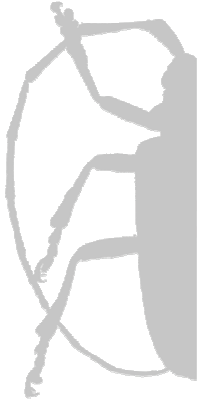


The bee flies (Diptera: Bombyliidae) of Ontario, with a key to the species of eastern Canada

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Abstract. Illustrated dichotomous keys to the 73 bee fly species of 25 genera occurring in or adjacent to eastern Canada are presented. Thirty-two of these species represent new or previously unrecognized records for Ontario. We review the distributions of these species in Ontario, focusing on rarely collected and habitat-restricted species, and summarize host use when known.

Introduction

It is astonishing that a diverse group of animals as attractive as the bee flies — fuzzy, colorful and conspicuous — should have been entirely neglected by a whole generation of Canadian entomologists, naturalists and ecologists. It is also unfortunate, for we have been almost completely ignorant of the many remarkable bombyliid species associated with habitats ranging from agro-ecosystems through to threatened dunes, grasslands and peatlands. The only possible reason for the dearth of bombyliid studies in Canada is the taxonomic impediment. Bee flies, like many arthropods, have been flying below the zoological radar screen because of the impression that they are difficult to identify. One of the main objectives of this paper is to correct that impression, or at least put it in the past tense.

The taxonomy of North American bee flies is relatively mature, with a complete recent catalog (Evenhuis and Greathead 1999) and a rich taxonomic literature. However, published keys are generally difficult to use and poorly illustrated, some being over 100 years old; it would be extremely difficult, if not impossible, to use the existing taxonomic literature to identify most Ontario bee flies without access to a good reference collection. We have combined our own recent observations with the extensive data available from regional insect collections (especially the

University of Guelph Collection) to review the fauna and develop a list of bee flies occurring in or near Ontario. We have also used this material to generate photographs showing general appearance and all key characters of 73 species now known from Ontario or nearby areas. These photographs allowed the development of the first user-friendly key to eastern Canadian bee flies, and the collection-based review led to the discovery of an unexpectedly rich fauna.

Prior to this review the majority of Ontario's bee fly species were not even recognized as occurring in the province. Evenhuis and Greathead (1999) recorded 13 genera and 29 species from Ontario; we now have records of 24 genera and 61 species from Ontario. Included in these unrecognized records are 5 genera and 25 species we first record here for Ontario, of which 3 genera and 20 species are also new for Canada (see checklist below).

Significant species

We have given brief notes on the Ontario distribution in each species treatment; however, some species are especially significant because of their apparent rarity or habitat-restriction. Two species (*Toxophora amphitea* Walker and *Poecilanthrax bicellata* (Macquart)) are known only from one or two southern Ontario grasslands

(Ojibway Prairie and Walpole Island), and another (*Paravilla separata* (Walker)) is known only from Walpole Island, Pinery Provincial Park and St. Joseph Island. Others (*Dipalta banksi* Johnson, *Chrysanthrax dispar* (Coquillett), *Bombylius fraudulentus* Johnson, and the Ontario species of *Geron* (*Geron*) Meigen and *Tmemophlebia* Evenhuis) are dune grassland associates; except for *D. banksi*, these are all known from very few sites. *Villa fumicosta* Painter is known from only two Ontario sites, both peatlands. Other very rarely collected species in Ontario without the apparent habitat restrictions of the dune, grassland and peatland species include *Apolysis sigma* (Coquillett), *Anastoechus barbatus* Osten Sacken, *Bombylius atriceps* Loew, *Aldrichia ehrmanii* Coquillett, *Metacosmus mancipennis* Coquillett, *Anthrax argropygus* Wiedemann, *Anthrax pauper* (Loew), and *Anthrax pluto* Wiedemann. Some of these species may be more common than collecting records suggest. For example, *Anthrax argropygus* and *Anthrax pauper* are both known in Ontario only from historical (1919) specimens labeled "Jordan, Ontario". We have relatively few recent specimens from the Niagara region of Ontario so it is possible that this apparent rarity/disappearance is a collecting artifact. *Anastoechus barbatus* is known to occur both in western Canada and the James Bay region of Quebec, and probably occurs across boreal Ontario; the lack of records may be due in part to the limited collecting effort in that range. Both *Apolysis sigma* and *Metacosmus mancipennis* are small and easily mistaken for other families (Empididae and Pipunculidae, respectively), which may cause general collectors to bypass them. For the most part, the habitat and host requirements of these rarely collected species are unknown, and may in some cases be limiting factors in their abundance.

Biology

Most bee flies are ectoparasitoids, with active first instar triungulin larvae that attach themselves to hosts, usually insect larvae, in concealed places such as burrows or nests. Although hosts remain unknown for the majority of Canadian species, most of the species with known hosts are ectoparasitoids of solitary bees and wasps and are thus most likely to be encountered in the kinds of open, dry habitats that support the greatest diversity of aculeate Hymenoptera. Some of the bee flies found seeking hosts over open, sandy ground attack hosts other than bee and wasp larvae, including grasshopper egg pods (*Anastoechus* Osten Sacken, *Systoechus* Loew), tiger beetle larvae (some

Anthrax Scopoli), or antlions (*Dipalta* Osten Sacken). Several groups, including *Villa* Lioy, *Exoprosopa* Macquart, *Systropus* Wiedemann and the Phthiriini, are parasitoids (usually endoparasitoids) of moth larvae and pupae. Some, such as *Hemipenthes* Loew, have been recorded as hyperparasitoids of other parasitoids that attack caterpillar and sawfly hosts (*Hemipenthes* species also attack the caterpillar and sawfly hosts). Host use in the Bombyliidae has been comprehensively reviewed, most recently by Yeates and Greathead (1997). Little work has been done specifically on host use in eastern Canada, although Packer (1988) found *Bombylius pulchellus* Loew to be a major cause of brood mortality in the halictid bee *Halictus ligatus* Say in Ontario.

Host and habitat data, where known, are given under each genus or species below, generally derived from Hull (1973) and Yeates and Greathead (1997).

Taxonomic problems

Although bee flies are relatively well known taxonomically, there are some remaining taxonomic issues that need to be resolved. Problems in some genera include difficulties both in assigning the correct names to Ontario taxa and in evaluating the distinctiveness of closely related forms. Of the taxa occurring in Ontario, the most problematic is the genus *Villa*. This is the largest genus in Ontario, but the most comprehensive key dates to the 19th century (Coquillett 1892b). Little has been published on *Villa* since then, and a thorough revision is required. Recent revisions of the Nearctic fauna are also lacking for several related genera, including *Hemipenthes*, *Chrysanthrax* Osten Sacken, and *Exoprosopa*, although Ontario has only a few species in each of these genera. The subgenus *Geron* (*Geron*) was recently revised (Hall and Evenhuis 2003), but species of this subgenus remain difficult to identify since the key relies on dissection and it is necessary to compare genitalia to published figures or reference specimens.

Some apparent pairs of very similar species currently treated as distinct require further study, as some might turn out to be single, variable species. Painter and Painter (1962) suggested that this might be the case for *Lepidophora lutea* Painter and the southeastern *L. lepidocera* (Wiedemann), and Hall and Evenhuis (1981) suggested the same for *Systoechus vulgaris* Loew and *S. candidulus* Loew. *Dipalta banksi* and the widespread *D. serpentina* (Osten Sacken), like some pairs of very similar *Villa* species, also need to be critically compared in the context of thorough taxonomic revisions.

How to use the key

The majority of species will be identifiable by reference to the species plates, but if in doubt it is best to begin with the dichotomous keys. There is considerable variation in some bee fly species: sexual dimorphism is frequent, and body size and colour often vary between specimens of the same species. Individuals occasionally show aberrant wing venation, sometimes with extra or missing crossveins. Hairs are easily rubbed off specimens; although many rubbed specimens can be identified by comparison with intact individuals, some can become impossible to identify when heavily denuded (particularly *Villa* species).

Non-technical terms have been used whenever possible in the keys, and where technical terms are used for brevity or clarity they are explained where they first appear in the key. An exception to this is the use of terms referring to the setae or hairs that typically cover bee flies' bodies. These setae are separated into *pile*, referring to long, thin, and usually erect setae, and *tomentum*, referring to thicker, curly or flattened setae pressed against the body surface. Other terms are occasionally used when particular groups of setae do not fit these broad categories, and the term *scales* has been used to refer to either flattened hairs on appendages or to the long, erect, flattened hairs on the abdomen of some *Lepidophora* and *Villa* species. Measurements given in the key and species notes refer to body length excluding the antennae and proboscis, and are derived from Ontario specimens when possible. There is considerable variation in body size in most Bombyliidae, and some specimens may fall outside of the ranges recorded here.

This key is focused on the fauna of Ontario, and we have restricted distribution notes to this province due to the paucity of records from the other eastern provinces. However, the key covers all species we know or expect to occur in eastern Canada, including apparently coastal species (such as *Bombylius incanus* Johnson and *Villa shawii* (Johnson)) which probably do not occur in Ontario. The key also covers the majority of species occurring in the northeastern United States. Bee fly diversity increases dramatically to the south and west, and less than 8% of the Nearctic species listed by Evenhuis and Greathead (1999) are included in this key.

Checklist of species included in the key (all species known to occur, or likely to occur, in eastern Canada)

‡ - New Canadian record

† - New Ontario record

* - Species not yet recorded in Ontario

Species listed without comment here were recorded from Ontario by Evenhuis and Greathead (1999), including the updates of Evenhuis and Greathead (2003).

Usiinae:

Apolysis Loew‡

A. sigma (Coquillett)‡ – Genus and species first recorded here for Ontario and Canada

Phthiriinae:

Poecilognathus Jaenicke

P. sulphureus (Loew)

Tmemophlebia Evenhuis

T. coquilletti (Johnson)

T. vockerothi Hall and Evenhuis – Recently described (2004), type locality is Sandbanks P.P.

Toxophorinae:

Geron Meigen – Genus first recorded for Ontario by Skevington et al. (2000)

G. (Geron) vitripennis Loew – First recorded for Ontario and Canada by Skevington et al. (2000)

G. (Geron) prosopidis Hall and Evenhuis† – Species first recorded here for Ontario

G. (Empidigeron) calvus Loew – Species first recorded for Ontario and Canada by Skevington et al. (2000)

Systropus Wiedemann

S. macer Loew – Genus and species recorded for Ontario by Painter and Painter (1963); not recorded in catalog

Toxophora Meigen†

T. amphitea Walker‡ - Genus and species first recorded here for Ontario and Canada

Bombyliinae:

Anastoechus Osten Sacken†

A. barbatus Osten Sacken† - Genus and species first recorded here for Ontario

Bombylius Linnaeus

B. atriceps Loew

B. comanche Painter‡ - Species first recorded here for Ontario and Canada

B. fraudulentus Johnson‡ - Species first recorded here for Ontario and Canada

B. fulvibasoides Painter*

B. incanus Johnson*

B. major Linnaeus

- B. mexicanus* Wiedemann‡ - Species first recorded here for Ontario and Canada
B. pulchellus Loew
B. pygmaeus Fabricius
B. validus Loew*
B. varius Fabricius*
Systoechus Loew
S. candidulus Loew‡ – Species first recorded here for Ontario and Canada
S. vulgaris Loew – Genus and species first recorded for Ontario and Canada by Skevington et al. (2000)
Aldrichia Coquillett‡
A. ehrmanii Coquillett‡ – Genus and species first recorded here for Ontario and Canada
Sparnopolius Loew
S. confusus (Wiedemann)
- Ecliminae
Lepidophora Westwood
L. lutea Painter
Thevenetimyia Bigot
T. funesta (Osten Sacken)
T. harrisi (Osten Sacken) – Species recorded for Ontario by Hall (1969); record not included in catalog
- Lomatiinae
Ogcodocera Macquart*
O. leucoprocta (Wiedemann)*
- Tomomyzinae
Metacosmus Coquillett – Genus first recorded for Ontario and Canada by Skevington et al. (2000).
M. mancipennis Coquillett‡ – Species first certainly recorded here for Ontario and Canada. Previously unrecorded sexual dimorphism precluded certain identification by Skevington et al. (2000).
- Anthracinae
Anthrax Scopoli
A. albofasciatus Macquart
A. argropygus Wiedemann
A. georgicus Macquart
A. irroratus Say
A. pauper (Loew)
A. picea Marston
A. pluto Wiedemann‡ – Unconfirmed literature record from Algoma Dist. (Williamson 1907) may refer to *A. stellans*
A. stellans (Loew)
Xenox Evenhuis
X. tigrinus (De Geer)
Exoprosopa Macquart
E. decora Loew
- E. dorcadion* Osten Sacken
E. fasciata Macquart‡ – Species first recorded here for Ontario and Canada
E. fascipennis (Say)
Chrysanthrax Osten Sacken
C. cypris (Meigen)*
C. dispar (Coquillett)
C. edititius (Say)*
Dipalta Osten Sacken
D. banksi Johnson – Genus and species first recorded for Ontario and Canada by Marshall (1998)
Hemipenthes Loew
H. sp. cf. catulina (Coquillett)‡ - *H. catulina* is not previously recorded from Ontario or Canada
H. morio (Linnaeus)† - Species first recorded here for Ontario
H. sinuosa (Wiedemann)‡ - Species first recorded here for Ontario and Canada
H. webberi (Johnson)
Paravilla Painter - Genus first recorded for Ontario by Skevington et al. (2000)
P. separata (Walker)† - Species first recorded here for Ontario
Poecilanthrax Osten Sacken
P. alycon (Say)
P. bicellata (Macquart)‡ - Species first recorded here for Ontario and Canada
P. nigripennis (Cole)*
P. tegminipennis (Say)
Thyridanthrax Osten Sacken‡
T. fenestratoides (Coquillett)‡ - Genus and species first recorded here for Ontario and Canada
Villa Lioy
V. alternata (Say) – Species first recorded for Ontario and Canada by Skevington et al. (2000)
V. arenicola (Johnson)‡ - Species first recorded here for Ontario and Canada
V. atra Painter
V. fulviana (Say)
V. fumicosta Painter‡ - Species first recorded here for Ontario and Canada
V. gracilis (Macquart)*
V. handfordi Curran† - Species first recorded here for Ontario
V. hypomelas (Macquart)
V. johnsoni Painter*
V. lateralis (Say)
V. nigra Cresson‡ - Species first recorded here for Ontario and Canada
V. nigricauda (Loew) ‡ - Species first recorded here for Ontario and Canada

- V. nigropecta* Cresson‡ - Species first recorded here for Ontario and Canada
- V. shawii* (Johnson)*
- V. vestita* (Walker)*
- V. cf. pretiosa* (Coquillett)‡ - Species first recorded here for Ontario and Canada

Key to the bombyliid genera of Ontario and eastern Canada

Based in part on Hall (1981); see also Hull (1973), Yeates (1994), Hall and Evenhuis (1980).

- 1 Elongate mimics of orange and black sphecid wasps; abdomen long, swollen apically; wings conspicuously shorter than abdomen (Figure 7A). Antennae and proboscis both very long (much longer than head, Figure 7B) **Systropus**
 1 Ontario species, *S. macer* (Plate 7). 13-17 mm. Southwestern and southeastern Ontario (also along the eastern U.S. seaboard and west into Texas). Larvae are parasitoids on limacodid larvae (slug caterpillars). Adults fly Aug. – Sept.
- Not as above; wings at least as long as abdomen. If proboscis very long then antennae relatively short (eg. Figure 15B) 2
- 2 Proboscis long, extending beyond anterior oral margin by more than length of antennae (Figures 15B, 24A) 3
- Proboscis short to medium length, extending beyond oral margin by less than length of antennae (Figures 25D, 48B)..... 11
- 3 Wing with M₂ entirely absent (Figure 6C); small, dark humpbacked flies 4
- Wing with M₂ present , normally complete (Figure 2C) but present as a stub of varying length (Figure 60h) in strongly humpbacked species with long bristles on thorax and white and yellow tomentum on abdomen (*Toxophora*)..... 5
- 4 Antennal flagellum blunt-tipped, with a subapical sulcus containing a stylus (Figure 1B); very small (2.5-3.5 mm), dark, bare flies **Apolysis**
 1 Ontario species, *A. sigma* (Plate 1). Rarely collected, known in Ontario from Constance Bay, Muskoka Co., and Metcalfe (also distributed along Appalachian states and Rocky Mountain and Sierra Nevada states in the U.S.). Host unknown. Adults recorded in May.
- Antennal flagellum pointed and entire, without a subapical sulcus (Figure 6B); small to medium sized (3-6.5 mm) flies with gold and silver tomentum **Geron**
 Two subgenera, with several Ontario species. Key 2.
- 5 Cell r5 closed before wing margin (Figure 15C). Medium sized (5-13 mm) flies with short antennae and very long proboscis, body covered with white, yellow, orange, or brown pile 6
- Cell r5 open to wing margin (Figure 24C). Variable size and colour..... 8
- 6 Crossvein r-m situated beyond basal quarter of cell dm, cell br longer than cell bm (Figure 16C) **Bombylius**
 7 Ontario species, 4 additional species. Key 3.
- Crossvein r-m situated before basal quarter of cell dm, cells br and bm of equal length (Figure 22C) .. 7
- 7 Face rounded in side view, with dense pile (Figure 9A) **Anastoechus**
 1 Ontario species, *A. barbatus* (Plate 9). 6-12 mm. Recorded in Ontario from Sault Ste. Marie and Kenora (widespread, from the Yukon south through most of U.S. except southeastern states). Larvae probably feed on grasshopper egg pods. Adults probably fly July-Aug
- .Face triangular in side view, with sparse pile (Figure 22B) **Systoechus**
 2 Ontario species. Key 4.
- 8 Medium to large (6-15 mm) flies with black tegument (Figures 24B, 26A); antennal flagellum entire (Figure 27D); mid- and hind tibia with rows of large bristles 9

- Small (1.5-6 mm) flies with yellowish or greyish tegument (Figures 2A, 3E); antennal flagellum with an apical sulcus containing a style (Figure 2D); mid- and hind tibia with bristles other than apical bristles tiny or absent..... 10
- 9 Abdomen broad and flattened, covered with dense yellow pile and tomentum (Figure 24B); wing clear (Figure 24C)..... ***Sparnopolius***
1 Ontario species, *S. confusus* (Plate 24). 6-9 mm. South of Canadian Shield (widespread from southeastern Canada, through eastern, central, southwestern and southeastern U.S. into Mexico south to neotropical Oaxaca). Larvae recorded as parasitoids on the scarab genus *Phyllophaga* (June beetles). Adults fly late July – Sept.
- Abdomen cylindrical, with sparse white and black tomentum and pile (Figure 26A); wing smoky brown along leading edge (Figure 26E)..... ***Thevenetimyia***
2 Ontario species. Key 5.
- 10 Yellow species with orange to reddish markings on thorax (Figure 2A); crossveins and surrounding wing membrane dark (Figure 2C)..... ***Poecilognathus***
1 Ontario species, *P. sulphureus* (Plate 2). 4-6 mm. Rarely collected in south-central Ontario (widespread from southeastern Canada through the U.S. into northern Mexico; also known from the Bahamas and Cuba). Host unknown. Adults fly late Aug. – mid Sept.
- Grey species with whitish pollinosity (powdery appearance) (Figure 3A), wings slightly milky with pale veins (Figure 3E)..... ***Tmemophlebia***
2 Ontario species. Key 1.
- 11 Antennae longer than head length, covered in dense scales or long pile (Figure 25D)..... 12
- Antennae shorter than head length, basal segments with short pile or bare (Figure 48B)..... 14
- 12 Basal antennal segment swollen, covered with long pile (Figure 23B). Wings smoky, without scales, R₂₊₃ arising from R₄₊₅ at a right angle (Figure 23C). Body not hump-backed, prothorax not strongly developed (Figure 23B)..... ***Aldrichia***
1 Ontario species, *A. ehrmanii* (Plate 23). 8-9 mm. Rarely collected, known in Ontario only from near London (also central and eastern U.S.). Host unknown. Adults recorded in May and June.
- Antenna covered in with long flattened scales, basal segment narrow, straight-sided (Figure 25D). R₂₊₃ arising from R₄₊₅ at an acute angle, wings either smoky with scales (Figure 25C) or smoky to clear without scales (Figure 8C). Strongly hump-backed, with prominent prothorax (Figure 8D)..... 13
- 13 Relatively large (10-19 mm), with long, cylindrical abdomen (Figure 25B); wing dark smoky brown, with scales on dorsal surface, M₂ complete (Figure 25C)..... ***Lepidophora***
1 Ontario species, *L. lutea* (Plate 25). Central Ontario, north to Sault Ste. Marie (also eastern U.S. south to Florida). Larvae feed on provisions in nests of aculeate Hymenoptera. Adults fly late July – Sept.
- Smaller flies (7-8mm), with short, tapered abdomen (Figure 8B); wing pale smoky brown, without scales, M₂ incomplete (Figure 8C)..... ***Toxophora***
1 Ontario species, *T. amphitea* (Plate 8). Rare in Ontario, known from Windsor and Walpole Is. (also in a few localities in the Appalachian states south to northern Mexico). Probably a parasitoid of solitary Hymenoptera. Adults fly mid June – Sept.
- 14 Hind margin of eye straight, not indented (Figure 29B); small (3-6 mm) blackish flies with sparse pile and hemispherical heads, resembling pipunculids..... ***Metacosmus***
1 Ontario species, *M. mancipennis* (Plate 29). Rarely collected in southern Ontario (Also known from Massachusetts, New Jersey and Pennsylvania). Host unknown. Adults recorded in July and August.
- Hind margin of eye strongly indented (Figure 53B); usually with dense pile or tomentum 15
- 15 Broad-bodied flies with conspicuous white pile on face and end of abdomen, remainder of body with jet black pile (Figure 28A). Vein R₂₊₃ arising from R₄₊₅ at an acute angle proximal to crossvein r-m (Figure 28C);..... ***Ogcodocera***
1 possible Ontario species, *O. leucoprocta* (Plate 28). 6-7 mm. Not collected in Ontario but known from adjacent parts of Quebec and the United States (eastern Canada south through central and southeastern U.S. to southern Mexico). Host unknown.
- Shape and colour variable, but not with conspicuous white pile on both face and end of abdomen. Vein R₂₊₃ arising from R₄₊₅ at a right angle near crossvein r-m (Figure 69C)..... 16
- 16 Antenna with two flagellomeres and a terminal tuft of hair (Figure 38D). Basicosta broad and projecting (Figure 34C), laterotergite and mediotergite (area between wing and halter) bare (Figure 34C)..... 17

- Antenna with one or two antennal flagellomeres and an apical stylus but without a terminal tuft of hair (Figure 46D). Basicosta sharply pointed and narrow (Figure 49D), laterotergite and mediotergite with pile (Figure 49D)..... 18
- 17 Wing with a closed cell posterior to cell dm, formed by a secondary crossvein between crossvein m and CuA₁ (Figure 38C); large flies (16-18 mm)..... **Xenox**
1 Ontario species, *X. tigrinus* (Plate 38). Southwestern Ontario, north to Guelph (widespread southeastern Canada and eastern and southeastern U.S.). Larvae are parasitoids of *Xylocopa virginica* (large carpenter bees). Adults fly Aug. – Oct.
- No closed cell posterior to cell dm (Figure 36D); small to medium flies (4-12 mm)..... **Anthrax**
8 Ontario species. Key 6.
- 18 Veins R₂₊₃ and R₄ connected by a crossvein (Figure 41C)..... 19
- Veins R₂₊₃ and R₄ not connected by a crossvein (Figure 69C)..... 20
(Some rare individuals have aberrant wing venation that could cause confusion. See alternative couplets 18-19 below for additional characters only visible with high magnification.)
- 19 Vein R₂₊₃ with a single curve near the apex (Figure 41C). Antenna with a basal conical flagellomere and an elongated second flagellomere ending in an apical stylus (Figure 39D)..... **Exoprosopa**
4 Ontario species. Key 7.
- Vein R₂₊₃ S-shaped near apex (Figure 46C). Antenna with one conical flagellomere ending in an apical stylus (Figure 46D)..... **Dipalta**
1 Ontario species, *D. banksi* (Plate 46). 8-11 mm. Known in Ontario from sandy areas along lakes Erie and Huron, occasionally inland (also known from Ohio and Virginia in the U.S.). Larvae parasitoids on Myrmeleontidae (antlions). Adults fly July – Sept.

[Alternative couplets 18-19. The following provide an alternative to couplets 18-19 above.

- 18 Antenna with one conical flagellomere ending in an apical stylus (Figure 46D); pulvilli (tarsal pads) rounded and not appearing as teeth as the base of tarsal claws 19
- Antenna with a basal conical flagellomere and an elongated second flagellomere ending in an apical stylus (Figure 39D); pulvilli pointed, appearing as teeth at the base of the tarsal claws **Exoprosopa**
- 19 Vein R₂₊₃ S-shaped near apex, connected to R₄ with a crossvein; wings clear with large coalesced dark spots (Figure 46C)..... **Dipalta**
- Vein R₂₊₃ with a single curve near apex, not connected to R₄ (Figure 69C); wings not spotted, or wings dark with clear spots..... 20]
- 20 Face not projecting, rounded (Figure 48B) 21
- Face projecting, usually conical (Figure 51C)..... 22
- 21 Anterior half of wings dark brown, sharply divided from clear posterior half (Figure 48C)
..... **Hemipenthes**
4 Ontario species. Key 8.
- Wings usually clear (Figure 66C), anterior edge occasionally smoky brownish as far as crossvein r-m, but dark portion not sharply divided from clear posterior part (Figure 61C)..... **Villa**
12 recorded Ontario species, 4 additional species. Key 10.
- 22 Face with only thin, mostly erect hairs (Figure 52E); wings extensively smoky brown with or without clear spots (Figure 52C); basal antennal segment strongly expanded at apex, wider than 2nd segment (Figure 55C)..... **Poecilanthrax**
3 recorded Ontario species, 1 additional species. Key 9.
- Face with some flattened scale-like hairs (Figure 51C); apical third or more of wings clear (Figure 51A); basal antennal segment not strongly expanded at apex (Figure 56D) 23

- 23 Fore tibia with bristles about as long as diameter of the tibia; claws on each leg equal in size; basal half of wing dark brown (Figure 51A); abdomen black with yellow and black bands of tomentum (Figure 51A) **Paravilla**
1 Ontario species, *P. separata* (Plate 51). 9-12 mm. Known in Ontario from Lambton Co. and St. Joseph I. (southern Canada, south through central and southeastern U.S.). Larvae are probably parasitoids of solitary bees. Adults fly late July – early Sept.
- Fore tibia without long bristles, at most very short hairs present; claws on fore tibia smaller than claws of other legs (); wing pattern variable, if basal half of wing dark brown without clear spots then sides of abdomen orange and body covered with orange tomentum (Figure 43B) 24
- 24 Basal half of wing dark brown with clear windows around crossveins (Figure 56C); pale bands on abdomen interrupted in middle by black tomentum (Figure 56B) **Thyridanthrax**
1 Ontario species, *T. fenestratooides* (Plate 56). 13 mm. Known in Ontario from north and west of Lake Superior (southern Canada, south through central U.S. to north central Mexico). Host unknown, hosts of the genus include Hymenoptera, Coleoptera, Lepidoptera, and Orthoptera. Adults fly late June – early July.
- Wing pattern variable, either pale smoky brown with dark crossveins (Figure 45C) or dark brown basally, but without clear windows (Figures 43C, 44C); abdomen covered in yellow to orange tomentum (Figure 43B, 45A) or dark with complete pale bands (Figure 44A)..... **Chrysanthrax**
1 recorded Ontario species, 2 additional species. Key 11.

