

## NATURAL HISTORY AND OBSERVATIONS

***Microdon tristis* (Diptera: Syrphidae):  
notes on biology with a new ant host  
record from British Columbia**

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The unusual myrmecophilous flower fly subfamily Microdontinae (Diptera: Syrphidae) contains 470 valid species worldwide, with many more to be described (Reemer and Ståhls 2013a, 2013b; Evenhuis and Pape 2021). Although many of the species previously placed in the cosmopolitan *Microdon* Meigen have been transferred to other genera in recent revisions, the genus remains an important part of this subfamily, with 69 known species, 14 of which are recorded in the Nearctic (Reemer and Ståhls 2013a, 2013b). Eight species are known from British Columbia (BC; Thompson 1981). This note presents photographs and some natural history observations related to *Microdon tristis* (Loew) and its relationship to the carpenter ant *Camponotus herculeanus* (Linnaeus) (Hymenoptera: Formicidae), which is a new host record for the fly.

*Microdon* species develop asinquilines in ant nests. The larvae were initially described as mollusks, then later as coccids, because of the slug-like appearance of the third instar (Figures 1–3; Duffield 1981). Recently hatched larvae move quickly into the ant nest, where they and subsequent immature stages are accepted by the colony, avoiding attack because some species at least produce cuticular hydrocarbons that mimic those of the ants; adults are not protected and will be killed (Duffield 1981). This chemical mimicry suggests that the risk of being recognised as interlopers has resulted in the flies evolving some necessary host specialisation (Reemer and Ståhls 2013a). First and second instars mimic ant cocoons; if the nest is disturbed, worker ants move both ant cocoons and *Microdon* larvae to safety (Garnett *et al.* 1985).

First-instar fly larvae apparently prompt host ant larvae to regurgitate digested food while later-instar fly larvae are predators of the eggs, larvae, and pupae of their ant hosts (Duffield 1981; Reemer and Ståhls 2013a). *Microdon* species are voracious predators; Duffield (1981) noted that a third-instar larva could devour 8–10 ant larvae in 30 minutes.

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**Figure 1.** *Microdon tristis* third-instar larvae in the *Camponotus herculeanus* colony. The dorsal posterior spiracle is readily visible. Photo (©): B. Kelly-McArthur.



**Figure 2.** *Microdon tristis* third-instar larvae, one clinging upside down to the wood, with larvae of *Camponotus herculeanus*. Photo (©): B. Kelly-McArthur.



**Figure 3.** *Microdon tristis* third-instar larva, lateral view. Dorsal posterior spiracle clearly visible. Photo (©): B. Kelly-McArthur (taken in lab).

It is presumed that late-instar larvae migrate towards the surface of the nest before pupation. The vulnerable adults emerge in the early morning, when the ants are torpid and are deeper inside the nest (Duffield 1981). Adults usually appear in spring and early summer, perching and flying near ant colonies and searching for mates; they do not visit flowers (Duffield 1981; Cheng and Thompson 2008).

The flies reported herein were found at a property near Nicholson (51.4534° N, 117.0811° W), just south of Golden, BC, in the Columbia River Valley. The site was in open farmland in the valley bottom, bordered mainly by *Populus tremuloides* Michaux (Salicaceae). Collections of sawn beams and lumber of mixed species had been stored onsite for many years, and much of the wood was rotted to some degree. On 6 September 2019, while salvaging some of the lumber for firewood, BK-M opened a bundle of four-foot lengths of 8" × 8" Douglas-fir (*Pseudotsuga menziesii* Mirbel Franco) (Pinaceae): it contained a colony of carpenter ants, *Camponotus herculeanus*, hosting numerous *Microdon* larvae. Photographs were taken on 9 September (Figures 1–3); some are accessioned in the Canadian National Collection of Insects, Arachnids and Nematodes (CNC; CNC1584218), Ottawa, Ontario, Canada. The rotting wood and ant colony were removed to BK-M's property at Moberly, 19 km northwest of Golden, wrapped in screening, and loosely covered with a sheet of tin to accommodate natural conditions but prevent the escape of any emerging adult flies. Eleven *Microdon* larvae were counted. Five larvae, two live and three preserved in 70% isopropyl alcohol, were sent to JHS at the CNC for rearing and identification. The rest were kept by BK-M in an overwintering environment in a basement cool-room.

