Photographic key to the Pseudoscorpions of Canada and the adjacent USA

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Abstract. The pseudoscorpion fauna of northern North America is poorly known, in part because of the scarcity of taxonomic resources. This photographic key was developed by combining existing keys with photographs of diagnostic characters from about 80 specimens of pseudoscorpions from North America. The key will classify 35 taxa (to genera and some species) of pseudoscorpions occurring in Canada and the adjacent USA**.** Some distribution notes are presented, along with information about habitat affinities and general ecology.

Introduction

The order Pseudoscorpiones is a small and curious group of arachnids. They are dorsally-ventrally flattened animals, typically less than 5 mm in length and generally light tan to reddish brown to black in colour. Although the order is relatively species-poor (i.e., 3,385 known species, globally (Harvey 2009)), pseudoscorpions are fascinating for their natural history and behaviour (e.g., Weygoldt 1969, Zeh and Zeh 1994, Tizo-Pedroso and Del-Claro 2005), and they exhibit wonderful variability in size and form (Figure 1). Typical habitats for pseudoscorpions include leaf-litter, under rocks, within compost piles, under bark and within decaying wood, in caves, and in bird nests. Many species are phoretic on insects or birds (e.g., Haack and Wilkinson 1987), and species such as *Chelifer cancroides* (L.) are cosmopolitan, typically found in buildings, barns or other human-made structures. Key references for the pseudoscorpions in North America include Muchmore (1990), Hoff (1949), Nelson (1975), and Chamberlin (1931). These publications, especially Hoff (1949) provide detailed information about collecting specimens and preparing them for taxonomic study.

The most recent phylogenetic treatment of the order was proposed by Harvey (1992), and there has been recent activity on the higher-level taxonomy for the group (e.g., Murienne et al. 2008). Harvey's (2009) on-line catalogue is a key resource for nomenclature and classification, and for its extensive bibliography. However, resources for identification of pseudoscorpions in northern benchmarked the taxonomic status of

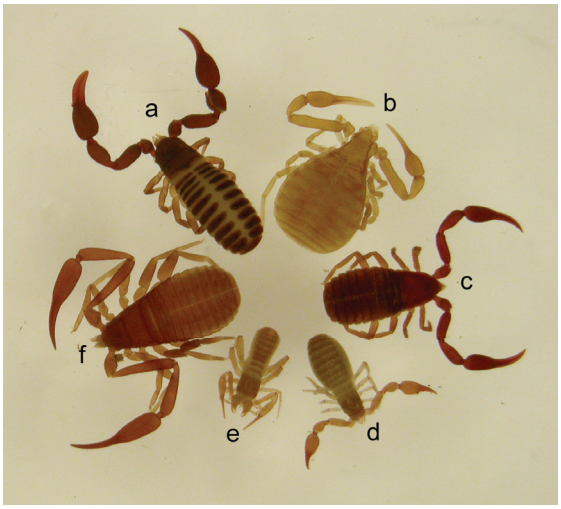

Fig. 1 Selection of pseudoscorpions to illustrate range in body form and size: a. *Dendrochernes* (Chernetidae); b. *Pseudogarypus* (Pseudo-garypidae); c. *Wyochernes* (Chernetidae); d. *Microbisium parvulum* (Neobisiidae); e. *Chthonius* (*Ephippiochthonius*) *tetrachelatus* (Chthoniidae); f. *Chelifer cancroides* (Cheliferidae).

North America remain scarce. Buddle (2005) benchmarked the taxonomic status of pseudoscorpions in Canada, and suggests there are 23 valid species known from Canada, with another 20-30 species likely to occur in the country.

Taxonomic keys for pseudoscorpions in Canada are not available; the only key that is workable for North American specimens is that written by Muchmore (1990). This key is an excellent resource, but it is difficult to navigate and

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the drawings are difficult for those not trained or experienced in general pseudoscoropion taxonomy. Seeing the characters on actual specimens can help make the taxonomy more accessible; with this in mind, the purpose of this paper is to provide a taxonomic key to genera and some species of pseudoscorpions found in Canada and the adjacent United States of America. This key is not meant to replace other resources, but instead the goal is to provide an additional resource for workers interested in pseudoscorpions. Some information on the general anatomy of pseudoscorpions is included, with the purpose of supplementing information available elsewhere as line drawings (e.g., Hoff 1949, Muchmore 1990). I have also included some notes on the ecology, habitat affinities, and distribution for each taxon, and as more information is gathered in the future, I hope these notes can be developed into formal species pages.

Methods

For each taxon, specimens were either collected in the field, were sent to me over the last several years, or were borrowed from Museums (primarily the Canadian National Collection (CNC), Ottawa, and the Florida State Collection of Arthropods (FSCA)). Whenever possible, I used and examined specimens from northern North America for photographs. William Muchmore also provided many Canadian specimens, and I have relied heavily on many of his slide specimens currently housed at the FSCA. The bulk of the specimens used were slide-mounted, although some characters were better displayed with alcohol specimens and/or only wet specimens were available for study. Slide specimens were photographed using a Leica Infinity1 Camera housed on a Leica DM 2500 compound microscope. For most specimens, 4-6 photographs at different depths of field were taken and subsequently stacked using Combine Zm software (available at http://hadleyweb.pwp.blueyonder.co.uk/CZM/News.htm. Wet specimens were photographed with either the Leica Infinity 1 Camera, or a Nikon Coolpix 4500 Camera, attached to a Nikon SMZ 1500 dissecting microscope. Images were then edited using Adobe Photoshop Elements (Version 4.0).

Over 150 specimens were examined, including all taxa currently represented in Canada. About 80 of these were photographed for generalized anatomy and for diagnostic images for the taxonomic key. For some rarely encountered taxa known only from the adjacent USA, I was unable to obtain specimens to photograph and these couplets are not accompanied by images (e.g., *Aspurochelifer littlefieldi*). The key was written by relying heavily on the works of Muchmore (1990), Hoff (1949), and the unpublished manuscripts by M.J. Sharkey. Distributions and ecological information is taken from Muchmore (1990), Harvey (1990, 2009), unpublished reports by M.J. Skarkey, and my personal collections and experience. Unfortunately, some taxa remain unresolved and I have taken a conservative approach when necessary. I have adopted nomenclature proposed by Harvey (2009), unless indicated otherwise, and the key is for a total of 35 taxa (Table 1).

