An Illustrated Identification Key to Assassin Bug Subfamilies and Tribes (Hemiptera: Reduviidae)

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Abstract

Reduviidae (assassin bugs) is the second largest family of the hemipteran suborder Heteroptera (true bugs). The family contains 25 subfamilies, the largest number amongst true bugs, and 28 tribes. Most previously published keys do not include all recognized subfamilies and even complete keys lead to incorrect identification of certain taxa. We here present a comprehensive and well-illustrated identification key to subfamilies and tribes (except Emesinae) of Reduviidae. The key is complemented by taxon treatments that provide, for each subfamily, diagnostic features, notes on taxonomy and distribution, a comment on taxa occurring in Canada, natural history notes, and a short bibliography.

Introduction

With roughly 7,000 described species in 25 subfamilies, Reduviidae are one of the megadiverse families of insects and the third largest family within the order Hemiptera (after Cicadellidae and Miridae). Reduviidae, the assassin bugs, occur worldwide, but species-level diversity is clearly highest in the tropics of the Old and New Worlds and several subfamilies are confined to specific biogeographic regions (Froeschner and Kormilev 1989; Maldonado 1990; Cassis and Gross 1995). Assassin bugs occur in most terrestrial ecosystems and microhabitats, from mammal burrows in the Sonoran desert to decaying logs in the Bornean rainforest (Ryckman 1954; Miller 1959). Their morphological diversity is immense and evidently tied to the plethora of different life history strategies displayed by assassin bugs. A "typical" reduviid, such as many species of Harpactorinae or Reduviinae, is easily recognized as belonging to this family by layman and specialist alike, but skinny and sticklike Emesinae or the harpactorine tribe Rhaphidosomini can be mistaken for Berytidae or Hydrometridae and flattened Elasmodeminae deceptively resemble Aradidae, to name only 3 examples. Species in at least 7 subfamilies display contrasting warning coloration, but the great majority of species are drab colored, often matching color patterns in the microhabitats they occupy such as bark, leaf litter, or rock crevices. Many Reduviidae are fairly large-bodied, but overall body length ranges from an impressive 4 centimeters in species of *Psyttala* Stål to very small species of only

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about 2 to 3 millimeters, such as *Tribelocodia* Weirauch.

The great majority of assassin bugs prey on other arthropods and the range of morphological adaptations to prey capture is striking: Phymatinae, the ambush bugs, have evolved subchelate (foretibia clamps against distal process on forefemur) and chelate (foretibia folds back against incrassate forefemur) raptorial grasping legs, the long appendages of Emesinae allow them to steal from spider webs, and species in a clade of Harpactorinae have invented "flypaper" by coating their legs with self-generated sticky gland secretions. Even though natural history data for the majority of assassin bugs species are lacking, chance observations and dedicated studies have revealed a fascinating picture over the last century. It has become clear that Reduviidae display a remarkable range of prey specializations including predation on millipedes (Ectrichodiinae: Forthman and Weirauch 2012), termites (Salyavatinae, some Harpactorinae: McMahan 1982, 1983; Bérenger and Pluot-Sigwalt 2009), ants (Holoptilinae, some Reduviinae: Weirauch and Cassis 2006; Jackson and Pollard 2007; Weirauch et al. 2010), and spiders (some Emesinae: Wignall and Taylor 2011), in addition to vertebrate blood feeding that is restricted to the Triatominae (Lent and Wygodzinsky 1979; Schofield and Galvão 2009).

Reduviidae are also economically important and include both, destructive disease vectors and beneficial predators of insect pest species. All Reduviidae in the subfamily Triatominae (~140 spp., Schofield and Galvão 2009) feed on vertebrate blood, and as vectors of Chagas disease, pose a significant risk to human health. Chagas disease affects most Central and South American countries (Dias and Schofield 1999; Franco-Paredes et al. 2007; De Noya et al. 2010), is endemic in the United States, primarily as a zoonosis (Beard et al. 2003), and on the verge of worldwide dispersal due to human migration (Schmunis and Yadon 2010). More than 150 species of Reduviidae are predators of insect pests (Ambrose 1999) and several species are used as natural enemies, most importantly *Pristhesancus plagipennis* (Walker) as predator of cotton bollworm (Grundy and Maelzer 2000). Other species that are being explored for integrated pest management include species of *Zelus* and *Sinea* that feed, among others, on Lygus bugs, caterpillars and boll weevils (Cogni et al. 2002; Cohen and Tang 1997).

Despite serious taxonomic and phylogenetic efforts during the past 2.5 centuries, the classification of Reduviidae is far from being settled and numerous taxa at the level of genus, tribe, or subfamily are in need of modern systematic revisions. Peaks in taxonomic activity in Reduviidae occurred in the late 19th and early 20th century, spearheaded by the prolific Swedish entomologist Carl Stål as well as William Lucas Distant and Gustav Breddin. Four men, who together contributed >40% of all valid species names in Reduviidae, were the dominant figures in reduviid systematics around the middle of the 20th century: Norman Cecil Egerton Miller (London), Henri Schouteden (Brussels), André Villiers (Paris), and Petr Wolfgang Wygodzinsky (Rio de Janeiro, Tucumán, and New York). Two world catalogs (Putchkov and Putchkov 1986-1989; Maldonado 1990) are supplemented by regional catalogs (e.g., Cassis and Gross 1995) and catalogs focusing on the Phymatinae (Kormilev 1962; Froeschner and Kormilev 1989), a subfamily that was omitted from both world catalogs. Recent and ongoing taxonomic research on Reduviidae shows that there is no shortage of as yet undescribed species, but also emphasizes the need for comprehensive taxonomic revisions to reveal synonymies amongst described taxa (e.g., Bérenger 2006; Cai et al. 2003; Chlond 2011; Forero et al. 2004; Gil-Santana et al. 2000; Ishikawa and Okajima 2004; Melo and Coscarón 2005; Rédei 2007; van Doesburg and Pluot-Sigwalt 2007; Weirauch 2006).

The early higher-level classification of Reduviidae was mostly shaped by Charles Jean-Baptist Amyot and Jean-Guillaume Audinet Serville, who recognized many of the larger subfamilies. During the 20th century, numerous new subfamilies and tribes were established, with Wygodzinsky, Villiers, and Miller taking the lead on most of them. As opposed to Miller and Villiers, who described new subfamilies mostly on grounds of the species in question being "very different" and "difficult to accommodate in existing subfamilies", Wygodzinksy's approach was more synthetic and clearly informed by the Hennigian School of thought. Despite this, formal cladistic analyses of Reduviidae at the subfamily-level did not become available until the 1990s and beyond (Clayton 1990; Weirauch 2008; Weirauch and Munro 2009; Hwang and Weirauch 2012).

Published phylogenies using morphological (Weirauch 2008), molecular (Weirauch and Munro 2009; Hwang and Weirauch 2012), and combined datasets (Schuh et al. 2009) show high support for the monophyly of the family Reduviidae, with Pachynomidae recovered as their sister group. The monophyly of most subfamilies and some tribes has been tested in these analyses, and many are strongly supported (Hwang and Weirauch 2012). Interestingly, the situation for Triatominae, the only reduviid subfamily with medical importance, is not settled: different analyses found Triatominae to be polyphyletic (Paula et al. 2005), paraphyletic with respect to the Zelurus clade among Reduviinae (Hwang and Weirauch 2012), or monophyletic (Hypsa et al. 2002; Weirauch 2008; Weirauch and Munro 2009; Patterson and Gaunt 2010). Even more challenging are Reduviinae, the second largest assassin bug subfamily (~1,100 described spp., 145 genera): based on current analyses,

Reduviinae are polyphyletic and fall into 11-14 clades, depending on dataset and analysis (Hwang and Weirauch 2012). Comparatively more minor issues are the potential polyphyly of Cetherinae (Hwang and Weirauch 2012), paraphyly of harpactorine tribes (Zhang and Weirauch 2013), uncertain delimitation of Ectrichodiinae with respect to Tribelocephalinae (Weirauch 2010), and potential paraphyly of Salyavatinae (Weirauch 2008). Another limitation is that 6 of the subfamilies have so far not been included in phylogenetic analyses. A comprehensive, combined morphological and molecular analysis of Reduviidae is now essential that will provide the phylogenetic framework and the diagnostic features for a meaningful re-classification of the family.

We realize that the classification of Reduviidae is on the verge of undergoing significant transformations. Nevertheless, we feel that it is valuable to provide identification keys and taxon treatments for the currently recognized 25 subfamilies, most importantly because many of these taxa will persist after re-classification. Existing identification keys to subfamilies of Reduviidae are outdated and therefore incomplete (e.g., Usinger 1943; China and Miller 1959), have a regional focus (e.g., China 1940), or fail to correctly key out a number of species (e.g., Schuh and Slater 1995). In addition, the now available wealth of digital images of live bugs in their natural environment and recent advances in imaging systems of preserved specimens allow, for the first time, the creation of very well-illustrated subfamily identification keys and taxon treatments. The subfamily-level keys are complemented by keys to the tribes of 5 subfamilies. We omitted a key to tribes of Emesinae, because we could not obtain photo-quality specimens for certain key taxa (please refer instead to the comprehensive tribal-level key provided by Wygodzinsky [1966]). The keys are followed by taxon treatments that provide, for each subfamily, diagnostic features, notes on taxonomy and distribution, a comment on taxa occurring in Canada, natural history notes, and a short, up to date, bibliography. The great majority of images of live assassin bugs were contributed by one of the authors, shot at various locations and using different photographic equipment. Digital images of preserved specimens were mostly taken in the Weirauch Lab using imaging systems by Microptics USA, GT Vision, and Leica Microsystems.

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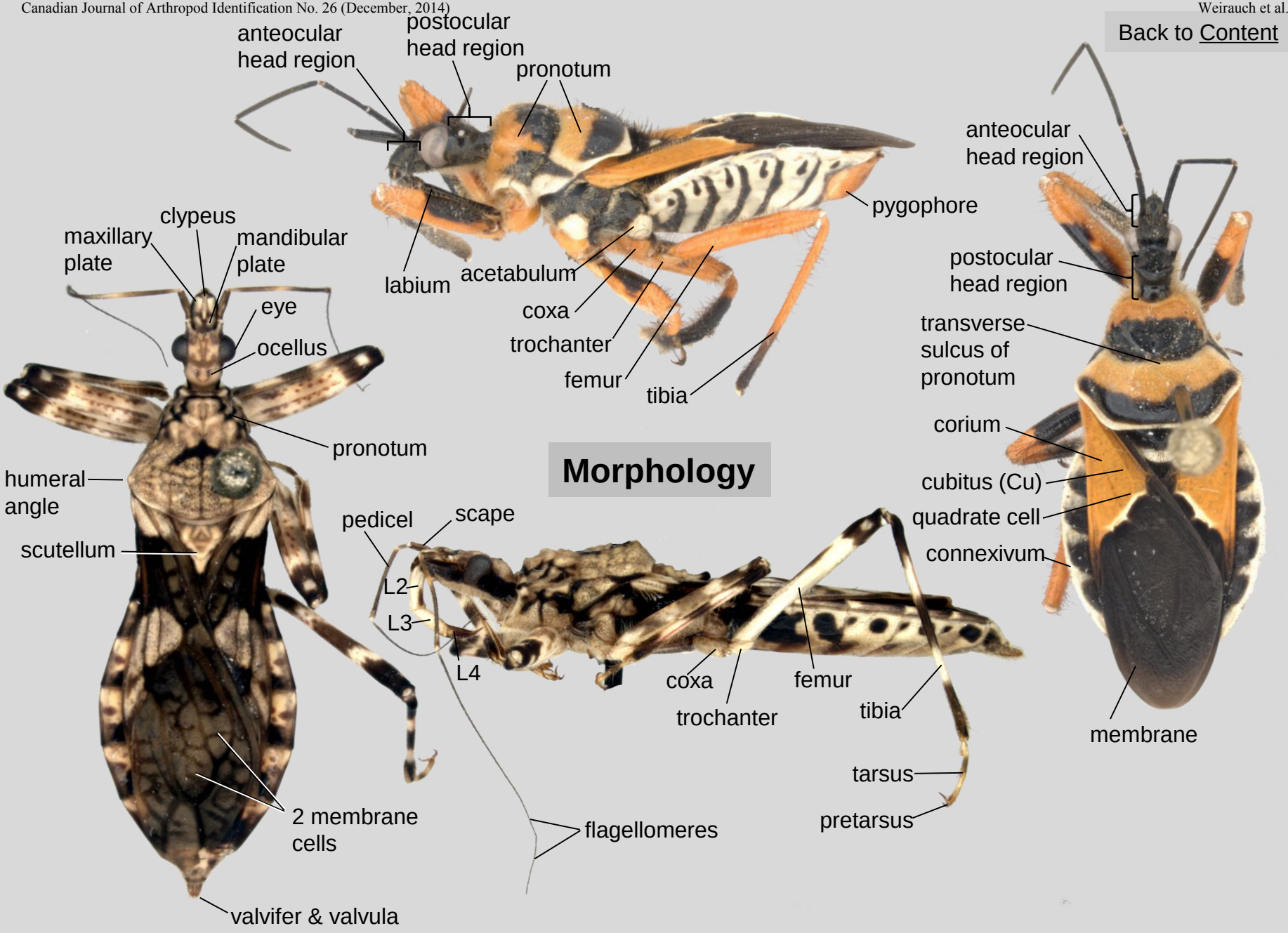
Morphology



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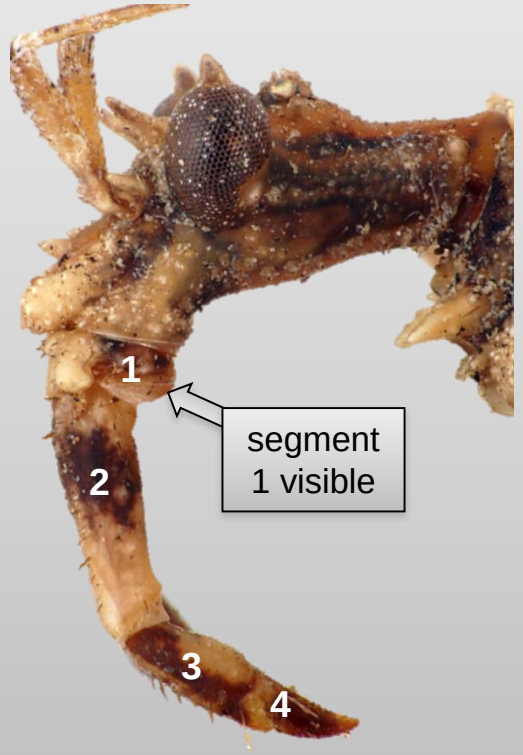
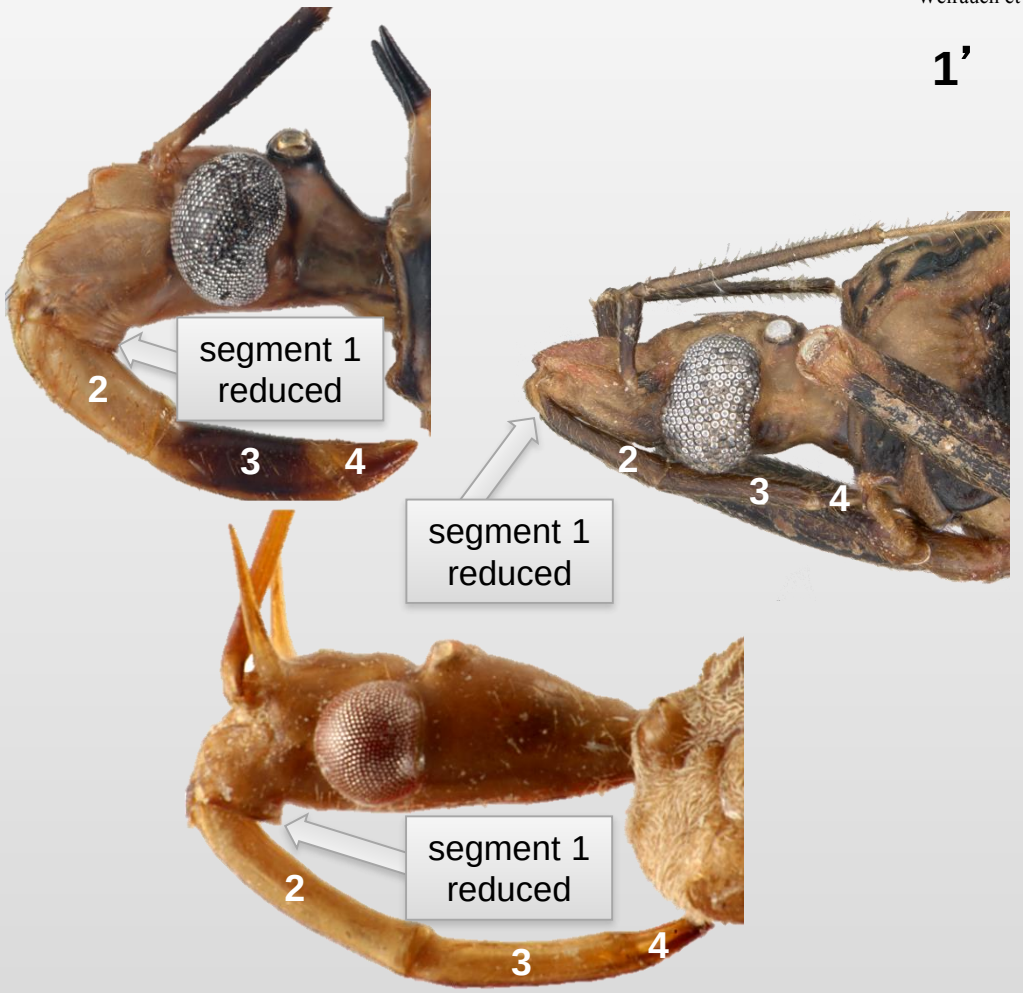
1



1’



1	Labium with 4 segments visible (separated by membrane)	**2**
1’	Labium with 3 segments visible (separated by membrane), segment 1 reduced	**3**

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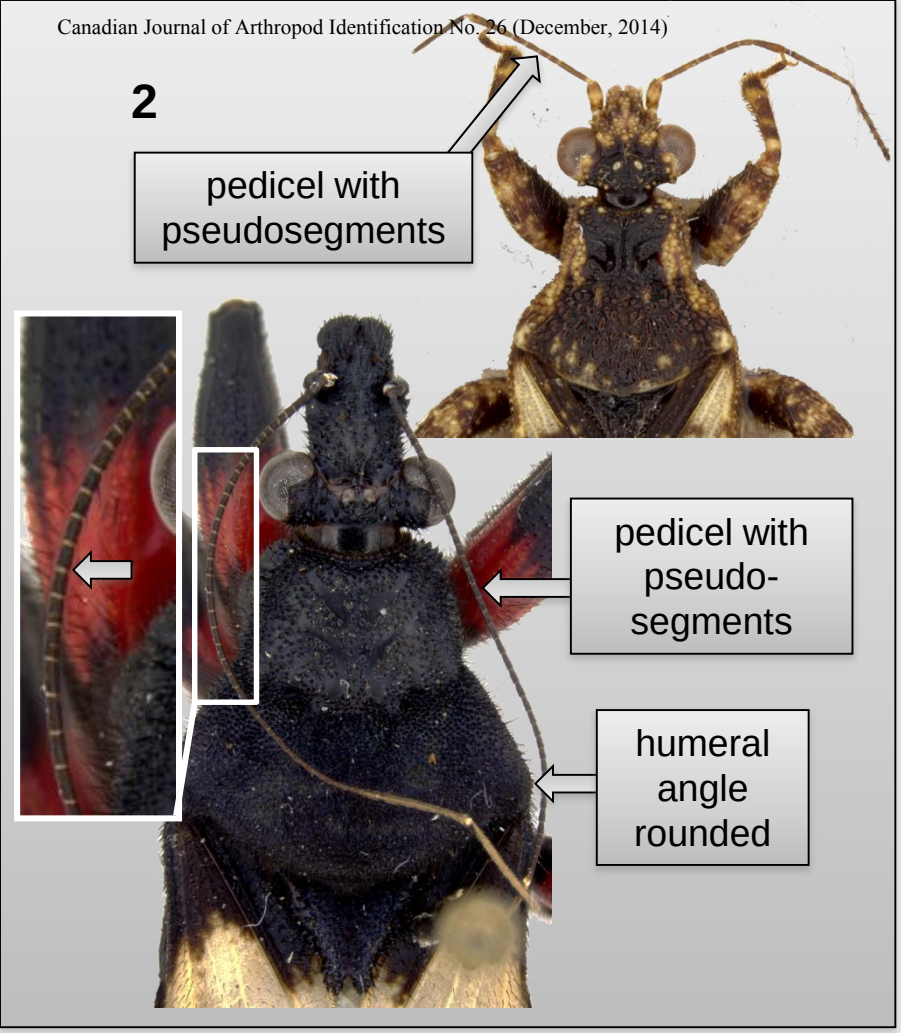

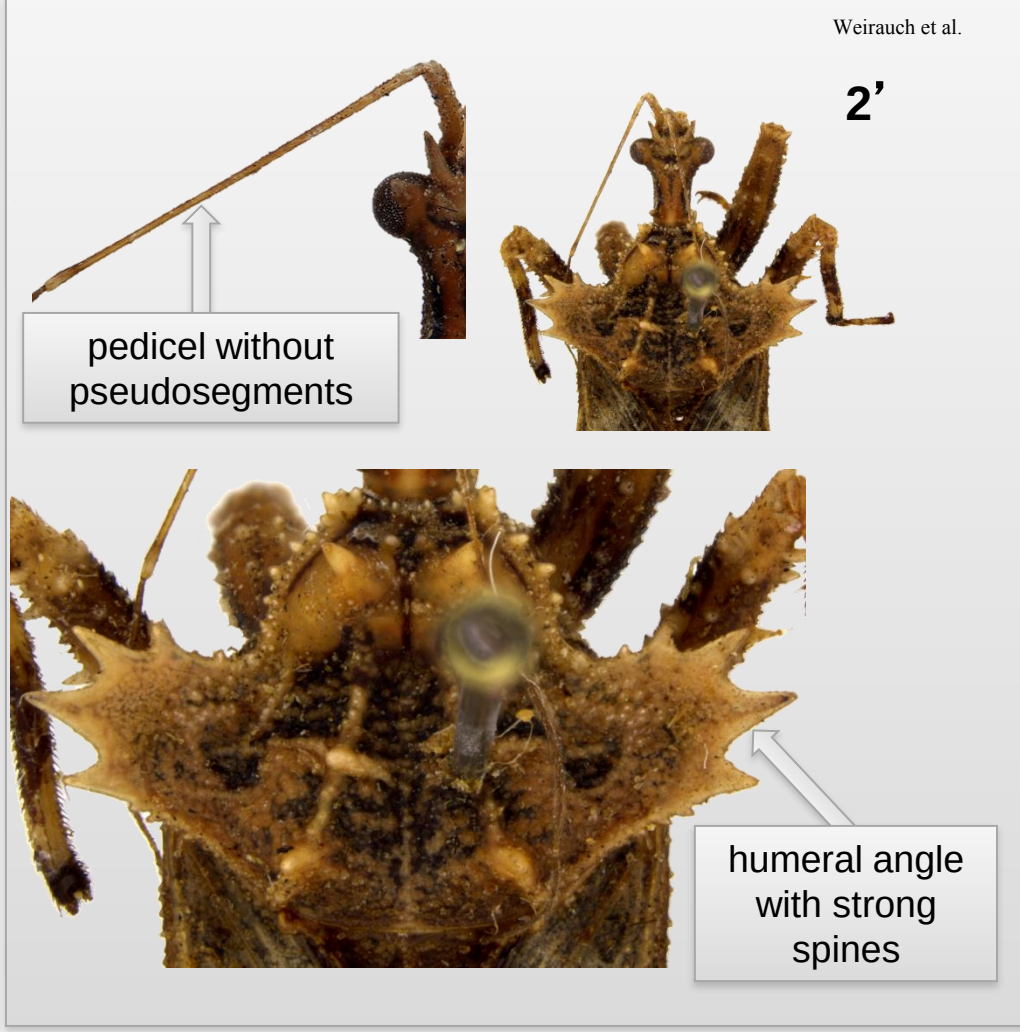

2 (<u>1</u>)	Pedicel subdivided into 4-36 pseudosegments, humeral angle of pronotum rounded .....**<u>Hammacerinae</u>** [Nearctic; Neotropical]
2’ (<u>1</u>)	Pedicel consisting of one uniform segment, humeral angle of pronotum with strong spines .....**<u>Centrocnemidinae</u>** [Oriental]

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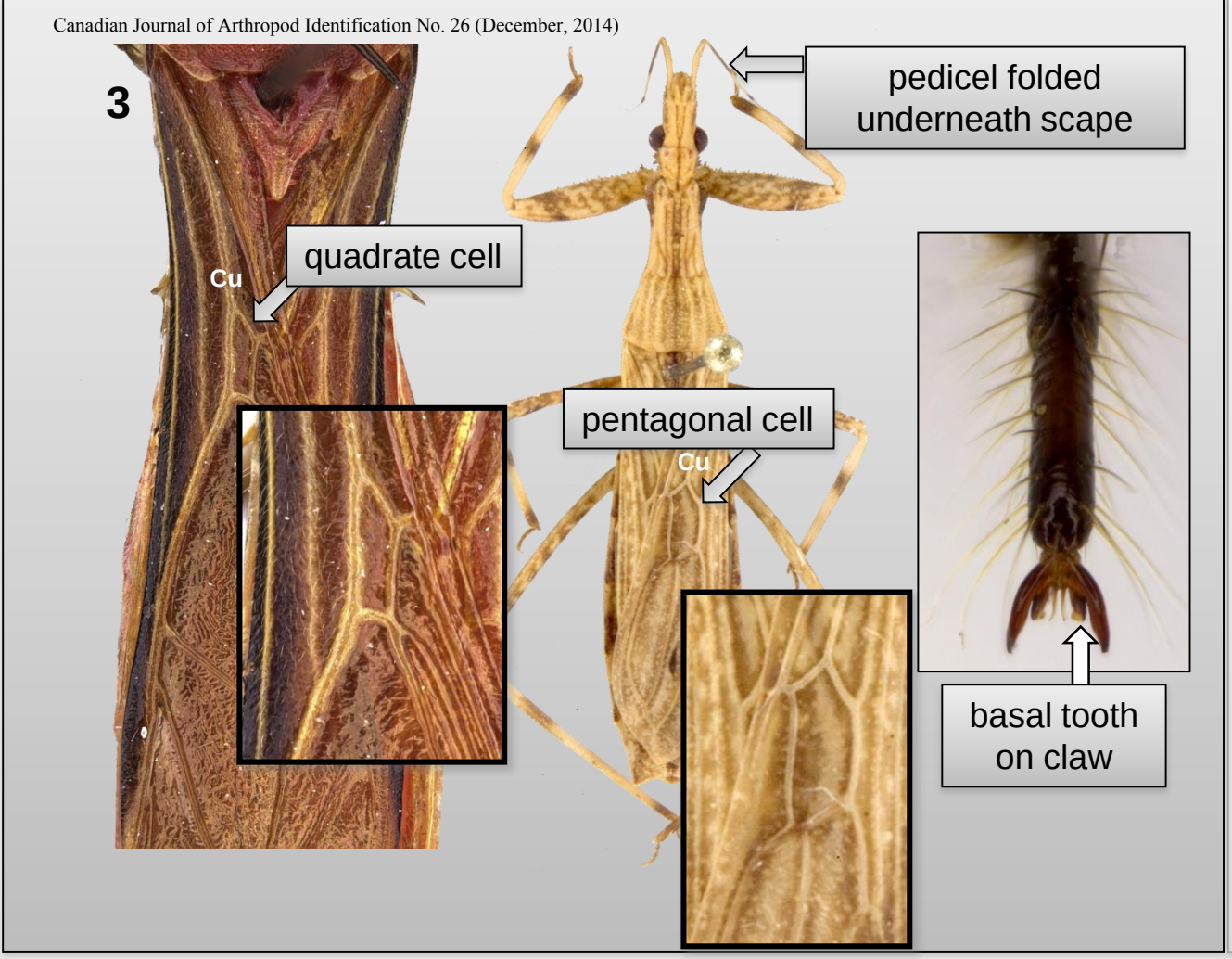

3 (1)	Cubitus (Cu) usually forming quadrate, pentagonal, or hexagonal cell; pedicel and flagellomeres folded underneath scape or claw with basal tooth (*the latter two characters are important should the specimen be apterous*)	**4**
3’ (1)	Cubitus (Cu) without quadrate, pentagonal, or hexagonal cell; pedicel and flagellomeres not folded underneath scape or claw without basal tooth	**5**

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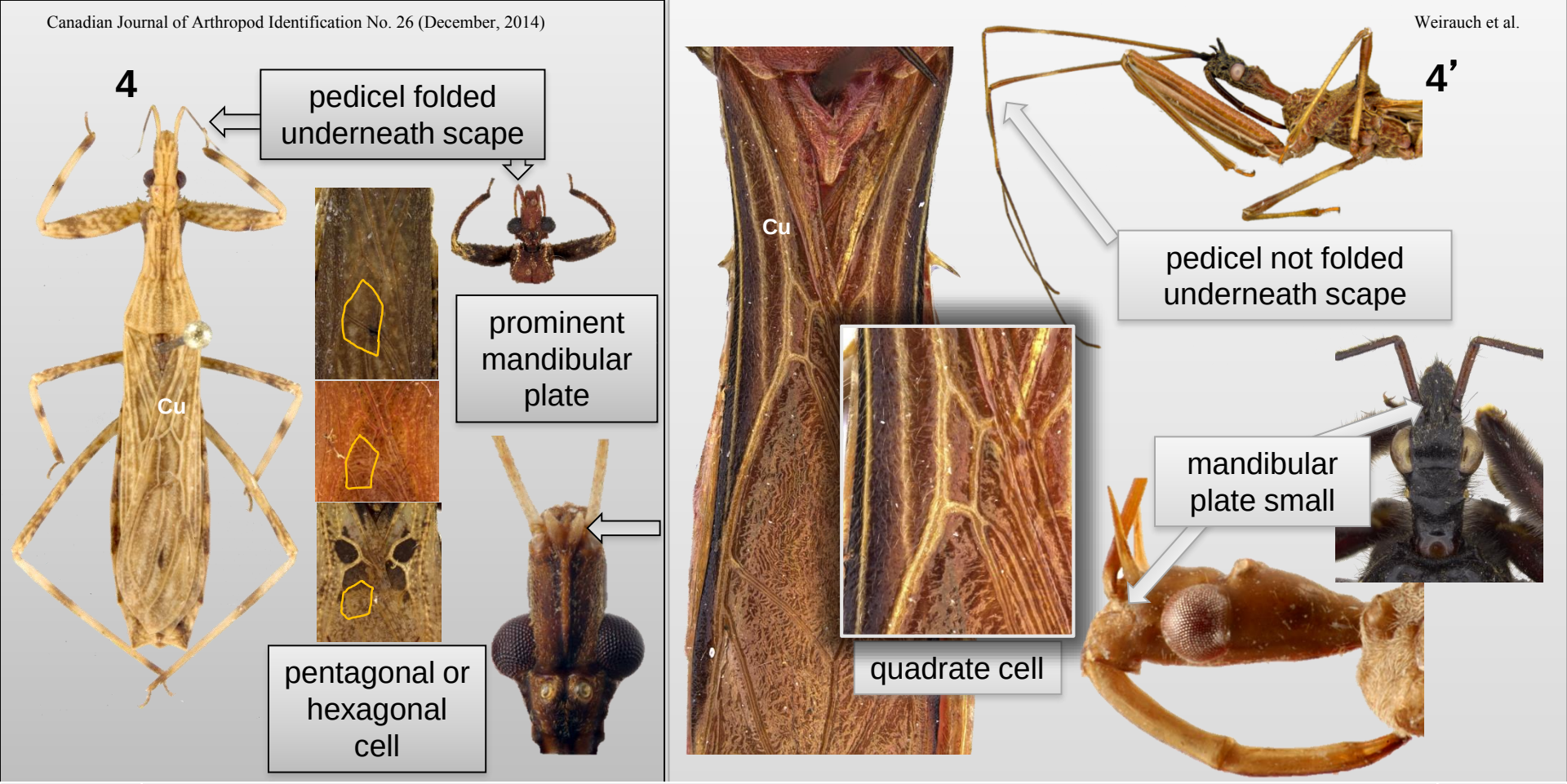

4 (3)	Cubitus (Cu) usually forming pentagonal or hexagonal cell; if cubital cell absent, with prominent mandibular plate, pedicel and flagellomeres usually folded underneath scape, body often brown or pale……**Stenopodainae** [Cosmopolitan]	
4’ (3)	Cubitus (Cu) usually forming quadrate cell, mandibular plate small, pedicel and flagellomeres usually not folded under scape, body color variable ……**Harpactorinae** [Cosmopolitan]	**See key to tribes**

