

TAXONOMIC STUDIES ON CLICK-BEETLES
(COLEOPTERA: ELATERIDAE)

by

Frank Eric Etzler

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of the requirements for the degree

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in

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DEDICATION

This dissertation is dedicated to all of my grandparents, for encouraging my curiosity and giving me great examples of what toughness looks like.

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VITA

Frank Eric Etzler was born January 12, 1987 to Judy L. Etzler and Frank M. Etzler in Lexington, Kentucky. He is the younger brother of Eleanore Weaver (née Etzler). Their time in Kentucky was short, with the family quickly moving to Wisconsin, then to Georgia a few years later. In March of 1993, the family would make a final move to New Milford, Connecticut, where they would remain for the rest of Frank's schooling. Frank graduated from New Milford High School in 2005. That fall, Frank started his undergraduate at the State University of New York at Buffalo, commonly referred to as the University at Buffalo (UB). He would finish his time there in 2010 with two bachelor's degrees, a Bachelor's of Arts in Anthropology and a Bachelor's of Science in Biological Sciences. While at UB, he was introduced to the world of insects in the laboratory of Katharina Dittmar, by helping out with research on endosymbionts found in batflies. After a period of setbacks, Frank was fortunate to be accepted into the lab of Michael Ivie at Montana State University (MSU). There he was given a choice between two projects, and through chance, chose to look at DNA barcoding to match wireworms to adults. This started a passion for the Elateridae, as the many problems present in the group provided a fascinating puzzle to explore. In December 2013, Frank E. Etzler finished his Master's of Sciences in Entomology at MSU. He chose to stay at MSU for a Ph.D. to focus more on the systematics of the group, the result of which is presented here.

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ABSTRACT

Click-beetles (Coleoptera: Elateridae) have historic difficulties at the subfamilial, tribal, and generic level, with many genera poorly defined at the global scale. This dissertation makes the definitions of four groups work world-wide to enable easier communication between regions. These clearer definitions also serve as foundations for future studies at higher levels, such as the tribal and subfamilial level. In this work, two new genera are described, seven species are described as new, 109 new combinations are proposed, and 5 new names are proposed to correct new homonyms. Keys to species are provided for the North American species in *Athoplastus* and *Hemicrepidius* and the species north of Mexico for *Paradonus*. A key to genera in the *Limonius* genus-group is provided, with a key to species provided for the newly described genus in that group. Important morphological characters are illustrated for each genus or genus group, and habitus photos are provided for all species in the examined regions for the genera *Athoplastus*, *Hemicrepidius*, and *Paradonus*.

DISCLAIMER

This thesis is not intended to meet the provision of the ICZN (1999) regarding publication of new nomenclatural acts [Art. 8.2]. No name or nomenclatural act proposed herein should be considered available as defined by the ICZN.

CHAPTER ONE

INTRODUCTION

The family Elateridae, or click-beetles, is the ninth largest family of Coleoptera in the world, with approximately 10,000 species (Johnson 2002), and the seventh largest in North America (Marske and Ivie 2003). However, despite having a large number of species, the relationships between higher level taxonomic groups is not well understood. Most of the difficulties exist at the subfamily level, tribal level, and in many frustrating cases, the generic level. Many of these difficulties arise from the fact that morphological characters used to define groups are shared between widely disparate groups (Kundrata *et al.* 2016). Another issue is that little work has been done on which morphological characters are phylogenetically important (Calder 1996, Douglas 2011a).

These issues are so well known and prevalent that previous workers have remarked on the difficulties with understanding this group. During her revision of the tribe Agrypnini (treated by her as a subfamily), Christine M. F. von Hayek (1973) noted that many characters used to define genera, both old and new, were only compared between type species. This caused many species to fit any defining character of a genus, or to fit “equally well into two or more genera” (von Hayek 1973, pg.4). She went on to state that “[t]his unsatisfactory state of affairs suggests that the characters until now used for the separation of the genera display a greater degree of variation than has been hitherto suspected” (von Hayek 1973, pg. 4). These issues were compounded, she states, by the focus of limited regional faunas without considering global relationships (von

Hayek 1973). She later admitted that the higher-level classification was artificial, but brought “order into the chaos existing within a fairly easily recognizable group of Elateridae” (von Hayek 1979, pg. 184).

These issues with generic concepts, and the associated higher-level concepts, were also noted by Edward C. Becker (1979). He stated “[n]early everyone who has worked on the elaterids has become frustrated sooner or later (more often sooner!) because there are so many problems at the generic level and proportionally the same number at the tribal or subfamilial level” (Becker 1979, pg. 401). This quote was mentioned by Edward R. Fuller (1994) in the opening of his dissertation on the classification of the tribe Elaterini, where he also noted that this complaint had become a tradition for those who study the family. In his dissertation, Fuller (1994) stresses the importance of clearly defined taxonomic characters and a global perspective when trying to define generic groups.

This dissertation is a cumulation of many different taxonomic works, all dealing with making our understanding of the family Elateridae more complete. All of the included works focus on the generic level to make our understanding of the various groups more consistent and clearer. This enables us to be able to predict evolutionary relationships, as well as forming a clear way to communicate generic concepts on the world-wide level.

The second chapter of this dissertation is the description of a new genus of Elateridae, found in the Pacific Northwest region of North America. This new genus, *Athoplastus* Johnson and Etzler, encompasses some species that were formerly in

Ctenicera Latrielle, 1829. The genus *Ctenicera* has had a long, complex taxonomic history (Lane 1948). In the past, there has been lots of confusion with what name to use, with members variously placed into the genera *Corymbites* Latrielle, 1834 or *Ludius* Eschscholtz, 1829 depending on the year of publication (Lane 1948). Another issue is that until the late 20th century and early 21st century, there was different generic concepts used in different regions, with European and Asian authors recognizing many genera for species formerly in *Ctenicera*, while North American authors continued the usage of a single, broad, genus. With the description of the genus, apparently endemic to North America, we can begin to understand the different groups within the old concept of *Ctenicera* and examine the monophyly of the group. This is helped by the presence of both larval and adult characters in this newly described genus.

The third chapter provides a review of the genus *Paradonus* Stibick, 1971. This genus, unlike the others treated here, belongs to the subfamily Negastrinae. The beetles in *Paradonus* are small, ranging from 2.0mm to 3.5mm. While the eastern North Americans species were reviewed in 1991 (Stibick 1991), the majority of the included species have not yet been formally treated. In this chapter, I provide the first key to all included species in North America, north of Mexico, as well as describe three new species. I provided the first list of all included species, as well as illustrate all North American species north of Mexico. This work provides a foundation for the genus, and helps make the identification of the many species easier.

The fourth chapter deals with the generic reclassification of the genus *Limonius* Eschscholtz, 1829. While the North American species were recently revised (Al Dhafer

2009), issues with the global generic concept still remained. While the genus is large and diverse in North America, in Europe and Asia it is limited to only a few species, with many other species having been moved to other genera (Cate 2007). This chapter deals with comparing the faunas in these two regions, Nearctic and Palearctic, and developing global generic concepts using morphological characters. Genera are defined to be identifiable globally, and a list of included species is given for each genus.

The fifth chapter is a revision of New World *Hemicrepidius* Germar, 1839. Historically, this genus was considered to only be limited to the New World (Cand ze 1863). However, by the early 1990's the genus had been recognized throughout the Palearctic (Platia 1994, Cate 2007). While originally intended to cover the whole world, the species-level revisions were limited to the New World only due to issues with generic concepts in the Palearctic. The genus is defined globally, and a list of species included is provided for the world. The species in the New World are revised, with full illustrations of the habitus and male genitalia of all species provided for the first time. The key to species is updated, which has not been updated since Horn (1880). Central American species of *Hemicrepidius* are moved to *Athous*.

While these four chapters deal with separate genera covering two subfamilies (Dendrometrinae [Chapters 2, 4, and 5] and Negastrinae [Chapter 3]), they all work towards the goal of increasing the knowledge of these genera in a global framework. With a better understanding of these genera and morphological definitions that work on a global scale, a foundation is set for future revisionary studies at the tribal and subfamilial

level. Hopefully these studies will lessen the frustrations of future elaterid workers and break the trend of complaining about elaterid classification.

CHAPTER TWO

ATHOPLASTUS JOHNSON AND ETZLER (COLEOPTERA: ELATERIDAE:
DENDROMETRINAE), A NEW GENUS OF CLICK BEETLE FROM
THE NORTHWESTERN CONTINENTAL USA

Contribution of Authors and Co-Authors

Manuscripts in Chapters 2, 3, 4, and 5

Author: Frank E. Etzler

Contributions: Conducted DNA extractions and analyses. Identified majority of specimens. Did all drawings, and took genitalia photos. Edited habitus figures. Compiled figure plates. Wrote original manuscript.

Co-Author: Paul J. Johnson

Contributions: Original identifier of specimens belonging to a new genus. Provided genus name. Helped with species names. Provided specimens for description. Edited manuscript.

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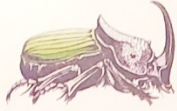
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ATHOPLASTUS JOHNSON AND ETZLER (COLEOPTERA: ELATERIDAE:
DENDROMETRINAE), A NEW GENUS OF CLICK BEETLE FROM THE
NORTHWESTERN CONTINENTAL USA

FRANK E. ETZLER
Montana Entomology Collection
1911 W. Lincoln St., Montana State University
Bozeman, MT 59717, USA
fetzler@montana.edu

AND

PAUL J. JOHNSON
Severin-McDaniel Insect Research Collection
Box 2207A, SAG 361 South Dakota State University
Brookings, SD 57007, USA

ABSTRACT

Athoplastus Johnson and Etzler, new genus, is described for two species formerly in *Ctenicera* Latreille, 1829: *Athoplastus acutus* (Knull, 1946), new combination, and *Athoplastus rainieri* (Van Dyke, 1932) new combination; and two new species occurring in the Pacific Northwest region of the USA. *Athoplastus lochsa* Etzler and Johnson, new species, from northern Idaho and *Athoplastus palouse* Etzler and Johnson, new species, from eastern Washington and northern Idaho are described. The larva of *A. acutus* is described, matching Montana adults with COI barcoding. Cool-season vernal activity observations on ethology, habitat, and phenology are provided. Taxonomic comparisons are also given.

Key Words: taxonomy, click beetles, new species, larva, *Ctenicera*, COI barcoding, Nearctic

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Zoobank.org/urn:lsid:zoobank.org:pub:30BB6AD1-E4CD-409B-B39D-593C29A96AC6

During the curation of the Elateridae at the Montana Entomology Collection, two unusual adult females were discovered that were collected in pitfall traps left to overwinter at selected sites in western Montana. These specimens were matched to *Ctenicera acutus* (Knull, 1946), and this discovery stimulated this report. The North American concept of *Ctenicera* Latreille, 1829 was limited by Johnson (2002) and Majka and Johnson (2008) based on Johnson (1992), following concepts of Binaghi (1940), Glen (1950), Dolin (1978), Gurjeva (1984, 1985, 1987, 1989), and Platia (1994). *Ctenicera* in North America is limited to a single species, *Ctenicera kendalli* (Kirby, 1837). Species in *Ctenicera sensu stricto* possess a distinct medial impression on the pronotum, pectinate antennae in males beginning at the third antennomere, strongly serrate antennae in females beginning at the third antennomere, and a male aedeagus lacking apical expansions of the parameres (Binaghi 1940; Leseigneur 1972). Of the approximately 187 species-group names applied to North American click beetles once placed in *Ctenicera* (Johnson 1992), 106 species have been formally transferred to 17 other genera (see references above, plus Tarnawski 1995, 1996).

Two of the species remaining to be reassigned to a different genus are *C. acutus* and *Ctenicera rainieri* (Van Dyke, 1932). These species are considered congeneric and do not fit the current concept of *Ctenicera* or any defined genus known to us. Herein, these two species and two new species described below are assigned to a new genus. Associated larvae are confirmed congeneric using mitochondrial DNA data and are described.

MATERIAL AND METHODS

Specimens Examined. A total of 53 specimens in addition to related groups were examined from the following collections, including all holotypes and four paratypes:

CASC	California Academy of Science Collection, San Francisco, California, USA
CMNH	Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, USA
FMNH	Field Museum of Natural History, Chicago, Illinois, USA
FSCA	Florida State Arthropod Collection, Gainesville, Florida, USA

MTEC	Montana Entomology Collection, Montana State University, Bozeman, Montana, USA
NHMUK PJJC	Natural History Museum, London, UK Paul J. Johnson personal collection, Brookings, South Dakota, USA
USNM	National Museum of Natural History, Washington, District of Columbia, USA
WFBM	W. F. Barr Entomology Collection, University of Idaho, Moscow, Idaho, USA
WSUC	James Entomology Collection, Washington State University, Pullman, Washington, USA

Individual labels of specimens are separated by a “;” (semicolon). To present information as accurately as possible, some labels have data included that are not present on the actual label. These data are in brackets []. At the end of each label, the number of specimens with the label and the collection those specimens are from appear in parentheses. Collection dates are written as day, month in Roman numerals, and year. States and counties are not repeated for the label data. It should be noted that making all dates follow the same format may inject an element of error. However, we feel that the ease of comparing the data across multiple collections, collectors, and styles will compensate any minor errors that may come from interpreting dates. Specimens of the genera *Pleonomus* Ménéttriés, 1849 and *Athous* Eschscholtz, 1829 subgenus *Neonomopleus* Schenkling, 1927 were examined in the NHMUK due to similar body morphology with the species treated here.

DNA Extraction and Data Analysis. DNA was extracted from six larval and adult specimens (three of each life stage) collected in Montana during 2013–2014 and preserved in 95% ethanol. Larval specimens were cut between the third and fourth abdominal segment, and adults had their abdomens removed when preparing the specimens for extraction. The extraction method followed the protocol for total DNA from animal tissue in the Qiagen® (Hilden, Germany) DNeasy® kit with an extended lysis time of 24 hours and was non-destructive. As the focus of this study was adult-larval associations, we only amplified the COI barcoding region. The primers used were LCO1490 and HCO2198 (Folmer *et al.* 1994), and the elaterid-specific primers LCO1490au and HCO2198au (Han *et al.* 2016). Amplification of each primer pair followed the protocols given in Etzler *et al.* (2014) and Han *et al.* (2016), respectively.

The sequence chromatographs were analyzed and consensus sequences produced using the program SeqTrace (Stucky 2012). The consensus sequences were aligned using MAFFT (Katoh and Standley

2013). An unrooted Neighbor-Joining tree using the Jukes-Cantor Substitution model was created, with bootstrap values calculated from 700 runs, and edited using the Archaeopteryx program (Han and Zmasek 2009). It should be clarified that this is a method to associate different life stages, and the resulting tree should not be interpreted as a phylogeny.

As a secondary test of life-stage matching, the Automated Barcode Gap Discovery (ABGD) program was also used (Puillandre *et al.* 2012). This allowed a second way of grouping sequences, as well as an automated way to determine sequence distances. Sequences are available on the BOLD website (MTNG001-18–MTNG006-18) and GenBank (NCBI GenBank MH282374–MH282379).

Preparation of Genitalia. Abdomens of both sexes were removed and placed in 10% KOH for approximately 1 hour at room temperature. Genitalia were dissected following the protocol outlined in Becker (1956). The reaction was stopped using two drops of white vinegar, and the genitalia were rinsed in water to prevent overclearing of the genitalia.

Photographs and Drawings of Specimens. Photographs were taken using a JVC (DC Ky- F75U) digital camera mounted on a Leica® MS5 stereoscope and a Visionary Digital Passport II imaging system equipped with a Canon 6D DSLR (www.duninc.com). Enhancements to digital images were made using the Zerene Stacker® software version 1.04 and edited in Adobe PhotoShop® CS 6. Drawings of key characters were based on photographs of specimens and drawn using Adobe Illustrator® CC.

RESULTS

All specimens sampled for barcode delimitation produced sequences. The resulting tree matched larvae to adult specimens, as well as male to female (Fig. 30), confirming predicted associations. Two populations were observed, one from Ravalli County, Montana and one from Sanders and Lincoln Counties, Montana, from both larvae and adults (specimens MTEC008126, MTEC010381, MTEC010382, MTEC019709, MTEC019710, and MTEC019713).

A distance matrix of the sequences was produced using ABGD (Table 1). The groups are sequences 1 to 6 and sequences 7 to 9. The two populations differed by 5.5–6.0% but demonstrate a close relationship within each group. Within group variation was 0.0–1.2% in both groups.

TAXONOMY

Athoplastus Johnson and Etzler, new genus
 Zoobank.org/urn:lsid:zoobank.org:act:3D7049D7-1D09-476F-8B0C-D0A3CFC1D847

Type species: *Aplastus acutus* Knull 1946: 142.

Aplastus LeConte, 1859 (Knull 1946: 142, not LeConte, 1859: 73).

Ctenicera Latreille, 1829 (part); Knull 1957: 202, 1958: 154; Lane 1971: 29.

Ludius Eschscholtz, 1829 (part); Van Dyke 1932: 421.

Species included:

Athoplastus acutus (Knull 1946: 142), **new combination.**

Ctenicera idahoensis Knull 1958: 154.

Athoplastus rainieri (Van Dyke 1932: 421), **new combination.**

Athoplastus lochsa Etzler and Johnson, **new species.**

Athoplastus palouse Etzler and Johnson, **new species.**

Adult Diagnosis. Adults can be recognized by the combination of large body size (15–25 mm long); prognathous mouthparts; supra-antennal carinae widely separated on frontoclypeal area; elongate, weakly serrate antenna in the male passing the posterior edge of the pronotum by five antennomeres or more; third antennomere similar in size to second; and moderately long, slender, and divergent posterior angles of the pronotum.

Adults of *Athoplastus* will key to *Aplastus* (Cebriioninae) in couplet 99 of the generic key to North American Elateridae in American Beetles (Johnson 2002). *Athoplastus* can be distinguished from *Aplastus* by the prognathous head (directed ventrally in *Aplastus*); weakly serrate antennae (strongly serrate in *Aplastus*); pronotum with sub-lateral incisures on the posterior margin at the base of the hind angle and notches anterad the scutellum (see Fig. 10; lacking sublateral incisures on pronotum in *Aplastus*); and parameres with apical expansions (lacking apical expansion in *Aplastus*). Additionally, the anterior lobe of the prosternum is longer in *Athoplastus* than the extremely short and truncate anterior lobe in *Athoplastus*. Also, to our knowledge, none of the species of conifer forest-associated *Athoplastus* overlap in distribution or habitat with any species of *Aplastus*, which are known from chaparral and desert shrublands of southern Utah and New Mexico west to southern California and northern Baja California.

Description of Adult. Male: Length 15.0–17.5 mm, width 3.50–4.25 mm (measured across bases of elytra); female: length 21–25 mm, width 5.25–6.50 mm. Body elongate, subparallel, shallowly convex. Color variable, ranging from yellow-brown to dark brown, carinae and apex of mandibles darker, tarsi, antennae, palpi, and coxae often lighter. Pubescence fine, long, ashy-grey (cinereous); recumbent to suberect. Integument dull to shiny (dorsal habitus of male in Figs. 1–4, 6, of female in Fig. 5; ventral habitus of male in Fig. 7). **Head:** Prognathous, flat on vertex; frons shallowly concave, coarsely punctured, punctures umbilicate, very close, separation less than

puncture diameter; frontal carina obsolete medially; supra-antennal carinae often directed downwards toward labrum, rarely medially; frontoclypeal region gradually sloping to base of labrum. Compound eyes large to moderate in size, bulging, moderately coarsely faceted; ocular index [ratio of frons width and head width inclusive of the eyes] 55.0–68.4 in males, 70.8–74.1 in females. Labrum semi-circular, densely to moderately punctured, often impunctate posteriorly, with long setae directed anteriorly. Mandibles arcuate, bidentate. Maxillary palps with distal segment expanded anteriorly, forming broadly triangular shape; setae on distal segment ending before anterior edge, which is lighter in color, appearing membranous.

Antenna: Long, slender (Figs. 12–14), reaching mid-length of body or just beyond it, or about 5.0–5.5 antennomeres beyond apex of hind angle (male); moderate, slender, reaching just beyond posterior edge of pronotum, or about 1.5–2.0 antennomeres beyond apex of hind angle (female). Antennomeres 2 and 3 much shorter than antennomere 4, together approximately 2/3 length of 4 (male), antennomeres 2 and 3 shorter than antennomere 4, together subequal in length to 4 (female); antennomeres 2 and 3 subequal or 2 slightly shorter than 3 (male), antennomere 2 usually shorter than 3, 2 approximately 2/3 length of 3, but sometimes appearing just slightly shorter (female). Antennomeres 4–10 narrowly serrate with apical end slightly expanded, much longer than wide (male), narrowly serrate with apical end slightly expanded, or approaching filiform (female); apical antennomere elongate-oval, appendiculate; antennomeres 4–11 covered with dense setae. **Pronotum:** 1.2–1.7X wider than long (Figs. 1–4), widest point at hind angles (male); as wide as long to 1.25X wider than long, widest point at hind angles (female). Anterior margin slightly arched in dorsal view; lateral margin completely carinate, subparallel to sinuate, sometimes with secondary widening at midlength or anterior third, often dorso-ventrally flattened along lateral edges from at most midlength anteriorly (less pronounced in females). Punctures distinct, sometimes deep, simple to subumbilicate and sparse to dense on disc, separated by less than half their own diameter, although in some specimens impunctate areas just laterad of midline (males only); punctures becoming denser along anterior and lateral margins (Figs. 10–11). Pronotal hind angles narrow, moderately long (male) or short (female) and divergent; sharply or bluntly pointed; carina present, but length variable. Posterior margin with sublateral incisures, base of pronotum with notches anterior of scutellum. Pubescence radiating from anterior angles and posterior angles, meeting at midlength to form the appearance of line of setae, which may be indistinct in some specimens. **Hypomeron:** With dense to

Table 1. Automatic Barcode Gap Discovery (ABGD) distance matrix for populations of *Athoplastus acutus*. Only values on the top half of the matrix are given to avoid repetition. The numbers along the top, 1 to 11, refer to the sample number in the left most column.

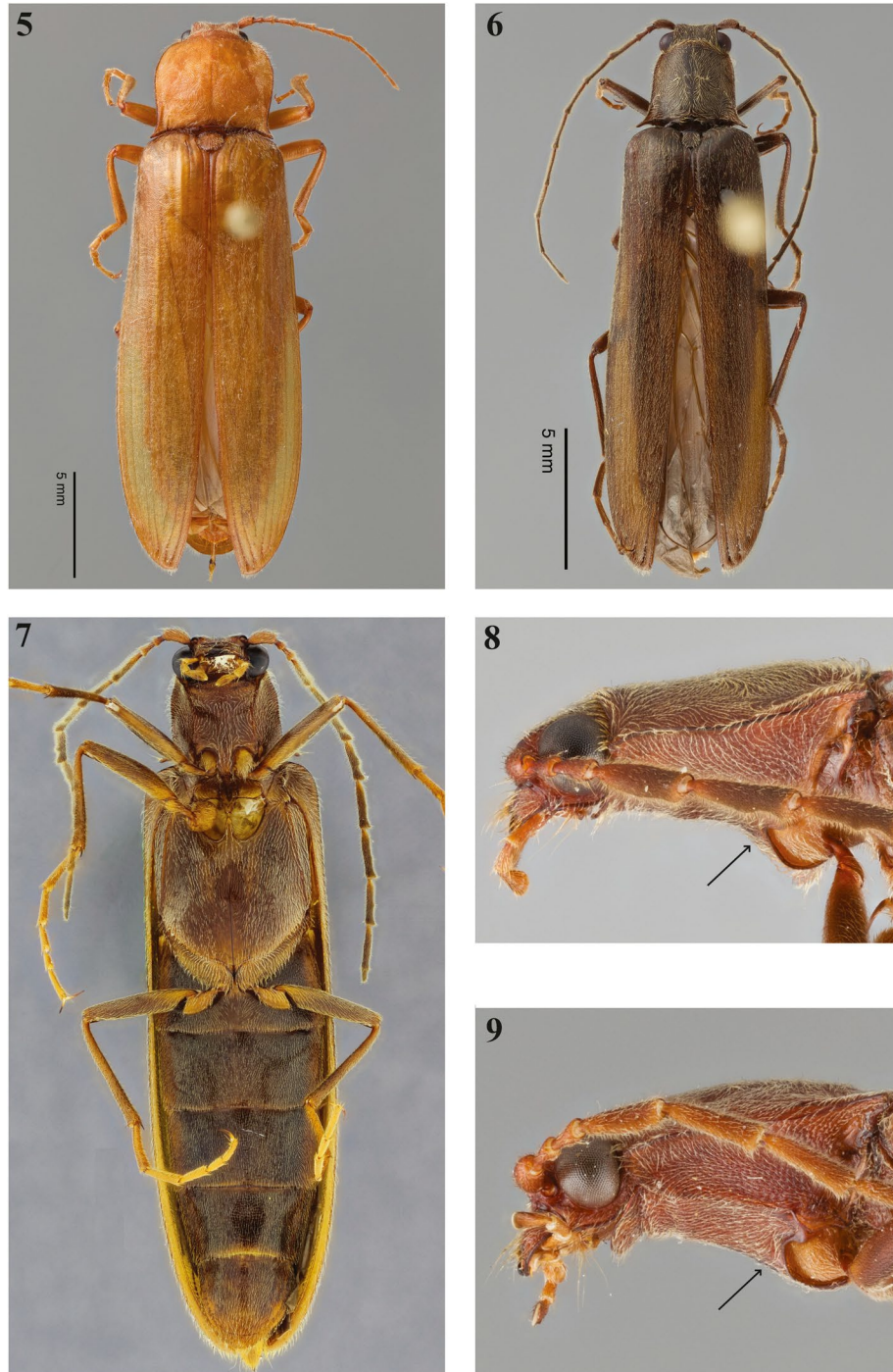
Sample number		Distance value										
	Sample name	1	2	3	4	5	6	7	8	9	10	11
1	<i>Athoplastus acutus</i> (M) (MTEC010381)	0.00000	0.00000	0.00365	0.00000	0.00396	0.01232	0.05620	0.05708	0.05426	0.14695	0.21257
2	<i>Athoplastus acutus</i> (L) (MTEC019709B)		0.00000	0.00182	0.00000	0.00198	0.01027	0.05213	0.05478	0.05478	0.14871	0.20564
3	<i>Athoplastus acutus</i> (L) (MTEC019713)			0.00000	0.00000	0.00398	0.00000	0.05282	0.05674	0.05674	0.15304	0.21349
4	<i>Athoplastus acutus</i> (L) (MTEC019713B)				0.00000	0.00398	0.00000	0.05280	0.05702	0.05702	0.15400	0.20634
5	<i>Athoplastus acutus</i> (L) (MTEC019709)					0.00000	0.00425	0.05962	0.06202	0.06202	0.16023	0.21084
6	<i>Athoplastus acutus</i> (F) (MTEC010382)						0.00000	0.05956	0.06178	0.06178	0.15884	0.21935
7	<i>Athoplastus acutus</i> (L) (MTEC008126)							0.00000	0.01252	0.01274	0.14049	0.21952
8	<i>Athoplastus acutus</i> (M) (MTEC019710)								0.00000	0.00000	0.14272	0.22395
9	<i>Athoplastus acutus</i> (M) (MTEC019710B)									0.00000	0.14272	0.22090
10	<i>Metanomus insidiosus</i> (MTEC007772)										0.00000	0.20780
11	<i>Limoniuss infuscatus</i> (MTEC007691)											0.00000

very dense, shallow, umbilicate punctures, becoming smooth posteriorly; mesal margin simple, slightly excavated anteriorly or not excavated; posterior edge sinuate, with hind angle visible ventrally. **Prosternum:** With dense, shallow, umbilicate punctures; anterior lobe short, broadly rounded to truncate, shallowly deflexed (male), anterior lobe very short, almost absent, broadly rounded, shallowly deflexed (female); not covering ventral mouthparts. Posterior process short, arcuate; procoxal cavity open posteriorly. **Scutellum:** Subpentagonal, anterior edge broadly rounded to straight, always carinate, posterior edge broadly rounded (*A. palouse*, *A. rainieri*) or narrowing slightly to a broad, blunt point (*A. acutus*, *A. lochsa*); setae moderately dense, ash-grey, radiating from midline. **Mesoventrite:** With median fossa narrow, side gradually declivous; mesanepisternon and mesanepimeron indistinctly punctured, appearing rough, both forming part of mesocoxal cavity. **Metaventrte:** Finely or roughly, shallowly, moderately densely punctured, closer laterally and sometimes rougher; declivous anteriorly, planate posteriorly (male); broadly convex (female). **Elytra:** Elongate, subparallel, 3.7–5.0X pronotal length (male); 4X pronotal length (female); striae shallowly impressed, deeper apically and sometimes basally, punctures variable, evanescent to rough and shallow; intervals flat to shallowly convex, punctures fine or rough, shallow, and irregularly distributed; setae uniformly directed posteriorly and only on intervals. **Legs:** Elongate, slender; spines present on ventral apex of tibia; tarsi filiform, with ventral surface covered with dense setose pads, tarsomeres gradually decreasing in length until tarsomere 5, ratio of tarsomere 5 to other tarsomeres variable, usually equal in length to tarsomere 1 or tarsomere 2; pretarsal claws slender, arcuate, and asetose. **Hind wing:** Well developed; about 3X as long as wide; wing membrane not notched in anal area (between AA₃₁₄ and AP). Venation as in Fig. 28. Wedge cell present.

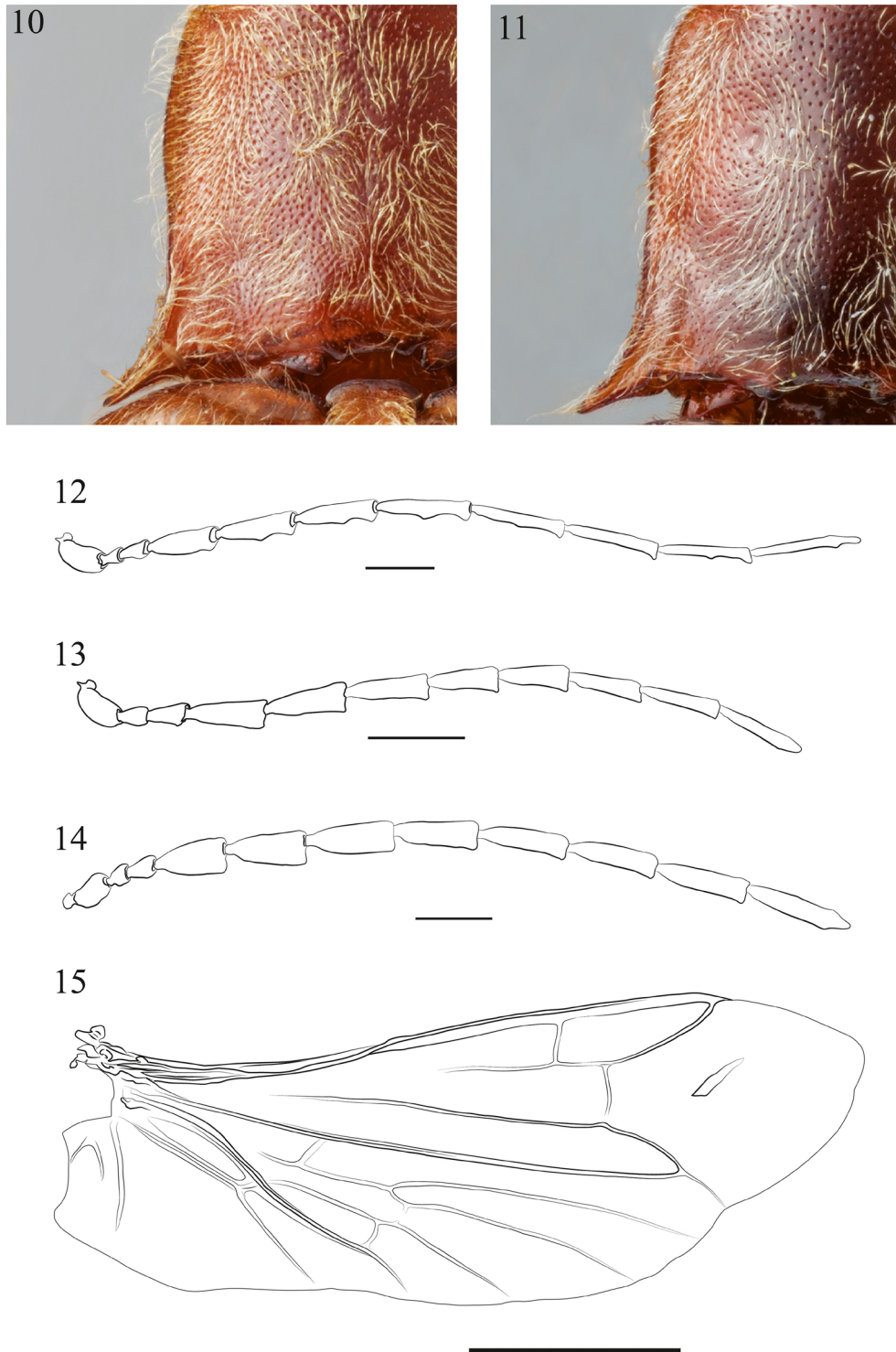
Apex of wing membrane without venation occupying 0.1X length of wing membrane; with single slanting sclerotization. **Abdomen:** Finely, moderately densely punctured, becoming denser and rougher at apex of ventrite 5; ventrite 5 slightly wider than long, tapering to broad point (male), wider than long, tapering to broad point (female); intersegmental sutures transverse; lateral edges simple, not crenulate; setae moderately dense, uniform, and directed posteriorly. **Aedeagus:** Tri-lobate, median lobe deflexed apically, parameres with apical expansion and setose at apex (Figs. 16–27); basal piece about 1/3 total length. **Female genitalia:** Gonocoxites lightly sclerotized; ovipositor rods long, extending to sternite 3 when not extruded from gonocoxites; bursa copulatrix and uterus represented as narrow swellings along tubular tract; accessory gland (spermatheca of Calder 1996) short, arcuate, basal; spermathecal reservoir absent; colleterial glands not observed (Fig. 28) (after Han *et al.* 2012 and Calder 1996). **Larval Diagnosis.** The combination of unidentate nasale, postepicranial setae (Fig. 45), divided prosternum (Fig. 46), and four setae on the ninth abdominal segment together serve to separate *Athoplastus* from similar larvae in North America. The most recent key to related North American larvae is by Glen (1950). *Athoplastus* larvae will key near the *nitidulus* species-group (5 *Paraphotistus* Kishii, 1966 subgenus *Setasomus* Gurjeva, 1985) in the generic key but can be distinguished by the unidentate nasale (Fig. 45) and prosternum divided in three parts (Fig. 43). In the key to the species-groups of *Ludius* Eschscholtz, 1829 (5 *Ctenicera sensu lato*/ tribe Prosternini), *Athoplastus* larvae will key near the *propola* species-group (5 *Pseudanostirus* Dolin, 1964) but can be distinguished by the presence of postepicranial setae (Fig. 45) and the numerous lateral blunt tubercles present on the ninth abdominal segment (Figs. 40–44).



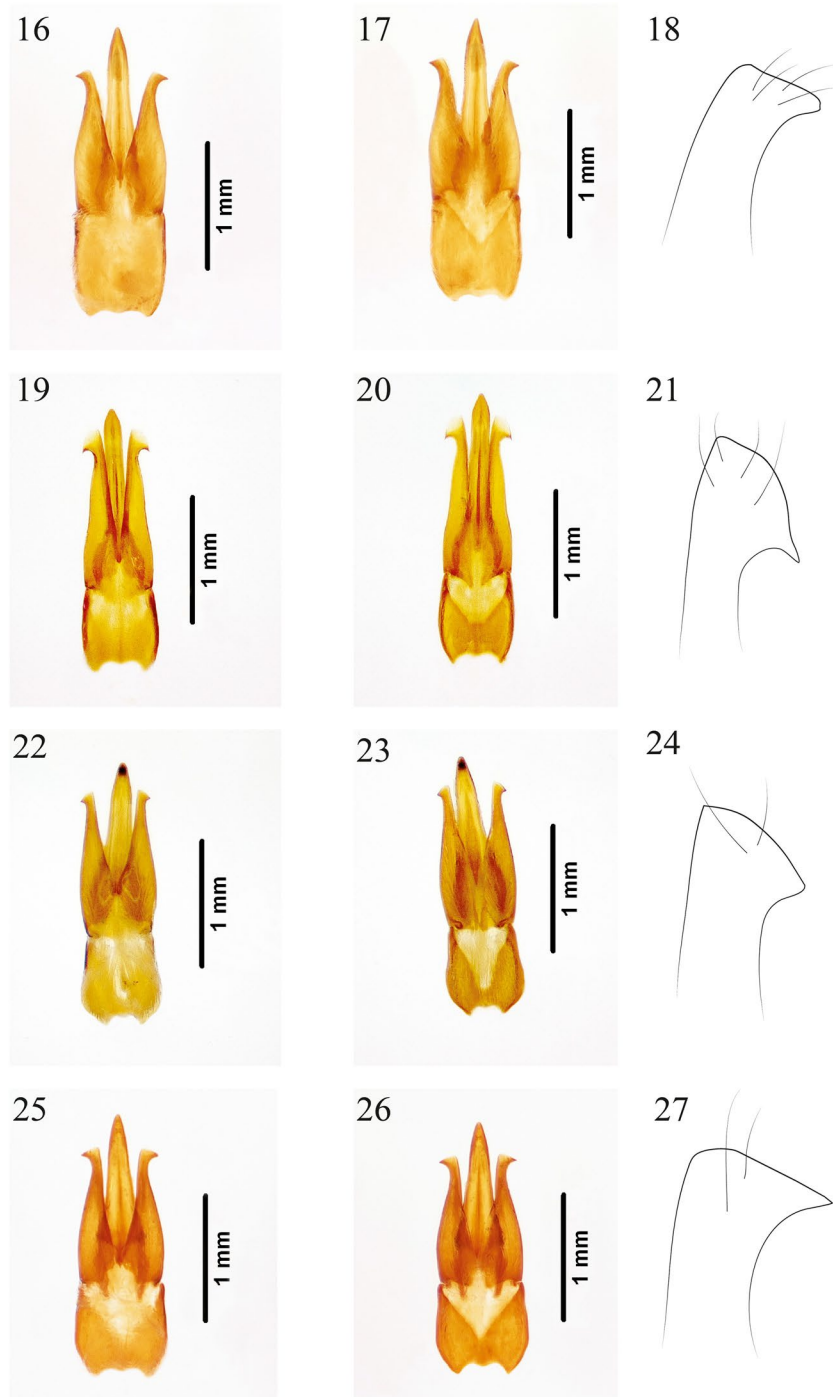
Figs. 1–4. *Athoplastus* species, dorsal habitus. 1) *A. acutus*; 2) *A. palouse*; 3) *A. lochsa*; 4) *A. rainieri*.



Figs. 5–9. *Athoplastus* species. 5) *A. acutus*, female dorsal habitus; 6) *A. acutus*, male dorsal habitus, darker coloration; 7) *A. acutus*, male ventral habitus; 8) *A. acutus*, prothorax, lateral view (arrow indicates start of area between procoxae); 9) *A. rainieri*, prothorax, lateral view (arrow indicates start of expanded area between procoxae).



Figs. 10–15. *Athoplastus* species. 10) *A. acutus*, prothorax, dorsal view; 11) *A. lochsa*, prothorax, dorsal view; 12) *A. acutus*, left antenna; 13) *A. lochsa*, left antenna; 14) *A. palouse*, left antenna; 15) *A. acutus*, female, left wing. Scale bars for antennae = 1 mm; for wing = 5 mm.



Figs. 16–27. *Athoplastus* species, aedeagi, dorsal view, ventral view, and close up of paramere apex, respectively. 16–18) *A. acutus*; 19–21) *A. lochsa*; 22–24) *A. rainieri*; 25–27) *A. palouse*.

While adults of *Athoplastus* and *Aplastus* appear similar, their larvae do not. *Aplastus* larvae lack urogomphi and the resulting caudal notch present in *Athoplastus*. The ecdysial scar of the spiracle is adnate to the atrium, instead having a ninth abdominal segment broadly rounded posteriorly and a spiracular ecdysial scar distant from the atrium, similar to species in the subfamily Elaterinae (Stibick 1979).

Larval Description. Body: Slightly dorso-ventrally compressed; testaceous on terga; nota and terga sparsely, finely and setiferously punctured, each puncture partially surrounded by short, transverse carinula, which is less evident on thoracic segments. Spiracular scars adnate to atrium. **Head** (Figs. 31–33, 45): Posteroepicranial setae present, minute; nasale unidentate, with 6–8 basal setae; subnasale teeth absent. Posterior frontal setae present, minute; lateral epicranial setae unpaired. Antennal segments 1 and 2 with apices rung by 1–12 setae; segment 2 with apex bearing moderately large sensorium on distal membrane. Mandibles arcuate, with small medial tooth. Maxilla with cardio unisetose. Labial palp with basal segment bearing 3 setae. Postmentum subrectangular, 2 setae anteriorly, 2 setae posteriorly, 3 pairs of minute setae also present along lateral edges which are only visible in larger larvae. Eye spots present. **Thorax** (Figs. 34–36, 46): Prosternum with median suture with 2 setae anterior of median posterior median sclerite. Episternum with 0–3 setae. Meso- and metanota with abbreviated but evident antero-lateral carinae. **Abdomen** (Figs. 37–44): Abdominal terga 1–8 with setation consisting of 3 anterior, 2–4 lateral, and 9–14 posterior setae, on smaller larvae some setae more difficult to observe, often appearing at first glance as 1 anterior, 1 lateral, and 8 posterior setae; anterolateral carina with anterior branch often reaching to ecdysial suture, lateral branch 0.5X length of tergum. Segment 8 spiracle positioned anteriorly, subequal in size to previous spiracles. Tergite 9 with disc depressed and with 4 shallow and subparallel longitudinal grooves; 4 discal setae; median emargination usually narrowly U-shaped but approaching V-shaped in smaller larvae; urogomphal tuberculae moderate to long, arcuate, and acute dorsally, obtuse ventrally; lateral tuberculae not forming distinct groups, 7 larger and 9–11 smaller tuberculae each side, and each with basal seta. Sterna 1–5 with distinct parasternites bearing 2–4 large setae, large larvae also bearing 3–4 minute setae; laterosternite with 1–4 setae; sterna 6–9 without parasternite incompletely separated from sternite; sternite 9 entire, with 16–18 setae.

Etymology. The generic name is coined from the combination of *Atho-* and *-plastus*, the former to demonstrate superficial similarity of males to species in *Athous* and the latter from *Aplastus* to

note the gross similarity of adults in these two genera.

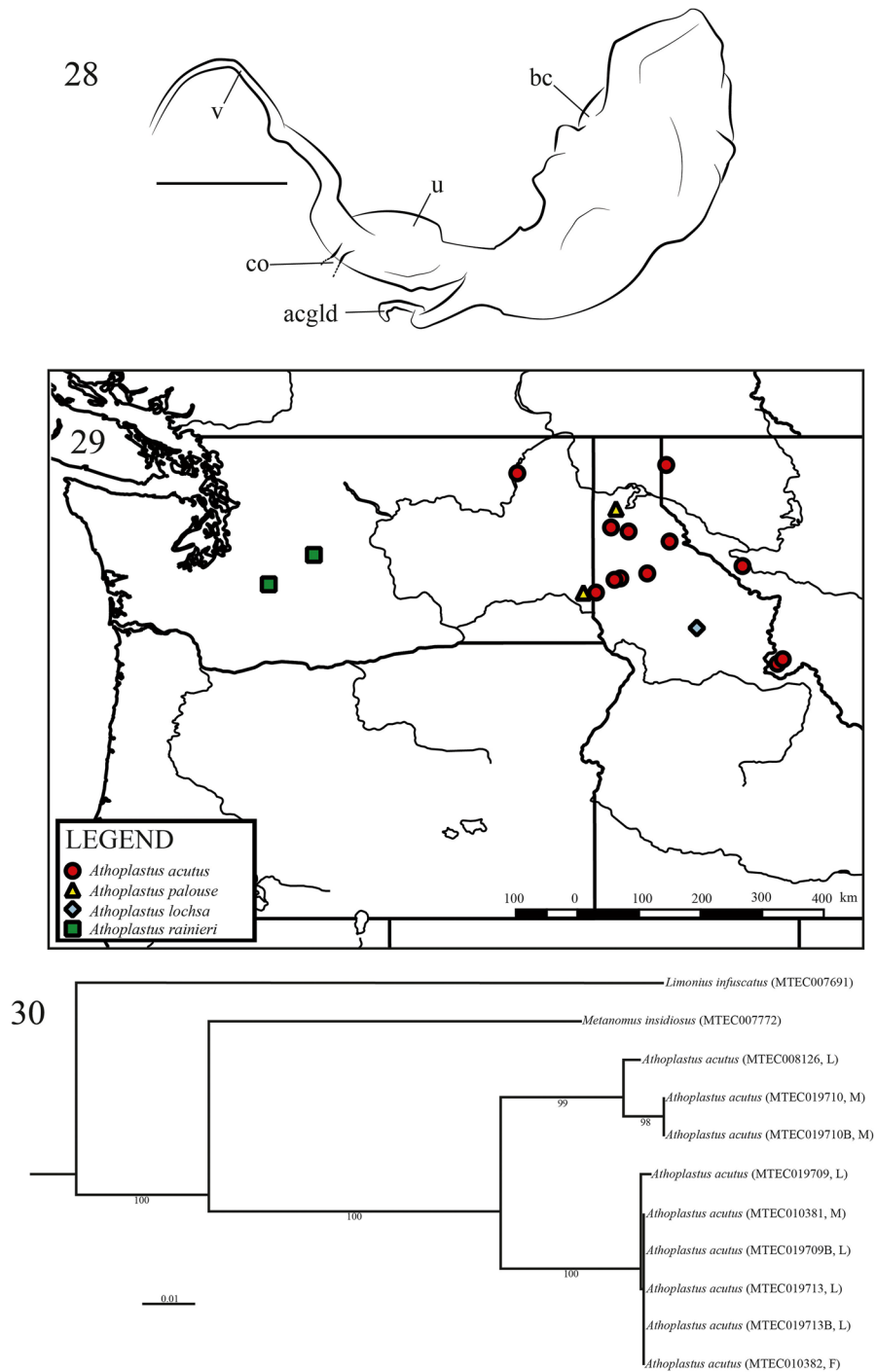
Taxonomic Remarks. There are a few species of large, brown elaterids that may be confused with species of *Athoplastus* when sorting through collections. Both males and females can be confused with "*Ctenicera*" *pyrrhos* (Herbst, 1806) (Dendrometrinae, Prosternini) (Note: This species is not congeneric with the type species of *Ctenicera* and awaits proper generic placement). *Athoplastus* is distinguished by the relatively small third antennomere (third is subequal to fourth in "*C.*" *pyrrhos*), and the anterior carina on the visible scutellum (scutellum lacks a carina in "*C.*" *pyrrhos*). *Athoplastus* females also have a much broader and less convex pronotum than females of "*C.*" *pyrrhos*, which has the pronotum clearly longer than wide and moderately convex.

Athoplastus is also similar in appearance to species in the genus *Pleonomus* and the *Athous* subgenus *Neonomopelus*. From *Pleonomus*, it can be distinguished by having 11 antennomeres, the third antennomere closer in length to antennomere 2, and the presence of posterior sublateral pronotal incisures (Fig. 23). From *Neonomopelus*, it can be distinguished by the posterior sublateral pronotal incisures and the long pronotal hind angles, with the posterior edge of the hypomeron sinuate (ear-like in *Neonomopelus*). Neither group is represented in the fauna of the New World.

No morphological evidence was discovered to remove the species placed in *Athoplastus* from the tribe Prosternini Gistel, 1856 (5 Ctenicerini Fleutiaux, 1936 (1863) of Cate 2007, see discussion below). Members of this genus are quite distinctive for the North American fauna. However, species are very difficult to distinguish from one another based on external structure. Therefore, the species descriptions below are much reduced to avoid unnecessary repetition, instead focusing on characteristics that appear to be unique to each species. A key to species is provided, which is limited to adult males only. Very few female specimens are known and are best identified by association with males.

KEY TO THE SPECIES OF ADULT MALE *ATHOPLASTUS*

1. Pronotum with discal punctures separated by less than puncture diameter (Fig. 10), closer laterally; aedeagus with parameres not broadly rounded apically or membranous 2
- 1'. Pronotum with discal punctures separated by more than puncture diameter (Fig. 11); aedeagus relatively narrower and paramere tips broadly rounded and membranous apically (Figs. 19–21) *Athoplastus lochsa* Etzler and Johnson, new species (Fig. 3)



Figs. 28–30. *Athoplastus* species. 28) *A. rainieri*, female, internal genitalia, v = vagina, u = uterus, acgld = accessory gland, bc = bursa copulatrix (after Han *et al.* 2012); 29) Distribution map of examined specimens, with rivers; 30) Neighbor-joining tree of Montana populations of *A. acutus*, COI mtDNA, 500 runs, scale bar = 1% difference.

2. Prosternum dorso-ventrally flattened on anterior 3/4 before expanding ventrally between procoxae (Fig. 9); antennomeres 6 and 7 with secondary expansion at apical third (Fig. 12); male genitalia with median lobe relatively narrowed, parameres with apical expansion bearing narrow sharp or blunt point (Figs. 16–18) ***Athoplastus acutus* (Knull, 1946)** (Fig. 1)
- 2'. Prosternum sloped, not flattened, gradually joining area between procoxae (Fig. 8); antennomeres 6 and 7 not expanded in apical third; male genitalia with broad median lobe, parameres with apical expansion bearing a sharp or blunt point.....3
3. Parameres with rounded apical ends and lateral expansion short and blunt, basal piece of single known male with narrow, U-shaped, membranous area ventrally (Figs. 22–24); known from western and central Washington State (Fig. 29) ***Athoplastus rainieri* (Van Dyke, 1932)** (Fig. 4)
- 3'. Parameres with apical ends flattened laterally, lateral expansion narrow and sharply pointed, basal piece with typical broad, V-shaped, membranous area ventrally (Figs. 25–27); known from eastern Washington State (Fig. 29) ***Athoplastus palouse* Etzler and Johnson, new species** (Fig. 2)

***Athoplastus acutus* (Knull, 1946), new combination**

(Adult: Figs. 1, 5–7, 8, 10, 12, 15–18)
(Larva: Figs. 31–46)

Aplastus acutus Knull 1946: 142

Ctenicera acutus Knull 1957: 202

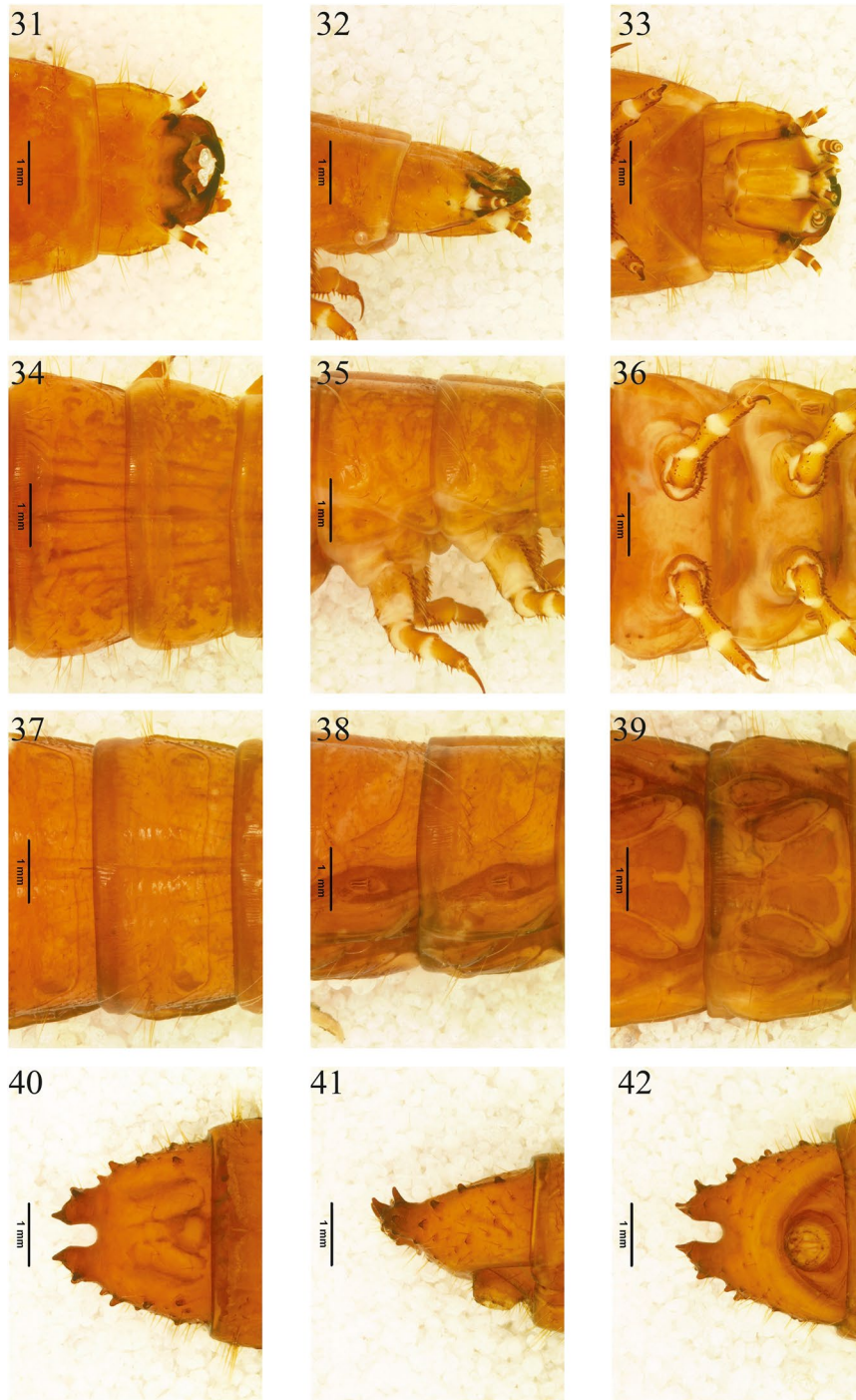
Ctenicera idahoensis Knull 1958: 154. Invalid replacement name to prevent homonymy with *Athous acutus* Mulsant and Guillebeau, 1855 (= *Metanomus infuscatus* (Eschscholtz, 1829)). The Mulsant and Guillebeau name was considered a junior synonym of *Metanomus infuscatus* (Eschscholtz) since de Buysson (1887) but never appeared as a valid taxon name in combination with *Ctenicera*, so no homonymy exists (see ICZN 1999, Art. 60.2).

Diagnosis. Males of *A. acutus* have the prosternum dorsoventrally flattened until it reaches the procoxae, where it is abruptly expanded ventrally (Fig. 9). Males of other species of the genus have the prosternum gradually expanding ventrally toward the procoxae (Fig. 8). Antennomeres 6 and 7 usually have a secondary expansion at approximately two-thirds of total length from base, which is not present in the other species (Fig. 12). This character may be difficult to see or absent in some specimens, but it is

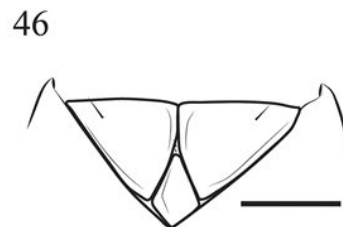
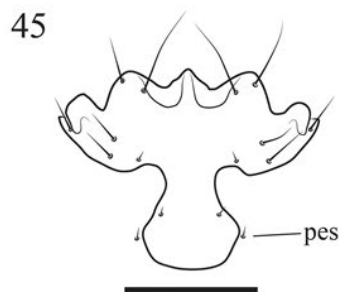
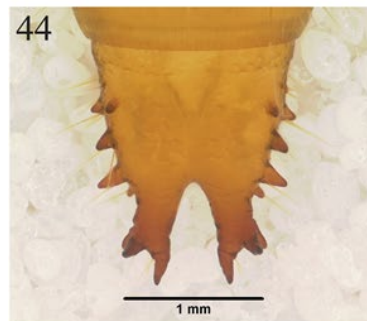
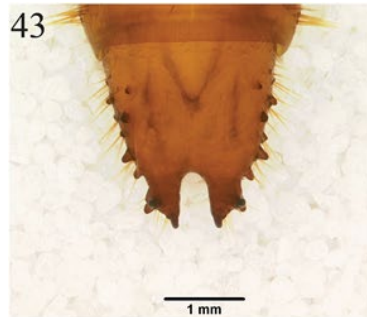
usually visible on other antennomeres. Females have a slight impression on the prosternum anterad the procoxae and setae on the scutellum that are mostly projecting posteriorly.

Description. Male. Length 15.0–17.5 mm, width 3.5–4.0 mm (measured across bases of elytra). Yellow-brown to dark brown (Figs. 1, 6–7). **Head:** Ocular index = 55.0–63.6 (mean = 58.1; mode = 60; $n = 30$). **Antenna:** Mean ratio of antennomeres [antennomere length relative to pedicle (antennomere 2)] 2–11: 1: 1.4: 3.5: 3.9: 3.9: 4.1: 4.1: 4.1: 3.9: 4.8 ($n = 11$). Antennomeres 6 and 7 often with secondary expansion at 2/3 total length (see Fig. 12). This character may also be on other antennomeres but is usually less pronounced. **Pronotum:** 1.2–1.7X wider than long. Lateral margin sinuate anterad divergent hind angles, widening just anterad midlength, lateral carina dorsoventrally flattened on anterior half. Punctures distinct, subumbilicate and dense on disc, separated by less than half their own diameter, although some specimens have impunctate areas just laterad midline; punctures becoming clearly umbilicate and denser along anterior and lateral margins. **Prosternum:** Dorsoventrally flattened with dense, shallow, umbilicate punctures; anterior lobe short, broadly rounded, shallowly deflexed. Posterior process short and arcuate, distinctly raised ventrally between procoxae, then sharply deflexed dorsally before ending in small hook; midline of prosternum often with raised section just anterad procoxal rise, sometimes nearly carinate, flanked by indentations in prosternum. **Legs:** Tarsomere 5 equal in length to tarsomere 1 on pro- and mesotarsi, tarsomere 5 equal in length to tarsomere 2 on metatarsi. **Elytra:** Elongate, sub-parallel, 5.2X pronotal length; striae shallowly impressed, deeper basally and apically, punctures evanescent; intervals shallowly convex, punctures rough, shallow, and irregularly distributed. **Aedeagus** (Figs. 16–18): Basal piece about 1/3 total length, with triangular membranous section on ventral surface (Fig. 17); median lobe 1.3X length of parameres, slightly deflexed ventrally at tip, median carina on ventral surface, basal struts coming off at an obtuse angle; parameres wide basally, edges sinuate and distinctly narrowing toward tip, tip with acute lateral expansion bearing 4–6 setae, either blunt or sharp (Fig. 18).

Female. Length 21–26 mm, width 5–6 mm (measured across bases of elytra). Yellow-brown to red-brown (Fig. 5). **Head:** Ocular index = 70.8–74.1 (mean 5 72.7, $n = 3$). **Antenna:** Mean ratio of antennomeres 2–11: 1: 1.2: 2.1: 1.9: 1.9: 1.8: 1.7: 1.6: 1.5: 1.7 ($n = 3$). Note: Values for antennomeres 8, 10, and 11 are each based only on two specimens. **Pronotum:** As wide as or 1.1X wider than long. Lateral edge sinuate anterad divergent hind angles, widening just anterad midlength. **Scutellar shield:** Setae directed posteriorly.



Figs. 31–42. *Athoplastus* larva MTEC008126, dorsal, lateral, and ventral views, respectively. 31–33) Head and prothorax; 34–36) Meso- and metathoraces; 37–39) Abdominal segments 2 and 3; 40–42) Ninth abdominal segment.



Figs. 43–46. *Athoplastus* larval characters. 43) Ninth abdominal segment of medium-sized larva, MTEC019709; 44) Ninth abdominal segment of small larva, MTEC019713; 45) Frontoclypeal region, dorsal view, detail from Fig. 31, pes = postepicranial seta; 46) Divided prosternum, detail from Fig. 33. Scale bars = 1 mm.

Specimens Examined (45). Males. Holotype. USA: IDAHO: [Shoshone Co.], Wallace; 14.iv.[19]40, Otto Huellemann (FMNH). Paratypes. USA: IDAHO: [Shoshone Co.], Wallace, 14.iv.1940, [Otto Huellemann?] (2, FSCA; 1, FMNH); Wallace, Otto Huellemann (1, FMNH).

Other Male Specimens Examined. USA: IDAHO: [Kootenai Co.] Ft. Sherman [Coeur d'Alene], Mch. [March?] 1896, J. C. Merrill (1, USNM); 4th of July Summit, 30.iv.1974, W. F. Barr (1, WFBM); Kidd Island Bay, 1987, E. Cardwell (1, WFBM); Latah Co., Harvard, Laird Pk, 03.iv.1962, S. D. Smith, attracted by U.V. light (1, USNM; 4, WFBM); Near Moscow, Spring 1932, P. L. Rice (1, USNM); Sect. @ Pond; Moscow, 01.v.[19]57, D. T. Allison, Collector (1, WFBM); [Shoshone Co.] Clarkia, 8.iv.1934, I. W. Bales (1, USNM); Wallace, 8.iv.1939, Huellemann (1, USNM); Wallace, 14. iv.1939, Huellemann (1, FMNH); Wallace, 26.iv.39, Huellemann (2, FMNH); Wallace, 1.v.1939, Huellemann (1, FMNH); Wallace, 9.v.39, Huellemann (1, FMNH); Wallace, 20.vii.1939, Huellemann (1, FMNH); Wallace, [no date], Huellemann (1, FMNH); Wallace, 12–20.iv.1940, O. Nudlemann [likely a mistype of Huellemann] (3, FMNH). **MONTANA:** Lincoln Co., Jct. Kootenai & Yaak Rs., 48.5855°N, 115.9769°W, 12.iv.-03.vi.2014, [elev.] 1927ft, C.J. Hart, Lindfinl [with] PSB [lure] (1, MTEC, MTEC019710); Ravalli Co., Rombo Campgrd, 45.7644°N, 114.2815°W, 25. iv.2013, [elev.] 4505ft, F. E. Etzler, Handnet at Night (1, MTEC010381); Rombo Campgrd, 45.7680°N, 114.2810°W, 04.v.2013, [elev.] 4508ft, F. E. Etzler, Handnet at Night (1, MTEC); Rombo Campgrd, 45.7642°N, 114.2818°W, 19.iv.2014, [elev.] 4505ft, F. E. Etzler, Blacklight (8, MTEC). **WASHINGTON:** Stevens Co., Pleasant Valley, 4.v.1957, on maple, A. R. Gittins Collector (1, WFBM).

Females. USA: IDAHO: [Latah Co.], Moscow Mt., iv.[19]12, Idaho (1, USNM); Moscow, 23.iv.1955, F. T. Cook (1, USNM; 1, WFBM). **MONTANA:** Mineral Co., Trout Creek Camp, 17.iii–22.vi.1995, D. L. Gustafson, pitfall trap (1, MTEC); Ravalli Co., Sand Crk - Blue Joint [Crk], 05.x.1996–06.vi.1997, D. L. Gustafson, pitfall trap (1, MTEC); Rombo Campgrd, 45.7644°N, 114.2815°W, 25.iv.2013, [elev.] 4505ft, F. E. Etzler, handnet at night (1, MTEC010382).

Larvae. USA: IDAHO: Moscow Mtn, 15.v.1951, Lane-Downie (2, USNM). **MONTANA:** Mineral Co., Trout Creek Campground, 47.1174°N, 114.8673°W, 25.iv–19.vi.2013, elev. 2940ft, F. E. Etzler, pitfall (1, MTEC, MTEC008126); Ravalli Co., Blue Joint Creek, base of stump, 45.6985°N, 114.3586°W, 26. iv–5.v.2013, elev. 4960ft, F. E. Etzler, pitfall (1, MTEC, MTEC019709); Rombo Campground, 45.7680°N, 114.2810°W, 4.v.2013, elev. 4508ft, F. E. Etzler, by hand (1, MTEC, MTEC019713).

Distribution. This species is known from westernmost Montana, northern Idaho (north of

Idaho County), and the northeast corner of Washington State (Fig. 29).

Taxonomic Remarks. This species is represented by the greatest number of specimens and has the broadest known species range of the four species in the genus. Due to this and the soft-bodiedness of the species, variation exists among specimens. However, no clear link to locality or date of collection was discovered. The presence of impunctate areas on either side of the midline is very rare, only occurring in a small number of northern Idaho specimens. Subtle variation also exists in male genitalia, but again there is no link to locality or collecting date. Mitochondrial DNA was amplified for Montana specimens. These results are discussed below. This is the only known species with associated larvae and ecological notes.

Field Notes. The collecting localities of the Montana specimens of *A. acutus* were visited in early spring of 2013 to place pitfall traps in an attempt to capture fresh specimens and reliable DNA samples. While camped at Rombo Creek Campground near one of the localities of the MTEC females, the first author was examining trees around the campsite at dusk when a female was collected at the base of a ponderosa pine. A few minutes afterwards, a male was collected at the same spot, then additional males were observed flying and a few more collected.

The collecting site was revisited in 2014, and specimens were collected at an ultra-violet (UV) light set up near a white sheet. Field observations were recorded and are discussed below. Larvae were collected at three Montana sites and tentatively associated with adults. Due to the apparent adult sexual dimorphism and lack of reared larvae, we confirmed associations using DNA barcoding.

***Athoplastus lochsa* Etzler and Johnson, new species**

(Adult: Figs. 3, 11, 13, 19–21)

Zoobank.org/urn:lsid:zoobank.org:act: 53CAEDD4-4FC0-4042-ABEF-8D7369F90FCC

Diagnosis. This species can be separated from all others in the genus by the combination of relatively sparse pronotal punctation (separated by greater than the diameter of a single puncture) (Fig. 11), sloped, non-depressed prosternum (Fig. 8), and antennomeres without secondary expansions (Fig. 13). The male genitalia are also distinctive, with the parameres broadly rounded apically (Fig. 21).

Description. Male. Length 16.0 mm in length, width 3.5 mm (measured across bases of elytra). Red-brown, carina, tips of mandibles, and palps darker; edges of hypomeron and abdomen lighter, almost tawny yellow (Fig. 3). **Head:** Ocular index 563.1. Antenna: Ratio of antennomeres 2–11: 1: 1.25: 2.9: 3: 3: 2.9: 2.9: 2.9: 2.9: 3.25 (Fig. 13).

Pronotum: 1.5X wider than long. Lateral margin

completely carinate, sinuate anterad divergent hind angles, widening at anterior third; dorso- ventrally flattened along lateral edges on anterior half. Punctures distinct, simple and moderately dense on disc, separated by at least diameter of a puncture, with 2 “dimples” on either side of midline just anterad midlength that are nearly impunctate; punctures remain uniform along lateral edges, becoming denser on hind angles.

Prosternum: Slightly convex with dense, shallow, subumbilicate punctures; anterior lobe short, broadly rounded, shallowly deflexed. Posterior process short and arcuate, gradually raised ventrally between procoxae, then gradually deflexed posteriorly before becoming parallel to body plane. **Legs:** Tarsomere 5 longest on pro- and mesotarsi, tarsomere 5 equal in length to tarsomere 1 on metatarsi. **Elytra:** Elongate, subparallel, 4.8X length of pronotum; striae shallowly impressed, deeper apically; intervals flat, punctures rough, shallow, and irregularly distributed. **Aedeagus** (Figs. 19–21): Basal piece 1/3 total length, with roughly trapezoidal membranous section on ventral surface (Fig. 20); median lobe just slightly longer than parameres when measured from basal struts, slightly deflexed ventrally at tip, median carina on ventral surface, basal struts coming off at an obtuse angle; parameres subparallel, gradually narrowing toward tip, tip with expanded lateral expansion bearing 4 setae (Fig. 21), which is broadly rounded apically.

Female. Unknown.

Specimens Examined (1). Holotype. USA:

IDAHO: Idaho Co.; Lochsa RNA [Research Natural Area]; 29.iv.1985; P.J. Johnson (1, PJJ to USNM).

Distribution. This species is only known from the Lochsa River Valley in Idaho County, Idaho (Fig. 29).

Etymology. The specific name “*lochsa*” is a noun in apposition representing the Nez Perce name for the Lochsa River, along which the only known specimen was collected.

Taxonomic Remarks. While it is best to describe a species based on more than one specimen, the unique pronotal punctation and male genitalia support recognition as a new species. We also feel that this description will promote collecting trips to collect more specimens of this species and expand its known range.

***Athoplastus palouse* Etzler and Johnson, new species**

(Adult: Figs. 2, 14, 25–27)

Zoobank.org/urn:lsid:zoobank.org:act: 9601386F-4698-4376-8144-FB8FED38DAB2

Diagnosis. This species can be distinguished from other *Athoplastus* species by the combination

of the non-compressed prosternum (Fig. 8), dense pronotal punctation (Fig. 10), and elytra without dark markings along the striae of the elytra. More subtle characters that help distinguish this species are the more parallel-sided pronotum (Fig. 2) and the slightly wider antennomeres (Fig. 14). These last two characters are best used when comparing specimens of different species and become quite clear in this way. However, when identifying just a single specimen, these characters are less useful, so the characters from the key should be used to eliminate other potential species. This species is quite similar to *A. rainieri*, but the paramere tips and V-shaped membranous area of the basal piece of the male genitalia (Figs. 25–27) and geographic distribution, in addition to the subtle characters above, will distinguish these two species.

Description. Male. Length 15–17 mm in length, width 3–4 mm (measured across bases of elytra). Red-brown to brown, carina, palps, and tips of mandibles darker; posterior margin of hypomeron, coxae, and tarsi lighter, almost tawny yellow (Fig. 2). **Head:** Ocular index = 60.0–68.4 (mean 5 65.0, $n = 3$). **Antennae:** Mean ratio of antennomeres 2–11: 1: 1.25: 3.4: 3.6: 4; 4: 3.8: 4: 5.2 ($n = 2$). [Note:

Antennomeres 8–11 are adjusted values based only on one specimen. The antennomeres, on average, are less narrowed than in other species. This is difficult to describe, so compare Fig. 14 to Figs. 12 and 13.]

