A Guide to the Mosquitoes (Diptera: Culicidae) of the Yukon

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Abstract
Mosquitoes (Diptera: Culicidae) are highly diverse, with over 3500 extant species worldwide. At least 33 species occur in the Yukon Territory. Correct identification of mosquitoes, as well as knowledge of their ecology, natural history, blood-feeding preferences, and ability to vector pathogens are essential for effective control measures and mosquito research. The Yukon is home to unending hordes of mosquitoes, and here we provide a comprehensive guide to their identification and biology. This guide may be of interest to students of Yukon natural history, mosquito-borne diseases, and wetland ecology, as well as mosquito control professionals, and is formatted for convenient printing and use.

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Introduction

The Yukon Territory is home to a variety of different eco-districts, from towering mountains and moist Pacific Maritime conditions in the southwest to coastal plains and Arctic conditions in the north (Smith et al., 2004). Mean annual temperatures are below freezing, with mean winter temperatures of around -20 °C and mean temperatures during July, the warmest month, of 10-15 oC (Oswald and Jenyk, 1977). However, The Yukon is a land of extremes. Daily temperature fluctuations of 30 oC are not uncommon (Smith et al. 2004) and the lowest recorded temperature in North America, -63 °C, is from the Territory (Thomson 1958). The Yukon Territory is also home to seemingly unending hordes of mosquitoes. Some of these belong to species that are widespread and abundant, easily surviving cold winters and thriving during brief summer conditions, while others are found in low numbers only in certain habitats, at the very northern margin of their distribution. In the last review of the mosquitoes of the Yukon (Belton & Belton, 1990) a total of 28 species were known to have been recorded from the Territory, with an additional 4 species that probably occur there. Since this review two additional territorial records have been made and three of the species that were thought to exist in the Yukon have been confirmed (Peach 2017, 2018; Peach and Poirier 2020). Changes in the distribution records of several species in British Columbia indicate that there may be additional species in the territory that should be considered when identifying specimens. The purpose of this paper is to provide an updated list of mosquitoes known from the Yukon, bringing together the scattered literature on all 33 species known from that territory. We also provide keys to the adult females of Yukon mosquitoes, including those of an additional 5 species that are expected to occur there.

While many of the mosquito-borne viruses found in southern Canada have not been reported from the Yukon, there are two endemic arboviruses vectored by mosquitoes: snowshoe hare virus (SSHV) and Northway virus (NORV). SSHV is an Orthobunyavirus of the California encephalitis virus (CEV) serogroup primarily found in snowshoe hares (*Lepus americanus*) and arctic ground squirrels (*Citellus undulatus*) (McLean et al., 1972). *Aedes communis* is thought to be the primary vector of SSHV, though *Ae. nigripes, Ae. hexodontus*, and *Cs. inornata* may also be vectors, and the virus has been isolated from a variety of other species (McLean et al., 1972, 1974; Ritter & Feltz, 1974; McLean & Lester, 1984). SSHV can infect humans and livestock and while clinical cases are rare, they do occur (Heath et al., 1989; Meier-Stephenson et al., 2007; Goff et al., 2012; Lau et al., 2017). NORV was originally isolated from mosquitoes in Alaska (Ritter & Feltz, 1974) and has since been found in the Yukon and Northwest Territories (McLean et al., 1977, McLean et al., 1979a, McLean et al. 1979b). Antibodies for NORV have been found in humans and large ungulates (Walters et al., 1999), but no clinical infections have been reported. Western equine encephalitis virus (WEEV) and eastern equine encephalitis (EEEV) have not been reported from the

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Yukon (McLean et al., 1974; Artsob, 1990), though Burton & McLintock (1970) did find serum neutralizing antibodies for WEEV in caribou (*Rangifer tarandus*) in the Northwest Territories. West Nile virus (WNV) and St. Louis encephalitis virus (SLEV) have both been detected in migratory birds in Alaska (Pedersen et al., 2016), and may similarly be present in the Yukon. While mosquito transmission of these pathogens seems unlikely due to the short duration of the growing season, with respect to WNV some climate models predict increasing prevalence in adjacent areas (Chen et al., 2012) which may also indicate increased risk in the Yukon.

Most of the records in the Yukon are the results of collecting in the early to mid 20th century (Dyar, 1919, 1920, 1921; Freeman, 1952; Curtis, 1953), with some sporadic efforts made up to the late 20th century (Nelson 1977; Wood *et al.* 1979; McLean *et al.* 1981; McLean & Lester 1984; Wood 1989 pers. comm. in Belton & Belton 1990). However, there is not just a paucity of collecting records but also unevenness in their distribution. Outside of the main transportation corridors most of the Yukon is inaccessible other than on foot, by canoe, or by air, and many of the areas that can be reached by automobile are only accessible on rough, pitted gravel roads. Due to this lack of access most collecting has been done from easily-accessible locations, often close to population centres.

There is a dearth of information on the bionomics of Yukon mosquitoes, and western and northern mosquitoes in general. We have had to rely on information from a variety of other areas to provide a background on some of the species in this guide. While information from adjacent areas such as Alaska or Northern British Columbia is likely comparable, much information comes from much farther afield and one should be aware this may not be reflective of western/northern populations of even the same species.

Nomenclature used here follows Wilkerson *et al.* (2015) with respect to generic names within the tribe Aedini, and subgeneric names are included to show the earlier name changes found in Darsie & Ward (2005). We also follow Darsie & Ward (2005) in considering *Aedes* (*Ochlerotatus*) *idahoensis* a subspecies of *Aedes* (*Ochlerotatus*) *spencerii*.

For additional information see guides to all Canadian mosquito species by Wood et al. (1979) and Thielman and Hunter (2007), to the mosquitoes of British Columbia by Belton (1983), to the mosquitoes of Alaska by Gjullin et al. (1961), and to the mosquitoes of North America, north of Mexico, by Darsie & Ward (2005).

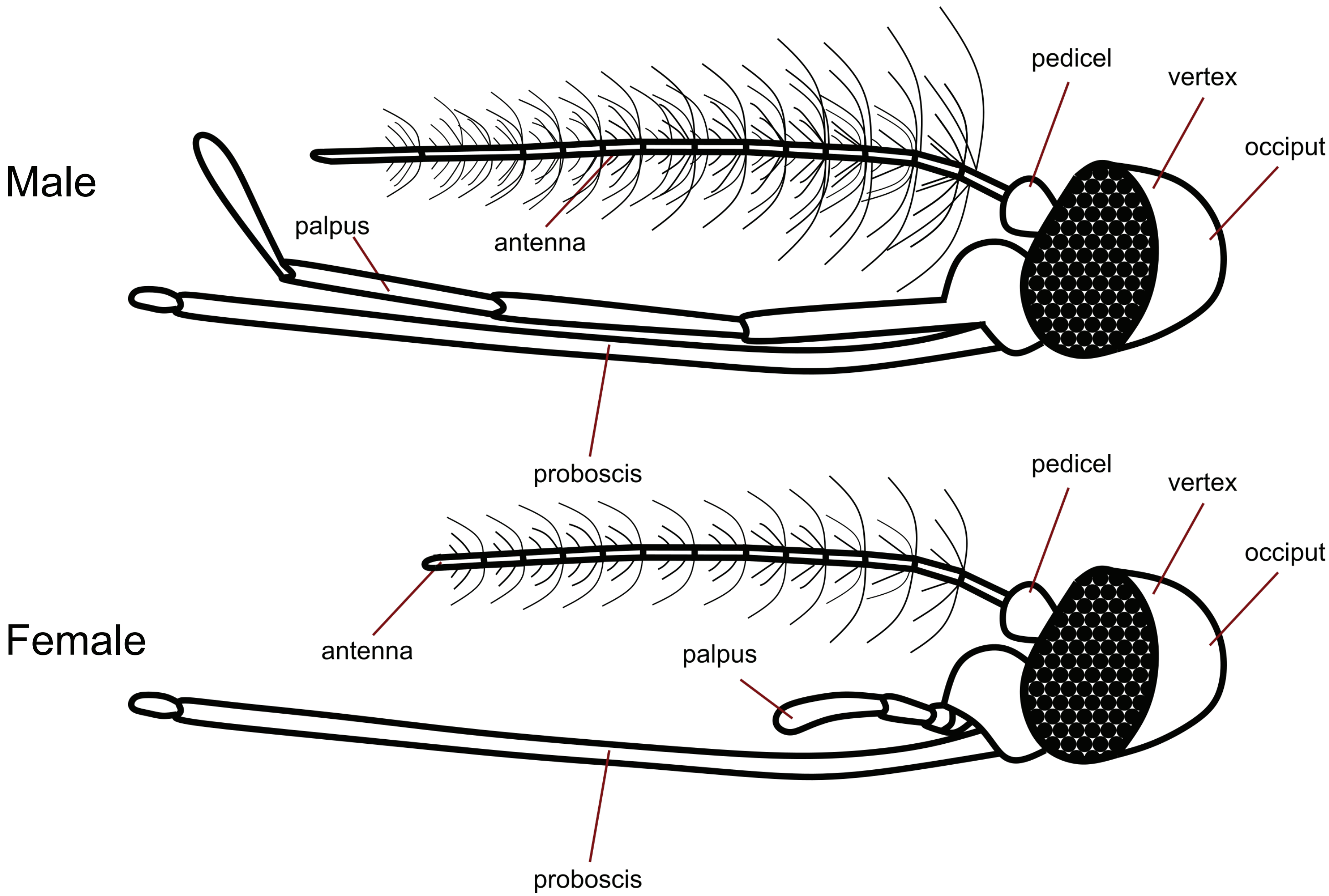
Table 1: Checklist of mosquitoes of the Yukon. †Unrecorded but expected to occur in the Yukon.

Aedes (*Aedes*) *cinereus* Meigen	*Aedes* (*Ochlerotatus*) *nigripes* (Zetterstedt)
Aedes (*Aedimorphus*) *vexans* (Meigen)	*Aedes* (*Ochlerotatus*) *nigromaculis* (Ludlow)†
Aedes (*Ochlerotatus*) *campestris* Dyar and Knab	*Aedes* (*Ochlerotatus*) *pionips* Dyar
Aedes (*Ochlerotatus*) *canadensis* (Theobald)	*Aedes* (*Ochlerotatus*) *provocans* (Walker)†
Aedes (*Ochlerotatus*) *cataphylla* Dyar	*Aedes* (*Ochlerotatus*) *pullatus* (Coquillett)
Aedes (*Ochlerotatus*) *aboriginis* Dyar†	*Aedes* (*Ochlerotatus*) *punctor* (Kirby)
Aedes (*Ochlerotatus*) *churchillensis* Ellis and Brust†	*Aedes* (*Ochlerotatus*) *riparius* Dyar and Knab
Aedes (*Ochlerotatus*) *communis* (de Geer)	*Aedes* (*Ochlerotatus*) *spencerii* ssp. *spencerii* (Theobald)
Aedes (*Ochlerotatus*) *decticus* Howard, Dyar, and Knab	*Aedes* (*Ochlerotatus*) *sticticus* (Meigen)
Aedes (*Ochlerotatus*) *diantaeus* Howard, Dyar, and Knab	*Aedes* (*Ochlerotatus*) *ventrovittis* Dyar†
Aedes (*Ochlerotatus*) *euedes* Howard, Dyar, and Knab	*Anopheles* (*Anopheles*) *earlei* Vargas
Aedes (*Ochlerotatus*) *excrucians* (Walker)	*Coquillettidia* (*Coquillettidia*) *perturbans* (Walker)
Aedes (*Ochlerotatus*) *fitchii* (Felt and Young)	*Culex* (*Culex*) *tarsalis* Coquillett
Aedes (*Ochlerotatus*) *flavescens* (Müller)	*Culex* (*Neoculex*) *territans* Walker
Aedes (*Ochlerotatus*) *hexodontus* Dyar	*Culiseta* (*Culiseta*) *alaskaensis* (Ludlow)
Aedes (*Ochlerotatus*) *impiger* (Walker)	*Culiseta* (*Culiseta*) *impatiens* (Walker)
Aedes (*Ochlerotatus*) *implicatus* Vockeroth	*Culiseta* (*Culiseta*) *incidens* (Thomson)
Aedes (*Ochlerotatus*) *intrudens* Dyar	*Culiseta* (*Culiseta*) *inornata* (Williston)
Aedes (*Ochlerotatus*) *mercurator* Dyar	*Culiseta* (*Culicella*) *morsitans* (Theobald)

General Tips for Mosquito Identification

- Watch out for missing scales or setae by checking for empty pits where they should be.
- Northern specimens seem to have reduced abundance of pale scales, so check for these very carefully in steps that use them.
- Take care when collecting specimens to keep them as undamaged as possible. The best specimens are adults reared directly from pupae.
- Characteristics are in hierarchical order of reliability.

Anatomy: Lateral View of Head



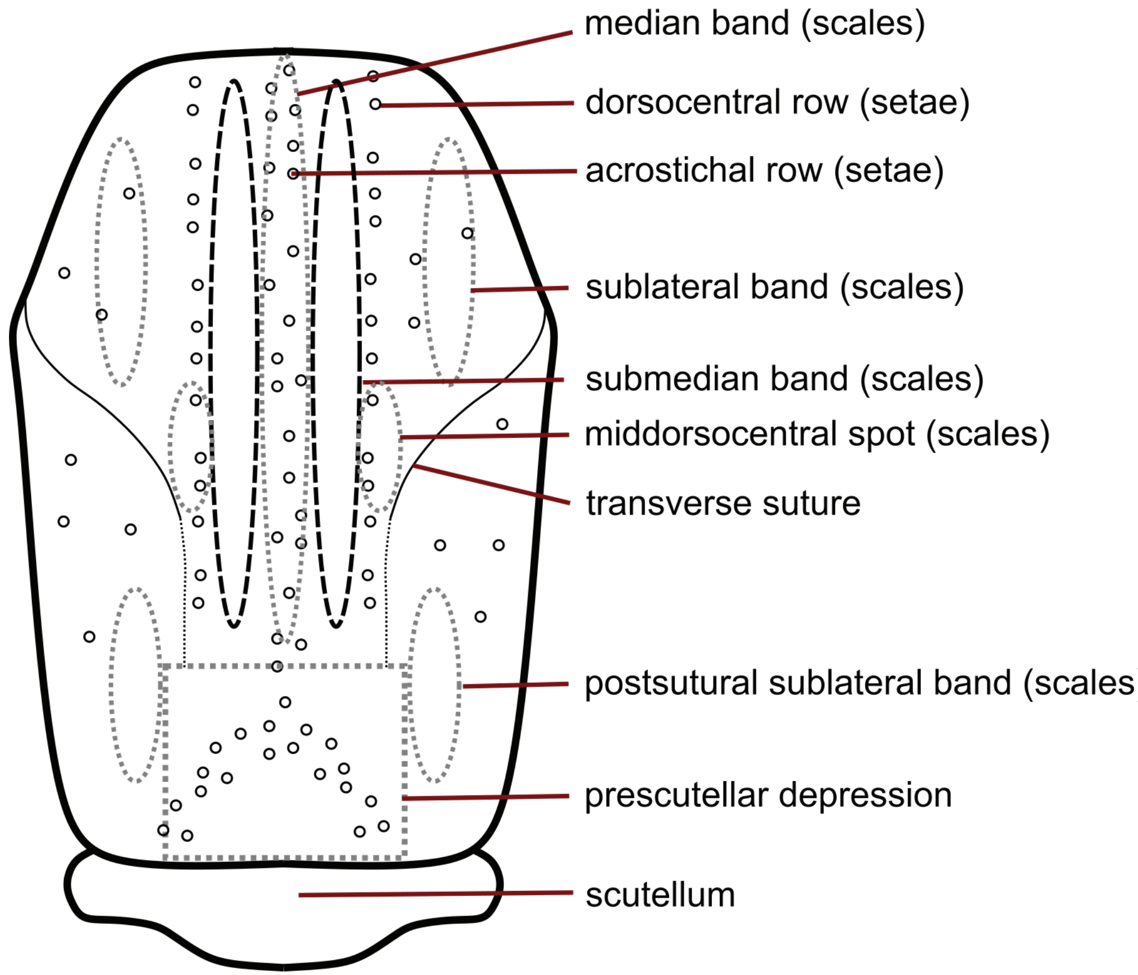
Note: for a more detailed overview of anatomy, see Wood et al. (1979)

Anatomy: Lateral View of Thorax

Note: the hypostigmal area, postspiracular area, and subspiracular area comprise the anepisternum.