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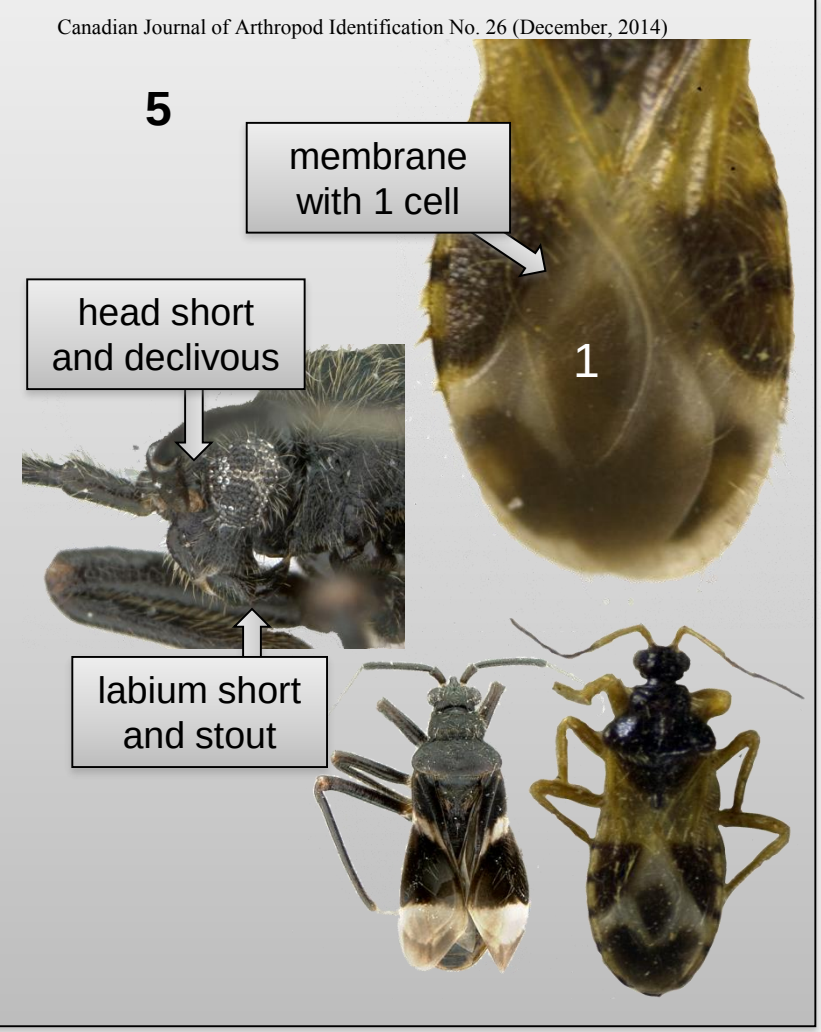

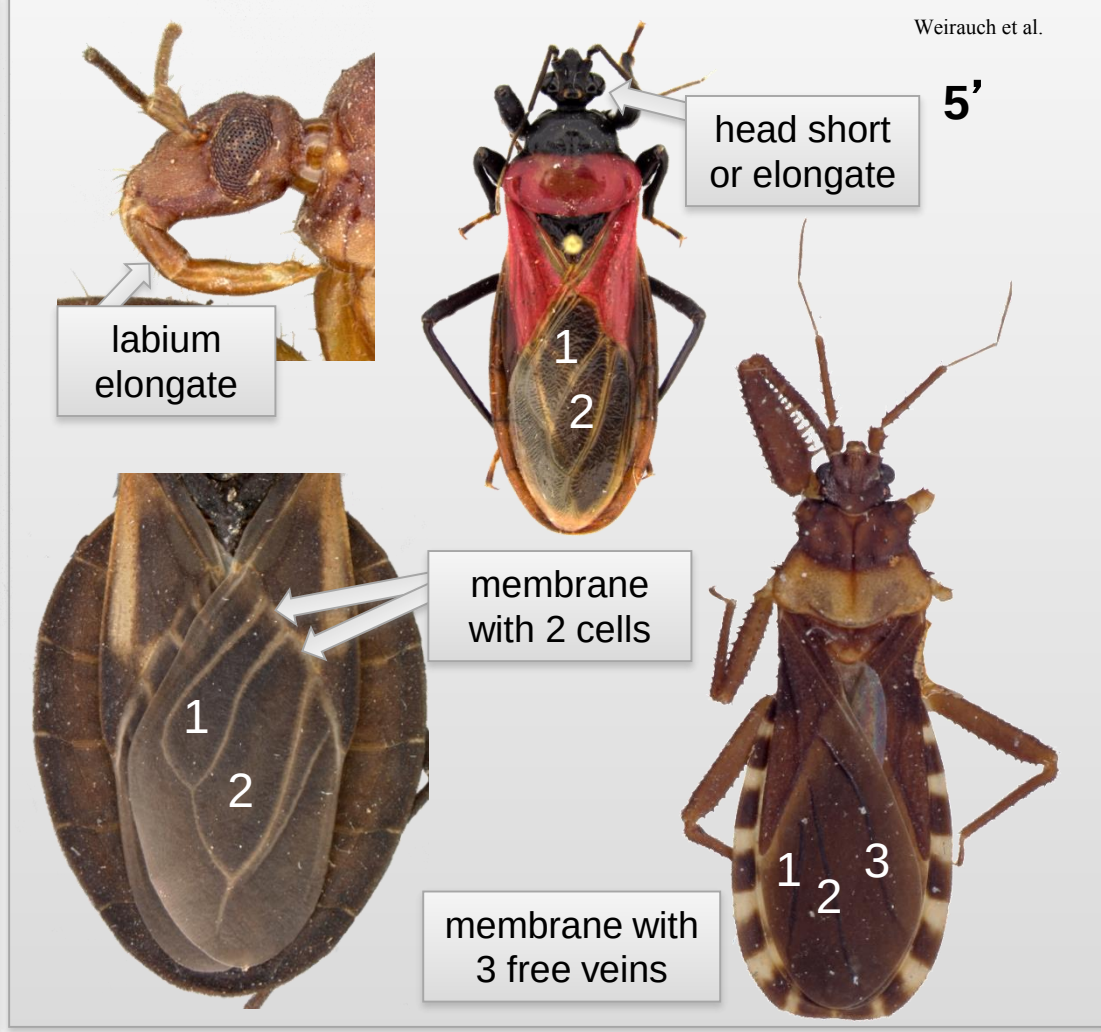

5 (3)	Small (3-9 mm), membrane with a single cell, head short and transverse, anteriorly declivous, labium short and stout ……**Chryxinae** [Neotropical]	
5’ (3)	Body size variable, membrane usually with 2 cells (rarely only 1) or 3 free veins, head short or elongate, rarely anteriorly declivous, labium usually elongate	**6**

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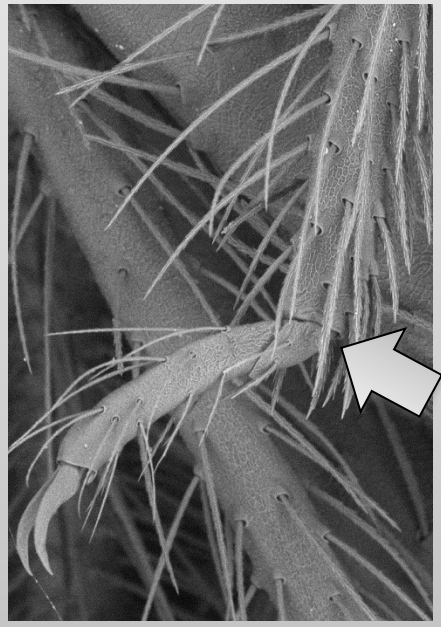
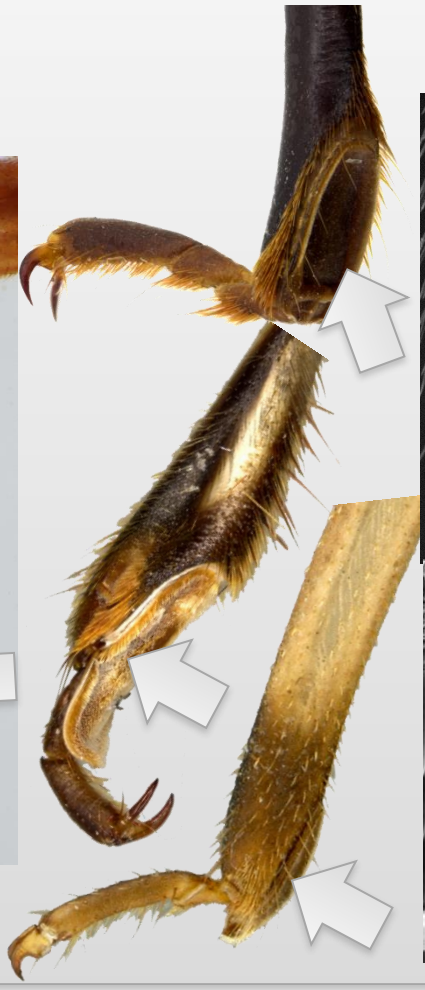
6

fossula spongiosa absent

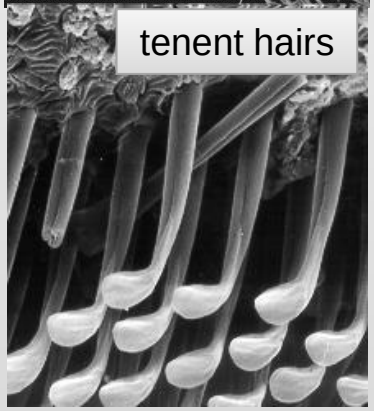


fossula spongiosa



6’

tenent hairs



6 (5)	Apex of foretibia ventrally without obvious fossula spongiosa, i.e. never with specialized tenent hairs (acanthae with capitate apex)	**7**
6’ (5)	Apex of foretibia ventrally with obvious fossula spongiosa, i.e. an area densely beset with specialized tenent hairs (acanthae with capitate apex)	**21**

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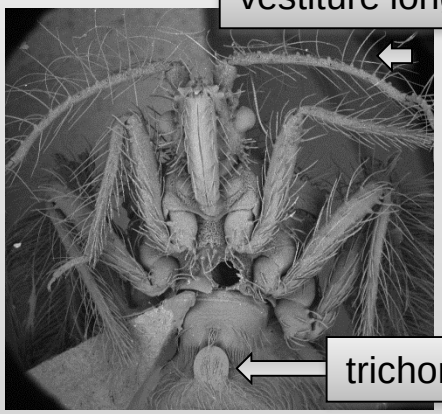
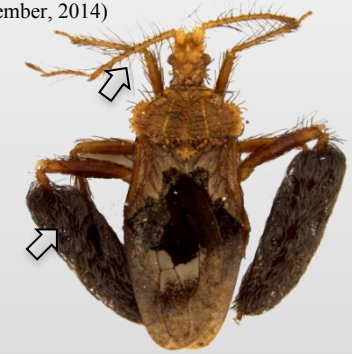
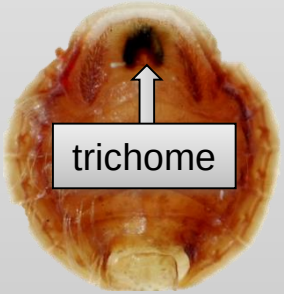
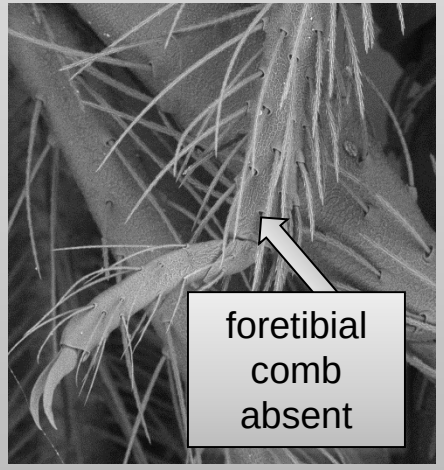
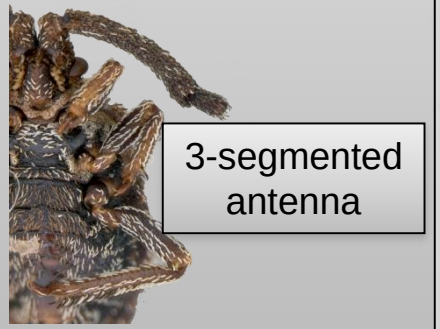
7



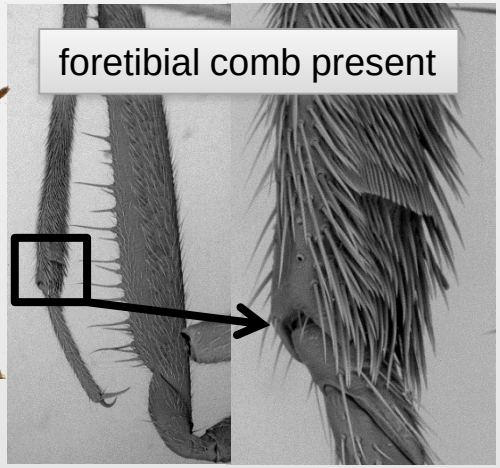


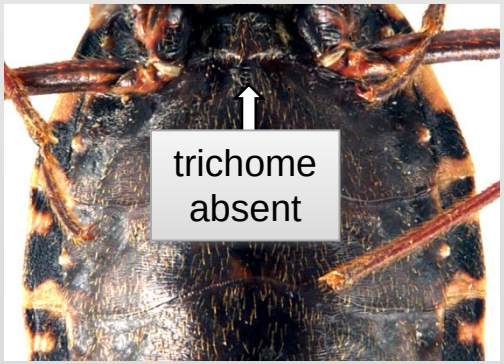






7’





7 (6)	Vestiture on antenna and tibiae usually longer than twice the diameter of segment, often with trichome, foretibial comb absent; if setation dense but short, antenna with only 3 segments ..... **Holoptilinae** [Circumtropical]	**See key to tribes**
7’ (6)	Vestiture on antenna and tibiae, if present, usually shorter than diameter of segment, trichome absent, foretibial comb present; if antenna 3-segmented, then without dense setation	**8**

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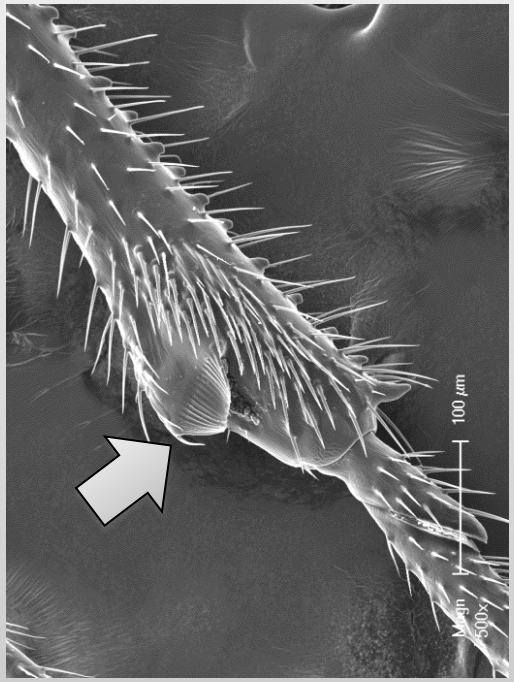
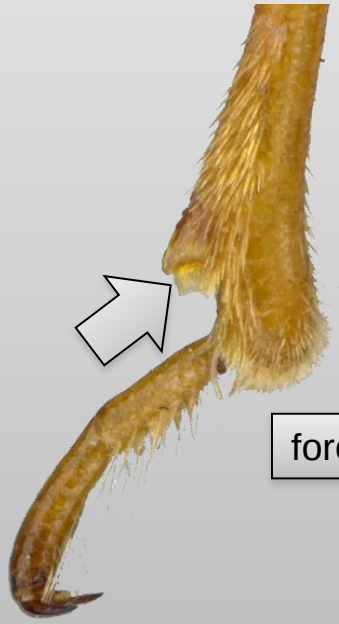
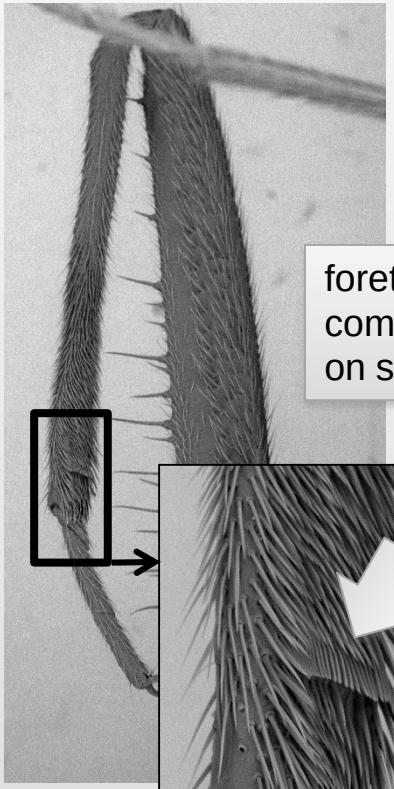
8



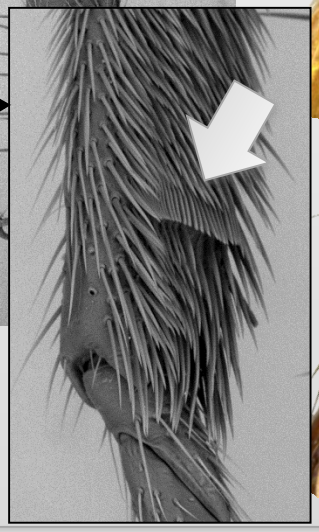


foretibial comb on spur

8’



foretibial comb not on spur



8 (7)	Foretibial comb located on prominent spur	9
8’ (7)	Foretibial comb not located on prominent spur	10

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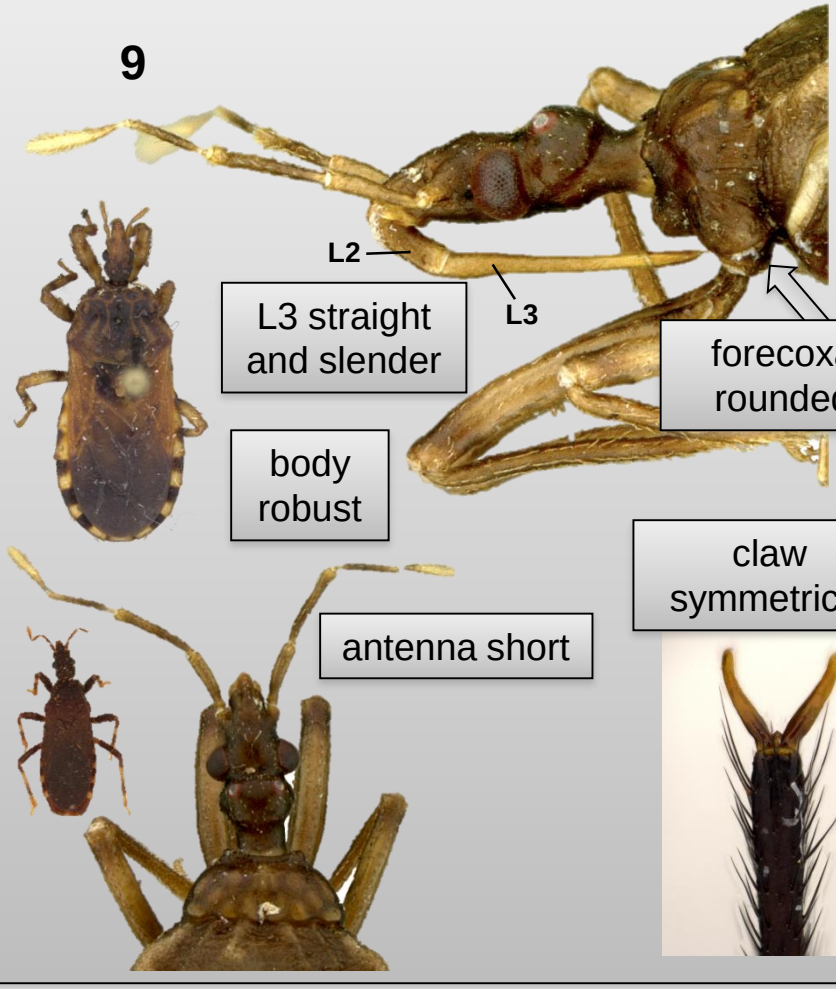
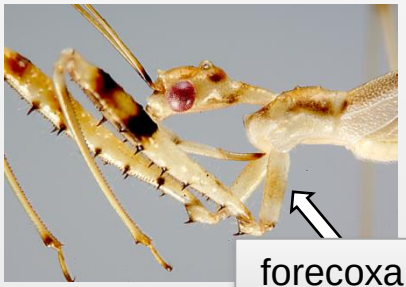
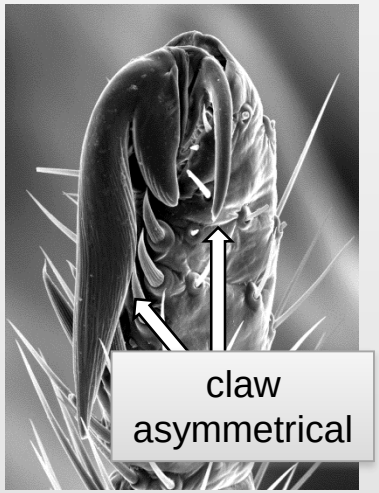
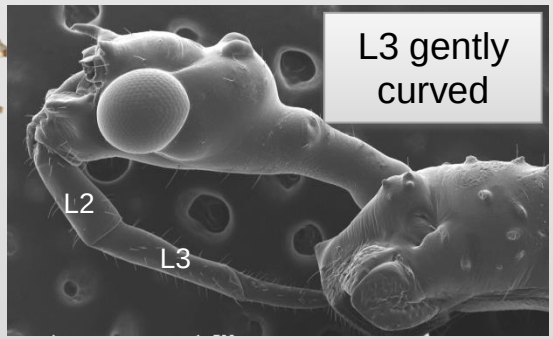
9



9’

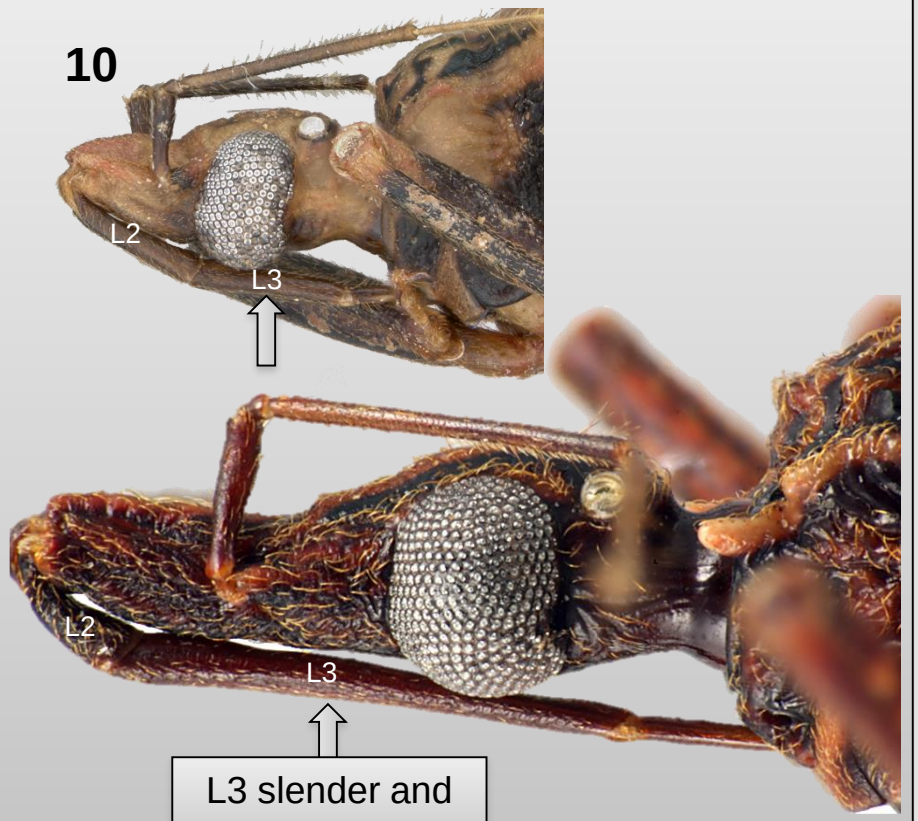






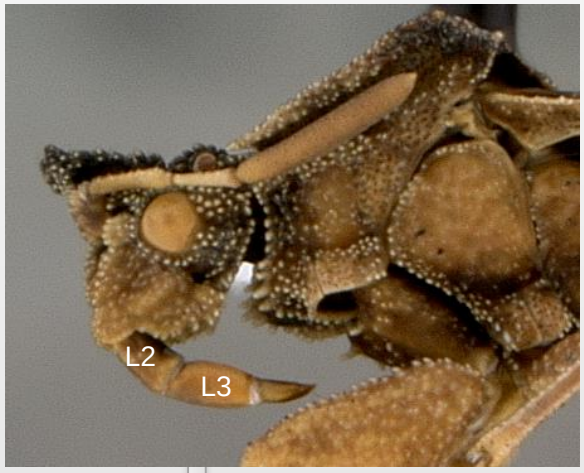
9 (8)	Body robust, third (second visible) labial segment (L3) straight, antenna short, scape and pedicel of about the same length, forecoxa short and rounded, claw symmetrical ……..**Physoderinae** [Circumtropical]
9’ (8)	Body slender, third (second visible) labial segment (L3) gently curved, scape much longer than pedicel, forecoxa elongate, claw asymmetrical ……..**Bactrodinae** [Neotropical]

10



L3 slender and straight

10’



L3 curved and usually slightly incrassate

10 (8)	Third (second visible) labial segment (L3) slender and straight ……**Triatominae (in part)** [Cosmopolitan]	**See key to tribes**
10’ (8)	Third (second visible) labial segment (L3) curved and usually slightly incrassate	**11**

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membrane with 3 free ending veins, without cells

body in lateral view extremely flattened

body in lateral view usually not extremely flattened

if flattened, then membrane with 1-2 cells

11 (10)	Body in lateral view extremely flattened, membrane with 3 free ending veins, without cells ……**Elasmodeminae** [Neotropical]	
11’ (10)	Body in lateral view usually not extremely flattened; if flattened, then membrane with 1-2 cells	**12**

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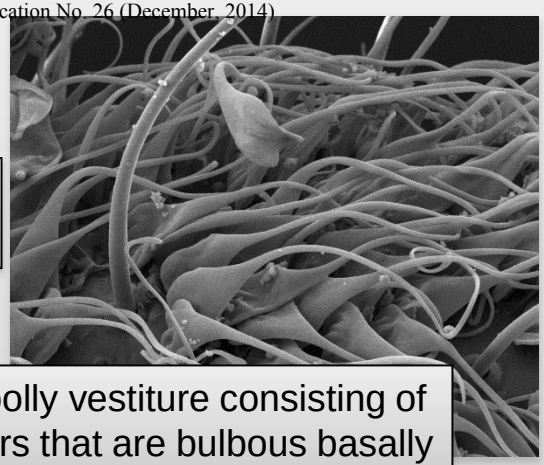
12



ocelli absent

woolly vestiture consisting of hairs that are bulbous basally and curved apically

pedicel + flagellomeres folded

12’

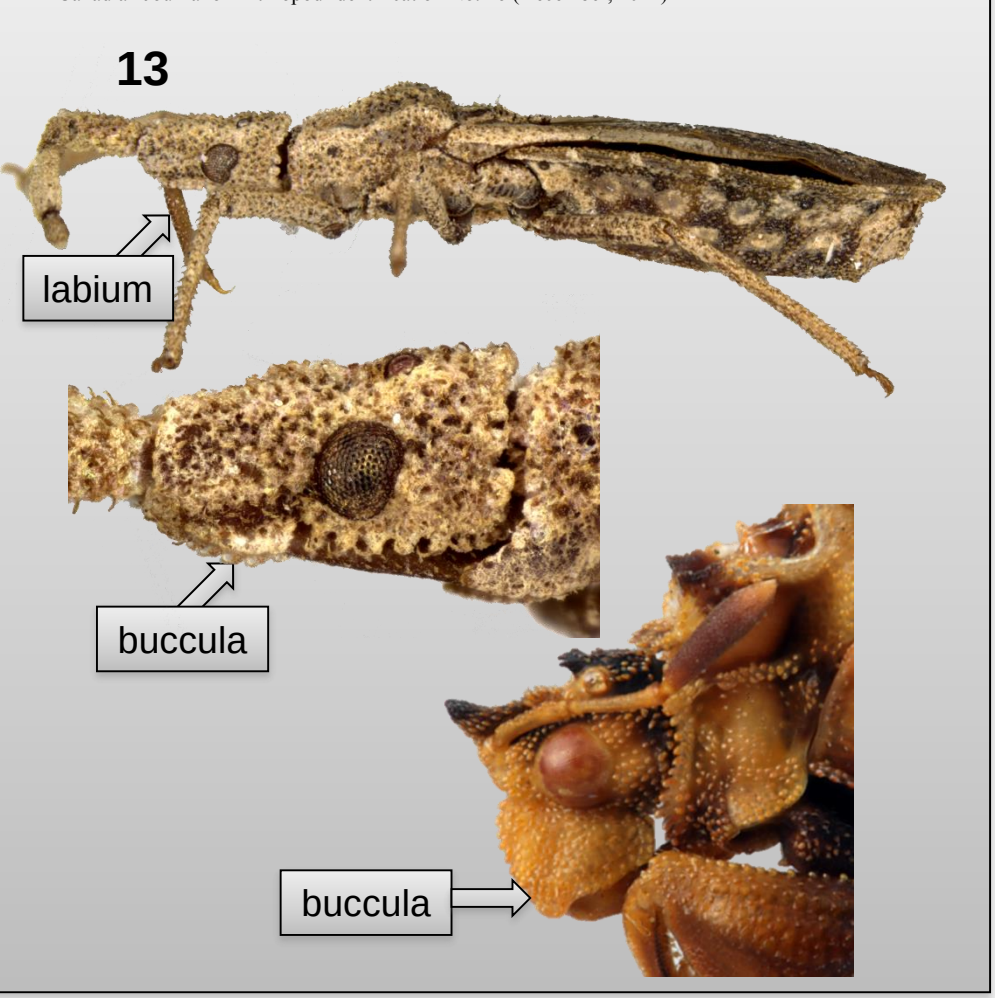
ocelli present

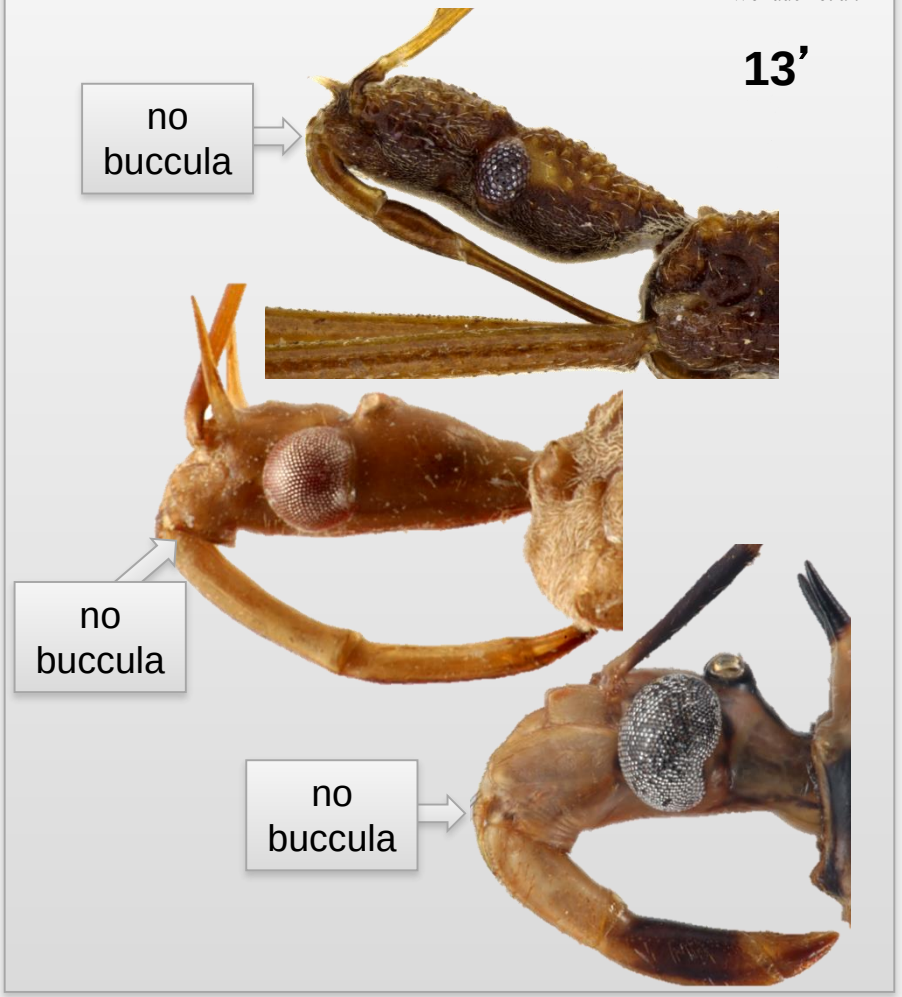
pedicel + flagellomeres not folded

glabrous or with sparse to dense vestiture, never with woolly vestiture

12 (11)	Body with woolly vestiture consisting of hairs that are bulbous basally and curved apically, ocelli absent, pedicel and flagellomeres often folded underneath scape ……**Tribelocephalinae** [Circumtropical]	**See key to tribes**
12’ (11)	Body glabrous or with sparse to dense vestiture, never with woolly vestiture, ocelli present or absent, pedicel and flagellomeres not folded underneath scape	**13**