Pronotum: 1.4–1.6X wider than long. Lateral margin completely carinate, subparallel anterad divergent hind angles; subtly dorsoventrally flattened along lateral edges near anterior fourth. Punctures distinct, simple and dense on disc, separated by at most 1 diameter, often by about 0.5X diameter of puncture; punctures becoming denser along margins, nearly continuous laterally. **Prosternum:** Slightly convex with dense, shallow, subumbilicate punctures; anterior lobe short, broadly rounded, shallowly deflexed. Posterior process short and arcuate, gradually raised ventrally between procoxae, then deflexed posteriorly. **Legs:** Tarsomere 5 equal to tarsomere 1 on all tarsi. **Elytra:** Elongate, subparallel, 4.0–4.5X pronotal length; striae shallowly impressed, deeper apically; intervals flat, punctures fine, shallow, and irregularly distributed. **Aedeagus** (Figs. 25–27): Basal piece 2/5 total length, with broadly triangular membranous section on ventral surface (Fig. 26); median lobe 1.3X length of parameres, slightly deflexed ventrally at tip, median carina on ventral surface, basal struts following edges of median lobe; parameres wide basally, edges slightly sinuate and gradually narrowing toward tip, tip with very acute lateral expansion bearing 2 setae (Fig. 27).

Female. Unknown.

Specimens Examined (8). Holotype. USA: WASHINGTON: [Whitman Co.], Pullman, 7.vi.

[18]98, C. V. Piper (1, WSUC). **Paratypes. USA: IDAHO:** Kootenai Co., Athol, 29.iv.1957, W. F. Barr Collector (1, WFBM). **WASHINGTON:** Washington Territory] (1, USNM); Pullman, Sept. [year unknown] (1, USNM); [Whitman Co.], Pullman, 8.vi.[18]99 (1, WSUC); Pullman, 31.iii. [19]11 (1, WSUC); Pullman, 01.iv.[19]17 (1, USNM); Pullman, Apr[il] [19]20, Chester Dixon (1, USNM); Kamiak Butte, 23.ii.[19]34 Wn, J.F. Clarke (1, USNM).

Distribution. This species is only known from the areas of Pullman, Washington and Athol, Idaho (Fig. 29).

Etymology. The specific name “*palouse*” is a noun in apposition derived from the geographic area of collection of the majority of specimens.

Taxonomic Remarks. The distance between localities is quite a surprise, but the morphology of specimens from the two localities is consistent. *Athoplastus palouse* may co-occur with *A. acutus*.

Athoplastus rainieri (Van Dyke, 1932), new combination

(Adult: Figs. 4, 9, 22–24, 28)

Ludius rainieri Van Dyke 1932: 397, 421.

Ctenicera rainieri (Van Dyke, 1932); Lane 1971: 32.

Diagnosis. This species is distinguished from all other species of the genus by the combination of close pronotal punctures (separated by less than one diameter of a puncture) (Fig. 10), sloped prosternum (Fig. 8), and dark markings at each puncture along the striae of the elytra (Fig. 4). This last character is likely not a good species-level character and may be related to specimen development. *Athoplastus rainieri* is quite similar to *A. palouse*, which can be distinguished as noted above.

Description. Male. Length 16 mm, width 4 mm (measured across bases of elytra). Red-brown, carina and tips of mandibles darker; antennae, palps, coxae, and tarsi lighter, almost tawny yellow (Fig. 4). **Head:** Ocular index = 61.1. **Antennae:** Ratio of antennomeres (2–11): 1: 1.25: 3: 3.25: 3.5: 3.25:

3.75: 2(?): X: X. [Antennomere 9 appears to be broken, and 10 and 11 are missing on the specimen measured.]

Pronotum: 1.1X wider than long. Lateral margin completely carinate, slightly sinuate, almost subparallel anterad hind angles; convergent and slightly dorsoventrally flattened along lateral edges on anterior fourth. Punctures distinct, sub-umbilicate and dense on disc, separated by less than 0.2X their own diameter, with 2 “dimples” on either side of midline just anterad midlength, with less close punctures; punctures becoming clearly umbilicate and denser along anterior and lateral margins. **Prosternum:** Slightly convex with dense,

shallow, umbilicate punctures; anterior lobe short, broadly rounded, shallowly deflexed. Posterior process short and arcuate, gradually raised ventrally between procoxae, then sharply deflexed posteriorly; distinct ridge present immediately before procoxal cavity and along ventral surface of prosternal process. **Legs:** Tarsomere 5 equal to tarso- mere 1 on pro- and mesotarsi, tarsomere 5 missing on both metatarsi. **Elytra:** Elongate, subparallel, 4X pronotal length; striae shallowly impressed, deeper apically, punctures marked by darkening of the integument; intervals shallowly convex, punctures fine, shallow, and irregularly distributed. **Aedeagus** (Figs. 22–24): Basal piece approximately 1/3 total length, with deep, narrowly U-shaped, membranous section on ventral surface (Fig. 23); median lobe 1.2X length of parameres, slightly deflexed ventrally at tip, median carina on ventral surface, basal struts following edges of median lobe; parameres wide basally, edges slightly sinuate and gradually narrowing toward tip, tip with subacute lateral ex- pansion bearing 2 setae (Fig. 24).

Female. Length 21 mm, width 5 mm (measured across bases of elytra). Yellow-brown. **Head:** Ocular index = 72.7. Antenna: Ratio of antennomeres 2–11: 1: 1.6: 2.2: 2: 1.8: 1.6: 1.8: 1.6: X: X: X.

[Note: Antennae are broken on specimen examined, so the last three antennomeres of longest intact antenna are missing.] **Pronotum:** 1.25X wider than long, hind angles divergent, sides broadly sinuate. **Legs:** Tarsomere 5 intermediate in size between tarsomeres 1 and 2 on metatarsi; pro- and mesotarsi as in male. **Scutellar shield:** Setae radiating from midline.

Specimens Examined (3). Male. Holotype. USA: WASHINGTON: [Pierce Co.]; Mt. Rainier [E.C. Van Dyke, date unknown] (CASC, 1, CASC type no. 3181). **Female. USA: WASHINGTON:** [Kittitas Co.] Lk. Cle Elum; 13.v.1936; M.C. Lane (1, USNM); Lk. Cle Elum [?], 26.v.1937, M.C. Lane (1, USNM).

Distribution. This species is only known from the Cascade Range of mountains in Washington.

Taxonomic Remarks. Van Dyke (1932) mentions a specimen seen “in the collection of Prof. W. J. Chamberlin at Corvallis, Oregon.” Chamberlain’s collection was deposited at the Oregon State Arthropod Collection (OSAC) at Oregon State University (Oman 1970). However, a search of the OSAC yielded no specimen matching this description.

DISCUSSION

Together, adult (wing venation, Fig. 15, Dolin 1975) and larval (ninth abdominal segment with urogomphi, Figs. 40–44) morphology supports the placement of the species treated here in a distinct genus in the subfamily Dendrometrinae Gistel, 1848

(= Denticollinae Stein and Weisse, 1877 (1848) and Athoinae Candèze, 1859 of previous authors; see Bouchard *et al.* 2011). However, the tribal placement of this genus is ambiguous due to a host of morphological similarities shared with many tribes. The ambiguity is compounded in that there is no modern classification of tribes, nor have the tribes been tested for monophyly.

Both adult and larval morphology suggest a possible close affinity with the tribe Pleonomini (sometimes treated as a subfamily as in Cate 2007), where the two previously described species were tentatively placed by Johnson (1992). The larvae of *A. acutus* share a broad U-shaped caudal notch of the ninth abdominal segment and many lateral tubercles on the ninth abdominal segment with *Pleonomus* larvae as described by Dolin (1979). However, in *Pleonomus* the larva has a tridentate nasale (unidentate in *Athoplastus*) and chitinized hooks on either side of the 10th abdominal segment (*Athoplastus* lacks these hooks). This last character is used to define the tribe in Dolin’s tribal key, in which *Athoplastus* larvae will key to Prosternini (= Ctenicerini in key). Also, both *Pleonomus* and *Athoplastus* share a divided prosternum. This last character is often considered a defining character of Prosternini larvae (see below), suggesting more comparisons should be done between these two tribes.

Adding to the confusion is that Stibick (1979) considered Pleonomini as a tribe of Aplastinae Stibick, 1979 (= Aplastini, Cebriioninae, see Bouchard *et al.* 2011). Larvae of *Pleonomus* possess urogomphi, while larvae of *Aplastus* do not, highlighting an artificiality of Stibick’s classification. *Athoplastus* will also key to Denticollinae (5 Dendrometrinae) in Stibick’s key due to the prognathous mouthparts.

Alternatively, the presence of postepicranial setae (Fig. 45) in the larva suggests a close relationship with Hypnoidini Schwarz, 1906 (sometimes treated as a subfamily, Cate 2007, Stibick 1976), but no other character supports placement in this tribe. The presence of postepicranial setae also appears in larvae of the Prosternini genus *Paraphotistus*, again suggesting that characters used to define tribes need to be reevaluated.

Until tribal classifications in Elateridae can be adequately tested, we think it is best for *Athoplastus* to remain in the tribe Prosternini. The unidentate nasale and divided prosternum of *Athoplastus* larvae support this placement. The most similar genus to *Athoplastus* appears to be the Holarctic *Metanomus* Buysson, 1887 (preliminary genetic data, see also Johnson 1992 for morphological justification), although a more detailed study needs to be conducted to support this hypothesis.

The DNA data (Fig. 30) support our association of adult males and females and larvae of *A. acutus*,

but it does bring up other questions. The genetic distance of the CO1 sequence from the two Montana populations of *A. acutus* is very high (5.5–6.0%, Table 1), which is above the general threshold of 3% to delimit species (Kartavtsev 2011). However, we have taken the conservative approach and consider both populations the same species. First, there are no consistent morphological characters that separate the populations reliably. Second, the possibility of poor female flight dispersal means that it is possible for very large divergences to occur in mitochondrial lineages between distant populations. Female flight dispersal will need to be tested, as all examined females have well-developed wings, yet have only been caught in pitfall traps or by hand. The geo- graphic gap between these populations may well harbor undiscovered populations that would have intermediate sequences that would eliminate this apparent gap. Since the males appear to be strong fliers, these differences could be maintained in mitochondrial lineages, but the nuclear genes may be more unified among populations. Alternatively, this level of difference could be reflective of cryptic species separated by distance, habitat, or phenology.

Little habitat data and few observations are available for any of the species of *Athoplastus*. The field observations for *A. acutus* in Ravalli County, Montana show that adults are active in the early spring from late March to early May when daytime temperatures are above 15° C. Males are active fliers, becoming active after sunset. Males were attracted to UV lights and observed flying short distances at temperatures as low as 5.5° C (FEE, personal observation). Based on label data, male specimens from Idaho have also been collected at UV lights. Females were not observed flying. One female was collected at the base of a tree, and others were collected in pitfall traps. Females likely release sex pheromones for mate attraction, suggested by male antennal waving patterns observed in the field, a male landing on the location of a recently collected female (FEE, personal observation), and densely setose sensory punctures on the antennomeres of the males.

The few larvae known were either collected by hand or in pitfall traps. The pitfall traps were placed near the base of a tree or a stump in or near open areas in the forest and relatively near a river or creek. The hand-collected larva from Ravalli County, Montana was found beneath a partially burned log sitting in some grass near a campsite. Based on these observations, the larvae likely move along the top of the ground or in forest duff. It is unclear if they are soil or litter dwelling, occur in rotten wood, or both.

Specimens of *Athoplastus* are rare in collections, but the cool evening and early spring flight behavior

suggests that there is a collecting bias with these species. The cool flight temperature and evening flight pattern contribute to their rarity since few collectors conduct fieldwork in the region at the peak activity time of the beetles. Future collecting efforts should be focused in each of the localities above to monitor for the presence of these species during late March to early May. Based on the collecting dates given in works describing *Athous* (*Neonomopelus*) species from Spain, it is likely that these species follow a similar activity pattern (Platia 2003; Rosa *et al.* 2011). Peak activity of *Pleonomus canaliculatus* (Faldeman) appears to be similar, with peak activity between mid-March and mid- April (Wu and Pengzhong 1954). The three genera (*Athoplastus*, *Athous* (*Neonomopelus*), and *Pleonomus*) also appear to have converged on a similar set of morphological characteristics (*i.e.*, large eyes, long antennae, reduced sclerotization). Despite these superficial similarities, direct comparison of representative species suggests that these three genera represent different homoplastic lineages.

The cool-weather flying observed in *Athoplastus* at first seems quite unusual but is shared with other cool season activities of hypnoidines and some prosternines, such as *Anthracoptyx* Horn (PJJ, personal observation). By noting this early activity, we hope to inspire other collectors to investigate areas around them during March or April. There are likely many more exciting discoveries to be made with other early spring active elaterids.

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CHAPTER THREE

REVIEW OF THE GENUS *PARADONUS* STIBICK, 1971
(ELATERIDAE: NEGASTRIINAE), WITH THREE
NEW NORTH AMERICAN SPECIES

Contribution of Authors and Co-Authors

Manuscripts in Chapters 2, 3, 4, and 5

Author: Frank E. Etzler

Contributions: Examined all specimens. Wrote manuscript. Took many of the photos.
Drew all line drawing. Compiled all figures into final form.

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Abstract

Three new North American species of *Paradonus* Stibick are described:

Paradonus gallatinensis **new species**, *Paradonus gustafsoni* **new species** and *Paradonus stibicki* **new species** is described for specimens formerly called *Paradonus pectoralis* *sensu* Stibick, 1991. The type species of the genus, *Paradonus pectoralis* Say, 1839 is redefined, the Holotype of *Paradonus oliverea* Stibick, 1991 is designated as the Neotype of *P. pectoralis*, a common, widespread species. The genus is redescribed, a checklist of species is included, and notes on the described species north of Mexico are given. *Hypnoidus guatemalensis* Champion, 1895 is removed from the genus and placed in *Zorochrus* Thompson, 1858 as *Zorochrus guatemalensis* (Champion, 1895) **new combination**. A key to all described species north of Mexico is provided, along with illustrations of characters used in identifying species.

Key words: click beetles, North America, taxonomy

Paradonus Stibick, 1971 is a New World elaterid genus in the subfamily Negastrinae. Species in this genus are readily separated from other negastrines by the lack of striae on their elytra and presence of a short carina on the pronotal hind angles (Stibick 1971). Before 1991 the majority of North American species and specimens were identified as *Paradonus pectoralis* (Say, 1839), but this group was recently revised for eastern North America, and the species redefined (Stibick 1991). Stibick (1991) described four new species that were previously confused with *P. pectoralis*, and provided a key to six eastern species of the genus. Stibick (1991) mentioned that many western species remained to be described.

While curating the Elateridae in the Montana Entomology Collection (MTEC) for a checklist of species (Etzler and Seibert, in prep; Seibert 1993), it became clear that the *Paradonus* species in the state were unworkable. With Stibick's redefinition of *P. pectoralis*, the only recorded species for Montana was *Paradonus beckeri* Stibick, 1991. While searching for *P. beckeri* among the over 200 specimens of the genus in the MTEC, it became clear that many of the specimens belonged to undescribed species and that previous species concepts broke down upon close examination. These new species needed to be named for the upcoming checklist, but this quickly became embroiled in deeper problems.

Eastern species covered by Stibick were examined in order to give the new species proper context among the other described species. However, during the examination, a problem with the concept of *P. pectoralis* emerged. A visit to the Museum of Comparative Zoology Collection (MCZC), supported the idea that the concept of *P.*

pectoralis needed to be revisited, and in doing so, a review of all the described North America north of Mexico species was the result. Brief summaries and diagnoses, synonymical tables, as well as a key to and illustrations of all described North American north of Mexico species are provided, in addition to the originally intended new species descriptions. This paper is not intended to be a full revision, and much work remains to be done, especially on the far-west species, but it is hoped this will be considered an incremental improvement to our knowledge of these tiny click beetles.

Materials and Methods

Over 400 specimens were examined from the following collections:

ANSP – Academy of Natural Sciences, Philadelphia, PA, USA.

BMNH – Natural History Museum, London, United Kingdom.

INHS – Illinois Natural History Survey Collection, Champaign, IL, USA.

LSAM – Louisiana State Arthropod Museum, Louisiana State University, Baton Rouge, LA, USA.

MCZC – Museum of Comparative Zoology Collection, Harvard University, Cambridge, MA, USA.

MTEC – Montana Entomology Collection, Montana State University, Bozeman, MT, USA.

USNM – United States National Museum of Natural History, Washington, D.C., USA

Since the MTEC does not retain types, MTEC holotypes are placed on permanent loan at the California Academy of Science Collection (CASC), San Francisco, CA, USA. Paratypes are deposited among multiple collections, which are noted under each new species. For ease of reference, the following collections contain paratype specimens: ANSP, CASC, INHS, MCZC, MTEC.

Adult specimens were floated off of their points using hot water just below the boiling point. Abdomens were carefully removed, and the male genitalia removed. In some instances, entire abdomens of males were placed in a room temperature, low concentration (ca. 10%) KOH solution for ca. 1 hour, before the genitalia were removed. Abdomens thus treated were moved to distilled water and the reaction was stopped using 2 drops of white vinegar to prevent over-clearing of the genitalia. Parts were then rinsed in distilled water. Dried abdomens, genitalia, and terminal abdominal segments were glued on cards for continued study.

Photos were taken using a JVC (DC Ky-F75U) digital camera mounted on a Leica® MS5 stereoscope and a Visionary Digital Passport II imaging system, equipped with a Canon 6D DSLR (www.duninc.com). Enhancements to digital images were made using the Zerene Stacker® software version 1.04 and edited in Adobe PhotoShop® CS 6. Drawings of key characters were based off of photos of specimens and drawn using Adobe Illustrator® CC.

Species descriptions and morphological terminology follow the style of Stibick 1991, to enable ease of comparison of species. Stibick (1991) used atypical terms to

describe the male genitalia, which are given in parentheses in the species and generic descriptions.

Results and Discussion

I have combined aspects of Stibick's 1971 generic description, his 1991 species descriptions, and my own observations in the redescription of the genus below. This includes characters not mentioned in species descriptions that are shared by all members of the genus. A large portion of each species description covers color patterns and variation within a species. The notes and provided tables are not exhaustive and do not include every instance of species name usage. They should rather be used as a convenient way to track generic concepts through time. A key to Negastrinae genera is provided in Stibick 1971.

Redescription of the genus *Paradonus* Stibick, 1971

Type species: *Elater pectoralis* Say, 1839 [1836]: 173 (by original designation).

Description: Length 0.9–4mm, color variable, body somewhat flattened relative to most other genera of Negastrinae. **Head:** Color variable, yellow to piceous; moderately, closely punctate, surface variably microreticulate; eyes proportionately normal; frontal margin complete and somewhat arcuate between antennae; antennae feebly to moderately serrate, color variable, yellow to brown, first segment (pedicel) expanded, cylindrical, 2nd and 3rd cylindrical, 3rd just slightly smaller than 2nd almost appearing subequal, 4th

through 10th segments serrate and very gradually decreasing in length, 11th segment oval with one or two apical indentions, total antennal length shorter than pronotal length, all segments covered with moderately dense, short yellow pile. **Thorax:** Color variable, yellow to piceous. Pronotum wider than long, ratio slightly variable, South American species may be narrower, as wide as long; sides arcuate at various degrees; hind angles variable, blunt or sharp, curved or straight, never embracing humeral angle of elytra, carina variable, straight or curve, barely exceeding hind angles at most; punctures variable, often evenly rugose, with an impunctate central area/stripe in most species, interspaces variable, dull to shining. Hypomeron finely, shallowly punctate, spaces between punctures variable, nearly touching to separated by up to diameter of puncture; interspaces variable, dull to shining. Prosternum broad, widest in middle; punctuation variable, nearly touching to separated by 1.5x diameter of a puncture, males with a small densely punctured, pubescent patch in center (Fig. 3.6); prosternal lobe prominent, rectangular, prosternal sutures moderately curved, single, simple; prosternal process straight, slender, and acutely pointed, appearing concave between procoxae, sharply convex from procoxae to apex, moderately punctate, interspaces feebly microreticulate. Mesosternal fossa raised along sides, sometimes sharply, posterior side flat with fossa veering into ventrally expanded mesosternum. mesepisternum and mesepimeron not reaching mesocoxal cavity, mesocoxae surrounded by meso- and metaventrite. Metaventrite with variable punctuation, interspaces variable, dull to shining. Scutellum subpentagonal, flat, mostly moderately elongate (width/length ratio variable), rarely subquadrangle, slightly inclined, anterior edge slightly curved, surface variable, rough to

nearly smooth. Elytra without striae, finely, more or less evenly punctuate, distance between punctures variable, nearly touching to separated by a diameter of a puncture, interspaces variable, dull to shining, color variable, yellow to piceous. Legs of variable color, yellow to piceous, tarsal segments simple, 1st to 4th segments gradually decreasing in length, 5th longer than last two together, claws simple. **Abdomen:** Punctures variable, nearly touching to separated by a diameter of a puncture, interspaces variable, dull to shining. **Male Genitalia:** Parameres heavily modified; basal portions (basimere) fused to one another and medio-ventral strut of median lobe, forming rigid cylinder, dorsal side covering ventral side except over basimeral plate, this gradual attenuate basad, apex moderately rounded to subacute; apical portions (telomere) slender, separated dorsally as a movable condylite with digitate base and articulate to medio-ventral strut of median lobe, bearing one major subapical seta, apex with or without lateral expansion or hook; full paramere complex usually widest near mid-length. Median lobe (centerpiece) broad or narrow, lateral struts slightly arcuate at base, otherwise straight, relative length to paramere complex variable, apex usually moderately acuminate, exceeding apex of parameres. Basal piece variable, subquadrate to subrectangular. (examples, Figs. 3.18–3.21). **Female internal genitalia:** Completely membranous with large uterus and one equally large colleterial gland on each side, connected to a very small, completely separate bursa copulatrix with a small, sac-like accessory gland and also connected to the spermathecal diverticulum (Fig. 3.4).

Discussion: By far the best character to distinguish males and females is the small densely punctured and pubescent spot in the center of the male prosternum (Fig. 3.6). All species examined possess this character, although the smaller species have smaller and less distinct patches.

The lower end of the size range for the genus, 0.9 mm, was first reported by Stibick (1971) in his generic description. I have seen no specimen approaching this size, with the smallest I have examined being just over 2mm in size. The size of 0.9 mm needs to be confirmed before it can be accepted as an accurate size range for the genus. However, I have included it here to retain cohesiveness with the original description

At the time of description (Stibick 1971), 21 species were placed in this genus, with five named species names — one each from North, Central, and South America, one fossil species, and an uncertain African species — and at least 16 undescribed species mentioned.

To date, there are 20 species described, including the fossil species. An African species is considered *insertus setus* and not included in the species count (see below). Many more species undoubtedly remain undescribed. I have seen many undescribed species that require more material to describe, particularly from the Southwest USA. There are nine extant species described from North America north of Mexico; these are treated in the key and descriptions below. Stibick also placed the fossil species *Cryptohypnus hesperus* Wickham (Miocene, USA) in this genus.

Five species are described from Central America (including Mexico): *Paradonus mexicanus* (Fleutiaux, 1895), *Paradonus quadriplagiatus* (Champion, 1895), *Paradonus*

quadrisignatus (Champion, 1895), *Paradonus teapensis* (Champion, 1895), and *Paradonus tetraspilotus* (Champion, 1895). A key to these species is found in Champion (1897, pg. 408) under *Hypnoidus auctorum* part b.

Hypnoidus guatemalensis Champion, 1895, is sometimes placed in *Paradonus*, but it is better placed in *Zorochrus* Thompson, 1858, *Zorochrus guatemalensis* (Champion, 1895) **new combination**, based on the partially striate elytra and lack of a carina on the pronotal hind angles.

Five South American species are described: *Paradonus aequalis* (Candeze, 1881), *Paradonus atomus* (Candeze, 1878); *Paradonus esaejas* Johnson, 2018; *Paradonus nivalis* (Fairmaire and Germain, 1860); and *Paradonus oberthuri* (Candeze, 1881). *Paradonus kosnipata* Johnson 2018 is a *nomina nuda* that appears only in the abstract of Johnson *et al* 2018. *Cryptohypnus andicola* Fairmaire and Germain, 1860, is a species in *Margaiostus* (Mesemiostus) Stibick, 1978, but appeared in combination with *Paradonus* in Arias-Bohart and Elgueta 2012 (pg. 649). The reference given for the combination, Stibick 1978, does not have the combination of *Paradonus andicola*, so this appears to be an error.

The African species *Monadicus gagates* Fleutiaux, tentatively included in the genus by Stibick (1971) is considered here to be *incertae sedis* and I agree with Stibick that it likely belongs in a distinct genus.

Biology. Stibick (1991) provided in-depth habitat data for *Paradonus beckeri* Stibick. He stated that this species has blue grass (*Poa pratensis* Linnaeus, Poaceae) as a host plant

and is likely a grassland species. Stibick also stated that *P. beckeri* is the only negastriine pest of blue grass. Based on the many specimens examined, a stronger link to riparian habitats was suggested by collecting localities. I have also seen numerous specimens collected under bark of apple trees. I am doubtful if any species of *Paradonus* is truly a pest of any grasses, and the presence of adults in an area is part of the native fauna. However, this claim needs to be tested. Associated larvae are unknown.

Many specimens have been collected at lights or in light traps, suggesting nocturnal activity.

Explanation of characters used in key and descriptions:

The character of the pronotal hind angle carina was first used by Stibick (1991) without explanation. The two character states are if the carina reaches the margin at the apex of the hind angle, or if it reaches the posterior edge of the pronotum medial to the apex. To accurately view this character, one should try to view the pronotum from the most dorsal and level position possible.

In the case when the carina of the hind angle connects to the posterior carina the exact form is quite variable between species. In some species the separation from the hind angle is quite distinct, and there is no doubt that the carina does not reach the apex (Fig. 3.1). In others, it can be more difficult, with the carina not appearing to connect to the apex at low magnification, but at higher magnification, there is a small curve at the tip to apparently connect to the apex (Fig. 3.2). However, this small curve is connected to the

posterior carina, slightly mesad the actual hind angle. The carina may be curved or straight.

When the hind angle carina connects at the apex, one will be able to determine this at a wide range of magnifications, from low to high power. It will be clearly offset from the carinae of both the lateral and posterior margins (Fig. 3.3). The carina may be curved or straight.

Pronotal punctures are described from directly above. It is quite common for these punctures to be in rows along the long axis of the body, creating a rippling pattern in the integument. Punctures, if required for confirmation of identification, should be used at the highest power available (64x here). The interspaces are frequently microreticulate. These appear as small punctures or indents between actual seta bearing punctures, and an increase in density will make for a duller integument.

The male genitalia of *Paradonus* species are modified from the typical tri-lobate type. The basal portion of the parameres are fused into a cylinder-like structure, which can be confused with the typical basal piece of the aedeagus. The apical portions of the parameres are modified into a movable condylite (telomere), which is noticeably separated from the base in the dorsal view and can be easily confused with a normal paramere. This condylite has the apex sometimes expanded laterad (“apex of paramere expanded laterally” in key below). It is likely that all species possess this character, but it is too sometimes small to see under a dissecting scope.

Color definitions follow the Torre-Bueno (1989) glossary of terms. The range from lightest to darkest is: yellow, testaceous, light brown, brown, dark brown, and

piceous. Testaceous will be a yellow-brown, or amber, color, and under certain lighting conditions will appear reddish, matching descriptions of previous authors. However, patterns on the elytra appear consistent within a species.

Key to species in North America, north of Mexico:

1. Pronotal hind angle with carina connecting at apex (Fig. 3.3); carina curved or straight.....2
- 1'. Pronotal hind angle with carina connecting to posterior margin mesad apex (Figs. 3.1 and 3.2); carina curved or straight; in uncertain cases, carina of hind angle straight, oriented perpendicular to posterior margin.....5
2. Pronotum subtly bicolored, lighter on disc than along edges; elytra with apical spot and faint dark band near apical one-third (Fig. 3.16); legs contrasting with metaventricle and abdomen; length 3mm or more; aedeagus with laterad apical expansions on parameral condylite (Fig. 3.20).....
.....*P. gustafsoni* **new species** (Fig. 3.16)
- 2'. Pronotum unicolorous; elytra variable, but never with the above combination; legs variable, matching body or contrasting; size variable, usually less than 3mm; aedeagus without laterad apical expansions on parameral condylite (e.g. Fig. 3.21).....3

3. Body unicolorous, brown to dark brown dorsally, legs not contrasting with body; generally larger, 3mm or more in length; pronotal hind angles relatively more elongate; aedeagus with medial lobe broadly triangular and straight along lateral edges (Fig. 3.19) *P. gallatinensis* **new species** (Fig. 3.15)
- 3'. Body testaceous dorsally, at most elytra light brown, often with vague elytral maculations; legs yellow to testaceous, sometimes contrasting with metaventrite and abdomen; generally smaller, less than 3mm in length; pronotal hind angles shorter (e.g. Fig. 3.17); aedeagus not as above 4
4. Head usually brown to piceous, contrasting with testaceous pronotum, rarely lighter, matching pronotum; aedeagus with median lobe narrow (Fig. 3.21); length usually 2.5mm or greater, rarely smaller (2.4mm), broadly distributed east of the Rocky Mountains *P. stibicki* **new species** (Fig. 3.17)
- 4'. Head light brown, not strongly contrasting with pronotum; aedeagus unknown; length 2.5 mm or less; known only from the San Diego area, California
..... *P. futilis* (LeConte, 1853)
5. Elytra bicolored, with varying patterns of maculation, at least humeral angles and/or apex lighter than rest6
- 5'. Elytra unicolorous, rarely with subtle dark patch in 'V'-shape around scutellum
..... 9

6. Body piceous to light brown; elytra with triangular yellow spot just posterior to midpoint and often apical spot *P. obliquatulus* (Melsheimer, 1845) (Fig. 3.14)
- 6'. Body variable in color; elytra often banded, but never with basal half dark 7
7. Pronotum with disk lighter, elytra with humeral angles lighter, angled light band at midlength, and lateral apical light spot, light areas may be smaller than figured specimen *P. inops* (LeConte, 1853) (Fig. 3.8)
- 7'. Pronotum often unicolorous, sometimes with hind angles lighter or extreme posterior edge darker, disk never lighter than lateral edges; elytral patterning various 8
8. Carina of hind angles broadly arcuate and widely separate from sides, hind angles comparatively slender; elytron often with two humeral spots, uncommonly additionally with two apical spots; body oblong, convex and elytra more acuminate towards apex; generally smaller, 2.5–3 mm in length
 *P. beckeri* Stibick, 1991 (Fig. 3.7)
- 8'. Carina of hind angles feebly arcuate and moderately divergent from sides, hind angles with broad base; elytron with variable yellowish humeral patch and smaller apical patch; body broader, more flattened and elytra blunter at apex; generally larger, 3–3.6mm in length, rarely smaller, around 2.75mm
 *P. pectoralis* (Say, 1839), pars (Figs. 3.10–3.12)

9. Interspaces of pronotum shining; hind angles sharp and elongate, carina of hind angles broadly arcuate; parameral condylite lacking apical laterad expansion; uniformly dark brown *P. jersiensis* Stibick, 1991 (Fig. 3.9)
- 9'. Interspaces of pronotum dull; hind angles with an acute tip, not elongate, carina of hind angles straight to weakly arcuate; apex of parameral condylite expanded laterad (Fig. 3.18); color variable, usually uniformly piceous, rarely brown or testaceous *P. pectoralis* (Say, 1839), pars

Notes on previously described species:

1. *Paradonus beckeri* Stibick, 1991: 117.

Fig. 3.7.

Paradonus beckeri; Bousquet et al. 2013: 189.

Diagnosis: See key above for diagnostic characters.

Material Examined: Over 70 specimens examined, including fifteen paratypes (INHS, USNM). Specimens were examined in the following collections: INHS, LSAM, MCZC, MTEC, USNM. This species is represented in the LeConte collection under *P. pectoralis* by three specimens. These specimens are: #4, In[diana]; #5, Col[orado]; and #7, pale green disc [NE, KS, ND, SD, OK, CO, WY, MT] (MCZC handout).

In addition to the localities given in Stibick (1991), I add the following:

ILLINOIS: Champaign; Havana; Homer; Muncie (18, INHS830091–INHS830107, INHS830134–INHS830140). **KANSAS:** Ottawa; Stromberg (7, INHS830118–

INHS830121, INHS830131–INHS830133, INHS830188). **MISSOURI:** Columbia; Lathrop (21, INHS830108–INHS830117, INHS830122–INHS830130, INHS830186–INHS830187); **MONTANA:** Carter Co., Ridge Road; Custer Co., 4mi S. Miles City (2, MTEC). **OHIO:** Warren Co., Ceaser [sic] Creek (3, MTEC). **OKLAHOMA:** Grady Co.; Payne Co (3, LSAM). It is a widespread species east of the Rocky Mountains, and has been collected in every month.

A second character that Stibick mentions is the presence of setose sensoral pits at the apex of antennomere 11. In the majority of species, there is only a single, dorsal pit, which gives the apex a blunt appearance (Fig. 3.6). Stibick (1991) states that *P. beckeri* has two sensorial pits, which gives the apex an acute, sharp appearance. However, I am unable to confirm this, with the specimens before me, including paratypes, all bearing a single, dorsal pit.

2. *Paradonus futilis* (LeConte, 1853).

Cryptohypnus futilis LeConte, 1853: 488; Candèze 1860: 91.

Cryptohypnus pectoralis var. *futilis* (LeConte, 1853); Horn 1891: 28.

Negastrius pectoralus var. *futilis* (LeConte, 1853); Lane 1971: 20.

Diagnosis: See key above for diagnostic characters.

This species was described by LeConte (1853) from specimens collected in San Diego, California. Images of the holotype are available on the MCZC type database under the original species combination

(http://naskreck.oeb.harvard.edu/mcz/Species_record.php?id=2190). The pronotal hind angle has the carina connecting to the apex, and the two specimens in the LeConte collection (MCZC) are quite small, each being around 2.25mm. The female type has a faint band on the elytra near the apical one-fourth of the elytra, and the other specimen has completely testaceous elytra. The Sonoran specimens collected by Champion (BMNH) and reported under this name are not *P. futilis*, and represent an undescribed species. The full range of this species needs to be explored with more material.

3. *Paradonus inops* (LeConte, 1853).

Figs. 3.1, 3.8.

Cryptohypnus inops LeConte, 1853: 488; Candèze 1860: 91.

Cryptohypnus pectoralis var. *inops* (LeConte, 1853); Horn 1891: 28.

Negastrius pectoralis var. *inops* (LeConte, 1853); Lane 1971: 20.

Diagnosis: See key above for diagnostic characters.

Four specimens examined from MCZC and MTEC.

Described by LeConte from San Diego, I have also seen specimens from Washington and Utah in the MTEC. Specimen #13 in the LeConte collection under *P. pectoralis* is this species, but the specimen does not have a locality label.

4. *Paradonus jerseiensis* Stibick 1991: 121.

Fig. 3.9.

Paradonus jerseiensis Stibick, 1991: 121; Roble and Hoffman 2012: 52.

Diagnosis: See key above for diagnostic characters.

This species is known only from New Jersey and Virginia, but likely has a wider distribution. Stibick (1991) states that it is closely related to *P. beckeri*, and I find that it is also quite similar to *Paradonus obliquatulus* (Melsheimer, 1845). I have examined three paratypes and the allotype of this species from MCZC and USNM. The two MCZC paratypes of *P. jerseiensis* are in the Horn Collection mixed with *P. obliquatulus* specimens. This species is likely confused under other names in most collections.

5. *Paradonus obliquatulus* (Melsheimer, 1845).

Figs. 3.4, 3.14.

Cryptohypnus obliquatulus Melsheimer, 1845: 214; LeConte 1853: 488; Candèze 1860: 90; Horn 1891: 27.

Hypnoidus obliquatulus (Melsheimer, 1845); various authors.

Negastrius obliquatulus (Melsheimer, 1845); various authors, noted in van Herk and Vernon 2014: 93.

Paradonus obliquatulus (Melsheimer, 1845); Stibick 1991: 122; Majka et al.

2011:142; Bousquet et al. 2013: 189; van Herk and Vernon 2014: 93.

Hypnoidus felti Notman, 1921: 159.

Diagnosis: See key above for diagnostic characters.

Over 20 specimens examined from INHS, MCZC, and LSAM.

This species is the only one that historically has consistently been considered distinct from *P. pectoralis* (Stibick 1991). Stibick stresses a piceous pronotum in his key to species, but the pronotum is often lighter in specimens I have seen. I have found many specimens of *P. beckeri*, *P. jerseiensis*, and *P. pectoralis* (see below) mixed under this name. Van Herk and Vernon (2014) report this species from Alberta. This record may represent a misidentification of the wide-spread *P. pectoralis*, which is found throughout Montana south of Alberta, as *P. obliquatulus* is only known as far west as Southeast South Dakota. In addition to the localities given in Stibick 1991, I add the following localities: **ILLINOIS:** Elgin; Havana; and Grand Tower (INHS 830141 – INHS 830153). **LOUISIANA:** Bossier Parish (4, LSAM).

6. *Paradonus pectoralis* (Say, 1839).

Figs. 3.2, 3.5, 3.6, 3.10–3.12, 3.18.

Elater pectoralis Say, 1839: 173.

Cryptohypnus pectoralis (Say, 1839); LeConte 1853: 488; Candèze 1860: 89;

Horn 1891: 27.

Hypnoidus pectoralis (Say, 1839); Champion 1897: 413.

Negastrius pectoralis (Say, 1839); Lane 1952: 66; Lane 1971: 20.

Paradonus pectoralis (Say, 1839); Stibick 1971: 386; Stibick 1991: 125; Majka and Johnson 2008: 9; Majka et al. 2011:142; Bousquet et al. 2013: 189; van Herk and Vernon 2014: 93.

Paradonus oliverea Stibick, 1991: 123. **New synonymy**; Majka and Johnson 2008: 9; Majka et al. 2011:142; Bousquet et al. 2013: 189.

Paradonus illinoiensis Stibick 1991: 119. **New synonymy**.

Diagnosis:

This species has historically been confused with all other species recognized here. In collections, it is often confused with *P. beckeri* and *P. obliquatulus*. From *P. beckeri*, it can be distinguished by the basal testaceous area not limited to humeral angle (Figs. 3.10–3.12), the laterally closer pronotal hind angle carina, apical laterad expansion of the parameral condylite, and the generally larger size. *Paradonus beckeri* specimens are also never unicolorous, which occurs in some specimens of *P. pectoralis*. From *P. obliquatulus*, it can be distinguished by never having the basal half of the elytra brown to piceous when the elytra are patterned and the relatively duller pronotal interspaces.

Redescription: (Figs. 3.10–3.12). Length 3.0–3.6mm (avg. 3.25mm, n=32), color in general testaceous to brown, elytra noticeably bicolored, with a piceous band at posterior third of elytra and often a piceous triangular mark near the scutellum, very rarely bands are very faint, so elytra seem unicolorous, body relatively dorso-ventrally flattened, covered in short, appressed, grey to yellowish setae. Rarely completely piceous. **Head:** light brown to piceous, rarely testaceous; punctures simple, separated by a diameter or

more, subequal in size to pronotal punctures, surface moderately shining and distinctly microreticulate, setae appressed, short, and golden; antennae feebly serrate, testaceous to light brown and lighter than head, rarely nearly same color as testaceous head, 11th segment with one indentation on dorsal side. **Thorax:** Pronotum testaceous to nearly piceous dorsally; in testaceous specimens, color is uniform with only carina along edges and on hind angle dark; in darker specimens, anterior and posterior edges, including hind angles testaceous, carina dark. Pronotum wider than long (avg. 1:1.28, n=16); sides broadly and evenly arcuate, widest in middle; hind angles sinuate laterally, sometimes subtly so, tip of hind angle sharp and noticeably curved laterally, carina of hind angle distinct, straight, rarely slightly arcuate, connecting to posterior carina of pronotum, carina barely exceeding hind angles, reaching bulbous part of pronotum; punctures subumbilicate, small, evenly spaced, separated by a diameter or more on disc, closer posteriorly, interspaces dull to moderately shining, noticeably microreticulate.

Hypomeron testaceous to dark brown, often lighter than dorsal surface, posterior edge darker, dark brown to piceous, punctures simple, small, separated by diameter or more at midlength, closer anteriorly, posterior fourth impunctate, interspaces moderately shining to shining, microreticulate to feebly microreticulate. Prosternum testaceous to dark brown, often same color as hypomeron, but sometimes darker, prosternal process darker, brown to piceous, punctuation small, simple, dense, separated by less than a diameter of a puncture, interspaces shiny and microreticulate. Metaventricle light brown to brown, with small, simple punctures separated by a diameter or less, closer laterally and posteriorly, sometimes very dense throughout, interspaces shining and feebly microreticulate to

moderately shining and microreticulate. Scutellum subpentagonal, subtly convex, moderately elongate, longer than broad, slightly inclined, anterior edge slightly curved, surface rugosely and indistinctly punctured, testaceous to brown medially, matching pronotum, piceous along edges. Elytra with small, simple punctures, separated by a diameter to two diameters, interspaces shining, feebly microreticulate, mostly testaceous, with dark brown to piceous band nearly posterior one-third, which rarely fades laterally, dark brown to piceous along suture, basally often subtly darker or with a faint dark brown to piceous v-shaped patch near scutellum, these latter specimens also sometime piceous along lateral edge of elytral apex, very rarely nearly entirely testaceous, with apical band reduced to a faint light brown patch near medial edge. Legs testaceous to light brown, distinctly lighter than metaventricle and abdomen. **Abdomen:** Light brown to brown, often unicolorous, but rarely becoming subtly lighter posteriorly; punctures simple, small, dense, nearly contiguous, interspaces moderately shining. **Male Genitalia** (Fig. 3.18): Parameres with apical expansion of dorsal condylite, dorsal condylite around 0.48x total paramere length. Median lobe broad, extending past parameres by around 0.19x of total aedeagal length. Basal piece quadrate, convex, around 0.25x of total aedeagal length.

Discussion:

Based on the examination of 85 specimens in the MTEC, 13 exemplars of *P. oliverea* in the MCZC, 24 specimens from the INHS, seven specimens from LSAM, and the holotype and 10 paratypes of *P. oliverea* from the USNM, I have found that the pronotal coloration is highly variable. After examining these specimens, it became

apparent that LeConte's concept of *P. pectoralis* was based on specimens of what Stibick (1991) called *P. oliverea*. This makes sense, as Say's original description of *P. pectoralis* matches *P. oliverea*, not what Stibick called *P. pectoralis*.

First, several aspects of Stibick's (1991) description are misleading or incomplete. The pronotal coloration is much more variable than stated by Stibick. Stibick states that *P. oliverea* has a piceous pronotum, only rarely a lighter pronotum, and used this character in the key to identify this species. Among the Montana specimens, 34 have a testaceous pronotum, 16 have a piceous pronotum and match Stibick's description, and another 34 are intermediate (Figs. 3.10–3.12). I was first inclined to consider the Montana specimens a new species closely related to *P. oliverea*, but examination of more Eastern specimens confirmed a match based on male genitalia. The drawing of the male genitalia in Stibick 1991 is also not 100% accurate. The single long setae present at the apical end of the parameres is not depicted in Stibick's drawing, but is mentioned in the description. The apical ends of the parameres possess small diagnostic apical expansions (hooks, Fig. 3.18). This character is very difficult to see if the light source is not diffuse. Additionally, Stibick states that the hind angles on the pronotum are straight posteriorly. Again, this is not completely accurate as the tip of the hind angle comes to a sharp point and is curved dorso-laterally. The hind angle tip can be obstructed at some angles by the anterior edge of the elytra, but will become clear at high power.

Second, LeConte's concept of the Say species is based on specimens equal to Stibick's *P. oliverea*, with LeConte making special note of the patterned elytra in his description. The LeConte collection has three representations of this species: #1 and #2,

each with a pink disk (Middle States, MD, DE, NY, NJ, PA, CT?, RI?) and #1 also bearing the ID label; #6, pale green disk (NE, KS, ND, SD, OK, CO, WY, MT). Three more are also *P. pectoralis*, but lack state labels, being #10, #12, and #14, with the latter with a light-colored pronotum.

Finally, Say's original description is a better match to Stibick's *P. olivereae* than Stibick's concept of *P. pectoralis*, despite the size difference. Say's specimen was collected in Missouri and was a specimen with a yellow pronotum and elytra with maculations and an apical spot (similar to Fig. 3.12). He also compares it to the similarly-patterned *Ampedus areolatus* Say, 1823 (Fig. 3.13). The mention of a completely testaceous appearance — Stibick's concept — only starts with Horn (1891). It also stands to reason that Say would mostly likely describe a common species rather than a rare one.

The size given in the original description by Say does deserve comment. Say gave the size of *P. pectoralis* as “less than one-tenths of an inch” (Say 1839, pg. 173) which is around 2.5 mm. I hypothesize that Stibick chose small, testaceous specimens (rarely with elytra maculations, see *P. stibicki* below) to represent *P. pectoralis* since they matched the size given in the original description and followed Horn's concept of the species. But only one of the 14 specimens in LeConte's collection at the MCZC fits Stibick's concept, the majority matching *P. olivereae* (three are *P. beckeri*, see above). LeConte's *P. pectoralis* is also larger (.12 inch [equals a bit more than 3 mm]) than the measurements he gives for *P. futilis* (.08 [about 2.1mm]) and *P. inops* (.08–.09 [2.1–2.3mm]), and slightly larger than *P. obliquatulus* (.10–.11 [2.5–2.8mm]), all of which support this interpretation of Say's species. The size and coloration of Say's description also seem to

be a near match to the description of *P. illinoensis*, which I consider small specimens of *P. pectoralis*. Finally, LeConte (1859) stated in the introduction to Say's collected works that he examined the types of Say species lending more support to his concepts (although with reservations, see Prena 2018). All these factors support the concept of the species proposed here.

Currently there is existing taxonomic confusion about the concept of *Paradonus pectoralis*. Say's type is not located in the Harris material within the MCZC (Mawdsley 1993, personal observation). A request was also made for specimens in the Schönherr collection located in the Naturhistoriska riksmuseet, Stockholm, Sweden (NHRS), where Prena (2018) located many original Say specimens. To correct this taxonomic issue, I have designated the Holotype of *P. oliverae* as the Neotype of *P. pectoralis*, making the two names objective synonyms. Under Art. 75.3 of the ICZN (1999) this neotype is designated for the express purpose of clarifying the taxonomic status of this name. The characters that distinguish this taxon are those provided in the description above.

Holotype/Neotype: *Oliverae*, Ulster Co., N. Y. VII.9/ Shoemaker -tion, 1956; in USNM. This removes any confusion about the identity of *P. pectoralis* and makes these species objective synonyms. Although the six specimens in the LeConte collection may be better choices of a neotype in some opinions, there is more data available on the label of the *P. oliverae* type, and this Neotype designation also prevents future confusion. Although the Neotype comes from New York rather than Missouri where Say described the species from, the many specimens before me indicate that the species occurs in both regions. I

also have put preference for current type material over designating new material as a Neotype.

The coloration of this species is highly variable. In addition to the variation of pronotal color mentioned above, the strength and placement of the elytral maculations are variable. Some specimens have a distinct piceous triangular mark around the scutellum, while others lack this character, with many intermediate examples known. Some specimens have the elytral maculations so faint as to appear entirely testaceous at first glance.

I have included 11 unicolorous, piceous specimens from disparate locations in Montana and Balsam, North Carolina with this species (MTEC and USNM). These specimens tend to be slightly smaller, and the Montana specimens have more rugose punctation throughout, but the male genitalia of both populations are exactly the same as more typically colored specimens of *P. pectoralis*. The legs and antennae are also dark brown, weakly contrasting the head and body. In Montana, completely piceous specimens are known from West of the Continental Divide and high on isolated mountain ranges east of the Divide. The Western specimens may represent the piceous variation mentioned by Horn (1891), but specimens from Washington state have not been examined to confirm this.

I also include a paratype of *P. beckeri* in *P. pectoralis* (see Material Examined, below). This specimen is entirely dark brown, similar to the piceous specimens discussed above, but otherwise shares all features with typical specimens.

I also synonymize *Paradonus illinoiensis* with *P. pectoralis*. *Paradonus illinoiensis* is known only from two specimens, supposedly deposited in the INHS (Stibick 1991). These specimens are not present in the collection, nor are there records of them (C. S. Grinter, T. McElrath, pers. comm.). An examination of the type collection in the USNM, the collection where other Stibick types were deposited, also failed to discover these specimens (E. Nearn, pers. comm.). It is not clear at this time where these types are located.

Material Examined:

Holotype of *P. oliverea*/**Neotype** of *P. pectoralis*: Oliverea, Ulster Co., N. Y. VII-9/ Shoemaker -tion, 1956; in USNM. **Paratypes**: of *P. oliverea*; Easton, Pa, VII-4/ G. W. Caffrey collector/ GeoMGreen collection (1, USNM); Marquette, Mich., 4-7/ Coll. Hubbard and Schwarz (1, USNM); Oliverea, Ulster Co., N.Y. VII-9/ Shoemaker,-tion, 1956/ E. Shoemaker collector (2, USNM); Oliverea, N.Y., VII-10-19/ E. Shoemaker collector (2, USNM); Oliverea, Ulster Co., N. Y., VII-9/ Shoemaker, -tion, 1956 (1, USNM); Washgtn D. C., 9-5/ Coll. Hubbard and Schwarz (2, USNM). Of *P. beckeri*: Michpctn, Riv8LS/ Coll Hubbard & Schwarz (1, USNM).

Other material examined (summarized): **CANADA: Quebec:** Montreal (1, MCZC). **USA: Arkansas:** Fayetteville (20, INHS830163–INHS830182); Polk Co. (1, LSAM); Wash. Co., Devil’s Den State Park (1, LSAM). **Iowa:** No data (3, INHS830183–INHS830185). **Maryland:** No Data (1, INHS830139; Stibick *P. pectoralis* specimen). **Massachusetts:** No data (5, MCZC); Savoy (1, MCZC). **Missouri:** Boone Co. (1, LSAM); Christain Co. (2, LSAM); Shannon Co. (1, LSAM). **Montana:** Bighorn Co. (3,

MTEC); Carter Co., (1, MTEC); Dawson Co. (19, MTEC); Fergus Co. (8, MTEC); Phillips Co. (2, MTEC); Richland Co. (6, MTEC); Rosebud Co. (21, MTEC); Treasure Co. (1, MTEC); Valley Co. (10, MTEC); Yellowstone Co. (7, MTEC). **New Hampshire:** No data (2, MCZC). **New York:** No data (4, MCZC) **Oklahoma:** McCurtain Co. (1, LSAM).

Piceous specimens: **Montana:** Broadwater Co. (1, MTEC); Fergus Co. (2, MTEC); Flathead Co. (2, MTEC); Sanders Co. (1, MTEC). **North Carolina:** Balsam (4, USNM). **Wyoming:** Yellowstone N.P. (1, MTEC).

Other paratype localities (57 specimens not examined, CASC, JNLS, LEMC (LEMQ?), MNHF (MNHN?), USNM, ZSMG (ZSM)): **CANADA:** No data. **Nova Scotia:** Portauipique. **Quebec:** Montreal. **USA:** **Michigan:** Ann Arbor; Eagle Harbor, Lake Superior. **New Jersey:** Boonton. **New York:** Catskill Mts; Central New York; Ithaca. **Vermont:** Bennington Co. **Virginia:** Alexandria Co., Great Falls.

Descriptions of new species:

7. Paradonus gallatinensis new species

Figs. 3.15, 3.19.

Diagnosis:

This species will most likely be confused with *Paradonus gustafsoni* (see below) with which it shares a similar range. It can be distinguished by being unicolorous brown or piceous (compared to an apical testaceous spot on elytra and testaceous pronotal disc in *P. gustafsoni*), the generally smaller size (2.45–3.1mm), and, in males, the narrower

medial lobe of the aedeagus. When compared side by side, *P. gallatinensis* has a relatively narrower pronotum. In Montana, this species may also be confused with unicolorous individuals of *P. pectoralis*, but the pronotal hind angle carina reaching the apex will distinguish *P. gallatinensis*.

Description: Length 2.45–3.1 mm (avg. 2.8 mm, n=25), color brown to dark brown, generally unicolorous dorsally, sometimes lighter areas on humeral angles and apex of elytra, body moderately dorso-ventrally flattened, evenly covered in short, appressed grey setae. Habitus Fig. 3.15. **Head:** brown to dark brown; punctures subumbilicate, dense, separated by a diameter or less, some specimens with punctation almost contiguous in spots, slightly smaller than punctures on pronotum, surface relatively dull to moderately shining and microreticulate; antennae feebly serrate, antennae usually mostly brown, often light brown; scape sometimes dark brown, matching head, with apex brown, other antennomeres brown, usually lighter apically, most noticeable on antennomeres 8-11, rarely all dark brown, 11th segment with indentation on dorsal side only. **Thorax:** Pronotum brown to dark brown dorsally, nearly piceous in some, with anterior and posterior edges often subtly lighter. Pronotum wider than long, (avg. ratio: 1:1.23; n= 26), widest at midlength; sides broadly arcuate, evenly curved anteriorly and posteriorly; hind angles sinuate laterally, acute tip pointing laterally and slightly dorsally in lateral view, carina strong, straight to subtly arcuate, connecting only to apex of hind angle, reaching bulbous area of pronotum; punctures umbilicate, dense, separated by a diameter or less, interspaces relatively dull and microreticulate. Hypomeron usually testaceous to light brown, rarely dark brown, punctures umbilicate, dense, almost contiguous anteriorly,

gradually becoming less so to impunctate area on posterior one-fourth, interspaces relatively dull and microreticulate. Prosternum testaceous, rarely dark brown, punctures umbilicate, separated by a diameter or less, more distant medially, interspaces shining and feebly microreticulate. Metaventrite light brown to brown, punctures simple to subumbilicate, dense, separated by a diameter or less, closer posteriorly and laterally, smaller than prosternum, interspaces moderately shining and microreticulate or shining and feebly microreticulate. Scutellum subpentagonal, flat, moderately elongate, wider than long, slightly inclined, anterior edge slightly curved, surface indistinctly but rugosely punctured, brown medially, piceous along edges. Elytra brown, mostly unicolorous, uncommonly a vague dark patch medially near apical one-third, punctures simple, regularly spaced, separated by one to two diameters in most cases, sometimes closer, interspaces relatively dull and microreticulate to moderately shining and feebly microreticulate. Legs light brown to brown, often subtly lighter at apical ends of each segment, usually not strongly contrasting metaventrite and abdomen, some specimens with uniform light brown legs, contrasting body.

Abdomen: Light brown to brown, darker specimens often subtly lighter along edges and fifth ventrite, and darker along lateral edges in lighter specimens; Punctures minute, very dense, almost contiguous in spots, interspaces moderately shining and feebly microreticulate. **Male Genitalia** (Fig. 3.19): Parameres without apical expansion of dorsal condylite, dorsal condylite around 0.48x total paramere length. Median lobe narrow, extending past parameres by around 0.21x of total aedeagal length. Basal piece quadrate, convex, around 0.18x of total aedeagal length.

Specimens Examined: 68 specimens: **Holotype:** Gallatin Co., Bridger Cr. 4800', pitfall trap, 16 Apr – 10 May 1987, D. L. Gustafson col., male, deposited in CASC.

Paratypes: Montana: Broadwater Co., Missouri R-Townsend, 28 June 1989, D. L.

Gustafson col (1, MTEC); Flathead Co., Glacier National Park, N. Fork Flathead area, 26

Aug 1991, K. B. Miller Colr./ Flathead R., .5mi S. Quartz Creek, 3420', 26 Aug 1991/

stream-side washing (1, MTEC); Gallatin Co., Bridger Cr. 4800', pitfall trap, 01-14 Apr

1987, D. L. Gustafson col (2, MTEC); as previous but dates 14-26 Apr 1987 (3 ANSP, 3

INHS, 3 CASC, 4 MTEC); as previous but dates 26 Apr – 10 May 1987 (5 CASC, 2

ANSP, 2 INHS, 5 MTEC); as previous but dates 19 May – 7 June 1987 (2 CASC, 3

MTEC); as previous but dates 7-20 June 1987 (2 CASC, 2 MTEC); as previous but dates

20-30 June 1987 (3 CASC, 3 MTEC); as previous but dates 1-28 July 1987 (1, MTEC),

as previous but date July 1987 (1, MTEC); Gallatin Co., Bozeman UV light, 25 Jul 1987,

D. L. Gustafson col. (1, MTEC); Gallatin Co., Gallatin R. 4700', 12 Mar 1987, D. L.

Gustafson col. (1, MTEC); Gallatin Co., Gallatin R., West Bozeman, 05 May 1987, D. L.

Gustafson col. (4, MTEC); Gallatin Co., Gallatin R. 4700', 05 May 1987, D. L.

Gustafson col. (3, MTEC); as previous but date 15 July 1987 (1, MTEC); as previous but

date Aug 1987, pitfall trap (1, MTEC); Gallatin Co., Gallatin R., Bozeman, 03 May 1988,

D. L. Gustafson col., (2, MTEC); as previous but date 19 June 1987 (1, MTEC); Lake

Co., Lion Cr. Trail, 26 June 1989, D. L. Gustafson col. (2, MTEC); Missoula Co.,

Missoula, 20-vii-1988, P. Skelley, blacklight trap (1, MTEC). **Nevada:** Elko Co., Marys

R. Orange Br., 41.5796°N, 115.3578°W, 14 Jul 2004, 1889m, D. L. Gustafson A0088 (1,

MTEC). **Wyoming:** Yellowstone N. P., 44°55'N, 110°24'W, Lamar Valley, 1993

ungulate carcass study, D. S. Sikes colr./ E. side Yellowst. Riv, NE. of Bridge nr. Tower Jctn. 6080' (49.74.001N, 5.47.002E)/ Site 5, control, N pitfall trap, 15-22 Jun 1993 (1, MTEC).

Etymology: The specific name is derived from Gallatin County, Montana, where the majority of specimens were collected. Gallatin County, the Gallatin Mountains and the Gallatin River are named after Albert Gallatin, the United States Secretary of Treasury during the Lewis and Clark expedition.

Discussion: The majority of specimens (47) were collected at a single locality over the course of late spring to mid-summer. Based on the specimens above, peak activity is likely in mid-April to Mid-May, before tapering off by the end of July in Montana. There is also a strong association with rivers and creeks, lending support to the hypothesis that *Paradonus* is a riparian genus. The single specimen from Northeast Nevada also suggests that this species has a much broader range than that given here.

8. *Paradonus gustafsoni* new species

Figs. 3.16, 3.20.

Diagnosis:

Paradonus gustafsoni will most likely be mixed with *P. gallatinensis*, *P. inops*, and *P. pectoralis*. The connection of the pronotal hind angle carina to the apex will readily separate this species from the latter two. The light pronotal disc in *P. gustafsoni* will separate it from *P. pectoralis* as will the lack of apical expansions on the parameres of the aedeagus. *Paradonus gustafsoni* is also larger than *P. inops*, and the banding pattern is

less distinct when compared to the later species. The characters used to separate this species from *P. gallatinensis* are discussed above. Habitus Fig. 16.

Description: Length 3.1– 3.4mm (avg. 3.23mm, n=9), color generally piceous to brown, with a testaceous triangular spot on apex of each elytra, and lighter areas on pronotum, hypomeron, and abdomen, setae grey, short, and moderately dense, body moderately dorso-ventral flattened. **Head:** Piceous to dark brown, sometimes with a lighter testaceous spot above each eye near anterior edges of pronotum; punctures even and dense, separated by puncture diameter or less, umbilicate and shallow, smaller than pronotal punctures, setae grey; interspaces moderately shining and microreticulate; antennae feebly serrate, testaceous and lighter than head, 11th segment with one indentation on dorsal side. **Thorax:** Pronotum brown to piceous, with disc lighter, sometimes testaceous, and edges always darker; Pronotum wider than long, average length to width ratio 1:1.23 (n=9); sides broadly arcuate, widest just posterior of midlength, slightly narrower anteriorly than posteriorly in most specimens, rarely evenly arcuate; hind angles relatively straight laterally, weakly curved only at acute tip, inner margin relatively straight to weakly arcuate at most, carina of hind angle strong, straight to slightly curved, connecting only to apex of hind angle, carina just exceeding hind angles, reaching bulbous area of pronotum; punctures umbilicate, separated by a diameter of a puncture or less, interspaces moderately shining and microreticulate, covered in even, short, grey setae. Hypomeron piceous with testaceous parts at anterior and posterior edges to nearly entirely testaceous, densely punctured on anterior two-thirds, punctures almost continuous, to impunctate posterior one-third, interspaces moderately shining and

microreticulate. Prosternum darker to similar to hypomeron in color, with dense punctuation, almost touching laterally, less so medially, sometimes with an impunctate area near prosternal process and a lateral ridge just anterior of male pubescent spot. Metaventrite with dense, simple, punctuation separated by less than a diameter of a puncture, interspaces moderately shining and microreticulate, dark brown in color. Scutellum subpentagonal, flat to subtly convex, moderately elongate, longer than broad, slightly inclined, anterior edge slightly curved, surface densely punctured, with short grey setae directed posterior, edges darker, center piceous to fusco-testaceous. Elytra with evenly spaced, simple punctures, separated by a diameter or less, interspaces moderately shining and microreticulate, basally piceous or brown, similar to pronotum, a darker piceous lateral band present near apical third, with apical third testaceous, with edges darker. Legs testaceous, lighter than metaventrite. **Abdomen:** Punctures small, simple, and dense, almost contiguous, interspaces moderately shining and microreticulate, color dark brown to brown, fifth ventrite always lighter, brown to testaceous, light color often along edges of previous two (third and fourth) ventrites. **Male Genitalia** (Fig. 3.20): Parameres with apical laterad expansion of dorsal condylite, dorsal condylite around 0.47x total paramere length. Median lobe broad, extending past parameres by around 0.22x of total aedeagal length. Basal piece subrectangular, convex, around 0.22x of total aedeagal length.

Specimens Examined: 10. **Holotype:** Montana, Gallatin Co., Madison R. [elevation] 4100', 13 July 1989, D. L. Gustafson col. (male, deposited in CASC).

Paratypes: Montana: Broadwater Co., Missouri R. – Townsend, 28 June 1989, D. L. Gustafson col. (2 CASC, 1 MTEC); Gallatin Co., Madison R. [elevation] 4100', 13 July 1989, D. L. Gustafson col. (2 CASC, 1 MTEC); Gallatin Co., E. Gallatin R. [elevation] 4600', 22 June 1988, D. L. Gustafson col. (1, MTEC). **Nevada:** Elko Co., Marys R. - Orange Br., 41.5796°N, 115.3578°W, 14 Jul 2004, [elevation] 1889m, D. L. Gustafson A0088 (1, MTEC). **Washington:** N. Bend, VII-30-1927 (1, MCZC).

Etymology: The specific name is in honor of Dr. Daniel L. Gustafson, who has collected the majority of known specimens of this species and the vast majority of *Paradonus* specimens in the MTEC.

Discussion: I have examined specimens from Arizona that are quite similar to this species, but differ in the pronotum is completely testaceous as is the base of the elytra. Due to the color variance in this genus within species, it is likely these may be a different color form of *P. gustafsoni*. However, I have taken the cautious approach and have not included them in the type series until more material throughout the Mid- and Southern Rockies can be examined.

Other specimens examined: **ARIZONA:** Cochise Co., 5mi W. Portal, SWRS, 5400', 21-28-July-1988, R. S. Miller family (3, MTEC); 2.4mi NW Portal, BL, 18-May-1990, R. S. Miller family (1, MTEC).

9. *Paradonus stibicki* New Species

Paradonus pectoralis sensu Stibick 1991 not Say, 1839, part, not Fig. 17 in Stibick 1991.

Figs. 3.3, 3.17, 3.21.

Diagnosis: This species is quite similar to *P. futilis*. These two species are very difficult to tell apart other than locality, with *P. futilis* described from San Diego. Specimens of *P. stibicki* tend to be larger than those of *P. futilis*, and usually have a darker colored head.

Description: Length 2.4–2.8 mm (avg. 2.6mm, n=15); color generally testaceous to light brown, elytra often with subtly darker maculations, a triangular area around the scutellum and a faint band at midway point, covered evenly in very short yellow setae, body slightly dorso-ventrally flattened, relatively convex compared to other species in the genus. Habitus Fig. 3.17. **Head:** Brown to piceous; punctures small, appearing simple, separated by around diameter of puncture, closer medially and posteriorly, almost touching, interspaces relatively dull to moderately shining and microreticulate; antennae feebly serrate, unicolorous testaceous to light brown, 11th segment with dorsal indentation. **Thorax:** Pronotum testaceous to light brown. Pronotum wider than long, average length to width ratio 1:1.27 (n=8); sides moderately and evenly arcuate; hind angles relatively straight to slightly arcuate laterally, with a small curve at tip, inner margin subtly sinuate, carina strong, weakly to moderately arcuate, carina connecting to apex of hind angle, reaching bulbous area of pronotum; punctures subumbilicate, just slightly larger than punctures on head, separated by about 1 diameter on average, some closer, some further, tending to form rows of punctures, interspaces relatively dull and microreticulate. Hypomeron testaceous to light brown, punctures subumbilicate, separated by less than a diameter medially, nearly touching anteriorly, and further apart near impunctate posterior one-third, interspaces relatively dull to moderately shining and

microreticulate. Prosternum testaceous to light brown, punctures subumbilicate, separated by less than a diameter of a puncture, closer laterally, almost touching, larger than punctures on metaventrite and hypomeron, interspaces relatively dull to moderately shining and microreticulate. Metaventrite light brown to brown, punctuation simple, dense, separated by less than a diameter of a puncture, interspaces moderately shining and microreticulate. Scutellum subpentagonal, flat, moderately elongate, about twice as long as broad, slightly inclined, anterior edge slightly curved, surface testaceous to light brown, edges piceous, microreticulate, and feebly punctate at most. Elytra with simple, evenly spaced punctures, separated by 1-2 diameters of a puncture, interspaces moderately shining and microreticulate, color testaceous to light brown, rarely brown, often with a subtle dark, triangular spot around scutellum, often also with a subtle dark band at midlength, these marks can be so subtle that the elytra appears unicolorous. Legs yellow to light brown, often contrasting metaventrite and abdomen, although it is not uncommon to not contrast one or both. **Abdomen:** Light brown to brown, punctures small, very dense, separated by less than a diameter of a puncture, sometimes almost touching, interspaces moderately shining and microreticulate to shining and feebly microreticulate. **Male Genitalia** (Fig. 3.21): Parameres without apical expansion of dorsal condylite, dorsal condylite around 0.50x total paramere length. Median lobe narrow, extending past parameres by around 0.17x of total aedeagal length. Basal piece subrectangular, convex, around 0.26x of total aedeagal length.

Specimens Examined: 15; **Holotype:** New Hampshire: Walpole, V-31-1920, C. A. Frost (male, ANSP).

Paratypes: **Arkansas:** Fayetteville, VIII-1-1942, M. V. Sanderson/ Collected at light (1, INHS 830160). **Montana:** Carter Co., 5 mi W. of Alzada @ UV light, 18 July 1990, D. L. Gustafson col. (2 MTEC); Carter Co., 5 mi W. of Alzada, funnel trap, 7 June – 5 Aug 1991, D. L. Gustafson col. (1, MTEC); Richland Co., Missouri R. @ Culbertson blt., 19 Aug 1992, D. L. Gustafson col. (2 CASC, 3 MTEC). **New Hampshire:** Walpole, V-31-1920, C. A. Frost (3, ANSP). **North Carolina:** Raleigh, IV-12-1953, D. M. Weismann (2, INHS 830161, INHS 830162). LeConte #3, pink disc [Middle States, MD, DE, NY, NJ, PA, CT?, RI?] (1 MCZC).

Etymology: The specific name is for the late J. N. L. Stibick to honor his important work on the group, and to recognize this species as being his concept of *P. pectoralis*.

Discussion: This species, as noted by Stibick (1991), is fairly rare in collections, likely due to its small size. There is some variation in color, elytral markings, and the curve of the pronotal carina. However, this variation is more noticeable within a population than between populations, with specimens from Montana, New Hampshire, and North Carolina nearly identical to one another, but appearing different than nearby specimens. The male genitalia also does not vary between localities. Seven of the specimens above are from the 29 specimens examined by Stibick for his concept of *P. pectoralis*, stated as being in the following institutions: ANSP, CASC, IEMS, INHS, NRSS, SEMC, UICU, USNM, and VMCK. None of these specimens completely match Stibick's description or figures, however. I have been unable to locate the other 21 specimens examined by Stibick, with no specimens discovered in the CASC. Three collection abbreviations used by Stibick (1991) are unknown to me, being: IEMS, UICU, and VMCK. The

Naturhistoriska riksmuseet, Stockholm, Sweden (NHRS, as NRSS in Stibick 1991) was contacted, but no specimens with Stibick ID labels were discovered.

Conclusions

Building on Stibick's (1991) work, this work will hopefully make the identification of described and undescribed species of *Paradonus* easier and provide a framework for future study. The apparent presence of additional new species indicates that this work should be considered a temporary solution that will require further additions in the future to fully understand the North American fauna.

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Pennsylvania. This work was partially funded by an Ernst Mayr Grant. This is a publication of the Montana Agricultural Experiment Station.

