Ectoparasites and other ectosymbiotic arthropods of vertebrates in the Great Smoky Mountains National Park, USA

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Abstract

We review previously published accounts of ectoparasites and other ectosymbiotic arthropods of vertebrates and report on the collections from 4 species of reptiles, 54 species of birds, and 47 species of mammals from the Great Smoky Mountains National Park, or immediately adjacent lands in North Carolina and Tennessee, USA. Our list includes 1 species of beetle, 2 hemipteran bugs, 9 flies, at least 42 species of lice, 23 species of fleas, and at least 75 species of Acari (11 ticks/64 mites). We discuss the potential for transmission of pathogens by these ectoparasites and the relevance of disjunct populations of boreal species at high elevations in the Great Smoky Mountains.

Key words: Ectoparasites, Ectodytes, Vertebrates, Great Smoky Mountains, Tennessee, North Carolina
**Introduction**

Vertebrates are infested with a diverse assemblage of symbiotic macroinvertebrates that range from obligate parasites to transient commensal mites phoretically attached to hair or feathers. Wild and domestic animals harbor ectoparasites, which can serve as reservoirs or vectors of pathogens to humans. Ectoparasites are vectors or intermediate hosts of bacteria, rickettsiae, viruses, and helminths. Monitoring of ectoparasites is important from both a conservation standpoint and for the protection of public and wildlife health. Ectoparasite-borne pathogens have decimated troops in almost every major war and threaten survivors of natural and man-made disasters (Szybalski 1999; Raoult et al. 2004). For example, an epidemic of louse-borne relapsing fever killed more than 50,000 people during World War II (Borgnolo et al. 1993).

The Great Smoky Mountains National Park (GSMNP) is one of the largest and most visited National Parks in the eastern USA. Previous biological surveys of vertebrates (e.g. Linzey 1995) have reported some ectoparasites and other ectosymbiotic arthropods. Some ectoparasites have been described in annotated lists of arthropods from the Park (e.g. Reeves et al., 2004a), and novel species of ectoparasites have been described from the GSMNP (e.g. Linzey & Crossley 1971). However, no attempt has been made to catalog all of the ectoparasitic and ectosymbiotic arthropods of vertebrates from the GSMNP. Our checklist is intended to function as a review of all previous published work on ectoparasites and ectosymbiotic arthropods and to include new records from animals in the Park.

**Methods**

We reviewed primary literature on the ectoparasites and ectosymbiotic arthropods of vertebrates of North Carolina and Tennessee. All records from the GSMNP are summarized below. In addition, ectoparasites and ectosymbiotic arthropods were removed from vertebrates or collected throughout the GSMNP. Animals that had been killed by a car were later examined on site. When possible they were washed with ethanol, sealed in a plastic bag, and examined under a dissecting microscope. Preserved vertebrates from the GSMNP, University of Tennessee, and Clemson University museums were carefully examined with a microscope and ectoparasites or ectosymbiotic arthropods were removed. Specimens from the GSMNP museum, University of Tennessee Veterinary Parasitology Collection, Georgia Museum of Natural History, Clemson University Arthropod Collection, National Tick Collection, and Georgia Southern University Parasitology Collection were examined and unpublished records of ectoparasites were added to our checklist. Published records or specimens from the GSMNP that did not report a specific collection locality are listed as “GSMNP” in the records that follow. When records were reported or specimens were collected from areas directly adjacent to the Park (Foothills and Blue Ridge Parkways and communities that border the Park) these were included in our checklist for the sake of completeness. Our nomenclature for mammals follows that of Wilson & Reeder (2005).

When possible we deposited voucher specimens in the Great Smoky Mountains National Park Museum. The following abbreviations denote accession numbers for specimens deposited in, or identified for, certain collections:

L: General ectoparasite collections in the Department of Biology, Georgia Southern University—maintained by L. A. Durden.

RML: U.S. National Tick Collection, Georgia Southern University—RML denotes ‘Rocky Mountain Laboratory” the original depository for this collection.

Collector names are reported as they are on collection labels. When possible the life stages and numbers of specimens are included (at the beginning of a collection entry), the following abbreviations are used: L = Larva(e), N = Nymph(s),
DN = Deutonymph(s), M = Male(s), F = Female(s), P = Pupa(e).

Many species in this paper should not be considered true parasites. The life histories of most ectoparasites or eктosymbiotic arthropods are poorly documented. In most cases there is little or no data to document the health and fitness effects of infestations by these arthropods. As a result we can not differentiate true parasites from harmless mutualists and commensalists. Some taxa can be detrimental to individual hosts are harmless to others. We denote phoretic or presumably non-parasitic species with an asterisk (*).

Class Insecta

Order Phthiraptera—lice

Lice are wingless hemimetabolous insects that are ectoparasitic on birds and mammals. The sucking louse fauna of Tennessee was reviewed by Durden et al. (1997a). Lice are vectors of disease agents or intermediate hosts of parasites of both wildlife and humans. Lice are known or suspected of transmitting helminths, viruses, rickettsiae, bacteria, and protozoa (Durden 2002, Reeves et al., 2006a).

Family Haematopinidae

Haematopinus suis (L.)—hog louse


The hog louse occurs almost worldwide as a host-specific parasite of domestic and feral hogs (Durden & Musser 1994). Feral hogs are not native to the Smoky Mountains but they are established there (Linzey 1995). Haematopinus suis is a vector of Swinepox Virus and Eperythrozoon parvum (Durden 2002).

Family Hoplopleuridae

Hoplopleura hesperomydis (Osborn)


This louse has been recorded across much of North America and Mexico as a parasite of Peromyscus spp. and Ochrotomys nuttalli (Durden & Musser 1994). Hoplopleura hesperomydis appears to be fairly common on these rodents in the Park.

Hoplopleura hirsuta Ferris


Hoplopleura hirsuta is an ectoparasite of Sigmodon spp. in the Nearctic and Neotropical regions (Durden & Musser 1994).

Hoplopleura sciuricola Ferris


This tree squirrel-associated sucking louse is widely distributed in North, Central, and South America (Durden & Musser 1994). Durden et al. (1997a) reported *H. sciuricola* from Tennessee and the GSMNP. This louse has been implicated in the transmission of *Rickettsia prowazekii*, the agent of epidemic typhus (Bozeman et al., 1981). In addition an undescribed genotype of *Bartonella* was detected in this louse (Durden et al. 2004).

**Hoplopleura trispinosa Kellogg & Ferris**


This louse parasitizes both northern and southern flying squirrels across much of North America including Tennessee (Kim et al. 1986, Durden & Musser 1994, Durden et al. 1997a). Our collection is the first recorded for this louse from North Carolina and the GSMNP.

**Family Linognathidae**

**Solenopotes ferrisi** (Fahrenholz)


This sucking louse is widely distributed in North America as an ectoparasite of cervids, especially *Odocoileus* spp. (Kim et al. 1986, Durden & Musser 1994).

**Family Polyplacidae**

**Neohaematopinus sciuri** Jancke


In eastern North America, this louse is a host specific parasite of the gray squirrel (Kim et al. 1986, Durden & Musser 1994). Durden (1980) found this louse to be abundant on *S. carolinensis* in central Tennessee but the above record is the first one for the GSMNP. Several genotypes of undescribed *Bartonella* have been isolated from this louse (Durden et al. 2004).

**Neohaematopinus sciuropteri** (Osborn)


This louse is widely distributed in North America as an ectoparasite of both the northern and southern flying squirrel (Kim et al. 1986, Durden & Musser 1994) but the above record is the first for both North Carolina and the Park. *Neohaematopinus sciuropteri* might be involved with the enzootic transmission of *Rickettsia prowazekii* (Sonenshine et al 1978).

**Neohaematopinus semifasciatus** Ferris


The primary hosts of this louse are *Tamiasciurus douglasii* and *T. hudsonicus* in North America; but it is known to infest several other species of tree squirrels in Panama and Venezuela (Durden & Musser 1994).

