

Ectoparasites of Opossums and Raccoons in Southeastern Georgia

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ABSTRACT Twelve species of ectoparasites (four fleas, three ticks, three chiggers, one macronyssid mite, and one atopomelid mite) were recovered from 42 opossums, *Didelphis virginiana* Kerr, live-trapped from September 1992 through April 1994 in southeastern Georgia. The fleas, *Ctenocephalides felis* (Bouché) (prevalence = 19%) and *Polygenis gwyni* (C. Fox) (36%); the ticks, *Dermacentor variabilis* (Say) (40%) and *Ixodes scapularis* Say (19%); and the macronyssid mite, *Ornithonyssus wernecki* (Fonseca) (21%), exhibited the highest infestation prevalences on opossums. The atopomelid mite, *Didelphilichus serrifer* Fain, and the chigger mite *Leptotrombidium peromysci* Vercammen-Grandjean & Langston, both ectoparasites of opossums, are reported from Georgia for the first time. Six species of ectoparasites (one chewing louse, four ticks, and one macronyssid mite) were collected from 58 raccoons, *Procyon lotor* (L.), examined between October 1992 and September 1993 in the same region. The chewing louse, *Trichodectes octomaculatus* Paine (prevalence = 24%); and the ticks, *Amblyomma americanum* (L.) (69%), *D. variabilis* (55%), and *Ixodes texanus* Banks (24%), exhibited the highest infestation prevalences on raccoons. Three species of ticks, *A. americanum*, *D. variabilis*, and *I. scapularis*, were the only ectoparasites recovered from both host species. Several of the ectoparasites collected are proven vectors of pathogenic agents that affect humans and animals.

KEY WORDS ectoparasites, opossums, raccoons

LITTLE INFORMATION is available on the ectoparasites associated with opossums, *Didelphis virginiana* Kerr, and raccoons, *Procyon lotor* (L.), in Georgia. In southwestern Georgia, ectoparasites from both of these hosts were documented by Morlan (1952), and fleas recovered from opossums were reported by Mohr & Morlan (1959). Ticks associated with both hosts in Bulloch County, Georgia, were studied by Lavender (1985), and records of ticks from the entire state of Georgia were collated by Wilson & Baker (1972). Elsewhere in the Southeast, ectoparasites of opossums and raccoons in Florida were documented by Forrester (1992). Opossum ectoparasites were surveyed in central Tennessee by Durden & Wilson (1990) and on Merritt Island, FL, by Durden et al. (1993). Ticks were sampled from raccoons in eastern Tennessee by Rabinowitz et al. (1983), and the ticks of Alabama were documented by Cooney & Hays (1972). Important studies on the ectoparasites of these hosts in other parts of the United States include those by Whitaker et al. (1977) and Whitaker & Goff (1979) for opossums and raccoons, respectively, in In-

diana, and by Hopkins (1980) for opossums in Oregon. The ectoparasite records from opossums and raccoons reported here from southeastern Georgia contribute to our knowledge of the geographical distribution and biology of these arthropods including those of public health importance.

Materials and Methods

Live traps (81 by 30 by 25 cm; [Tomahawk Live Trap, Tomahawk, WI]) were baited with apples, canned cat food, or fresh fish. Trap lines were set in six counties (Bulloch, Bleckley, Bryan, Candler, Liberty, and Screven) in southeastern Georgia, including St. Catherines Island, a large (5,600 ha) barrier island in Liberty County. Trapping was conducted from September 1992 through April 1994. Traps were examined the morning after being set, and captured animals were anesthetized with a mixture of xylazine (0.25 mg/kg body weight [Moby, Animal Health Division, Shawnee, KS]) and ketamine hydrochloride (25 mg/kg; [Aveco, Fort Dodge, IA]) administered intramuscularly. Each anesthetized animal was examined carefully (without magnification) for 10 min by two persons, and ectoparasites were removed with fine forceps.

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Ectoparasites were placed in labeled vials either alive or in 70% ethanol and identified in the laboratory. Voucher tick specimens are deposited in the U.S. National Tick Collection, Georgia Southern University, Statesboro, GA (accession numbers RML 121145–RML 121151). Ear tags were attached to captured opossums and raccoons before release; ectoparasites were not sampled from recaptured animals.

