

Ectoparasites from the North American Beaver,
Castor canadensis,
from Indiana*

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Summary

A few individuals of the beaver beetle, *Platypsyla castoris*, and the muskrat hypopus, *Zibethacarus ondatrae*, were found, but nearly all ectoparasites of beavers from Indiana are mites of the genus *Schizocarpus* Trouessart, 1896, including eight different species. These species are distributed mostly in different areas on the host, with *S. mingaudi* Trouessart being on the head and outside of the front legs; *S. virgulatus* Fain, Whitaker and Smith is from the chest and venter; *S. subvirgulatus* Fain, Whitaker and Smith is on the venter and inside of the legs; *S. indianensis* Fain, Whitaker and Smith and *S. tetrapilis* Fain, Whitaker and Smith are primarily on the dorsum and sides. To date we have taken very few individuals of *S. inversus* Fain, Whitaker and Smith, *S. furcatus* Fain, Whitaker and Smith, and *S. spinifer* Fain, Whitaker and Smith, but the majority of individuals of these species were from the venter. There was relatively little overlap of species between areas, i.e., most samples contained only or predominantly one mite species. This was especially true in the head, throat, and dorsal areas whereas the greatest amount of mixing of species occurred on the venter.

Résumé

Les ectoparasites de *Castor canadensis* d'Indiana, USA sont étudiés. Le Coleoptère *Platypsyla castoris* ainsi que l'hypope de *Zibethacarus ondatrae* (Acari), parasite habituel du Rat Musqué, ont été rencontrés en petit nombre d'exemplaires. La grande majorité des parasites récoltés étaient des acariens pilicoles du genre *Schizocarpus* Trouessart, 1896. Huit espèces de ce genre ont été récoltées. La plupart de celles-ci occupaient des endroits bien déterminés sur l'hôte : *S. mingaudi* Trouessart, 1896 était localisé sur la tête et sur les pattes antérieures ; *S. virgulatus* Fain, Whitaker et Smith se trou-

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vait sur la poitrine et le ventre ; *S. subvirgulatus* Fain, Whitaker et Smith était sur le ventre et en dedans des pattes ; *S. indianensis* Fain, Whitaker et Smith and *S. tetrapilis* Fain, Whitaker et Smith se trouvaient principalement sur le dos et les côtés du corps. La localisation exacte des trois autres espèces n'est pas connue avec certitude étant donné le petit nombre de spécimens récoltés mais la plupart des spécimens étaient attachés au ventre. Il y avait relativement peu de chevauchement des espèces sur deux ou plusieurs régions ; la spécificité de l'habitat étant plus marqué pour la tête, la gorge ou le dos que pour le ventre.

Few species of ectoparasites are known from the Beaver, *Castor canadensis*, but those that occur are highly modified and exceedingly host specific. The main ones are the beaver beetle, *Platyp-sylla castoris* (sometimes called the beaver flea) and mites of the genus *Schizocarpus*. Trouessart (1896) described one beaver mite, *Schizocarpus mingaudi*, from the fur of the beaver from Europe and North America (the holotype was from a California beaver). Although European and North American beavers are considered to be synonymous by some, they are currently recognized as separate species, *Castor fiber* of Eurasia, and *C. canadensis* of North America. Until 1964, *S. mingaudi* was the only known species of beaver mite, although a few other mites have been reported on the North American Beaver (*Androlaelaps fabrenholzi*, *Laelaps multispinosa*, see Whitaker and Wilson, 1974 ; and *Ornithonyssus bacoti*, see Mumford and Whitaker, 1982).

However, E. V. Dubinina (1964) studied mites of the genus *Schizocarpus* from 22 beavers from Russia and found them to comprise a group of 12 distinct species, eleven of which she described as new. Seven of these were distributed on various parts of the body as follows : *S. capitis* on the head, *S. numerosus* on the head and dorsum, *S. grandis* on the throat and around the hind legs, *S. latus* around the base of the tail, *S. brevicauda* on the central abdomen, *S. brachyurus* on the venter and on the legs, and *S. fedjushini* laterally. Too few individuals were found of the other five species to make generalizations concerning location on the beaver.

The purpose of this study is to determine the species and distribution of mites of this genus on the North American Beaver, *Castor canadensis*, from Indiana.

Materials and methods

Eleven beavers from Indiana have been examined, one from Potato Creek State Park (St. Joseph County), three from Willow Slough Fish and Wildlife Area (Newton County), three from LaSalle Fish and Wildlife Area (Newton, Lake Counties), two from Winamac Fish and Wildlife area (Pulaski County), one from Kingsbury Fish and Wildlife Area (LaPorte County) and one from Glendale Fish and Wildlife Area (Daviess County). Our thanks go to Richard Hudson, Roger Stonebreaker, Bill Bean, Randy Haney and Roger Neal, personnel of these respective areas, for collecting the beavers.