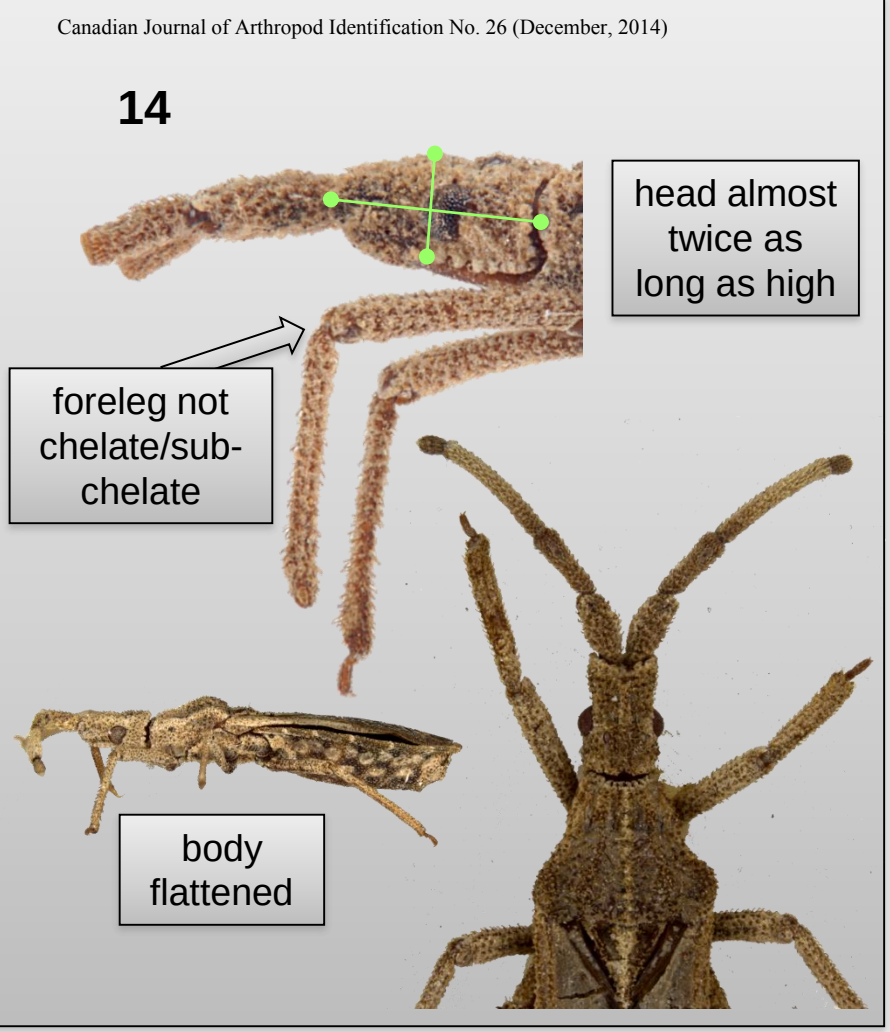
doi:10.3752/cjai.2014.26

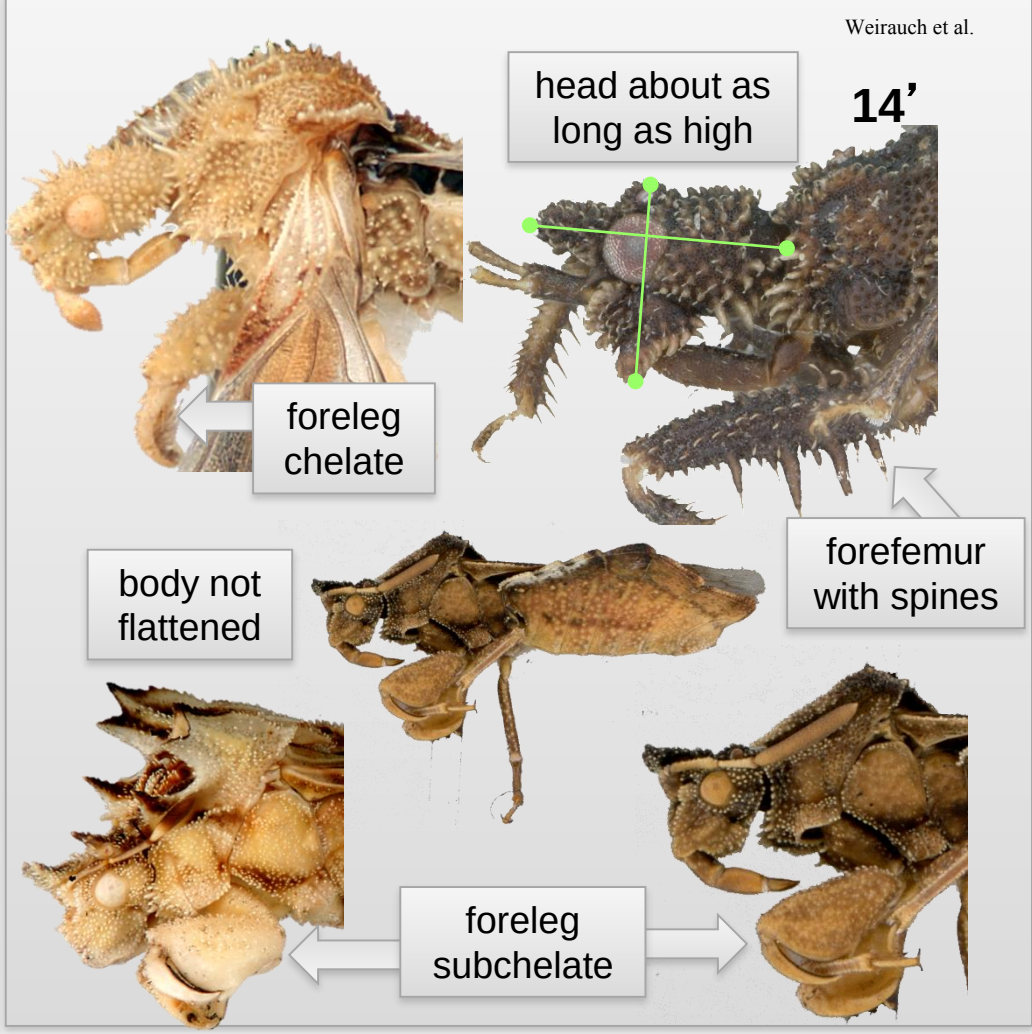




13 (12)	Head with buccula obscuring the base of the labium	**14**
13’ (12)	Head without buccula obscuring the base of the labium	**15**

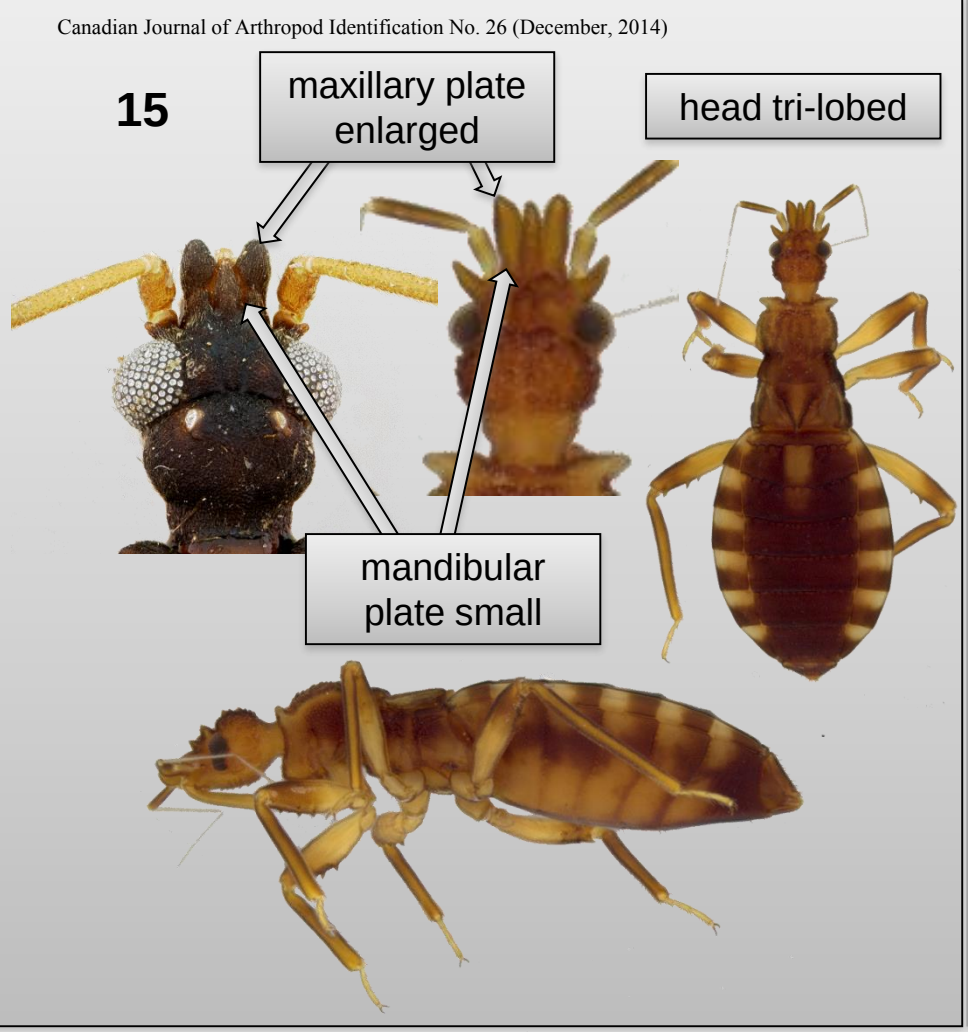
doi:10.3752/cjai.2014.26

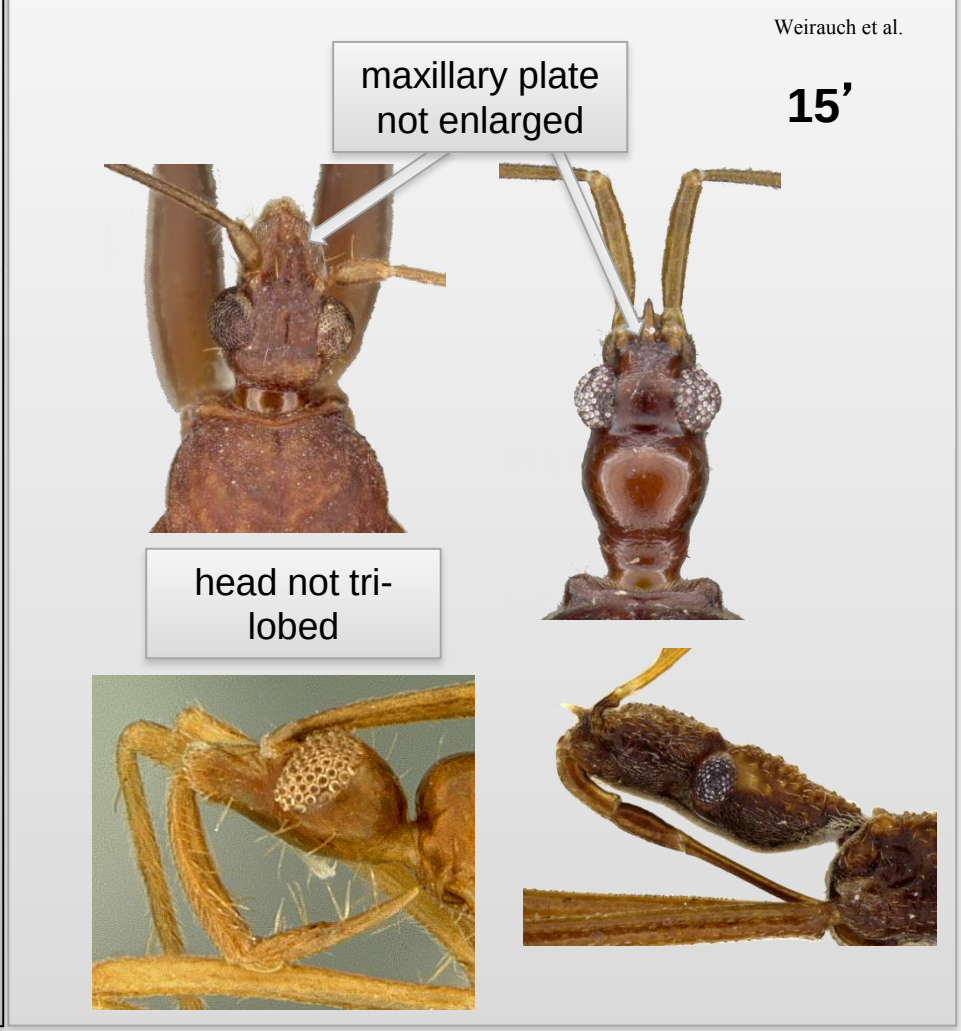




14 (13)	Foreleg not chelate or subchelate, forefemur without prominents spines, body somewhat flattened, head almost twice as long as high ……**Phimophorinae** [Neotropics, Oriental]	
14’ (13)	Foreleg usually chelate or subchelate; if not thus modified, then forefemur with prominent spines, body not flattened, head almost as high as long ……**Phymatinae** [Cosmopolitan]	**See key to tribes**

doi:10.3752/cjai.2014.26





15 (13)	Maxillary plate greatly enlarged, mandibular plate small, clypeus elongate and thus head appearing tri-lobed in dorsal view ……**Pseudocetherinae** [Circumtropical]	
15’ (13)	Maxillary plate typically small, mandibular plate small or large, head not appearing tri-lobed	**16**

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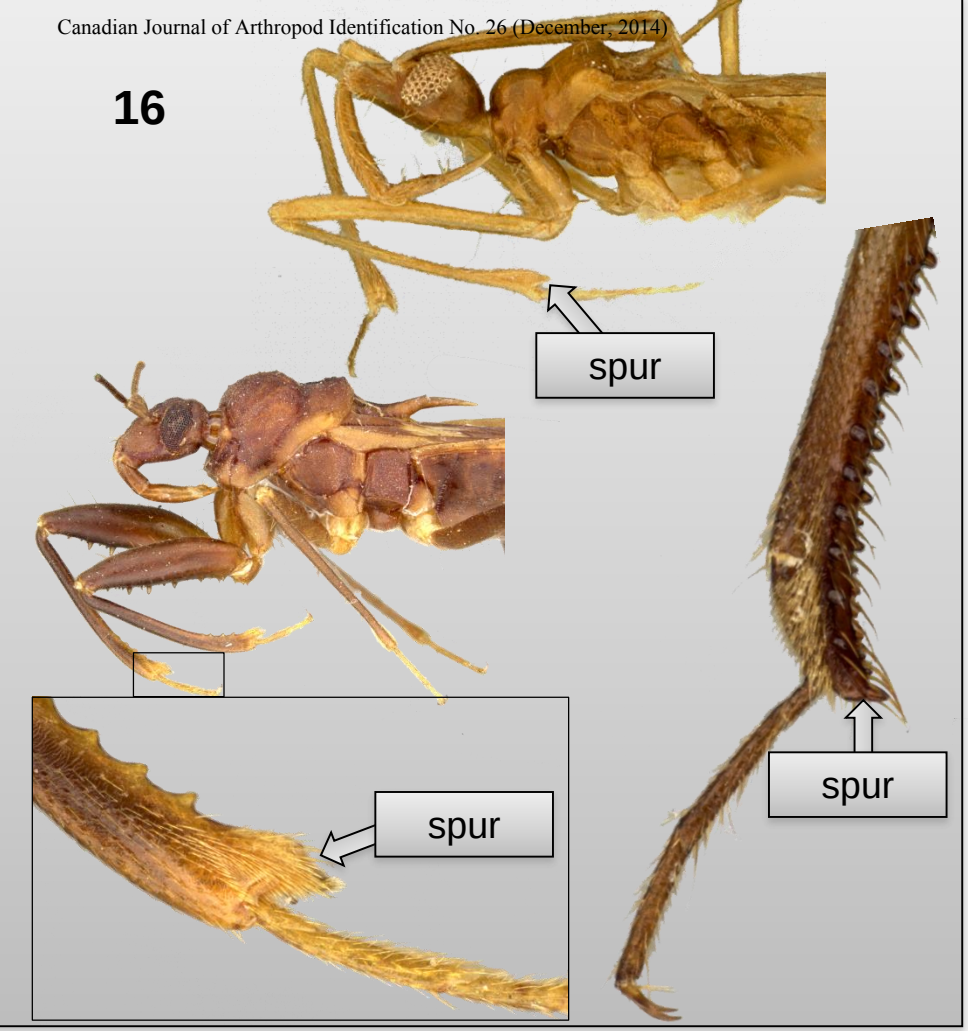
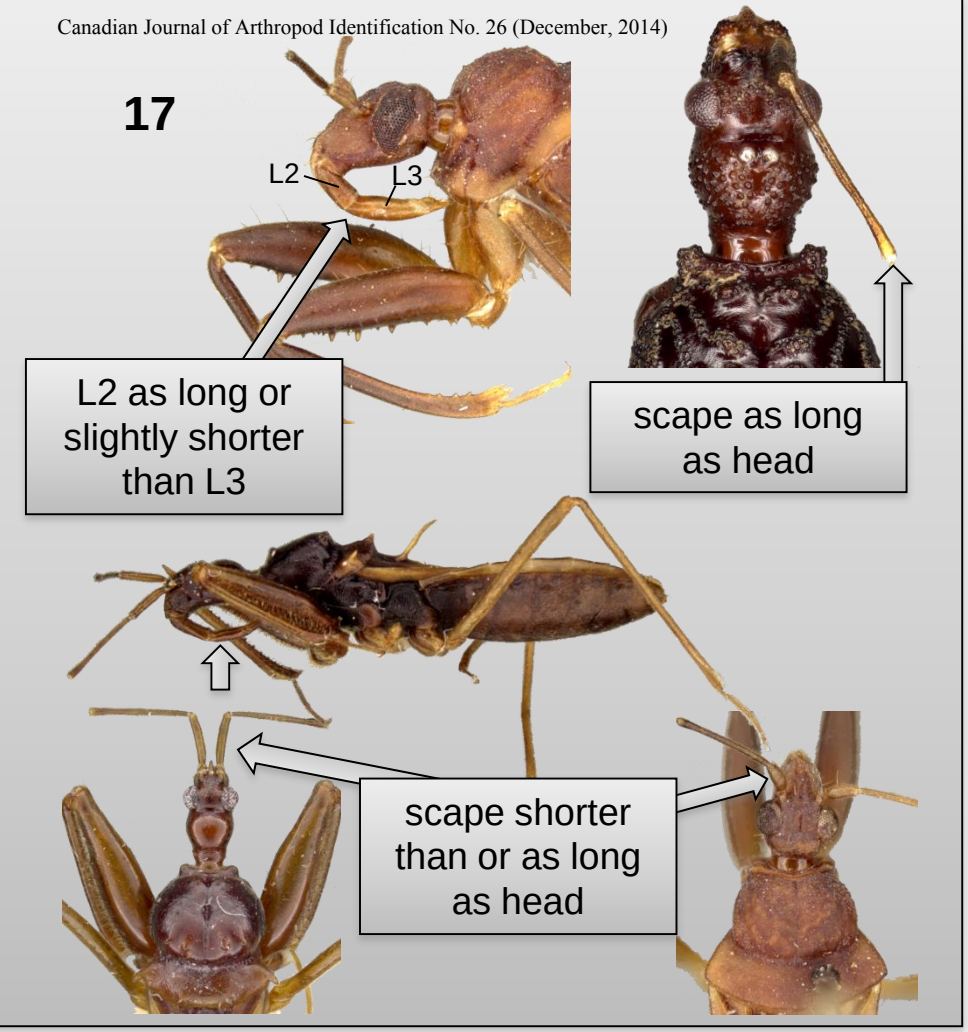
16

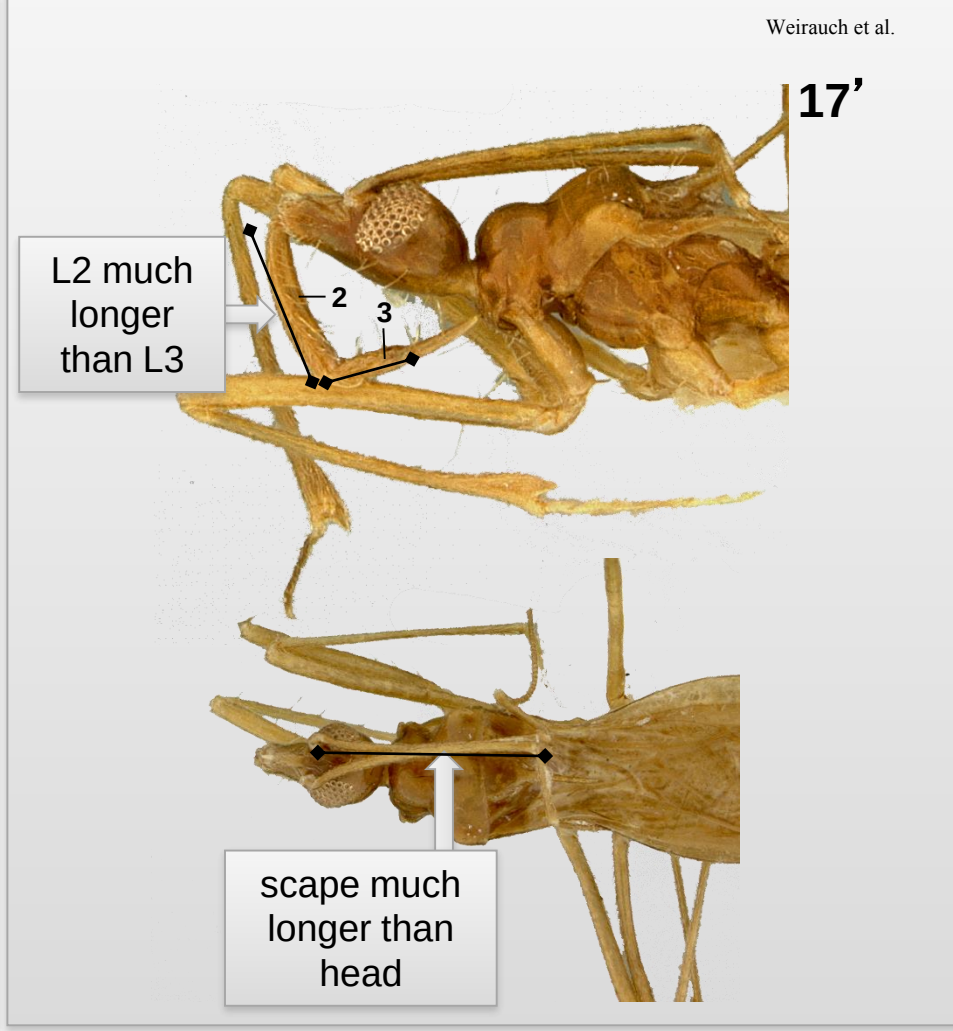


16’

16 (15)	Foretibia with spur	**17**
16’ (15)	Foretibia without spur	**18**

doi:10.3752/cjai.2014.26





17 (16)	Second (first visible) labial segment (L2) as long or slightly shorter than third segment (L3), scape shorter than or as long as head ……..**Vesciinae** [Neotropical]	
17’ (16)	Second (first visible) labial segment (L2) much longer than third segment (L3), scape much longer than head …….. **Visayanocorinae** [Paleotropical]	

18

ocelli absent

ocelli present

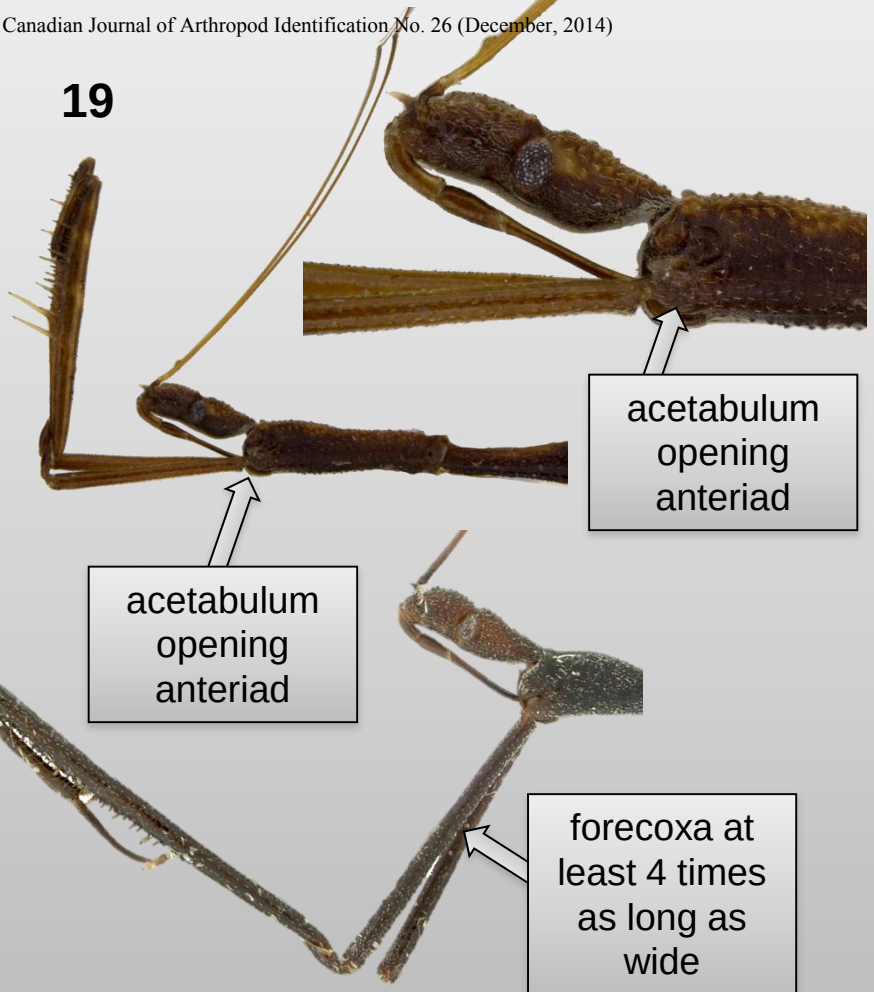
18’

ocelli present

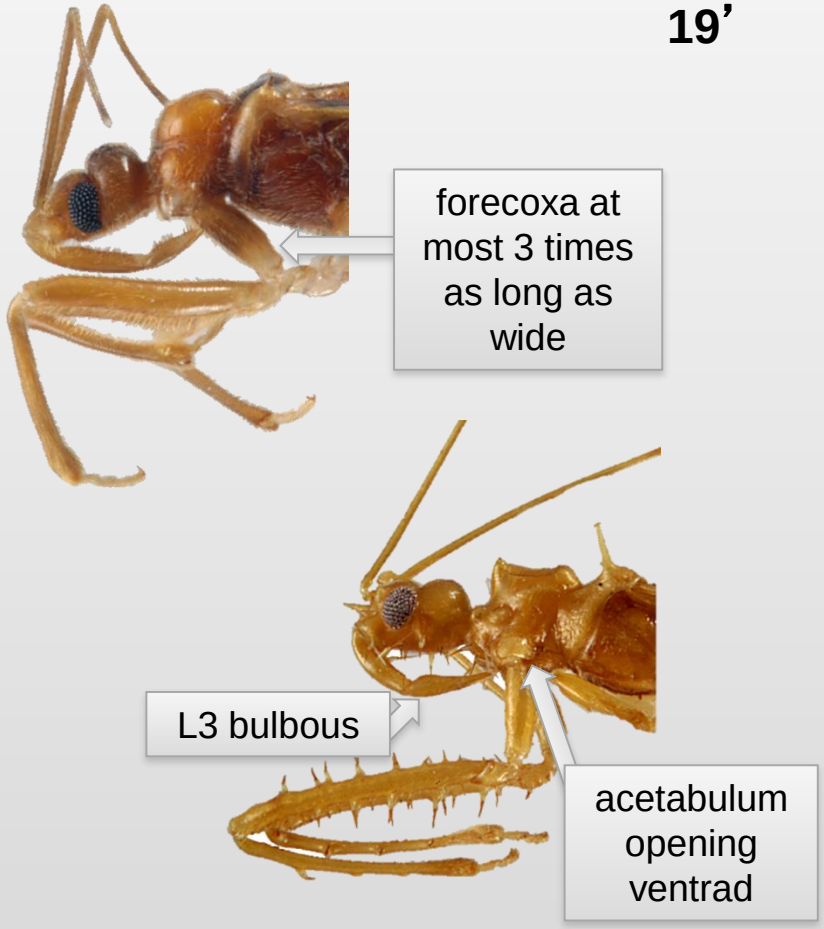
18 (16)	Ocelli absent, even in macropterous forms; if ocelli present (1 genus of Emesinae) forecoxa usually at least 4 times as long as wide	**19**
18’ (16)	Ocelli present	**20**

doi:10.3752/cjai.2014.26

19

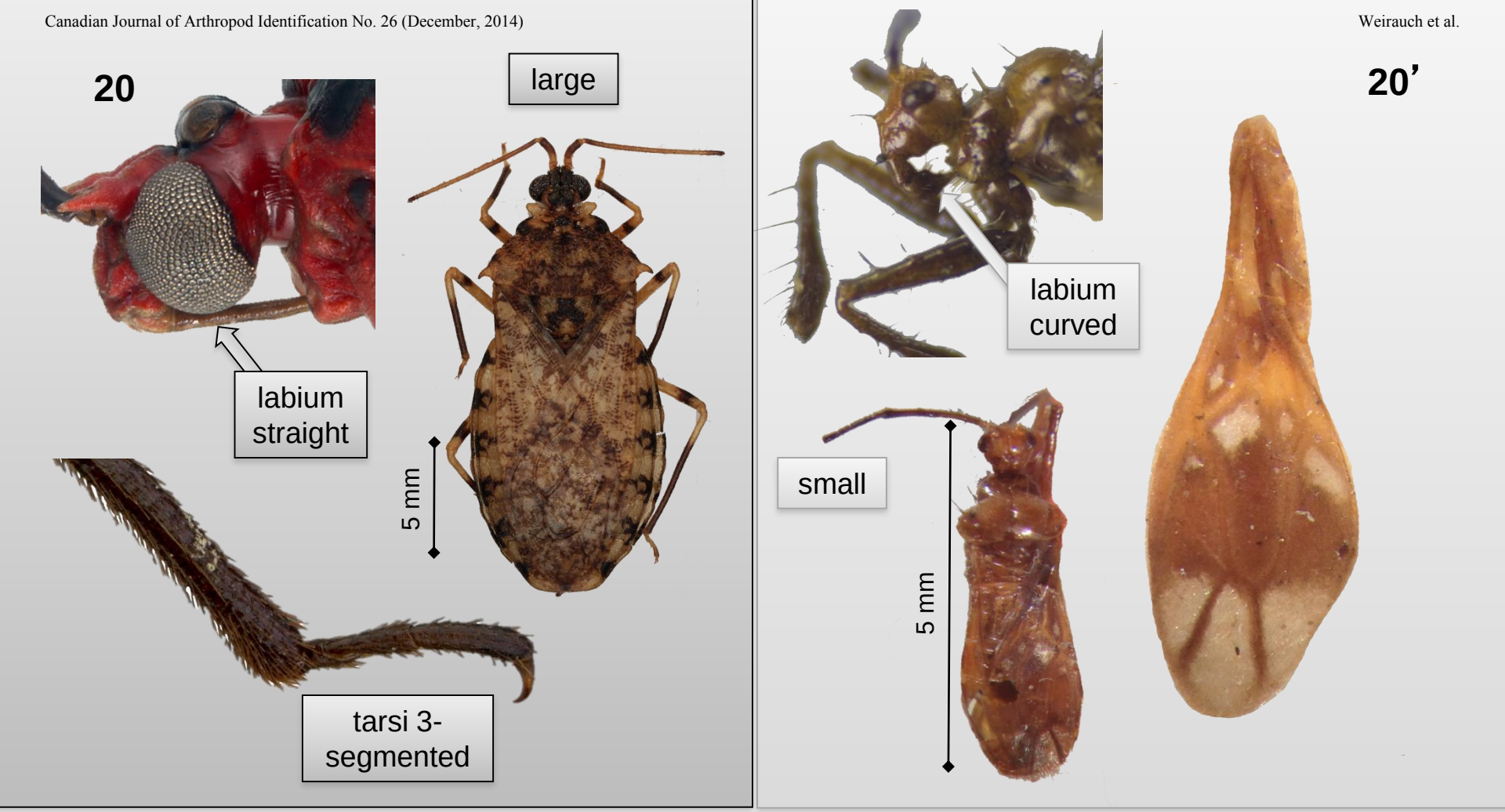


19’