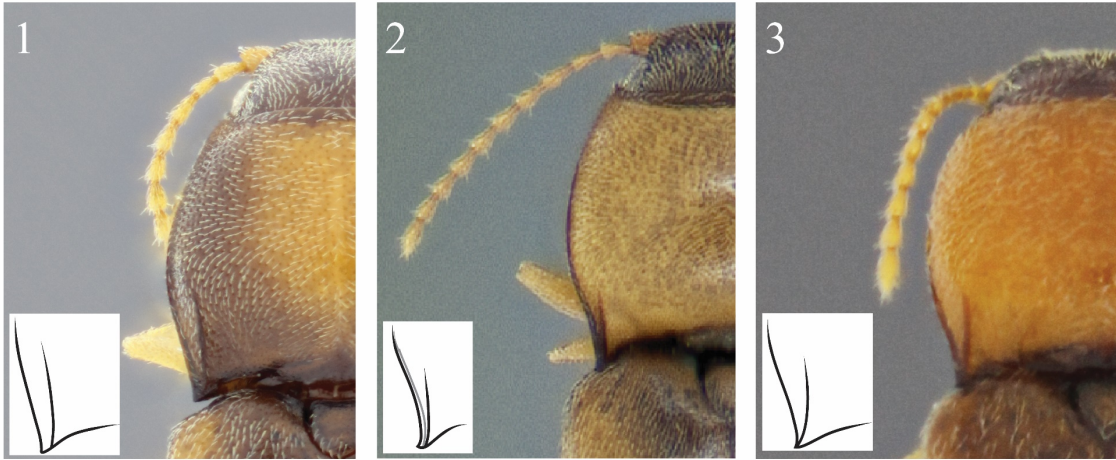


Figure 3.1. Pronotal hind angle carina connecting to posterior margin of pronotum, *Paradonus inops*. Inset: drawing of hind angle for clarity.

Figure 3.2. Pronotal hind angle carina connecting to posterior margin of pronotum, *P. pectoralis*. Inset: drawing of hind angle for clarity, lateral carina drawn in grey to highlight difficulty of observing this character.

Figure 3.3. Pronotal hind angle carina connecting to apex of hind angle, *P. stibicki*. Inset: drawing of hind angle for clarity.

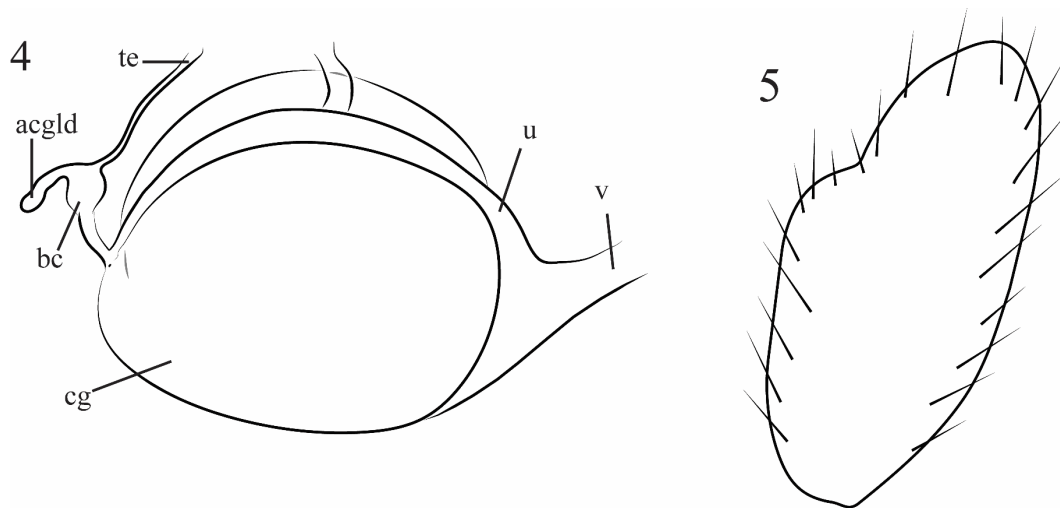


Figure 3.4. *P. obliquatulus*. Internal female genitalia . After Stibick 1991, Figure 15a. acgld= accessory gland, bc = bursa copulatrix, cg= colleterial gland, te= tubular extension, u= uterus, v= vagina. Scale bar is 0.5mm.

Figure 3.5. *P. pectoralis*. Eleventh antennomere with a single dorsal apical pit.



Figure 3.6. *Paradonus pectoralis*. Arrow, pubescent spot on the prosternum of males.

Figure 3.7. Dorsal habitus, *P. beckeri*, paratype, USNM. Scale bar equals 1 mm.

Figure 3.8. Dorsal habitus, *P. inops*. Scale bar equals 1 mm.

Figure 3.9. Dorsal habitus, *P. jerseiensis*, paratype, USNM. Scale bar equals 1 mm.

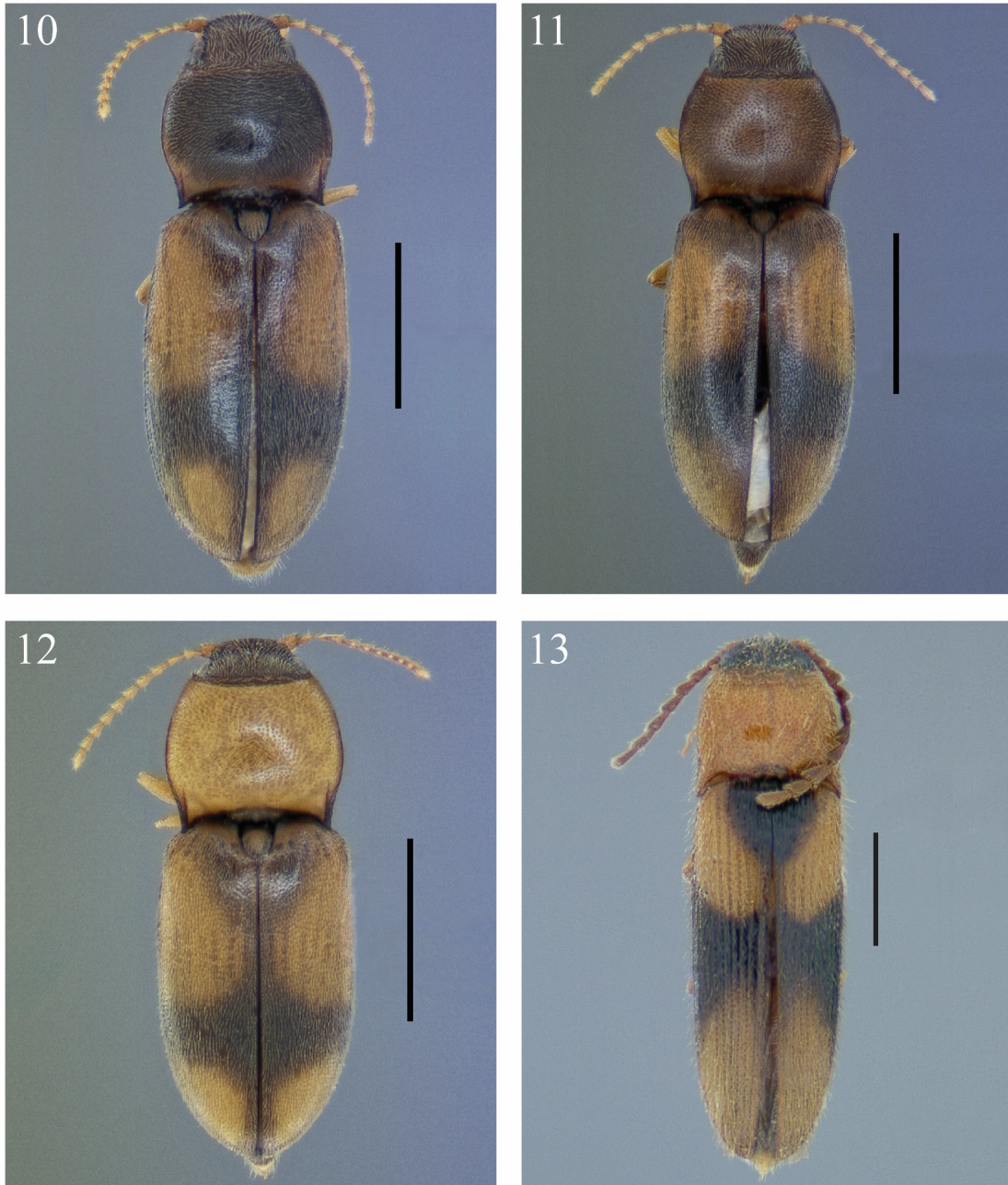


Figure 3.10. *Paradonus pectoralis*, dark pronotum form, Montana, Rosebud Co. Collected in Rosebud area, 18 July 1990, by D. L. Gustafson at a black light trap. This form was described by Stibick as *P. oliverea*. Scale bar is 1mm.

Figure 3.11. *P. pectoralis*. Intermediate-colored pronotum form, same data as Fig. 3.10. Scale bar is 1mm.

Figure 3.12. *P. pectoralis* Light pronotum form, same data as Fig. 3.10. Scale bar is 1mm.

Figure 3.13. *Ampedus areolatus* (Say), which Say compared to *P. pectoralis* in his original description. Scale bar is 1mm.

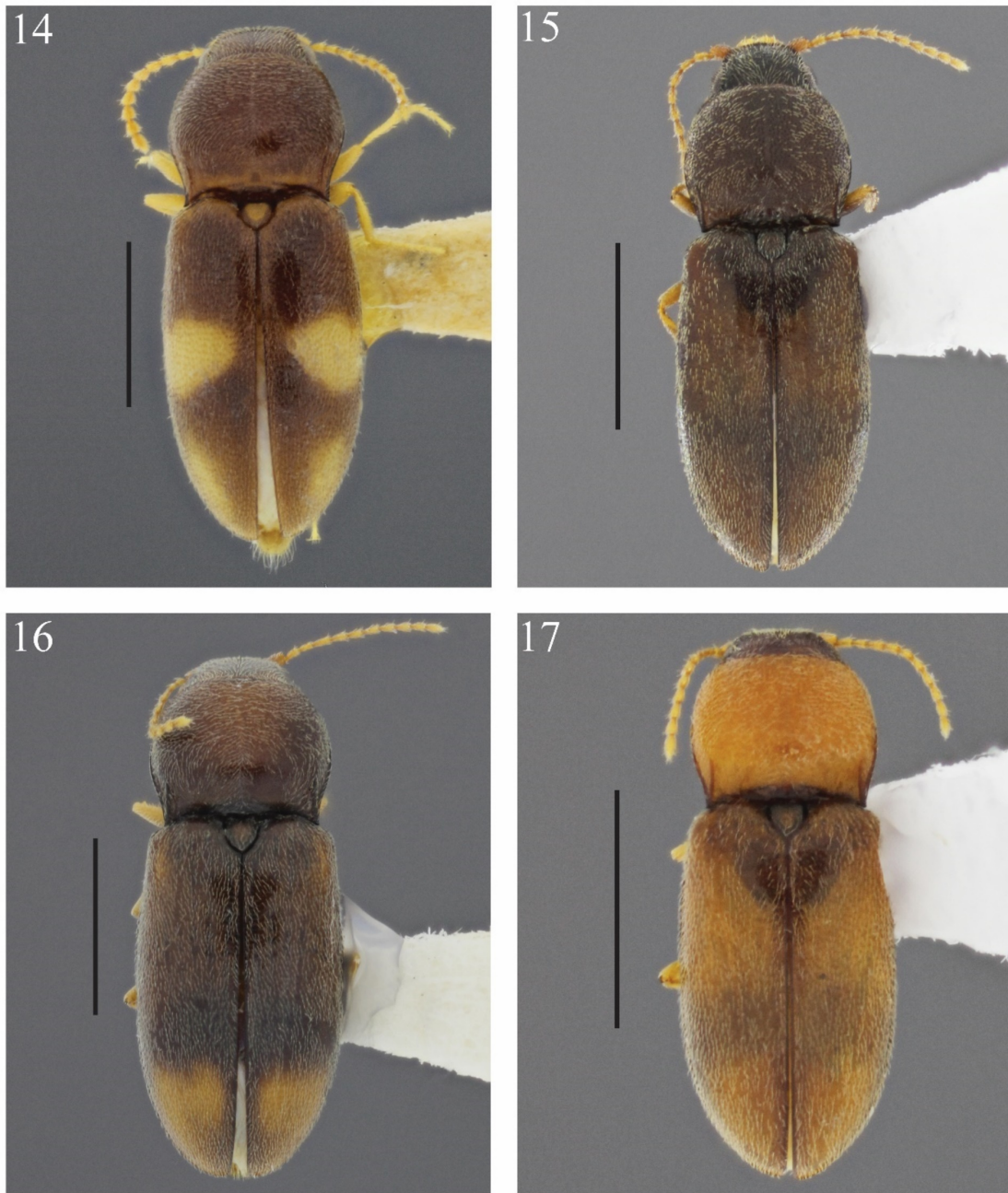


Figure 3.14. Dorsal habitus, *Paradonus obliquatulus*. Often confused with *P. pectoralis*. Yellow elytra maculations, may be darker or narrower than specimen depicted. Scale bar equals 1 mm.

Figure 3.15. Dorsal habitus, *P. gallatinensis*, holotype. Scale bar equals 1 mm.

Figure 3.16. Dorsal habitus, *P. gustafsoni*, holotype. Scale bar equals 1 mm.

Figure 3.17. Dorsal habitus, *P. stibicki*, holotype. Scale bar equals 1 mm.

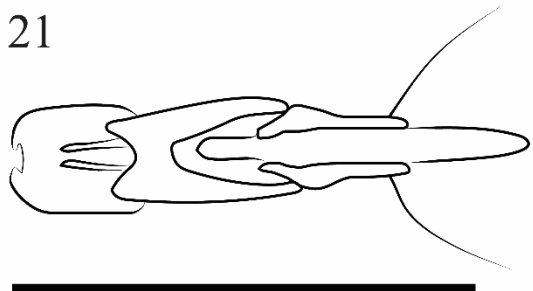
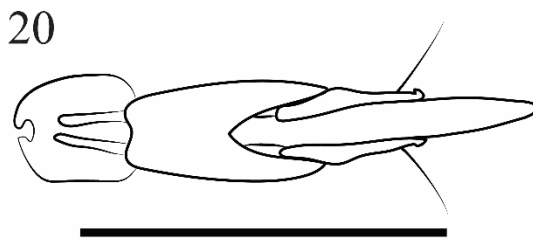
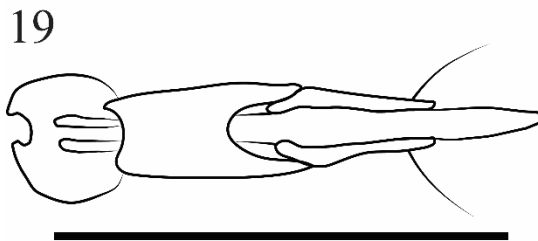
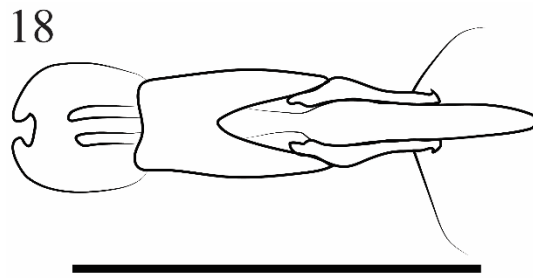


Figure 3.18. *Paradonus pectoralis*, male genitalia, Montana, dorsal view. Scale bar equals 0.5mm.

Figure 3.19. *P. gallatinensis* male genitalia, holotype, dorsal view. Scale bar equals 0.5mm.

Figure 3.20. *P. gustafsoni* male genitalia, paratype, same locality as holotype, dorsal view. Scale bar equals 0.5mm.

Figure 3.21. *P. stibicki* male genitalia, holotype, dorsal view. Scale bar equals 0.5mm.

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CHAPTER FOUR

REVIEW OF THE GENUS *LIMONIUS* ESCHSCHOLTZ, 1829

(ELATERIDAE: DENDROMETRINAE) *SENSU*

CANDÈZE 1860 OF THE WORLD.

Contribution of Authors and Co-Authors

Manuscripts in Chapters 2, 3, 4, and 5

Author: Frank E. Etzler

Contributions: Wrote manuscript. Took all photographs. Did all line drawings. Examined all specimens.

Manuscript Information

Frank E. Etzler
Zootaxa

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Abstract

The genus *Limonius* Eschscholtz, 1829 was last treated as a whole by Candèze (1860). Since then, members have been placed in eight other genera: *Cidnopus* Thomson, 1859; *Gambrinus* LeConte, 1853; *Elathous* Reitter, 1890; *Kibunea* Kishii, 1966; *Limoniscus* Reitter, 1905; *Nothodes* LeConte, 1861; *Pheletes* Kiesenwetter, 1858; and *Solskyana* Dolin, 1978. Based on the examination of adult and larval characters, five genera are recognized: *Elathous* Reitter, 1890; *Gambrinus* LeConte, 1853; *Limonius* Eschscholtz, 1829; *Pheletes* Kiesenwetter, 1858; and *Tetralimonius* **new genus**. *Limoniscus* Reitter, 1905 and *Sichuanelater* Platia and Gudenzi, 2006 are **new synonymies** of *Gambrinus* LeConte, 1853; *Micrathous* Lane, 1971, *Neoathousius* Schimmel and Platia, 1991 and *Solskyana* Dolin, 1978 are all **new synonymies** of *Limonius*. A total of 83 new combinations are proposed: **Nearctic**: *Elathous huguenini* (Van Dyke, 1932) **new combination**; *Elathous kondratieffi* (Al Dhafer, 2009) **new combination**; *Gambrinus angulatus* (Motschulsky, 1859) **new combination**; *Gambrinus bicolor* (Van Dyke, 1932) **new combination**; *Gambrinus clypeatus* (Motschulsky, 1859) **new combination**; *Gambrinus confusus* (LeConte, 1853) **new combination**; *Gambrinus cribriceps* (Van Dyke, 1943) **new combination**; *Gambrinus crotchii* (Horn, 1872) **new combination**; *Gambrinus flavomarginatus* (Knull, 1938) **new combination**; *Gambrinus fulvipilis* (Candèze, 1860) **new combination**; *Gambrinus griseus* (Beauvois, 1805) **new combination**; *Gambrinus humidus* (Lane, 1941) **new combination**; *Gambrinus interstitialis* (Melsheimer, 1846) **new combination**; *Gambrinus lanchesteri* (Lane, 1941) **new combination**; *Gambrinus meridianus* (Knull, 1947) **new combination**; *Gambrinus*

mirus (LeConte, 1853) **new combination**; *Gambrinus norahae* (Al Dhafer, 2009) **new combination**; *Gambrinus olentangyi* (Knull, 1947) **new combination**; *Gambrinus plebejus* (Say, 1825) **new combination**; *Gambrinus propexus* (Candèze, 1860) **new combination**; *Gambrinus rudis* (Brown, 1933) **new combination**; *Gambrinus rufihumeralis* (Lane, 1941) **new combination**; *Gambrinus seminudus* (Van Dyke, 1932) **new combination**; *Gambrinus shircki* (Lane, 1965) **new combination**; *Gambrinus sinuifrons* (Fall, 1907) **new combination**; *Gambrinus snakensis* (Lane, 1965) **new combination**; *Gambrinus stigma* (Herbst, 1806) **new combination**; *Gambrinus pictus* (Van Dyke, 1932) **new combination**; *Gambrinus ulkei* (Horn, 1871) **new combination**; *Gambrinus ursinus* (Van Dyke, 1932) **new combination**; *Gambrinus venerlesii* (Wickham, 1913) **new combination**; *Limonius brevis* (Van Dyke, 1932) **new combination**; *Limonius sordidus* (Van Dyke, 1932) **new combination**; *Pheletes lecontei* (Lane, 1971) **new combination**; *Tetralimonius definitus* (Ziegler, 1845) **new combination**; *Tetralimonius humeralis* (Candèze, 1860) **new combination**; *Tetralimonius maculicollis* (Motschulsky, 1860) **new combination**; *Tetralimonius nimbatus* (Say, 1825) **new combination**; *Tetralimonius ornatulus* (LeConte, 1857) **new combination**. **Palaearctic:** *Gambrinus elegans* (Buysson, 1891) **new combination**; *Gambrinus gibbosus* (Platia and Gudenzi, 2006) **new combination**. *Gambrinus henanensis* (Schimmel, 2006) **new combination**; *Gambrinus hinakurai* (Kishii, 1998) **new combination**; *Gambrinus katoi* (Kishii, 2002) **new combination**; *Gambrinus kawaharai* (Kishii, 2002) **new combination**; *Gambrinus kucerae* (Schimmel, 2006) **new combination**; *Gambrinus naomii* (Kishii, 1997) **new combination**; *Gambrinus*

shaanxiensis (Schimmel, 2006) **new combination**; *Gambrinus suturalis* (Gebler, 1844) **new combination**; *Gambrinus takabai* (Kishii, 1997) **new combination**; *Gambrinus violaceus* (Müller, 1821) **new combination**; *Gambrinus wittmeri* (Chassain, 1998) **new combination**; *Gambrinus yamato* (Kishii, 1998) **new combination**; *Gambrinus yujii* (Arimoto, 2013) **new combination**; *Gambrinus zhejiangensis* (Schimmel, 2015) **new combination**; *Limonium brancuccii* (Schimmel and Platia, 1991) **new combination**; *Limonium decorus* (Gurjeva, 1975) **new combination**; *Limonium exiguus* (Schimmel and Platia, 1991) **new combination**; *Limonium hartmanni* (Schimmel, 1998) **new combination**; *Limonium hiermeieri* (Schimmel and Platia, 1991) **new combination**; *Limonium hirta* (Dolin, 1978) **new combination**; *Limonium hubeiensis* (Kishii and Jiang, 1996) **new combination**; *Limonium kubani* (Schimmel, 1996) **new combination**; *Limonium loebli* (Schimmel and Platia, 1991) **new combination**; *Limonium longicornis* (Schimmel and Platia, 1991) **new combination**; *Limonium macedonicus* (Cate and Platia, 1989) **new combination**; *Limonium marginellus Brusteli* (Leseigneur, 2004) **new combination**; *Limonium manaliensis* (Schimmel and Platia, 1991) **new combination**; *Limonium miandamensis* (Schimmel and Platia, 1991) **new combination**; *Limonium minusculus* (Schimmel and Platia, 1991) **new combination**; *Limonium nigronitidus* (Han and Lee, 2012) **new combination**; *Limonium platiai* (Mertlik, 1996) **new combination**; *Limonium pseudopilosus* (Platia and Gudenzi 1985) **new combination**; *Limonium reticornis* (Schimmel and Platia, 1991) **new combination**; *Limonium riesei* (Platia, 1988) **new combination**; *Limonium rusticus* (Schimmel and Platia, 1991) **new combination**; *Limonium schurmanni* (Platia and Gudenzi, 1998) **new combination**; *Limonium sinensis*

(Schimmel and Platia, 1994) **new combination**; *Limonius singularis* (Schimmeland Platia, 1991) **new combination**; *Limonius turcicus* (Platia, 2004) **new combination**; *Limonius wittmeri* (Schimmel and Platia, 1991) **new combination**; *Tetralimonius quercus* (Olivier, 1790) **new combination**; *Tetralimonius reitteri* (Gurjeva, 1976) **new combination**. The following 12 North American species are removed from synonymy and recognized as valid species: *Gambrinus interstitialis* (Melsheimer, 1846) **status resurrected**; *Gambrinus propexus* (Candèze, 1860) **status resurrected**; *Gambrinus shircki* (Lane, 1965) **status resurrected**; *Gambrinus snakensis* (Lane, 1965) **status resurrected**; *Gambrinus ulkei* (Horn, 1871) **status resurrected**; *Limonius anceps* LeConte, 1853 **status resurrected**; *Limonius dubitans* LeConte, 1853 **status resurrected**; *Limonius infuscatus* Motschulsky, 1859 **status resurrected**; *Limonius pilosulus* Candèze, 1891 **status resurrected**; *Limonis semianeus* LeConte, 1853 **status resurrected**. *Tetralimonius humeralis* (Candèze, 1860) **status resurrected**; *Tetralimonius maculicollis* (Motschulsky, 1860) **status resurrected**. New replacement names are proposed for three homonyms: *Limonius schimmeli* Etzler **new name** for *Neoathousius ferrugineus* Schimmel and Platia, 1991; *Elathous malatyanus* Etzler **new name** for *Elathous bicolor* Platia, 2010, not *Elathous bicolor* (LeConte, 1853); and *Microdesmes carteri* Etzler **new name** for *Limonius angulatus* Carter, 1939 (= *Microdesmes angulatus*). A key to genera, generic descriptions, notes on species, and definitions of important characters are provided.

Key words: taxonomy; wireworm; click beetles; classification

Introduction

The genus *Limonius* Eschscholtz, 1829, has seen many taxonomic changes over the last 110 years, with the last key to all known species in the world in the third volume of Candèze's (1860) Monograph. Since then, many genera have been split from Candèze's concept of *Limonius*. However, these changes have often been limited to specific regions, which has caused parallel taxonomic concepts to develop, particularly between the Nearctic and Palearctic faunas. These parallel concepts have made the understanding of larger groups nearly impossible, and hampers our understanding of the monophyly of the group.

The purpose of this review is to provide unified Holarctic generic-level groups for the genera allied to *Limonius* Eschscholtz, 1829, in the hopes of improving our understanding of evolutionary patterns and eliminating the non-congruence of Palearctic vs Nearctic classifications of this difficult but economically important group (Etzler *et al.* 2014). Due to the number of species and names involved, a world-wide species-level revision has not been attempted, however, type species for each generic name involved have been examined, and new integrated Holarctic concepts are proposed. Key morphological characters which support the five recognized genera are defined and discussed, and a key to recognized genera is provided. One hundred ninety (190) described species are placed in their respective genera. Hopefully this work will provide a framework for future revisionary work which will better explore some of the hypotheses proposed here.

To understand the scope of the problem, it is necessary to understand the history of how the constituent species were grouped. More works than those discussed below exist, but these cover the major changes in generic usages and possible ways to group species. The chronology of literature is best done in a list format, as follows:

- 1829 – Johann F. G. von Eschscholtz described *Limonius* for *Elater* species with a carinate frontal margin and small 2nd and 3rd antennomeres. He included 9 Palearctic species: *Elater cylindricus* Rossi, 1792; *Elater nigripes* Gyllenhal, 1817; *Elater minutus* Linnaeus, 1758; *Elater bructeri* Panzer, 1795; and *Elater parvulus* Panzer, 1799, *Elater serraticornis* Paykull, 1800; *Elater lythrodes* Germar, 1813; *Elater bipustulatus* Linnaeus, 1767; and *Elater tenuicornis* Germar, 1824. He did not designate a type species.
- 1838a – John Curtis designated *E. minutus* as the type of *Limonius* in his work British Entomology in June. (N.B. This designation is cryptically placed after the description of *Elater atterimus* Linnaeus, 1758 on page 695 where Curtis listed type species for Elateridae genera described by Eschscholtz that occur in the British Isles.)
- 1838b – In August of the same year, John O. Westwood designated *E. bructeri* (= *Elater aeneoniger* DeGeer, 1774) as the type of *Limonius*. This work is often cited as 1840. The date differences between type designations was first noted by Sanchez-Ruiz (1996).

- 1853 – During his revision of North American Elateridae, John L. LeConte erected the genus *Gambrinus* for *Elater armus* Say, 1836 (= *Elater stigma* Herbst, 1806), type species by monotypy. He also defined *Limonius* for the North American fauna.
- 1858 – Ernst A. H. von Kiesenwetter described the genus *Pheletes* for the species *E. bructeri*. Type species by monotypy.
- 1859 – Carl G. Thomson described the genus *Cidnopus* for the species *E. nigripes* (= *Elater pilosus* Leske 1785), type species by monotypy.
- 1860 – Ernest C. A. Candèze synonymized *Pheletes* with *Limonius* and followed Lacordaire's (1857) synonymization of *Gambrinus* with *Limonius*. He recognized two divisions based on the form of the prosternal suture. He was apparently unaware of *Cidnopus*, but its type species *E. nigripes* was placed in Section 1 of *Limonius*. This is the last time species from Europe and Asia were directly compared to the species in the North American fauna in a key format.
- 1861 – LeConte erected the genus *Nothodes* for his species *Limonius dubitans* LeConte, 1853, type species by monotypy.
- 1905 – Edmund Reitter revised some of the genera in Elateridae, removing *Pheletes* from synonymy, and described the genus *Limoniscus* for four Palearctic species formerly in *Limonius*, including *Elater violaceus* Muller, 1821, without designating a type species.
- 1907 – Otto Schwarz moved the North American species in Candèze's Section 2 to *Pheletes sensu* Reitter, while treating his Section 1 as a restricted *Limonius*.

Species described after Candèze (1860) are left in *Limonius*. This is the starting point for the confusing generic concepts in North American species, and these concepts are followed by later catalogues. Without explanation, Schwarz placed *Limonius baconi* Candèze, 1860, described from the Himalayas, in the Nearctic species list as a member of *Pheletes* and the Palearctic species list as a member of *Limonius*.

1921 – James A. Hyslop published a list of generic names for Elateridae. He designated *E. violaceus* as the type of *Limoniscus* and noted that the type species of *Limonius* (*sensu* Westwood) and *Pheletes* were the same, apparently unaware of the earlier Curtis (1838) designation for *Limonius*.

1930 – Auguste E. Mequignon also mentioned that the type species of *Limonius* (*sensu* Westwood) and *Pheletes* are the same and suggested that they be synonymized.

1932 – Edwin C. Van Dyke reviewed some North American genera in the family Elateridae, including *Limonius*. He synonymized *Pheletes* and *Nothodes* with *Limonius*, but retained *Pheletes* as a subgenus for species in Candèze's Section 2. He made no mentions of type species for his reason for synonymizing the genera.

1944 – Richard E. Blackwelder published a catalogue of species from Mexico, Central America, the West Indies, and South America. The Mexican species were retained in *Pheletes*, following their treatment by Schwarz (1907).

1950 – Robert Glen published on the larvae of the now defunct tribe Lepturoidini (= Dendrometrinae *pars*). He examined the larvae of *Limonius* species, and proposed three groups which were *Cidnopus pilosus* (group 1), *Pheletes sensu* Reitter with

one North American species added (group 2), and the remainder of examined *Limonius* (group 3).

- 1955 – Takehiko Nakane and Kishii described *Gambrinus limbatipennis* from Honshû, limiting the genus to species with emarginate hind angles. This was the first usage of the genus as distinct since its synonymization by Lacordaire.
- 1956 – Edward C. Becker discussed the importance of female internal genitalia for forming species groups of *Limonius* (North American usage of Van Dyke). He suggested that the North American species belong to at least four groups.
- 1959 – Hitoo Ôhira tentatively placed *Limonius marginipennis* Lewis, 1894 in *Nothodes*.
- 1962 – Ôhira again used *Nothodes*, along with *Gambrinus*, when he treated the elaterid larvae of Japan.
- 1966 – Kishii described the genus *Kibunea* for *Limonius eximus* Lewis, 1894, type by monotypy. He also apparently confused *Limonius marginicollis* Lewis, 1894 with *L. marginipennis*, based on his inclusion of this latter species in his synonymical table, placing the first species in *Nothodes* (C. M. F. von Hayek, BMNH collection notes).
- 1971 – Merton C. Lane keyed the Elateridae of the Pacific Northwest, including 23 species in the genus *Limonius*. He abandoned Van Dyke's subgenera, choosing to use *Gambrinus* and the combined *Cidnopus*/*Pheletes* as subgenera.
- 1972 – Lucien Leseigneur revised the fauna of France. He used the name *Cidnopus* for species traditionally treated as *Limonius* and *Limonius* for those species

traditionally treated as *Pheletes*, due to the shared type species as mentioned by Hyslop and Mequignon.

1977 – Kishii examined European specimens and transferred *L. minutus* to *Kibunea* and *L. parvulus* to his concept of *Nothodes*.

1978 – Vladimir G. Dolin examined the larvae of Elateridae of the USSR. He used the genera *Limonius*, *Limoniscus*, and *Pheletes*, following Reitter, and described the genus *Solskyana* for *Limonius villiger* Solsky, 1881, as the type, and a second new species.

1990 – Ôhira compared type species of *Gambrinus* and *Limoniscus*, considering both to be valid. He moved all Japanese species formerly in *Gambrinus* to *Limoniscus*.

1991 – Rainier Schimmel and Giuseppe Platia described the genus *Neoathousius* for 14 species found in the mountainous regions of Afghanistan, Pakistan, and Northern India, with *Neoathousius loebli* Schimmel and Platia, 1991 designated as the type species. They separate this genus from *Nothodes*, *Cidnopus*, and *Elathous* by the lack of a distinct anterior prosternal suture groove, a character shared with many Nearctic *Limonius*.

1994 – Platia reviewed the Elateridae of Italy. He follows Leseigneur's (1972) concepts, but recognized *Kibunea* for *E. minutus* and *Nothodes* for *E. parvulus* (both formerly in *Cidnopus*), following the concepts of Kishii (1977).

1996 – Antonio Sánchez-Ruiz reviewed the Elateridae of Spain. He is the first to recognize Curtis' (1838) earlier type designation, ending decades of mistaken usage of *Limonius*. *Kibunea* was synonymized with *Limonius*. *Pheletes* was once

again used for species called *Limonius* since 1972, and *Cidnopus*, *Limoniscus*, and *Nothodes* are used as by Leseigneur (1972) and Platia (1994).

2007 – Peter Cate produced a checklist of Palearctic species, following Sánchez-Ruiz's generic concepts.

2009 – Hathal M. Al Dhafer revised the North American species of *Limonius*. He continued Van Dyke's subgeneric concepts, making no mention of Becker (1956), Lane's (1971) subgeneric concepts, or the different concepts in the Palearctic (Cate 2007). The Mexican species were not included.

2012 – Taeman Han *et al.* reviewed the subtribe Athouina of Korea. They recorded *Cidnopus*, *Limonius*, and *Limoniscus* in their fauna. They also moved *Cidnopus scutellaris* Dolin, 2003 to *Limonius*, noting the inconsistent morphological characters that had been used to define the genera in the past. They also highlight the recent usage (2002) of *Gambrinus* in regional checklists.

There is more literature available than what is covered above, but this summary is sufficient to confirm that the history of confusion within this group. To summarize, it appears the North American fauna has been treated independently since 1860, despite evidence that it belongs to a greater Holarctic fauna. Next, there were parallel generic concepts within the Palearctic fauna until around 1990-1994, with separate concepts used by European and Asian authors. Lastly, the confusion surrounding the type species of *Limonius* leaves a long history of unclarified generic placements, with many species moved to *Cidnopus* and never re-examined. Even today, incorrect usages of *Kibunea*

(Majzlan and Vidlička 2016; Elateridae of the British Isles website) and confused placement of some species exists, e.g. *Pheletes quercus* (Olivier, 1790) sometimes placed in *Cidnopus*, although this is limited to un-updated websites.

Materials and Methods

Over 2,000 specimens were examined, from the following collections:

BMNH – Natural History Museum, London, UK.

CASC – California Academy of Sciences Collection, San Francisco, CA, USA.

CMNC – Canadian Museum of Nature Collection, Ottawa, ON, Canada.

CNCI – Canadian National Collection of Insects and Arthropods, Ottawa, ON, Canada.

FMNH – Field Museum of Natural History, Chicago, IL, USA

FEEC – Frank E. Etzler Collection, Bozeman, MT, USA.

MAIC – Michael A. Ivie Collection, Montana State University, Bozeman, MT, USA.

MCZC – Museum of Comparative Zoology Collection, Harvard University, Cambridge, MA, USA.

MTEC – Montana Entomology Collection, Montana State University, Bozeman, MT, USA.

NMPC – Národní muzeum, Praha, Czech Republic.

OSAC – Oregon State Arthropod Collection, Oregon State University,
Corvallis, OR, USA.

PMNH – Peabody Museum of Natural History, Yale University, New
Haven, CT, USA.

RSMC – Richard S. Miller Collection, Bozeman, MT, USA (now
incorporated into the MTEC).

Female internal genitalia were extracted using the following method: the abdomen was removed and placed in a cold 10% KOH solution for approximately an hour (occasionally an additional hour would be required for larger specimens), the reaction was stopped by moving the abdomen to a second dish with distilled water with a drop of white vinegar, then the abdomen was rinsed in a third container of distilled water; the tergites were separated from the ventrites along one edge using a sharpened pin, and the trachea and other internal parts carefully removed leaving the female tract visible for study (after Becker 1956). Male genitalia were extracted in a similar manner.

Photographs of specimens and genitalia were taken using a JVC (DC Ky-F75U) digital camera mounted on a Leica® MS5 stereoscope. In order to ensure clarity of structures, the female internal genitalia, male genitalia, and selected morphological characters were traced in Adobe Illustrator® CC and photographs were slightly edited in Adobe PhotoShop® CS 6. I have attempted to orient female internal genitalia in a way so they can be compared to drawings in Becker (1956) and Han *et al.* (2012). Male genitalia are presented in ventral position, as this shows characteristics of the basal piece

that are not visible in the dorsal position. Heavier sclerotizations of female internal genitalia are colored brown in the drawings. Grey lines on drawings indicate structures behind other structures.

Generic descriptions are adapted following Han *et al.* (2012). These descriptions are quite short, but highlight key characters to define each genus presented here. For each recognized genus, I have included generic names, including synonymized names, in parentheses near the species groups when a type species is included in the group.

Taxonomic Discussion – Generic Classification

Five genera are recognized herein: *Elathous* Reitter, 1890; *Gambrinus* LeConte, 1853; *Limonius* Eschscholtz, 1829; *Pheletes* Kiesenwetter, 1858; and *Tetralimonius* **new genus**. The later four genera are recognized for species once placed in *Limonius*, notably by Candèze (1860). *Elathous* species have been historically confused with both *Athous* Eschscholtz, 1829, and with *Limonius* prior to and even after the description of the genus. These genera should be easily identifiable throughout the Holarctic region, and remove confusion surrounding how species may be related between the Nearctic and Palearctic faunas. Generic discussions are below, following the key to genera. Only the adults are used for the generic descriptions, as the vast majority of species lack associated larvae. I have included notes on the species included, proposed species groups, and discussed larvae for each of the above genera. Within species lists, the abbreviation ‘[HN]’ is added after a species name if that name is a homonym of another name. The genera of the *Limonius* generic-group can be recognized by the combination of narrowly open procoxal

cavities [e.g. Figs. 4.12 and 4.13 (rarely completely closed (Fig. 4.48)] and micro serrations on the lateral edge of abdominal ventrites (Fig. 4.9). Additionally, the mouth parts are oriented at about a 45° angle (Fig. 4.16).

Key to Genera

1. Posterior margin of hypomeron emarginate so pronotal hind angle is visible from below (“nail- like extension” or “dentate” of previous authors) (Fig. 4.4)
..... *Gambrinus* LeConte, 1853
- Posterior margin of hypomeron slightly sinuate or straight, not emarginate, so pronotal hind angle not visible from below 2

2. Frontal margin of head extended, almost shelf-like, thickly carinate, head with triangular depression on frons; posterior edge of hypomeron nearly perpendicular to length of body (Fig. 4.1); male genitalia often wedge-like (Fig. 4.3)
..... *Elathous* Reitter, 1890
- Without the above combination of characters; male genitalia never wedge-like 4

3. Scutellum broadly rounded posteriorly (Figs. 4.14, 4.15); pronotum usually longer than wide, prosternal sutures variable; if pronotum as wide or wider than long prosternal sutures clearly grooved and excavate anteriorly..... *Limoni* Eschscholtz, 1829

- Scutellum pentagonal, sometimes appearing subtriangular, pointed posteriorly (Fig. 4.47); pronotum as wide or wider than long; prosternal sutures at most weakly grooved anteriorly, never excavate5

- 4. Pronotum completely piceous, pronotal hind angles acute at tips in dorsal view; prosternal process weakly expanded behind procoxae, so procoxal cavity narrowly open posteriorly (Fig. 4.42); parameres with apical expansions (Fig. 4.44)
.....*Pheletes* Kiesenwetter, 1858

- Pronotum usually bicolored, with hind angles lighter; pronotal hind angles blunt and truncate in dorsal view; prosternal process strongly expanded behind procoxae, so procoxal cavity nearly completely closed posteriorly (Fig. 4.46); parameres lacking apical expansions (Figs. 4.49–4.51) *Tetralimonius* **new genus**

Elathous Reitter, 1890; pg. 247, 44 Species

Type species: *Elathous buyssoni* Reitter, 1890 (designated by Hyslop 1921: 644).

Elathous; Van Dyke 1932: 357; Fall 1934:30; Glen 1950: 167; Lane 1971: 21;

Kishii 1987: 80; Platia 1994: 105; Sánchez-Ruiz 1996: 106; Johnson 2002: 169; Cate 2007: 167 [164?].

Athoina Reitter, 1906: 399. Incorrect subsequent spelling of *Elathouina* (Sánchez-Ruiz 1996).

Athouinus Reitter, 1905: 114. Incorrect subsequent spelling of *Elathouina* (Sánchez-Ruiz 1996), appears only in table at end of Reitter 1905.

Elathouina Reitter, 1905: 19. Type species: *Athous revelierei* Mulsant and Rey, 1875 (= *A. perrisii*); by monotypy: Schwarz 1907, pg. 197; Leseigneur 1972: 183.

Leptoschema auct. nec. Horn, 1884 (pars): Reitter 1905a; Schwarz 1907: 196.

Limonius auct. nec. Eschscholtz, 1829 (pars): Van Dyke 1932; Al Dhafer 2009.

Melanathous Reitter, 1905a: 24. Type species: *Melanathous sequensi* Reitter, 1905 (= *Elathous brucki* (Candèze, 1878)); by monotypy: Schwarz 1907, pg. 198.

Nearctic Species, 7 Species

Elathous bicolor (LeConte, 1853): 428 (*Athous*).

Limonius kondratieffi Al Dhafer, 2009: 299 **new synonymy**.

Elathous brevicornis Fall, 1934: 30.

Elathous brunellus Fall, 1934: 31.

Elathous californicus Van Dyke, 1932: 359.

Elathous discalceatus (Say, 1839): 169 (*Elater*).

Elathous oberndorfferi Schwarz, 1903: 207 (syn. by Van Dyke, 1932).

Elathous huguenini (Van Dyke, 1932): 346 (*Limonius*) **new combination**.

Elathous nebulosus (Van Dyke, 1932): 345 (*Limonius*).

Palearctic Species, 37 Species

Elathous brucki (Candèze, 1878): clxviii (*Athous*).

Melanathous sequensi Reitter, 1905: 25.

Elathous brunneus (Lewis, 1894): 195 (*Limonius*).

Elathous buyssoni Reitter, 1890: 248.

Elathous candezei Reitter, 1890: 248.

Elathous chiarae Guglielmi and Platia, 1985: 192.

Elathous crovatoi Platia and Schimmel, 1992: 52.

Elathous cyprius Baudi di Selve, 1871: 54 (*Athous*).

Elathous depressus Platia and Schimmel, 1991: 131.

Elathous ekaterinae Preiss, 2003: 55.

Elathous emgei (Schwarz, 1893): 191 (*Leptoschema*).

Elathous emrei Platia, 2011: 208.

Elathous graecus Platia, 2008:143.

Elathous impressifrons (Hampe, 1866): 373 (*Athous*).

Elathous lizleri Mertlik, 2005: 170.

Elathous lizlerwernerii Mertlik and Dusanek, 2006: 152.

Elathous maestrei Zapata and Sánchez-Ruiz, 2012: 108.

Elathous malatyanus Etzler **new replacement name**

Elathous bicolor Platia, 2010: 27, not *Athous bicolor* LeConte, 1853. [HN]

Elathous melanarius Platia and Kakiopoulos, 2014:102.

Elathous mertliki Platia and Schimmel, 1992: 93.

Elathous murzovi Platia, 2010: 27.

Elathous niger Schwarz, 1897: 130.

Elathous nigricans Platia and Schimmel, 1991: 132.

Elathous nurayae Platia, 2011: 207.

Elathous pavesii Platia and Schimmel, 1992: 94.

Elathous perrisii (Desbroches des Loges, 1873): 366 (*Athous*).

Athous amicus Perris, 1874: 4.

Athous revelierei Mulsant and Rey, 1875: 81.

Elathous platiai Zapata and Sánchez-Ruiz, 2007: 221.

Elathous rufobasalis Wurst, 1994: 62.

Elathous rufus (Candèze, 1860): 384 (*Limonius*).

Elathous schwarzi Reitter, 1898: 346.

Elathous serti Kabalak, Avcı, and Platia, 2013: 86.

Elathous smyrnensis Schwarz, 1903: 207.

Elathous syriacus Schwarz, 1903: 208.

Elathous talassemtani Németh and Platia, 2015: 92.

Elathous tezcani Platia, 2014: 44.

Elathous turcicus Platia and Gudenzi, 2005: 114.

Elathous vasquezi (Cobos, 1969): 11 (*Leptoschema*).

Elathous yamamotoi Ôhira, 1995: 189.

Diagnosis

Species in this genus share the following unique combination of characters: the frontal margin is well developed with a triangular depression on the frons; prosternal sutures are excavate and grooved anteriorly; hypomer on with posterior edge nearly

straight, not emarginate; tarsi lacking membranous lobes; male genitalia variable, but usually wedge-like with parameres lacking apical hooks (type species genitalia) (e.g. Fig. 4.3); female internal genitalia have a pear-shaped uterus and an inverted pear-shaped bursa copulatrix bearing three apical accessory glands and subtle sclerotizations (Fig. 4.2). The colleterial glands may be incorporated into the uterus, but are not distinct. The type species of the genus was examined through photographs only, so no generic description is provided.

Discussion

Species in this genus recall characteristics of *Limonius* and *Athous* Eschscholtz, 1829, but are clearly distinct. However, the identification of this genus is impossible using the current North American generic key (Johnson 2002), which probably led to misidentification of species in this genus by Al Dhafer (2009). In order to get to the correct couplet for this genus in Johnson (2002, couplet 29), one needs to choose that the specimen has lobed tarsomeres (Johnson 2002, couplet 23), despite the lack of lobed tarsomeres in these species, leading inevitably to misidentification.

Three species, *E. huguenini*, *E. kondratieffi*, and *E. nebulosus*, treated by Al Dhafer (2009) as *Limonius* are better placed in this genus based on male genitalia and other morphological characteristics. In fact, Lane (1971) placed *L. nebulosus* in *Elathous*. It appears that Al Dhafer (2009) was unaware of this, despite citing that work. Lane also moved the single *L. huguenini* specimen in the BMNH to *Elathous* when he visited in

1965, but this transfer was never published (C. M. F. von Hayek, BMNH collection notes).

The types of *L. kondratieffi* were not located in the FSCA, where they were reportedly deposited (Al Dhafer 2009). It is unclear at this time where these specimens are actually located. The description and depicted male genitalia of *L. kondratieffi* is identical to that of *Elathous bicolor*, a species common in the type locality of the former, so I consider *L. kondratieffi* a synonym of *Elathous bicolor*.

In the Palearctic region there are 37 recognized species, two from Japan, and the rest from the Mediterranean region (Cate 2007, Kabalak *et al.* 2013). There are currently seven species in North America, mostly in the eastern regions. The last Nearctic key to this group is Van Dyke (1932). Glen (1950) described the larvae of *E. bicolor*, the only Nearctic species with associated larvae. *Elathous* needs a revision to determine the relationships of the approximately 40 species. Based on male genitalia, there appear to be two groups of species. During this review it was discovered that the species *Elathous bicolor* Platia, 2010 is a secondary junior homonym of *Elathous bicolor* (LeConte, 1853), so I propose *Elathous malatyanus* as a **new name**, after the type locality of the Turkish Province Malatya.

Gambrinus LeConte, 1853: 435, 58 Species

Type species: *Elater armus* Say, 1839: 171 (= *Elater stigma* Herbst, 1806)), by

monotypy; Nakane and Kishii 1955: 205; Lane 1971 (as subgenus of *Limonius*): 21; Kishii 1987: 82; Ôhira 1990: 108; Han et al. 2012: 58 (and references therein).

Gambrinus as synonym of *Limonius*: Candèze 1860: 377.

Limoniscus Reitter, 1905: 12 [14] **new synonymy.**

Type species: *Elater violaceus* Müller, 1821 (designated by Hyslop, 1921); Schwarz 1907: 195; Leseigneur 1972: 182; Dolin 1978: 43; Ôhira 1990: 108; Sanchez-Ruiz 1996: 107; Cate 2007: 165; Han et al. 2012: 58; *auctorum*.

Sichuanelater Platia and Gudenzi, 2006: 137 **new synonymy.**

Type species: *Sichuanelater gibbosus* Platia and Gudenzi, 2006, by original designation; Platia 2008: 197.

The following are suggested species groups. I have included generic names in parentheses near the species groups when a type species is included in the group.

Nearctic Species, 29 Species

Stigma Species-group (*Gambrinus*).

Gambrinus confusus (LeConte, 1853): 430. (*Limonius*) **new combination.**

Gambrinus crotchii (Horn, 1872): 148 (*Limonius*) **new combination.**

Gambrinus flavomarginatus (Knull, 1938): 20 (*Limonius*) **new combination.**

Gambrinus humidus (Lane, 1941): 137 (*Limonius*) **new combination.**

Gambrinus lanchesteri (Lane, 1941): 135 (*Limonius*) **new combination**.

Gambrinus meridianus (Knull, 1947): 177 (*Limonius*) **new combination**.

Gambrinus mirus (LeConte, 1853): 429 (*Limonius*) **new combination**.

Gambrinus norahae (Al Dhafer, 2009): 312 (*Limonius*) **new combination**.

Gambrinus olentangyi (Knull, 1947): 179 (*Limonius*) **new combination**.

Gambrinus rufihumeralis (Lane, 1941): 133 (*Limonius*) **new combination**.

Gambrinus stigma (Herbst, 1806): 86 (*Elater*) **new combination**.

Gambrinus shircki (Lane, 1965): 183 (*Limonius*) **new combination, removed from synonymy**.

Gambrinus snakensis (Lane, 1965): 185 (*Limonius*) **new combination, removed from synonymy**.

Gambrinus pictus (Van Dyke, 1932): 343 (*Limonius*) **new combination**.

Gambrinus ulkei (Horn, 1871): 314 (*Limonius*) **new combination, removed from synonymy**.

Gambrinus venablesi (Wickham, 1913): 27 (*Limonius*) **new combination**

Griseus Species-group.

Gambrinus angulatus (Motschulsky, 1859): 370 (*Limonius*) **new combination**

Gambrinus bicolor (Van Dyke, 1932): 344 (*Limonius*) **new combination**.

Gambrinus clypeatus (Motschulsky, 1859): 369 (*Limonius*) **new combination**.

Gambrinus cribriceps (Van Dyke, 1943): 44 (*Limonius*) **new combination**.

Gambrinus fulvipilis (Candèze, 1860): 383 (*Limonius*) **new combination**.

Gambrinus griseus (Beauvois, 1805): 1805 (*Elater*) **new combination.**

Elater cylindriformis Say, 1823: 176.

Limonius hirticollis Melsheimer, 1846: 215.

Gambrinus interstitialis (Melsheimer, 1846): 215 (*Limonius*) **new combination, removed from synonymy.**

Gambrinus plebejus (Say, 1825): 263 (*Limonius*) **new combination.**

Gambrinus propexus (Candèze, 1860): 386 **new combination, removed from synonymy.**

Gambrinus rudis (Brown, 1933): 175 (*Limonius*) **new combination.**

Gambrinus seminudus (Van Dyke, 1932): 348 (*Limonius*) **new combination.**

Gambrinus sinuifrons (Fall, 1907): 227 (*Limonius*) **new combination.**

Gambrinus ursinus (Van Dyke, 1932): 349 (*Limonius*) **new combination.**

Palearctic Species, 31 Species

Stigma Species-group (*Limoniscus*, *Sichuanelater*).

Gambrinus ainu Ôhira, 1968: 9.

Gambrinus amamiensis Ôhira, 1966: 10.

Gambrinus atricolor (Lewis, 1879): 157 (*Limonius*).

Gambrinus elegans (Buysson, 1891): cxxxvii (*Limonius*) **new combination.**

Gambrinus gibbosus (Platia and Gudenzi, 2006): 139 (*Sichuanelater*) **new combination.**

Gambrinus henanensis (Schimmel, 2006): 252 (*Limoniscus*) **new combination.**

Gambrinus hinakurai (Kishii, 1998): 2 (*Limoniscus*) **new combination.**

Gambrinus hiramatsui Ôhira, 1976: 48.

Gambrinus hosodai Kishii, 1989: 65.

Gambrinus imitans (Lewis, 1894): 196 (*Limonius*).

Gambrinus katoi (Kishii, 2002): 129. (*Limoniscus*) **new combination.**

Gambrinus kawaharai (Kishii, 2002): 129. (*Limoniscus*) **new combination.**

Gambrinus kraatzi kraatzi (Candèze, 1879): 281 (*Limonius*).

Gambrinus kraatzi nihonicus Kishii, 1966: 46.

Gambrinus kucerai (Schimmel, 2006): 253 (*Limoniscus*) **new combination.**

Gambrinus limbatipennis Nakane and Kishii, 1955: 43.

Gambrinus naomii (Kishii, 1997): 4 (*Limoniscus*) **new combination.**

Gambrinus nanshanensis (Arimoto and Hiramatsu, 2013): 85 (*Limoniscus*) **new combination.**

Gambrinus niponensis (Lewis, 1894): 194 (*Limonius*).

Gambrinus ogatai Kishii, 1985: 8.

Gambrinus rufipennis (Lewis, 1894): 197 (*Limonius*).

Gambrinus rufovittatus Ôhira, 1963: 15.

Gambrinus shaanxiensis (Schimmel, 2006): 253 (*Limoniscus*) **new combination.**

Gambrinus suturalis (Gebler, 1844): 99 (*Ampedus*) **new combination.**

Gambrinus takabai (Kishii, 1997): 1 (*Limoniscus*) **new combination.**

Gambrinus violaceus (Müller, 1821): 184 (*Elater*) **new combination.**

Gambrinus vittatus (Candèze, 1873): 22 (*Limonius*)

Gambrinus wittmeri (Chassain, 1998): 120 (*Limoniscus*) **new combination**.

Gambrinus yamato (Kishii, 1998): 5. (*Limoniscus*) **new combination**.

Gambrinus yujii (Arimoto, 2013): 79 (*Limoniscus*) **new combination**.

Gambrinus zhejiangensis (Schimmel, 2015): 290 (*Limoniscus*) **new combination**.

Diagnosis

Species of the genus *Gambrinus* are readily separated from other genera of the *Limonius* genus-group by the emarginate posterior margin of the hypomeron (Fig. 4.4). They are also united by similar female internal genitalia (Figs. 4.5 and 4.6). Generally, species in this genus are larger than the other genera in the *Limonius* genus group, but exceptions are common. Other characters are quite variable within the genus, and are shared with species in *Limonius*.

Generic Description

Medium sized, mostly longer than 8mm, sub-cylindrical to cylindrical, lustrous or dull, quite variable in color. Head with simple or umbilicate punctures; frons depressed or rather flattened; frontal margin entire, straight or undulate anterad. Antennae with 2nd and 3rd antennomeres variable, often small, usually sub-equal in size, ratio of length of 2+3 to 4th variable, often sub-equal, 4th to 10th antennomere serrate, 11th ovoid, sometimes noticeably longer than others. Pronotum usually longer than wide, sometimes with anterior angles expanded; hind angles broad at base, often with single carina, rarely with carina weak or absent, with a nail-like projection on inner side; posterior margin

lacking basal incisures and a basal notch; prosternal sutures double, often distinctly grooved anteriorly; posterior margin of hypomeron emarginate near apex; prosternal process expanded laterally; procoxal cavities narrowly opened. Scutellum subpentagonal, with or without longitudinal elevation. Abdomen with lateral microserrations on each ventrite. Legs slender; tarsomeres simple, often with dense setose pads ventrally; claws simple, lacking setae. Male aedeagus narrow with narrow sinuate parameres with membranous apical end (Fig. 4.11, *Stigma* species-group), or moderate with parameres more sclerotized with apical ends sinuate with distinct lateral expansions (Fig. 4.10, *griseus* species-group). Female internal genitalia with uterus bearing moderate sclerotization, colleterial glands incorporated into uterus, bursa copulatrix weakly sclerotized basally with long narrow expansion ending in finger-like glands and long tubular extension to spermatheca (Fig. 4.5, *Stigma* species-group), or completely weakly sclerotized, with short narrow expansion (Fig. 4.6, *Griseus* species-group); both types with basal accessory gland off of bursa copulatrix.

Discussion

This definition encompasses the species traditionally used with the generic name *Limoniscus*. While *Limoniscus* has been used consistently since it was described in 1905, its synonymy with *Gambrinus* requires a change in names. A reversal of precedence under Art. 23.9.1 of the International Code of Zoological Nomenclature (ICZN 1999) is precluded by the use of *Gambrinus* as a valid genus by Ôhira (1990), Han *et al.* (2012), and others within the last 50 years.

The relationship between these two names has been recognized since the 1950s (Ôhira 1954), with a direct comparison of type species done by Ôhira (1990). Ôhira decide to move the Japanese species to *Limoniscus* based on the lack of a carina on the posterior pronotal angles and the less serrated antennomeres present in *G. stigma*, stating that they were a better match with *Limoniscus violaceus*. However, close examination of many specimens of many species from both regions show that the strength of the hind angle carina is variable within the group, and the strength of serration of the antennomeres is species specific. I also disagree with Ôhira (1990) when he states that the antennae of *G. stigma* are weakly serrate (see Fig. 4.7) and there is a carina, although weaker than in *G. violaceus*, present on the hind angle (Fig. 4.8). Due to the variability of both characters, I can only recognize one genus.

I also consider the monotypic *Sichuanelater* to be a highly derived member of this genus. While it has many unique characters, which led to the type species being described in its own genus, the male genitalia are typical for *Gambrinus* (Platia 1998, see his Fig. 4.11). *Gambrinus gibbosus*, from main land China and type species of *Sichuanelater*, also appears similar to the Taiwanese *G. nanshanensis* further strengthening this synonymy.

This genus is defined by the emargination of the posterior edge of the hypomeron. In addition, these species share characters of both the male and female internal genitalia. All species can be linked by the female internal genitalia, a character that Becker (1956) noted was a strong character to discover natural groups of species.

Within *Gambrinus*, there appear to be two species groups, the Stigma species-group and the Griseus species-group. Despite the differences in bursa copulatrix shapes

(Figs. 4.5 and 4.6), both species groups have colleterial glands as subtle expansions of the uterus, and bear accessory glands near the junction of the uterus and bursa copulatrix. Additionally, the male genitalia were used here to form species groups, matching those of the female internal genitalia. The Stigma species-group have aedeagi that possess narrow parameres (Fig. 4.11) and include all Palearctic species and part of the Nearctic species. The Griseus species-group has relatively wide parameres (Fig. 4.10), and is limited to the remaining Nearctic species. Other general trends in the species groups are that the Stigma species-group contains species with completely piceous pronota, and elytra bearing orange humeral markings, while the Griseus species-group contains species with bicolored pronota and unicolorous brown elytra. Exceptions to these color patterns are not uncommon, so these can only be used as general trends and not definitions of the groups.

Larvae are only confidently associated for a few Palearctic species. Important works are Dolin (1978) and Whitehead (2003) for Western Eurasian species, and Ôhira (1962) for Japanese species. Known larvae are very close in appearance to *Limonium*, but the outer urogomphal prong is usually quite long relative to *Limonium* species (Fig. 9 in Whitehead 2003, *cf.* Fig. 4.72 here). While never specifically mentioned in keys, known species lack stemmata (Paul F. Whitehead, in lit.). In the Nearctic, only *G. confusus* has tentatively associated larvae (Glen 1950). These larvae possess stemmata, differing from known Palearctic species, but were found in decayed wood and in well decayed leaf-litter (Glen 1950), similar to the habitat of *G. violaceus* (Whitehead 2003). However, the

examined larvae lack associated adults, so these observations should be used with caution.

This reorganization exposes a need for considerable work to be done at the species level, particularly in the Nearctic. Notable examples include the previously excluded *G. angulatus* (Al Dhafer 2009), the *G. crotchii* complex, and the *G. griseus* complex of species.

Limonius Eschscholtz, 1829: 33, 79 Species

Type species: *Elater minutus* Linnaeus, 1758, designated by Curtis 1838.

LeConte 1853: 428; Candèze 1860: 377; Reitter 1905: 16; Schwarz 1907: 193; Leng 1920: 168; Lane 1971: 21; Leseigneur 1972: 180; Sanchez-Ruiz 1996: 108; Johnson 2002: 169; Leseigneur and Mertlik 2007; Cate 2007: 165; Al Dhafer 2009; Han *et al* 2012: 53.

Cidnopus Thomson, 1859: 106.

Type species: *Elater nigripes* Gyllenhal, 1808 (= *Elater pilosus* Leske, 1785), by monotypy. Leseigneur 1972: 175; Kishii 1987: 81; Platia 1994: 102, Sanchez-Ruiz 1996: 105; Cate 2007: 163; Han *et al* 2012: 49.

Dendrometrus Gistel, 1848: xi [unjustified replacement name for *Limonius*].

Noted as synonym of *Limonius*: Sanchez-Ruiz 1996: 108.

Kibunea Kishii, 1966: 46.

Type species: *Limonius eximius* Lewis, 1894: 318, by original designation.

Kishii 1987: 84, Platia 1994: 106. Synonymized by Sanchez-Ruiz 1996: 108.

Micrathous Lane, 1971: 24, **new synonymy**.

Type species: *Athous brevis* Van Dyke, 1932: 379, by original designation. Johnson 2002: 169.

Neoathousius Schimmel and Platia, 1991: 881, **new synonymy**.

Type species: *Neoathousius loebli* Schimmel and Platia, 1991, by original designation: Schimmel and Platia 1994; Cate 2007: 166.

Nothodes LeConte, 1861: 171.

Type species: *Limonius dubitans* LeConte, 1853, by monotypy: Leng 1920: 168; Kishii 1987: 82; Platia 1994: 112; Sanchez-Ruiz 1996: 108; Cate 2007: 165.

Solskyana Dolin, 1978: 45, **new synonymy**.

Type species: *Limonius villiger* Solsky, 1881, by original designation. Cate 2007: 166.

The following are suggested species groups. I have included generic names in parentheses near the species groups when a type species is included in the group. For this genus, I have grouped both Nearctic and Palearctic species together under each species-group. This will make it easier for future revisionary work. No consistent character was discovered to be able to separate these groups at the generic-level, with groups blurring

together. Species-level synonyms for Palearctic species are not provided, but can be found in Cate (2007). For the Nearctic region, species level synonyms follow Al Dhafer (2009) unless noted.

Minutus Species-group (*Limonius*, *Kibunea*)

Nearctic Species (4).

Limonius aurifer LeConte, 1853: 429.

Limonius basilaris (Say, 1823): 172 (*Elater*).

Limonius lanei Van Dyke, 1932: 350.

Limonis semianeus LeConte, 1853: 432 **removed from synonymy**.

Palearctic Species (7).

Limonius approximans Lewis, 1894: 198.

Limonius eximia Lewis, 1894: 318.

Limonius ignicollis Lewis, 1894: 197.

Limonius kouichiana (Kishii, 1989): 63 (*Kibunea*).

Limonius minutus (Linnaeus, 1758): 406 (*Elater*).

Limonius narukawai (Kishii, 1993): 151 (*Kibunea*).

Limonius scutellaris (Dolin, 2003): 36 (*Cidnopus*).

Parvulus Species-group (*Micrathous*)Nearctic Species (4).

Limonius aeger LeConte, 1853: 431.

Limonius brevis (Van Dyke, 1932): 379 (*Athous*) **new combination**.

Limonius quercinus (Say, 1825): 262 (*Elater*).

Limonius sordidus (Van Dyke, 1932): 380 (*Athous*) **new combination**.

Palaearctic Species (3).

Limonius marginicollis Lewis, 1894: 196

Limonius parallelus Motschulsky, 1860: 111.

Limonius parvulus (Panzer, 1799): 7 (*Elater*).

Consimilis Species-group (*Solskyana*)Nearctic Species (5).

Limonius beutenmuelleri Van Dyke, 1932: 351.

Limonius consimilis Walker, 1866: 325. [see note below]

Limonius nitidulus Horn, 1871: 315.

Limonius jonesi Lane, 1965: 182.

Limonius seibertae Etzler, 2018: 863.

Limonius pappi Becker, 1976: 689.

Palearctic Species (6).

Limonium crassipes Schwarz, 1900: 105.

Limonium hirta (Dolin, 1978): 48 (*Solskyana*) **new combination.**

Limonium koltzei Reitter, 1895: 256.

Limonium montivagus Lewis, 1894: 194. [see notes below]

Limonium nigronitidus (Han and Lee, 2012): 50 (*Cidnopus*) **new combination.**

Limonium villiger Solsky, 1881: 237.

Pilosus Species-group (*Cidnopus*)Nearctic Species (3).

Limonium auripilis (Say, 1823): 172. (*Elater*)

Limonium kuschei Van Dyke, 1932: 349.

Limonium pectoralis LeConte, 1853: 391.

Palearctic Species (6).

Limonium marginellus Brusteli (Leseigneur, 2004): 231 (*Cidnopus*) **new combination.**

Limonium marginellus marginellus Perris, 1864: 284.

Limonium pilosus (Leske, 1785): 11 (*Elater*).

Limonium pseudopilosus (Platia and Gudenzi 1985): 21 (*Cidnopus*) **new combination.**

Limonius schurmanni (Platia and Gudenzi, 1998): 53. (*Cidnopus*) **new combination.**

Limonius turcicus (Platia, 2004): 40. (*Cidnopus*) **new combination.**

Canus Species-group (*Nothodes*, *Neoathousius*)

Nearctic Species (13).

Limonius agonus (Say, 1839): 171 (*Elater*).

Limonius anceps LeConte, 1853: 433 **removed from synonymy.**

Limonius californicus (Mannerheim, 1843): 238 (*Cardiophorus*).

Limonius canus LeConte, 1853: 433.

Limonius dubitans LeConte, 1853: 433 **removed from synonymy.**

Limonius ectypus (Say, 1839): 167 (*Elater*).

Limonius infuscatus Motschulsky, 1859: 371 **removed from synonymy.**

Limonius longulus Champion, 1897: 455.

Limonius mandibularis Motschulsky, 1859: 370.

Limonius pilosulus Candèze, 1891: 149 **removed from synonymy.**

Limonius quadraticollis Candèze, 1860: 412.

Limonius rectangularis Fall, 1934: 30.

Limonius subauratus LeConte, 1853: 433.

Palaearctic Species (26).

Limonius aeruginosus (Olivier, 1790): 33 (*Elater*).

Limonius baconi Candèze, 1860: 412.

Limonius brancuccii (Schimmel and Platia, 1991): 884 (*Neoathousius*)

new combination.

Limonius decorus (Gurjeva, 1975): 169 (*Athousius*) **new combination.**

Limonius exiguus (Schimmel and Platia, 1991): 885 (*Neoathousius*) **new**

combination.

Limonius hartmanni (Schimmel, 1998): 151 (*Neoathousius*) **new**

combination.

Limonius hiermeieri (Schimmel and Platia, 1991): 888 (*Neoathousius*)

new combination.

Limonius hubeiensis (Kishii and Jiang, 1996): 131. (*Cidnopus*) **new**

combination.

Limonius kubani (Schimmel, 1996): 172 (*Neoathousius*) **new**

combination.

Limonius loebli (Schimmel and Platia, 1991): 890 (*Neoathousius*) **new**

combination.

Limonius longicornis (Schimmel and Platia, 1991): 890 (*Neoathousius*)

new combination.

Limonius macedonicus (Cate and Platia, 1989): 185. (*Cidnopus*) **new**

combination.

Limonius manaliensis (Schimmel and Platia, 1991): 892 (*Neoathousius*)

new combination.

Limonium marginipennis Lewis, 1894: 195. [see note below]

Limonium miandamensis (Schimmel and Platia, 1991): 892 (*Neoathousius*)

new combination.

Limonium minusculus (Schimmel and Platia, 1991): 101 (*Neoathousius*)

new combination.

Limonium nigrinus Candèze, 1900: 94.

Limonium platiai Mertlik, 1996: 203 (*Cidnopus*) **new combination.**

Limonium recticornis (Schimmel and Platia, 1991): 893 (*Neoathousius*)

new combination.

Limonium riesei Platia, 1988: 9 (*Athousius*) **new combination.**

Limonium rusticus (Schimmel and Platia, 1991): 894 (*Neoathousius*) **new combination.**

Limonium ruzenae Laibner, 1977: 388.

Limonium schimmeli **new replacement name.**

Neoathousius ferrugineus Schimmel and Platia, 1991: 88 [HN], not

Limonium ferrugineus Buysson, 1902.

Limonium sinensis (Schimmel and Platia, 1994): 233 (*Neoathousius*) **new combination.** [see note below]

Limonium singularis (Schimmel and Platia, 1991): 894 (*Neoathousius*)

new combination.

Limonium stapfi (Schimmel, 2007): 183 (*Neoathousius*) **new combination.**

Limonium wittmeri (Schimmel and Platia, 1991): 895 (*Neoathousius*) **new combination.**

Species Incertae Sedis

Limonium obienesis Cherepanov, 1966: 23. Western Siberia

Limonium substriatus (Gebler, 1833): 279 (*Elater*) “Siberia”.

Nomina Dubia in Cate 2007

Limonium araratensis Faldermann, 1835: 168.

Diagnosis

This genus can be distinguished from other genera in the *Limonium* genera-group by the non-emarginate posterior edge of the hypomeron and the procoxal cavity narrowly open posteriorly. Other characters are quite variable among species.

