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A new cryptic species of *Aleochara* Gravenhorst associated with *Marmota monax* (Linnaeus) burrows and caves in North America (Coleoptera: Staphylinidae: Aleocharinae)

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*Marmota monax* (Linnaeus) burrows and caves in North America  
(Coleoptera: Staphylinidae: Aleocharinae)

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A new cryptic species of *Aleochara* Gravenhorst associated with *Marmota monax* (Linnaeus) burrows and caves in North America (Coleoptera: Staphylinidae: Aleocharinae)

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**Abstract.** A new cryptic species, *Aleochara (Xenochara) castaneimarmotae* Klimaszewski, Webster, and Brunke, **new species** (Coleoptera: Staphylinidae: Aleocharinae), associated with *Marmota monax* (Linnaeus) burrows and caves in eastern North America, is described and illustrated. A key to Canadian species of subgenus *Xenochara* Mulsant and Rey and revised distributions of the taxonomically difficult fumata species group are provided. *Aleochara quadrata* Sharp is recorded from Washington and Oregon for the first time.

**Key Words.** Canada, rove beetles, parasitoid, taxonomy, nidicolous, troglophile

## Introduction

*Aleochara (Xenochara) castaneipennis* Mannerheim was considered to be a polymorphic species at the time of the revision of the Nearctic species of *Aleochara* (Klimaszewski 1984). As a member of the fumata species group, specimens are difficult or impossible to identify based on external characters alone. However, a careful study of the aedeagus in lateral view, particularly the shape of the median lobe and subapical sclerite in the internal sac, will provide a reliable identification. Examination of newly collected series of specimens from *Marmota monax* (Linnaeus) burrows (often called woodchucks, ground hogs, or marmots), previously identified as *A. castaneipennis*, revealed an aedeagus and spermatheca different from those that were collected from other habitats. A large portion of the material originally identified as *A. castaneipennis* in Klimaszewski (1984) was re-examined and led to updated distributions of species of the fumata species group.

## Materials and Methods

All specimens in this study were dissected to examine the genital structures. Extracted genital structures were dehydrated in absolute alcohol, mounted in Canada balsam on celluloid micro-slides, and pinned with the specimen from which they originated. Images of the entire body and the genital structures were taken using an image processing system (Nikon SMZ 1500 stereoscopic microscope; Nikon Digital Camera DXM 1200F, and Adobe Photoshop software).

Morphological terminology mainly follows that used by Klimaszewski (1984). The ventral side of the median lobe of the aedeagus is considered to be the side of the bulbus containing the foramen mediale, the entrance of the ductus ejaculatorius, and the adjacent ventral side of the tubus of the median lobe with the internal sac and its structures (this part is referred to as the parameral side in some recent publications); the opposite side is referred to as the dorsal part.

Information from labels is separated by a // where more than one label is present on specimens.

### Depository/institutional abbreviations

|             |   |
|-------------|---|
| <b>CNC</b>  | Canadian National Collection of Insects, Arachnids, and Nematodes, Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada.         |
| <b>LFC</b>  | Natural Resources Canada, Canadian Forest Service, Laurentian Forestry Centre, R. Martineau Insectarium, Quebec City, Quebec, Canada. |
| <b>NBM</b>  | New Brunswick Museum, Saint John, New Brunswick, Canada.  |
| <b>RWC</b>  | Reginald Webster Collection, Charters Settlement, NB, Canada.   |
| <b>UAM</b>  | University of Alaska Museum, Fairbanks, Alaska, USA.  |
| <b>USNM</b> | United States National Museum, Washington, D.C., USA.   |
| <b>UWP</b>  | University of Wrocław, Wrocław, Poland.   |

USA state abbreviations follow those of the US Postal Service. The following abbreviations are used in the text for Canadian jurisdictions:

|           |                       |
|-----------|-----------------------|
| <b>AB</b> | Alberta               |
| <b>BC</b> | British Columbia      |
| <b>LB</b> | Labrador              |
| <b>NB</b> | New Brunswick         |
| <b>NF</b> | Newfoundland          |
| <b>NS</b> | Nova Scotia           |
| <b>NT</b> | Northwest Territories |
| <b>ON</b> | Ontario               |
| <b>QC</b> | Quebec                |
| <b>YT</b> | Yukon Territory       |

### Genus *Aleochara* Gravenhorst, 1802

(Fig. 1–27)

Klimaszewski 1984

**Diagnosis.** Body length very variable within same species, 1.8–13 mm; broadly oval or subparallel, robust; tarsal formula 5-5-5 (4-5-5 in subgenus *Tinotus* Sharp); last palpomere of maxillary and labial palps with pseudosegment; lacinia with tuft of apical setae; ligula small, bilobed apically; mesoventrite varying from non-carinate to completely carinate, depending on subgenus. Male tergite IX divided by tergite X, each half narrowly elongate anteriorly and posteriorly and bearing ventral strut; median lobe of aedeagus usually consisting of narrowly elongate tubus and moderately-sized bulbus (except some species of subgenus *Aleochara*); internal sac with complex sclerites; flagellum from moderately long to several times longer than length of median lobe of aedeagus; spermatheca consisting of capsule, chamber, duct and seminal channel, variably modified in different subgenera.