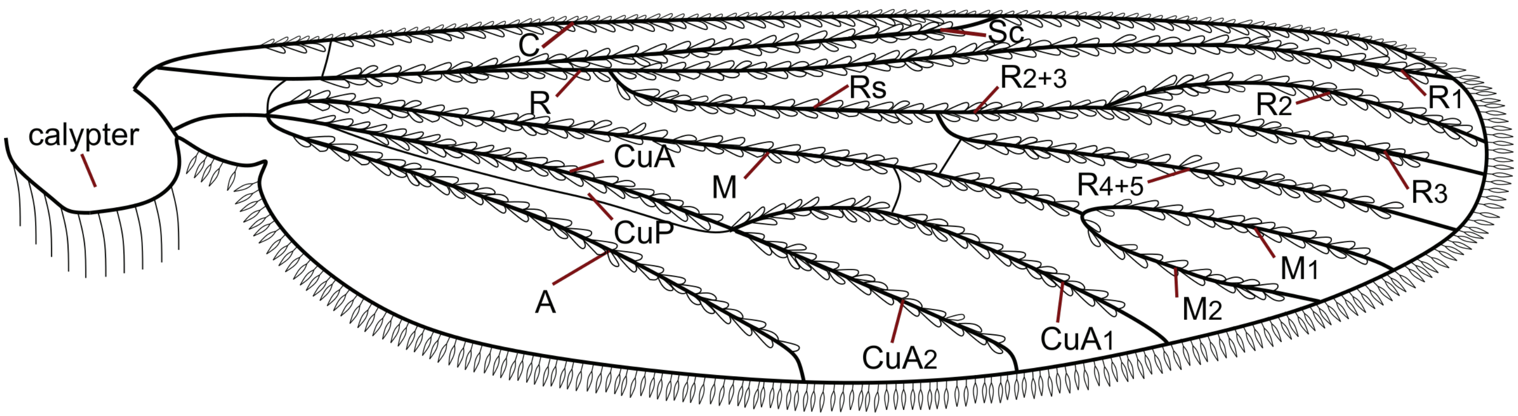
Note: for a more detailed overview of anatomy, see Wood et al., (1979)

Anatomy: Dorsal View of Thorax



Note: for a more detailed overview of anatomy, see Wood et al. (1979)

Anatomy: Dorsal View of Wing



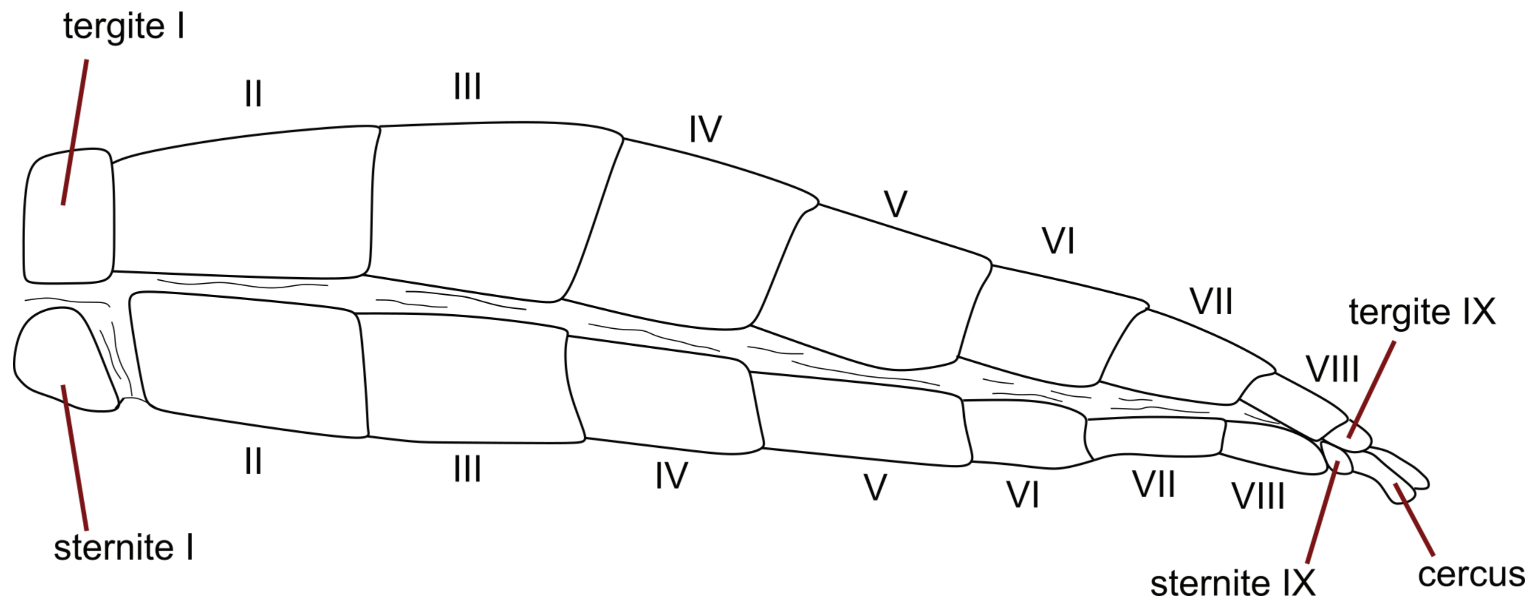
Wing Vein Notation

A = anal
C = costa
CuA = anterior branch of the cubitus
CuP = posterior branch of the cubitus

M = media
R = radial
Rs = radial sector
Sc = subcosta

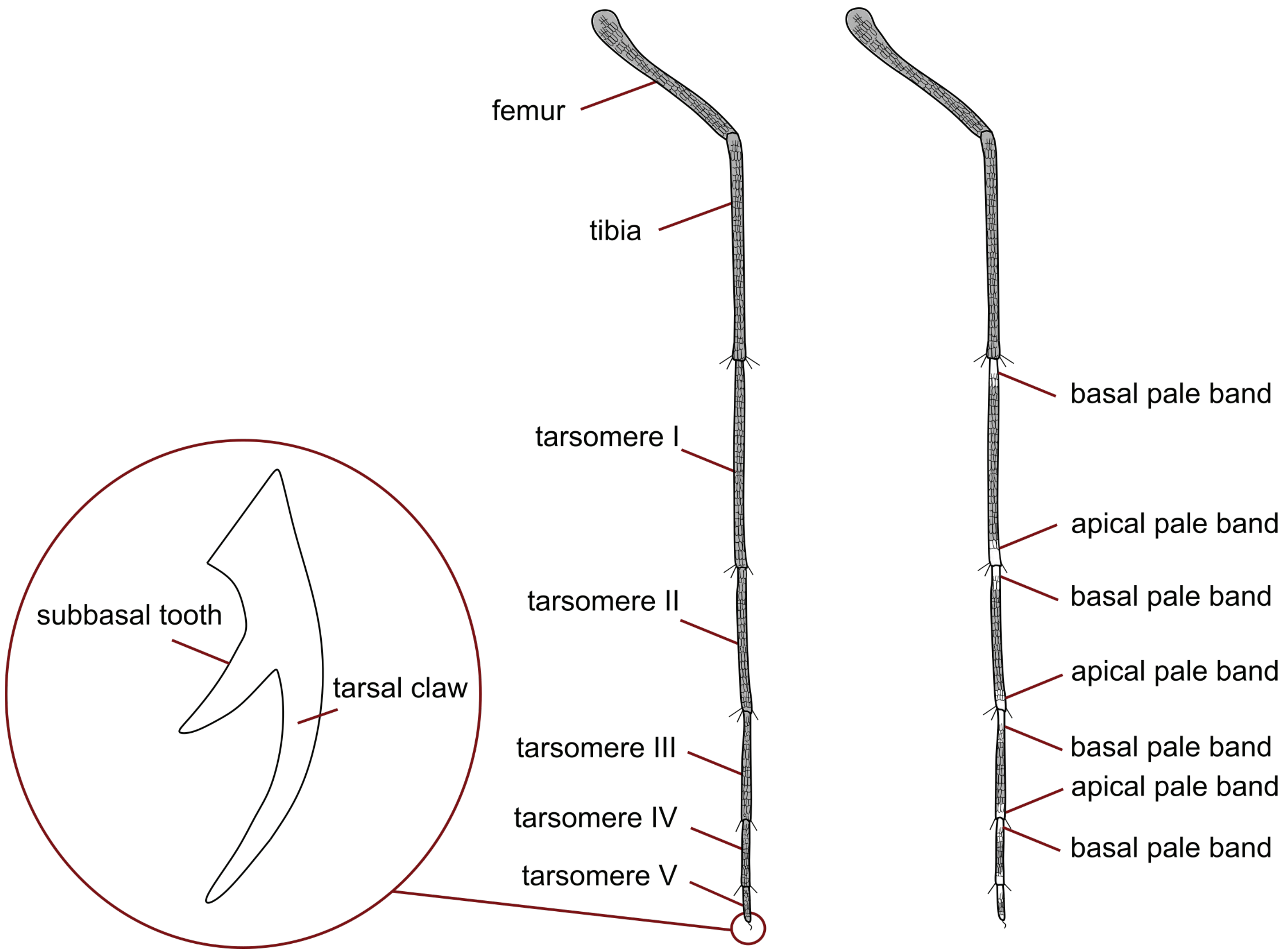
Note: for a more detailed overview of anatomy, see Wood et al. (1979)

Anatomy: Lateral View of Abdomen



Note: for a more detailed overview of anatomy, see Wood et al. (1979)

Anatomy: Lateral View of Leg



Note: for a more detailed overview of anatomy, see Wood et al. (1979)

Key to Genera of Adult Female Mosquitoes

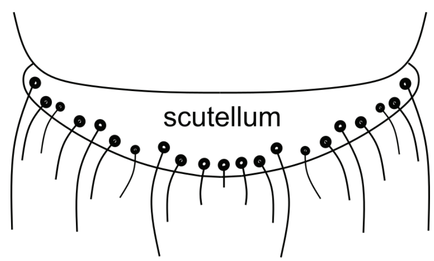


Fig 1. Rounded scutellum.
(E.g. *Anopheles*)

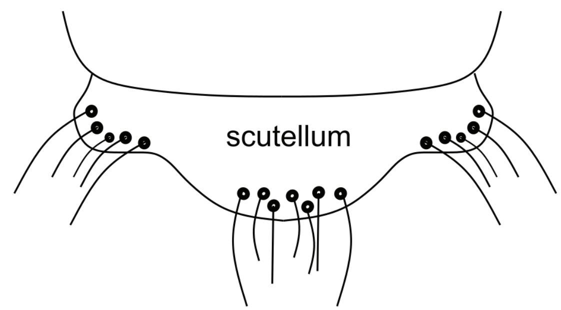


Fig 2. Tri-lobed scutellum.
(E.g. *Aedes*, *Culex*, *Culiseta*)

1.	Scutellum rounded (Fig. 1), palps of female about as long as proboscis…………………………………………………........... *Anopheles*
1'	Scutellum tri-lobed (Fig. 2), palps of female much shorter than proboscis……………………………………….. 2

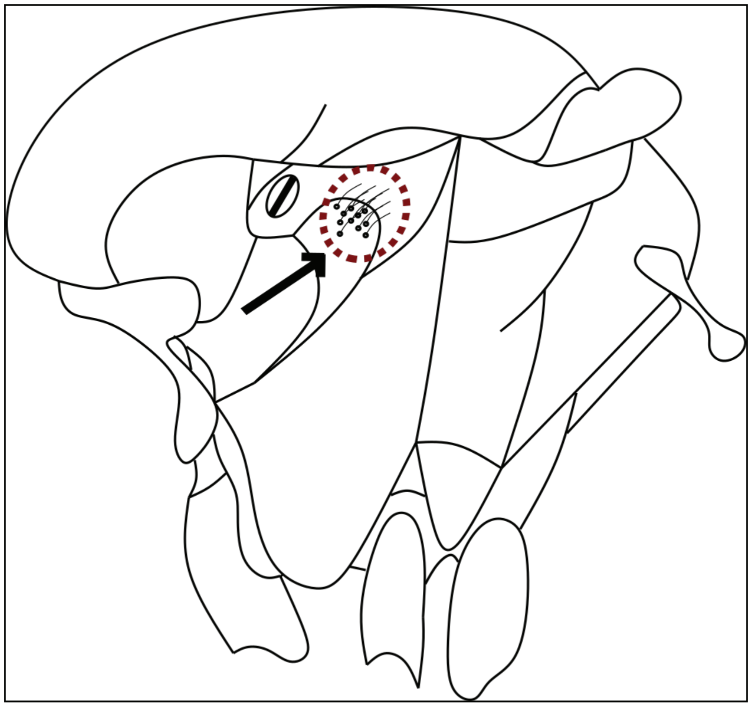


Fig 3. Postspiracular setae present.

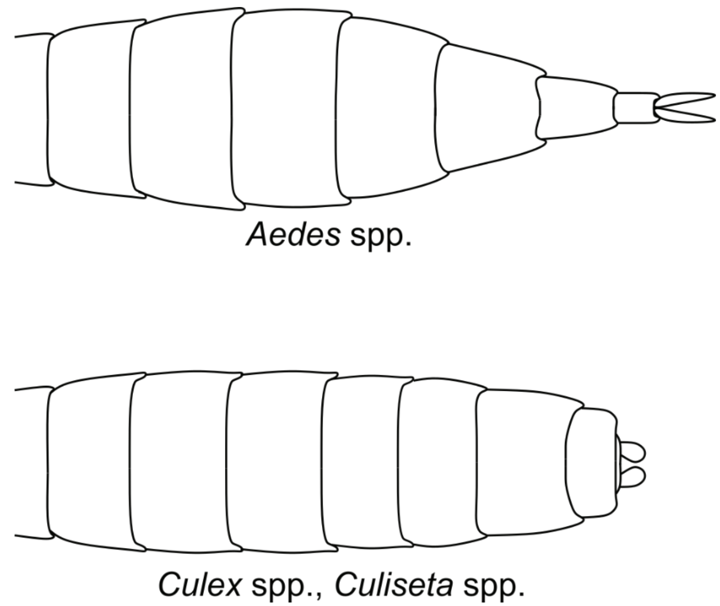


Fig 4. Abdominal shapes.

2(1)	Postspiracular setae present (Fig. 3), abdomen wide at mid-length, tapering towards the tip (Fig. 4)…………………………………..….. *Aedes*
2’	Postspiracular setae absent, abdomen uniformly wide with blunt tip (Fig. 4) ……………………………………………………………… 3

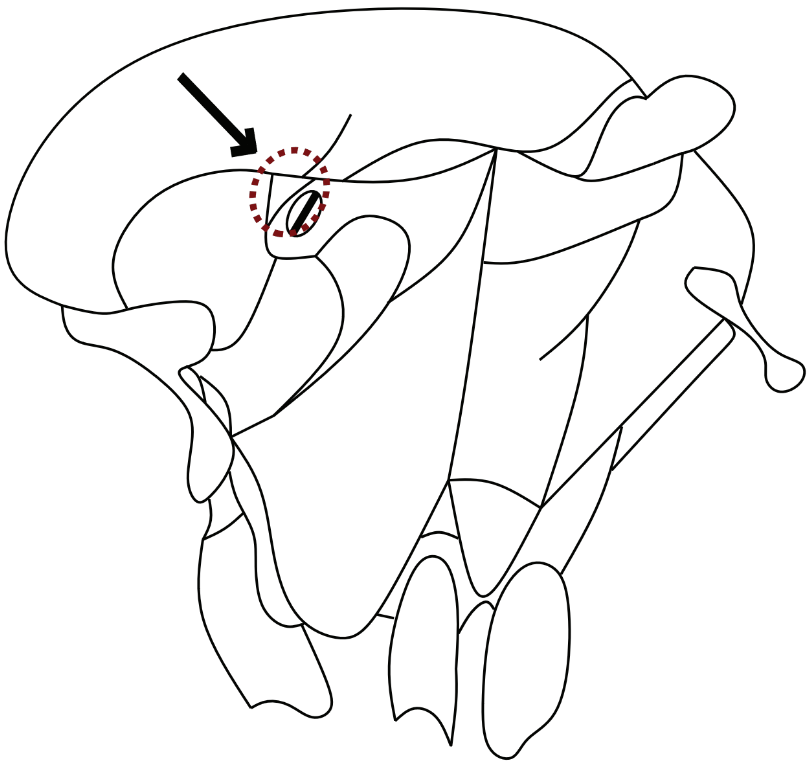


Fig 5. Prespiracular setae absent.