Generic Description

Small to medium sized, 5.5 mm to 13 mm in length, sub-cylindrical. Head with simple or umbilicate punctures; frons weakly depressed or rather flattened; frontal margin variable, entirely carinate to absent medially, straight to strongly undulate in specimens with margin present. Antennae variable and sexually dimorphic, usually longer in males, extending past posterior edge of pronotum by one or two antennomeres, and reaching posterior edge in females, although exceptions are common; 2nd and 3rd antennomeres

usually subcylindrical, ratio of 2nd and 3rd variable, ratio of 2nd and 3rd to 4th variable, usually serrated from 4th to 10th antennomeres, although some species have a weakly serrate 3rd antennomere, 11th ovoid. Pronotum variable and sexually dimorphic, usually appearing longer than wide but actually as wide as long, although some species clearly longer than wide or wider than long; anterior angles variable, sometimes expanded; hind angles short, broad at base, often with short single carina; posterior margin lacking incisures at base of hind angles and usually lacking notches anterior of scutellum; prosternal sutures double, anterior end variable, distinctly grooved and strongly excavate anteriorly to nearly closed with barest hint of groove; posterior edge of hypomeron not emarginate posteriorly, straight and “ear-like” or slightly sinuate; prosternal process expanded laterally; procoxal cavities narrowly opened. Scutellum variable, simple, smoothly convex, or with medial longitudinal ridge, often an oblong oval shape (Fig. 4.14) or a broad sub-quadrate shape (Fig. 4.15). Mesepisternum sometimes not reaching mesocoxal cavity (Fig. 4.24). Legs slender, moderately long; tarsomeres simple, often with dense setal pads ventrally; claws simple, lacking basal setae. Male genitalia variable, but always with apical expansions on the parameres (Figs. 4.17–4.23). Female internal genitalia variable, but all bearing two distinct colleterial glands off of weakly sclerotized uterus; uterus never with distinct sclerotizations (Figs. 4.25–4.34).

Discussion

This concept of *Limonius* returns to the older, broader concept of the genus. The biggest issue with the concept of this genus was the confusion about the type species

during the mid-20th century (Sanchez-Ruiz 1996). Due to this confusion, many authors tried to move some species to other genera without looking at broader patterns, leaving this group essentially unworkable.

Species that are listed as *incertae sedis* were treated as *Limonius* by Cate (2007), but I haven't been able to examine specimens of these names, nor have I been able to look at the original descriptions. As Cate spent considerable work on the Palearctic Catalogue, I accept his placement, but am unable to place these species into a species-group. The *nomina dubia* is a name that Cate (2007) did not place in any genus. I have included the name here to have a full catalogue of species names for the genus.

The order of species groups above is important, as the order is a hypothesis of which species groups have closer relationships, which are discussed below. No attempt at a phylogeny has been attempted for species groups nor species within each species group.

Unlike the other genera presented here, there is quite a bit of variation in the internal female genital tracts. Based on my observations, there are at least six types present within the genus. These genitalic groups likely represent true species-groups, however, I am unable to find consistent external morphological characters to readily distinguish genera. In many instances, there is more variation within a species group than between species groups, increasing the difficulties in choosing informative characters. I have chosen the conservative approach and recognized a large, variable genus until all species can be examined in detail and a phylogenetic analysis conducted.

Despite the variation, all female internal genitalia do appear to follow a similar pattern. All examined species bear two distinct colleterial glands off the uterus. The

uterus is also often slightly more sclerotized than the bursa copulatrix, which is indicated on the drawings by brown lines. Unlike the genera *Pheletes* and *Tetralimonius*, there are no distinct sclerotized sections of the uterus.

The *Minutus* species-group is equivalent to *Limonius sensu stricto*. It is based on members sharing the characters of flared anterior margins of the pronotum, and a narrow aedeagus (all similar to Fig. 4.17). The female internal genitalia belong to what I call Type A (Fig. 4.25). The bursa copulatrix is often weakly sclerotized basally, bears at least two accessory glands, a smaller one basally and a moderate one medially, and a tubular extension at the end. Some species (not figured) also bear another gland near the tubular extension (diverticulum of Becker 1956). Some authors (e.g. Platia 1994) have used the flared anterior margins to separate this group at the genus level. However, this character also repeatedly appears in the genus *Gambrinus*. An unreported character is that *L. minutus*, the type species of *Limonius*, possesses a mesocoxal cavity where the mesepisternum does not reach the mesocoxal cavity (Fig. 4.24). This character is shared by all North American species in this species group. The modern concept of *L. minutus* was established by Lseigneur and Mertlik (2007). Larvae have only been associated with a few Palearctic species (e.g. Dolin 1978), and are of the typical *Limonius* type, with the ninth abdominal segment similar to Fig. 4.72, but with urogomphal prongs reduced to tubercles.

The *Parvulus* species-group is equivalent of *Nothodes auct.* The misuse of the generic name for this group stems from confusion of the Japanese species *L. marginicollis* and *L. marginipennis*, both described by Lewis (1894) (C. M. F. von

Hayek, BMNH collection notes). I have examined both types at the BMNH and only the later species is closely related to the type species of *Nothodes*. Members of this group are intermediate between the preceding group and the following group (Consimilis species-group). Members also share characters with the other two species groups (Pilosus species-group and the Canus species-group). Species in both regions look very similar to species in the Minutus species-group, but lack the flaired anterior margins of the pronotum. The male genitalia of species in this group are also intermediate, combining characteristics of both groups (e.g. Figs. 4.18 and 4.19). For the mesocoxal cavity, the mesepisternum just reaches the cavity in *L. parvulus*, and is borderline in *L. aeger*, suggesting this character is variable within the species group.

Larvae are associated with species from both regions, with the larva of *L. aeger* described for the Nearctic (Glen 1950), and *L. parvulus* for the Palearctic (Dolin 1978). These larvae belong to the same group as the known larvae in the Minutus species-group. I fully expect this group to be artificial when a phylogenetic study of the genus is conducted.

To the Parvulus species-group, I also add two species from California formerly placed in the genus *Micrathous*. This genus was defined by small, setose lobes on the tarsi, and grooved prosternal sutures, which separated these species from *Athous*, the genus the two included species were described in. However, careful examination revealed that the setose lobes are better classified as dense setose pads, a common character in *Limoni* species. No other characters were discovered to recognize these two species as belonging to a distinct genus.

The female internal genitalia of species I place into the *Parvulus* species-group are quite variable relative to other groups. There are four main genitalia types known, all possessing a curved bursa copulatrix. Type B (Fig. 4.26), found in *L. aeger*, is similar to Type A, but lacks the small accessory gland, a more curved bursa copulatrix and a corkscrew-shaped tubular extension. It appears similar to the drawing of the genitalia for *L. pseudopilosus* in Fig. 6d of Han *et al.* (2012). Type C (Fig. 4.27), found in *L. quercinus*, is strongly modified, possessing a tubular bursa copulatrix without a clear separation from the uterus and lacking distinct accessory glands or a tubular extension. The bursa copulatrix also bears a heavily sclerotized area at the inner curve. However, the male genitalia of *L. quercinus* is very similar to that of *L. aeger* (Fig. 4.18). While the male genitalia of *L. parvulus* appear similar to those found in the *Consimilis* species-group (Fig. 4.19), the female internal genitalia link this species to others within the species-group (Fig. 4.28). The female internal genitalia of *L. parvulus* shares many characteristics with other groups. It shares the basal accessory gland and basal sclerotization of the bursa copulatrix with Type A genitalia. It also has the inner heavy sclerotization of the bursa copulatrix as in Type C (insert, Fig. 4.28). Finally, it has a medial accessory gland and general bursa copulatrix shape as in Type F (below). Due to this combination of many characters, I consider this a Type C/ F combination. Finally, *L. brevis* (formerly in *Micrathous*) has Type D genitalia (Fig. 4.30), with a long, curved bursa copulatrix, lacking basal or medial accessory glands. This shares some characteristics with species in the *Pilosus* species-group (see below).

The Consimilis species-group contains species previously placed in *Cidnopus* and *Solskyana* and may also be an artificial grouping. These species are grouped together by the slightly sinuate posterior edge of the hypomer on (Fig. 4.13), and the widened parameres of the aedeagus (Fig. 4.20). The majority of specimens have the prosternal sutures strongly excavate anteriorly, with the antennae able to fit in a short groove between the hypomer on and the prosternum. In all examined specimens the mesepisternum does not reach the mesocoxal cavity, similar to the *Minutus* species group. The female internal genitalia are also quite distinctive (Fig. 4.29), bearing a cork-screw shaped, elongate bursa copulatrix ending in many accessory glands and a long tubular extension. I consider this Type E genitalia. It should be compared to Figs. 3b and 3c in Han *et al.* (2012).

Some of the species in the Consimilis species-group require explanation. Until recently, considerable confusion existed about *L. consimilis*. These issues are discussed in detail in Etzler (2018), where key to the North American species of this species group is also provided.

Limonius montivagus is also an interesting case. Many authors treat this species as a *Gambrinus* (i.e. Cate 2007). However, I have examined the type, and it seems better placed in the Consimilis species-group. The slightly sinuate posterior edge of the hypomer on may have led to this placement in *Gambrinus*.

Finally, the two species formerly in *Solskyana* (*L. hirta* and *L. villiger*) deserve comment. The genus was described by Dolin (1978) based on larval characters. He stated that they had a double pointed mandible (Fig. 4.67) compared to typical *Limonius* (Figs.

4.65, 4.69). I have examined two specimens identified as *L. villiger*, one from the NMPC and one at the BMNH. I am unable to find any characters to distinguish this species at the genus level. While Dolin's (1978) larval key is a foundational work, he doesn't state how he made the associations or numbers of individuals he examined. Due to this, I have taken the conservative approach and included these species here until a larger phylogenetic study can be conducted to determine their relationship and the strength of the mandibular character in the larvae.

The *Pilosus* species-group encompasses species that are apparently closely related to the type species of *Cidnopus*. These species all share excavated anterior ends of the prosternal suture, and strongly hooked parameres of the aedeagus (Fig. 4.21). Species are intermediate between the previous group and the following (*Canus* species-group). The mesepisternum does not reach the mesocoxal cavity in *L. auripilis*, barely reaches it in *L. pectoralis*, and clearly reaches it in *L. pilosus*, again showing variability of this character within a species group.

The understanding of internal female genitalic characters for this group have been hindered by a lack of availability of specimens for dissection. Illustrations of *L. pseudopilosus* (Han *et al.* 2012, Fig. 6d in that work) shares a general shape with that of *L. aeger* (Fig. 4.26). I have also studied the internal genitalia of *L. auripilis*, and it is quite similar to *L. brevis* (Fig. 4.30), lending additional support in synonymizing *Micrathous* with *Limonius*. Of the approximately 20 specimens of *L. pilosus* I have been able to examine in detail, all have been males, leaving the internal female internal genitalia of that species unknown.

Of the species group, only *L. pilosus* has a purportedly associated larvae, which is unique for the genus. While the adults are typical *Limonius*, the questionably associated larvae are not. The larvae possess stemmata and have a single-pointed nasale (Fig. 4.64), neither of which is known in other *Limonius* species (Glen 1950, Dolin 1978). Additionally, the mandible (Fig. 4.66), is subtly different than typical *Limonius* (Fig. 4.65), bearing tubercles on the main tooth. This association needs to be re-confirmed, since I predict that the original match is based on miss-associated specimens and the error has been simply repeated in subsequent literature. It is unclear what these unknown larvae are, but it is likely a common northern European species.

The final group is the Canus species-group which encompasses species formerly in the genus *Neoathousius*, includes the type species of *Nothodes*, and part of *Cidnopus*. The group name was first suggested by Lanchester (1946) for a group of North American species, and I have broadened the definition here. The Canus species-group encompasses a wide variety of characters, with some species having excavated anterior ends of the prosternal suture, while others are nearly closed anteriorly. The variability of characters is best demonstrated with the Nearctic species of the Canus species-group. There is a wide range of variation between species with frontal margins (Figs. 4.35 and 4.36), antennomere ratios, the anterior ends of prosternal sutures (Figs. 4.37 and 4.38), types of ovipositors (Figs. 4.39–4.42), and two main types of male genitalia (Figs. 4.22 and 4.23). However, they all share similar internal female internal genitalia (Figs. 4.31–4.34, all considered Type F). It also appears that the mesepisternum reaches the mesocoxal cavity for species in this group. This group contains the species of *Limonius* traditionally

considered agricultural pests and requires a tremendous amount of study to understand the diversity. Additionally, *L. mandibularis* is returned to the species list in this group, after it has been absent from most Nearctic catalogues for nearly 100 years (Woodworth 1913, Leng 1920).

The examined internal female internal genitalia of this group show some variation, but all share common characteristics. The majority of North American species in the group are similar to Fig. 4.33 (this is the genitalia type depicted in Becker 1956, for his third group). This type has a large sclerotized area in the bursa copulatrix near the junction of the bursa copulatrix and the uterus. The bursa copulatrix also has a medial offshoot bearing two accessory glands and a terminal tubular extension, shared by all variations (Figs. 4.31–4.34). This type is heavily modified in *L. infuscatus* (Fig. 4.34) where the accessory glands appear to be expanded into a large sac. The genitalia of *L. aeruginosus* (Fig. 4.31) only has a small sclerotized area at the base of the bursa copulatrix near the junction with the uterus. The genitalia of *L. longicornis* (formerly in *Neoathousius*) (Fig. 4.32) is very similar to that of *L. aeruginosus*, but apparently lacks any sclerotized sections of the bursa copulatrix. It should be noted that the genitalia depicted in Fig. 4.32 are shrunken compared to the inflated genitalia in Fig. 4.31.

In many collections, species in *Sylvanelater* Johnson, 2008 (formerly part of *Ctenicera*) are misidentified as *Nothodes dubitans* (= *Limonius dubitans* here). These specimens can be readily differentiated by their long pronotal hind angles and posteriorly widely open procoxal cavities (similar to Fig. 4.43). This confusion resulted in the over-emphasis on the weak frontal margin in *Limonius dubitans*, which often led to this

species being placed in other tribes, such as the Steatoderini (= modern Elaterini and Agriotini) (Schwarz 1906).

The synonymy of *Neoathousius* may seem controversial, but the relationship of these species to *Limonius* has been noted since its description (Schimmel and Platia 1991, Schimmel and Platia 1994). There is no character that reliably separates these species at the generic level, and they are remarkably close to species from Northern Mexico and Texas. Additionally, as stated above, associated females share similar genitalia to *Limonius* species, confirming the synonymy. A species level revision is needed, as *L. baconi* and *L. nigrinus* are related to the species formerly in *Neoathousius*. The Palearctic *Limonius baconi* is also removed from the Nearctic species list, first appearing there without comment in Schwarz 1907. With the synonymy of *Neoathousius* with *Limonius*, *Neoathousius ferrugineus* Schimmel and Platia becomes a secondary homonym of *Limonius ferrugineus* Buysson (= *L. pilosus*). I have renamed this species *Limonius schimmeli* in honor of one of the original describers, the late Rainier Schimmel.

The species *L. rectangularis* from west Texas is similar to the two Mexican species *L. longulus* and *L. quadraticollis*. This species is known from a single male holotype which I have recently (2017) examined (MCZC), and it was undissected. The genitalia figured in Al Dhafer (2009, Fig. 56 of that work) belongs to a different species, as the photograph is identical to that of a specimen of *L. auripilis* also at the MCZC. The actual genitalia of *L. rectangularis* remain unknown. As stated above, these three species are quite close to Palearctic species formerly in *Neoathousius*, and there are likely more species to be discovered in Northern Mexico.

Larvae have been associated with many species in the *Canus* species-group from all regions (Lanchester 1946, Ôhira 1962, Dolin 1978, Etzler *et al.* 2014). Species in this group are considered to be economically important in the Nearctic, particularly the Pacific Northwest (Lanchester 1946, Milosavljević *et al.* 2017, among many others). The larvae can be diagnosed by the frontal clypeal area with a tridentate nasale (Figs. 4.62, 4.71) and lacking setemata on the head (Fig. 4.69). The ninth abdominal segment is also characteristic (*e.g.* Fig. 4.72), with all species possessing urogomphi forming a caudal notch. The dorsal tubercles (Fig. 4.72, arrow) are helpful for species-level diagnoses (Lanchester 1946).

Pheletes Kiesenwetter, 1858: 328, 2 Species

Type species: *Elater bructeri* Panzer, 1795 (= *Elater aeneoniger* DeGeer, 1774) by monotypy; Reitter 1905: 18; Leng 1920: 168; Blackwelder 1944: 291; Cate 2007: 166.

Treating *Pheletes* as a synonym of *Limonius*: Candèze 1860: 377; Leseigneur 1972: 180; Platia 1994: 109.

Pheletes as subgenus of *Limonius*; Van Dyke 1932: 334; Glen 1950: 159; Al Dhafer 2009: 215.

Hammionus Gistel, 1834: 11 [HN], not *Hammionus* Charpentier, 1825 – type species *Elater bructeri* Panzer, 1795, by monotypy.

Nearctic Species (1)

Pheletes lecontei (Lane, 1971): 24 (*Limonius*) **new combination.**

Limonius consimilis auct. nec Walker, 1866: 325.

Limonius nitidicollis LeConte, 1869: 378. [HN], not *Limonius nitidicollis*
Laporte 1840.

Palearctic Species (1)

Pheletes aeneoniger (DeGeer, 1774): 328. (*Elater*).

Elater bructeri Panzer, 1795: 243.

Elater minutus Paykull, 1800: 40. [HN], not *Elater minutus* Linnaeus,
1758.

Elater nitidus Gmelin, 1790: 1915.

Limonius pusillus Sahlberg, 1900: 17.

Diagnosis

From small black, true *Limonius*, this genus can be distinguished by the prosternal sutures never grooved anteriorly and the posteriorly pointed scutellum (similar to Fig. 4.47). Additionally, both the male genitalia (Fig. 4.46) and the female internal genitalia (Fig. 4.45) distinguish this genus. This genus is very closely related to the new genus *Tetralimonius*, whose members were previously placed here. In addition to the genitalic characters, *Pheletes* can be distinguished from *Tetralimonius* by the carinate hind angles, simple pronotal punctation, and the narrowly open procoxal cavities (Fig. 4.44). The larvae of *Pheletes* possess unique mandibles, bearing three cusps anterad the retinaculum

(Fig. 4.68), which readily separates them from *Limonius* which has a mandible with a single point anterad the retinaculum (Fig. 4.65). Larvae have a tridentate nasale on the frontal clypeal area (Fig. 4.63) similar to true *Limonius* (Fig. 4.62).

Generic Description

Piceous, relatively small, 3.5–7mm in length, shining. Head with simple, well-spaced, punctures; frons with center bulbous and surrounded by faint triangular impression; frontal margin entire, narrowly carinate, broadly arcuate when viewed anteriorly. Antennae with 2nd antennomere subcylindrical, slightly wider than 3rd and subequal to or shorter than 3rd, 3rd subcylindrical, slightly shorter than or subequal to 4th, 4th to 10th antennomeres weakly serrate, almost filiform in *P. lecontei*, 11th ovoid. Pronotum as wide as long or wider than long, anterior angles not expanded; hind angles moderately wide at base, with single carina, acute at tip and weakly divergent at most; posterior margin lacking basal incisures and basal notch; prosternal sutures double, not grooved anteriorly; posterior margin of hypomeron slightly sinuate at most; prosternal process weakly expanded laterally; procoxal cavities narrowly opened (Fig. 4.44). Scutellum sub-pentagonal, sometimes appearing sub-triangular, medially convex (*P. aeneoniger*) or relatively flat (*P. lecontei*). Mesepisternum not reaching mesocoxal cavity. Abdomen with lateral micro-serrations on each ventrite. Legs slender, tarsomeres simple, with dense setal pads ventrally; claws simple, lacking setae. Male genitalia with medial lobe wide, parameres relatively wide, well sclerotized, with apical expansion, not membranous near apex (Fig. 4.46). Female internal genitalia with uterus bearing two

distinct colleterial glands and a band of distinct sclerotization; bursa copulatrix long, ending in bulbous area, with tubular extension (duct to spermatheca of Becker 1956) arising from end with accessory gland or diverticulum at base, base of glands surrounded by sclerotized ring (Fig. 4.45); medial accessory gland sometimes arises at mid-length of spermatheca.

Discussion

These two species have been compared several times. Becker (1956) compared the female internal genitalia, finding them to be very similar (Fig. 4.45), and suggested they formed a natural group. Male genitalia are also similar between these two species (Fig. 4.46). Lanchester (1941) and Glen (1950) compared the larvae, also stating that these two species likely represent a distinct group, based on the unique larval mandibles and the presence of stemmata. With the characters of the female internal genitalia, and the characteristic larvae (Figs. 4.55 and 4.60), the recognition of *Pheletes* as a distinct genus is well supported. Larvae have been collected from moss (Glen 1950).

The disjunct distribution of these species, one found across Europe and the other limited to the Pacific Northwest of North America, should be explored. It could be a product of misidentification of a related species as a member of another genus in the *Limoni* genus-group, or a lack of collecting in the areas between (Northern Asia). It may also be that these two species are relict populations of a group that had a much broader distribution in the past. With this recognition of the similarity between these two species, these questions can now be explored.

Tetralimonius New Genus. 7 species

Type species: *Limonius ornatulus* LeConte, 1857: 46.

Nearctic Species, 5 Species

Tetralimonius definitus (Ziegler, 1845): 268 (*Limonius*) **new combination.**

Tetralimonius humeralis (Candèze, 1860): 402 (*Limonius*) **new combination,**
removed from synonymy.

Tetralimonius maculicollis (Motschulsky, 1860): 372 (*Limonius*) **new**
combination, removed from synonymy.

Limonius discicollis Candèze, 1865: 49.

Tetralimonius nimbatus (Say, 1825): 265 (*Elater*) **new combination.**

Limonius infernus LeConte, 1853: 434.

Tetralimonius ornatulus (LeConte, 1857): 46 (*Limonius*) **new combination.**

Palaearctic Species, 2 Species

Tetralimonius quercus (Olivier, 1790): 51. (*Elater*) **new combination.**

Pheletes candezei Buysson, 1888: cxxii.

Elater lythroides Germar, 1813: 129.

Limonius nigricollis Schilsky, 1888: 187.

Pheletes soldarii Buysson, 1902: 284.

Corymbites testaceus Schilsky, 1888: 187.

Tetralimonius reitteri (Gurjeva, 1976): 195. (*Pheletes*) **new combination.**

Diagnosis

This genus can be readily differentiated from the other *Limonius* genus-group members by the short, truncate pronotal hind angles, posteriorly pointed scutellum (Fig. 4.47), nearly closed pronotal coxal cavities (Fig. 4.48), female uterus bearing two spinose sclerotizations (Fig. 4.50, inset), and the parameres of the male aedeagus lacking apical expansions (Figs. 4.51–4.53). *Tetralimonius* is most similar to *Pheletes*, which shares a sub-pentagonal scutellum, but differs in all other characters that diagnose *Tetralimonius*. *Pheletes* species also have simple and sparse pronotal punctation laterally, whereas all *Tetralimonius* species have umbilicate and close lateral pronotal punctation.

Tetralimonius species possess a partially closed mesocoxal cavity (Fig. 4.49), similar to genera in the tribe Hypnoidini. This character is also shared by some species in *Limonius*, including the type species (Fig. 4.25), and species in *Pheletes*. This character should be reevaluated as to its usefulness in defining genera or tribes (*e.g.* Kishii 1987).

Description

Testaceous to piceous, pronotum and elytra often distinctly bicolored, relatively small, around 3.5–7mm in length, dull to shining. Head with umbilicate and close punctures; frons flat to subtly impressed; frontal margin entire, narrowly carinate, straight and weakly projecting. Antennae with 2nd antennomere subcylindrical, noticeably wider than 3rd and subequal to or slightly longer than 3rd, 3rd subcylindrical, shorter than 4th,

sometimes just slightly shorter, ratio of length of 2nd + 3rd to 4th variable, 4th to 10th antennomeres weakly serrate, sometimes almost filiform, 11th ovoid. Pronotum as wide as long, anterior angles not expanded; hind angles wide at base not extending past posterior edge of pronotum, a faint single carina is visible in some species but is parallel and close to lateral pronotal carina as to appear absent at first glance, tip truncate; posterior margin lacking basal incisures and basal notch; prosternal sutures double, weakly grooved anteriorly, but not excavated to receive antennae; posterior margin ear-like, not emarginate; prosternal process expanded laterally; procoxal cavities closed posteriorly by expansions of hypomeron and prosternal process so only a line is visible (Fig. 4.48). Scutellum sub-pentagonal, posteriorly pointed (Fig. 4.47), relatively flat. Mesepisternum not reaching mesocoxal cavity (Fig. 4.49). Abdomen with lateral micro-serrations on each ventrite. Legs slender, tarsomeres simple, with dense setal pads ventrally; claws simple, lacking setae. Male genitalia with a narrow aedeagus and parameres lacking apical expansions (Figs. 4.51–4.55). Female internal genitalia with uterus bearing two colleterial glands and two spinose sclerotized sections (Fig. 4.50), bursa copulatrix with narrow tube attaching to uterus, expanding apically, with medial accessory gland, and terminating into long tubular extension with basal accessory gland or diverticulum.

Etymology. The name *Tetralimonius* is derived from the combination of *Tetra-* due to the nearly quadrate pronotum possessed by the species in this genus and *Limonius* to recognize the historic ties to this genus.

Key to Species

1. Anterior one-fourth of elytra, including humeral angle, orange-yellow, rarely with infusate line along lateral edge of humeral angle; Nearctic..... 2
 - Anterior one-fourth of elytra unicolorous, remainder brown to black, rarely with indistinct light spot not reaching lateral edges of elytra; Holarctic 3

2. Elytron pattern variable, never with striae 1 and 2 completely piceous (Figs. 4.60 and 4.61); size generally larger, 6–7mm; parameres relatively wide and truncate basally, basal piece with membranous area short and triangular (Fig. 4.51) *Tetralimonius ornatulus*
 - Elytron with striae 1 and 2 completely piceous (Fig. 4.56); size generally smaller, 4.5–6mm; parameres relatively narrower, basal piece with membranous area moderate and U-shaped (Fig. 4.52)
..... *Tetralimonius humeralis*

3. Palearctic region..... 4
 - Nearctic region..... 5

4. Pronotal disc with sparse punctation, separated by diameter of a puncture or more; male antennae reaching posterior edge of pronotum, antennomeres 4–10 1.8× as long as wide; body piceous, with antennal base, part of legs, and sometimes the anterior and posterior edges of pronotum and posterior margin

of hypomeron yellow-brown; 5.5–6mm in length; Europe and Syria

..... *Tetralimonius quercus*

- Pronotal disc with dense punctation separated by less than diameter of puncture; male antennae not reaching posterior edge of pronotum, antennomeres 4–10 1.5× as long as wide; body piceous, with entire antenna, legs, anterior and posterior margin of pronotum, and medial and posterior edges of hypomeron pale yellow; 6mm in length; Mongolia and China (Inner Mongolia)..... *Tetralimonius reitteri*

- 5. Hind angles and posterior edges of pronotum distinctly lighter colored dorsally; punctures on pronotum variable, Eastern or Western North America .
..... 6

- Posterior edge of pronotum only subtly lighter colored; punctures on pronotum very close, nearly touching throughout; aedeagus as in Fig. 4.54; Eastern North America *Tetralimonius definitus**

- 6. Pronotal punctation very close, nearly touching on disc; size generally larger, 5–6mm; parameres elongate, basal piece with large membranous area (Fig. 4.53), Western North America.....
..... *Tetralimonius maculicollis* (Figs. 4.58 and 4.59)

- Pronotal punctation close, but not nearly touching on disc, with shining interspaces visible; size generally smaller, 3.5–5mm; aedeagus as in Fig. 4.55; Eastern North America *Tetralimonius nimbatus* (Fig. 4.57)

* = some specimens of *T. humeralis* will key out here excepting the distribution and genitalia. They can be distinguished by small, indistinct spots on the base of each elytra (Fig. 4.59). Based on the few specimens I have examined, it is unclear if this variation represents a cryptic species or is just variation.

Discussion

These species have traditionally been considered to be congeneric with *Pheletes*, due to the lack of strong apical grooves on the prosternal sutures. However, previous studies of female internal genitalia (Becker 1956) suggested that they be recognized as a distinct group. This genus is Holarctic, with most of the diversity on the Pacific coast of North America. It is very likely that there are species undescribed in Northeast Asia, or that are placed in a different genus.

I have also rejected the synonymies proposed by Al Dhafer (2009) for *T. ornatulus*. All western North American species possess similar, but distinct, male genitalia (Figs. 4.51–4.53), in addition to other characters that readily distinguish the three Pacific coast species (see key above, and compare Figs. 4.56, 4.58–4.61).

Couplet 4, which separates the Palearctic species *T. quercus* and *T. reitteri*, is adapted from Gurjeva's (1976) key to species. There appears to be variation in *T. quercus*

that deserves a more thorough examination. Some specimens are nearly entirely piceous, while others have the posterior margin of the pronotum, and parts of the legs and antennae yellow-brown. These color patterns either represent intraspecific variation, or a complex of species confused under the name *T. quercus*.

Species Previously Removed from *Limonius*

Microdesmes Candèze, 1882 is the correct genus for Australian species formerly placed in *Limonius* (Calder 1996). The species *Limonius angulatus* Carter, 1939 (= *Microdesmes angulatus*) is a junior primary homonym of *Limonius angulatus* Motschulsky, 1859 (= *Gambrinus angulatus*). The replacement name *Microdesmes carteri* Etzler **new replacement name** is proposed for this name.

The following North American species were described in *Limonius* but have been removed (see Van Dyke 1932 for explanations):

Limonius cribricollis Horn, 1874 – synonym of *Melanotus longulus* LeConte, 1853.

Limonius estriatus LeConte, 1853 – moved to *Eanus* LeConte, 1861.

Limonius ornatipennis LeConte, 1861 – moved to *Athous*.

Limonius posticus Melsheimer, 1844 – moved to *Athous*.

Limonius quadrimaculatus Horn, 1871 – moved to *Megapenthes* Kiesenwetter, 1863.

Limonius vagus LeConte, 1853 – synonym of *Eanus decoratus* (Mannerheim, 1853).

The name *Limonius resplendens* Eschscholtz, 1829 appears in Majka and Johnson 2008 when designating the type species of *Nitidolimonius* Johnson, 2008, and is stated to be the original combination. The correct original combination is *Ludius resplendens* Eschscholtz, 1829.

Palaearctic species that were previously removed from *Limonius* can be found in Cate (2007).

Conclusions

While this work does not cover the species level for most genera, it is the first work since Candèze 1860 to propose a global classification for all described species of *Limonius sensu lato*. It is hoped that this work improves the taxonomic confusion surrounding this group. Although no phylogeny of the group has been proposed, this work provides a starting point for study of evolutionary relationships in this group.

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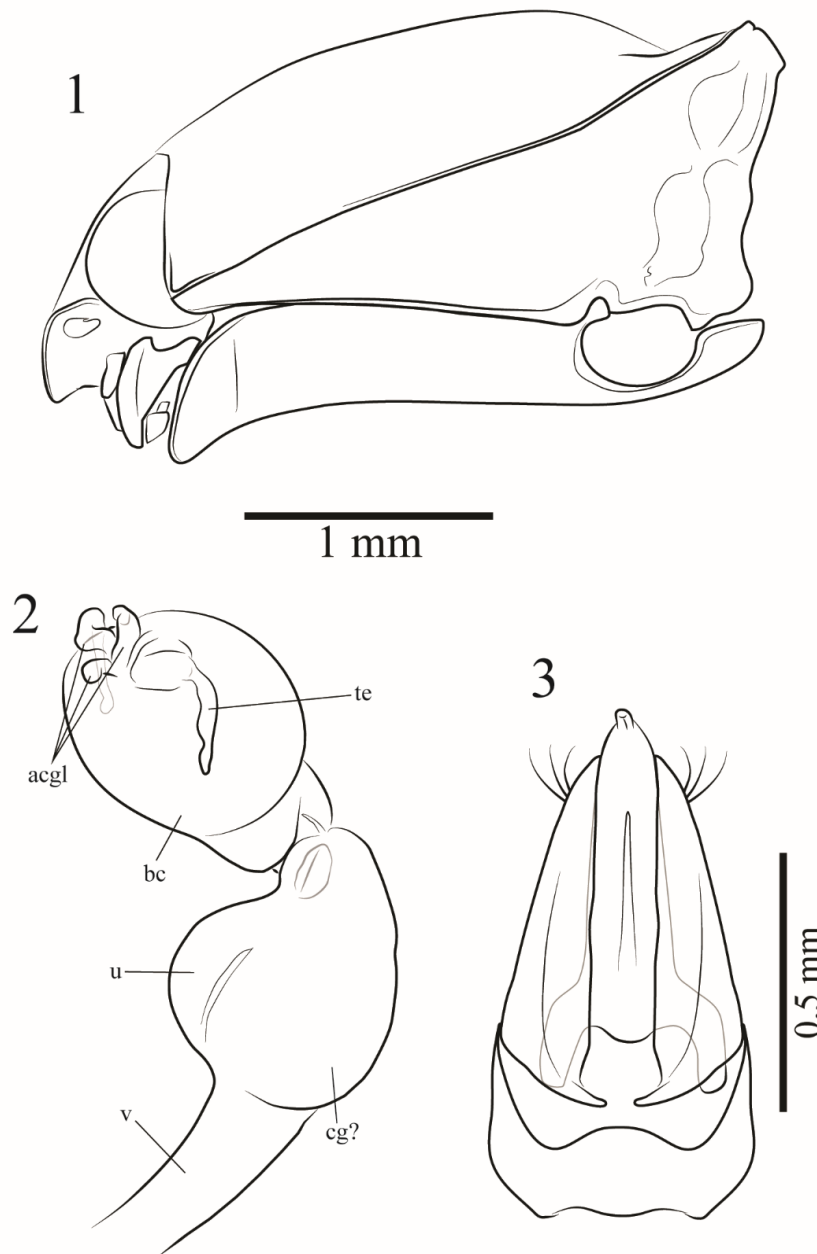


Figure 4.1. *Elathous nebulosus*, lateral view of pronotum. Notice posterior margin of hypomeron.

Figure 4.2. *E. nebulosus*, female internal genitalia. acgl: accessory gland; bc: bursa copulatrix; cg: colleterial gland; te: tubular extension (likely connects to spermatheca (Becker 1956)); u: uterus; v: vagina; labeling follows Han et al. 2012. The bursa copulatrix is lightly sclerotized.

Figure 4.3. *E. nebulosus*, aedeagus, ventral view.

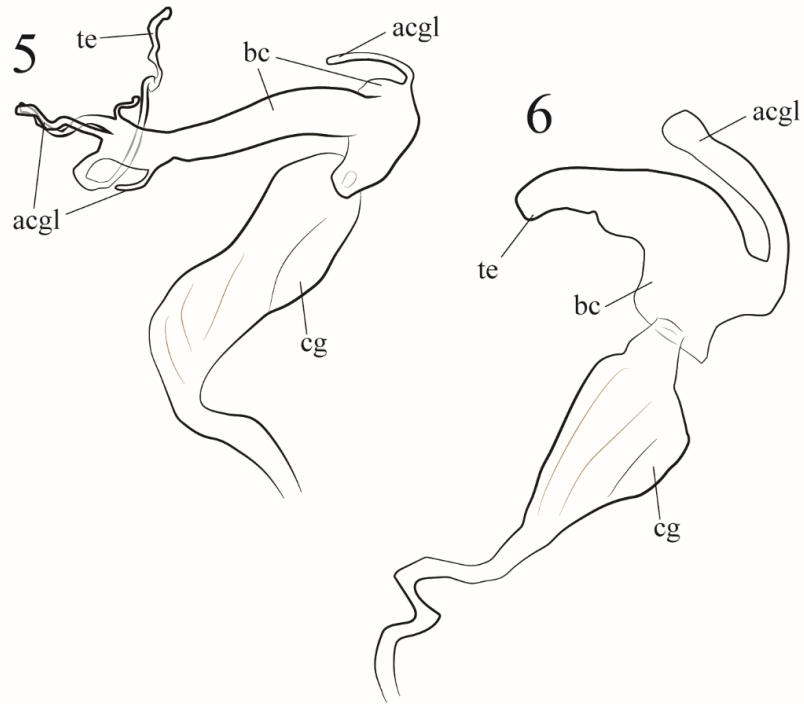
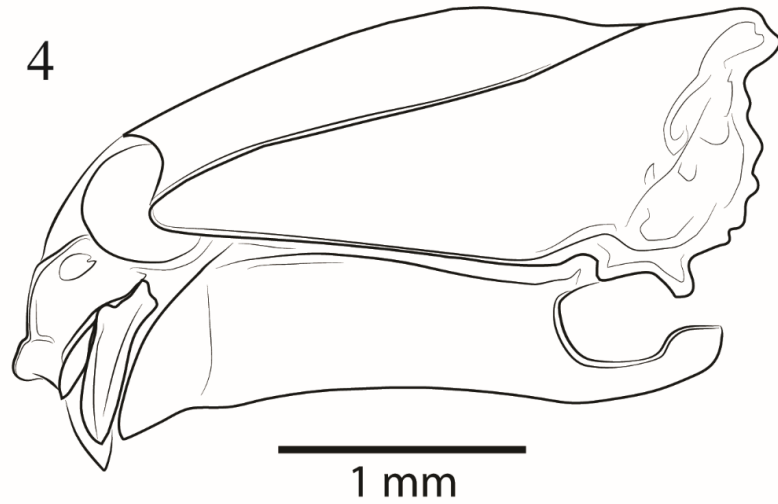


Figure 4.4. *Gambrinus rufihumeralis*, lateral view of pronotum. Notice posterior margin of hypomeron.

Figure 4.5. *G. rufihumeralis*, female internal genitalia. acgl: accessory gland; bc: bursa copulatrix; cg: colleterial gland; te: tubular extension; u: uterus; v: vagina. Compare with Fig. 8c in Han et al. 2012 and Fig. 14 in Becker 1956. Base of bursa copulatrix weakly sclerotized.

Figure 4.6. *G. griseus*, female internal genitalia. Bursa copulatrix weakly sclerotized.

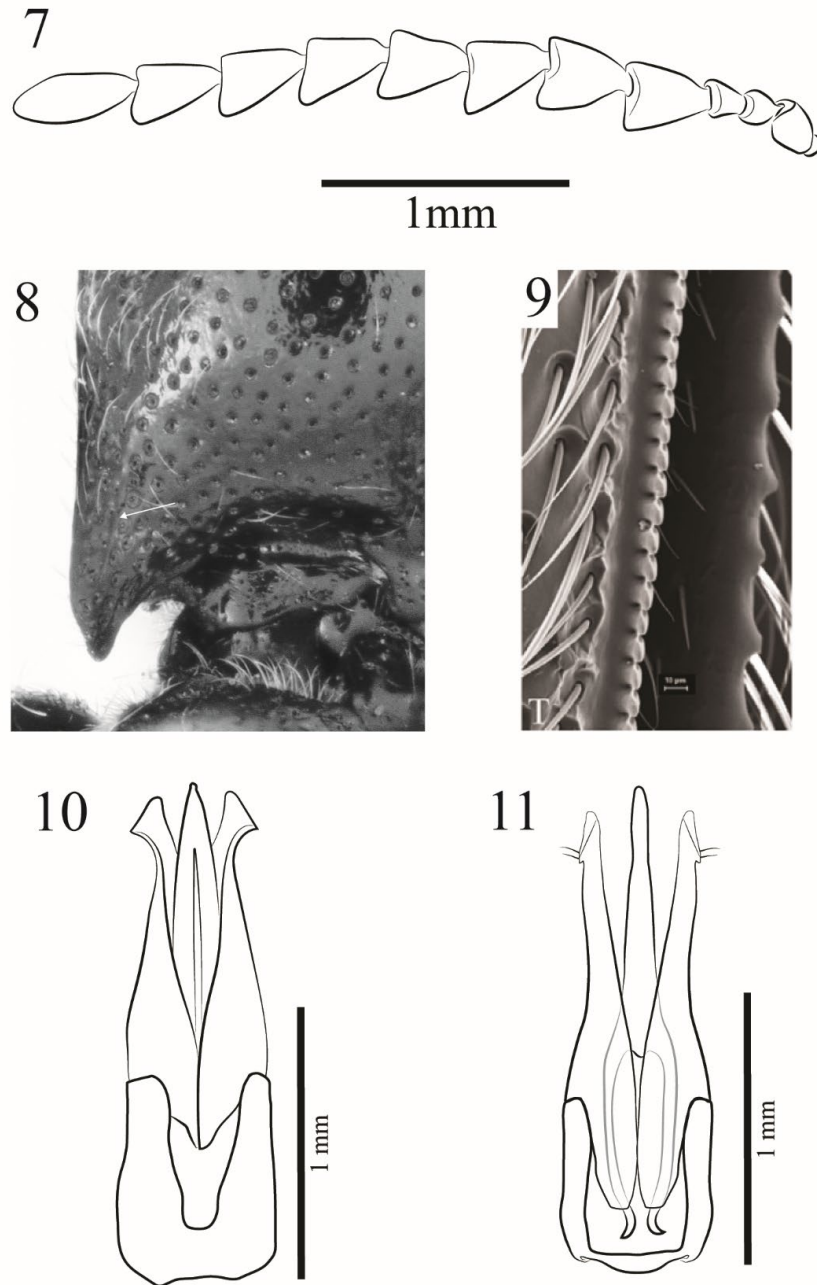


Figure 4.7. *Gambrinus stigma*, right antenna.

Figure 4.8. *G. stigma*, left pronotal hind angle, dorsal view. Note the faint carina, arrow.

Figure 4.9. *G. kraatzii*, lateral microserrations on abdominal ventrites. Fig. 7T, Han et al. 2012.

Figure 4.10. *G. griseus*, aedeagus, ventral view. *G. griseus* species-group.

Figure 4.11. *G. rufihumeralis*, aedeagus, ventral view. *G. stigma* species-group.

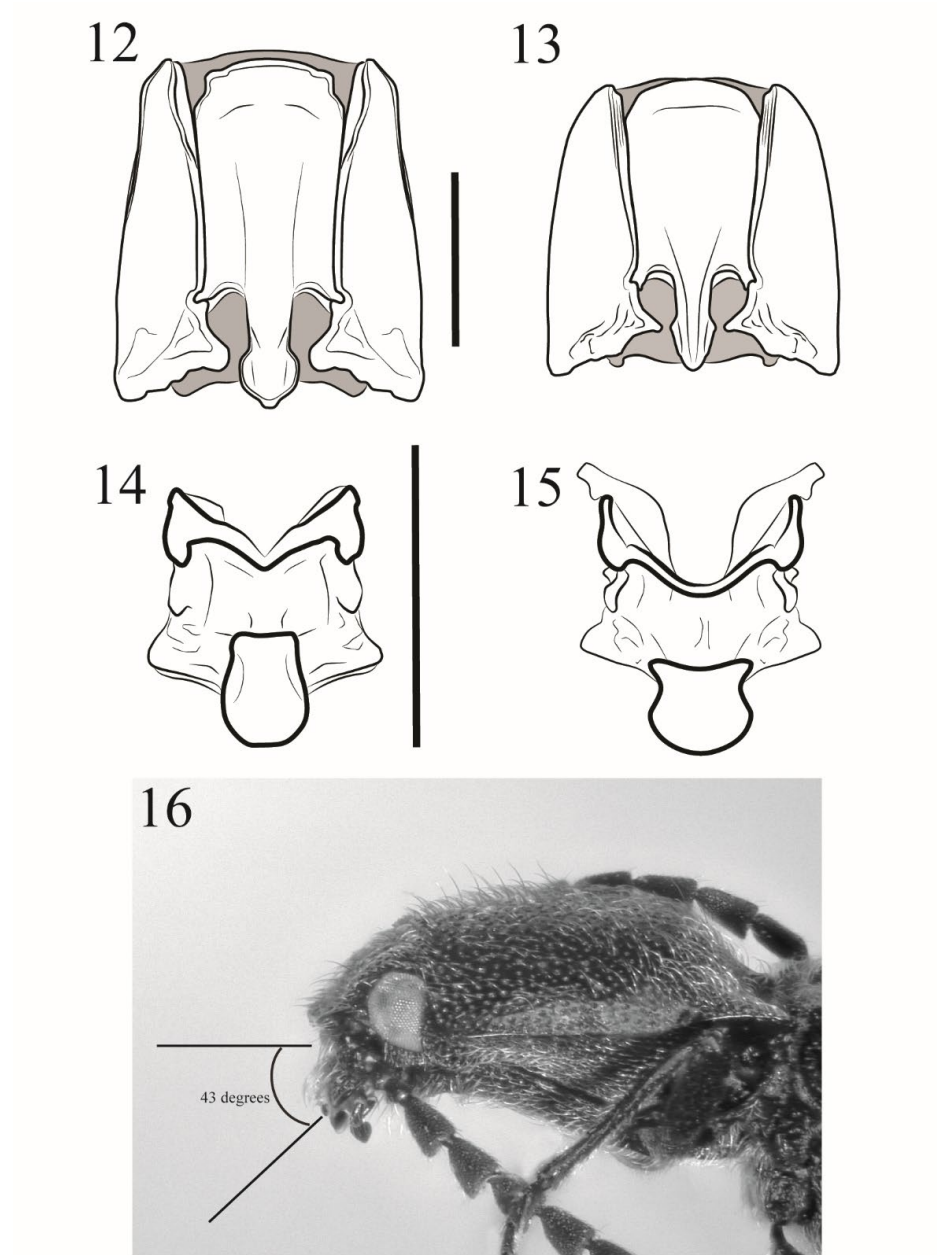


Figure 4.12. *Limonius minutus*, procoxal cavity. Narrowly open. Line is 1 mm, and is the same for Fig. 13.

Figure 4.13. *L. consimilis*, procoxal cavity. Narrowly open.

Figure 4.14. *L. minutus*, oblong scutellum. Line is 1 mm, and is the same for Fig. 15.

Figure 4.15. *L. consimilis*, subquadrate scutellum.

Figure 4.16. Orientation of mouth parts in *L. minutus*. Orientation of most species is around 45°.

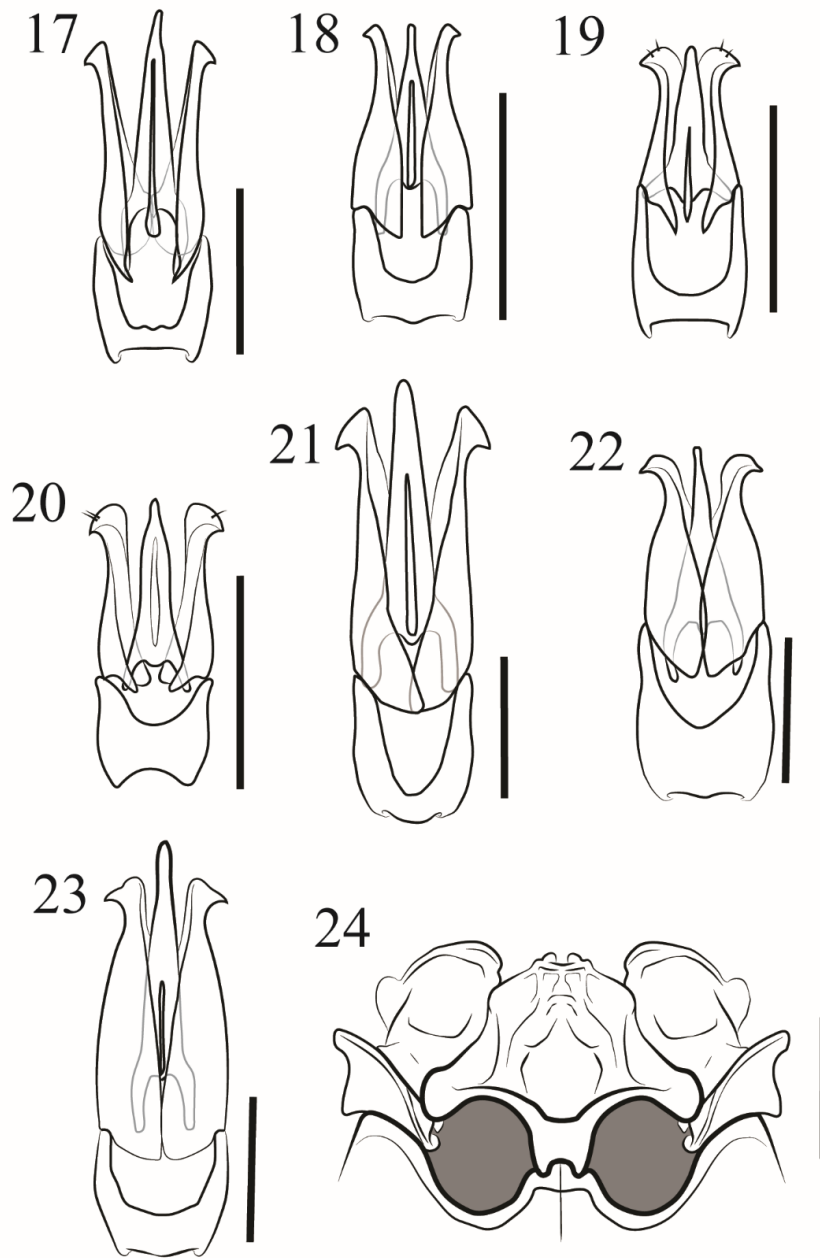


Figure 4.17. *Limonius minutus*, aedeagus. Minutus species-group. Scale bar equals 1mm.

Figure 4.18. *L. aeger*, aedeagus. Parvulus species-group. Scale bar equals 1mm.

Figure 4.19. *L. parvulus*, aedeagus. Parvulus species-group. Scale bar equals 1mm.

Figure 4.20. *L. consimilis*, aedeagus. Consimilis species-group. Scale bar equals 1mm.

Figure 4.21. *L. pilosus*, aedeagus. Pilosus species-group. Scale bar equals 1mm.

Figure 4.22. *L. agonus*, aedeagus. Canus species-group. Scale bar equals 1mm.

Figure 4.23. *L. subauratus*, aedeagus. Canus species-group. Scale bar equals 1mm.

Figure 4.24. *L. minutus* mesocoxal cavity. Scale bar equals 1mm.

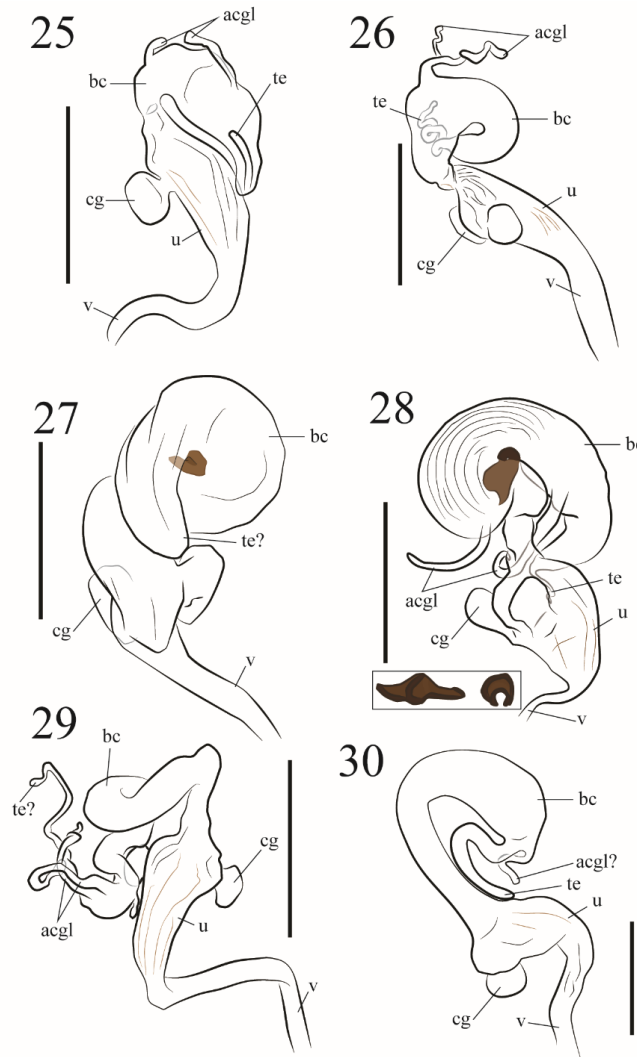


Figure 4.25. *Limonius basilaris*, internal female internal genitalia. acgl: accessory gland; bc: bursa copulatrix; cg: colleterial gland; te: tubular extension; u: uterus; v: vagina. Base of bursa copulatrix weakly sclerotized. Type A; Minutus species-group. Compare with Figs. 6b and 6c in Han et al. 2012.

Figure 4.26. *L. aeger*, internal female internal genitalia. Bursa copulatrix weakly sclerotized. Type B; Parvulus species-group. Compare with Fig. 6d in Han et al. 2012.

Figure 4.27. *L. quercinus*, internal female internal genitalia. Type C; Parvulus species-group.

Figure 4.28. *L. parvulus*, internal female internal genitalia. Type C/ F; Parvulus species-group. Bursa copulatrix weakly, but noticeably, sclerotized at base (noted by lines) Inset: Sclerotization of bursa copulatrix; view from colleterial gland side, left; lateral view, right.

Figure 4.29. *L. consimilis*, internal female internal genitalia. Type E; Consimilis species-group. Compare with Figs. 3b and 3c in Han et al. 2012.

Figure 4.30. *L. brevis*, internal female internal genitalia. Type D; Parvulus species-group.

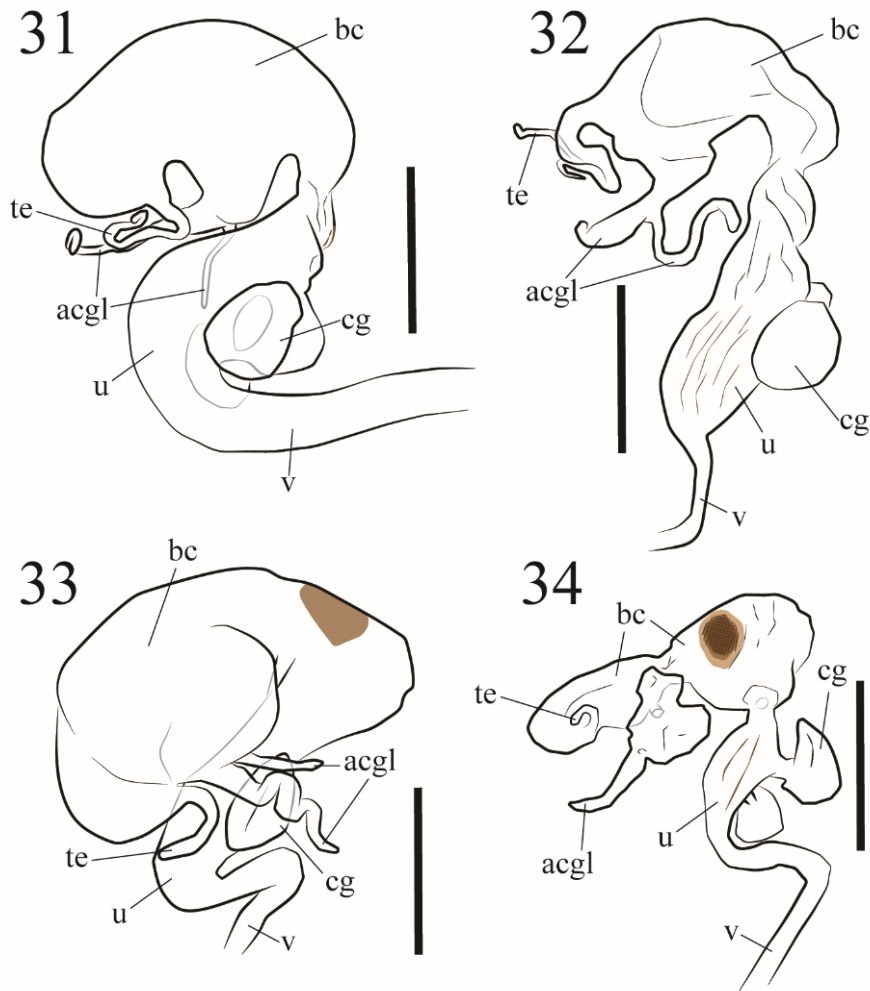


Figure 4.31. *Limonius aeruginosus*, internal female internal genitalia. Bursa copulatrix weakly sclerotized. Type F; *L. canus* species-group. acgl: accessory gland; bc: bursa copulatrix; cg: colleterial gland; te: tubular extension; u: uterus; v: vagina.

Figure 4.32. *L. longicornis*, internal female internal genitalia, Punjab, identified by association with male. Bursa copulatrix weakly sclerotized.

Figure 4.33. *L. dubitans*, internal female internal genitalia. Bursa copulatrix weakly sclerotized. Compare with Fig. 13 in Becker 1956.

Figure 4.34. *L. infuscatus*, internal female internal genitalia. Bursa copulatrix weakly sclerotized.

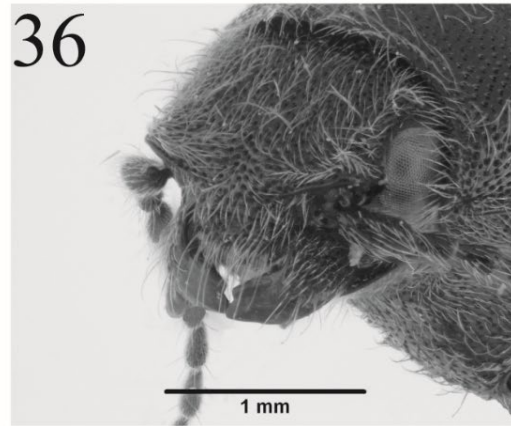
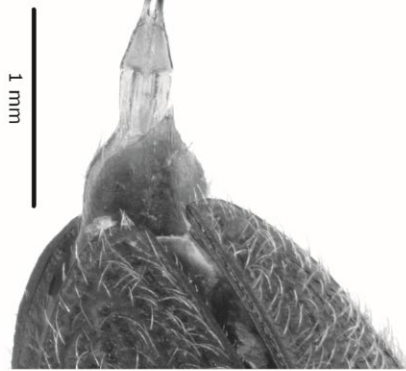


Figure 4.35. Complete frontal margin, *Limonius infuscatus*. In *Canus* species-group.
 Figure 4.36. Frontal margin interrupted medially, *L. dubitans*. In *Canus* species-group
 and type species of *Nothodes*.



Figure 4.37. Weakly grooved anterior ends of prosternal sutures, *Limonius canus*. White
 arrow points to groove.
 Figure 4.38. Anterior ends of prosternal sutures nearly entirely closed, *L. subauratus*.
 White arrow points to where groove is present on other species.

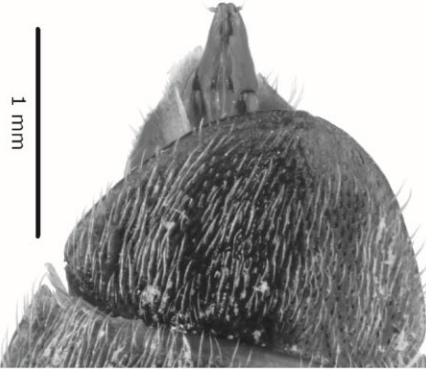
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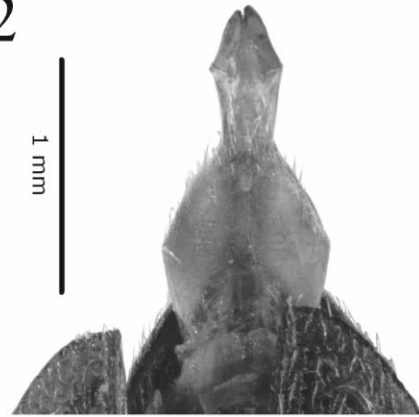


Figure 4.39. Weakly sclerotized ovipositor, *Limonius infuscatus*. In Canus species-group. This is the typical ovipositor for most species in *Limonius* and related genera. Compare with Fig. 6a in Han et al. 2012.

Figure 4.40. Drawing of weakly sclerotized ovipositor, to highlight detail.

Figure 4.41. Moderately sclerotized ovipositor, *L. californicus*. In Canus species-group.

Figure 4.42. Heavily sclerotized ovipositor, *L. canus*. In Canus species-group. Also found in *L. auruginosus*.

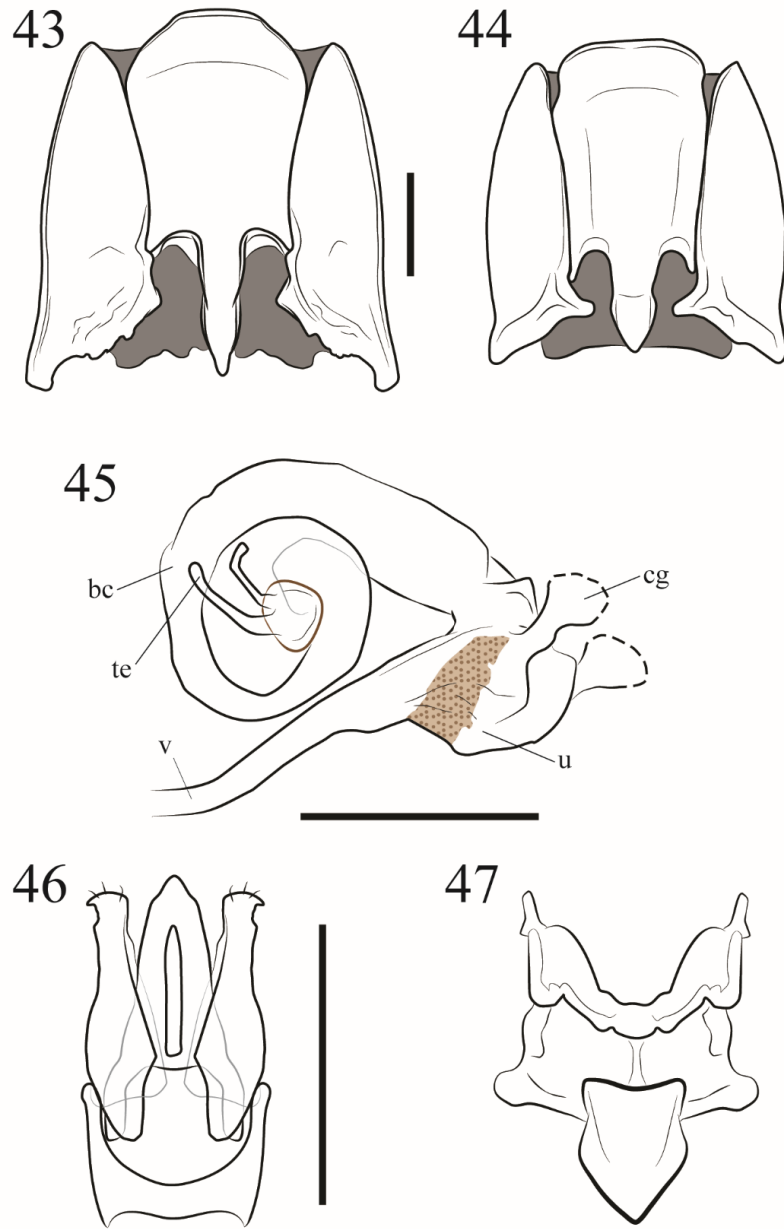


Figure 4.43. *Hemicrepidius memnonius*, procoxal cavity. Not narrowed by expansion of prosternal process. Scale bar equals 1 mm.

Figure 4.44. *Pheletes aeneoniger*, procoxal cavity. Partially narrowed with weak expansion of prosternal process. Not to scale.

Figure 4.45. *P. lecontei*, internal female genitalia. Compare with Fig. 12 in Becker 1956. Bursa copulatrix weakly sclerotized. Scale bar equals 1 mm. Colleterial gland size is estimated in figure due to being damaged. The accessory gland noted by Becker (1956) was not seen in the examined specimen.

Figure 4.46. *P. lecontei*, aedeagus. Scale bar equals 0.5 mm.

Figure 4.47. Pentagonal scutellum. *Tetralimonius ornatipennis*. Not to scale.

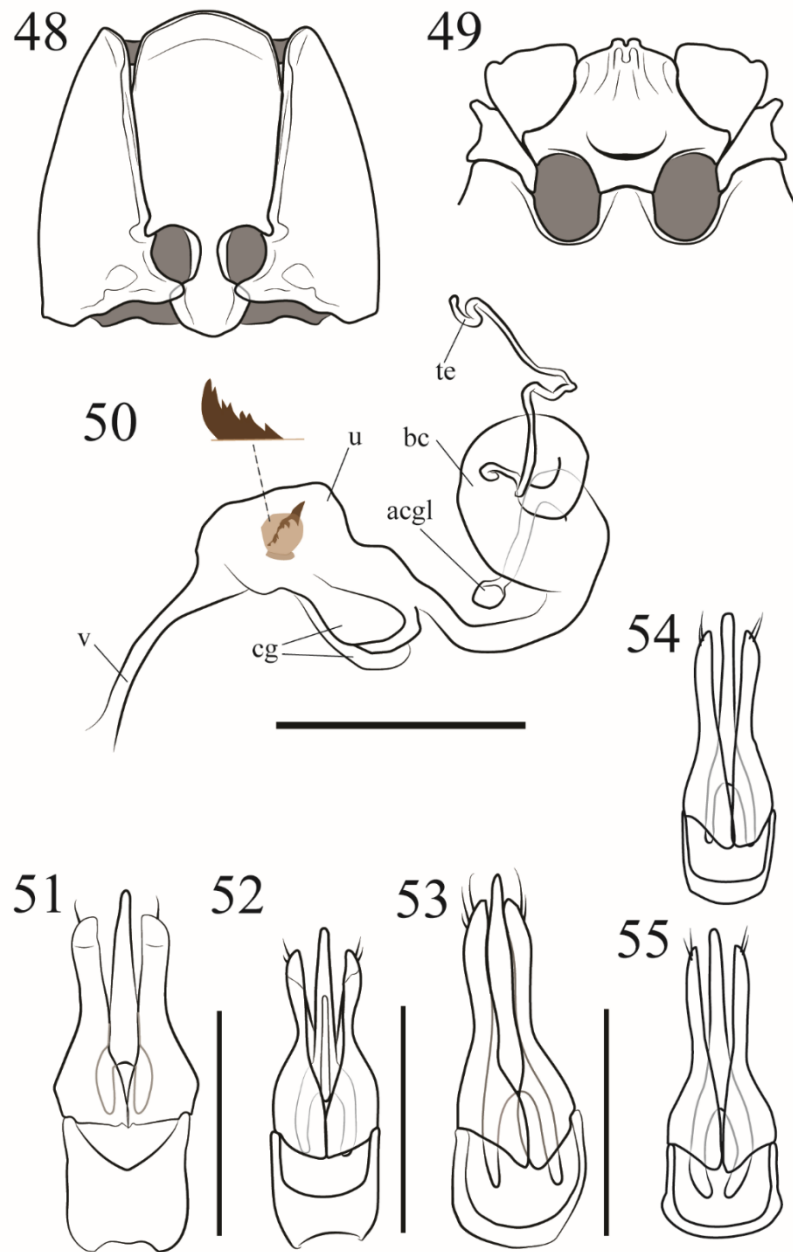


Figure 4.48. Procoxal cavity nearly closed. *Tetralimonius ornatipennis*

Figure 4.49. *T. ornatipennis*, mesocoxal cavity.

Figure 4.50. *T. humeralis*, internal female genitalia. Bursa copulatrix is weakly sclerotized. Compare to Fig. 11 in Becker 1956, and illustration of sclerite in Fig. 131 in Laibner 2000. Inset: one sclerite of uterus. Scale bar equals 1mm.

Figure 4.51. *T. ornatipennis*, aedeagus, ventral view. Scale bar equals 0.5mm.

Figure 4.52. *T. humeralis*, aedeagus, ventral view. Scale bar equals 0.5mm.

Figure 4.53. *T. maculicollis*, aedeagus, ventral view. Scale bar equals 0.5mm.

Figure 4.54. *T. definitus*, aedeagus, ventral view. Scale bar equals 0.5mm.

Figure 4.55. *T. nimbatus*, aedeagus, ventral view. Scale bar equals 0.5mm.

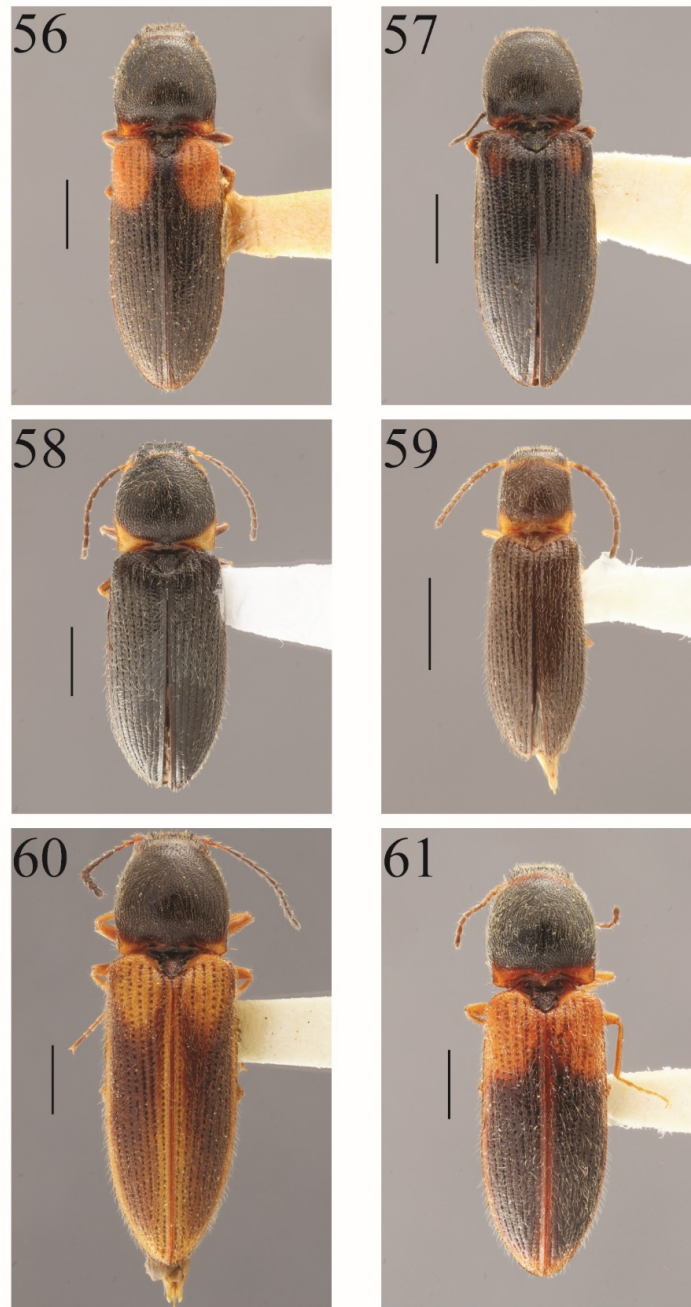


Figure 4.56. *Tetralimonius humeralis*, dorsal habitus. Scale bar equals 1mm.
Figure 4.57. *T. humeralis*, color variation, dorsal habitus. Scale bar equals 1mm.
Figure 4.58. *T. maculicollis*, dorsal habitus. Scale bar equals 1mm.
Figure 4.59. *T. nimbatus*, dorsal habitus. Scale bar equals 1mm.
Figure 4.60. *T. ornatulus*, dorsal habitus. Scale bar equals 1mm.
Figure 4.61. *T. ornatulus*, color variation, dorsal habitus. Scale bar equals 1mm.