**Polyplax auricularis** Kellogg & Ferris


This louse is a widespread ectoparasite of sigmodontine rodents (some species of *Onychomys, Peromyscus* and *Reithrodontomys*) in North and Central America (Durden & Musser 1994). *Polyplax auricularis* appears to be more common in northern latitudes or at higher elevations in southern latitudes.

**Polyplax serrata** (Burmeister)—house mouse louse

The house mouse louse has a cosmopolitan distribution as an ectoparasite of *M. musculus*. *Polyplax serrata* is a mechanical vector for the bacterium, *Eperythrozoon coccoides* (Berkenkamp & Wescott 1988).

*Polyplax spinulosa* (Burmeister)—spined rat louse


The spined rat louse parasitizes domestic rats (*Rattus* spp.) throughout the world (Durden & Musser 1994) but this is the first record of it from the Park. This louse is vector of *Rickettsia typhi* and *Haemobartonella muris* (Durden 2002, Roberts & Janovy 2000) and might be a vector of “*Bartonella rattimassiliensis*” to rats (Reeves et al 2006a).

**Family Pthiridae**

*Pthirus pubis* (L.)—crab louse


The crab louse has a cosmopolitan distribution as an ectoparasite of humans (Kim et al. 1986, Durden & Musser 1994). The specimen listed above was presented by a Park visitor as something that had bitten her.

**Family Menoponidae**

All menoponids are ectoparasites of birds (Price et al. 2003).

*Colpocephalum brachysomum* Kellogg & Chapman

Ex *Bubo virginianus* (great horned owl): 1F, TN, Blount Co., Cades Cove, 1 Apr. 1937, Unknown.

Price et al. (2003) lists *C. brachysomum* as a typical ectoparasite of *B. virginianus*.

*Kurodaia magna* Emerson

Ex *Strix varia* (barred owl): GSMNP (no other data).

*Strix varia* is the type host of *K. magna* (Price et al. 2003).

*Menacanthus aurocapillus* Carriker


Price et al. (2003) listed *S. motacilla* as a typical host of *Menacanthus aurocapillus*.

*Menacanthus chrysophaeus* (Kellogg)


A subspecies of the song sparrow, *Melospiza melodia samuelis*, is the type host for *M. chrysophaeus* (Price et al. 2003).

*Menacanthus pricei* Wiseman

Ex *Colinus virginianus* (northern bobwhite): NC, Haywood Co., Big Creek, 25 May 1959, Unknown.

*Colinus virginianus* is the type host for *M. pricei* (Price et al. 2003) and is infested with this louse in the southeastern USA (Doster et al. 1980).

*Menacanthus stramineus* (Nitzsch)—chicken body louse


This louse is distributed almost globally on chickens (Emerson 1956, Durden 2002) but this is the first record from the Park.

*Menopen gallinae* (L.)—shaft louse


Like the previous species, this louse has an almost cosmopolitan distribution (Emerson 1956, Durden 2002), but this appears to be the first record from the Park.
Myrsidea melanorum (Kellogg)

The eastern towhee is the type and principle host for *M. melanorum* (Price et al. 2003).

**Pseudomenopon pilosum** (Scopoli)

*Pseudomenopon pilosum* is a louse of rallids (Price et al. 2003).

**Family Philopteridae**
All philopterid chewing lice are ectoparasites of birds and some are vectors of filarial nematodes (Seegar et al. 1976).

**Brueelia brunneinucha** Cicchino

Price et al. (2003) list eight hosts for *B. brunneinucha* including *D. carolinensis*.

**Brueelia pallidula** (Piaget)

*Junco hyemalis* is the type host for *B. pallidula* (Price et al. 2003).

**Brueelia vulgata** (Kellogg)

According to Price et al. (2003), *Brueelia* spp. are not known to parasitize *C. fuscescens*. These specimens represent either stragglers (short-term infestation of an atypical host species) or undescribed species.

**Chelopistes meleagridis** (L.)—large turkey louse

The large turkey louse can be common on both domestic and wild turkeys (Durden 2002).

**Cuculicola coccygii** (Osborn)

*Coccyzus americanus* is the type host for *C. coccygii* (Price et al. 2003).

**Fulicoffula longipila** (Kellogg)

*Fulica americana* is the type host of *F. longipila* (Price et al. 2003).

**Oxylipeurus clavatus** (McGregor)
Ex Colinus virginianus (northern bobwhite): NC, Haywood Co., Big Creek, 25 May 1959, Unknown.

*Colinus virginianus* is the type host for *O. clavatus* (Price et al. 2003).

**Philopterus fuscoventralis** (Osborn)

The eastern wood-pewee is the type host for this louse (Price et al. 2003).

**Philopterus siali** (Osborn)

This louse is a host-specific ectoparasite of the eastern bluebird in North America (Price et al. 2003).

**Philopterus spp.**

According to Price et al. (2003), *Philopterus* spp. are not known to parasitize these birds. These specimens represent either stragglers (short-term infestation of an atypical host species) or undescribed species. Peters (1928) reported *Philopterus subflavescens* (Geoffroy) from both *Junco hyemalis* and *Cardinalis cardinalis*, but *Philopterus subflavescens* was not included in the world checklist by Price et al. (2003).

*Picicola foedus* (Kellogg and Chapman)

*Picicola foedus* has been recorded from several species of tyrannid birds in the New World including *Sayornis phoebe* (Price et al. 2003).

*Sturnidocus simplex* (Kellogg)

*Sturnidocus simplex* is an ectoparasite of the American robin (Price et al. 2003).

**Family Ricinidae**

All ricinid lice parasitize birds (Durden 2002)

*Ricinus* sp.

*Junco hyemalis* is a host to at least 2 species of *Ricinus* (Price et al. 2003).

*Trochiliphagus lineatus* (Osborn)

*Trochiliphagus lineatus* is a host-specific ectoparasite of the ruby-throated hummingbird (Price et al. 2003).

**Family Trichodectidae**

Trichodectid lice are ectoparasites of mammals including carnivores, hyraxes, rodents, ungulates, and some primates (Lyal 1985).

*Neotrichodectes mephitidis* (Packard)
Ex *Mephitis mephitis* (striped skunk): NC, Swain Co., Oconaluftee, 25 Nov. 2003, W. K. Reeves; GSMNP (Komarek & Komarek 1938) (as *Neotrichodectes* sp.).

Few skunks have been examined for ectoparasites in the Park. This louse parasitizes both striped and hooded (*Mephitis macroura*) skunks (Price et al. 2003).

*Neotrichodectes minutus* (Paine)

*Neotrichodectes minutus* is an ectoparasite of both the long tailed weasel and black-footed ferret (*Mustela nigripes*) (Price et al. 2003).

*Neotrichodectes osborni* Keler

*Neotrichodectes osborni* is a host-specific ectoparasite of the eastern spotted skunk (Price et al. 2003).

*Stachiella mustelae* (Schrunk)
This louse is host-specific to the least weasel (Price et al. 2003). Balsam Gap is adjacent to the GSMNP on the Blue Ridge Parkway.

**Trichodectes pinguis euarctidos** Hopkins


Few black bears in the Park have been examined for ectoparasites, but we assume that this bear-specific louse (Price et al. 2003) is common. This is the first record of this louse from the Park.

**Tricholipeurus lipeuroides** (Mégnin)


This louse parasitizes mule deer (*Odocoileus hemionus*) and white-tailed deer in North America (Price et al. 2003). Additional examinations of deer in the Park will determine the abundance of *T. lipeuroides*.

**Tricholipeurus parallelus** (Osborn)


The comments stated above for *T. lipeuroides* also apply to this species.