General Anatomy and Taxonomic Characters

The pseudoscorpion body is divided into an anterior cephalothorax (or prosoma) (dorsally, the carapace) and a posterior abdomen (or opisthoma), broadly connected to each other (Figure 2). Males can be differentiated from females, but sexual determination can be difficult. The genital openings occur between the second and third opisthosomal sternites. In general the genital area of females is lightly sclerotized and appears as a bright zone behind the coxae of the legs (Figure 3). In males, this region is relatively dark and more highly sclerotized (Figure 3). Males are also typically smaller than females. Some species also exhibit sexual differentiation in the palps.

The chelicerae contain important taxonomic characters (Figures 2, 4): they are two-segmented structures used to grasp and macerate prey items, and include a fixed and movable finger (Figure 4). Each of the chelicera bears a variety of setae, the placement of which are important for taxonomic purposes. The *rallum* is a tight grouping on the medial side (Figure 4); the setae of the lateral side are named as follows: exterior seta (*es*), basal seta (*bs*), subbasal seta (*sbs*), interior seta (*is*), laminal seta (*ls*), and galeal seta (*gs*) on the movable finger. A comblike or membraneous *serrula* occurs along the side of the movable finger, with the *spinneret* or *galea* at the end, which carries the openings of the silk glands. The third pair of appendages is the pair of long *palps* or *pedipalps*, with the coxae of these serving as accessory mouthparts (Figure 2). Beyond the coxa, each palp is comprised of the trochanter, femur, patella, and chela, with a fixed and movable finger. The chela is used for defense and prey capture. The palpal chela usually has numerous teeth along the inner margins, ending with a sharp tip (*venedens*), which has an opening for the venom gland. The sensory setae

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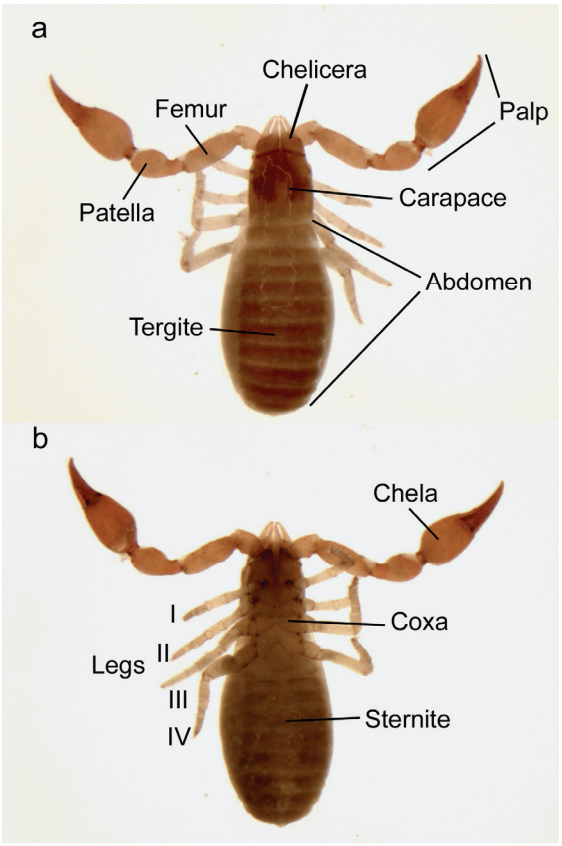

Fig. 2 *Microbisium parvulum* habitus: a. dorsal view; b. ventral view.

(*trichobothria*) on the movable finger are named as follows (Figure 5), divided by a lateral or exterior series and a medial or interior series: basal (*b*), subbasal (*sb*), subterminal (*st*) and terminal (*t*). The setae for the fixed finger are named as follows: exterior basal (*eb*), exterior subbasal (*esb*), exterior subterminal (*est*), exterior terminal (*et*), interior basal (*ib*), interior subbasal (*isb*), interior subterminal (*ist*), and interior terminal (*it*).

The remaining four pairs of appendages are walking legs (Figure 2), consisting of a coxa, trochanter, basifemur, telofemur, tibia, and one or two tarsal segments. The legs terminate with two claws and an arolium. The abdomen is divided into 11 or 12 segments, with sclerotized *tergites* dorsally and *sternites* ventrally (Figure 2), separated by soft, flexible *intersegmental* and *pleural membranes*. The *spiracles* are found at the lateral edges of the third and fourth sternites.

How to use this key

This dichotomous key is designed for use with both wet specimens and specimens mounted on slides. For most general collections of pseudoscorpions, specimens are typically preserved in 70-95% ethanol; typically slide mounts are done only for long-term storage of voucher specimens. When working with wet specimens, it is advised to handle the specimens with small insect pins or fine forceps. For using the key accurately, legs I and IV should be removed (including trochanter but not the coxa), and one chelicera and one chela are typically removed. These are placed separately from the whole specimen on a flat slide with a cover slip propped up with a small piece of fishing line; some structures may need to be cleared for a period of 1-3 days or more (i.e., if heavily sclerotized) with a clearing agent (e.g., lactic acid) if required. It is possible to gently rotate the structure under the