All requirements of the state of Georgia, relative to capture, anesthetization, handling, and release of wild animals were met. Permits and approvals are on file in the offices of O.J.P. and L.A.D.

Results and Discussion

Forty-two opossums (14 males, 28 females) ranging in weight from 0.68 to 3.20 kg (mean = 1.60 kg) were live-trapped and examined for ectoparasites from Bulloch (26), Bleckley (2), Bryan (10), Candler (3), and Screven (1) Counties. Opossums are absent from St. Catherines Island. Fifty-eight raccoons (36 males, 22 females) ranging in weight from 1.40 to 8.20 kg (mean = 4.28 kg) were live-trapped and examined from Bulloch (11), Bryan (17), Candler (5), and Liberty (25 [all from St. Catherines Island]) counties.

Infestation parameters for the 12 species of ectoparasites recovered from opossums, and the six species collected from raccoons, are listed in Table 1.

Opossum Ectoparasites. Four species of fleas were recovered from opossums (Table 1), with *Polygenis gwyni* (C. Fox) being the most prevalent. The cat flea, *Ctenocephalides felis* (Bouché), also infested a large proportion of hosts. Similar flea data from opossums in southwestern Georgia were reported by Morlan (1952) and Mohr & Morlan (1959), except that *C. felis* was more prevalent than *P. gwyni* in their samples. However, in Tennessee *C. felis* was the dominant flea (with *P. gwyni* absent on this host), and on Merritt Island, FL, *P. gwyni* was present in large numbers (with *C. felis* absent) on this host (Durden et al. 1993). Forrester (1992) reported six species of fleas from opossums in Florida but did not give infestation details. In Indiana, six species of fleas were recovered from opossums by Whitaker et al. (1977), but only *C. felis* was common in their study. In Oregon, three species of fleas were found on opossums by Hopkins (1980), with both *C. felis* and the northern rat flea, *Nosopsyllus fasciatus* (Bosc), being common. The remaining two species of fleas that we collected from opossums parasitize numerous species of mammals (*Pulex simulans* Baker) or prefer tree squirrels (*Orchopeas howardi* [Baker]) (Benton 1980). We noted fewer fleas on opossums during the warmer months; although 12 (29%) of our opossums were examined in June/July, only one (0.57%) of the 175 fleas we recov-

ered was collected during those months. A similar but less concentrated phenology for *C. felis* on opossums in Indiana was reported by Whitaker et al. (1977). In Oregon, however, fleas (species not stated) infested opossums throughout the year but with a slight increase in prevalence during the summer months (Hopkins 1980).

Although the American dog tick, *Dermacentor variabilis* (Say), infested a greater proportion of opossums than the other two species of ticks recovered from this host, the lone star tick, *Amblyomma americanum* (L.), was present in larger numbers (Table 1). These two species of ticks similarly were recovered from opossums in central Tennessee (Durden & Wilson 1990). We also recovered 27 specimens of the blacklegged tick, *Ixodes scapularis* Say, from opossums in southeastern Georgia. These three species of ticks similarly were reported from opossums in Georgia and Florida by Morlan (1952), Wilson & Baker (1972), Lavender (1985), and Forrester (1992). In both Alabama and Indiana, only *D. variabilis* and *Ixodes cookei* Packard were recovered from opossums (Cooney & Hays 1972, Whitaker et al. 1977). In Oregon, only one species of tick, *Ixodes angustus* Neumann, infested opossums (Hopkins 1980); the absence of other ticks presumably reflects the urban setting of that study. In our study, *A. americanum* was recovered from opossums in April and July, *D. variabilis* from April through July, and *I. scapularis* from October through April.

The macronyssid mite *Ornithonyssus wernecki* (Fonseca) has been reported from opossums by several authors including Morlan (1952) in Georgia, Whitaker et al. (1977) in Indiana, and Durden & Wilson (1990) in Tennessee. The three species of chiggers that we collected from opossums, *Eutrombicula alfreddugesi* (Oudemans), *Leptotrombidium peromysci* Vercammen-Grandjean & Langston, and *Neotrombicula whartoni* (Ewing), all are widely distributed North American mammal ectoparasites (Whitaker 1982). Larvae of *E. alfreddugesi* parasitize virtually any species of terrestrial vertebrate including humans (Yunker 1973). Our records of the atopomelid mite *Didelphulichus serrifer* Fain and the chigger mite *L. peromysci* are the first ones from Georgia.

