The Canadian Entomologist (2025), **157**, e25, 1–25
doi:10.4039/tce.2025.10

Published on behalf of the Entomological Society of Canada

ARTICLE

Four species of adventive Staphylininae (Coleoptera: Staphylinidae) new to North America

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(Received 20 December 2024; accepted 3 February 2025)

Abstract
Four Palaearctic species of Staphylininae (Coleoptera: Staphylinidae) are reported from North America for the first time: *Heterothops cognatus* Sharp, *H. praevius* (Erichson), *Philonthus chujoi* Dvořák, and *Quedius* (*Raphirus*) *maurorufus* (Gravenhorst). We suspect that these species are part of a more recent cohort of accidental introductions to North America. Notably, two of them are native to the East Palaearctic, an unusual source of adventive staphylinids in North America because nearly all others are native to Central Europe. We suggest that the East Palaearctic is an underrecognised and increasingly important source for recently adventive soil invertebrates and that increased taxonomic focus on this fauna is important to North American biosecurity. The detection of trans-Palaearctic *H. praevius* resulted in the recognition of *H. praevius* Erichson (= *H. marmotae* Smetana **syn. nov.**). We also newly report the Nearctic species *Heterothops conformis* Smetana and *H. sordidus* Smetana from eastern North America. *Philonthus debilis*, a close relative of *P. chujoi*, is reported from the Yukon Territory, representing the northernmost locality known for this long-established adventive species. Illustrations of diagnostic features, barcode data, and distribution maps are provided for all four species. Updated or new identification keys are provided to aid in the recognition of these species in eastern North America.

Introduction

Human activity has drastically altered the composition of the beetle fauna of North America through the establishment of nonnative (adventive) species. Adventive beetles have been detected in North America as early as 1620 (Prévost and Bain 2007), migrating with shipping traffic during European colonisation, and they continue to become established *via* the international trade of various organic products (reviewed in Klimaszewski *et al.* 2010). Rove beetles (Coleoptera: Staphylinidae) represent the greatest number of accidental beetle introductions, at least in Canada. As of 2019, 154 species had become adventive in Canada, about 8.6% of the roughly 1800 beetle species recorded at the time (Brunke *et al.* 2019, incorporating the former Silphidae; see Sikes *et al.* 2024).

Unlike plant-feeding groups, potential impacts of adventive rove beetles, mostly predators and recyclers of decaying organic matter, have received relatively little scientific attention. Nevertheless, the potential impact of these accidental introductions is particularly evident in the fragmented forests and wetlands of rural and urban northeastern North America, where

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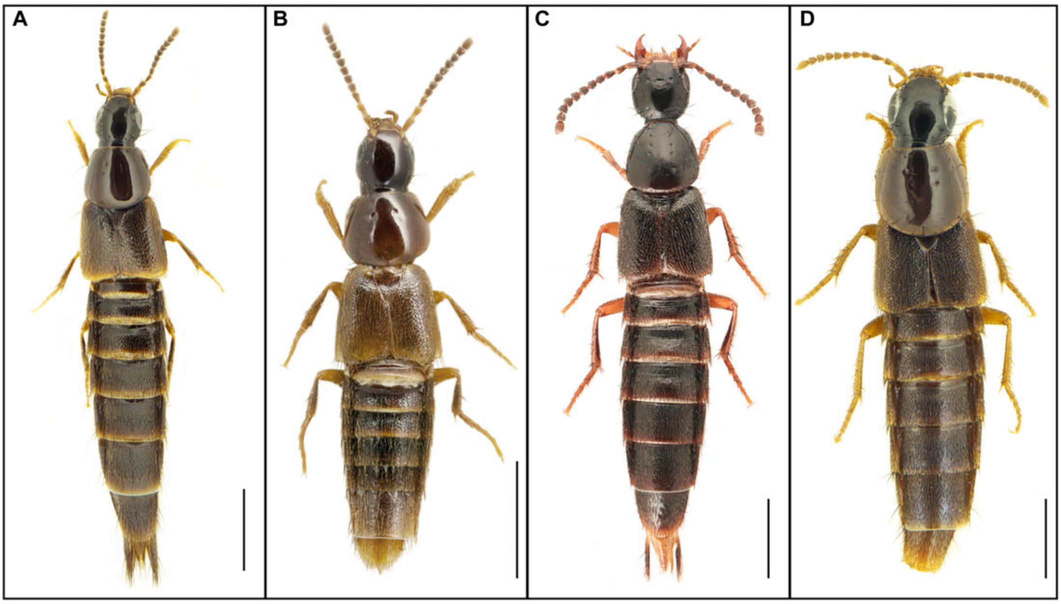

Figure 1. Habitus of each of **A**, *Heterothops cognatus* Sharp; **B**, *H. praevius* Erichson; **C**, *Philonthus chujoi* Dvořák; and **D**, *Quedius maurorufus* (Gravenhorst). Scale bars = 1 mm.

adventive staphylinids tend to predominate over Nearctic ones. In a recent five-year study (2006–2010) of ground-dwelling beetles in an old field and forest fragment in southern Quebec (Scotstown), Canada, about 55% of all rove beetle specimens belonged to adventive species (Levesque and Levesque 2024). These numbers may be even higher in areas with intense development, such as in southwestern Ontario and along the St. Lawrence River in Quebec. Klimaszewski and Brunke (2018) highlighted inadequate taxonomic knowledge and incomplete sequence reference libraries as two major impediments to the timely detection of new introductions and the tracking of established species as they expand their distributions in North America.

Recently, we have encountered specimens of *Heterothops* Stephens, *Philonthus* Stephens, and *Quedius* Stephens (Coleoptera: Staphylinidae: Staphylininae) collected in eastern Canada that could not be identified to species (Fig. 1). This was unexpected because all genera of Staphylininae in this region have modern revisions and taxonomic supplements available, including identification keys (*e.g.*, Smetana 1971a, 1982, 1995; Frank 1975, 1981; Brunke *et al.* 2011). These unknown taxa were recognised as such by ourselves or colleagues as early as 2005, 2009, and 2010 but have remained a mystery until now. In the process of re-examining Nearctic *Heterothops* specimens and associated barcode sequences, it was discovered that Palaearctic *H. praevius* Erichson has been adventive in eastern North America (Ontario, Canada) for some time and had been described subsequently as *H. marmotae* Smetana **syn. nov.** from the same region. Two Nearctic *Heterothops* were also newly discovered in eastern North America and are probably northern transcontinental species. Here, we newly report four rove beetle species as adventive and established in North America, and we provide illustrations of their diagnostic features, new or updated keys, barcode sequence data, and distribution maps. With the present study, 14 species of *Heterothops*, 114 *Philonthus*, and 92 *Quedius* species are now known to occur in North America.

Methods

Depositories

BIO – Biodiversity Institute of Ontario, University of Guelph, Guelph, Ontario, Canada (M. Pentinsaari, A. Brown)

cCC – personal collection of Claude Chantal, Varennes, Quebec, Canada

cLC – personal collection of Ludovic Leclerc, Gatineau, Quebec, Canada

cNB – personal collection of Nicolas Bédard, City of Québec, Quebec, Canada

cPB – personal collection of Pierrick Bloin, City of Québec, Quebec, Canada

CNC – Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Ontario, Canada

DEBU – University of Guelph Insect Collection, University of Guelph, Guelph, Ontario, Canada (S. Paiero)

LFC – Laurentian Forestry Centre, Canadian Forest Service, Natural Resources Canada, City of Québec, Quebec, Canada

NFC – Northern Forestry Centre, Canadian Forest Service, Natural Resources Canada, Edmonton, Alberta, Canada (G. Pohl)

Specimen examination

Non-type label data were standardised to improve clarity. Specimens were georeferenced using Google Earth or Google Maps, and GPS coordinates were included in the materials examined as verbatim. Specimen localities were mapped using SimpleMappr (Shorthouse 2010). Specimens were examined dry using a Leica M80 stereomicroscope (Leica, Wetzlar, Germany). Genitalia and terminal segments of the abdomen were dissected and placed in glycerine-filled vials, pinned with their respective specimens. Several specimens were dissected previous to this study, and genitalia were sometimes mounted in Canada Balsam or Euparal. Line drawings were made from images and then digitally inked in Adobe Illustrator, Creative Cloud 2024 (Adobe Canada, Ottawa, Ontario, Canada). All imaging, including photomontage, was accomplished using a motorised Nikon SMZ25 microscope (Nikon Canada, Mississauga, Ontario, Canada) and NIS Elements Basic Research, version 4.5 (Nikon; https://www.microscope.healthcare.nikon.com/products/software/nis-elements/nis-elements-basic-research). Photos were postprocessed in Adobe Photoshop, Creative Cloud 2024 (Adobe Canada).

Molecular data

Extraction, amplification, and sequencing of the barcoding fragment of cytochrome *c* oxidase subunit 1 (*CO*1) mitochondrial DNA were performed by the Canadian Centre for DNA Barcoding, Biodiversity Institute of Ontario (BIO; University of Guelph, Guelph, Ontario, Canada). The DNA was extracted from both dried museum specimens and specimens preserved in 95% alcohol. Sequences were uploaded to the Barcode of Life Data System, version 4 (BOLD; https://v4.boldsystems.org/index.php), and those sequences deemed to be barcode compliant by BOLD were assigned BINs (barcode index numbers; Ratnasingham and Hebert 2013) and were considered as tentative species hypotheses. Using the Taxon-ID tree tool in the workbench of BOLD, barcodes and their associated BINs were visualised in a neighbour-joining tree using the BOLD aligner and Kimura 2-parameter (K2P) distances. The DNA barcode sequences studied here, including both previously unpublished data and the sequences published in earlier studies, have been compiled into a publicly available dataset on BOLD (DS-ADSTAPH1, https://dx.doi.org/10.5883/DS-ADSTAPH1), along with collecting data, images of the specimens (if available), and other metadata related to the specimens and sequences.

Results

Staphylininae Latreille, 1802

Amblyopinina Seevers, 1944. Amblyopinina can be recognised among the Nearctic Staphylininae by a combination of the following characters: antennal bases closer to eyes than each other; superior and inferior marginal lines of the pronotum separated throughout their length; apical maxillary palpomere aciculate; and dorsal rows of pronotum located just lateral of midline. Only *Heterothops* occurs in North America.

Heterothops Stephens, 1829

Recently, some *Heterothops* species (including the Nearctic Occidentis and Pusio Groups of Smetana 1971a) were moved to a new genus (*Chiquiticus* Reyes-Hernández and Solodovnikov), based on the results of comprehensive phylogenomic analyses that showed these to be only superficially similar to true *Heterothops* (Reyes-Hernández and Solodovnikov 2024). *Chiquiticus* is currently a member of the newly erected Ctenandropina (Reyes-Hernández *et al.* 2025).

Heterothops cognatus Sharp, 1874

Figs. 1A, 2B, 3A, 3B, 7A

BIN BOLD: AAU7313

Heterothops cognatus Sharp 1874: 20; Nakane *et al.* 1963 (habitus photo, distribution in Japan); Li 1993 (distribution in China); Cho 1996 (diagnosis, aedeagus illustration, distribution in South Korea); Shibata *et al.* 2013 (distribution in Japan); Cho 2019 (habitus illustration, additional records)

Diagnosis. In eastern North America, *H. cognatus* can be identified by the following combination of characters: eyes large, distinctly longer than the temple; first antennomere paler than other antennomeres, sometimes darkened dorsally (Fig. 2B). The internal sac of this species is distinctive for the heavily sclerotised bases of the short pair of sclerites (sclerite “c” of Israelson 1979; Fig. 2B), which appear as two small arcuate markings *in situ* (Fig. 2A).

Type material. The type material of *H. cognatus* was not examined for this study, but one male was dissected from material identified by David Sharp and collected by G. Lewis in Japan before accession in 1910 (exchange between the Natural History Museum, London, United Kingdom, and the CNC). Additional non-type males from Japan were dissected, and their aedeagi correspond exactly with the species now established and widespread in eastern North America.

Non-type material. JAPAN: no locality, G. Lewis, 1910–320. (2, CNC); **Hokkaido:** Oshamanbe, Toyotsu, seashore, 27.vii.1991, A. Smetana (1, CNC); **Honshu:** *Ibariki Pref.*: Tsukuba, pan and flight traps, 6–26.v.1989, M. Sharkey (1, CNC); “Yatabeho,” 12.vii.1980, A. and Z. Smetana (1, CNC); *Kyoto Pref.*: “Seryo-loge,” 500–700 m, 6.viii.1980, A. and Z. Smetana (1, CNC); *Nagano Pref.*: Shibu Onsen, 800 m, 23.vii.1980, A. and Z. Smetana (4, CNC); Komoro, 800 m, 19.vii.1980, A. and Z. Smetana (1, CNC); *Shimane Pref.*: Matsuda, 12.iv.1957, Y. Higo (1, CNC); **Shikoku:** *Ehime Pref.*: Hiromi [= Kihoku], 20.vi.1957, K. Kagami (1, CNC).