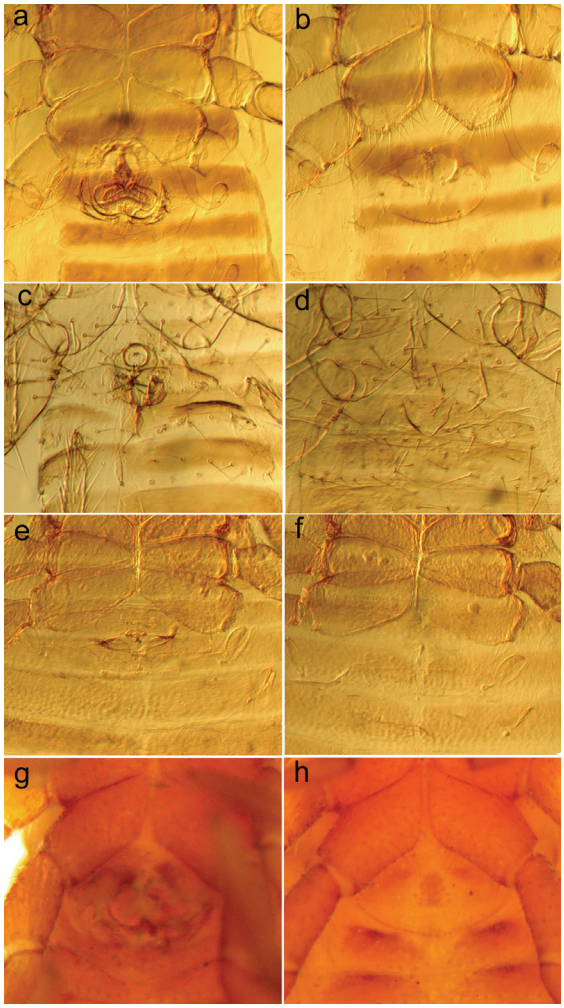

Fig. 3 Representative males (left) and females (right) from different families and species of pseudoscorpions: a,b. *Americhernes oblongus* (Chernetidae); c,d. *Apochthonius moestus* (Chthoniidae); e,f. *Larca* sp. (Larcidae); g,h. *Wyochernes* sp. (Chernetidae). Photographs from slide specimens except for *Wyochernes* (specimens in 70% ethanol).

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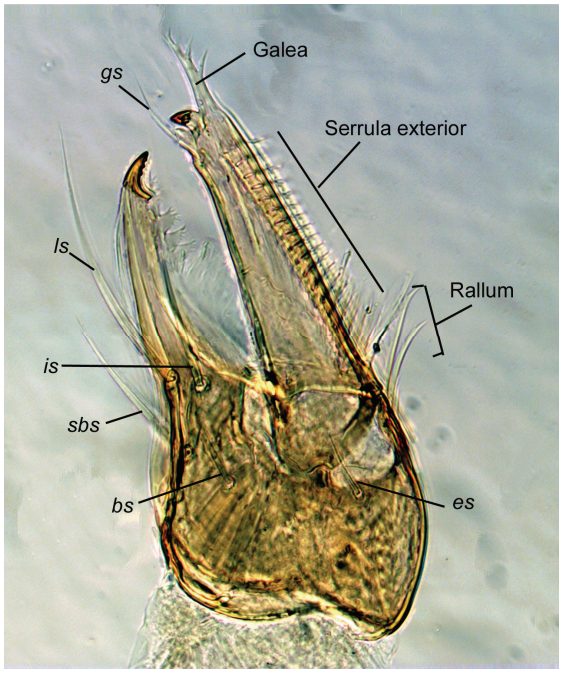

Fig. 4 *Acuminochernes* sp. chelicera illustrating movable finger with membranous exterior serrula, galea (spinneret), and galeal seta (*gs*). Fixed finger and base typically contains five setae: exterior seta (*es*), basal seta (*bs*), subbasal seta (*sbs*), interior seta (*is*) and laminal seta (*ls*). The rallum is a group of setae near the base of the movable finger.

cover slip by gently moving the cover slip and, provided the fishing line is thin enough, the structure will rotate with ease. In this manner, the correct orientation is achieved. The whole specimen can be viewed by placing in a depression slide with ethanol.

Acknowledgements

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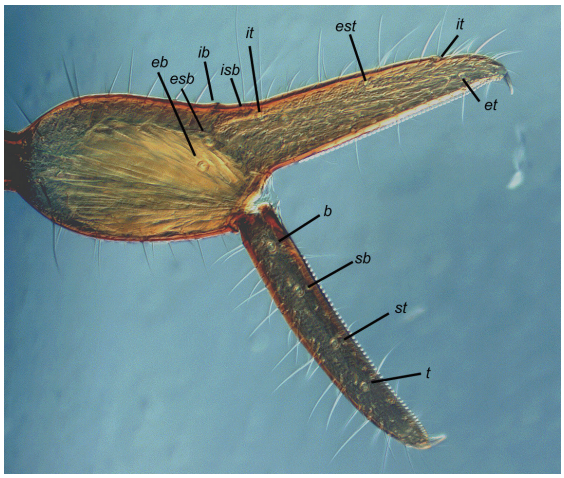

Fig. 5. Palpal chela of *Microcreagris* sp. showing sensory setae (trichobothria). Movable finger contains basal (*b*), subbasal (*sb*), subterminal (*st*) and terminal (*t*) setae. The fixed finger contains exterior basal (*eb*), exterior subbasal (*esb*), exterior subterminal (*est*), exterior terminal (*et*), interior basal (*ib*), interior subbasal (*isb*), interior subterminal (*ist*) and interior terminal (*it*) setae. Trichobothria can be recognized as they are typically longer than other setae, and by the recessed pit at the base of the seta.

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Table 1. Summary of pseudoscorpion taxa that can be determined using the key. Nomenclature follows Harvey (2009).

Family	Genus/Species
Chthoniidae	*Chthonius* (*Chthonius*) *ischnocheles* (Hermann)
	Chthonius (Ephippiochthonius) tetrachelatus (Preyssler)
	Apochthonius Chamberlin
	Mundochthonius Chamberlin
	Pseudotyrannochthonius Beier
Syarinidae	*Syarinus* Chamberlin
Neobisiidae	*Americocreagris* Ćurčić, *Globocreagris* Ćurčić, *Microcreagris* Balzan
	Halobisium occidentale Beier
	Microbisium brunneum (Hagen)
	Microbisium parvulum (Banks)
	Roncus lubricus L. Koch
Larcidae	*Larca* Chamberlin
Garypinidae	*Pseudogarypinus* Beier
Pseudogarypidae	*Pseudogarypus* Ellingsen
Cheiridiidae	*Apocheiridium* Chamberlin
Chernetidae	*Acuminochernes* Hoff
	Americhernes Muchmore
	Chernes Menge
	Dendrochernes Beier
	Dinocheirus Chamberlin
	Epactiochernes Muchmore
	Hesperochernes Chamberlin
	Illinichernes Hoff
	Mirochernes dentatus (Banks)
	Parachernes Chamberlin
	Pselaphochernes Beier
	Wyochernes Hoff
Cheliferidae	*Aspurochelifer littlefieldi Benedict and Malcolm*
	Chelifer cancroides (L.)
	Dactylochelifer Beier
	Haplochelifer philipi (Chamberlin)
	Hysterochelifer Chamberlin
	Idiochelifer nigripalpus (Ewing)
	Parachelifer Chamberlin
	Paisochelifer Hoff