**Biology.** Adults are predaceous on larvae, eggs and pupae of cyclorrhaphous Diptera and larvae are ectoparasitoids of dipteran pupae (within the puparium).

**Subgenus *Xenochara* Mulsant and Rey, 1874**

(Fig. 1–28)

Klimaszewski 1984

**Diagnosis.** Species of this subgenus are distinguished by the following combination of characters: pronotum evenly pubescent (Fig. 1, 11, 20); mesoventrite with complete or almost complete carina, carina is as long as mesoventrite or slightly shorter; last article of maxillary palpus varying in length, from 1/3 to 3/4 length of penultimate article.

**Remarks.** There are many different evolutionary lineages in this subgenus that were formerly recognized as species groups (see Klimaszewski 1984) and *Xenochara* is not likely monophyletic (Maus 2000). Habitats diverse: various decaying organic matter, rotting mushrooms, moss, animal droppings, and forest litter.

**Key to Canadian species of subgenus *Xenochara***

1. Abdominal tergites with distinctive scale-like microsculpture ..... *Aleochara lacertina* Sharp
- Abdominal tergites without scale-like microsculpture ..... 2
- 2(1). Body surface matte; pronotum densely pubescent; basal transverse impressions of abdominal tergites I–III with round or longitudinally elongate depressions .....  
..... *Aleochara sculptiventris* (Casey)
- Body surface moderately to strongly glossy; pronotum sparsely pubescent; basal tergal impressions with punctures only ..... 3
- 3(2). Body widely oval and robust; posterior inner corner of each elytron with reddish-spot or reddish margin ..... 4
- Body narrowly elongate, subparallel, moderately robust; posterior inner corner of each elytron without reddish spot, sometimes with paler, yellowish-brown area ..... 6
- 4(2). Pronotum broadest in anterior half of disc; elytra black with trace of red on posterior margin of disc; internal sac of median lobe of aedeagus with two narrowly elongate and apically hooked sclerites ..... *Aleochara inexpectata* Klimaszewski
- Pronotum broadest in basal third of disc; elytra black with large reddish or orange spots on posteromedian area of disc; internal sac of median lobe of aedeagus with differently shaped sclerites ..... 5
- 5(4). Elytra at suture shorter than maximum length of pronotum ... *Aleochara tristis* Gravenhorst
- Elytra at suture at least as long as maximum length of pronotum .....  
..... *Aleochara lanuginosa* Gravenhorst
- 6(5). Pronotum about one fourth wider than long, slightly expanded laterally; pronotal microsculpture weak or absent; spaces between setae smooth and highly glossy (Fig. 20, 21); apex of tubus completely straight in lateral view (Fig. 22), other genital features as illustrated (Fig. 10 a, 23, 28) ..... *Aleochara fumata* Gravenhorst
- Pronotum about one third wider than long; not expanded laterally; pronotal microsculpture moderate to strong; spaces between setae covered with microsculpture and appearing less glossy (Fig. 1, 2, 11, 12); apex of tubus bent ventrad, other genital features as illustrated (Fig. 3, 4, 9, 10 b, c, 13, 14, 19) (male of *A. carmanah* unknown) ..... 7
- 7(6). Punctuation on pronotum moderately coarse (Fig. 11, 12); tubus of median lobe of aedeagus evenly arcuate in lateral view (Fig. 13); subapical sclerite of internal sac with apex upturned but not sinuate or hooked (Fig. 10 b); spermatheca with capsule narrowly spheroidal, slightly compressed (Fig. 19) ..... *Aleochara castaneipennis* Mannerheim

- Punctuation on pronotum strongly coarse (Fig. 1, 2); genital structures not as above ..... 8  
8(7). Species known from eastern North America; subapical sclerite of internal sac with apex sinuate or hooked (Fig. 10 c); antecostal suture of female sternite VIII arcuate and not pointed medially (Fig. 8); spermatheca with apical invagination of capsule broad, stem with chamber connected to duct at 90° in vertical plain (Fig. 9); often found in burrows of *Marmota monax* or in caves .... ***Aleochara castaneimarmotae* Klimaszewski, Webster and Brunke, new species**
- Species known only from Vancouver Island; male unknown; antecostal suture of female sternite VIII sharply pointed medially (fig. 129, in Klimaszewski and Winchester 2002); spermatheca with apical invagination of capsule narrow, stem with chamber connected to duct at 90° in horizontal plain (fig. 128, in Klimaszewski and Winchester 2002) .....  
..... ***Aleochara carmanah* Klimaszewski**

***Aleochara (Xenochara) castaneimarmotae* Klimaszewski, Webster and Brunke, new species**  
(Fig. 1–9, 10 c)

**Holotype:** Canada, New Brunswick, Carleton Co., Jackson Falls, 46.2216°N, 67.7231°W, 31.V.2013, R.P. Webster // Meadow/hayfield, entrance to burrow of *Marmota monax* (CNC) 1 male.