Keys to species

* by a species name indicates the species is not recorded from Ontario

1. *Tmemophlebia*

Larval hosts are unknown; both Ontario species are restricted to sand dunes and extensive sandy areas. Adults of both species fly July – Sept. Key based on Hall and Evenhuis 2004.

- 1 Males with basal $\frac{3}{4}$ of femora black (Figure 4A); females with upper legs of “H” pattern on occiput long and thin (Figure 4D); usually larger (3.5-6 mm). Male with epandrium subtriangular in lateral view with sclerotized villi on posterior surface (Figure 4C)..... **vockerothi**
Known in Ontario east to Sandbanks Provincial Park and north to Inverhuron Provincial Park. (Great Lakes area). Plate 4.
- Males with femora yellow to brown basally (Figure 3A); females with upper legs of “H” pattern on occiput short and wide (Figure 3D); usually smaller (1.5-3.5 mm). Male with epandrium subglobular in lateral view with sclerotized villi on dorsal surface (Figure 3C)..... **coquilletti**
Known in Ontario east to Constance Bay and north to Manitoulin Island (widespread from southern Canada to northern Mexico). Plate 3.

2. *Geron*

Larvae are endoparasitoids of Lepidoptera in several families. Adults fly July – Sept. Key based in part on Hall (1981) and Hall and Evenhuis (2003).

- 1 Vein R_5 as long as section of R_{4+5} following crossvein r-m (Figure 6C); frons of female almost bare (Figure 6B)..... subgenus **Empidigeron**
1 Ontario species, *G. (E.) calvus* (Plate 6). 3-6.5 mm. Found in Ontario south of the Canadian Shield. (also northeastern U.S. from Pennsylvania east to New Hampshire).
- Vein R_5 shorter than section of R_{4+5} following crossvein r-m (Figure 5E); frons of female tomentose (Figure 5C)..... subgenus **Geron 2**
Note: There are several species in this subgenus in the northeast, but they can only be reliably identified by dissection of the female genitalia. The two positively recorded Ontario species (Plate 5) are keyed here
- 2 Crossvein m-cu sinuous (Figure 5E). Female with a medial stripe of golden tomentum above antennae (Figure 5C)..... **vitripennis**
3-6 mm. Rare in Ontario, known from Windsor, Elgin Co., Pinery Provincial Park, and Pelee Island (widespread in U.S., south to northeastern Mexico). Adults recorded July – Sept.
- Crossvein m-cu straight (Figure 5D). Female with silver tomentum above antennae (Figure 5B) **prosopidis**
4 mm. Rare in Ontario, known from a single specimen from Rondeau Provincial Park (early Sept.) (western and eastern Canada, south through central and western U.S. to Nuevo León, Mexico).

3. *Bombylius*

Larval hosts are solitary bees. Adults are mostly active in spring and early summer, with occasional later records. Key based in part on Hall and Evenhuis (1980).

- 1 Wing with dark spots or transverse bands (Figures 17C, 18C) 2
- Wings clear to extensively brown at base, not spotted (Figures 11C, 16C, 15C)..... 3
- 2 Wing spots connected in bands across wing (Figure 17C), pile yellow and black (Figure 17A) *pulchellus*
5-7 mm. South-central Ontario, north to Washago (southern Canada and northeastern U.S., west to Kansas). Adults fly May – mid June. Plate 17.
- Wing spots not connected into bands (Figure 18C), pile reddish brown and white (Figure 18B) *pygmaeus*
6-10 mm. Widespread in Ontario, but apparently absent from the southwest (Alaska, Canada, northeastern U.S. south to Georgia; also China). Adults fly May – mid June. Plate 18.
- 3 Wings almost entirely clear, slightly darkened at base. Crossvein r-m situated near basal $\frac{1}{4}$ – $\frac{1}{3}$ of cell dm (Figure 11C). Body pile golden yellow, no black pile present (Figure 11B) *comanche*
6-8 mm. Rarely collected in Ontario, recorded from Windsor north to Simcoe Co. (Great Lakes area and central U.S. to the Rockies). Adults recorded from late June to early August, mostly in first half of July. Plate 11.
- Wings extensively darkened at base. Crossvein r-m at or beyond basal $\frac{1}{3}$ of cell dm (Figures 15C, 16C). Body pile various colours but never entirely yellow 4
- 4 Dark anterior and clear posterior portions of wing sharply demarcated (Figure 15C) *major*
7-13 mm. Widespread in Ontario north to Sioux Lookout (widespread Holarctic including China and Japan; also Oriental region [India, Nepal, Bangladesh, and Thailand]). Adults fly late April – early June. Plate 15.
- Dark portion of wing blending into clear portion (Figure 16C) 5
- 5 Pile on face and cheeks white, body pile predominately white, with black and brown pile scattered on mesonotum and margins of abdominal tergites (Figure 14A) *incanus**
8-10 mm. Not recorded from Ontario (eastern U.S. seaboard, Maine south to Georgia). Plate 14.
- Pile on face black (Figure 10B); body pile of various colours, but predominately yellow dorsally 6
- 6 Wing entirely smoky brown, darker at base (Figure 12C) 7
- Smoky brown colour restricted to base of wing, posterior portion clear or grayish (Figure 16C) 8
- 7 Long black pile on posterior margins of abdominal tergites (Figure 12D), coxae and abdominal sternites with pale yellow to white pile (Figure 12A), humeral and postalar callus usually black (Figure 12B) *fraudulentus*
7-8 mm. Rare in Ontario, collected from Pinery Provincial Park and Norfolk Co. (also northeastern U.S. from Massachusetts south to Georgia). Adults recorded in July. Plate 12.
- Abdominal tergites covered in yellow pile (Figure 19A), coxae and abdominal sternites with black pile (Figure 19B), humeral and postalar callus red (Figure 19A) *validus**
12-13 mm. Not recorded from Ontario (rarely collected in the northeastern United States). Plate 19.
- 8 Large species (10-13 mm), female with stripe of whitish tomentum along center of abdominal tergites 2-5 (Figure 16E) 9
- Medium-sized species (8-9 mm), female with extensive yellow tomentum on abdomen, without a central stripe of white on tergites 2-5 (Figure 10E)..... 10
- 9 Postalar callus red (Figure 20A), abdomen with prominent bands of black pile on segments 2 and 3, posterior segments with white pile laterally and black pile medially (Figure 20D) *varius**
11-13 mm. Not recorded from Ontario (eastern U.S. from Ohio east to Maine and south to Florida). Plate 20.
- Postalar callus black (Figure 16A), abdomen with a few black hairs along posterior edges of segments (Figure 16E), otherwise covered with yellow pile *mexicanus*
10-12 mm. South-central to central Ontario (widespread in eastern and southern U.S.). Adults fly late May – early July. Plate 16.
- 10 Face yellowish to reddish brown (Figure 10B). Brown part of wing extending to near tip of R_1 (Figure 10D). Both sexes with white pile on all coxae (Figure 10C) *atriceps*

9 mm. Rare in Ontario, known only from Constance Lake and “Severn” [=Severn Bridge?] (widespread, southern Canada and northeastern and midwestern U.S.) Adults recorded in late June. Plate 10.

- Face dark brown to black (Figure 13D). Brown part of wing extending to near tip of R_{2+3} (Figure 13C). Male with black pile on coxae (Figure 13A), female with white pile on fore coxa, mixed black and white pile on middle and hind coxae (Figure 13B) *fulvibasoides**
8 mm. Not recorded from Ontario (widespread in northeastern and central U.S.). Plate 13.

4. *Systoechus*

Larvae feed on grasshopper egg pods. Adults fly late June – mid Aug. Key based on Hall and Evenhuis (1981).

- 1 Face with yellow and black pile (Figure 22D); body pile yellow (Figure 22B) *vulgaris*
5-10 mm. Southern Ontario, north to north shore of Georgian Bay (central U.S. to southern Canada). Plate 22.
- Face with entirely black pile (Figure 21D); body pile white (Figure 21A) *candidulus*
7-9 mm. Southern Ontario, rarely collected (also central U.S. north to Wisconsin). Plate 21.

5. *Thevenetimyia*

Larval hosts are not recorded for either of the Ontario species but congeners have been recorded as possible parasitoids of wood-boring Coleoptera.

- 1 Larger species (12-15 mm); scutellum with only white pile (Figure 27E); upper half of occiput (posterior side of head behind eyes) with white pile in both sexes, a few black hairs sometimes present near top; abdominal segment 5 with black pile ventrally (Figure 27A) *harrisi*
Boreal areas south to Ottawa (Mer Bleue bog), rarely collected (eastern Canada and northeastern U.S.). Adults recorded in June and July. Plate 27.
- Smaller species (7-9 mm); scutellum with some long black hairs (Figure 26B); male with mostly black pile on upper half of occiput, and mixed black and white pile ventrally on abdominal segment 5 (Figure 26D); female with white pile on upper occiput with a few black hairs near top and white pile on abdominal segment 5 (Figure 26C) *funesta*
Rarely collected in central Ontario (southeastern Canada to adjacent U.S.). Adults recorded from May to early July. Plate 26.

6. *Anthrax*

Larvae of all Ontario species except *A. georgicus* are probably parasitoids of solitary wasps and bees. Key based on Marston (1963, 1970)

- 1 Wing solid black at the base, not broken into spots (Figure 32C) 2
- Wings spotted (Figure 30E) 3
- 2 Posterior margin of alula convex; wing broad (Figure 32C) *georgicus*
Formerly known as *A. analis*. 7-10 mm. Larvae are parasitoids of Cicindellidae (tiger beetles). Widespread in Ontario north to Algonquin Provincial Park (widespread, Canada south to Nicaragua; also Cuba). Adults fly July – Sept. Plate 32.
- Posterior margin of alula straight; wing elongate and narrow (Figure 31C) *argyropygus*
7-8 mm. One Ontario record, from Jordan (Sept.) (widespread from U.S. into central Mexico; also Cuba). Plate 31.
- 3 Wing with numerous spots beyond the bases of cells (Figures 33C, 37D). Medial angle of crossvein m usually with a short spur and a distinct spot; vein R_4 with a short spur (Figure 37D) 4
- Spots on wings restricted to bases of cells (Figure 35D). Medial angle of crossvein m without a spur or spot; medial angle of R_4 without a spur (Figure 35D) 6
- 4 Cells c and sc with alternating dark and clear spots; many large and small spots, not all connected to veins (Figure 33C) *irroratus*
5-10 mm. Widespread in Ontario north to north shore of Lake Superior (widespread from Canada south to Honduras; also Puerto Rico). Adults fly late May to Sept. Plate 33.
- Cells c and sc entirely brown; spots large and connected to veins (Figure 36D) 5
- 5 Femora brown, hind femur with brown scales, abdominal sternites with brown and white tomentum (Figure 37C) *stellans*

12 mm. Widespread but rarely collected in Ontario (western and eastern Canada, south into New Hampshire, and western cordillera to Mexico). Adults fly June – July. Plate 37.

- Femora black, hind femur with black scales, abdominal sternites with black and white tomentum (Figure 36C)..... **pluto**
11-12 mm. Confirmed records from Windsor and Guelph, unconfirmed literature record from Algoma District (Williamson 1907) (also fairly widespread in central U.S.). Adults recorded in July and August. Plate 36.
- 6 Cell r4 with a spot at base (Figure 30E)..... 7
- Cell r4 clear at base (Figure 34D)..... **pauper**
7 mm. One Ontario record, from Jordan (July) (Rockies east to Great Lakes area and New York and Maryland). Plate 34.
- 7 Cell m1 with a large spot at base (Figure 35D). Distal lobes of male gonocoxites more than twice as long as the width of one lobe at the base and curved inwards, with stout hairs at tip (Figure 35C)
..... **picea**
8-10 mm. Found in boreal areas in Ontario (widespread in Canada, south to northern U.S.). Adults fly in July. Plate 35.
- Cell m1 with spot at base often faint or absent (Figure 30E). Distal lobes of male gonocoxites less than twice as long as the width of one lobe, not incurved, with fine hairs at the tip (Figure 30D)
..... **albofasciatus**
4-11 mm. Widespread in Ontario north to Sudbury (widespread from Canada south to Honduras; also Brazil). Adults fly June – early Sept. Plate 30.

These species are closely related and are best separated by geography and male genitalia; females from central Ontario may not be identifiable.

7. Exoprosopa

Most recorded larval hosts in the genus are aculeate wasps. One of the Ontario species (*E. fasciata*) has been recorded as a parasitoid of larval *Phyllophaga* sp. (Scarabaeidae – June beetles); another (*E. fascipennis*) has been recorded as a hyperparasitoid on tiphiid parasitoids of *Phyllophaga* sp.

- 1 Wing entirely smoky brown, darker along veins (Figure 41C). Face nearly round, proboscis relatively long (Figure 41A)..... **fasciata**
13-18 mm. Southwestern Ontario, north to Barrie (also eastern U.S. west to Wyoming and New Mexico). Adults fly July – Sept. Plate 41.
- Wing dark brown with clear bands and spots (Figure 39C). Face conical, proboscis short (Figure 42D)
..... 2
- 2 Clear area at tip of wing reaching into cells r1, r5 and the basal part of r2+3 (Figure 42C). Abdominal segment 4 with a band of white tomentum (Figure 42B)..... **fascipennis**
5-14 mm. In Ontario found south of the Canadian Shield (Canada south through central and eastern U.S.; also Cuba). Adults fly mid June – early Sept. Plate 42.
- Clear area at tip of wing restricted to cell r4 and the distal part of cell r2+3 (Figure 40C). Abdominal segment 4 not distinctly banded (Figures 40A, 39B)..... 3
- 3 Wing with basal band clear and distinct (Figure 40C); extensive white tomentum on abdomen including a band at base of tergite 2 (Figure 40A). **dorcadion**
10-12 mm. Northern Ontario south to northern Bruce Peninsula (widespread from Canada south to Mexico). Adults recorded in July. Plate 40.
- Wing with basal band brownish and poorly defined (Figure 39C); white tomentum on abdomen restricted to small spots (Figure 39B)..... **decora**
10-15 mm. Southern Ontario, north to Spanish (widespread Canada and U.S.). Adults fly late June – Aug. Plate 39.

8. Hemipenthes

Known larval hosts include both Lepidoptera and diprionid sawflies and the tachinid flies and ichneumonoid wasps parasitizing them.

- 1 Brown part of wing crossing apex of cell r1 (Figure 49C)..... **sinuosa**
5-13 mm. South of the Canadian Shield in Ontario (widespread in southern Canada through central and eastern U.S.). Larvae recorded as parasitoids of *Neodiprion* sp. (pine sawflies). Adults fly late May – Sept. Plate 49.

- Brown part of wing not crossing apex of cell r1 (Figure 48C).....2
- 2 Up to 2/3 of cell a2 brown, hind margin of cell clear (Figure 50C)3
- More than 3/4 of cell a2, including hind margin, brown (Figure 48C)..... **morio**
6-13 mm. Widespread in Ontario north to Thunder Bay District (widespread in Holarctic including central and southern Asia; also possibly Thailand). Larvae recorded as hyperparasitoids on tachinids and ichneumonids. Adults fly late May – Aug. Plate 48.
- 3 Anterior and lateral edges of mesoscutum with yellow pile; whitish tomentum forming a crossband on abdominal tergite 4 (Figure 47B) cf. **catulina**
5-9 mm. Northern Ontario south to Sault Ste. Marie (also western and northern U.S.). Adults fly June – July. Plate 47. We are uncertain if this northeastern population is conspecific with true *H. catulina*, but in the absence of a revision we are treating it under this name.
- Lateral edges of mesoscutum with mixed black and gold pile; abdominal tomentum mostly black with scattered gold, not forming bands (Figure 50A)..... **webberi**
6-10 mm. Southern Ontario north to Powassan, St. Joseph Is. (southeastern Canada and central to northeastern U.S.). Adults fly June – July. Plate 50.

9. Poecilanthrax

Larvae are endoparasitoids of noctuid moths. Key based on Painter and Hall (1960).

- 1 Wing entirely smoky brown, without clear spots (Figure 55D) **tegminipennis**
12-17 mm. Southern Ontario north to Sudbury (southern Canada into mountainous western and northern and northeastern U.S.). Adults fly mid July – early Sept. Plate 55.
- Wing with clear spots (Figure 52C)2
- 2 Entire face with black hair (Figure 53B); abdominal tergites with median stripe of black tomentum (Figure 53A); wing without closed cell below cell dm (Figure 53D)..... **bicellata**
14-16 mm. Rare in Ontario, only known from Windsor (known in U.S. from Great Lakes region to midwest and eastern states). Adults fly mid July – Aug. Plate 53.
- Lower half of face with yellow hair (Figure 52E); abdomen without median dorsal stripe of black tomentum (Figure 52B); closed cell below cell dm formed by extra crossvein (Figure 52C).....3
- 3 Humeral callus black (Figure 52B); wings pale brown with spots clear (Figure 52C); front coxa with half or more black (Figure 52D)..... **alycon**
10-17 mm. Rarely collected, southern Ontario and Rainy River District (Great Lakes area west to south central Canada, central U.S., and the Rockies; also North Carolina). Adults fly July – Sept. Plate 52.
- Humeral callus partially or entirely reddish (Figure 54B); wings dark brown with spots smoky grey (Figure 54D); front coxa with 1/3 or less black (Figure 54C)..... **nigripennis***
13 mm. Not recorded from Ontario (rarely collected in the northeastern United States).

10. Villa

Larvae are mostly parasitoids of noctuid moths, and may also attack tenebrionid beetles. Key based in part on Painter (1926). This genus needs to be revised based on male genitalia; the characters used in this key may not be reliable and identifications based on them should be regarded as tentative. Some forms treated here may not be good species.

- 1 Tarsal claws of forelegs similar in size to those of other legs (Figure 62A). Fore tibia with prominent spines, sides of abdomen with long, flattened black scales (Figure 62B) **gracilis***
11 mm. Not recorded from Ontario (apparently extremely rare, recorded from Pennsylvania, Florida). Plate 62.
- Tarsal claws of forelegs much smaller than those of other legs. Fore tibia with prominent spines or sides of abdomen with long, flattened scales, but never with both characters2
- 2 Sides of abdomen with long flattened scales (Figure 66A). Fore tibia usually without spines, or with tiny spines.....3
- Sides of abdomen with normal pile only, not flattened scales (Figure 57B). Fore tibia usually with robust spines.....9

- 3 Wing extensively smoky brown (Figure 61C). Abdomen with distinct bands of black and yellow tomentum (Figure 61B)..... *fumicosta*
7-8 mm. Rarely collected, known from near Guelph and Ottawa (uncommon, known only from Ohio, Florida, Georgia, Texas and Coahuila in Mexico). Adults recorded in July and Aug. Plate 61.
- Wing mostly clear, costa and subcosta sometimes brownish (Figure 66C). Abdomen pattern variable .4
- 4 Sides of thorax and first three abdominal segments with deep orange pile (Figure 70B), tomentum of face black (Figure 70D)..... *shawii**
7 mm. Not recorded from Ontario (occurs on the east coast of the U.S. north to New Hampshire). Plate 70.
- Sides of thorax and first three abdominal segments with yellow pile sometimes mixed with black (Figure 67A), tomentum of face pale (Figure 59C) or black.....5
- 5 Abdomen uniformly colored or with narrow bands of light-coloured tomentum; thorax with black tomentum dorsally (Figure 67A).....6
- Abdomen with wide bands of light-coloured tomentum ; thorax with a triangle of light tomentum in front of scutellum (Figure 66A)8
- 6 Pile on pleuron (side of thorax) entirely pale (Figure 59B).....7
- Patch of black pile present on lower pleuron (Figure 67B)..... *nigra*
6-12 mm. Widespread in Ontario, collected as far north as Moosonee. (widespread in eastern U.S.; also Colorado). Adults fly June – Aug. Plate 67.
- 7 Tomentum of face pale (Figure 59C) *atra*
6-9 mm. Southern Ontario, rarely collected (eastern U.S. southwest to New Mexico). Adults recorded in July and August. Plate 59.
- Tomentum of face black..... *johnsoni**
Not recorded from Ontario (eastern U.S.). Not illustrated.
- 8 Light-coloured tomentum uniformly yellowish (Figure 66A)..... *lateralis*
5-13 mm. Widespread in Ontario, north to Thunder Bay District (widespread Canada south to Panama and Caribbean). Adults fly June – Sept. Plate 66.
- Light-coloured tomentum white on anterior part of abdomen, yellow on abdominal segment 7 and pre-scutellar triangle (Figure 58A) *arenicola*
5-9 mm. Rarely collected in Ontario, but widespread (also northern U.S.). Adults fly July – Aug. Plate 58.
- 9 Abdomen with only yellow pile on sides of segment 3 (Figure 72A).....10
- Abdomen with black pile on the sides of segment 3 (Figure 57B).....12
- 10 Abdomen with alternating bands of black and pale tomentum; pile on sides of segments 5 and 6 mostly black (Figure 72A) *pretiosa*
9-16 mm. Widespread, recorded north to Thunder Bay District (Canada south to Utah and California). Adults fly June – July. We are uncertain if this northeastern population is conspecific with true *V. pretiosa*, but in the absence of a revision we are treating it under this name. Plate 72.
- Abdomen without alternating bands of tomentum; pile on sides of segments 5 and 6 mostly yellow to orange, occasionally with some black pile mixed in (Figure 68B).....11
- 11 Pile and tomentum on face, legs, ventral side of body, and dorsum of last 4 abdominal segments black (Figure 68D); leading edge of wings dark smoky grey (Figure 68C)..... *nigricauda*
8-15 mm. Widespread, north to Thunder Bay District (northeastern U.S.; also Colorado). Adults fly July – Sept. Plate 68.
- Pile and tomentum on body almost entirely yellow (Figure 60B); leading edge of wings pale brown to clear (Figure 60C) *fulviana*
11-14 mm. One Ontario record from near Kenora (July) (widespread southern Canada, western, northern, and northeastern U.S.). Plate 60.
- 12 Dark pile present on pleuron (Figure 64B).....13
- Pleuron with only pale pile (Figure 57D).....14
- 13 Abdominal segment 4 without pale tomentum or pile (Figure 64A)..... *hypomelas*

13-16 mm. Southern Ontario, north to Algonquin Provincial Park, St. Joseph Is. (southern Canada south to central and eastern U.S.). Adults fly July – Sept. Plate 64.

- Abdominal segment 4 with pale tomentum and pile (Figure 69A) *nigropecta*
13-15 mm. Southern Ontario, north to Algonquin Provincial Park (also present, but uncommon, in the central U.S.). Adults fly late June – Sept. Plate 69.
- 14 Wings almost entirely clear, slightly brownish at base (Figure 57C)..... 15
- Wings mostly clear but with brownish colour extending to vein M, crossvein r-m, and tip of vein R₁ (Figure 71C)..... *vestita**
Known only from the type locality in Nova Scotia. Plate 71.
- 15 Abdomen distinctly banded, tergite 2 with pale tomentum only on anterior half (Figure 57B). *alternata*
10-17 mm. South of Canadian Shield in Ontario (northern and eastern U.S.). Adults fly July – Sept. Plate 57.
- Abdomen without distinct bands, tergite 2 with pale tomentum throughout (Figure 63A)..... *handfordi*
12-15 mm. Widespread but rarely collected in Ontario (also known from Manitoba). Adults recorded in July and Aug. Plate 63.

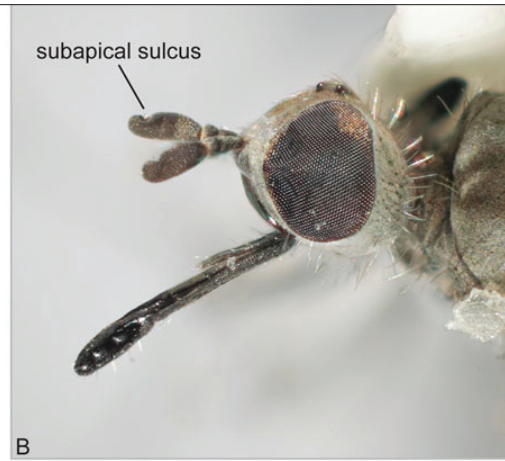
11. *Chrysanthrax*

1. Abdomen black with bands of white tomentum (Figure 44A) *dispar*
8-9 mm. In Ontario, along lakes Erie and Huron (widespread from the Great Lakes south to Mexico). Sandy areas, host unknown. Adults fly Aug. – Sept. Plate 44.
- Abdomen black and orange without bands of white tomentum (Figure 43B)..... 2
2. Basal half of wing dark brown, sharply divided from clear apical part (Figure 43C) *cypriis**
8-15 mm. Not recorded from Ontario (central and eastern U.S. south to Neotropical Mexico). Recorded as a parasitoid on a tiphiid wasp. Plate 43.
- Wing smoky with dark crossveins (Figure 45C) *edititius**
9-11 mm. Not recorded from Ontario (widespread in midwestern, central, and western U.S., south to Honduras.) Recorded as a parasitoid on anthophorid bees. Plate 45.