19 (18)	Forecoxa usually at least 4 times as long as wide, acetabulum of foreleg opening anteriad ……..……**Emesinae** [Cosmopolitan]
19’ (18)	Forecoxa at most 3 times as long as wide, acetabulum of foreleg opening ventrad; third visible labial segment (L3) often bulbous ……**Saicinae** [Cosmopolitan]

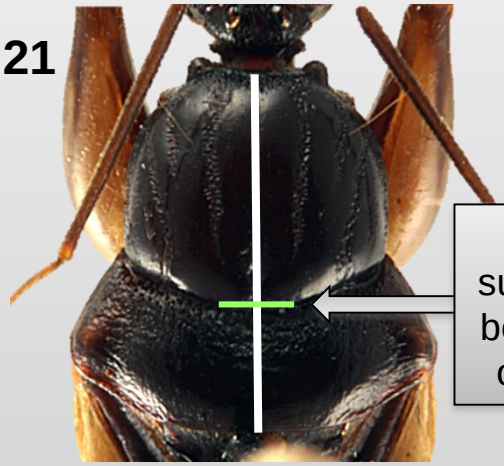
doi:10.3752/cjai.2014.26



20 (18)	Large, with small head, labium straight and slender, tarsi 3-segmented, color brown (or red and black in species with fossula spongiosa) ……**Sphaeridopinae (in part)** [Neotropical]	
20’ (18)	Small, labium curved and stout, tarsi 2-segmented, wing venation and color as in Plate 20’ ……**Manangocorinae** [Oriental]	

doi:10.3752/cjai.2014.26

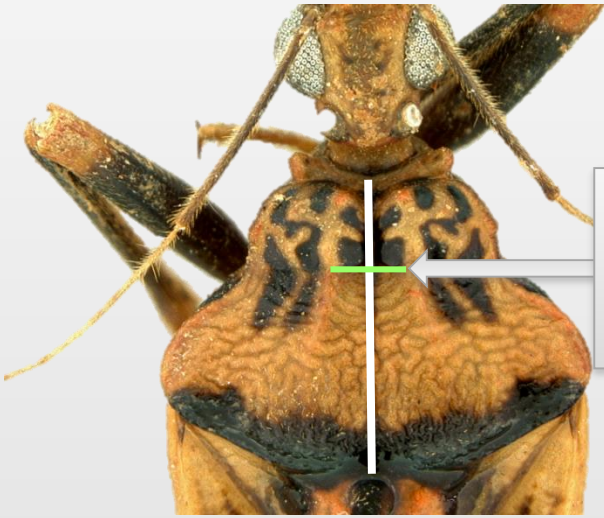
21



transverse sulcus located behind middle of pronotum

forecoxa usually ~2 times as long as wide; flat laterally

21’



transverse sulcus at or in front of middle of pronotum

forecoxa usually less than 2 times as long as wide; rounded laterally

21 (6)	Transverse sulcus on pronotum located behind middle of pronotum, forecoxa usually ~2 times as long as wide and with lateral surface flat ……..…. **Peiratinae** [Cosmopolitan]	
21’ (6)	Transverse sulcus on pronotum usually located at or in front of middle of pronotum, forecoxa usually less than 2 times as long as wide and without lateral surface flat	**22**

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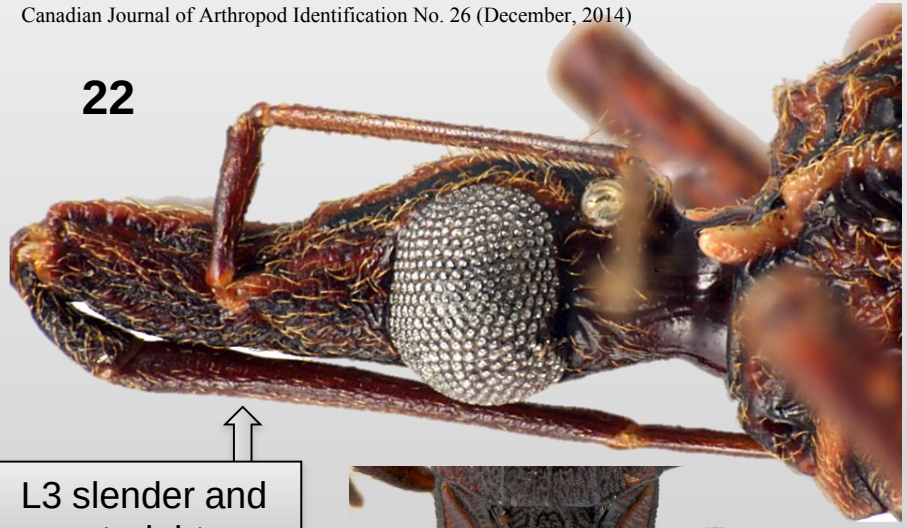
22



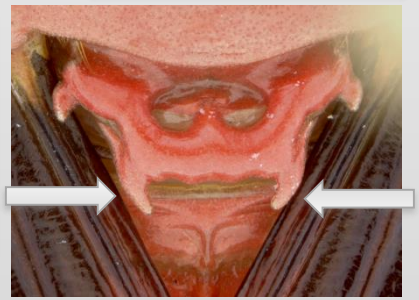
L3 slender and straight

scutellum without posteriorly projecting prongs

22’

L3 curved and incrassate

if L3 slender and straight, then scutellum with posteriorly projecting prongs



22 (21)	Third (second visible) labial segment (L3) slender and straight; scutellum never with posteriorly projecting lateral prongs ……**Triatominae (in part)** [Cosmopolitan]	**See key to tribes**
22’ (21)	Second visible (third) labial segment (L3) curved and usually slightly incrassate; if slender and straight, then with two posteriorly projecting lateral prongs	**23**

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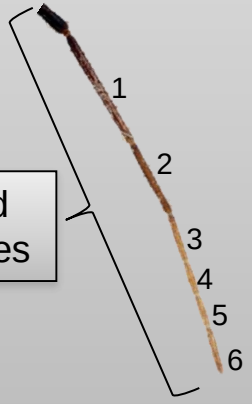
23

scutellum with two prongs and without median tip

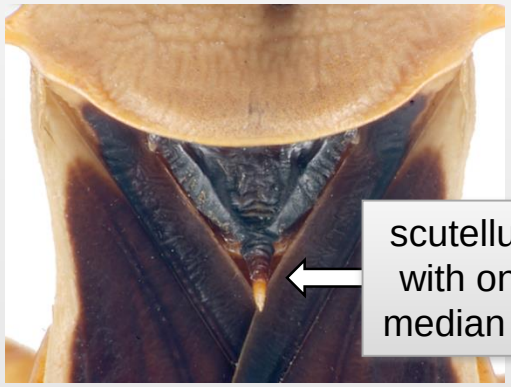
scape

pedicel

subdivided flagellomeres



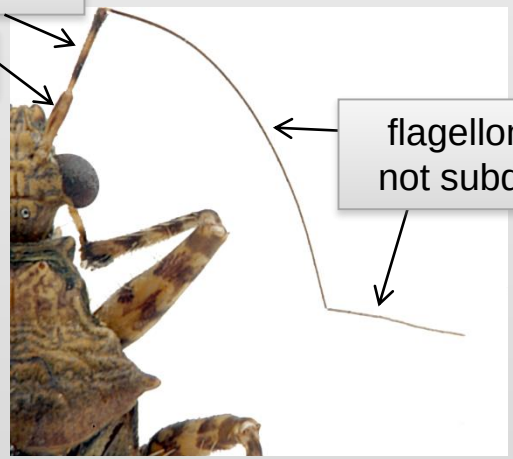
23’



scutellum with one median tip

pedicel

scape



flagellomeres not subdivided

23 (22)	Scutellum usually with two posteriorly projecting lateral prongs and usually without the median tip, flagellomeres usually subdivided into 4-6 pseudosegments ……..……**Ectrichodiinae** [Cosmopolitan]	
23’ (22)	Scutellum with one median tip and without posteriorly projecting lateral prongs, flagellomeres not subdivided into pseudosegments	**24**

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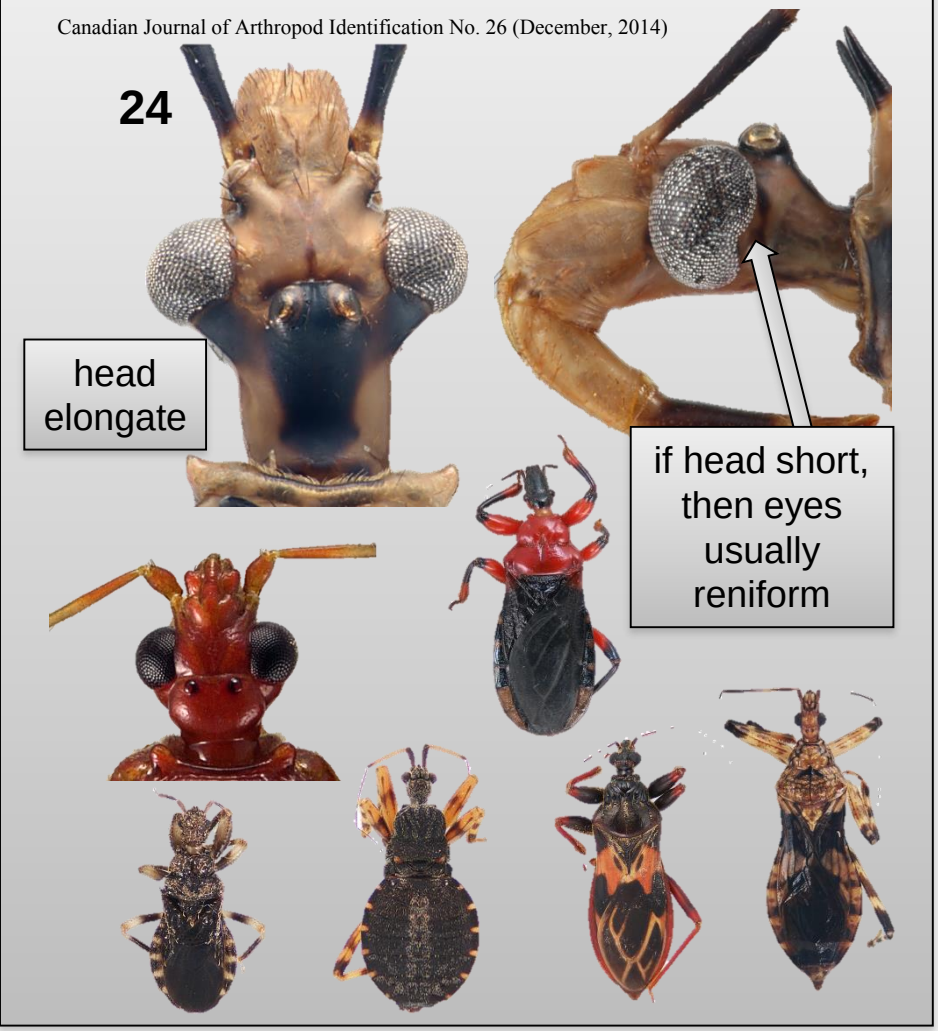
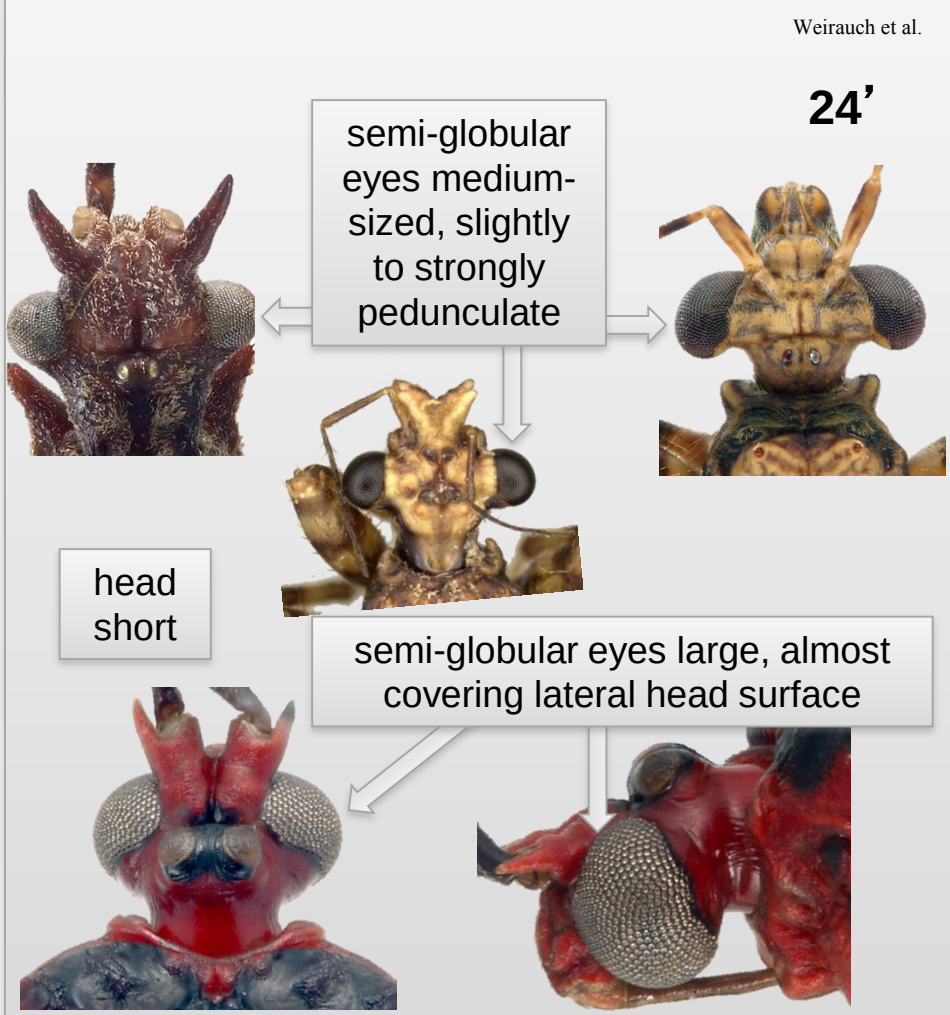
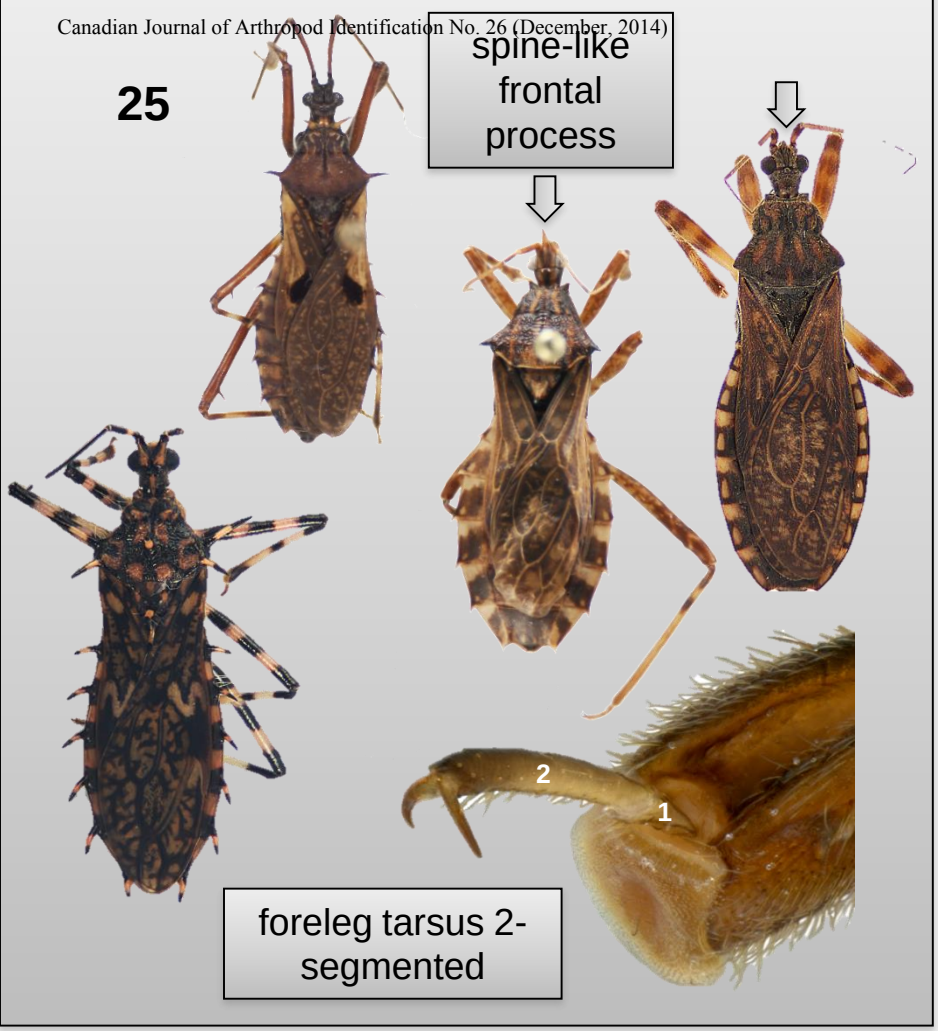
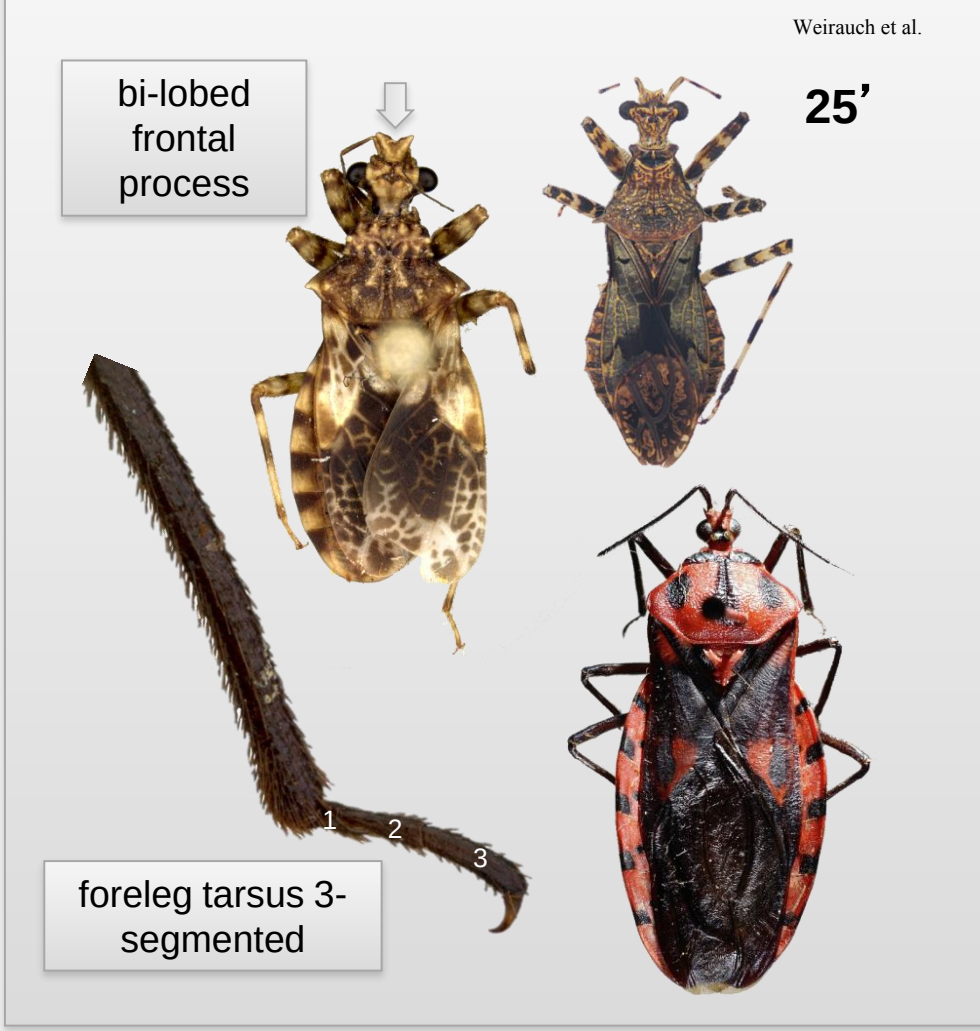




24 (23)	Head usually elongate; if short, then eyes usually reniform and neither strongly pedunculate nor covering almost the entire lateral surface of the head ……**Reduviinae** [Cosmopolitan]	
24’ (23)	Head short, with semi-globular eyes that are either medium-sized and slightly to strongly pedunculate or large and almost covering the entire lateral surface of the head	**25**

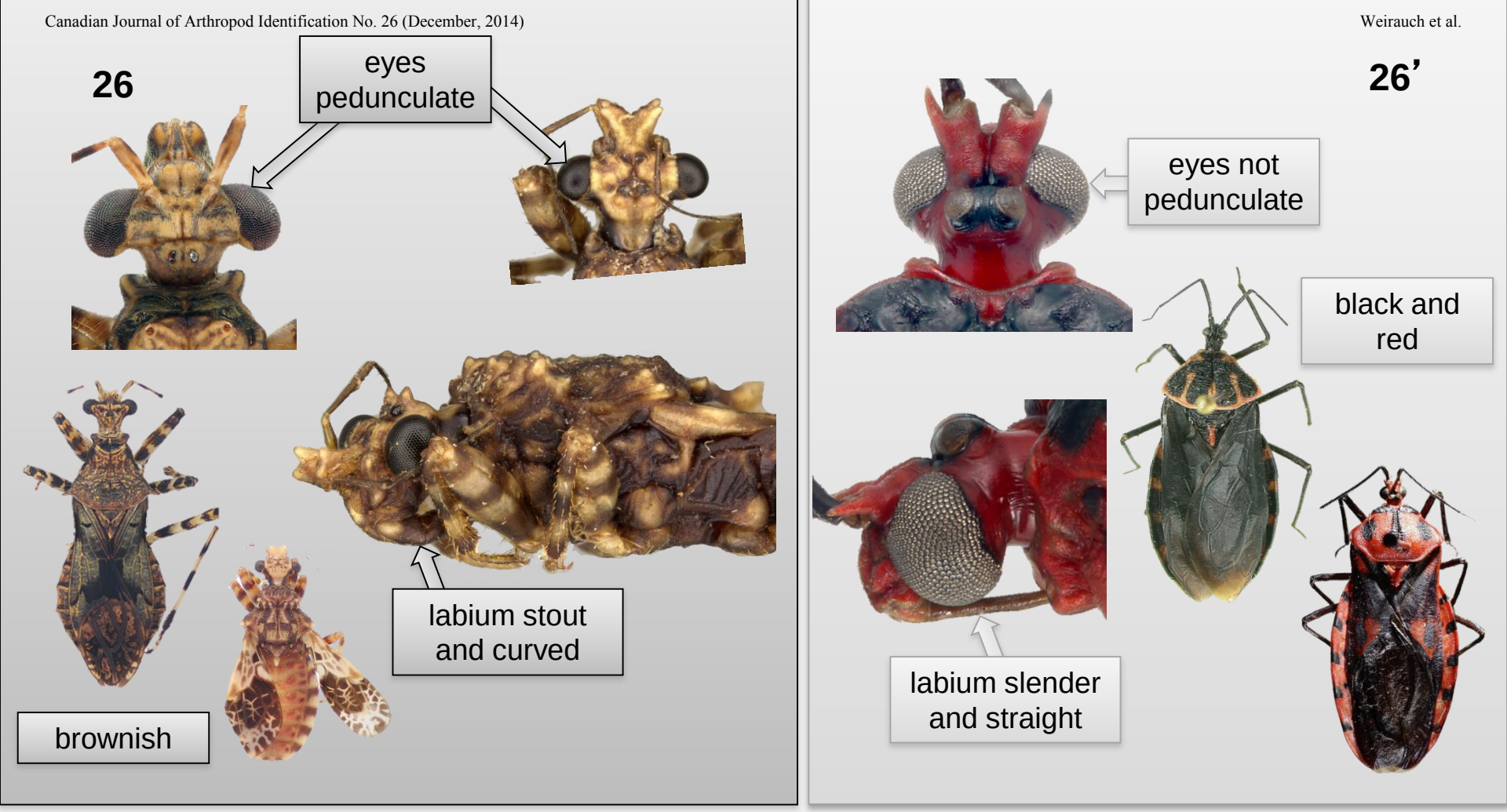
doi:10.3752/cjai.2014.26





25 (<u>24</u>)	Tarsal formula 2-3-3, habitus as in Plate 25, sometimes with median, spine-like frontal process or dilated foretibia ……**<u>Salyavatinae</u>** [Circumtropical]	
25’ (<u>24</u>)	Tarsal formula 3-3-3, habitus as in Plate 25’, never with dilated foretibia; if frontal process present, then process bi-lobed	**<u>26</u>**

doi:10.3752/cjai.2014.26



26 (25)	Eyes pedunculate, labium stout and curved, body mottled brownish ……**Cetherinae** [Afrotropical; Neotropical]
26’ (25)	Eyes not pedunculate, labium slender and straight, body black and red ……**Sphaeridopinae (in part)** [Neotropical]

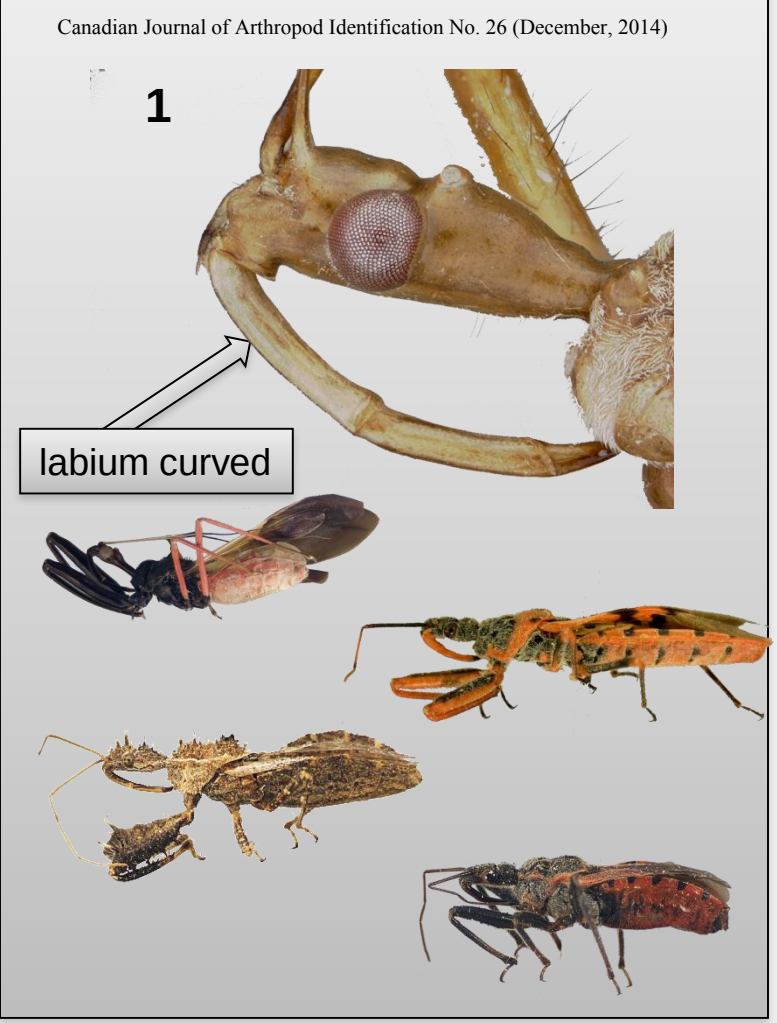
doi:10.3752/cjai.2014.26

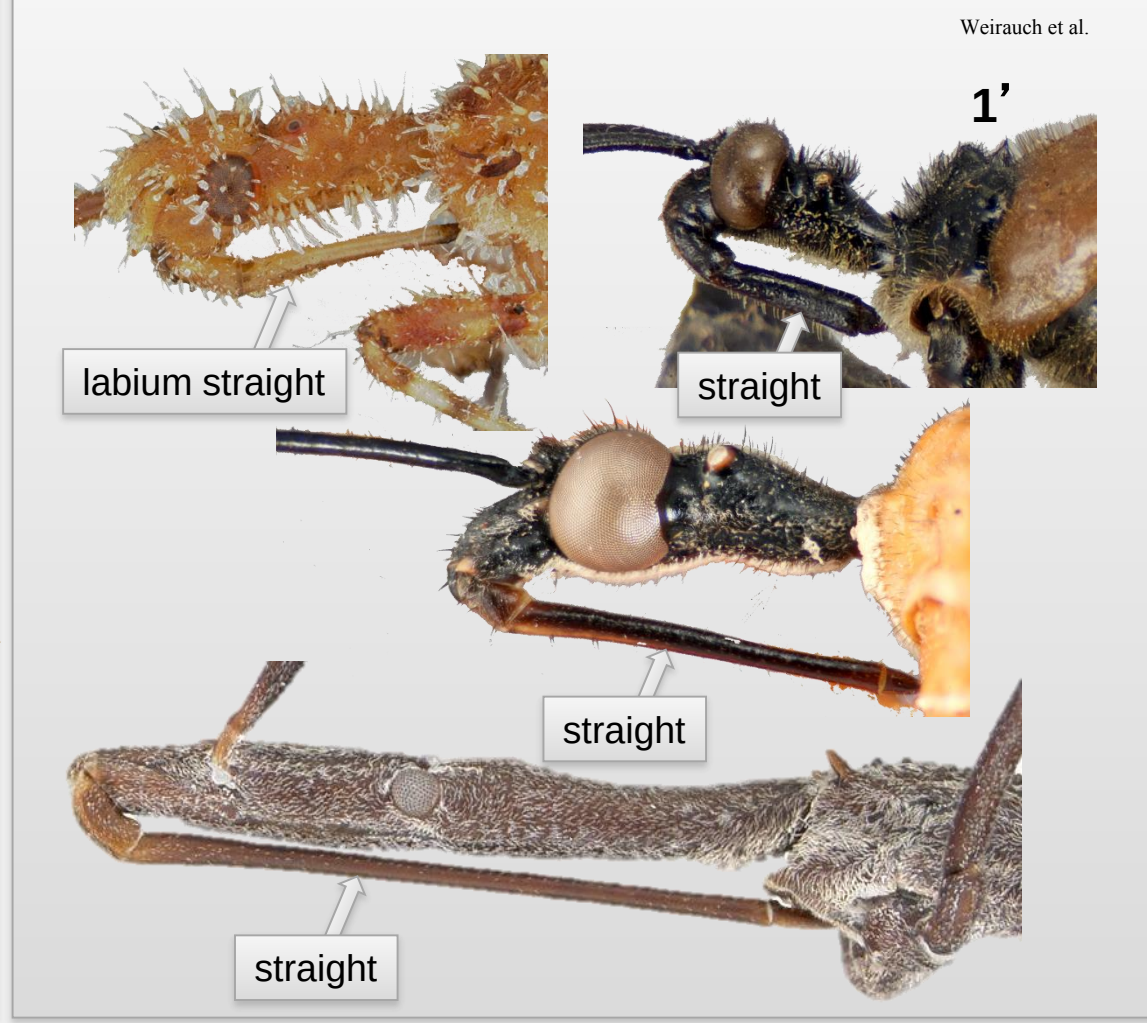
Key to the Tribes of Harpactorinae

To Tribe Key

Back to Subfamily Key

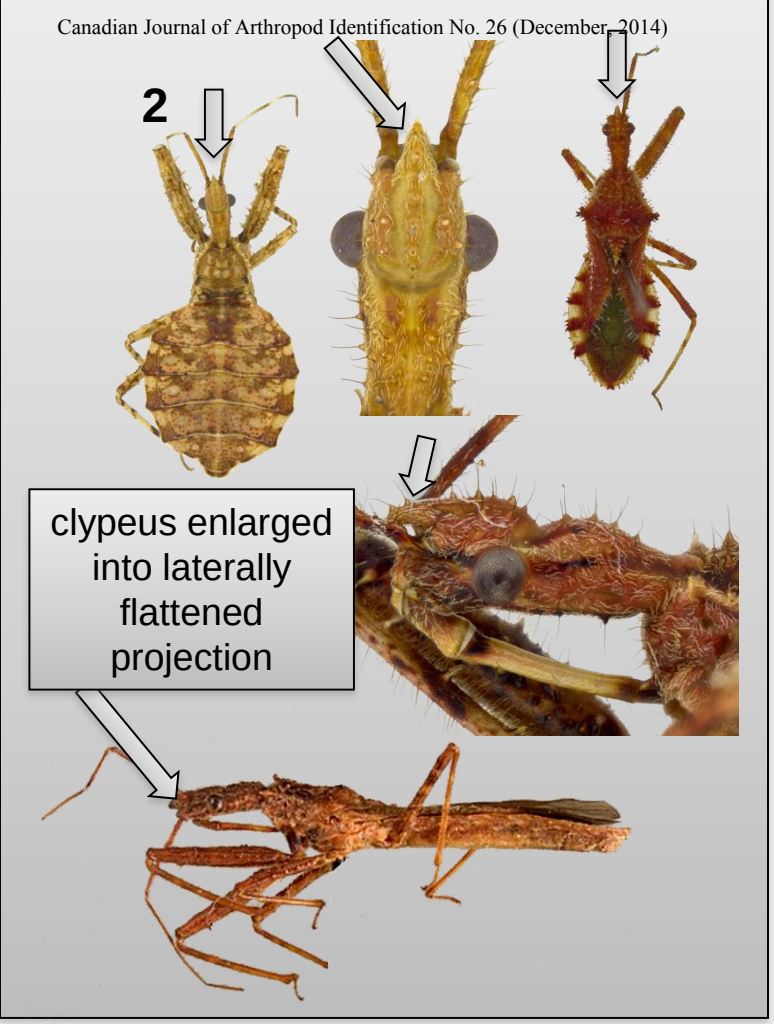
doi:10.3752/cjai.2014.26





1	Labium curved …… **Harpactorini** [Cosmopolitan]	
1’	Labium straight	**2**

doi:10.3752/cjai.2014.26



2 (1)	Clypeus enlarged into laterally flattened projection …… **Dicrotelini** [Oriental]	
2’ (1)	Clypeus short and rounded, not enlarged into projection	**3**