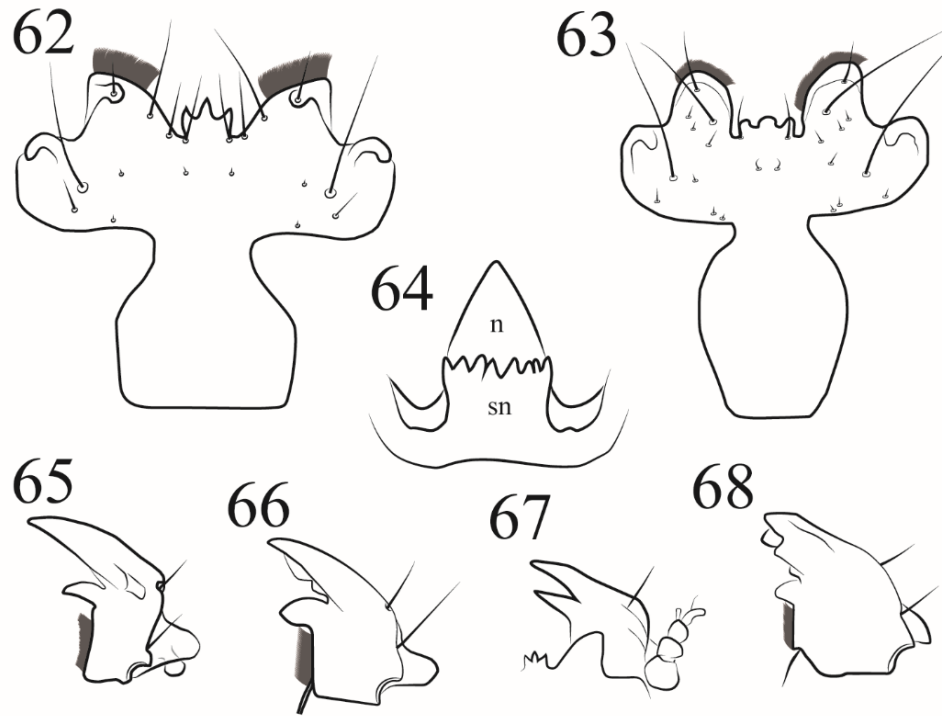


Figure 4.62. *Limonius dubitans*, larva, frontal clypeal area, dorsal view. After Fig. 32a in Glen 1950.

Figure 4.63. *Pheletes aeneoniger*, larva, frontal clypeal area, dorsal view. After Fig. 30a in Glen 1950.

Figure 4.64. *Limonius pilosus*, larval nasale, ventral view. After Fig. 30g in Glen 1950. n= nasale; sn = subnasale.

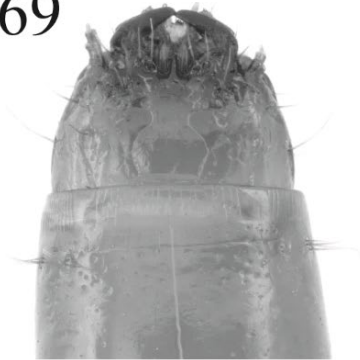
Figure 4.65. Right larval mandible of *L. dubitans* larva. After Fig. 32b in Glen 1950. Compare with Fig. 91a in Dolin 1978.

Figure 4.66. Right larval mandible of *L. pilosus* larva. After Fig. 30e in Glen 1950.

Figure 4.67. Right larval mandible of *L. hirtus* larva. Dolin uses this character to define his genus *Solskyana*. Adapted from Fig. 93a in Dolin 1978.

Figure 4.68. Right larval mandible of *P. aeneoniger* larva. After Fig. 30c in Glen 1950. Compare to Fig. 97a in Dolin 1978.

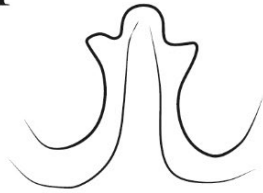
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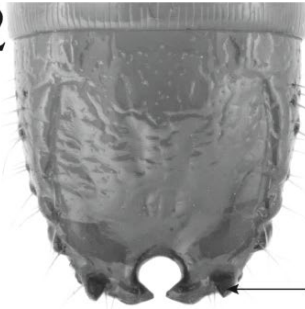


Figure 4.69. *Limonius californicus*, larval head and pronotum, dorsal view.

Figure 4.70. *L. californicus*, larval head and pronotum, ventral view. Note undivided prosternum.

Figure 4.71. Close-up illustration of nasale in Fig. 4.69. *L. californicus*.

Figure 4.72. *L. californicus*, larval ninth abdominal segment. Urogomphal prongs (black arrow) are often small tubercles in other species, such as *L. aeger*.

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CHAPTER FIVE

REVISION OF THE GENUS *HEMICREPIDIUS* GERMAR, 1839
(COLEOPTERA, ELATERIDAE) OF
THE NEW WORLD

Contribution of Authors and Co-Authors

Manuscripts in Chapters 2, 3, 4, and 5

Author: Frank E. Etzler

Contributions: Wrote Manuscript. Analyzed all specimens. Did all dissections. Took all photographs. Analyzed DNA sequences. Prepped all figures.

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Abstract

The world fauna of the genus *Hemicrepidius* Germar, 1839 is redefined and its species revised for North America. A key, diagnoses, illustrations, and synonymical tables to North American species are provided. A total of 39 taxonomic changes are made. *Asaphites* is removed from synonymy with Oxynopterinae and **returned to synonymy** with *Hemicrepidiina*. *Yukara* Kishii, 1962 and *Medakathous* Kishii, 1964 are **returned to synonymy** with *Hemicrepidius*. *Barrelater* Johnson, 2014 is placed as a **new synonym** of *Hemicrepidius*, and *Barrelater audreyae* Johnson, 2014 placed as *Hemicrepidius audreyae* (Johnson) **new combination**. Two species are described: *Hemicrepidius brooksi* Etzler **new species** (western North America) and *Hemicrepidius mescalero* Etzler **new species** (New Mexico). Three species are removed from synonymy and recognized as valid species: *Hemicrepidius decoloratus* (Say, 1863) **status resurrected**, *Hemicrepidius melanophthalmus* (Melsheimer, 1846) **status resurrected**, and *Hemicrepidius ruficornis* (Kirby, 1837) **status resurrected**. Five species in Eurasia are returned to *Hemicrepidius* from other genera, *Hemicrepidius amami* Kishii, 1985 **return to combination**, *Hemicrepidius dauricus* (Mannerheim, 1852) **return to combination**, *Hemicrepidius inornatus* (Lewis, 1894) **return to combination**, *Hemicrepidius jactatus babai* (Ohira, 1956) **return to combination**, and *Hemicrepidius jactatus jactatus* (Lewis, 1894) **return to combination**. Two species are removed from *Megathous* Reitter, 1905 and placed in *Hemicrepidius*, *Hemicrepidius jacobsoni* (Reitter, 1905) **new combination** and *Hemicrepidius nigerrimus* (Desbrochers des Loges, 1869)

new combination, and five Southeast Asian species are removed from *Athous* Eschscholtz, 1829 and placed in *Hemicrepidius*, *Hemicrepidius birmanicus* (Fleutiaux, 1942) **new combination**, *Hemicrepidius ebeninus* (Fleutiaux, 1918) **new combination**, *Hemicrepidius malaisei* (Fleutiaux, 1942) **new combination**, *Hemicrepidius nodieri* (Fleutiaux, 1918) **new combination**, and *Hemicrepidius vitalisi* (Fleutiaux, 1918) **new combination**. Thirteen species of *Hemicrepidius* from Central America are moved to *Athous*, making the following new combinations, *Athous acuminatus* (Champion, 1897) **new combination**, *Athous bivittatus* (Champion, 1897) **new combination**, *Athous candezei* (Champion, 1897) **new combination**, *Athous consanguineus* (Champion, 1897) **new combination**, *Athous consobrinus* (Champion, 1897) **new combination**, *Athous cruciatus* (Champion, 1897) **new combination**, *Athous flavipes* (Candéze, 1863) **new combination**, *Athous germanus* (Champion, 1897) **new combination**, *Athous instabilis* (Candéze, 1863) **new combination**, *Athous nitidus* (Champion, 1897) **new combination**, *Athous parvulus* (Champion, 1897) **new combination**, *Athous patruelis* (Champion, 1897) **new combination**, *Athous pictipes* (Chevrolat, 1843) **new combination**. One South American species is removed from *Hemicrepidius* and placed in *Pomachilus* Candéze, 1860, *Pomachilus longipennis* (Candéze, 1863) **new combination**. *Asaphes longicollis* Candéze, 1863 is **reduced to synonymy** with *Athous deceptor* (Candéze, 1863) **new combination, status resurrected**, the next available name for the species, to prevent secondary homonymy with *Elater longicollis* Olivier, 1790, previously recognized as valid within *Athous*. Two species require new names with the transfer of the species to *Athous*, which are *Athous chiacamensis* Etzler **new name** for

Hemicrepidius biformis Champion, 1897 to prevent a secondary homonymy with *Athous biformis* Redtenbacher, 1859, and *Athous chiriqui* Etzler **new replacement name** for *Hemicrepidius longicornis* Champion, 1897 to prevent secondary homonymy with *Athous longicornis* Candéze, 1865.

Hemicrepidius Germar, 1839, is a Holarctic genus of moderately large elaterids possessing tarsomeres bearing membranous lobes. For most of the history of this genus, it was considered to only occur in the New World, and was only broadly recognized in the Palearctic since the 1980's. However, no global generic concept of *Hemicrepidius* currently exists. The goal of this work is to establish a global generic concept, highlighting the characters that distinguish the genus, and revise the species for the Americas.

Taxonomic History of *Hemicrepidius*

For most of the 19th Century, species now considered *Hemicrepidius* were placed in *Asaphes* Kirby, 1837 (not *Asaphes* Walker, 1834, Hymenoptera). Kirby described *Asaphes* as a subgenus of *Pedetes* Kirby, 1837 (not *Pedetes* Illiger, 1811, Mammalia), for the single species, *Asaphes ruficornis* Kirby, 1837, from Nova Scotia. The modern grouping of species began with LeConte (1853) in his revision of the Elateridae of America. LeConte separated *Asaphes* species from *Athous* Eschscholtz, 1829, and *Pedetes* by the lack of distinct frontal margin, placing *Asaphes* close to species in *Corymbetes* Latreille, 1834 (now considered Prosternini and Selatosomini). LeConte recognized thirteen species in the his *Asaphes*, describing five as new.

A unique and important work on global Elateridae classification was Candeze's monograph series (1857-1863). Candeze placed *Athous* and *Asaphes* quite far from one another in his classification, emphasizing characteristics of the frontal margin. *Athous*

was placed in Section One of Candeze's tribe Élatérides vrais (true Elateridae), with *Pedetes* as a synonym (Candeze 1859, 1860), which included 62 species. Candeze placed *Asaphes* in his Section Two of Élatérides vrais, in its own subtribe (Candeze 1863). He recognized 18 species in the genus, describing nine species, and extending generic membership into northern South America. Unknown to Candeze at the time, Philippi (1861) tentatively placed his *Asaphes amoenus* Philippi, 1861, here, extending the generic distribution to Chile.

Horn (1880) provided the most recent key to species in North America north of Mexico. He recognized 11 species, synonymized four and included three that were described after or missed by Candeze (1863). Champion (1897) recognized 19 species in Central America and Mexico, with 15 described as new. He was the first to note the homonymy of *Asaphes* Kirby and *Asaphes* Walker in Hymenoptera, and to use *Hemicrepidius* in the modern sense. These two works are the last full species keys for their respective regions.

An important but often overlooked work is Schwarz (1902), where he described *Hemicrepidius tonkinensis* Schwarz, 1902, and *Hemicrepidius subpectinatus* Schwarz, 1902, both from the Tonkin region of Vietnam. These two species represent the first recognition of the genus in the Old World and would appear in Schwarz's (1906–1907) catalogue, where *Hemicrepidius* was placed in the tribe Hemicrepidini (tribe 20) with the Chilean genera *Tibionema* Solier, 1851, and *Compsoctenus* Philippi, 1861, and the Australian genera *Asaphoides* Schwarz, 1906 (= *Doloporus* Candeze, 1887) and *Parasaphes* Candeze, 1882, and well separated from *Athous* in the tribe Athouini (tribe

16). *Tibionema*, *Compsoctenus*, *Doloporus*, and *Parasaphes* have subsequently been moved elsewhere in Elateridae by more recent authors (i.e. Calder 1996).

While Schwarz's (1906–1907) work was in progress, Reitter (1905) was revising generic concepts for Palearctic species. By far Reitter's biggest contribution to modern classification was his treatment of genera in the tribe Elaterini, subtribe Athouina (= modern tribe Dendrometrini). Two genera he treated in detail and that are relevant here are *Harminius* Fairmaire, 1851, and *Athous*. He separated *Harminius* from *Athous* based on the former having emarginate posterior margins of the hypomeron and the latter having unemarginated posterior margins of the hypomeron. He divided *Harminius* into three subgenera and *Athous* into 12 subgenera. The *Athous* subgenera were split into two main groups based on the antennal serrations starting on antennomere three (four subgenera including his *Athous* s.str.) or four (the remaining eight subgenera).

Twenty-five years later, Mequinon (1930) reexamined type species for elaterid genera. He discovered that the type species of *Athous* was not *Elater niger* Linnaeus, 1758, as had been thought, but was actually *Elater vittatus* Fabricius, 1792. This meant the subgenus *Grypocrarus* Thomson, 1859, of Reitter (1905) must be synonymized with *Athous*, while *Athous* s.str. of Reitter (1905) was left without a valid name. Mequinon proposed *Pseudathous* Mequinon, 1930, to correct this issue.

An additional layer of complexity was added by Glen (1950) during his study of the then tribe Lepturoidini (part of which is currently subfamily Dendrometrinae). While focused mostly on the species in the genus *Ludius* Eschscholtz, 1829 (now tribes Prosternini and Selatosomini), Glen did look at closely related genera, including *Athous*

and *Hemicrepidius*. He was the first to notice that the larvae of *Athous niger* (Linnaeus) and *Athous hirtus* (Herbst, 1784), both members of the subgenus *Pseudathous*, were clearly congeneric with North American species in the genus *Hemicrepidius*. The placement of these species in *Hemicrepidius* was made official by Becker (1979), when he discussed the new generic placement of species removed from *Athous* during his revision of the genus of the Nearctic.

Kintaro Baba and Hitoo Ôhira (1956) moved some Japanese species of elaterids from *Athous* to *Hemicrepidius*, and used two subgenera. This was the first recognition of the genus in Eurasia since Schwarz (1906–1907).

Becker (1979) defined characters to distinguish the genera he recognized (including *Athous*, *Harminius*, and *Hemicrepidius*), and also noted that Japanese authors had variously recognized as many as six subgenera of *Hemicrepidius*. Becker also synonymized the monospecific genus *Yukara* Kishii, 1962, with *Hemicrepidius*.

In 1987, Kishii treated the Japanese Elateridae fauna. He placed *Hemicrepidius* in a tribe separate from *Athous*. He also recognized *Yukara* as a valid genus, not commenting on Becker's synonymy, and placed it in the same tribe as *Athous*. Kishii also treated *Miwacrepidius* Ohira, 1962 as a subgenus of *Hemicrepidius*.

By 1994, *Hemicrepidius* was recognized broadly by European authors (e.g. Platia 1994) for species once in the *Athous* subgenus *Pseudathous*. Cate (2007) provided the most recent checklist to the Palearctic species, recognizing *Yukara* following Kishii 1987.

In 2015, Philippi's (1861) Chilean species *Asaphes amoenus* was moved from *Hemicrepidius* to the newly erected genus *Sharon* Arias-Bohart and Elgueta, 2015, which they placed in the Oxynopterinae.

Currently, a total of 95 species are recognized in the genus *Hemicrepidius*, with 59 species occurring in Eurasia and 36 occurring in the Americas. Because of confusion in current generic concepts in Eurasia (see Discussion: Classification, below), only the New World species are treated here at the species level.

Material and Methods

A total of around 5,000 specimens were examined from the following collections:

ASUHC – Arizona State University Hasbrouck Insect Collection, Tempe, Arizona, USA.

BMNH – The Natural History Museum, London, United Kingdom.

BYUC – Monte L. Bean Life Science Museum, Brigham Young University, Provo, Utah, USA.

CASC – California Academy of Science Collection, San Francisco, California, USA.

EMEC – Essig Museum of Entomology, University of California, Berkeley, California, USA.

FEEC – Frank E. Etzler Collection, Bozeman, Montana, USA.

FMNH – Field Museum of Natural History, Chicago, Illinois, USA.

FSCA – Florida State Arthropod Collection, Gainesville, Florida, USA.

INHS – Illinois Natural History Survey, Champaign, Illinois, USA.

JMLC – John M. Leavengood Collection, Tampa, Florida, USA.

KESC – Kyle E. Schnepf Collection, Gainesville, Florida, USA.

LSAM – Louisiana State Arthropod Museum, Louisiana State University, Baton Rouge, Louisiana, USA.

MCZC – Museum of Comparative Zoology Collection, Harvard University, Cambridge, Massachusetts, USA.

MTEC – Montana State Entomology Collection, Montana State University, Bozeman, Montana, USA.

NMPC – National Museum of Natural History, Prague, Czech Republic.

OSAC – Oregon State Arthropod Collection, Oregon State University, Corvallis, Oregon, USA.

PMNH – Peabody Museum of Natural History, Yale University, New Haven, Connecticut, USA.

SEMC – Snow Entomological Museum, University of Kansas, Lawrence, Kansas, USA.

USNM – National Museum of Natural History, Washington, D.C., USA.

WSUC – Maurice T. James Entomological Collection, Washington State University, Pullman, Washington, USA.

Morphology

Female genitalia were removed using the following method (after Becker 1956): the abdomen was removed and placed in a cold 10% KOH solution for approximately an

hour (occasionally an additional hour would be required for larger specimens). The reaction was stopped by moving the abdomen to a second dish with distilled water with a drop of white vinegar, then the abdomen was placed into a third container of distilled water. The tergites were separated from the ventrites along one edge using a sharpened pin, and the trachea and other internal parts carefully removed. Male genitalia were dissected in a similar manner.

Photographs of specimens and genitalia were taken using a JVC (DC Ky-F75U) digital camera mounted on a Leica® MS5 stereoscope. Photographs were slightly edited in Adobe PhotoShop® CS 6, in order to ensure clarity of images.

DNA Analysis

Some specimens were selected for DNA extraction, and their abdomens were removed before lysis began. The non-destructive extraction method followed the protocol for total DNA from animal tissue in the Qiagen® (Hilden, Germany) DNeasy® kit with an extended lysis time of 24 hours. After extraction, the specimens were washed with distilled water and 75% ethanol before they were remounted.

Four loci were chosen for this study, two from the CO1 gene in the mitochondria, and two from the 28S ribosomal gene in the nuclear genome. The primers used for CO1 were LCO1490 and HCO2198 (Folmer *et al.* 1994), covering the DNA barcode region at the 5' end of the gene, and Jerry and Pat (Simon *et al.* 1994), covering the 3' end. The primers used for 28S rDNA were 28S-01 and 28SR-01 (Kim *et al.* 2000), covering the 5' region, and ff and dd (Kundrata and Bocak 2011), covering a separate region of the 28S

rDNA. The amplification protocol of LCO and HCO followed the protocols given in Etzler *et al.* (2014), for 28S-01 and 28SR-01 followed the protocols in Sagegami-Oba *et al.* (2007), while the remaining primers followed the protocol in Kundrata and Bocak (2011). These loci were chosen to enable comparison with many previous data sets of Elateridae (add citations).

The sequence chromatographs were analyzed and consensus sequences produced using the program Geneious 2019.1.1. The consensus sequences were aligned using MAFFT (Katoh *et al.* 2017). The aligned sequences were converted to the NEXUS format using PhyDE® v0.9971. A Bayesian analysis was done on the aligned NEXUS files using the program BEAST 2 (Bouckaert *et al.* 2014) with the following parameters: clock models and trees were linked for all four loci; each loci with a Gama site model with a substitution rate of 1.0, Gamma category count of 4, a shape of 1.0, and proportion invariant 0.2, with rate, shape, proportion estimated, the substitution model was RB (Gowri-Shankar and Rattray 2007); the clock model was relaxed clock log normal (Drummond *et al.* 2006); the tree model used was the Fossilized Birth Death Model (Heath *et al.* 2014), with two priors, one for all samples set for 65mya and a normal distribution, and the other prior for *Selatosomus gravidus* (Germar) and *Aplotarsus incanus* (Gyllenhal) set as outgroups estimated at 10mya and a normal distribution, following tutorial recommendations. The analysis was run for 10 million chains.

Species Descriptions

For the majority of species, the distribution of examined specimens are given as postal codes. For two species, *H. audreyae* and *H. niger*, due to the lack of physical specimens, the species distribution is mentioned, but no map is provided. For the rest of the species, the locality of the examined specimens is given as a blue dot, with estimated range provided as a grey area. This area likely underestimates the actual range of each species. Occasionally, states and provinces are marked with a question mark, ‘?’, when records flank the particular region and the presence of the species in the region is likely. When only the state or province is provided without further data, the particular region is marked with a star, to indicate the state or provincial record.

Results and Discussion

DNA Result

The resulting tree of 42 taxa (Fig. 5.1) supported *Hemicrepidius* as defined here as monophyletic. Within *Hemicrepidius* there are two main clades, one with some North American species and all included Palearctic species, and the other with the rest of North American species. The following four specimens are represented by only a single sequence of the four: MTEC008111, MTEC023702, MTEC023726, and BIOUG06825. Their placement within the tree should be read cautiously.

Two Central American species formerly placed in *Hemicrepidius* were closest to the genera *Athous* and *Denticollis* Piller and Mitterpacher, 1783. This placement is supported by morphological data (see Classification, below).

Classification

The relationship of the genus *Hemicrepidius* to other genera is very difficult to determine using the historical literature. This largely has to do with the late recognition of the genus in the Palearctic region and its tribal or subtribal placement. *Hemicrepidius* historically was placed within its own tribe quite distant from *Athous*, the genus which once contained all of the Palearctic *Hemicrepidius*. Today, *Hemicrepidius* is placed within the tribe Dendrometrini (= Denticollini or Athouini of previous authors), but it is either placed in a subtribe separate from *Athous* (i.e. Cate 2007) or in the same subtribe as *Athous* (i.e. Zapata and Sanchez-Ruiz 2012). While preliminary molecular data support the monophyly of the tribe (Kundrata *et al.* 2016), I am of the opinion that the subtribes should be abandoned until a test of monophyly can be done.

An additional difficulty is that the majority of published keys will not correctly identify all *Hemicrepidius*. In fact, other than Becker (1979), no key will accurately key the type species of *Hemicrepidius* to the tribe or genus, and will also fail to place the majority of North American species. These keys (Kishii 1987, Platia 1994, Laibner 2000, Han *et al.* 2012) should be used with extreme caution when trying to extrapolate beyond their original regions and should not be used as a basis for defining higher-level morphological traits for tribes or genera.

Still another point of difficulty was found when examining species in the Palearctic. After examining some genera related to *Hemicrepidius*, it turned out that some species of *Megathous* Reitter, 1905, should be moved to *Hemicrepidius*. In addition to *Megathous dauricus* (Mannerheim, 1852), which was originally moved by Becker

(1979), these are: *Hemicrepidius jacobsoni* (Reitter, 1905) **new combination** and *Hemicrepidius nigerrimus* (Desbrochers des Loges, 1869) **new combination**. Another likely candidate for placement in *Hemicrepidius* is *Megathous sedakovi* (Mannerheim, 1852), but I have only seen photographs of this species. All species that should be removed from *Megathous* will have apical expansions on the parameres of the aedeagus (c.f. Figs. 5.4d, 5.5d, and 5.7d, as examples). The moved species are noted in the list of species below. The species that should remain in *Megathous*, including the type species *Megathous menetriesi* (Reitter, 1890), all possess aedeagi lacking apical expansions (c.f. Fig. 5.35a). However, there are numerous genera that share this aedeagal character that have an uncertain relationship to one another. A serious examination should be conducted on the genera *Diacanthous* Reitter 1905, *Harminius*, *Megathous* (in the restricted sense presented here), *Mucromorphus* Ohira 1962, *Parathous* Fleutiaux 1918, *Scutellathous* Kishii 1955, *Stenagostus* Thomson 1859, *Ohirathous* Han and Park 2012 and the *Athous cucullatus* species-group of Becker (1979), to determine the boundaries of the genera. It is highly likely that these are over-divided and that many of these names should be reduced to synonymy.

The Central American species are removed from *Hemicrepidius* and placed in the genus *Athous* Eschscholtz, 1829. All species lack membraneous lobes on their tarsomeres. However, the fourth tarsomere is expanded ventrally, similar the *Athous* species. Additionally, the internal female genitalia are nearly identical to the internal female genitalia of *Athous vittatus*, the type species of *Athous*, which supports the

movement of these species to *Athous*. This generic transfer once again returns the genus *Athous* to the Central American fauna, and removes *Hemicrepidius*.

Asaphes longipennis Candéze, 1863, described from Venezuela and Columbia, is moved to the genus *Pomachilus* Candéze, 1860. All characters of the type specimen support this placement.

The genus *Sharon*, which was erected for the Chilean species *Asaphes amoenus*, was originally placed in the subfamily Oxynopterinae. This is due to the appearance of *Asaphites* Candéze, 1863 as a synonym of that subfamily in the classification in Bouchard et al. (2011). However, the type genus of *Asaphites* is *Asaphes*, a synonym of *Hemicrepidius*, which is placed in the subfamily Dendrometrinae, tribe Dendrometrini, and often subtribe Hemicrepidina all names recognized in Bouchard et al (2011). *Asaphites* must be a synonym of Hemicrepidina **return to synonymy**, as was recognized by earlier authors such as Champion (1897). Arias-Bohart and Elgueta (2015) compared *Sharon* to three Australian genera, *Parasaphes* Candéze, 1881, *Wynarka* Calder, 1986, and *Tasmanelater* Calder, 1996, all currently placed in the subfamily Parablacinae Kunderata, Gunter, Douglas & Bocak 2015. *Sharon* was moved to Parablacinae in Kunderata et al. 2019.

Due to these difficulties, I am unable at this time to accurately determine the relationship of *Hemicrepidius* to other genera at this time. Based on male aedeagi, *Hemicrepidius* is hypothesized to be most closely related to *Athous*, more so than other genera traditionally placed by authors in the same subtribe. A brief analysis of female internal genitalia suggests that *Athous* species in the *A. brightwelli*-species group may be

closely related to *Hemicrepidius*, but this raises questions about the monophyly of Nearctic *Athous*. However, these claims need to be tested and examined more thoroughly to be anything more than conjecture. A full revision at the tribal level is needed in order to test the validity of the subtribes, the genera, and even the monophyly of the tribe as currently defined.

Redescription of *Hemicrepidius* Germar, 1839

Hemicrepidius Germar, 1839: 212. Leng 1920: 170. Schenkling 1927: 413.

Becker 1979: 407. Type species: *Hemicrepidius thomasi* Germar, by monotypy.

Pedetes Kirby, 1837: 145 (not *Pedetes* Illiger, 1811, Mammalia) (see Becker 1956: 26; 1974: 713). Type species: *Elater obscurus* Linnaeus, 1758, by original designation. This Linnaean species is now considered as a valid species in *Agriotes* Eschscholtz, 1829 (see Becker 1956, 1974 for full list of usage).

Asaphes Kirby, 1837:146 (not *Asaphes* Walker, 1834, Hymenoptera) (described as a subgenus of *Pedetes*). Type species: *Pedetes (Asaphes) ruficornis* Kirby, by monotypy.

Heterathous Reitter, 1905: 32. Type species: *Athous sanguinicollis* Fivaldszky, 1892.

Pseudathous Mequignon, 1930: 95 (described as a subgenus of *Athous*). Type species: *Elater hirtus* Herbst, 1784 by original designation. As subgenus

of *Athous*: Leseigneur 1972: 195. As a subgenus of *Hemicrepidius*: Baba and Kishii 1957: 69.

Miwacrepidius Ohira, 1962: 263. Type species: *Athous subcyaneus* Motschulsky, 1866.

Yukara Kishii, 1962: 21. Type species: *Athous inornatus* Lewis, 1894, by monotypy. **Return to synonymy.**

Medakathous Kishii, 1964: 17. Type species: *Athous jactatus* Lewis, 1894, by monotypy. **Return to synonymy.**

Barrelater Johnson, 2014: 407. Type species: *Barrelater audreyae* Johnson, 2014, by original designation. **New synonymy.**

Diagnosis

The genus is quite variable in the shape of the antennomeres, strength of the frontal carina, and shape of the posterior margin of the hypomeron, all characters often used to define genera, subtribes, and tribes. In all species of *Hemicrepidius*, the tarsi bear membranous lobes on tarsomeres 1–4, with lobes on tarsomeres 2 and 3 being the largest and most distinct, and the lobes on 1 and 4 sometimes minute and difficult to see (see Notes below). All species also bear a posterior notch on the pronotum anterad the scutellum, often approaching an ‘m’-shape. Males always have the apical ends of the parameres with lateral expansions (e.g. Figs 5.4d, 5.4e, 5.5d, 5.5e, 5.7d, 5.7e). Females have unique internal genitalia, with a large uterus bearing sclerotized rows, two apical colleterial glands, and a small, weakly sclerotized bursa copulatrix (Figs. 5.2a–5.2c).

Only the female internal genitalia is unique to *Hemicrepidius*, with the other characters shared by one or more genera. However, the above combination of characters (number and strength of lobed tarsi, medial posterior pronotal notch, male genitalia, and female genitalia) is unique to *Hemicrepidius*.

Species in *Hemicrepidius* may be confused with other genera with tarsomeres bearing membranous lobes. Species in Elaterinae genera with lobed tarsi, such as *Crepidius* Candèze, 1859 and *Dicrepidius* Eschscholtz, 1829, may be mistaken for *Hemicrepidius* at a quick glance. These genera can easily be distinguished from *Hemicrepidius* by the wide impunctate area on the mesal margin of the hypomeron which is often grooved anteriorly, the wide space between the frontal carina and the clypeal margin, and by the male and female genitalia.

The most easily confused genus is the closely related *Athous*. In the Nearctic, all *Athous* species can be distinguished from *Hemicrepidius* by the lack of a notch anterad the scutellum. Other characters, such as the large protruding frontal carina, and the male and female genitalia, are more species-specific characters that help distinguish *Athous* species from *Hemicrepidus*. In the Palearctic region, this situation becomes more complex. Species in the *Athous* subgenus *Exanthrotus* Méquignon, 1930 (often treated as a synonym of subgenus *Haplathous* Reitter, 1905) possess a notch anterad the scutellum, but in addition to differences in female genitalia, can be distinguished from *Hemicrepidius* by having the membranous lobe on tarsomere 4 subequal to the lobe on tarsomere 3. The genus *Athous* will need extensive reclassification, as the last attempt at defining the genus as a whole (or nearly so) was by Reitter (1905) whose generic concept

also included species now placed in *Hemicrepidius*. Additional complexity is added to *Athous* with the addition of the Central American species formerly placed in *Hemicrepidius*. However, their inclusion based on internal female genitalia is a strong character to support this generic placement.

Other genera in the Palearctic, such as some species in *Stenagostus* and *Megathous*, also share many characteristics with *Hemicrepidius*, and until they are revised, can only be distinguished due to genitalic characters of the males and females.

Adult Description

Length 7–26mm, width 2–8mm; color variable, usually unicolorous red-brown to black, some species with elytra lighter, yellow-brown or red-brown, contrasting pronotum, or with pronotum red-brown dorsally; integument dull or shining, some with slight metallic undertones, rarely completely metallic. Body shallowly to moderately convex. Setae variable, short and depressed, to long and erect, color variable, grey, gold, brown, or piceous. **Head:** Color variable, red-brown to piceous, usually matching pronotum, sometimes slightly darker, rarely darker than dorsal surface of pronotum; punctures indistinctly subumbilicate to noticeably subumbilicate, nearly contiguous to separated by diameter of one puncture, integument dull to shining; frons weakly to strongly concave anteromedially; frontal carina usually complete, sometimes indistinct medially, broadly curved to v-shaped, usually nearly confluent with medial posterior margin of clypeal edge, sometimes weakly projecting; eyes variable, small and weakly bulging to large and strongly bulging; antennae weakly to strongly serrate (Figs. 5.2d–5.2g), antennomere 2

globular to subcylindrical, antennomere 3 subcylindrical to triangular, setation similar to antennomere 2 or similar to antennomere 4, usually intermediate between 2 and 4, antennomeres 4 to 10 usually longer than wide, either uniformly densely setose or with medial line bearing less setae than edges, antennomere 11 uniformly oval or with tip constricted as pseudosegment (Fig. 5.2e), total antennal length variable, not reaching pronotal posterior edge by two antennomeres to passing pronotal edge by five antennomeres, females with shorter antennae than males within the same species.

Thorax: Color usually unicolorous, sometimes with pronotal disc lighter, commonly with pronotal hind angles and posterior edge lighter; Pronotum shape variable, wider than long to longer than wide, sides subparallel to broadly arcuate, often narrowed anteriorly, lateral carina complete, sometimes slightly deplanate anteriorly; hind angles subparallel to slightly divergent, dorsal carina variable, absent to very strongly raised; punctures variable, small, appearing simple, separated by two diameters of a puncture to large, subumbilicate and nearly contiguous, often with punctures closer laterally than on disc, integument dull to shining; posterior edge with sublateral incisures usually present, rarely absent, notch always present anterad scutellum, usually m-shaped, rarely vague.

Hypomeron variably punctured, small, not clearly subumbilicate, separated by one puncture diameter, to large, subumbilicate and nearly touching, posterior third or fourth often with impunctate area; posterior margin variable, either emarginate so pronotal hind angle visible ventrally to sinuate to ear-like, so hind angle not visible ventrally (e.g. Figs. 5.4c, 5.11c, 5.20c), medial margin often without impunctate line medially, limited to posterior end near procoxal cavity and at extreme anterior end, sometimes impunctate

line complete. Prosternum punctuation variable, often matching punctuation on hypomeron, less dense medially; anterior lobe variable, straight to slightly deflexed, usually short, not extending past dorsal anterior edge, prosternal sutures straight, simple, not excavate or grooved anteriorly; prosternal process variable, straight to strongly arcuate, never with lateral expansions extending behind procoxae, procoxal cavity opened posteriorly. Mesosternal fossa with lateral edges sinuate to expanded ventrally in 90-degree angle, posterior edge of fossa pointed to truncate, mesepisternum and mesepimeron reaching mesocoxal cavity. Metaventricle with punctures variable, smaller than punctures on hypomeron, simple to subumbilicate, dense throughout, nearly touching, or becoming less dense medially, separated by 1–2x puncture diameter. Scutellar shield elongate oval to subtriangular, about twice as long as wide, lateral margins straight or sinuate, dorsal surface flat to strongly convex, sometimes with vague medial carina, anterior margin straight to broadly rounded, punctuation small, setae radiating from midline, similar to setae on pronotum and elytra. Elytra with striae, usually deeply impressed basally, sometimes apically, strial punctures connected by groove throughout, often indistinct in groove; interstriae flat to slightly convex, punctures smaller than strial punctures, integument smooth to rough in appearance; basal end with carina, carina variable, straight to crenulate; apical end broadly rounded; color variable, mostly unicolorous, without maculations, yellow to piceous, usually similar in color to pronotum. Legs variable in color, yellow to piceous, matching body or contrasting; tarsomeres 1–4 bearing apical membranous lobes ventrally, lobe on tarsomere 3 usually largest, lobe on tarsomere 2 second largest or subequal to lobe on 3, lobe on tarsomere 1

smaller, sometimes difficult to see and visible only ventrally, lobe on tarsomere 4 usually smallest, sometimes minute and visible only ventrally; claws simple, lacking basal setae, metacoxa with ventral plate widest medially and gradually narrowing laterally.

Hind wing: Venation as in Fig. 5.36a. Wedge cell present. Apical end with single slanting sclerite. **Abdomen:** Punctures small, simple, similar in size to punctures on metaventrite, moderately to very dense, almost touching to separated by a puncture diameter, less dense medially; fifth ventrite narrowly to broadly rounded; lateral edge of each ventrite usually with distinct microserrations (Fig. 5.36b), some species with serrations less distinct and difficult to see. **Male genitalia:** typical trilobate type for Elateridae; parameres broad, open ventrally, apical expansion always present, parameres slightly membranous apically, with setation limited to ventral side. **Female internal genitalia:** (Figs. 5.2a–5.2c) The uterus is broadly triangular with basal sclerotizations laterally forming a ridged or striate pattern. Two membranous colleterial glands are present latero-apically at the apical end of the sclerotizations. The bursa copulatrix is rounded, membranous, and attached to the uterus by a narrow opening, some with small faint lateral sclerotized striations. A single tubular extension is present at the apico-ventral end of the bursa copulatrix.

Distribution

Species in the genus *Hemicrepidius* are mainly Holarctic in distribution, being found throughout Europe, Asia, and North America, with species also occurring in the Indomalayan ecozone. In North America, the genus occurs as far south as the Nearctic

mountains of northern and central Mexico. The genus is not known to occur in the Neotropics or Afrotropics.

Notes

The minute lobes on tarsomeres 1 and 4 has led to the inaccurate statement that species in *Hemicrepidius* only have tarsomeres 2 and 3 lobed (e.g. Kishii 1987). In many species, the lobe on tarsomere 4 is so minute that it appears absent (e.g. *Hemicrepidius rufiventris* Han et. al 2013, Figs. 1F and 2R, in that work). In this instance it is best to view the lobe in the ventral position, if possible.

Historically, the lack of a medial frontal carina or one conjoining the clypeal margin was stressed to define the genus. This has led some workers to mistakenly assign specimens in the tribes Elaterini, Prosternini, and Selatosomini to *Hemicrepidius*, despite these specimens lacking membraneous lobes on their tarsi. The character of the frontal carina is quite variable among species, but all are very close to the clypeal margin, even in species where the frontal carina is slightly projecting.

Japanese authors (e.g. Baba and Ôhira, 1956), among the first to accept the genus in the Palearctic, often recognize as many as six subgenera within *Hemicrepidius*. These six are: *Hemicrepidius*; *Heterathous*; *Medakathous*; *Miwacrepidius*; *Pseudathous*; and *Yukara*. These all have been treated as distinct genera at one time or another. I have chosen to synonymize *Medakathous* despite remarks made by Becker (1979) that the type species was not congeneric with European *Hemicrepidius*. I have only been able to study males of the type species, but I am unable to find any characters to separate this species

from *Hemicrepidius*. Species traditionally placed in *Medakathous* are quite similar to some North American species, such as *Hemicrepidius simplex* LeConte. *Miwacrepidius* is the most widely recognized subgenus, mostly defined from a convex scutellum bearing a distinct medial ridge. This character seems to be very weak as a subgeneric character, as I have seen similar ridges, although less distinct, in *H. hirtus* specimens and subtle medial ridges in many other species. This is, however, a great character at the species level.

Due to issues with larval associations, the larval descriptions for the genus and some species will be presented in a later work.

Key Morphological Characters for Species Diagnosis

Certain morphological terms are used in the key and species descriptions that require explanation. The term frontal carina is used for what was historically called the frontal margin. This is often not a true carina, usually a thin, impunctate ridge. It is stated as being incomplete if there are lots of punctures that interrupt the line.

Antennae are a good species level character, ranging from weakly serrate to strongly serrate (Figs. 5.2d –5.2g). The third antennomere is a very useful character, ranging from subcylindrical to triangular, similar to the fourth antennomere. The setation on the third antennomere is also useful, ranging from similar to antennomere 2 to similar to antennomere 4, with most species having intermediate setation between the two.

The prosterior margin of the hypomeron is also useful. This margin is quite variable ranging from ear-like (Fig. 5.13c) or straight (Fig. 5.4c) to strongly emarginate (Fig. 5.24c). Illustrations of this character are provided for all species treated. Another good species-level character is the orientation of the prosternal process, from straight, parallel to the body plane (Fig. 5.7c), to strongly curved dorsally (Fig. 5.13c). I have also figured this character for each species. Often species with straight and thickened prosternal processes have a mesosternal fossa expanded ventrally in a 90-degree angle (Fig. 5.2h).

Due to the mostly membranous surface of the ventral side of the aedeagi, particularly the parameres, it should be noted that mounted and dried specimens will have their aedeagi appear narrower than the dissected and relaxed illustrations presented here. The apexes of the parameres may also appear different, particularly in species where this is more membranous. These cautions should be kept in mind when comparing specimens to the illustrations presented here.

List of Species Included in the Genus

No attempt has been made to place these species into species group. The names and synonymies of Palearctic species follow Cate (2007), with new combinations of Indomalayan species noted here (together under Eurasian species). Synonyms and original combinations for North American species are given in their species descriptions below.

Eurasian Species – 63 Species and Subspecies.

Hemicrepidius agajewi Platia, 2008

Hemicrepidius amami Kishii, 1985 **return to combination**

Hemicrepidius yamawakii Ohira, 1987

Hemicrepidius birmanicus (Fleutiaux, 1942) (*Athous*) **new combination**

Hemicrepidius carbonarius (Stepanov, 1935) (*Harminius*)

Hemicrepidius chinensis Kishii and Jiang, 1996

Hemicrepidius colichicus (Iablokoff-Khnzorian, 1962) (*Athous*)

Hemicrepidius consors (Heyden, 1884) (*Athous*)

Hemicrepidius coreanus Kishii, 2002

Hemicrepidius corvinus (Reitter, 1905) (*Athous*)

Hemicrepidius cotesi (Candeze, 1895) (*Athous*)

Hemicrepidius cylindricus Kishii and Jiang, 1996

Hemicrepidius dauricus (Mannerheim, 1852) (*Athous*) **return to combination**

Athous eximius Buysson, 1904

Athous urgensis Schwarz, 1900

Hemicrepidius decorus (Fleutiaux, 1918) (*Athous*)

Hemicrepidius desertor amacicola Kishii, 1969

Hemicrepidius desertor chejuanus Kishii, 2002

Hemicrepidius desertor desertor (Candeze, 1873) (*Psephus*)

Athous virens Candeze, 1873

Athous sanguinicollis J. Frivaldszky, 1892

Athous brunneipennis Lewis, 1894

Corymbites isshikii Miwa, 1928

Athous flavipennis Miwa, 1934

Hemicrepidius shirozui Kishii, 1958

Hemicrepidius desertor taishu Kishii, 2001

Hemicrepidius desertor yakuensis Kishii, 1969

Hemicrepidius rufoabdominalis Nakane and Kishii, 1958

Hemicrepidius ebeninus (Fleutiaux, 1918: 245) (*Athous*) **new combination**

Hemicrepidius flavipennis (Cherepanov, 1957) (*Harminius*)

Hemicrepidius guizhouensis Kishii and Jiang, 1996

Hemicrepidius hirtus (Herbst, 1784) (*Elater*)

Elater ater Geoffroy, 1785

Elater nigrinus Marsham, 1802 [HN]

Athous porrectus C.G. Thomson, 1868

var. *maculicollis* Pic, 1897

var. *meles* Buysson, 1906

var. *rambouseki* Roubal, 1925

var. *dalberti* Buysson, 1926

var. *lublini* Buysson, 1926

var. *balthasari* Roubal, 1935

Hemicrepidius inornatus (Lewis, 1894) (*Athous*) **return to combination**

Athous fluvipennis Matsumura, 1911

Athous testaceipennis Miwa, 1928

Hemicrepidius jacobsoni (Reitter, 1905) (*Harminius*) **new combination**

Hemicrepidius jactatus babai (Ohira, 1956) (*Athous*) **return to combination**

Hemicrepidius jactatus jactatus (Lewis, 1894) (*Athous*) **return to combination**

Hemicrepidius jugicola (Perez Arcas, 1872) (*Athous*)

Hemicrepidius kibane Kishii, 2001

Hemicrepidius koenigi Schwarz, 1897

Hemicrepidius kroliki Platia, 2011

Hemicrepidius kumaso Kishii, 2001

Hemicrepidius malaisei (Fleutiaux, 1942) (*Athous*) **new combination**

Hemicrepidius niger (Linnaeus, 1758) (*Elater*)

Elater scrutator Herbst, 1806

Elater laesus Germar, 1824

Elater pubescens Mannerheim, 1827

Athous alpinus L. Redtenbacher, 1858

Athous deflexus C.G. Thomson, 1868

Athous aeneithorax Desbroch. des Loges, 1870

Athous semirufus Desbroch. des Loges, 1873

var. *schaumi* Buysson, 1901

var. *leporinus* Buysson, 1916

var. *rubrocallatus* Laco, 1936

Hemicrepidius nigerrimus (Desbrochers des Loges, 1869) (*Athous*) **new combination**

Athous langsдорфи Stierlin, 1880

Hemicrepidius nigripennis (Miwa, 1928) (*Athous*)

Hemicrepidius nigrutilus (Reitter, 1890) (*Athous*)

Hemicrepidius nodieri (Fleutiaux, 1918: 247) (*Athous*) **new combination**

Hemicrepidius oblongus (Solsky, 1871) (*Athous*)

Athous insulsus Buysson, 1904

Athous plicatulus Reitter, 1905

Hemicrepidius pullus (Reitter, 1905) (*Athous*)

Hemicrepidius raddei (Faust, 1877) (*Athous*)

Hemicrepidius rahmei Nemeth and Platia, 2014

Hemicrepidius rubriventris Han et al, 2013

Hemicrepidius rufangulus rufangulus (Miwa, 1928) (*Athous*)

Athous nigricollis Miwa, 1928

Athous ruficollis Miwa, 1930

Hemicrepidius rufangulus tricolor Kishii and Jiang, 1996

Hemicrepidius secessus hallaensis Kishii, 2002

Hemicrepidius secessus izuinsulanus (Kishii, 1977) (*Pseudathous*)

Hemicrepidius secessus kuniyoshii Ohira, 1967

Hemicrepidius secessus okadomei Ohira, 1966

Hemicrepidius secessus secessus (Candeze, 1873) (*Athous*)

Hemicrepidius secessus yakuensis Kishii, 2001

Hemicrepidius schneideri (Kiesenwetter, 1878) (*Athous*)

Athous perniger Reitter, 1896

Hemicrepidius sinuatus insularis Kishii, 2002

Hemicrepidius sinuatus satouchii Kishii, 1961

Hemicrepidius sinuatus sinuatus (Lewis, 1894) (*Athous*)

Athous harmandi Fleutiaux, 1902

Hemicrepidius subcyanus (Motschulsky, 1866) (*Athous*)

Athous prae nobilis Lewis, 1895

Hemicrepidius subopacus Kishii and Jiang, 1996

Hemicrepidius subpectinatus Schwarz, 1902

Hemicrepidius tartarus (Candeze, 1860) (*Athous*)

Hemicrepidius terukoanus Kishii, 1961

Hemicrepidius tonkinensis Schwarz, 1903

Hemicrepidius variabilis (Fleutiaux, 1918) (*Athous*)

Hemicrepidius vitalisi (Fleutiaux, 1918: 244) (*Athous Stenagostus*) **new**

combination

Hemicrepidius vulpeculus (Reitter, 1890) (*Athous*)

North American Species – 22 Species

Hemicrepidius audreyae (Johnson, 2014)

Hemicrepidius bilobatus (Say, 1836)

Hemicrepidius brooksi Etzler **new species**

Hemicrepidius californicus Becker, 1979

Hemicrepidius carbonatus (LeConte, 1860)

Hemicrepidius decoloratus (Say, 1863) **status resurrected**

Hemicrepidius falli (Reitter, 1908)

Hemicrepidius hemipodus (Say, 1825)

Hemicrepidius indistinctus (LeConte, 1853)

Hemicrepidius melanophthalmus (Melsheimer, 1846) **status resurrected**

Hemicrepidius mescalero Etzler **new species**

Hemicrepidius montanus Lane, 1965

Hemicrepidius morio (LeConte, 1853)

Hemicrepidius niger (Linnaeus, 1758) – introduced

Hemicrepidius nemnonius (Herbst, 1806)

Hemicrepidius obscurus (LeConte, 1853)

Hemicrepidius pallidipennis (Mannerheim, 1843)

Hemicrepidius palpalis (Fall, 1907)

Hemicrepidius ruficornis (Kirby, 1837) **status resurrected**

Hemicrepidius simplex (LeConte, 1876)

Hemicrepidius soccifer (LeConte, 1876)

Hemicrepidius tumescens (LeConte, 1861)

Key to Species in North America

1. Antennae weakly serrate, antennomeres 4-10 much longer than wide, and appearing rounded, antennomere 3 subcylindrical with setation more similar to antennomere 2 (similar to Fig. 5.2g)2

- Antennae serrate to strongly serrate, antennomere 4-10 triangular with noticeable apical expansions (similar to Figs. 5.2d–5.2f); antennomere 3 subtriangular with setation intermediate between 2 and 4 (similar to Figs. 5.2e and 5.2f) or antennomere 3 triangular with setation similar to 4 (similar to Fig. 5.2d)..... 11

- 2. Posterior margin of hypomeron sinuate to emarginate (e.g. Fig. 5.4c), so pronotal hind angle is visible ventrally3
- Posterior margin of hypomeron straight to ear-like (Fig. 5.13c), so pronotal hind angle is not visible ventrally or only as a very small projection at apical end (Fig. 5.10c)6

- 3. Sublateral notches not present on posterior margin of hypomeron; pronotal hind angle carina absent or rarely as a vague puncture interrupted ridge; body nearly unicolorous red-brown to dark red-brown 4
- Sublateral notches present on posterior margin of hypomeron, some small and difficult to see; pronotal hind angle carina variable, present to thin and difficult to see; body unicolorous piceous or bicolored with elytra lighter 5

- 4. Pronotal hind angle broad dorsally; posterior margin of hypomeron emarginate with hind angle clearly projecting; body color nearly uniformly dark red-brown; male aedeagus as in Figs. 5.4d, 5.4e *Hemicrepidius bilobatus* (Say)

- Pronotal hind angle narrow dorsally; posterior margin of hypomeron sinuate with hind angle narrow and weakly projecting; body color nearly uniformly light red-brown; male aedeagus as in Figs. 5.16d, 5.16e ..*Hemicrepidius melanophthalmus* (Melsheimer)

- 5. Body unicolorous dark brown to black, elytra not contrasting pronotum; setae long, erect and black; pronotum with dense, nearly contiguous punctures throughout; prosternal process straight *Hemicrepidius californicus* Becker, 1979
- Body bicolored, yellow-brown elytra contrasting dark brown to black pronotum; setae moderate, suberect, grey or gold; pronotum with punctures smaller and less dense medially than laterally; prosternal process curved ventrally
.....*Hemicrepidius pallidipennis* (Mannerheim, 1843)

- 6. Tarsomeres with membranous lobes wide, easily noticeable on tarsomeres 1 through 37
- Tarsomeres with membranous lobes narrow, most noticeable on tarsomere 3, less so on 2, lobe on tarsomere 1, very small and difficult to see 9

- 7. Prosternal process straight between procoxae (Fig. 5.10c); small convex bump medially on frons flanked by two indentions; body often bicolored with yellow-brown elytra contrasting a piceous or bicolored pronotum; aedeagus as in Figs. 5.10d, 5.10e
.....*Hemicrepidius decoloratus* (Say, 1863)

- Prosternal process curved between procoxae (e.g. Fig. 5.13c); frons evenly, but weakly concave; body rarely bicolored 8

- 8. Pronotal punctures small, simple, throughout, never touching; aedeagus as in Figs. 5.14d, 5.14f *Hemicrepidius indistinctus* (LeConte, 1853)
- Pronotal punctures along lateral edge dense, nearly touching, disc with punctures nearly touching or well-spaced; aedeagus as in Figs. 5.13d, 5.13e
..... *Hemicrepidius hemipodus* (Say, 1825)

- 9. Pronotal hind angles subparallel, not diverging; frontal carina incomplete medially; setae moderately long, dense, grey; aedeagus as in Figs. 5.27c, 5.27d
..... *Hemicrepidius palpalis* (Fall, 1907)
- Pronotal hind angles usually diverging; rarely subparallel; frontal carina complete, weakly projecting; setae not as long or dense; aedeagus not as above10

- 10. Pronotal hind angles long and diverging; pronotal hind angles with distinct, thin, carina; pronotal punctures smaller than punctures on head, moderately dense throughout; aedeagus as in Figs. 5.11d, 5.11e *Hemicrepidius falli* (Reitter, 1908)
- Pronotal hind angles short, usually diverging; pronotal hind angles with carina thin, nearly touching lateral margin or absent; pronotal punctures equal in size to punctures on head, well-spaced on disk; aedeagus as in Figs. 5.30d, 5.30e
..... *Hemicrepidius simplex* (LeConte, 1876)

11. Antennae strongly serrate, third antennomere similar in shape and punctation to fourth antennomere 12
- Antennae serrate, third antennomere intermediate in shape and punctation between antennomeres two and four 13
12. Setae moderately long, gold; punctures on disc smaller than punctures on head, simple, dense; carina on pronotal hind angle thin
..... *Hemicrepidius niger* (Linnaeus, 1758)
- Setae short, piceous; punctures on disc, larger than punctures on head, simple, separated by a puncture diameter, laterally larger and denser; carina on pronotal hind angle thickened; aedeagus as in Fig. 5.19d, 5.19e
..... *Hemicrepidius montanus* Lane, 1965
13. Posterior margin of hypomeron straight or sinuate, hind angle not distinct ventrally
..... 14
- Posterior margin of hypomeron emarginate or sinuate, hind angle always visible ventrally 15
14. Antennae long, passing pronotal hind angles by up to five antennomeres; prosternal process strongly curved dorsally; pronotal punctures smaller than punctures on

- simple, dense but never touching; aedeagus as in Fig. 5.3b
 *Hemicrepidius audreyae* (Johnson, 2014)
- Antennae shorter, never passing pronotal hind angles by more than two antennomeres;
 prosternal process weakly curved dorsally; pronotal punctures similar in size to
 punctures on head, often nearly touching; aedeagus as in Figs. 5.32d, 5.32e
 *Hemicrepidius soccifer* (LeConte, 1876)
15. Prosternal process straight or nearly so; mesosternal fossa raised ventrally in around
 90-degree angle (Fig. 5.2h) 16
- Prosternal process curved; mesosternal fossa sinuate, never raised ventrally 20
16. Pronotal punctures on disc simple, smaller than punctures on head, never touching
 17
- Pronotal punctures on disc larger, equal in size to punctures on head, touching 19
17. Punctures on disc small, simple, well separated; posterior margin of hypomeron
 emarginate; aedeagus as in Figs. 5.20d, 5.20e
 *Hemicrepidius morio* (LeConte, 1853)
- Punctures on disc larger, closer, often nearly touching; posterior margin of hypomeron
 sinuate; aedeagus not as above 18

18. Hind angle very narrow and projecting ventrally; tarsomeres with very small lobes, difficult to see; aedeagus as in Figs. 5.33d, 5.33e
 *Hemicrepidius tumescens* (LeConte, 1861)
- Hind angle broad and projecting ventrally; lobes on tarsomeres moderate, visible; aedeagus as in Figs. 5.5d, 5.5e *Hemicrepidius brooksi* Etzler
19. Hind angle narrow ventrally; setae very long; antennomeres short and wide, never 2× longer than wide; aedeagus as in Figs. 5.7d, 5.7e
 *Hemicrepidius californicus* Becker, 1979
- Hind angle broad ventrally; setae moderate; antennomeres longer, 2× longer than wide, aedeagus as in Fig. 5.24d, 5.24e *Hemicrepidius obscurus* (LeConte, 1853)
20. Posterior margin of hypomeron sinuate, with hind angle projecting narrowly ventrally; pronotal hind angle carina thin, difficult to see; aedeagus as in Figs. 5.17c, 5.17d *Hemicrepidius mescalero* Etzler
- Posterior margin of hypomeron emarginate, with hind angle broader ventrally; pronotal hind angle carina thick, easy to see; aedeagus not as above21
21. Punctures on disc dense, touching; color piceous or dark brown; no impunctate area present on the hypomeron; aedeagus as in Figs. 5.8d, 5.8e
 *Hemicrepidius carbonatus* (LeConte, 1860)

- Punctures on disc never touching; color dark brown or lighter, never piceous;
impunctate area usually present; aedeagus not as above 22

22. Setae moderate, erect, gold; punctures on disc smaller than punctures on head;
aedeagus as is Figs. 5.29d, 5.29e *Hemicrepidius ruficornis* (Kirby, 1837)
- Setae short, depressed, gold; punctures on disc equal in size to punctures on head;
aedeagus as in Figs. 5.22d, 5.22e *Hemicrepidius nemnonius* (Herbst, 1806)

Revision of North American Species

Hemicrepidius audreyae (Johnson, 2014) – New Combination

Barrelater audreyae Johnson, 2014: 408.

Figs. 5.3a–5.3c.

Diagnosis

Hemicrepidius audreyae can be distinguished from all other *Hemicrepidius* by the combination of long antennae passing the posterior margin of the pronotum by five antennomeres, the ear-like posterior margin of the hypomeron, the This species is most similar to *H. simplex*. *Hemicrepidius audreyae* can be distinguished by the long antennae which reach the mid-length of the body and passing the posterior edge of the pronotum by four to five antennomeres, antennomere 3 about twice as long as antennomere 2, and the non-divergent hind angles of the pronotum which do not encompass the humeral angles of the elytra. In *H. simplex*, the antennae are shorter, only passing posterior edge

of the pronotum by two antennomeres, antennomere 3 is just slightly longer than antennomere 2, and the hind angles are more divergent, encompassing most of the humeral angle of the elytra (e.g. Fig 5.30a).

Description

See Johnson 2014.

Distribution

This species has only been collected in the US states of Washington, Idaho, Oregon, and Nevada (Johnson 2014).

Type specimen

Holotype: Prosser, Wn [Washington] / May 20, 1938 / H.P. Lanchester; male; in USNM.

Notes

I have only examined the holotype of this species, and this through photographs only (Figs. 5.3a–5.3c). This species shares many characters with *H. simplex*, and other *Hemicrepidius* species, including similar male genitalia, but it appears to be a distinct species. However, I am unable to determine any characters that would justify this species being placed within its own genus, hence the synonymy of the genus within *Hemicrepidius*.

Hemicrepidius bilobatus (Say, 1836)

Elater bilobatus Say, 1836: 174.

Asaphes bilobatus (Say): LeConte 1853: 452; Candeze 1863: 222; Horn 1880: 74.

Hemicrepidius bilobatus (Say): Wickham 1911: 23; Thomas 1941: 247;

Athous fastiditus Dejean, 1837: 101 *nomina nuda*; Candeze 1863: 221 (as syn. of *H. melanophthalmus*). **New synonymy.**

Asaphes consentaneus LeConte, 1853: 452; Candeze 1863: 222.

As synonym of *H. bilobatus*, Horn 1880: 75.

Asaphes planatus LeConte, 1853: 453; Candeze 1863: 223.

As synonym of *H. bilobatus*, Horn 1880: 75.

Figs. 5.4a–5.4e.

Diagnosis

Hemicrepidius bilobatus is most similar to *H. nemnonius* and *H. melanophthalmus*.

The lack of a carina on the pronotal hind angle and the lack of sublateral basal incisures will readily separate *H. bilobatus* from *H. nemnonius*. From *H. melanophthalmus*, *H. bilobatus* can be distinguished by the darker color, the wider pronotal hind angles in dorsal and ventral views (Figs. 5.4a–5.4c), and by the parameres of the aedeagus being thicker at constriction point at apical one-third, and with the basal struts of the medial lobe angled (Figs. 5.4d–5.4e).

Description

Length 11–18mm, width 3–5mm; color dark red-brown, elytra not contrasting pronotum, legs, antennae and sometimes posterior edge of pronotum, edges of elytra, and edges of abdominal segments lighter. Setae moderate, depressed, gold.

Head: punctures subumbilicate, nearly contiguous; integument shining; frons weakly concave anteromedially, some with slight triangular impression medial; frontal carina complete, roughly v-shaped, confluent with medial posterior margin of clypeal edge, at most weakly projecting; eyes large and strongly bulging; antennae weakly serrate, antennomere 2 subcylindrical, antennomere 3 subcylindrical and $1.5\times$ length of 2, antennomere 3 subequal in length to 4, antennomeres 4 to 11 about $3\times$ longer than wide, each with medial line bearing less setae than edges, antennomere 11 with tip constricted as a pseudosegment, antennae passing pronotal posterior edge by one to two antennomeres. **Thorax:** Pronotum as wide as long (males) to $1.2\times$ wider than long (females), widest at hind angles or just anterior of midlength; sides weakly arcuate, almost subparallel laterally, narrowing at anterior one fourth, lateral carina complete; hind angles usually subparallel, sometimes appearing slightly divergent due to sinuate edge anterior of hind angle, dorsal carina absent; punctures large, subumbilicate, separated by one to two diameters of one puncture on disc in females, nearly touching in males, punctures closer laterally, nearly contiguous, integument shining; posterior edge with sublateral incisures absent. Hypomeron with large, subumbilicate punctures, nearly contiguous anteriorly and becoming less dense posteriorly; posterior margin emarginate with hind angle visible ventrally and truncate at tip (Fig. 4c), medial margin without

impunctate line medially. Prosternum punctuation matching punctuation on hypomeron, less dense medially; anterior lobe slightly deflexed, broadly rounded and covering ventral mouthparts; prosternal process slightly curved dorsally, narrow and straight past procoxae. Mesosternal fossa with lateral edges sinuate, posterior edge of fossa truncate. Metaventrite with punctures subumbilicate, smaller than punctures on hypomeron, dense throughout, nearly touching. Scutellar shield elongate, about twice as long as wide, narrowly rounded posteriorly, lateral margins sinuate, dorsal surface weakly convex, anterior margin nearly straight, punctuation small, setae radiating from midline, similar to setae on pronotum and elytra. Elytral striae moderately impressed basally; interstriae flat to slightly convex, integument shining with wrinkled appearance; basal carina not crenulate. Legs with tarsomere lobe on tarsomere 3 largest, wide, lobe on tarsomere 2 second largest, wide, lobe on tarsomere 4 minute, visible only ventrally, lobe on tarsomere 1 smallest, barely visible ventrally. **Abdomen:** Punctures small, simple, a bit smaller than punctures on metaventrite, moderately dense, separated by a puncture diameter, less dense medially; fifth ventrite broadly rounded; lateral edge of each ventrite with distinct microserrations. **Male genitalia:** (Figs. 5.4d and 5.4e) Parameres broadly triangular apically, subparallel on basal two-thirds with broad sinuation on apical one third just posteriad of apical expansion; apical expansion hooked laterally, setose ventrally. Medial lobe broadly triangular, basal struts angled near 90-degrees. Basal piece with membranous area transverse medially.

Distribution

Specimens have been examined from the following: USA: AL, AR, GA, IL, IN, IA, KS, KY, LA, MD, MS, MO, NJ, NY, NC, PA, OH, TN, VA, WI (Fig. 5.6a).

Notes

The color and setation of this species makes it surprisingly easy to mix with *H. nemnonius*. I have seen many specimens identified as this later species. One specimen of note is Germar's fourth syntype of *Hemicrepidius thomasi* in the BMNH, which is a typical specimen of *H. bilobatus*.

Historically, *H. bilobatus* has been confused with *H. melanophthalmus*. In addition to the morphological differences discussed in the diagnosis above, there is some genetic differences (Fig. 5.1). The tree suggests that both *H. bilobatus* and *H. melanophthalmus* are sister species.

One locality that deserves further investigation are the specimens in the BMNH labeled San Domingo (=island of Hispaniola in the Greater Antilles) from the Palisot de Beauvois collection. Many Palisot de Beauvois specimens described and collected by him have been discovered to have dubious collection localities, with some American species as being described from Africa and vice versa (Chase 1925). A thorough search of the West Indian Beetle Fauna Project (WIBF) collection at Montana State University yielded no specimens of *H. bilobatus* from Hispaniola, or any other West Indian island, and the locality is treated as an error.

Larvae have been tentatively associated with this species (Glen 1950).

Specimens Examined

Type Specimens. Of *Elater bilobatus* Say, 1836; Holotype missing; type locality Indiana. Of *Asaphes consentaneus* LeConte, 1853; **Holotype**: pink disc (= Middle States (Md., Del., N.Y., N.J., Pa., Conn.?, R.I.?))/*A. consentaneus* Lec. *bilobatus* male?/ type 2615/ *bilobata* #7; type locality New York; in MCZC. Of *Asaphes planatus* LeConte, 1853; **Holotype**: pink disc (=Middle States (Md., Del., N.Y., N.J., Pa., Conn.?, R.I.?))/*H. planatus* Lec. N.G./ type 2616/ *bilobata* #13; type locality New Jersey; in MCZC.

LeConte Collection (MCZC), 7. [yellow disc] (=)/*A. bilobatus* Say/ *bilobata* #1; [yellow disc] (=)/ *bilobata* #2 & *bilobata* #3; [no disc]/ *bilobata* #4; [pink disc] (=Middle States (Md., Del., N.Y., N.J., Pa., Conn.?, R.I.?))/*bilobata* #8; [yellow disc] (=)/ *bilobata* #9; [orange disc] (=)/ *bilobata* #10.

Other Specimens Examined, 80. **North America:** 85-53 (2, BMNH); *A. melanophthalmus* Melsh/ Coll. Janson, Ex Dejean/ *Athous fastiditus mihi* (pars), h. in Amer. Bor., D. Beauvois [5] [one w/ green 'Say' label] (3, BMNH); Green Rectangle/ Coll. Janson, Ex Dejean/ *A. melanophthalmus* Melsh., *Ath fastididus* Dej., Amer. Bor. Beauv./ *Athous fastididus* var *longicornis* Harris, in Amer. Bor, D. LeConte [3] (1, BMNH); [Red rectangle]/[blue]296/ Ex Deyrolle, Coll. Janson/ *Asaphes* sp., Amer. Bor./ *A. fastiditus* Dy, Amer. Bor [Abd missing since 1977] (1, BMNH); 30/ Coll. Janson, Ex. Mniszech, ID label Amer. Bor (1, BMNH); Coll. Janson, Ex Schaum / *memnonius*,

thomasi ID label / Am. Bor. [Germar *H. thomasi* Syntype, #4] (1, BMNH); [red rectangle]/ [yellow]458 / *A. bilobatus* Say, Amer. Bor/ Coll. Janson, Ex Deyrolle (1, BMNH). **USA: Alabama:** [Mobile Co.], Mobile/ Coll. by H. P. Loding (1, CASC; 1, MCZC), VI-4-[190]8 (1, MCZC) . **Arkansas:** [Washington Co.], Fayetteville, VII-16-1942, M. V. Sanderson/ in light trap (1, INHS 830270). **Georgia:** No data (1, MCZC); Union Co., Blairsville, 18-24 June 1990, P. J. Landolt (1, FSCA). **Illinois:** [No data]/ Andreas Bolter Collection (1, INHS 830292); [5476] (1, INHS 830268); E. St. Louis, June 26, 1931, Frison, Betten & Ross (1, INHS 830193); Elizabethtown, July 4, 1948, Mills & Ross/ At light (1, INHS 830266); Peoria, May 26, 1938, June 20, 1938, Aug. 1, 1942, F. F. Hasbrouck (3, INHS 830393, INHS 830400, INHS 830405). **Indiana:** Bloomington, 7.13.[19]38, Daris[?] coll (1, PMNH); Tippecanoe Co., V-16-1986, N. M. Downie (1, FSCA) Lafayette, 8-21-1985, 4-Jul-1989, 7-17-1990, 7-18-1990, 7-20-1990, 7-24-1990, 28 July 1990, U-V light, N. M. Downie (6, FSCA; 1, WSUC). **Iowa:** [No data]/ Fall Collection (1, MCZC). **Kansas:** Douglas Co., F.H. Snow (1, SEMC); Lawrence, 7-15-1925, W. Benedict (1, SEMC). **Kentucky:** [Jefferson Co.], Louisville, VII-17 (1, MCZC). **Louisiana:** [Winn Parish], Winnfield, 6/21/ Fall Collection (1, MCZC). **Maryland:** Anne Arundel Co., Edgewater, 12-15 July 1991, C. L. Staines, blacklight (1, FSCA). **Mississippi:** Yallobusha Co., Water Valley, 10-20 VII- 1971, Michael Horan, Malaise Trap (1, FSCA). **Missouri:** St Louis, VII-10 (1, MCZC). **New Jersey:** [No data], R. Hopping Collection (1, CASC); [No locality], VII-29 (1, MCZC). **North Carolina:** [Haywood Co.], L. Junaluska/ H. V. Weens, Jr, coll. 1 VIII [19]57/ 2 VIII [19]57/ 3 VIII [19]57/ coll. at light (3, FSCA). **Pennsylvania:** [No data]/ Van Dyke

Collection (1, CASC); [No data] (3, MCZC); [Allegheny Co.], Allegh[en]y/ Liebeck Collection (3, MCZC, MCZ-ENT00642007); Allegh[en]y/ R. Hopping Collection (1, CASC); All[eghen]y (1, SEMC); Pittsburg, VII-20, VIII-7, VIII-10 (3, OSAC), VIII-10/ J. W. Green Collection (1, CASC); [Dauphin Co.], Rockville, VII-8-[19]10 (1, MCZC); [Indiana Co.], Indiana, 10-1930/ Hinton Coll. (1, BMNH); [Northampton Co.], Easton, VII-26-[19]45, J. W. Green (1, CASC); [Philadelphia Co.], Phila[delphia], VII-15/ J. W. Green Collection (1, CASC), VII-14 (1, MCZC), 7-20 (1, MCZC); [Westmoreland Co.], Jeannette (1, MCZC). **Ohio:** Franklin Co., Columbus, 20 Aug. 1989, R. S. Miller Colr. (1, MTEC); [Hamilton Co.], Cincinnati, 7-23-[19]38, W. D. Hartman (1, PMNH). **Tennessee:** Sevier Co., GSMNP, ATBI Plot, Twin Creeks, 273810E, 3951793N/ Malaise Trap MT02, 31 Jul- 15Aug 2002, B. Merritt (1, LSAM); GSMNP, Twin Creeks ATBI plot, MT-0119990817, 9-17 August 1999, MT-019990902, 17 Aug – 2 Sept 1999, MT-0120000619, 5-19 June 2000, Parker, Stocks, and Peterson (3, LSAM0103597, LSAM0103554, LSAM0103462). **Virginia:** Arlington Co., Arlington, 38.859°N, 77.123°W, 16-VII-2014, M. A. Johnson (1, FEEC, DNA–MTEC023671); Fairfax Co., Scott's Run, 21-VII-1963/ D. C. & K. A. Retz Collectors (1, CASC). **Wisconsin:** Purple disc / Coll. Janson, Ex Candeze/ [ID label w/ locality] (1, BMNH); Coll. Janson., Ex Candeze/ *Asaphes bilobatus* Say (1, BMNH). Gold disc (1, MCZC).