The beavers were skinned and then examined under the binocular dissecting microscope. The first beaver examined was heavily infested with mites and samples were taken in separate vials from 37 different portions of the beaver. Mites, after being mounted on slides in Hoyer's solution and ringed with Euparal, were examined and found to include six species. Further, four of them were distributed on various parts of the body, with relatively little overlap between. On the basis of these data, samples were taken from 23 sections from subsequent beavers. Numbers of mites present in the various parts of the body were estimated and samples were taken in separate vials of alcohol from each section. Mites were cleared and stained in Nesbitt's solution containing acid fuchsin, mounted in Hoyer's Solution and ringed with Euparal. Since species descriptions are based on males, all males collected were examined. Females and nymphs were counted, but set aside for later study of their life histories and various life stages. Since the species were relatively area specific, females and other life stages could be collected and counted for many of the individuals. Most of the data presented here are for males or other life stages when identification was relatively certain, although table 1 includes estimates of total numbers of *Schizocarpus* rather than information based on actual counts.

Results

A total of ten species of ectoparasites was found on the Beaver from Indiana : 8 species of *Schizocarpus*, the Beaver Beetle, *Platyp-sylla castoris*, and the hypopial glycyphagid, *Zibethacarus onda-*

TABLE I

Ectoparasites of 11 North American Beavers, *Castor canadensis*, from Indiana (estimates of numbers of *Schizocarpus*)

	Number		Infestation	
	Total	Av # / host	Nr.	%
<i>Schizocarpus mingaudi</i> . . .	132,071	12,006.5	10	90.9
<i>Schizocarpus tetrapilis</i> . . .	8,008	728.0	2	18.2
<i>Schizocarpus indianensis</i> . . .	7,777	707.0	10	90.9
<i>Schizocarpus virgulatus</i> . . .	837	76.1	3	27.3
<i>Schizocarpus subvirgulatus</i> . . .	707	64.3	5	45.5
<i>Schizocarpus furcatus</i> . . .	11	1.0	1	9.1
<i>Schizocarpus spinifer</i> . . .	10	0.9	5	45.5
<i>Schizocarpus inversus</i> . . .	7	0.6	1	9.1
<i>Platypsilla castoris</i> . . .	29	2.6	5	45.5
<i>Zibethacarus ondatrae</i> . . .	9	0.8	2	18.2

trae (table I). The beetle is a true beaver parasite, may have been more abundant than indicated as some individuals may have dropped off the beavers. The glycyphagid is an abundant parasite of the muskrat, the Indiana species most closely sharing the niche of the beaver. These hypopi undoubtedly moved onto the beaver from muskrats entering beaver houses, or as a result of some other such close relationship. Likely it is a relatively common immigrant onto the beaver, but apparently has not managed to become established there or it would undoubtedly be found in much larger numbers.

This leaves the tiny fur inhabiting mites of the genus *Schizocarpus* as the major Indiana beaver parasites. Fain, Whitaker and Smith (1984) have described seven of the species as new and have redescribed *S. mingaudi*. They are also in the process of identifying and describing the various life stages of at least some of the species. This paper will discuss abundance and distribution of the species on Indiana beavers.

Schizocarpus mingaudi was originally described from *Castor canadensis* from California, and reported from *Castor fiber* from Eurasia. Dubinina (1964) identified this as one of the 12 species she found on the Beaver from Russia. However, *Schizocarpus mingaudi* as observed on Indiana beavers is not the same species as classed as *S. mingaudi* by Dubinina. Fain (pers. comm.) compared our specimens to the holotype and found these to be the true *S. mingaudi*. The form recognized as *S. mingaudi* by Dubinina apparently needs redescription.

By far the most abundant mite of the genus *Schizocarpus* on the Indiana Beaver was *S. mingaudi*, the great majority of which occurred on the head, neck, and outside of the front legs (tables I and II). It was abundant in those areas and was the only common species there. Most samples from any part of the head and neck contained only this species. This species formed a group by itself, being the only species in which the male had two large suckers on the sucker plate.

The second most abundant species was *S. indianensis* Fain, Whitaker & Smith, which was abundant on the dorsum. This species and another one closely related, *S. tetrapilis* Fain, Whitaker & Smith, form a group characterized in the males by an elongate protruding or tubular large sucker. The great majority of mites over the entire dorsum and sides was one of these species.

