

**NOTE*****Quedius spelaeus* Horn, a troglophilic beetle discovered in New Brunswick, Canada**

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The rove beetle genus *Quedius* includes a number of troglobite (obligate cavernicoles) and troglophile (facultative cavernicoles) species. In North America four frequently occur as troglophiles: *Quedius erythrogaster* Mannerheim, *Quedius fulgidus* (Fabricius), *Quedius mesomelinus* (Marshall), and *Quedius spelaeus* Horn (Peck and Thayer 2003). One of these, *Quedius (Microsaurus) spelaeus*, has eyes and is normally pigmented but is only found in subterranean habitats.

The nominate subspecies, *Quedius spelaeus spelaeus*, has been reported from caves in California, Colorado, Idaho, Iowa, Illinois, Indiana, Kentucky, Missouri, New Mexico, New York, Oregon, Pennsylvania, Virginia, Washington, West Virginia, and Wisconsin in the United States, and Alberta, British Columbia, Nova Scotia, and Saskatchewan in Canada by Smetana (1971). Peck and Thayer (2003) added records from Maryland, Minnesota, and Utah. Blatchley (1910) observed that *Quedius spelaeus spelaeus*, "Occurs in decaying organic matter, usually the excrement of raccoons and other cave visiting vertebrates, or beneath stones in the vicinity thereof." The only other subspecies, *Quedius spelaeus aplodontiae* Smetana, 1971, is known only from the nests of mountain beavers (*Aplodontia rufa* (Rafinesque) (Rodentia: Aplodontiidae)) in Oregon (Smetana 1971).

Quedius spelaeus spelaeus was first reported from Nova Scotia by Calder and Bleakney (1967) who found adults in a small porcupine-inhabited cave known as Frenchman's Cave. Moseley (1998, 2007, 2009) reported it from six caves in Nova Scotia: Frenchman's Cave (FC), Frenchman's II (F2), Cheverie Cave (CC), Woodville Ice Cave (WIC), Minasville Ice Cave (MIC) (all in Hants County), and Fairy Hole II (FH2) (in Victoria County on Cape Breton Island) (Figure 1). Moseley et al. (2006) described the pupa of *Quedius spelaeus spelaeus* and discussed the biology and distribution of the species. It is the top predator in subterranean ecosystems in Nova Scotia. Adults and larvae are almost always associated with dung of common porcupine (*Erethizon dorsatum* (Linnaeus) (Rodentia: Erethizontidae)), feeding on the small arthropods found in the dung and the associated mycelial growth (Moseley et al. 2006).

The distribution of *Quedius spelaeus spelaeus* remains a continuing zoogeographic puzzle. In Canada, the species occurs from northern British Columbia east to central Saskatchewan (Dundurn and Great Deer), approximately 3,200 km west of sites in Nova Scotia (Smetana 1971). In the United States, it is found both west and east of the Great Plains, but is known to occur north only as far as Sullivan County, New York, 950 km southwest of sites in Nova Scotia (Smetana 1971). It was not found in the extensive survey of 35 caves and mine sites in adjacent southern Ontario (Peck 1988). Thus, the disjunct population of this troglophilic beetle in Nova Scotia has sparked zoogeographic interest. Moseley et al. (2006) suggested that it might have dispersed to Nova Scotia via post-glacial land bridges and offshore continental-shelf island networks that existed for several thousand years in the wake of post-Wisconsinian deglaciation that commenced circa 21,000 years BP.

Bearing this in mind, the first author began to search in cave systems in southeastern New Brunswick to see if the species could be found on the other side of the isthmus of Chignecto that connects Nova Scotia to the North American mainland. The first site investigated was the Underground Lake (45.8587°N; 64.6742°W) on Wilson Brook, in Albert Mines,