Incorrect Localities. **Hispanola:** Coll. Janson, Ex Dejean/ *A. melanophthalmus* Melsh., *Ath. subglaber* Beauvois, S. Domingo/ [Dejean label with last part of previous], S. Domingua, D. Beauvois [2] (2, BMNH).

Hemicrepidius brooksi New Species

Hemicrepidius sp. A; Brooks 1960: 32.

Hemicrepidius sp. A nr. *carbonatus*; Seibert 1993: 65.

Figs. 5.5a–5.5e.

Diagnosis

Hemicrepidius brooksi can be distinguished from all other species of *Hemicrepidius* by the sinuate posterior margin of the hypomeron, weakly curved prosternal process, a mesosternal fossa with edges slightly raised ventrally in a near 90-degree angle, punctures on the pronotal disc never cribrate, and the male genitalia. It is most similar to *H. carbonatus* and *H. soccifer*. From *H. carbonatus*, *H. brooksi* can be distinguished by the generally smaller size, the pronotal punctures on the disc never cribrate, the ventrally raised edges of the mesosternal fossa, and the parameres of the aedeagus with point of apical expansion narrower. From *H. soccifer*, *H. brooksi* can be separated by the sinuate posterior margin of the hypomeron so the hind angle is well projecting ventrally, the ventrally raised edges of the mesosternal fossa, and the narrower apical point of the apical expansion of the paramere of the aedeagus. Molecular data also serves to separate *H. brooksi* from *H. soccifer* (Fig. 5.1).

Description

Length 10.5–15.0mm, width 2–4mm; color dark brown to piceous, elytra not contrasting pronotum, legs, antennae and edges of segments often slightly lighter; integument shining. Setae moderate, suberect, gold to dark brown. **Head:** punctures subumbilicate, nearly contiguous, often with impunctate areas over antennal insertions; frons weakly concave anteromedially, some with slight triangular impression medial; frontal carina broadly rounded, complete, confluent with medial posterior margin of clypeal edge, at most weakly projecting; eyes moderate, rounded and bulging; antennae moderately serrate, antennomere 2 spherical, about as long as wide, antennomere 3 subtriangular $2\times$ length of 2, setae intermediate between 2 and 4, but more similar to 2, antennomere 3 subequal in length to 4, basal antennomeres wider than apical antennomeres, from $1.5\times$ longer than wide to about $3\times$ longer than wide, antennomeres 4–11 with subtle medial line bearing less setae than edges, antennomere 11 with tip constricted, sometimes as a pseudosegment, antennae reaching pronotal posterior edge to passing by two antennomeres. **Thorax:** Pronotum $1.1\times$ to $1.2\times$ wider than long, widest at hind angles or just anterior of midlength; sides weakly arcuate, gradually narrowing anteriorly, lateral carina complete, sometimes slightly deplanate laterally; hind angles slightly divergent, sinuate laterally on anterior edge of hind angle, dorsal carina present, moderate directed anteromedially; punctures on disc small to moderate, smaller than punctures on head, vaguely subumbilicate, separated by one diameter of puncture on disc to nearly touching in males, punctures closer and larger laterally, nearly contiguous and clearly subumbilicate; posterior edge with sublateral incisures. Hypomeron with

moderate, subumbilicate punctures, nearly contiguous anteriorly and becoming less dense posteriorly, small semicircular impunctate area often present on posterior one-sixth; posterior margin sinuate with hind angle visible ventrally, well projecting and truncate at tip (Fig. 5.5c), medial margin with impunctate line on extreme anterior and posterior ends only, punctate medially. Prosternum punctuation smaller than punctuation on hypomeron, simple, nearly touching laterally, much less dense medially, separated by over two puncture diameters; anterior lobe straight to very slightly deflexed, broadly rounded, not covering to partially covering ventral mouthparts; prosternal process slightly curved dorsally between procoxae, sometimes impunctate between procoxae, thickened, straight to slightly sinuate past procoxae. Mesosternal fossa with lateral edges slightly raised ventrally in 90-degree angle, posterior edge of fossa truncate. Metaventricle with punctures simple, smaller than punctures on hypomeron, dense laterally, nearly touching, less dense medially separated by one to two puncture diameters. Scutellar shield elongate, about twice as long as wide, narrowly rounded posteriorly, lateral margins sinuate, dorsal surface flat to weakly convex, anterior margin nearly straight, punctuation small, setae radiating from midline, similar to setae on pronotum and elytra. Elytral striae weakly impressed basally; interstriae flat to slightly convex, punctures small, scattered, giving wrinkled appearance; basal carina straight. Legs with tarsomere lobe on tarsomere 3 largest, wider than tarsomere, lobe on tarsomere 2 second largest, narrow, lobe on tarsomere 1 small, lobe of tarsomere 4 smallest, both lobes on 1 and 4 narrow, visible laterally. **Abdomen:** Punctures small, simple, a bit smaller than punctures on

metaventricle, moderately dense, separated by a puncture diameter, less dense medially; fifth ventrite broadly rounded; lateral edge of each ventrite with distinct microserrations.

Male genitalia: Figs. 5.5d and 5.5e. Parameres subparallel laterally on basal three-fourths, weakly sinuate laterally on apical fourth posterad of apical expansion, apical expansion coming to narrow sharp point; apex of paramere narrowly rounded and membranous, setose ventrally. Medial lobe narrow, constricted on apical half, basal struts curved latero-basally. Basal piece with membranous area broadly rounded medially in ventral view.

Etymology

The specific name is in honor of the late Arthur Robinson Brooks of Saskatchewan for his early recognition that this species was undescribed.

Distribution

Specimens have been examined from the following states and provinces; CANADA: AB. USA: CO, ID, MT, OR, UT, WA, WY (Fig. 5.6b).

Notes

This species has been previously confused with *H. carbonatus*. The diagnosis above and the key to species should enable this species to be correctly identified. Preliminary molecular data suggests it belongs to a clade of *Hemicrepidius* that possess a 90-degree ventral expansion of the mesosternal fossa (Fig. 5.2h). One specimen,

MTE023702, is quite distinct from the other specimens included in the tree (Fig. 5.1), but is represented by only a single sequence, the CO1 barcode region, which is 97% identical to the Montana specimens. However, no other characters exist to accurately separate this specimen from all the others, so it is included here as a paratype.

Larvae have been associated with *H. brooksi* (Etzler *et al.* 2014, as *Hemicrepidius* sp. nr. *carbonatus*), but they remain undescribed.

Specimens Examined

Types Examined. **Holotype. USA: Montana:** Glacier Co., N. Cutbank, Eney Farms Rd, 48.8799°N, 112.3000°W, 16-Jul-28-Aug-2015, Hart, Etzler, Vane Trap, ETOH; male, from MTEC on permanent loan to CASC; DNA data under barcode MTE023711. **Paratypes, 80. NORTH AMERICA:** Calgary, 95-215/ 29 (1, BMNH); **CANADA: Alberta:** Calgary, H. G. W., VII-1910/ G. Bryant coll. 1919-147 (1, BMNH); Calgary, VII-6-1921, O. Bryant (1, CASC); St. Mary River, 6-7-[19]23, R. D. Bird (1, MCZC, MCZ-ENT00641966). **USA: Colorado**[No data] (1, MCZC, MCZ-ENT00641982); [Chaffee Co.] Salida/ July/ A. Fenyes collection (1, CASC); [County?], Chimney Gulch/ Liebeck collection (1, MCZC, MCZ-ENT00642002); La Plata Co., Vicinity of Durango, 55-7000ft, July-23-Aug-1885/ F. C. Bowditch coll. (1, MCZC, MCZ-ENT00641983); [County?]; Mt. Lookout, 7000ft/ Golden, VII-10-[19]11, C. A. Frost (1, MCZC, MCZ-ENT00641975); Pitkin Co., 4mi SW Aspen, VIII-6-1964/ J. S. Buckett collector (1, CASC); [Routt Co.], Steamboat Springs, VI-1943, VII-15-[19]45, O. Bryant (2, CASC). **Idaho:** [Bear Lake Co.], Paris/ C. Lynn Hayward collector (1,

BYUC); [Cassia Co.], Oakley, June-1928/ D. Elden Beck collector (1, CASC); Latah Co., Moscow, Aug-5-1953, W. F. Barr collector/ at light (1, FSCA); [Twin Falls Co.], Twin Falls, July-30-1927, V. E. Romney col (1, MTEC). **Montana:** Beaverhead Co., 7-11-1928/ E26-416 (1, MTEC); Dillon, 7-13-[19]36/ William L. Jellison (1, MTEC); Broadwater Co., Canyon Ferry Wildlife Mngt. Area, N of Townsend/ 22-June-1988, C. E. Seibert (1, MTEC); [Flathead Co.?], East Flathead, July-25-1902/ elev 5700 (1, MTEC); Gallatin Co., 6-24-1951, 7-23-1951, Student Collecot (2, MTEC); Bridger Range, 5mi NE Bozeman, 30-June-1988, M. M. Hooten (1, MTEC); Bridger Canyon, Stone Creek, 18-VI-1988, T. K. Philips (1, MTEC); Bridger Cr, 4800', 3-Jul-1987, D. L. Gustafson, col (1, MTEC); Gallatin Val., July-9-1903 (1, MTEC); Bozeman, June-16-1909 (1, MTEC); Boze[man], Aug-1-[19]46, Underdahl (1, MTEC); Bozeman, 7-6-1946, Howard collectoe (1, MTEC); 4.8 mi W of Bozeman, VI-26-1986, R. S. Lang colr (1, MTEC); Talc Rd. E Three Forks, pitfall, elev. 4050ft, 22-Jun-20-Jul-1988, C. E. Seibert Colr (1, MTEC); Fort Ellis Research Farm, 45.6674°N, 110.9779°W, May-Aug-2011, 4905ft, P. S. Gill, WW canister trap (1, MTEC; DNA-MTEC008111); Hill Co., Beaver Creek, 6300ft, S. J. Hunter, August-1913 (2, SEMC); 1 mi E Big Sandy, 20-July-1996, M. A. Ivie and R. L. Hurley, on roadside milkweed (1, MTEC); Madison Co., Hidden Lake Bench, 7400' 22-July-1989, D. L. Gustafson col (1, MTEC); Hidden Lake Bench, 7400', pitfall trap, 12-Aug-1-Sep-1990, R. T. Ryti colr (1, MTEC); ponds near Hidden Lake, 26-July-1991, D. L. Gustafson col. (1, MTEC); Trudau Warm Sp., 09-July-1993, D. L. Gustafson col (1, MTEC); Park Co., Carters Bridge, S of Livingston, Yellowstone R/ 9-VII-1988, H. W. Ziolkowski (1, MTEC); Toole Co., 5 mi S Shelby, Marias R., L.

funnel, 3060ft, 18-Jun-21-Jul-1988, C. E. Seibert Colr (1, MTEC); Wheatland Co., Two Dot, Musselshell R., pitfall, elev. 4600ft, 28-Jun-24-Jul-1988, C. E. Seibert colr (1, MTEC). **Oregon:** [Baker Co.] Farewell Bend, Snake R., VI-18-[19]41 (1, OSAC0000551187); [Umatilla Co.] Freewater, 4mi N Milton, VII-11-1963, coll. J. A. Osanger (2, MTEC). **Utah:** Garfield Co., Boulder Creek, Boulder, near Hwy 12, 37°54'30"N, 111°25'20"W, 2-July-2001, D. J. Cavan, K. F. Kuehnl #112, blacklight (1, BYUC; DNA–MTEC023702); [Sanpete Co.], Milburn, 7-1920/ Vasco M. Tanner collector (1, CASC); [Tooele Co.], Stockton, VII-8-[19]13, Tom Spalding (1, CASC). **Washington:** [Columbia Co.], Dayton, 7-2-1933, L. T. Turner col (1, WSUC); Yakima Co., Parker, BL Trap, 1977, J. F. Howell coll. (1, WSUC); [Walla Walla Co.], College Place, VI-20-[19]44, VI-29-[19]44, VI-4-[19]46, VII-1-[19]46, VII-8-[19]46, G. H. Nelson (5, FSCA); Walla Walla, 6-10-[19]40 (7, OSAC0000551179-OSAC0000551184, OSAC0000551186); Walla Walla, 6-4-1926, 8-25-1926, M. W. Stone (2, CASC); Walla Walla, 4-27-[19]31, 6-8-[19]31, 6-21-[19]31, 7-3-[19]31, 7-9-[19]31, 7-23-[19]31, D. H. Brannon (2, CASC; 6, WSUC); Walla Walla, July-8-1938, July-30-1938, H. P. Lanchester (4, WSUC). **Wyoming:** Carbon Co., Vic Battle Creek Cpgd, 7400-8000', Med Sow NF, leg: C.D.F. 25-VII-[19]78 (1, FSCA); [Lincoln Co.], Kemmerer, VII-20-[19]54, G. T. Knowlton (1, SEMC); [Sweetwater Co.], Green River City, 6-7,000ft, July-20-27-1877/ F. C. Bowditch coll. (1, MCZC, MCZ-ENT00641976); Teton Co., Grand Teton Nat'l Park, ½ mi ESE Jackson Lk. Jct., 43.8613°N, 110.5604°W, 06-Aug-1999, K. A. Keating (4, MTEC; DNA–MTEC023713); Grand Teton Nat'l Park, Snake R. floodplain E. of the Potholes, 2104m, 43.7754°N, 110.5972°W, 07-Aug-1999, K. A.

Keating (1, MTEC); Yellowstone, VII-[19]35, J. H. Blum (1, CASC). **No locality** (5, INHS830317-INHS830320, INHS830322).

Hemicrepidius californicus Becker, 1979

Asaphes hirtus Candeze, 1865: 54; Horn 1880: 70; Candeze 1891: 181.

Hemicrepidius hirtus (Candeze, 1865): Secondary homonym with *Hemicrepidius*

hirtus (Herbst, 1784); Leng 1920: 170; Schenkling 1927: 415

Hemicrepidius californicus Becker, 1979: 410. Replacement name.

Figs. 5.2f, 5.2h, 5.7a–5.7e.

Diagnosis

Hemicrepidius californicus is most similar to *H. tumescens*, and has been historically confused with *H. obscurus*. *Hemicrepidius californicus* and *H. tumescens* have similar body shapes, antennae, and posterior edges of the hypomeron. However, *H. californicus* can be distinguished from *H. tumescens* by its darker coloration, its long, erect piceous setae, and the narrow acute apical expansion of the paramere of the aedeagus. From *H. obscurus*, *H. californicus* can be distinguished by the generally smaller size, the longer and more erect setae, the shorter and more densely punctate antennomeres, the posterior edge of the hypomeron with the posterior angle narrower ventrally; and the overall narrower aspects of the aedeagus.

Description

Length 10–16mm, width 3–4mm; color dark brown to piceous, unicolorous; integument shining. Body shallowly convex. Setae long and erect, piceous.

Head: Punctures subumbilicate, nearly contiguous; frons weakly to strongly concave anteromedially; frontal carina indistinct medially, broadly curved and confluent with medial posterior margin of clypeal edge; eyes small and weakly bulging; antennae moderately serrate, antennomere 2 globular, antennomere 3 with apical end weakly expanded, almost subcylindrical, 2× longer than antennomere 2 and with setation closer to antennomere 2, antennomeres 4 to 11 almost uniformly densely setose, medial line not distinct, antennomeres 4-10 gradually increasing in length, so antennomere 4 about just slightly longer than wide and antennomere 10 about 1.5× longer than wide, antennomere 11 with tip slightly constricted, antennae passing pronotal posterior edge by one to two antennomeres in males, and reaching posterior edge in females. **Thorax:** Pronotum as wide as long or just slightly wider than long, widest at hind angles or just anterior of midlength, sides broadly arcuate, more so in females, lateral carina complete; hind angles slightly divergent, dorsal carina present, thin, directed antero-medially and often interrupted by punctures; punctures subumbilicate and nearly contiguous throughout; posterior edge with sublateral incisures present. Hypomeron with subumbilicate punctures nearly contiguous anteriorly and becoming less dense posteriorly; posterior margin broadly rounded to hind angle which is strongly projecting posteriorly and truncate apically, medial margin without impunctate line medially. Prosternum punctuation vaguely subumbilicate, smaller than punctuation on hypomeron, less dense

medially; anterior lobe straight, short, not covering ventral mouthparts; prosternal process straight, impunctate between procoxae, broad dorso-ventrally. Mesosternal fossa with lateral edges expanded ventrally in near 90-degree angle, posterior edge of fossa truncate. Metaventrite with punctures smaller than punctures on hypomeron, simple, dense, nearly touching laterally and becoming less dense medially. Scutellar shield elongate, twice as long as wide, lateral margins sinuate, dorsal surface flat, punctures large, very dense, setae radiating from middle, long, anterior margin straight to slightly concave. Elytral striae moderately impressed basally; interstriae slightly convex, noticeably punctured; basal carina subtly crenulate. Legs with membranous lobes narrow, not visible dorsally, lobe on tarsomere 3 largest, lobe on tarsomere 2 second largest, lobe on tarsomeres 1 and 4 minute, lobe on tarsomere 1 slightly larger than lobe on tarsomere 4. **Abdomen:**

Punctures small, simple, similar in size to punctures on metaventrite, dense, almost touching, less dense medially; fifth ventrite narrowly rounded in females and broadly rounded in males; lateral edge of each ventrite with distinct microserrations. **Male**

genitalia: Figs. 5.7d and 5.7e. Parameres subparallel on basal four-fifths, weakly sinuate on apical one-fifth posterad of apical expansion, apical expansion acutely pointed laterally; apex of paramere broadly pointed, membranous, setose ventrally. Medial lobe narrow, weakly constricted apically, basal struts angled latero-basally at near 90-degree angle. Basal piece with membranous area broadly rounded medially in ventral view.

Distribution

Specimens have been examined from the following states: USA: CA. (Fig. 5.9a).

Notes

This is likely a coastal shore species based on the collecting localities of specimens examined. Larvae have not been associated with this species.

Specimens Examined

Types Examined. Of *Asaphes hirtus*: **Holotype:** Coll. Janson, Ex Candeze / *Asaphes hirtus* Cdz, Calif; male; type locality California, without further notes; in BMNH.

LeConte Collection (MCZC), 3. gold disk (= California)/ *hirtus* #1; [No label]/ *hirtus* #2; Cala./ *hirtus* #3.

Horn Collection (MCZC), 5. Cal./ with ID label; Cal.; California; California/ *carbonatus* #4; Cal./ *carbonatus* #5.

Other Specimens Examined, 72. **USA: California:** [No data]/ Coll. Janson (2, BMNH); Sharp collection/ 228/ ID label (1, BMNH); [No data]/ Sharp Coll. (2, BMNH); [No data] / ex Mus Murray (1, BMNH); [No Data]/ ex Saunders., Coll. Janson (1, BMNH); [No Data]/ 4501/ Bolter Coll., No. E79538 (1, INHS830196); [No data]/ Bolter Coll., No. E79539 (1, INHS830195); [No data] (1, MCZC); [No data] (1, SEMC); Alameda Co., Niles, V-10-[19]14/ F. E. Blaisdell Collector (1, CASC); [Humboldt Co.], Samoa Beach, 6-24-[19]56, P. S. B[artholomew] (4, CASC); Marin Co., McClure's

Beach, IV-20-[19]62/ J. K. Drew Collr. (1, CASC); Pt. Reyes, V-3-[19]36/ Van Dyke Collection (2, CASC), IV-7-[19]38 (1, CASC); Point Reyes, National Seashore North Beach, VI-12-1974/ M. S. Wasbauer, Fred G. Andrews, Collectors (1, CASC); Pt. Reyes Penin., Ten Mile Beach, 6-22-[19]57/ D. Giuliani Collector (1, CASC), RCA Sand Dunes/ D. Giuliani Collector (1, CASC); Monterey Co./ June 21- [18]98/ male/ A. Fenyes Collection (1, CASC); Ulke/ x42/ ex. Coll. Carl Fuchs via E. R. Leach Coll. (1, CASC); VI-2-[19]39, E. R. Leach (1, CASC); Pac. Grove, V.2.1918/ 3 und. Lupines on dunes/ L. S. Slavin Collection (1, CASC); Pac. Grove/ [19?]04-5 June, [19?]04-6 June/ [blue circle]/ A. Fenyes Collection (2, CASC); Pac. Grove/ [19]04.5 June/ Fall Collection (1, MCZC); San Francisco Co., [No date] (1, MCZC), June/ Fall Collection (1, MCZC); Pt. Lobos, 5-[19]65/ D. Giuliani Collector (2, CASC); San Francisco, [No date] (4, MCZC), V-28-[19]08 (1, CASC), V-14-1911 (2, CASC), IV-24-1912 (11, CASC), V-1912/ Van Dyke Collection (7, CASC), 11-24-[19]17/ F. E. Blaisdell Collector (1, FMNH), 16-IV-1946, Derham Giuliani, Cal. Acad. Sci. Coll. (2, CASC), VI-1-1946/ Pres. By P. Raven (1, CASC), 5-24-[19]52/ C. E. Kaufeldt (2, CASC), VI-5-[19]54/ Present by Peter H. Raven Collector (1, CASC), 5-VI-1967, Hugh B. Leech (1, CASC); S. Francisco, Ocean Beach, 6.14.[19]08/ Fall Collection (1, MCZC); San Francisco, Presodio, 5-21-[19]58/ D. Giuliani Collector (1, CASC); S. F. Bay Area/ D. Giuliani Collector (1, CASC); [San Luis Obispo Co.], Morro Bay/ May 1-5, 1944, Eugene Ray / under beach drift (1, FMNH); Oso Flaco Lake, ex: sand dunes, IV-12-1972/ E. A. Kane Collector/ Marshall W. Stone Collection (1, CASC); San Mateo Co., Ano Nuevo Pt., 6-[19]65/ Derham Giuliani Collection (1, CASC).

Hemicrepidius carbonatus (LeConte, 1860)

Asaphes carbonatus LeConte, 1860: 320; Candeze 1863: 214; Horn 1880: 71;
Champion 1897: 479.

Hemicrepidius carbonatus (LeConte, 1860); Glen 1950: 180; Brooks 1960: 32.

Figs. 5.8a–5.8e.

Diagnosis

Hemicrepidius carbonatus can be distinguished from all other species in *Hemicrepidius* by the combination of dense, nearly cribrate, punctures on the pronotal disc, and the curved prosternal process, and. *Hemicrepidius carbonatus* will most likely be confused with *H. brooksi*, *H. obscurus*, and *H. soccifer*. Characters that can be used to distinguish *H. carbonatus* from *H. brooksi* are those above. From *H. obscurus*, *H. carbonatus* can be distinguished by the curved prosternal process and apical expansion of the paramere of the sedaeagus larger and pointed latero-basally. From *H. soccifer*, *H. carbonatus* can be distinguished by the pronotal hind angle being more projecting on the hypomeron, the more concave frons, the longer antennomeres, and the parameres of the aedeagus.

Description

Length 13–21mm, width 3–6mm; color dark red-brown to piceous, elytra not contrasting pronotum, legs and ventral side often a bit lighter than dorsal side; integument dull to shining. Setae moderate, depressed, piceous. **Head:** punctures subumbilicate,

nearly contiguous; integument shining; frons concave anteromedially; frontal carina broadly rounded, complete, not confluent with medial posterior margin of clypeal edge, at most weakly projecting; eyes moderate, rounded, bulging; antennae serrate, antennomere 2 spherical, antennomere 3 subtriangular, $2\times$ length of 2, and with intermediate setation between 2 and 4, antennomere 3 subequal in length to 4, antennomeres 4 to 11 about $3\times$ longer than wide, or with basal segments a bit wider about $2.5\times$ longer than wide, usually densely setose throughout, sometimes medial area with subtly less setation, antennomere 11 with tip constricted, antennae passing pronotal posterior edge by one to two antennomeres. **Thorax:** Pronotum as wide as long to $1.3\times$ wider than long, widest at hind angles or just anterior of midlength; sides weakly arcuate, lateral carina complete; hind angles slightly divergent, lateral edge sinuate anterior of hind angle, dorsal carina present, thick, directed antero-medially; punctures on disc same size as punctures on head, subumbilicate, nearly contiguous, punctures shallower laterally; posterior edge with sublateral incisures. Hypomeron with subumbilicate punctures, nearly contiguous anteriorly and becoming slightly less dense posteriorly; posterior margin sinuate with hind angle visible ventrally and truncate at tip (Fig. 8c), medial margin usually without impunctate line throughout, sometimes just present at either extreme anterior or posterior end or both. Prosternum punctuation smaller than punctuation on hypomeron, simple, nearly touching laterally, less dense medially; anterior lobe straight to weakly deflexed, short, broadly rounded, not covering to partially covering ventral mouthparts; prosternal process curved dorsally between procoxae, narrow and straight past procoxae. Mesosternal fossa with lateral edges sinuate, posterior

edge of fossa truncate. Metaventrite with simple punctures, smaller than punctures on hypomeron, moderately dense throughout, separated by one puncture diameter. Scutellar shield elongate, about twice as long as wide, broadly rounded posteriorly, lateral margins sinuate, dorsal surface flat, anterior margin nearly straight, punctuation small, setae radiating from midline, similar to setae on pronotum and elytra. Elytral striae moderately impressed basally; interstriae flat to slightly convex, punctures small, scattered, giving wrinkled appearance; basal carina crenulate. Legs with lobes on tarsomeres 2 and 3 largest, subequal, narrow, lobe on tarsomere 4 minute, visible only ventrally, lobe on tarsomere 1 smallest, barely visible ventrally. **Abdomen:** Punctures small, simple, smaller than punctures on metaventrite, moderately dense throughout, separated by a puncture diameter; fifth ventrite narrowly rounded; lateral edge of each ventrite with distinct microserrations. **Male genitalia:** Figs. 5.8d and 5.8e. Parameres subparallel on basal four-fifths, strongly sinuate on apical one-fifth posterad of apical expansion, apical expansion acutely pointed latero-basally; apex of paramere broadly pointed, weakly membranous, setose ventrally. Medial lobe narrow, weakly constricted apically, basal struts curved latero-basally. Basal piece with membranous area broadly pointed medially in ventral view.

Distribution

Specimens have been examined from the following states; USA: CA, CO, ID, MT, NV, UT, OR, WA (Fig. 5.9b).

Notes

Considerable confusion exists in the literature about this species. All specimens of Mexican *H. carbonatus* examined by Champion in 1897 have turned out to be other species, mostly the dark form of *H. soccifer*. The vast majority of historical identifications belong to other species of *Hemicrepidius* and should be used with caution. A good example is Brooks' (1960) record of *H. carbonatus* in the Canadian Prairie Provinces. These records represent *H. soccifer*, as *H. carbonatus* will never have yellow or gold setae. The dense pronotal punctation in both species and the lack of clarity in Horn's key likely led to this misidentification.

Larvae have been tentatively associated with this species (Glen 1950).

Specimens Examined

Types Examined. Of *Asaphes carbonatus*: **Holotype**: [blue disk] (=) / A. carbonatus Lec. / Type #2609; female [not male as in original description]; type locality Oregon or Rocky Mountains; in MCZC.

LeConte Collection (MCZC), 4. Utah / carbonatus#6; [silver disk] / this sp.= *Asaphes carbonatus* / carbonatus #7; [green disk] / A. coracinus Cand. / carbonatus #8; Col. / carbinatus #9.

Horn Collection (MCZC), 6. In *H. carbonatus* tray: Cal., #1; #2; #6; #7; #9. In unidentified *Hemicrepidius* tray: W.T.

Other Specimens Examined, 37. **CANADA: British Columbia:** Lillock, July-24-1917, R. C. Treherne (1, CASC); Vernon, Aug-1-1921, Ralph Hopping (1, CASC). **USA:** **California:** Ex Mus Murray / Fry Coll. 1905–100 (1, BMNH); [No data]/ Liebeck collection (1, MCZC, MCZ-ENT00641960); Modoc Co., Goose Lake, VII-23-[19]22, VII-24-[19]22/ C. L. Fox collector (2, CASC). **Colorado:** [Larimer Co.], 21 mi East of Estes Park, 8-11-[19]32/ collector K. Maehler (1, CASC). **Idaho:** [Twin Falls Co.], Twin Falls, July-4-1927, V. E. Romney col (1, MTEC). **Montana:** Lincoln Co., 899 Florence Rd, Libby, 48.41645°N, 115.52374°W, 31-July-2014; 2368ft, Bares, Dolan, blacklight (1, MTEC). **Nevada:** [Humboldt Co.], Sheldon Refuge, 6500ft, Schawatz (1, OSAC0000541755); Lander Co., 5mi ESE Austin, Hwy 50 at Hwy 21, alt. 6750ft/ 15-VII-1964, H. B. Leech (1, CASC). **Oregon:** [No data] (1, SEMC); [No data]/ Collection of Frederick Allen Eddy (2, MCZC, MCZ-ENT00641963, MCZ-ENT00641964); [No data]/ Coll. Janson, Ex Candeze / *Asaphes carbonatus* LeC. (1, BMNH); Deschutes Co., 7 miles S Bend, T19S, R12E, S11, June-25-1958, Gerald F. Kraft (1, OSAC0000566843); Juniper Lake, June-18-1951, Borys Malkin (1, OSAC0000551188); Harney Co., “P” Ranch, VI-20-[19]22/ W. J. Chamberlain collector (1, OSAC0000567995); [Jackson Co.], Medford, July-1-1950/ L. G. Gentner collector (1, OSAC0000836971); [Klamath Co.], Klamah Falls, 7-8-[19]14/ H. F. Wilson collector (1, OSAC0000567993); Lake Co., Hart Mt., Antelope Range Hot Spr. Campground, springs, VIII-26-1983, R. S. Zack collector (1, WSUC); 15mi NW Silver Lake, VII-1-[19]56/ H. B. Leech collector (1, CASC); [Wasco Co.], Antelope, 7-31[?]-[19]22 (1, CASC); [County?], Ochoco Nat. For, Snow Mt. Distr., July-1947, Paul Hatch (1, OSAC0000551189). **Utah:** Garfield Co., Calf

Crk. Cpgd, 4-Aug-1983, R. W. Baumann (2, BYUC); Millard Co., 15mi S Delta, 28-July-1969, J. L. Perry (1, BYUC); Tooele Co., Clover Creek, VII-20-1954/ at light/ J. L. Eastin collector (1, BYUC). **Washington:** Benton Co., Hanford Site ALE, Lower Snively Spring, 46°27.583'N, 119°43.249'W, 12-July-1995, R. S. Zack/ collected at mercury vapor lamp (1, WSUC, DNA-MTEC023701); Hanford Site ALE, Rattlesnake ridge, spring, N46°24.391' W119°36.312', 31-July-1995, R. S. Zack collr/ collected at mercury vapor lamp (2, WSUC); [Kittitas Co.], Easton/ Koebele collection (1, CASC); Ellensburg (1, WSUC); Ellensburg, VI-14-[19]30, W. [and?] W. Baker (1, OSAC0000551178); [Thurston Co.], Olympia/ 6-25-[18]97/ Van Dyke Collection (1, CASC); [Walla Walla Co.], Walla Walla, 6-7-1926, M. W. Stone col (1, CASC); [Yakima Co.], Tieton, VI-20-1936/ S. E. Crumb [Jr] collector (1, OSAC0000566844). **Washington Territory:** [No data] (1, INHS 830311).

Hemicrepidius decoloratus (Say, 1836) – Status Resurrected

Elater decoloratus Say, 1836: 180.

Asaphes decoloratus (Say, 1863): LeConte 1853: 151; Candeze 1863: 216; Horn 1880: 73.

Hemicrepidius decoloratus (Say, 1863): Leng 1920: 170; Schenkling 1927: 414; Dietrich 1945: 29; Hayes and Wheeler 1968: 207.

As synonym of *H. hemipodus*: Becker 1979: 410.

Figs. 5.10a–5.10e.

Diagnosis

Hemicrepidius decoloratus can be distinguished from all other *Hemicrepidius* by the combination of a slightly convex center of the frons flanked by two indentions, a straight prosternal process, the slight pronotal hind angle projection on the hypomeron, and relative squat aedeagus. *Hemicrepidius decoloratus* is very close in appearance to both *H. hemipodus* and *H. indistinctus*. From *H. hemipodus*, *H. decoloratus* can be distinguished by the smaller punctation, the straight prosternal process, and the slight projection of the pronotal hind angle on the hypomeron. Many specimens of *H. decoloratus* will be bicolored, with yellow-brown elytra and a piceous pronotum, a combination which never appears in *H. hemipodus*. From *H. indistinctus*, *H. decoloratus* can be distinguished by the straight prosternal process, the convex area on the frons, and by having the pronotal punctures closer and larger laterally.

Description

Length 9.0–15mm, width 3–4mm; color variable, pronotum piceous, sometimes with anterior edge, posterior edge, hind angles, margins or hypomeron, and anterior lobe of prosternum yellow-brown, elytra dark brown, brown, or yellow brown, legs and antennae brown to yellow-brown, sometimes parts of head, parts of metathorax, and edges of abdominal segments lighter; integument shining. Setae moderate, depressed, grey, although sometimes appearing gold. **Head:** punctures subumbilicate, nearly contiguous; frons with two weakly concave indentions lateral of a weakly convex center; frontal carina complete, roughly v-shaped, not confluent with medial posterior margin of

clypeal edge, at most weakly projecting; eyes moderate, rounded, moderately bulging; antennae weakly serrate, antennomere 2 subcylindrical, antennomere 3 subcylindrical and $1.5\times$ length of 2, with similar punctation to antennomere 2, antennomeres 4 to 11 about $3\times$ longer than wide, each densely and uniformly punctate, antennomere 11 usually oval-shaped, sometimes with tip subtly constricted, antennae passing pronotal posterior edge by one to three antennomeres. **Thorax:** Pronotum as wide as long, or $1.1\times$ wider than long, widest at hind angles or just anterior of midlength; sides weakly and broadly arcuate, lateral carina complete; hind angles divergent, dorsal carina present, thin, parallel to lateral carina, more pronounced in females; punctures small, appearing simple, separated by one to two diameters of a puncture on disc, punctures closer laterally, and larger, some more obviously subumbilicate; posterior edge with sublateral incisures present. Hypomeron with small punctures, subumbilicate or appearing simple, dense, separated by less than a diameter of a puncture or nearly contiguous, posterior one-fourth with large impunctate area; posterior margin almost ear-like except for small projection at hind angle, medial margin with short impunctate line near procoxae (Fig. 10c). Prosternum punctuation matching punctuation on hypomeron, although less dense, much sparser medially; anterior lobe slightly deflexed, short, broadly rounded, usually not covering ventral mouthparts; prosternal process narrow and straight past procoxae. Mesosternal fossa with lateral edges sinuate, posterior edge of fossa truncate. Metaventricle with punctures simple, much smaller than punctures on hypomeron, dense laterally, nearly touching, becoming much less dense and sparser medially. Scutellar shield elongate, about twice as long as wide, narrowly rounded posteriorly, lateral

margins sinuate, dorsal surface weakly convex, anterior margin nearly straight, punctuation small, setae radiating from midline, dense. Elytral striae weakly impressed basally; interstriae flat to slightly convex, punctures small, simple, and well spaced; basal carina simple. Legs with tarsomere lobes broad, visible dorsally, lone on tarsomere 3 largest, lobe on tarsomere 2 second largest, lobe on tarsomere 1 small, lobe on tarsomere 4 minute, barely visible ventrally. **Abdomen:** Punctures small, simple, similar to punctures on metaventrite, moderately dense, separated by a puncture diameter, less dense medially; fifth ventrite narrowly rounded; lateral edge of each ventrite with microserrations small and difficult to see. **Male genitalia:** Figs. 10d and 10e. Parameres relatively wide, subparallel on basal two-thirds, strongly sinuate on apical one-third basad of apical expansions, apical expansion pointed laterally; apex of pointed, weakly membranous, setose ventrally. Medial lobe broadly triangular, basal struts weakly curved latero-basally. Basal piece with membranous area transverse medially in ventral view.

Distribution

Specimens have been examined from the following states and provinces:

CANADA: ON, PQ. USA: CT, IL, IN, IA, KS, ME, MD, MA, MI, NE, NH, NJ, NY, NC, OH, PA, TX, VA, WV, WI. (Fig. 5.12a).

Notes

This species has been historically confused with *H. hemipodus*, which occurs in the same region. After careful study, I find that these two species are not the same, removing the synonymy that has existed since Horn (1880) (see also Becker 1979, for discussion of synonymical issues). The morphological observations have also been supported by preliminary molecular data (Fig. 5.1). *Hemicrepidius decoloratus* is more often bicolored, with the elytra yellow brown, compared to the typically unicolorous *H. hemipodus*. However, unicolorous *H. decoloratus* are not uncommon.

Due to the historic confusion between *H. hemipodus* and *H. decoloratus*, the following observations and associations should be used with caution, as they could refer to either species.

Based on observations in an alfalfa field in New York State, a sex pheromone is suspected (Hayes and Wheeler 1968). These observations are fairly typical for elaterids, with the males flying and moving towards females on alfalfa stalks in the field. However, no tests or studies have been conducted to verify or determine the chemical nature of these attractants.

Larvae have also been tentatively associated with this species (Glen 1950). However, in examining the 28 vials from the INHS of larvae, exuviae, and adults identified as *H. decoloratus*, all adults were *H. hemipodus*. A re-evaluation of larval association needs to be conducted using molecular methods.

I have examined a specimen in the BMNH collected from Antigua and identified as this species. The specimen was actually *Conoderus lividus* (De Geer 1774), a common

species in the West Indies. *Hemicrepidius decoloratus* is removed from the West Indian fauna.

Specimens Examined

Types Examined. Of *Elater decoloratus*, Say: holotype missing; type locality Pennsylvania. **Neotype:** pink disk (= Middle States: Md., Del., N.Y., N.J., Pa., Conn.?, R.I.?) / *decoloratus* #1/ *A. decoloratus* Say; female; LeConte collection in MCZC.

LeConte Collection (MCZC), 8. pink disk/ *decoloratus* #2; pink disk/ *decoloratus* # 3; yellow disk/ *decoloratus* #4/ yellow disk/ *decoloratus* #5; pink disk/ *decoloratus* #8; pink disk/ *decoloratus* #12; yellow disk/ *decoloratus* #13; yellow disk/ *decoloratus* #14.

Horn Collection (MCZC), 9. in *H. decoloratus* tray: #1, ID label only; #2, Buffalo, N.Y.; #3, Buffalo, N.Y.; #4, Can.; #5, Can; #9, no locality. In *H. hemipodus* tray: #2, no locality; #4, yellow disk. In unidentified *Hemicrepidius*: Hot Springs, Va., 2400-2600ft, VII-3-1916(H).

Other Specimens Examined, 471. **North America:** Coll. Janson., Ex Candeze / yellow disc (1, BMNH); Coll. Janson, Ex Dejean/ *Athous anachoreta*, h. in Amer. Bor. (3, BMNH); Coll. Janson, Ex Dejean/ *A. decoloratus* Say, *Ath. viduus* Dej., Amer. Bor. LeC (pars) (3, BMNH). **Canada:** [No data] (1, MCZC); Canada, 52 – 106/ *Asaphes decoloratus* Say (sec. CdZ Coll) (1, BMNH); Kemp/ A. Fenyes collection (2, CASC).

Ontario: [No data] (2, MCZC); Godmet, VII-28-[19]24 (1, MCZC); Strathroy, Jul-12-[19]16 (1, INHS830357); Toronto, [no date], 7-2-[18]95, R. J. Crew (5, MCZC); Toronto, R. J. Crew/ [silver star] (7, CASC); Toronto/ Blaisdell Collection (3, CASC); W. Ont/ [4509]/ R. Hopping collection (1, CASC). **Quebec:** [No data] (4, MCZC); Lake Memphremagog, June-24-29-1906, Jun-27-30-1920 (12, MCZC); Laval Co., 13-VII-[19]07 (1, MCZC); Mon[treal?] (1, MCZC); Montreal (2, MCZC); Potion Springs, July 1-4. [19]20 (1, MCZC); Arthabaska, Nic., 8-VII-[19]67, C. Chantal (2, FSCA); Cap Rouge, 22-VII-[19]58, 22-VII[19]62, C. Chantal (2, FSCA); Como, July-1932, Jul-Aug-1933, Jul-1938, Olive R. Leech (3, CASC); Lac Beauport, 18-VII-[19]53, C. Chantal (1, FSCA); Lake Memphremagog, June-24-29-1906 (1, MCZC, MCZ-ENT00642003); Montreal, [no date], June-190[0?], VII-09 (11, CASC); Montreal/ Chagnon (2, CASC); Que[bec] Co., 20-VII-[19]67, C. Chantal (1, FSCA); Rigaud, 26-VII-[19]02 (1, CASC); Rouville Co., 11-VII-[19]07 (1, CASC); Ste-Catherine Port., 26-VII-[19]61, C. Chantal (1, FSCA); Ste-Foy, 18-VII-[19]67, C. Chantal (1, FSCA). **Dubious locality: British Columbia:** ?Vancouver I., Coll. Janson (1, BMNH). **USA:** Coll. Janson, Ex Candeze/ decoloratus ID label, Est. Uni (1, BMNH). **Connecticut:** No Branford, 8-Jul-1921, M. P. Zappe (1, MCZC); N.W. Conn., VII-2-[19]33/ L. Gressitt collector (3, CASC). **Illinois:** [No data] (2, INHS830342, INHS830336); [Knox Co.], Galesburg (1, MCZC); White Pine Forest Park, July-12-1934, Delong and Ross (2, INHS830425, INHS830431); Apple River Can., State Park July-11-1934, Delong and Ross (3, INHS830407, INHS830415, INHS830421); Putnam Co., June-30-1932, M. C. Glenn (1, INHS830519); [Rock Island Co.], Rock Island, 1880 (1, INHS830487); Rock Id, June 1880 (1, INHS830509).

Indiana: Montgomery Co., Shades State Park, June-23-2013, at light, Kyle E. Schnepf (1, KESC, DNA–MTEC023672); Parke Co., June-20-1980, N. M. Downie (1, FSCA); Tippecanoe Co., VI-23-1953, N. M. Downie (1, FSCA); Wayne Co., Hagerstown, VI-26-[19]71, D. Brzoska (1, SEMC). **Iowa:** [Johnson Co.], Iowa City, Wickham, VII-3-[18]98 (1, MCZC); Linn Co., 3.0mi N Viola, VI-27-29-[19]73, B and S, E. L. Sleeper Collr. (2, CASC). **Kansas:** [No data] (1, MCZC); Reno Co., VIII-6-[19]12/ Blaisdell collection (1, CASC). **Maine:** 664, Maine / Ex Coll. E. A. Butler, 1926—171 (1, BMNH); [No data] (1, MCZC); [County?], Chr. C. (3, MCZC); S. Thompson, VII-19-[19]19 (1, MCZC); [Androscoggin Co.], Lewiston, S. Stebbins (1, MCZC), Geo. Dimmock (1, MCZC); Wales, VII-11-[19]04, C. A. Frost (1, MCZC); Wales, VII-16-[19]13, C. A. Frost/ sweeping (1, PMNH); [Cumberland Co.], Sebago Lake, 7-7-[19]09 (1, MCZC); Sebago L., VII-2-[19]09 (1, MCZC); [Hancock Co.], Cape Rosier, VIII-12-1922/ P. J. Darlington (1, MCZC); [Kennebec Co.], Monmouth, VII-17-[19]14, C. A. Frost (1, MCZC); Lincoln Co., 7-13-[19]48, 7-9-[19]50, D. J. Borrer (2, FSCA); [Oxford Co.], Bethel (6, MCZC); Bethel, 7-9-[19]29, 7-30-[19]29/ Milkweed (3, MCZC); Paris, VII-9-[19]41, 8-VII-1949, VII-27-[19]58, VII-28-[19]58, C. A. Frost (2, CASC; 3, FSCA; 1, MCZC); Paris, VII-10-[19]37, C. A. Frost/ Coll'd on *Corvius rostratus* (1, MCZC); [York Co.], Old Orchard Beach, 7-23-1884 (1, MCZC). **Maryland:** Allegany Co., Green Ridge St. For., 22-VI-1985, C. L. Staines, Jr (1, FSCA); Bethesda, VI-24-1967, B. K. Dozier (1, FSCA); Montgomery Co., Poolsville, 15-June-1978, W. E. Steiner (1, FSCA); Seneca, VI-29-[19]50; D. Beisiegel (1, FSCA); Gar, Carey Run, 19-VI-[19]81, C. L. Staines, Jr. (1, FSCA?); Plimmers Id, VI-17-[19]13 (1, INHS830435); Carrol Co., Ditman [?], 7-12-

[19]32 (1, WSUC). **Massachusetts:** [No data] (1, CASC; 2, MCZC; 1, SEMC); [Light Brown discs = Cambridge, 1871, Hubbard and Schwarz] (3, MCZC); [Berkshire Co.], Monterey, VII-9-[19]19, VII-12-[19]21, C. A. Frost (3, MCZC); Monterey, 8-VII-1923 (2, SEMC); South Egremont, 2-VII-1923/ L. Lacey, B. M. 1950-61 (1, BMNH); [Hampden Co.], Montgomery/ Knab (1, CASC); [Worcester Co.], Petersham, VII-15-1920, G. C. Wheeler (1, FSCA); Mt. Washington, June-22-25-1913 (1, MCZC, MCZ-ENT00642005); [County?], Spet Is./ 7-20-[19]33 (1, PMNH). Frederick Allen Eddy Collection: July 1880 (1, MCZC); [River?/ Bruins?] 4 m E RR, 7-9-[18]96 (4, MCZC); 7-13-[18]96, Harold (1, MCZC); Hoo[pers] L. H., July 10-12, [18]99 (1, MCZC); Hoo[fere] Hill, 7-12-[18]99 (1, MCZC); 7-18-24-1899, [Abendherine?]; 9-8-[18]99, [R?]. J. Whe (1, MCZC); 7-6/8-1900, Hoo[fuse?] [Treh?] (1, MCZC); 7-14-1900, Mulford H[agl] (1, MCZC); 7-5/6-1902, [Cottage lrfel] (1, MCZC); 7-19-[19]07, on the lake surface (1, MCZC); 7-4-1913, Paula [Camela] (1, MCZC); 7-26-1913, Mill 8m Ea. (1, MCZC). **Michigan:** Midland Co., VII-10-[19]39, R. R. Breisbach (1, OSAC0000569385); Oakland Co., 1258ab, VII-3-1921, M. H. Hatch (1, OSAC0000551172); VI-20-1926, VI-20-1930, VI-20-1931, VII-10-1938, A. W. Andrews (1, FSCA; 4, MCZC); Washtenaw Co., Ann Arbor, VII-19-1927, N. K. Bigelow (1, FSCA). **Nebraska:** Walses [?], VII-9-1913 (1, FSCA). **New Hampshire:** [No data] (7, MCZC); [No data]/ Davies/ [red star] (1, CASC); [Belknap Co.], Center Harbor, 7-[19]38, 7-15-[19]38, July-1951, P. B. Lawson (11, SEMC); Meridith, 7-10-[18]99 (1, MCZC); [Carroll Co.], Chocorene [*sic*], I-[19]31 (1, MCZC); No. Conway, Jul 30, 1891 (1, MCZC); Tamworth, VI-26-1923, P. J. Darlington (1, MCZC); [Grafton Co.],

Franconia (2, MCZC); Fraconia Notch, J. H. E. (1, MCZC); Lebanon, 7-8-[19]38, M. W. Sanderson (1, SEMC); Mt. Moosilauke, Jul-3-9-[19]12, N. S. Easton (3, MCZC); Mt. Stinson, VII-3-[19]24 / Darlington (1, MCZC); Rumney, VI-24-1925, VII-19-1935, Darlington (2, CASC; 1, MCZC); Warren, 7-26-[19]40 (2, OSAC0000569390, OSAC0000569394); [Merrimack Co.], Franklin, VII-1951, E. C. Zimmerman, B. M. 1951-394 (1, BMNH); [Strafford Co.], Farmgtn, 8-[18]93, 7-28-[19]07 (2, MCZC); Vic. Dover, 7-18-[19]27, M. J. Smith (1, MCZC); [County?] Squam Lk, VII-11-[19]37, J. W. Green (1, CASC). **New Jersey:** [No data] (7, MCZC); [Passaic Co.] Ringwood, 7-3-1917 (1, INHS830447); [Sussex Co.], Stockholm, VII-7, VII-28, A. Nicolay (4, OSAC0000569387, OSAC0000569389, OSAC0000569396, OSAC0000569397); [Warren Co.], Phillipsburg, VII-1-[19]17/ J. W. Green collector (1, CASC); W. Gap, 7-12 (1, MCZC). **New York:** [No data] (3, MCZC; 1, SEMC); Albany Co., Resselaerville Huyck Preserve/ Ross H. Arnett, Jr., July-18-31-1975 (1, FSCA); [Cattaraugus Co.], Dayton, VII-27-[19]20, M. C. Van Duzee (1, CASC); Little Valley, VII-3-[19]20, M. C. Van Duzee (1, CASC); Cayuga Co., Sterling, 5-July-[19]67, R. A. Greenwood (2, LSAM); [Erie Co.], Buffalo (2, MCZC; 1, SEMC); Buffalo, M. C. V[an Duzee] coll. (1, CASC); East Aurora, 7-25-[19]09, 7-17-[19]10, M. C. Van Duzee (4, CASC); Lancaster, 6-28-[19]08, M. C. V[an Duzee] (5, CASC); [Essex Co.], Ticonderoga, July-25-[19]28/ F. C. Lutman (1, PMNH); [Niagara Co.], Olcott, VII-4-[19]25, M. C. Van Duzee (1, CASC); [Onondaga Co.], Elbridge, June-26-1940, June-23-1941, N. M. Downie (1, FSCA; 1, WSUC); [St. Lawrence Co.], Canton, July-1-1936 (1, FSCA); [Tompkins Co.], Ithaca (1, MCZC); Ithaca, VII-10-1940, VII-16-1940, VII-17-1940, VII-24-1940, VII-31-

1940, J. N. Belkin (23, FSCA); Ithaca, 26-June-1937, 9-July-1937, 22-July-1937, 29-July-1937, 29-July-1939, J. G. Franclemont (5, FSCA); Ithaca, VII-10-1946, 14-VII-1946, 9-VII-1947, Ross H. Arnett, Jr (3, FSCA); Ithaca, 17-July-[19]54, W. D. Stockton (1, CASC); Ithaca, 9-July-[19]04, 16-July-[19]04, 15-July-[19]07, 17-July-[19]17, 20-July-[19]17, 24-July[19]17, 27-July-[19]17, 28-July-[19]17, 30-July-[19]17, 31-July-[19]17, 4-Aug[19]17, 9-July-22, VIII-12-[19]34, 12-July[19]35 (2, CASC; 2, FSCA; 28, INHS830343, INHS830436, INHS830440, INHS830444, INHS830449, INHS830451-INHS830455, INHS830457, INHS830459-INHS830461, INHS830464, INHS830466, INHS830470-INHS830473, INHS830476, INHS830477, INHS830480, INHS830485, INHS830486, INHS830494-INHS830496, INHS830504; 1, WSUC); Ithaca, July-1921, Paul B. Lawson (1, SEMC); Ithaca, 12-July-[19]35, N. M. Downie (1, WSUC); McLean, Aug-13-1917 (INHS830492); [Ulster Co.], Ellenville, 6-18-July-1937, E. J. Gerberg (1, FSCA); [Wyoming Co.], Rock Glenn VII-8-[19]23 (1, CASC). **North Carolina:** [Haywood Co.?], Mt. Pisgah/ H. V. Weems, Jr, 20-VI-[19]55 (1, FSCA); [Macon Co.], Highlans, J[un?]e-[18]89 (1, MCZC). **Ohio:** [Franklin Co.], Columbus, 6-28-[19]21, A. E. Miller/ from sweeping (1, FSCA); Wyandot Co., Sycamore, P. S. Bartholomew (1, CASC). **Pennsylvania:** [No data] (1, MCZC); [Allegheny Co.], Pittsburgh, VII-1-[19]24, VI-19-[19]25 (3, BYUC); Wall, X-4-[19]17 (1, BYUC); [Dauphin Co.], Inglenook, VI-3-[19]17, VII-3-[19]17 (2, MCZC); Inglenook, VI-11-[19]11, H. B. Kirk (1, MCZC); Inglenook, VI-17-[19]11/ Van Dyke collection (1, CASC); Inglenook, VI-21-[19]12, Champion (1, MCZC); Rockville, 6-10-[19]21 (1, MCZC); [Erie Co.], North East, 7-20-[19]20/ J. N. Knull coll. (1, CASC); Presque Il, 7-21-[19]20/ T. L. Guyton coll. (1,

CASC); [Monroe Co.], Effort, VII-20-[19]32, VII-2-[19]39, J. W. Green (12, CASC); Water Gap (1, MCZC); [Northampton Co.], Easton, VI-12-[19]21/ L. S. Slevin collection (1, CASC); Easton, VII-4-[19]26, VII-19-[19]28, VII-10-[19]29, VI-1934, VI-24-[19]34, J. W. Green (2, FSCA; 14, CASC); Wind Gap, July-1946, J. W. Green (5, WSUC); [Pike Co.], Greentown/ 17-VII-1926, Quirsfeld (2, CASC); [Sullivan Co.], Forksville, VII-17-[19]30, J. N. Knull (1, MCZC); [Susquehanna Co.], Montrose, VIII-6-[19]21, J. W. Green (1, CASC); [Westmoreland Co.], Jeanette, VI (1, OSAC0000569388). **Texas:** [No data] (1, MCZC). **Vermont:** [No data] (4, INHS830326, INHS830332, INHS830334, INHS830335; 5, MCZC; 1, WSUC); Vt. / N. America, 74—12/ ID label (1, BMNH); Vt./ Belfrage / Am. Bor., Vermont / Fry Coll., 1905—100 (2, BMNH); Northern Vermont, July-1881, July-1882, Aug-1883 (3, MCZC); [Addison Co.], Ripton, July-7-[18]95 (6, MCZC); Salisbury, 7-5-[18]95 (2, MCZC); [Lamoille Co.] Luce Hill, Stowe, sweeping, Coll. R. T. Bell, July-23-1961 (3, CASC); W. Elmore, summer 1968, coll. R. T. Bell (1, CASC); WB, 7-9-[19]48, GM (1, CASC) [Orange Co.], Bradford, R. Chipman (x), June-July, 1965 (1, CASC); [Windsor Co.], Norwich, Jul-1-1923 (1, MCZC); So. Royalton, VII-[19]10, K. A. F. (2, MCZC); W. Elmore, blacklight, July-25-1966, Coll. R. Bell (1, CASC). **Virginia:** 10-20mi S Rt 211, Skyline drive, VII-27-1951, G. H. Nelson/ bugbane (4, FSCA); Giles Co, #97 Wind Rock, 5 mi N Mt. Lakem 27-July-1973, 4100', George W. Bryers (1, SEMC). **West Virginia:** Grant Co., Smoke Hole Cave, 20-VI-1994, Eric and L. Stange (1, FSCA); Greenbriar Co., 12-18mi E of Richwood Along WV-39, 10-VII-1986, Howard V. Weems, Jr (1, FSCA); 6-16mi E of Richwood on WV-39, 12-VII-1986, Howard V. Weems, Jr. (1, FSCA); Pocahontas Co., Cranberry glades, 7-VII-

[19]67, H. V. Weems, Jr., Hilltop, 4300ft (1, FSCA); Pocahontas Co., Cranberry glades, 9-VII-[19]67, H. V. Weems, Jr. (1, FSCA); Pocahontas Co., Monongahela National Forest, Tea Creek Campground, on flowers, 25-26-VI-2010, Coll J. M. Leavengood Jr. w/ E. G. Chapman and M. Spelman (2, JMLC); Pendleton Co., Spruce Knob, nr summit, 11-VII-1991, M. C. Thomas, *Hydrangea* blossoms (1, FSCA); Randolph Co., Spruce Knob, 25-Jun-1955, N. M. Downie (1, FSCA); Winchester, June-25-1963, K. Stephens leg (1, FSCA). **Wisconsin:** [No data] (4, INHS830467, INHS830484, INHS830489, INHS830493; 2, MCZC); [Dane Co.], Madison, 28-VII-[19]53, 53-863/ beaten ex Fir (1, FSCA); Sauk Co., Pine Hollow, 43°22'13"N, 89°54'11"W, 10-July-2000, col. Alistair S. Ramsdale/ ex: foliage, 1–2 pm, mesic hardwood forest (1, MTEC, DNA–MTEC023670). **Unknown locality:** Mt Tom, J[ul]y-[18]73 (1, MCZC); Drac-7/15-[18]88 (1, MCZC); O. S. Wescott collection (1, WSUC). **No label/ ID label only:** (1, INHS830491; 5, MCZC, MCZ-ENT00642004). **Dubious locality: Oregon:** Ft. Klamath (1, MCZC).

Hemicrepidius falli (Reitter, 1908)

Athous quadricollis Fall, 1907: 229. Not *Athous quadricollis* Desbrochers des Loges, 1870: 134.

Athous falli Reitter, 1908: 36, replacement name; Van Dyke 1932: 372; Lane 1971: 27.

Hemicrepidius falli (Reitter, 1908): Becker 1979: 409.

Figs: 5.11a–5.11e.

Diagnosis

Hemicrepidius falli can be distinguished from all other *Hemicrepidius* by the combination of a slightly projecting frontal carina, the straight to ear-like posterior margin of the hypomeron, the moderately dense, simple to vaguely subumbilicate punctures on the pronotal disc, and the diverging hind angles with thin, but noticeable carina. *Hemicrepidius falli* is most similar to species that have been historically placed in *Athous*, which are *H. palpalis* and *H. simplex*, as well as *H. audreyae*. From both *H. audreyae* and *H. simplex*, *H. falli* can be distinguished by having punctures on the disc smaller, closer to being simple, distinct carina on the pronotal hind angle, and the prosternal process not being strongly curved dorsally. From *H. palpalis*, it can be distinguished by the longer and more divergent pronotal hind angles, with the carina more distinct, being less setose, with the punctures on the disc not as dense and larger, and the weakly pointed apical expansion of the paramere of the aedeagus.

Description

Length 10–14mm, width 2–4mm; color uniformly red-brown to dark brown, elytra not contrasting pronotum, often with posterior and anterior edges of pronotum and ventral side lighter. Setae moderate, depressed, gold. **Head:** punctures subumbilicate, nearly contiguous; frons concave anteromedially, with triangular impression medially; frontal carina complete, broadly rounded, not confluent with medial posterior margin of clypeal edge, and slightly projecting; eyes large and strongly bulging; antennae weakly serrate, antennomere 2 subcylindrical, antennomere 3 subcylindrical and 1.5× length of 2

and with similar punctation as antennomere 2, antennomere 2 and 3 together subequal in length to antennomere 4, antennomeres 4 to 11 about 3× longer than wide, each with slightly less setae medially, not quite distinct line and less noticeable on darker specimens, antennomere 11 nearly oval or with tip subtly constricted, antennae passing pronotal posterior edge by two to three antennomeres. **Thorax:** Pronotum as wide as long to 1.2× wider than long, usually widest just anterior of midlength, sometimes widest at hind angles; sides weakly arcuate, some almost subparallel laterally, narrowing at anterior one fourth, lateral carina complete; hind angles weakly divergent due to sinuate edge anterior of hind angle, dorsal carina present, thin, subparallel to lateral carina; punctures small, appearing simple to vaguely subumbilicate, dense, separated by at most two diameters of a puncture on disc, punctures becoming larger and clearly subumbilicate laterally, nearly contiguous; posterior edge with sublateral incisures present. Hypomeron with small, subumbilicate punctures, nearly contiguous throughout, except for impunctate area on posterior one-fifth in some specimens; posterior margin ear-like, hind angle not visible ventrally, medial margin with impunctate line, which sometimes is partially interrupted medially (Fig. 5.11c). Prosternum punctuation slightly smaller than punctuation on hypomeron, less dense medially, separated by two diameters of a puncture at most; anterior lobe deflexed, sometimes just slightly deflexed, broadly rounded and partially covering ventral mouthparts; prosternal process slightly curved dorsally between procoxae, narrow and straight past procoxae. Mesosternal fossa with lateral edges sinuate, posterior edge of fossa narrowly truncate. Metaventricle with punctures simple, smaller than punctures on hypomeron, separated by a diameter of a puncture laterally,

further apart medially. Scutellar shield elongate, almost oval, about twice as long as wide, narrowly rounded posteriorly, lateral margins sinuate, dorsal surface flat, anterior margin broadly curved, punctuation small, setae radiating from midline, similar to setae on pronotum and elytra. Elytral striae weakly impressed basally; interstriae flat to subtly convex, punctures small, scattered, giving wrinkled appearance; basal carina not crenulate. Legs with tarsomere lobes small and narrow, lobe on tarsomere 3 largest, lobe on tarsomere 2 second largest, lobe on tarsomeres 4 minute, usually visible only ventrally; lobe on tarsomere 1 smallest, very minute. **Abdomen:** Punctures small, simple, slightly smaller than punctures on metaventrite, moderately dense, separated by at most one puncture diameter laterally, less dense medially; fifth ventrite narrowly rounded; lateral edge of ventrites 1 to 4 with microserrations indistinct and difficult to see, appearing absent, not visible on fifth ventrite. **Male genitalia:** Figs. 5.11d and 5.11e. Parameres subparallel laterally on basal three-fourths, weakly sinuate laterally basad of apical expansion, apical expansion weakly pointed laterally; apex of paramere narrowly rounded, membranous, setose ventrally. Medial lobe narrowly triangular, basal struts curved latero-basally. Basal piece with membranous area broadly pointed medially in ventral view.

Distribution

Specimens have been examined from the following states; USA: AZ, CA, NV, OR (Fig. 5.12b).

Notes

I have examined five female specimens which I have tentatively associated with *H. falli* specimens, previously only known from the males. From the description above, these females differ by being much larger, 17–20mm in length; antennae being less serrate and just reaching the posterior edge of the pronotum; the pronotum much broader and laterally rounded; and in some, the pronotal punctation being a bit denser medially. Otherwise they share many characteristics with *H. falli*. Since the most recent specimen was collected in 1968, DNA extraction was not attempted on these specimens. These females can be distinguished from similar sized *Athous* species in the region by having a notch on the posterior edge of the pronotum just anterad the scutellum.

I have also included here three male specimens from Inyo County, California, that are a bit different than typical specimens. These specimens have a bit longer pronotal hind angles and the punctation on the pronotal disc is larger and appears more subumbilicate. Despite these differences, other characters are typical for *H. falli*. There are other specimens which are intermediate between typical *H. falli* and these specimens, further lending credibility that these small differences are just variation.

Specimens Examined

Types Examined. Of *Athous falli*: **Holotype:** Lake Tahoe Cal., Jul 17-21, [18]97/ quadricollis type/ *Athous falli* Reitt./ H. C. Fall collection/ Type #24371.

Other Specimens Examined, 45. USA: Arizona: [Navajo Co.], Tesgi Canyon, 8mi N of Marsh Pass, IX-4-1950/ coll. by J. P. Figg-Hobiyn (1, CASC). **California:** [No data] (1, MCZC); Alpine Co., Carson Pass, July-23-1964, Fred G. Andrews (1, CASC); El Dorado Co./ H. C. Fall collection (1, MCZC); Inyo Co., 1.5mi E. Glacier Lodge/ collected at blacklite/ E. L. Sleeper collr. (1, CASC); George Creek, altitude 11,300ft, 31-VII-1971, Derham Giuliani (2, CASC); Mt. Whitney Trail, 2560m-3230m, 11-July-1981, stop#81-25, D. H. Kavanaugh collector (1, CASC); Lassen Co., Lassen N.F., 210/ Westwood Junction, 7-18-1915/ R. Hopping collection (1, CASC); Madera Co./ Flight/ R. L. Furniss (2, OSAC, WFIC0000353604, WFIC0000353605); Soquel Meadow, Willow Creek/ VII-1951, W. C. Day (3, CASC); Placer Co., VII-25-[19]25/ F. X. Williams (1, FSCA); Carnelian Bay, VII-8/ E. G. Linsley (1, FMNH); Tahoe National Forest, Pineland Drive, 4km S. of Tahoe City, 1900m, 5-VIII-1983, Thomas W. Davies (2, CASC); [Plumas Co.], Chester, VII-11-[19]51, VII-4-[19]58, VI-30-[19]60 / D. J. & J. N. Knull Collrs. (7, FMNH); Plumas Nat. For., 8-18-[19]50/ Coll. Lee Colston (1, BYUC); Lassen View Camp, VII-3-[19]47/ W. Lee collector (1, CASC); [County?] Riverton Cal., 3000ft 7-30 / Hinton Col. (1, BMNH); [Shasta Co.], Castella, VII-7-8-1912/ Van Dyke collection (1, CASC); Cayton, VII-17/ R. Hopping collection (1, CASC); SW of Old Station, ca 11mi S Hat Creek, 14-July-1989, R. S. Zack, at lights (1, WSUC); Siskiyou Co., McCloud, 7-17-[19]56/ D. Giuliani collector (2, CASC); Ash Creek Sta., VII-8-[19]64[?], D. H. Hennings (1, CASC); Toulumne Co., Pinecrest, 7-29-[19]46/ W. Russell collection (1, CASC); Pinecrest, ca 1700m, 28-VII-1947, Paul H. Arnaud Jr. (1, CASC); Twaine Harte, VII-27-1982/ M. R. Lundgren collector (1, CASC);

Tulare Co., 7-21-[19]12/ H. C. Fall collection (1, MCZC); [County?] Y. S./ O. S. Wescott collection (1, WSUC). **Nevada:** [No data]/ Fredrick Blanchard Collection (1, MCZC). **Oregon:** [Klamath Co.], Klamath Falls, 6-24-[19]31/ Y. Pine stump in pitch/ R. L. Furniss collector (1, OSAC, WFIC0000397138). **Females?: USA: California:** Plumas Co., Thompsons Crk, July-25-1953, F. X. Willaims (1, CASC); Siskiyou Co., Everitt Memorial Highway, alt.6520 feet, 6-VIII-1968, Hugh B. Leech (1, CASC); Tulare Co., Giant Forest, I-15-[19]05, R. Hopping (1, CASC); Giant Forest, Round M'd'w, Aug, Hopping (1, CASC); Tulumne Co., Pinecrest, ca 1700m, 31-VII-1947, Paul H. Arnaud, Jr (1, CASC).

Hemicrepidius hemipodus (Say, 1825)

Elater hemipodus Say, 1825: 245; Say 1836: 176.

Asaphes hemipodus (Say, 1825) LeConte 1853: 449; Candeze 1863: 210;

Diacanthus corporosus Germar, 1843: 72. Synonym by Candeze, 1863.

Hemicrepidius hemipodus (Say, 1825): Becker 1979: 410; Webster et al. 2012:X.

As synonym of *H. decoloratus*: Horn 1880: 73; Leng 1920: 170.

Athous aeneolus Melsheimer, 1846: 156

As synonym of *A. aereus*: LeConte 1853: 450; Candeze 1863, 215.

Athous aereus Melsheimer, 1846: 156.

Asaphes aereus (Melsheimer, 1846): LeConte 1853: 450; Candeze 1863: 215.

As synonym of *H. decoloratus*: Horn 1880: 73.

Figs. 5.2g, 5.13a–5.13e.

Diagnosis

Hemicrepidus hemipodus can be distinguished from all other species of *Hemicrepidius* by the combination of dense pronotal punctation on the disc (most noticeable in males), the ear-like posterior end of the hypomeron, the curved pronotal process. *Hemicrepidius hemipodus* will most likely be confused with *H. decoloratus* and *H. indistinctus*. Key characters to separate *H. hemipodus* and *H. decoloratus* are provided in the diagnosis for *H. decoloratus* above. With *H. indistinctus*, only female *H. hemipodus* will likely be confused. They can be separated by female *H. hemipodus* having much closer and subumbilicate punctures on the lateral side of the pronotum, the punctures on the head being very dense and close, and often the slight metallic reflection on the elytra.