**Paratypes:** Canada, Ontario, Ottawa Reg., Ottawa, Kanata, 27.IV.1975, *Marmota* burrow, A. Smetana (CNC) 3 females; Ottawa Reg., Ottawa, Kanata, 1.V.1977, *Marmota* burrow, A. & Z. Smetana (CNC) 1 male; same except 19.V.1977, A. Smetana (CNC) 1 male; same except 25.V.1979, 1 male (CNC). **New Brunswick:** Carleton Co., Jackson Falls 46.2216°N, 67.7231°W, 8.V.2013, R.P. Webster // Meadow/hayfield, entrance to burrow of *Marmota monax* (RWC) 1 male, 2 females; Carleton Co., Jackson Falls, 46.2216°N, 67.7231°W, 25.V.2013, R.P. Webster // rich Appalachian hardwood forest with some conifers, entrance to burrow of *Marmota monax* (RWC) 1 female; Carleton Co., Jackson Falls, 46.2216°N, 67.7231°W, 31.V.2013, R.P. Webster // Meadow/hayfield, entrance to burrow of *Marmota monax* (LFC), 1 male, 1 female (NBM), 1 male, 3 females (RWC) 3 males; Carleton Co., Jackson Falls, 46.2202°N, 67.7235°W, 29.IV.2013, R.P. Webster // Rich Appalachian hardwood forest with some conifers, entrance to burrow of *Marmota monax* (RWC) 1 female; Carleton Co., Jackson Falls, Bell Forest, 46.2202°N, 67.7235°W, 8.V.2013, R.P. Webster // Rich Appalachian hardwood forest with some conifers, entrance to burrow of *Marmota monax* (LFC) 1 male, 1 female, (RWC) 5 male, 5 females; Kent Co., Kouchibouguac National Park, 46.8279°N, 64.9397°W, 27.V.2015, R.P. Webster // Old field / forest margin, entrance to *Marmota monax* (Linnaeus) burrow (NBM) 1 male; York Co., Douglas, Currie Mountain, 45.9832°N, 66.7564°W, 11–24.VI.2013, C. Alderson and V. Webster // old *Pinus strobus* stand, Lindgren funnel trap 1 m high under *P. strobus* (RWC) 1 female; York Co., Keswick Ridge, 45.9962°N, 66.8781°W, 27.V.2015, R.P. Webster // Old field/forest margin, entrance to burrow of *Marmota monax* (NBM) 1 male, 1 female (RWC) 1 male, 2 females.

**United States: Arkansas:** Boone Co., W. of Aipena, Thompsons Cave, 24.VI.1964, S. Peck, (CNC) 1 female. **Illinois:** Monroe Co., Mammoth Cave, 1000' from entrance, fungus bait, 25.VI.1965, S. Peck (CNC) 1 male. **Kentucky:** Barren Co., SE of Cave City, Hansons Cave, 15.VII.1973, S. Peck (CNC) 1 female. **Missouri:** McDonald Co., 2.5 mi ENE Pineville, Long Cave, 7.V.1979, J.E. Gardner (CNC) 1 female. **Tennessee:** Anderson Co., 5 mi S Oak Ridge, Melton Hill Cave #1, 19.V.1965, J. A. Payne, 2 males, 1 female (CNC); Bradley Co., Quarry Cave, 8.IV.1967, S. Peck (CNC) 1 female; Cannon Co., Tenpenney Cave, 1–15.VII.1973, S. Peck (CNC) 1 female.

**Diagnosis.** This species may be distinguished by the following combination of characters: body subparallel, length 2.8–7.0 mm; brown to dark brown, with elytra, tarsi and palpi rusty-brown; meshed microsculpture of forebody strong, sculpticells flat (Fig. 1, 2); punctuation on pronotum strong and coarse, antennomers V–X strongly transverse (Fig. 1). **Male:** tergite VIII truncate and slightly emarginate apically (Fig. 5); sternite VIII triangularly produced apically (Fig. 6); median lobe of aedeagus with tubus arcuate and sinuate in apical half in lateral view (Fig. 3), apex of tubus bent ventrad, subapical sclerites of internal sac in lateral view with sinuate or hooked apex that is upturned (Fig. 10c); median lobe in dorsal view as illustrated (Fig. 4). **Female:** tergite VIII truncate apically and shallowly emarginate

medially (Fig. 7); sternite VIII rounded apically with short apical pubescence (Fig. 8); spermatheca L-shaped, capsule spherical (Fig. 9).