**Order Hemiptera—true bugs**

**Family Cimicidae—bedbugs, batbugs, & birdbugs**

*Cimex adjunctus* Barber


This batbug is an ectoparasite of several species of bats mainly in the eastern United States including North Carolina (Usinger 1966). This record appears to be the first for *C. adjunctus* from Tennessee and from the Park. *Cimex adjunctus* might be a vector of a *Bartonella* sp. of bats (Reeves et al. 2005a).

**Family Reduviidae—assassin & conenose bugs**

*Triatoma sanguisuga* (Le Conte)—eastern conenose bug


*Triatoma* or kissing bugs are blood feeding ectoparasites of vertebrates. *Triatoma sanguisuga* feed on rodents, raccoons, opossums, and humans (Ryckman 1986). This bug is a potential vector of *Trypanosoma cruzi*, the agent of Chagas’ disease (Beard et al. 1988).

**Order Siphonaptera—fleas**

**Family Ceratophyllidae**

*Ceratophyllus gallinae* (Schrank)—chicken flea


Although the chicken flea has been introduced from Europe to various parts of the world along with its domesticated host, in North America, it is primarily found in the northern United States and the above record represents a significant range extension (Benton 1980, Nelder et al. 2005).

*Ceratophyllus vison* Baker


This flea is a relatively host-specific ectoparasite of the red squirrel and it mainly occurs in boreal North America (Durden & Kollars 1997). Nevertheless, it occurs in the Park at higher elevations where the climate and vegetation resemble those of more northern regions. The above record from an eastern chipmunk is atypical.

**Opisodasys pseudarctomys** (Baker)


Although this is a largely boreal flea species associated with sciurids (flying squirrels), there are a few records from southern U.S. states including Tennessee and Florida (Benton 1980, Durden & Kollars 1997). This is the first record of this flea from NC and the Park. Sonenshine et al (1978) did not examine *O. pseudarctomys* as a potential vector of the agent of epidemic typhus to flying squirrels, but this flea could be involved with transmission of *Rickettsia*.

**Orchopeas howardi** (Baker)—squirrel flea


**Orchopeas howardi** is a widespread flea associated with Nearctic tree squirrels that is especially common in the eastern United States (Durden & Kollars 1997). As one of the above records indicates, *O. howardi* can infest bird nests. This flea has been implicated in the transmission of *Rickettsia prowazekii* from flying squirrels to humans (Sonenshine et al. 1978; Bozeman et al. 1981) and was recently associated with uncultured *Rickettsia* sp. and *Bartonella* sp. genotypes (Reeves et al. 2005b). Durden et al. (2004) reported two additional genotypes of *Bartonella* from this flea.

**Orchopeas leucopus** (Baker)

Ex *Microtus* sp. (listed as *M. montanus* which might have been *M. gapperi*): 1F, TN, Sevier Co., Mount Le Conte, 12 Apr. 1931, R. L. Boke (Fox 1940, Benton 1980, Durden & Kollars 1997).


Ex *Peromyscus maniculatus* (deer mouse): GSMNP (Linzey & Linzey 1968, Durden & Kollars 1997); 1F,


This widely distributed Nearctic flea of *Peromyscus* spp. and *O. nuttalli* (Durden & Kollars 1997) is widespread in the Park. The record from a vole is atypical.

**Orchopeas pennsylvanicus (Jordan)**


This flea parasitizes woodrats (*Neotoma*) in the eastern and central United States including Tennessee (Durden & Kollars 1997, Durden et al. 1997b).

**Family Ctenophthalmidae**

**Catallagia borealis Ewing**


This is a vole flea with boreal affinities in North America although its range extends southwards at higher elevations along the Appalachians (Durden & Kollars 1997).

**Catallagia new species**


This undescribed flea has been collected from voles at high elevations in the Park. It will be described in a separate paper by R. P. Eckerlin (who has collected additional specimens) and L. A. Durden.

**Corrodopsylla curvata (Rothschild)**


*Corrodopsylla curvata* is primarily a flea of shrews. This is a new Park and state record.

**Ctenophthalmus pseudagyrtes Baker**


Ex *Microtus* sp. (listed as *M. montanus* which may have been *M. gapperi*): 3F, NC, Swain Co., Oconaluftee, 18 Apr. 1931, R. L. Boke (Fox 1940, Benton 1980).


This small-mammal flea is common and widely distributed in the Park and in most eastern U. S. states (Benton 1980, Durden & Kollars 1997).

*Doratopsylla blarinae* Fox


This flea is a relatively host-specific ectoparasite of *Blarina* spp., short-tailed shrews, in the eastern United States (Whitaker et al. 1994, Durden & Kollars, 1997). The above record from a golden mouse represents an atypical host.

*Epitedia cavernicola* Traub


This nidicolous (nest-associated) flea is a parasite of woodrats in the eastern U. S. and is typically collected during the cooler months (Durden & Kollars 1997, Durden et al. 1997b).

*Epitedia wenmanni* (Rothschild)


Epitedia wenmanni was the most frequently collected flea in the Park; it is widely distributed in the eastern USA (Durden & Kollars 1997).

Stenoponia americana (Baker)

This large Nearctic flea parasitizes small mammals, especially Peromyscus and Microtus spp., east of the Great Plains (Lewis 1974).

Family Hystrichopsyllidae

Hystrichopsylla tahavuana Jordan

This relatively large flea parasitizes small mammals (Durden & Kollars 1997). It is most common on insectivores, especially moles, in the northeastern United States and eastern Canada. The GSMNP record and the additional Tennessee records are from high elevations along the Appalachians; the next closest records are from Pennsylvania (Lewis 1974, Benton 1980, Durden & Kollars 1997).

Family Ischnopsyllidae—bat fleas

Myodopsylla insignis (Rothschild)

Family Leptopsyllidae

Peromyscopsylla catatina (Jordan)


The vole flea is a northern species in the USA that extends its range southwards along the Appalachian mountains (Durden & Kollars 1997). The record from the deer mouse represents an atypical host association.

Peromyscopsylla hamifer (Rothschild)


Our records of this northern vole-associated flea represent the southern most collection and are both a new Tennessee and new Park record (Benton 1980, Durden & Kollars 1997). While P. hamifer is primarily a northern flea, the collection at Twin Creeks was from a low elevation of approximately 724 m.

Peromyscopsylla hesperomys (Baker)


This relatively commonly collected flea of Peromyscus spp. has a boreal distribution in North America with most southern records being from higher elevations along the Appalachian Mountains (Benton 1980, Durden & Kollars 1997).

Peromyscopsylla scotti Fox

Peromyscopsylla scotti, a Peromyscus-associated flea is widely distributed in much of eastern North America including Tennessee (Durden & Kollars 1997), but the above record is the first one for the Park.

Family Pulicidae
Cediopsylla simplex (Baker)—rabbit flea

As indicated by its vernacular name, the rabbit flea mainly parasitizes lagomorphs (Durden & Kollars 1997). This flea also forms short-term associations with predators of lagomorphs, such as foxes and dogs (Durden et al. 2005).
*Ctenocephalides canis* Curtis—dog flea


The above record appears to be the first from the Park for this cosmopolitan flea of domestic dogs and some other canids (Durden & Kollars 1997). The dog flea is an intermediate host for the double pored dog tapeworm (Durden & Traub 2002). Parola et al. (2003) reported novel genotypes of *Rickettsia*, from the dog flea.

*Ctenocephalides felis* (Bouché)—cat flea


Like the previous species, this flea has a cosmopolitan distribution. *Ctenocephalides felis* is more common than *C. canis* in most regions and parasitizes several mammalian species such as cats, dogs, humans, and Virginia opossums (Durden & Kollars 1997). The cat flea is a potential vector or intermediate host of *Acanthocheilonema reconditum*, *Bartonella henselae*, *Bartonella koehlerae*, *Bartonella quintana*, *Dipylidium caninum*, *Rickettsia felis*, *Rickettsia* sp. RF2125, *Rickettsia* sp. RF31, and *Rickettsia typhi* (Durden & Traub 2002; Reeves et al. 2005b; Rolain et al. 2005).