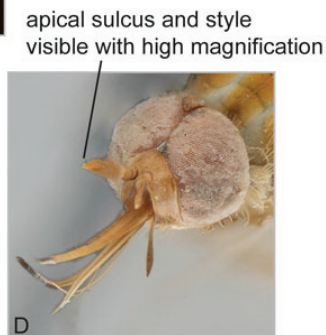
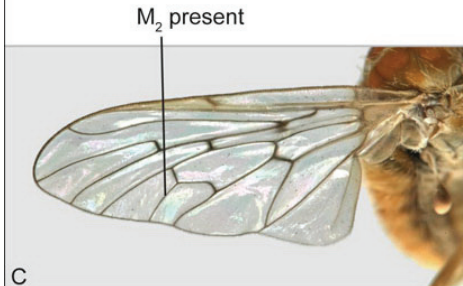
1. *Apolysis sigma* (Coquillett)

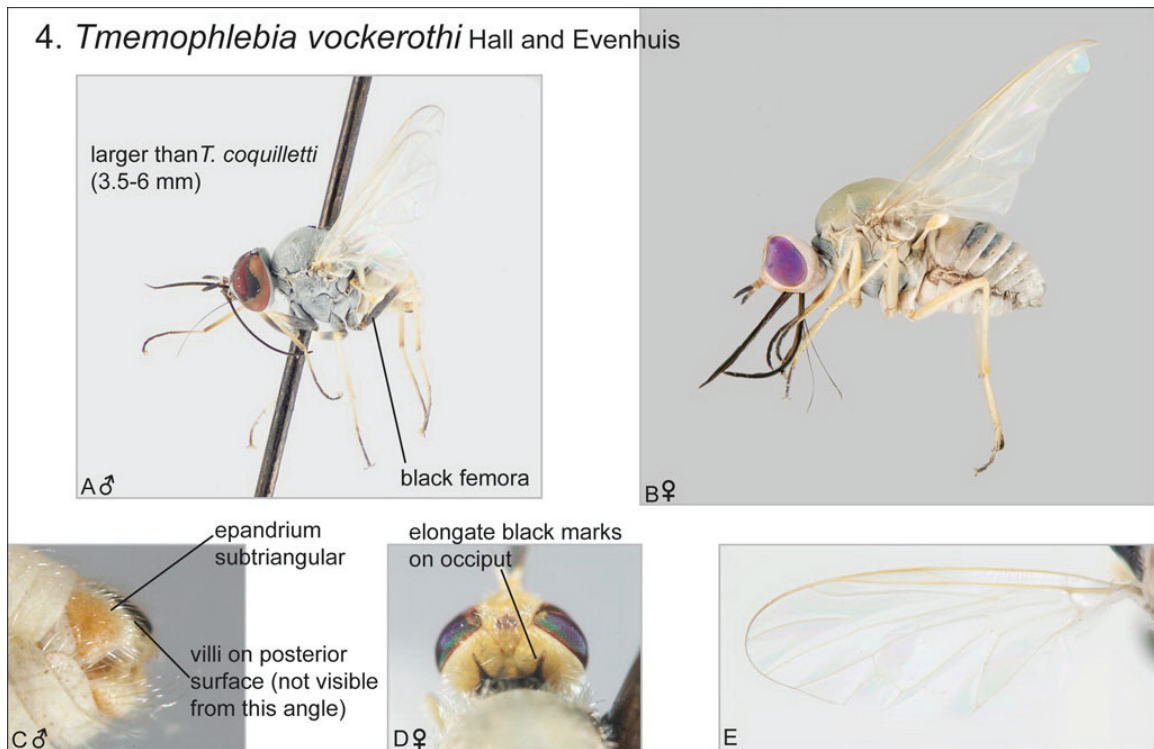
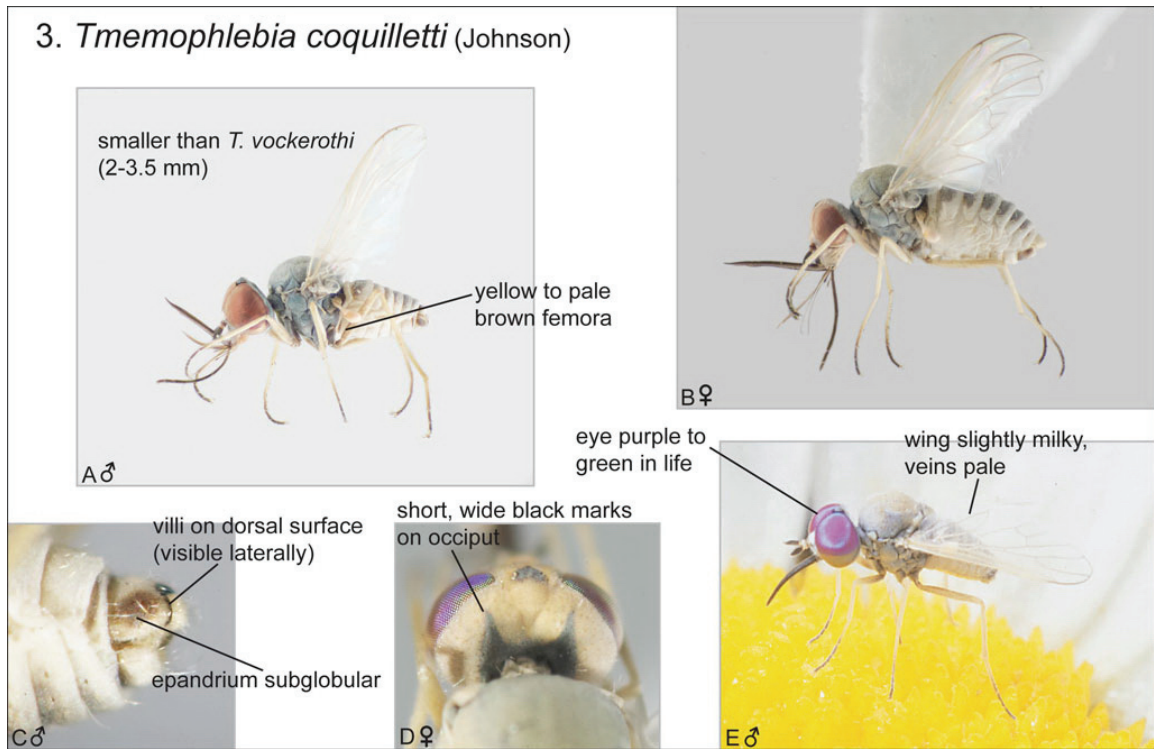


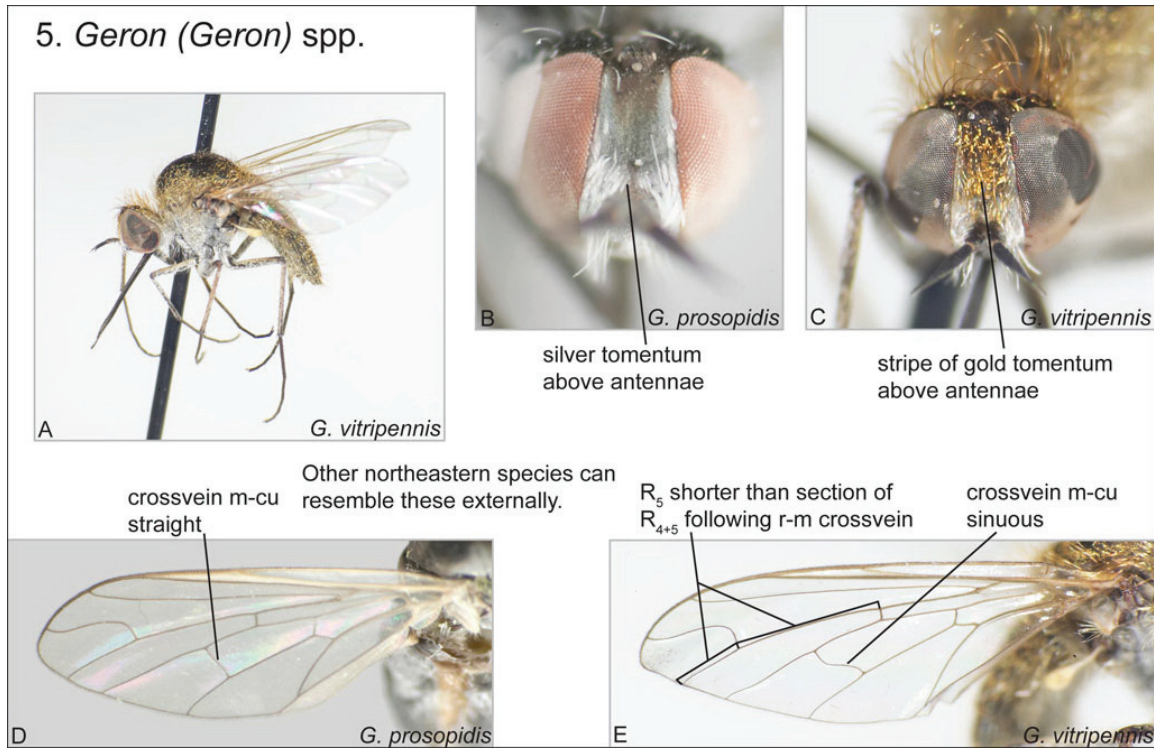
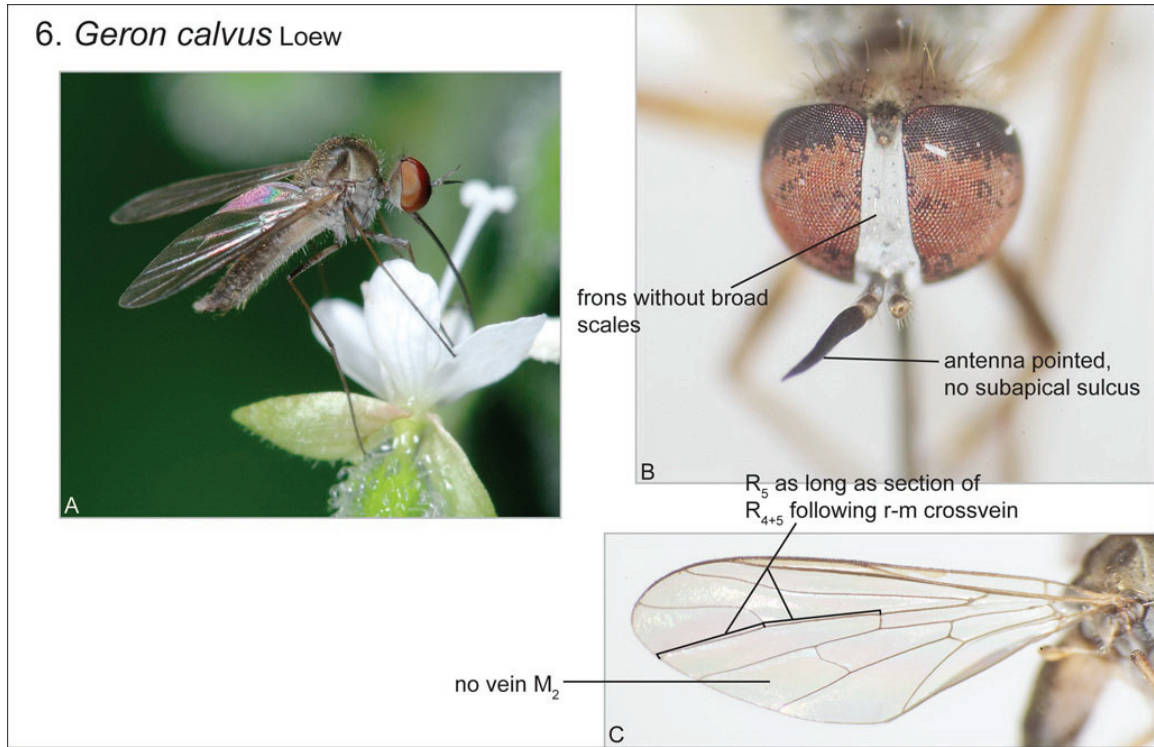
Very rarely collected in Ontario,
little is known about this species.

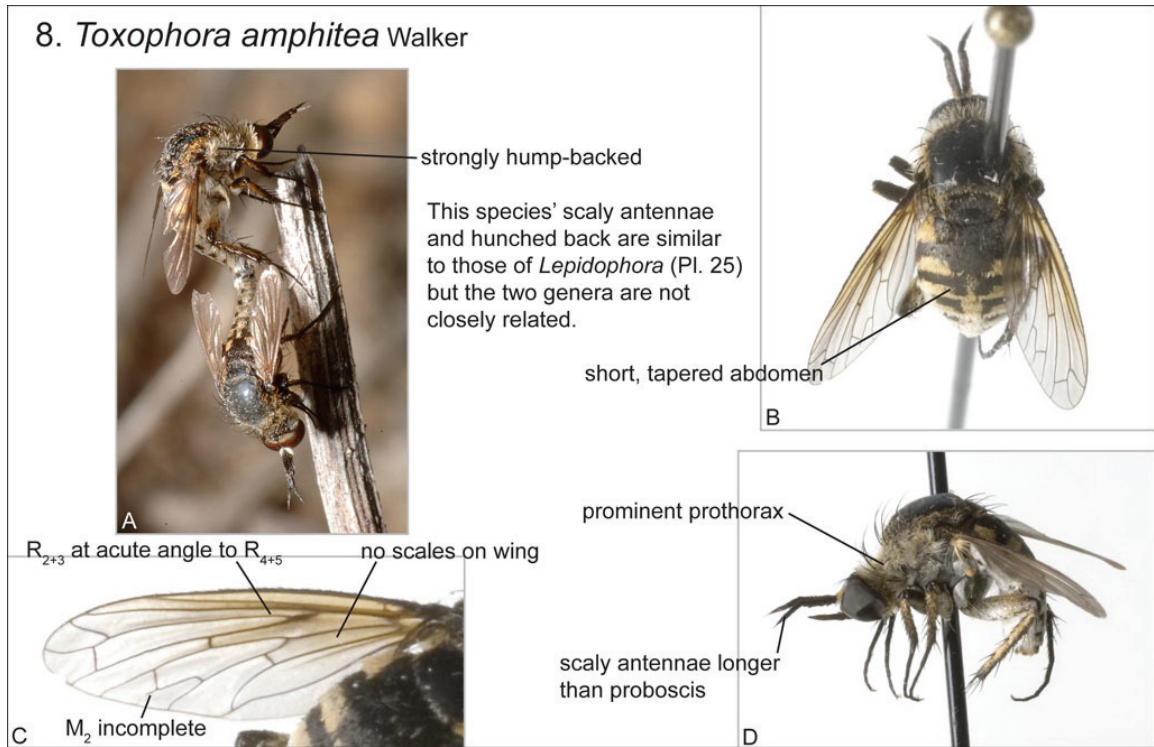
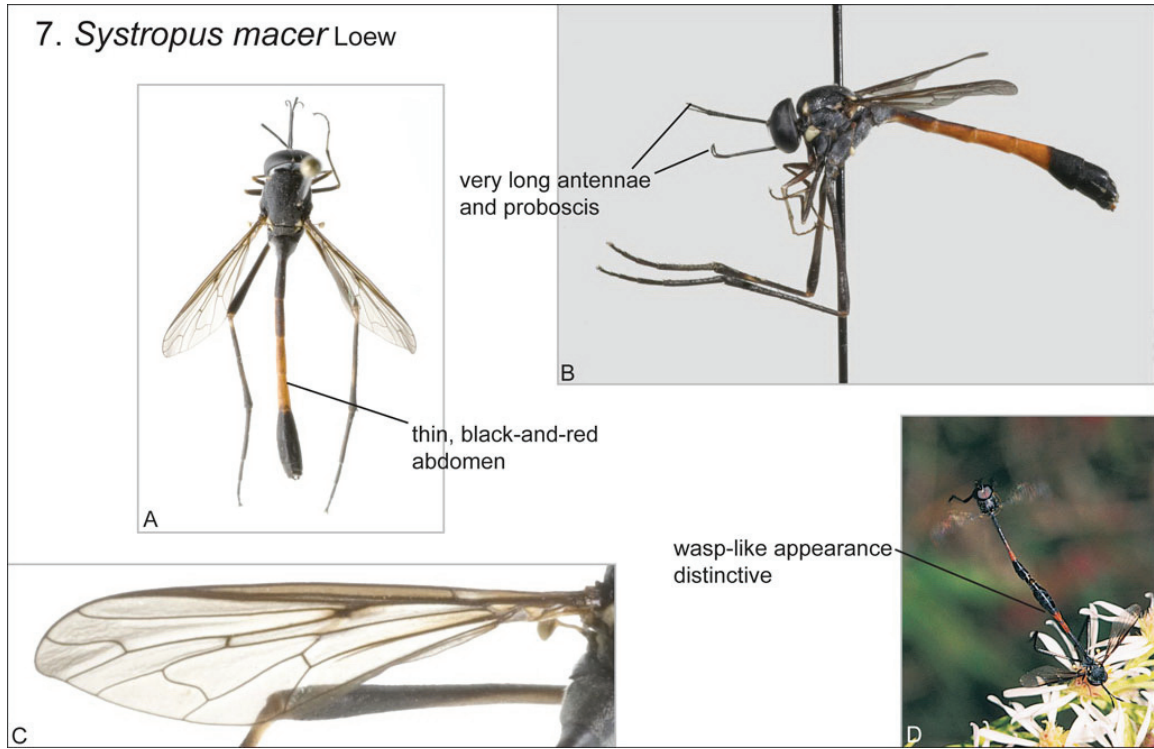


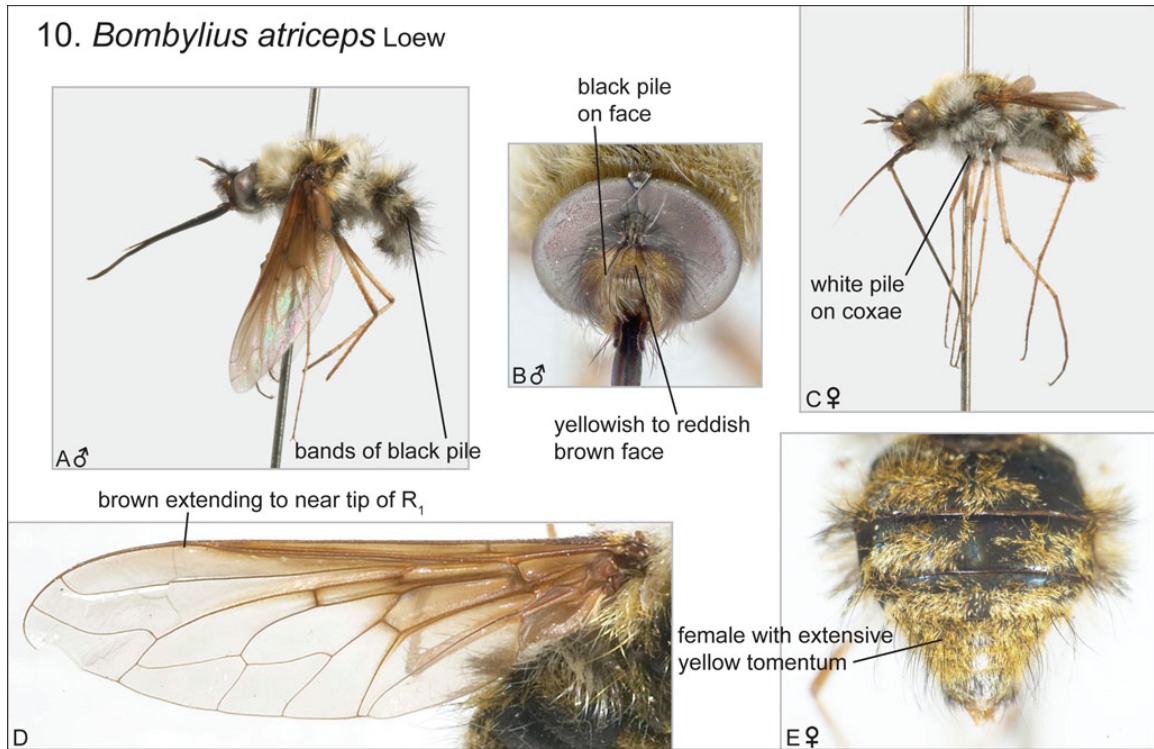
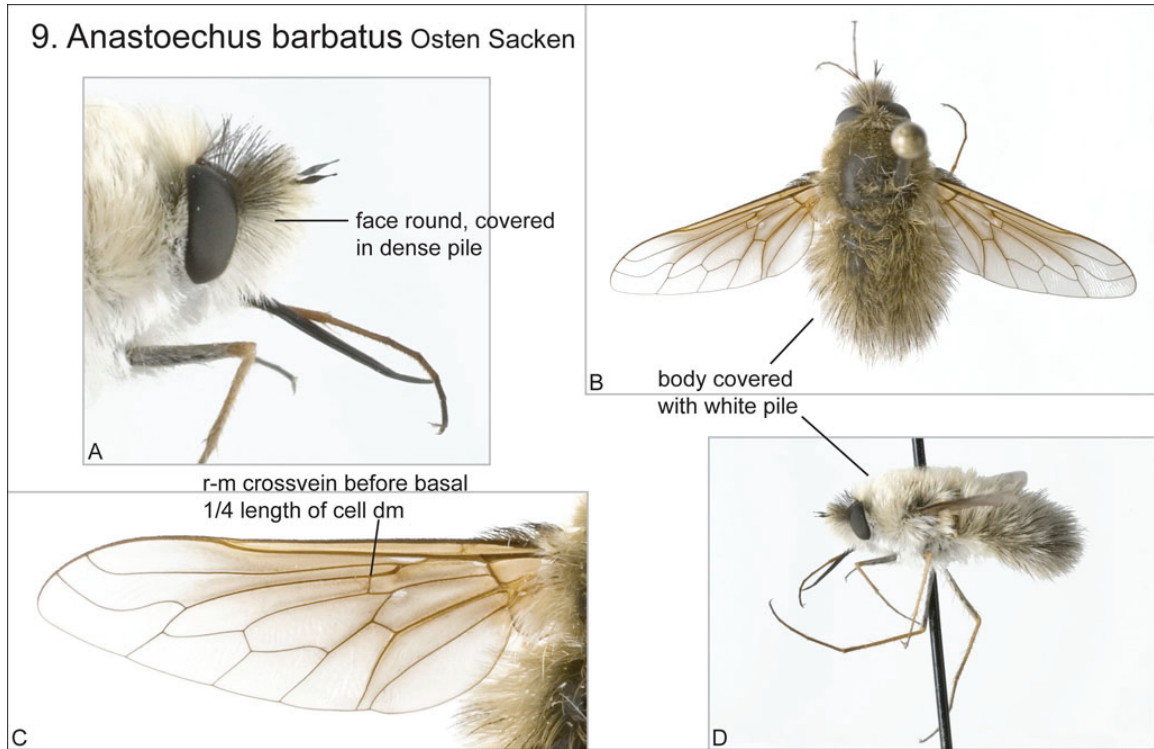
2. *Poecilognathus sulphureus* (Loew)

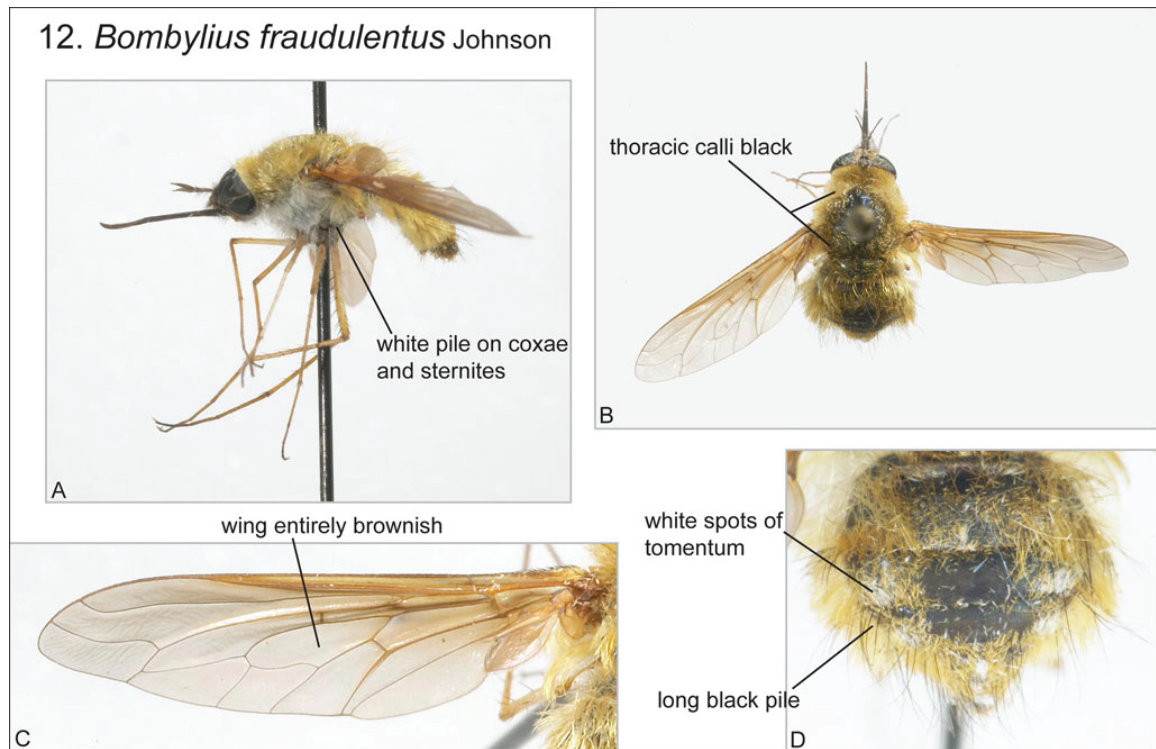
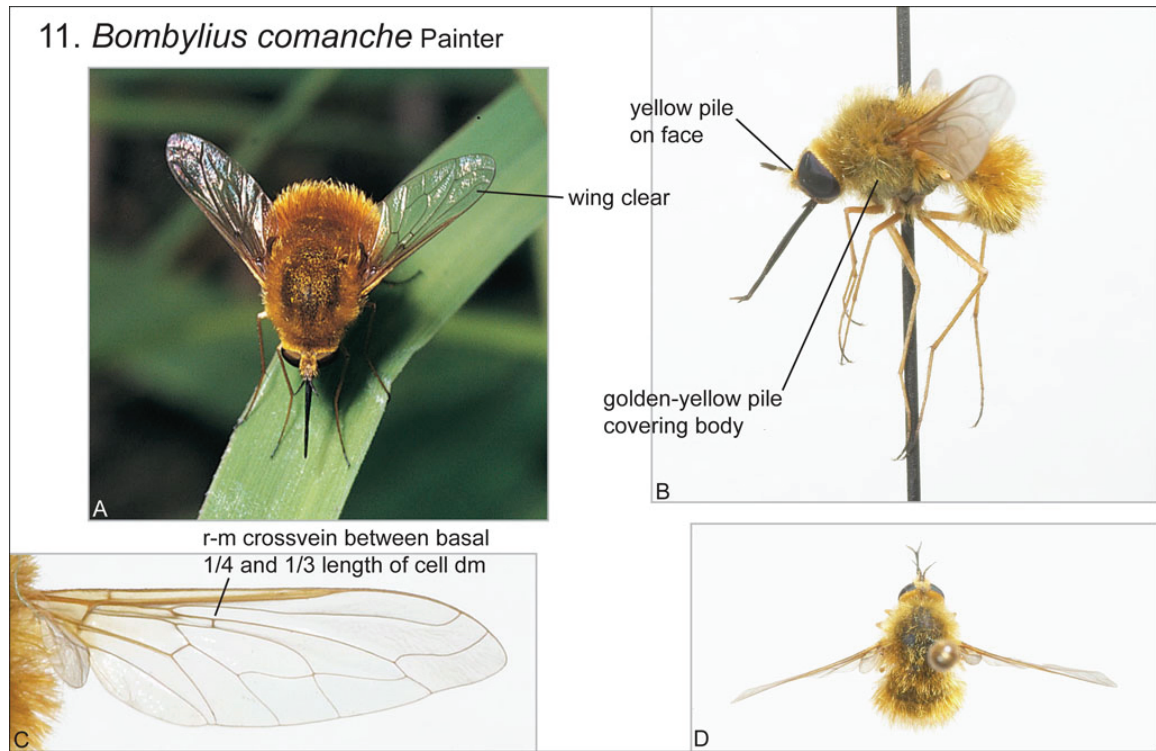