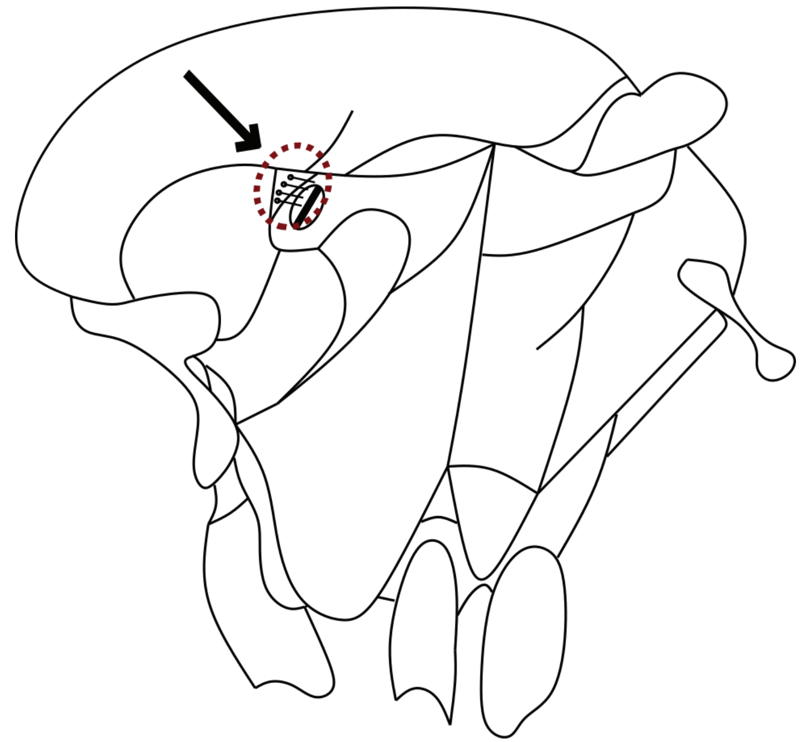


Fig 6. Prespiracular setae present.

3(2)	Prespiracular setae present (Fig. 5)…………………………….... *Culiseta*
3’	Prespiracular setae absent (Fig. 6)……………………………………….. 4

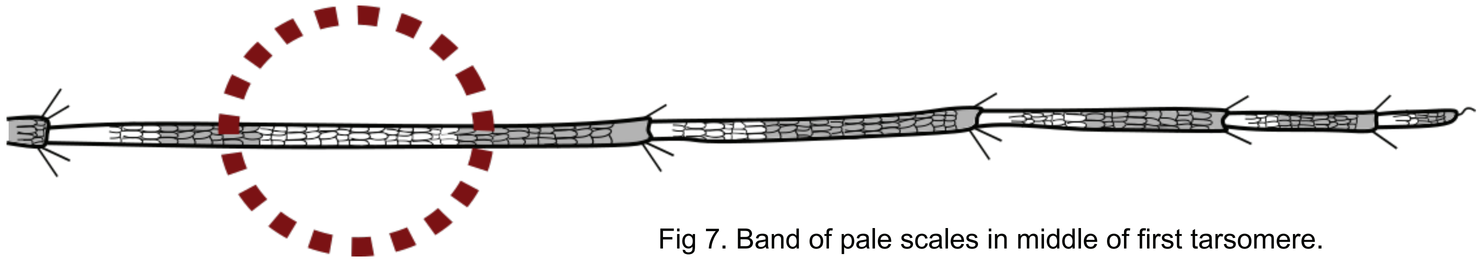


Fig 7. Band of pale scales in middle of first tarsomere.

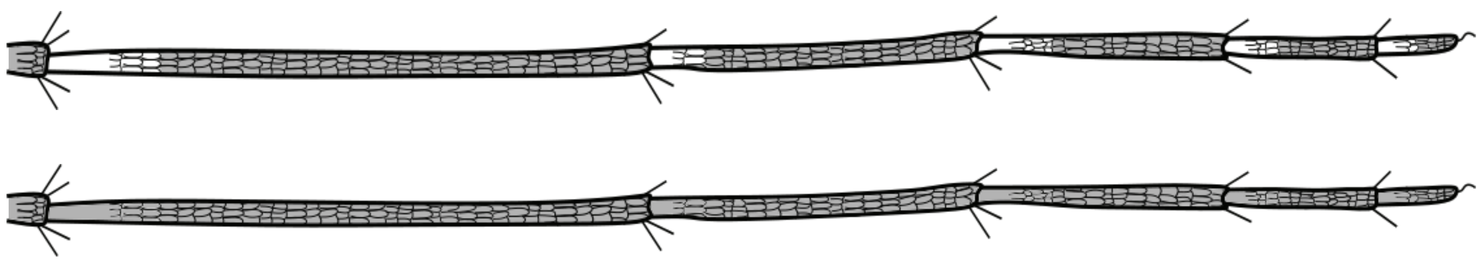


Fig 8. First tarsomere without band of pale scales in middle.

4(3)	First tarsomere and hind tibia with a band of pale scales at middle; wing scales broad and a mix of dark and pale (Fig. 7)………….. *Coquillettidia*
4’	First tarsomere and hind tibia without a band of pale scales at middle; wing scales narrow and dark (Fig. 8)………………………………… *Culex*

Key to Adult Females of the Genus *Anopheles*

1.	Fringe wing scales between apices of R1 and R4+5 bronze or cream-coloured, remaining wing scales dark and aggregated into patches (Fig 9) .... <u>*Anopheles earlei*</u>

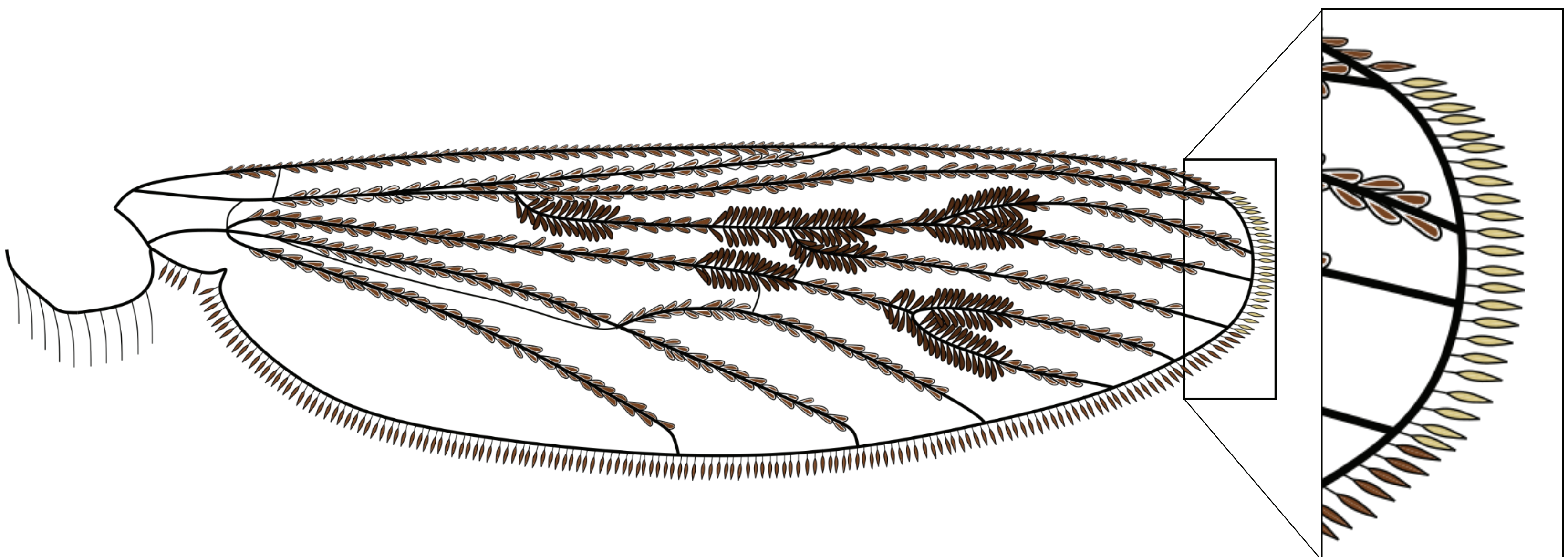


Fig 9. Wing of *An. earlei*.

Key to Adult Females of the Genus *Aedes*

1.	Tarsomeres with basal or apical bands of pale scales………………………………………………………… 2
1’	Tarsomeres without bands of pale scales………………………………………………………………… 13

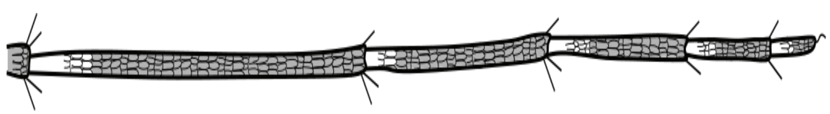


Fig 10. Pale scales basal on tarsomeres.

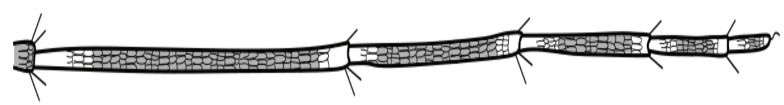


Fig 11. Pale scales basal and apical on tarsomeres.

2(1)	Tarsomeres with bands of pale scales at base only (Fig. 10) ………….. 3
2’	Tarsomeres with basal and apical band of pale scales (Fig. 11) …….. 12

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3(2)	Pale bands of hind tarsomeres narrow, occupying 1/5 or less of the length of segment two…………………………………………..… *vexans*
3’	Pale basal band of hind tarsomere two more than 1/4 the length of the segment………..…………………………………………………..…. 4
4(3)	Abdominal tergites almost completely covered in yellowish scales or with a median longitudinal paler stripe (Fig. 12)………………………..….. 5
4’	Abdominal tergites with pale scales in basal bands only (Fig. 13) ………..………………………………………………………….………… 6

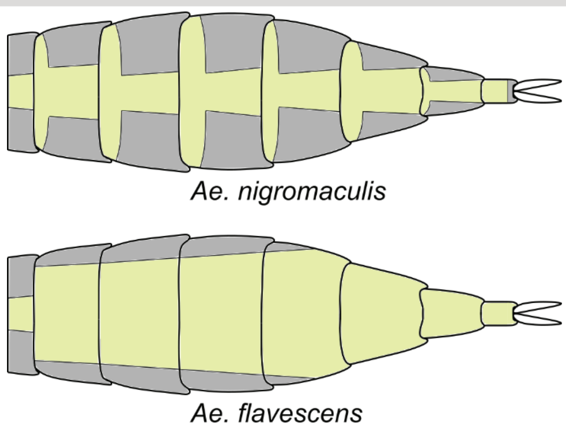


Fig 12. *Aedes nigromaculis* (top) and *flavescens* (bottom).

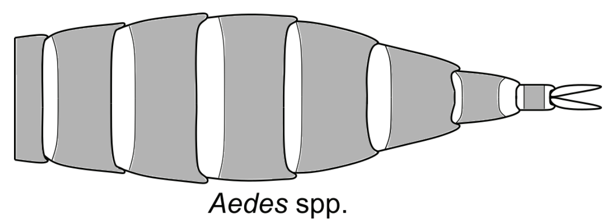


Fig 13. Pale scales in basal bands.

5(4)	Abdominal tergites almost completely covered in yellowish scales; proboscis dark-scaled with scattered pale scales.................. *flavescens*
5’	Abdominal tergites with paler median longitudinal stripe; proboscis with distinct band of pale scales at mid length........................ *nigromaculis**
6(4)	Claws of fore and mid tarsi strongly and abruptly bent, running nearly parallel to subbasal tooth (Fig. 14) .... *excrucians*
6’	Claws of fore tarsi evenly curved and not nearly parallel to subbasal tooth (Fig. 15)... 7

Fig 14. Claws abruptly bent.

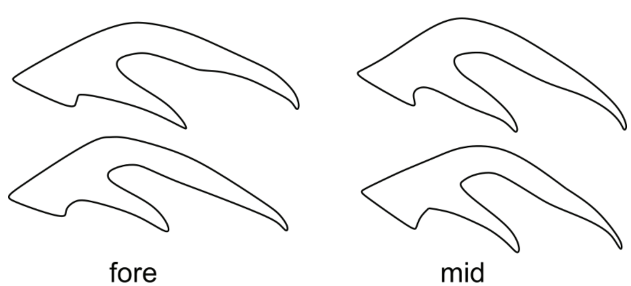
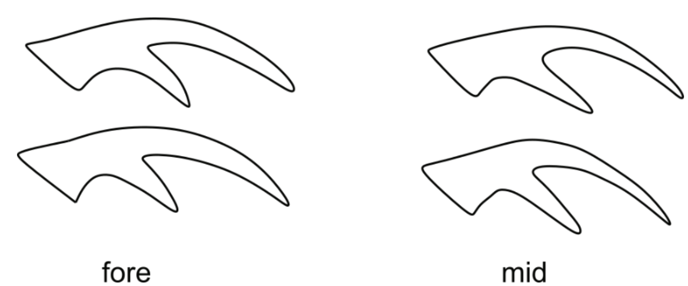


Fig 15.Claws evenly curved.



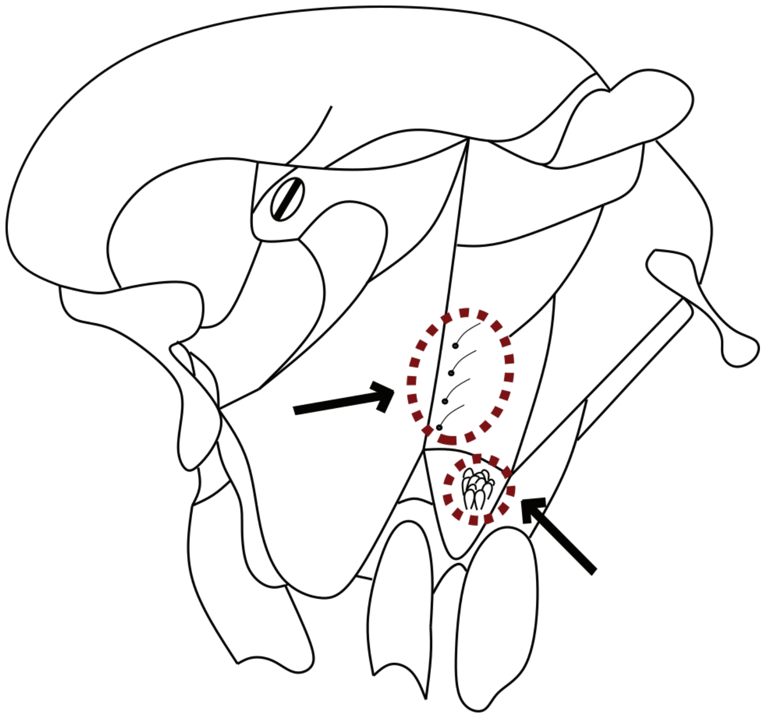


Fig 16.Lower mesepimeral setae present and mesomeron with scales.