CANADA: **Ontario**: *Brant County*: Brantford Water Works Park, 43.14 N, 80.3 W, 3.vii.2013, 2015PHS IFT-039060 (1, CNC); *Chatham-Kent County*: Rondeau Provincial Park, near entrance, temporary pool with oak and poplar, dead leaves, 30.v.1985, L. LeSage (1, CNC); *Essex County*: Harrow, Harrow Research and Development Centre, 42° 01′ 34.2″ N, 82° 5′ 59.9″ W, Malaise trap in hedgerow, 2–5.vi.2021, L. Des Marteaux (1, CNC); same except 5–8.vi.2021 (1, CNC); same except Malaise trap in forest, 8–11.vi.2021 (2, CNC); *Niagara Region*: Welland, St. George Park, 42.968, −79.274, 16.vii.2014, IAS forest pest trapping (2, CNC); *Norfolk County*: Verhoeve Site, 42° 52′ 30.5″ N, 80° 29′ 52.0″ W, Malaise trap in forest, 8–11.vi.2021, L. Des Marteaux (1, CNC); same except 2–5.vi.2021 (1, CNC); same except Malaise in hedgerow, 8–11.vi.2021 (2, CNC); Hodgsen site, 42° 49′ 43.3″ N, 80° 38′ 49.0″ W, Malaise in hedgerow, 5–8.vi.2021, L. Des

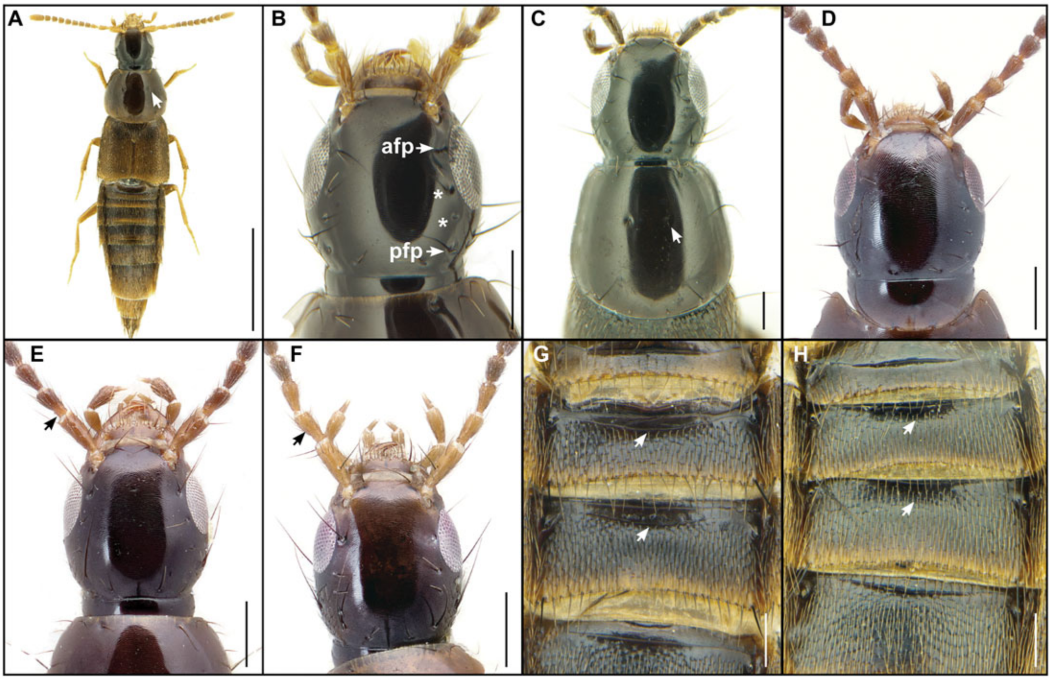

Figure 2. A, Habitus of *Chiquiticus pusio* (LeConte). Dorsal heads or forebodies of the following *Heterothops* species: **B**, *H. cognatus* Sharp; **C**, *H. minor* Smetana, indicating puncture of dorsal row; **D**, *H. praevius* Erichson; **E**, *H. conformis* Smetana, indicating second antennomere; and **F**, *H. sordidus* Smetana, indicating second antennomere. Basal abdominal tergites, indicating presence or absence of posterior transverse basal ridge, on the following *Heterothops* species: **G**, *H. fumigatus* LeConte; and **H**, *H. sordidus*. Asterisks indicate parocular punctures; afp, anterior frontal puncture; pfp, posterior frontal puncture. Scale bars = 1 mm (**A**); 0.2 mm (**B–H**).

Marteaux (1, CNC); same except 2–5.vi.2021 (2, CNC); Lammens Site, 42° 43′ 45.7″ N, 80° 42′ 10.9″ W, Malaise trap at field margin, 30.v–2.vi.2021, L. Des Marteaux (2, CNC); same except 17–20.vi.2021 (1, CNC); same except 5–8.vi.2021 (1, CNC); same except Malaise in hedgerow, 20–23.vi.2021 (1, CNC); same except Malaise in hedgerow, 30.v–2.vi.2021 (6, CNC); same except Malaise trap in forest, 30.v–2.vi.2021 (2, CNC); Timpf site, 42° 39′ 01.0″ N, 80° 33′ 25.0″ W, Malaise trap in hedgerow, 2–5.vi.2021, L. Des Marteaux (1, CNC); same except Malaise trap in forest, 30.v–2.vi.2021 (1, CNC); same except Malaise trap at field margin, 5–8.vi.2021 (1, CNC); same except Malaise trap at field margin, 2–5.vi.2021 (1, CNC); Boothby site, 42° 39′ 57.5″ N, 80° 41′ 58.6″ W, Malaise trap in forest, 30.v–2.vi.2021, L. Des Marteaux (2, CNC); same except Malaise trap at field margin, 5–8.vi.2021 (1, CNC); Chanyi site, 42° 34′ 55.7″ N, 80° 34′ 34.1″ W, Malaise trap at field margin, 2–5.vi.2021, L. Des Marteaux (1, CNC); Csoffi site, 42° 52′ 18.1″ N, 80° 32′ 37.8″ W, Malaise trap in forest, 5–8.vi.2021, L. Des Marteaux (2, CNC); same except 2–5.vi.2021 (1, CNC); LLON 6 site, 42° 46′ 57.1″ N, 80° 37′ 01.3″ W, Malaise trap in hedgerow, 2–5.vi.2021, L. Des Marteaux (1, CNC); same except Malaise trap in forest, 2–5.vi.2021 (1, CNC); Bonnieheath site, 42° 52′ 55.0″ N, 80° 15′ 28.5″ W, Malaise trap in hedgerow, 5–8.vi.2021, L. Des Marteaux (1, CNC); same except 8–11.vi.2021 (1, CNC); Gilvesy site, 42° 47′ 24.5″ N, 80° 40′ 19.7″ W, Malaise trap in hedgerow, 5–8.vi.2021, L. Des Marteaux (2, CNC); same except 30.v–2.vi.2021 (1, CNC); VanTil site, 42° 49′ 30.8″ N, 80° 14′ 17.4″ W, Malaise trap in forest, 5–8.vi.2021, L. Des Marteaux (1, CNC); Blake site, 42° 48′ 25.2″ N, 80° 17′ 45.1″ W, Malaise at field margin, 30.v–2.vi.2021, L. Des Marteaux (1, CNC); same except 8–11.vi.2021 (2, CNC); *Ottawa Region*: Ottawa, Britannia Bay, Mud Lake, 45.367 N, 75.793 W, sifting forest edge, 7.iv.2021, A. Brunke (5, CNC); **Quebec:** *Deux-Montagnes*: Oka National Park, 45.476, −74.054, white tulle intercept trap at compost site, 11.v.2023, R. Vigneault (1, cNB); *Vallée-du-Richelieu*: Carignan, Goyer Island, 45.476, −73.278, mature oak forest, sifting dead leaves, grass and riverside debris, 6.v.2022, N. Bédard (2, cNB). **UNITED STATES OF AMERICA: Alabama:** *Lee County*: Auburn, 6.iv.1977, E.J. Kiteley (1, CNC); **Massachusetts:** *Middlesex County*: Townsend, pasture 15.iv.2010, T. Murray (2, DEBU); Groton, 30.iv.2010, T. Murray (1, DEBU); Wayland community garden on Rt. 27, 25.iii.2010, T. Murray (1, DEBU); *Northampton*: Northampton, 9.viii.1974, E.J. Kiteley (1, CNC); same except 1.v.1971 (2, CNC); same except 14.viii.1982 (2, CNC); **New Jersey:** *Monmouth County*: Eatontown, 11–21.vi.1991, M. Schülke (2, CNC); **Pennsylvania:** *Dauphin County*: Harrisburg, North Cameron St. and Maclay St., 40° 17′ 03″ N, 76° 52′ 42″ W, sifting leaf litter, 18.v.2010, S.M. Paiero (3, DEBU).

Photo only records. CANADA: Ontario: *Essex County*: Amherstburg, Texas Rd., 13.iii.2024, user russjones, iNaturalist record 202358793; *Oxford County*: 11.vii.2024, user: wrenwraith, iNaturalist record 228748478. **UNITED STATES OF AMERICA: Massachusetts:** *Middlesex County*: Cambridge, 27.iii.2010, user name: tom murray, bugguide.net record 380272; *Suffolk County*: Boston Nature Centre, 18.iii.2023, user: JaredAd, bugguide.net record 2227639; **Michigan:** *Calhoun County*: Springfield, 9.vi.2009, user: Sharon Warner, bugguide.net record 297778; **North Carolina:** *Wake County*: Raleigh, 9.iii.2023, user: David Guzman, bugguide.net record 750221; **Pennsylvania:** *Allegheny County*: Alison Park, 26.iv.2015, user: John Rosenfeld, bugguide.net record 1060056.

DNA-only records. CANADA: Ontario: *Essex County*: Point Pelee National Park, 41.939, −82.516, Cedar/Savannah, cactus field, 9.v.2012, H. Brown, BIOUG02913-B02 (1, CBG); *Hamilton Region*: Waterdown, St. Thomas the Apostle Catholic School, 43.331, −79.894, 3.v.2013, K. Armstrong, BIOUG05621-E07 (1, CBG); *Middlesex County*: London, Oakridge Secondary School, 42.978, −81.312, Malaise trap, 8.v.2015, S. Smith, BIOUG21997-D01 (1, CBG); *Oxford County*: Woodstock, St. Michael's Catholic School, Malaise trap, 43.1464, −80.732, 5.v.2014, S. Cox, BIOUG13090-C09 (1, CBG); *Toronto Region*: Toronto, East York Collegiate Institute, 43.696, −79.326, Malaise trap, 8.v.2015, I. Lolja, BIOUG21923-F02 (1, CBG); *Waterloo Region*: Cambridge, Southwood Secondary School, 43.3502, −80.336, Malaise trap, 3.v.2013, S. Gray, BIOUG05555-D09 (1, CBG); Kitchener, Huron Heights Secondary School, 43.392, −80.466, Malaise trap, 22.iv–3.v.2013, C. Roth, BIOUG05652-G08 (1, CBG); *Wellington County*: Arkell Research Station, Malaise trap, 43.5187, −80.1709, 26.vi.2015, BIOUG31800-D11 (1, CBG); Guelph, 25 Division St., 43.554, −80.264, 1.v.2010, A. Smith, BIOUG00818-G05 (1, CBG). **UNITED STATES OF AMERICA: New York:** *Westchester County*: Pocantico Hills, Stone Barns Center for Food and Agriculture, 41.104, −73.825, Field 40, Malaise trap, 27.viii.2021, BIOUG74646-E08 (1, CBG). **CHINA: Beijing:** Beijing, Institute of Plant Protection, Chinese Academy of Agricultural Sciences, 40.0217, 116.279, 9.ix.2016, Chenxi Liu, BIOUG37506-F05 (1, CBG).

Distribution. Adventive: Canada (Ontario, Quebec); United States of America (Alabama, Massachusetts, Michigan, North Carolina, New Jersey, New York, Pennsylvania). **Native:** Japan (Hokkaido, Honshu, Kyushu, Shikoku, Ryukyu Islands); South Korea; China (Beijing, Liaoning, Shaanxi).