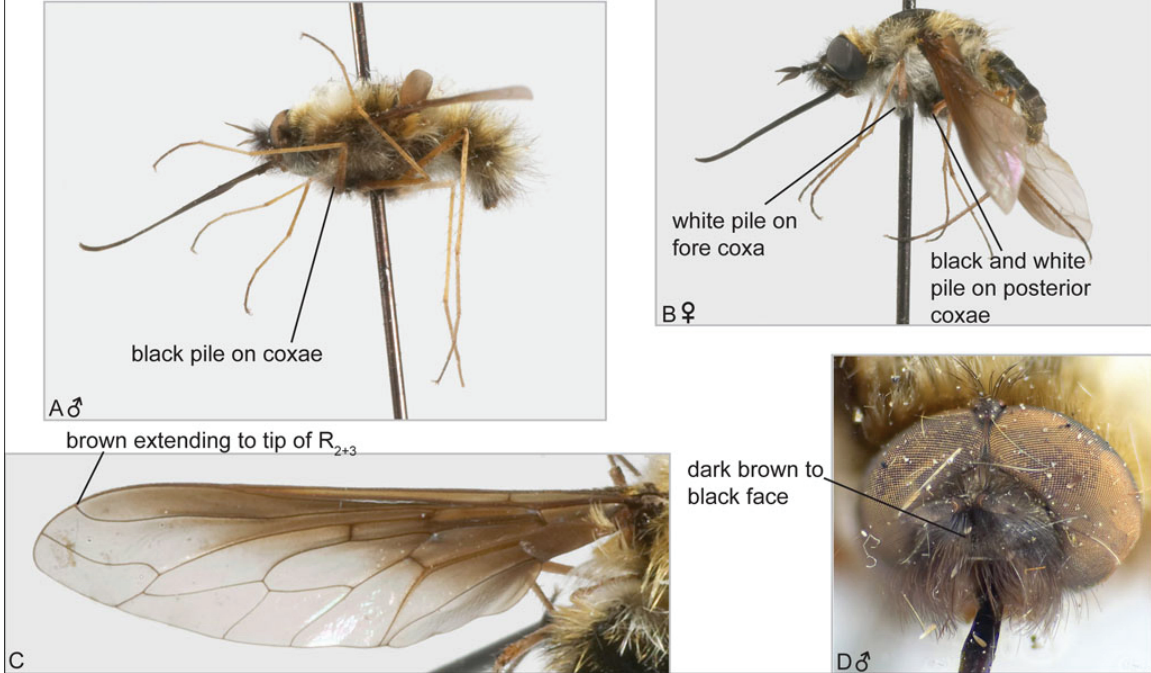




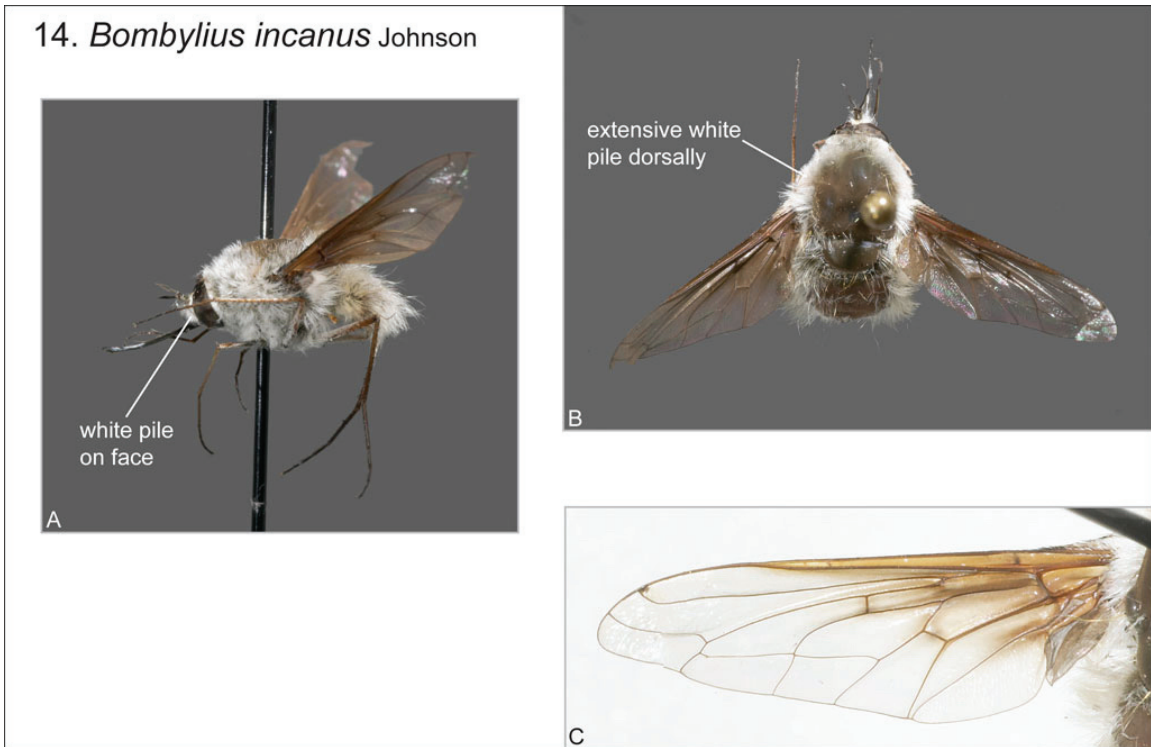




13. *Bombylius fulvibasoides* Painter



14. *Bombylius incanus* Johnson



15. *Bombylius major* Linnaeus



A

cell r5 closed

wing pattern sharply divided



C



proboscis much longer than antennae in *Bombylius* and related genera

B



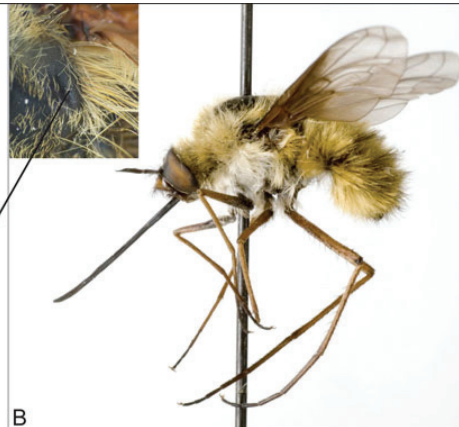
D

16. *Bombylius mexicanus* Wiedemann



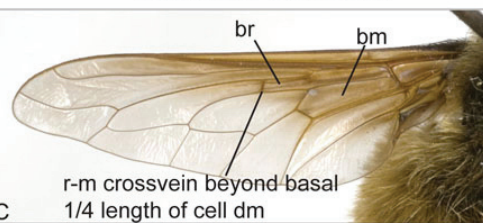
A

black thoracic calli



B

cell br longer than cell bm

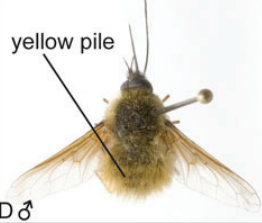


C

r-m crossvein beyond basal 1/4 length of cell dm

br

bm



D ♂

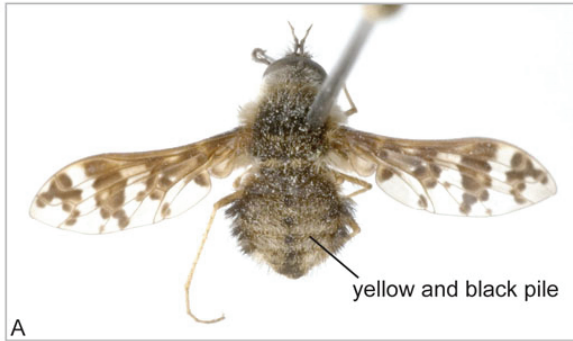
yellow pile

female with medial stripe of sparse black pile white tomentum on tergites 2-5

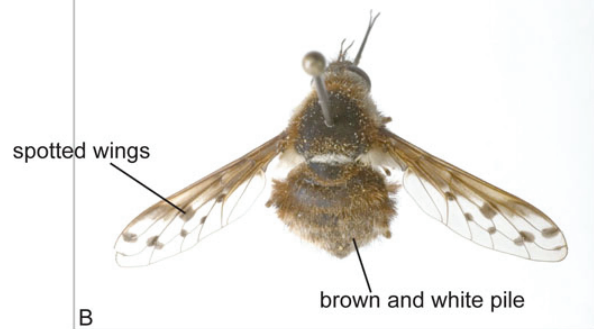


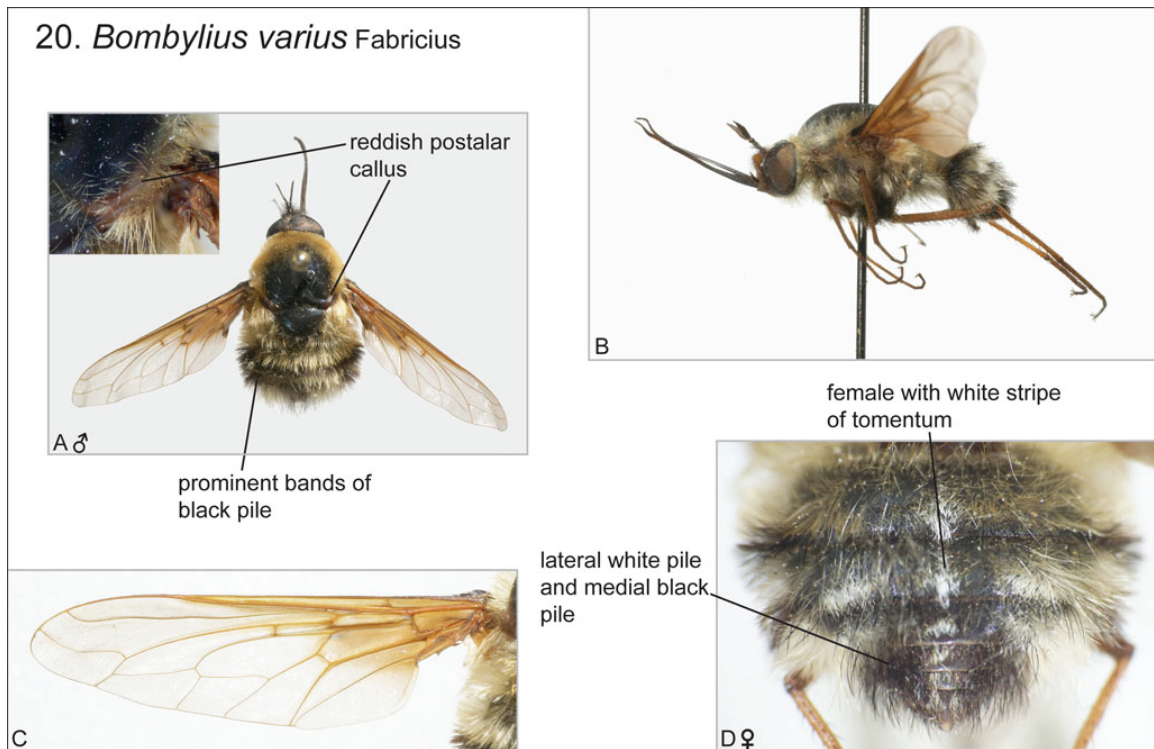
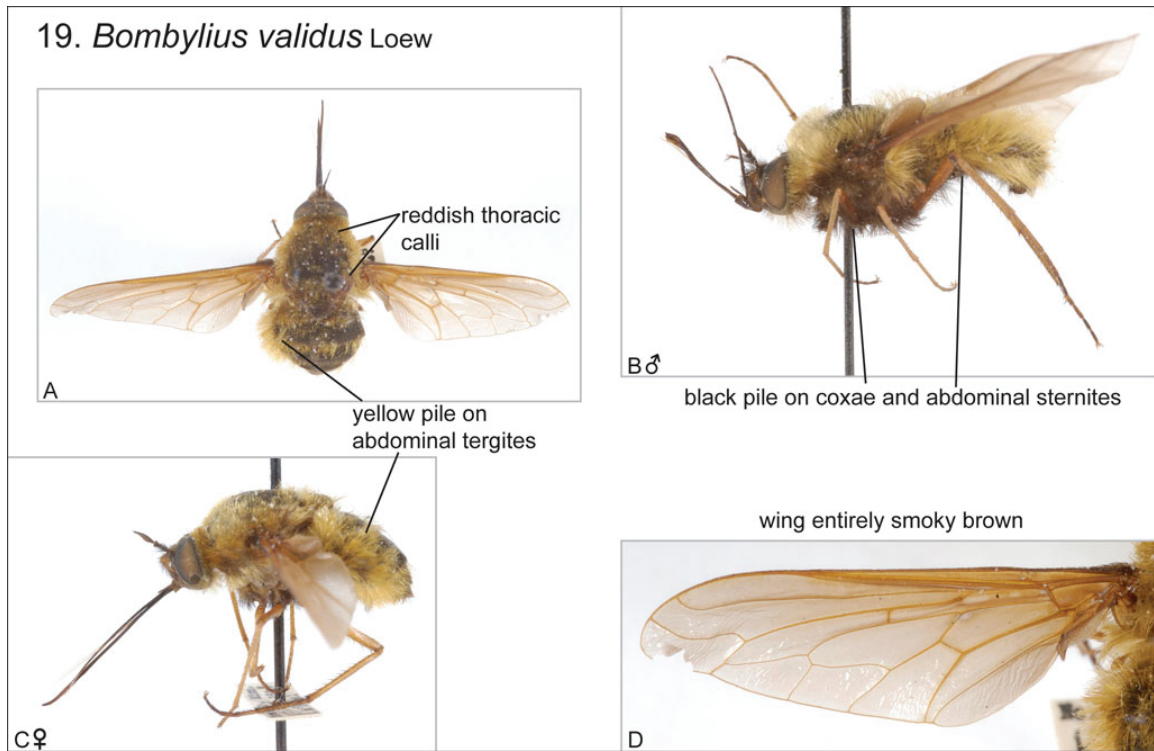
E ♀

17. *Bombylius pulchellus* Loew

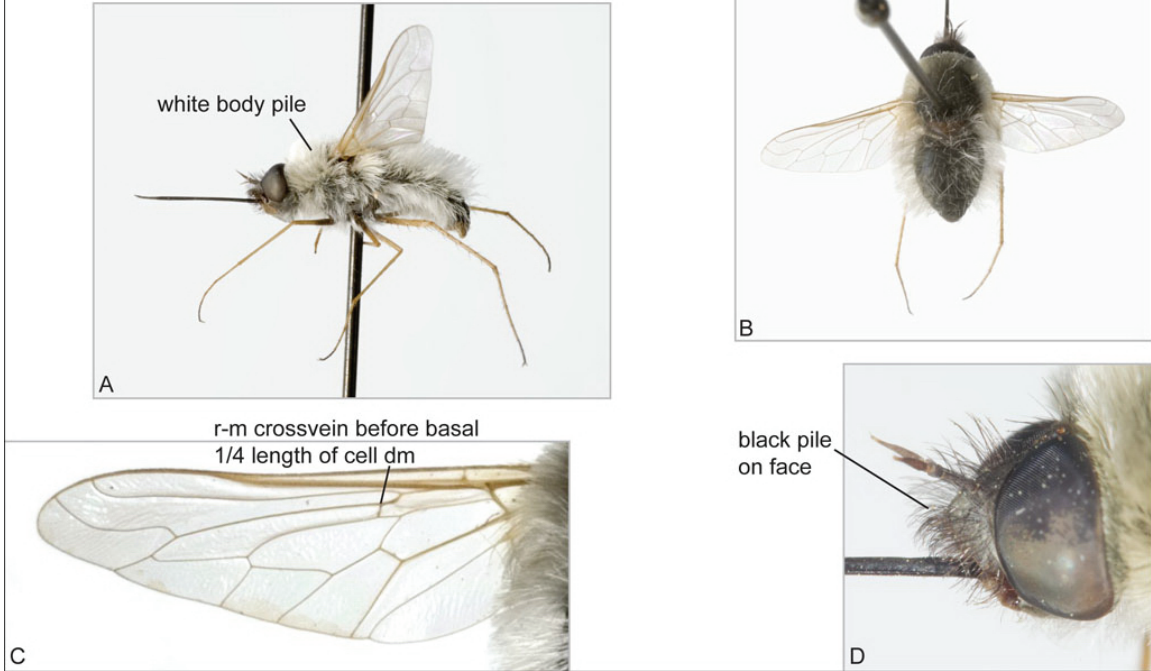


18. *Bombylius pygmaeus* Fabricius

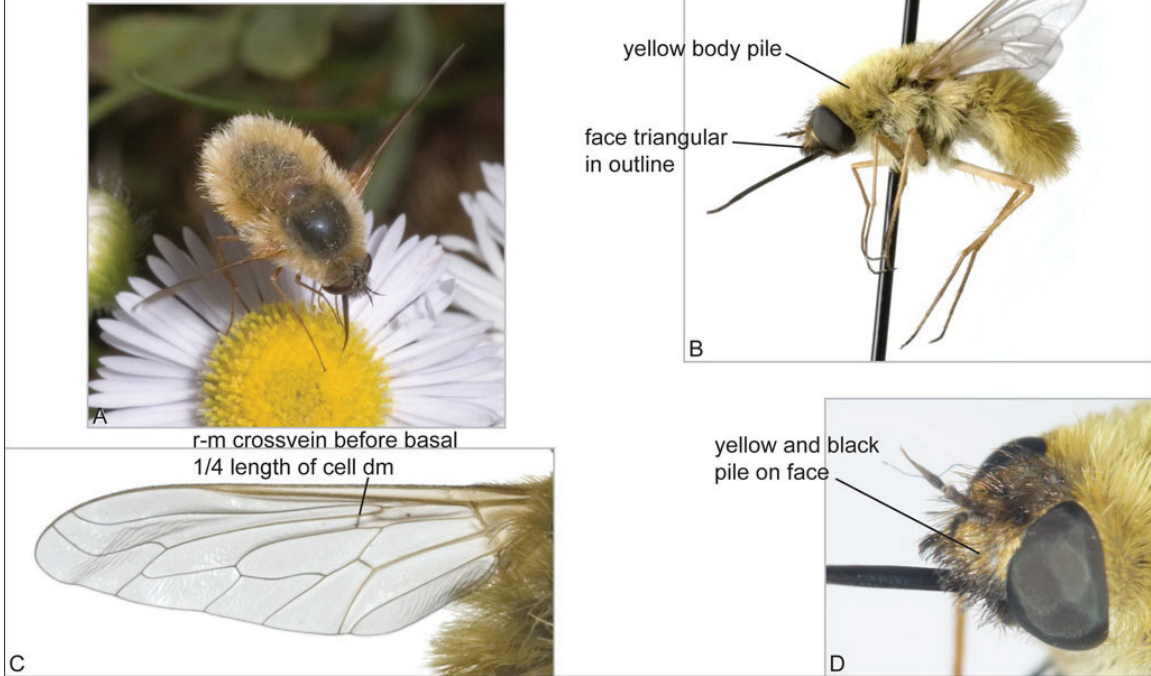


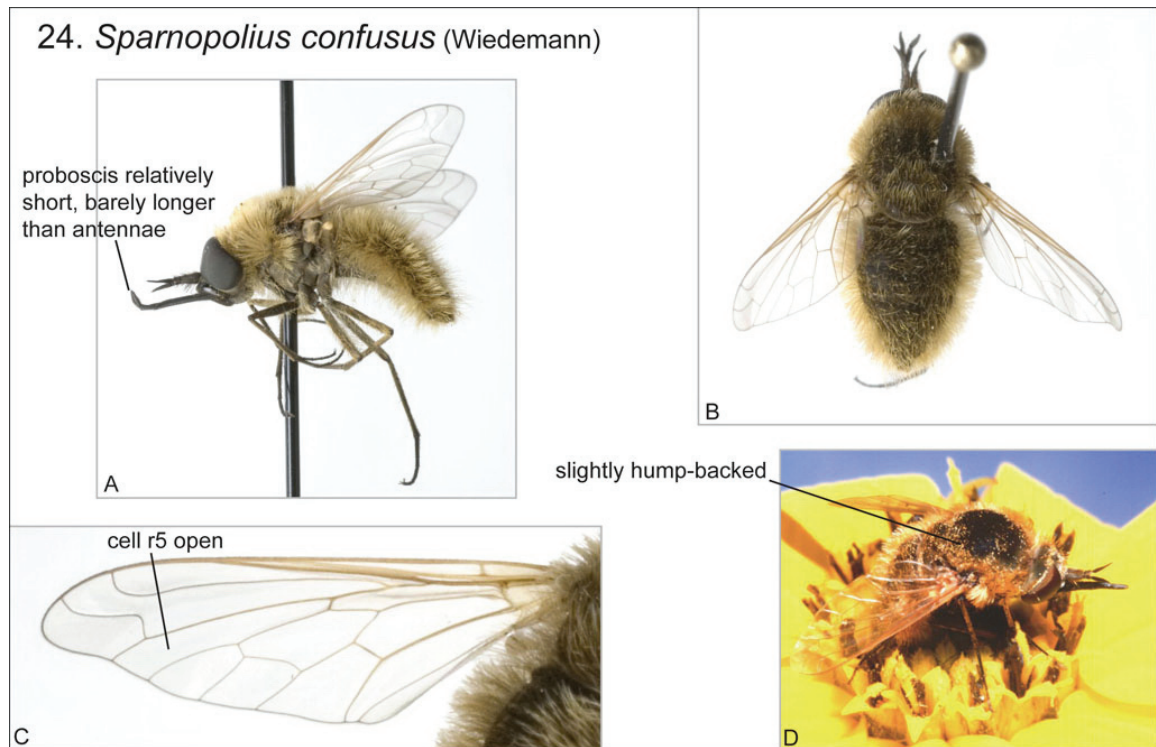
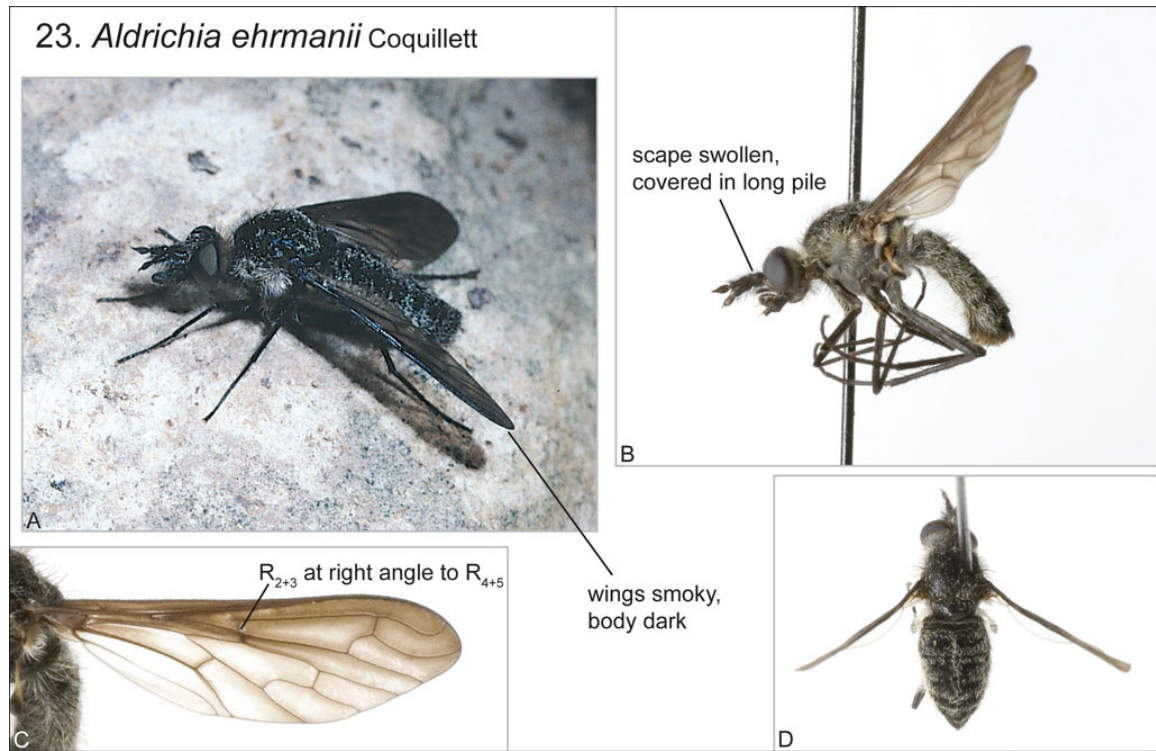