This species can be misidentified as the externally similar sibling species *A. castaneipennis*, from which it may be distinguished by the on average more parallel-sided body, stronger and coarser punctation on pronotum, the sinuate apical half of tubus of median lobe in lateral view, the apically hooked or sinuate subapical sclerite of the internal sac, and the shorter and more spherical capsule of the spermatheca. It can also be confused with *A. fumata* from which it differs by having coarser pronotal punctation, strong microsculpture, a less glossy pronotum, often larger body and different genital features.

**Distribution. Origin:** Nearctic. **Canada:** NB, ON. **USA:** AR, IL, KY, MO, TN.

This species also very likely occurs in Alabama, Ohio, Pennsylvania, and additional localities in Missouri based on the specimens of '*A. castaneipennis*' from caves reported by Klimaszewski (1984) and Klimaszewski and Peck (1986) that were not re-examined by us.

**Collection and habitat data. Habitat:** adults found in soil and litter in and near entrances to burrows of *Marmota monax* (Linnaeus) in meadows, hayfields, forest margins, and in a rich Appalachian hardwood forest with some conifers near a meadow. Specimens in the southern portions of its distribution were found in caves; one of these specimens was collected using a fungus bait. In NB, this species was often associated with *Aleochara rubripes* (Blatchley) (often the most common species of *Aleochara*), *A. sculptiventris* (Casey), *Atheta campbelli* (Lohse), *Anotylus tetracarlinatus* (Block), and the histerid *Margarinotus egregius* (Casey). **Collecting period:** IV, V, VI, VIII. **Collecting method:** sifting soil and litter in and near entrances to *Marmota monax* burrows, Lindgren funnel trap 1 m high under *P. strobus*, fungus bait in cave.

**Etymology.** The name of this species is derived from the combination of the stem *castanei* (brown) and *marmotae* in reference to the preferred habitat of this species.

### *Aleochara (Xenochara) castaneipennis* Mannerheim

(Fig. 10 b, 11–19)

*Aleochara castaneipennis* Mannerheim, 1843. Klimaszewski 1984, Klimaszewski and Peck 1986 (misidentification of *A. castaneimarmotae*), Lohse et al. 1990, Klimaszewski and Winchester 2002, Gouix and Klimaszewski 2007, Klimaszewski et al. 2005, Majka and Klimaszewski 2010, Majka et al. 2011, Klimaszewski et al. 2011.

**Diagnosis.** This species may be distinguished by the following combination of characters: body subparallel, length 2.8–6.5 mm; brown to dark brown, with tarsi and palps rusty-brown, elytra often paler than remainder of body (Fig. 11); meshed microsculpture of forebody strong but broken or absent in many places (Fig. 12); antennomers V–X strongly transverse (Fig. 11). **Male:** tergite VIII truncate and slightly emarginate apically (Fig. 15); sternite VIII strongly triangularly produced apically (Fig. 16); median lobe of aedeagus with tubus evenly arcuate in lateral view (Fig. 13), apex of tubus bent ventrad, subapical sclerites of internal sac with apex upturned but not hooked or sinuate (Fig. 10 b); median lobe in dorsal view as illustrated (Fig. 14). **Female:** tergite VIII truncate apically and shallowly emarginate medially (Fig. 17); sternite VIII rounded apically with short apical pubescence (Fig. 18); spermatheca L-shaped, capsule slightly elongate sac-shaped (Fig. 19).

This species is often misidentified as the externally similar *A. fumata*, from which it differs by having slightly coarser pronotal punctation, interstices between punctures less glossy, body often larger and different genital features. It may also be confused with the western North American species *A. quadrata* Sharp, from which it can be distinguished by the distinctly paler disc of the pronotum compared to the head, evenly arcuate apical half of the tubus and subapical sclerite of the internal sac upturned at apex. For a comparison with its sibling species, *A. castaneimarmotae*, see above.

**Distribution (verified localities). Origin:** Nearctic. **Canada:** AB, BC, LB, NB, NF, NS, NT, ON, QC, YT. **USA:** AK, AZ, CO, WA, WY.



Based on a re-examination of the material originally examined by Klimaszewski (1984) and new material available to us, we state above only those records which can be confirmed here. Many of the state records south of the northeastern U.S. may refer to *A. castaneimarmotae*, but this needs to be confirmed. All specimens from Oregon and the available males from California listed by Klimaszewski (1984) refer to *A. quadrata*. All 134 specimens re-examined from Alaska (UAM), and identified by one of us (JK) as *A. castaneipennis*, are correctly identified.

**Collection and habitat data. Habitat:** coniferous, deciduous and mixedwood forest types, coastal limestone barrens. Adults often found in rotting mushrooms, carrion, forest leaf litter, moss, and human feces. In NB, this species was often abundant in decaying mushrooms but was seldom found in other microhabitats. **Collecting period:** IV–XI. **Collecting method:** sifting decaying mushrooms, forest litter, using unbaited and carrion-baited pitfall traps, flight intercept traps.