Heterothops cognatus is an East Palaearctic species widespread in Japan (Shibata *et al.* 2013) and is also reported from South Korea (Cho 1996, 2019) and northern China (Li 1993). Here, we confirm its presence in China, based on a barcoded specimen from urban Beijing. *Heterothops cognatus* has become widespread in eastern North America, from southern Canada south to Alabama.

Bionomics. This species has been collected in both disturbed and forested areas by sifting leaf litter and other debris. The species has also been readily collected in Malaise traps. In North America, it is active from early spring to the end of summer.

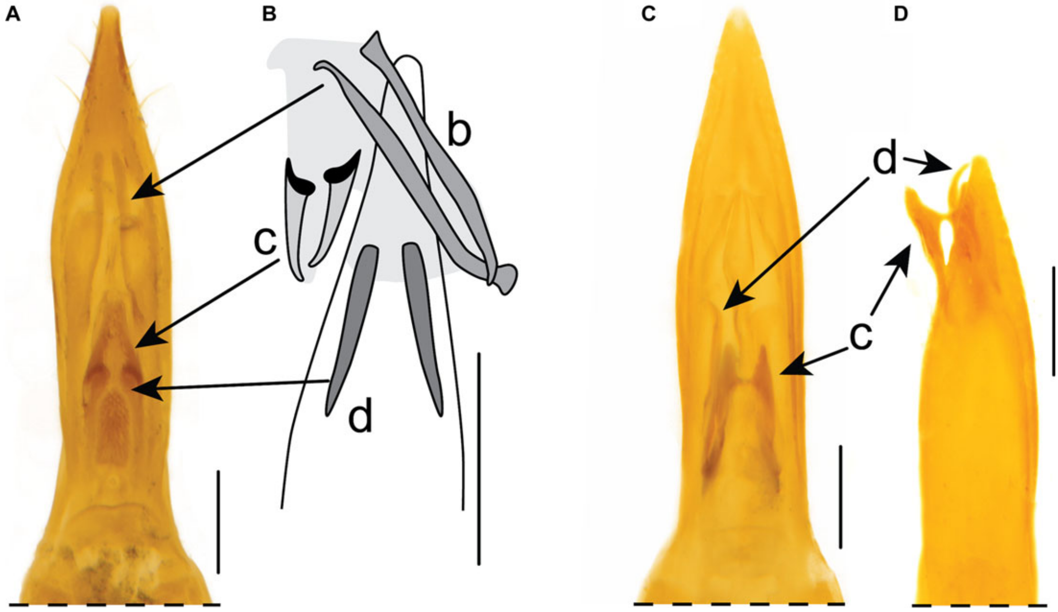

Figure 3. Male genitalia of *Heterothops cognatus* Sharp and *H. praevius* Erichson: **A,** *H. cognatus*, non-type male, internal sac *in situ*, and **B,** internal sac everted; and **C**, *H. praevius*, non-type male from Slovakia, internal sac *in situ*, and **D**, *H. marmotae* Smetana **syn. nov.** (= *H. praevius*) holotype male, internal sac partly everted. Lowercase letters refer to internal sac sclerites following the scheme of Israelson (1979). Scale bars = 0.1 mm.

Comments. The earliest record of this adventive species in North America is based on two specimens from Northampton, Massachusetts, United States of America, collected in 1971. By 1977, it had reached as far south as Alabama, United States of America, and is known from southern Canada (Ontario) as early as 1985. This species is now quite common in eastern North America and can be readily collected from sifted litter in urbanised and rural areas.

Heterothops praevius **Erichson, 1839**

Figs. 1B, 2D, 3C, 3D, 7B

BIN BOLD: AAX0829

Heterothops praevius Erichson (1839: 480); Israelson 1979 (diagnosis in West Palaearctic); Assing and Schülke 2012 (diagnosis in Central Europe); Schülke and Smetana 2015 (distribution, *H. niger* Kraatz as synonym)

Heterothops niger Kraatz (1868: 352)

Heterothops marmotae Smetana (1971b: 1837) **new synonym**

Diagnosis. In eastern North America, *H. praevius* can be identified by the following combination of characters: eyes distinctly shorter than temples, head transverse, with a broad neck, and very sparse microsculpture of the head and pronotum, with spaces many times broader than lines (Fig. 2D).

Type material. The type material of Palaearctic *Heterothops praevius* was not studied because the species is well-known and illustrated in detail (*e.g.*, Israelson 1979).

Heterothops marmotae Smetana, 1971 **new synonym**

Holotype (male, CNC): Ontario, Ottawa, Kanata, 26.iv.69, Smetana [type label]/Marmota burrow [typed label]/HOLOTYPE *Heterothops marmotae* Smetana, 1968 CNC No. 4463 [red typed and handwritten label]/CNC1589889 [identifier]. **Paratype (male, CNC): CANADA: Ontario:** Kanata, *Marmota* burrow, 25.iv.1969, A. Smetana.

The everted internal sac of the male paratype of *H. marmotae* bears the characteristic pair of long sclerites of Palaearctic *H. praevius*, which are expanded at the apex into a circular or ovoid flange (illustrated in Smetana 1971b, Fig. 3, for *H. marmotae*; everted sclerite "d" illustrated by Israelson 1979, Fig. 10). If the sclerites are viewed *in situ* or in a partly everted state such as that of the male holotype, the apices of sclerite "d" may instead appear as thin, laterally pointing hooks (*e.g.*, Fig. 3C and 3D; Israelson 1979, Fig. 10). It was also possible to view the paired short sclerites (sclerite "c" of Israelson 1979) on the holotype preparation (Fig. 3D), which each bear a median tooth and together form a basal "H"-shape when the internal sac is *in situ* or partly everted. These short sclerites are identical to those found in *H. praevius* (Fig. 3C); it was not possible to match the "triangular plate" illustrated in Smetana (1971b) with the sclerites of the holotype. This may be an artefactual amalgamation of overlapping, paired sclerite "c." A non-type male (the only other Nearctic male available) collected at the same site as the type series was observed to have the same morphology of the internal sclerites as the holotype of *H. marmotae* and non-type European specimens of *H. praevius*.

Non-type material. CANADA: Ontario: *Ottawa Region*: Kanata, *Marmota* burrows, 12.v.1972, A. Smetana (3, CNC); *Prince Edward County*: 20.vi.1962, J.F. Brimley (1, CNC). **CZECHIA:** Bohemia, Plačice, Smetana 1947 (1, CNC); Bohemia, Kukleny, 1947, Smetana (1, CNC). **DENMARK:** Sealand [= Zealand], Boserup, mole nest, E.C. Rosenburg (1, CNC).

DNA-only record. CANADA: Ontario: *Kawartha Lakes*: east of Orange Corners, Meadowview Rd., farm, 44.296, –78.452, 290 m, Malaise trap, 24.vi.2016, B. McClenaghan (ProcID: BARSM1095–17) (1, CBG).

Distribution. Adventive: Canada (Ontario). **Native:** Trans-Palaearctic; Europe (including European Russia), North Africa (Algeria), Middle East (Afghanistan, Iran), Mongolia, Uzbekistan, and eastern Russia, including the Far East.

Bionomics. In the Palaearctic, *H. praevius* occurs in a variety of anthropogenic habitats, especially in hay and straw piles but also in a variety of other types of decaying vegetation and wood (Assing and Schülke 2012). The species also occurs frequently in mammal nests, including those of badgers and moles (Lott 2008). In North America, *H. praevius* has been found in groundhog burrows, and one recent specimen was collected in a Malaise trap placed on a farm.

Comments. Before the present study, *Heterothops marmotae* was an eastern species known only from a single site near Ottawa, Ontario, and collected exclusively in groundhog burrows. In addition to having the same internal sclerites and shape of the median lobe, all specimens of *H. marmotae* are externally indistinguishable (microsculpture, eye size, colouration, subapical antennomere shapes) from the pale form of Palaearctic *H. praevius*. We continue to treat the darker form of *H. praevius* (previously as *H. niger* Kraatz) as colour polymorphism (as in Assing and Schülke 2012), but this question was outside of the scope of the present study. A partial *CO*1 barcode sequence was obtained from a non-type, female specimen of *H. marmotae* (307 bp; BOLD ProcID: CNCCJ3027-14), collected by A. Smetana from the same site as the type series (records in Smetana 1973) and during the same collecting event as the examined dissected male (see above). This partial sequence matched sequences of *H. praevius* in BOLD with 100% identity. Recently, a specimen from Kawartha Lakes, Ontario was collected in a Malaise trap and produced a full-length barcode that also matched *H. praevius* with 100% identity, consistent with the hypothesis that the species known in North America as *H. marmotae* is indeed *H. praevius* and continues to be established there (at least in northeastern Ontario), despite few records. All undetermined *Heterothops* from eastern North America at the CNC were screened for additional records of *H. praevius*, which resulted in the discovery of one female collected from Prince Edward County, Ontario, in 1962. This site is just east of the most recent record of the species and represents the oldest known occurrence of *H. praevius* in North America, pre-dating the type series of *H. marmotae*.

Heterothops conformis Smetana, 1971

Fig. 2E

BIN BOLD: ACT2650

Heterothops conformis Smetana (1971a: 30); Smetana 1973 (additional records); Smetana 1978 (additional records)

Diagnosis. In eastern North America, *Heterothops conformis* can be recognised by the following combination of characters: eyes at least slightly smaller than temples; head longer than wide; antennomere 2 distinctly paler at base (Fig. 2E).

Type material. B.C., 8 mi. W. Creston, VI.10.1968, Campbell & Smetana [printed label]/ex river debris [printed label]/HOLOTYPE *Heterothops conformis* Smetana, 1968, CNC No. 10849 [red printed label, partly handwritten].

Non-type material. CANADA: British Columbia: Vancouver Island, 21 km SW Campbell River, 49° 51′ 55” N, 125° 27′ 51″ W, “Balsam CrLT-1B,” 29.vi–9.vii.1996 (1, CNC); same except “Balsam CrLT-1A,” 22.v–6.VI.1996 (1, CNC); **Ontario:** *Sudbury District*: ~22 km SW Chapleau, Island Lake Biomass, Clearcut (2011), 47° 41.66′ N, 83° 35.60′ W, pitfall, 1–14.v.2012, L. Venier (2, CNC); same except 11–25.vi.2012 (1, CNC); *Thunder Bay District*: Manitouwadge, Caramat Side Rd., Rudder Lake Creek, under old grass beside creek, 22.vii.1992, T. Bakker (1, CNC); Manitouwadge, #1 rail crossing, under pine log, 20.vi.1990, T. Bakker (1, CNC); Manitouwadge, Wowan Lake Road, under poplar bark, 18.v.1987, T. Bakker (1, CNC). **UNITED STATES OF AMERICA: California:** *Shasta County*: Lassen National Park, Manzanita Lake, 1783 m, 15.vii.1979, J.M. Campbell and B.A. Campbell (1, CNC).

DNA-only records. CANADA: Alberta: NE of Peace River, chip residue pile 2002, 56.635, –116.933, 551 m, 11.vi.2008, ProcID: COLNF2002–15 (1, NFC); same except 57.239, –116.738, 457 m, 7.viii.2008 (1, NFC); **British Columbia:** Spences Bridge, Highland Valley Copper Mine, 50.4793, –121.0264, 1261 m, Malaise trap, 9.viii.2017, L. Fraser, ProcID: LFBC1028-18 (1, CBG).

Distribution. Native: Canada (Alberta, British Columbia, Ontario); United States of America (Arizona, California, Colorado, Idaho, New Mexico, Nevada, Oregon, Washington).

Heterothops conformis is a classic boreomontane species that has been previously overlooked outside of the western cordilleras. It is here newly reported from Alberta (east of the Rockies) and Ontario, and its distribution is very likely transboreal across Canada.

Bionomics. This species has been collected in river debris (Smetana 1971a), leaf litter, and under pieces of wood in a montane forest and in wet debris near a stream (Smetana 1971b), willow and aspen litter along canal and swamp edges (Smetana 1973), moss along a waterfall, and under stones near springs (Smetana 1978). The Alberta specimens were collected in the chip residue piles left after forest cutting. The Ontario specimens were collected in a clear-cut, in old grass near a creek, under a log, and under bark.