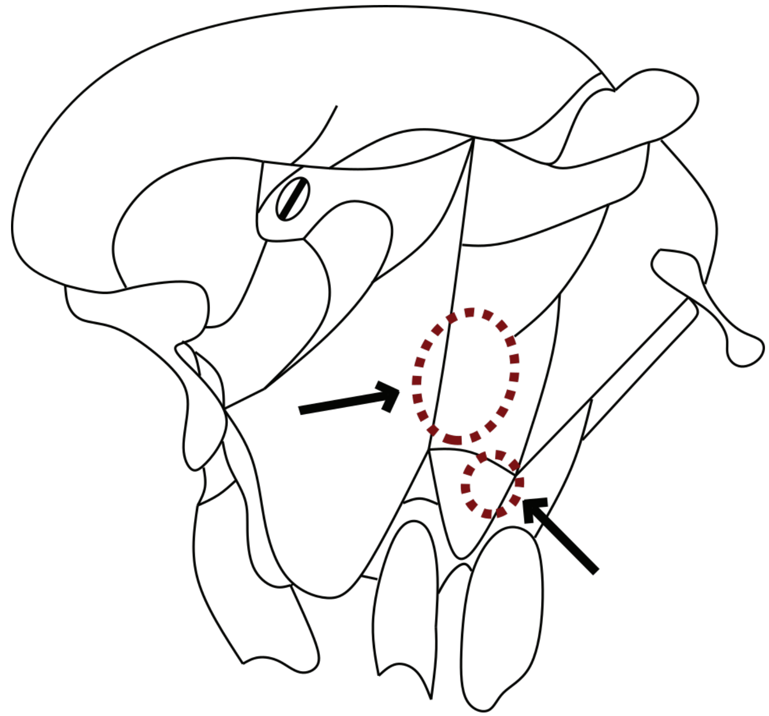


Fig 17. Lower mesepimeral setae absent and mesomeron without scales.

7(6)	Lower mesepimeral setae present; mesomeron with scales on posterodorsal corner (Fig. 16)……………………………………..………… 8
7’	Lower mesepimeral setae absent; mesomeron bare (Fig. 17) …..……..……………………………………..………………………..…. 10

8(7)	Scales on antennal pedicel numerous, mostly pale; brown-scaled (in some specimens dark brown) median and submedian bands on scutum……….…………………….…….. 9
8’	Scales on antennal pedicel few and all or most dark; scutum with reddish brown scales, in some specimens with narrow dorso-central stripe of light scales……………………………………….. *euedes* (in part)

9(8)	Wing veins dark-scaled; third fore-tarsomere with an incomplete basal band of pale scales; scutum with pale yellowish scales laterally………………………………………………………. *mercurator*
9’	Wings of most specimens with scattered pale scales intermixed with predominantly dark scales; third fore-tarsomere with complete basal band of pale scales; scutum with pale white scales, often mixed with yellow or light brown scales laterally……………………….... *fitchii* (in part)

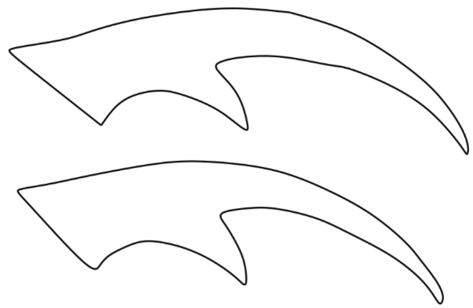


Fig 18. Blunt subbasal tooth.

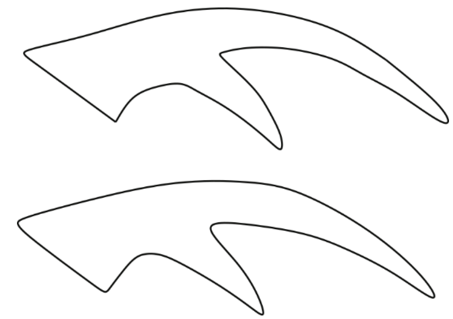


Fig 19. Narrow subbasal tooth.

10 (7)	Foretarsi with claws weakly curved, and with a short, blunt subbasal tooth, 1/5 or less the length of claw (Fig. 18)…………………… *riparius*
10	Claws of foretarsi moderately curved, subbasal tooth at least 1/4 the length of claw (Fig. 19)…………………………………………….. 11
11(10)	Proboscis, cerci, and first tarsomere (in addition to their basal band of pale scales) strewn with mottling of pale scales…..…. *euedes* (in part)
11’	Proboscis, cerci, and first tarsomere (other than basal band of pale scales) without pale scales………………………………. *fitchii* (in part)

12(2)	Wing veins mostly pale-scaled…..…………………………........... *campestris*
12’	Wing veins dark-scaled……………………………………….…. *canadensis*

13(1)	Wing veins with pale scales beyond the base…...…………………….. 14
13’	Wing veins entirely dark-scaled or with pale scales at base of vein C and occasionally Sc and R……………………………….………….…….. 16

14(13)	Wing veins alternating between dark-scaled and pale-scaled with R_1, R_{4+5}, and C and Cu dark-scaled…...………………………..……. <u>*spencerii*</u>
14’	Pale scales scattered over all wing veins……………………………….. <u>15</u>

15(14)	Palps and proboscis completely dark-scaled; lower mesepimeral setae absent………………………………………………. *ventrovittis** (in part)
15’	Palps and proboscis with some pale scales; lower mesepimeral setae present……………………………………………………. <u>*cataphylla*</u>

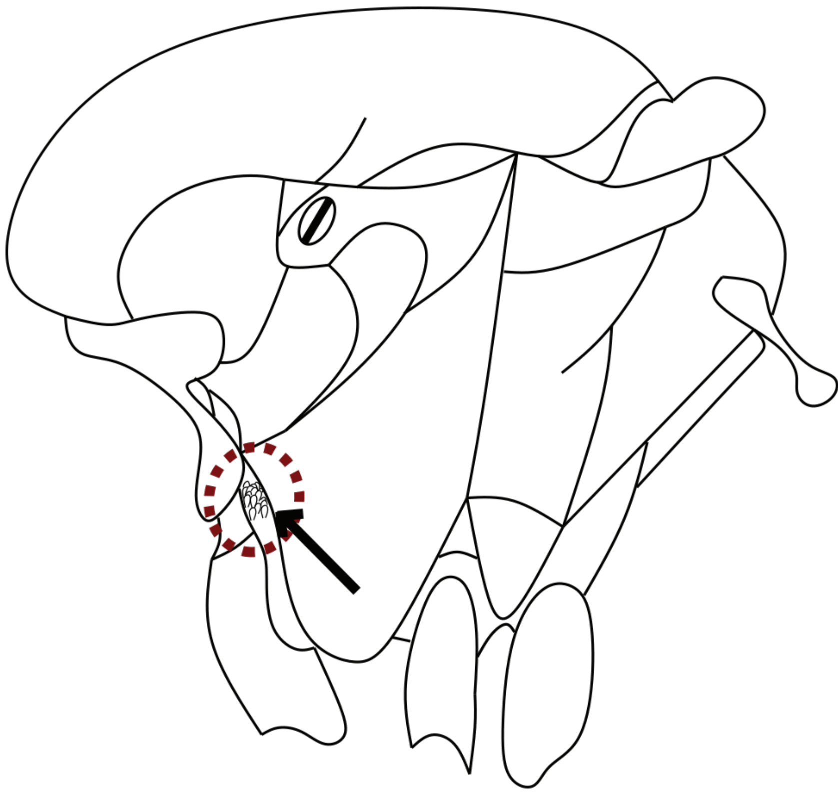


Fig 20. Scaled postprocoxal membrane.

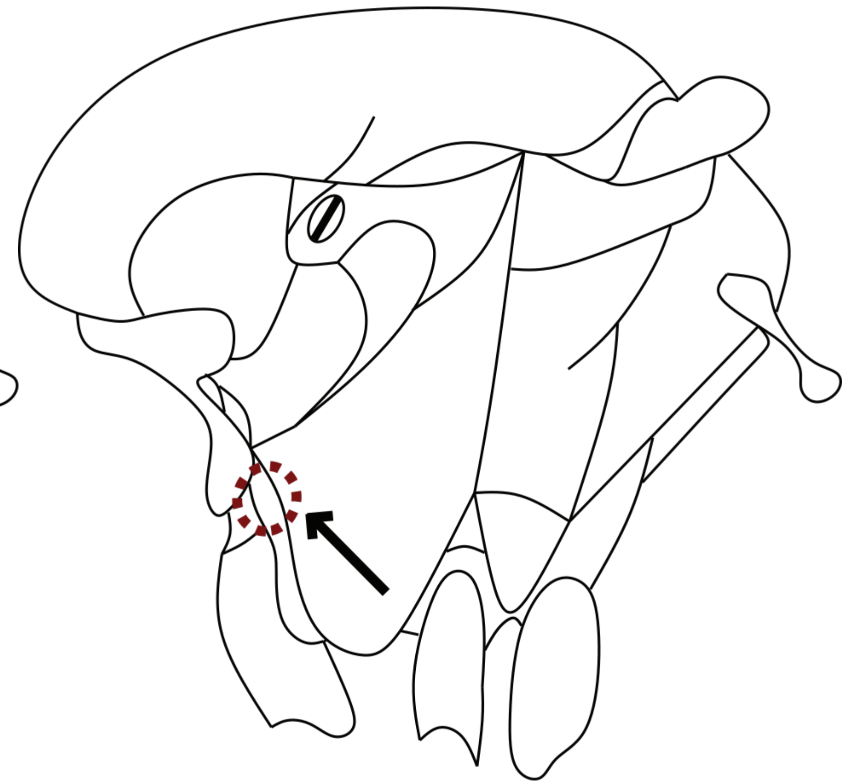


Fig 21. No scales on postprocoxal membrane.

16(13)	Postprocoxal membrane with patch of scales (Fig. 20)……………... 17
16’	Postprocoxal membrane without patch of scales (Fig. 21)………….. 25

17(16)	Numerous setae arising from postpronotum and scutum, long and scattered in distribution giving thorax a hairy appearance…………... 18
17’	Postpronotum with setae restricted to one or two rows on posterior margin and scutum with normal, sparse setae……………………….... 19

18(17)	Hind tarsal claw sharply bent beyond, and nearly parallel to, its subbasal tooth (Fig. 22)….………………………………………….. *impiger*
18’	Hind tarsal claw weakly bent beyond, and not parallel to, its subbasal tooth (Fig. 23)……………………………………………….... *nigripes*

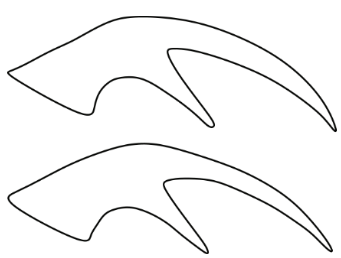


Fig 22. Claw sharply bent.

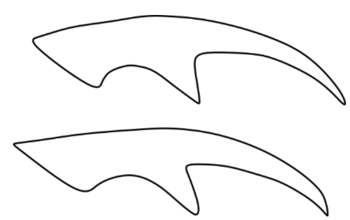


Fig 23. Claw not sharply bent.

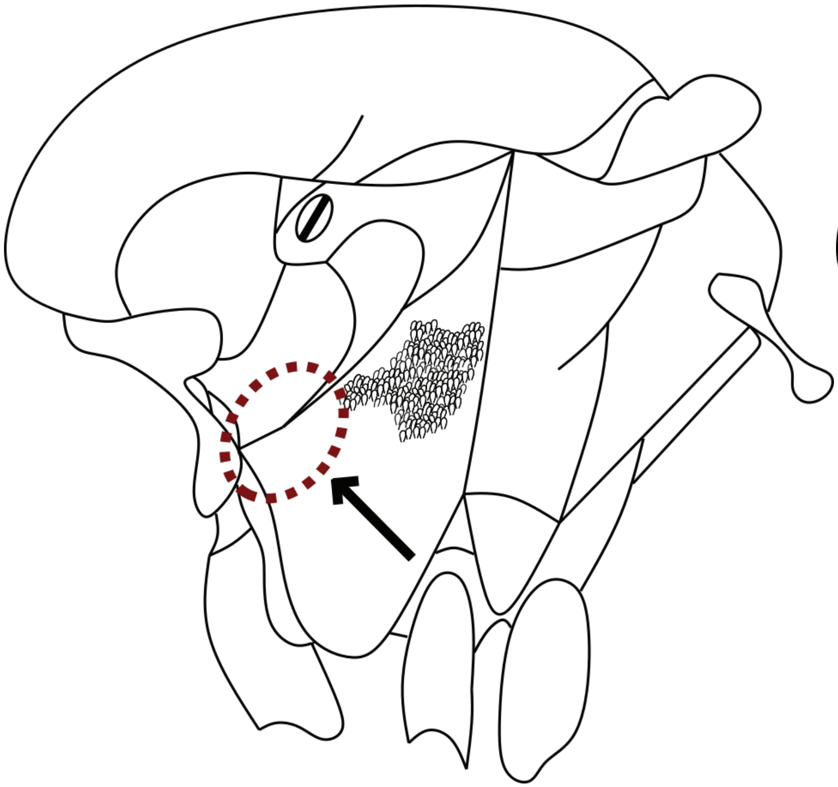


Fig 24. Without scales in anterodorsal corner of katepisternum.

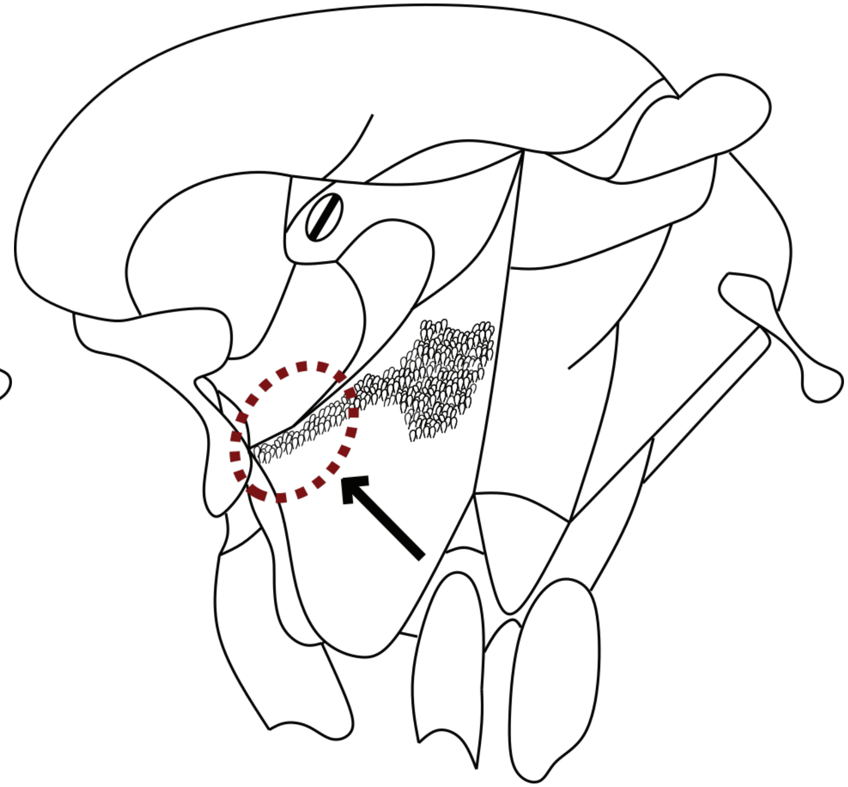


Fig 25. Scales in anterodorsal corner of katepisternum.