Description

Length 10–16mm, width 2–4mm; color variable, uniformly brown to piceous or with elytra brown to dark brown and lighter than dark brown to piceous pronotum, legs and antennae variable, yellow-brown to dark brown, antennae usually darker than legs, sometimes edges of pronotum, edges of elytra, and edges of abdominal segments lighter; integument shining, some with slight metallic reflection. Setae moderately long, usually dense on pronotum, shorter on elytra and ventrally, depressed, gold or grey. **Head:** punctures subumbilicate, nearly contiguous; frons weakly concave anteromedially; frontal carina broadly rounded, often interrupted medially by punctation, not reaching medial posterior margin of clypeal edge, weakly projecting; eyes moderate, rounded,

somewhat bulging; antennae weakly serrate, antennomere 2 subcylindrical, antennomere 3 subcylindrical, $1.5\times$ to $2\times$ length of 2 and with similar punctation to 2, antennomere 3 subequal in length to 4, antennomeres 4 to 11 about $3\times$ longer than wide, getting longer and narrower apically, antennomere 11 oval, sometimes with tip subtly constricted, antennae passing pronotal posterior edge by 1.5 to 2.5 antennomeres. **Thorax:** Pronotum as wide as long to $1.2\times$ wider than long, widest at hind angles (most males) or at midlength (females); sides weakly to broadly arcuate, gradually narrowing at anteriorly, lateral carina complete; hind angles divergent or weakly divergent, lateral edge sinuate anterior of hind angle, dorsal carina variable, absent (some males) to present, if present, thin and parallel to lateral carina; punctures small, appearing simple, nearly touching to separated by one to two diameters of a puncture on disc, females ususally less punctate than males, punctures larger, shallower, and closer laterally, nearly contiguous, noticeably subumbilicate; posterior edge with sublateral incisures present. Hypomeron with moderate, subumbilicate punctures, nearly contiguous anteriorly and becoming less dense posteriorly, small impunctate area present on posterior one-fifth at most; posterior margin ear-like so hind angle not visible ventrally, medial margin with impunctate line on posterior half (Fig. 13c). Prosternum punctuation smaller than punctuation on hypomeron, appearing simple, dense and nearly contiguous laterally, quickly becoming less dense medially, separated by two diameters of a punctation of more; anterior lobe slightly deflexed, slightly truncate anteriorly and partially covering ventral mouthparts; prosternal process slightly curved dorsally between procoxae, narrow and straight past procoxae. Mesosternal fossa with lateral edges sinuate, posterior edge of fossa truncate.

Metaventrite with punctures smaller than punctures on hypomeron, appearing simple, dense laterally, nearly touching, becoming less dense medially. Scutellar shield elongate, about twice as long as wide, broadly rounded posteriorly, lateral margins weakly sinuate, dorsal surface weakly convex, anterior margin nearly straight, punctuation small, dense, setae radiating from midline, longer than setae on elytra. Elytral striae weakly impressed basally; interstriae flat to slightly convex, punctures moderate in size, scattered, giving wrinkled appearance; basal carina not crenulate. Legs with lobes on tarsomeres 2 and 3 moderately wide, visible dorsally, lobe on 3 just slightly larger than lobe on tarsomere 2, lobe on tarsomere 1 small, lobe on tarsomere 4 smallest, both lobes on tarsomeres 1 and 4 visible laterally. **Abdomen:** Punctures small, simple, a bit smaller than punctures on metaventrite, very dense, nearly contiguous, less dense medially; fifth ventrite narrowly rounded; lateral edge of each ventrites 1 to 4 with weak microserrations that are difficult to see, microserrations on ventrite 5 appearing absent. **Male genitalia:** Figs. 5.13d and 5.13e. Parameres broadly sinuate laterally, apical expansion acutely pointed laterally, apex of paramere broadly pointed, membranous, and setose ventrally. Medial lobe moderately thick, slightly sinuate laterally, basal struts, broadly curved latero-basally. Basal piece with membranous area broadly curved medially in ventral view.

Distribution

Specimens have been examined from the following states: USA: AZ, AR, CT, FL, IL, IN, IA, KS, LA, MD, MA, MI, MS, MO, NM, NJ, NY, OH, PA, TN, VA, DC, WV, WI (Fig. 5.15a).

Notes

This species has been historically confused with *H. dilaticollis*. Areas of confusion with that species are discussed under notes for *H. dilaticollis* above.

Under *H. hemipodus*, I unite *Athous aeneolus* and *Athous aereus*. These have long been associated with the hemipodus-dilaticollis complex, but are placed here. It appears that *Elater hemipodus* was described from a female specimen, and females are generally more convex and less punctate on the disc than males (Compare Figs. 5.13a and 5.13b). Males match the type of *A. aereus* in the Melsheimer collection in the MCZC. The amount of sexual dimorphism observed in this species is common within *Hemicrepidius*.

The one remaining troubling name is the concept for *A. aeneolus*. LeConte (1853) states that *A. aereus* is the female form and *A. aeneolus* is the male form of the same species. However, the specimen labeled *A. aereus* in the LeConte collection is actually a male, not a female. Adding to this issue is that all six specimens of males of this group in the Melsheimer collection are under the name *A. aereus*, likely following LeConte. This means the original types of these two names are likely mixed within this series of six specimens. To avoid future confusion with these names I have designated the neotype of *Athous aereus* as the type of *Athous aeneolus*, making them objective synonyms.

As with most Say names, the type of *Elater hemipodus* is either lost or a Say specimen, and potential neotype, is located in a collection somewhere in Europe (Prena 2018). The original description of this species is very close to the two specimens labeled with the species name in the LeConte collection in the MCZC. Since the designation of a neotype of *H. decoloratus* here should eliminate confusion between these two species, I

refrain from making one here for *Elater hemipodus* until European collections can be examined thoroughly.

Specimens Examined

Types Examined. Of *Elater hemipodus*: type lost or missing; type locality Pennsylvania[?]. Of *Diacanthus corporosus*: type not examined; type locality North America, not further limited; in BMNH[?]. Of *Athous aeneolus*: type not located; **Neotype**: type of *Athous aereus*; type locality Pennsylvania; in MCZC (here designated). Of *Athous aereus*: **Lectotype**: red label, Melsheimer specimen #1; male; type locality Pennsylvania; in MCZC (unpublished by Becker, here designated).

LeConte Collection (MCZC), 5. pink disk/ “A. aereus (Mels)!/ decoloratus #6; pink disk/ var. aeneolus Mels. !/ decoloratus #7; pink disk/ decoloratus #9; pink disk/Asaphes hemipodus (Say) Lec., corporosus Germ./ decoloratus #10; pink disk/ hemipodus (Say) Mels/ decoloratus #11.

Horn Collection (MCZC), 6. In *H. hemipodus* tray: Pen., #1; Pink disk, #3; yellow disk, #4. In *H. decoloratus* tray: N.H., #6; N.H., #7; no locality, #8.

Melsheimer collection (MCZC), 11: With *A. hemipodus* label, 6 specimens without locality labels. With *A. aereus* type, 5 specimens without locality labels.

Zeigler Collection (MCZC), 1. Pa.

Other Specimens Examined, 245. **USA:** Coll. Janson, Ex. Candeze/ Asaphes
aereus Mels, Est. Un. LeC. [one with pink disk, purple rim] (2, BMNH); Red rectangle/
[yellow rectangle] 494/ Athous aeneolus Mels., Am. Bor./ Coll. Janson, ex Deyrolle (1,
BMNH). **Arizona:** [Graham Co.], Graham Mts., May-4-1964, K. Stephan leg. (1,
FSCA). **Arkansas:** Marion Co., 1897/ May (1, OSAC0000569393). **Connecticut:**
[Hartford Co.], Southington, 7-5 (1, MCZC); New Haven Co., Hamden, Broosvale Park,
1-VII-1973, leg. K. W. Brown (1, PMNH); New Haven, West Rock nr. Judges' Cave, 19-
VI-1973, K. W. Brown (1, PMNH). **Florida:** Alachua Co., 5-7-1959, W. R. Cave (1,
FSCA). **Illinois:** N[orthern] Ill[inois], June [18]83 (5, WSUC); Champaign Co, 23-VI-
1926, K. F. Auden (1, INHS830408); Champaign, June-17-1939, coll. C. O. Mohr (1,
INHS830417); Decatur, June-12-1935, Frison and DeL. (1, INHS830192); Coles Co.,
Fox Ridge St. Pk., VII-5-1966, John D. Pinte (1, CASC); Shobanier, June-16-[19]48,
Sand and Becker/ yucca flowers (1, INHS830341); Urbana (1, INHS830294); Urbana, 6-
7-1927, A. E. Miller, coll. (1, FSCA); Urbana, 6-25-1940, W. V. Balduf (1, INH830209):
Urbana, June-20-1941, J. Slater (1, INHS830253); Urbana, June-24-1948, H. H. Ross (1,
INHS830328); Vermilion Co., 27-VI-1926, K. F. Auden (1, INHS830420); Wheaton,
June-27-29-1952, M. H. Hatch (1, OSAC0000541751); [Wabash Co.], Allendale, June-7-
1941, Ross and Mohr (1, INHS830525); Wills [sic] Co., Lockport, VI-28-1961, N. G.
Seaborg (1, CASC); [247]/ Hart Coll'n (1, INHS830423); [5908]/ Hart Det (1,
INHS830333); [6124] (1, INHS830396); [6126] (1, INHS830442); [2(?)6] (1,
INHS830419); [3442] (1, INHS830340); [18215] (1, INHS830338); [18257] (3,

INHS830331, INHS830337, INHS830339); [18615] (1, INHS830330); [38826] (1, INHS830507). **Indiana:** Allen Co., New Haven, 7-17-1981, N. M. Downie (1, FSCA); [Marion Co.], Camp Belzer, BSA, Indianapolis, July-15-1966, Charles E. White (3, FSCA); Indianapolis, 7-14-[19]10 (1, MCZC). **Iowa:** [Des Moines Co.], Burlingtn (1, MCZC); [Story Co.], Ames, 6-9-[19]39, W. W. Wirth (1, LSAM). **Kansas:** Crawford Co., 3mi NE Pittsburg, 37°26.64'N, 94°37.04'W, 1-13-VI-2005, G. A. Salsbury, ex canopy trap, KAN1S05 098 (1, SEMC, SM0695929 KUNHM-ENT); Pittsburg, 2 mi W, 37°25.16'N, 94°45.47'W, 6-15-VI-2006, G. A. Salsbury, ex canopy trap KAN1S06 064 (1, SEMC, SM0806259 KUNHM-ENT); Douglas Co., F. H. Snow (2, SEMC); June-17-1919, William F. Hoffman (1, SEMC); Lawrence, 6-20-1926, W. Benedict (1, SEMC); Jefferson Co., University of Kansas Field Station unit 3001, Rockefeller Prairie, 39.04529°N, 95.20491°W, 13-VI-2008, Z. H. Falin, ex fogging crowns/corms of *Tripsicum dactyloides* KSR08 025 (1, SEMC, SM0794080); Johnson Co., 1915, R. H. Beamer (6, SEMC); Montgomery Co., Elk City S.P. Memorial Overlook area 37.27994°N, 95.77835°W, 11-VI-2010, Z. H. Falin, K. T. Eldredge, ex. Sifted leaf litter, KDEE1F10 051 (1, SEMC0905888); Montgomery Co. State Fishing Lake, below dam, 37.16171°N, 95.68542°W, 9-11-VI-2010, Z. H. Falin, K. T. Eldredge, S. R. Davies, J Ortega-Blanco, ex flight intercept trap, KDEE1F10 046 (2, SEMC0904689, SEMC0904690); Neosho Co., IN Montana Bridge, 13-June-2010, uv light 37.28320,- 95.10360, M. Bollin (3, SEMC1274794, SEMC1274800, SEMC1274814); Woodson Co., Woodson Co. State Lake W side, 25-V-1976, leg. S. Hamilton, SWH9 US.KS.HamiltonS1976.05.25 001 (1, SEMC1057562); Cross Timbers S. P., East

Spillway access, nr lagoon, 37.73741°N, 95.92025°W, 8-11-VI-2010, Z. H. Falin, K. T. Eldredge, S. R. Davies, J. Ortega-Blanco, ex flight intercept trap, KDEE 1F10 044 (1, SEMC0905227). **Louisiana:** [New Orleans Parish], New Orleans/ Coll. Janson/ decoloratus ID (1, BMNH). **Maryland:** [No data] (3, BYUC; 3, OSAC0000569386, OSAC0000569391, OSAC0000569400); Allegany Co., Green Ridge St. For., 22-VI-1985, C. L. Staines, Jr. (1, FSCA); Baltimore, V-1902/ Van Dyke Collection (2, CASC); Baltimore, VI-6-[19]09, VI-12-[19]09/ F. E. Blaisdell collector (4, CASC); College Park, 5-2-[19]48, B. K. Dozier/ Sweeping in woods (1, FSCA); College Park, 6-3-[19]32/ Collected by L. Putnam (2, WSUC); [Charles Co.], Pope's Cr., May-22-[18]96 (2, MCZC); Montgomery Co., Bethesda. 11-VII-1984, H. V. Weems, Jr., ultraviolet light (1, FSCA); Great Falls, 02-June-1987, J. B. Stribling colr (1, MTEC, MTEC018134); Prince Georges Co., Laurel, Patuxent Wildlife Res. Ctr., 28-June-1979, W. E. Steiner (1, FSCA); Seneca, VI-19-[19]50, E. A. Fildes (1, FSCA). **Massachusetts:** [Brown disk] [Cambridge 1871, Hubbard and Schwarz] (1, MCZC); Mt. Washington, June 22-25, 1913 (1, MCZC); Mt. Tom, July-4-[18]73 (1, MCZC). **Michigan:** Washtenaw Co, Ann Arbor, VII-18-1927, N. K. Bigelow (1, FSCA). **Mississippi:** [Oktibbeha Co.], A & M college, 5-16-[19]31, C. F. Randle (1, WSUC); A & M College, 5-24-[19]31, J. H. Thomas (1, WSUC). **Missouri:** [No data] (1, BYUC; 1, MCZC); Henry Co., 7mi E Clinton, 17-VI-1973, G. H. Nelson/ on *Diospyros virginiana* L. (2, FSCA); 14 mi SE Clinton, 28-VI-1973, G. H. Nelson/ on *Diospyros virginiana* L. (1, FSCA); Jackson Co., May-1951, Ronald H. Pine (1, SEMC); Raytown, 16-VI-1977, G. H. Nelson/ ultraviolet light (1, FSCA); Newton Co., Shoal Creek at Alt. US Hwy 71, 24-V-1986, C. B. Barr (1, LSAM);

Ray Co., 5mi NW of Orrick on N, June-5-1999, coll F. W. Shockley, Black light trap (1, LSAM). **New Mexico:** [Colfax Co.], Kochler [Koehler?], VIII-9 (1, MCZC). **New Jersey:** [Camden Co.], S. Camden (1, MCZC); [Morris Co.], Schooleys Mt, VI-29-[19]11/ J. W. Green collector (1, CASC). **New York:** [No data] (3, MCZC); Albany Co., Rensselaerville Huyck Preserve/ Ross H. Arnett, Jr. collector, July-17-1975 (1, FSCA); [Greene Co.], Catskill, 6-19-[19]37 (2, CASC); Ontario Co., Geneva, V-30-VI-10-1991, VI-10-1991, J. Huether (2, FSCA; DNA–MTEC023673, MTEC023674); [Oswego Co.], Oswego, July-16-1896 (1, MCZC); [Tompkins Co.], Ithaca, July-03, 7-July-[19]03, 12-July-[19]04, 17-July-[19]13, 18-July-[19]17, 20-July-[19]17, 15-July-[19]17, 27-July-[19]17, 28-July-[19]17, 25-July-[19]39 (4, CASC; 1, FSCA; 9, INHS 830446, INHS830448, INHS830456, INHS830458, INHS830462, INHS830468, INHS830469, INHS830475, INHS830490); Ithaca, 1-July-[19]28, 18-July-[19]28/ H. A. Scullen (2, OSAC0000569392, OSAC0000569398); Ithaca, VII-10-1940, VII-16-1940, VII-24-1940, VII-30-1940, J. N. Belkin (9, FSCA); Ithaca, 5-VII-1945, 9-VII-1947, R. H. Arnett, Jr (4, FSCA); Ithaca, VII-4-1966, H. P. Lanchester (1, WSUC); Ithaca, 14-June-1995, Michael S. Engel (2, SEMC); Cornell Plantations, 18-June-1991, M. F. Whiting (3, BYUC). **Ohio:** [No data]/ Coll. Janson, ex Shaum/ aeneolus ID (2, BMNH); Clark Co., Clark Lake, VI-16-[19]74, D. Brzoska (1, SEMC); Clinton Co., VI-9-[19]55/ E. I. Hazard collector (1, FSCA); Delaware Co., Scioto River, south of O'Shaughnessy Reservoir, 40.141°N, 83.120°W, 20-June-2016, S. M. Clark (2, BYUC; DNA–MTEC023703). **Pennsylvania:** [No data] (3, MCZC); [No data]/ Coll. Janson, Ex Candeze/ hemipodus ID label (1, BMNH); No. 22 Reiche, N. Pennsylvannia/ Coll. Janson, Ex Dejean/ A.

decoloratus Say, *Ath. viduus* Dej., Amer. Bor. LeC (pars) (1, BMNH); [Cambria Co.], Ferndale, VII-25-1940, Wm. Spector (1, FSCA); [Chester Co.], Avondale, VI-25-1931, coll. C. A. Thomas (1, CASC); [Cumberland Co.], Camphill, VI-2-[19]11/ Van Dyke collection (1, CASC); [Dauphin Co.], Harrisburg, VI-15-[19]09/ Van Dyke Collection (1, CASC); Harrisburg, VI-20-[19]10 (1, MCZC); Hummelstown, VI-24-1917, VIII-2-1919/ Van Dyke Collection (7, CASC); Del[aware]. Co., 6-2, 6-12 (2, MCZC); Villanova, VI-10-[19]70, D. Brzoska (2, SEMC); [Monroe Co.], Water Gap (1, MCZC); [Montgomery Co.], Abington, VI-8 (1, MCZC); [Northampton Co.], Easton, VII-24-[19]11, VII-8-[19]17, VII-14-[19]28/ J. W. Green collector (4, CASC); Easton, VI-19-[19]21/ L. S. Slevin collection (1, CASC); Wind Gap, VI-25-[19]30, VII-2-[19]30, VI-11-[19]33, VII-7-[19]36, VI-11-[19]39, J. W. Green (6, CASC); [Philadelphia Co.], W. Park, 7-2 / Phila[delphia] (1, MCZC); Angora, VI-5 (1, MCZC); Manayunk (2, MCZC); Tioga Co., Crooked Creek, 17-VI-1991, J. Huether (2, FSCA); [Westmoreland Co.], Jeannette, VI-30 (1, OSAC0000569395). **Tennessee:** Blount Co., Cades Cove GSMNP, 13-VI-1986, Howard V. Weems, Jr. (1, FSCA); GSMNP, Cades Cove ATBI Plot, Malaise Trap MT-0320010604, serviced 4-June-2001, I. Stocks (1, LSAM0129231); GSMNP, Cades Cove ATBI Plot, MT-0320010618, 4-18-June-2001, J. Burbank and R. Hightower (8, LSAM0128948, LSAM0129076, LSAM0129086, LSAM0129087, LSAM0129199, LSAM0129209, LSAM0129213, LSAM0129215); GSMNP, Cades Cove ATBI Plot, Lindgren #03, 18-June-2-July-2001, Parker, Stocks, and Peterson (1, LSAM0128802); GSMNP, Cades Cove ATBI Plot, 35°35'31"N, 83°50'17"W, Malaise Trap/ 18-Jun-2-Jul-2001, I. C. Stocks and R. Hightower, MT0320010702 (1, LSAM0103382); GSMNP,

Cades Cove ATBI Plot, MT-042001010702, 18-June-2-July-2001, R. Hightower and J. Burbank (1, LSAM0103565); GSMNP, Cades Cove ATBI Plot, Malaise Trap, MT-0420020603, 9-May-3-Jun-2002, J. H. Burbank (3, LSAM0134553, LSAM0134558, LSAM0134559). **Virginia:** Arlington Co., R. H. Arnett, Jr. (1, FSCA); Approx. 20 mi SW of Alexandria, 26-V-1975/ B. J. Harrington, P. S. Broomfield, B.M. 1975-392 (1, BMNH); [Fairfax Co.], Vienna, Je-13/ F. G. Carnochan (1, MCZC, MCZC-ENT 00642006); Vienna, J[un]-13 (1, MCZC); [Fauquier Co.], Warrenton, 52[?]-5-28, L. C. Woodruff (1, SEMC); Giles Co., #164, Sinking Creek at Va Hwy 700, 17-June-1986, 1950', George W. Byers (1, SEMC); [Rockingham Co.], Blue Ridge Mounts and Shenandoah Valley, 3-6-VI-1975/ B. J. Harrington, P. S. Broomfield, B.M. 1975-392 (1, BMNH). **Washington, D. C.:** N. Amer./ 4.74, E. Doubleday, decoloratus det. Horn (1, BMNH). **West Virginia:** Grant Co., Cave Mountain, west of Landes, 8-VI-2001, S. M. Clark and R. A. Androw (13, BYUC; MTEC023704); [Marion Co.], Fairmont, 1928, P. N. Musgrove (3, CASC). **Wisconsin:** [No data] (2, INHS830327, INHS830344). **No locality info:** (3, INHS830465, INHS830479, INHS830481; 1, MCZC).

Hemicrepidius indistinctus (LeConte, 1853)

Asaphes indistinctus LeConte, 1853: 451; Horn 1880: 73.

Figs. 5.14a–5.14e.

Diagnosis

Hemicrepidius indistinctus can be distinguished from all other species of *Hemicrepidius* by the sparse, simple pronotal punctation, the ear-like posterior margin of the hypomeron where the pronotal hind angle is only visible ventrally as a small projection at the tip. *Hemicrepidius indistinctus* is most easily confused with *H. decoloratus* and *H. hemipodus*. The characters to distinguish these species is given in their diagnoses above.

Description

Length 11.5–15.0mm, width 3–4mm; color uniformly dark red-brown to dark brown, elytra not contrasting pronotum, sometimes legs, antennae, posterior edge of pronotum lighter, ventral side ususually lighter particularly edges of elytra, and edges of abdominal segments lighter; integument shining. Setae moderately long, depressed, grey or gold. **Head:** punctures subumbilicate, separated by half of a diameter to a diameter of a puncture, sometimes puncture more sparse in areas; frons weakly to moderately concave anteromedially, some with slight triangular impression medially; frontal carina complete, nearly transverse to broadly rounded, not confluent with medial posterior margin of clypeal edge, at most weakly projecting; eyes large and strongly bulging; antennae weakly serrate, antennomere 2 subcylindrical, antennomere 3 subcylindrical and 1.25× length of 2 and with similar punctation, antennomere 3 two-thirds length of 4, antennomeres 4 to 11 about 3× longer than wide, each with subtle medial line bearing less setae than edges, antennomere 11 oval, at most tip slightly constricted, antennae

reaching pronotal posterior edge to passing by two antennomeres. **Thorax:** Pronotum as wide as long to just over $1.1\times$ wider than long, widest at midlength; sides weakly to broadly arcuate, gradually narrowing anteriorly, lateral carina complete; hind angles almost subparallel, appearing slightly divergent due to sinuate lateral edge anterior of hind angle, dorsal carina present, thin, directed anteromedially; punctures small, smaller than punctures on head, moderately dense, appearing simple, separated by one to two diameters of a puncture on disc, punctures slightly closer laterally, still appearing simple, separated by half to one diameter of a puncture; posterior edge with sublateral incisures present. Hypomeron with moderately sized subumbilicate punctures, nearly contiguous on anterior half, often becoming slightly less dense towards impunctate area on posterior one-fifth; posterior margin ear-like so hind angle not visible ventrally except for small truncate projection dorsolaterally (Fig. 5.14c), medial margin with short impunctate line, often ending just anterad procoxae and never past mid-length. Prosternum punctuation smaller than punctuation on hypomeron, appearing simple, dense throughout, separated by half diameter of puncture; anterior lobe slightly deflexed, broadly rounded, short, partially covering ventral mouthparts; prosternal process slightly curved dorsally between procoxae, narrow and straight past procoxae. Mesosternal fossa with lateral edges sinuate, posterior edge of fossa narrowly truncate. Metaventricle with punctures smaller than punctures on hypomeron, appearing simple, dense throughout, separated by half to one diameter of a puncture. Scutellar shield elongate, about twice as long as wide, narrowly rounded posteriorly, lateral margins sinuate, dorsal surface weakly to moderately convex, anterior margin nearly straight, punctuation small, setae radiating

from midline, denser than setae on elytra. Elytral striae weakly impressed basally; interstriae flat to slightly convex at most, punctation small but giving wrinkled appearance; basal carina not crenulate. Legs with tarsomere lobes narrow, difficult to see dorsally, lobe on tarsomere 3 largest, lobe on tarsomere 2 second largest, lobe on tarsomere 1 small, visible laterally, lobe on tarsomere 4 minute, usually visible only ventrally. **Abdomen:** Punctures small, simple, similar to punctures on metaventrite, dense, separated by less than puncture diameter, uniform throughout; fifth ventrite broadly rounded; lateral edge of each ventrite with microserrations small, but visible under high magnification. **Male genitalia:** Figs 5.14d and 5.14e. Parameres subparallel laterally on basal three-fourths, sinuate laterally on apical one-fourth basad of apical expansion, apical expansion acute and sharply pointed laterally; apex of paramere pointed, slightly membranous, setose ventrally. Medial lobe broadly triangular, basal struts straight and directed latero-basally. Basal piece with membranous area roughly transverse medially.

Distribution

Specimens have been examined from the following states, USA: AL, FL, GA, MS, NC, SC, TN (Fig. 5.15b).

Notes

This species appears to be relatively uncommonly collected and limited to the Southeastern United States. It is likely closely related to *H. decoloratus*, but it can be readily distinguished by the morphological characters in the diagnosis above.

A strange observation I discovered in collections is the prevalence of *H. ruficornis* specimens identified as *H. indistinctus*. The species key by Horn (1880) likely led to many identifiers to this confusion, as they both share the characters given by Horn in the key. *Hemicrepidius ruficornis* specimens are quite distinct from *H. indistinctus*, and with the figures (compare Figs. 5.14a and 5.14b with Figs. 5.29a and 5.29b) and key above, should no longer be misidentified.

No larvae have been associated with this species.

Specimens Examined

Types Examined. Of *Asaphes indistinctus*: **Holotype:** *H. indistinctus*, LeC, Ga/Type#2614; male[?]; type locality Georgia; in MCZC.

Horn Collection (MCZC), 1. S. C. [South Carolina].

Other Specimens Examined, 15. **USA: Alabama:** Colbert Co., Barton, VI-9-14-1937/ Van Dyke collection (1, CASC). **Florida:** Walton Co., Eglin AFB, Range Rd 205, 4.5 mi W Hwy 331, 16-VI-1995, P. E. Skelley et al., MV and blacklight (1, FSCA). **Georgia:** [No data] (1, MCZC); [Fulton Co.], Atlanta, VI-14, V-29-[19]29, VI-14-

[19]39/ P. W. Fattig (3, FMNH); Stephens Co., VII-4-[19]64, L. A. Cambre (2, FMNH).

Mississippi: Yalobusha Co., Water Valley, 10-20-VII-1971, Michael Horan, Malaise

Trap (2, FSCA). **North Carolina:** [Moore Co.], Southern Pines, A. H. Manee, VI-6-1914

(1, CASC). **South Carolina:** [No data] (2, MCZC). **Tennessee:** Benton Co., VI-8-1950,

VI-22-1950, Thomas J. Walker, Jr. (2, FSCA); Great Smokey M. N. Pk, VI-23-[19]42/ D.

J. and J. N. Knull Collrs (1, FMNH).

Hemicrepidius melanophthalmus (Melsheimer, 1846) – Status Resurrected

Athous melanophthalmus Melsheimer, 1846: 154.

Asaphes melanophthalmus (Melsheimer), unjustified emendation; LeConte 1853:

450; Candeze 1863: 221.

As synonym of *H. bilobatus*: Horn 1880: 75.

Athous cavifrons Melsheimer, 1846: 154.

Asaphes cavifrons (Melsheimer) LeConte 1853: 453; Candeze 1863: 223.

As synonym of *H. bilobatus*, Horn 1880: 75.

Asaphes tener LeConte, 1853: 452.

A. tener as synonym of *H. melanophthalmus*: Candeze 1863: 221

A. tener as synonym of *H. bilobatus*: Horn 1880: 75

Figs: 16a–16e.

Diagnosis

Hemicrepidius melanophthalmus can be distinguished from all other *Hemicrepidius* species by the lack of a carina on the pronotal hind angle, the lack of sublateral basal incisures, a sinuate posterior margin of the hypomeron, and the narrowing of the parameres basad of the apical expansion on the aedeagus. It is most similar to *H. bilobatus*, and the ways to distinguish the two species is provided above.

Description

Length 12–19mm, width 3–5mm; color uniformly light red-brown to dark red-brown, elytra not contrasting pronotum, legs and antennae often lighter, almost yellow-brown, ventrally lighter; integument shining. Setae moderate, depressed, gold. **Head:** punctures subumbilicate, nearly contiguous; frons weakly concave anteromedially, some with slight triangular impression medial; frontal carina roughly v-shaped, sometimes interrupted medially by punctations, confluent with medial posterior margin of clypeal edge, at most weakly projecting; eyes large and strongly bulging; antennae weakly serrate, antennomere 2 subcylindrical, antennomere 3 subcylindrical, $1.5\times$ length of 2 and with similar punctation, antennomere 3 subequal in length to 4, antennomeres 4 to 11 about $3\times$ longer than wide, each with medial line bearing less setae than edges, antennomere 11 oval or with tip slightly constricted, antennae reaching pronotal posterior edge to passing by two antennomeres. **Thorax:** Pronotum as wide as long to $1.2\times$ wider than long, widest at hind angles (most males) or just anterior of midlength (most females); sides almost subparallel laterally and narrowing at anterior one fourth in males,

broadly arcuate in females, lateral carina complete and somewhat deplanate laterally; hind angles usually subparallel, sometimes appearing slightly divergent due to sinuate edge anterior of hind angle, dorsal carina absent; punctures subumbilicate, similar in size to punctures on head, separated by less than diameter of a puncture to nearly touching on disc, punctures larger and nearly contiguous laterally; posterior edge with sublateral incisures absent. Hypomeron with large, subumbilicate punctures, nearly contiguous anteriorly and becoming less dense posteriorly; posterior margin sinuate with hind angle weakly visible ventrally at truncate tip (Fig. 5.16c), medial margin without impunctate line. Prosternum punctuation slightly smaller than punctuation on hypomeron, nearly contiguous laterally, less dense medially; anterior lobe weakly deflexed, broadly rounded and covering ventral mouthparts; prosternal process curved dorsally between procoxae, narrow and straight past procoxae. Mesosternal fossa with lateral edges sinuate, posterior edge of fossa narrowly truncate. Metaventrite with punctures smaller than punctures on hypomeron, appearing simple, dense throughout, nearly touching. Scutellar shield elongate, about twice as long as wide, narrowly rounded posteriorly, lateral margins sinuate, dorsal surface weakly convex, anterior margin nearly straight, punctuation small, setae radiating from midline, similar to setae on pronotum and elytra. Elytral striae weakly impressed basally; interstriae flat to slightly convex, punctures small but giving wrinkled appearance; basal carina not crenulate. Legs with tarsomeres 2 and 3 moderately wide, visible dorsally, lobe on tarsomere 3 largest, lobe on tarsomere 2 slightly smaller than lobe on 3, lobe on tarsomere 4 minute, visible only ventrally, lobe on tarsomere 1 smallest, barely visible ventrally. **Abdomen:** Punctures small, simple, a

bit smaller than punctures on metaventrite, moderately dense, separated by puncture diameter, less dense medially; fifth ventrite broadly rounded; lateral edge of each ventrite with distinct microserrations. **Male genitalia:** Figs. 5.16d and 5.16e. Parameres gradually rounded mesad on lateral edge on basal two-thirds, greatly narrowed and subparallel on apical one-third basad of apical expansion; apical expansion hook-shaped; apex of paramere pointed, weakly membranous, and setose ventrally. Medial lobe narrowly triangular, narrowed further on apical half, basal struts straight, directed latero-basally, laterally forming about 135-degree angle. Basal piece with membranous area covering two-thirds of length, transverse medially.

Distribution

Specimens have been examined from the following states: AK, CT, GA, IL, IN, IA, KS, LA, ME, MD, MA, MI, MO, NH, NJ, NY, NC, OH, OK, PA, RI, SC, TN, VA, WI. (Fig. 5.18a).

Notes

Below I have designated lectotypes for *Athous melanophthalmus* and *Athous cavifrons* in the Melsheimer collection in the MCZC. Along with the type of *Asaphes tener*, these types should solidify the concept of this species relative to *H. bilobatus*.

Starting with LeConte (1853), an extra ‘h’ was added between the ‘p’ and ‘th’ in the specific name for *H. melanophthalmus*. A return to the Code compliant original spelling is followed here.

Due to the historic confusion of this species with *H. bilobatus*, it is unclear what species the specimens in Canada under the name *H. bilobatus* actually represent (Bousquet *et al.* 2013). Based on the DNA data on the BOLD website and the DNA tree here (Fig. 5.1), it appears that *H. melanophthalmus* is the appropriate name for many Ontario specimens, and likely for the majority of Canadian specimens previously identified as *H. bilobatus*.

Specimens Examined

Types Examined. Of *Athous melanophthalmus* Melsheimer, 1846; **Lectotype (here designated):** female in Melsheimer collection, lacking head, ID label only; type locality Pennsylvania; in MCZC. Of *Athous cavifrons* Melsheimer, 1846; **Lectotype (here designated):** male in Melsheimer collection, ID label only; type locality Pennsylvania; in MCZC. Of *Asaphes tener* LeConte, 1853; **Holotype:** male, [pink disc] (=Middle States (Md., Del., N.Y., N.J., Pa., Conn.?, R.I.?.)/ *A. tener* Lec. melanophth male? / type 2617/ bilobata #14; type locality New York; in MCZC.

Leconte Collection (MCZC), 3. [orange disc]/ bilobata #5; [pink disc] (=Middle States (Md., Del., N.Y., N.J., Pa., Conn.?, R.I.?.)/ bilobata #6; [pink disc]/ bilobata #11.

Other Specimens Examined, 344. **USA:** Coll Janson, Ex Candeze/ ID label, Et Unis, LeConte (1, BMNH); Coll. Janson, Ex Dejean/ *A. melanophthalmus* var, *Athous*

corticinus Dejean, h. in Amer. Bor., D. LeConte (3, BMNH); [Green Square]/ 483 / Ent Club 44-12 (1, BMNH). **Arkansas:** Polk Co., S of Board Camp, R29W T3S SE Sec. 22, 17-20-VIII-1985, C. B. and J. E. Barr, MV&BL (1, LSAM); Washington Co., near Fayetteville/ 20 August 1967, taken at UV light, leg. J. R. Heitzman (1, FSCA).

Connecticut: [No data] (2, MCZC); New Haven Co., Mt Carmel, River Rd., 25 July 1985, leg. Joyce R. Gilbert (1, PMNH); Long Hill, VII-29-1948, VIII-3-1948, Coll. D. J. Comboni (2, PMNH); New Haven, VII-24, VIII-4-[19]10 / J. N. Knull Collection (2, FMNH); New Haven, VIII-15-1910 (1, MCZC); Waterbury, VII-17 (1, MCZC); [New London Co.], Lyme, VII-30-1910 (1, MCZC); Windham Co., Willimantic, South Ridge Drive, Mercury vapor light, 28-August-2000, 4-August-2002, 15-August-2002, 19-20-August-2002, leg. R. J. Pupedis (4, PMNH; DNA-MTEC023685); Willimantic, South Ridge Drive, UV light, 4 August 2004, leg. R. J. Pupedis (1, PMNH); Hampton, at 15w BLT, August 6, 2011, leg. Eric L. Quinter/ Clarks Corner, 0.6mi ESE BM577 powerline cut, N 41°45'59.35", W 72°0.5'6.96" (1, PMNH). **Georgia:** [No data] (3, MCZC); Union Co., Emergence Trap 20, Aug. 28, 1975, Pasture, W. W. Morill (1, MTEC). **Illinois:** [No data] (2, INHS830290, INHS830291); Amer. Bor, Illinois (1, BMNH); [23] (1, INHS830293); Carroll Co., 8-1-[19]51/ W. B. Price Colr (1, FSCA); [Champaign Co.], Champaign, Aug 22, 1939, Aug 1939, Sept 1, 1939, Sept 6, 1939, C. C. Mohr (5, INHS830280, INHS830281, INHS830283, INHS830501, INHS830502); Det. Blatchley, #1445 (1, INHS830502); [19569] (1, INHS830463); [18684] (2, INHS830277, INHS830478); Urbana, 10-2-1927/ frequenting oak (1, MTEC); Urbana, Sept 10, 1950, L. J. Stannard, on porch of house (1, INHS830284); Urbana, Oct 9, 1949, L. Stannard, in

town (1, INHS830272); Urbana, Sept 3, 1890, Hart & Shira, at light, forest (2, INHS830273, INHS830279); [Cook Co.], Chicago, June 6 [19]08, Aug. / A. L. Melander collection (2, WSUC); LaSalle Co., 8-1935, Floyd G. Werner (1, CASC); [McHenry Co.], Algonquin, Nason (1, INHS830348); [18688] (5, INHS830276, INHS830366, INHS830368, INHS830370, INHS830474); [McLean Co.], Normal (1, INHS830269); [Peoria Co.], Peoria, Aug. 23, 1944, F. F. Hasbrouck (1, INHS830374); [Piatt Co.], Monticello, Aug. 20, 1948, Ross & Stan, Acc.No. 49514 (1, INHS 830267); Putnam Co., Aug 28, 1932, Aug. 31, 1931, May 20, 1933, M. C. Glen (3, INHS830364, INHS830413, INHS830488); Will County, Lockport, 18-7-[19]68, leg. Seaborg (1, CASC); [18685] (3, INHS830278, INHS830416, INHS830483); [7330]/[4511] (1, INHS830531); [18740] (1, INHS830482); [18745] (2, INHS830506, INHS830508); [38138] (1, INHS830510); [18744] (1, INHS830282); [10770] (1, INHS830286); [4511] (1, INHS830285); [14021] (1, INHS830287); [7326] (1, INHS830275); [14035] (1, INHS830288); [18749] (1, INHS830289). **Indiana:** Allen Co., New Haven, Aug. 1985, J. P. & N. M. Downie (1, FSCA); New Haven, VIII-5-1983, VIII-5-1983, N. M. & P. J. Downie (3, FSCA); [Crawford Co.], Grantsburg, at blacklight, August 1, 1964, August 15, 1964, Dianne Eckert (2, FSCA); Howard Co., NW Howard Co, 16-VIII-1983, 17-VIII-1983, D. A. Rider/ collected at black light (2, LSAM); [Knox Co.], Bicknell, VIII-31-[19]37, E. N. Tryon (2, CASC); [Marion Co.], Indianapolis, August 3, 1962, August 1, 1963, August 14, 1964, August 16, 1965, August 27, 1969, September 1, 1969, Charles E. White (6, FSCA); Parke Co., 8-25-1961, N. M. Downie (1, FSCA); [Posey Co.], Hovey Lake, June 24, 1965, August 12, 1965, Charles E. White, Blacklight trap (2, FSCA); Tippecanoe Co.,

IX-6-1970, VIII-10-1981, N. M. Downie (1, FSCA); Lafayette, 8-13-1985, 8-15-1985, 8-20-1985, 25 Aug 1990, U. V. light, N. M. Downie (4, FSCA); Wells Co., Bluffton. 23-Aug-1967/ Coll. David Wilkey (1, CASC). **Iowa:** [No data] (1, MCZC); [Des Moines Co.], Burlngtn (3, MCZC); Burl (1, MCZC); [Johnson Co.], Iowa City, Wickham (1, MCZC); Iowa City (1, MCZC); Iowa City, Wickham (1, CASC; 1 MCZC, MCZ-ENT00642008); Linn Co., 3.0mi N. Viola, VIII-9-12-[19]72, BL, E. L. Sleeper collr. (1, CASC); [Story Co.], 2mi S. Ames, ISU Farm, se. $\frac{1}{4}$, sec. 21, T83N, R24W, VIII-8-12-1968, coll. pitfall trap (1, FSCA). **Kansas:** Jefferson Co., The Falin Property, 1.5km N jct 94th St and Kingman Rd, 39°13'N, 95°24'W, 8-15-VIII-2004, Z. H. Falin, ex FIT near lower meadow (2, SEMC, SM0622981, SM0622982 KUNHM-ENT); The Falin Property, 1.5km N jct 94th St and Kingman Rd, 39°13'N, 95°24'W, 15-23-VIII-2004, Z. H. Falin, ex FIT, near upper meadow (1, SEMC, SM0625986 KUNHM-ENT); The Falin Property, 1.5km N jct 94th St and Kingman Rd, 39°13'N, 95°24'W, 2-9-VIII-2005, Z. H. Falin, ex FIT near lower meadow, KAN1F05 171 (4, SEMC, SM0699996, SM0699999, SM0700002, SM0719097 KUNHM-ENT); The Falin Property, 1.5km N jct 94th St and Kingman Rd, 39°13'N, 95°24'W, 9-18-VIII-2005, Z. H. Falin, ex canopy malaise, nr lower meadow, KAN1F05 184 (2, SEMC, SM0686459, SM0686460). **Louisiana:** E Baton Rouge Parish, Baton Rouge downtown, 14-ix-1996, H. Fei, under light (1, LSAM). **Maine:** [No data] (2, MCZC); York Co., West Newfield, UV Trap, 3-4 August 1983, leg. David s. MacDonald (7, PMNH). **Maryland:** P. G. Ritchie, 17-VII-[19]77, ex. Blacklight, C. L. Staines (1, MTEC?); Anne Arundel Co., 22-24 August 1994, C. L. Staines, blacklight (3, FSCA). **Massachusetts:** [No data] (2, MCZC; 2,

OSUC0000551173, OSUC0000551174); E. Mass/ *H. bilibatus* [sic] Day (1, BMNH); [Barnstable Co.], Dennis, VII-26-[19]56, D. Green (2, CASC); Woods Hole, 8-19-[19]10/ A. L. Melander Collection (1, WSUC); [Bristol Co.], Fall River, VIII-11-[19]07, N.S. Easton (1, MCZC); Freetown, VII-25-[19]09 (2, MCZC); [Essex Co.], Magnolia, 8-5-[18]96 (1, MCZC); [Middlesex Co.], [light brown disc = Cambridge, Mass, Hubbard and Schwarz, 1871] (1, MCZC); Concord bridge, 7-26-[19]06 (1, MCZC); Fram'hain, VII-22-[19]06, C. A. Frost (1, FSCA; 1, MCZC); Framingham, 8-1-[19]51, C.A. Frost/ At light (1, MCZC); Melrose, Dodge Collection (1, CASC); Melrs Hghds, 8/19/[19]17/ Stockwell's Moth trap (1, PMNH); At Arc light, Melrose Hlds, 7-19-[19]20/ J. E. R. Holbrook collector (1, PMNH); Melrs Hghds, 7/31/[19]17/ Stockwell's Moth Trap (1, PMNH); Sherborn, July-23-1892, Jul-1 (2, MCZC); Tyngs, 7-17-[18]92, July-[18]97, July 1900, 11-VII, July-19' / H.F.B. (5, MCZC); Tyngsboro 03-VIII-[19]03, Aug-[19?]03, 06-VIII-[19]28, 06-VIII-[19]29 (5, MCZC); Tyngsboro, from well, 03-VIII-30, 06-VII-30, '06 VIII, 07-VIII-5, 08-VIII-8/ Blanchard collection (5, MCZC); Tyngs, 8-4-[18]96 (1, MCZC); Tyngsboro 8-11-[19]04, 8-8-[19]15 (3, MCZC); Tyngsboro, '21 Aug/ Blanchard/ A. Fenyes Collection (1, CASC); Tyngs/ Blanchard/ A. Fenyes Collection (1, CASC); Wakefield, VIII-3 (1, MCZC); [Nantucket Co.], Natuck, July-30-1894/ A.P. Morse (1, MCZC); Nantucket Isl./ [red square]/ Bolter Coll., No. E7963e (1, INHS830295); [Norfolk Co.], Brookline (4, MCZC); Cohasset, Aug-1-[19]05, Aug-15-[19]08, Aug-15, Aug-20 (5, MCZC); Milton, 7-21-[18]95 (1, MCZC); Nor. Co. / Hayward Collection (4, MCZC); [Plymouth Co.], Marshfield, VIII-5 (1, MCZC); Marion, Aug-1-[19]03, Aug-13-[19]03, 7-20 (3, MCZC); Marion, Bowditch/ A. Fenyes

Collection (6, CASC); [Suffolk Co.], Dorchester, Jul-29-1905 (1, MCZC); [County?] Teurla [?], 7-28 –[18]72 (1, MCZC). **Michigan:** Oakland Co., VIII-23-1931, A. W. Andrews (1, MCZC); Washtenaw Co., Ann Arbor, VIII-15-1924, F. M. Gaige/ taken at light (3, FSCA); Ann Arbor, at porch light, VIII-2-1927, W. W. Newcomb (1, FSCA); Ann Arbor, VII-29-1953, VIII-8-[19]53, VIII-12-[19]53, G. H. Nelson/ Collected at light (4, FSCA); Van Buren Co., Kendel, 21 May 1986, J. A. Shuev colr. (1, MTEC).

Missouri: [No data] (1, INHS830271); St Louis Co., 1 mile North of Eureka on August 17th, 1979, S. Jay Hanselmann, coll. (1, BYUC). **New Hampshire:** [No data] (1, MCZC); [County?], Ramper, VII-24-1925, Darlington/ flying at night (1, MCZC). **New Jersey:** [No data] (4, MCZC); [Essex Co.], Livingston, Sept. 2, 1950, V. Roth (1, OSAC0000566838). **New York:** [No data] (1, BMNH; 3, CASC; 1, WSUC); Albany Co., Rensselaerville Huyck Preserve/ Ross H. Arnett Jr. Collector, August 1, 1975 (1, FSCA); Columbia Co., nr. Kinderhook, Oxycopsis Pond/ Ross H. Arnett Jr. Collector, 15-VII-1981 (1, FSCA); [Essex Co.], Ticonderoga, Aug. 6, 1929, F. C. Listman (1, PMNH); Ontario Co., nr. Victor/ See note no. 276, 1956, R. H. Arnett, Jr. (1, FSCA); [Richmond Co.], Staten Is., IX-1901 (1, CASC); Suffolk Co., Gardiner's Island, August 18, 2013, leg. R. J. Pupedis/ baited pitfall traps, meadow nr. Tob. Pd., N 41°5'25.83", W 72°5'28.66" (3, PMNH, YPM ENT. No 828275, YPM ENT. No 828279, YPM ENT. No 828281; DNA–MTEC023683, MTEC023684); [Tompkins Co.], Ithaca, 17-Aug-[18]89 (1, MCZC); Ithaca, 29 July 1937, 27 July 1939, J. G. Franclemont (3, FSCA); Ithaca, 8 Aug. [18]90/ Van Dyke Collection (1, CASC); Ringwood Res., 24 July 1964/ R. Silverglier (1, MCZC). **North Carolina:** [Wake Co.], Apex, 26-VI-[19]49, Chermock

(1, CASC). **Ohio:** Clinton Co., VIII-28-[19]55, IX-25-[19]55/ Collr. E. I. Hazard (2, FSCA); Franklin Co., VIII-27-[19]60/ Collr. E. I. Hazard (1, FSCA); Columbus, IX-1-[19]56, VIII-8-[19]64/ D. J. & J. N. Knull Collrs. (1, FMNH; 1, FSCA); [Hamilton Co.], Cin[cinnati], 8/17/[19]00/ Van Dyke Collection (2, CASC); [Knox Co.], Gambier, VIII-6-[19]44 (1, FSCA); [Muskingum Co.], Zanesville, 6-17-[19]18, 7-14-[19]18, A. E. Miller (2, FSCA); [Wayne Co.], Wooster, 07-16-[19]20, 07-20-[19]20, R. Miller (2, FSCA). **Oklahoma:** Latimer Co., VIII-[19]86, IX-1986, VIII-1987, IX-1987, VII-1988, IX-1988, VIII-1991, VIII-1992, VIII-[19]93, Karl Stephan (57, FSCA). **Pennsylvania:** [No data] (2, data); [Berks Co.], Stony Crk Mills, VIII-10-[19]48, D. G. Kissinger (1, FSCA); [Dauphin Co.], Harrisburg (3, MCZC); Rockville, VII-30-1911, H. B. Kirk (1, MCZC); Rockville, VII-27-[19]11/ J. N. Knull Collection (1, FMNH), Rockville, VIII-21-1910/ Coll. by A. Champlain (1, CASC); [Lackawanna Co.], Chinchilla, VII-26-[19]10 (1, MCZC); [Northampton Co.], Easton, J. W. Green, VII-30-[19]29 (1, CASC). **Rhode Island:** [Washington Co.], Watch Hill, July 22, 1909, W. Robinson (1, CASC). **South Carolina:** [Pickens Co.], Clemson, IX-15-[19]31/ D. Cartwright (1, FMNH). **Tennessee:** Clay Co., Standing Stone State Park (1, PMNH); Servier Co., GSMNP, Twin Creeks ATBI Plot 273819E 3951793N, 31-Jul-15-Aug-2002, B. Merritt, MT0120020815 (1, LSAM0156885). **Virginia:** [Chesapeake I.C.], Deep Creek, VII-17-[19]52, G. H. Nelson/ Dismal Swamp/ collected at light (3, FSCA); [56855]/ J. Smart (1, BMNH). **Wisconsin:** [Dane Co.], Madison, 9-15-1928/ C. E. Woodworth collector (2, WSUC); Madison, Aug 1927, leg. Henry Bunting (1, PMNH); Sauk Co., Pine Hollow S. N. A., 42°22'33"N, 89°54'11"W, 20-30 July 2000, A. S. Ramsdale Colr., F.I.T. mesic *Acer*

forest (1, MTEC); Hemlock Draw, T10N/R5E/Sec.07, July 26-Aug. 3, 1999, Alistair Ramsdale/ Flight Intercept Trap, mesic hardwood forest (1, MTEC); Milwaukee, 4-8-[19]35, Harry van Emden (1, BMNH). **Unknown locality:** 7-20-[18]84, G(?). H. (1, MCZC); Brewer, Jul-11-[18]79 (1, MCZC); ID label only (1, MCZC).

Hemicrepidius mescalero Etzler – **New Species**

Figs. 5.17a–5.17d.

Diagnosis

Hemicrepidius mescalero can be distinguished from all other *Hemicrepidius* species by the combination of a curved prosternal process, posterior margin of hypomeron with small narrow projection of the pronotal hind angle visible ventrally, a weak, thin hind angle carina that often appears absent. It is most similar in appearance to *H. tumescens* and *H. soccifer*. From *H. soccifer*, *H. mescalero* can be distinguished by the narrow projection of the hind angle and the relatively thicker parameres and less hooked apical expansions. From *H. tumescens*, *H. mescalero* can be distinguished by the curved prosternal process, the distribution in southern New Mexico, and, most noticeably, the more noticeably narrowed apical end on the medial lobe of the aedeagus.

Description

Length 8.0–11.5mm, width 2–3mm; body color almost uniformly red-brown to dark brown, elytra usually not contrasting pronotum, sometimes slightly lighter than

pronotum, often legs, antennae, posterior edge of pronotum, ventral edges of elytra, and edges of abdominal segments lighter; integument shining. Setae short, depressed, grey.

Head: punctures subumbilicate, nearly contiguous; frons weakly concave anteromedially, some with slight triangular impression medial; frontal carina broadly u-shaped, often interrupted medially by punctures, confluent with medial posterior margin of clypeal edge, at most weakly projecting; eyes moderate, rounded, bulging; antennae serrate, antennomere 2 spherical, antennomere 3 subtriangular and $1.5\times$ length of 2, setation on 3 intermediate between antennomeres 2 and 4, antennomere 3 three-fourths length of 4, antennomeres 4 and 5 about $1.5\times$ longer than wide, 6 to 8 about $2\times$ longer than wide, and 9 to 11 about $3\times$ longer than wide, antennomeres 4-11 with subtle medial line bearing less setae than edges, less distinct in specimens with dark antennae, antennomere 11 oval, antennae passing pronotal posterior edge by three antennomeres. **Thorax:** Pronotum as wide as long to $1.2\times$ wider than long, widest at hind angles or just anterior of midlength; sides weakly arcuate, often almost subparallel laterally, narrowing at anterior one fourth or less, lateral carina complete; hind angles usually subparallel, at most subtly divergent due to sinuate lateral edge anterior of hind angle, dorsal carina variable, thin, subparallel to lateral edge to interrupted by punctures and appearing absent; punctures on disc small, same size as punctures on head, simple to vaguely subumbilicate, separated by half to one diameter of a puncture, punctures larger and closer laterally, clearly subumbilicate and nearly contiguous; posterior edge with sublateral incisures present, small and weakly impressed. Hypomeron with moderate, subumbilicate punctures, nearly contiguous throughout except for small, semicircular impunctate area on posterior one-sixth;

posterior margin emarginate with hind angle visible and well projecting ventrally, narrowly truncate at tip, medial margin with impunctate line limited to just anterad procoxae at most (Fig. 5.17b). Prosternum punctuation similar in size to punctuation on hypomeron or slightly smaller, appearing simple, nearly touching laterally, much less dense medially, separated by one to two puncture diameters; anterior lobe weakly deflexed, short, broadly rounded to almost truncate, not covering ventral mouthparts; prosternal process curved dorsally between procoxae, narrow and sinuate past procoxae. Mesosternal fossa with lateral edges sinuate, posterior edge of fossa pointed to narrowly truncate. Metaventrite with punctures smaller than punctures on hypomeron, simple, dense throughout, nearly touching. Scutellar shield elongate, about twice as long as wide, narrowly rounded posteriorly, lateral margins weakly sinuate, dorsal surface almost flat, anterior margin nearly straight, punctuation small, setae radiating from midline, similar to setae on pronotum and elytra. Elytral striae weakly impressed basally; interstriae flat to slightly convex, punctures small, dense, giving wrinkled appearance; basal carina not crenulate. Legs with tarsomere lobe on tarsomere 3 largest, lobe on tarsomere 2 second largest, lobe on tarsomere 4 small, lobe on tarsomere 1 smallest, barely visible ventrally, all narrow. **Abdomen:** Punctures small, simple, a bit smaller than punctures on metaventrite, dense throughout nearly touching; fifth ventrite narrowly rounded; lateral microserrations on ventrites small, difficult to see, best visible on ventrites 2 to 4 only. **Male genitalia:** Figs. 5.17c and 5.17d. Parameres broadly and weakly sinuate laterally, apical expansion as narrow hook; apex of paramere bluntly pointed, membranous, setose ventrally. Medial lobe narrow, subparallel on basal four-fifths, apical fifth strongly

narrowed to apex; basal struts broadly curved and directed basally. Basal piece with membranous area limited to apical third and broadly round medially.

Distribution

Specimens are only known from Cloudcroft, New Mexico (Fig 5.18b).

Etymology

The specific name is a noun in apposition for the Mescalero Apache Tribe whose reservation is located near to the holotype locality of Cloudcroft, New Mexico.

Notes

This species has only been collected in Cloudcroft, New Mexico, mostly from a single collecting date. All specimens known are males. Larvae have not been associated.

Specimens Examined

Types Examined. **Holotype:** **New Mexico:** [Otero Co.], Cloudcroft, VI-27-[19]40, L. J. Lipovsky; male; in SEMC. **Paratypes: 16: USA: New Mexico:** [Otero Co.], Cloudcroft, 9000ft, July-7-[19]17, Wheeler, leg (1, CASC); Cloudcroft, VI-27-[19]40, L. C. Kuitert (2, SEMC); as previous except, L. J. Lipovsky (11, SEMC); as previous except, D. E. Hardy (1, SEMC); as previous except, E. E. Kenaga (1, SEMC).

Hemicrepidius montanus Lane, 1965

Hemicrepidius montanus Lane, 1965: 188; 1971:26.

Figs. 5.19a–5.19e.

Diagnosis

Hemicrepidius montanus can be distinguished from all other *Hemicrepidius* by the combination of strongly serrate antennae with the third antennomere triangular, the straight prosternal process, and the sinuate posterior margin of the hypomeron.

Hemicrepidius montanus can likely be confused with *H. carbonatus*, *H. morio*, and *H. obscurus*, but the strongly serrate antennae, unique for North American species, will readily separate *H. montanus* from the others.

Description

Length 11.5–19.0mm, width 3.0–5.5mm; color usually nearly uniformly dark brown to piceous dorsally, elytra not contrasting pronotum, pronotal hind angles often lighter, reddish brown, ventral side often lighter, dark brown, particularly posterior edge of hypomeron, legs, basal segments of antennae, and edges of elytra and abdominal segments; ingeument shining. Setae short, depressed, piceous. **Head:** punctures subumbilicate, nearly contiguous; frons weakly concave anteromedially; frontal carina complete, roughly v-shaped, confluent with medial posterior margin of clypeal edge, at most weakly projecting; eyes moderate, rounded and slightly bulging; antennae strongly serrate, antennomere 2 spherical, antennomere 3 triangular and just over 2× length of

2, antennomere 3 subequal in length to 4 and with punctation closer to that on 4, antennomeres 3 to 8 as wide as long, 9 to 10 slightly longer than wide, 11 longer than wide, antennomeres 3 to 11 with medial line bearing less setae than edges, antennomere 11 with tip constricted, antennae failing to reach pronotal posterior edge by two antennomeres in females and passing by two antennomeres in males. **Thorax:** Pronotum as wide as long, widest at hind angles; sides weakly arcuate, narrowing gradually anteriorly, lateral carina complete; hind angles slightly divergent, lateral carina sinuate anterior of hind angle, dorsal carina present, thickened, directed anteromedially; punctures on disc moderate, a bit larger than punctures on head, simple, separated by half to one diameters of a puncture, punctures closer and larger laterally, nearly contiguous, subumbilicate; posterior edge with sublateral incisures present. Hypomeron with subumbilicate punctures, nearly contiguous anteriorly and becoming less dense posteriorly towards impunctate area on posterior one-fifth to one-fourth, some specimens with impunctate area very small; posterior margin sinuate with hind angle weakly projecting ventrally and truncate at tip, medial margin with impunctate line anteriorly and posteriorly, line punctured medially. Prosternum punctuation smaller than punctuation on hypomeron, simple, separated by half to one diameter of a puncture laterally, becoming much less dense medially, almost impunctate in some specimens; anterior lobe nearly straight to weakly deflexed, broadly rounded, short, partially covering ventral mouthparts; prosternal process straight and impunctate between procoxae, straight and thickened past procoxae. Mesosternal fossa with lateral edges expanded ventrally in almost 90-degree angle, posterior edge of fossa truncate. Metaventrite with punctures

simple, smaller than punctures on hypomeron, dense and nearly touching laterally, becoming sparser medially. Scutellar shield elongate, about twice as long as wide, narrowly rounded posteriorly, lateral margins sinuate, dorsal surface weakly concave to flat, some specimens with slight medial raised ridge, anterior margin nearly straight, punctuation small, almost impunctate, setation sparse. Elytral striae moderately impressed basally; interstriae slightly convex, punctuation small and even, smooth basally, appearing a bit wrinkled apically; basal carina crenulate. Legs with tarsomere lobes on tarsomeres 2 and 3 wide, visible dorsally, lobes on tarsomeres 2 and 3 subequal or with 3 slightly larger, lobe on tarsomere 4 small, lobe on tarsomere 1 minute, a bit smaller than lobe on 4, visible only ventrally. **Abdomen:** Punctures small, simple, a bit smaller than punctures on metaventrite, very dense, nearly touching laterally, less dense medially; fifth ventrite broadly rounded; lateral edge of each ventrite with distinct microserrations. **Male genitalia:** Figs. 5.19d and 5.19e. Parameres with lateral edge subparallel on basal two-thirds, sinuate on apical third basad of apical expansion, apical expansion with acute laterally directed point; apex broadly pointed, weakly membranous, setose ventrally. Medial lobe relatively narrow, gradually narrowing apically, basal struts forming near 90-degree angle directed latero-basally. Basal piece with membranous area covering majority and transverse medially in ventral view.

Distribution

Specimens have been examined from the following states and provinces;
CANADA: BC; USA: AZ, CA, MT, NV, NM, OR, UT, WA, WY (Fig. 5.21a).

Notes

Historically, *H. montanus* has been confused under both *H. carbonatus* and *H. obscurus* (as *H. dilaticollis*). The antennae are quite distinctive and readily separate *H. montanus*. Despite having described the species, it appears that Lane confused this species with *H. morio* later in life based on specimens examined in OSAC. While both *H. montanus* and *H. morio* have the pronotal punctures on the disc well separated and a straight prosternal process, *H. morio* will have a small and intermediate antennomere 3, and the posterior edge of the hypomeron is emarginate, similar to that in *H. nemnonius*.

Larvae have not been associated with this species.

Specimens Examined

Types Examined. Of *Hemicrepidius montanus*: **Holotype:** Moscow, Ida, June-23-1932, Alt 2560 ft/ Paul Rice/ California Academy of Sciences Type No: 11174; male; in CASC.

LeConte Collection (MCZC), 4. Sierra C. / carbonatus #2; W.T./ carbonatus #3; W. T./ carbonatus #4; Cal./ N. sp. [if?] [females] [7?] [rel?]/carbonatus #5.

Horn Collection (MCZC), 6. In *H. carbonatus* tray: Cal, #3; Cal., #8. In *H. morio* tray: Nev., #2; Nev., #4; Or., #6. In unidentified *Hemicrepidius* tray: Nev.

Other Specimens Examined, 88. Canada: British Columbia: Midday Val., Merritt, VI-24-1924, VI-20-1925, R. Hopping (2, CASC); Midday Val., Merritt, VI-25-[19]24, M. L. Cutler/ 17132 Lot 1922/ *Pinus ponderosa* (1, CASC); Midday Val., Merritt, 6-VII-1924/ K. F. Anden (2, CASC); Midday Val., Merritt, VI-17-1925, Wm. Mathers/ 17161 Lot 26/ *Pinus ponderosa* (2, CASC); Waterloo Mine, Aug. 1934, Hughes (1, CASC). **USA:** 19361d, Hopk./ Flight (1, OSAC, WFIC0000353516). **Arizona:** Cochise Co., Rustler Park, 31.9052°N, 109.2780°W, 01-08-Aug-2012, 8467ft, Hart, Etzler, M. & L. Ivie, LF (1, MTEC, DNA-MTEC023675); [Coconino Co.], Flagstaff, VI-26-1939, R. P. Allen (1, CASC); [Gila Co.], Tonto Crk, 1640, 15m. E. Payson, 26-VII-1976/ stream banks (1, BMNH*). **California:** [No data] (1, MCZC); Calaveras Co., 4.8km S. West Point, 3-5-VII-1981, Stanley C. Williams (1, CASC); Big Trees, VIII/ F. E. Blaisdell Collector (1, CASC); Mokel Hill/ F. E. Blaisdell collector (4, CASC); Mokel Hill, VI-6-[18]96, V-10/ F. E. Blaisdell collector (2, CASC); Murphys, Alta. 2500ft, V-16-[19]36/ F. E. Blaisdell collector (1, CASC); Fresno Co., L. McKenzie Mill, VI-3-[19]09, R. Hopping (1, CASC); [Inyo Co.], Bishop/ [19]05-16-June/ [yellow circle]/ A. Fenyes Collection (1, CASC); Lake Co, Mt. St. Helena, V-22/23-1954, D. Guiliani and W. A. Russell collectors (2, CASC); Madera Co., Miami R. S., VI-24-[19]38/ L. R. Gillogly collector (1, CASC); Bass Lake, V-16-1934/ R. P. Allen collector (1, CASC); Sugar Pine, Dr. A. Fenyes/ [1191] (1, CASC); [Modoc Co.], Willow Rch, 8-13-[19]28/ 17966i, Hopk. (2, OSAC, WFIC0000352879, WFIC0000353515); Napa Co., N. side Howell Mt., 2mi NNE. Angwin, 1300ft, H. B. Leech, 6-VI-1981 (1, CASC); Nevada Co., Russell Vly, VII-1-1968/ F. D. Parker collector (1, CASC); Placer Co., E. R. Leach Coll.

(1, CASC); Donner, L-VII-16/ E. S. Ross collection (1, CASC); Plumas Co., Spring Garden, VII-20-1919/ R. Hopping collection (1, CASC); 4 mi. W Quincy, VII-2-[19]49/ H. A. Hunt Collector (1, CASC); Santa Barbara Co., Los Padres Nat. For., VII-29-1958 (1, CASC); 3 mi SE Zaca Pk, 3700', VII-6-1965/ M. R. Gardner collector (1, CASC); Shasta Co., Echo Lake/ July (1, CASC), Echo Lake, J. E. Cottle (2, FSCA); 1 mi N.E. Montgomery Creek, 13-VII-[19]83, R. M. and M. A. Brown collectors (1, CASC); Castella, J. E. Cottle/ July (1, FSCA); Siskeyou Co., Pondosa, 7-4-[19]57/ D. Guiliani collector (1, CASC); Dunsmuir/ [19]04-4-July/ [blue circle]/ A. Fenyes Collection (1, CASC); Yreka/ Hopk./ H. E. Burke collector (1, OSAC, WFIC0000352878); McCloud/ [19]04-28-June/ [blue circle]/ A. Fenyes collection (2, CASC); McCloud/ 04-29-June/ A. Fenyes collection (1, CASC); Trinity Co., Carryville [*sic*], Alt. 2400-2500ft., VI-3-1934/ G. E. Rehart collector (1, CASC); Carryville, VI-27-[19]31 (1, CASC); Carryville, VII-6-[19]50/ W. A. Russell collector (1, CASC); Carrville, VI-22-1913 (1, CASC); Tulare Co., Pine Crest, VI-28-[19]42/ collection of Robert E. Beer (1, SEMC); N. of Johnsondale, 2-VII-[19]77/ collected on *Abies* slash / B. K. Dozier coll. (1, FSCA); Tuolumne Co., VII-[19]34, E. R. Leach (1, CASC); Twain Harte, VI-14-1982, VII-11-1982, VII-20-1982/ M. R. Lundgren collector (3, CASC). **Montana:** Carter Co., 5 mi W. Alzada at uv light, 18-July-1990, D. L. Gustafson colr (1, MTEC); Lincoln Co., Rexford, 48.8982°N, 115.1588°W, 20-Jun-16-Aug-2012, 2619ft, Hart, E. Ivie, LF, aP, ETOH lures (1, MTEC); Mineral Co., Hwy135, 7.5mi NE St. Regis, 47.3423°N, 114.9707°W, 19JUN-15AUG2012, elev. 2636ft, C. Hart and E. Ivie, LF (1, MTEC); Missoula Co., Missoula, MT West Lumber, 46.8944°N, 114.0239°W, 23-May-22-June-2006, USDA, Exotic *Ips*

Lindfñl (1, MTEC; DNA–MTEC023676). **Nevada:** [No data] (1, CASC; 1, INHS830325, 4, MCZC); [4502] (1, INHS830315); Ormsby Co., July, Baker (1, MCZC). **New Mexico:** [No data] (2, MCZC); [San Miguel Co.], Las Vegas (6, INHS830308, INHS830310, INHS830312-INHS830314, INHS830324); Near Hot Springs, Las Vegas, 7000ft, Aug-[18]82, F. H. Snow (1, SEMC); Porvenir, Dr. A. Fenyes/ [1409] (1, CASC). **Oregon:** Harney Co., Burns, 3 Aug 1998, leg. D. Delaney & A. Sohns (1, OSAC0000541456). **Utah:** [Garfield Co.], W of BCNP 41, E. Fork, July-5-[19]56, Pete Brussard (1, BYUC). **Washington:** Chelan Co., Cashmere, Yaxon Cyn. VI-14-1985, G. Henderson collector (1, WSUC); Pierce Co., Fort Lewis, 27-VI-1944, Paul H. Arnaud, Jr. (1, CASC); [Spokane Co.] Spokane (2, MCZC). **Wyoming:** [No data] (1, MCZC).

Hemicrepidius morio (LeConte, 1853)

Asaphes morio LeConte, 1853: 450, 1869: 371; Candeze 1863: 213; Horn 1880: 71.

Hemicrepidius morio (LeConte, 1853): Lane 1952:66, 1971: 26; Hatch and Kincaid 1958: 14; Chapman 1964: 909.

Asaphes verna Candeze, 1863: 212–213

As synonym of *H. morio*: Horn 1875: 149; Horn 1880: 71.

Figs. 5.20a–5.20e.

Diagnosis

Hemicrepidius morio can be distinguished from all other *Hemicrepidius* by the combination of very sparse pronotal punctation, a straight pronotal process, and an emarginate posterior margin of the hypomeron. It is possible that *H. montanus* could be confused with *H. morio*, but the strongly serrate antennae with the third antennomere similar in shape to the fourth and the sinuate posterior margin of the hypomeron of *H. montanus* will readily separate this species from *H. morio*. Another possibility is confusion with dark *H. nemnonius*, which will never have the straight pronotal process found in *H. morio*, and will have much denser and larger pronotal punctation.

Description

Length 13–22mm, width 4–6mm; color nearly uniformly dark brown to piceous dorsally, elytra not contrasting pronotum, sometimes parts of ventral surface lighter; integument shining. Setae short, depressed, piceous. **Head:** punctures small, appearing simple, separated by half to two diameters of puncture; frons weakly concave anteromedially, some with slight triangular impression medial; frontal carina complete, roughly v-shaped to broadly rounded, confluent with medial posterior margin of clypeal edge, at most weakly projecting; eyes moderate and weakly bulging; antennae serrate, antennomere 2 spherical, antennomere 3 subtriangular, 2× length of 2 and with similar punctation, antennomere 3 subequal in length to 4, antennomeres 4 to 6 about 2× longer than wide, antennomeres 7-10 narrower, about 3× longer than wide, antennomeres 4-11 with subtle medial line bearing less setae than edges, antennomere 11 with tip

constricted, some almost appearing as pseudosegment, antennae not reaching pronotal posterior edge by one to two antennomeres to passing by up to two antennomeres.

