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Ectoparasites of the Raccoon (*Procyon lotor*) from North-Central Arkansas

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ABSTRACT: Nine species of ectoparasitic arthropods were collected from 27 raccoons from north-central Arkansas between November 1989 and April 1990. Collected were 5 acarine (*Androlaelaps casalis*, *Dermacentor variabilis*, *Ixodes cookei*, *I. scapularis*, *I. texanus*), 3 siphonapteran (*Chaetopsylla lotoris*, *Orchopeas howardi*, *Pulex simulans*), and a single mallophagan species (*Trichodectes octomaculatus*). The rodent mite, *A. casalis* is reported for the second time from a raccoon. The occurrences of the fleas *O. howardi* and *C. lotoris* and the louse *T. octomaculatus* represent new geographic distribution records.

Little information exists regarding the ectoparasitic fauna of the raccoon (*Procyon lotor*) from Arkansas and other regions of North America. Surveys of ectoparasitic arthropods of wildlife provide, in addition to information concerning the distribution and ecology of the parasite fauna, valuable epidemiological information in that many serve as vectors of etiologic agents of disease to man and other animals, both wild and domestic. The purpose of this study was to characterize the ectoparasitic fauna of the raccoon in north-central Arkansas. These findings may serve as a basis for comparative studies on the ectoparasitic fauna of the raccoon within the state and throughout North America.

Materials and Methods

Twenty-seven live-trapped or hunter-shot raccoons from Van Buren County, Arkansas were examined for the presence of ectoparasites between November 1989 and April 1990. A detailed description of the study site, which is situated in the Ozark mountains of north-central Arkansas, and a report of the helminth fauna of these animals was given by Richardson et al. (1992). The animals were placed in plastic bags upon being killed, and examined as soon as possible for the presence of ectoparasitic arthropods by detailed visual searches of the fur aided by a magnifying glass. All arthropods collected were fixed and stored in 70% ethanol. Fleas and lice were later cleared in 10% potassium hydroxide, and mounted in Canada balsam, while the single mite was cleared in lactophenol and mounted in Hoyer's medium for identification.

Results and Discussion

Four tick, 3 flea, 1 louse, and 1 mite species were collected. Representative specimens of each tick species recovered were deposited in the U.S. National Tick Collection, Georgia Southern University, Statesboro, Georgia. Representative

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Table 1. Ectoparasitic arthropods collected from the raccoon (*Procyon lotor*) from north-central Arkansas.

Arthropods (accession #)	Ontogenetic stages collected*	Number infested (%) (n = 27)
Mallophaga		
Trichodectidae		
<i>Trichodectes octomaculatus</i> Paine, 1912 (82677)	7M, 15F, 11N	5 (18.5%)
Siphonaptera		
Pulicidae		
<i>Pulex simulans</i> Baker, 1895 (82678)	2M, 6F	3 (11.1%)
Vermipsyllidae		
<i>Chaetopsylla lotoris</i> (Stewart, 1926) (82679 & 80)	15M, 24F	9 (33.3%)
Ceratophyllidae		
<i>Orchopeas howardi</i> (Baker, 1895) (82681 & 2)	6M, 19F	10 (37.0%)
Acari		
Laelapidae		
<i>Androlaelaps casalis</i> (Berlese, 1887) (82676)	1F	1 (3.7%)
Ixodidae		
<i>Dermacentor variabilis</i> (Say, 1821) (RML 120864)	3M	1 (3.7%)
<i>Ixodes cookei</i> Packard, 1869 (RML 120865)	2M, 11F, 60N, 31L	16 (59.3%)
<i>Ixodes scapularis</i> Say, 1821 (RML 120867)	3M, 1F	2 (7.4%)
<i>Ixodes texanus</i> Banks, 1909 (RML 120866)	2F, 10N, 1L	4 (14.8%)

* M = male(s), F = female(s), N = nymph(s), L = Larva(e).

specimens of the remaining species collected were deposited in the U.S. National Parasite Collection in Beltsville, Maryland. A taxonomic listing of the arthropods collected, along with their accession numbers, prevalence, and ontogenetic stages or sexes are given in Table 1.

Ixodes cookei was the predominant tick with the other 3 species exhibiting relatively low prevalences (Table 1). All are common parasites of the raccoon and have previously been reported from this host in northwest Arkansas (Tugwell and Lancaster, 1962). *Ixodes scapularis* and *I. cookei* were reported from Arkansas by Cooley and Kohls (1945). *Ixodes ozarkus*, which is a junior synonym of *I. scapularis* (Keirans and Clifford, 1978), described from specimens taken from a dog in Huntsville, Arkansas was reported to parasitize man and raccoons (Cooley, 1944). *Dermacentor variabilis*, *I. scapularis*, and *I. cookei* were also reported from domestic dogs in northwestern Arkansas by Koch (1982). Additionally, all 4 tick species found in this survey were reported from the raccoon in Shelby County, Tennessee by Kollars (1993).