**Order Coleoptera—beetles**

**Family Leptinidae—mammal nest beetles**

*Leptinus orientamericanus* Peck*


This mammal nest beetle lives in the fur and nests of small mammals, especially insectivores, in eastern North America (Peck 1982). The above records are the first for the Park.

**Order Diptera—true flies**

Blood feeding flies of the Park were reported by Reeves et al. (2004a). Most of these flies are short term ectoparasites that take a blood meal and are not permanently associated with their hosts. For the sake of completeness and to make this checklist useful for parasitologists working in the Park we include only two families of ectoparasites in this checklist.

**Family Calliphoridae**

*Protocalliphora aenea* Shannon & Dobroscky


Reeves et al. (2004a) reported *P. aenea* for the first time from the Park and noted the northern distribution of this species.

*Protocalliphora bennetti* Whitworth


Reeves et al. (2004a) reported *P. bennetti* for the first time from the Park, and noted the range extension for the species.

*Protocalliphora braueri* (Handel)


**Protocalliphora deceptor** Sabrosky, Bennett, & Whitworth

These adult *P. deceptor* were reared from pupae; the specimens are in the Park museum.

**Protocalliphora sialis** Shannon & Dobroscky

Reeves et al. (2004a) reported *P. sialis* from the Park.

**Family Hippoboscidae—louse flies/flat flies/keds**

**Icosta americana** (Leach)

*Icosta americana* was previous reported by Reeves et al. (2004a), and it typically infests accipitrid, phasianid, and strigid birds.

**Ornithoica vicina** (Walker)

*Ornithoica vicina* is the smallest hippoboscid reported from the Park (Reeves et. al. 2004a).

**Ornithomyia anchineuria** Speiser
Ex *Sturnus vulgaris* (European starling): NC, Swain Co., Oconaluftee, 11 Jul. 2006, P. Super


*Ornithomyia anchineuria* and *Ornithomyia bequaerti* Maa are members of a cryptic species complex previously reported from a wide variety of bird in the Park (Reeves et al. 2004a).

**Ornithomyia bequaerti** Maa


*Ornithomyia bequaerti* and *Ornithomyia anchineuria* are members of a cryptic species complex previously reported from a wide variety of bird in the Park (Reeves et al. 2004a).

Class Arachnida

Subclass Acari—mites and ticks

**Family Acaridae**

*Rhizoglyphus* sp.*

A deutonymph of an unidentified *Rhizoglyphus* sp. was found attached to the hair of a feral cat in the Park. *Rhizoglyphus* sp. are not typically considered ectoparasites and this association could be accidental. Fain & Beaucournu (1972) reported *Rhizoglyphus* as phoretic parasites of fleas from moles in Europe.

**Family Analgidae**—analgid feather mites

*Analges* n. spp.


Several new species of *Analges* were collected in the Park. These mites live on the downy feathers of birds.

**Family Cheyletidae**

*Cheyletus eruditus* (Shrank)*

*Cheyletus eruditus* is a predatory mite that commonly occurs in house dust and stored food products. It can infest mammals and probably feeds on other small arthropods mainly in mammal fur and nests (Whittaker & Wilson 1974, Nutting 1985, McGarry 1989).

**Family Demodicidae**—follicle mites

Demodicidae live in sebaceous glands and hair follicles of mammals (Nutting 1985). The species diversity
for the Park is poorly represented by the two species below.

**Demodex phylloides Czokor**


*Demodex phylloides* is a host specific parasite of hogs and can cause skin lesions (Nutting 1976, 1985).

*Demodex folliculorum* (Simon)


*Demodex folliculorum* is one of two species of *Demodex* of humans.

**Family Dermanyssidae**

**Dermanyssus gallinae** (DeGeer)—chicken mite


The chicken mite is a blood-feeding parasite of birds that will also feed on small mammals and humans (Whitaker & Wilson 1974, Kwochka 1987).

**Dermanyssus hirudinis** (Hermann)


*Dermanyssus hirudinis* infests a wide variety of birds in North America and will also infest human habitats (Moss et al. 1970).

**Dermanyssus prognephilus** Ewing


*Dermanyssus prognephilus* is a nest dwelling ectoparasite of birds.

**Family Glycyphagidae—glycyphagid fur mites**

**Glycyphagus hypudaei** (Koch)


Deutonymphs of *G. hypudaei* have been collected from the hair and fur of rodents throughout the Nearctic region (Fain & Whitaker 1973, Whitaker & Wilson 1974). The records from *Sorex* are unusual and might rep-
resent contaminants if rodent traps were not washed prior to resetting.

**Glycyphagus sp.**


Phoretic hypopi of *Glycyphagus* were reported as *Labidophorus* by Linzey (1968) and Linzey & Linzey (1968). The family Labidophoridae was synonymized with Glycyphagidae.

**Marsupialichus brasiliensis** Fain


*Marsupialichus brasiliensis* is host specific to *Didelphis* spp. and in North America they infest *D. virginiana* (Fain & Whitaker 1973, Whitaker & Wilson 1974)

**Orycteroxenus canadensis** Fain, Kok, Lukoschus, & Clulow


*Orycteroxenus canadensis* is primarily an ectoparasite of the star-nosed mole and this record could indicate some cross contamination or is a rare association. The mite was removed from the hair of a museum specimen collected in the 1930s. The history of this animal is not known.

**Orycteroxenus soricis** (Oudemans)


*Orycteroxenus soricis* has been reported to infest insectivores and some voles (Fain & Whitaker 1973, Whitaker & Wilson 1974).

**Family Ixodidae - hard ticks**

**Amblyomma americanum** (L.) - lone star tick


The lone star tick is common and widespread in the eastern United States and occurs as far north as Maine (Keirans & Lacombe 1998). However, the relatively small number of records from the Park suggests that it is not common there. Immature ticks parasitize a variety of birds and mammals whereas adults typically parasitize larger mammals including humans (Bishop & Trembley 1945, Strickland et al. 1976, Durden & Kollars 1992). This tick is a vector of *Ehrlichia chaffeensis, Ehrlichia ewingii, Rickettsia* spp., *Coxiella burnetii*, and “*Borrelia lonestarii*” a putative agent of southern tick associated rash illness (STARI) also known as “Lyme-like disease” (Childs & Paddock 2003). A new *Ehrlichia* sp., similar to the agent of heartwater, was recently reported from *A. americanum* in Georgia (Loftis et al. 2006).

**Dermacentor albipictus** (Packard)—winter tick


This one-host tick primarily parasitizes large ungulates especially during the cooler months (Strickland et al. 1976) as reflected by its vernacular name. *Dermacentor albipictus* is widespread in North America (Bishop & Trembley 1945) and probably parasitizes white-tailed deer in the Park.

**Dermacentor variabilis** (Say)—American dog tick


Dermacentor variabilis was the most frequently collected tick in the Park. Immature stages mainly parasitize small mammals whereas adults parasitize larger mammals including humans, dogs, raccoons, and opossums (Durden & Kollars 1992). Dermacentor variabilis is the principal vector of the agent of Rocky Mountain spotted fever (Rickettsia rickettsii) in eastern North America and toxins released by certain individual attached females can cause tick paralysis especially in dogs and humans (Strickland et al. 1976, Durden & Kollars 1992).

Haemaphysalis leporispalustris (Packard)—rabbit tick
This tick is widely distributed in North America and there are records of it from across Tennessee (Durden & Kollars 1992). Adult rabbit ticks typically parasitize rabbits whereas larvae and nymphs parasitize birds and rabbits (Durden & Kollars 1992).
Ixodes angustus Neumann
This is a commonly collected tick in the Park that primarily parasitizes small mammals in moist or montane habitats (Robbins & Keirans 1992). All of the southern U.S. records are from higher elevations in the Appalachians. This tick might be an enzootic vector of Borrelia burgdorferi, the Lyme disease agent (Durden & Keirans 1996).