19(17)	Katepisternum without scales in anterodorsal corner, and bottom 1/5 of mesepimeron also without scales (Fig. 24)……………………………. 20
19’	Katepisternum with scales extending to anterodorsal corner and mesepimeron completely covered in scales (Fig. 25)………………... 21

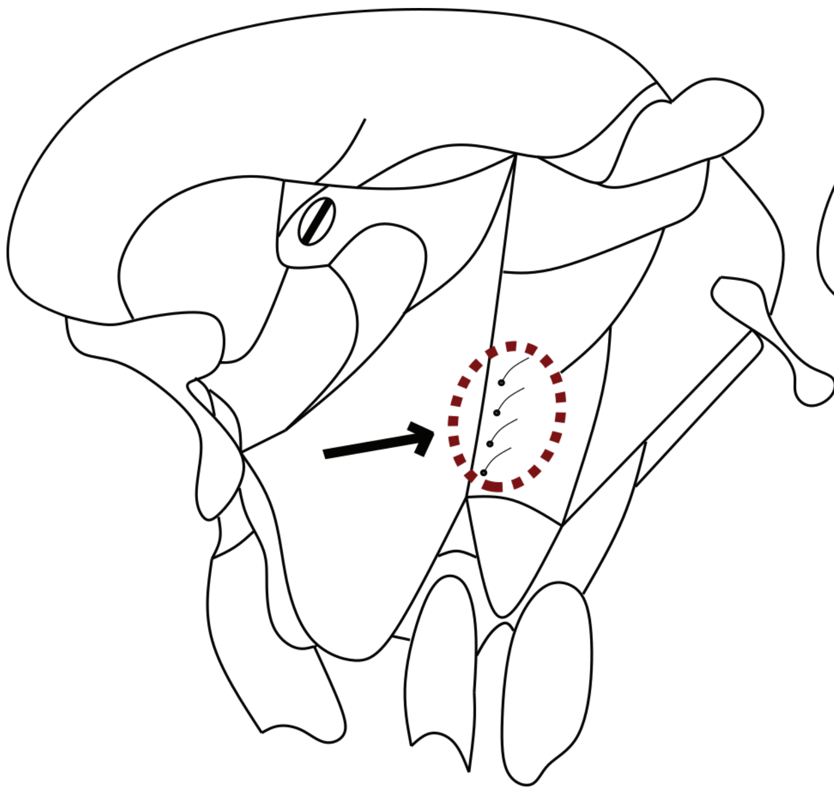


Fig 26. Presence of lower mesepimeral setae.

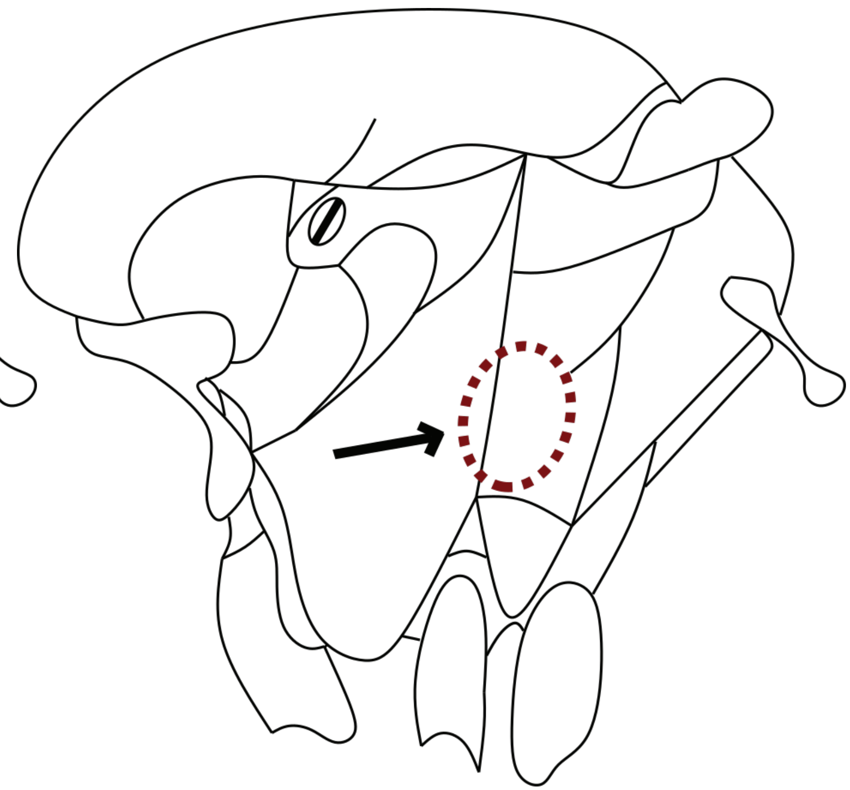


Fig 27. Absence of lower mesepimeral setae.

20(19)	Lower mesepimeral setae present (Fig. 26)………………….. *implicatus*
20’	Lower mesepimeral setae absent (Fig. 27)………. *ventrovittis** (in part)

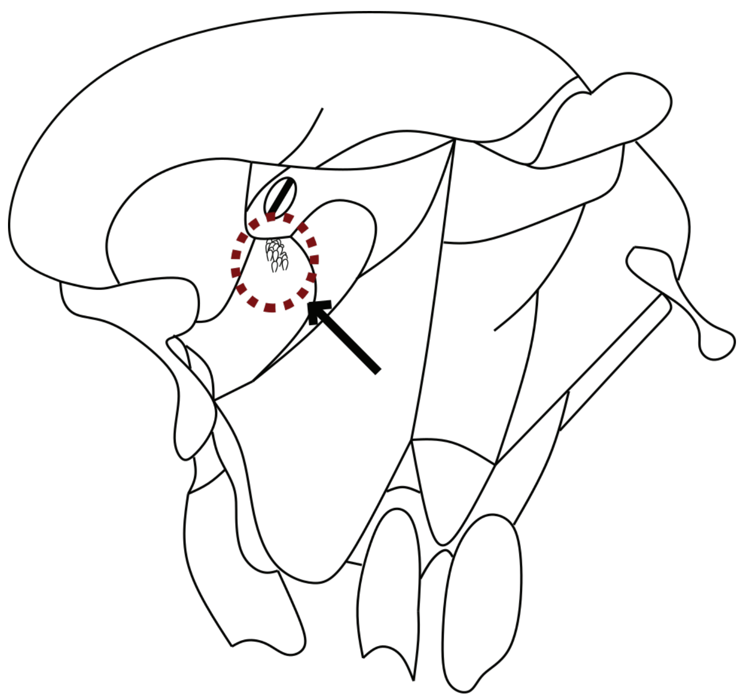


Fig 28. Presence of scales in hypostigmal area.

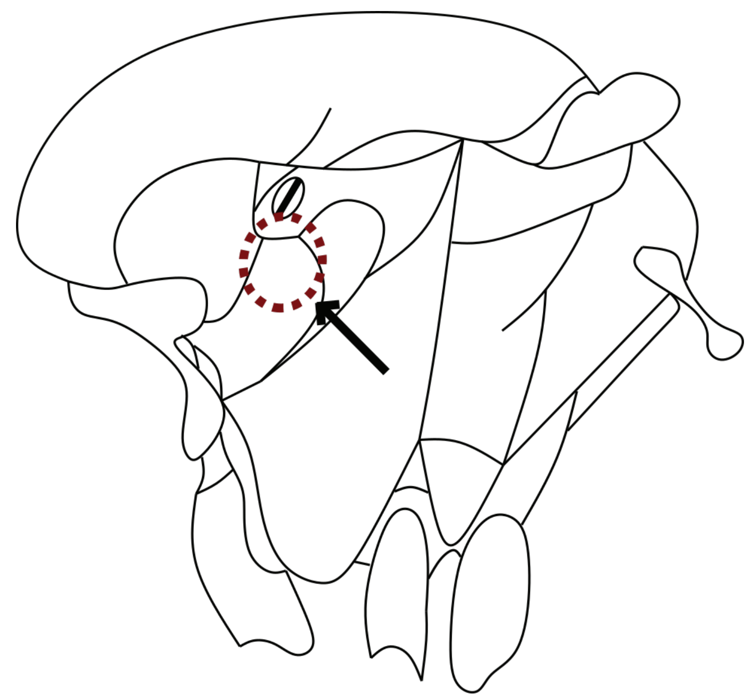


Fig 29. Absence of scales in hypostigmal area.

21(19)	Hypostigmal area with scales (Fig. 28)…………………….. *provocans**
21’	Hypostigmal area without scales (Fig. 29)……………………….…... 22

doi:10.3752/cjai.2021.43

22(21)	Scutum with narrow, pale-scaled median band separating dark-brown scaled submedian bands……………………………………… *pionips*
22’	Median and submedian bands of scutum dark-scaled and fused, forming a single, comprehensive middorsal stripe, OR lacking dark submedian stripes………………………………………………….. 23

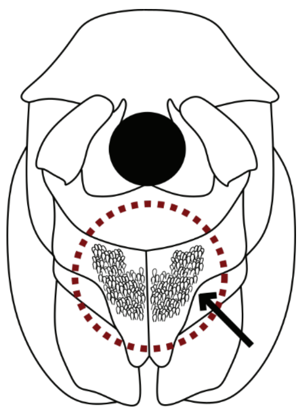


Fig 30. Anterior view of thorax with probasisternum covered with scales.

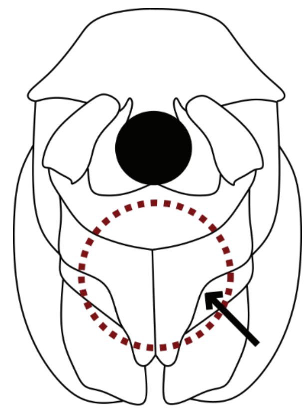


Fig 31. Anterior view of thorax with probasisternum not covered with scales.

23(22)	Probasisternum wholly covered with scales (Fig. 30)…..…. *hexodontus*
23’	Probasisternum bare or with scattered pale scales on dorsal half (Fig. 31) ……………………………………………………………………… 24

24(23)	Median and submedian bands of scutum appearing as single broad middorsal stripe of dark brown scales; base of wing vein C with pale scales in some specimens…………………………………..…. *punctor*
24'	Scales of scutum uniformly medium brown (narrow scales may cause submedian bands to appear darker); base of wing vein C invariable dark scaled; southwest Yukon.. *aboriginis**

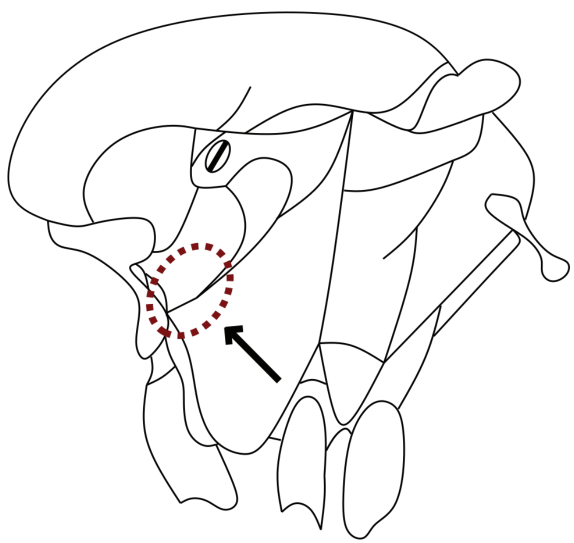


Fig 32. Ventral anepisternum un-scaled.

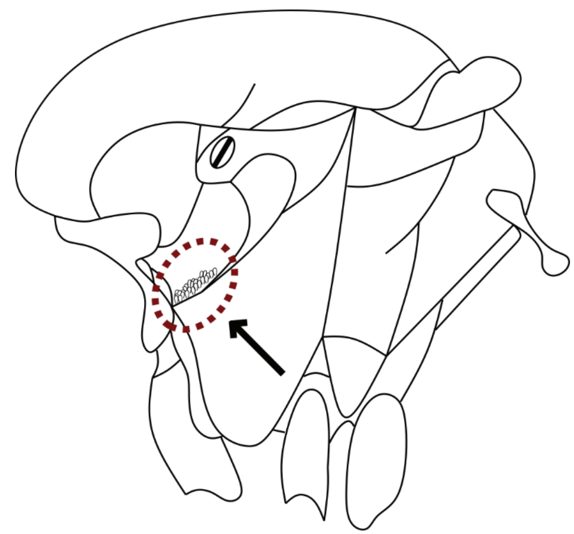


Fig 33. Ventral anepisternum scaled.

25(16)	Ventral margin of anepisternum without scales (Fig. 32); patch of black scales behind each eye..…...…………………………..…… *cinereus*
25'	Ventral margin of anepisternum with numerous pale scales (Fig. 33); no dark-scaled patches behind eyes... 26

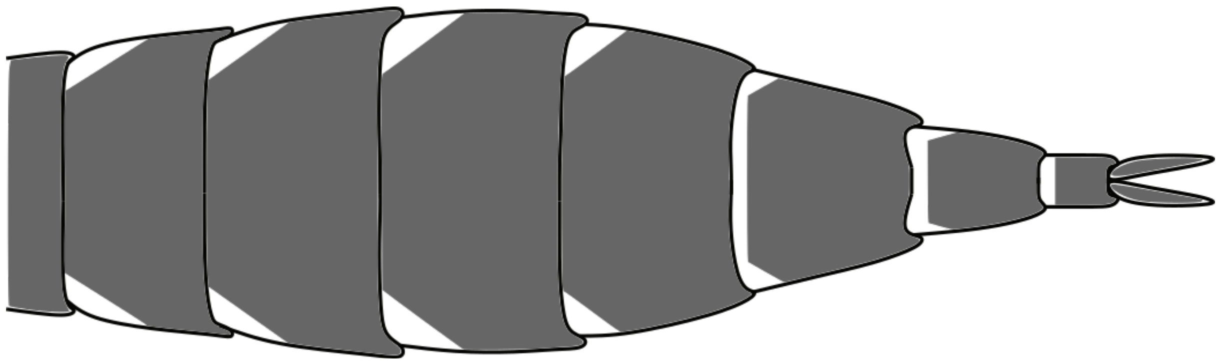


Fig 34. Abdominal tergites with pale-scaled basolateral patches and narrow basal bands on apical segments.

26(25)	Abdominal tergites with basal bands of pale scales…………………... 27
26’	Abdominal tergites without basal bands but with pale-scaled basolateral patches (may be joined by narrow basal bands on apical segments) (Fig. 34)………………………………………………… 31

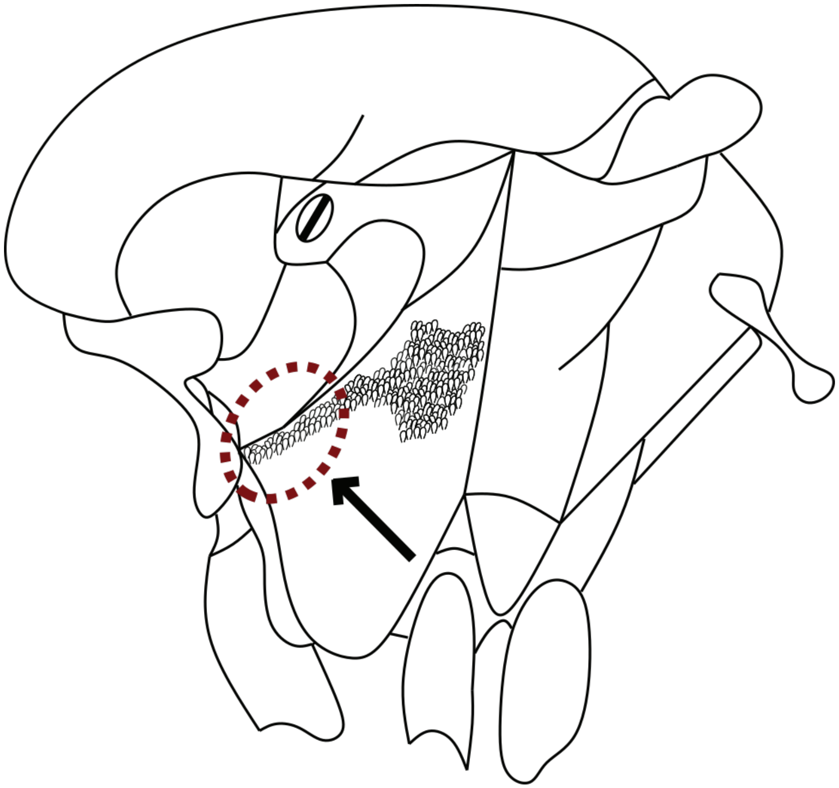


Fig 35. Scales to anterodorsal corner of katepisternum.