### *Aleochara (Xenochara) quadrata* Sharp

(Fig. 10 d, and 82, 79, 321, 322, in Klimaszewski 1984)

*Aleochara quadrata* Sharp, 1883: 149. Klimaszewski 1984, Klimaszewski and Cervenka 1986, Majka and Klimaszewski 2008.

**Diagnosis.** This species may be distinguished by the following combination of characters: body dark brown, disc of pronotum as dark as or only slightly paler than head, elytra paler than remainder of the body with darkened basal area; meshed microsculpture of forebody absent or weak and broken in many places.

**Male:** median lobe of aedeagus with apical half of tubus sinuate in lateral view, apex of tubus bent ventrad, subapical sclerites of internal sac of about equal width throughout its length and with apices not upturned (Fig. 10 d).

**Remarks.** This species is sympatric with western populations of *A. castaneipennis* but has not yet been taken with it in the same collection event. Generally, *A. quadrata* is much darker and the pronotum is glossier. Males of *A. quadrata* can be reliably distinguished from *A. castaneipennis* by the sinuate apical half of the tubus and subapical sclerites of the internal sac, which are not upturned (Fig. 10d). *Aleochara quadrata* is extremely similar to the Palaearctic species *A. moerens* Gyllenhal but can be distinguished by its subapical sclerite which does not gradually narrow to a point in *A. moerens* (Fig. 10 e). The latter species is not yet known from the Nearctic region.

**Distribution. Origin:** Nearctic. **Canada:** BC. **USA:** CA, NV, OR, WA. **Mexico.**

This species is newly reported from Washington and Oregon based on the following material: Oregon, Clackamas Co., Camp Creek Cmpgr., 2.8 mi SE Rhododendron, A. & D. Smetana (CNC) 10 specimens; Upper Applegate Rd. (CNC) 1 specimen. Washington, 6 mi E Joyce, 12.V.1968, Campbell and Smetana (CNC) 22 specimens, Olympic Nat. Pk., Hoh Ranger Sta., 600', 13.V.1968 (CNC) 15 specimens

These records link the previously isolated records from BC (Klimaszewski and Cervenka 1986; Majka and Klimaszewski 2008 [claimed to be the first record for BC and Canada]) with those much farther south.

**Collection and habitat data.** Nothing specific is known about the collection circumstances of this species. The collecting period includes: V, VII, VIII.