21. *Systoechus candidulus* Loew

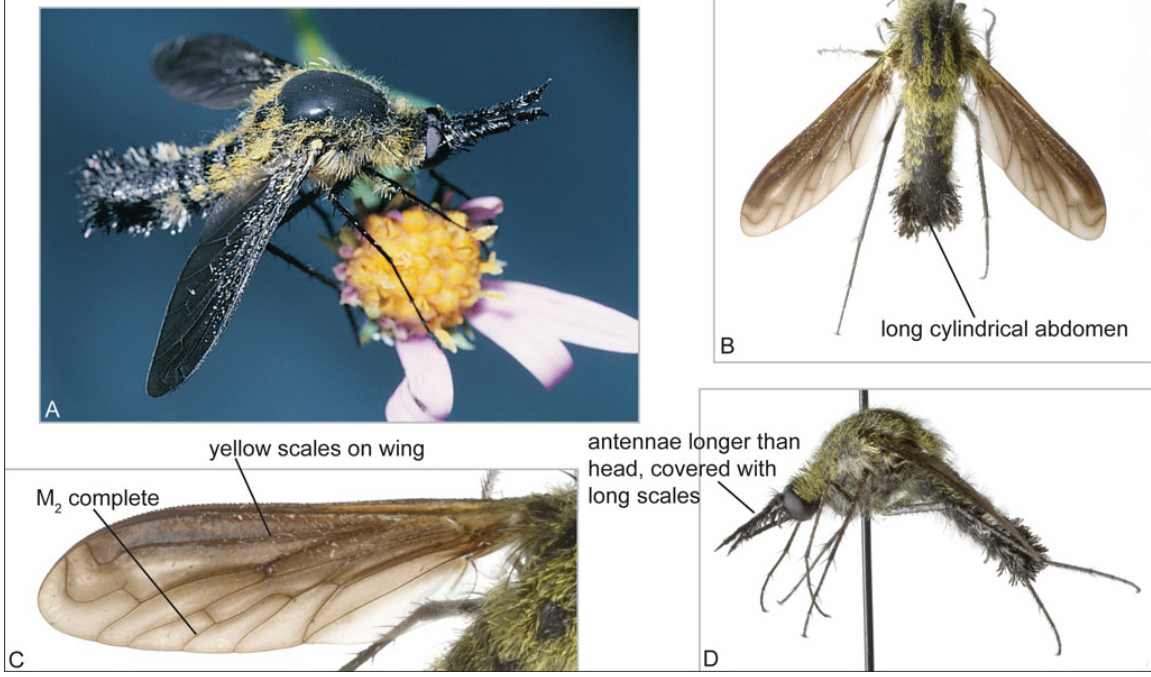


22. *Systoechus vulgaris* Loew

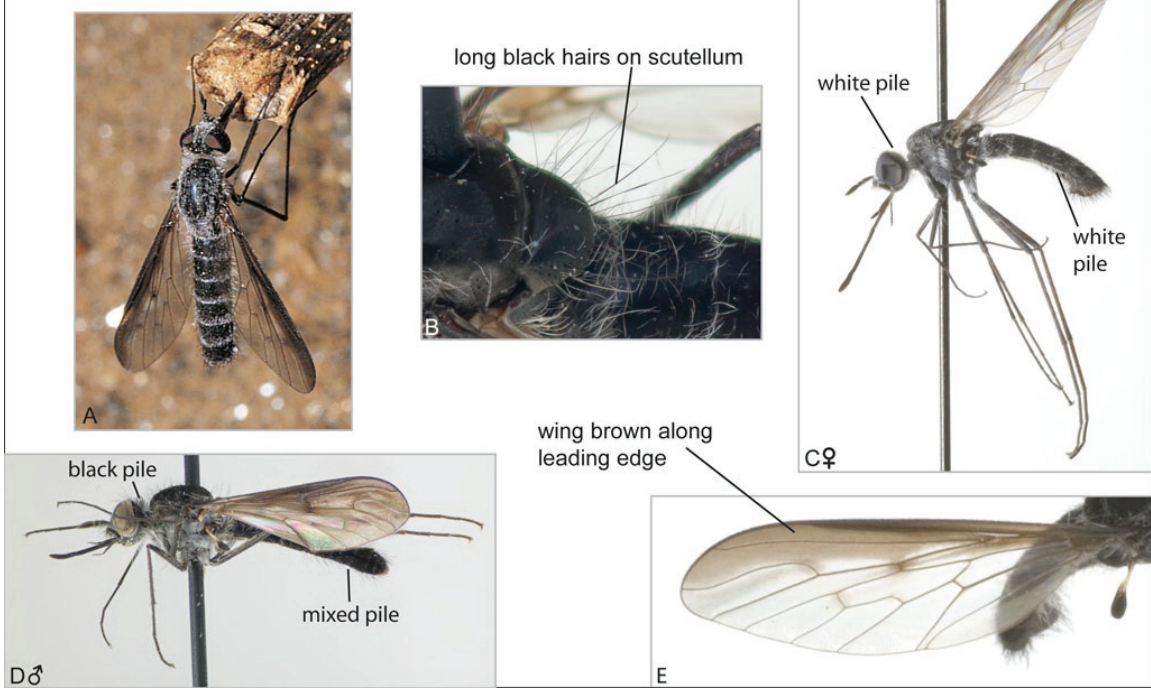


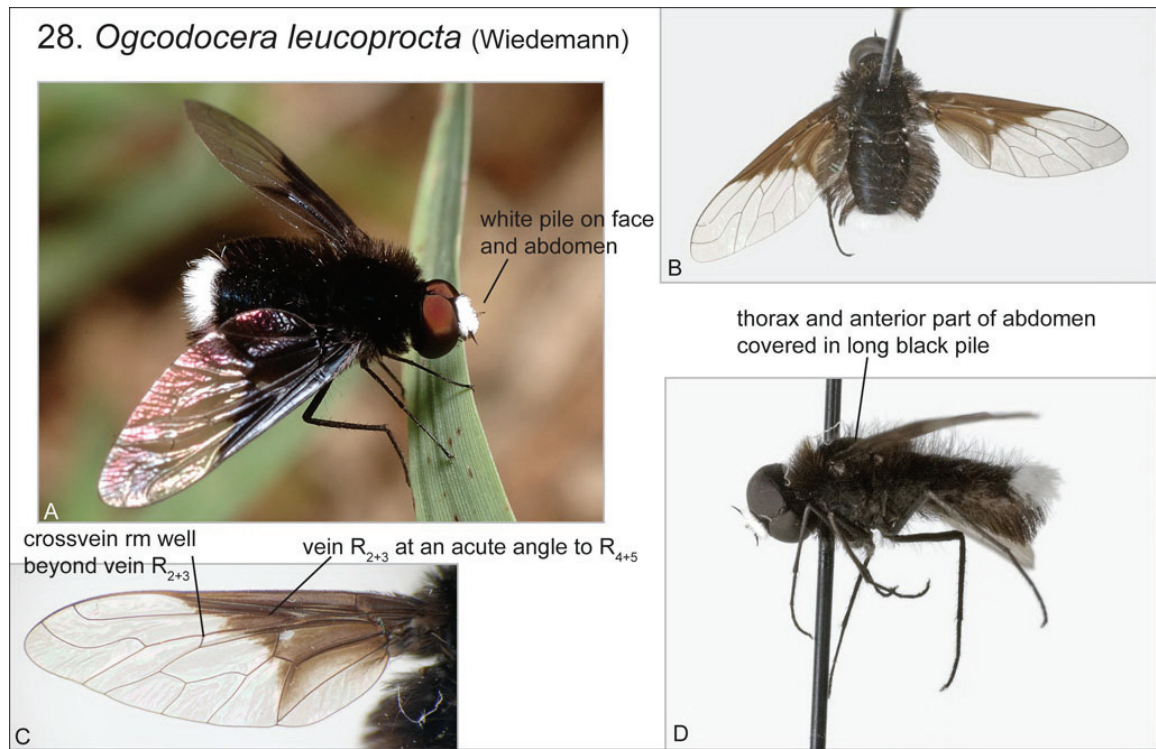
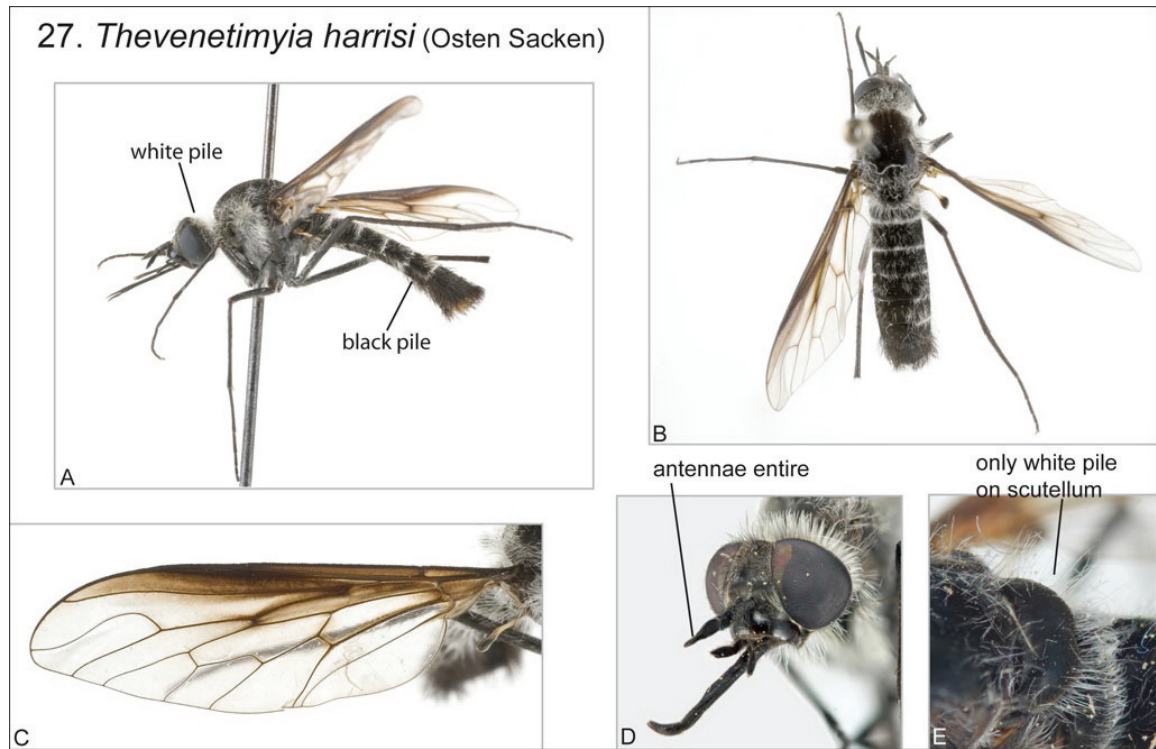


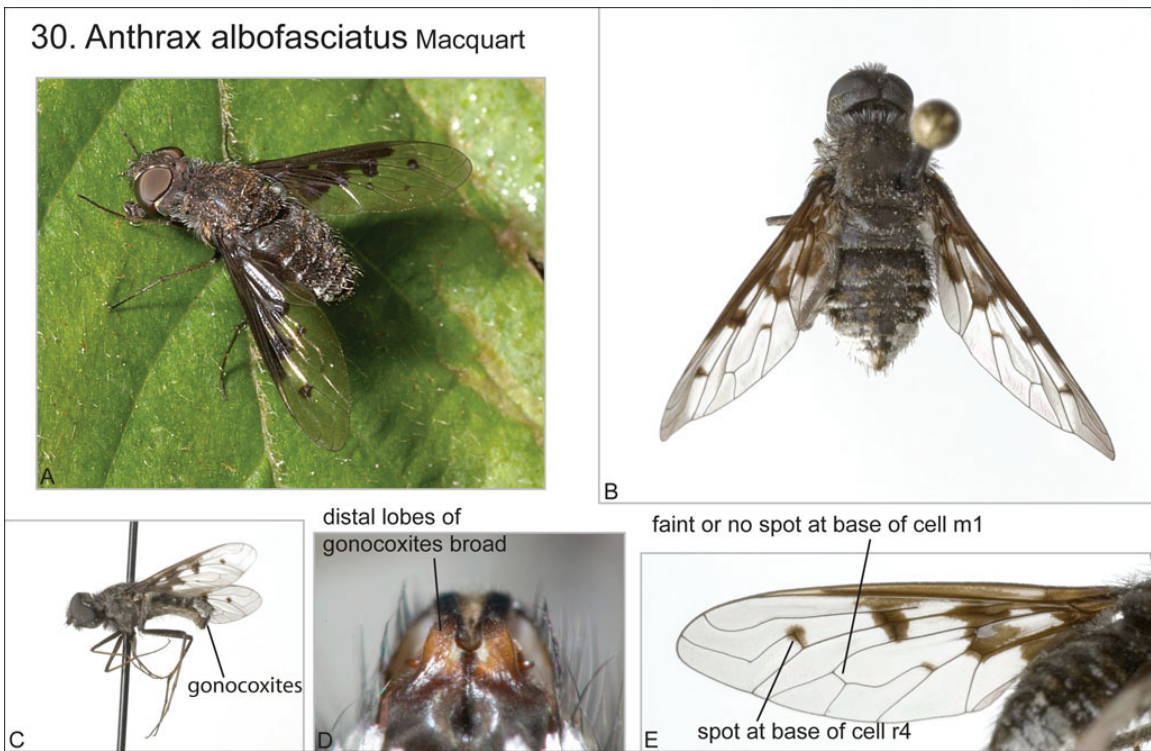
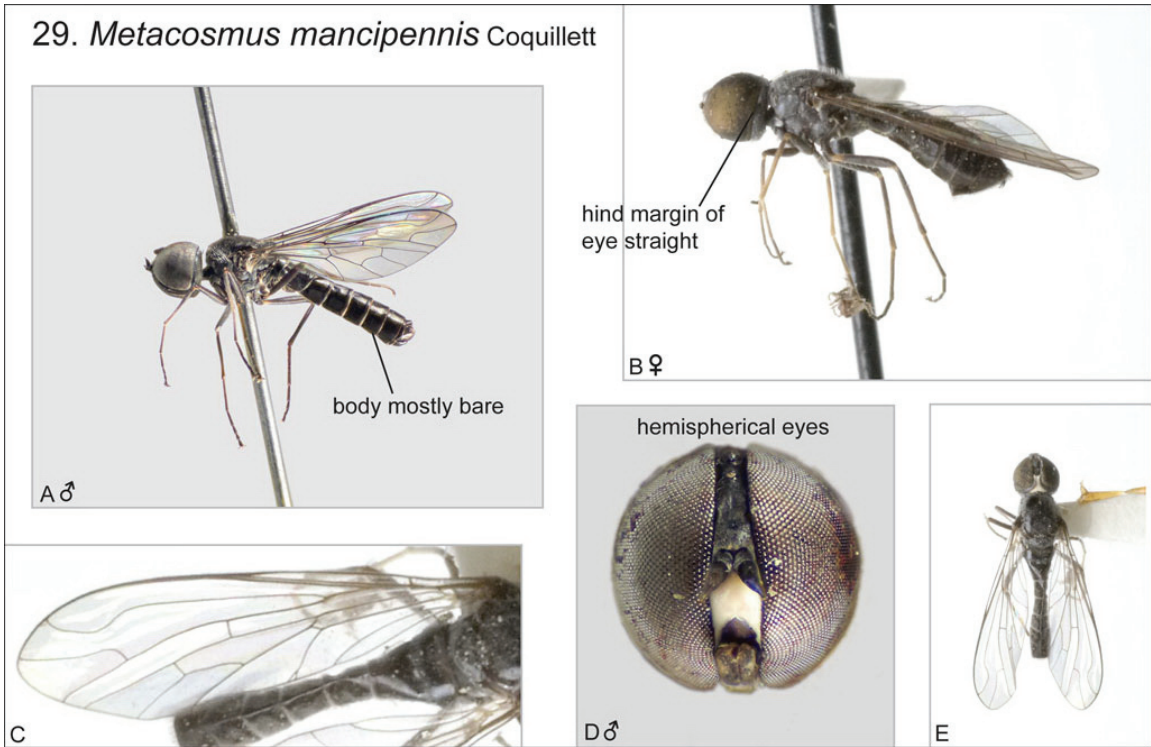
25. *Lepidophora lutea* Painter



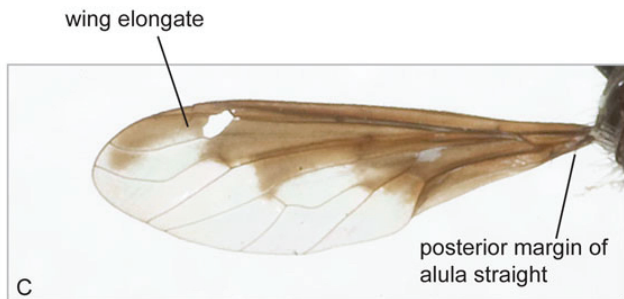
26. *Thevenetimyia funesta* (Osten Sacken)



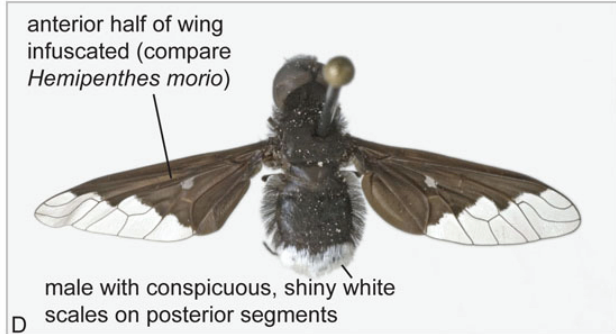
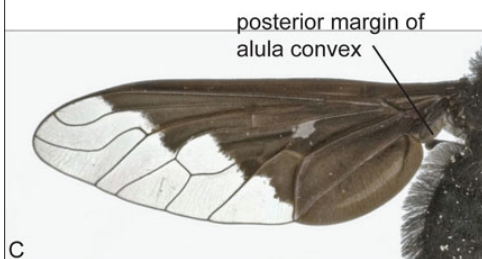




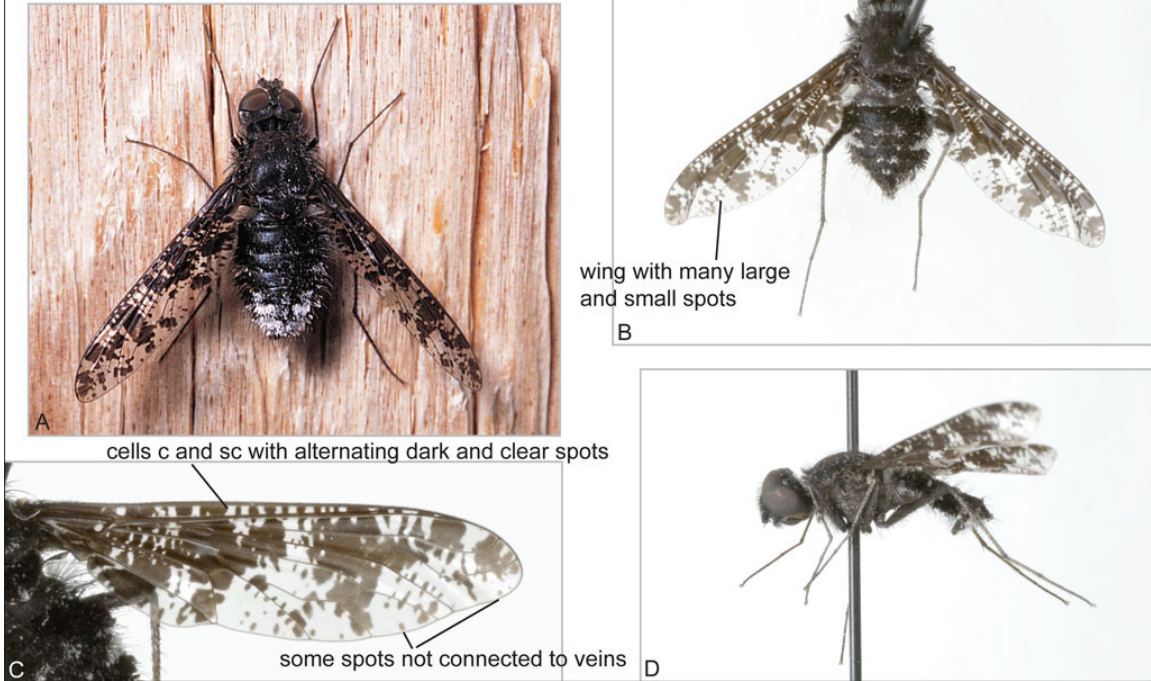
31. *Anthrax argropygus* Wiedemann



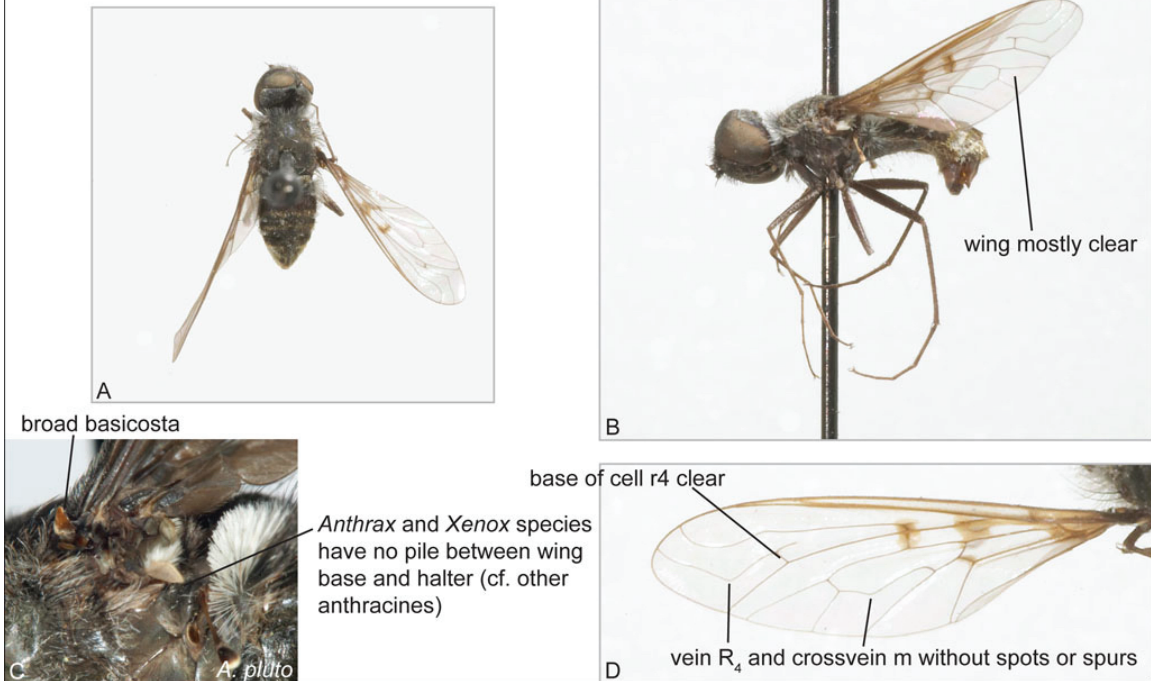
32. *Anthrax georgicus* Macquart

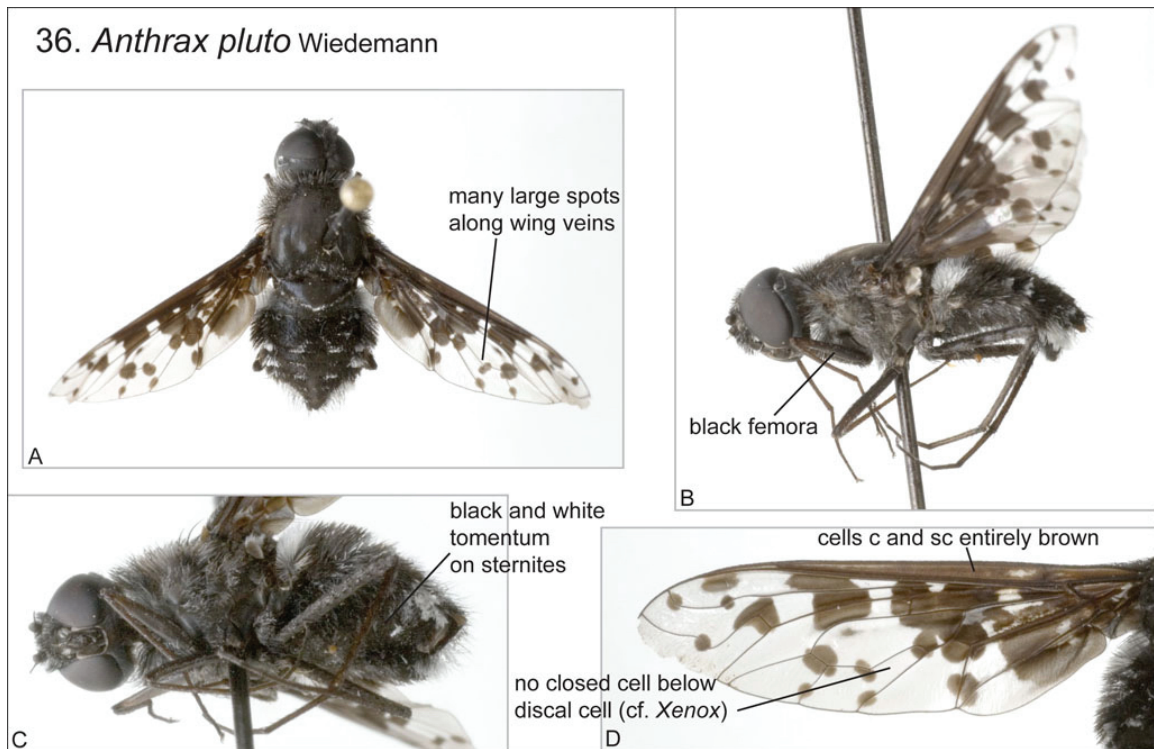
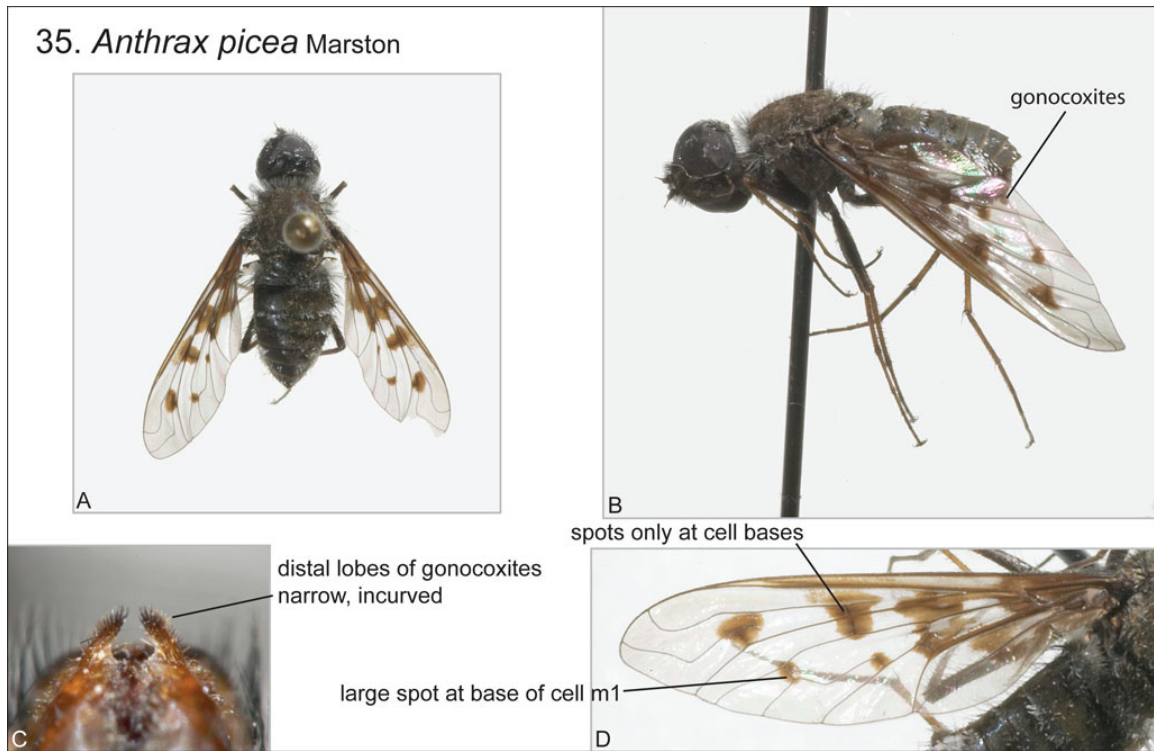


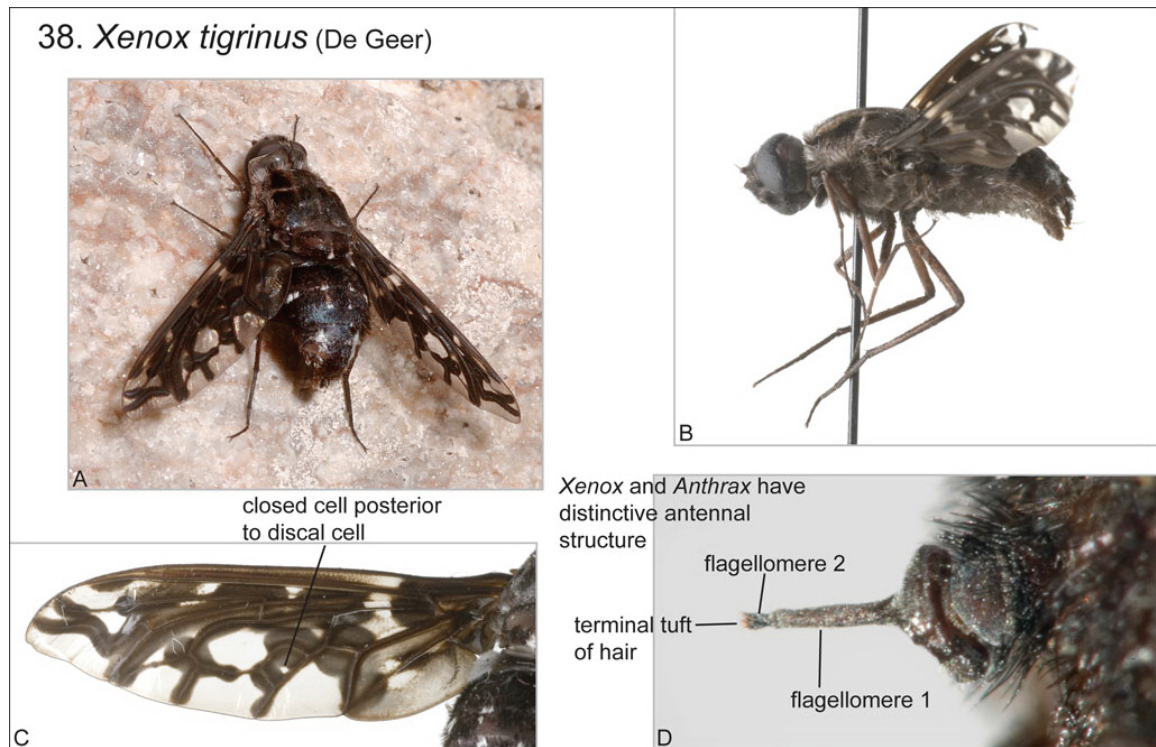
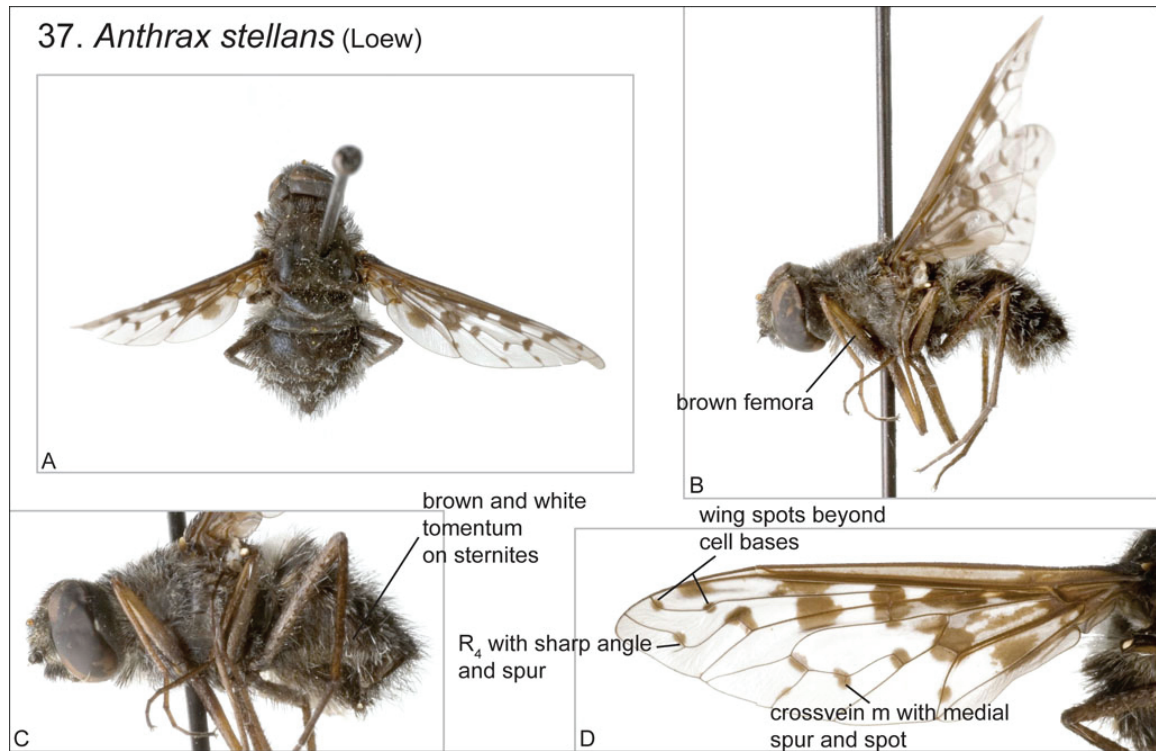
33. *Anthrax irroratus* Say