Comments. Until the present study, *H. conformis* was considered to be a western montane species. An examination of the available barcode data revealed two specimens from boreal Alberta, east of the Rockies, that belong to the same BIN as the examined specimen listed above from Shasta County, California, United States of America. Six additional specimens from two localities in northern Ontario (all females) correspond perfectly with the above diagnosis and are considered conspecific with *H. conformis.* Although it can be reliably separated from *H. fumigatus* by the colouration of the basal antennomeres (unlike *H. sordidus*), *H. conformis* is likely its sister species, based on the shared central sclerotised area of the internal sac that is basally positioned *in situ* (see Smetana 1971a) and the observation that these species’ barcode sequences form sister clusters.

Heterothops sordidus Smetana, 1971

Figs. 2F, 2H

BIN BOLD: ACU5289

Heterothops sordidus Smetana (1971a: 32); Smetana 1973 (additional records); Smetana 1981 (additional records)

Diagnosis. In eastern North America, *Heterothops sordidus* can be identified using the following combination of characters: eyes smaller than temples (Fig. 2F); antennomeres 1–3 uniformly pale (Fig. 2F); abdominal tergites III–IV without posterior transverse basal line (Fig. 2H). In eastern North America, it is the only species to entirely lack the posterior transverse basal line.

Type material. B.C., 8 mi. W. Creston, VI.10.1968, Campbell & Smetana [printed label]/ex river debris [printed label]/HOLOTYPE *Heterothops sordidus* Smetana, 1968, CNC No. 10 851 [red printed label, partly handwritten].

Non-type material. CANADA: Northwest Territories: 10 miles NW Fort Simpson, Martin River, 20.vi.1972, A. Smetana, ProcID: CNCCJ3020-14 (1, CNC). **UNITED STATES OF AMERICA: Alaska:** Prudhoe Bay Road, Bonanza Creek, 66.667, −150.667, 274 m, 9.vii.1978, J.M. Campbell, ProcID: CNCCJ3022-14 (1, CNC).

DNA-only records. CANADA: Manitoba: Winnipeg, Ecole Precieux-Sang, 49.878, −97.12, Malaise trap, 20.iv.2015, S. Hamilton, ProcID: SMTPL5848-15 (1, CBG); Winnipeg, Landmark Collegiate, 49.669, −96.818, 240 m, Malaise trap, 20.iv.2015, S. Hiebert, ProcID: SMTPM603–15 (1, CBG). **Saskatchewan:** Yorkton, M.C. Knoll Elementary School, 51.217, −102.433, 499 m, Malaise trap, 8.v.2015, S. Muir, ProcID: SMTPL8062-15 (1, CBG).

Distribution. Native: Canada (British Columbia, Manitoba, Northwest Territories, Saskatchewan); United States of America (Alaska).

Heterothops sordidus is a northern species that is newly reported here from Saskatchewan and Manitoba. As it occurs in the Taiga and south to Winnipeg, it is likely transcontinental.

Bionomics. This species has been collected from river flood debris (Smetana 1973), mouldy piles of straw containing mice nests, and in pitfall traps in a spruce forest (Smetana 1981).

Comments. *Heterothops sordidus* was originally described from British Columbia (Smetana 1971a) and later found in the Taiga of interior Alaska and Northwest Territories (Smetana 1973, 1981). Here we report it from much farther south and east of its prior-known distribution and propose that it is a widespread transcontinental species that has been overlooked in the east.

Key to *Heterothops* of eastern North America

With the recent transfer of two eastern *Heterothops* to genus *Chiquiticus* by Reyes-Hernández and Solodovnikov (2024), the detection of two adventive species, and the discovery of two western species in eastern Canada, the composition of *Heterothops* in eastern North America now differs drastically from that depicted in Smetana (1971a) and Smetana's (1978) updated Nearctic key. We here provide a novel key below, based entirely on stable external differences. The key should work for *Heterothops* within an area including Manitoba, south to eastern Texas, and eastwards.

1. Head with only one interocular puncture; pronotum with dorsal rows very widely spaced (Fig. 2A); apical antennomere conspicuously elongate, distinctly more than twice as long as penultimate antennomere (Fig. 2A) . . . . *Chiquiticus* Reyes-Hernández and Solodovnikov (previously *H. campbelli* and *H. pusio*; see Reyes-Hernández and Solodovnikov 2024)

– Head with two or, rarely, three interocular punctures (*e.g.*, Fig. 2B); pronotum with dorsal rows in usual position along either side of midline (as in Fig. 2C); apical antennomere less than twice as long as penultimate antennomere (Fig. 1A and 1B) 2

2. Maximum length of eyes longer than temples (Fig. 2B and 2C) 3

– Maximum length of eyes slightly to distinctly shorter than temples (Fig. 2D and 2F) . . . 4

3. Minute, narrower-bodied species (3.4–4.0 mm), pronotum only about 1.2 times as wide as head (Fig. 2C); antennomeres entirely dark, except for base of antennomere 2; elytra without paler apex; northern, boreal species, occurring in bogs in the southernmost part of its distribution . . . . *H. minor* Smetana (BOLD BIN: ACU3133)

– Much larger, more strongly fusiform species (>4.0 mm), pronotum about 1.4 times as wide as head (Fig. 1A); antennomere 1 much paler than 2–11, at least ventrally (Fig. 2B); elytra with distinctly paler apex (Fig. 1A); East Palaearctic species, widespread adventive, and common in a variety of habitats in eastern North America . . . . *H. cognatus* Sharp (BOLD BIN: AAU7313)

4. Head transverse, with temples weakly converging to a broader neck (Fig. 2D); microsculpture of the head and pronotum with lines markedly sparse (Fig. 2D); Palaearctic species, adventive in at least Canada (Ontario) . . . . *H. praevius* Erichson (= *H. marmotae* Smetana **syn. nov.**) (BOLD BIN: AAX0829)

– Head elongate, with temples more strongly converging to narrower neck (Fig. 2E and 2F); microsculpture of the head and pronotum with lines much denser (Fig. 2E and 2F) 5

5. Antennomere 2 distinctly paler at base, antennomere 1 usually as pale as base of antennomere 2 (Fig. 2E); pronotum dark reddish to brownish (Fig. 2E); boreomontane species that is probably transcontinental in the north, east to at least Ontario . . . . *H. conformis* Smetana (BOLD BIN: ACT2650)

– Antennomeres 1–3, or rarely 1–2, uniformly coloured and distinctly paler than other antennomeres (Fig. 2F); pronotum pale orange to yellow, rarely darkened medially 6

6. Abdominal tergites III–IV with at least medial fragment of posterior transverse basal line (in line with spiracles; Fig. 2G); widespread in North America, species in need of revision . . . . *H. fumigatus* LeConte (previously as *H. fusculus* LeConte) (BOLD BIN: ACU7125, BIN: ACU5449)

– Abdominal tergites III–IV without posterior transverse basal line (Fig. 2H); boreomontane species that is probably transcontinental in the north, east at least to southeast Manitoba . . . . *H. sordidus* Smetana (BOLD BIN: ACU5289)

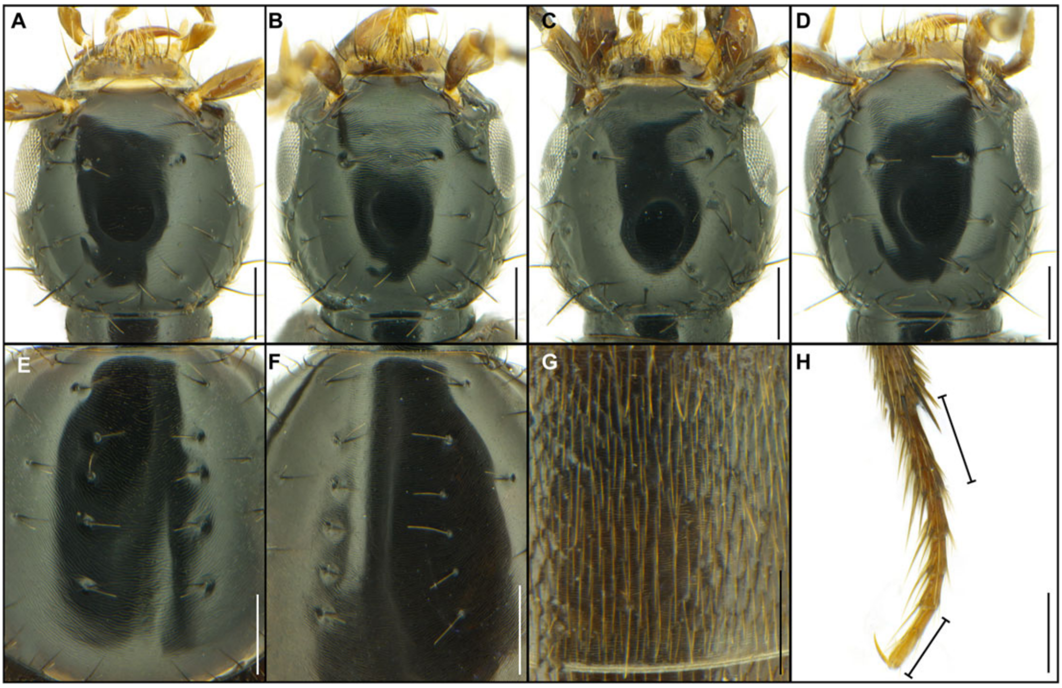

Figure 4. Dorsal heads of *Philonthus debilis* (Gravenhorst) (**A**, male and **C**, female) and *P. chujoi* Dvořák (**B**, male and **D**, female); pronota of **E**, *P. chujoi* and **F**, *P. sericans* (Gravenhorst); **G**, microsculpture of abdominal tergite VII in *P. debilis*; and **H**, metatarsus of *P. chujoi*. Scale bars = 0.2 mm.

Philonthina Kirby, 1837

Philonthus Stephens, 1829

Rufipes group. In the most recent revision of Nearctic Philonthina (Smetana 1995), *P. debilis* was included in the Immundus Group following the concept of Coiffait (1967). The group was diagnosed based on the sharply acute apex of the paramere, the two regular rows of peg setae that do not reach the apex, and the position of a pair of normal setae basal to the basalmost peg setae (Coiffait 1974). Since then, the Palaearctic species previously known as *P. immundus* Gyllenhal is now referred to as *P. rufipes* (Stephens) (Smetana and Herman 1999), so the species group should now be known as the Rufipes Group. In addition to West Palaearctic species (*P. debilis*, *P. immundus*, *P. aculeatus* Coiffait, and *P. gagates* Mulsant and Rey), the group also has a close relative in the East Palaearctic, *P. chujoi* Dvořák (Schillhammer 2024). Unlike the others, *P. chujoi* has a rounded apex of the median lobe but otherwise shares the acute apex of the paramere, arrangement of peg setae into two rows, eyes shorter than the temples, five punctures in each dorsal row, sparse microsculpture of the head and pronotum (space between lines distinctly greater than line width), and the distinct transverse microsculpture on the abdominal tergites (Figs. 4 and 5). Some of these characters were used to identify the pair *P. debilis* and *P. rufipes* in Central Europe, where they are the only members of the group (*e.g.*, Assing and Schülke 2012). The Rufipes Group is strictly Palaearctic, although *P. debilis* and *P. chujoi* have become adventive in the Nearctic (see below), likely as a result of their affinity to rapid decay microhabitats like compost.