Schizocarpus virgulatus Fain, Whitaker and Smith was third in abundance and along with closely related *S. subvirgulatus* Fain, Whitaker and Smith formed the bulk of the *Schizocarpus* mites over most of the posterior venter, forward to the chest, and on the inside of the front legs. In the abdominal area, however, the most mixing of species occurred. All of the species taken, except for *S. tetrapilis* Fain, Whitaker and Smith, were taken on the abdomen. *Schizocarpus virgulatus* Fain, Whitaker and Smith is characterized by having two small setae and two small suckers in a convexly curved row far behind the main suckers and in soft tissue. The species is closely allied to and forms a third grouping (*virgulatus* group) with all of the remaining species except *S. spinifer* Fain, Whitaker and Smith which alone forms the fourth group. Members of this group have comma shaped (virgulate) opisthotal plates.

The remaining four species were taken in low numbers, too low to be sure of the part of the body on which they are generally found although the majority (11 of 14 in *Schizocarpus spinifer* Fain, Whitaker and Smith) or all (2 in *S. inversus* Fain, Whitaker and Smith, 13 in *S. furcatus* Fain, Whitaker and Smith) were found on the abdomen.

Schizocarpus subvirgulatus, like *S. virgulatus*, had two large suckers, two small setae and two small suckers in the soft tissue. However, rather than being behind the suckers in a curved row, they are between the suckers, with one pair in a line with the

anterior portion and one in line with the posterior portion of the large suckers. This was the most commonly taken species on the abdomen and some individuals were taken inside the legs.

Thus based on males, the species of *Schizocarpus* fall into four main groupings:

Group I.

Two large suckers in each sucker plate — *Schizocarpus mingaudi*.

Group II.

One large protruding sucker in each sucker plate — *S. indianensis* and *S. tetrapilis*.

Group III.

No suckers? one enlarged, triangular setae on side in both male and female — *S. spinifer*.

Group IV.

Opisthonotal plates comma shaped. One large but little protruding sucker in each sucker plate, with a pair of small setae and small suckers in various positions with respect to large suckers — *S. virgulatus*, *subvirgulatus*, *inversus*, and *furcatus*.

Both numbers of individuals and numbers of species of *Schizocarpus* varied greatly from beaver to beaver. One 54-pound beaver from Potato Creek had an estimated 133,000 mites of six species, whereas on one from Willow Slough we found only 26 mites including two species, one from Winamac yielded 20 mites of two species, and one from LaSalle Fish and Wildlife Area yielded 30 mites, all *S. indianensis*.

Numbers of species of *Schizocarpus* on beavers were 7, 6, 3 with 5, 2 with 4, 1 with 3, 2 with 2, and 1 with 1.

Schizocarpus mingaudi and *S. indianensis* were each found on 10 of the beavers, *Schizocarpus subvirgulatus*, and *S. spinifer* although the latter was rare, were each found on 5, *S. tetrapilis* was found on 2, and *S. inversus* and *S. furcatus* each were found on one beaver.

The other large aquatic rodent of Indiana, the muskrat, *Ondatra zibethicus*, is the other North American mammal known to have

a similar situation — several species of mites in a single genus on a single host species. In the muskrat, the species broadly overlap, with several species being routinely found in one place, although there are major differences in proportions in different areas (see Bauer and Whitaker, 1981).

Examination of these summarized data for the beaver (table II) would seem to indicate that there was much overlap in the beaver

TABLE II

Location on beaver of mites of the genus *Schizocarpus* for which specimens were actually identified

	Head and neck	Outside front legs	Inside front legs	Dorsum and sides	Chest	Outside hind legs	Inside hind legs	Venter	
<i>Schizocarpus mingaudi</i> . . .	992	133	52	14	1	1	7	19	1219
<i>Schizocarpus tetrapilis</i> . . .	21				24		1	24	70
<i>Schizocarpus indianensis</i> . . .				1	2			11	14
<i>Schizocarpus virgulatus</i> . . .			12	1		17	47	366	453
<i>Schizocarpus subvirgulatus</i> . . .	7	24	6	502		13	8	11	571
<i>Schizocarpus furcatus</i> . . .				79					79
<i>Schizocarpus spinifer</i> . . .								3	3
<i>Schizocarpus inversus</i> . . .								13	13
	1021	157	70	607	27	31	63	448	2424

also, with some areas, especially the venter, harboring several species. On the contrary, however, there was relatively little overlap in the beaver as compared to the muskrat. In the muskrat, 2-4 species were generally found in the same sample on the same individual, with proportions differing with location on the host. In the beaver, any one sample (from one body region of one beaver) generally consisted of one species of *Schizocarpus*, although occasional variations from this occurred.