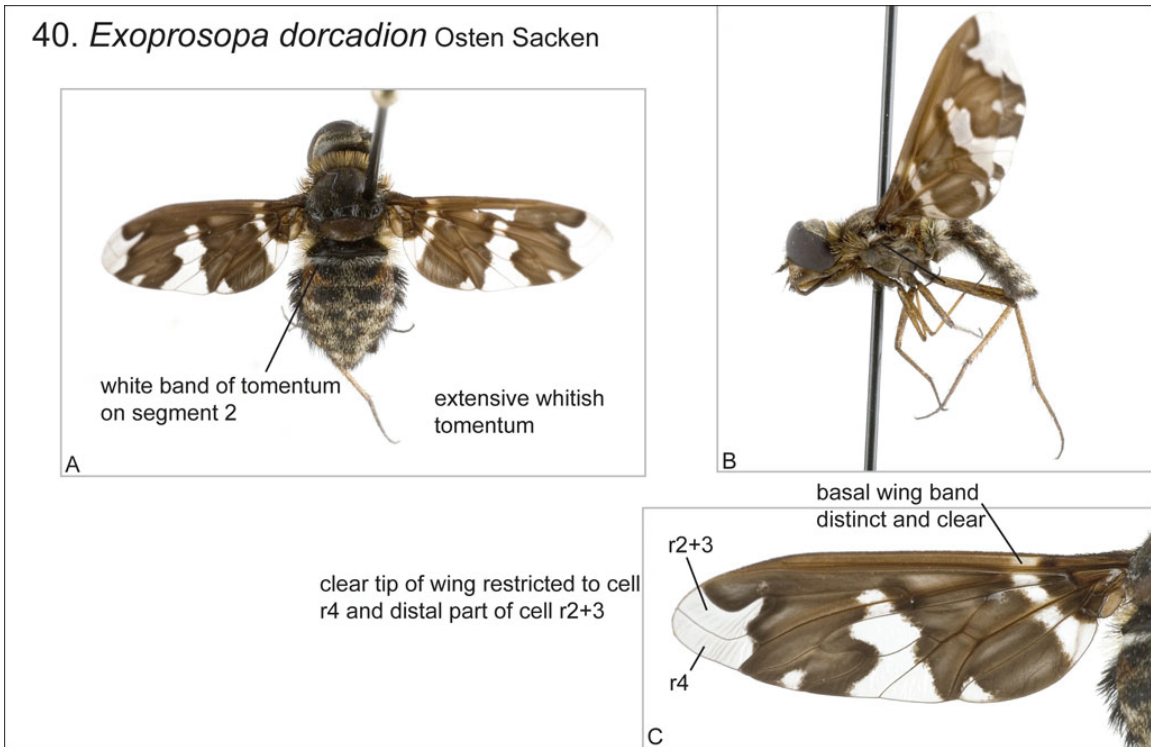
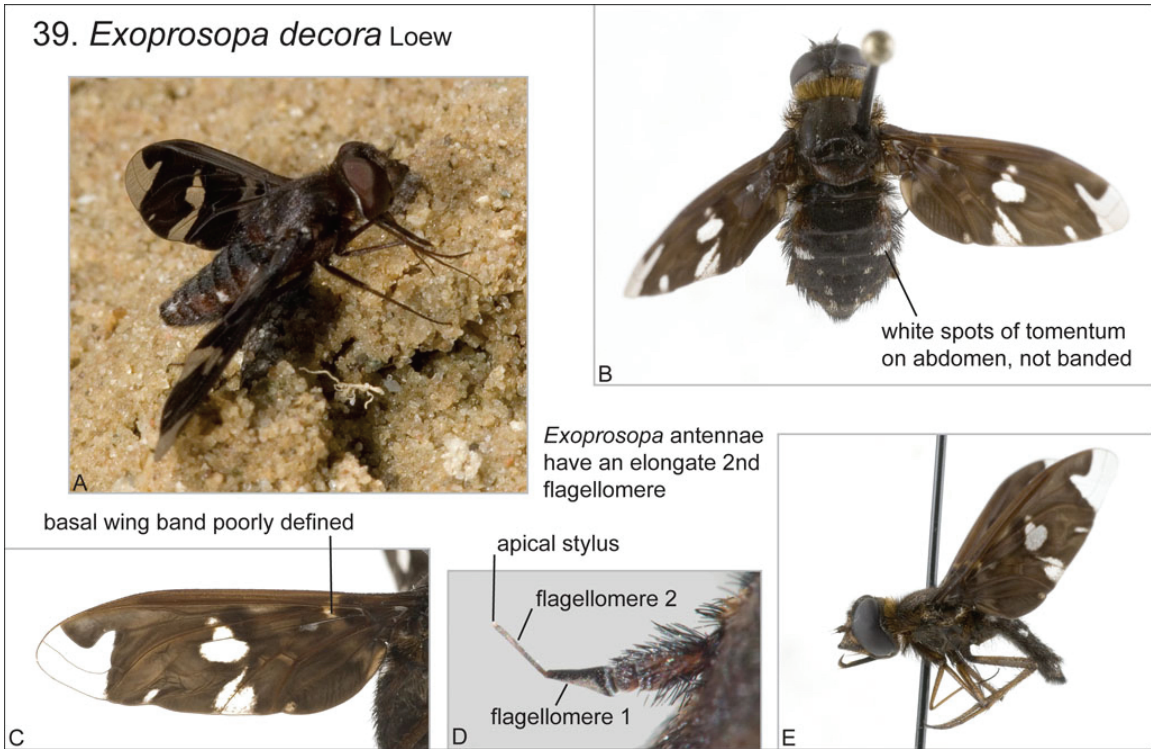


34. *Anthrax pauper* (Loew)

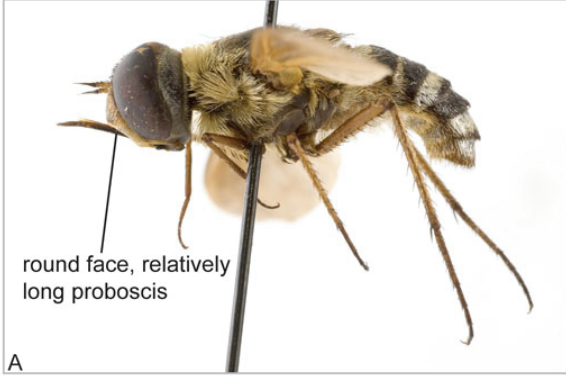











41. *Exoprosopa fasciata* Macquart


A  round face, relatively long proboscis


B  abdomen banded (cf. *Poecilanthrax tegminipennis*)


C  wing entirely smoky brown, somewhat darker along veins
vein R_{2+3} with a single curve near apex (cf. *Dipalta*)
veins R_{2+3} and R_4 connected by a crossvein

42. *Exoprosopa fascipennis* (Say)

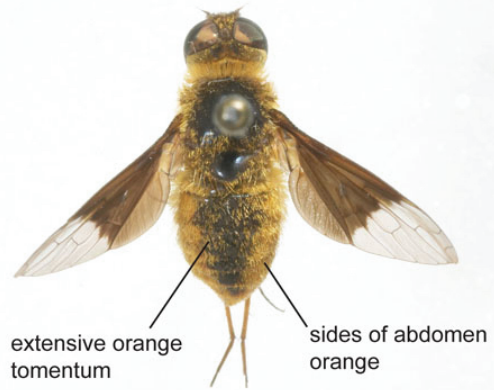
A  clear tip of wing reaching into cells r_1 , r_5 , and basal part of r_{2+3}

B  white band of tomentum on segment 4

C  r_1
 r_{2+3}
 r_5

D  conical face, short proboscis

43. *Chrysanthrax cypris* (Meigen)

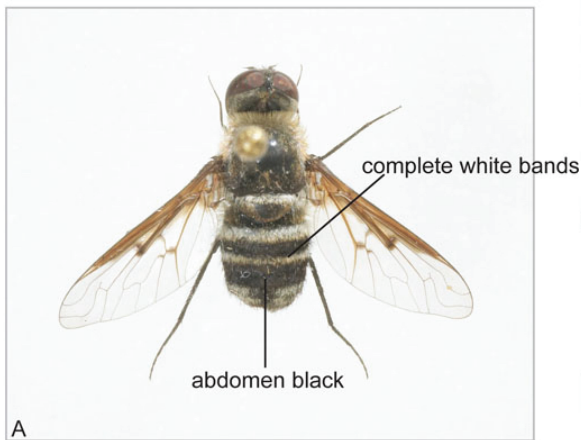


B



C

44. *Chrysanthrax dispar* (Coquillett)



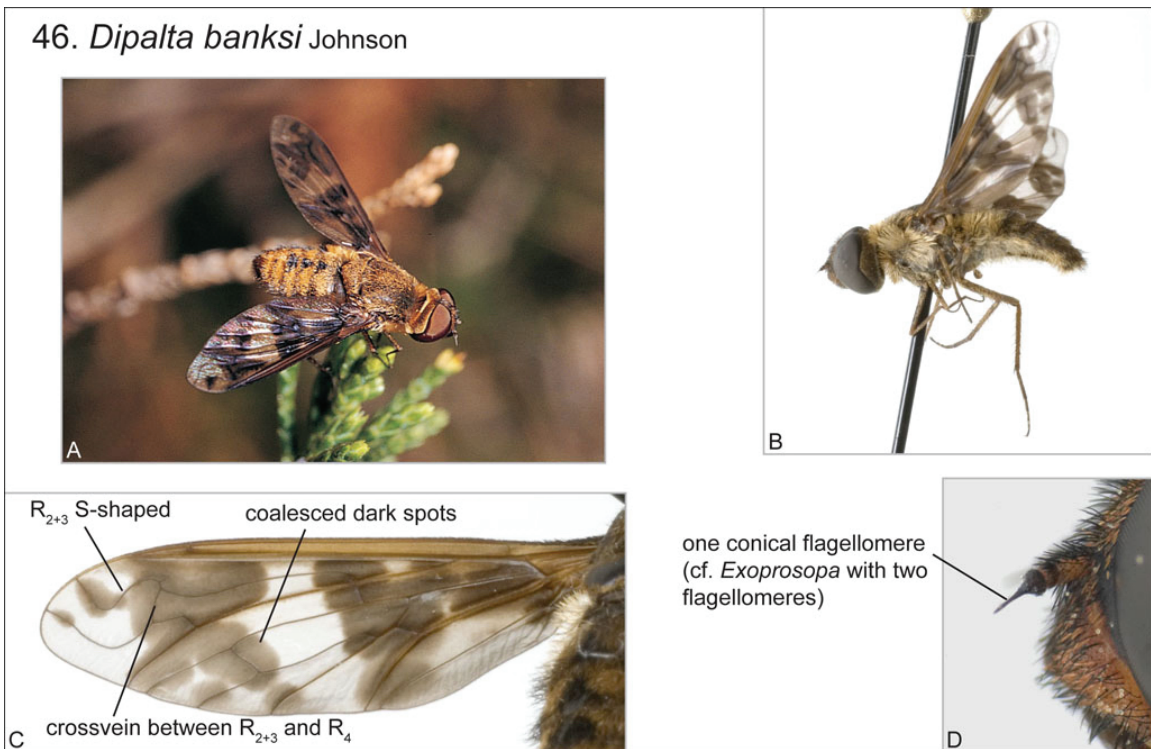
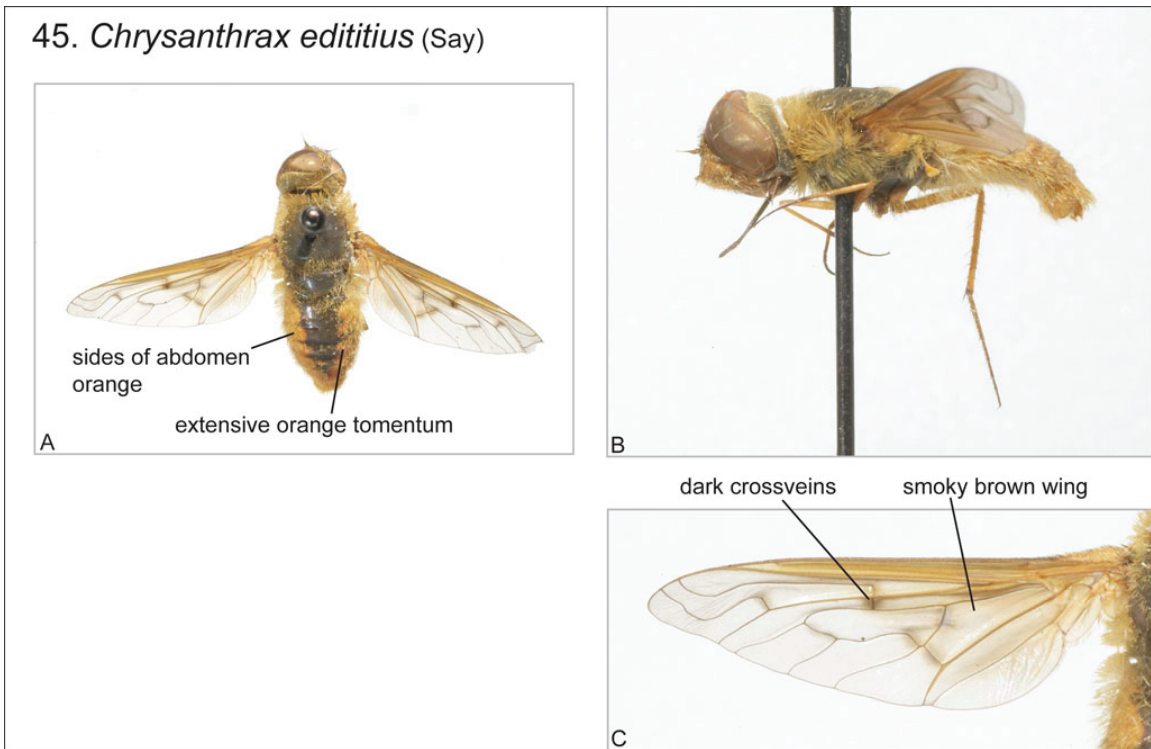
A

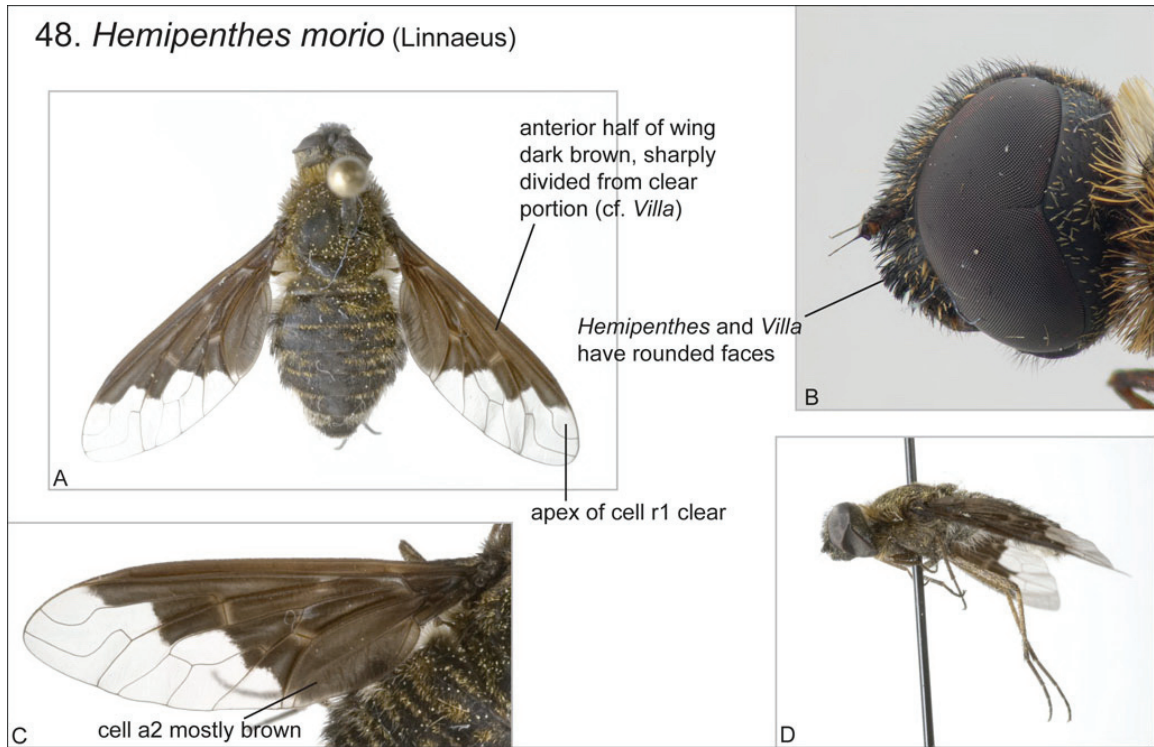
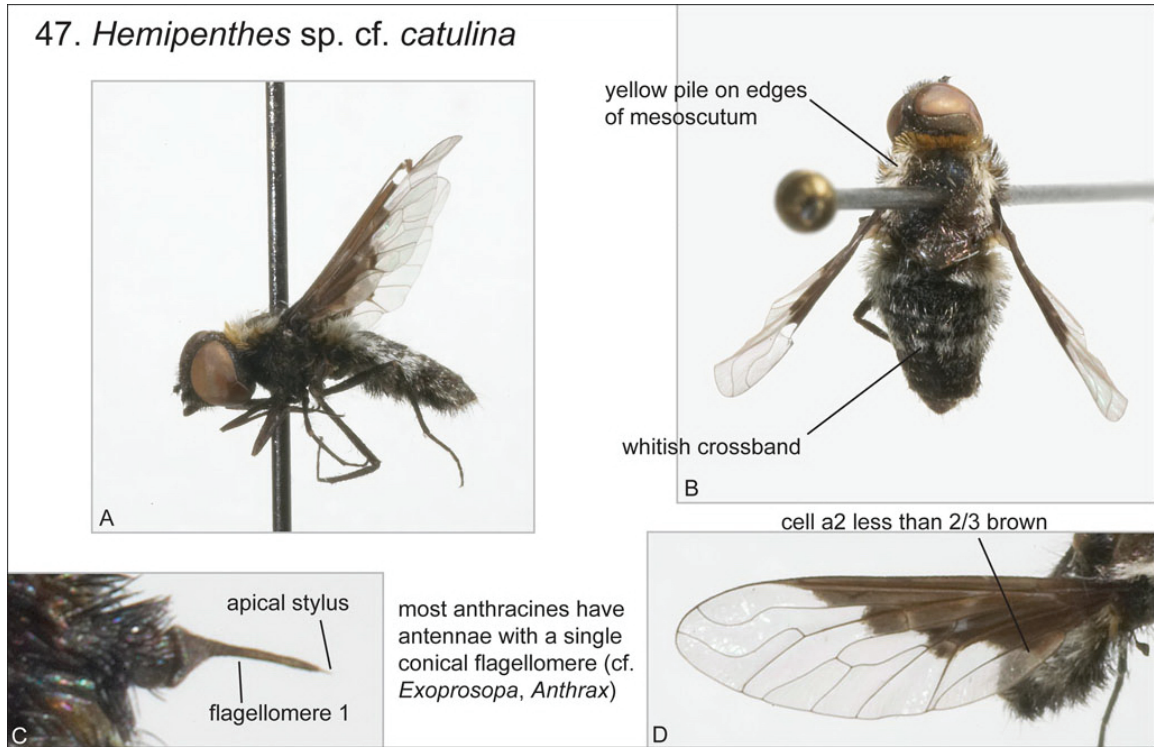


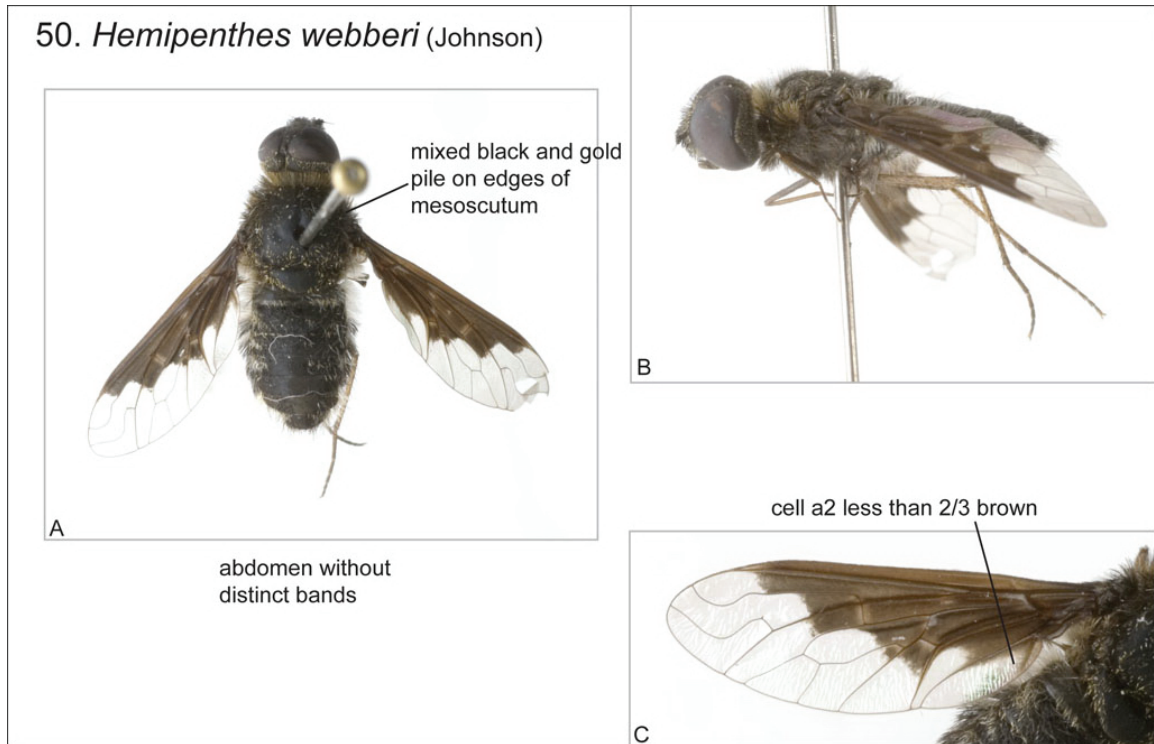
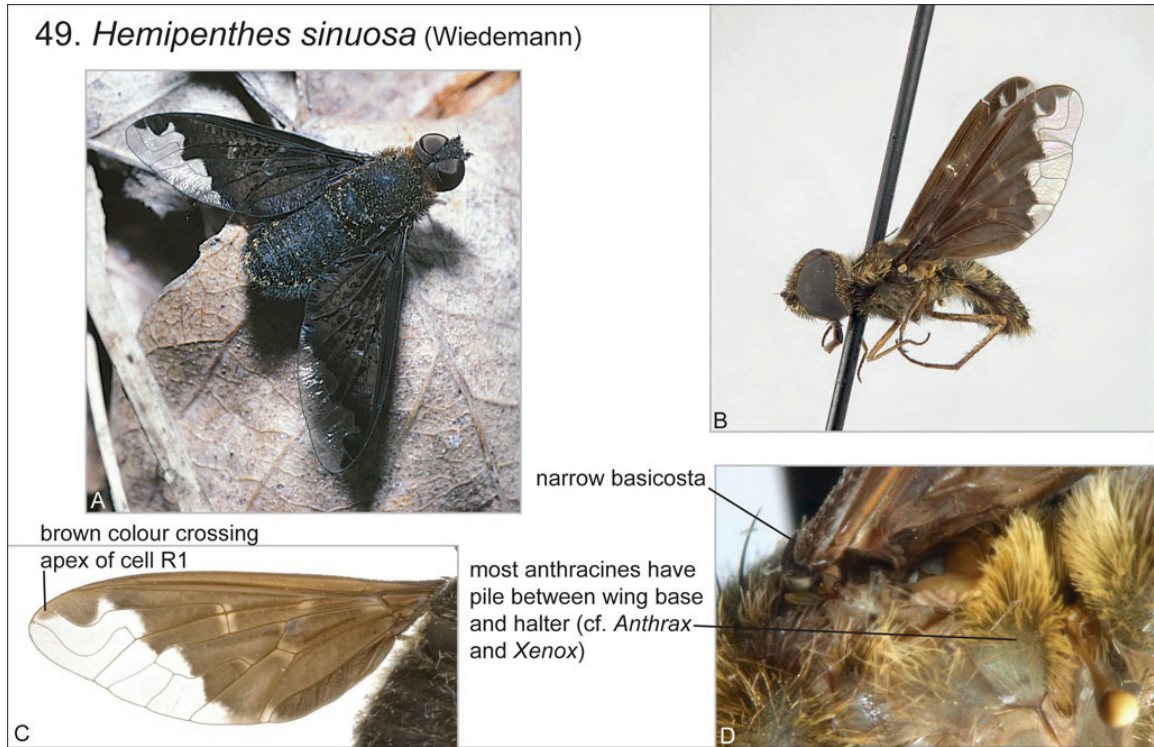
B