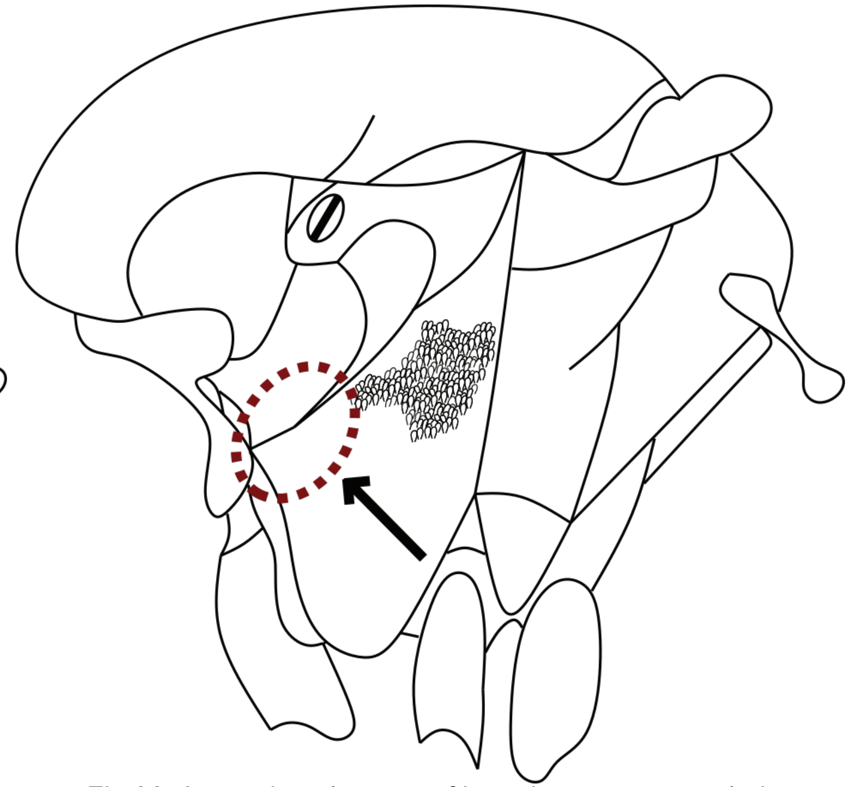


Fig 36. Anterodorsal corner of katepisternum un-scaled

27(26)	Scales of katepisternum extending to the anterodorsal corner (Fig. 35) 28
27'	Scales of katepisternum not extending to the anterodorsal corner (Fig. 36).. 30

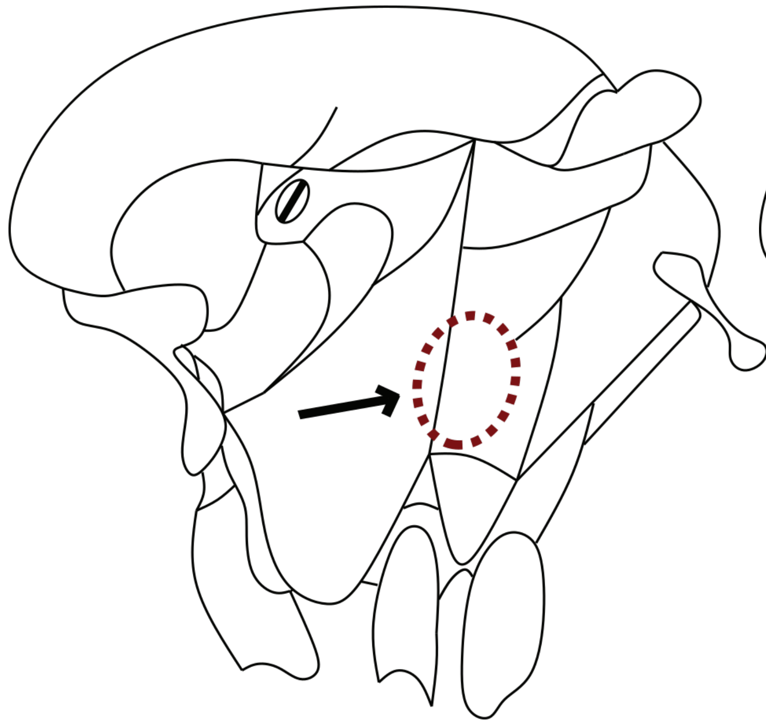


Fig 37. Lower mesepimeral setae absent.

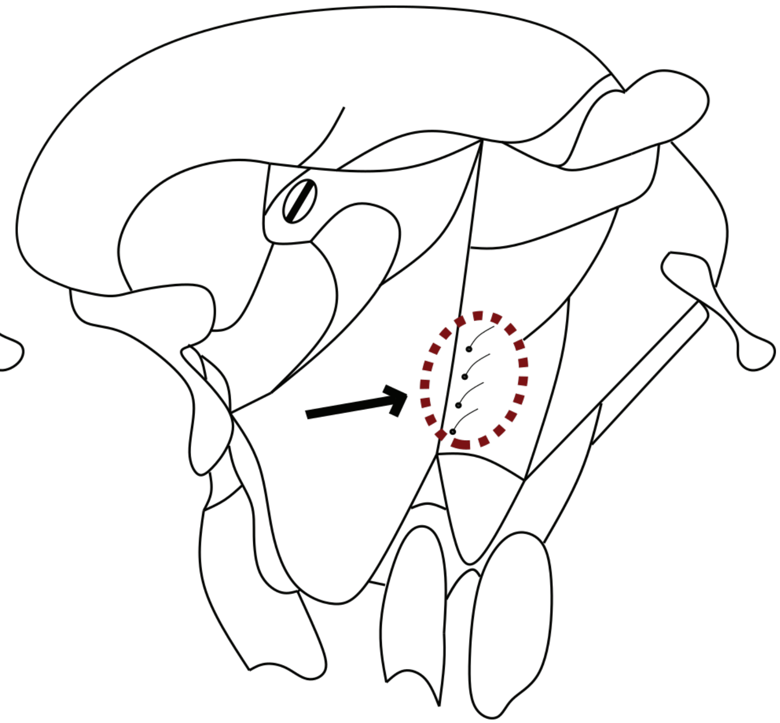


Fig 38. Lower mesepimeral setae present.

28(27)	Scales of median and submedian scutal bands uniformly reddish-brown; dorsal half of postpronotum with reddish-brown scales; lower mesepimeral setae absent (Fig. 37); ventral 1/4 of mesepimeron without scales………………………………………………… *sticticus*
28'	Scales of submedian scutal band brown and median band pale; dorsal half of postpronotum with yellowish-brown scales; lower mesepimeral setae present (Fig. 38); ventral 1/4 of mesepimeron scaled………… 29

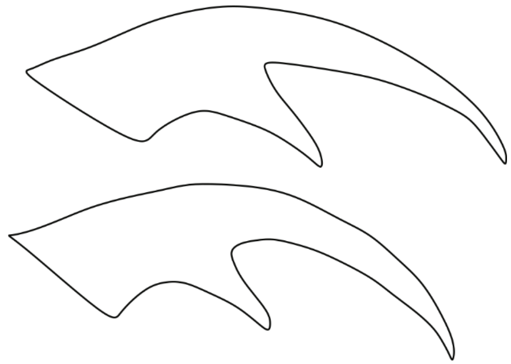


Fig 39. Long and narrow subbasal tooth.

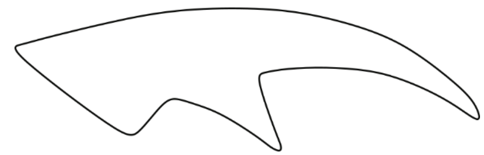


Fig 40. Short and thick subbasal tooth.

29(28)	Subbasal tooth long and narrow (Fig. 39)……………………. *communis*
29’	Subbasal tooth short and thickened at base (Fig. 40)….. *churchillensis**
30(27)	Scutum with scales a uniformly bronzy or yellowish-brown; vertex scales yellow……………………………………………………. *intrudens*
30’	Scutum with submedian bands of dark brown scales separated by pale scales of median band; vertex scales both light and dark…….. *pullatus*

doi:10.3752/cjai.2021.43

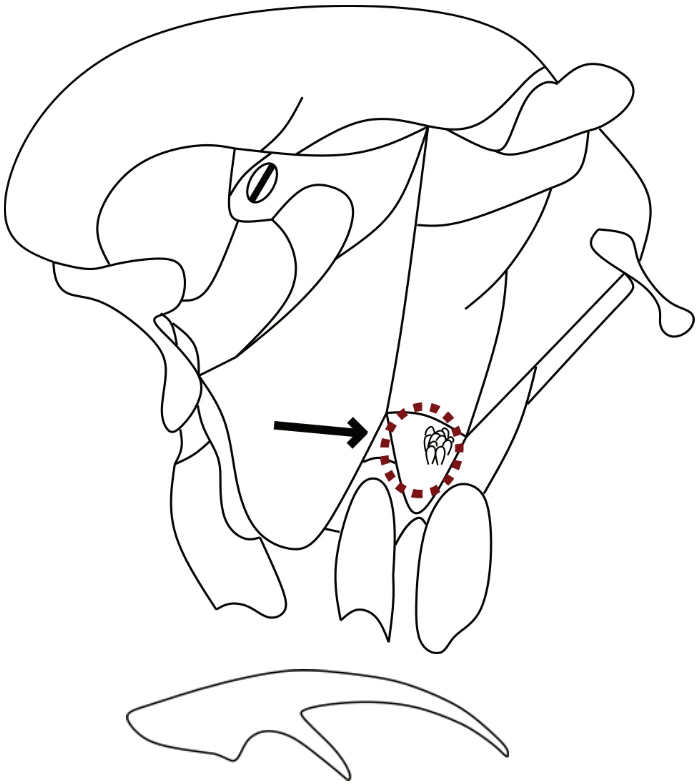


Fig 41. *Ae. diantaeus* claw and metameron.

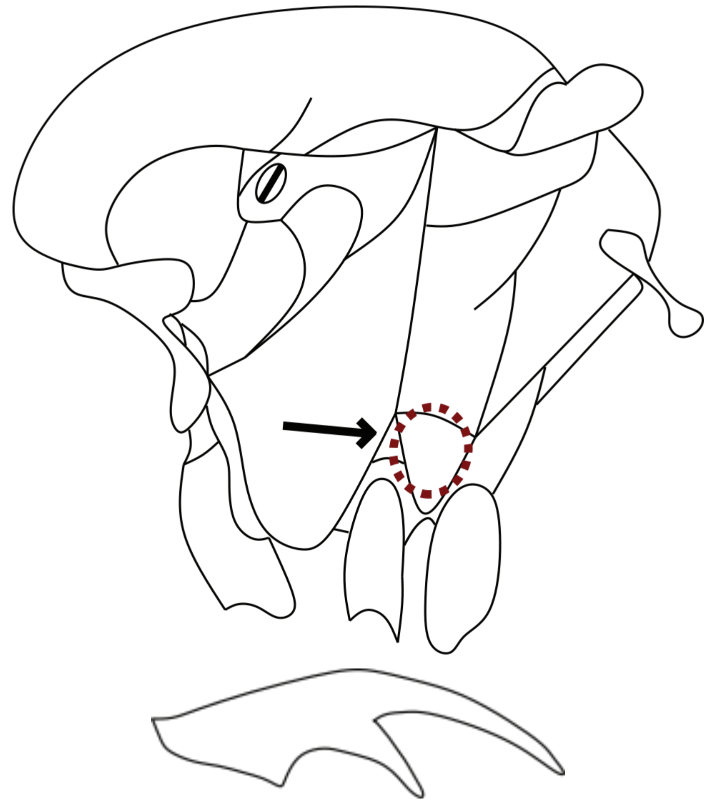


Fig 42. *Ae. decticus* claw and metameron.

31(26)	Vertex scales homogenously yellowish; patch of scales on metameron, claw of fore tarsi long, slender, and less curved (Fig. 41)…... *diantaeus*
31’	Vertex with dark scales, in two sub-median patches, mixed into pale scales; metameron un-scaled; claw of fore tarsi heavily curved (Fig. 42)……………………………………………………………… *decticus*

Key to Adult Females of the Genus *Coquillettidia*

1.	Wing scales broad; proboscis with a band of pale scales at mid-length; hind tibia usually with a band of pale scales at mid-length ………………..………………..…………………….. *Coquillettidia perturbans*

Fig 43. Broad wing scales of *Cq. perturbans*.

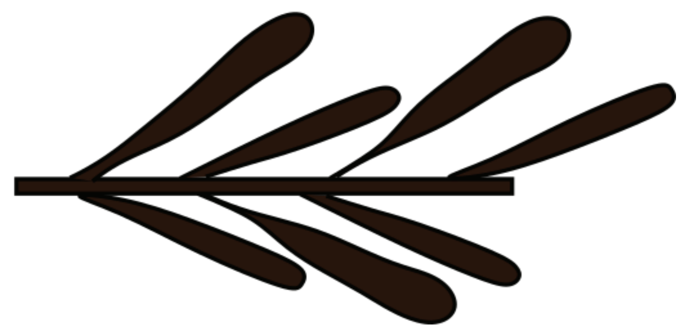


Fig 44. Generalized narrow wing scales of other species.

Key to Adult Females of the Genus *Culex*

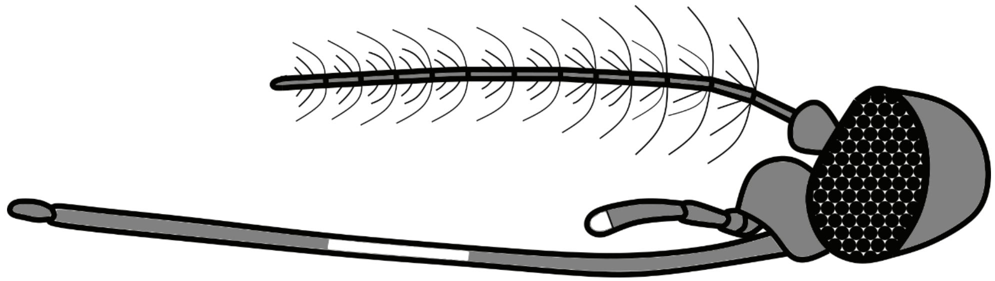


Fig 43. *Cx. tarsalis* proboscis with band of pale scales.

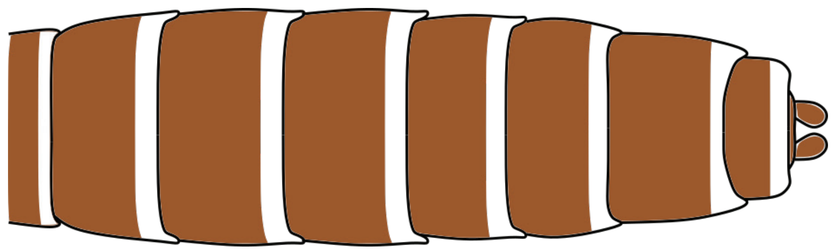


Fig 44. *Cx. territans* abdominal tergites with apical transverse bands of pale scales.

1.	Tarsomeres with basal and apical bands of pale scales; basal transverse bands of pale scales on abdominal tergites; proboscis with band of pale scales at mid-length (Fig. 43)……………………….. *tarsalis*
1’	Tarsomeres and proboscis unbanded; apical transverse bands of pale scales on abdominal tergites (Fig. 44)……………………............. *territans*

Key to Adult Females of the Genus *Culiseta*

1.	Hind tarsomeres without band of pale scales (can be very narrow in some specimens)…………………………..……………………………. 2
1’	Hind tarsomeres with bands of pale scales on at least some segments, very narrow in some species……………………………………………. 3

2(1)	Wings with scattered pale scales; abdominal tergites with scattered pale scales and broad basal bands……………………………… *inornata*
2’	Wings dark-scaled; abdominal tergites with narrow basal band of pale scales………………………………………………………... *impatiens*

3(1)	Hind tarsomeres with narrow basal bands about as long as diameter of segment is wide (can be small and difficult to see) …………………… 4
3’	Hind tarsomeres with broad basal bands covering about ¼ of the segment……………………………………………………… *alaskaensis*

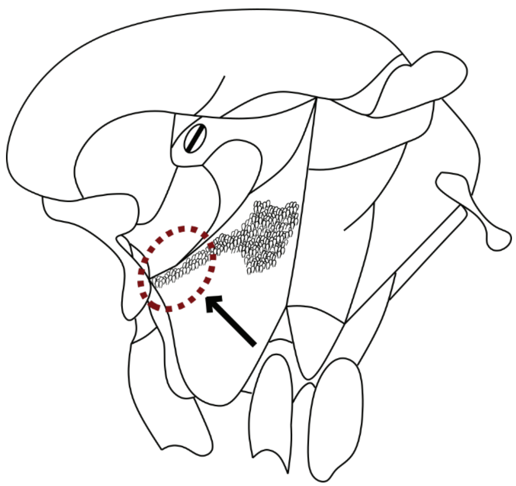


Fig 45. *Cs. incidens* katepisternum.

