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Robert W. Husband  
*Adrian College*

David O. Husband

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**DISTRIBUTION OF CROTALOMORPHIDAE AND PODAPOLIPIDAE  
(ACARI: HETEROSTIGMATA), ECTOPARASITES OF STENOLOPHUS  
(COLEOPTERA: CARABIDAE) IN NORTH AMERICA**Robert W. Husband<sup>1</sup> and David O. Husband<sup>2</sup>**ABSTRACT**

*Eutarsopolipus elzingai* Husband (Tarsonemoidea: Podapolipidae), parasitic on *Stenolophus comma* (Fabricius) and *Stenolophus lecontei* (Chaudoir) (Coleoptera: Carabidae) is reported from southern Canada and the United States from Oregon to Maine and from Michigan to North Carolina. *Eutarsopolipus brevichelus* Husband and Husband is distributed east of the Rocky Mountains in southern Canada and in the United States from Colorado to Virginia and from Michigan to Louisiana. *Crotalomorpha camini* Lindquist and Krantz is reported from Kansas and Nebraska east to Massachusetts and from Michigan to Arkansas. Hosts for *E. brevichelus* and *C. camini* are *S. lecontei* and *S. comma*. *Stenolophus fuliginosus* (Dejean) is a new host for *E. brevichelus* in New Brunswick, Canada. *S. maculatus* (Leconte) in Oregon and *S. lineola* (Fabricius) in southern California, U.S.A. are newly reported hosts of *E. elzingai*.

Mites in the family Podapolipidae (Acari: Heterostigmata) are parasites of insects, particularly Coleoptera. Most of the 200 described species are known from relatively few hosts and relatively small areas.

Two exceptions to the limited knowledge of distributions of podapolipid species are illustrated by *Locustacarus (Bombacarus) buchneri* Stammer (Stammer 1951) and *Chrysolobia labidomerae* Eickwort (Eickwort 1975). *L. buchneri* is found in tracheae of 25 species of bumble bees (Hymenoptera: Apidae; Bombinae) in the northern hemisphere (Husband and Husband 1997). *C. labidomerae*, a parasite of *Labidomera clivicollis* (Kirby), *Leptinotarsa decemlineata* (Say), *L. signaticollis* (Stal.), *L. undecemlineata* (Stal.) and *L. cacia* Stal. (Coleoptera: Chrysolmelidae) is widely distributed in North America (Eickwort 1975, Baker and Eickwort 1975, Drummond et al. 1984, Houck 1992, Abbot and Dill 2001).

The first parasitic mite species noted from *Stenolophus*, (Coleoptera: Carabidae) Crotalomorphidae (Acari: Heterostigmata), was illustrated by Krantz (1970) based on an unpublished drawing by Joseph Camin. The species was later described as *Crotalomorpha camini* Lindquist and Krantz (Lindquist and Krantz 2002) from *Stenolophus (Agonodorus) lecontei* (Chaudoir) and *Stenolophus* sp. collected in eastern Kansas and Nebraska. The second species described from *S. lecontei* and *S. comma* (Fabricius) was *Eutarsopolipus elzingai* Husband (Acari: Prostigmata: Heterostigmata) (Husband 1998) from Arkansas, Indiana, Michigan, Missouri and Texas. Husband and Husband (2004) discussed the distribution of podapolipid parasites of Michigan *Stenolophus* and summarized previous studies of these parasites. The purpose of this paper is to report additional *Stenolophus* species as hosts for subelytral acarine parasites and observations on the occurrence of these parasites in southern Canada and the U. S. A.

<sup>1</sup>Biology Department, Adrian College, Adrian, MI 49221, U.S.A. (email: husbandadrian@aol.com).

<sup>2</sup>346 Jamacha #61, El Cajon, CA 92019, U.S.A. (email: davidhsbnd@aol.com).