C







51. *Paravilla separata* (Walker)

A

B

C

D

black and yellow bands of tomentum

face projecting conically, with flattened scales

fore tibia with bristles, claws same size on each leg

52. *Poecilanthrax alycon* (Say)

A

B

C

D

E

humeral callus black

no medial stripe of tomentum

face with only thin hairs (cf. *Paravilla*, *Chrysanthrax*)

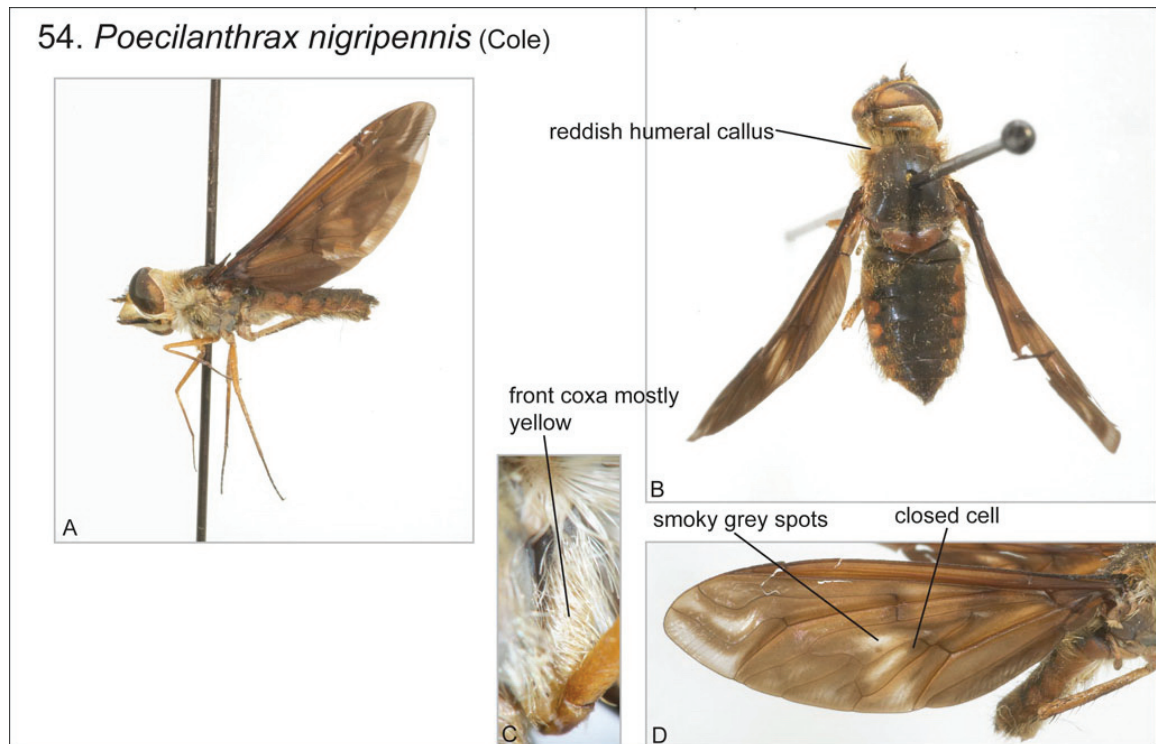
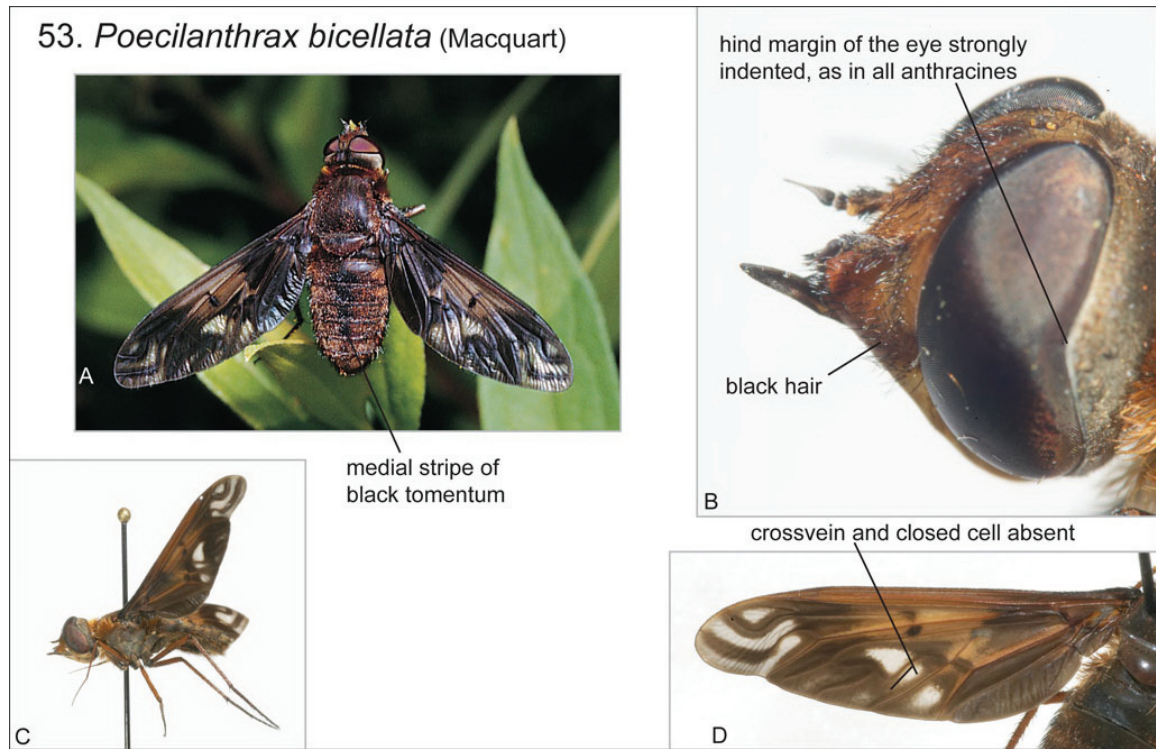
front coxa at least half black

yellow hair

clear spots

closed cell below cell dm

extra crossvein



55. *Poecilanthrax tegminipennis* (Say)

A covered in yellow pile, abdomen not banded

B wing entirely smoky brown (cf. *Exoprosopa fasciata*)

C *Poecilanthrax* antennae have strongly expanded basal segment

D

56. *Thyridanthrax fenestratoides* (Coquillett)

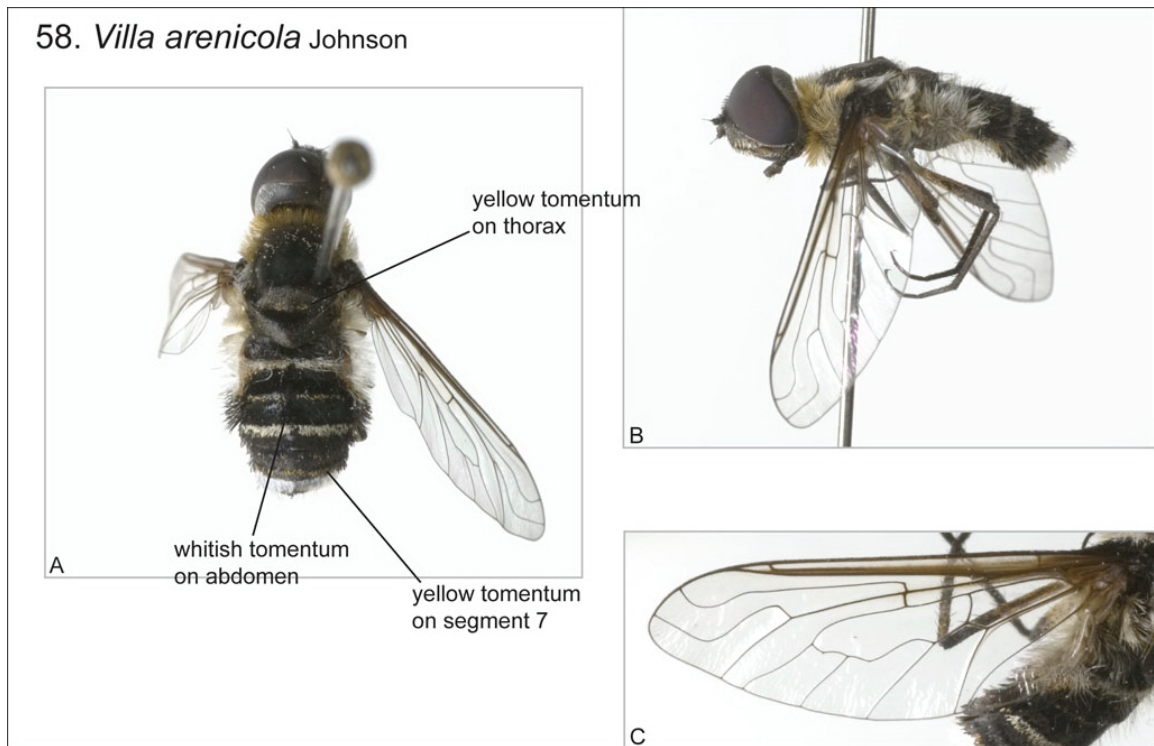
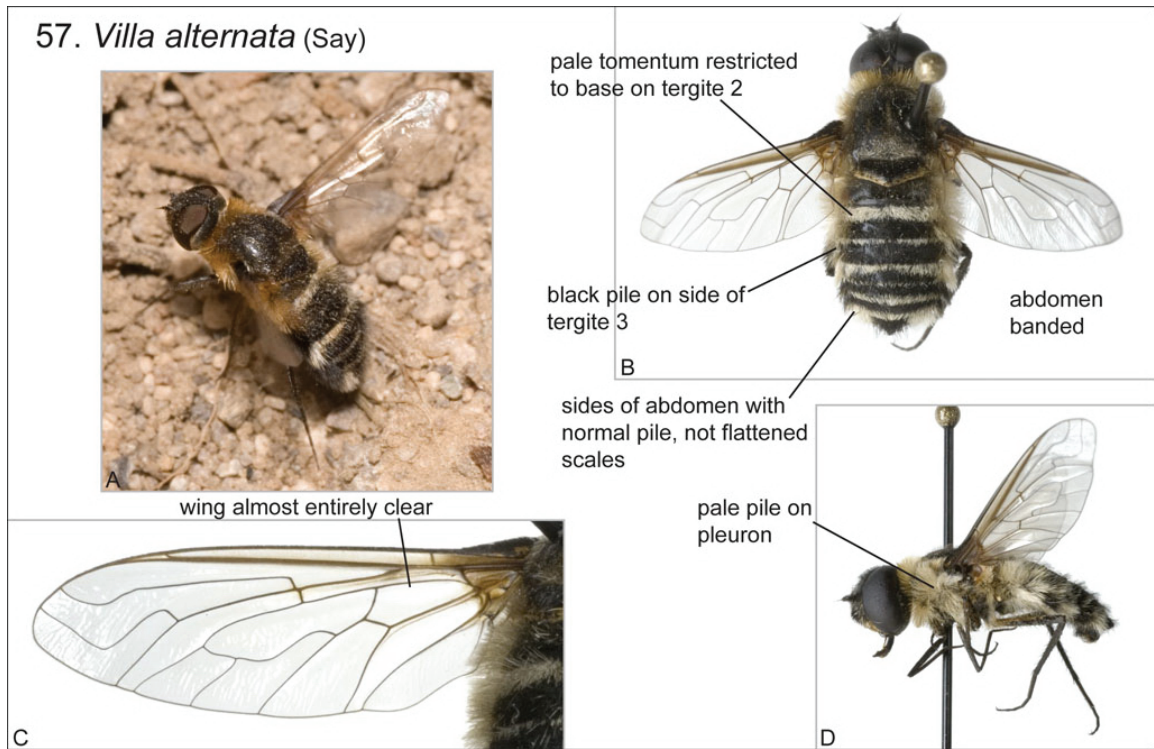
A

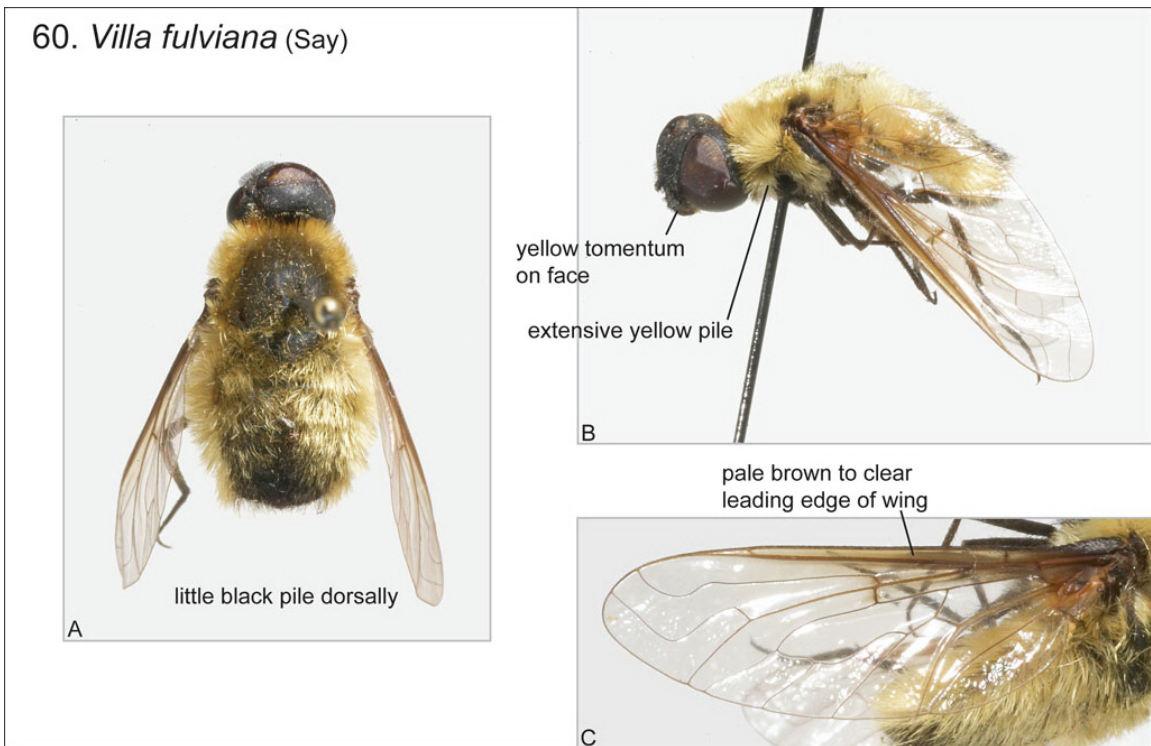
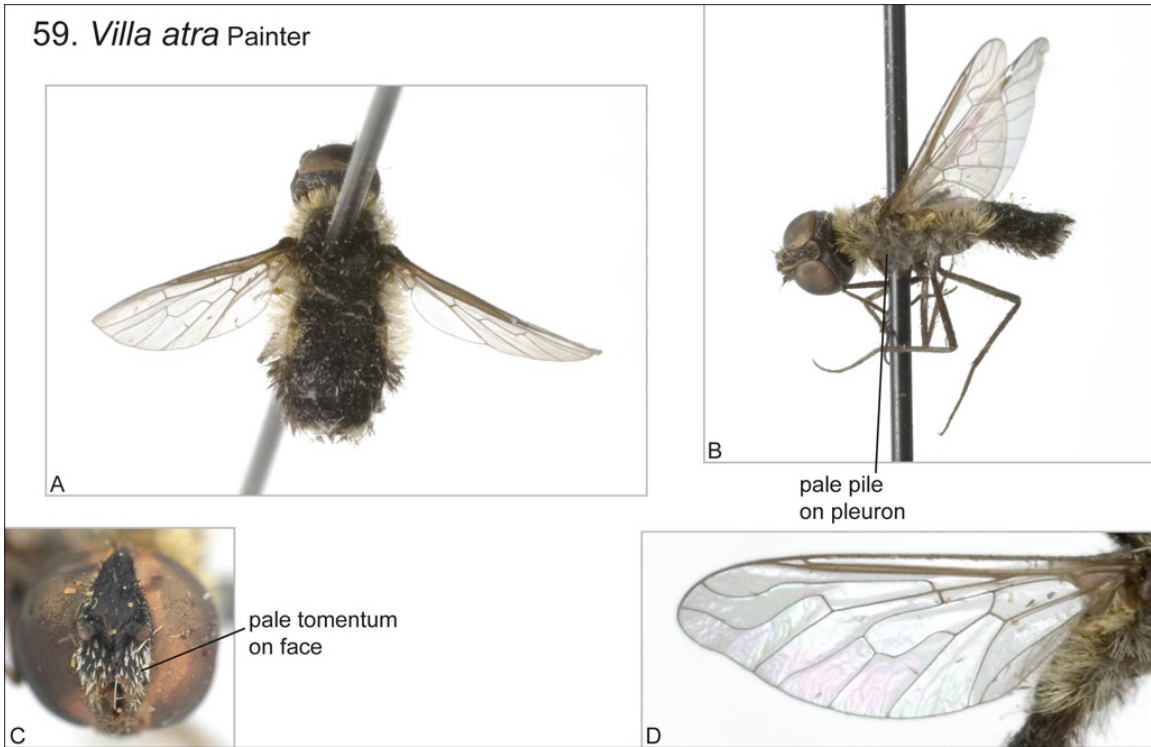
B interrupted bands of white tomentum

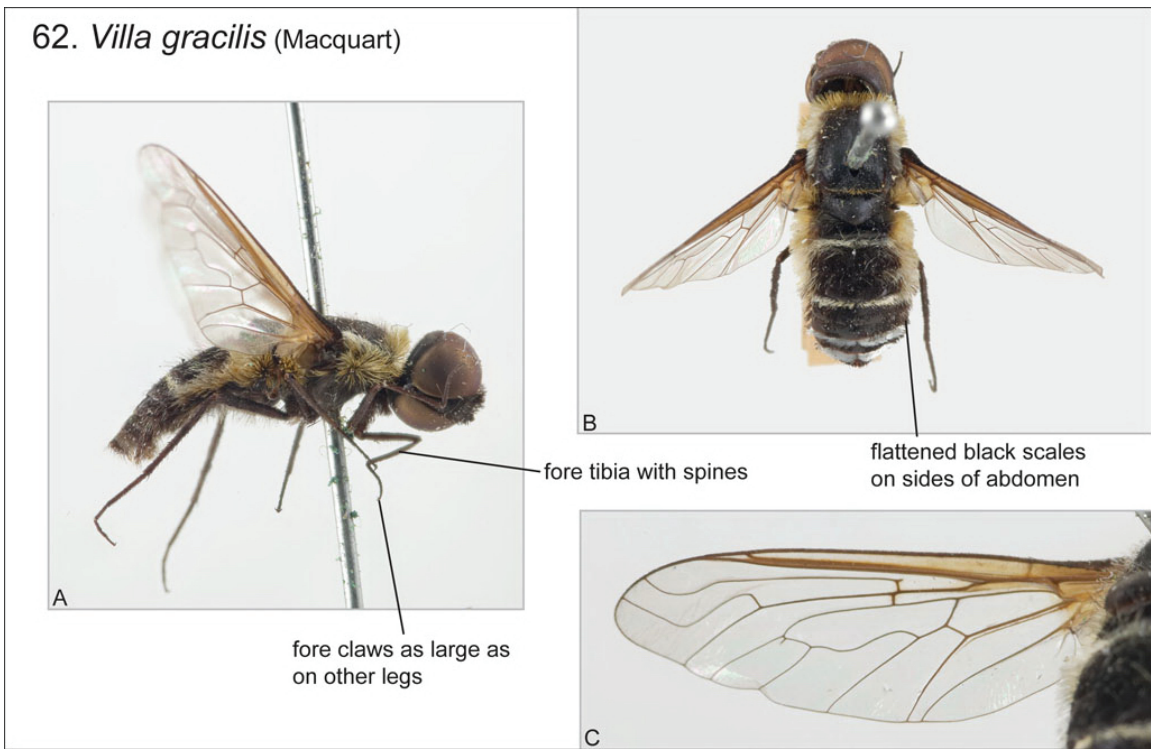
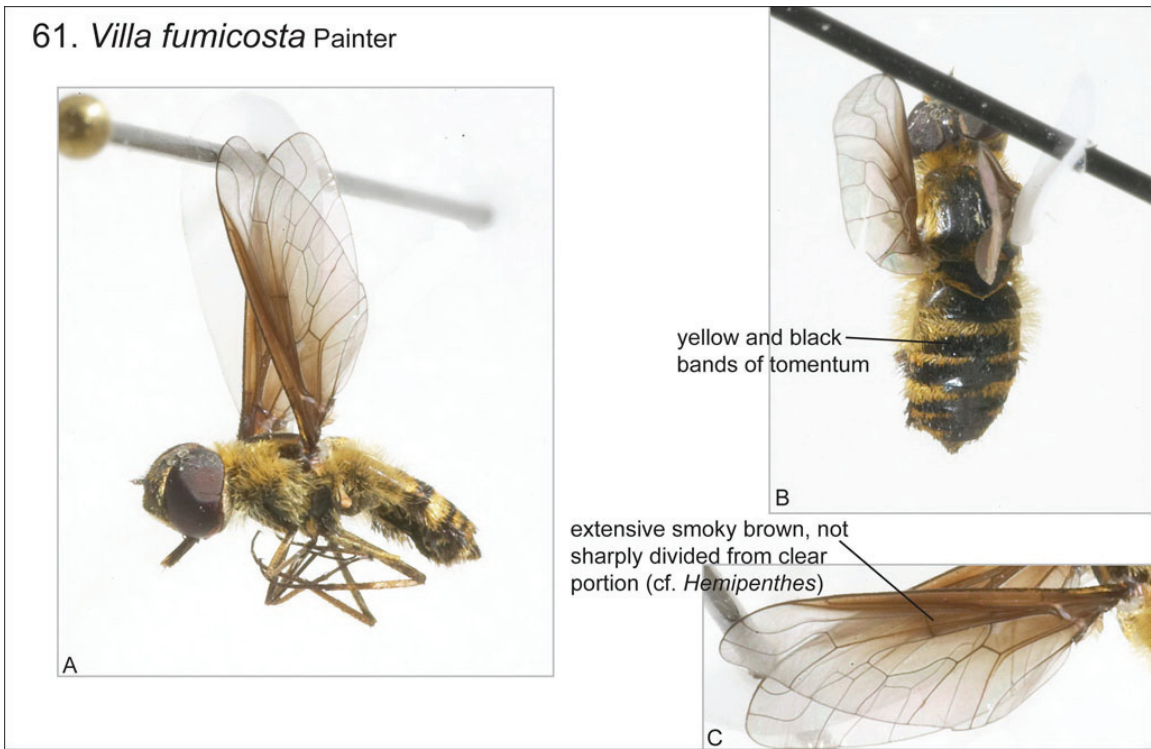
C clear windows in wing

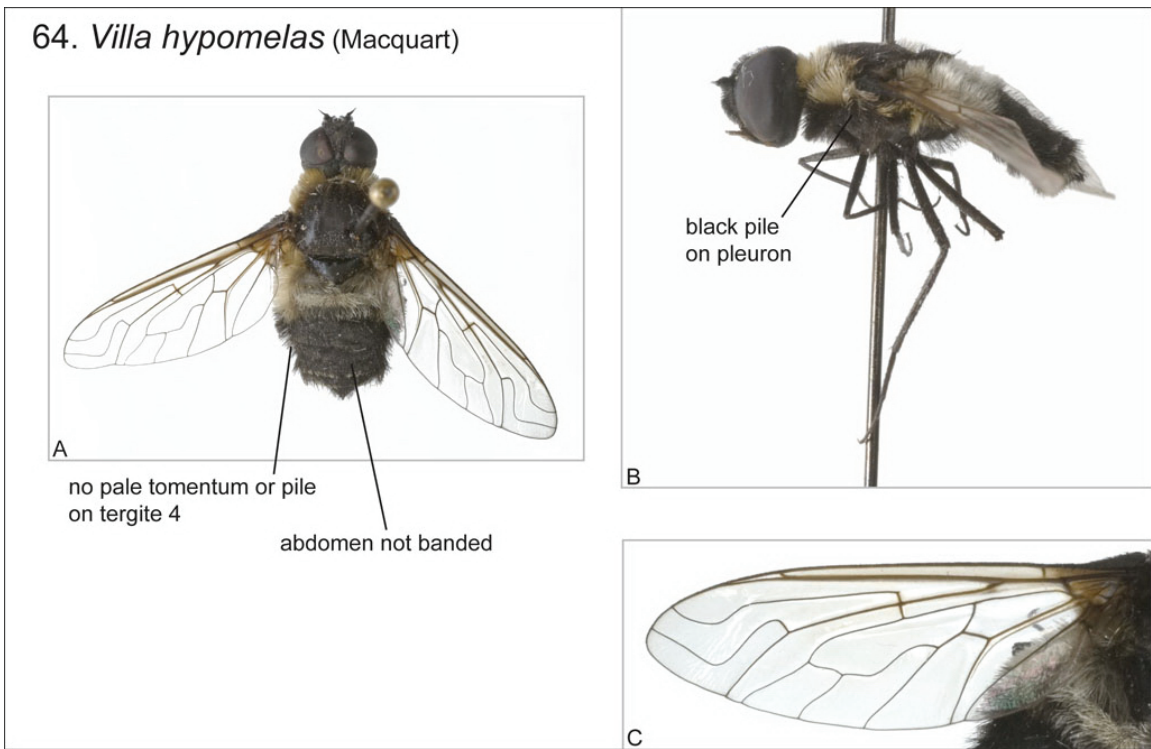
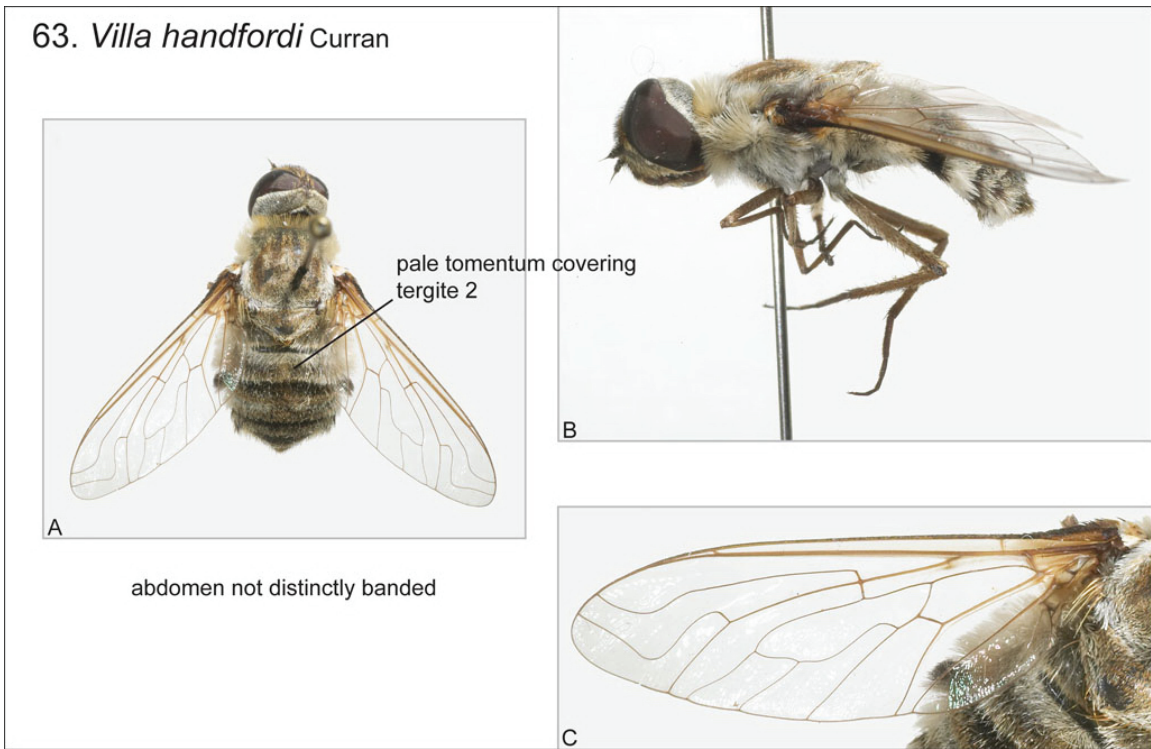
D

