of the parasites previously reported from the North American opossum are of larger species. There has been little effort to study the smaller forms, especially some of the mites.

Several workers have examined stomachs or scats from the opossum (1, 6, 8, 11, 12, 13, 16), but the data of Hamilton (6), who examined 461 stomachs from New York, were the most extensive. All studies reflect the great diversity in the foods eaten by this species. Hamilton found an overall percent volume of 22.6% mammals, 14.1% fruit, 10.3% earthworms, 9.3% amphibians, 8.1% green vegetation, 7.9% insects, 7.2% birds, 6.0% carrion, 5.6% reptiles and 3.0% mollusks. There is no food habits information available for the opossum from Indiana.

Materials and Methods

Sixty-six opossums were examined for ectoparasites between 1962 and 1976, mostly by direct examination of the hair and skin under a zoom dissecting microscope (10-70X). Parasites were cleared in Nesbitt's solution and mounted in Hoyers solution and the coverslips were ringed with Euparal. Stomach materials from 83 individuals were examined in water, and were identified by comparison with items collected in the field. Visual estimates were made of the volume of each material in each stomach, and the data were summarized as percent volume and percent frequency.

PARASITES:

The major parasites of *Didelphis virginiana* in Indiana are four kinds of mites: *Marsupialichus brasiliensis, Archemyobia inexpectatus, Ornithonyssus wernecki* and *Didelphilicus serrifer*; a chigger: *Neotrombicula whartoni*; and the cat flea: *Ctenocephalides felis* (Table 1).

Archemyobia inexpectatus (Myobiidae) and *Ornithonyssus wernecki* (Macronyssidae) are common North American parasites of *Didelphis* (14).

TABLE 1. *Ectoparasites and other associates of 66 opossums,* Didelphis virginiana *from Indiana.*

Mites (other than chiggers)	Total No. taken	Avg. No. per host	Percentage of hosts infested
Marsupialichus brasiliensis	16,920	256.36	25.7
Archemyobia inexpectatus	4,436	67.21	28.8
Ornithonyssus wernecki	1,138	17.24	39.4
Didelphilichus serrifer	903	13.68	31.8
Zibethacarus ondatrae	259	3.92	4.5
Oribatid mites	27	.41	10.6
Androlaelaps fahrenholzi	9	.14	9.1
Listrophorus dozieri	5	.08	3.0
Anoetidae	3	.05	1.5
Macrocheles sp.	2	.03	1.5
Haemogamasus reidi	1	.02	1.5
Androlaelaps casalis	1	.02	1.5
Lophuromyopus sp.	1	.02	1.5
Ornithonyssus sylviarum	1	.02	1.5
Ornithonyssus bacoti	1	.02	1.5
Laelaps multispinosus	2	.03	1.5
Chiggers			
Neotrombicula whartoni	137	2.08	21.2
Eutrombicula alfreddugesi	2	.03	1.5
Ticks			
Ixodes cookei	4	.06	3.0
Dermacentor variabilis	1	.02	1.5
Fleas			
Ctenocephalides felis	147	2.23	25.7
Orchopeas leucopus	6	.09	3.5
Ctenocephalides canis	3	0.05	3.0
Orchopeas howardi	2	.02	1.5
Ctenopthalmus pseudagyrtes	1	.02	1.5
Chaetopsylla lotoris	1	.02	1.5
Biting Lice			
Trichodectes octomaculatus	1	.02	1.5

Marsupialichus brasiliensis, Fain, 1967 (Labidophoridae, Glycyphagidae), a non-feeding, phoretic mite (hypopus) has previously been reported for North America (4). However, *M. marsupialis* was described from *Didelphis marsupialis* from Surinam in 1972 (3), and in 1973 hypopi from *D. virginiana* from Louisiana were identified by Pence (10) as the latter species. The adult, tritonymph, protonymph and larva of *M. marsupialichus* have been described (3); the hypopus is similar to that of *M. brasiliensis* except that the tibial spine of leg IV is distinctively curved and solenidion w3 is considerably longer than w1. We have examined some of the slides from Pence's Louisiana material, and find them very similar, if not identical, to the Indiana hypopi. Pence (10) suggested, and we concur, that the hypopi and other life stages of *M. marsupialis* and *M. brasiliensis* be further examined and compared with those of *M. andretti,* the other species of *Marsupialichus* described from an opossum.

The only previous description and record of *Didelphilichus serrifer* (Listrophoridae) was from *Didelphis azurae* from Brazil (2); thus, the present occurrence constitutes a new mite record for North America, and also a new host record for *D. virginiana.*

Although a variety of fleas was found, the cat flea, *Ctenocephalides felis*, was the only one of regular occurrence. Seven of nine fleas found by Wilson (15) on Indiana opossums were this species; the others were *Cediopsylla simplex* and *Orchopeas howardi*. The cat flea occurs primarily on domestic cats and dogs. The few records in the literature where dates of collection are given (15) indicate that this may be a winter flea, as the majority of the records fall between September and March. Data collected during the present study support this hypothesis, as 13 opossums collected from April to August had a total of 7 fleas of this species (0.53 per opossum), while 140 were found on the 53 opossums taken from September through March (2.64 per opossum). This difference is significant (Chi-square = 20.74, 1 df). The fact that *C. felis* is the only flea of regular occurrence on the opossum probably reflects its host's close affinity with man and his domesticated animals.

Few ticks were found during the present study; they represented the same two species previously reported on *D. virginiana* from Indiana (15).