### METHODS AND MATERIALS

More than 2500 *Stenolophus* were borrowed from the collections of the following institutions: University of Alberta, Canada, University of Arkansas, California Academy of Sciences, Florida Department of Agriculture, Harvard University, Illinois Natural History Survey, Iowa State University, Kansas State University, Los Angeles County Museum of Natural History, Michigan State University, University of Michigan, University of Missouri, Ohio State University, Oklahoma State University, Oregon State University, Purdue University, Texas A. & M. University, and Texas Tech. University. Twenty-two species of *Stenolophus* from Canada and the United States from these collections were examined for subelytral parasitic mites using the technique described in Husband and Husband (2004). Mites were studied with the aid of a Zeiss phase contrast microscope with an ocular micrometer. The terminology for mite structures used here follows Lindquist (1986).

### RESULTS

Three species of Heterostigmatina were recovered from the examined collections of *Stenolophus*: *Eutarsopolipus elzingai*, and *E. brevichelus* Husband and Husband (Tarsonemoidea: Podapolipidae) and *Crotalomorpha camini* (Dolichocyboidea: Crotalomorphidae).

Characteristics of the three species of mites are discussed in Husband and Husband (2003, 2004). Figures of adult females are reproduced here with their distribution patterns in North America (Figs. 1-3). Specific records of localities in Michigan are found in Husband and Husband (2004).



Figure 1. Distribution of *Eutarsopolipus elzingai*, a parasite of *Stenolophus comma*, *S. lecontei*, *S. lineola* and *S. maculatus*.

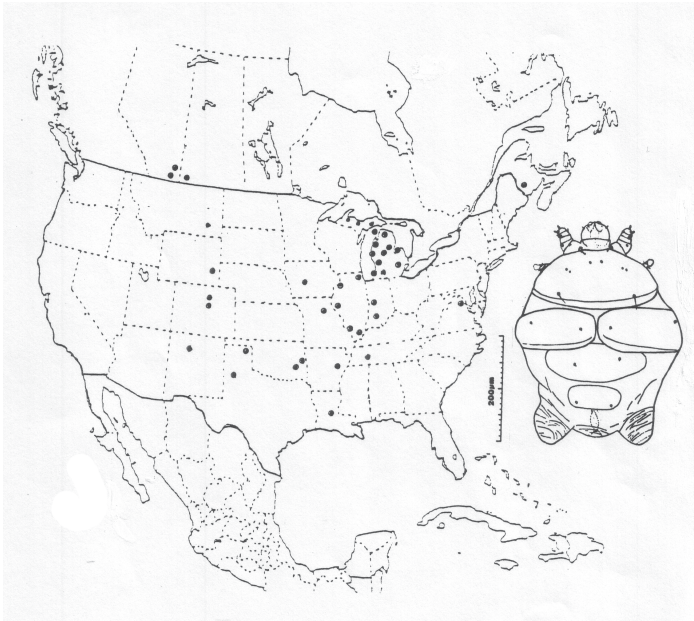


Figure 2. Distribution of *Eutarsopolipus brevichelus*, a parasite of *Stenolophus comma*, *S. fuliginosus* and *S. lecontei*.