To indicate this, numbers of samples with greater than five mites actually identified are summarized, with the numbers of individuals and numbers of species in each. From the eleven beavers, 92 samples were collected (table III) from which five or more mites were identified, and of the 92, 63 or 68.5 % had only 1 species of mite, and of the remaining 29 samples, 10 contained only one species except for 1 other identified mite, and three had all one

TABLE III

Samples with 5 or more *Schizocarpus* mites indicating community homogeneity in various areas

Samples containing only 1 species

<i>S. mingaudi</i> only	
from head and neck	20
outside front legs	5
inside front legs	3
<i>S. virgulatus</i> only	
venter	3
inside front legs	1
<i>S. subvirgulatus</i> only	
venter	7
outside hind legs	1
<i>S. indianensis</i> only	
dorsum	20
outside front legs	2
inside hind legs	1
Total homogeneous samples	(63)

Samples with some mixing, but predominantly one species

<i>S. mingaudi</i>	
head and neck	4
outside front legs	1
<i>S. subvirgulatus</i>	
venter	2
outside hind legs	2
<i>S. virgulatus</i>	
venter	1
dorsum	3
outside hind legs	1
Total slightly mixed samples	(13)

Mixed samples

inside front legs	1
ventral areas	5
outside front legs	4
outside hind legs	2
dorsum	4
Total mixed samples	16

Total samples 92

species except for two other identified mites. Thus 76 or 82.6 % of the samples had only 1 species or an overwhelming predominance of mites belonging to one species.

None of the 14 remaining « mixed » samples are from the head and neck area, indicating that the great preponderance of *Schizocarpus* mites in this area are all one species, *S. mingaudi*. Four of the mixed samples were from the outside of the front or hind legs; all were mixtures of *S. indianensis* and *S. mingaudi*, the second most often inhabited areas for both species, the only two species which were found on the outside of the front legs, whereas *S. subvirgulatus* was the most abundant species of the outside of the hind legs. Four of the mixed samples were from the dorsum, two of them contained a preponderance of *S. indianensis*, plus a few individuals of 1 or two other species, 1 contained only 6 mites, 2 *S. indianensis*, 2 *S. mingaudi*, and 2 *S. subvirgulatus*, and the last contained 10 *S. subvirgulatus* and 2 *S. mingaudi*. The remaining 6 samples were from the venter or the inside of the front legs and showed the greatest mixing, with 3 to 5 species in each of the samples.

Further evidence of low overlap of species can be seen in table II. On the head and neck area, 97.2 % of the 1021 mites taken were *S. mingaudi*, and on the dorsum, 581 of 607 mites taken were *S. indianensis* or *S. tetrapilis*.

Again, the greatest amount of overlap appeared to be on the ventral portions of the animal, including the insides of the legs. However, even here, many of the samples contained a single species. On the inside of the front legs, 74 % of the mites were *S. mingaudi*, but 46 of the 52 mites of this species were in samples with only that species. Four species were taken from the inside of the hind legs, totalling 63 mites, but all were in samples dominated by 1 species. On the venter itself, as mentioned above, there were several mixed samples with little or no evidence of dominance being shown. However, even here, other than for a few samples, one or the other species generally dominated.

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Systematic notes on the Speleognathinae
(Acari, Ereyneidae)
with description of new taxa
and a key to the Trispeleognathini*

by A. FAIN**

Summary

The Speleognathinae (Acari, Ereyneidae) are divided in five new tribes. Four new genera and two new subgenera are created in this subfamily. A key to the Trispeleognathini is provided.

Résumé

Les Speleognathinae (Acari, Ereyneidae) sont divisés en cinq nouvelles tribus. Quatre nouveaux genres et deux nouveaux sous-genres sont créés dans cette sous-famille. Une clé des Trispeleognathini est donnée.

The Ereyneidae include free-living mites and species living in the respiratory tract of various animals : molluscs, batrachians, birds and mammals. This family has been divided in three subfamilies mainly on the basis of the number of sensillae, the presence or absence of genital suckers and the shape of the chaetotaxy.

The classification of this group of mites, especially at the genus level, is particularly difficult owing to the polymorphism of the chaetotaxy and the relative instability of some characters such as the number of palpal segments and the presence or absence of the dorsal shield and the eyes. The polymorphism of the chaetotaxy is specially marked in the genera parasitizing the non-passeri-form birds. We have described and depicted all the different setae

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