The rather large number of parasite species taken and the appearance of a few species normally considered to be host specific on other hosts probably reflect the food habits of the opossum. This species eats a great variety of foods, many of them taken as carrion. We suspect that parasites are more likely to move from a dead and cold host to a carrion feeder than when their normal host is still warm, as would often be the case when a predator kills and eats its prey. During our laboratory studies of dead animals, we have often observed the movement of parasites to the ends of the hairs when the host has become cold. We believe this tendency helps to explain the occurrence of some of the more host specific forms on *Didelphis*, such as *Zibethacarus ondatrae*, *Listrophorus dozieri* and *Laelaps multispinosus*, normally found on muskrats; *Ornithonyssus sylviarum*, normally found on chickens; *Trichodectes octomaculatus*, normally of the raccoon, and *Androlaelaps casalis*, *Orchopeas howardi* and *Haemogamasus reidi*, normally of squirrels. The presence of these species probably indicates that the opossum has recently fed on the respective hosts. That two of the three opossums that harbored *Zibethacarus ondatrae* were the only opossums found to harbor *Listrophorus dozieri* further supports this idea. Only one opossum harbored *Orchopeas howardi* but the same animal was the only one that harbored *Haemogamasus reidi*.

Food Habits

As in previous studies in other areas, a great variety of food items (total of 71 categories listed) was found in the stomach of opossums from Indiana (Table 2). The total volume of mammal remains in stomachs was 22.2%, while birds totaled 21.3%. Amphibians, mostly *Bufo woodhousei* totaled 2.2% of the volume, while reptile (turtle) totaled 0.1%. Carrion totaled 4.9% of the volume of the sample, while unidentified flesh comprised 1.8%. It is likely that much of the vertebrate material listed as bird and mammal remains was carrion, and that it was probably scavenged from highways. Total insect remains

TABLE 2. *Foods eaten by 83 opossums,* Didelphis virginiana, *from Indiana.*

Mammal (Total 22.2% volume)		
Unidentified mammal	4.2	8.4
Blarina brevicauda	3.8	4.8
Microtus ochrogaster	2.7	3.6
Didelphis virginiana	2.5	3.6
Tamias striatus	2.2	2.4
Sylvilagus floridanus	2.1	2.4
Microtus pennsylvanicus	1.5	2.4
Sciurus niger	1.2	1.2
Peromyscus sp.	0.9	1.2
Peromyscus maniculatus	0.7	1.2
Mus musculus	0.2	1.2
Cryptotis parva	0.2	3.6
Bird (Total 21.3% volume)		
Unidentified bird	15.4	22.9
Colinus virginiana	2.4	2.4
Turdus migratorius	1.9	2.4
Domestic chicken	1.3	2.4
Colaptes cafer	0.3	2.4
Other vertebrates (Total 9.0% volume)		
Carrion	4.9	8.4
Bufo woodhousei	2.1	6.0
Flesh, unidentified	1.8	6.0
Turtle	0.1	1.2
Salamander	0.1	1.2
Insects (Total 11.7% volume)		
Carabidae	2.8	10.8
Acrididae	2.7	8.4
Gryllidae	1.9	14.5
Lepidopterous larvae	1.2	13.3
Pentatomidae	0.5	4.8
Gryllacrididae	0.4	1.2
Tettigoniidae	0.4	2.4
Scarabaeidae	0.2	3.6
Muscoid fly	0.2	2.4
Tipulid larvae	0.2	3.6
Scarabaeid larvae	0.2	1.2
Lampyrid larvae	0.1	2.4
Lygaeidae	0.1	1.2
Unidentified Coleoptera	0.1	1.2
Unidentified Diptera	0.1	1.2
Coleopterous larvae	0.1	3.6
Unidentified Hemiptera	0.1	1.2
Acalypterate Diptera	0.1	1.2
Tabanid larvae	0.1	1.2
Tenebrionidae	0.1	1.2
Alleculidae	trace	1.2
Chauliognathus larva	trace	1.2
Nitidulidae	trace	1.2
Formicidae	trace	1.2
Staphylinidae	trace	1.2
Other invertebrates (Total 13.6% volume)		
Earthworm	10.9	34.9
Crayfish	0.7	2.4
Unidentified invertebrates	0.6	6.0
Snail	0.5	7.2

Sowbug	0.5	3.6
Mollusk	0.2	2.4
Slug	0.1	1.2
Spider	0.1	2.4
Vegetation (Total 19.0% volume)		
Unidentified vegetation	13.4	47.0
Wheat seeds	1.2	2.4
Dead leaves	1.1	1.2
Apple	1.1	3.6
Physalis sp. (fruit)	0.8	6.0
Corn	0.4	2.4
Sorghum	0.4	1.2
Grass seeds	0.2	3.6
Phytolacca americana	0.2	1.2
Unidentified seeds	0.2	1.2
Chenopodium seeds	0.1	1.2
Prunus virginiana seeds	trace	1.2
Ambrosia trifida seeds	trace	1.2
Moss	trace	1.2
Garbage	3.1	6.0
Unidentified material	trace	1.2
TOTAL	99.9	

amounted to 11.7% of the volume of food in the sample, and other invertebrates totaled 16.3%. The only important individual item in this last category was earthworms, at 10.9% of the volume. Earthworms were eaten by 34.9% of the opossums in the sample, and were the third most abundant food item, after unidentified bird and unidentified vegetation. Plant items of various sorts totaled 19.0% of the overall volume in the sample, but included the cultivated foods, corn, wheat, and sorghum at low rates (total of 2.0% volume). Garbage was recorded when obvious human food items, wrapping paper, etc., were found in stomachs, but many items in other categories could have been scavenged from dumps, garbage pails, etc.

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