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3

body elongate, appendages slender

3’

body robust, appendages not very slender

3 (2)	Body elongate, appendages very slender and long ……..…… **Rhaphidosomini** [Afrotropical; Oriental]	
3’ (2)	Body robust, appendages not very slender and long	**4**

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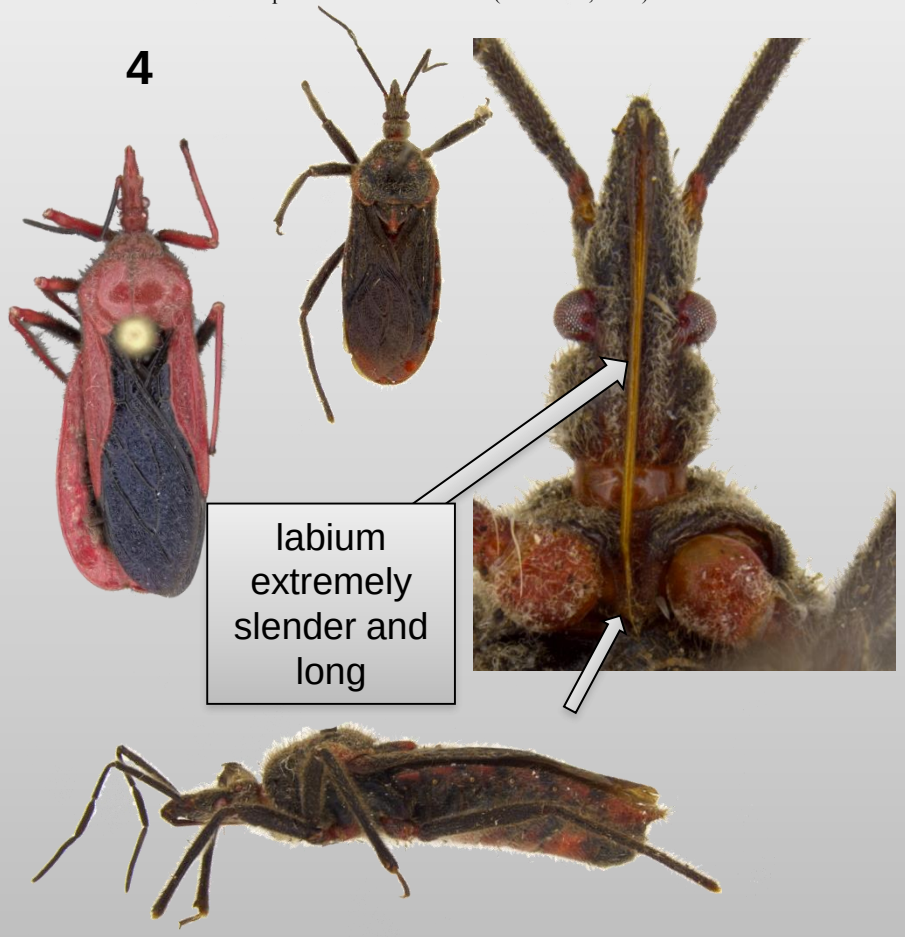
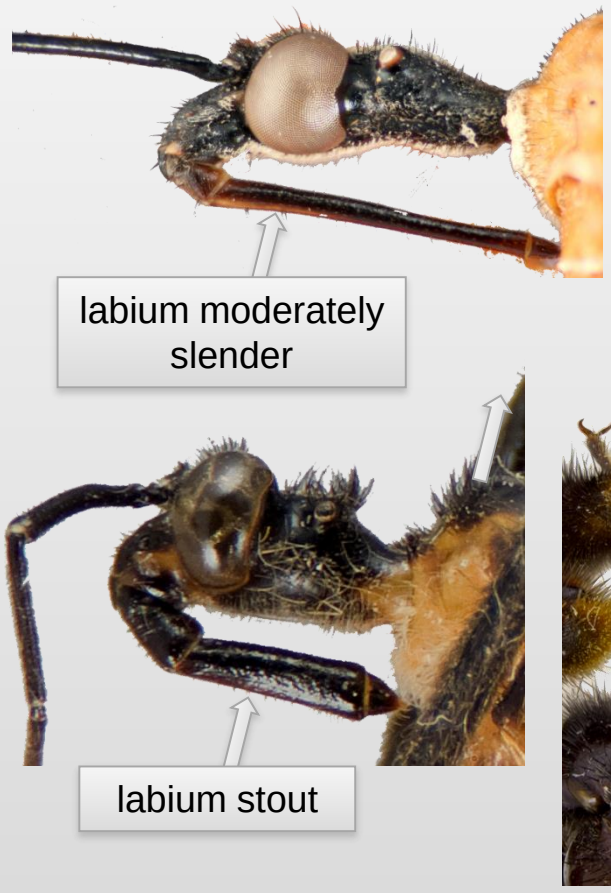
4



4’



4 (3)	Labium extremely slender, reaching to middle of forecoxa …… **Tegeini** [Afrotropical; Oriental]	
4’ (3)	Labium short and usually moderately slender or stout; if slender, then at most reaching anterior margin of forecoxa	**5**

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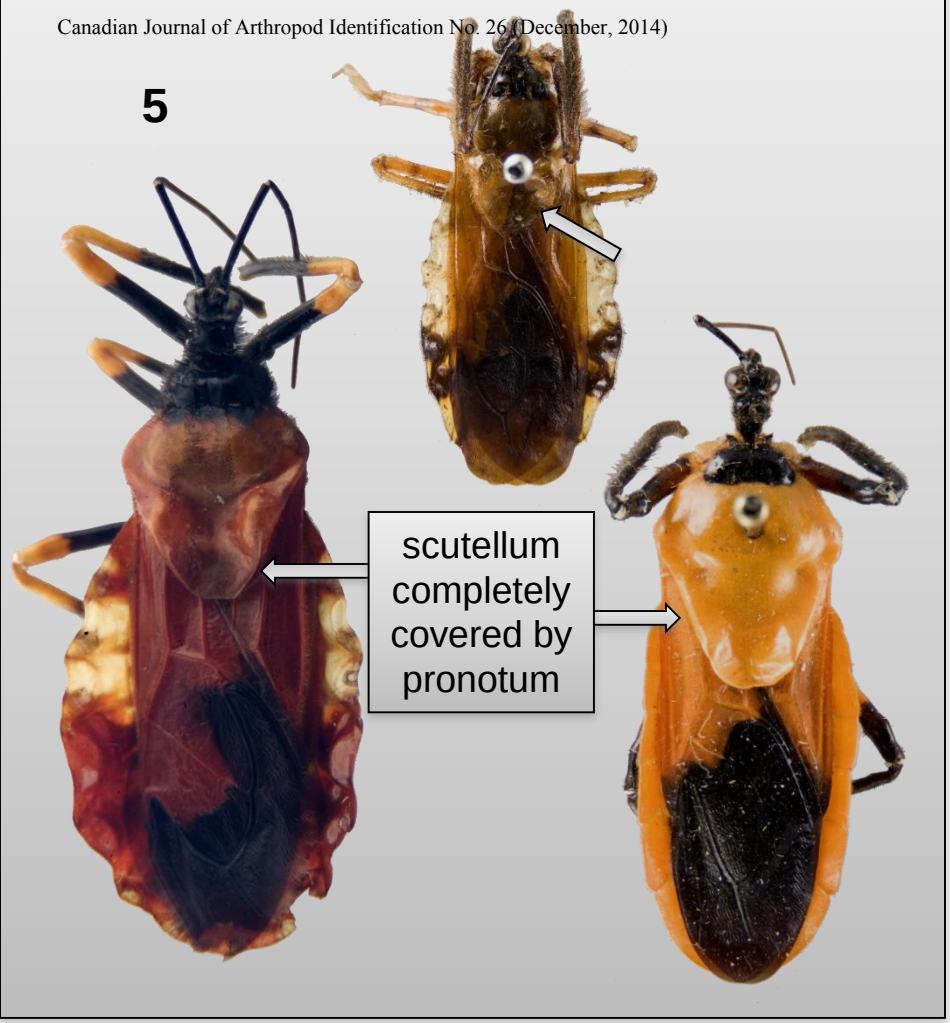
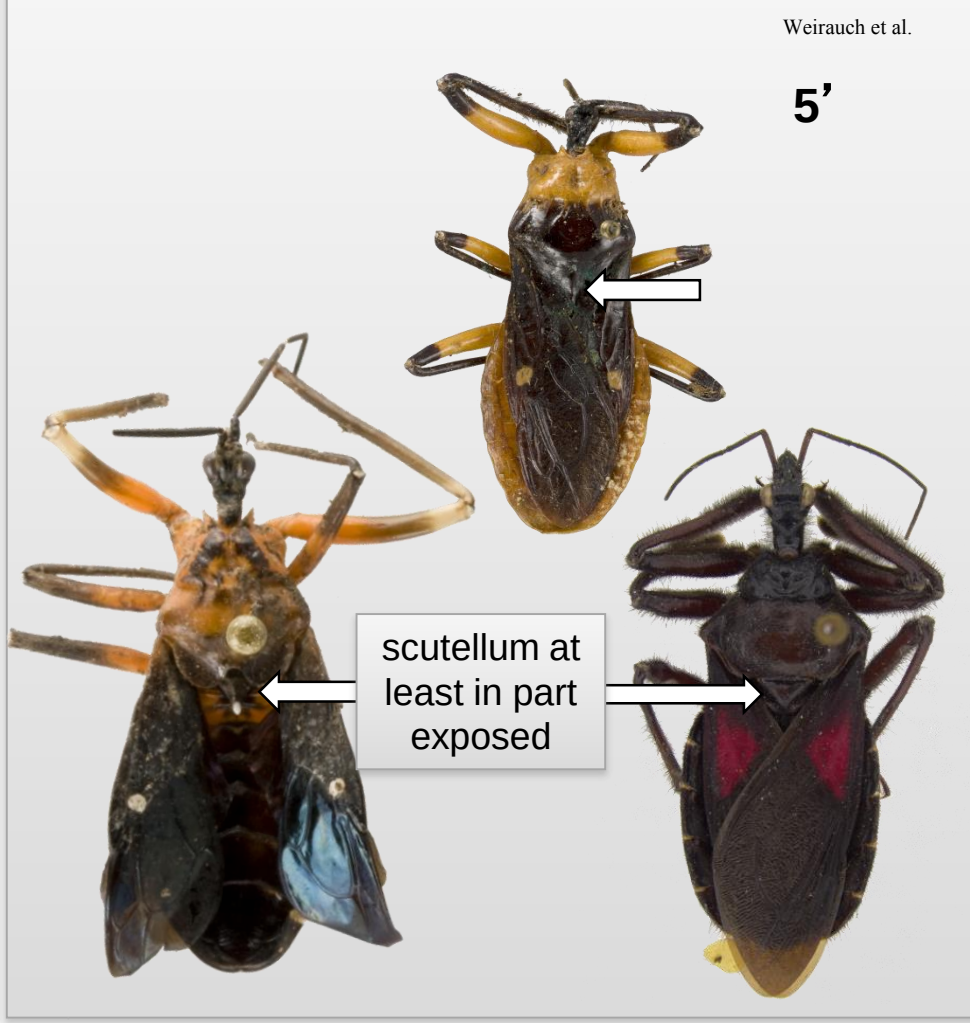
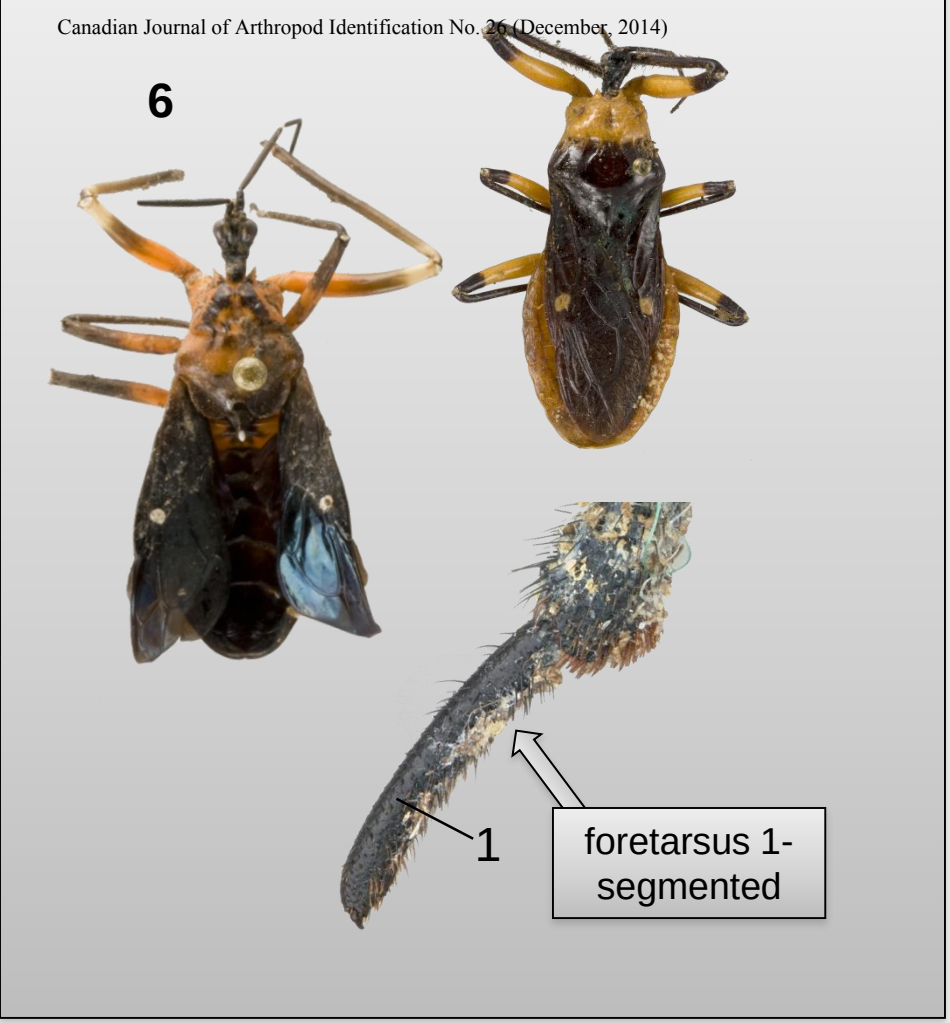
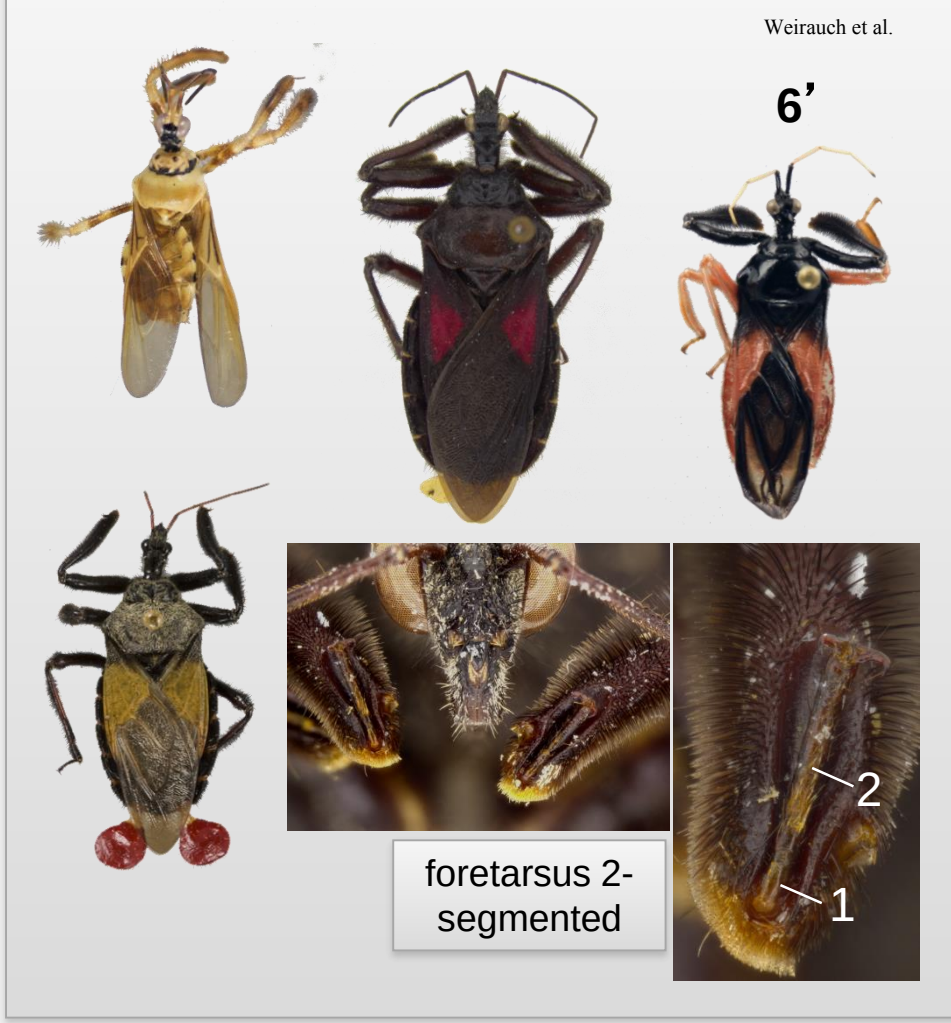




5 (4)	Pronotum completely covering scutellum …… **Diaspidiini** [Afrotropical]	
5’ (4)	Scutellum at least in part exposed	**6**

doi:10.3752/cjai.2014.26





6 (5)	Foretarsus 1-segmented, habitus as in Plate 6 …… **Ectinoderini** [Oriental]
6’ (5)	Foretarsus 2-segmented, habitus as in Plate 6’ ……**Apiomerini** [Neotropical]

doi:10.3752/cjai.2014.26

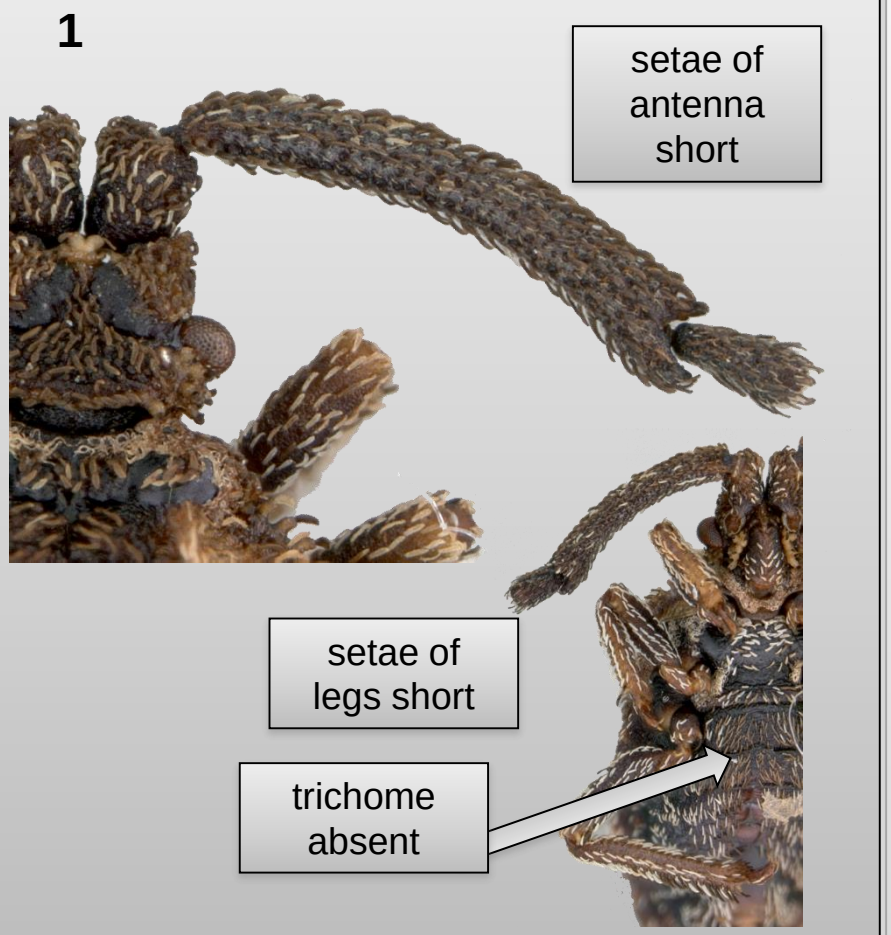
Key to the Tribes of Holoptilinae

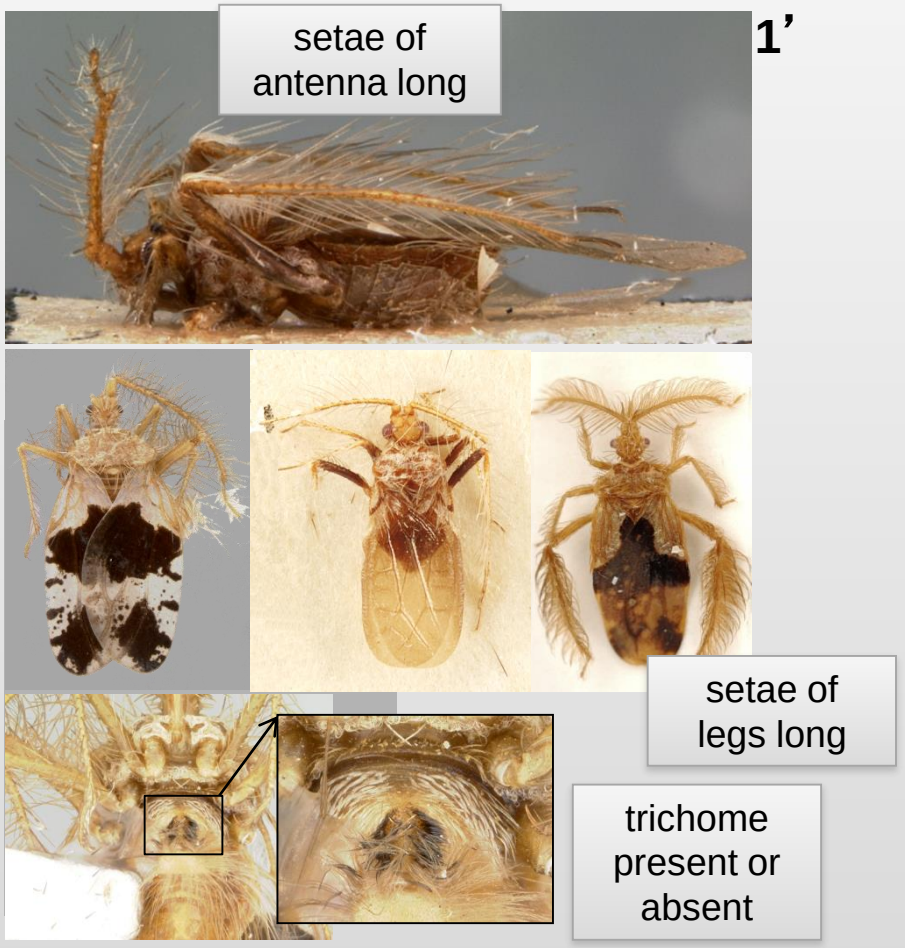
Modified from Wygodzinsky and Usinger (1963)

To Tribe Key

Back to Subfamily Key

doi:10.3752/cjai.2014.26

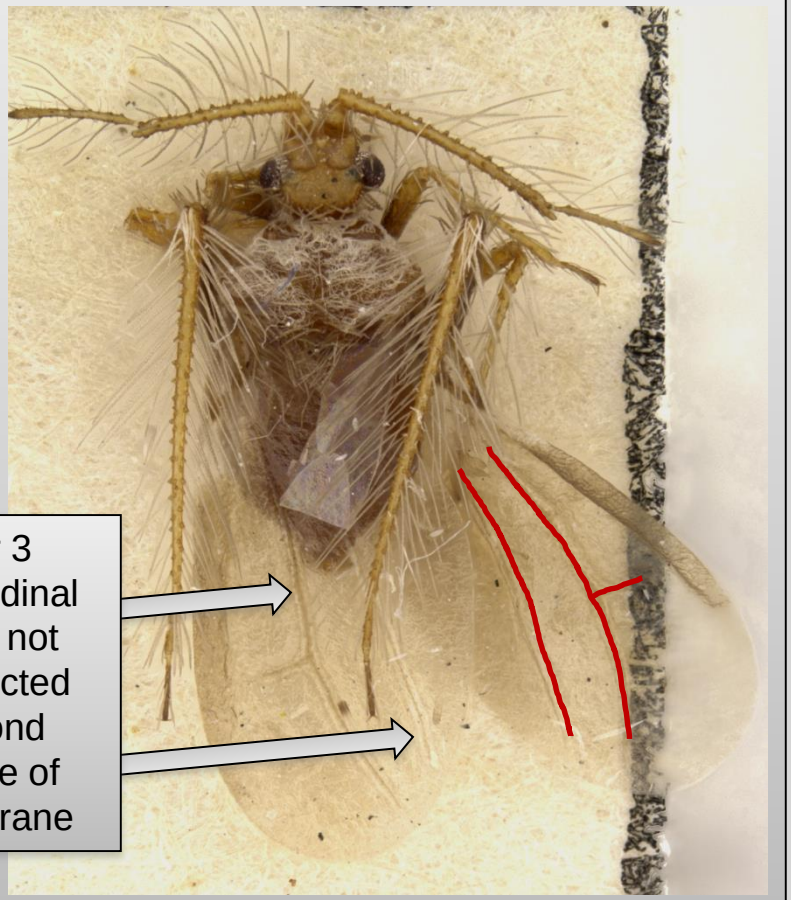




1	Setae of antenna and legs shorter than diameter of respective segments, trichome absent …… **Aradellini** [Australia]	
1’	Setae of antenna and legs longer than diameter of respective segments, trichome absent or present	**2**

doi:10.3752/cjai.2014.26

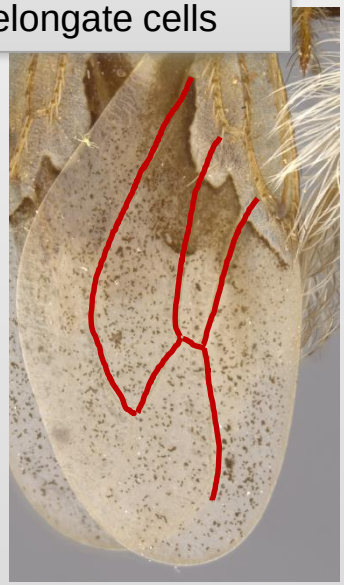
2



2 or 3 longitudinal veins not connected beyond middle of membrane

2’

3 longitudinal veins, inner and middle veins joining subapically to form elongate cells



trichome present

2 (1)	Membrane with 2 or 3 free longitudinal veins not connected beyond middle of membrane; trichome absent; usually 5 mm or less …… **Dasycnemini** [Circumtropical]
2’ (1)	Membrane with 3 longitudinal veins, at least inner and middle veins joining subapically to form an elongate cell; trichome present; usually 5 mm or longer …….. **Holoptilini** [Afrotropical; Oriental; Australian]