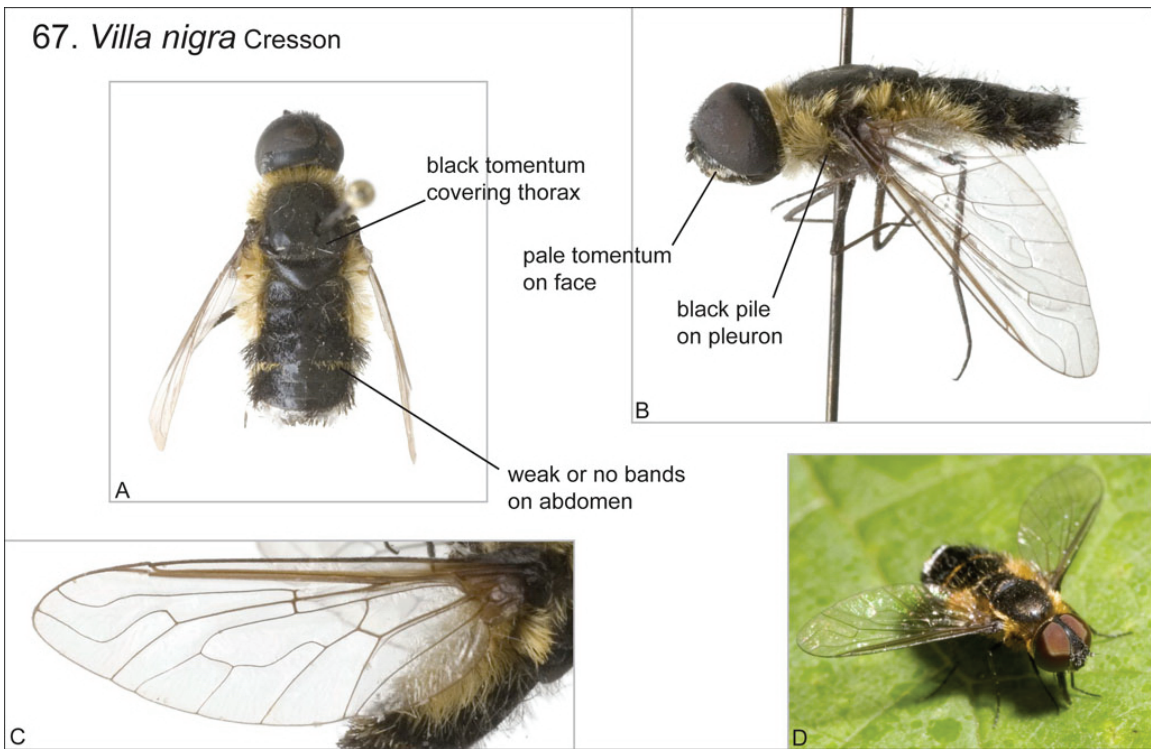
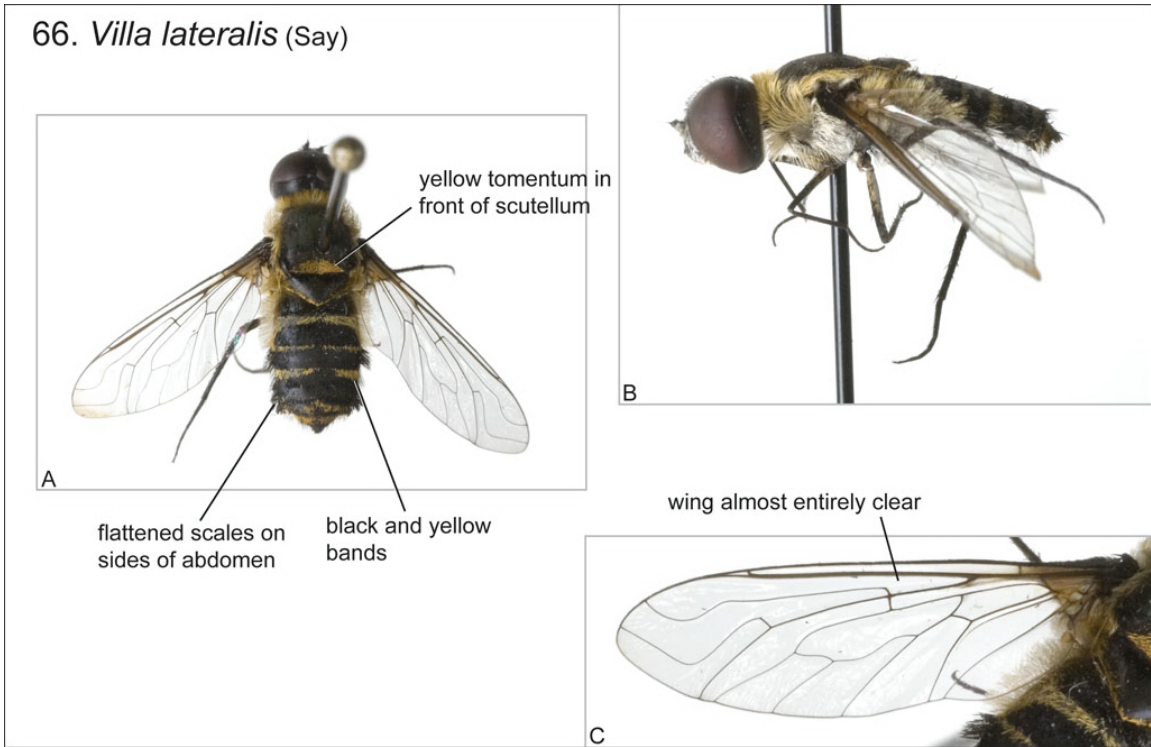
Thyridanthrax, *Paravilla*, and *Chrysanthrax* have antennae without expanded basal segment (cf. *Poecilanthrax*)

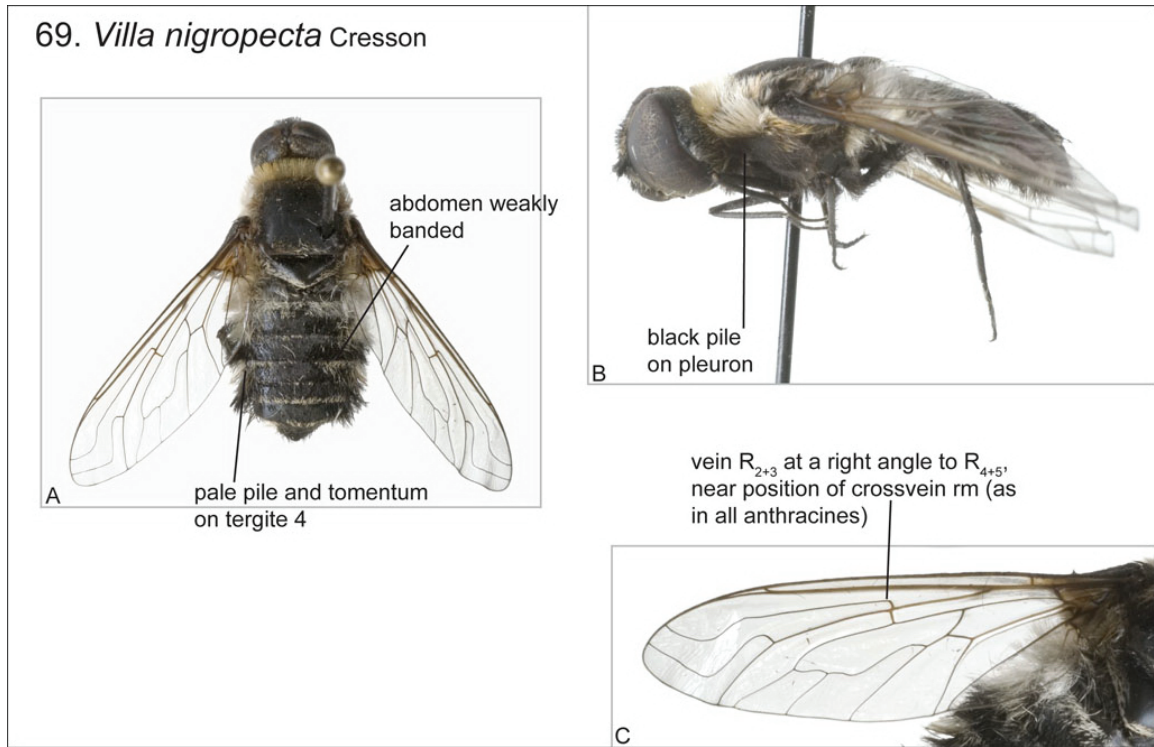
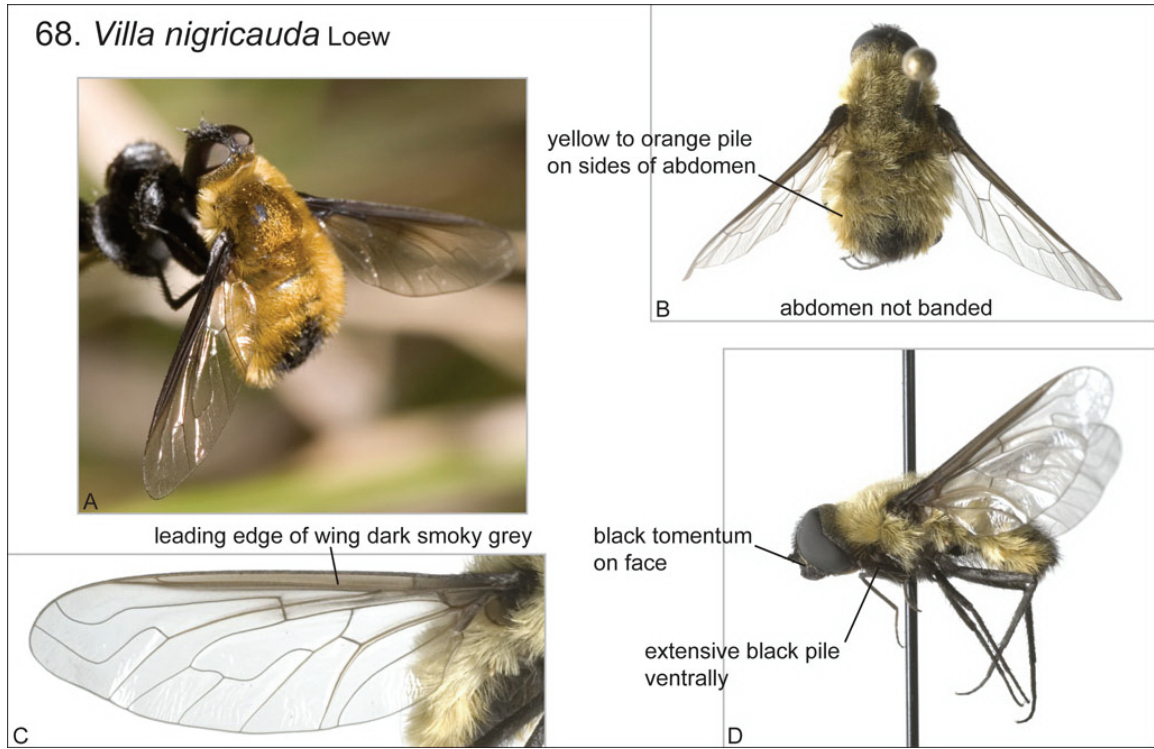


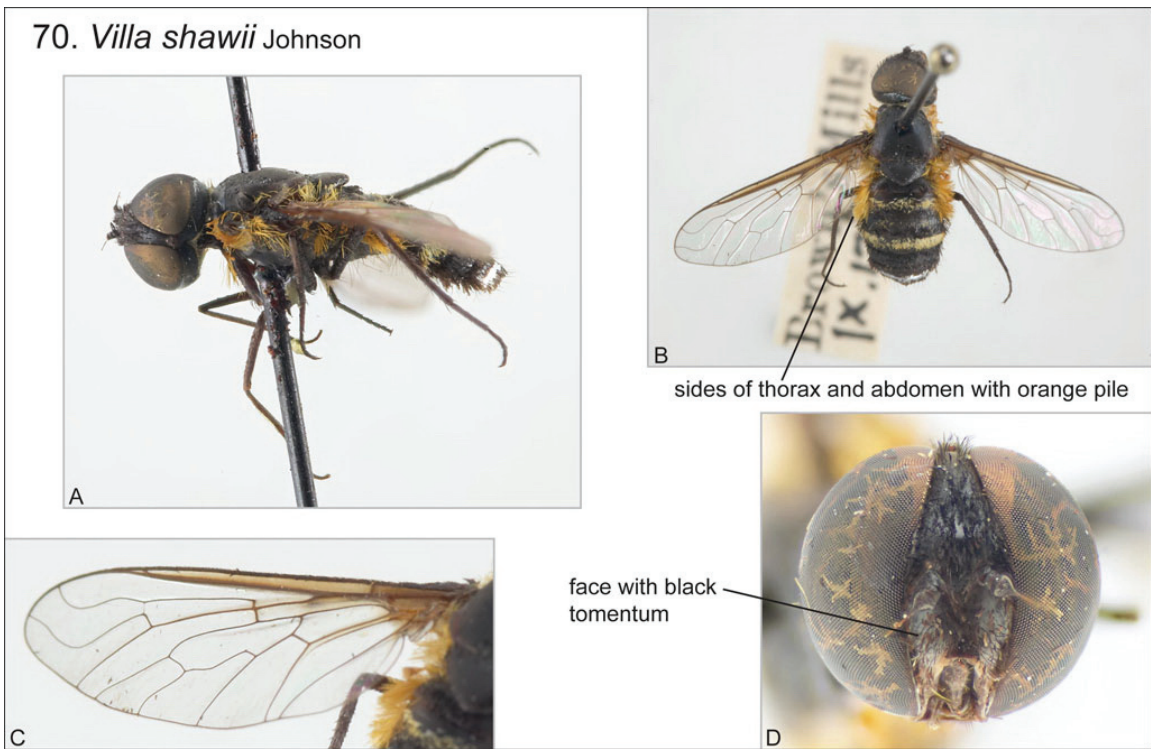
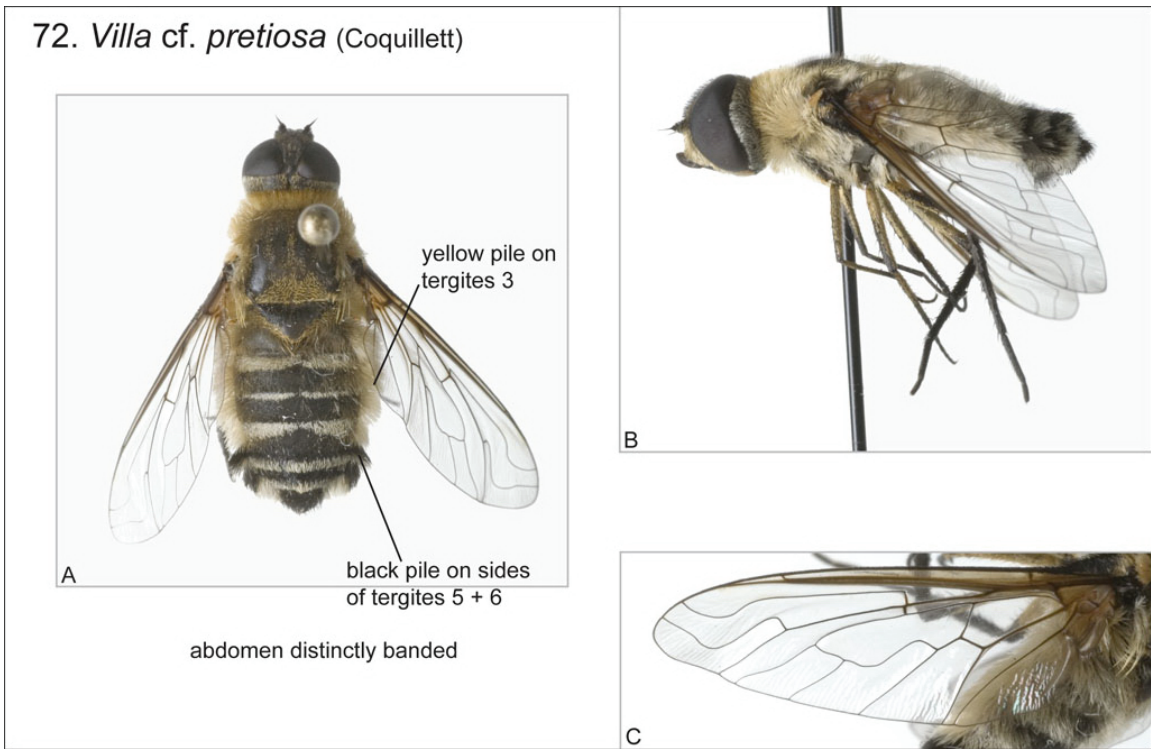


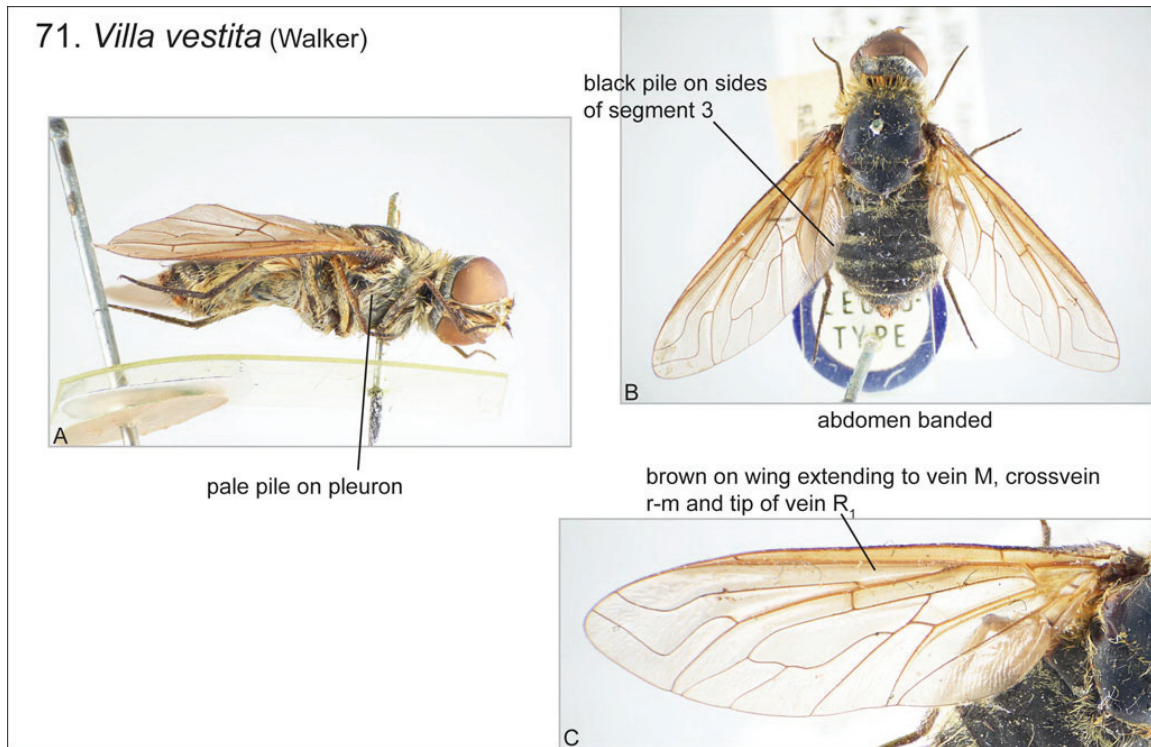












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References

- Coquillett, D.W. 1886. The North American species of *Toxophora*. *Entomologica Americana* **1**: 221–222.
- Coquillett, D.W. 1887. Monograph of the species belonging to the genus *Anthrax* from America north of Mexico. *Transactions of the American Entomological Society* **14**: 159–182.
- Coquillett, D.W. 1892a. Notes and descriptions of Bombyliidae. *Canadian Entomologist* **24**: 123–126.
- Coquillett, D.W. 1892b. Revision of the species of *Anthrax* from America north of Mexico. *Transactions of the American Entomological Society* **19**: 168–187.
- Coquillett, D.W. 1894. Notes and descriptions of North American Bombyliidae. *Transactions of the American Entomological Society* **21**: 89–112.
- Cresson, E.T., Jr. 1916. Dipterological notes. II. A study of the *lateralis*-group of the bombyliid genus *Villa* (*Anthrax* of authors, in part). *Entomological News* **27**: 439–444.
- Curran, C.H. 1930. New Diptera from North and Central America. *American Museum Novitates* **415**: 1–16.
- Curran, C.H. 1935. New American Diptera. *American Museum Novitates* **812**: 1–24.
- Evenhuis, N.L. 1984. Revision of the *Bombylius comanche* group of the New World (Diptera: Bombyliidae). *International Journal of Entomology* **26**: 291–321.

- Evenhuis, N.L., and Greathead, D.J. 1999. World catalog of bee flies (Diptera: Bombyliidae). Backhuys Publishers, Leiden.
- Evenhuis, N.L., and Greathead, D.J. 2003. World catalog of bee flies (Diptera: Bombyliidae): corrigenda and addenda. *Zootaxa* **300**: 1–64.
- Hall, J.C. 1969. A review of the subfamily Cylleniinae with a world revision of the genus *Thevenemyia* Bigot (*Eclimus* auct.) (Diptera: Bombyliidae). University of California Publications in Entomology **56**: 1–85.
- Hall, J.C. 1981. A review of the North and Central American species of *Paravilla* Painter (Diptera: Bombyliidae). University of California Publications in Entomology **92**: 1–198.
- Hall, J.C. 1970. The North American species of *Villa* (*Thyridanthrax*) (Osten Sacken) (Diptera: Bombyliidae). Transactions of the American Entomological Society **96**: 519–542.
- Hall, J.C., and Evenhuis, N.L. 1980. Bombyliidae. In *Flies of the Nearctic Region*. Edited by G.C.D. Griffiths. E. Schweizerbart, Stuttgart. Vol. V, pt. 13, no. 1, pp 1–96.
- Hall, J.C., and Evenhuis, N.L. 1981. Bombyliidae. In *Flies of the Nearctic Region*. Edited by G.C.D. Griffiths. E. Schweizerbart, Stuttgart. Vol. V, pt. 13, no. 2, pp 97–184.
- Hall, J.C., and Evenhuis, N.L. 1982. Bombyliidae. In *Flies of the Nearctic Region*. Edited by G.C.D. Griffiths. E. Schweizerbart, Stuttgart. Vol. V, pt. 13, no. 3, pp 185–280.
- Hall, J.C., and Evenhuis, N.L. 2003. Review of the subgenus *Geron* (*Geron*) Meigen in the Nearctic Region (Diptera: Bombyliidae: Toxophorinae). *Zootaxa* **181**: 1–72.
- Hall, J.C., and Evenhuis, N.L. 2004. Bombyliidae. In *Flies of the Nearctic Region*. Edited by G.C.D. Griffiths. E. Schweizerbart, Stuttgart. Vol. V, pt. 13, no. 7, pp 657–716.
- Hull, F.M. 1973. Bee flies of the world: the genera of the family Bombyliidae. Bulletin of the United States National Museum **286**: 1–687.
- Johnson, C.W. 1902. New North American Diptera. *Canadian Entomologist* **34**: 240–242.
- Johnson, C.W. 1903. Descriptions of three new Diptera of the genus *Phthiria*. *Psyche* **10**: 184–185.
- Johnson, C.W. 1907. A review of the species of the genus *Bombylius* of the eastern United States. *Psyche* **14**: 95–100.
- Johnson, C.W. 1908. Notes on New England Bombyliidae, with a description of a new species of *Anthrax*. *Psyche* **15**: 14–15.
- Johnson, C.W. 1919. New species of the genus *Villa* (*Anthrax*). *Psyche* **26**: 11–13.
- Johnson, C.W. 1921. New species of Diptera. Occasional Papers of the Boston Society of Natural History **5**: 11–17.
- Marshall, S.A. 1998. Brachycera (Diptera) of the Fathom Five Islands and the upper Bruce Peninsula, Ontario [online]. Available from <http://www.uoguelph.ca/debu/Georgian-Bay-Is-Dip-list.htm> [accessed November 27, 2007].
- Marston, N. 1963. A revision of the Nearctic species of the *albofasciatus* group of the genus *Anthrax* Scopoli (Diptera: Bombyliidae). Technical Bulletin of the Kansas State University Agricultural Experiment Station **127**: 1–79.
- Marston, N. 1970. Revision of New World species of *Anthrax* (Diptera: Bombyliidae), other than the *Anthrax albofasciatus* group. *Smithsonian Contributions to Zoology* **43**: 1–148.
- Melander, A.L. 1950. Taxonomic notes on some smaller Bombyliidae (Diptera). *Pan-Pacific Entomologist* **26**: 139–156.
- Packer, L. 1988. The effect of *Bombylius pulchellus* (Diptera; Bombyliidae) and other mortality factors upon the biology of *Halictus ligatus* (Hymenoptera; Halictidae) in southern Ontario. *Canadian Journal of Zoology* **66**: 611–616.
- Painter, R.H. 1926. The *lateralis* group of the bombyliid genus *Villa*. *Ohio Journal of Science* **26**: 205–212.
- Painter, R.H., and Hall, J.C. 1960. A monograph of the genus *Poecilanthrax* (Diptera: Bombyliidae). Technical Bulletin of the Kansas State University Agricultural Experiment Station **106**: 1–132.
- Painter, R.H., and Painter, E.M. 1962. Notes on and redescriptions of types of North American Bombyliidae (Diptera) in European museums. *Journal of the Kansas Entomological Society* **35**: 2–164.

- Painter, R.H., and Painter, E.M. 1963. A review of the subfamily Systropinae (Diptera: Bombyliidae) in North America. *Journal of the Kansas Entomological Society* **36**: 278-348.
- Skevington, J., Stead, K., Caloren, D., and Connop, J. 2000. The insects of North Lambton County, Ontario, Canada [online]. Lambton Wildlife, Inc. Available from <http://www.uoguelph.ca/debu/Lambton-tableofcontents.htm> [accessed 24 October 2007].
- Williamson, E.B. 1907. A collecting trip north of Sault Ste. Marie, Ontario. *The Ohio Naturalist*, **7**: 129–148.
- Yeates, D.K. 1994. The cladistics and classification of the Bombyliidae (Diptera: Asiloidea). *Bulletin of the American Museum of Natural History* **219**: 1–191.
- Yeates, D.K., and Greathead, D.J. 1997. The evolutionary pattern of host use in the Bombyliidae: a diverse family of parasitoid flies. *Biological Journal of the Linnean Society* **60**: 149–186.