Ticks that parasitize free-ranging mammals, including the species identified in this study, are known to serve as vectors of various disease causing agents. The spatial and temporal distribution of Lyme disease, which results from infection with the spirochete *Borrelia burgdorferi*, has traditionally been correlated with the occurrence of *Ixodes dammini*; however, indigenous cases have been reported in areas beyond the known range of this tick (Levine et al., 1991). *Ixodes dammini* has recently been made a junior subjective synonym of *I. scapularis* (Oliver et

al., 1993); thus, the principal etiologic agent of Lyme disease has a greater distribution than earlier suspected. *Ixodes cookei* has also been implicated as having a possible role in the transmission of Lyme disease (Hall et al., 1991). Levine et al. (1991) collected *I. cookei* infected with *B. burgdorferi* from raccoons in Virginia, and Fish and Daniels (1990) found that 55% of raccoons collected in Westchester County, New York produced spirochete positive ticks, implicating the raccoon as a competent reservoir of *B. burgdorferi*. Further, *I. cookei* has been associated with human Lyme disease in West Virginia (Hall et al., 1991).

From 1988 through 1992, 105 cases of Lyme disease were reported in Arkansas (morbidity statistics, Arkansas Department of Health, available from Arkansas Department of Health, Division of Epidemiology, 4815 West Markham Street, Little Rock, Arkansas 72205-3867). Since the raccoon is a common inhabitant of both rural and urban environments, intimate contact with man and domestic pets frequently occurs. In view of the competency of the raccoon as a reservoir for *B. burgdorferi* and the tick fauna which it hosts it is conceivable that this animal could serve as a potential reservoir for the transmission of Lyme disease to man.

Dermacentor variabilis may serve as a vector for etiological agents of Rocky Mountain spotted fever, babesiosis, tick paralysis, anaplasmosis, tularemia, and cytauxzoonosis (Hoskins and Cupp, 1988). In 1979, St. Louis encephalitis virus was isolated from *D. variabilis* removed from a raccoon in Memphis, Tennessee and neutralizing antibodies against St. Louis encephalitis virus were detected from a raccoon in the same area (McLean et al., 1985).

Ixodes cookei may serve as a vector of Powassan virus to wild mammals and, occasionally, to humans (Karabatsos, 1985). *Ixodes scapularis* is a competent laboratory vector of *Babesia odocoilei*, the agent of deer babesiosis (Waldrup et al., 1990). Additionally, both *Anaplasma marginale* and *Francisella tularensis* have been isolated from *I. scapularis* (Strickland et al., 1977).

The mite, *Androlaelaps casalis* and the flea, *Orchopeas howardi*, frequently reported as squirrel parasites, were collected. Although *O. howardi* utilizes squirrels as its principal hosts, it is often collected from their ecological associates and has been reported from the raccoon by several authors. The finding of this flea in Arkansas represents a new geographic distribution record. *Rickettsia prowazeki*, the causative agent of epidemic typhus, has been isolated from *O. howardi* specimens removed from flying squirrels (*Glaucomys volans*) in the eastern United States. Human infections occasionally occur and are usually referred to as "sporadic epidemic typhus," although the exact route of infection is unknown (McDade, 1987). The only previous report of *Androlaelaps casalis* from the raccoon was by Whitaker and Goff (1979) who collected a single specimen from a raccoon in Indiana. *Androlaelaps casalis* has previously been reported from Arkansas associated with other hosts (Whitaker and Wilson, 1974). As pointed out by Whitaker and Goff (1979), since raccoons often utilize holes in hollow trees that may also be used by squirrels and other animals, some parasites may be acquired from such sites. It is also conceivable that transmission of such parasites may occur through predator-prey interactions.

The flea *Pulex simulans* has been reported from a wide variety of domestic and wild animals, including the report of two specimens from a raccoon in Cumberland County, North Carolina by Harlan and Palmer (1974). Jordan and Rothschild

(1908) considered *P. simulans* to be a junior synonym of *Pulex irritans*. Subsequently, the literature reflects much confusion regarding the taxonomic status of the 2 species. Smit (1958) concluded that *P. irritans* and *P. simulans* were distinct, valid species, a decision which has gained wide acceptance. In view of this information it is conceivable that specimens previously collected in Arkansas (Fox, 1940) and reported as *P. irritans* may have been *P. simulans*. The host(s) from which these 2 individuals were collected was not given.

Chaetopsylla lotoris is the common raccoon flea, utilizing the raccoon and the gray fox (*Urocyon cinereoargenteus*) as its principal hosts. The finding of this flea in Arkansas represents a new geographic distribution record. Lewis (1973) stated that this is an exclusively Nearctic species occurring in the eastern and central United States. Benton (1980) pointed out that most specimens have been taken between November and March, suggesting this to be a cold-weather flea. The southern-most reports of this flea are from Rutherford, Caldwell, and Cumberland Counties in North Carolina, all situated at approximately 35°N latitude (Fox, 1940; Johnson, 1955; Harlan and Palmer, 1974; Benton, 1980). The specimens collected in this study were collected at approximately 35°33'N latitude; thus, it appears that approximately 35°N latitude may mark the southern boundary of the range of *C. lotoris*.

Trichodectes octomaculatus, a host-specific mallophagan of *P. lotor* appears to be ubiquitous but the present report of this chewing louse represents a new geographic distribution record for the state of Arkansas.

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