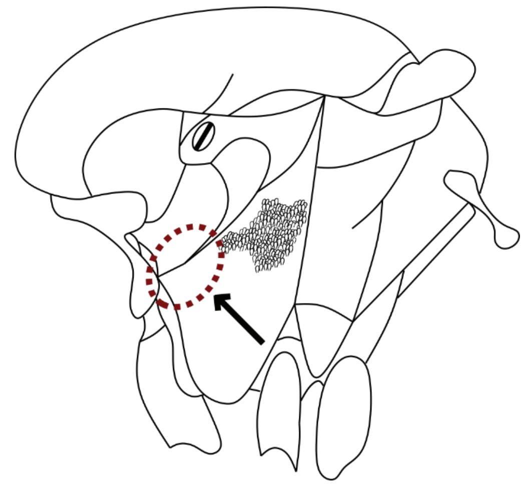


Fig 45. *Cs. morsitans* katepisternum.

4(3)	Wing scales aggregated into dark patches on veins; anterodorsal corner of katepisternum with scales (Fig. 44)………………….. *incidens*
4’	Wing scales distributed evenly; anterodorsal corner of katepisternum without scale (Fig. 45)………………………………………….. *morsitans*

Species Profiles

Anopheles earlei Vargas

The only anopheline known from the Yukon, this species completes only one generation per year in the northern climate, rather than two per year in the south (Wood et al., 1979). Adult females overwinter in warm areas such under tree bark, in sheds or houses, in mammal burrows (Belton, 1983), and notoriously even in beaver lodges (Hudson, 1978). Mammals are the preferred host (Anderson & Galloway, 1988). Eggs are laid singly on standing water such as marshes, ponds, ditches, or other permanent or semi-permanent bodies of water with abundant emergent vegetation at the margins (Wood et al., 1979; Anderson & Galloway, 1988). *An. earlei* are found throughout the Yukon near appropriate larval habitat. We have found larvae in late June and early July in southern parts of the Territory, and have even occasionally observed adults day-resting under the roof inside outhouses.

Aedes (Ochlerotatus) campestris Dyar and Knab

A light-coloured grassland species that can reach prodigious numbers and bite aggressively, this species completes only one generation a year in the north (Wood et al., 1979). Overwintering in the egg stage, the larvae are found in temporary water pools, particularly in grassy areas, and can tolerate alkaline conditions (Wood et al., 1979). The preferred hosts of *Ae. campestris* are mammals (Belton, 1983), and it is one of the most common mosquitoes at livestock facilities in Alberta (Lysyk, 2010). Viruses of the California serogroup have been isolated from *Ae. campestris* in New Mexico (Clark et al., 1986), and WEEV has been isolated from this species in areas south of the Yukon (McLintock et al., 1970; Clark et al., 1986). We have collected adult specimens from Kluane National Park with orchid pollinia attached to them, and this has also been observed in other areas (Hocking et al., 1950). We have also collected specimens from other parts of the Yukon, particularly Ibex Valley, carrying heavy loads of mites. This species is found locally in the southern Yukon in or near grassy areas and occasionally in other open areas.

Aedes (*Ochlerotatus*) *canadensis* (Theobald)

This woodland species takes blood primarily from small mammals, but will also bite birds, amphibians, and reptiles (Hayes, 1961; Shepard et al., 2016). It has one, or possibly two, generations a year (Wood et al., 1979). Winter is spent in the egg stage and hatching after diapause may be staggered (Wood et al., 1979). Larvae are found in a wide variety of temporary pools, usually in wooded areas, including those formed by snowmelt, flooding, or intense rainfall (Wood et al., 1979; Belton, 1983). SSHV has been isolated from this species (McLean et al., 1972). We have only collected it from one location southeast of Watson Lake in the Yukon, in July, and literature records indicate a sparse distribution. In Northern British Columbia it is most common early in the summer (D.A.H. Peach, personal observation), a phenology that has also been noted in Southern Ontario (Giordano et al., 2018) and Quebec (Shahhosseini et al., 2020).

Aedes (*Ochlerotatus*) *cataphylla* Dyar

This species completes a single generation per year (Becker et al., 2010). It overwinters in the egg stage and is among the earliest species to emerge in the spring, often as soon as the snow melts (West and Black, 1998). Larvae can develop quickly even at low temperatures (Pritchard and Scholfield, 1983) and are found in a variety of temporary pools but are most common in snow melt pools in grassy areas and forests (Belton, 1983; Becker et al., 2010). Females take blood from mammals and can be very aggressive (Wood et al., 1979; Belton, 1983). It can be found all over the Yukon in grassland and open forest, though it is more numerous in the south. Many specimens we have seen appear to have fewer scattered white scales present on the wing beyond the basal patch on C than specimens from southern British Columbia.

Aedes (*Aedes*) *cinereus* Meigen

Ae. cinereus overwinters in the egg stage and can complete multiple generations per year in southern Canada and Europe (Wood et al., 1979; Becker et al., 2010), although whether this occurs in northern Canada is unknown. Larvae are found at the edges of permanent or semi-permanent marshes, bogs, lakes, ditches, or other water with standing vegetation (Wood et al., 1979; Becker et al., 2010). In North Carolina adults of this species was associated with forest habitat (Reiskind et al., 2017), and it takes blood meals from mammals and birds (Börstler et al., 2016; Shepard et al., 2016). This species will bite readily throughout the day in shaded conditions (Gilardi and Hilsenhoff, 1992). *Ae. cinereus* is predominantly an early summer species in Quebec (Shahhosseini et al., 2020), and we have collected it in late June and July from the Yukon.

Aedes (*Ochlerotatus*) *communis* (de Geer)

The Yukon's most widespread and abundant mosquito south of the treeline, this forest species (Hocking et al., 1950) can be found in large numbers in the vicinity of most population centres in the Territory. Winter is spent in the egg stage and larvae are found in temporary pools of acidic water formed by heavy rainfall or melting snow (Wood et al., 1979; Becker et al., 2010). *Ae. communis* is an aggressive biter (Belton, 1983) that emerges early in the summer (Shahhosseini et al., 2020) and takes blood from mammals (Börstler et al., 2016). It is the north's primary natural vector of SSHV (McLean & Lester, 1984), and is a predominant species in mosquito pools that test positive for *Francisella tularensis* in Alaska (Triebenbach et al., 2010).

Aedes (*Ochlerotatus*) *decticus* Howard, Dyar, and Knab

This is a forest species (Gjullin et al., 1961) that completes one generation per year and overwinters in the egg stage (Gilardi & Hilsenhoff, 1992). Larvae are found in bogs or swamps, particularly sphagnum bogs (Gjullin et al., 1961; Gilardi & Hilsenhoff, 1992; Peach and Poirier, 2020) and in northern Quebec are associated with bog pools below adjacent ridges dominated by *Carex limosa* (Maire, 1982). *Ae. dectictus* is widely distributed but fairly rare (Wood et al., 1979). In the Yukon we have collected it from just outside of Whitehorse and from Watson Lake, but have also found it in nearby Northern British Columbia (Peach and Poirier 2020). *Ae. decticus* will take blood from humans (Barr & Balduf, 1965), but little is known about its feeding habits or its biology in general.

Aedes (*Ocherlotatus*) *diantaeus* Howard, Dyar, and Knab

This species overwinters in the egg stage and completes one generation per year (Becker et al., 2010). Larvae are most often found in boggy habitat or similar conditions and in Wisconsin are affiliated with sphagnum (Gilardi and Hilsenhoff, 1992). *Ae. diantaeus* larvae are commonly associated with the larvae of other species, particularly those of *Ae. communis* (Wood et al., 1979). *Ae. diantaeus* larvae suspend themselves vertically on the debris at the bottom of a pool, resting on the tips of their antennae, and may rely upon the organic matter thrown up by the feeding of other larvae as a food source (Wood et al., 1979). Most adult females probably take blood from mammals (Jaenson, 1985). We have collected this species from Watson Lake and from the southern shore of Kluane Lake.

Aedes (*Ochlerotatus*) *euedes* Howard, Dyar, and Knab

Ae. euedes overwinters in the egg stage and completes one generation per year (Wood et al., 1979). It will take blood from humans (Belton, 1983) and larvae tend to be found in association with large open marshes or nearby woodlands (Gilardi and Hilsenhoff, 1992). *Ae. euedes* has been recorded only from the southeastern Yukon (Peach and Poirier, 2020), but there are records of this species from the Arctic coast of the Northwest Territories (Wood et al., 1979) and as such it may occur throughout the Yukon.

Aedes (*Ochlerotatus*) *excrucians* (Walker)

Ae. excrucians overwinters in the egg stage and completes one generation per year (Wood et al., 1979). Larvae are found in a wide variety of temporary pools and semi-permanent marshes, though there is likely a high-degree of flexibility in larval habitat (Wood et al., 1979; Belton, 1983). While *Ae. excrucians* larvae are common, they are usually not the dominant species in a given breeding site (Gilardi and Hilsenhoff, 1992). The adults are fiercely aggressive biters (Becker et al., 2010) that tend to be found in the early summer (Shahhosseini et al., 2020), and are frequently the predominant species in mosquito pools that test positive for *Francisella tularensis* in Alaska (Triebenbach et al. 2010). In the Yukon adults are found in low numbers in most habitats other than tundra, similar to other areas (Wood et al., 1979). Wood et al. (1979) noted that specimens from the Yukon and other northern areas seem to appear larger and darker than those from the south, and our observations corroborate this.

Aedes (*Ochlerotatus*) *fitchii* (Felt and Young)

A mosquito primarily of open woodland areas, this species is very similar to *Ae. excrucians* in appearance and the larvae of these two species often co-occur. *Ae. fitchii* and *Ae. excrucians* are similar in appearance and habitats and the two are easily confused, though *Ae. fitchii* adults tend to emerge later than *Ae. excrucians* (Gilardi and Hilsenhoff, 1992). *Ae. fitchii* completes one generation per year and overwinters in the egg stage (Wood et al., 1979). Larvae are most often found in temporary pools of water such as those left behind by heavy rains or melting snow (Belton, 1983). It has been found throughout the Yukon but is usually present in low numbers, though it can be an aggressive biter.

Aedes (*Ochlerotatus*) *flavescens* (Müller)

A large species found in grassland or prairie-like habitat, this is the largest *Aedes* species in Canada (Wood et al., 1979). *Ae. flavescens* overwinters in the egg stage and produces only one generation per year (Wood et al., 1979). Adult females take blood from mammals and birds (Wang et al., 2012), including livestock (Hudson, 1983) and can be aggressive in their biting (Belton, 1983). Larvae can tolerate a wide range of salinity (Becker et al., 2010), are found in a variety of temporary pools in grassy habitat, and are among the latest species to develop (Wood et al., 1979). We have not collected it from the Yukon and it may be present only in very low numbers.

Aedes (*Ochlerotatus*) *hexodontus* Dyar

This cold-adapted species completes one generation per year and overwinters in the egg stage (Wood et al., 1979), hatching when water is just above 0 ºC (Becker et al., 2010). Larvae are found in a variety of temporary freshwater habitats but are particularly abundant in pools along the margins of rivers in cold areas (West and Black, 1998) as well as tundra and into nearby forested areas where they will fly and bite even in strong winds (Wood et al., 1979). Further south *Ae. hexodontus* becomes abundant in the alpine and sub-alpine (Wood et al., 1979; Belton, 1983). In northern Quebec this species was associated with bog pools below adjacent ridges dominated by *Carex limosa* (Maire, 1982). Wood et al. (1979) believed that "This species, probably more than any other, is responsible for the formidable reputation that the arctic has for mosquitoes. It attains extraordinarily high populations in the northern fringes of the boreal forest and adjacent tundra in Canada, Alaska, and Eurasia, where permafrost and poor drainage combine with a relatively warm summer and abundant algal growth to provide almost unlimited opportunities for mosquito breeding". *Ae. hexodontus* may serve as a mammalian vector of SSHV and NORV in the Yukon (McLean & Lester, 1984). In Russia it has been observed feeding on haemolymph from eclosing reindeer nose botflies, *Cephenemyia trompe* (Poliakova and Gomojunova, 1973).

Aedes (*Ochlerotatus*) *impiger* (Walker)

A cold-adapted species found throughout the arctic tundra, subarctic, and in alpine areas, adults are small and fast fliers able to fly in windy conditions (Wood et al., 1979). *Ae. impiger* overwinters in the egg stage and completes one generation per year (Becker et al., 2010). It undergoes an extended diapause, with eggs from Russian populations requiring at least 180 days below -3 ºC before larvae, which develop rapidly, will emerge (Tamarina and Aleksandrova, 1984). Adults bite throughout the extended northern day and feed on a variety of animals (Tamarina and Aleksandrova, 1984), but notably have also been observed feeding on haemolymph of eclosing reindeer nose botflies, *Cephenemyia trompe* (Poliakova and Gomojunova, 1973). Whether or not similar behaviour occurs in the Yukon is unknown. If an adult female consumes nectar she can develop a small number of eggs without taking a blood meal (Wood et al 1979). This species is a pollinator of *Dryas integrifolia* in the Canadian high arctic (Kevan, 1972) and may play such a role in parts of the Yukon as well. Unidentified *Orthobunyavirus* DNA was found in *Ae. impiger* collected at Thule air base in Greenland, where breeding conditions and access to blood allowed this species to reach pest status (Reeves et al., 2013).

Aedes (*Ochlerotatus*) *implicatus* Vockeroth

A forest species that completes one generation per year and overwinters in the egg stage (Wood et al., 1979). Larvae are fairly ubiquitous and are found in a wide variety of temporary pools such as those left by melting snow (Denke et al., 1996). *Ae. implicatus* is an early season mosquito that emerges as adults before most other species (Gjullin et al., 1961). Adults can be vigorous biters (Belton, 1983) and can be very annoying when present in large numbers. SSHV has been isolated from larvae reared to adulthood (McLintock et al., 1976), possibly implicating this species as an overwintering virus reservoir.

Aedes (*Ochlerotatus*) *intrudens* Dyar

This species overwinters in the egg stage and has one generation per year in northern areas (Becker et al., 2010). Eggs are deposited on soil in depressions that turn into temporary pools of snow meltwater (Wood et al., 1979; Schäfer and Lunström, 2001). *Ae. intrudens* feeds on mammals and is a persistent biter of humans (Wood et al., 1979), though at least in southern Canada it is generally only present early in the season (Trueman and McIver, 1986). Named *intrudens* for its aptitude at entering human buildings, this species is generally found south of the treeline (Wood et al., 1979) and it prefers forested habitats (Schäfer and Lunström, 2001). It is an aggressive biter, though it is considered a short-lived species (Wood et al., 1979) and we have only encountered a few of them in the Yukon.

Aedes (*Ochlerotatus*) *mercurator* Dyar

This is an uncommon mosquito that was confused with *Ae. stimulans* in the past, and as such there are many gaps in our knowledge of it (Wood et al., 1979). It was first described from specimens collected at Dawson, Yukon Territory (Dyar, 1920). Larvae are found at the open, vegetated edges of semipermanent pools (Wood et al., 1979). Belton (1983) found it in dry forest and parkland in British Columbia, similar to the conditions it has been found from in northern Russia (Panyukova, 2019), and the specimens we have collected in the Yukon came from a dry forest area. On the opposite side of the country, on Prince Edward Island, it has been reported from similar habitat (Giberson et al., 2007).

Aedes (*Ochlerotatus*) *nigripes* (Zetterstedt)

The most abundant and widespread arctic mosquito (Müllerová et al., 2018), *Ae. nigripes* is found in tundra north of the treeline or in alpine areas as far south as northern British Columbia (Wood et al., 1979) and is one of the first species to appear (Lewis and Webber, 1985). This species overwinters in the egg stage and completes one generation per year (Becker et al., 2010). *Ae. nigripes* takes blood meals from mammals and birds (Wood et al., 1979) but can also develop a small number of eggs without taking a blood meal by obtaining energy from floral nectar (Wood et al., 1979). In the Yukon *Ae. nigripes* is a secondary vector of SSHV (McLean & Lester, 1984). This species is a pollinator of the white mountain-avens, *Dryas integrifolia*, in the Canadian high arctic (Kevan, 1972) and may play a similar role in the Yukon. When the right environmental conditions are met *Ae. nigripes* numbers and the timing of their emergence can induce egg-loss in arctic-nesting birds in other areas of northern Canada (Gaston et al., 2002).