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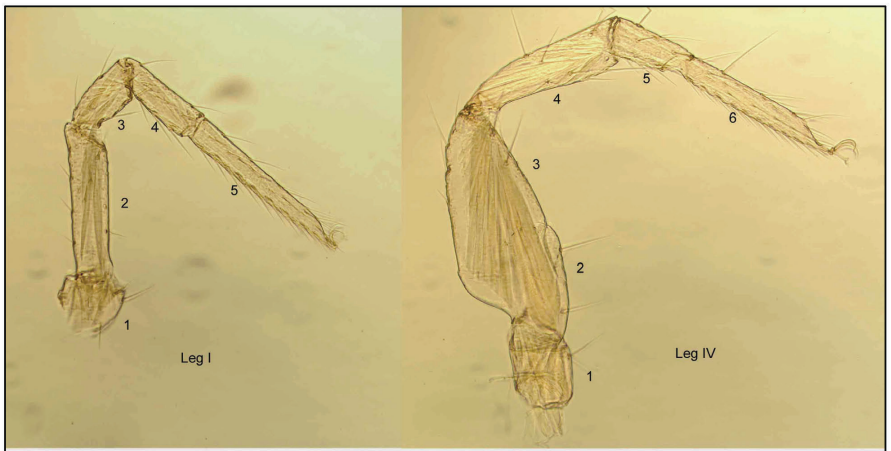

Figure 6. Leg I (five segments) and leg IV (six segments) of *Apochthonius moestus* (Chthoniidae), exluding coxa.

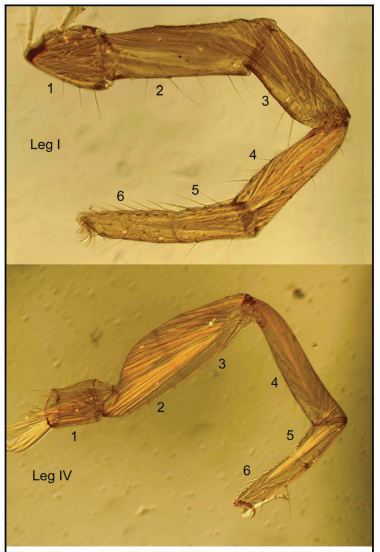

Figure 7. Leg I and leg IV of *Microcreagris* sp. showing equal number of segments (six) beyond coxa.

1	Legs I and II with fewer segments, excluding coxa, than legs III and IV (Family Chthoniidae) (Figure 6)	2
1’	All legs with the same number of segments (Figure 7)	6

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Figure 8. Chela of *Apochthonius moestus* chela showing trichobothria near middle of chelal hand.

Figure 9. Chela of *Pseudotyrannochthonius* sp. showing trichobothria pair near base of fixed finger.

2 (1)	Transverse pair of trichobothia of dorsum of chelal hand near or proximal to middle (Figure 8)	3
2'	Transverse pair of trichobothria on dorsum of chelal near base of fixed finger (Figure 9)	*Pseudotyrannochthonius* Beier

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Figure 10. Ventral view of *Chthonius* (*Ephippiochthonius*) *tetrachelatus*; coxal spines indicated on coxae II and III.

Figure 11. Ventral view of *Apochthonius* sp; coxal spines confined to coxae I.

3 (2)	Coxal spines on second and/or third pedal coxae (Figure 10)	4
3'	Coxal spines confined to first coxa (Figure 11)	*Apochthonius* Chamberlin

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Figure 10. Ventral view of *Chthonius* (*Ephippiochthonius*) *tetrachelatus*; coxal spines indicated on coxae II and III.

Figure 12. Chela of *Chthonius* sp., noting teeth on fixed finger.

Figure 13. Ventral view of *Mundochthonius* sp. with coxal spine confined to coxae II.

Figure 14. Chela of *Mundochthonius* sp., noting teeth on fixed finger.

4 (3)	Coxal spines on second and third pedal coxae (Figure 10); marginal teeth of at least the fixed chelal finger acute and distinctly spaced (Figure 12)	5
4'	Coxal spines confined to second pedal coxae (Figure 13); marginal teeth of chelal fingers small, blunt and contiguous (figure 14)	*Mundochthonius* Chamberlin

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Figure 15. Chela of *Chthonius* (*Chthonius*) *ischnocheles*; arrow indicates evenly curved shape of chelal hand.

Figure 16. Chela of *Chthonius* (*Ephippiochthonius*) *tetrachelatus*; arrow indicates depression on chelal hand.

5 (4)	Teeth on chelal fingers somewhat conical, recurved and contiguous; chelal hand evenly curved on dorsal margin (Figure 15)	*Chthonius (Chthonius) ischnocheles* (Hermann)
5'	Teeth on chelal fingers straight and separated; chelal hand with dorsal depression (Figure 16)	*Chthonius (Ephippiochthonius) tetrachelatus* (Preyssler)

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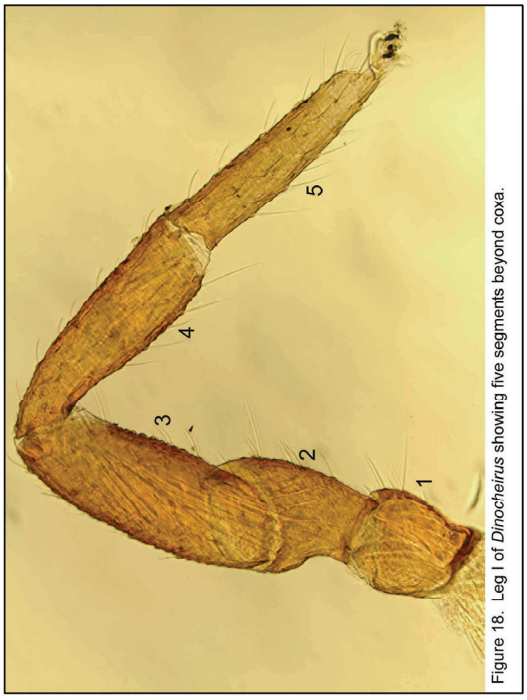

Figure 18. Leg I of *Dinocheirus* showing five segments beyond coxa.