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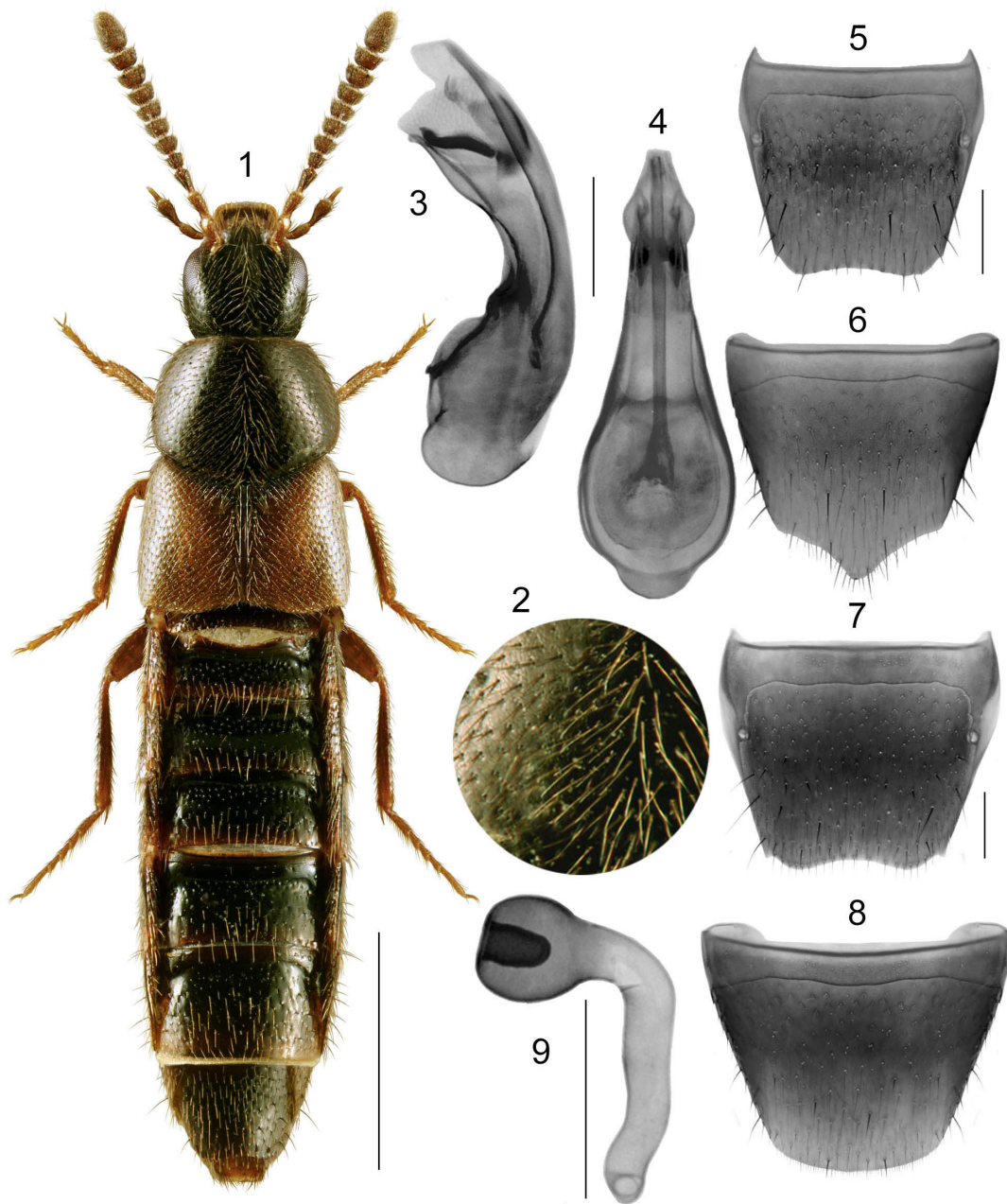
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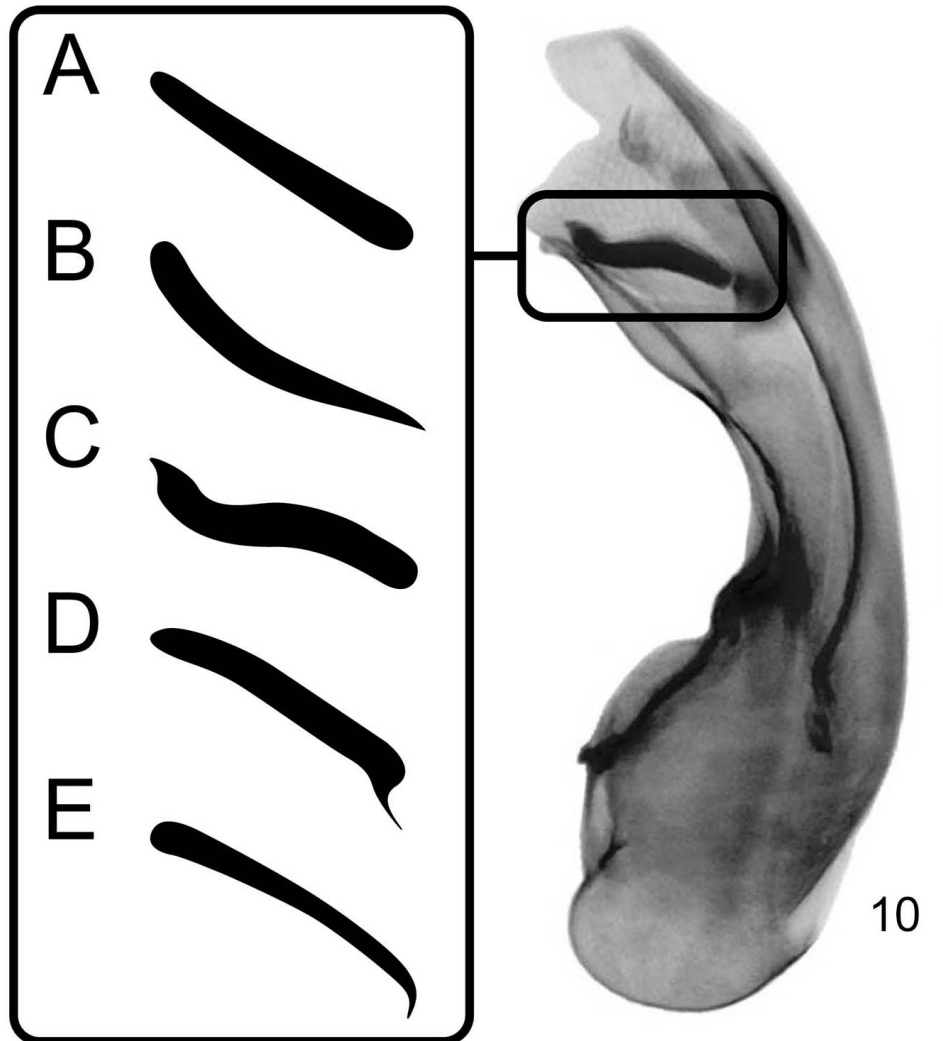
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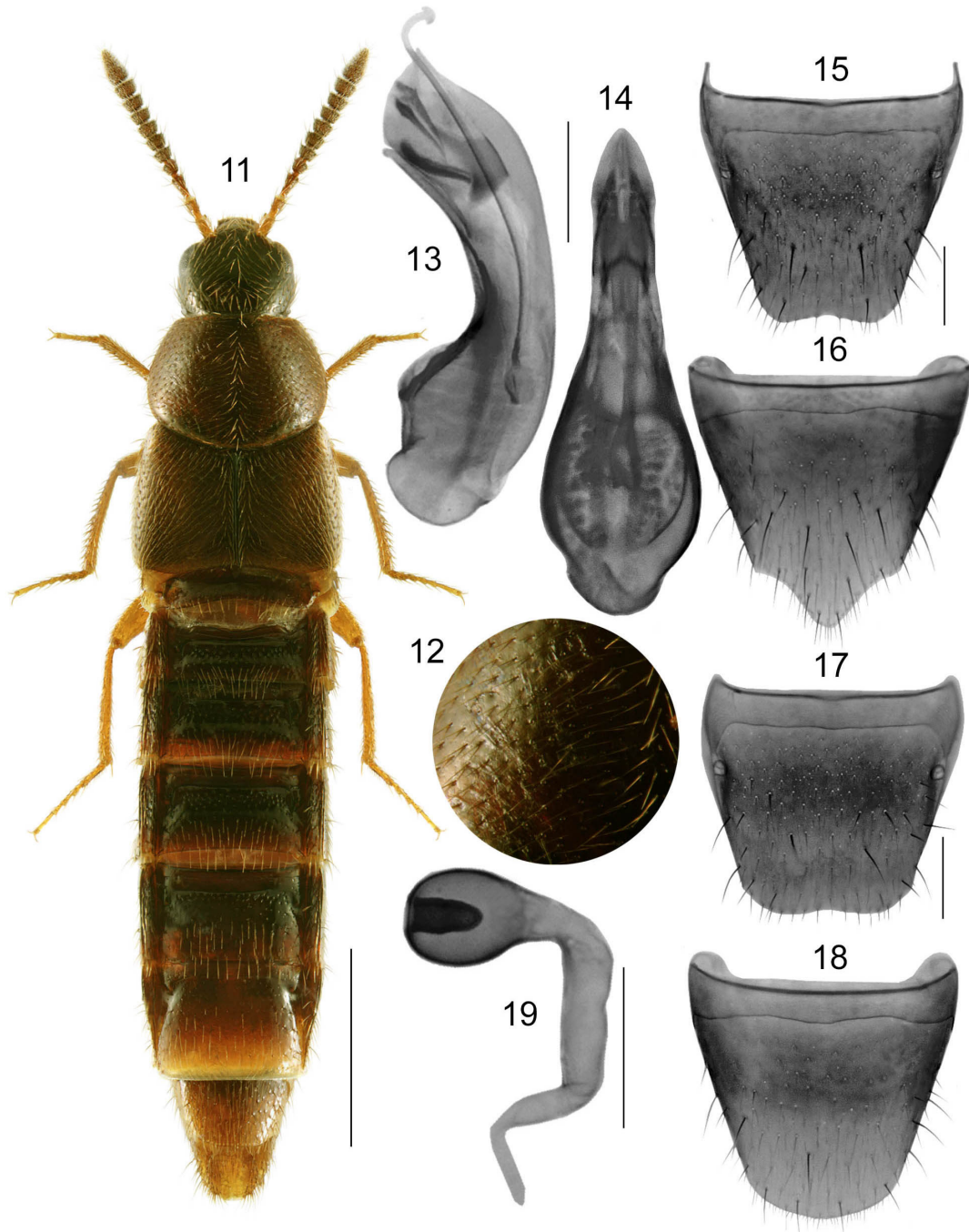
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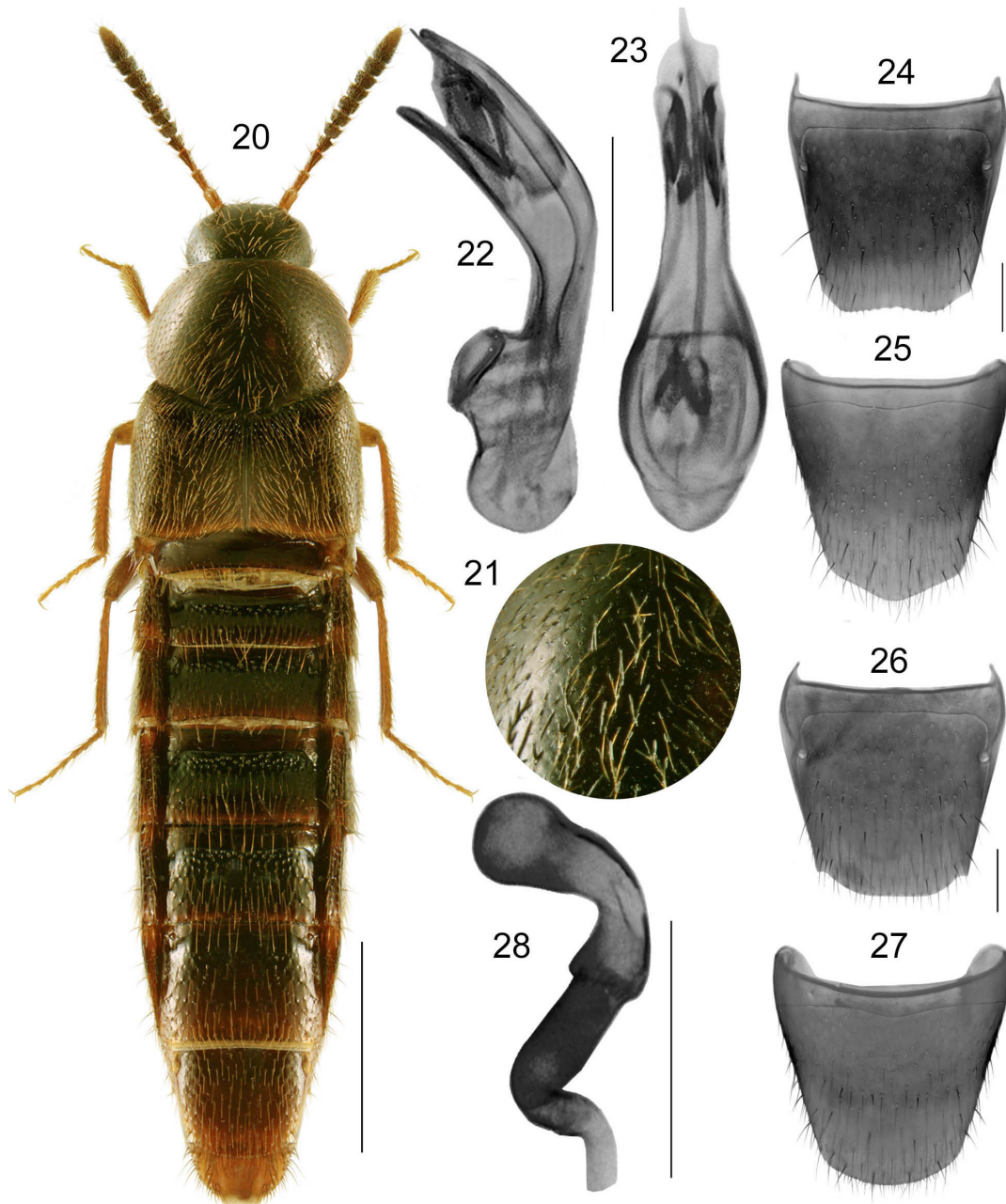
**Figures 1–9.** *Aleochara castaneimarmotae* Klimaszewski, Webster, and Brunke, sp. nov. **1)** Habitus in dorsal view. **2)** Enlarged fragment of pronotum showing pubescence and microsculpture. **3)** Median lobe of aedeagus in lateral view. **4)** Median lobe of aedeagus in dorsal view. **5)** Male tergite VIII. **6)** Male sternite VIII. **7)** Female tergite VIII. **8)** Female sternite VIII. **9)** Spermatheca. Scale bar for habitus = 1 mm, remaining scale bars = 0.2 mm.