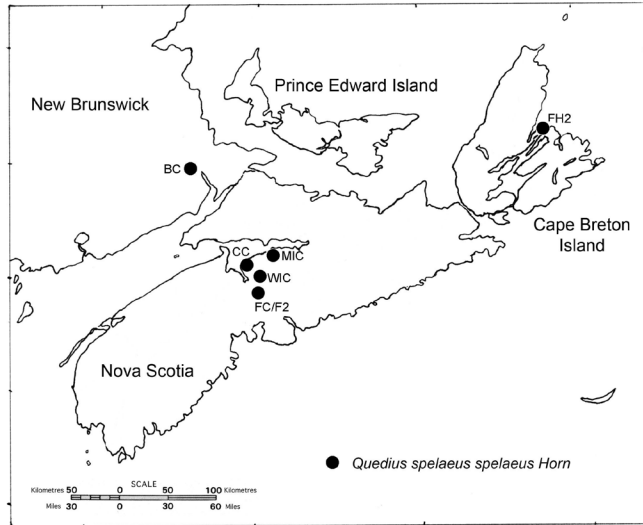
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Figure 1. The distribution of *Quedius s. spelaeus* in caves of the Maritime Provinces of Canada. **Note:** Cave name abbreviations follow Moseley (2007).



Albert County. This is a large gypsum solution cave that is partially occupied by a water body fed by a subterranean watercourse. Although some leaf litter, branches, and other organic material fall into this cave through the cave mouth, and it supports a small population of bats, porcupines have not ventured into the cave and so accumulations of organic matter, both on the cave floor and in the water body, are relatively small. After a couple hours of careful searching on 28 September 2008, no specimens of *Quedius spelaeus spelaeus* were found. Indeed, the only arthropods found were a specimen of the opilionid, *Leiobunum elegans* Weed, 1889 (Opiliones: Sclerosomatidae), and a *Culex* sp. (Diptera: Culicidae) mosquito.

The second site investigated was the Hillsborough Bat Cave (45.9048°N; 64.6780°W), a complex of gypsum solution caves along Gray's Brook approximately 3.2 km southwest of Hillsborough in Albert County. This cave system has a large number of sinkholes and several entrances with interconnected passages, some of which are traversable by humans. The two main entrances are the so-called North Cave and South Cave. On 3 October 2010, the North Cave, through which a small brook flows, was visited. Beyond the entranceway and cave threshold were several extensive deposits of porcupine dung that began approximately 6 m in and continued into the dark zone of the cave. These varied in depth from approximately 8–16 cm and included both small amounts of fresh dung as well as dung that varied from slightly decomposed (still

retaining its original form) to thoroughly decomposed (broken down to its constituent fibres). In some areas, this porcupine dung supported considerable growth of fungal hyphae. These deposits were searched carefully, however, no specimens of *Quedius spelaeus spelaeus* were found. Indeed, no arthropods of any kind were observed associated with the dung, although a small number of *Culex pipiens* Linnaeus, 1758 (Diptera: Culicidae) mosquitoes were observed hibernating on the cave walls.

On the same day, the South Cave of this complex was also searched. In most respects it resembles the North Cave, however there was no watercourse flowing through the cavern and the deposits of porcupine dung were less extensive. However, in these deposits, located 25–30 m beyond the entrance and within the dark zone of the cave, *Quedius spelaeus spelaeus* was abundant. Approximately 40 larvae (Figure 2) were observed moving on or near the surface of the slightly decomposed porcupine dung, particularly in areas that supported ample growth of fungal hyphae (Figure 3). Also abundant in the porcupine dung

Figure 2. Dorsal and lateral habitus photograph of *Quedius spelaeus spelaeus* larva. **Photo credit:** Jan Klimaszewski.



were adults, larvae, and pupae of *Trichocera maculipennis* Meigen, 1818 (Diptera: Trichoceridae), adult fungus gnats of the family Sciaridae (Diptera), and an unidentified pale mite (Acari). These are all arthropods that Moseley et al. (2006) identified as being associated with *Quedius spelaeus spelaeus* and porcupine dung in Nova Scotia caves, and which presumably are part of the diet of this beetle. Despite extensive searching in the dung deposits and under nearby rocks, no adult *Quedius spelaeus spelaeus* were observed. Other arthropods found in this cave included hibernating *Culex pipiens*, a single *Leiobunum elegans* opilionid (both in the deep threshold zone), and a single *Oniscus asellus* (Linnaeus, 1758) (Isopoda: Oniscidae), which was found in the deep cave subzone of the dark zone. This specimen was found in the large innermost chamber of the cave which