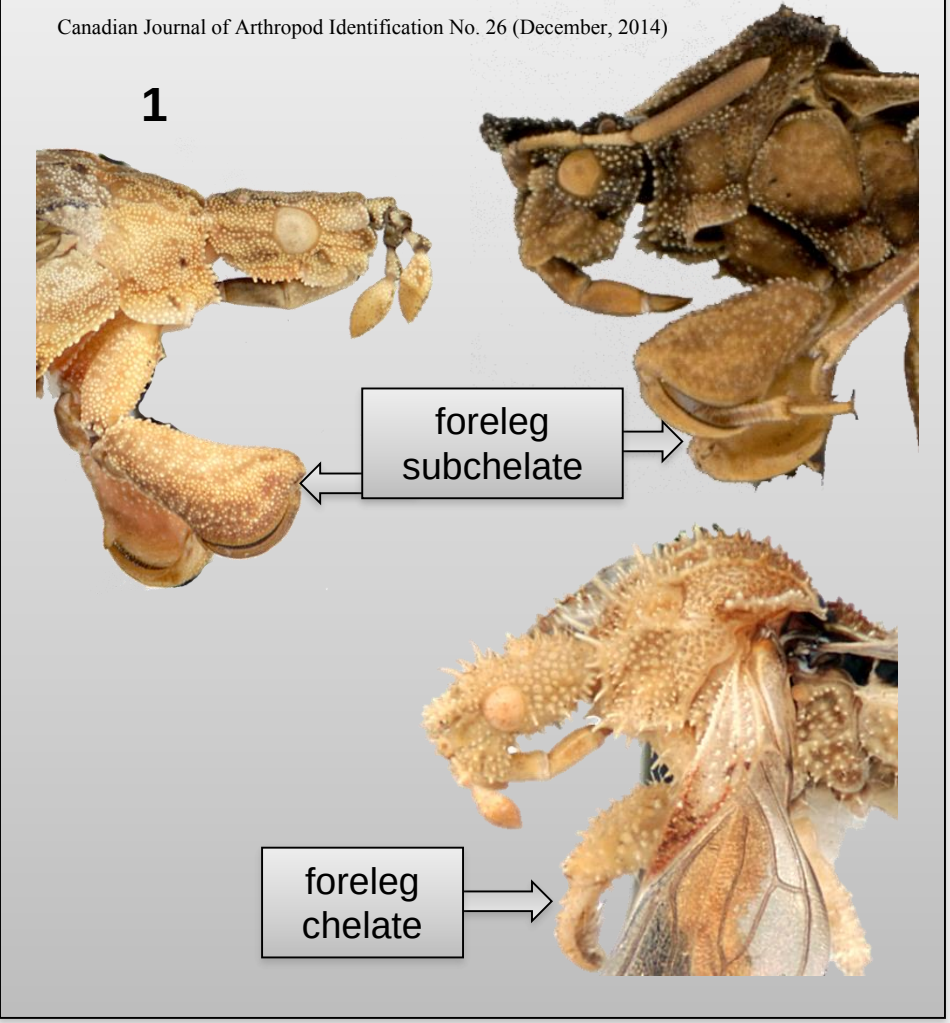
doi:10.3752/cjai.2014.26

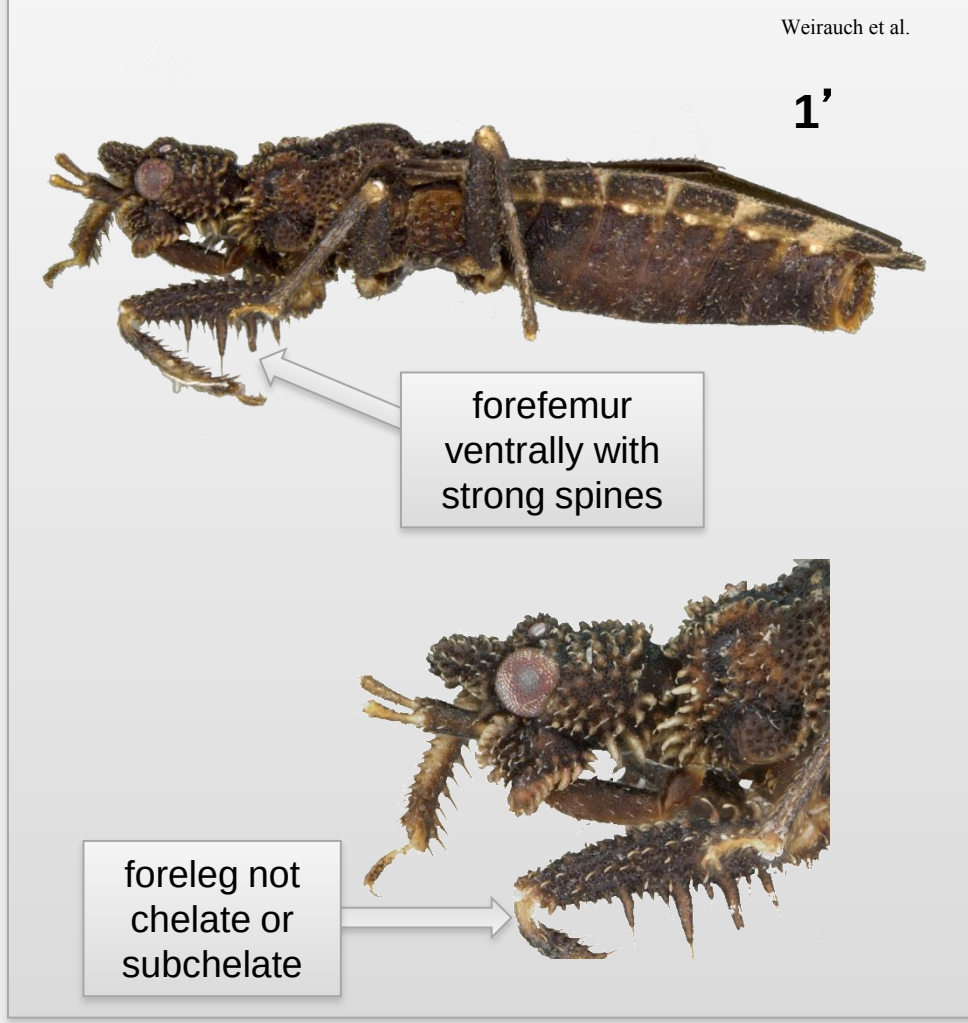
Key to the Tribes of Phymatinae

To Tribe Key

Back to Subfamily Key

doi:10.3752/cjai.2014.26

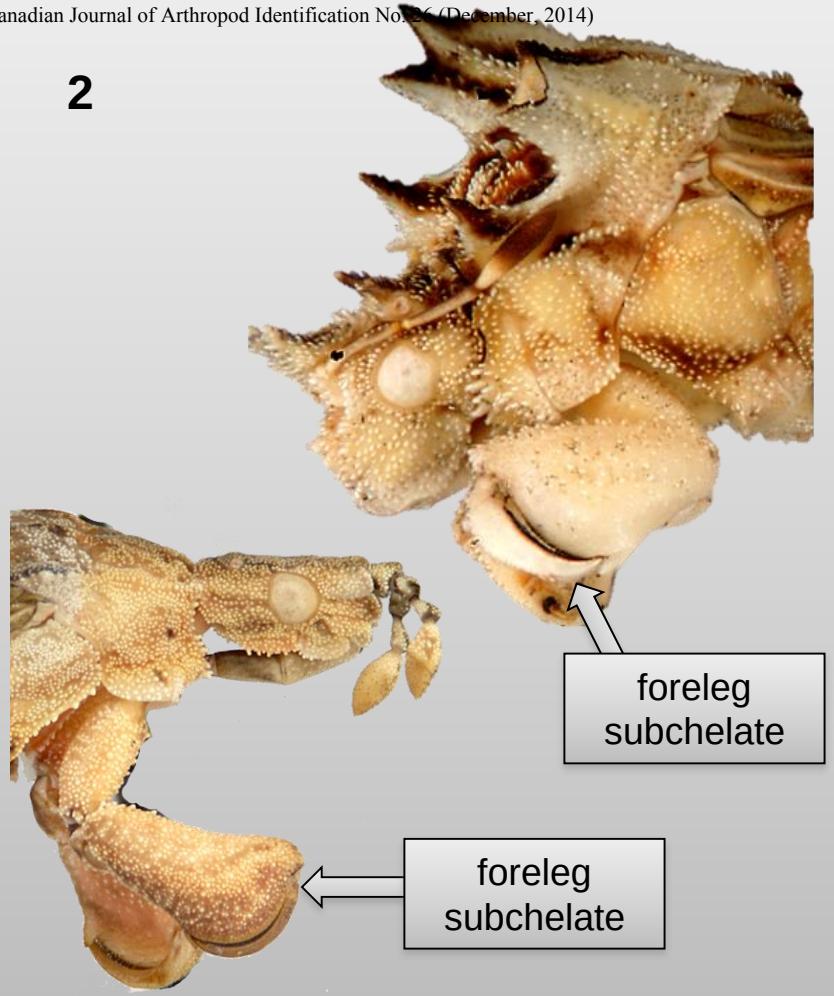




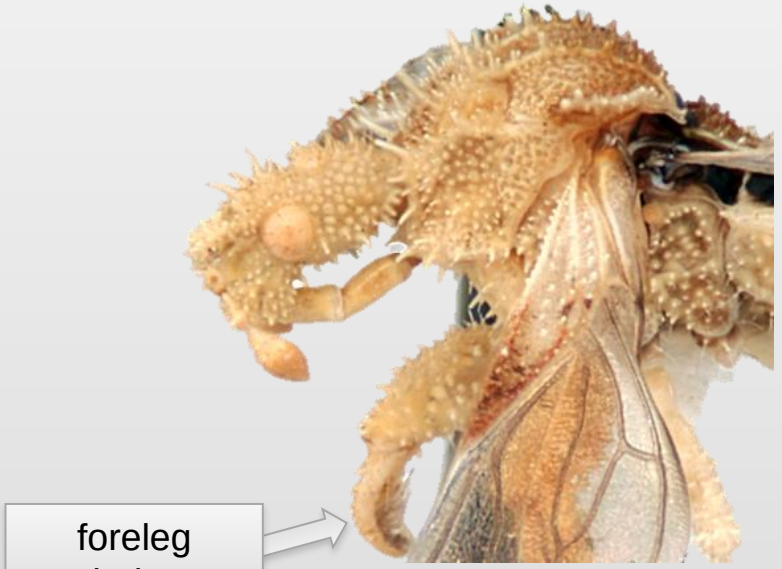
1	Forefemur and foretibia forming a chelate or subchelate raptorial leg, forefemur ventrally not with strong spines	**2**
1’	Forefemur and foretibia not forming a chelate or subchelate raptorial leg, forefemur ventrally with strong spines …….. **Themonocorini** [Afrotropical]	

doi:10.3752/cjai.2014.26

2



2’



2 (<u>1</u>)	Foreleg subchelate (i.e., tibia clasped against enlarged body of femur)	**<u>3</u>**
2’ (<u>1</u>)	Foreleg chelate (i.e., tibia clasped against distal process on femur) …….. **Carcinocorini** [Oriental]	

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3

scutellum small and triangular

3’

scutellum large and tongue-shaped

3 (2)	Scutellum small and triangular ..... **Phymatini** [Cosmopolitan]
3’ (2)	Scutellum large and tongue-shaped ..... **Macrocephalini** [Cosmopolitan]

doi:10.3752/cjai.2014.26

Key to the Tribes of Triatominae

Modified from Lent and Wygodzinsky (1979)

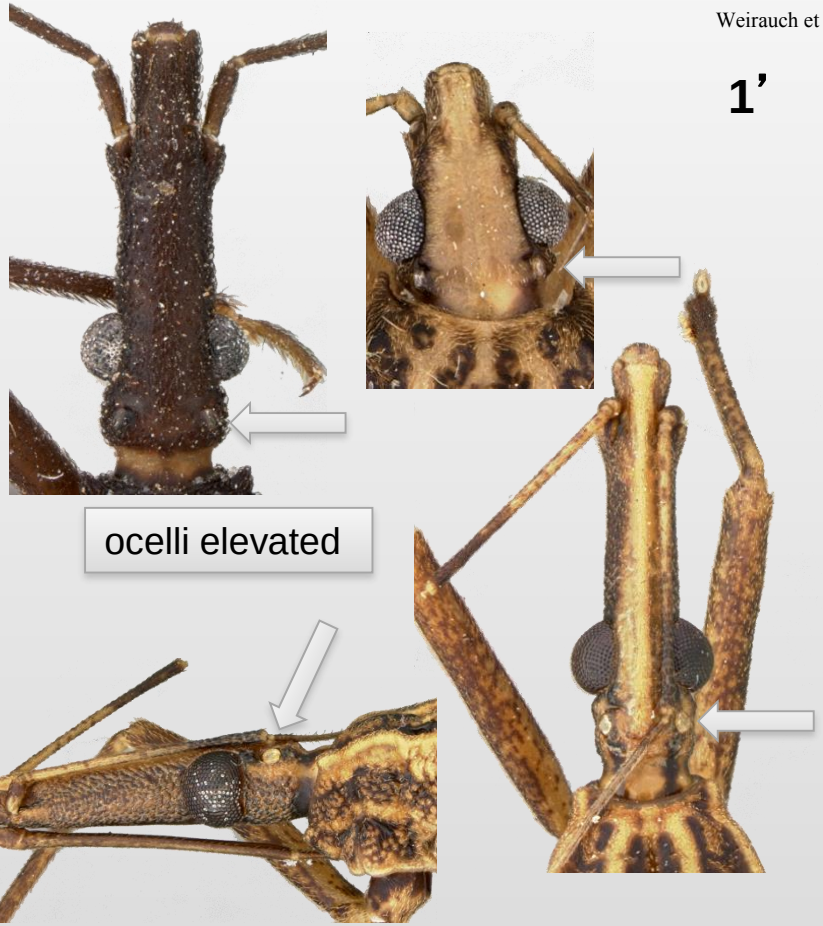
To Tribe Key

Back to Subfamily Key

doi:10.3752/cjai.2014.26

1

1’



1	Ocelli not elevated, situated at level of integument, inconspicuous among coarse head granules or in or very close to interocular sulcus	**2**
1’	Ocelli situated on distinct elevations on disc of postocular portion of head	**3**

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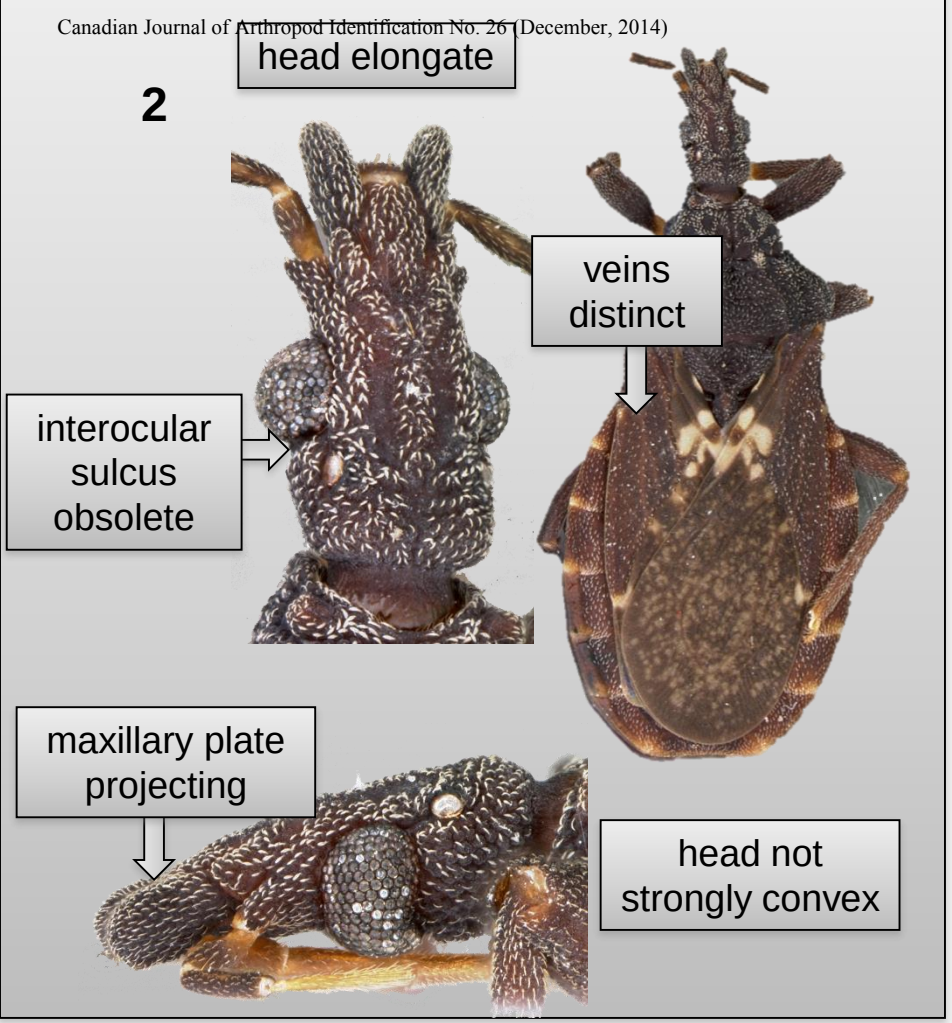

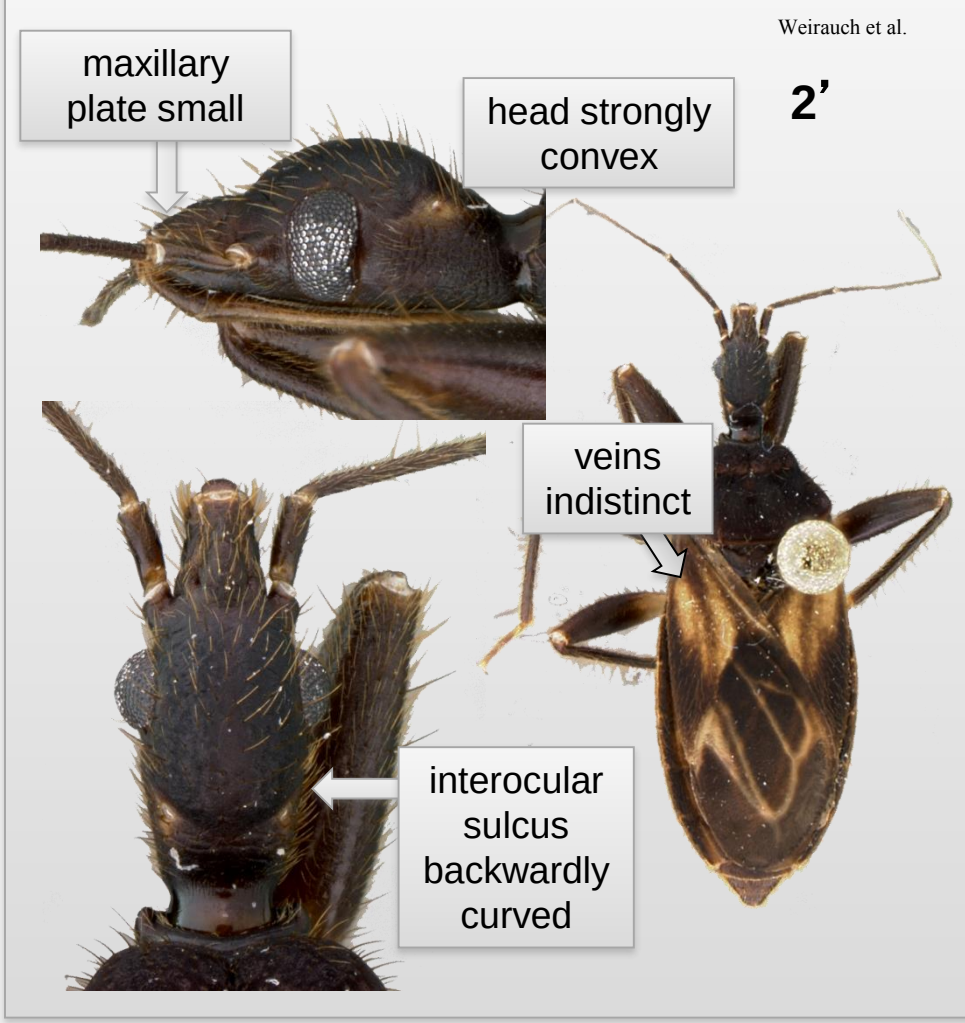

2 (1)	Head usually elongate, not strongly convex dorsally; maxillary plate projecting beyond apex of clypeus; interocular sulcus obsolete; corium with veins distinct; integument heavily granulose...**Bolboderini** [Neotropical]
2’ (1)	Head ovoid, strongly convex dorsally; maxillary plate small; interocular sulcus strongly backwardly curved; corium with veins obsolete; integument smooth, hairy ……..…… **Cavernicolini** [Neotropical]

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3

head elongate

insertion of antenna close to apex of head

3’

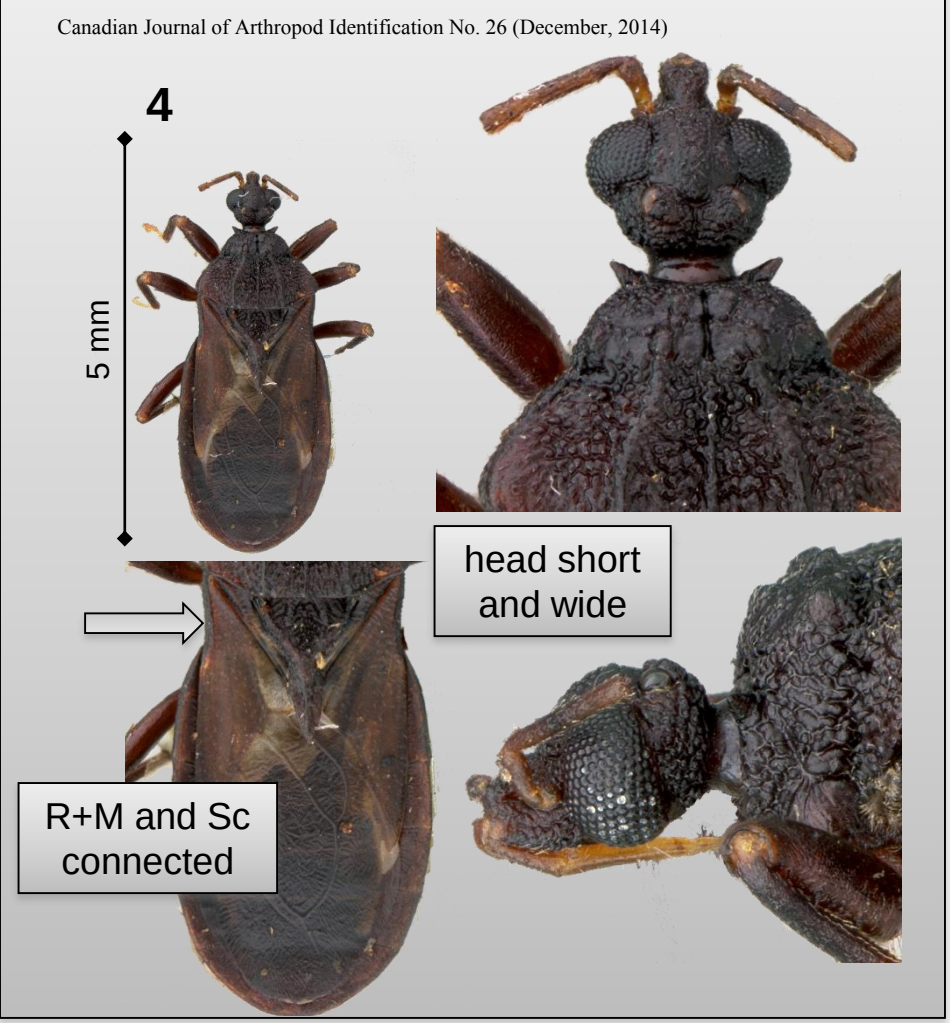
antenna inserted remote from apex of head

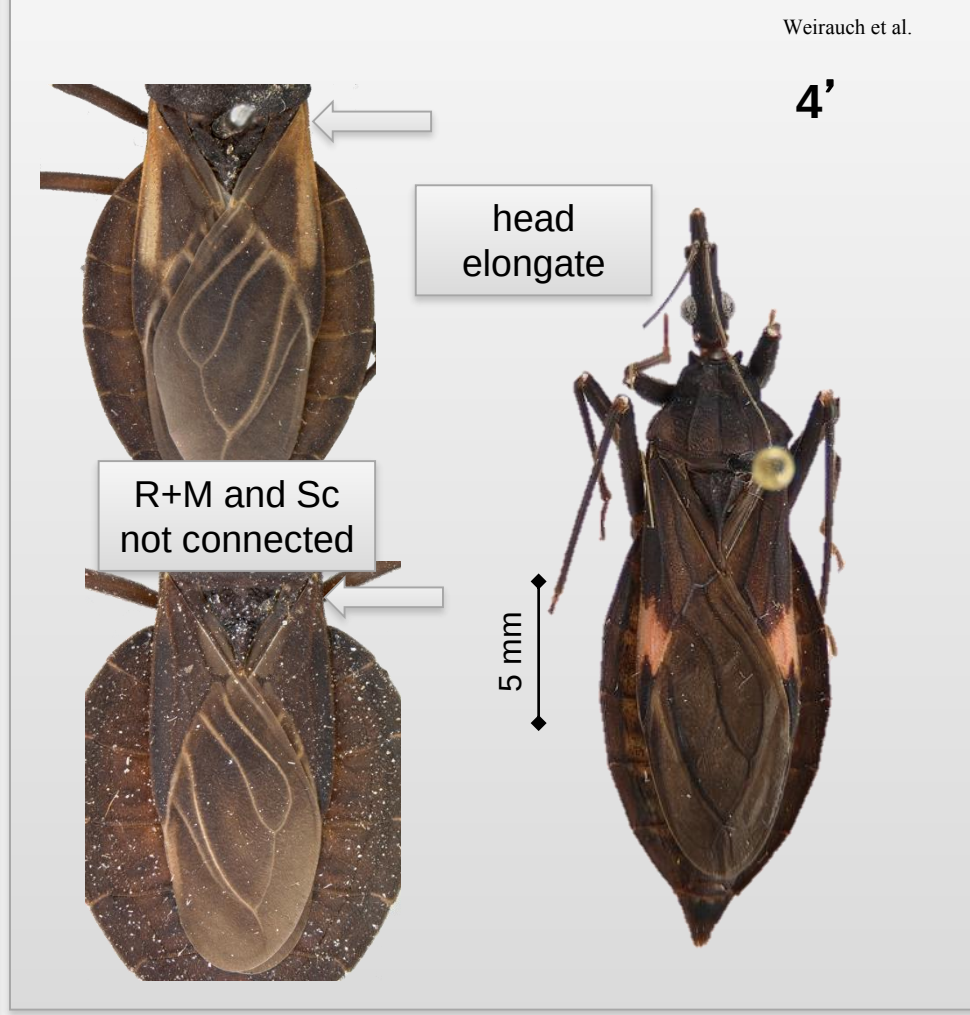
head ovoid

head elongate

3 (1)	Head elongate, insertion of antenna close to apex of head ……**Rhodniini** [Neotropical]	
3’ (1)	Head elongate or short and wide, if elongate then antenna inserted remote from apex of head	**4**

doi:10.3752/cjai.2014.26





4 (3)	Body length ~ 5 mm; head very short and wide; hemelytra with small branch connecting basal portion of R+M to Sc …… **Alberproseniini** [Neotropical]
4’ (3)	Body length > 5 mm; head elongate; small branch connecting basal portion of R+M to Sc absent …… **Triatomini** [Circumtropical]

doi:10.3752/cjai.2014.26

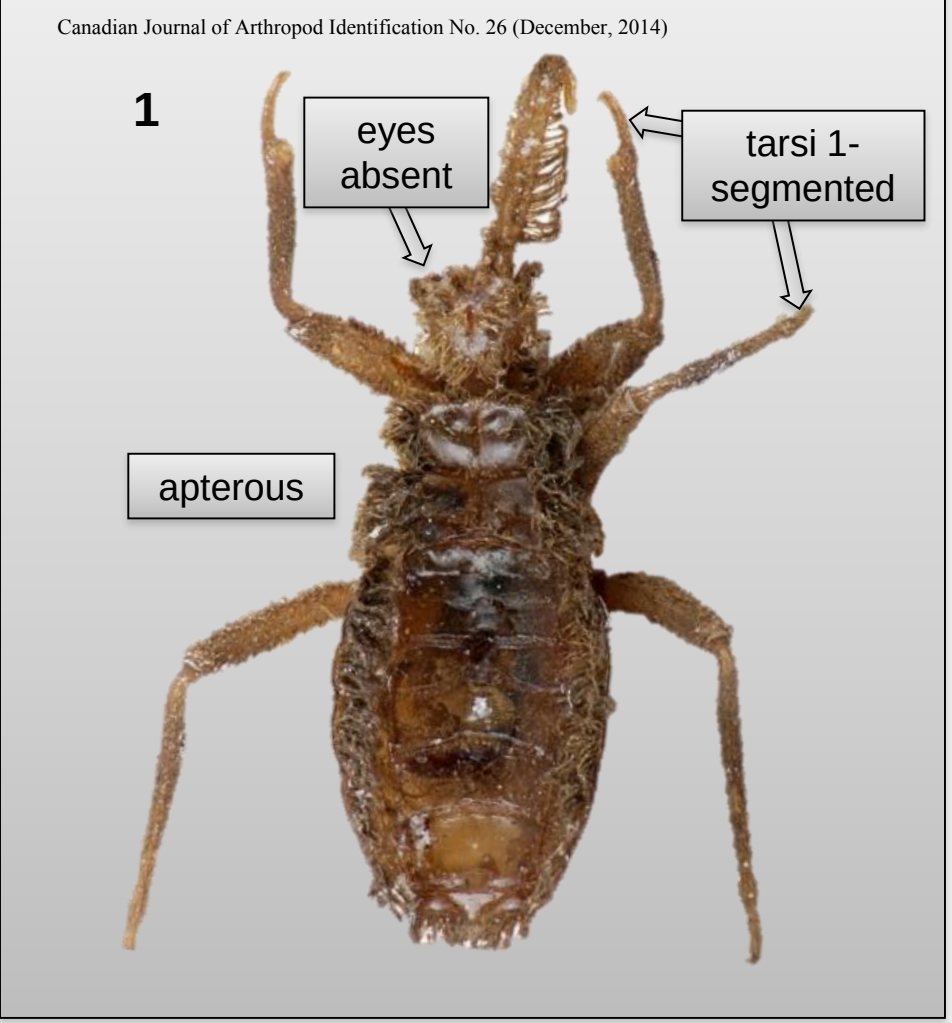
Key to the Tribes of Tribelocephalinae

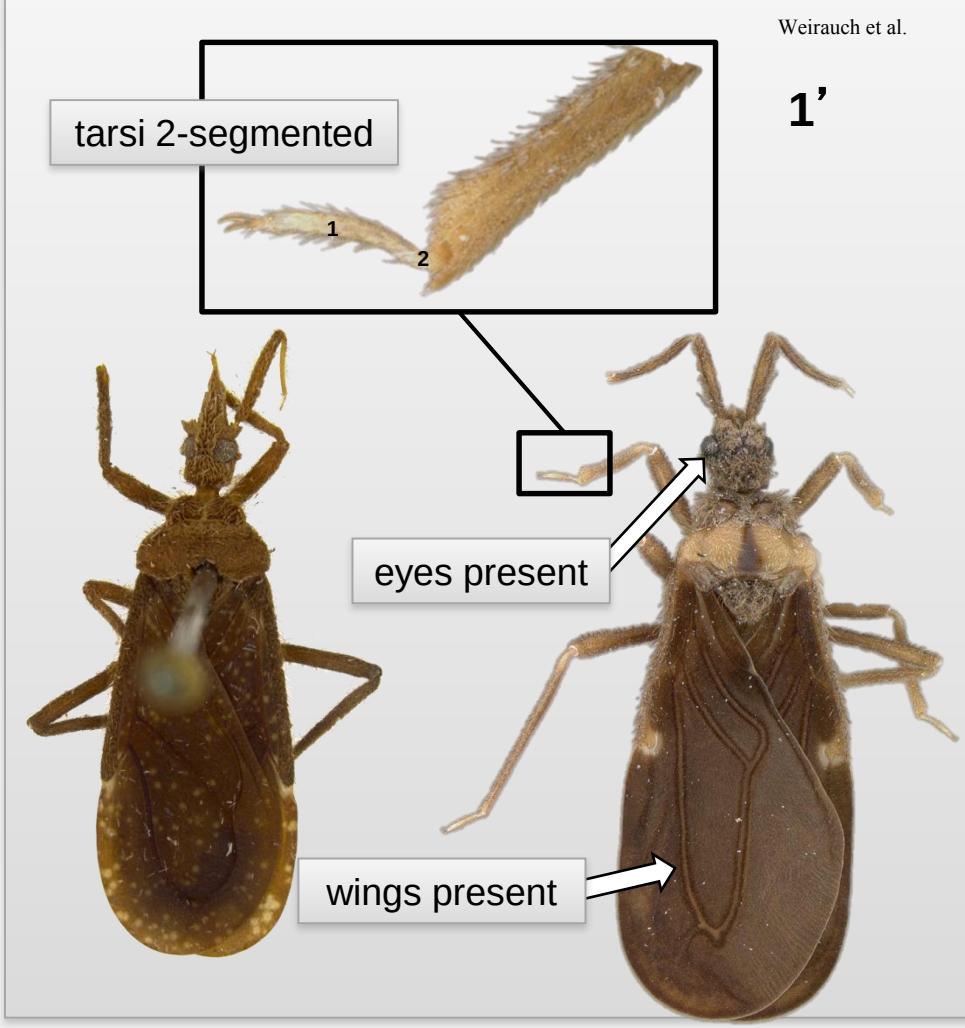
Modified from Maldonado (1996)

To Tribe Key

Back to Subfamily Key

doi:10.3752/cjai.2014.26

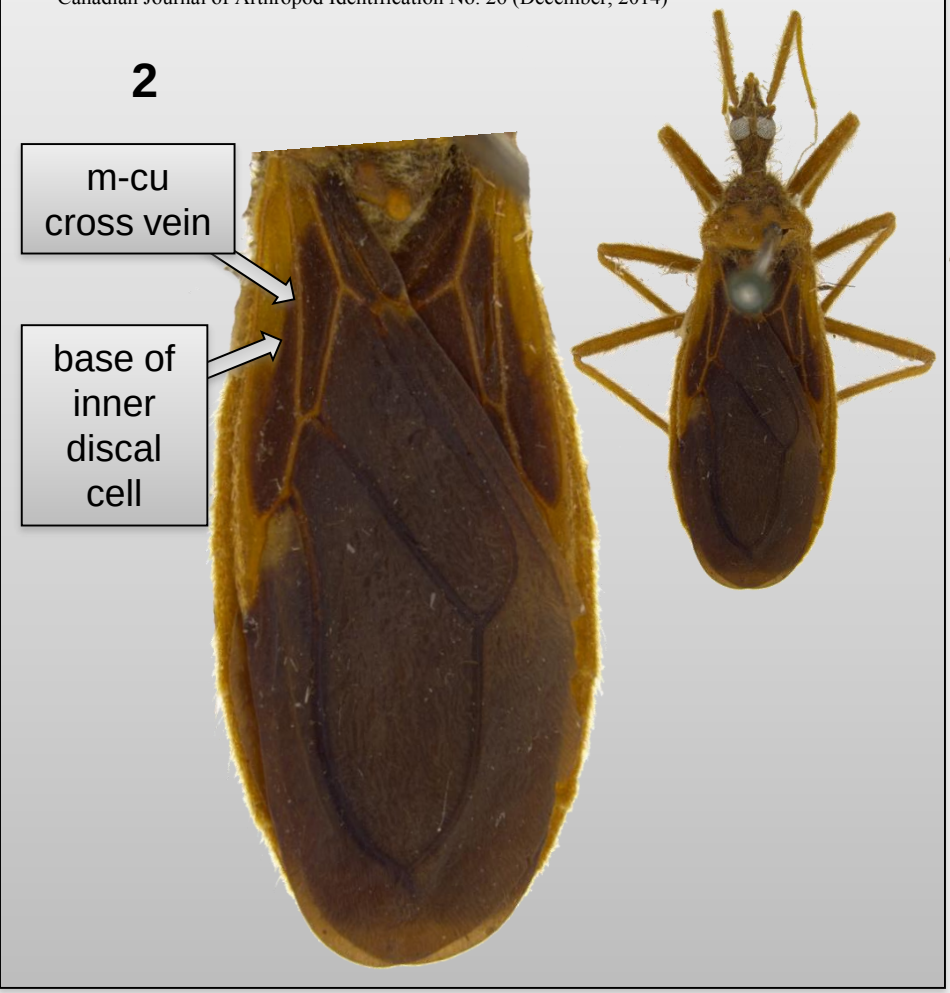




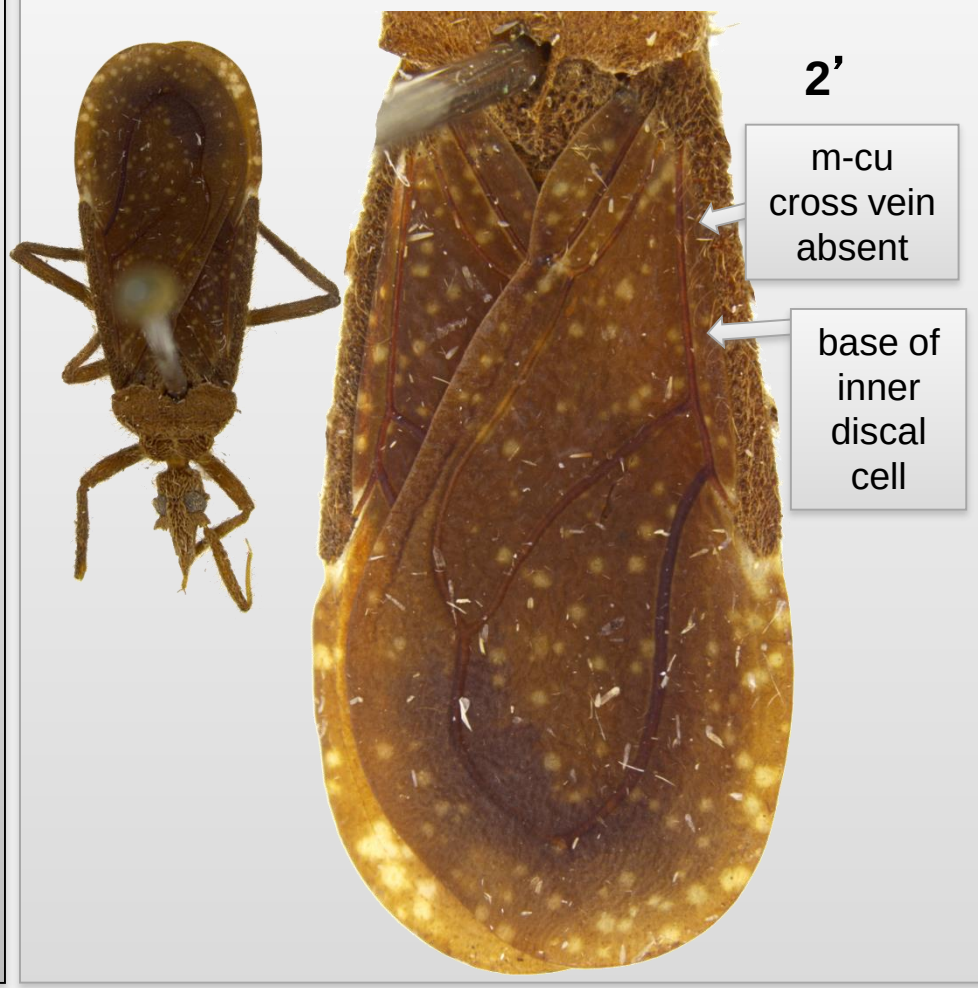
1	Apterous, eyes absent, tarsi 1-segmented…….. **Xenocaucini** [Afrotropical]	
1'	Winged, with eyes, tarsi 2- or 3-segmented	**2**

doi:10.3752/cjai.2014.26

2



2’



2 (1)	Hemelytron with base of inner discal cell divided in two by cross vein m-cu …… **Opistoplatyini** [Afrotropical, Oriental, Australian]	
2’ (1)	Hemelytron with base of inner discal cell not divided in two by a cross vein …… **Tribelocephalini** [Afrotropical, Oriental, Australian]	

doi:10.3752/cjai.2014.26

Taxon Treatments: Subfamilies of Reduviidae

doi:10.3752/cjai.2014.26

Taxon treatments: The following taxon treatments are designed to combine short diagnoses, summaries of the taxonomic history and distribution of the subfamily, some notes on the natural history, the most important references for each of the subfamilies, and additional images of specimens, dead and, where available, alive and in their natural surroundings. Diagnoses of the 25 subfamilies of Reduviidae here recognized are meant to complement the identification key. The taxonomic scope and history varies in depth from a fairly comprehensive treatment for some of the smaller subfamilies, to a rather superficial perspective for some of the larger and more diverse groups. The taxonomic notes are complemented by comments on the phylogenetic status of many of the subfamilies, making it evident that the classification of Reduviidae we accepted for the purposes of this project will be in flux in the near future. To shorten the list of references on each taxon treatment, we list below several references that are of importance to all of the taxon pages and that we do not repeat for individual subfamilies. The hyperlinks “Back to Content” and “Back to Key” point back to the main content page and the final page in the subfamily key for a given taxon, respectively.