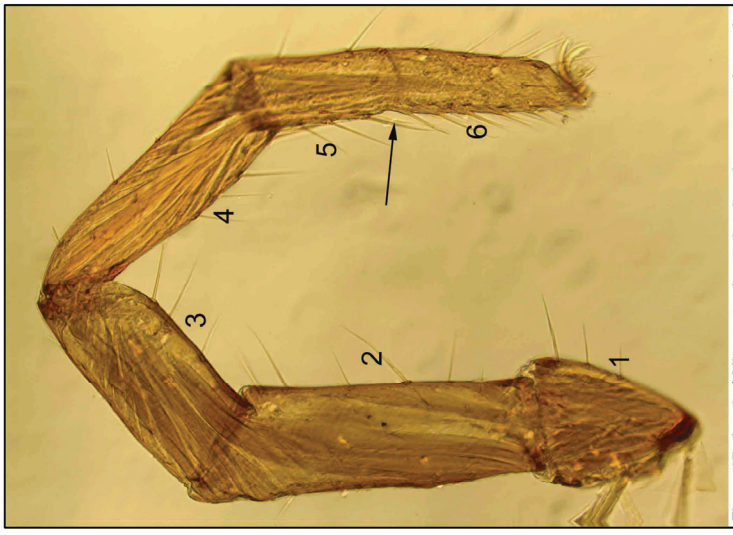

Figure 17. Leg I of *Microcreagris* sp. showing six segments beyond coxa (arrow indicate division of tarsus).

6 (1)	Tarsus of each leg divided into two parts; each leg with six segments beyond coxa (Figure 17)	7
6'	Tarsus of each leg undivided; each leg with five segments beyond coxa (Figure 18)	14

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Figure 19. Chelicera of *Microcreagris* sp; arrows indicate (a) galea and (b) dentate inner margin of movable finger.

Figure 20. Chelicera of *Pseudogarypinus* sp.; arrow indicates smooth inner margin of movable finger.

7 (6)	Chelicera with inner margin of movable finger distinctly dentate (Figure 19)	8
7'	Chelicera with inner margin of movable finger smooth (Figure 20)	13

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Figure 21. Ventral view of *Microbisium* sp.; arrow indicates granulate pleural membrane.

Figure 22. Ventral view of *Syarinus* sp.; arrow indicates longitudinally striate pleural membrane.

8 (7)	Pleural membranes of abdomen granulate (Figure 21). Family NEOBISIIDAE	9
8'	Pleural membranes of abdomen longitudinally striate (Figure 22). Family SYARINIDAE	*Syarinus* Chamberlin

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Figure 19. Chelicera of *Microcreagris* sp; arrows indicate (a) galea and (b) dentate inner margin of movable finger.

Figure 23. Chelicera of *Microbisium* sp; arrow indicates sceloritic knob.

9 (8)	Cheliceral galea present, having one or more ramus (Figure 19)	10
9'	Cheliceral galea absent or represented by a sceloritic knob (Figure 23)	11

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Figure 24. Tip of *Microcreagris* sp. chelicera.

Figure 25. Tip of *Halobisium* sp. chelicera.

10 (9)	Spinneret consisting of a single, usually branched galea (Figure 24)	*Microcreagris* Balzan, *Americocreagris* Ćurčić and *Globocreagris* Ćurčić
10’	Spinneret in the form of 8-10 simple galea aligned in a row (Figure 25)	*Halobisium occidentale* Beier

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Figure 26. Dorsal view of carapace and chelicerae of *Microbisium* sp.; arrows indicate two of the eyes.

11 (9)	With four eyes (Figure 26)	12
11’	With two eyes	*Roncus lubricus* L. Koch

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12 (11)	Chelal length generally greater than 0.70 mm; femur length typically greater than 0.40 mm.	*Microbisium brunneum* (Hagen)
12'	Chelal length generally less than 0.70 mm; femur length typically less than 0.40 mm.	*Microbisium parvulum* (Banks)

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Figure 27. Ventral view of *Larca* sp.; arrows illustrate the widening of the coxae from anterior to posterior.

Figure 28. Ventral view of *Pseudogarypinus* sp.; arrows illustrate similar width of the coxae from anterior to posterior. Note: Leg IV on right side is missing.

13 (7)	Coxal area widened posteriorly (Figure 27). Family LARCIDAE	*Larca* Chamberlin
13'	Coxal area with sides approximately parallel (Figure 28). Family GARYPINIDAE	*Pseudogarypinus* Beier

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Figure 29. Carapace of *Wyochernes asiaticus*.

Figure 30. Carapace of *Pseudogarypus* sp. with anterolateral processes indicated with arrows

14 (6)	With two eyes or without eyes; carapace lacking prominent anterolateral processes (Figure 29)	15
14'	With four prominent eyes; carapace with distinct anterolateral processes (Figure 30). Family PSEUDOGARYPIDAE	*Pseudogarypus* Ellingsen

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Figure 31. Legs I and IV of *Wyochernes asiaticus*; arrows indicate femora.

Figure 32. Legs I and IV of *Apocheiridium* sp.; arrows indicate femora.

15 (14)	Femora of legs I and II different in shape than femora of legs III and IV (Figure 31)	16
15'	Femora of legs I and II similar in shape to femora of legs III and IV (Figure 32). Family CHEIRIDIIDAE	*Apocheiridium* Chamberlin

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Figure 33. Chela of *Dendrochernes* sp.

Figure 34. Chela of *Chelifer cancroides*.

16 (15)	Venom apparatus developed in movable finger only, may be present as a vestige in fixed finger; accessory teeth usually present on chelal fingers (Figure 33). Family CHERNETIDAE	17
16'	Venom apparatus equally well developed in fixed and movable fingers; accessory teeth absent from chelal fingers (Figure 34). Family CHELIFERIDAE.	29

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Figure 35. Chelicera of *Lamprochernes* sp.; arrows indicate three setae of rallum

Figure 36. Chelicera of *Dendrochernes* sp; arrows indicate four setae of rallum.

17 (16)	Rallum on chelicera composed of three setae (Figure 35)	18
17'	Rallum on chelicera composed of four setae (Figure 36)	22

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Figure 37. Leg IV of *Americhermes oblongus* showing setae on tibia.