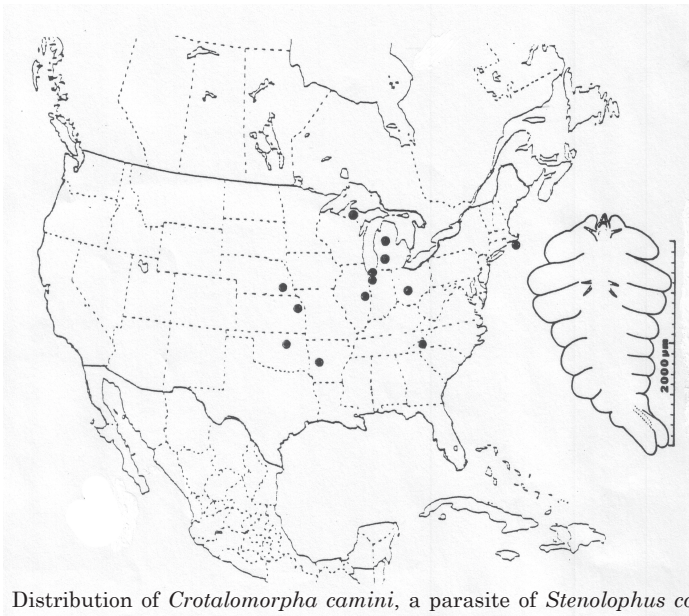


Figure 3. Distribution of *Crotalomorpha camini*, a parasite of *Stenolophus comma* and *S. lecontei*.



**Distribution of *Eutarsopolipus elzingai*.** All records cited here are from *Stenolophus comma* unless otherwise noted.

New distribution records in Canada are: **Alberta:** Lethbridge, 25 July 1956 and 8 July 1972; **British Columbia:** Boundary Bay, 46° 00'N, 123° 03'W, 1 June 1958; **Quebec:** Como, July-August 1933; **Saskatchewan:** 9 km. NE Robsart, 21 May 1976 (Fig. 1).

Previous distribution records from Michigan, U.S.A. are noted in Husband and Husband (2004). New distribution records in the U.S.A. are: **California:** Imperial Co., Brawley, 5 June 1962, host *S. lineola* (Fab.); **Idaho:** Bannock Co., Pocatello, June 1933; **Illinois:** Champaign Co., Homer Park, 11 July 1927, Mahomet, 7 July 1937 and Urbana, 20 May 1926, Cook Co., Palos Park, 10 April 1935, Douglas Co., Arcola, 10 July 1937, McHenry Co., Richmond, 9 June 1938, Peoria Co., Peoria, 8 Aug. 1938; **Indiana:** Lawrence Co., Spring Mill State Park, 19 June 1983, Monroe Co., Bloomington, 18 Oct. 1933; **Iowa:** Boone Co., Ledges State Park, 22 April 1950, host *S. lecontei*, Story Co., Ames, 3 June 1938, host *S. lecontei*, Webster Co., 8 mi. W. Dayton, 22-27 July 1965, Woodbury Co., Sioux City, 1 July 1914; **Maine:** Oxford Co., Norway, no date; **Missouri:** Boone Co., Columbia, June 1986, Linn Co., Linnaeus, June 1983; **New Mexico:** Sandoval Co., Jemez mts., 21 July, no year, host *S. lecontei*; **New York:** Tompkins Co., Ithaca, 12 July 1915; **North Carolina:** Catawba Co. Hog Hill, 19-26 May 1976, 3 July 1959, Haywood Co. Lake Junaluska, 30 June 1959; **Ohio:** Ashtabula Co., Saybrook Park, 8 July 1930, Athens Co., Athens, 10 May 1931, Franklin Co., Columbus, 9 May 1929, Hocking Co., Spruce Run, 20 April 1935, Putnam Co., Pleasant Township, section 23, 6 July 1934; **Oregon:** Baker Co., Robinette, 18 June 1938, Benton Co. Corvallis, 6 October 1960 and Coffin Butte, 25 Sept. 1952, Polk Co., Independence, 24 July 1934, host *S. maculatus* (Leconte), Yamhill Co., McMinnville, 6 July 1953; **Pennsylvania:** Erie Co., Presque Isle, 12 July 1940; **Texas:** Lubbock Co. Texas A. & M. Experiment Station, 8 Oct. 1968, host *S. lecontei*, Hale Co., Abernathy, 25 July 1968, host *S. lecontei*; Virginia, Fairfax Co., Falls Church, 12-15 July, host *S. lecontei*; **Utah:** Cache Co., 28 July 1955 and Logan, 14 July 1922, Millard Co., Delta, 14 July 1947, Utah Co., 31 July 1956, Weber Co., 31 July 1957; **Virginia:** Fairfax Co., Falls Church, 12-15 July, no year; **Washington:** Kittitas Co., Vantage, 9 May 1963, Whitman Co., Palouse, 28 Aug. 1932; **Wisconsin:** Dane Co., 20 May 1925, host *S. lecontei*; **Wyoming:** Converse Co., Douglas, 27 July 1964, and Platte Co., 11.5 mi. SW Fort Laramie, 29 July 1964 (Fig. 1).