**Figures 10 a–e.** Lateral view of subapical sclerites of the internal sac of median lobe of aedeagus in species of the *fumata* species group occurring or potentially occurring in Canada. **10 a)** *Aleochara fumata* Gravenhorst. **10 b)** *A. castaneipennis* Mannerheim. **10 c)** *A. castaneimarmotae* Klimaszewski, Webster and Brunke. **10 d)** *A. quadrata* Sharp. **10 e)** *A. moerens* Gyllenhal (Palearctic). At right: aedeagus in lateral view of *A. castaneimarmotae*. Scale bar = 0.2 mm.



**Figures 11–19.** *Aleochara castaneipennis* Mannerheim. **11)** Habitus in dorsal view. **12)** Enlarged fragment of pronotum showing pubescence and microsculpture. **13)** Median lobe of aedeagus in lateral view. **14)** Median lobe of aedeagus in dorsal view. **15)** Male tergite VIII. **16)** Male sternite VIII. **17)** Female tergite VIII. **18)** Female sternite VIII. **19)** Spermatheca. Scale bar for habitus = 1 mm, remaining scale bars = 0.2 mm.



**Figures 20–28.** *Aleochara fumata* Gravenhorst. **20)** Habitus in dorsal view. **21)** Enlarged fragment of pronotum showing pubescence and microsculpture. **22)** Median lobe of aedeagus in lateral view. **23)** Median lobe of aedeagus in dorsal view. **24)** Male tergite VIII. **25)** Male sternite VIII. **26)** Female tergite VIII. **27)** Female sternite VIII. **28)** Spermatheca. Scale bar for habitus = 1 mm, remaining scale bars = 0.2 mm.