Together, *P. debilis* and *P. chujoi* can be readily distinguished from the superficially similar, common Nearctic species *P. sericans* (Gravenhorst), which occurs in the same microhabitats, by the sparse microsculpture of the head and pronotum alone (Fig. 4E; lines and spaces of about equal width in *P. sericans* (Fig. 4F)). Most specimens of the Rufipes Group have five punctures in

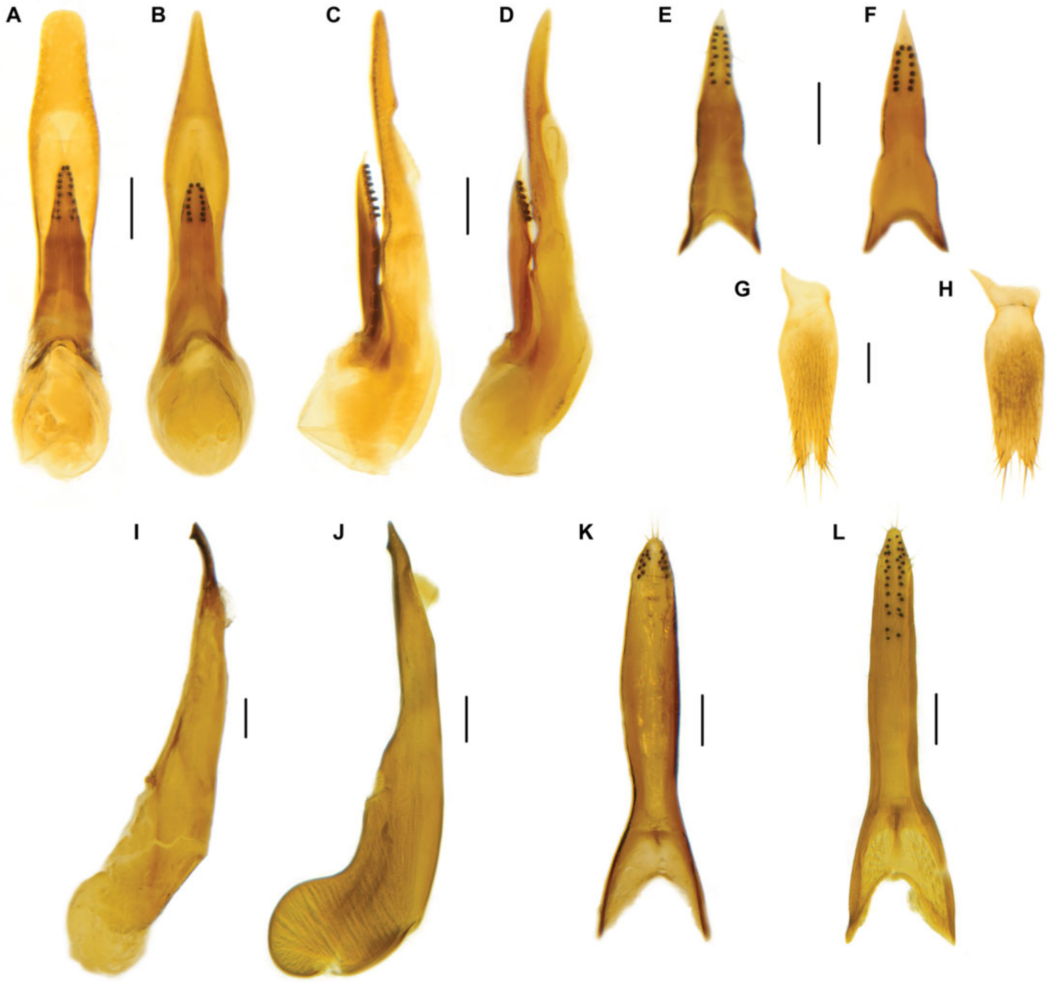

Figure 5. Male genitalia of the following species: **A**, **C**, **E**, and **G**, *Philonthus chujoi* Dvořák; **B**, **D**, **F**, and **H**, *P. debilis* (Gravenhorst); **I** and **K**, *Quedius* (*Raphirus*) *maurorufus* (Gravenhorst); and **J** and **L**, *Q.* (*R.*) *sublimbatus* Mäklin; **A** and **B**, aedeagi in ventral view; **C**, **D**, **I**, and **J**, aedeagi in lateral view; **E**, **F**, **K**, and **L**, underside of parameres; **G** and **H**, male sternites IX. Scale bars = 0.1 mm.

the dorsal row of the pronotum, whereas *P. sericans* has at least six, but rare individuals of *P. chujoi* have been seen with six in one row. Other somewhat similar species in compost include adventive *P. ventralis* (Gravenhorst) and *P. discoideus* (Gravenhorst), but these species have the first metatarsomere slightly shorter than the apical one, whereas the members of the Rufipes Group have the first metatarsomere slightly longer (Fig. 4H).

Philonthus chujoi Dvořák, 1958

Figs. 1C, 4B, 4D, 4G, 5A, 5C, 5E, 5G, 7C

BINS BOLD: AAU6969 and BOLD: ACU4940

Philonthus chujoi Dvořák (1958: 138); Shibata *et al.* 2013 (distribution in Japan); Cho 2014 (distribution in South Korea); Schillhammer 2024 (synonymy, species chosen as senior synonym as first reviser)

Philonthus azabuensis Dvořák (1958: 137); Schillhammer 2024 (synonymy)
Philonthus yokohamus Dvořák (1958: 138); Schillhammer 2024 (synonymy)

Diagnosis. In the Nearctic fauna, *P. chujoi* is most similar to *P. debilis* and can be distinguished by the more elongate head that is subquadrate in males and slightly elongate (~0.95 width/length) in females (Fig. 4B and 4D). The aedeagus is markedly different in ventral view, with a rounded apex of the median lobe and a longer paramere bearing longer rows of peg setae (Fig. 5A and 5E). The shape of female tergite X was found to overlap in the two species.

Type material. Photos of the male genitalia and head of a Nearctic specimen were found to correspond well with the type series of *P. chujoi* deposited in the Slóvenske Národné Múzeum (Bratislava, Slovakia) and studied by Harald Schillhammer (Schillhammer, personal communication). Recently and in preparation for the present study, Schillhammer (2024) synonymised *P. azabuensis* Dvořák and *P. yokohamus* Dvořák with *P. chujoi* and reported that the differences shown in the illustrations of the aedeagi for these species (Dvořák 1958) were not observed on the actual specimens.

Non-type material. JAPAN: Honshu: *Ibariki*: Tsukuba, pan and flight traps, 6–26.v.1989, M. Sharkey (2, CNC).

CANADA: Ontario: *Toronto Region*: Toronto, John Polanyi Collegiate Institute, 43.7176 N, 79.4396 W, 180 m, 20.iv.–8.v.2015, N. Anthony, BIOUG21939-D03, BIOUG21939-E04 (2, CBG); *Middlesex County*: London, St. Thomas Aquinas Catholic Secondary School, 42.9708 N, 81.3371 W, 3.v.2013, L. McAdam, BIOUG05630-F06 (1, CBG); *Ottawa Region*: Ottawa, 1305 Normandy Crescent, 1–15.v.2010, H. Goulet (3, CNC); Ottawa, Britannia Conservation Area, Mud Lake, 45.367 N, 75.793 W, forest edge, sifting litter, 4.iv.2021, A. Brunke (11, CNC); *Wellington County*: Puslinch Township Concession 11, 43.54, −80.14, 320 m, 10.vii.2010, P. Hebert, BIOUG01144-D11 (1, CBG); same except 22.v.2010, 10PHMAL-0285 (1, CBG). **Quebec:** *Agglomération de Québec*: St-Augustin-de-Desmaures, Ch. Cabouron, 46.7445 N, 71.5523 W, sifting old hay in an open field, 31.x.2024, N. Bédard (2, cNB); *municipalité régionale de comté des Deux-Montagnes*: Parc National d'Oka [collected with permit], 45.4764 N, 74.0542 W, compost site, white tulle flight-interception trap, 16.vi.2023, R. Vigneault (1, cNB); same but 1.vi.2024, L. Leclerc (3, cLC); *municipalité régionale de comté de Marguerite-D'Youville*: Varennes, flying, 27.iv.2009, C. Chantal (1, cCC); *municipalité régionale de comté de Portneuf*: Pont-Rouge, Rue Paradis, 46.7526 N, 71.7196 W, sandpit, sifting dead leaves and vegetation, 22.iv.2023, N. Bédard (3, cNB); *Ville de Gatineau*: Aylmer, [Ouest Forêt Boucher], Berlese of porcupine dung in a hollow base of a large maple tree, in a mixed forest, 6.iv.2010, V. Théberge and L. LeSage (18, CNC); same except 15.iv.2010 (5, CNC); same except 3.v.2010 (6, CNC); same except 12.v.2010 (3, CNC); same except 18.vi.2010 (24, CNC); same except 31.iii.2010 (1, CNC); *Ville de Québec*: Québec, La Cité-Limoliou, 46.7950 N, 71.2284 W, compost site, sifting wood chips, 9.ix.2023, L. Leclerc (4, cLC); Ste-Foy, Cité-Universitaire, 46.7863 N, 71.2686 W, compost site, sifted from a compost heap, 27.iv.2023, L. Leclerc (7, cLC); same but white tulle flight-interception trap, 5.v.2023 (3, cLC); Rue Frank-Carrel, 46.7921 N, 71.2285 W, sifted from dried vegetal debris, 12.v.2023, L. Leclerc (1, cLC); Rue Carré-Pijart, 46.7874 N, 71.2915 W, sifting compost, 22.ix.2022, N. Bédard (1, cNB); same except 1.x.2022 (3, cNB); same except L. Leclerc (4, cLC); same except P. Bloin (6, cPB; 2, LFC); same except 27.iv.2023, L. Leclerc (2, cNB): same except 29.iv.2023, N. Bédard (3, cNB).

Distribution. Adventive: Canada (Ontario, Quebec). **Native:** Japan (Honshu), South Korea. *Philonthus chujoi* is native to the East Palaearctic, including Japan and South Korea, and has become adventive and quite common in southern Ontario and Quebec. It is likely broadly distributed in eastern North America but overlooked.

Bionomics. Nothing has been previously published about this species' microhabitat preferences. In the Nearctic, it lives in a similar way to *P. debilis*: in compost and other rapid decay microhabitats but also in litter at the edge of a forest in early Spring. In Quebec, both species have been frequently collected together in compost.

Comments. *Philonthus chujoi* is here reported from North America for the first time, based on numerous specimens collected in southern Ontario and Quebec. The earliest known record is dated 2009 from southern Quebec. This species is native to the East Palaearctic, including Japan and South Korea (Shibata *et al.* 2013; Cho 2014). Unlike *P. debilis*, which has become extremely widespread in North America since becoming established sometime before 1857 (Smetana 1995; "1957" listed in Klimaszewski and Brunke 2018 is a typo for 1857), *P. chujoi* seems to be a much more recent addition to the Nearctic fauna. Currently, the available barcode data from North America (all from southern Ontario) forms two clusters, each of which is assigned a BIN. A male from each of these BINs was dissected, and no differences could be found in the male genitalia or externally. The distance between BINs is approximately the same as that observed within the single BIN corresponding to *P. debilis*, and it is likely that further sequencing, especially in its native, Palaearctic range, will reveal additional haplotype diversity and collapse these two BINs into one.

Philonthus debilis (Gravenhorst, 1802)

Figs. 4A, 4C, 4G, 5B, 5D, 5F, 5H

BIN BOLD: ABV1529

Staphylinus debilis Gravenhorst (1802: 35)

Philonthus debilis (Gravenhorst): Smetana 1995 (summary of important references, Nearctic distribution, diagnosis)

Diagnosis. In the Nearctic, *P. debilis* is most similar to *P. chujoi* and can be distinguished by the shape of the head, which is transverse in males (~1.1 width/length) and subquadrate in females (Fig. 4A and 4C). The pointed apex of the median lobe also distinguishes it immediately from *P. chujoi*. The aedeagus and external morphology of Nearctic *P. sericans* are superficially similar, but this species can be distinguished easily by the denser microsculpture and six punctures of the dorsal row (Fig. 4F).

Non-type material. CANADA: Yukon: Whitehorse, Granger, compost, 5.ix.2005, 'EP-Yukon (2, CNC).

Distribution. Adventive: Canada (Alberta, British Columbia, Manitoba, Ontario, New Brunswick, Newfoundland and Labrador, Nova Scotia, Quebec, Prince Edward Island, Saskatchewan, Yukon Territory); United States of America (Arizona, California, Colorado, Connecticut, District of Columbia, Florida, Idaho, Illinois, Indiana, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, New Hampshire, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Utah, Virginia, Washington, West Virginia, Wisconsin, Wyoming). **Native:** Trans-Palaearctic species, from Europe and North Africa to the Russian Far East, Mongolia, northeastern China, and Japan (Newton 2025).

Philonthus debilis is an extremely widespread adventive species in North America but is somewhat limited by the climate of the far north. However, it likely can persist farther north in urban compost piles that are perpetually much warmer than their surroundings. The new record above from Whitehorse, Yukon Territory, likely represents such an occurrence.

Bionomics. *Philonthus debilis* lives in a variety of litter-based microhabitats in disturbed habitats and along ecotones and can be quite abundant in rapid decay microhabitats such as compost.

Comments. The identification key in Smetana (1995) contains an error that would not allow *P. debilis* to key correctly. Couplet 39 should lead to couplet 42, not 41, and couplet 40 should lead to 41 in the second half. The only way to arrive at *P. debilis* is to select "eyes at least as large as temples." This is clearly a mistake because the eyes are correctly stated elsewhere in Smetana (1995) to be shorter than the temples. We correct this below and modify the couplets to accommodate *Philonthus chujoi*.