Figure 38. Leg IV of *Wyochermes asiaticus*.

18 (17)	Tibia of leg IV with one or two prominent tactile setae on outer margin (Figure 37)	19
18'	Tibia of leg IV without conspicuous tactile setae (Figure 38)	20

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Figure 37. Leg IV of *Americhernes oblongus* showing setae on tibia.

Figure 39. Leg IV of *Lamprochernes* sp. showing single tactile seta on tibia.

19 (18)	Tibia of leg IV with one tactile seta, near distal end of outer margin (Figure 39)	*Lamprochernes* Tömösvary
19'	Tibia of leg IV with two tactile setae, at middle and distal end (Figure 37)	*Americhernes* Muchmore

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Figure 40. Leg IV of *Parachermes virginicus* showing single tactile seta on tarsus.

Figure 38. Leg IV of *Wyochermes asiaticus*.

20 (18)	Tarsus of leg IV with a conspicuous tactile seta (Figure 40); accessory teeth present on chelal fingers.	21
20'	Tarsus of leg IV without a conspicuous tactile seta (Figure 38); accessory teeth non-distinct or absent from chelal fingers.	*Wyochermes* Hoff

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Figure 41. Chela of *Parachernes virginicus*.

Figure 42. Chela of *Pselaphochernes* sp. with arrows indicating some trichobothria on fixed finger.

21 (20)	All trichobothria on fixed finger of chela (except *et*) confined to proximal half of finger (Figure 41)	*Parachernes* Chamberlin
21'	Trichobothria on fixed finger of chela of standard arrangement (Figure 42)	*Pselaphochernes* Beier

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Figure 43. Leg IV of *Epactiochernes* sp. with arrow showing tactile seta on tarsus.

Figure 44. Leg IV of *Hesperochernes* sp.

22 (17)	Tarsus of leg IV with a conspicuous tactile seta (Figure 43)	23
22'	Tarsus of leg IV without a conspicuous tactile seta (Figure 44)	27

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Figure 46. Movable finger of *Dendrochernes* sp. chela, illustrating relative distance between trichobothria *sb*, *st*, and *t*.

Figure 45. Movable finger of *Dinocheirus* sp. chela, illustrating relative distance between trichobothria *sb*, *st* and *t*.

23 (22)	Movable chelal finger with trichobothrium *st* nearer to *t* than to *sb* (Figure 45)	24
23'	Movable chelal finger with trichobothrium *st* nearer to *sb* than to *t* (Figure 46)	*Dendrochernes* Beier

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Figure 47. Leg IV of *Acuminochernes* sp. with arrow showing tactile seta on tarsus.

Figure 43. Leg IV of *Epactiochernes* sp. with arrow showing tactile seta on tarsus.

24 (23)	Tactile seta on tarsus of leg IV distinctly distal to middle in position (Figure 47)	25
24'	Tactile seta on tarsus of leg IV mid-length in position (Figure 43)	*Epactiochernes* Muchmore

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Figure 49. Chelicera of *Acuminochernes* sp. showing *sbs* simple and acuminate.

Figure 48. Chelicera of *Dinocheirus* sp. showing terminally denticulate *sbs*.

25 (24)	Hand of chelicera with seta *b* acuminate and *sb* terminally denticulate (Figure 48)	26
25'	Hand of chelicera with both *b* and *sb* simple and acuminate (Figure 49)	*Acuminochernes* Hoff

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Figure 50. Chela of male *Mirochernes dentatus*.

Figure 51. Chela of male *Dinocheirus* sp.

26 (25)	Male with prominent, anvil-shaped process on medial side of chelal hand (Figure 50)	*Mirochernes dentatus* (Banks)
26'	Males without a process on the medial side of chelal hand (Figure 51)	*Dinocheirus* Chamberlin

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Figure 52. Fixed finger of *Hesperochernes* sp. chela.

Figure 53. Fixed finger of *Illinichernes* sp. chela; arrow indicates clavate and elongate setae.

27 (22)	Setae of palps and tergites regular in form; setae on fixed palpal chelal finger all similar in length and form (Figure 52)	28
27'	Setae of palps and tergites large, pinnate and leaflike; several long, clavate setae near centre of outer margin of fixed chelal finger (Figure 53)	*Illinichernes* Hoff

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Figure 54. Ventral view of female *Hesperochernes* sp., with arrows indicating terminally expanded spermathecae.

Figure 55. Ventral view of female *Chernes* sp, with arrow showing terminal end of single visible spermatheca.

28 (27)	Hand of chelicera usually with setae *b* and *sb* both denticulate; spermathecae of female terminally expanded sac-like (Figure 54)	*Hesperochernes* Chamberlin
28'	Hand of chelicera with seta *b* acuminate and *sb* denticulate; spermathecae of female not terminally expanded (Figure 55)	*Chernes* Menge

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Figure 56. Ventral view of male *Paisochelifer* sp. showing coxae IV with genital sacs indicated by arrows.

29 (16)	Male with genital sacs in coxae of legs IV (Figure 56); female with median cribriform plates smaller in diameter than diameter of anterior tracheal trunk.	30
29'	Male without genital sacs in coxae of legs IV; female with median cribriform plates as large in diameter as diameter of anterior tracheal trunk.	*Haplochelifer philipi* (Chamberlin)

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Figure 56. Ventral view of male *Paisochelifer* sp. showing coxae IV with genital sacs indicated by arrows.

Figure 57. Ventral view of male *Dactylochelifer* sp. showing genital sacs, with atria indicated, in coxae IV.

30 (29)	Coxal sacs of males without well-defined atria (Figure 56)	31
30'	Coxal sacs of male with well-defined atria (Figure 57)	*Dactylochelifer* Beier

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Figure 58. Tarsal claw of leg IV of *Chelifer cancroides*; arrow indicates bifid claw.

Figure 59. Tarsal claw of leg IV of *Hysterochelifer* sp.

31 (30)	Tarsal claws of leg IV bifid or with an accessory tooth (Figure 58)	32
31’	Tarsal claws of leg IV simple and without accessory tooth (Figure 59)	33

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Figure 60. Chelicera of *Parachelifer* sp. showing five setae (numbered) on fixed hand.

Figure 61. Chelicera of *Chelifer cancroides* showing four setae (numbered) on fixed hand.