Two species of small mites that are specific ectoparasites of *D. virginiana* were not recorded in our survey: the myobiid *Archemyobia inexpectatus* Jameson and the glycyphagid *Marsupialichus brasiliensis* Fain. Both of these mites were abundant on opossums in Indiana (Whitaker et al. 1977) but were rare on this host in Tennessee (Durden & Wilson 1990) and were not found on opossums in Florida (Forrester 1992, Durden et al. 1993). Although it is possible that we failed to sample these mites because our collecting technique did not use magnification,

Table 1. Ectoparasites collected from 42 opossums and 58 raccoons in southeastern Georgia, 1992–1994

| Ectoparasites | Opossums | | | | Raccoons | | | |
|---|-------------------------|-----------------------------|---------|------------------|-------------------------|-----------------------------|---------|---------------------------------|
| | Prevalence ^a | Mean intensity ^b | Range | Total collected | Prevalence ^a | Mean intensity ^b | Range | Total collected |
| Mallophaga | | | | | | | | |
| Trichodectidae | | | | | | | | |
| <i>Trichodectes octomaculatus</i> | 0 | 0 | — | 0 | 24 | 8.4 | 1–44 | 19 ♂♂, 44 ♀♀, 55 N ^c |
| Siphonaptera | | | | | | | | |
| Ceratophyllidae | | | | | | | | |
| <i>Orchopeas howardi</i> | 12 | 1.4 | 1–2 | 3 ♂♂, 4 ♀♀ | 0 | 0 | — | 0 |
| Pulicidae | | | | | | | | |
| <i>Ctenocephalides felis</i> | 19 | 4.4 | 1–9 | 2 ♂♂, 33 ♀♀ | 0 | 0 | — | 0 |
| <i>Pulex simulans</i> | 5 | 10.0 | 1–9 | 4 ♂♂, 16 ♀♀ | 0 | 0 | — | 0 |
| Rhopalopsyllidae | | | | | | | | |
| <i>Polygenis gwyni</i> | 36 | 7.5 | 1–33 | 38 ♂♂, 75 ♀♀ | 0 | 0 | — | 0 |
| Acari | | | | | | | | |
| Atopomelidae | | | | | | | | |
| <i>Didelphulichus serrifer</i> ^d | 5 | 200.0 | 100–300 | 400 (mostly ♀) | 0 | 0 | — | 0 |
| Ixodidae | | | | | | | | |
| <i>Amblyomma americanum</i> ^d | 14 | 31.7 | 1–20 | 1 ♀, 71 N, 118 L | 69 | 181.2 | 1–1,207 | 2 ♂♂, 375 N, 6,870 L |
| <i>Dermacentor variabilis</i> | 40 | 5.2 | 1–18 | 51 ♂♂, 37 ♀♀ | 55 | 5.0 | 1–26 | 97 ♂♂, 62 ♀♀ |
| <i>Ixodes scapularis</i> | 19 | 3.4 | 1–14 | 3 ♂♂, 24 ♀♀ | 2 | 1.0 | 1 | 1 ♀ |
| <i>Ixodes texanus</i> | 0 | 0 | — | 0 | 24 | 3.4 | 1–10 | 21 ♀♀, 25 N, 1 L |
| Macronyssidae | | | | | | | | |
| <i>Ornithonyssus bacoti</i> | 0 | 0 | — | 0 | 2 | 1.0 | 1 | 1 ♀ |
| <i>Ornithonyssus wernecki</i> ^d | 21 | 37.2 | 1–240 | 285 ♀♀, 50 N | 0 | 0 | — | 0 |
| Trombiculidae | | | | | | | | |
| <i>Eutrombicula alfreddugesi</i> ^d | 5 | 88.0 | 26–150 | 176 L | 0 | 0 | — | 0 |
| <i>Leptotrombidium peromysci</i> | 2 | 1.0 | 1 | 1 L | 0 | 0 | — | 0 |
| <i>Neotrombicula whartoni</i> | 2 | 18.0 | 18 | 18 L | 0 | 0 | — | 0 |

^a Percentage infested as defined by Margolis et al. (1982).

^b Mean per infested host as defined by Margolis et al. (1982).

^c ♂, male(s); ♀, female(s); N, nymphs; L, larva(e).

