

# New records of the Strepsiptera genera *Halictophagus*, *Leionotoxenos*, and *Xenos*, in Canada and in Washington State, United States of America

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## ABSTRACT

Strepsiptera are parasitic insects that primarily develop in Hymenoptera and Hemiptera. The diversity of species in Canada and the Pacific Northwest of the USA remains poorly documented. While conducting an examination of the potential host specimens and holdings in the Western Washington University Insect Collection (Bellingham, Washington, United States of America) and the Royal BC Museum (Victoria, British Columbia, Canada), I discovered previously unreported records for five species from two families. New records for *Halictophagus americanus* (Perkins), *Halictophagus callosus* Bohart, *Halictophagus mackayi* (Bohart), *Xenos peckii* Kirby, and *Leionotoxenos tigridis* (Pierce) are presented for British Columbia and Yukon Territory, Canada and for Washington State.

Strepsiptera are a relatively small order of parasitic holometabolous insects closely related to Coleoptera, with less than 650 validly named species, including 28 fossil taxa (Cook 2019). Males are parasitic as immatures, and free-living adult males are rare in most insect collections, probably because they are small and short lived. Conversely, female Strepsiptera are obligate parasites of other insects, primarily Hymenoptera and Hemiptera, and are frequently overlooked in their hosts during curation. Searching through the appropriate hosts in museums can produce records for previously undetected Strepsiptera (Kenner 2002; Reeves and Cook 2005).

The Western Washington University Insect Collection (WWUC; Bellingham, Washington, United States of America) holds more than 70 000 insect specimens, primarily from Washington State, and the Royal BC Museum (RBCM-ENT; Victoria, British Columbia, Canada) holds over 191 000 pinned specimens, primarily from British Columbia. Neither collection had any Strepsiptera identified in their holdings. I examined all possible hymenopteran and hemipteran hosts, based on the known species discussed by Cook (2019), in both collections to determine if undetected styloped specimens were present. None of the Pompilidae, Sphecidae, Formicidae, Crabonidae, Bembicidae, Andrenidae, Apidae, Halictidae, or Cercopidae in the museums were found styloped. Those Cicadellidae, Delphacidae, and Vespidae with Strepsiptera are discussed below. Hosts of the family Stylopidae were examined, but none were found to harbour parasites. In addition, male specimens were found in the unidentified material from the Herschel Island Survey (Yukon Territory, Canada) at the RBCM-ENT.

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All specimens remain in their respective collections, with both host and strepsipteran identifications.

Identifications were based on morphological characters in keys by Bohart (1943) and Benda *et al.* (2022), original descriptions by Pierce (1911) and Bohart (1943), and comparisons to previously identified material. Unidentified Hymenoptera were identified using keys by Carpenter (2004) and comparisons to existing material in the museums.

## **Halictophagidae**

*Halictophagus americanus* (Perkins) from *Ceratagallia nanella* Hamilton (Hemiptera: Cicadellidae) from one location.

Canada: Yukon Territory, Kluane, 4 July 1979 (RBCM-ENT).

*Halictophagus americanus* has a widespread distribution across North America and is known to parasitise at least nine species of Cicadellidae. Distribution is known from the southeastern United States of America to the southern border in Arizona through the Rocky Mountains and the western coast to Oregon and the upper Midwestern states (Cook 2019). The new record from the Yukon is new for Canada, based on the checklist by Peck (1991) and Cook (2019).

*Halictophagus callosus* Bohart from *Idiocerus couleanus* Ball (Hemiptera: Cicadellidae) from one location.

Canada: British Columbia, Salt Spring Island, 21 July 1925 (RBCM-ENT).

*Halictophagus callosus* was described with only female specimens from Washington State. The single female found in a *I. coulaneus* was slightly damaged but appears to match the limited description by Bohart (1943). The type localities in Washington and on Salt Spring Island in Canada are separated by less than 300 km. This appears to be a new species record for Canada.

*Halictophagus mackayi* (Bohart) (two males) from flight-intercept traps on an Arctic island.

Canada: Yukon Territory, Herschel Island, 10 July 2007 and 12 July 2008. (RBCM-ENT)

*Halictophagus mackayi* is one of two *Halictophagus* spp. described from central Canada. The primary known hosts are Cicadellidae, including several species known from the Arctic (Weber 1950). Two adult males of *H. mackayi* were collected in traps on Herschel Island during insect surveys. None of the cicadellids from the Herschel Island Survey were stylipised. Yukon collections present a new territorial record, with previous collections being from Saskatchewan (Peck 1991; Cook 2019).

An unidentified male Halictophagidae had previously emerged from a puparium found in *Liburnia consimilis* (Van Duzee) (Hemiptera: Delphacidae), and the parasitised host insect was collected from the following location:

Canada: British Columbia, Cowichan, 30 July 1926 (RBCM-ENT).

Some Halictophagidae parasitise Delphacidae in North America and the genus of this parasite is not determined from the open puparia. There is a possibility this represents *Stenocranophilus canadensis* Kinzelbach, which is

known from Saskatchewan, Canada (Kinzelbach 1971). Further collections could determine the species present in this host.

## Xenidae

*Xenos peckii* Kirby stylopidised *Polistes aurifer* de Saussure (Hymenoptera: Vespidae) from the following locations.

Canada: British Columbia, Okanagan Bay, 15 July 1995; Osoyoos, 8 September 1995 and 9 October 2013 (RBCM-ENT); USA: Washington, Chelan County, Washington State University Field Station, 5 May 1995 and 6 May 2001 (WWUC); Washington, Kittitas County, Ellenburg, 30 April 1967 (WWUC).

*Xenos peckii* is widely distributed across much of North America and Hawaii, stylopidising several species of *Polistes* (Cook 2019). Based on the regional records reported by Benda *et al.* (2022), the Washington records are the first for the state. Leech (1966) and Kenner (2002) previously reported material from the British Columbia mainland from the same host. An additional specimen in the WWUC was reported from USA: Florida, Alachua County, Newmans Lake, October 1997, ex. *Polistes carolina* (Linnaeus).

*Leionotoxenos tigridis* (Pierce) stylopidised *Ancistrocerus adiabatus* (de Saussure) (Hymenoptera: Vespidae: Eumeninae).

USA: Washington, Chelan County, Washington State University Field Station, 15–16 July 2000 (WWUC); Washington, Kittitas County, Ellenburg, 8 July 1998; Washington, Kittitas County, Schnebly Coulee, 7 April 2022 (WWUC).

*Leionotoxenos tigridis* is poorly reported, with most of the records from the midwestern United States of America occurring in Illinois (Benda *et al.* 2022) and from Canada occurring in Ontario (Peck 1991). The original description by Pierce (1911) was somewhat vague but adequate when combined with those by Benda *et al.* (2022) for identifications.

Additional species in the WWCU were not from North America, do not appear to represent new locality records, and include *Xenos zarattarii* (Pierce) *s.l.* from Liberia, 16 September 1965, ex. *Belonogaster* sp. (Hymenoptera: Vespidae). Benda *et al.* (2021) recently suggested that *Xenos* spp. from *Belonogaster* spp. probably represent two or more cryptic species.

Examining host species in entomological collections is a viable method to detect previously unreported Strepsiptera. The limited entomological collections from Washington and British Columbia indicate that additional records are likely.

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