Anatomical orientation: When referring to specific surfaces of appendages, in particular the legs, we think of the appendages being extended. For example, we refer to surface of the foretibia that carries the foretibial comb as anterior surface.

General references

Henry, T.J. and Froeschner, R.C. 1988. Catalog of the Heteroptera, or true bugs, of Canada and the Continental United States. CRC Press, Boca Raton.

Hwang, W.S. and Weirauch, C. 2012. Evolutionary history of assassin bugs: insights from divergence dating and ancestral state reconstruction. PLoS ONE**, 7**: 1– 12. e45523. doi:10.1371/journal.pone.0045523

Maldonado, J. 1990. Systematic catalogue of the Reduviidae of the world (Insecta: Heteroptera). Caribbean Journal of Science, Special Edition.

Maw, H.E.L., Foottit, R.G., Hamilton, K.G.A., and Scudder, G.G.E. 2000. Checklist of the Hemiptera of Canada and Alaska. NRC Research Press, Ottawa.

Putchkov, V.G. and Putchkov, P.V. 1985. A catalog of assassin-bug genera of the World (Heteroptera, Reduviidae). [Published by the authors], Kiev.

Schuh, R.T. and Slater, J.A. 1995. True bugs of the World (Hemiptera: Heteroptera): classification and natural history. Cornell University Press, Ithaca.

Bactrodinae

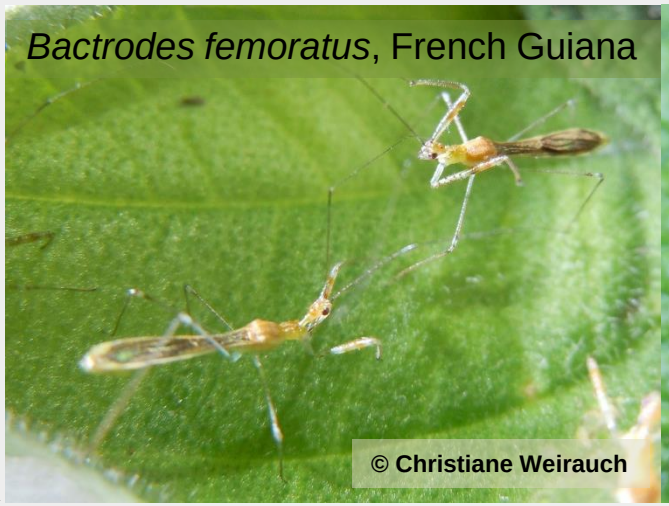
Back to Content Back to Key

Diagnosis: Bactrodinae are characterized by the slender body, gently curved third (second visible) labial segment, elongated postocular region, elongate forecoxa, asymmetrical claws, scape longer than the pedicel, foretibial comb on prominent spur, single cell in the forewing membrane, bifurcated median pygophore process, and the ventral spine on the foretrochanters. The third tarsal segment on the mid- and hindlegs is incrassate and has a stout spine near the middle of the ventral surface.

Taxonomic Notes and Distribution: This subfamily comprises 5 Neotropical species in the genus *Bactrodes* Stål that are distributed from Mexico to Argentina (Coscarón and Melo 2003). McAtee and Malloch (1923) and Coscarón and Melo (2003) provided keys to species. Bactrodinae were first treated as a subfamily by Stål (1862). Davis (1969) considered Bactrodinae to be closely related to, but distinct from, the Harpactorinae. Recent phylogenetic analyses have failed to include Bactrodinae, and the phylogenetic position of this subfamily remains to be investigated.

Occurrence in Canada: Bactrodinae do not occur in Canada.

Natural History: Bérenger and Pluot-Sigwalt (1997) reported *Bactrodes femoratus* (Fabricius) in French Guiana to be associated with plants in the family Melastomataceae.



Next

doi:10.3752/cjai.2014.26

Bactrodinae (cont.)

References

Bérenger, J. and Pluot-Sigwalt, D. 1997. Special relationships of certain predatory Heteroptera Reduviidae with plants. First known case of a phytophagous Harpactorinae. Comptes Rendus de l'Academie des Sciences Series III Sciences de la Vie, **320**: 1007-1012.

Coscarón, M.C. and Melo, M.C. 2003. Revision of the subfamily Bactrodinae (Heteroptera, Reduviidae), with a phylogenetic analysis of *Bactrodes*. Zootaxa, **304**: 1-15.

Davis, N.T. 1969. Contribution to the morphology and phylogeny of the Reduvioidea. Part IV. The harpactoroid complex. Annals of the Entomological Society of America, **62**: 74-94.

McAtee, W.L. and Malloch, J.R. 1923. Notes on American Bactrodinae and Saicinae (Heteroptera: Reduviidae). Annals of the Entomological Society of America, **16**: 247-254.

Stål, C. 1862. Hemiptera Mexicana enumeravit speciesque novas descripsit. Stettiner Entomologische Zeitung, **23**: 437-462.

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Centrocnemidinae

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Diagnosis: Centrocnemidinae are diagnosed by 4 visible labial segments, the pedicel consisting of one uniformly sclerotized segment, strong spines on the humeral angle of the pronotum, 2 elongate cells in the forewing membrane, and the tuberculate body.

Taxonomic Notes and Distribution: About 33 extant species in 4 genera are currently recognized in this subfamily (Miller 1956; Truong et al. 2010; Rédei and Tsai 2011). See Rédei and Tsai (2011) for a discussion on the recent change of the subfamily name. All recent taxa are Oriental in distribution (Maldonado 1990), but reduviid fossils that may belong to this subfamily are known from Baltic Amber (Popov and Putchkov 1998). Comparative morphology and phylogenetic analyses indicate that Centrocnemidinae are part of the phymatine complex of reduviid subfamilies (Clayton 1990; Weirauch et al. 2011; Hwang and Weirauch 2012).

Occurrence in Canada: This subfamily does not occur in Canada.

Natural History: Most species are collected on tree trunks (Schuh and Slater 1995).

Next

Neocentrocnemis signoreti, Singapore

Centrocnemidinae sp., Singapore

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Centrocnemidinae (cont.)

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References

Clayton, R.A. 1990. A phylogenetic analysis of the Reduviidae (Hemiptera: Heteroptera) with redescription of the subfamilies and tribes. Ph.D. thesis, The George Washington University, Washington, DC.

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Popov, Y. and Putchkov, P.V. 1998. *Redubinotus liedtkei* n. gen. n. sp. - the second Centrocnemina from the Baltic amber (Heteroptera: Reduviidae: Centrocnemidinae). Annals of the Upper Silesian Museum in Bytom Entomology, **8-9**: 205-210.

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Truong, X.L., Li, H., and Cai, W. 2010. First record of the assassin bug subfamily Centrocnemidinae (Hemiptera: Heteroptera: Reduviidae) from Vietnam, with the description of a new species. Zootaxa, **2347**: 64-68.

Weirauch, C., Forero, D., and Jacobs, D.H. 2011. On the evolution of raptorial legs – an insect example (Hemiptera: Reduviidae: Phymatinae). Cladistics, **27**:138-149.

Cetherinae

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Diagnosis: Cetherinae are diagnosed by the pedunculate compound eyes, stout and curved labium, presence of ocelli and fossula spongiosa, and the transverse sulcus on the vertex.

Taxonomic Notes and Distribution: About 23 species in 5 genera are currently classified in this subfamily. Villiers (1948) revised the 4 Afrotropical genera; the Neotropical genus *Eupheno* Gistel comprises only 3 described species. Based on a recent molecular phylogenetic analysis of Reduviidae that included Old and New World representatives of Cetherinae, this group may be polyphyletic (Hwang and Weirauch 2012). Cetherinae were first treated as a tribe within the Reduviinae by Jeannel (1919) and the group was given subfamily status by Miller (1955; as Eupheninae). These authors recognized 3 tribes, the Cetherini, Euphenini, and Pseudocetherini. The latter is here treated as a distinct subfamily (in agreement with Maldonado [1990]). Pending a combined phylogenetic analysis of Reduviidae, Cetherini and Euphenini may in the future be treated as separate subfamilies.

Occurrence in Canada: This subfamily does not occur in Canada.

Natural History: Some species are known to prey on termites (Miller 1956). Species of *Eupheno* and *Cethera* Amyot and Serville are found on the underside of fallen tree trunks and logs and similar hidden microhabitats that are typically also inhabited by termites.

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Cethera musiva, Madagascar

Eupheno sp., Peru

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Cetherinae (cont.)

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References

Hwang, W.S. and Weirauch, C. 2012. Evolutionary history of assassin bugs: insights from divergence dating and ancestral state reconstruction. PLoS ONE**, 7**(9): 1-12. e45523. doi:10.1371/journal.pone.0045523.

Jeannel, R. 1919. Voyage de Ch. Alluaud et R. Jeannel en Afrique Orientale (1911-1912). Resultats scientifiques. Insectes Hemipteres. III. Henicocephalidae et Reduviidae. L. Lhomme, Paris. pp. 133-313.

Miller, N.C.E. 1955. The synonymy of *Eupheno* Gistel (Hemiptera-Heteroptera, Reduviidae, Reduviinae) and the description of a new subfamily. Annals and Magazines of Natural History, **8**: 449-452.

Miller, N.C.E. 1956. The Biology of the Heteroptera. Leonard Hill Books, London.

Villiers, A. 1948. Faune de l'Empire Francais. IX. Hemipteres Reduviides de l'Afrique Noire. Office de la Recherche Scientifique Coloniale, Editions du Museum, Paris.

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Chryxinae

Diagnosis: Chryxinae are small (3-9 mm) assassin bugs with a short, stout labium with 3 visible segments; a short, stout, transverse, anteriorly declivous head; and a single cell in the forewing membrane.

Taxonomic Notes and Distribution: This subfamily comprises 5 Neotropical species in 4 genera (Gil-Santana et al. 2007; Weirauch 2012). Generic limits within the subfamily may be doubtful (Weirauch 2012). Champion (1897-1901) first described this group by giving subfamily status to the genus *Chryxus* Champion. Chryxinae are restricted to the Neotropics.

Occurrence in Canada: Chryxinae do not occur in Canada.

Natural History: The biology of species in this subfamily is unknown. *Petasolentia goellnerae* Weirauch was collected at light in the Andean foothills of Southeastern Peru.

References

Champion, G.C. 1897-1901. Biologia Centrali Americana. Insecta. Rhynchota. Hemiptera-Heteroptera. Vol. II.

Gil-Santana, H.R., Costa, L.A.A., and Marques, O.M. 2007. Sinopse dos Chryxinae (Hemiptera, Reduviidae). Revista Brasileira de Zoologia, **24**: 77-83.

Weirauch, C. 2012. *Petasolentia*, a new genus and species of Chryxinae (Hemiptera: Reduviidae). Entomologische Zeitschrift, **122**: 119-122.

Chryxus tomentosus, Panama

Petasolentia goellnerae, Peru

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Ectrichodiinae

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Diagnosis: The Ectrichodiinae, or millipede assassin bugs, are typically diagnosed by the presence of a bifurcated scutellum (2 lateral posteriorly projecting processes), subdivided antennal basi- and distiflagellomeres (flagellum appears 4- to 6-segmented), forewing membrane with 2 or 3 cells, and the fossula spongiosa on the fore- and midtibiae. There are several taxa that do not possess all of these diagnostic features, such as *Zirta* Stål and *Schuhella* Dougherty (flagellomeres not subdivided) and some species of *Katanga* Schouteden and *Cimbus* Hahn (without fossula spongiosa). The lateral processes of the scutellum are very short in some taxa, especially in apterous forms.

Taxonomic Notes and Distribution: More than 660 species in ~120 genera have been described (Maldonado 1990; Dougherty 1995; Carpintero and Maldonado 1996; Bérenger and Gil-Santana 2005; Weirauch et al. 2009; Chlond 2010). More than half of the described genera are monotypic and no tribes are recognized. Amyot and Serville (1843) described Ectrichodiinae as a subfamily. Dougherty (1995) provided a review of the taxonomic history for the subfamily. This subfamily is largely restricted to the tropical and subtropical areas around the world, but some taxa also occur in temperate regions.

Next

Pothea sp., Ecuador

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Neolibavius sp., Vietnam

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Ectrichodiinae (cont.)

Occurrence in Canada: Ectrichodiinae have not been recorded from Canada.

Natural History: Many, if not all, Ectrichodiinae are in all likelihood specialized millipede predators (Forthman and Weirauch 2012). Aposematic or metallic coloration and strong sexual dimorphism are common in this group. Some species in the Neotropical and Afrotropical regions exhibit wing polymorphism within species (Dougherty 1995). Ectrichodiinae are frequently found in leaf litter and are predominantly nocturnal (and often attracted to artificial lights), although some species may also be active during the day (Miller 1953; Louis 1974; Schuh and Slater 1995).

References

Amyot, C.J.B. and Serville, A. 1843. Histoire Naturelle des Insectes. Hemipteres. Roret, Paris.

Bérenger, J.M. and Gil-Santana, H. 2005. Nouveau genre et nouvelles espèces d'Ectrichodiinae d'Amérique Du Sud (Heteroptera, Reduviidae). Bulletin de la Société entomologique de France, **110**: 509-516.

Carpintero, D.J. and Maldonado, J. 1996. Diagnostic characters and key to the genera of American Ectrichodiinae (Heteroptera, Reduviidae). Caribbean Journal of Science, **32**: 125-141.

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Ectrichodiinae (cont.)

Previous

References (cont.)

Chlond, D. 2010. A new, remarkable genus and two new species of Ectrichodiinae (Hemiptera: Heteroptera: Reduviidae) from Madagascar. Zootaxa, **2522**: 61-68.

Dougherty, V. 1995. A review of the New World Ectrichodiinae genera (Hemiptera: Reduviidae). Transactions of the American Entomological Society, **121**: 173-225.

Forthman, M. and Weirauch, C. 2012. Toxic associations: a review of the predatory behaviors of millipede assassin bugs (Hemiptera: Reduviidae: Ectrichodiinae). European Journal of Entomology, **109**: 147-153.

Louis, D. 1974. Biology of Reduviidae of cocoa farms in Ghana. American Midland Naturalist, **91**: 68-89.

Miller, N.C.E. 1953. Notes on the biology of the Reduviidae of southern Rhodesia. Transactions of the Zoological Society of London, **27**: 541-672.

Weirauch, C., Rabitsch, W., and Rédei, D. 2009. *Austrokatanga*, gen. nov., new genus of Ectrichodiinae (Hemiptera: Heteroptera: Reduviidae) from Australia. Zootaxa, **2094**: 1-15.

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Schottus sp., Thailand

Ectrychotes sp., Vietnam

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Elasmodeminae

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Diagnosis: The subfamily Elasmodeminae is distinguished by the dorsoventrally flattened body and the 3 free veins reaching the posterior margin of the forewing membrane. Other features that characterize this subfamily include the presence of a fossula spongiosa on the foretibia, 3 visible labial segments, and the spiny legs.

Taxonomic Notes and Distribution: This subfamily is comprised of 3 Neotropical species (southern Brazil, Paraguay, and Argentina) in the genus *Elasmodema* Stål. Several authors have treated Elasmodeminae as a distinct family (Wygodzinsky 1944; China and Miller 1959; Maldonado 1990), but Carayon et al. (1958) convincingly argued for its inclusion into the Reduviidae, based on a close relationship with the Holoptilinae.

Occurrence in Canada: Elasmodeminae do not occur in Canada.

Natural History: Species live under bark and prey on other insects (Wygodzinsky 1944).

References

Carayon, J., Usinger, R.L., and Wygodzinsky, P.W. 1958. Notes on the higher classification of the Reduviidae, with the description of a new tribe of the Phymatinae (Hemiptera-Heteroptera). Revue de zoologie et de botanique africaine, **57**: 256-281.

China, W.E. and Miller, N.C.E. 1959. Checklist and keys to the families and subfamilies of the Hemiptera-Heteroptera. Bulletin of the British Museum (Natural History) (Entomology), **8**: 1-45.

Wygodzinsky, P.W. 1944. Contribuição ao conhecimento do genero *Elasmodema* Stål, 1960 (Elasmodemidae, Reduvioidea, Hemiptera). Revista Brasileira de Biologia, **4**: 193-213.

Elasmodema setigerum

Elasmodema erichsoni

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doi:10.3752/cjai.2014.26

Emesinae

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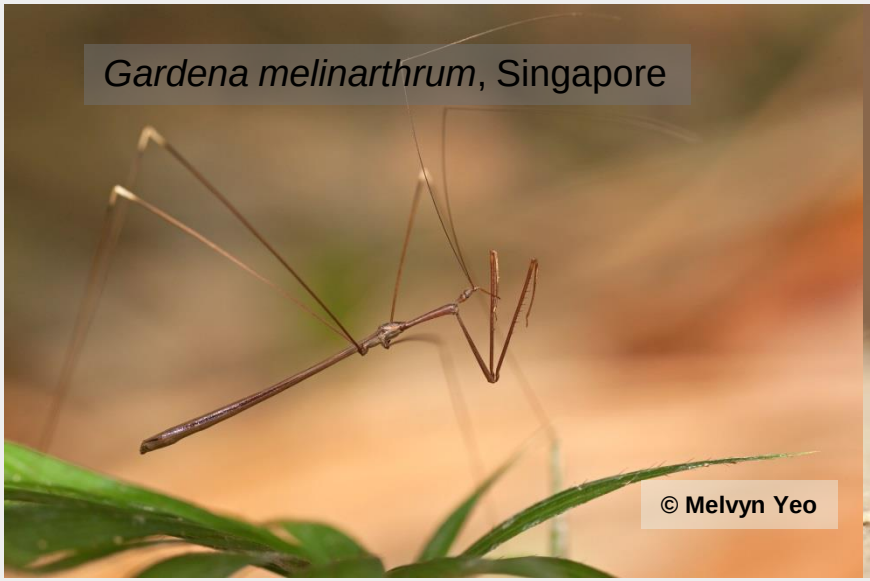
Diagnosis: Emesinae, or thread-legged bugs, are characterized by the elongate and slender body, typically thread-like legs with the forecoxa usually at least 4 times as long as wide, acetabulum of the foreleg opening anteriorly, absence of ocelli (except in *Armstrongocoris* Wygodzinsky) and the tibial fossula spongiosa, and the often asymmetrical pretarsal claws of the forelegs.

Taxonomic Notes and Distribution: Wygodzinsky (1966) produced a monographic revision of the extant species in the subfamily and recognized 6 tribes: Collartidini, Leistarchini, Emesini, Ploiariini, Deliastini, and Metapterini. The group comprises >900 extant species in >90 genera (Maldonado 1990) and a number of fossil taxa (see Popov et al. 2011). Wygodzinsky considered the Emesinae to be closely related with the Saicinae and Visayanocorinae, a scenario that is supported by recent phylogenetic analyses (Weirauch 2008; Weirauch and Munro 2009; Hwang and Weirauch 2012). Emesinae are cosmopolitan, but diversity is highest in the tropics. The group shows significant species diversity on Pacific islands, areas not typically inhabited by a diverse fauna of Reduviidae.



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Emesinae (cont.)

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Occurrence in Canada: Species in the genera *Barce* Stål, *Emesaya* McAtee and Malloch, and *Empicoris* Wolff occur in Canada.

Natural History: Emesinae are cryptic and often found associated with dense vegetation, tree trunks, leaf litter, and spider webs (Wygodzinsky 1966). Some species appear to be obligate predators of web-building spiders, and some are facultatively associated with spiders and spider prey (Gillet 1957; Santiago-Blay and Maldonado 1988; Forero 2007; Wignall and Taylor 2008). A number of species of Emesinae are known to be cave-dwelling (Gagne and Howarth 1974; Maldonado 1994; Ribes et al. 1997; Pape 2013), a microhabitat that harbors otherwise only few reduviid species.

References

Forero, D. 2007. Description of a new species of *Liaghinella* (Hemiptera: Heteroptera: Reduviidae: Emesinae) from the Colombian Andes, with notes on its feeding habits and conservation status. Zootaxa, **1502**: 55-68

Gagne, W.C. and Howarth, F.G. 1974. The cavernicolous fauna of Hawaiian lava tubes, Part VII. Emesinae or thread-legged bugs (Heteroptera: Reduviidae). Pacific Insects, **16**: 415-426.

Gillet, J.D. 1957. On the habits and life history of captive emesine bugs (Hemiptera: Reduviidae). Proceedings of the Royal Entomological Society London Series A, 32, **10-12**: 193-195.

Emesinae (cont.)

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Reference (cont.)

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Hammacerinae

Diagnosis: Hammacerinae are characterized by the 4-segmented labium, the antennal pedicel being subdivided into 4-36 pseudosegments, the head strongly produced anteriorly and not constricted or elongated behind the compound eyes, the forewing membrane with 2 closed cells, and the fossula spongiosa on fore- and midlegs.

Taxonomic Notes and Distribution: This group was originally proposed as a subfamily by Stål (1859), and is sometimes referred to as Microtominae. The subfamily consists of 2 genera and ~19 described species that occur in the New World: *Homalocoris* Perty and *Microtomus* Illiger. *Microtomus* was revised by Stichel (1926), with subsequent taxonomic publications focusing on species occurring in South America (e.g., Coscarón and Giacchi 1985; Melo and Coscarón 2004). Maldonado (1987, 1991) treated *Homalocoris*.

Occurrence in Canada: This subfamily is not known to occur in Canada.

Natural History: Hammacerinae are typically found underneath bark (Readio 1927).

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Hammacerinae (cont.)

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Homalocoris sp., Brazil

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Harpactorinae

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Diagnosis: Harpactorinae are characterized by the presence of a quadrate cell on the corium formed by the cubitus and a well-developed subapical spur on the foretibia that carries the foretibial comb. Most Harpactorinae also have a cylindrical postocular region and an elongated antennal scape.

Taxonomic Notes and Distribution: With more than 2,800 described extant species in ~320 genera, Harpactorinae is the largest subfamily of Reduviidae. Harpactorinae have been recognized as a group since Amyot and Serville (1843), but the tribal classification has been in flux, with Davis (1969) and Schuh and Slater (1995) recognizing 6 tribes (Apiomerini, Diaspidiini, Ectinoderini, Harpactorini, Rhaphidosomini, and Tegeini), but others also accepting Dicrotelini as a separate tribe (Miller 1954; Tomokuni and Cai 2002). We follow the latter and recognize 7 tribes in the subfamily. Members of this group are variable in body shape and color, with many species being rather colorful. Among the most visually striking Harpactorinae are the resin bugs (Apiomerini, Ectinoderini, and Diaspidiini; Forero et al. 2013), the wasp or bee mimicking bugs (e.g., *Hiranetis* Spinola, *Notocyrtus* Burmeister, and *Coilopus* Elkins; Zhang and Weirauch 2013a), the wheel bugs in the New World genus *Arilus* Hahn, stick-like Rhaphidosomini, and species of the Oriental *Eulyes* Amyot and Serville and related taxa.

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Taxonomic Notes and Distribution (cont.): Phylogenetic analyses support the monophyly of Harpactorinae, but relationships among tribal-level taxa within the group are in need of additional research: Harpactorini were recently shown to be paraphyletic or even polyphyletic (Hwang and Weirauch 2012; Forero et al. 2013; Zhang and Weirauch 2013a). Harpactorinae and the tribe Harpactorini have a worldwide distribution; Apiomerini are restricted to the New World; Diaspidiini and Rhaphidosomini are Afrotropical; Ectinoderini are restricted to the Oriental region; and Dicrotelini and Tegeini occur in the Old World tropics.

Occurrence in Canada: Genera recorded from Canada are *Acholla* Stål, *Apiomerus* Hahn, *Arilus* Hahn, *Fitchia* Stål, *Pselliopus* Bergroth, *Rhynocoris* Hahn, *Sinea* Amyot and Serville, and *Zelus* Fabricius.

Harpactorinae (cont.)

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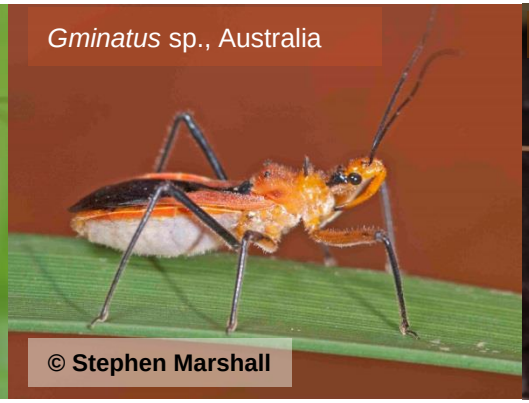
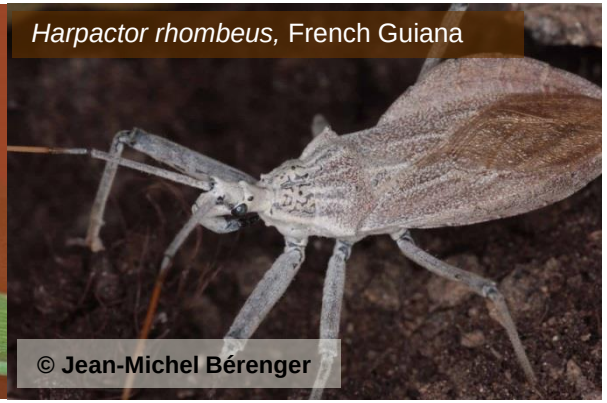
Natural History: The biology of Harpactorinae shows tremendous variation. The majority of species are diurnal and frequently found on plants, but some species are ground-dwelling or bark-inhabiting. Some harpactorine species show close association with specific plants (Bérenger and Pluot-Sigwalt 1997). Due to the general predacious habits of many species, some Harpactorinae are explored for biological control purposes (e.g., Grundy and Maelzer 2000; Ambrose 2002). Among the exciting phenomena displayed by Harpactorinae are maternal care (Tallamy et al. 2004), specialization on termites in at least 2 lineages (Hwang and Weirauch 2012), the use of endogenous sticky secretions to aid in prey capture (Barth 1953; Zhang and Weirauch 2013b), and the collecting of plant resins to enhance prey capture and maternal care (Eisner 1988; Forero et al. 2011).





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Harpactorinae (cont.)

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Harpactorinae (cont.)

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Holoptilinae

Diagnosis: Holoptilinae are sometimes referred to as feather-legged assassin bugs. They are diagnosed by the absence of the foretibial comb, presence of dense and long setae on the body and legs (Dasycnemini and Holoptilini), the trichome on the abdominal sternum (Holoptilini), and one closed cell (Holoptilini) or 2 longitudinal veins (Dasycnemini) on the forewing membrane. Feather-legged bugs in the tribe Aradellini share the general habitus of other Holoptilinae, but have short instead of long setation on legs and antenna.

Taxonomic Notes and Distribution: Holoptilinae comprise ~80 species in 16 extant and fossil (Poinar 1991) genera and 3 tribes (Holoptilini, Dasycnemini, and Aradellini; Wygodzinsky and Usinger 1963). The majority of species occur in the southern Palearctic, the Old World tropics and Australia (Malipatil 1985). One extant genus, *Neolocoptiris* Wygodzinsky and Usinger, is found in Guyana (Wygodzinsky and Usinger 1963).

Occurrence in Canada: Holoptilinae do not occur in Canada.

Natural History: Holoptilini appear to be specialized on ants and attract their prey with a seemingly glandular structure on the abdomen called the trichome (Weirauch and Cassis 2006; Weirauch et al. 2010).

Aradellus sp., Australia

Putoniola sp., Sudan

Smiliopus sp., Australia

Holoptilus ursus, South Africa

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Holoptilinae (cont.)

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Ptilocnemus sp., Australia

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Manangocorinae

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Diagnosis: Manangocorinae are characterized by 2-segmented tarsi, the short and globose head that barely projects anteriorly beyond the small compound eyes, and the presence of a spine on the scutellum.

Taxonomic Notes and Distribution: This subfamily contains only one species described from Malaysia (Miller 1954). Whether this taxon merits subfamily status remains questionable (Schuh and Slater 1995). This is the most rarely collected subfamily of Reduviidae and is currently only known from the poorly preserved holotype.

Occurrence in Canada: Manangocorinae do not occur in Canada.

Natural History: The biology of Manangocorinae is unknown.