Ixodes brunneus Koch
This tick is exclusively a parasite of birds. This is the first record for the park. Goddard et al. (2003) reported evidence of both Rickettsia and ehrlichiae from I. brunneus.

Ixodes cookei Packard
This tick mainly parasitizes carnivores such as raccoons, foxes, and mustelids across North America (Bishopp & Trembley 1945, Durden & Keirans 1996). Ixodes cookei is a vector of Powassan encephalitis virus in the northeastern US (Main et al. 1979), but the vector potential of this tick and status of the virus in the GSMNP has not been studied.

Ixodes dentatus Marx
Super, L-3371.

*Ixodes dentatus* is primarily known as a rabbit tick but the larvae feed on birds and other small mammals. *Ixodes dentatus* has been associated with *Borrelia burgdorferi* the agent of Lyme disease, *Anaplasma phagocytophilum* an agent of human granulocytic anaplasmosis, and *Babesia divergens* the agent of European red-water (Anderson et al. 1996, Goethert & Telford 2003 a,b).

**Ixodes marxi** Banks


This tick parasitizes sciurid rodents in eastern North America (Bishopp & Trembley 1945, Durden & Keirans 1996). There are few records from the southern United States and the above records represent the first ones for Tennessee and the Park.

**Ixodes scapularis** Say—blacklegged tick

The blacklegged tick is widespread in eastern North America (Strickland et al. 1976, Dennis et al. 1998). It is not common at high elevations which might explain the apparent rarity in the Park. Immature stages of this tick typically feed on reptiles (mainly lizards), birds, and small mammals, whereas adults feed on larger mammals such as white-tailed deer, raccoons, humans, and feral hogs (Durden & Oliver 1999, Durden et al. 2002). All stages can also feed on humans and this tick is the principal vector of *Borrelia burgdorferi* the agent of Lyme disease, *Anaplasma phagocytophilum* an agent of human granulocytic anaplasmosis, and *Babesia* spp. in many parts of eastern North America (Durden & Keirans 1996). The collection of a nymph from a box turtle represents the first record of *I. scapularis* from this host. This tick has not been reported from white-tailed deer in the Park but adults should be present in the cooler months.

**Ixodes texanus** Banks—raccoon tick

This tick parasitizes carnivores, especially the raccoon, across North America (Durden & Keirans 1996). *Rickettsia rickettsii*, the agent of Rocky Mountain spotted fever, has been isolated from *I. texanus* (Anderson et al. 1986).

**Ixodes sp.**
Ex *Didelphis virginiana* (opossum): LL, GSMNP (Komarek & Komarek 1938).

Ex *Mephitis mephitis* (striped skunk): GSMNP (Komarek & Komarek 1938).


Ex *Neotoma magister* (Allegheny woodrat): 1N, TN, Blount Co., the Sinks, 21 May 1951, R. Traub & D. W. Pfitzer, RML31648 (specimen not in vial—if located, it could be identified to species).

Ex *Procyon lotor* (raccoon): GSMNP (Komarek & Komarek 1938).

These ticks were not identified beyond genus in the various reports cited above so no more can be stated about these records.

**Family Laelapidae**

**Androlaelaps casalis** (Berlese)

*Androlaelaps casalis* is a facultative ectoparasite of Nearctic mammals (Whitaker & Wilson 1974, Radovsky 1985).
Androlaelaps fahrenholzi (Berlese)
Androlaelaps fahrenholzi is a facultative ectoparasite of Nearctic mammals but unlike the previous species it seems more commonly collected in the Park (Whitaker & Wilson 1974, Radovsky 1985).

Echinonyssus talpae (Zemskaya)

This mite was primarily collected from insectivores in North America (Whitaker & Wilson 1974).

Eulaelaps stabularis (Koch)

Eulaelaps stabularis parasitizes numerous mammals, especially rodents, in North America (Whitaker & Wilson 1974).

Eulaelaps sp.

Eulaelaps spp. are generally not associated with elk and this is an unusual host association. Some Eulaelaps live preys on other small arthropods and could have been hitchhiking on the elk.

Haemogamasus longitarsus (Banks)

Haemogamasus longitarsus is a widely collected ectoparasite of rodents in North America (Whitaker & Wilson 1974).

Laelaps alaskensis Grant

The record of Laelaps alaskensis from Ochrotomys is suspect, since this species is only found on arvicoline rodents and Ochrotomys is a neotomin rodent.

Laelaps kochi Oudemans
Ex Microtus chrotorrhinus (rock vole): ): GSMNP (as Laelaps microti) (Komarek & Komarek 1938); NC, Swain Co., Kanati Fork, along Route 441, 2800 ft., “Dec.” (Linzey & Linzey 1968).
Laelaps stupkai Linzey & Crossley

Laelaps stupkai was originally described from the Park (Linzey & Crossley 1971).

Myonyssus jamesoni Ewing & Baker

Myonyssus jamesoni is a widely distributed ectoparasite of B. brevicauda and some other shrews ranging from Canada (Ontario) to the southern USA (Tennessee) (Ewing & Baker 1947, Whitaker & Wilson 1974).

Family Listrophoridae - listrophorid fur mites

Listrophorus dozieri Radford

This record appears to represent a case of straggling because L. dozieri typically parasitizes the muskrat, Ondatra zibethica, which also occurs in the Park (Fain & Hyland 1974, Linzey 1995).

Listrophorus mexicanus squamiferus Fain

Listrophorus mexicanus has been recorded from several species of voles in North America and Mexico (Fain & Hyland 1974). Listrophorus mexicanus squamiferus is almost certainly a distinct species.

Prolistrophorus bakeri (Radford)

Prolistrophorus bakeri mainly occurs on the hispid cotton rat but it has also been recorded from the rice rat, Oryzomys palustris, as recorded by Fain & Hyland (1974). This appears to be the first record of this mite from the Park.

Family Macrochelidae

Macrocheles sp.

Some species of macrochelid mites are known to be phoretic on mammals including Macrocheles mesochthonius on D. virginiana in North America (Krantz & Whitaker 1988).

Family Macronyssidae

Macronyssus crosbyi (Ewing & Stover)


Macronyssus crosbyi has been recorded from several species of bats, mainly Myotis spp., across much of...
North America (Whitaker & Wilson 1974).

*Ornithonyssus bacoti* (Hirst)—tropical rat mite

Ex *Rattus* sp.: TN, Blount Co. (Pratt & Good 1954).

The tropical rat mite is widely distributed in the tropical, subtropical and mild temperate regions of the world together with its domestic rat hosts (Radovsky 1985). However, it also parasitizes several other mammals and Whitaker & Wilson (1974) list records from 37 species of mammals in North America alone. This hematophagous mite will bite humans and can cause “tropical rat mite dermatitis” (Durden et al. 1997b).

*Ornithonyssus sylviarum* (Canestrini & Fanzago)—northern fowl mite

Ex *Iridoprocne bicolor* (tree swallow) nest: 34F, 1N, GSMNP, no other data, W. K. Reeves, L-3051.

Despite its vernacular name, this blood-feeding mite parasitizes many species of wild birds (Garvin et al. 2004) and some mammals (Whitaker & Wilson 1974).

*Ornithonyssus wernecki* (Fonseca)


*Ornithonyssus wernecki* mainly parasitizes the Virginia opossum in North America (Whitaker & Wilson 1974).

Family Myobiidae - myobiid fur mites

*Amorphacarus hengererorum* Jameson


Whitaker & Wilson (1974) reported *A. hengererorum* from four species of shrews (including *S. cinereus*) and one species of rodent in North America but this is the first record of this mite from North Carolina and the Park.