The attempt by BK-M to rear the larvae to adults failed: the larvae died in the winter before pupating. The live larvae sent to Ottawa also did not pupate. However, through DNA analysis, JHS identified the species as *Microdon tristis*. The sequence data are publicly available on GenBank (MZ438532) and are a

100% match to *Microdon tristis* using the BOLD ID Engine (Ratnasingham and Hebert 2007). No species share a barcode BIN with *Microdon tristis*.

After final snowmelt in early May 2020, the screen-wrapped pile of lumber was checked daily for adult fly activity, and on 12 July, a single adult female was seen under the screen. The fly was rather lethargic and presumably was waiting for a mate to appear. It was photographed by BK-M *in situ* (Figure 4) and in his photo lab before being released back into the lumber pile. Neither this fly nor other adults were later observed, but images were sent to JHS and identified as *M. tristis*, thus confirming the larval identification. The photos are accessioned in the CNC (CNC1714207).



**Figure 4.** *Microdon tristis*, adult female. Photo (©): B. Kelly-McArthur.

*Microdon tristis* ranges widely in North America, from BC east to Nova Scotia and south to Alabama and Colorado (Skevington *et al.* 2019). In BC, it is widespread, at least east of the Coast Mountains. Records in the CNC are from Robson, BC, in the southern West Kootenay district (latitude 49.33° N), north to McQueen Lake (Kamloops area), Likely (Cariboo region), and Terrace in the Skeena Valley (latitude 54.50° N). The Royal British Columbia Museum (Victoria, BC) has BC specimens from localities included in this latitudinal range – from Robson and from Lavington, just east of Vernon. The four specimens from the latter locality (50.2267° N, 119.1157° W) were reared from larvae by James Grant (15 May 1959; RBCM ENT991-119070 to -119073); two

*Camponotus herculeanus* specimens, a queen and male (RBCM ENT991-119070 (queen), ENT991-119072 (male)), are associated with them. A specimen from Kaslo, BC was listed by Osburn (1907); the location of this specimen is unknown. Neither the collections of the Beaty Biodiversity Museum at the University of British Columbia (Vancouver, BC) nor the Pacific Forestry Centre (Victoria, BC) have specimens identified as *M. tristis*.

The flight period of *M. tristis* in the province, based on adult specimens, ranges from 15 May (Lavington) to 7 August (Likely). Eight of the 10 dates fall in May and June.

Specimens of the ant from the Nicholson colony (Figure 5) were examined by RJH and tentatively identified as the carpenter ant *Camponotus modoc* Wheeler (Hymenoptera: Formicidae), although identification was uncertain because characters can overlap with the closely related *C. herculeanus* (Mackay 2019). Subsequent molecular analysis by JHS identified the ant as *C. herculeanus* (CNC1584225). The sequence data are publicly available on GenBank (MZ438533) and are a 100% match to *C. herculeanus* using the BOLD ID Engine (Ratnasingham and Hebert 2007). No species share a barcode BIN with *C. herculeanus*. The two *Camponotus* specimens associated with the *Microdon tristis* specimens from Lavington also were identified as *C. herculeanus* by RJH. *Camponotus herculeanus* is a common and widespread Holarctic species, ranging through much of North America from the Arctic tree line south to the central United States of America, from Europe east to central and northern Asia (Mackay 2019). Thus, in North America, its range contains the known distribution of *Microdon tristis*. *Camponotus herculeanus* represents a new host species record for *Microdon tristis*. It is also a host for *Microdon piperi* Knab (Diptera: Syrphidae) (Reemer 2013), which also occurs in BC (Thompson 1981).

*Microdon* species are associated with a wide range of ant hosts, and in particular, *M. tristis* has been recorded in colonies of *Camponotus novaeboracensis* (Fitch) and *C. pennsylvanicus* (DeGeer) (both Hymenoptera: Formicidae) (Duffield 1981; Reemer 2013).

The chance discovery of larvae and an adult female of *Microdon tristis* developing in a colony of the carpenter ant *Camponotus herculeanus* was an unusual opportunity to learn more about the natural history of this fascinating syrphid fly. This record also documents a new ant host species for this fly. The usefulness of molecular study for species identification is highlighted; it was used to confirm the identity of the ant as well as of the fly larvae. However, the real highlight of the present study is the terrific photography of BK-M, which illustrates, in particular, the strange and unique beauty of the inquiline fly larvae.

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**Figure 5.** *Camponotus herculeanus*, major worker. Photo (©): B. Kelly-McArthur.

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