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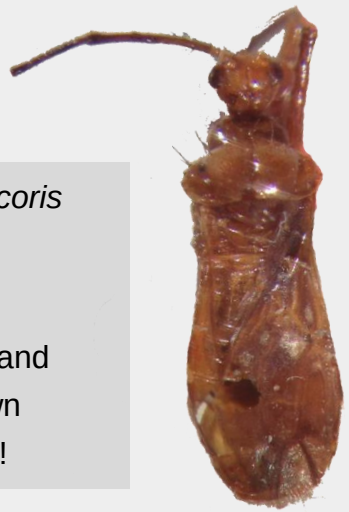

Manangocoris horridus, Malaysia

Holotype and only known specimen!

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Peiratinae

Diagnosis: Peiratinae are characterized by the transverse sulcus on the pronotum located behind the middle of the pronotum, the typically rather elongate forecoxa with a distinctly flattened anterior surface, a typically very prominent fossula spongiosa on fore- and midtibiae, and the at least slightly asymmetrical male genitalia.

Taxonomic Notes and Distribution: The subfamily comprises ~350 species in ~34 genera. A number of peiratine genera were revised in modern times (e.g., Coscarón 1983, 1997; Willemse 1985; Zhang and Weirauch 2011). Peiratinae were supported as one of the early lineages within the Higher Reduviidae and are thus likely a rather old (~100 million years) group of Reduviidae (Hwang and Weirauch 2012). Peiratinae have cosmopolitan distribution.

Occurrence in Canada: One species, *Melanolestes picipes* (Herrich-Schäffer), is known to occur in Canada.

Natural History: Members of this subfamily are primarily ground-dwelling or found on decomposing tree trunks and in other cryptic microhabitats. They are usually nocturnal and thus frequently attracted to lights. Peiratinae are also known for their extremely painful bite (Readio 1927). Male Peiratinae are unique among Reduviidae in possessing slightly to strongly asymmetrical genitalic structures (e.g., Willemse 1985). Males in some species also feature “extragenital structures” that may be involved in mating (Ghauri 1964). Some peiratine species mate end-to-end (Haridass 1985; Ambrose 1999), a mating position that is otherwise unknown in Reduviidae.

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Peiratinae (cont.)

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Rasahus brasiliensis, French Guiana

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Ectomocoris atrox, Singapore

© Melvyn Yeo

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Phimophorinae

Diagnosis: The Phimophorinae are characterized by an aradid-like body that is covered with waxy secretions, the head almost twice as long as high, incrassate antennal segments, buccula obscuring the base of the labium, the second (first visible) labial segment much longer than segments 3 and 4 combined, the largely membranous forewings, the small 2-segmented tarsi, and the prosternum with shield-like structures near the stridulatory groove.

Taxonomic Notes and Distribution: This cryptic and rarely collected subfamily currently only contains the genera *Mendanocoris* Miller (2 species; Solomon Islands and Malaysia) and *Phimophorus* Bergroth (one species; Neotropics) [Usinger and Wygodzinsky 1964; Schuh and Slater 1995]. The phylogenetic position of this group has been the focus of much debate throughout the 20th century (Handlirsch 1897a, 1897b; Usinger and Wygodzinsky 1964). Maldonado (1990) recognized 2 tribes, the Mendanocorini Miller and Phimophorini Handlirsch, a scheme we do not follow in the current study. Due to the great rarity of specimens in collections, Phimophorinae have not been included in recently published phylogenies of Reduviidae, making the analysis of the phylogenetic position of this group one of the top priorities in reduviid systematics.

Occurrence in Canada: Phimophorinae do not occur in Canada.

Phimophorus spissicornis, Colombia

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Phimophorinae (cont.)

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Natural History: The natural history of Phimophorinae was virtually unknown until recently. Fieldwork in Colombia revealed that *Phimophorus spissicornis* Bergroth is typically associated with palms (family Arecaceae), but may also occur in bromeliads and bananas (Chaverra-Rodriguez et al. 2010). Specimens were collected in association with *Rhodnius pallescens* Barber, confirming earlier observations that *Phimophorus* may co-occur with Triatominae (Lent and Jurberg 1977; Lent and Wygodzinsky 1979). An association with palm trees and specimens of *Rhodnius prolixus* was also observed in Ecuador (Bérenger, unpublished data).

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Phymatinae

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Diagnosis: Commonly called ambush bugs, Phymatinae are a group of morphologically very distinctive assassin bugs. Most members of the subfamily are characterized by the presence of buccula obscuring the base of the labium and the head often being about as high as long. The conspicuously enlarged forefemur is diagnostic for Macrocephalini and Phymatini and the chelate or subchelate foreleg is characteristic for Carcinocorini, Macrocephalini, and Phymatini. The foreleg in Themonocorini is shaped like a standard walking leg with the femur featuring long and stout spines.

Taxonomic Notes and Distribution: Phymatinae were considered as a distinct family within Cimicomorpha by several authors (Froeschner and Kormilev 1989; Maldonado 1990), and the name Phymatidae is still being used in some current literature and popular websites. However, Carayon et al. (1958) made a very convincing case for treating Phymatinae as part of the Reduviidae, based on shared unique features with several other reduviid subfamilies. All recent cladistic analyses have confirmed Phymatinae to be part of the "phymatine complex" of reduviid subfamilies that also contains the Centrocnemidinae, Elasmodeminae, and Holoptilinae (Weirauch 2008; Weirauch and Munro 2009; Hwang and Weirauch 2012). Monographs on Phymatinae include Handlirsch (1897), Kormilev (1962), and Maa and Lin (1959). Four tribes are currently recognized: Carcinocorini (Oriental), Macrocephalini (cosmopolitan), Phymatini (cosmopolitan), and Themonocorini (Afrotropical). Froeschner and Kormilev (1989) provided a catalogue of Phymatinae, recording 281 species and 26 genera. Since then, 2 new genera, 10 new species, and one new subspecies have been described (Kormilev 1990a, 1990b, 1990c; Kormilev and van Doesburg 1991, 1992; van Doesburg 1997, 2004; Cui et al. 2003; Rabitsch 2003; Rabitsch et al. 2006; van Doesburg and Pluot-Sigwalt 2007; van Doesburg and Jacobs 2011).

Occurrence in Canada: Some species in the genus *Phymata* Latreille are known to occur in Canada.

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Phymatinae (cont.)

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Themonocoris endroedyi, South Africa

Macrocephalus sp., United States

Natural History: Phymatinae typically hide among flowers or vegetation, and mount an ambush attack on their prey that consists of a variety of small arthropods. Adults and nymphs of the African *Themonocoris kinkalanus* Carayon, Usinger, and Wygodzinsky were observed to seek their prey in nests of the weaver bird genus *Ploceus* Cuvier, in flower and fruit clusters of the palm genus *Elaeis* Jacquin, and in dead plant matter (Carayon et al. 1958). Pre- and postcopulatory mate guarding behaviors occur in *Phymata fasciata* (Gray) [Dodson and Marshall 1984], production of acoustical signals has been recorded for *Phymata crassipes* (Fabricius) [Gogala and Cokl 1983], and species of *Phymata* have recently become the focus of sexual selection studies (e.g., Punzalan et al. 2008a, 2008b).

Phymata spp., various countries

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Phymatinae (cont.)

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Phymatinae (cont.)

Previous

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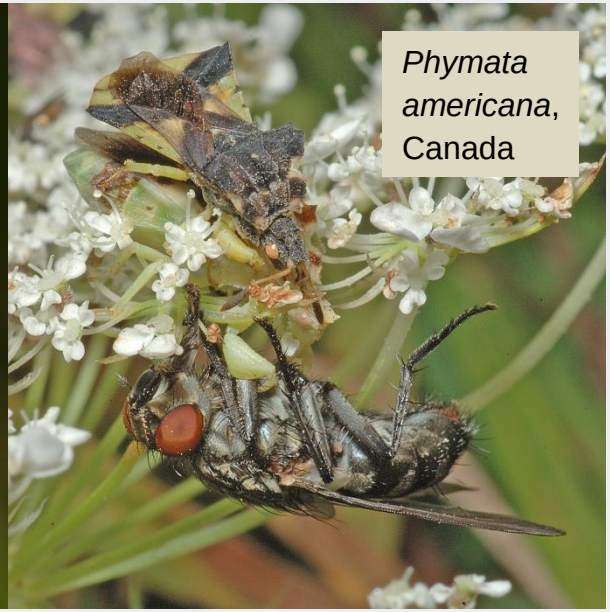
Glossopelta sp., China

Phymata cf. *americana*, United Sates



Phymata americana, Canada

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Physoderinae

Diagnosis: Species of Physoderinae are characterized by a tuberculate body with spatulate setae, the foretibial comb located on a subapical spur, a usually elongate head with small compound eyes that are far from the anterior margin of the pronotum, the third labial segment (second visible) very long and straight, the forewing membrane with 2 cells, the rounded forecoxa, and the absence of a fossula spongiosa.

Taxonomic Notes and Distribution: The subfamily status of Physoderinae was established by Miller (1954). The group currently comprises >60 species in ~15 genera. Villiers (1962) monographed the fauna of Madagascar, one of the hotspots of physoderine biodiversity. *Cryptophysoderes fairchildi* Wygodzinsky and Maldonado was described as the first Neotropical representative of this otherwise Old World clade (Wygodzinsky and Maldonado 1972), followed by the description of a second monotypic New World genus, *Leptophysoderes* Weirauch (Weirauch 2006). Despite its diversity in Madagascar, Physoderinae were not known to occur on the African mainland until the discovery of a cryptic, apterous taxon from Tanzania that was described as *Porcelloderes* Rédei (Rédei 2012).

Occurrence in Canada: Physoderinae do not occur in Canada.

Natural History: Specimens of the subfamily have been found in caves, hollow trees, vegetable debris, and at the bases of banana and *Pandanus* plants (Schuh and Slater 1995).

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Physoderes notata, Indonesia

Breviphysoderes decora, Brunei

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Physoderinae

Previous

References

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Pseudocetherinae

Diagnosis: Pseudocetherinae are sometimes referred to as lobe-headed bugs. Members of this subfamily are characterized by the short mandibular plates with the apices well separated by the elongate clypeus; the maxillary plates with a large anterior projection giving the head a tri-lobed appearance; the forewing membrane with a small triangular Cu-PCu cell; the first visible labial segment long and slender, longer than the second and third segments combined; the antennal scape short and not or only slightly surpassing the apex of the head; the prosternum projecting anteriorly, forming a nearly ventrally flattened surface; and the dorsal abdominal glands entirely absent in adults.

Taxonomic History and Distribution: In 1963, Villiers described the genus *Pseudocethera* and placed it in a new subfamily, the Pseudocetherinae. The systematic position of the genus, which currently contains 3 Afrotropical species, was modified subsequently by different authors, some treating it as part of the Cetherinae (Putchkov and Putchkov 1985), others retaining it as a separate subfamily. Species of *Pseudocethera* were not included in recent phylogenetic analyses of Reduviidae. However, several genera currently treated as part of the (polyphyletic) subfamily Reduviinae share many of the diagnostic features listed above, among them *Kayanocoris* Miller and part of the genus *Gerbelius* Distant (Weirauch and Rédei , unpublished). Hwang and Weirauch (2012) found these 2 genera to be part of the *Reduvius* clade of Reduviinae, refuting a close relationship with the Cetherinae. We here treat Pseudocetherinae as a distinct subfamily, pending the inclusion of several additional genera.

Pseudocethera sp., Kenya

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Pseudocetherinae (cont.)

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Occurrence in Canada: Pseudocetherinae do not occur in Canada.

Natural History: The biology of *Pseudocethera* is unknown.

Reference

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Pseudocethera sp., Kenya

Reduviinae

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Diagnosis: Reduviinae are recognized by usually having ocelli, 3-segmented tarsi, 2 closed cells on the forewing membrane, and a fossula spongiosa on fore- and midtibiae. In addition, Reduviinae are typically recognized by the absence of specialized morphological features that are characteristic for other subfamilies.

Taxonomic History and Distribution: At least 140 genera and ~1,000 species are currently classified as Reduviinae. Species of Reduviinae are primarily recognized by the absence of characters found in other reduviids (Schuh and Slater 1995), a fact that is not surprising given the polyphyletic nature of this assemblage of unrelated groups (Hwang and Weirauch 2012). The extent of the "reduviine polyphyly problem" is currently being investigated, and the most recent, molecular-only phylogenetic analysis of Reduviidae (Hwang and Weirauch 2012) indicates that Reduviinae may fall into at least 11-13 distinct monophyletic clades. Reduviinae, as currently classified, are cosmopolitan, with the greatest diversity in the Old and New World tropics.

Occurrence in Canada: Only the cosmopolitan species *Reduvius personatus* (Linnaeus) occurs in Canada.

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Reduviinae (cont.)

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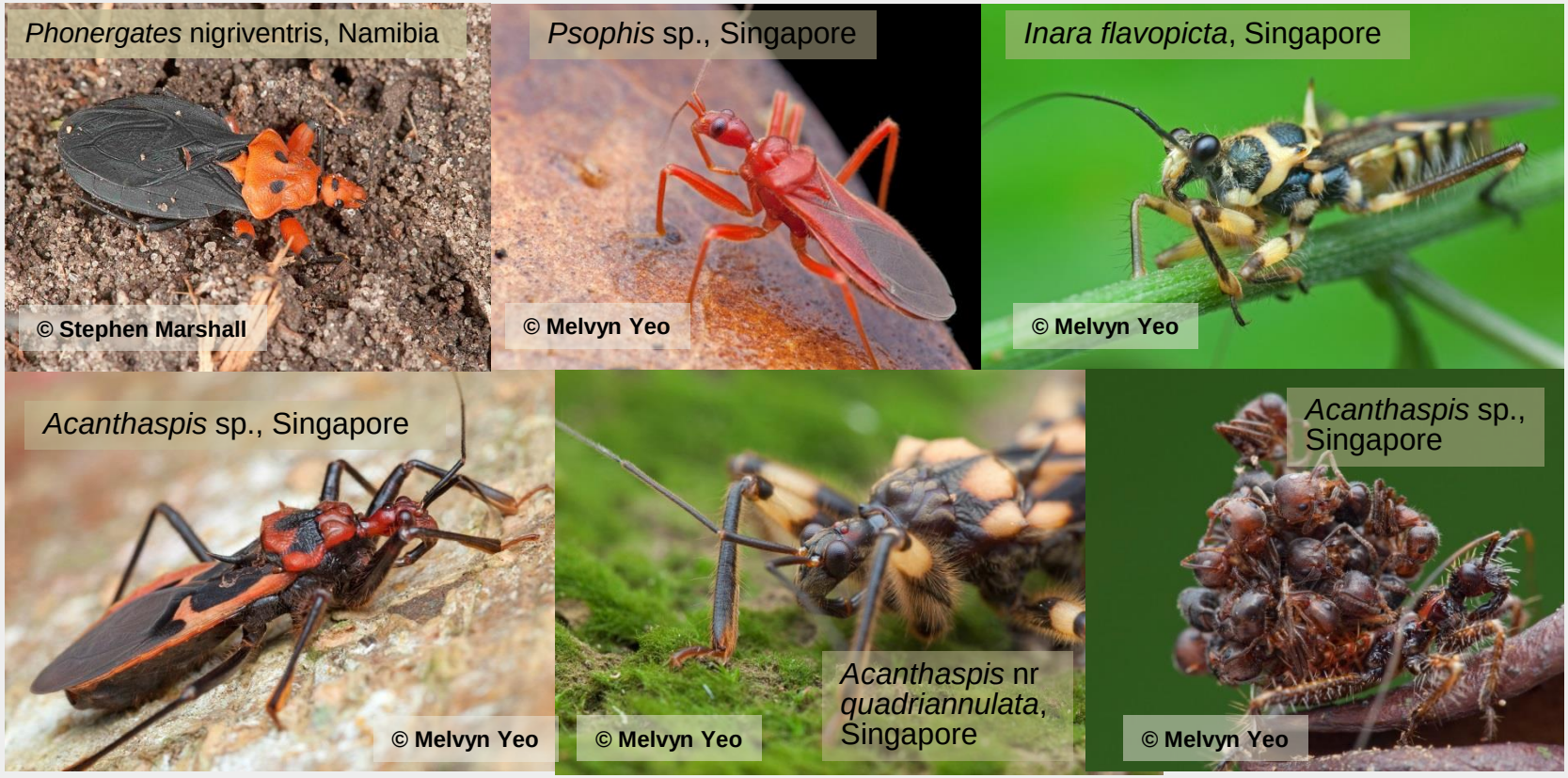
Natural History: Most species are nocturnal and believed to be generalist predators of insects and other arthropods (Schuh and Slater 1995). Many Reduviinae are found in association with the bark of either living or dead trees (Miller 1953), some species are specialized ant predators (*Acanthaspis* spp.; Louis 1974; Haridass 1985), and some species may live in animal burrows and nests (e.g., *Reduvius* spp. and *Opisthacidius* spp.; Lent and Wygodzinsky 1956; Ryckmann 1954). The cosmopolitan *R. personatus* is closely associated with humans: adults are attracted to lights and camouflaged immatures can be found in houses.



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Reduviinae (cont.)

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Zelurus spinidorsis, French Guiana

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Zelurus sp., Ecuador

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Acanthaspis sp., Vietnam

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Saicinae

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Diagnosis: Saicinae are diagnosed by the absence of ocelli and fossula spongiosa, the second visible labial segment frequently expanded and basally bulbous, the forecoxa at most 3 times as long as wide, the usually enlarged and slightly bulbous tarsal segments, the acetabulum of the foreleg oriented ventrad, and the opposing surfaces of head and labium frequently with stiff setae or spines.

Taxonomic History and Distribution: Saicinae were first recognized by Stål (1859). The subfamily currently comprises ~25 genera and >140 species. Wygodzinsky (1966) treated Saicinae as closely related to the Emesinae and Visayanocorinae, and recent phylogenetic analyses have confirmed this relationship (e.g., Hwang and Weirauch 2012). Gil-Santana and Costa (2009) and Villiers (1969) produced keys to the American and African genera, respectively.

Occurrence in Canada: Saicinae have not been recorded from Canada.

Natural History: Specimens of this subfamily are commonly collected at lights. Little else is currently known of Saicinae life history.

Saicinae (cont.)

Previous

References

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Salyavatinae

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Diagnosis: Salyavatinae are characterized by a 2-segmented foretarsus, fossula spongiosa on the fore- and midtibiae, and a small, short head with antennal tubercles at the base of the antennae. Most members possess various spines on the head, pronotum, scutellum, postscutellum (metanotum), legs, and abdomen. Almost all species of this group are cryptically colored (primarily brown, some with pale and dark marmorated patterns). Members of the largest genus *Lisarda* Stål have a frontal process, while members of several African and Oriental genera have variously inflated foretibiae.

Taxonomic History and Distribution: Salyavatinae were classified as a subfamily by Amyot and Serville (1843). Currently, the subfamily consists of 17 genera and 108 species but the group is in need of revision. Van Doesburg and Forero (2012) revised the genus *Salyavata* Amyot and Serville. With the exception of the Neotropical genus *Salyavata*, all species occur in the Old World tropics.

Occurrence in Canada: Salyavatinae do not occur in Canada.

Natural History: Many genera are known to camouflage as nymphs and all members of this group are suspected to feed on termites (Miller 1953), with the genus *Salyavata* being the best studied (McMahan 1982, 1983a, 1983b). The function of the inflated foretibial structures is unknown.

Salyavatinae (cont.)

Previous

References

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Sphaeridopinae

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Back to Key (taxa with fossula)

Diagnosis: Sphaeridopinae are characterized by a large, robust body; large eyes almost covering the entire head; and a short, straight, thin labium. They share the presence of antennal tubercles with the Salyavatinae but differ in possessing a 3-segmented foretarsus. *Sphaeridops* Amyot and Serville and *Volesus* Champion are mostly red and black, whereas species of *Veseris* Stål are brown marmorated.

Taxonomic History and Distribution: Sphaeridopinae were classified as a family by Pinto (1927), and as a subfamily by Costa Lima (1940), and currently consist of 3 genera and 6 species (Maldonado and Santiago-Blay 1992; Gil-Santana et al. 2000; Gil-Santana and Alencar 2001). They are only found in the Neotropics.

Occurrence in Canada: Sphaeridopinae do not occur in Canada.

Natural History: Nymphs of Sphaeridopinae have camouflaging structures, have been found in association with termites, and have been fed on termites in captivity (Wygodzinsky, pers. com. in: McMahan 1982).

Veseris bellator, French Guiana

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Sphaeridopinae (cont.)

References

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Volesus nigripennis, Colombia

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Sphaeridops amoenus, Brazil

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Stenopodainae

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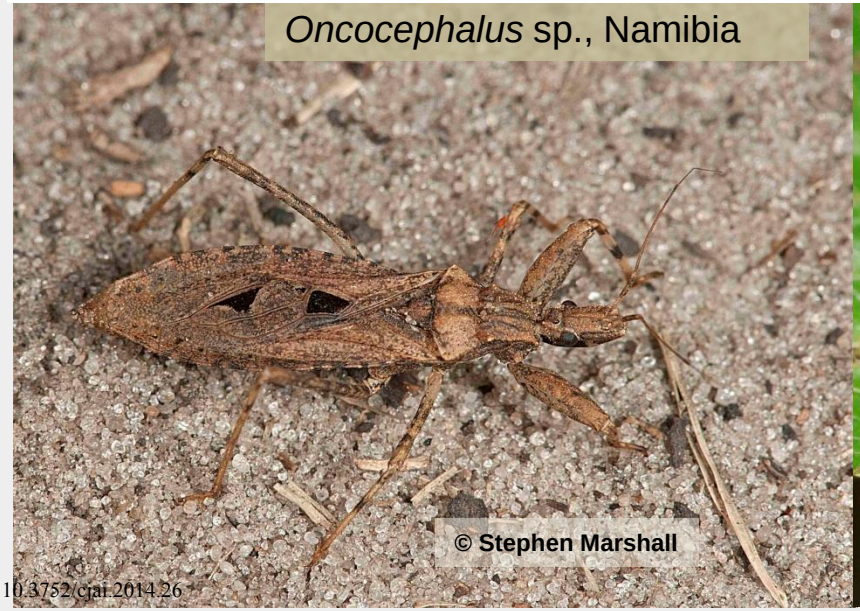
Diagnosis: Stenopodainae are a cryptically colored group of assassin bugs characterized by a pentagonal or hexagonal cell in the corium. The mandibular plates are prominent, and the pedicel and flagellomeres of the antennae are often folded backwards under the scape.

Taxonomic History and Distribution: This is a large group of more than 110 genera (Maldonado 1990). The group is worldwide with most species occurring in the tropics. Barber (1929) published a first synopsis on the subfamily, Wygodzinsky and Giacchi (1991) provided a key for Neotropical genera and Giacchi (e.g., 1969, 1998) revised the Neotropical genera in a series of 12 papers. Stenopodainae of Madagascar were studied by Villiers (1968).

Occurrence in Canada: Stenopodaine genera recorded from Canada are *Pnirontis* Stål, *Pygolampis* Germar, and *Stenopoda* Laporte.

Natural History: Stenopodainae are often found in leaf litter or soil, but many specimens have also been collected at lights. Numerous species are apterous. Stenopodainae are also commonly found on islands (Rédei 2005; Chlond 2010).



Stenopodainae (cont.):

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Triatominae

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Diagnosis: Triatominae, or kissing bugs, are characterized by a long, straight third (second visible) labial segment with flexible membranous connection between the last 2 segments. Most members have an elongate head with no constriction behind the eyes and the ocelli elevated on a protuberance. The connexivum sometimes has membranous areas to allow for expansion upon blood feeding.

Taxonomic History and Distribution: Lent and Wygodzinsky (1979) monographed Triatominae, and this publication is still an important reference. The subfamily consists of 5 tribes (Rhodniini, Cavernicolini, Bolboderini, Alberproseniini, Triatomini) containing 16 genera and ~140 species (Galvão et al. 2003). Most are found in the New World but one genus, *Linshcosteus* Distant, is restricted to India and several species of *Triatoma* Laporte are found throughout the Oriental region. Even though Triatominae have been treated as a distinct subfamily for a long time, recent phylogenetic research has cast doubt on the monophyly of this group. Published hypotheses currently find support for either the monophyly of Triatominae (Hypša et al. 2002; Weirauch and Munro 2009; Patterson and Gaunt 2010), their polyphyly (Paula et al. 2005; Schofield and Galvão 2009), or their paraphyly (Hwang and Weirauch, 2012) with respect to several genera of large-bodied Reduviinae.

Triatoma dimidiata, Costa Rica

Panstrongylus geniculatus, French Guiana

Rhodnius robustus, French Guiana

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Triatominae (cont.)

Previous

Occurrence in Canada: Triatominae have not been recorded from Canada.

Natural History: Members of this group feed on vertebrate blood and many species are vectors of Chagas disease that is caused by the parasite *Trypanosoma cruzi* (Chagas) [Lent and Wygodzinsky 1979].

References

Galvão, C., Carcavallo, R.U., Rocha, D.S., and Jurberg, J. 2003. A checklist of the current valid species of the subfamily Triatominae Jeannel, 1919 (Hemiptera, Reduviidae) and their geographical distribution, with nomenclatural and taxonomic notes. Zootaxa, **202**: 1-36.

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Schofield, C.J. and Galvão, C. 2009. Classification, evolution, and species groups within the Triatominae. Acta Tropica, **110**: 88-100.

Weirauch, C. and Munro, J.B. 2009. Molecular phylogeny of the assassin bugs (Hemiptera: Reduviidae), based on mitochondrial and nuclear ribosomal genes. Molecular Phylogenetics and Evolution, **53**: 287-299.

Tribelocephalinae

Diagnosis: Tribelocephalinae are characterized by dense specialized setae with a bulbous base and curved apex that cover much of the body. In almost all members, the ocelli are absent, the eyes are flat, and the scape is stout and longer than the head, with the more distal segments folded backwards underneath it. In addition, the corium is reduced such that the membrane takes up most of the hemelytron. Members are often brown, cryptic and slightly flattened.

Taxonomic History and Distribution: The group consists of 16 genera and ~130 species (Maldonado 1990; Rédei 2007; Weirauch 2010). Tribelocephalinae were first recognized by Stål (1866). Villiers (1943) divided the group into 2 tribes, the Opistoplatyini and Tribelocephalini. Maldonado (1996) created a third tribe, the Xenocaucini. The genus *Xenocaucus* China and Usinger, with 2 species, is known from Bioko Island in the Gulf of Guinea and from Tanzania. It is eyeless, wingless, and covered in dense setae (China and Usinger 1949). Tribelocephalinae occur in the Old World tropics with exception of the recently described genus *Tribelocodia* Weirauch that is found in French Guiana. *Tribelocodia* possesses some features otherwise typically found in Ectrichodiinae (ocelli, 2-pronged scutellum, and fossula spongiosa), suggesting that either the monophyly of these 2 closely related taxa is questionable, or that character evolution within these groups is more complex than previously assumed (Weirauch 2008; Weirauch 2010; Hwang and Weirauch 2012).

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Opistoplatys sp., Indonesia

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Abelocephala sp., Australia

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Tribelocephalinae (cont.)

Occurrence in Canada: Tribelocephalinae do not occur in Canada.

Natural History: Tribelocephalinae are often found in leaf litter and some are attracted to lights, but their biology is largely unknown (Schuh and Slater 1995).

References

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Tribelocephala sp., Tanzania

Xenocaucus mancinii, Bioko

Opistoplatys sp., Indonesia

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Vesciinae

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Diagnosis: Vesciinae are characterized by the foretibial spur projecting beyond the tarsal insertion, the large anterior pronotal lobe, and the scape shorter than or as long as the head. Most species do not possess ocelli (except *Mirambulus* Breddin) and some genera have a frontal spine (*Chopardita* Villiers and *Vescia* Stål) and an elongate forecoxa (*Microvescia* Wygodzinsky, *Pessoaia* Costa Lima, and *Vescia*).

Taxonomic History and Distribution: The group consists of 5 genera and 20 species (Maldonado 1990). Vesciinae were established as a subfamily by Fracker and Bruner (1924) for the genus *Vescia*, which was originally described by Stål (1866) in the subfamily Reduviinae. Members of 3 genera (*Mirambulus*, *Pessoaia*, and *Vescia*) were included in Weirauch's (2008) morphological cladistic analysis of Reduviidae. *Mirambulus* and *Vescia* were recovered as sister taxa, but *Pessoaia* as the sister taxon to a large clade comprising other reduviid taxa (e.g., Reduviinae, Peiratinae, Salyavatinae), thus rendering Vesciinae polyphyletic. The analysis by Hwang and Weirauch (2012) included only one species of *Mirambulus* and did therefore not test these hypotheses. One genus (*Chopardita*) is restricted to Africa, the remaining genera are Neotropical.

Occurrence in Canada: Vesciinae do not occur in Canada.

Natural History: The natural history of Vesciinae is largely unknown. *Mirambulus morio* Breddin has been found in disturbed habitats alongside roads or in secondary forests, and *Pessoaia limai* Usinger was collected in Malaise traps and at light in tropical dry forests (Forero 2006). Brachyptery may occur in females of *Vescia* spp. (Forero 2006).

Vescia sp., Brazil

Mirambulus sp., French Guiana

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Vesciinae (cont.)

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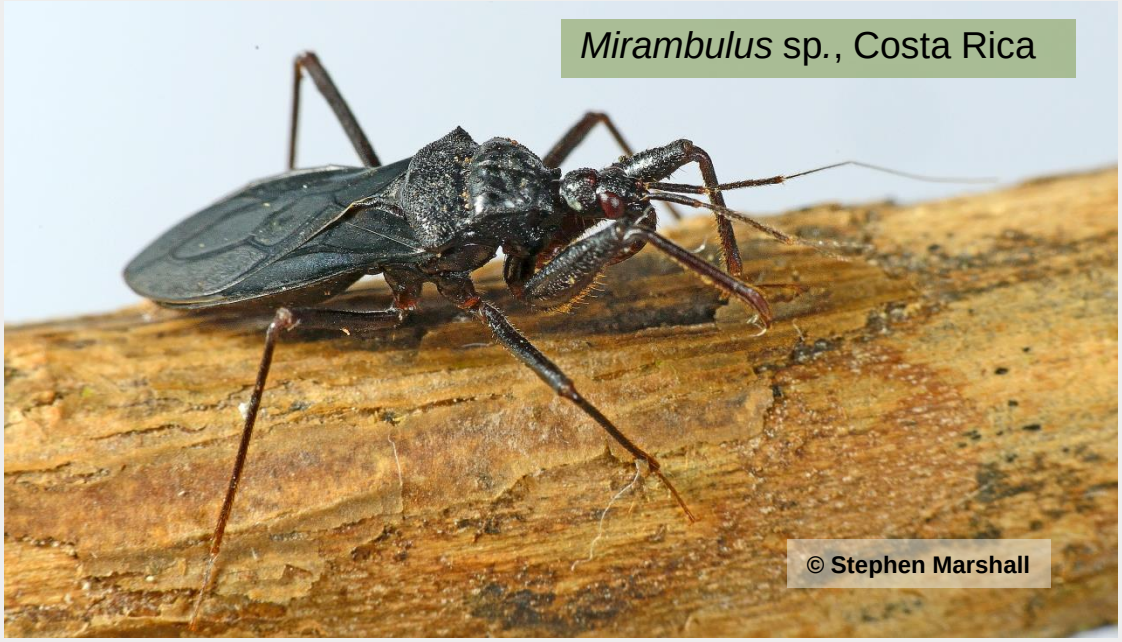
Pessoaia sp., French Guiana



Mirambulus sp., Costa Rica

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Visayanocorinae

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Diagnosis: Visayanocorinae are characterized by a foretibial spur projecting beyond the tarsal insertion, the small size, a very long second (first visible) labial segment, long second tarsomere, and the scape longer than the head. Members of this subfamily also have very smooth cuticle and lack ocelli and an anteocular sulcus.

Taxonomic History and Distribution: This group consists of only 2 genera, *Carayonia* Villiers and *Wardamanocoris* Malipatil, comprising 10 species. Visayanocorinae were established by Miller (1952) for a monotypic genus from the Philippines, but it was later synonymized with the saicine genus *Carayonia* by Villiers (1958). China and Miller (1959) disagreed with Villiers' classification and retained Visayanocorinae. Subsequently, the group was either treated as a distinct subfamily (Putshkov and Putshkov 1985) or as part of the Saicinae (Maldonado 1990). Villiers (1969) provided a key to the African species of *Carayonia*. Members are found in Australia and the Old World tropics.

Occurrence in Canada: Visayanocorinae do not occur in Canada.

Natural History: Little is known on the natural history of Visayanocorinae. They have been collected using light traps, flight intercept traps, or by sieving rainforest litter (Malipatil 1990). Females of *Carayonia camerunensis* Villiers may be micropterous (Villiers 1958).

Carayonia sp., Australia

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Visayanocorinae

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Carayonia sp., Australia

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