*Myobia musculi* (Koch)


*Myobia musculi* has an almost cosmopolitan distribution as an ectoparasite of the house mouse although Whitaker & Wilson (1974) also recorded it in North America from two additional rodent species.

*Radfordia affinis* (Poppe)


Like the previous species, *R. affinis* mainly parasitizes the house mouse (Whitaker & Wilson 1974).

*Radfordia ensifera* (Poppe)


*Radfordia ensifera* mainly occurs on domestic rats but Whitaker & Wilson (1974) also list records from some other species of mammals in North America.

*Radfordia subuliger* Ewing


This mite has been recorded from several species of sigmodontine rodents in North America (Whitaker & Wilson 1974).

*Radfordia zibethicalis* (Radford)


*Radfordia zibethicalis* has not been previously reported in the Park, but this mite is known to infest musk-
rats from Indiana and Texas (Bauer and Whitaker 1981).

Family Myoceptidae (myoceptid fur mites)

Myoceptes japonensis Radford

Whitaker & Wilson (1974) reported M. japonensis from three species of voles (including M. gapperi) and one species of sciurid (Marmota monax) in North America but this is the first record for North Carolina and the Park.

Myoceptes musculinus (Koch)

Although M. musculinus primarily infests the house mouse, Whitaker & Wilson (1974) provide records from six species of native North American rodents including O. nuttalli from the Park. However, our record from P. maniculatus represents the first for North Carolina.

Family Proctophyllodidae—proctophyllodid feather mites*
Proctophyllodid mites are often very numerous on the flight feathers of passeriform birds and hummingbirds. Host specificity is variable. Like most wing-inhabiting feather mites, they feed on preening oil, fungi, and other debris on the feathers. There are many undescribed species in North America. Gaud & Atyeo (1996) stated that, unlike the situation in most other groups of feather mites, proctophyllodid genera often occur on a particular bird species (or a group of species) as single species (i.e., multi-species associations on a single host species are rare). All of the following entries for proctophyllodids represent new records for the Park.

Allodectes n. sp.

This is the first record of this genus from the United States. Other species of Allodectes occur on Neotropical hummingbirds.

Proctophyllodes ateri Fritsch
Proctophyllodes breviquadratus Atyeo & Braasch
Proctophyllodes canadensis Fritsch
Proctophyllodes glanderinus (Koch)

Proctophyllodes musicus Vitzthum

Proctophyllodes polyxenus Atyeo & Braasch


Proctophylloides quadrisetosus Atyeo & Braasch

Proctophylloides reguli Gaud

Proctophylloides spini Atyeo & Braasch

Proctophylloides n. spp.

Pterodectes sialiarum (Stoll)

Pterodectes n. spp.


At least ten new species of Pterodectes were collected from birds in the Park.

Family Pteronyssidae—pteronyssid feather mites

Neopteronyssus pici (Scopoli)


This is the first record of this species from this host.

Scutulanyssus delichonum (Mironov)


This species was described originally from the Old World house martin, Delichon urbica and represents a new host and geographic record. Several species of Scutulanyssus are known to occur on barn swallows, but only S. obscurus (Berlese) and S. hirundicolus (Mironov) were previously reported from North America (Mironov and Galloway 2006)

Stenopteronyssus proctorae Mironov & Galloway


This species was recently described from this host in Canada (Mironov and Galloway 2006). This is the first record from the United States.

Family Spinturnicidae

Spinturnix americanus (Banks)

Spinturnix spp. are obligate ectoparasites of bats (Radovsky 1985). A partially characterized Spiroplasma sp. and a bacterium nearly identical to Anaplasma phagocytophilum were detected in a related species, Spinturnix psi (Reeves et al., 2006b).

Family Trombiculidae—chiggers

Euschoengastia jamesoni (Brennan)


Euschoengastia jamesoni is a parasite of insectivores in the Appalachians and the attachment sites of this mite often appear as depressed lesions (Reeves et al 2004b).

Euschoengastia peromysci (Ewing)


Euschoengastia peromysci has a wide host distribution and this chigger ranges from high elevations in the Appalachians to the coastal plan (Reeves et al. 2004b).

Euschoengastia pipistrelli Brennan


These chiggers were primarily removed from the ears and faces of bats that were roosting in caves (Reeves 2000).

Euschoengastia setosa (Ewing)


*Euschoengastia setosa* is primarily an ectoparasite of small rodents, such as *Peromyscus* spp., and lagomorphs (e.g. Whitaker & Loomis 1978).

**Eutrombicula sp.**

**Eutrombicula alfreddugesi** (Oudemans)

*Eutrombicula alfreddugesi* infests birds, reptiles, and mammals throughout the southeastern United States (Crossley & Proctor 1971, Reeves et al 2004b)

**Eutrombicula splendens** (Ewing)
Like the previous species, this chigger parasitizes several species of vertebrates and can be a pest to humans (Reeves et al. 2004b).

**Fonsecia palmella** Brennan & Loomis
Larvae of *F. palmella* are ectoparasites of birds and occasionally reptiles and mammals (Reeves et al. 2004b).

**Leptotrombidium peromysci** Vercammen-Grandjean & Langston
This is a common chigger of small mammals, especially rodents, in the southeastern United States (Darden et al. 1997b). In Asia and the Pacific region, chiggers in the genus *Leptotrombidium* transmit the causative agent of scrub typhus.

**Neotrombicula whartoni** (Ewing)

**Trouessartiidae—trouessartiid feather mites**
Trouessartiid mites are typically found on the head and upper wing covert feathers of a wide variety of bird hosts. The family is not well studied in North America, and all of the records reported here represent undescribed species.

**Trouessartia n. ssp.**
Host-associate list

Reptiles
Eumeces fasciatus (5-lined skink): Eutrombicula alfreddugesi
Eumeces laticeps (broad-headed skink): Fonsecia palmeta
Sceloporus undulatus (eastern fence lizard): Eutrombicula alfreddugesi, Eutrombicula sp.
Terrapene carolina (eastern box turtle): Ixodes scapularis

Birds
Archilochus colubris (ruby-throated hummingbird): Alloplacites new species, Trochiliphagus lineatus
Bird nest: Orchopeas howardi
Baeolophus bicolor (tufted titmouse): Philopterus sp.
Bombbyx cedrorum (cedar waxwing): Ornithomyia anchineuria, Pterodectes new species, Proctophyllodes glanderinus
Bubo virginianus (great horned owl): Colpocephalum brachysomum, Icosta americana
Carduelis pinis (pine siskin): Proctophyllodes spinis
Carduelis tristis (American goldfinch): Analges new species, Proctophyllodes spinis
Catharus fuscescens (veery): Brueelia sp., Proctophyllodes new species, Pterodectes new species
Catharus bicknelli or Catharus minimus (Bicknell's/grey-cheeked thrush): Pterodectes new species
Cardinalis cardinalis (Cardinal): Philopterus sp.
Carpodacus mexicanus (house finch): Amblyomma americanum, Ornithoica vicina, Ornithomyia anchineuria, Ornithomyia bequaerti
Certhia americana (brown creeper): Analges new species, Ornithomyia anchineuria, Proctophyllodes new species
Coccozyzus americanus (yellow-billed cuckoo): Cuculicola coocygii
Colaptes auratus (northern flicker): Stenopteronyssus proctorae
Colinus virginianus (northern bobwhite): Menacanthus pricei, Oxylipeurus clavatus
Contopus virens (eastern wood-pewee): Philopterus fuscoventralis (Osborn)
Dendroica caerulescens (black-throated blue warbler): Proctophyllodes new species, Pterodectes new species
Dendroica coronata (yellow-rumped warbler): Proctophyllodes quadrirsetosus
Dendroica pensylvanica (chestnut-sided warbler): Proctophyllodes new species, Pterodectes new species, Trouessartia new species
Dumetella carolinensis (gray catbird): Brueelia brunneinucha, Pterodectes new species
Empidonax minimus (least flycatcher): Pterodectes new species
Fulica americana (American coot): Fulicoffula longipila, Pseudomenopon pilosum
Gallus gallus (domestic chicken): Dermanyssus gallinae, Menacanthus stramineus, Menopon gallinae
Geothlypis trichas (common yellowthroat): Pterodectes new species
Helmitheros vermivorus (worm-eating warbler): Proctophyllodes new species, Pterodectes new species
Hirundo rustica (barn swallow): Dermanyssus hirundinis
Hirundo rustica (barn swallow) nest: Dermanyssus hirundinis, Protocalliphora braueri, Scutulanys sus delichonum
Hylocichla mustelina (wood thrush): Analges new species, Ornithomyia bequaerti, Pterodectes new species
Hylocichla mustelina (wood thrush) nest: Protocalliphora deceptor
Iridoprocne bicolor (tree swallow) nest: Ornithomyssus sylvianum
Junco hyemalis (dark-eyed junco): Brueelia vulgata, Ornithoica vicina, Ornithomyia anchineuria,
Philopterus spp., Proctophyllodes polyxenus, Ricinus sp.