**Distribution of *Eutarsopolipus brevicheilus*.** All records in Canada and U.S.A. are from *Stenolophus comma* unless otherwise noted. New distribution records for Canada are: **Alberta:** Lethbridge, 8 July 1972, Medicine Hat, 21 July 1956, near Ralston- 50° 16'N, 111° 34'W, 10 May 1955; **Saskatchewan:** 9 km. NE Robsart, 21 May 1976, 16 mi. S. Cypress Hill Park, Route 21, 28 June 1955, 2 July 1967; **New Brunswick:** Penobsquis, 29 July 1926, host *S. fuliginosus* (Dejean) (Fig. 2).

Previous distribution records are from Arkansas, Indiana, Michigan, Oklahoma and Texas (Husband and Husband 2003, 2004). New distribution records are: **Colorado:** Boulder Co., Lyons, 28 June 1957, Hayden Lake, 16 June 1956, Jefferson Co., Arvada, 12 June 1956; **Illinois:** Adams Co., Quincy, 6 July 1939, Hardin Co. Elizabethtown, 22 June 1927, host *S. lecontei*, Henry Co., Algonquin, no date, Jackson Co., Grand Tower, 21 July 1909, host *S. lecontei*, Rock Island Co., Rock Island, 12 July 1912; **Indiana:** Tippecanoe Co., Lafayette, July 1989, host *S. lecontei*; **Iowa:** Webster Co., 3 mi. W. Dayton, 22-27 July 1965; **Louisiana:** Alexandria, 23 July 1938, host *S. lecontei*; **Montana:** Rosebud Co., Centerville, 22 July 1915, L. S. Slevin coll.; **New Mexico:** Sandoval Co., Jemez mts., 21 July, no year, host *S. lecontei*; **Ohio:** Putnam Co., Pleasant Township, section 23, 6 July 1934; **Oklahoma:** Latimer Co., 5 mi. W. Red Oak, 2 Aug. 1971; **Tennessee:** Henderson Co., Natchez Trace State Park, 13 June 1978, host *S. lecontei*; **Virginia:** Fairfax

Co., host *S. lecontei*, Falls Church, 12-15 July, no year, host *S. lecontei*; **Wyoming**: Platte Co., 11.5 mi. SW Fort Laramie, 29 July 1964 (Fig. 2).

Male, female and larval instars of *E. elzingai* and *E. brevichelus* were removed from under the elytra of one host *S. comma* or *S. lecontei* from Alberta and Saskatchewan, Canada and Michigan, New Mexico, Ohio and Wyoming, U.S.A. Less than 10% of infested *Stenolophus* were parasitized by both *E. elzingai* and *E. brevichelus*.

**Distribution of *Crotalomorpha camini*.** Previous records are from *S. lecontei* or *Stenolophus* species from eastern Kansas and Nebraska (Lindquist and Krantz 2002), from *S. lecontei* from northern Oklahoma and western Arkansas (Husband and Husband 2003), and from *S. lecontei* and *S. comma* in Michigan (Husband and Husband 2004).

New distribution and host records from *S. comma* are: **Illinois**: Champaign Co., Urbana, Oct. 1925 and 31 March 1917; **Indiana**, Lake Co., Hammond (Osborn), 4 June 1911 and Porter Co., Dune Park, 1 May 1927; **Massachusetts**: Nantucket Co., Nantucket; **North Carolina**: Haywood Co., Lake Junaluska, 30 June, 1959; **Ohio**: Licking Co., Hebron, 10 June 1954 (Fig. 3). The number of *C. camini* per beetle varied from 1-4. No larval instars or nonphysogastric females were found. No individual *Stenolophus* had both *C. camini* and *Eutarsopolipus* mites.