^d Populations of these acarine species were estimated on some heavily infested hosts.

we propose that both species are rare or absent in Florida and southeastern Georgia.

Raccoon Ectoparasites. As a group, ticks were the dominant ectoparasites on the raccoons we sampled (Table 1). However, the chewing louse *Trichodectes octomaculatus* Paine, a well-documented parasite of this host (Morlan 1952, Whitaker & Goff 1979), also was frequently collected. A single specimen of the tropical rat mite, *Ornithonyssus bacoti* (Hirst), presumably an accidental infestation, was also recovered (Table 1). All four species of ticks that we collected from raccoons have been reported from this host in adjacent regions (Morlan 1952, Cooney & Hays 1972, Wilson & Baker 1972, Rabinowitz et al. 1983, Lavender 1985, Forrester 1992). Two of the tick species we collected (*D. variabilis* and *Ixodes texanus* Banks), plus a third species (*I. cookei*) that we did not collect, were recovered from raccoons in Indiana (Whitaker & Goff 1979). All 25 raccoons from St. Catherines Island were infested by *A. americanum* but only 45% (15 of 33) of the raccoons trapped in mainland locations were infested by this tick. This suggests that *A. americanum* may be more abundant on barrier islands, although mean intensity of raccoon infestation by this tick was similar on both St. Catherines Island (183.0) and on the mainland (178.0). *A. americanum* parasitized raccoons from June through September, *D. variabilis* from April through September, *I. scapularis* in December, and *I. texanus* from May through August.

Our raccoon ectoparasite data are intriguing because several ectoparasites, including all fleas and the carnivore tick *I. cookei*, were absent. The vermipsyllid flea *Chaetopsylla lotoris* (Stewart) is a specific parasite of raccoons in the northern United States and Canada, but, along the Atlantic seaboard, it has not been recorded farther south than North Carolina (Benton 1980). Although *I. cookei* has been reported from Georgia (Morlan 1952, Wilson & Baker 1972), it was not collected by Lavender (1985) in Bulloch County, and it seems to be rare in southeastern Georgia.

Comparison of Ectoparasite Faunas on Opossums and Raccoons. Our data show that, in southeastern Georgia, opossums are parasitized by a greater diversity of arthropod species (four fleas, three ticks, three chiggers, one macronyssid mite, and one atopomelid mite) than are raccoons (one chewing louse, four ticks, and one macronyssid mite). However, few of these ectoparasite species are specific associates of opossums or raccoons. Only two species of mites (*O. werneckii* and *D. serrifer*) collected are specific ectoparasites of opossums, whereas one species of chewing louse (*T. octomaculatus*) and one tick (*I. texanus*) are considered to be host specific on raccoons. Three species of ticks (*A. americanum*, *D. variabilis*, and *I. scapularis*) were the only ectoparasites recovered from both hosts. These

ticks also parasitize several other host species (Morlan 1952, Cooney & Hays 1972, Wilson & Baker 1972).

Zoonotic Significance of Ectoparasite Collections. Several ectoparasites collected in this survey are proven vectors of pathogens that cause zoonotic diseases. *C. felis* serves as a vector of *Rickettsia typhi* (Wolbach & Todd), the causative agent of murine (endemic) typhus (Azad 1990). Similarly, *O. howardi* may be involved in the transmission of *Rickettsia prowazekii* Da Rocha-Lima in sylvatic epidemic typhus cycles (McDade 1987). The tick *I. scapularis* is a vector of the Lyme disease spirochete (Piesman & Sinsky 1988), and *D. variabilis* can cause tick paralysis and is the principal vector in eastern North America of *Rickettsia rickettsii* (Wolbach), the causative agent of Rocky Mountain spotted fever. Current evidence strongly suggests that *A. americanum* is a vector of *Ehrlichia chaffeensis* Anderson, Dawson, Jones & Wilson, an etiologic agent of human ehrlichiosis (Anderson et al. 1993). Last, the tropical rat mite, *O. bacoti*, is a laboratory vector for several zoonotic pathogens such as Langat virus (the agent of Langat encephalitis), *Coxiella burnetii* (the agent of Q fever), *Rickettsia akari* (the agent of rickettsialpox), *R. typhi*, and *Yersinia pestis* (the agent of plague) (Yunker 1973, Azad 1990, Durden & Turell 1993).

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