Meleagris gallopavo (wild turkey): Chelopistes meleagridis

Melospiza melodia (song sparrow): Analges new species, Haemaphysalis leporispalustris, Ixodes brunneus, Menacanthus chrysophaeus, Ornithoica vicina, Ornithomyia anchineuria, Ornithomyia bequaerti, Proctophyllodes polyxenus

Mniotilta varia (black and white warbler): Proctophyllodes new species, Pterodectes new species

Meleagris gallopavo (wild turkey): Chelopistes meleagridis

Melospiza melodia (song sparrow): Analges new species, Haemaphysalis leporispalustris, Ixodes brunneus, Menacanthus chrysophaeus, Ornithoica vicina, Ornithomyia anchineuria, Ornithomyia bequaerti, Proctophyllodes polyxenus

Parus carolinensis (Carolina chickadee): Proctophyllodes ateri

Passerina cyanea (indigo bunting): Haemaphysalis leporispalustris, Trouessartia new species

Pheucticus ludovicianus (rose-breasted grosbeak): Brueelia pallidula, Pterodectes new species

Picoidea pubescens (downy woodpecker): Neopteronyssus pici

Pipilo erythrophthalmus (eastern towhee): Myrsidea melanorum, Ornithomyia anchineuria, Proctophyllodes polyxenus

Regulus satrapa (golden-crowned kinglet): Proctophyllodes reguli

Sayornis phoebe (eastern phoebe): Ornithomyia anchineuria, Picicola foedus, Proctophyllodes new species

Sayornis phoebe (eastern phoebe), nest: Protocalliphora aenea, Protocalliphora bennetti

Seiurus aurocapillus (ovenbird): Pterodectes new species

Seiurus motacilla (Louisiana waterthrush): Menacanthus auropalpii, Pterodectes new species

Setophaga ruticilla (American redstart): Proctophyllodes new species, Trouessartia new species

Sialia sialis (eastern bluebird): Philopterus sialis, Pterodectes sialiarum

Sialia sialis (eastern bluebird), nest box: Dermamyssus progneophilus, Protocalliphora sialis

Sitta canadensis (red breasted nuthatch): Proctophyllodes canadensis new species

Strix varia (barred owl): Kurodaia magna

Sturnus vulgaris (European starling): Ornithomyia anchineuria

Thryothorus ludovicianus (Carolina wren): Haemaphysalis leporispalustris, Ornithomyia anchineuria, Philopterus sp.

Toxostoma rufum (brown thrasher): Proctophyllodes new species, Pterodectes new species

Troglodytes aedon (house wren): Proctophyllodes new species

Turdus migratorius (American robin): Ornithomyia anchineuria, Proctophyllodes musicus, Sturnidoecus simplex, Trouessartia new species

Turdus migratorius (American robin), nest: Protocalliphora sialis

Vireo griseus (white-eyed vireo): Pterodectes new species

Vireo solitarius (blue-headed vireo): Proctophyllodes breviquadratus

Wilsonia canadensis (Canada warbler): Proctophyllodes new species

Zonotrichia albicollis (white throated sparrow): Ixodes dentatus Marx

Mammals

Blarina brevicauda (northern short-tailed shrew): Androlaelaps fahrenholzi, Ctenophthalmus pseudagyrtes, Doratopysilla blarinae, Epitedia wenmanni, Euschoengastia peromysci, Glycyphagus hypudaei, Ixodes angustus, Leptinus orientamericanus

Canis lupus (domestic dog): Ctenocephalides canis, Ixodes cookei

Canis rufus (red wolf): Dermacentor variabilis, Ixodes cookei

Cervus elaphus (elk): Dermacentor albipictus, Eutaealops sp.

Corynorhinus rafinesquii (Rafinesque’s big-eared bat): Macronyssus crosbyi
Didelphis virginiana (Virginia opossum): Ixodes sp., Listrophorus dozieri, Macrocheles sp., Marsupialichus brasiliensis

Equus caballus (horse): Dermacentor variabilis

Felis silvestris (cat) (domestic/feral cat): Ctenocephalides felis, Rhizoglyphus sp.

Glaucomyos sabrinius (northern flying squirrel): Euschoengastia peromysci

Glaucomyos volans (southern flying squirrel): Hoplopleura trispinosa, Ixodes marxi, Neohaematopinus sciuroperti, Neotrombicula whartoni, Opisodasyx pseudarctomys

Homo sapiens (human): Ctenocephalides felis, Demodex folliculorum, Dermacentor variabilis, Eutrombicula splendens, Icosta americana, Pthirus pubis, Triatoma sanguisuga

Lama glama (lama): Dermacentor variabilis

Marmota monax (woodchuck): Androlaelaps fahrenholzi, Dermacentor variabilis, Ixodes cookei

Mephitis mephitis (striped skunk): Neotrichodectes mephitidis, Ixodes sp.

Microtus chrotorrhinus (rock vole): Ctenophthalmus pseudagyrtex, Euschoengastia peromysci, Glycyphagus hypudaei, Ixodes angustus, Ixodes sp., Leptotrombidium peromysci, Listrophorus mexicanus, Laelaps kochi, Orchopeas leucopus, Myocoptes soricis, Peromyscopsylla catatina

Microtus sp. (reported as “M. montanus”): Ctenophthalmus pseudagyrtex, Orchopeas leucopus

“Mouse nest”: Epitedia wenmanni

Mus musculus (house mouse): Myobia musculi, Myocoptes musculinus, Orchopeas canadensis, Radfordia affinis

Mustela frenata noveboracensis (long tailed weasel): Neotrichodectes minutus

Mustela nivalis (least weasel): Stachiella mustelae (Schrank)

Myodes gapperi (southern red-backed vole) (formerly Clethrionomys gapperi): Androlaelaps fahrenholzi, Catallagia borealis, Catallagia new species, Ctenophthalmus pseudagyrtex, Dermacentor variabilis, Epitedia wenmanni, Euschoengastia peromysci, Glycyphagus hypudaei, Myocoptes japonensis, Ixodes angustus, Peromyscopsylla catatina, Peromyscopsylla hamifer

Myotis lucifugus (little brown myotis): Cimex adjunctus, Myodopsylla insignis, Macronyssus crosbyi, Spinturnix americanus

Myotis septentrionalis (northern myotis): Euschoengastia pipistrelli, Macronyssus crosbyi

Napaeozapus insignis (woodland jumping mouse): Epitedia wenmanni

Neotoma magister (Allegheny woodrat): Orchopeas peninsylvanicus, Ixodes sp.