To determine if species other than *Stenolophus lecontei* and *S. comma* may have carried *Eutarsopolipus* or *Crotalomorpha* parasites, we examined the following species of *Stenolophus*: *S. anceps* LeConte (24), *S. binotatus* Casey (10), *S. carbo* Bousquet and Laroche (5), *S. cincticollis* LeConte (2), *S. dissimilis* Dejean (6), *S. flavipes* LeConte (2), *S. fuliginosus* (Dejean) (32), *S. fuscatus* Dejean (9), *S. humidus* Hamilton (3), *S. incultus* Casey (1), *S. infuscatus* Dejean (29), *S. limbalis* LeConte (16), *S. lineola* (Fabricius) (157), *S. maculatus* LeConte (18), *S. ochrapezus* (Say) (5), *S. peregrinus* Casey (4), *S. plebejus* Dejean (12), *S. rugicollis* LeConte (4), *S. semitinctus* Casey (2), *S. spetus* Dejean (2). In addition to *S. comma* and *S. lecontei* hosts, we found *E. brevichelus* on *S. fuliginosus* (1) and *E. elzingai* on *S. lineola* (1) and *S. maculatus* (1).

## DISCUSSION

Ball and Bousquet, in American Beetles, Volume 1 (Arnett and Thomas 2001), stated the range of Nearctic *Stenolophus* is transcontinental from southern Canada to the Mexican border and Gulf Coast. They recorded the habitat for *Stenolophus* as damp meadows, near borders of lakes and ponds with night flying adults often seen at lights. Parasites of *Stenolophus* would be expected to have similar distribution.

Studies of distribution of crotalomorphid and podapolipid mite parasites of *Stenolophus* beetles were previously restricted to investigations of relatively few specimens and relatively few species of *Stenolophus* (Lindquist and Krantz 2002 and Husband and Husband 2003). Our survey allows us to make conclusions on the hosts and distribution of these mites with some confidence. *Eutarsopolipus elzingai* is distributed from the Pacific to Atlantic coasts of southern regions of Canadian provinces adjacent to the U.S.A. and as far south as North Carolina, north Texas and New Mexico and southern California (Fig. 1). *E. brevichelus* is distributed east of the continental divide in the Rocky Mountains from southern Alberta to New Brunswick, Canada, in eastern Montana and Wyoming, central Colorado and New Mexico and as far south as Louisiana, U.S.A. (Fig. 2). Records of *Crotalomorpha camini* from Nantucket Island, Massachusetts and the upper peninsula of Michigan indicate that *C. camini* may be found throughout the eastern United States on at least 2 species of *Stenolophus*.

The percent of beetles from museums which carried either *E. elzingai* or *E. brevichelus* varied from 0% (2) to more than 10% (5) with the majority of museums 3-8% (11). *Eutarsopolipus* species were collected from late April to early October. Fourteen of more than 2500 *Stenolophus* specimens collected from March to October were found to carry *C. camini* parasites and only one *S. fuliginosus*, one *S. lineola* and one *S. maculatus* were infested by *Eutarsopolipus* species. None of the examined *Stenolophus* represents a preferred host for *C. camini*. We conclude that *C. camini* is rare and that *S. comma* and *S. lecontei* are the major hosts for *Eutarsopolipus* and *Crotalomorpha*.

We shall continue to examine *Stenolophus* species from different areas of North America for crotalomorphid and podapolipid mites to attempt to understand why *S. lecontei* and one of its parasites, *E. brevichelus*, is found only east of the continental divide and why *E. elzingai* has not been collected in wide areas adjacent to the Gulf of Mexico. A host beetle, *S. lecontei*, is common in the southern U. S. A. and appropriate wet meadow habitats are abundant. It is probable that species of *Eutarsopolipus* from other genera of Carabidae are also more widespread than current reports indicate.

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