Updated, corrected couplets to the Nearctic *Philonthus* key of Smetana (1995)

39. Eyes small, each seen from above shorter than temples (ratios 0.74–0.85) 40

– Eyes larger, each from above at least as long as temple 42

40. Punctures on head and pronotum conspicuously large and deep, pit-like. Pronotum narrowed posteriad, lateral margins each distinctly concave posteriorly in front of basal margin. Aedeagus as in figs. 1405–1407. Length 7.0–9.1 mm . . . Nudus Group . . . . *Philonthus nudus* Sharp

– Punctures on head and pronotum fine. Pronotum narrowed anteriad, lateral margins each slightly arcuate or parallel to each other posteriorly in front of basal margin. Aedeagus different 41a

41a. Small, length not exceeding 5.7 mm. Head and pronotum with fine and rather sparse microsculpture, interspaces between striae distinctly wider than diameters of striae. Pronotum slightly iridescent. Paramere of aedeagus entire (fig. 258). Length 4.2–5.7 mm . . . Rufipes Group [previously Immundus Group] 41b

– Large, length over 5.7 mm. Head and pronotum with exceedingly fine and dense microsculpture, interspaces between striae not wider than diameters of striae. Pronotum not iridescent. Paramere of aedeagus bilobed (fig. 344). Length 5.8–8.2 mm . . . Furvus Group . . . . *P. umbrinus* (Gravenhorst) (pars)

41b. Head transverse in males, subquadrate in females; median lobe of aedeagus with pointed apex in ventral view . . . . *P. debilis* (Gravenhorst)

– Head subquadrate in males, elongate in females; median lobe of aedeagus with rounded apex in ventral view . . . . *P. chujoi* Dvořák

Quediina Kraatz, 1857

***Quedius* (*Raphirus*) Stephens, 1829**

A phylogenomic study of Quediina by Brunke *et al.* (2021a) revealed that the subgenus *Raphirus* was highly polyphyletic and requires revision. The subgenus has never had a robust morphological definition that works for all included species, and this is even a problem within specific regions, such as the Nearctic (*e.g.*, Smetana 1971a). Some very distantly related lineages, previously associated with *Raphirus*, have recently been elevated to genus level (Brunke 2022), but much taxonomic work remains to be completed. Brunke *et al.* (2021a) proposed that their Clade X would represent a suitable future concept for *Raphirus*, but it is still not possible to provide a global, morphological diagnosis of this group or of the Raphirus lineage in its entirety without novel morphological characters (A.J.B., unpublished data). In the meantime, we provide a short key below, limited in scope to the two eastern North American members of Clade X *sensu* Brunke *et al.* (2021a), which can be recognised among other Quediina by the following combination of characters: head with single basal puncture, without interocular punctures; labrum with median notch; scutellum impunctate; and elytra with evenly distributed punctation, never with meshed microsculpture but sometimes with irregular micropunctures between the setose punctures. Clade X is quite poorly represented in the Nearctic, although one West Palaearctic species has recently become adventive (see below).

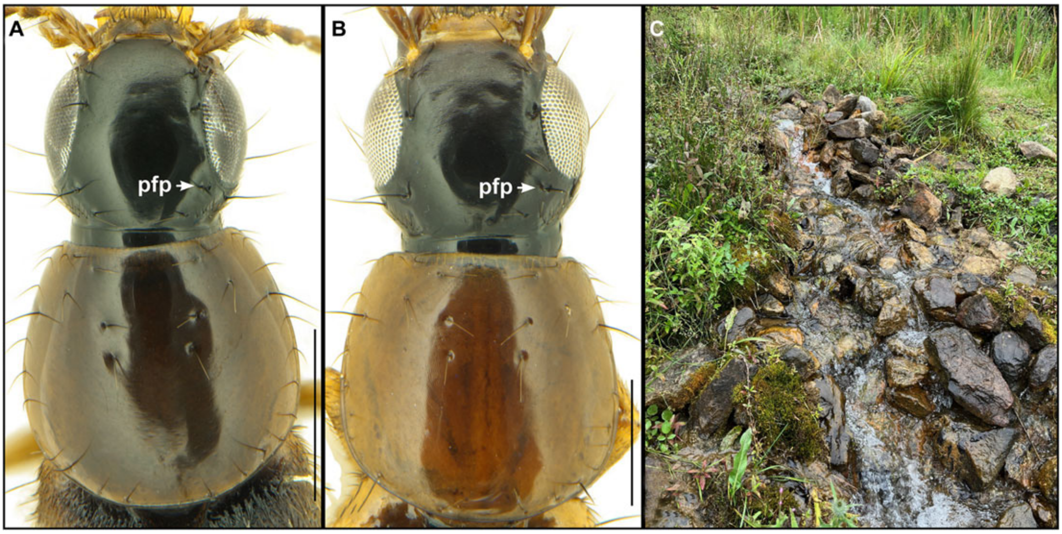

Figure 6. Dorsal forebodies of the following species: **A**, *Quedius* (*Raphirus*) *maurorufus* (Gravenhorst); and **B**, *Quedius* (*Raphirus*) *sublimbatus* Mäklin. **C**, Microhabitat of adventive *Q. maurorufus*, a groundwater-fed creek near Barrie, Ontario, Canada (photo by K. Brunke, used with permission). pfp = posterior frontal puncture. Scale bars = 0.5 mm.

***Quedius* (*Raphirus*) *maurorufus* (Gravenhorst, 1806)**

Figs. 5I, K, 6A, 6C, 7D

BIN BOLD: AAX9863 and BOLD: ACZ1264

Staphylinus maurorufus Gravenhorst (1806: 56)

Quedius (*Raphirus*) *maurorufus* Gravenhorst; Assing and Schülke (2012) (diagnosis, biology); Salnitska and Solodovnikov (2019) (diagnosis, Russian records doubtful)

Diagnosis. In eastern North America, *Q. maurorufus* can be recognised as a member of *Quedius* (*Raphirus*) Clade X *sensu* Brunke *et al.* (2021a) based on the following characters: head with single basal puncture, without interocular punctures; labrum with median notch; scutellum impunctate; and elytra with evenly distributed punctation, never with meshed microsculpture but sometimes with irregular micropunctures between the setose punctures. *Quedius maurorufus* can be externally distinguished from the only other eastern North American member of Clade X, *Q. sublimbatus* Mäklin, by the larger eyes and longer and wider pronotum (Fig. 6A). More obvious differences may be found on the male genitalia (Fig. 5).

Type material. The type material of this well-known and illustrated (*e.g.*, Assing and Schülke 2012) species was not studied.

Non-type material. CANADA: Ontario: *Northumberland County*: Peter's Woods Provincial Nature Reserve, 44.12417, −78.03917, moss, 6.x.2011, A. Brunke, ProcID: QUEDB084–19 (1, DEBU); same except cold wet moss on rocks in stream and at edge of spring, 15.ix.2011, A. Brunke (7, DEBU); *Oxford County*: 17 km NE Tillsonburg, Milldale, oak litter by stream in ravine, 4.x.2005, A. Davies (1, CNC); Milldale, 45° 56′ 08″ N, 80° 35′ 08″ W, seepage area at stream in deep ravine, 25.v.2011, A. Davies (4, CNC); same except pine and beech litter by stream in ravine (3, CNC); *Simcoe County*: Minesing, forest N Barrie Sports Complex, 44° 27′ 0.36″ N, 79° 46′ 23.88″ W, spring outflow to gravel pit pond, treading moss, 24.viii.2024, A. Brunke (2, CNC); *Toronto Region*: Rouge National Park, 43.7948, −79.124, pitfall traps, 15.ix.2015, BIO Team, ProcID: RBINA341–13 (1, CBG).

Distribution. Adventive: Canada (Ontario). **Native:** Europe.

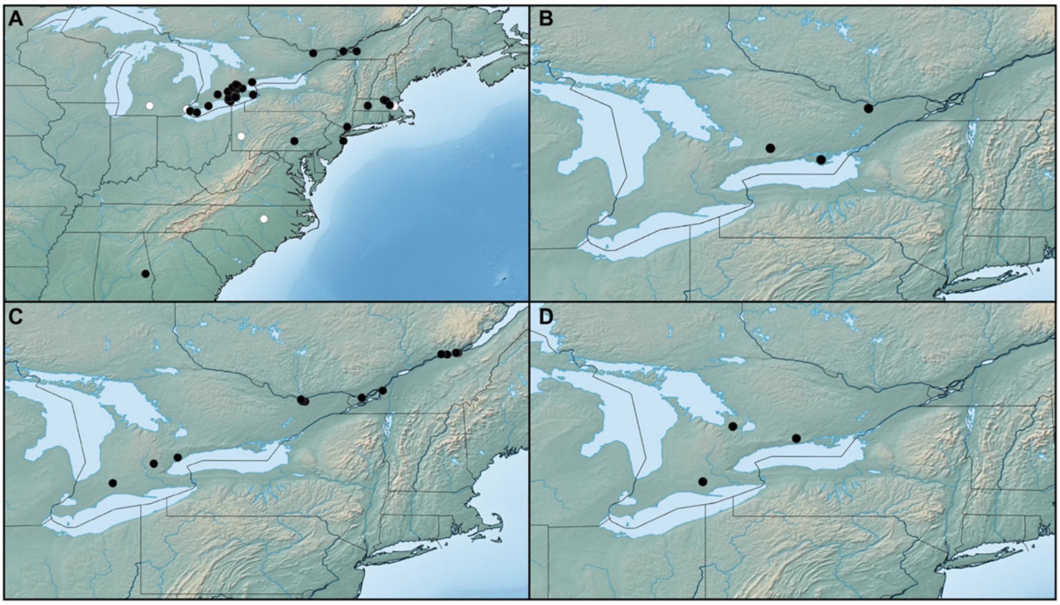

Figure 7. Adventive Nearctic distribution of the following species: **A**, *Heterothops cognatus* Sharp (white circles indicate photo records, black circles indicate specimen records); **B**, *H. praevius* Erichson; **C**, *Philonthus chujoi* Dvořák; and **D**, *Quedius* (*Raphirus*) *maurorufus* (Gravenhorst).

Quedius maurorufus is a West Palaearctic species that is widespread across Europe, but records from any part of Russia are doubtful (Salnitska and Solodovnikov 2019). In North America, it has been detected only in southern Ontario.

Bionomics. In its native range, *Q. maurorufus* is commonly found in a variety of moist microhabitats (Assing and Schülke 2012). At the time of publication, adventive populations in North America have been mostly found in or near wet, cold moss along the edges of seepages and springs and on mossy boulders in a cold, fast-flowing stream. The only other specimen was collected in pitfall traps placed in forested suburbs near the Rouge River (Toronto area) at its outflow to Lake Ontario, but the microhabitat is unknown.

Comments. Here, we report *Quedius* (*Raphirus*) *maurorufus* from North America for the first time as an adventive species, based on dissected males and several sequenced specimens that cluster amongst European specimens. Despite a complete screening of the CNC staphylinids, few North American specimens are available, and all are quite recent, with 2005 as the earliest date of detection. Nearly all specimens were collected in or near cold, wet moss associated with running groundwater-based microhabitats (Fig. 6C) that are very local on the low plains of southern Ontario and are usually quite poor in rove beetle diversity, either naturally or due to fragmentation from intense development in this region. In all three of the groundwater-associated sites, these were either the only rove beetles collected or there were only litter generalists present (*e.g.*, *Philonthus asper* Horn in the deep ravine at the Milldale locality). It is possible that *Q. maurorufus* has taken advantage of an empty or nearly empty niche in southern Ontario. The species will certainly be detected elsewhere in southern Canada and eastern United States of America, but it may be extremely local and require targeted collecting. Two barcode clusters, each representing a BIN cluster in BOLD, are only 1.28% different and are associated with this species; both sequenced Nearctic specimens belong to BOLD: AAX9863.