Figure 3. The habitat in the South Cave of the Hillsborough Bat Cave where *Quedius speleaus speleaus* was found. **Photo credit:** Christopher Majka. **Note:** Tall white fungal “stalks” (hyphae) growing from the surface of the porcupine dung.



serves as a bat hibernaculum. Ninety-two bats (*Myotis lucifugus* (LeConte) (Chiroptera: Vespertilionidae) and *Myotis evotis* Allen) were counted although probably more were present. The size of the chamber made it difficult to see all the bats present. On 10 October 2010, Leah Williams visited the South Cave, collected additional larvae, and also found one adult *Quedius speleaus speleaus* under a rock near the porcupine dung deposit.

This discovery establishes the presence of *Quedius speleaus speleaus* in New Brunswick (Figure 1). This site is approximately 100 km northwest of the sites in Hants County where the species has been found in Nova Scotia, and on the west side of the isthmus of Chignecto, the bridge of land that connects the provinces and which has served as a barrier to the dispersal of various species of vertebrates and invertebrates (Bleakney 1958). This discovery does not resolve the zoogeographic puzzle of *Quedius speleaus speleaus* as its presence on both sides of the isthmus of Chignecto could be the result of dispersal in either direction. In other words, the proposal advanced by Moseley et al. (2006) of dispersal to Nova Scotia via post-glacial land bridges and offshore island networks, and subsequently to New Brunswick across the isthmus of Chignecto could be possible. Alternatively, *Quedius speleaus speleaus* could have dispersed north along continental pathways through Maine and New Brunswick, colonizing Nova Scotia by crossing the isthmus of Chignecto from west to east. The absence of *Quedius speleaus speleaus* in caves in northern New England, Québec, and Ontario

(Peck 1988; Peck and Thayer 2003) would appear to favour the former hypothesis. Investigation of other caves in New Brunswick which harbour deposits of porcupine dung would be worthwhile in order to shed further light on this interesting member of the beetle fauna of the Maritime Provinces, and to better understand the history of colonization of cave habitats in the region.

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REFERENCES

- Blatchley, W.S. 1910. An Illustrated Descriptive Catalogue of the Coleoptera or Beetles (Exclusive of the Rhynchophora) Known to Occur in Indiana. Nature Publishing, Indianapolis, Indiana. 1386 pp.
- Bleakney, J.S. 1958. A zoogeographic study of the amphibians and reptiles of eastern Canada. National Museum of Canada Bulletin **155**: 1–119.
- Calder, D.R., and Bleakney, J.S. 1967. Observations on Frenchman's Cave, Nova Scotia, and its Fauna. National Speleological Society Bulletin **29**: 23–25.

- Moseley, M. 1998. Invertebrate Cave Fauna of Nova Scotia Caves. Nova Scotia Museum Curatorial Report 86. Halifax, Canada, 40 pp.
- Moseley, M. 2007. Acadian biospeleology: composition and ecology of cave fauna of Nova Scotia and southern New Brunswick, Canada. *International Journal of Speleology* **36**: 1-18.
- Moseley, M. 2007. Observations on the cave-associated beetles (Coleoptera) of Nova Scotia, Canada. *International Journal of Speleology* **38**: 163-172.
- Moseley, M., Klimaszewski, J., and Majka, C.G. 2006. Description of the pupa and observations on the distribution, ecology and life history of *Quediusspelaesus* Horn (Coleoptera: Staphylinidae) in Nova Scotia, Canada. *Zootaxa*, **1226**: 61-68.
- Peck, S. B. 1988. A review of the cave fauna of Canada, and the composition and ecology of the invertebrate fauna of caves and mines in Ontario. *Canadian Journal of Zoology* **66**: 1197-1213.
- Peck, S.B., and Thayer, M.K. 2003. The cave-inhabiting rove beetles of the United States (Coleoptera; Staphylinidae; excluding Aleocharinae and Pselaphinae): diversity and distribution. *Journal of Cave and Karst Studies* **65**: 3-8.
- Smetana, A. 1971. Revision of the tribe Quediini of America north of Mexico (Coleoptera: Staphylinidae). *Memoirs of the Entomological Society of Canada* **79**: 1-303.