32 (31)	Hand of chelicera with five setae (Figure 60)	*Parachelifer* Chamberlin
32’	Hand of chelicera with four setae (Figure 61)	*Chelifer cancroides* (L.)

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Figure 62. Apical spine (indicated by arrow) on leg I tarsus of male *Hysterochelifer* sp.

Figure 63. Tarsus of leg I of male *Idiochelifer nigripalpus*.

33 (31)	Tarsus of leg I of male with a well-developed apical spine (Figure 62)	34
33'	Tarsus of leg I of male lacking an apical spine (Figure 63)	35

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Figure 64. Lateral spurs (indicated by arrows) on abdominal tergites of male *Hysterochelifer* sp.

34 (33)	Male with well developed lateral spurs on anterior abdominal tergites (Figure 64).	*Hysterochelifer* Chamberlin
34'	Male without lateral spurs on abdominal tergites.	*Aspurochelifer littlefieldi* Benedict and Malcolm

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Figure 65. Ventral view of male *Idiochelifer nigripalpus* illustrating lateral spurs on coxae IV.

Figure 56. Ventral view of male *Piasochelifer* sp. showing coxae IV with genital sacs indicated by arrows.

35 (33)	Male with a lateral spur on coxa of leg IV (Figure 65)	*Idiochelifer nigripalpus* (Ewing)
35'	Males without a lateral spur on coxa of leg IV (Figure 56)	*Paisochelifer* Hoff

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Chthoniidae
Pseudotyrannochthonius Beier

- Taxonomy and distribution:
  - Four Nearctic species, two likely to occur in western Canada:
    - *P. gracilis* Benedict & Malcolm: WA
    - *P. incognitus* (R.O. Shuster): WA, ID
- Ecology: leaf litter, soil

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Chthoniidae
Apochthonius Chamberlin

- Taxonomy and distribution:
  - Nearctic genus; 24 described species, two Canadian records:
    - *A. minimus* R.O. Shuster*:* BC
    - *A. moestus* (Banks): ON, widespread species in USA, probably occurs across Canada
- Ecology: moist litter

Chthoniidae
Mundochthonius Chamberlin

- Taxonomy and distribution:
  - 10 Nearctic species, two occur or are likely to occur in Canada:
    - *M. rossi* Hoff: MB
    - *M. pacificus* (Banks): western North America
- Ecology: moist, cool litter

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Chthoniidae
Chthonius (*Chthonius*) *ischnocheles* (Hermann)

- Taxonomy and distribution:
  - Several sub-species recognized
  - Holarctic distribution: known from eastern USA and likely occurs in eastern Canada
- Ecology: moist litter, organic debris

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Chthoniidae
Chthonius (*Ephippiochthonius*) *tetrachelatus* (Preyssler)

- Taxonomy and distribution:
  - Holarctic distribution; widespread in central and eastern USA and known from Canada: ON, NS
- Ecology: moist litter, organic debris

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Syarinidae
Syarinus Chamberlin

- Taxonomy and distribution:
  - Six recognized species, five of which occur in North America
  - Three species known from Canada
    - *S. enhuycki* Muchmore: ON, central and eastern USA
    - *S. obscurus* (Banks): BC, SK, YK and western USA
    - *S. palmeni* Kaisila: NF
- Ecology: under rocks, moist litter, deep in soil

Neobisiidae
Americocreagris Ćurčić
Globocreagris Ćurčić
Microcreagris Balzan

- Taxonomy and distribution:
  - various genera have been proposed for *Microcreagris* (*sensu lato*) and taxonomic status of the group remains unstable
- Several species occur in North America and likely occur in Canada
  - *Americocreagris columbiana* (Chamberlin): OR, WA
  - *Globocreagris theveneti* (Simon): AK, AZ, CA, OR, WA
  - *Microcreagris tacomensis* (Ellingsen): WA
- Ecology: cool, moist littter, under rocks and stones

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Neobisiidae
Halobisium occidentale Beier

- Taxonomy and distribution:
  - Only representative of *Halobisium* in North America
  - Known in western USA (AK, CA, OR, WA) and Canada (BC)
- Ecology: littoral species, found under rocks, and in salt marshes

Neobisiidae
Roncus lubricus L. Koch

- Taxonomy and distribution:
  - Widespread in Europe, introduced to North America at least twice: NY, MA
- Ecology: in North America, known from greenhouses; in Europe, tends to occur in dry deciduous leaf litter

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Neobisiidae
Microbisium brunneum (Hagen)

- Taxonomy and distribution:
  - Nearctic species, widespread and common in North America, including across Canada: AB, MB, NF, NS, QC, ON
  - Occurs in northern latitudes
  - Difficult to distinguish from *M. parvulum*
- Ecology: in Canada, typically found in boreal forests litter, including bogs and forests with acidic soils; males are rare

Neobisiidae
Microbisium parvulum (Banks)

- Taxonomy and distribution:
  - Nearctic species, widespread and common across USA and southern Canada: MB, NS, ON, QC
  - Difficult to distinguish from *M. brunneum*
- Ecology: deciduous forest litter and soil; males are rare

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Larcidae
Larca Chamberlin

- Taxonomy and distribution:
  - Occurs in Europe and North America
  - Four species in North America
    - *L. notha* Hoff: Canada (SK), USA (OR, CO)
    - *L. granulata* (Banks) widespread in north-eastern USA and likely occurs in Canada
- Ecology: occurs in litter, frass, mammal nests

Garypinidae
Pseudogarypinus Beier

- Taxonomy and distribution:
  - three described species, two occur in southern and western USA
  - *P. frontalis* (Banks) known from WA and ID and likely occurs in western Canada
- Ecology: dry litter, under stones, bird and mammal nests

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Pseudogarypidae *Pseudogarypus* Ellingsen

- Taxonomy and distribution:
  - Six known species reported from USA and Canada
  - *P. banksi* Jacot known from QC and NS
- Ecology: under rocks, tree holes, rotten wood, stumps

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Cheiridiidae
Apocheiridium Chamberlin

- Taxonomy and distribution:
  - Widespread genus, occurs on multiple continents
  - At least six species known from USA
  - One record known for Canada: Alberta
- Ecology: small body size; varied habitats, including potential phoresy; known from bodies of noctuid moths