Key to the species of *Quedius* Clade X *sensu* Brunke *et al.* (2021a) in eastern North America

1. Eyes larger, such that the posterior frontal puncture is in line with hind margin of eye (Fig. 6A); pronotum distinctly wider and longer than head (Fig. 6A); median lobe in lateral view with apical tooth (Fig 5I); paramere with short fields of peg setae (Fig. 5K); West Palaearctic species, adventive in eastern North America . . . .*Q. maurorufus* Gravenhorst (BIN BOLD:AAX9863 and BOLD:ACZ1264)

– Eyes smaller, such that the posterior frontal puncture is just posterior to hind margin of eye (Fig. 6B); pronotum only slightly wider and longer than head (Fig. 6B); median lobe in lateral view with subapical tooth (Fig. 5J); paramere with long fields of peg setae (Fig. 5L); Holarctic species with boreomontane and Arctic distribution, unknown from southern Canada but occurring in high elevation refugia of New York and New Hampshire, United States of America . . . . *Q. sublimbatus* Mäklin (BIN BOLD: ACA9274)

Discussion

After the present study, 60 species of Staphylininae have been confirmed as adventive in North America, slightly more than the 56 species currently reported from Canada (Newton 1987; Rood *et al.* 2015; Klimaszewski and Brunke 2018; Bédard *et al.* 2024). *Philonthus* and *Quedius* are diverse genera with 17 and 8 species adventive in North America, respectively, some of which are strongly synanthropic and have become widely distributed around the world (Klimaszewski *et al.* 2013). Before the present study, no species of *Heterothops* had been reported as adventive, although Nearctic *Chiquiticus pusio*, previously *Heterothops*, was recently detected in Germany (Schülke and Renner 2020). Although *Heterothops cognatus* was present in North America before 1971, it was probably overlooked because rigorous identification of *Heterothops* species typically relies on difficult-to-observe, minute internal sclerites of the male genitalia. In the case of West Palaearctic *H. praevius*, this species was technically detected but described instead as a Nearctic species (Smetana 1971b), synonymised herein. It is important to note that Israelson's detailed and standardised study of the internal sclerites in West Palaearctic *Heterothops* was not published until 1979, and *H. praevius* (as *H. marmotae*) was not collected again in North America until 2016, providing little opportunity for reassessment. Fortunately, eastern North America is relatively poor in *Heterothops* spp., which can now be identified using external characters (see key above). We hope that this makes the genus more accessible.

The species detected as adventive in North America were first recognised through modern biomonitoring efforts, which consist of both detailed morphological study (including microdissections and curating records on citizen science–based websites) and *CO*1 barcode sequencing. The latter can be conducted on authoritatively identified specimens for building reference libraries or on a larger scale for faunistics (*e.g.*, metabarcoding of entire Malaise trap samples, as in Buchner *et al.* 2024). Through insect survey work undertaken in southern Quebec by the second and third authors of the present paper (N.B. and L.L.), with the help of collaborators, *Philonthus chujoi* was first detected after microdissections revealed male genitalia that were strongly incongruent with related and externally similar *P. debilis.* Corresponding *CO*1 barcodes were identified in BOLD after borrowing specimen vouchers from CBG and examining the database for sequences clustering near *P. debilis.* The true identity of *H. marmotae* **syn. nov.** and the detection of *Heterothops praevius* were first indicated through routine barcode clustering performed by research staff (including A.J.B.) at the Canadian National Collection of Insects, Arachnids and Nematodes. A partial sequence of *H. marmotae* had been generated several years before as part of a large reference library–building effort for Canadian Coleoptera (Agriculture and Agri-Food Canada, Genomics Research and Development Initiative) and was flagged for taxonomic follow-up. Finally, the detection of *Heterothops cognatus* began when live images of a species that did not match any known eastern *Heterothops* at the time were posted on bugguide.net in 2010. A similar integrative taxonomic approach was successful in the novel detection of adventive aleocharine rove beetles in both North America and Central Europe (Brunke *et al.* 2021b), and online citizen science observations continue to be critical for producing accurate distributions, including that of an adventive staphylinine that is rapidly expanding its range in eastern North America (Brunke 2016).

Accurate and timely detection of adventive species can be challenging in a group as diverse as Staphylinidae. It is fortunate that nearly all adventive staphylinids in North America have originated from Central Europe (Klimaszewski and Brunke 2018), one of the taxonomically best-known regions of the planet with identification resources such as Assing and Schülke (2012) and the well-illustrated Danish website https://danbiller.dk. A Eurocentric adventive fauna is a general trend in Coleoptera that are strongly connected to soil and other organic matter such as Carabidae, with 54 of 55 adventive species in Canada originating from the West Palaearctic (Klimaszewski *et al.* 2012), and many groups of Elateridae and Chrysomelidae, whose larvae develop in the soil and litter (Douglas 2011; Douglas *et al.* 2021, 2024). Both *P. chujoi* and *Q. maurorufus* appear to be recent introductions (2009 and 2005, respectively) and indicate that soil invertebrates continue to establish adventive populations in North America despite rigorous, no-soil phytosanitary requirements for importation of plants by both Canada and the United States of America (Eschen *et al.* 2015). Douglas *et al.* (2021, 2024) proposed that recent detections of soil Chrysomelidae and Elateridae may represent populations that have remained undetected at low densities since establishing in North America during 1960–1965, *via* imported plants with soil. However, trade of nonphytosanitary plants during this period was primarily with central Europe (*e.g.*, the Netherlands; Douglas *et al.* 2021), and this historical pathway therefore cannot account for the recent detections of soil invertebrates native to the East Palaearctic.

Compared to the West Palaearctic, the East Palaearctic soil invertebrate fauna is poorly known taxonomically, identification resources are generally scattered or absent, and little representation (identified or otherwise) exists in sequence reference libraries. For *Philonthus chujoi*, morphological taxonomic work (Schillhammer 2024) was needed to establish a reliable species concept and corresponding valid name before an identification could be made and published. Another case was recently solved for an adventive carabid beetle in the United States of America (Harden and Boyd 2024), when sequenced specimens were integrated into an in-progress phylogenetic dataset, which directed the authors' attention to the East Palaearctic fauna and, luckily, a recent modern description of the matching species. The situation is even more fraught for the terrestrial hammerhead flatworms (Tricladida: Geoplanidae: *Bipalium* Stimpson, *Diversibipalium* Kawakatsu *et al.*) that have become adventive in North America from the East Palaearctic (reviewed by Skvarla 2022). Due to a lack of existing taxonomic knowledge, four of the five species were described from their area of first detection (western North America, the Caribbean, the United Kingdom's Kew Botanical Gardens, *etc.*), even though the area of origin for all these species is known or thought to be in Asia (Skvarla 2022). For other pathways of introduction, including solid wood packing materials and shipping containers, the East Palaearctic has been the source of several, well-known adventive insects, including emerald ash borer, *Agrilis planipennis* Fairmaire (Coleoptera: Buprestidae), Asian longhorn beetle, *Anoplophora glabripennis* (Motschulsky) (Coleoptera: Cerambycidae), and soybean aphid, *Aphis glycines* Matsumura (Hemiptera: Aphididae), some of which have had devastating economic and ecological impacts (reviewed by Wheeler and Hoebeke 2017). In recognition of the above and potential impacts of similar introductions, the governments of Canada and the United States of America have responded by directly supporting taxonomic research on these genera in the East Palaearctic (Lingafelter and Hoebeke 2002; Jendek and Grebennikov 2011). Additional detections of East Palaearctic rove beetles in North America are in various stages of confirmation by ourselves and collaborators, further emphasising the importance of improving taxonomic knowledge of the East Palaearctic invertebrate fauna and its representation in North American biological collections, especially for poorly known soil-dwelling taxa.

Acknowledgements. The authors thank Harald Schillhammer (Vienna, Austria) for comparing detailed images of Canadian *Philonthus chujoi* with the Dvořák type material and for more than a decade of productive collaborations with A.J.B. Mikko Pentinsaari and Hume Douglas (both Agriculture and Agri-Food Canada (AAFC), Ottawa, Canada) provided important insights into East Palaearctic introductions and potential pathways. Dr. Sandrine Picq and Abdelmadjid Djoumad (LFC, Quebec, Canada) are thanked for their help in obtaining sequences for two *P. chujoi* specimens from Quebec. Pierrick Bloin, Robert Vigneault, and Claude Chantal (City of Québec, Quebec, Canada) generously shared data or donated specimens of *P. chujoi* from their collections. A.J.B. thanks Lauren Des Marteaux (AAFC, Harrow, Ontario) for providing numerous specimens of *H. cognatus* from southern Ontario Malaise trap surveys as part of AAFC's Living Labs project. The authors thank Kevin Brunke (Midhurst, Ontario, Canada) for photographing the microhabitat of *Q. maurorufus*.

Funding statement. This study received funding to A.J.B. from AAFC (Systematics of Beneficial Arthropods, J-002276).

Competing interests. The authors declare that they have no competing interests.

References

Assing, V. and Schülke, M. 2012. Die Käfer Mitteleuropas. Band 4. Staphylinidae I. Zweite neubearbeitete Auflage [The Beetles of Central Europe. Volume 4. Staphylinidae I. Second revised edition]. Spektrum Akademischer Verlag, Heidelberg, Germany. 560 pp.

Bédard, N., Brunke, A., Bloin, P., and Leclerc, L. 2024. New records of rove beetles from the province of Quebec and additional provincial records in Canada (Coleoptera, Staphylinidae). ZooKeys, **1196**: 303–329.

Brunke, A. 2016. First detection of the adventive large rove beetle *Ocypus nitens* (Schrank) in Canada and an update of its Nearctic distribution using data generated by the public. Biodiversity Data Journal, **4**: e11012.

Brunke, A.J. 2022. A world generic revision of Quediini (Coleoptera, Staphylinidae, Staphylininae). Part 1. Early diverging Nearctic lineages. ZooKeys, **1134**: 129–170.

Brunke, A.J., Bouchard, P., Douglas, H.B., and Pentinsaari, M. 2019. Coleoptera of Canada. *In* The Biota of Canada: A Biodiversity Assessment. Part 1: The Terrestrial Arthropods. *Edited by* D.W. Langor and C.S. Sheffield. ZooKeys, **819**: 361–376.

Brunke, A.J., Hansen, A.K., Salnitska, M., Kypke, J.L., Predeus, A.V., Escalona, H., *et al.* 2021a. The limits of Quediini at last (Staphylinidae: Staphylininae): a rove beetle mega-radiation resolved by comprehensive sampling and anchored phylogenomics. Systematic Entomology, **46**: 396–421.

Brunke, A.J., Newton, A.F., Klimaszewski, J., Majka, C.G., and Marshall, S.A. 2011. Staphylinidae of eastern Canada and adjacent United States – key to subfamilies; Staphylininae: tribes and subtribes, and species of Staphylinina. Canadian Journal of Arthropod Identification, **12**: 1–110.

Brunke, A.J., Pentinsaari, M., and Klimaszewski, J. 2021b. Integrative taxonomic of Nearctic and Palaearctic Aleocharinae: new species, synonymies, and records (Coleoptera, Staphylinidae). ZooKeys, **1041**: 27–99.

Buchner, D., Sinclair, J.S., Ayasse, M., Beermann, A.J., Buse, J., Dziock, F., *et al.* 2024. Upscaling biodiversity monitoring: metabarcoding estimates 31,846 insect species from Malaise traps across Germany. Molecular Ecology Resources, **25**: e14023. http://doi.org/10.1111/1755-0998.14023.

Cho, Y.B. 1996. Taxonomic study on the tribe Quediini (Coleoptera, Staphylinidae) from Korea. The Korean Journal of Systematic Zoology, **12**: 107–119.

Cho, Y.B. 2014. Insect Fauna of Korea. Volume 12. Number 18. Staphylininae, Philonthina. National Institute of Biological Resources, Incheon, South Korea. 95 pp.

Cho, Y.B. 2019. Insect Fauna of Korea. Volume 12. Number 28. Staphylininae. National Institute of Biological Resources, Incheon, South Korea. 130 pp.

Coiffait, H. 1967. Tableau de détermination des *Philonthus* de la région Paléarctique occidentale (Col. Staphylinidae) [Determination table of *Philonthus* from the western Palearctic region (Col. Staphylinidae)]. Annales de la Société Entomologique de France (N.S.), **3**: 381–450.

Coiffait, H. 1974. Coléoptères staphylinides de la région paléarctique occidentale II. Sous famille Staphilininae, tribus Philonthini et Staphylinini [Staphylinid beetles of the western Palearctic II. Subfamily Staphilininae, tribes Philonthini and Staphylinini]. Nouvelle Revue d'Entomologie, Supplément, **4**: 1–593.

Douglas, H.B. 2011. New records of European wireworm pests and other click beetles (Coleoptera: Elateridae) in Canada and USA. Journal of the Entomological Society of Ontario, **142**: 11–17.

Douglas, H.B., Dumont, S., Savard, K., and Chantal, C. 2021. Two adventive species of European Chrysomelidae (Coleoptera) new to North America: *Cryptocephalus moraei* (Cryptocephalinae) and *Psylliodes dulcamarae* (Galerucinae: Alticini), and the origins of adventive Chrysomelidae in Canada and United States of America. The Canadian Entomologist, **153**: 774–786. https://doi.org/10.4039/tce.2021.20.