Aedes (*Ochlerotatus*) *pionips* Dyar

The most common species encountered by Nelson (1977), this species is closely associated with *Aedes communis,* though it develops more slowly (Wood et al., 1979). *Ae. pionips* completes one generation per year, deposits its eggs on soil, and overwinters in the egg stage (Wood et al., 1979; Schäfer and Lunström, 2001). Larvae are found in a wide variety of habitats, and are a pioneer of new habitats (Jenkins, 1948), but they are most common in pools of water left behind by melting snow in boggy forests (Becker et al., 2010) or other timbered areas (Denke et al., 1996), and adults are common in most lowland areas of the Yukon below the treeline. Mammals are the preferred source of blood for *Ae. pionips* (Schäfer and Lunström, 2001).

Aedes (*Ochlerotatus*) *pullatus* (Coquillett)

This species has a disjunct range, with a population in northern Quebec and another in the Yukon and British Columbia, possibly due to incomplete dispersal from past glacial refugia (Wood et al., 1979). *Ae. pullatus* prefers forested habitat, completes one generation per year, overwinters in the egg stage, and is one of the last species to emerge in the spring (Wood et al., 1979; Schäfer and Lunström, 2001). It deposits eggs on the soil in and above depression that fill with snowmelt water or in other small pools with clear water (Jenkins, 1948; Schäfer and Lunström, 2001), and we have observed its larvae in mossy floodwater and snowmelt pools often surrounded by *Salix* spp. in alpine and subalpine areas of the Yukon and British Columbia. In the north *Ae. pullatus* can be found at all elevations, though they are more common at higher altitudes (Jenkins, 1948).

Aedes (*Ochlerotatus*) *punctor* (Kirby)

A woodland species (Hocking et al., 1950) that is one of the most common mosquitoes in the boreal forest in both Canada (Wood et al., 1979) and Russia (Panyukova, 2019), *Aedes punctor* is often among the first species to emerge in the spring in Ontario (Trueman and McIver, 1986), and is reported to be associated with sphagnum (Gilardi and Hilsenhoff, 1992). It has been observed to complete more than one generation per season under the right conditions in Britain (Packer and Corbet, 1989). Eggs are deposited in bands (Fallis and Snow, 1983) above the prevailing water level in in depressions that hold temporary pools, such as those formed by melting snow, in boggy forest areas (Becker et al., 2010). Adult females will take blood from birds and mammals and have been found with up to 170 eggs (Hocking et al., 1950).

Aedes (*Ochlerotatus*) *riparius* Dyar and Knab

This species spends the winter in the egg stage and is thought to complete only one generation per year (Becker et al., 2010). *Aedes riparius* is usually uncommon or rare within most of its range (Wood et al., 1979), though it is most common in grassland and open parkland habitat (Belton, 1983). Larvae can be found in tree-shaded pools or marshes in suitable habitat (Gilardi and Hilsenhoff, 1992), and also occasionally in peat bogs (Becker et al., 2010). In northern Quebec *Ae. riparius larvae* are associated with bog pools below adjacent ridges dominated by *Carex rostrata* (Maire, 1982). *Ae. riparius* has only been reported from the southern Yukon and in low numbers, though it has also been rarely found in central Alaska, in the vicinity of black spruce muskeg (Gjullin et al., 1961). We have only collected it from two locations in the Yukon, both near Watson Lake, and both locations were dry open parkland habitat. *Ae. riparius* takes blood from mammals (Schäfer and Lunström, 2001) and we have observed this to include humans.

Aedes (*Ochlerotatus*) *spencerii* ssp. *spencerii* (Theobald)

An inhabitant of grassland areas with characteristic alternating dark- and pale-scaled wing veins (Wood et al., 1979), in the Yukon *Ae. spencerii* is known only from the vicinity of grasslands in the southwest of the Territory (Peach, 2017), though low numbers may be found in nearby woodlands. In Wyoming it has been found from low elevations up to 3000 m (Denke et al., 1996). Adult females will take blood from birds and mammals (Rempel et al., 1946). Larvae are found in temporary pools of floodwater, rainwater, or meltwater, in grassy areas or pasture, and can develop rapidly at low temperatures, allowing for emergence in more southern locations as early as April or as late as September with multiple generations per season possible under the right environmental conditions (Philip, 1943; Wood et al., 1979).

Aedes (*Ochlerotatus*) *sticticus* (Meigen)

A floodwater species associated with bottomlands of river valleys, the eggs of *Aedes sticticus* are deposited in areas prone to flooding and can remain viable for several years and, therefore, adults may be absent for several seasons if conditions are unfavourable before emerging again when better conditions present themselves (Wood et al., 1979). Eggs can hatch in floodwater that is below 8 ºC (Becker et al., 2010), and with the right conditions several generations can occur each year (Becker et al., 2010). Adults can disperse, with the wind, up to almost 10 km from their larval habitats (Brust, 1980) and will invade houses (Hearle, 1926). This species seems to be rare in the Yukon, with our only two collection records from northwest of the Donjek River (Peach, 2017) and from near Squanga Lake, and what populations exist may be restricted to flat river floodplains, intermittently emerging only in particularly warm summers.

Aedes (*Aedimorphus*) *vexans* (Meigen)

Multiple generations of *Aedes vexans* can occur each year depending on temperature and rainwater runoff (Wood et al., 1979). This species overwinters in the egg stage and is highly adapted to ephemeral water conditions (Kroeger et al., 2014), their eggs hatching with sufficient flooding and warm temperatures (Wood et al., 1979). Eggs laid on soil in areas prone to flooding by the adults of this first spring generation can, after 3-5 days of dry weather and subsequent re-flooding, emerge as adults in as little as 120 hours in the right conditions (Wood et al., 1979). Temporary aquatic habitats such as flood water, irrigated pasture, and woodland pools all provide excellent habitat for *Ae. vexans* larvae (Belton, 1983). Female *Aedes vexans* can fly up to 17 km and can lay up to 120 eggs per batch (Briegel et al., 2001).

Females have been found naturally infected with WEEV in western Canada (McLintock et al., 1970) and the northwestern United States (Gjullin & Eddy, 1972). This species is a bridge vector of WNV in the US and southern Canada (Turell et al., 2005; Giordano et al., 2017), and field collected specimens in North Dakota yielded isolates of WNV, SSHV, and several other viruses (Anderson et al., 2015). *Aedes vexans* feeds on mammals and can be a terrible pest in southern Canada, with populations reaching astronomical numbers when appropriate conditions are met (Hearle, 1926). We have only collected this species twice, both in the south of the territory, and it seems to be very rare.

Coquillettidia (*Coquillettidia*) *perturbans* (Walker)

Coquillettidia perturbans is an aggressive biter known only from the southeast Yukon (Peach and Poirier, 2020). This species has prominent tarsal bands and wings which look “dusty” due to the presence of intermixed dark and pale scales (Wood *et al*., 1979; Belton, 1983; Thielman and Hunter, 2007). *Cq. perturbans* has a very unique life history - the larvae possess a modified siphon by which they attach to the roots of aquatic plants to breathe (Bosak and Crans, 2002). This allows them to stay buried in the mud at the bottom of ponds, marshes, and other permanent shallow waterbodies, where they also overwinter (Wood *et al*., 1979). *Cq. perturbans* larvae are associated with sites that have at least 0.5 m of water depth, lower dissolved oxygen content, and a mean detritus layer of greater than 10 cm in Minnesota (Batzer and Sjorgen, 1986). While they are associated with cattails (*Typha* spp.) elsewhere (Batzer and Sjorgen, 1986) these were not observed where *Cq. perturbans* have been collected in the Yukon (Peach and Poirier, 2020) and other larval host plants might be used. *Cq. perturbans* is particularly active just after dusk (Anderson *et al*., 2007). Females take blood meals from humans and other mammals, as well as birds (Wood *et al.,* 1979). *Cq. perturbans* is a vector of WNV (Turrell et al., 2005) and in eastern North America is a vector of EEEV (Cupp et al., 2003).

Culex (*Culex*) *tarsalis* Coquillett

A dark culicine possessing a conspicuous band of white scales at mid-length of the proboscis, as well as white tarsal bands (Wood et al., 1979). Eggs are deposited as a raft on the water’s surface and larvae are often found in standing water in or near grassy areas, as well as in flooded meadows or fields. While thus far it is known in the Yukon from only a single location in the southwest (Peach, 2018), *Cx. tarsalis* has also been found in the Northwest Territories (Wood et al., 1979) and should be watched for in collections. Adult females of *Cx. tarsalis* overwinter in warm, dry areas such as under rock piles, in mammal burrows, or in human structures (Belton, 1983). Blood meals are taken from birds and mammals (Becker et al., 2010), allowing *Cx. tarsalis* to function as the primary vector of WNV and WEEV in Western North America, among other pathogens (Goddard et al., 2002; Turell et al., 2005; Chen et al., 2012). WNV is endemic in British Columbia (Roth et al., 2010) and the Prairie provinces (Chen et al., 2012), and migratory birds with WNV antibodies have been detected in Alaska (Pederson et al., 2016). WNV transmission requires 109 degree days and cannot develop in *Cx. tarsalis* at temperatures below 14.3 ºC (Reisen et al., 2006), and although endemic transmission has not been documented in the Yukon some models predict the possibility of WNV risk in the extreme southern Yukon during the second half of the 21st century (Harrigan et al., 2014). *Cx. tarsalis* has been observed nectar feeding on several Asteraceae and may pollinate these flows (Peach and Gries, 2016; Philip, 1943).

Culex (*Neoculex*) *territans* Walker

Cx. territans overwinters in the adult stage and produces one generation per year in the north (Becker et al., 2010). A brown culicine with apical abdominal bands and brown tarsomeres, adult females of this species

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primarily take blood from amphibians and birds, ignoring mammals (Wood et al., 1979; Becker et al., 2010; Shepard et al., 2016), and can transmit amphibian pathogens including the nematode *Foleyella flexicanda* (Benach and Crans 1973), some trypanosomes (Bartlet-Healy et al., 2009), frog erythrocytic ranavirus (Gruia-Gray and Desser, 1992), and *Hematazoon clamatae* Stebbins (Kim et al.1998). Adult females are attracted to the sound of frogs croaking (Bartlett-Healy et al., 2008). Larvae of *Cx. territans* are often found in marshes or ponds with considerable vegetation, particularly duckweed (Wood et al., 1979), an observation which holds true in the Yukon. This species has only been collected in the southern Yukon, with our records occurring only as far north as Lake Laberge.

Culiseta (*Culiseta*) *alaskaensis* (Ludlow)

This species completes one generation per year (Wood et al., 1979) and females overwinter in sheltered locations (Belton, 1983). *Cs. alaskaensis* deposits eggs in a raft on the water's surface, and larvae have been found in a variety of habitats but are most often collected in *Carex* among the margins of semipermanent pools, including pools of water retained by permafrost (Wood et al., 1979). After emerging in the spring, adult females will take blood meals from humans (Carpenter & LaCasse, 1955) and livestock (Hudson, 1983) and have been known to invade buildings (Frohne, 1951). *Cs. alaskaensis* is a common species in interior Alaska, where it is often the predominant species in mosquito pools that test positive for *Francisella tularensis* DNA (Triebenbach et al., 2010), and we have noticed it to be quite common in the right habitat in the Yukon as well.

Culiseta (*Culiseta*) *impatiens* (Walker)

Only a single generation per year occurs (Wood et al., 1979), and in the north sometimes only one generation every two years (Frohne, 1953). Female *Cs. impatiens* overwinter in warm and sheltered locations and, as their Latin name suggests, are one of the earliest species to emerge and seek blood in the spring. Eggs are deposited as a raft on the water's surface and larvae are chiefly found in shaded pools, but have also been found in a variety of other aquatic habitats (Wood et al., 1979; Belton, 1983). In most locations they are not considered to be aggressive biters of humans, instead preferring cattle (Belton, 1983). However, in northern locations such as Alaska they bite humans avidly throughout the day (Frohne, 1953). *Cs. impatiens* is a common species in the vicinity of Fairbanks, Alaska, where it is often the predominant species in mosquito pools that test positive for *Francisella tularensis* DNA (Triebenbach et al., 2010).

Culiseta (*Culiseta*) *incidens* (Thomson)

This species completes multiple generations per year as permitted by environmental conditions (Wood et al., 1979). Females overwinter in protected sites such as mammal burrows and rockslides (Wood et al., 1979). Eggs are deposited as a raft on the water's surface and larvae are found in a wide variety of aquatic habitats, including artificial ones such as containers and inside tires, and can tolerate brackishness and pollution (Carpenter & LaCasse, 1955; Wood et al., 1979; Belton, 1983). It is one of the largest mosquitoes throughout its range but females only reluctantly feed on humans unless temperatures are warm (Belton, 1983) with peak feeding occurring in the late evening and at dusk. *Cs. incidens* takes blood meals from mammals (Belton, 1983) and in California this species may be a competent vector of NORV (Kramer et al., 1993). In northern populations the dark wing-spots of this species seem to be less prominent. Near Kluane Lake in the southwest Yukon, not far removed from Pacific Maritime climate conditions, we have found this species can occasionally be quite common. In British Columbia it has been observed feeding on the nectar of Asteraceae (Peach and Gries, 2016).

Culiseta (*Culiseta*) *inornata* (Williston)

Cs. inornata completes multiple generations per year as permitted by environmental conditions (Wood et al., 1979). In the north females of this species overwinter in sheltered sites such as mammal burrows and crevices in rocky ground (Belton, 1983). Eggs are deposited as a raft on the water's surface and larvae are found in irrigation seepage, ditches, and brackish and polluted water in open areas, as well as in woodland pools (Belton 1983). This was the most common mosquito larva found in swimming pools that were flooded by Hurricane Katrina and left abandoned in its aftermath (Caillouët et al., 2008) and it is the most common *Culiseta* species in prairie-like areas and grassland (Wood et al., 1979). Peak feeding activity occurs in the evening and at dusk, though large mammals such as livestock are preferred over humans for blood meals (Carpenter & LaCasse, 1955). However, some populations can produce eggs without access to blood (Fox, 1994). This species was the most common mosquito found at livestock facilities in Alberta (Lysyk, 2010). In the north *Cs. inornata* may vector WEEV (Burton & McLintock, 1970); however, this virus has not yet been found in the Yukon (McLean et al., 1974; Artsob, 1990). It may also vector SSHV, NORV (McLean & Lester, 1984; Kramer et al., 1993), and vertically transmit SSHV and LaCrosse virus (LCV) (Schopen et al., 1991).

Culiseta (Culicella) *morsitans* (Theobald)

This species completes only one generation per year and overwinters in the egg stage in most of Canada, hatching in the spring similar to many *Aedes* species (Wood et al., 1979). Eggs are deposited as a raft on moist substrate above the water level (Oliver and Howard, 2011) and hatch when flooding occurs (Wood et al., 1979). *Cs. morsitans* is a very cold-tolerant species and in less northern areas may hatch in the fall and overwinter in the larval stage, often surviving extended periods underneath ice (Becker, 2010). Larvae are most often found in shaded water-filled depressions on the edges of swamps, ponds, and bogs including cavities under rotting stumps and tree roots (Pierson and Morris, 1982; Giberson et al., 2007). This species has a relatively slow physiology compared to other mosquitoes (Morris and Zimmerman, 1981), and in Colorado it was found only in high elevation habitat (Eisen et al., 2008). In Prince Edward Island *Cs. morsitans* larvae can be found May-June with adults found into September (Giberson et al., 2007); however, this seasonality may be quite different in the Yukon. *Cs. morsitans* acquires blood-meals primarily from avian hosts (Shepard et al., 2016, and is a vector of EEEV in eastern North America (Morris and Zimmerman, 1981), though this virus is not endemic to the Yukon. We have not collected this species in the Yukon and based on the paucity of other records it does not appear to be abundant; however, this apparent sparsity may simply be due to a lack of affinity to feed on human collectors.

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