Neotoma magister (Allegheny woodrat), nest: Epitedia cavernicola, Orchopeas peninsylvanicus

Ochrotomys nutalli (golden mouse): Androlaelaps fahrenholzi, Ctenophthalmus pseudagyrtex, Dermacentor variabilis, Epitedia wenmanni, Euschoengastia peromysci, Glycyphagus hypudaei, Myocoptes japonsensis, Ixodes angustus, Peromyscopsylla catatina, Peromyscopsylla hamifer

Ochrotomys nutalli (golden mouse), nest: Epitedia wenmanni

Odocoileus virginianus (white-tailed deer): Solenopotes ferrisi, Tricholipeurus lipiroides, Tricholipeurus parallelus

Ondatra zibethicus (musk rat): Radfordia zibethicalis

Parascalops breweri (hairy-tailed mole): Androlaelaps fahrenholzi, Ctenophthalmus pseudagyrtex, Echino- nyssus talpae, Ixodes angustus

Peromyscus gossypinus (cotton mouse): Peromyscopsylla hesperomys

Peromyscus leucopus (white-footed mouse): Dermacentor variabilis, Euschoengastia peromysci, Glycyphagus hypudaei, Hoplopleura hesperomys, Ixodes angustus, Orchopeas leucopus, Peromyscopsylla hesperomys, Radfordia subuliger

Peromyscus leucopus (white-footed mouse), nest: Orchopeas leucopus

Peromyscus maniculatus (deer mouse): Androlaelaps fahrenholzi, Dermacentor variabilis, Epitedia wen-
manni, Euschoengastia peromysci, Euschoengastia setosa, Glycyphagus hypudaei, Hoplopleura hesperomydis, Ixodes angustus, Myocoptes musculinus, Orchopeas leucopus, Peromyscopsylla catatina, Peromyscopsylla hesperomys, Peromyscopsylla scotti, Polyplax auricularis, Radfordia subuliger, Ste-noponia americana

Peromyscus maniculatus (deer mouse), nest: Ceratophyllus gallinae
Peromyscus sp., nest: Peromyscopsylla hesperomys
Pipistrellus subflavus (eastern pipistrelle): Euschoengastia pipistrelli
Procyon lotor (raccoon): Amblyomma americanum, Dermacentor variabilis, Ixodes sp., Ixodes cookei, Ixodes texanus

Rattus norvegicus (Norway rat): Ctenophthalmus pseudagyrtex, Glycyphagus hypudaei, Haemogamasus longitarsus, Polyplax spinulosa
Rattus rattus (black rat): Radfordia ensifera
Rattus sp.: Ornithonyssus bacoti
Sciurus carolinensis (gray squirrel): Cheyletus eruditus, Hoplopleura sciuricola, Neohaematopinus sciuri, Orchopeas howardi

Shrew, nest: Hystrichopsylla tahavuana
Sigmodon hispidus (hispid cotton rat): Prolisthorus bakeri
Sorex cinereus (masked shrew): Amorhacarus hengererorum, Androlaelaps fahrenholzi, Euschoengastia peromysci, Glycyphagus hypudaei, Ixodes angustus, Orycteroxenus soricus
Sorex fumeus (smoky shrew): Euschoengastia jamesoni, Leptinus orientamericanus
Spilogale putorius (eastern spotted skunk): Neotrichodectes osborni
Squirrel, nest: Ceratophyllus vison, Orchopeas howardi
Sus scrofa (feral hog): Demodex phylloides, Dermacentor variabilis, Haematopinus suis
Sylvilagus floridanus (eastern cottontail): Cediopsylla simplex, Haemaphysalis leporispalustris
Synaptomys cooperi (southern bog lemming): Androlaelaps fahrenholzi, Dermacentor variabilis, Euschoengastia peromysci, Ixodes angustus, Laelaps stupkai, Peromyscopsylla catatina
Tamias striatus (eastern chipmunk): Ceratophyllus vison
Tamiasciurus hudsonicus (red squirrel): Ceratophyllus vison, Euschoengastia peromysci, Euschoengastia setosa, Hoplopleura sciuricola, Ixodes marxi, Neohaematopinus semifasciatus, Orchopeas howardi
Ursus americanus (black bear): Trichodectes pinguis euarctidos

Discussion

The following “northern” ectoparasite species were recorded in the Park and presumably represent southern extensions limited (or nearly so, in some cases) to higher elevations of the Appalachians (similar to boreal habitats and climates further north):

Sucking lice: Neohaematopinus semifasciatus, Polyplax auricularis
Fleas: Ceratophyllus gallinae, Ceratophyllus vison, Opisodasys pseudarctomys, Catallagia borealis, Epitedia cavernicola, Hystrichopsylla tahavuana, Peromyscopsylla catatina, Peromyscopsylla hamifer, Peromyscopsylla hesperomys
Flies: Ornithomyia bequaerti, Protocalliphora aenea
Tick: Ixodes angustus

At least one species of ectoparasites, Catallagia n. sp. (Siphonaptera: Ctenophthalmidae) might be endemic to the southern Appalachians and possibly even to the Park. Some ectoparasites such as the Allo-decetes n. sp. were new records for North America.

Our checklist of ectoparasites is far from complete. Only a portion of the vertebrate fauna of the Park has
been sampled. Even some species that have been examined are represented by only a few specimens from a single season. As a result, we expect that further research will uncover several times the number of ectoparasites reported here. The majority of these will be mites (Acari). The Nantahala Mountains are south of the Great Smoky Mountains and Whitaker et al. (1975) reported at least 51 species of ectoparasites from small mammals including: *Amorpha rhus hengererorum*, *Androlaelaps fahrenholzi*, *Aschirius clarincola*, *Chelostoma ouachitensis*, *Corrodopsylla curvata*, *Ctenopthalmus pseudagyrtes*, *Dermacentor variabilis*, *Echinomys sus talpa*, *Echinonyssus utahensis*, *Epizetia wegni*, *Eulaelaps stabularis*, *Euschoengastia jamesoni*, *Euschoengastia ouachitensis*, *Euschoengastia permosyi*, *Euschoengastia rubra*, *Euschoengastia setosa*, *Glycyphagus hypudaei*, *Haemogamus ambulans*, *Haemogamus liponyssoides*, *Holopeura hesperomydis*, *Hypoaspis sp.*, *Ixodes angustus*, *Laelaps alakensis*, *Leptotrombidium sp.*, *Listrophorus mexicanus*, *Miyatrombicula jonesae*, *Myocoptes sp.*, *Myocoptes japonensis*, *Myonyssus jamesoni*, *Neotrombicula carterae*, *Neotrombicula cuniculata*, *Notoedres lasionycteris*, *Orycteroxenus soricis*, *Orchopeas leucopus*, *Polyplax spinulosa*, *Protomyobia brasiliana*, *Pygmeophorus sp.*, *Radfordia ensifera*, *Radfordia subuliger*, *Steatonyssus furmani*, *Steatonyssus sp.*, *Stenoponia americana*, *Xenoporus latiporus*, and *Xenoryctes nudus*. We expect that all of these species will eventually be reported in the Park. We identified 11 species of ticks and do not expect that there are many undetected species in the Park. We expect that a few species of fleas are still unreported from the Park, including *Pulex simulans* and *Ceratophyllus celsus*. At least two or three additional species of parasitic Hemiptera such as, *Cimex lectularius*, *Oeci acus vicarius*, and *Triatoma lectularia*, are expected to eventually be collected in the Park.

Ectoparasites are vectors of parasites and microbial diseases. Most of the ectoparasites from the Smokies have not been studied as vectors of pathogens. The public health risk of these pathogens to humans is largely unknown. Some ectoparasites, such as lice of squirrels, are vectors of *Rickettsia prowazekii* (Sonenshine et al. 1978). Others such as ticks, transmit numerous rickettsial pathogens (Childs & Paddock 2003). Further research into vector borne pathogens and ectoparasites of the GSMNP are needed to determine if wildlife or humans are involved with the maintenance of parasite-borne pathogens.

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References


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