Douglas, H.B., Hammond, G., Smith, T.W., Mutz, J., and Konstantinov, A.S. 2024. Palaearctic flea beetle *Phyllotreta ochripes* (Curtis) (Coleoptera, Chrysomelidae, Galerucinae), herbivore of *Alliaria petiolata* (garlic mustard), new to North America. Biodiversity Data Journal, **12**: e135576.

Dvořák, R. 1958. Seven new species of *Philonthus* from Japan. Mushi, **32**: 135–141.

Erichson, W.F. 1839. Genera et Species Staphylinorum Insectorum Coleopterorum Familiae (1) [Genera and Species of Staphylina Beetles of the Insect Family (1)]. F.H. Morin, Berlin, Germany. 400 pp.

Eschen, R., Britton, K., Brockerhoff, E., Burgess, T., Dalley, V., Epanchin-Niell, R.S., *et al.* 2015. International variation in phytosanitary legislation and regulations governing importation of plants for planting. Environmental Science and Policy, **51**: 228–237.

Frank, J.H. 1975. A revision of the New World species of the genus *Erichsonius* Fauvel (Coleoptera: Staphylinidae). The Coleopterists Bulletin, **29**: 177–203.

Frank, J.H. 1981. A revision of the New World species of the genus *Neobisnius* Ganglbauer (Coleoptera: Staphylinidae: Staphylininae). Occasional Papers of the Florida State Collection of Arthropods, **1**: 1–160.

Gravenhorst, J.L.C. 1802. Coleoptera Microptera Brunsvicensia nec non exoticorum quotquot exstant in collectionibus entomologorum Brunsvicensium in genera familias et species distribuit [Not many Brunswick Coleoptera Microptera are exotic as many exist in the collections of Brunswick entomologists distributed into genera, families and species]. Carolus Reichard, Braunschweig, Germany. 206 pp.

Gravenhorst, J.L.C. 1806. Monographia Coleopterorum Micropterorum [Monograph of Coleoptera Microptera]. Henricus Dieterich, Göttingen, Germany. 248 pp.

Harden, C.W. and Boyd, O.F. 2024. *Tachyura lutea* (Andrewes, 1925), a new adventive species of ground beetle for North America (Coleoptera: Carabidae: Trechinae: Tachyini). The Coleopterists Bulletin, **78**: 408–409.

Israelson, G. 1979. On the taxonomy of some West European and Macaronesian *Heterothops* Stephens (Coleoptera: Staphylinidae). Entomologica Scandinavica, **10**: 261–268.

Jendek, E. and Grebennikov, V. 2011. Agrilus (Coleoptera, Buprestidae) of East Asia. Jan Farkač, Prague, Czech Republic. 362 pp.

Klimaszewski, J., Brunke, A., Assing, V., Langor, D., Newton, A.F., Bourdon, C., *et al.* 2013. Synopsis of Adventive Species of Coleoptera (Insecta) Recorded from Canada. Part 2: Staphylinidae. Series Faunistica No. 104. Pensoft Publishers, Sofia, Bulgaria. 360 pp.

Klimaszewski, J. and Brunke, A.J. 2018. Canada's adventive rove beetle (Coleoptera, Staphylinidae) fauna: a long-term case study on the detection, origin, introduction pathways and dynamic distribution of non-native beetles. Chapter 5. In Biology of Rove Beetles (Staphylinidae), Life History, Evolution, Ecology and Distribution. *Edited by* O. Betz, U. Irmler, and J. Klimaszewski. Springer, Cham, Switzerland. Pp. 65–79.

Klimaszewski, J., Langor, D., Batista, R., Duval, J.A., Majka, C.G., Scudder, G.G.E., and Bousquet, Y. 2012. Synopsis of Adventive Species of Coleoptera (Insecta) Recorded from Canada. Part 1: Carabidae. Pensoft Series Faunistica No. 103. Pensoft Publishers, Sofia, Bulgaria. 96 pp.

Klimaszewski, J., Langor, D., Majka, C.G., Bouchard, P., Bousquet, Y., LeSage, L., *et al.* 2010. Review of Adventive Species of Coleoptera (Insecta) Recorded from Eastern Canada. Pensoft Publishers, Sofia, Bulgaria. 272 pp.

Kraatz, G. 1868. Eine neue deutsche Staphylinen-Art [A new German species of staphyline]. Berliner Entomologische Zeitschrift, **12**: 352.

Levesque, C. and Levesque, G.Y. 2024. A five-year study of the ground-dwelling beetles (Coleoptera) from a grassland and an adjacent woods in southern Quebec (Canada). The Great Lakes Entomologist, **57**: 1–62.

Li, G. 1993. The rove beetles of Northeast China. *In* Studies on Fauna and Ecogeography of Soil Animal [sic; in Chinese]. *Edited by* G. Li and P. Chen. Northeast Normal University Press, Changchun, Jilin, China. Pp. 1–63, 151–163.

Lingafelter, S.W. and Hoebeke, E.R. 2002. Revision of *Anoplophora* (Coleoptera: Cerambycidae). Entomological Society of Washington, Washington, DC, United States of America. 236 pp.

Lott, D. 2008. Beetles from underground mammal nests in the East Midlands. The Coleopterist, **17**: 101–114.

Nakane, T., Ohbayashi, K., Nomura, S., and Kurosawa, Y. 1963. Iconographia Insectorum Japonicorum, colore naturali edita. Volumen II (Coleoptera) [Iconography of Japanese Insects, published in natural colour. Volume 2 (Coleoptera); in Japanese]. Hokuryaken, Tokyo, Japan. 443 pp.

Newton, A. 2025. StaphBase (version Aug 2022). *In* Catalogue of Life. Version 2025-02-13. *Edited by* O. Bánki, Y. Roskov, M. Döring, G. Ower, D.R. Hernández Robles, C.A. Plata Corredor, *et al.* Catalogue of Life, Amsterdam, The Netherlands. https://doi.org/10.48580/dg9ld-3gk.

Newton, A.F. 1987. Four *Staphylinus* (*sensu lato*) species new to North America, with notes on other introduced species (Coleoptera: Staphylinidae). The Coleopterists Bulletin, **41**: 381–384.

Prévost, M.A. and Bain, A. 2007. The establishment of a 17th-century Newfoundland colony: contributions from archaeobotanical and archaeoentomological analyses. *In* Measuring the Past: Contributions to Research in Archaeometry [2000–2006]. *Edited by* A. Bain, J. Chabot, and M. Mousette. BAR International Series 1700, Archaeopress, Oxford, United Kingdom. Pp. 205–216.

Ratnasingham, S. and Hebert, P.D.N. 2013. A DNA-based registry for all animal species: the barcode index number (BIN) system. PLOS One, **8**: e66213.

Reyes-Hernández, J.L., Brunke, A., Hansen, A.K., Qinghao, Z., Jenkins Shaw, J., Newton, A.F. and Solodovnikov, A. 2025. Evolutionary systematics of the Staphylininae rove beetles (Coleoptera: Staphylinidae) resolved by integration of phylogenomics, comparative morphology and historical biogeography. Systematic Entomology. https//doi.org/10.1111/syen.12677.

Reyes-Hernández, J.L. and Solodovnikov, A. 2024. Two new rove beetle genera in Staphylininae that reduce "*Heterothops*" and "*Quedius*" taxonomic wastebaskets (Coleoptera, Staphylinidae). ZooKeys, **1218**: 81–98.

Rood, R.J., Brunke, A., and Solodovnikov, A. 2015. *Othius punctulatus* (Goeze, 1777) (Coleoptera: Staphylinidae) detected in the Pacific Northwest: a Palearctic genus new to the USA. The Coleopterists Bulletin, **69**: 412–414.

Salnitska, M. and Solodovnikov, A. 2019. Rove beetles of the genus *Quedius* (Coleoptera, Staphylinidae) of Russia: a key to species and annotated catalogue. ZooKeys, **847**: 1–100.

Schillhammer, H. 2024. Synonymical notes on some species of *Philonthus* Stephens, 1832 from Japan (Coleoptera: Staphylinidae: Staphylininae). Koleopterologische Rundschau, **94**: 105–106.

Schülke, M. and Renner, K. 2020. *Heterothops pusio* LeConte, 1863 eine neue Adventivart aus Nordamerika in Deutschland (Coleoptera, Staphylinidae, Staphylininae, Amblyopinini) [*Heterothops pusio* LeConte, 1863, a new adventitious species from North America in Germany (Coleoptera, Staphylinidae, Staphylininae, Amblyopinini)]. Linzer Biologische Beitrage, **52**: 501–507.

Schülke, M. and Smetana, A. 2015. Staphylinidae. *In* Catalogue of Palaearctic Coleoptera. Volume 2. Hydrophiloidea-Staphylinoidea. Revised and updated edition. *Edited by* I. Löbl and D. Löbl. Brill, Leiden, The Netherlands. Pp. 304–1134.

Sharp, D. 1874. The Staphylinidae of Japan. Transactions of the Entomological Society of London, **22**: 1–103.

Shibata, Y., Maruyama, M., Hoshina, H., Kishimoto, T., Naomi, S.I., Nomura, S., *et al.* 2013. Catalogue of Japanese Staphylinidae (Insecta: Coleoptera). Bulletin of the Kyushu University Museum, **11**: 69–218.

Shorthouse, D. 2010. SimpleMappr, an online tool to produce publication-quality point maps [online]. Available from http://www.simplemappr.net [accessed 1 December 2024].

Sikes, D.S., Thayer, M.K., and Newton, A.F. 2024. Large carrion beetles evolved from Staphylinidae (Coleoptera, Staphylinidae, Silphinae), a review of the evidence. ZooKeys, **1200**: 159–182.

Skvarla, M. 2022. Hammerhead flatworms and other land Planaria of eastern North America [online]. PennState Extension, Pennsylvania State University, University Park, Pennsylvania, United States of America. Available from https://extension.psu.edu/hammerhead-flatworms-and-other-land-planaria-of-eastern-north-america [accessed 5 December 2024].

Smetana, A. 1971a. Revision of the tribe Quediini of North America north of Mexico (Coleoptera: Staphylinidae). Memoirs of the Entomological Society of Canada, **79**: 1–303. https://doi.org/10.4039/entm10379fv.

Smetana, A. 1971b. Revision of the tribe Quediini of America North of Mexico (Coleoptera: Staphylinidae). Supplementum 1. The Canadian Entomologist, **103**: 1833–1848. https://doi.org/10.4039/Ent1031833-12.

Smetana, A. 1973. Revision of the tribe Quediini of America North of Mexico (Coleoptera: Staphylinidae). Supplementum 2. The Canadian Entomologist, **105**: 1421–1434. https://doi.org/10.4039/Ent1051421-11.

Smetana, A. 1978. Revision of the tribe Quediini of America north of Mexico (Coleoptera: Staphylinidae). Supplementum 4. The Canadian Entomologist, **110**: 815–840. https://doi.org/10.4039/Ent110815-8.

Smetana, A. 1981. Revision of the tribe Quediini of America North of Mexico (Coleoptera: Staphylinidae). Supplementum 5. The Canadian Entomologist, **113**: 631–644. https://doi.org/10.4039/Ent113631-7.

Smetana, A. 1982. Revision of the subfamily Xantholininae of America north of Mexico (Coleoptera: Staphylininae). Memoirs of the Entomological Society of Canada, **120**: 1–389. https://doi.org/10.4039/entm114120fv.

Smetana, A. 1995. Rove beetles of the subtribe Philonthina of America north of Mexico (Coleoptera: Staphylinidae): classification, phylogeny and taxonomic revision. Memoirs on Entomology, International, **3**: 1–945.

Smetana, A. and Herman, L.H. 1999. *Philonthus immundus* of Gyllenhal, a misidentification (Coleoptera, Staphylinidae, Staphylinini, Philonthina). The Coleopterists Bulletin, **53**: 297–298.

Wheeler, A.G. and Hoebeke, R. 2017. Adventive (non-native) insects and the consequences for science and society of species that become invasive. *In* Insect Biodiversity: Science and Society. Volume I. Second edition. *Edited by* R.G. Foottit and P.H. Adler. John Wiley and Sons Ltd., Hoboken, New Jersey, United States of America. Pp. 641–711.

Cite this article: Brunke, A.J., Bédard, N., and Leclerc, L. 2025. Four species of adventive Staphylininae (Coleoptera: Staphylinidae) new to North America. The Canadian Entomologist. https://doi.org/10.4039/tce.2025.10.