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Chernetidae
Lamprochernes Tömösváry

- Taxonomy and distribution:
  - Widespread genus, with three species known from the Nearctic
  - *L. minor* Hoff occurs in central USA and Canada: BC, QC, ON, AB
- Ecology: moist, organic debris; phoretic on insects

Chernetidae
Americhernes Muchmore

- Taxonomy and distribution:
  - Large genus
  - Four species known from USA and one occurs in Canada:
    - *A. oblongus* (Say): AB
- Ecology: under bark of logs and trees

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Chernetidae
Wyochernes Hoff

- Taxonomy and distribution:
  - Several species and subspecies described from North America and Asia
  - Two species occur in North America
    - *W. asiaticus* (Redikorzev): YK, AK
      - Beringian species
    - *W. hustoni* Hoff: WY
- Ecology: under stones and rocks at high elevations and latitudes; dry creek beds

Chernetidae
Parachernes Chamberlin

- Taxonomy and distribution:
  - Diverse and primarily neotropical genus,
  - one species, *P. virginicus* (Banks), occurs in north-eastern USA and probably in adjacent Canada
- Ecology: under bark of trees and logs; leaf litter

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Chernetidae
Pselaphochernes Beier

- Taxonomy and distribution:
  - Diverse genus, occurs in North America and Europe
  - Three species known to occur North America, with two possibly occurring in Canada:
    - *P. parvus* Hoff: central USA
    - *P. scorpionides* (Hermann): north-eastern USA
- Ecology: moist litter, compost

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Chernetidae
Dendrochernes Beier

- Taxonomy and distribution:
  - Holarctic genus, four described species
    - One Palearctic species (*sensu lato*): *D. cyrneus* (L. Koch)
    - Three Nearctic species, and one undescribed species from Quebec
      - *D. crassus* Hoff: USA (CO, NM, OR), Canada (BC)
      - *D. instabilis* (Chamberlin): MT
      - *D. morosus* (Banks): USA (FI, NY, MI) and Canada (ON, SK)
- Ecology: under bark, or phoretic on insects (e.g., Cerambycidae beetles)

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Chernetidae
Epactiochernes Muchmore

- Taxonomy and distribution:
  - Two Nearctic species described
  - *E. tristis* (Banks): eastern seaboard (USA), likely occurs in eastern Canada
- Ecology: littoral habitats, under rocks and debris on shorelines

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Chernetidae
Acuminochernes Hoff

- Taxonomy and distribution:
  - Two Nearctic species described, both may occur in Canada
    - *A. crassopalpus* (Hoff): widespread in USA
    - *A. tacitus* Hoff: CO, MI
- Ecology: tree holes, decayed logs, often associated with birds and mammals

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Chernetidae
Mirochernes dentatus (Banks)

- Taxonomy and distribution:
  - Monotypic genus found across central USA, probably occurs in Canada
- Ecology: decayed trees, often associated with small mammals

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Chernetidae
Dinocheirus Chamberlin

- Taxonomy and distribution:
  - Widespread holarctic genus
  - 16 species known from USA, with several species likely occurring in Canada
    - *D. pallidus* (Banks): central and eastern North America
    - *D. serratus* (Moles): western USA
    - Undescribed species collected from Alberta
- Ecology: leaf-litter, organic debris, sometimes associated with animal nests

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Chernetidae
Illinichernes Hoff

- Taxonomy and distribution:
  - Two Nearctic species
  - *I. distinctus* Hoff: occurs in central and eastern USA and likley occurs in Canada
- Ecology: tree holes, decaying logs

Chernetidae
Hesperochernes Chamberlin

- Taxonomy and distribution:
  - Widespread and diverse genus in North America
  - Two species known from Canada
    - *H. canadensis* Hoff: AB, ON, SK
    - *H. tamiae* Beier: QC, ON, AB
- Ecology: organic debris, often associated with mammals

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Chernetidae
Chernes Menge

- Taxonomy and distribution:
  - Widespread, diverse, occurs in Europe, Asia, Africa and Americas
  - Several widespread species in North America
  - *C. lymphatus* (Hoff): occurs in ON
- Ecology: typically found in moist forest litter, under bark and phoretic on insects

Cheliferidae
Haplochelifer philipi (Chamberlin)

- Taxonomy and distribution:
  - Monotypic genus, occurs in western USA and likely occurs in western Canada
- Ecology: leaf litter

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Cheliferidae
Dactylochelifer Beier

- Taxonomy and distribution:
  - Widespread and diverse genus, with two species occuring in North America
    - *D. copiosus* Hoff: widespread in USA, Canada (NS, BC)
    - *D. silvestris* Hoff: western USA and Canada (AB, BC)
- Ecology: dry leaf litter, organic debris

Cheliferidae
Parachelifer Chamberlin

- Taxonomy and distribution:
  - Widespread in Americas
  - Eight species known from USA, generally occurring in southern USA except:
    - *P. monroensis* Nelson: MI
    - *P. montanus* Chamberlin: MT
- Ecology: under tree bark

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Cheliferidae
Chelifer cancroides (L.)

- Taxonomy and distribution:
  - Monotypic genus, with cosmopolitan distribution
  - Occurs across North America, including most regions of Canada
- Ecology: almost always found in close association with humans and/or domestic animals (homes, barns and other structures)

Cheliferidae
Hysterochelifer Chamberlin

- Taxonomy and distribution:
  - Holarctic, and widespread genus, with three species known from USA
    - *H. fuscipes* (Banks) and *H. proprius* Hoff may occur in central or western Canada
- Ecology: known from typically dry habitats

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Cheliferidae
Aspurochelifer littlefieldi Benedict and Malcolm

- Taxonomy and distribution:
  - Monotypic genus, known from western USA including WA, OR and may occur in western Canada
- Ecology: forest litter

Cheliferidae
Idiochelifer nigripalpus (Ewing)

- Taxonomy and distribution:
  - Monotypic genus, distributed across cenrral USA and likely occurs in Canada
- Ecology: typically found under bark

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Cheliferidae
Paisochelifer Hoff

- Taxonomy and distribution:
  - Two described species both occurring in North America
  - *P. callus* (Hoff): central USA and Canada (ON, NS, NB)
- Ecology: moist litter, bird nests

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