Thorax: Pronotum $1.1\times$ to $1.3\times$ wider than long, widest at hind angles or just anterior of midlength; sides weakly to broadly arcuate, gradually narrowing anteriorly, lateral carina complete and slightly deplanate laterally; hind angles divergent with lateral edge sinuate anterior of hind angle, dorsal carina present, thickened, directed antero-medially; punctures on disc small, appearing simple, sparse, separated by one to four diameters of puncture, becoming larger, closer, nearly contiguous, and subumbilicate laterally; posterior edge with sublateral incisures present. Hypomeron with moderate, subumbilicate punctures, nearly contiguous throughout; posterior margin emarginate with hind angle visible ventrally and truncate at tip, medial margin with impunctate line short and limited to just anterior of procoxae. Prosternum punctuation smaller than punctuation on hypomeron, appearing simple, separated by one puncture diameter, sparse medially with lots of impunctate areas; anterior lobe short, broadly rounded, nearly straight to subtly deflexed, only partially covering ventral mouthparts; prosternal process straight and impunctate between procoxae, thickened and straight past procoxae. Mesosternal fossa with lateral edges expanded ventrally in almost 90-degree angle, posterior edge of fossa truncate. Metaventricle with punctures smaller than punctures on hypomeron, simple, separated by one puncture diameter laterally, less dense medially. Scutellar shield elongate, about twice as long as wide, narrowly rounded posteriorly, lateral margins sinuate, dorsal surface weakly concave, anterior margin nearly straight, punctuation small, almost appearing impunctate, setae radiating from midline, similar to setae on

pronotum and elytra. Elytral striae moderately impressed basally; interstriae flat to slightly convex, punctures small, evenly spaced; basal carina crenulate. Legs with lobes on tarsomeres 2 and 3 wide, visible dorsally, lobe on 3 largest, lobe on tarsomere 2 second largest, lobes on tarsomeres 1 and 4 small, narrow, visible laterally. **Abdomen:** Punctures small, simple, a bit smaller than punctures on metaventrite, nearly contiguous laterally, much sparser medially; fifth ventrite broadly rounded; lateral edge of each ventrite with distinct microserrations. **Male genitalia:** Figs 5.20d and 5.20e. Parameres subparallel laterally on basal four-fifths, sinuate on apical fifth basad of apical expansion; apical expansion strongly and narrowly pointed laterally; apex of paramere narrowly pointed, membranous, and setose ventrally. Medial lobe relatively narrow, gradually narrowing apically throughout length; basal struts forming 90-degree angle latero-basally.

Distribution

Specimens have been examined from the following states and provinces;
CANADA: BC; USA: CA, ID, MT, NV, OR, WA (Fig. 5.21b).

Notes

The amount of sexual dimorphism in *H. morio* is quite high, with females often being much larger than males. I agree with Horn (1880) that the differences between *Asaphes morio* and *Asaphes verna* are sexual. The character of the impunctate first stria of the elytra in *A. verna* used by Candéze was likely an artifact of the light source as the type lacked this character when I examined it.

A sex pheromone is hypothesized for *H. morio* based on observations of specimens flying to cut logs and of males flying to females (Chapman 1964). However, the chemical make-up of this alleged attractant remains unknown.

Based on preliminary molecular data (Fig. 5.1), *H. obscurus* appears to be the closest related species. Larvae have not been associated.

Specimens Examined

Types Examined. Of *Asaphes morio*: **Holotype:** [blue disk]/ A. morio Lec. Oregon/ Type 2610; female; type locality Oregon; in MCZC. Of *Asaphes verna*: **Holotype:** California/ 311/ Coll. Janson/ ID label; male; type locality California; in BMNH.

LeConte Collection (MCZC), 3. [blue disk]/ morio #2; [blue disk]/ morio #3; Van./ morio #4.

Horn Collection (MCZC), 6. In *H. morio* tray: OR, #1; W.T., #3. In Unidentified *Hemicrepidius* tray: W.T.; W.T.; Tacoma, Wash/ 50; Victoria Fall, Id./ 59.

Other Specimens Examined, 389. **Canada: British Columbia:** Dean River, 52°49'N, 126°46'W, Aug. 20-25, 1988, W. W. Middlekauf (1, CASC); Duncan, Genoa bay, VII-4-1928, W. Mathers (1, CASC); Ft. Langley, May-27-1924, A. P. Macdougall (1, CASC); Galiano Is., S. end, July 2-4 1957, M. H. Hatch (2, OSAC0000836944,

OSAC0000836950); Nanaimo, VI-24-1920, E. C. Van Dyke (1, CASC); Nelson Island, Annis Bay, VIII-1-[19]27, G. R. Hopping (2, CASC); Parksville, 3-VIII-1979, N. Carter (1, CASC); Pender Harbor, VII-19-1920, VII-26-1929, R. T. Turner (3, CASC); Pender Harbor, July 17, [19]26, H. H. Thomes (1, CASC); Pender Harbor, VII-2-[19]28, VII-18-[19]28, G. R. Hopping (3, CASC); Pender Harbor, Hofel Lake, VII-20-[19]26, E. A. Rendell (1, CASC); Revelstore, 7-11-[19]49/ D. Guiliani collector (1, CASC); Saanich Dist., 12-VIII-[19]18, W. Downes (1, CASC); Salmon Arm, 15-VII-1952/ R. E. Leech collector (1, CASC); Vanc[ouver] Is/ Van Dyke Collection (1, CASC); Vanc[ouver], VI-11-[19]30, H. Leech (1, CASC); Vancouver, 15-VII-1932, K. F. Auden (1, INHS830194); V.I., Tofino, 31-VII-[19]49, A. guppy (1, OSAC0000836947); Tofino, 10-Aug-1953, R. guppy (1, OSAC0000836945); Victoria, July-17-1901/ Van Dyke Collection (1, CASC); Victoria, 11-VII-[19]18, 15-VIII-[19]19, W. Downes (2, CASC); Victoria, VII-26-[19]49/ E. R. Leech(1, CASC); Vancouver Island, Victoria, 9-VII-1957, Derham Giuliani (1, CASC); Wellington, S. Vancouver Id. 28-VII-1945, 19-VII-1945, VII-31-1948, July-4-1949, 21-July-1949, 10-Aug-1949, 20-June-1950, 17-Aug-1954, Richard Guppy (8, OSAC0000551219–OSAC0000551222, OSAC0000836946, OSAC0000836948, OSAC0000836949, OSAC0000836952); Esquimalt, Vancouver Isl., Walker/ H. G. Champion Coll., B.M.1953-156. (3, BMNH); Vancouver Isl (4, BMNH); Victoria, B. Columbia, G. H. Ashe (1, BMNH); Brit. Columb. Blecey (?) Station, Sept 1859 (1, BMNH); Canada, Vancouver, 25.vii.1930, D. Greenham (1, BMNH); Vancouver Is., 1900—170 (1, BMNH); Salmon Arm, May [19]36, O. R. Leach (1, BMNH); Salmon Arm, May [19]36, O. R. Leach (2, MCZC); Terrace, Mrs. M. E. Clark

(1, MCZC); Terrace, Mrs. M. E. Hippisley, 1930 (1, MCZC); Van[couver] I[sland] (3, MCZC). **British Columbia or Saskatchewan:** (1, MCZC). **USA: California:** Sonoma, 7-69 [?] 0.10. / H. Hinton Coll. (1, BMNH); Ex Horn, Coll. Janson / ID label, California (1, BMNH); Alameda Co., Niles Canyon/ May (1, FSCA); [Del Norte Co.], Crescent City, VII-25-[19]22/ Van Dyke Collection (1, CASC); Lake Tahoe, VII-15-1958, E. W. Erickson (1, FSCA); Humboldt Co., VI-01/ Van Dyke Collection (3, CASC); Blocksburg, VI-22-[19]41, 5-VII-[19]42/ B. P. Bliven collector (3, CASC); Eureka, July [19]28, VI-11-[19]36, 8-8-[19]60, B. P. Bliven (3, CASC); Green Point Ranch, VII-4-[19]16/ F. E. Blaisdell collector (1, CASC); Larabee Valley, VII-12-[19]36/ B. P. Bliven collector (1, CASC); Lord Ellis Rd, June[19]31 (1, CASC); Mad R. Mts., VII-2-[19]31/ Van Dyke Collection (2, CASC); Redwood Cr., VII-3-[19]31/Mad River Divide/ Van Dyke Collection (2, CASC); Weott, VII-12-[19]29/ Van Dyke collection (2, CASC); Marin Co./ Van Dyke Collection (2, CASC); Inverness, 6-VIII-1950, Derham Giuliani (1, CASC); Lagunitas, VII-15-1928/ E. H. Nast collector (2, CASC); Mill Valley, VII-06, VI-21-1931, 25-VII-[19]49, 27-VI-[19]50, 29-VIII-[19]50 (6, CASC); Mendocino Co./ Van Dyke collection (1, CASC); lon. 123°0', lat. 39°55'/ 26-VII-[19]46 (2, CASC); Comfort, VII-[18]96, IV-[18]98/ Van Dyke collection (2, CASC); Fort Bragg, VII-[18]96/ Van Dyke Collection (3, CASC); Napa Co./ Van Dyke collection (1, CASC); Placer Co., Loch Laum Lake Trail, 6-July-1977 (1, MTEC); Santa Clara Co., Alma/ Van Dyke Collection (3, CASC); Santa Cruz Mts, Koebele Collection (1, CASC); Santa Cruz Co., Ben Lomond, II-25-[19]44/ W. Lee collector (1, CASC); Zayante, VII-5-[19]48 (1, CASC); Big Basin, VII-21-[19]28/ Van Dyke Collection (1, CASC); S[an] Mateo Co./

Van Dyke Collection (1, CASC); La Honda, VIII-23-[19]53, Bryant, Lot.9 (1, CASC); Shasta Co., VII-3-[19]21/ J. A. Kusche collector (1, CASC); Castella, VII-1912/ Van Dyke Collection (2, CASC); Siskiyou Co., VI-15-[19]41, E. R. Leach (1, CASC); Shasta retreat, elev. 2416ft/ July/ F. E. Blaisdell collector (1, CASC); Sonoma Co., V-[19]22, VII-[19]33, E. R. Leach (2, CASC); Duncan Mills, VII-26-[19]08/ F. E. Blaisdell (1, CASC); Trinity Co., Carrville, VI-26-[19]31/ Van Dyke Collection (2, CASC); Carrville, VII-6-[19]50/ W. A. Russell Collector (1, CASC); Trinity Co., Trinity Center, 26-VII-1931 (1,CASC); Santa Cruz Mt, 8-13-[19]38, L. W. Hepner, P. I. Sailer (2, SEMC).

Idaho: Benewah Co., FS Rt 299 ca 8mi SE Enida, 29 July 1987, R. S. Zack, ex *Anaphalis margaritacea* (1, WSUC); [Bonner Co.], Coolin, Priest Lake, July-17-1927, July-19-1927/ E. C. Van Dyke (2, CASC); Boundary Co., Spruce Cr, -low Br., 48.9427°N, 116.1448°W, 02 Aug 2003, 946m, D. L. Gustafson W1909 (1, MTEC); [Latah Co.], Moscow Mts., 15-VII-[19]32, J. F. Clarke (1, WSUC). **Montana:** Flathead Co., Glacier National Park, W. Glacier Head Qtr., 04-15 Jul 1991, 02-14 Aug 1991, 09-20 Aug 1993, M. A. Ivie colr. (31, MTEC); Glacier National Park, McDonald Lk Rangr Sta, 10-16 Sep 1993, M. A. Ivie colr. (1, MTEC); Stillwater State Forest, Hwy 33, mi154, elev 992m, 48.6408°N, 114.7047°W, 25-July-02-Oct-2010/ baited Lindgren funnel, Kraus, Etzler, Ivie (1, MTEC; DNA–MTEC023677); [Lake Co.], Flathead L., MSU Biol. Station, July-27-1965, Mary Richardson (1, OSAC0000836941); Lincoln Co., Yaak river mouth, funnel traps, 09 June- 12 Sept 1994, D. L. Gustafson colr. (1, MTEC); Yaak River mouth, pitfall traps, 09 June- 11 Sept 1994, D. L. Gustafson colr (1, MTEC); Yaak River mouth, 04 July 1991, D. L. Gustafson col. (1, MTEC); Yaak R. -mouth down, pitfall

traps, 23 Jun-12 Aug 1995, 08 Jul-12 Sep 1996, D. L. Gustafson Colr. (3, MTEC); E of Lk Koocanusa, Sutton Rd, elev 875m, 48.7651°N, 115.2653°W, 26-July-02-Oct-2010/ baited LF, Krause, Etzler, Ivie (1, MTEC; DNA–MTEC023678); 899 Florence Rd, Libby, 48.4165°N, 115.5237°W, 31-July-2014, 2368ft, Bares, Dolan, Blacklight (1, MTEC; DNA–MTEC023679); Mineral Co., Trout Cr. – camp blt., 47.1176°N, 114.8670°W, 22 Aug 1995, 916m, D. L. Gustafson, G1778 (2, MTEC); Ravalli Co., Sula Rang. Sta. site, funnel traps, 26 June-31 July 1994, D. L. Gustafson colr. (1, MTEC).

Nevada: [No data] (1, MCZC). **Oregon:** [No data], (1, INHS830323; 7, MCZC); [No data]/ Sharp Coll. (1, BMNH); O. Dietz (1, CASC); Davies (1, CASC); Alder Ck/ Hood Loot, VII-9-[19]27, Darlington (1, MCZC); Dilley (1, MCZC); Baker Co., Spring Creek Blue Mtns., July-28-1968, Aug-9-1970, Aug-9-1972, J. H. Baker col. (6, FSCA); Blue Mtns, nr LaGrande, VII-9-1922/ Van Dyke collection (1, CASC); Blue Mts, 7-21-[18]96 (1, WSUC); Benton Co., Mary's Peak, 15mi W. Corvallis, 17-VIII-[19]73, H. V. Weems, Jr., 3000-3500ft elev. (1, FSCA); Coast Mts, Jun-11-[19]10 (1, OSAC0000836953); Corvallis/ Hayes (1, OSAC0000836963); Corvallis, 6-13-[19]09/ C. F. Moanette collector (1, OSAC0000836954); Corvallis, 20-8-[18]97 (1, OSAC0000836968); Coos Co., Beaver Hill Jct., VII-1913/ F. B. Herbert colr (1, OSAC, WFIC0000398839); North Bend Sand Dunes, VI-28-1968, A. H. Barnum (1, BYUC); Marshfield, VI-11-[19]36/ Van Dyke Collection (2, CASC); 15 mi SW Powers, Upper Cherry Cr., July-[19]60, B. Burwell (1, OSAC0000836955); Douglas Co., 9-5/ Evenden (1, OSAC0000836969); 12 mi E. Glide, June-25-1958, R. H. Hunt collector (1, OSAC0000836965); 8mi E. Riddle, June-25-1958/ R. H. Hunt (1, OSAC0000836967); Sulpher Sprgs., 6mi. N. Corvallis, 7-

8-1962 (2, PMNH); Grant Co., 7-7-[19]14, Chamberlin (1, MCZC); Lane Co., W of Elmira, VI-23-1911/ coll. by J. R. Slevin (1, CASC); Alder Springs, Willamette Nat'l For, Hwy 242, 9-VIII-[19]90/ R. M. & M. A. Brown collectors (3, CASC); HJ Andrews Exp. For, 11 mi NE Blue River, 26 Jun-18 Jul 1982, G. L. Parsons/ Litcol site 17-9 T15S R5E S31 NW ¼ clearcut WS-10, ex. Pitfall (2, OSACV0000144889, OSACV0000144890); HJ Andrews Exp For, nr Blue River, New growth area #L105, VII-18-[19]73/ 48hr pitfall trap Coll. Mike Mispagel, Sample #51-29, IBP Biome survey, W. P. Nagel & G. Daterman (2, OSACV0000145742-OSAC0000145743); McKenzie Bridge Dist. Clearcut response study, pitfall trap/ VII-13-30-1991, A. R. Meldenke (10, OSAC0000850810-OSAC0000850816, OSAC0000850819, OSAC0000850822, OSAC0000850823); Lane-Linn Co., HJ Andrews Exp. Forest 11mi NE Blue River, July-17-1986, July-22-1986, July-31-1986, Aug-5-1986/ Log Decomp study (9, OSACV0000144891- OSACV0000144899); Lincoln Co., Waldport, July-8-1956, John D. Lattin (1, OSAC0000836956); Cape Perpetua, Siuslaw N. For., VIII-11-[19]59, coll. R. T. Bell (1, CASC); Linn Co., HJ Andrews Exp Forest, nr Blue River, Midgrowth Doug Fir area, VIII-9-[19]73/ IBP Biome Survey M.P. Nagel & G Daterman (1, OSACV0000145741); Blue River Dist, Clearcut response study, Pitfall trap/ VII-13-30-1991, VIII-26-IX-17-1991, A. R. Meldenke (5, OSAC0000850817, OSAC0000850820, OSAC0000850821, OSAC0000850824, OSAC0000850825); Polk Co., 4H Educ. Center, VII-7-1973, Loren Russell (1, OSAC0000302832); Black Rock, 10mi SW Dallas, June-29-1960, July-25-1960, Don Allen (3, OSAC0000836957- OSAC0000836959); McMinnville, VI-14-1942, K. M. & D. M. Fender (3, OSAC0000551223,

OSAC0000551224, OSAC0000551236); McMinnville, VI-28-[19]42, K. M. Fender (4, CASC); Beaver Crk, E. of Sandy, VII-16-1947, K. M. Fender (1, OSAC0000836943); Bear Springs, Wapinitia Cutoff, Aug-8-1946, K. M. Fender (1, OSAC0000836951); Boyer, July-4-1938, 7-14-1939, K.M. & D.M. Fender (3, OSAC0000551228, OSAC0000551229, OSAC0000551239); Cannon Beach, 7-24-[19]35/ flight/ R. L. Furnis collector (1, OSAC, WFIC0000398834); Colton, 7-3-[19]32, 7-[19]33, 8-[19]33/ E. S. Ross (5, CASC); Drain, VI-9-[19]14, E. C. Van Dyke (1, CASC); Gardiner, 6-27-[19]36 (1, OSAC0000551232); Hillsboro, July-27-1965, Blk light trap, Kenneth Goeden (1, CASC); Hood River, Childs Coll., 7-20 (1, OSAC0000836962); House Rock F. C., S [Sontiam?] R, VIII-3-[19]44 (1, OSAC0000551230); Hubbard, VII-2-[19]44(1, OSAC0000551227); Independence, VI-15-1934/ N. J. Larson colr. (1, FSCA); Myrtle Point, VI-9-12-1911/ Col. By J. R. Slevin (1, CASC); Newburg, July-25-1966, blk light trap, Kenneth Goeden (1, CASC); Oak Ridge, V-31-[19]24, G. R. Hopping (1,CASC); Odell L., VIII-6-[19]48 (1, OSAC0000551231); Pacific City, VII-23-[19]32, K. M. & D. M. Fender (2, OSAC0000551235, OSAC0000551237); Peavine Ridge nr. McMinnville, VI-30-1945, Kenneth M. Fender (1, OSAC0000551225); Ranier, 7-17-1957 (1, OSAC0000567994); Rockaway, Aug-11-1923/ L. P. Rockwood Coll. (1, OSAC0000836970); Sheep Ridge, S. Santiam R, VI-13-[19]41 (1, OSAC0000551234); Silver Creek, VIII-2-[19]48 (1, OSAC0000551238); Sisters, 7-25-[19]28 (1, OSAC0000551233); Sumter/ Hopk. U.S./ H. E. Burke Collector (1, OSAC, WFIC0000353511); Sweet Home, VII-21-[19]36/ R. L. Furniss collector (1, OSAC, WFIC0000398838); Timber, 8-8-[19]35/ R. L. Furniss collector (2, OSAC,

WFIC0000398835, WFIC0000398836); Waldo Hills/ July-20-1901/ Thompson (1, OSAC0000836960); Willimina, 7-22-[19]11 (1, OSAC0000836966); West Woodburn, VI-9-[19]13 (1, OSAC0000551226); Columbia wy, Wilson's Cr./ E.H. Nast collector (1, CASC); [Multnomah Co.] Portland, 7-11-[18]96 (1, MCZC). **Washington:** [No data] (1, CASC; 1, OSAC0000551197; 1, WSUC); Clallam Co., Forks, July-4-1920/ E. P. Van Duzee collector (1, CASC); Lake Crescent, 7-10-[19]01 (2, CASC); Lake Crescent, coll. by J. R. Slevin (1, CASC); [Clark Co.], Vancouver, 6-39[?], O. Stout (1, OSAC0000551209); Vancouver, Jul-7-1917, A. L. Melander (1, WSUC); [Columbia Co.], Dayton, 8-3-1933, L. T. Turner col (1, WSUC); [Grays Harbor Co.], Melbourne, VII-29-1911/ coll. by J. R. Slevin (1, CASC); Montesano, VIII-20-[19]13 (1, CASC); [Island Co.], Caufeville [*sic*], 7-4-[18]98, 8-11-[18]98, 8-16-[18]98 (3, WSUC); [Jefferson Co.] Port Townsend, A. Seaton (1, MCZC); [King Co.], Cedar Falls, 6-28-[19]31, Art. Crews (2, WSUC); Issaguah, VII-11-1969, M. Braun No.(1, WSUC); Pine lake, 7-15-[19]34, J. L. Wilson (1, OSAC0000551206); Seattle (1, OSAC0000551190; 2, WSUC); Seattle/ collector O. B. Johnson (2, WSUC); Seattle/ collector C. V. Piper (1, WSUC); Seattle, VI-16-1920, E. C. Van Dyke (1, CASC); Seattle, [no date], 6-25-[19]07, 5-26-[19]11, 1929, Aug-III-1930, 5-29-1933 (6, OSAC0000551191- OSAC0000551196, OSAC0000551198); [Kitsap Co.] Bainebridge Island, 8-10-1938, R. R. Stapp, Jr. (1, OSAC0000836942); Charlestin, 7-21-[18]95 (1, WSUC); Keyport, July 1900, H. E. Burke, col. (1, WSUC); Seabeck, VI-17-[19]35, VI-20-[19]35, C. H. Lavers (2, OSAC0000551215, OSAC0000551216); [Kittatas Co.], Easton, K. / Koebele collection (6, CASC); [Mason Co.], Lebar, Olympics, Aug [19]33 (1, OSAC0000551201); Olympic

Nat. Park, Hurricane ridge (Ch.co), elev. 1807ft, 20-VIII-1977/ collection of N. L. Rump (1, CASC); Olympic Nat. Pk, Blue Mt, IX-1948, Paul Hatch (1, OSAC0000551202); [Pacific Co.], South Bend, VII-25-1911/ coll. by J. R. Slevin (1, CASC); Pierce Co, Chambers Creek, June 12, 1935 (1, OSAC0000551205); Electron, 3000ft elev., July-28-1934, Owen Bryant col (2, CASC); Lagrande, July-7-9-1928, M. H. Hatch (1, OSAC0000551204); Lk Tapps, 6-23-[19]60/ Bert Freeman (1, WSUC); Longmires, Ranier N. Pk., VII-12-[19]36/ Van Dyke Collection (1, CASC); Longmires, VII-11-[19]11/ coll. by J. R. Slevin (1, CASC); Mt. Ranier (1, WSUC); Shelton, VII19=1938/ R. L. Furniss (1, OSAC, WFIC0000398837); Spanaway, VI-10-1939/ S. E. Crumb coll. (1, OSAC0000836961); Sumner, VII-2-[19]29, R. Hansberry (1, WSUC); Tacoma/ United States, 1907—156 / Ex. Coll. Wickham (1, BMNH); Pack Forest, VIII-26-1937, Dan Bonnell (1, OSAC0000551203); [San Juan Co.], Fri[day] Hbr, VIII-5-[19]30, L. W. (1, OSAC0000551199); Friday Harb., Vance Tarter, 1932 (1, OSAC0000551217); Friday Harbor, July-10-1937, G. Minsk (1, OSAC0000551200); Friday Harb., July-9-1938, July-10-1938, VII-7-1940, M. H. Hatch (3, OSAC0000551207, OSAC0000551208, OSAC0000551218); Olga, 26 Jul 9 (1, WSUC); [Skagit Co.], 3 mi W. Anacortes, 7-6-[19]47, Otis Cleary (1, FSCA); [Skamania Co.], Underwood, 7-9-[19]35, R. H. Beamer (1, SEMC); [Snohomish Co.], Coal Crk. For. Cmp. Columbia Nat. For., VII-2-1957/ W. B. Langt Collector (1, CASC); Monroe, VII-4-14-[19]05/ Van Dyke collection (4, CASC); Spokane Co. [*sic*], McChord A. F. B, 06-02-1971, light trap (1, WSUC); Thurston Co., Black Lake, VI-27-[19]37 (1, OSAC0000551214); Olympia, 7-30 (1,

MCZC); Olympia, VI-25-[19]32/ J. Wilcox coll (1, CASC); Olympia/ C. L./ [no date], 7-16-[18]90 (2, OSAC0000551212, OSAC0000551213); Olympia, Aug [19]33 (1, OSAC0000551210); Rochester, 7-22-[19]31, M. W. Sanderson (1, SEMC); Yelm, 8-25-[19]36, D. L. C. (1, OSAC0000551211); [Whitman Co.], Pullman (1, WSUC); [Yakima Co.], Toppenish, 7-8-[19]35, R. H. Beamer (1, SEMC). **Washington Territory:** [No data] (3, MCZC). **Unknown locality:** Coll. Janson (1, BMNH). **Dubious record:** **Pennsylvania:** [Centre Co.], State College, II-18-[19]12/ J. N. Knull collection (1, FMNH).

Hemicrepidius nemnonius (Herbst, 1806)

Elater nemnonius Herbst, 1806: 29.

Elater memnonius Herbst, 1806. Unjustified emendation, Say 1836: 176.

Asaphes memnonius (Herbst, 1806): LeConte 1853: 450; Candeze 1863: 211; Horn 1880: 74.

Hemicrepidius memnonius (Herbst, 1806): Brooks 1960: 31; Webster et al. 2012: 100.

Elater baridus Say, 1836: 176.

Asaphes baridus (Say, 1836): LeConte 1853: 450.

As synonym of *H. nemnonius*: Candeze 1863: 211; Horn 1880: 74.

Hemicrepidius thomasi Germar, 1839: 213.

As synonym of *A. baridus*: LeConte 1853: 450.

As synonym of *H. nemnonius*: Candeze 1863: 211.

Figs: 5.2a–5.2c, 5.2e, 5.22a–5.22e, 5.36a, 5.36b.

Diagnosis

Hemicrepidius nemnonius can be distinguished from all other species of *Hemicrepidius* by the combination of an emarginate posterior margin of the hypomeron with a truncate projection of the hind angle, pronotal hind angles with thick carina, the curved prosternal process, and the presence of short, depressed setae. *Hemicrepidius nemnonius* will most easily be confused with *H. bilobatus* and *H. ruficornis*. From *H. bilobatus*, *H. nemnonius* can be easily distinguished by the carina on the pronotal hind angle and the presence of sublateral basal incisures. From *H. ruficornis*, *H. nemnonius* can be distinguished by the shorter setae on the pronotum, the less pronounced hind angle projection off of the hypomeron, and the greater sinuation of the lateral edge of the parameres just basad of the apical expansion, giving the apical expansion a sharper point.

Description

Length 14–26mm, width 4–8mm; color red-brown to dark brown, elytra not contrasting pronotum, legs, antennae, posterior edge of pronotum, ventral edges of elytra, and edges of abdominal segments sometimes lighter, yellow-brown; integument dull to shining. Setae short, depressed, gold. **Head:** punctures subumbilicate, nearly contiguous; frons weakly concave anteromedially, some with slight triangular impression medial; frontal carina roughly v-shaped, often complete, sometimes interrupted medially by punctation, confluent with medial posterior margin of clypeal edge, at most weakly

projecting; eyes large and moderately bulging; antennae serrate, antennomere 2 subcylindrical, a bit longer than wide, antennomere 3 subtriangular, $2\times$ length of 2 and with setae intermediatae between antennomeres 2 and 4, antennomere 3 subequal in length to 4, antennomeres 4 to 11 about $3\times$ longer than wide, each with medial line bearing less setae than edges, less noticeable in specimens with dark antennomeres, antennomere 11 with tip constricted as a pseudosegment, antennae passing pronotal posterior edge by 1.5 to 2.5 antennomeres. **Thorax:** Pronotum $1.1\times$ to $1.3\times$ wider than long, widest at hind angles or just anterior of midlength; sides weakly arcuate, narrowing at anterior one fourth, lateral carina complete; hind angles usually subparallel, sometimes appearing slightly divergent due to sinuate lateral edge anterior of hind angle, dorsal carina present, thickened, directed anteromedially; punctures on disc moderate, same size as punctures on head, faintly to clearly subumbilicate, separated by one to two diameters of a puncture, punctures closer and shallower laterally, nearly contiguous, and umbilicate; posterior edge with sublateral incisures present. Hypomeron with large, subumbilicate punctures, nearly contiguous anteriorly and becoming less dense posteriorly towards impunctate area on posterior one-fifth to one-fourth, rarely impunctate area very small or absent; posterior margin emarginate with hind angle visible ventrally and truncate at tip, medial margin without impunctate line. Prosternum punctuation matching punctuation on hypomeron or a bit smaller, separated by one diameter of a puncture, less dense medially; anterior lobe slightly deflexed, broadly rounded, partially covering to fully covering ventral mouthparts; prosternal process slightly curved dorsally between procoxae, narrow and straight past procoxae. Mesosternal fossa with lateral edges sinuate, posterior edge of

fossa truncate. Metaventrite with punctures simple, smaller than punctures on hypomeron, dense throughout, nearly touching. Scutellar shield elongate, about twice as long as wide, narrowly to broadly rounded posteriorly, lateral margins sinuate, dorsal surface flat to weakly convex, anterior margin nearly straight, punctuation small, setae radiating from midline, similar to setae on pronotum and elytra. Elytral striae moderately impressed basally; interstriae flat to slightly convex, punctures small, even and dense; basal carina crenulate. Legs with lobes on tarsomeres 2 and 3 wide, visible dorsally, lobe on tarsomere 3 largest, lobe on tarsomere 2 second largest, lobe on tarsomere 1 small, visible laterally, lobe on tarsomere 4 smallest, visible laterally. **Abdomen:** Punctures small, simple, a bit smaller than punctures on metaventrite, dense throughout, nearly touching; fifth ventrite narrowly to broadly rounded; lateral edge of each ventrite with distinct microserrations. **Male genitalia:** Figs. 5.22d and 5.22e. Parameres subparallel lateral on basal three-fourths, sinuate on apical one-fourth basad of apical expansion, which forms a strong hook; apex of paramere pointed, sclerotized, setose ventrally. Medially lobe narrow, gradually narrowing throughout length apically; basal struts forming 90-degree angle latero-basally.

Distribution

Specimens have been examined from the following states and provinces; Canada: AB, NS, ON, QC, SK; USA: AL, AZ, AR, CA, CO, CT, DC, FL, GA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, MT, NE, NV, NH, NJ, NM, NY, NC, ND, OH, OK, PA, RI, SC, SD, TN, TX, UT, VT, VA, WA, WV, WI, WY (Fig. 5.25a).

Notes

The correct name for this species is *H. nemnonius*, as it appears in the original description by Herbst (1806), as well as in the referece table at the beginning of the work. Say (1836) stated that that the original spelling was a mistype, and changed it to the historical and commonly used *H. memnonius*. This is an unjustified emendandation (ICZN 1999), so the most commonly used spelling must be rejected.

Specimens of *H. nemonius* are the most common of all species of North American *Hemicrepidius*. It also has the most obvious examples of variation, including differences in density of pronotal punctures, the presence of an impunctate area on the hypomeron, size, and coloration. This likely is due to the large range of the species, which is found in nearly all US states of the lower 48 (Fig. 5.25a). However, preliminary molecular data from across the range and covering different forms support the recognition of only one species (Fig. 5.1).

Two types were unavailable for examination, being the types of *Elater nemnonius* and *Elater baridius*. The types of Herbst were not able to be tracked down for this study, and the types of Say are presumed to be lost or Say specimens are mixed into European collections (Prena 2018). However, both original descriptions are of large, dark brown beetles, similar to the type of *Hemicrepidius thomasi*. Additionally, the abbreviated and apically confluent second and third elytral striae which was used to separate *Elater baridius* from *Elater nemnonius* is a highly variable character within Elateridae, sometimes differing between the elytra of the same specimen. Herbst's original description also mentioned smaller light brown forms in addition to the larger dark ones.

Due to the original descriptions matching the many specimens I have examined, and the commonness of the species, I have no doubt that this is the species that Herbst described.

Traditionally *Asaphes ruficornis* was placed in synonymy with *Hemicrepidius nemnonius*, following LeConte (1853). However, an examination of the type revealed that *A. ruficornis* is a valid species (see below).

Larvae have been associated with this species (Glen 1950).

Specimens Examined

Types Examined. Of *Elater nemnonius*: **Holotype**: not examined; type locality North America, not further limited; in ZMHB[?]. Of *Elater baridus*: **Holotype**: type missing or lost; type locality North Carolina. Of *Hemicrepidius thomasi*: **Lectotype**: Coll. Janson., Ex. Schaum [typed] / Thomasi [unknown], Grm – memno-, nius Hbst, 8166 Amer. Bor. / A. memnonius Herbst, thomasi Germ, Am. Bor.; female; type locality North America, not further limited; in BMNH. **Syntypes**: Janson Coll., ex Schaum, 1903–130, syntype #1; Janson Coll., ex Schaum/ A. memnonius Herbst, thomasi Germ., Am. Bor., syntype #2; Janson Coll., ex Schaum/ A. memnonius Herbst, thomasi Germ., Am. Bor/ A. memnonius/ [female symbol], syntype #3; [female symbol]/ Janson Coll., ex Schaum, 1903–130 / *Asaphes memnonius* Herbst, Am. Bor., syntype #5; all in BMNH.

LeConte Collection (MCZC), 6. pink disk/ A. memnonius Herbst, baridius Say, thomasi Germar, ruficornis Kirby/ memnonius #1; pink disk/ memnonius #2; pink [?]

disk/ *A. baridius* (Say)/ *memnonius* #6; Ga./ *memnonius* #7; yellow disk/ *memnonius* #10.

Horn Collection (MCZC), 13. In *Asaphes memnonius* tray: Can., #1; Pen., #2; Pen., #3; yellow disk, #4; Pen., #5; Tenn., #6; Neb., #7; “4”, #8. In sp. nr. *memnonius* tray: I.T., #1; Col., #2; Col., #3; Col., #5; Col., #6.

Melsheimer Collection (MCZC), 2. *Asaphes baridius* [labeled ‘basideus’] #1, no locality; *Asaphes memnonius* #1, no locality.

Zeigler Collection (MCZC), 4. *Asaphes memnonius*: green disk, #1; green disk, #4; green disk, #5, ID label with Pa; green disk, #8.

Other Specimens Examined, 1627. **NORTH AMERICA:** Amer. Bor. / ex Mus, Murray (2, BMNH); Amer. Bor. / Coll. Janson (3, BMNH); Coll. Janson, Ex Dejean / *Asaphes memnonius* Hrbst/ *Athous monachus* mihi, h. in Amer.bor. D. LeConte (1, BMNH); Coll. Janson, Ex Dejean / *Dicrepidius picicornis* mihi, h. in Amer.bor., D. LeConte / *Asaphes memnonius* (1, BMNH); Red rectangle/ 297 / ex Deyrolle, Coll. Janson / *Asaphes memnonius* Herbst, Am. Bor. (1, BMNH); Red rectangle/ Ex Deyrolle, Coll. Janson (1, BMNH); Etats – Unis / ID label / M. Cameron Coll., B.M.1936—555 (1, BMNH); Amer. Bor. / *Hemicrepid. Thomasi* var ? / Coll. Janson (1, BMNH); Amer. Bor./ *Hemicrepid. Thomasi* Germar / Coll. Janson/ *Asaphes memnonius* (1, BMNH); ID

label, Et. Unis (1, BMNH); Coll. Janson, Ex Dejean / *Asaphes memnonius* Herbst,
Athous monachus Dejean, Am. Bor. (1, BMNH). **CANADA:** W. Canada (1, BMNH).
Alberta: Edmonton, VII-25-1924, D. Mackie (1, CASC); Medicine Hat, VIII-5-[19]34,
 J. Carr (1, CASC). **Nova Scotia:** [No data] (3, BMNH; 1, INHS830523); [No data]/ Coll.
 Janson (1, BMNH); Bridgetown, 6-VIII-1913, 16-VIII-1913, G. E. Sanders (2,
 INHS830534, INHS830362). **Ontario:** Dunnville, 29-VII-1966, W. Plath, Sr. (1, FSCA);
 J. Brimley, 1915—94 / Grimsby, Ont., 11-6-1913 (3, BMNH); L. Joseph, VII-1923, K. F.
 Auden (2, INHS830354, INHS830385); Jeannettle's Creek, June 1967 (1, FSCA);
 Muskoka Co., Gull Lake, VII-7-1921, VII-8-1921, H. S. Parish (7, OSAC0000537356,
 OSAC0000537358, OSAC0000537362–OSAC0000537366); Toronto (1, MCZC; 1,
 OSAC0000537369); Wheatley, 22-VII-1965, W. Rosenberg Collection (1, FSCA);
 Wheatley, VII-12-1965, IX-1967, Karl Stephan, leg (2, FSCA). **Saskatchewan:** [No
 data] (2, BMNH); Fertile, June-1949, G. E. Belisle (6, WSUC); Pennant, VIII-1-1935,
 Roy Graham (1, CASC). **Dubious Record: British Columbia:** ?Vancouver I., Coll.
 Janson (1, BMNH). **USA:** [pink disk] (1, MCZC); [yellow disk] (1, MCZC). **Alabama:**
 [No data] (2, MCZC). **Arizona:** Apache Co., St. Johns, VII-29-[19]59/ at light/ R. S.
 Beal collector (4, ASUC); White Mts, July-12-1933, Parker, Lot 108 (1, CASC);
 [Cochise Co.], Chiricahua Mts, 7-[19]36, E. S. Ross (1, CASC); [Coconino Co.],
 Flagstaff, Clayton May/ July-14-1960 (1, CASC); Oak Creek Canyon, 6000ft, Aug, F. H.
 Snow (1, SEMC); Oak Creek Cn., 8-9-[19]32, R. H. Beamer (1, SEMC); Oak Creek
 Canyon, 1829m, 25-VII-1936, Owen Bryant (1, CASC); Oak Creek Canyon, 29-VII-
 [19]67/ J. W. Tilden collector (1, CASC); Sedona, 29-VII-1972, Suzy Frommer (1,

CASC); [Gila Co.] Payson/ 9-3-[19]38 (1, CASC); Red Lake, Young, VII-16-1955, R. R. Johnson (1, ASUC); Navajo Co., Pine Forest, 4mi SW of Forestdale, 23-24-VIII-[19]52/ H. B. Leech, J. W. Green, collectors (2, CASC); [Pinal Co.], S. Catalina Mts, 7-[19]36, E. S. Ross (1, CASC); Yavapai Co., Antelope Pk, VII-10-1910/ Van Dyke Collection (1, CASC); Prescott, 8-26-[19]17/ H. C. Fall collection (1, MCZC, MCZ-ENT00641984); Prescott, VIII-21-1953, G. H. Nelson/ collected at light (1, FSCA). **Arkansas:** Drew Co., 6-14-1939/ M. W. Sanderson collector (1, INHS830424); Washington Co., 6-22-[19]38, 6-24-[19]38, 7-5-[19]38/ Mt. Sequeyah, collected at light, M. W. Sanderson (4, INHS830378, INHS830379, INHS830388, INHS830406); 7-18-[19]38/ Mt. Sequeyah, bait trap (1, INHS830427); 7-28-[19]40/ M. W. Sanderson collector (1, INHS830418); Fayetteville, VI-28-1942, VI-30-1942, VII-9-1942, M. W. Sanderson/ collected at light (3, INHS830216, INHS830238, INHS830541). **California:** [Los Angeles Co.], Whittier, lite trap, 6-25-[19]50/ M. W. Stone, col. (1, CASC). **Colorado:** [County?] Clear Creek (1, MCZC); [Arapahoe Co.?], Aurora, Fleck, coll. (1, CASC); Bent Co., La Junta, 4000ft, June-24-25-1885/ F.C. Bowditch, Coll. (1, MCZC); Boulder Co., Boulder, 22-VII-1951, 23-VII-1951, 24-VII-1951, 26-VII-1951/ collector Helen H. Shinn (7, SEMC); Boulder, 16-VII-[19]63, coll. E. Vogel (1, LSAM); Front Range, Fourmile Cr. 0.1mi N Hwy119, 5800', 11-Aug-[19]73, D. H. Kavanaugh col. (1, CASC); [Denver Co.] Denver (2, INHS830198, INHS830199); Denver, VI-30-1911, C. A. Frost (1, MCZC); Denver, VII-14-[19]38, VII-15-[19]38, VII-18-[19]38, VII-10-[19]39, VII-19-[19]39, VII-23-[19]39, J. W. Green (12, CASC); [El Paso Co.], Col[orado] Spr[ings] (2, INHS830200, INHS830429); Colo[rado] Springs, July-August-[19]38, alt. 6,300ft, Bob Potts coll. (1,

CASC); [Fremont Co.], Phantom Canyon, 21-VII-1964, Benj. H. Banta/ Fremont Co. Station No.74, el 5830ft (1, CASC); Phantom Canyon, 28-VIII-1964, Benj. H. Banta/ F. Co. Station No. 66, el. 6295ft (1, CASC); as previous except/F. Co. Station No. 32, el. 8650ft (1, CASC); Phantom Canyon, 4-VIII-1964, Benj. H. Banta/ F. Co. Station No. 59, el. 6780ft (1, CASC); Phantom Canyon, 18-X-1964, Benj. H. Banta/ F. Co. Station No. 74, el. 5830ft (1, CASC); Jackson Co., Cowdrey, 8000' elev., July-1986, leg. Wilbur G. Downs (4, PMNH); [Jefferson Co.], Lookout Mt., el. 7000'/ Golden, VII-10-[19]71, C. A. Frost (1, MCZC, MCZ-ENT00641994); Larimer Co., 7-30-[19]51 (1, WSUC); Berthout [*sic*], VII-6-1962, G. H. Nelson, at light (3, FSCA); Ft. Collins, 10-15-1951 (1, WSUC); Fort Collins, 21-June-1952, 22-June-1952, collected J. A. Quist (2, WSUC); Ft. Collins, VIII-6-[19]68 (1, FSCA); [Las Animas Co.], Trinidad, 7-20/ Liebeck collection (1, MCZC, MCZ-ENT00641995); [Prowers Co.], Koen, light trap, 7-1-[19]52, 7-17-[19]52, G. R. Pesho, coll (15, WSUC); [Pueblo Co.] Pueblo, VIII-17-[19]49, VIII-16-[19]52, G. H. Nelson (2, FSCA); [Weld Co.], Greeley, 7-8-[19]52/ collector K. Maehler (1, CASC); Greeley, 20-June-1952, collected J. A. Quist (2, WSUC); St. Vrain Nuclear Plant Site, Platteville, pitfall trap, 9-Aug-1973, Brewer (1, MTEC). **Connecticut:** [No data] / 558 / Andrewes Bequest, B.M.1922–221 (1, BMNH); Fairfield Co., Chimon Is., Norwalk, VII-19-1984, VII-20-1984, leg. Douglas J. Comboni (2, PMNH); Chimon Is., Norwalk, June 1984, July 1984, leg. Scott Magnotta (6, PMNH); Fairfield, VII-7-1962, 4-July-1983, Douglas J. Comboni (2, PMNH); Newtown, VII-17-1983, leg. Douglas J. Comboni (1, PMNH); Noroton (1, PMNH); [Hartford Co.] Avon, June-24-1929, J. N. Belkin (1, FSCA); New Haven Co., Mt. Carmel, 27-July-1966, leg. R. T. Cail/ by lite (1,

PMNH); Hamden, VII-29-[19]42, S. C. Ball (1, PMNH); New Haven, 3-Aug-1914, H. J. Goodman (1, PMNH); New Haven, July-1955, W. D. Hartmann (1, PMNH); North Haven, Ridgewood Ave, July-19-1982, leg. E. M. Mahoney (1, PMNH); Wallingford, 15-July-1912, D. J. Caffrey (1); No. Plains, 9-23-[19]34, S. C. Ball (1, PMNH); Windham Co., Willimantic, South Ridge Drive, at light, 21-July-1990, 13-July-2002, 22-July-2002, leg. Raymond J. Pupedis (5, PMNH; DNA-MTEC023698); Pomfret (1, MCZC). **Florida:** Leon Co., Tall Timbers Res. Sta., 20 m. N. Tallahassee, July-23-31-1972, R. L. Jacques, Jr (1, FSCA; ?2, FSCA). **Georgia:** [No data] (1, MCZC); Clarke County, Whitehall Forest, 5-8-VI-1979, 28-VI-2-VII-1979, R. H. Turnbow, Jr., Insect Flight Trap (2, FSCA); [Fannin Co.], Blue Ridge, 7-23-1954, C. N. Patton (1, FSCA); Blue Ridge, July-6-12-1955, R. & C. Patton (1, FSCA); Hart Co., Nuberg, BLT, VII-4-6-1975, F. N. Young (1, FSCA); Lamar Co., Barnesville vic, 23-VI-[19]83, R. Morris (2, FSCA); Murray Co., Fort Mtn. State Park, 14-VII-1982, P. M. Choate (1, FSCA); Union Co., light trap, July-7-1976, col. W. Morris (1, MTEC); Wheeler Co., along Ocumulgee riv., VI-1997, BLT, E. Donalson (1, FSCA). **Illinois:** [No data] (9, INHS830189, INHS830242, INHS830247, INHS830254, INHS830298-INHS830301, INHS830410); N. Ill/ [no date], Aug (9, INHS830211, INHS830215, INHS830349, INHS830361, INHS830384, INHS830391, INHS830397, INHS830433, INHS830438; 3, WSUC); [No data]/ 31273 (1, BMNH); [Champaign Co.] Cham[paign], 7-8-1914, Coll. T. H. F. (1, INHS830249); Urbana, [no date], VII-7-[19]11, VII-8-[19]11, VII-12-[19]11 (5, INHS830365, INHS830375, INHS830381, INHS830515, INHS830539); Coles Co., Burgner Acres, 9-16-July-1992, R. S. Hanley, malaise trap (1, WSUC); Charleston, Aug-

20-[19]10/ forest (1, INHS830521); [Cook Co.] Chicago/ Aug/ A. L. Melander collection (3, WSUC); Chicago, VII-2-[19]08 (1, MCZC); Chicago, VII-17-[19]23/ col. by Owen Bryant (1, CASC); Oak Park/ July/ O. S. Westcott collection (3, WSUC); Willow Springs, VIII-16-[19]23/ Coll.by Owen Bryant (2, CASC); Jackson Co., 7 mi W Carbondale, 137m, mixed hardwood forest, Malaise, July-3-11-1993, M. A. Goodrich coll. (2, WSUC); [McHenry Co.] Algonquin, [no date], July-13-[19]05, July-12-1907, July-19-[19]07, July-26-1907, July-30-[19]07, August-19-[19]07, July-16-[19]08, July-8-[19]09, July-13-[19]09, July-20-[19]09, July-24-[19]09, July-13-1910, July-25-[19]10, July-3-[19]12, [W. A.] Nason (28, INHS830206, INHS830212, INHS830213, INHS830218, INHS830221, INHS830226, INHS830228, INHS830233, INHS830234, INHS830237, INHS830239, INHS830246, INHS830248, INHS830258-INHS830260, INHS830262, INHS830302, INHS830351, INHS830352, INHS830358, INHS830359, INHS830426, INHS830434, INHS830443, INHS830500, INHS830520, INHS830527, INHS830528; 3, MCZC); [Morgan Co.] Jacksonville, July-7-1935, John Bigger, Light trap (1, INHS830402); [Peoria Co.] Peoria, May-26-1938, June-27-1938, July-23-1940, F. F. Hasbrouck (6, INHS830387, INHS830389, INHS830394, INHS830399, INHS830401, INHS830403); Peoria, Aug-1-1941, F. F. Hasbrouck/ at light, Main St (1, INHS830428); Pope Co., Dixon Springs St. Park, 27-June-1987, W. G. Ruesink (1, INHS830241); Putnam Co., July-12-1915, July-5-1931, June-26-1932, M. C. Glenn (4, INHS830505, INHS830513, INHS830517, INHS830529); [Sangamon Co.] Spgfld [Springfield], 7-9-[19]57/ M. G. Naumann collector (1, SEMC); [Washington Co.] Dubois, Jun-22-[19]05/ at light (1, INHS830526); [Whiteside Co.] Prophetstown, July-

19-1937, coll. T. H. F. & R. D. G. (2, INHS830355, INHS830441); [Localities?] [14] (1, INHS830208); [204], [213], [214]/ Hart Coll'n (3, INHS830264, INHS830377, INHS830386); [7305] (1, INHS830210); [7313] (1, INHS830220); [14003] (1, INHS830207); [14006] (1, INHS830265); [18503] (1, INHS830383); [18506] (1, INHS830369); [18517] (2, INHS830363, INHS830376); [38960] (1, INHS830533).

Indiana: Allen Co., New Haven, 7-15-1981, 7-17-1981, 7-18-1981, 7-20-1981, 7-23-1981, N. M. Downie (14, FSCA); [Brown Co.], Bear Wallow, July-3-1965, Charles E. White (1, FSCA); Blacklight trap at Bear Wallow, VII-21-[19]68, C. E. White (1, FSCA); Howard Co., NW Howard Co., 4-VII-1984, 12-18-VIII-1985, D. A. Rider/ collected at light (3, LSAM); Knox Co., VII-8-1940/ E. N. Kjellesvig-Waering coll. (1, FSCA); [Kosciusko Co.], Mineral Springs, VII-29-[19]23/ col. by Owen Bryant (1, CASC); Winona L., July-21-1936, M. H. Hatch (1, OSAC0000569417); Lawrence Co., Bedford, VII-20-1969, R. L. Jacques (1, FSCA); [Marion Co.], Indianapolis, July-15-31-1958, Aug-1-25-1958, August-1-1959, July-15-1960, David S. White (8, FSCA); Indianapolis, August-2-1963, June-30-1964, July-20-1964, Charles E. White (4, FSCA); Indianapolis, Camp Belzer, BSA, July-26-1966, Charles E. White (2, OSAC0000569407, OSAC0000569414); [Monroe Co.] Bloomington, 7-27-[19]40 (1, PMNH); [Porter Co.], Chesterton, VII-10-[19]34/ Thos. Craig collector (1, CASC); [St. Joseph Co.], Notre Dame, VI-1965 (2, PMNH); Tippecanoe Co., VII-21-1974, VII-3-1987, 7-12-1989, N. M. Downie (3, FSCA); VII-3-1977, R. M. Brattain (3, BYUC); Lafayette, 7-7-1982, 7-12-1982, 7-16-1982, 7-20-1982, 7-23-1982, 7-13-1983, 7-15-1983, 7-17-1983, 7-23-1983, 7-24-1983, 2[?]-Aug-1984, VII-4-1987, VII-7-1987, 7-11-1987, 7-17-1989, 7-25-

1989, 7-19-1990, 7-25-1990, 28-July-1990, 18-August-1990, 25-August-1990, U. V. light, N. M. Downie (24, FSCA; 3, WSUC); W. Lafayette, McCormick's Wds., 26-July-1990, N. M. Downie (1, WSUC); 4mi SW Shadeland, 23-Jul-2012, J. D. Holland, general (4, MTEC). **Iowa:** [No data] (1, CASC); Adair Co., Stuart, 5-VII-1992, Robert L. Langston (2, CASC); [Bremer Co.], Plainfield, VII-9-1955, VII-19-1955, R. A. Didriksen (4, LSAM); [Des Moines Co.], Burlingtn (1, MCZC); Dickenson Co., VI-30-1920, col. F. M. Blanchard (1, OSAC0000537361); [Johnson Co.], Iowa City, 9-3-[19]31/ collector K. Maehler (1, CASC); [Lee Co.], Keokuk (1, MCZC); [Louisa Co.], Columbus Jct., VII-20-1931, G. L. Weber (1, WSUC); Polk Co., VII-6-1951, T. J. Walker, Jr. (1, FMNH); W. Saylorville Lk., VI-14, 30-85, R. Schieferstein (2, FSCA); [Story Co.], Ames, [no date], July-7-1954 (2, BYUC; 2, LSAM); Ames, July-14-[19]31, H. A. Scullen, coll. (1, OSAC0000569409); Ames, Aug-1-1935, H. L. Stahnke (1, CASC); Ames, VII-5-1955, VII-6-1955, VII-9-1955, VII-10-1955, VII23-1955, R. A. Didriksen (14, LSAM); Ames, 7-VII-1955, Wm. L. Downes (1, FSCA); Ames, VII-20-1958, A. H. Bamum (1, BYUC); Ames, July-12-1961/ collector J. J. Dinsmore (1, FSCA); 2mi S Ames, ISU farm, SE ¼, Sec.21, T83N R24W, VIII-5-8-1968, VIII-19-22-1968, IX-15-18-1968, coll Pitfall trap (8, FSCA); [Woodbury Co.], Sioux City, Hawerden [?]/ G. E. Thomas Collr (1, CASC). **Kansas:** [No data] (4, MCZC); Atchison Co., 7-9-[19]24, E. P. Breakey (1, SEMC); 7-9-1924, R. H. Beamer (1, SEMC); Bourbon Co., Ft. Scott, 9mi SW, 37°46.978'N, 94°49.421'W, 26-VI-6-VII-2006, G. A. Salsbury, ex. Canopy trap, KAN1S06 073 (1, SEMC, SM0792344); Cherokee Co, 888ft, 1915, R. H. Beamer (1, SEMC); 2mi S. Galena, 37°38.18'W, 94°38.18'W, 28-VI-13-VII-2005, G. A. Salsbury ex canopy trap,

KAN1S05 141 (1, SEMC, SM0704948); Cheyenne Co., 7-2-1925, R. H. Beamer (3, SEMC); 3300ft, F. X. Williams (1, SEMC); Comanche Co., Coldwater Lake, 14-Jul-2009, UV light, C. Ely, 37.25678°N, 99.34640°W (1, SEMC1098950); Crawford Co., 3 mi NE Pittsburg, 37°26.64'N, 94°37.04'W, 13-27-VI-2005, G. A. Salsbury, ex canopy trap, KAN1S05 120 (1, SEMC, SM0757283); Decatur Co., 2560ft, F. X. Williams (3, SEMC); Dickenson Co., L [?] 7-16-[19]23, C. H. Martin (1, SEMC); Douglas Co., 900ft, F. H. Snow (1, CASC); E. S. Tucker/ July (1, SEMC); July-25-1919, July-6-1920, July-7-1920, July-9-1920, William E. Hoffman (4, SEMC); Lawrence, VII-14-1922, C. H. Curran (1, CASC); Lawrence, 6-17-1925, 6-26-1925, W. Benedict (2, SEMC); Lawrence, 29-VI-[19]66 (1, FSCA); Ellis Co., 2000ft, F. X. Williams, July-18-1912 (2, SEMC); Ellsworth, 7-12-[19]23, G. H. Martin (1, SEMC); Ellsworth, 7-12-[19]23, L. C. Woodruff (1, SEMC); Gove Co., Gove, Hackberry Creek, 27-VII-1976, leg, P. Huggins, P. Liechti, DGH3; US.KSHuggensLietchti1976.07.27.27 002 (3, SEMC1057583-SEMC1057585); Graham Co., 2130ft, F. X. Williams, Aug-16-1912 (1, SEMC); Hodgman Co., July-17-25-1917 (5, SEMC); Jewell Co., Lovewell Reservoir, Cedar Point, 10-VII-1978, leg M. Dubois, F. Gilbert, US.KS.DuboisGilbert1978.07.10 003 (2, SEMC1057563, SEMC1057564); Kiowa Co., Greensburg, 17-June-1992, 10-July-1992, 17-July-1993, Glenn Salsbury, blacklight (3, SEMC); 4.5S Greensburg, 3-July-1992, 18-July-1992, Glenn Salsbury, blacklight (3, SEMC); 5SE Greensburg, 16-July-1993, Glenn Salsbury, blacklight (3, SEMC); [McPherson Co.] McPherson, VI-10 (1, CASC); Pot[tawatomie] Co., June-16-1955/ McReynolds (1, FSCA); Rawlins Co., 2850ft, F. X. Williams (7, SEMC); [County?] Republican R., 8-4-[19]54, P. S. Bartholomew (1, CASC); [Riley

Co.] Manhattan, Vasco M. Tanner collector (1, BYUC); Rooks Co. (1, SEMC); 1 mi W Webster State Park, 39°22.84'N, 99°32.31'W, 29-VI-19-VII-2005, R. Buhler, ex canopy trap, KAN1S05 112 (2, SEMC, SM0755353, SM0755354); Saline Co., July-23-1923, C. H. Martin (1, SEMC); Scott Co., 6-20-[19]25, H. J. Grady (1, SEMC); [Sedgwick Co.] Mt. Hope, W. C. Warren, 7-8-[19]09 (1, SEMC). **Kentucky:** [McCracken Co.], Paducah, 2 mi W., Bk Lite, 5-24-June-1968, Don R. Harris (1, BYUC); [Montgomery Co.], Crall [?] Hope, VI-18-1946, Car, Cook (1, WSUC). **Louisiana:** Caddo Parish, 10-VI-1978/ C. B. Barr collector (1, LSAM); [Livingston Parish], Denham Springs, VI-26-1968, P. W. Humphreys/ light trap (1, LSAM); Morehouse Par., Chemin-A-Haut St. Pk, 11-VII-1983, coll. A. Bressler (1, LSAM). **Maine:** [Cumberland Co.], N. Bridgeton [*sic*], Van, VII-13-1963 (1, PMNH); [Hancock Co.], Mt. Desert, August-8-1929, J. N. Belkin (1, FSCA); Mt. Desert Is., Tremont, Hodgdon Pd., Black light, 25-August-1992, leg. Martin Hamerman (1, PMNH); [County?], Ogangrist(?), W. P. K. (1, MCZC); [Washington Co.], Jonesboro, Aug-5-1948/ collector D. M. Tuttle (2, INHS830230, INHS830244); York Co., West Newfield, UV trap, 28-July-1983, 30-July-1983, 4-5-August-1983, leg. David S. MacDonald (10, PMNH). **Maryland:** [No data] / Coll. Janson (4, BMNH); [County?], Potomac River, Cabin John, 11.vii.1959/ W.R.B. Hynd Coll., BMNH(E), 1998–129 (1, BMNH); Allegany Co., Green Ridge S. P., 10-August-1988, R. J. Rabaglia (2, FSCA); Anne Arundel Co., Annapolis, 4-VII-1987, 9-VII-1987, 8-June-1991, 14-June-1991, 16-June-1991, 18-19-June-1991, 30-June-1991, 2-July-1991, 5-July-1991, 10-July-1991 11-July-1991, 20-July-1991, 26-July-1991, H. G. Stevenson (28, FSCA); Crofton, 25-VII-1988, R. J. Rabaglia (2, FSCA); Crownsville, 1-VII-1990, C. L. Staines

(1, FSCA); Edgewater, 7-3-[19]80, 27-VI-1982, 30-VI-2-VII-1983, 20-23-VII-1983, 27-VI-2-VII-1984, 15-18-VI-1990, 19-22-VI-1990, 22-25-VI-1990, 25-29-VI-1990, 29-VI-2-VII-1990, 16-20-VII-1990, 23-30-VII-1990, 28-31-May-1991, 3-11-June-1991, 10-17-June-1991, 17-21-June-1991, 21-24-June-1991, 24-28-June-1991, 28-June-1-July-1991, 12-15-July-1991, 15-19-July-1991, 30-IX-4-X-1991, 01-02-July-1992, 02-03-July-1992, 06-07-July-1992, 07-08-July-1992, 08-10-July-1992, 24-27-July-1992, 27-29-July-1992, 29-31-July-1992, C. L. Staines, Jr., blacklight (75, FSCA); Jug Bay, 20-VI-5-VII-1991, 25-VI-3-VII-1991, 7-12-July-1991, H. G. Stevenson (4, FSCA); [Baltimore Co.] Johnnycake Rd., 9-July-1985, E. J. Gerberg (1, FSCA); Baltimore, VI-18-[19]09, VII-3-[19]09, VII-4-[19]09, VII-12-[19]09/ F. E. Blaisdell collector (6, CASC); Sparrows Pt., VII-9-[19]32, J. W. Green (1, CASC); Calvert Co., Flag Ponds, 18-June-1991, 13-July-1991, H. G. Stevenson (2, FSCA); Kent Co., Kennedyville, 5-July-1983, C. L. Staines, Jr. (1, FSCA); Motgomery Co., Bethesda, 9-VII-1984, 11-VII-1984, Howard V. Weems, Jr., UV light (8, FSCA); 2 mi. S Burtonsville, 20-vi-10-vii-1980/ Scott E. Miller Collector (3, MCZC); Silversprings [*sic*], VI-26-1962, H. P. Lanchester (1, WSUC); Takoma Park, VI-24-[19]50, VII-23-[19]50, VI-26-[19]51, VII-3-[19]52, G. H. Nelson/ to light (4, FSCA); Plummerville Id, 16-VII-1920, 10-Aug-1920/ H. S. Barber (2, WSUC); [Prince Georges Co.], Beltsville, VI-30-1964, H. P. Lanchester (1, WSUC); College Park, 7-1-[19]32 (1, WSUC); College Park, VII-29-[19]50, G. H. Nelson/ to lightg (1, FSCA); College Park, VII-2-1961, B. K. Dozler/ light (1, FSCA); College Park, 16-June-1981, M. J. Rothschild (1, FSCA); Lake Arbor, Bowie, 25-VII-2003, T. P. Blumer (1, BYUC; DNA—MTEC023694). **Massachusetts:** [No data] (7, MCZC; 1, WSUC); [No data]/ F. E.

Blaisdell collector (2, CASC); [Barnstable Co.] Woods Hole, [no date], 7-16-2/ A. L.
 Melander collection (4, WSUC); [Bristol Co.], Fall River, VII-23-[19]12, VII-13-[19]14,
 7-19-[19]14, N. S. Easton (3, MCZC); Fall River, V-1-[19]29 (1, MCZC); [Dukes Co.],
 Elizabeth Is., Nashawena Is., VII-7-[19]71, C. T. Parsons / under stone (1, MCZC);
 Elizabeth Is., Penekise Is., VIII-11-[19]72, C. T. Parsons (2, MCZC); Martha's Vinyard,
 VII-25-[19]28, C. T. Parsons / Edgartown (1, MCZC); [Essex Co.] Beach Bluff, 18-VII-
 [19]15, H. M. Parshley/ Ocean Beach (1, CASC); Franklin Co., Heath, 15-July-1984, 15-
 July-1985, leg. Sophie Dobzhansky Coe & Michael D. Coe (2, PMNH); [Hampden Co.]
 Chicopee (1, MCZC); Springfield, G. Dimmock (2, MCZC); Middlesex Co., Lincoln, 10-
 24-vii-1982, window trap, E. T. Armstrong (1, MCZC); Arlington, VII-16-1924/
 Darlington (1, MCZC); Brown disc [Cambridge, 1871, Hubbard and Schwarz] (1,
 MCZC); Cambridge (1, MCZC); Cambridge, verrill (1, MCZC); Malden, VII-24-[19]03,
 C. A. Frost (1, MCZC); Framingham, VII-4-[19]04, C. A. Frost / At light (1, MCZC);
 Framham, VII-14-[19]30, C. A. Frost/ in house at night (1, MCZC); Fram., IX-26-
 1916, Coll. C. A. F. (1, INHS830235); Framingham, 5-VII-1934 / C. E. Tottenham Coll.,
 B.M.1963–414 (1, BMNH); Framingham, VII-8-1953, C. A. Frost (1, FSCA); Lowell, 9-
 3-[18]93 (1, MCZC); Natick, South Natick Border, 22-VI-2005, Col. S. LaFlour (1,
 BYUC; DNA–MTEC023699); Sudbury, VIII-8-[19]24 (1, MCZC); Tyngsboro, [no date],
 1906, well [19]07-VII-5 (3, MCZC); Tyngsboro, [no date], 8-21-[19]14, IX ? [19]14, 7-
 4-[19]15, 9-V-[19]21, 9-15-[19]22 (6, MCZC); Tyngsboro, [19]'11-VII 13, cobweb (1,
 MCZC); Tings(?), Au[gust?]-[19](08?) (1, MCZC); Tyngs (4, MCZC); [Nantucket Co.]
 Nantucket Is. (7, INHS830250, INHS830251, INHS830350, INHS830372, INHS830395,

INHS830409, INHS830437); Nantucket B., 2-24-[19]24 (1, MCZC); Nantucket B., 7-21-[19]24 (4, MCZC); [Norfolk Co.], Brookline (1, MCZC); Dedham, Sep-16-1917 (1, MCZC); [Plymouth Co.], Marion, Au[gust]-9-12-[19]02 (1, MCZC); [Suffolk Co.], Dorchester, Aug-10-1903 (1, BMNH); [Worcester Co.] Peterham [*sic*], VIII-27-1920, G. C. Wheeler (1, OSAC0000551177); [Freddrick Allen Eddy Collection]: 8-4-[18]83, [any/ cirry/ arrj] Sugar (1, MCZC); W. Brook[rirlli?], [Hatched?] Aug-[18]97 (1, MCZC); Lowell, 6/24-[18]91, M. L. B. (1); Hoofuri L. H., July 14-16 [18]99 (1). **Michigan:** [No data] (1, MCZC); Cass Co., Wakelee, VII-10-1966, leg. N. G. Seaborg (1, CASC); Cheboygan Co., Douglas Lake, VIII-1917, 295a, 297a, M. H. Hatch (2, OSAC0000537368, OSAC0000537372); U of M Biol. Sta. 26-July-1924[?], R. L. Stone (1, LSAM); Douglas Lake, 19-July-1957, Robert E. Beer (1, SEMC); Douglas L., VII/ C. H. Kennedy collector (1, FMNH); Genesee Co., VII-6-[19]39, D. E. Bullock (1, OSAC0000569404); [Kalamazoo Co.], Galesburg, F. S. Sleeper (2, MCZC); Livingston Co., George Reserve/ July-30-1932, S. Moore/ taken at light (1, FMNH); E. S. George Reserve, VII-16-1933, A. W. Andrews (1, FMNH); Lenawee Co., Adrian, VII-19-[19]71, D. Brzoska (1, SEMC); Macomb Co., E. of Memphis, 9-VII-1969, Brivio (1, PMNH); [Oakland Co.], Birmingham, July-14-1936, M. H. Hatch (1, OSAC0000569421); Rochester, July-10-1936, M. H. Hatch (5, OSAC0000569415, OSAC0000569416, OSAC0000569418-OSAC0000569420); Roscommon Co., 21-July-1978, coll. J. L. Foltz (1, FSCA); Washtenaw Co., VII-1-1922, AA40, M. H. Hatch (1, OSAC0000551175); Ann Arbor, VII-13-[19]53, G. H. Nelson/ collected at light (5, FSCA); Whitmore Lake, VII-19-[19]56, G. H. Nelson/ to light (1, FSCA); Wayne Co., Detroit, 1249c, VII-4-1921,

M. H. Hatch (1, OSAC0000537367); Detroit (1, CASC). **Minnesota:** Clay Co., 3 miles SE of Fallon/ 12-August-1965, leg. J. S. Nordin (1, FSCA); [Hennepin Co.], Minneapolis, 21-July-1953, leg. J. S. Nordin (1, FSCA); No. Mpls/ 10-July-1954, leg. J. S. Nordin (1, FSCA); Mower Co., VII-[19]80, Salsone (3, PMNH); Nobels Co., Worthington VII-27-1975 at 15w UV blacklight, A. Newton, M. Thayer/ under bark, conifer (1, MCZC); [Polk Co.], Erskine, 8-11-[19]37, C. L. Johnston (1, SEMC); [Waseca Co.], Waseca, 6-July-1959, 9-July-1959, 13-July-1939, A. E. Grable, light trap (5, WSUC). **Mississippi:** Alcorn Co., Corinth, 3-July-1985, R. S. Miller colr (1, MTEC); Oktibbeha Co., Starkville, 3-9-VII-1971, Gerd H. Heinrich, malaise trap (1, FSCA); Panola Co., 12-July-1987, K. E. M. Galley, at black light (1, FSCA). **Missouri:** Barton Co., Prairie S. P. 25-July-2003, Col. M. Ferro, Fleck Creek – Black Light (1, LSAM); Carter Co., Pinewoods Lake R. A., D. Brzoska, 8-VII-1991 (1, SEMC); Clay Co., Coolie Lake, July-18-1968, taken at UV light, leg. Roger L. Heitzman (1, FSCA); Jackson Co., July-1955, Ronald H. Pine (1, SEMC); Independence/ 23-June-1965, at black light, leg. J. R. Heitzman (1, FSCA); Independence/ July-15-1967, UV, leg. Roger L. Heitzman (1, FSCA); Independence, July-1-1987, leg. Robert Heitzman (1, FSCA); Lees Summit, 18-VII-1947, B. E. White, coll. (2, CASC); Raytown, 15-VII-1970, 18-VII-1970, 16-VIII-1971, 22-VIII-1971, 27-VIII-1971, 30-VI-1973, 1-VII-1973, 28-VI-1974, 7-VII-1974, 27-VII-1977, G. H. Nelson/ at UV light (13, FSCA); [County?] Kansas City, 7-28-1920/ taken by Warwick Benedict (1, SEMC); Macom [*sic*] Co., September-7-1975, coll. S. Quisenberry (1, LSAM); [Pulaski Co.], Ft. Leonard Wood, 4-29-7-9-[19]52/ D. Giuliani collector (1, CASC); [Saint Charles Co.], St. Charles, VIII-24 (1, MCZC); St. Louis Co.,

1 mile North of Eureka on August-17-1979, S. Jay Hanselmann, coll (2, BYUC); Wayne Co., 3.2 mi WSW of Patterson Co., Rd 332, deciduous Ozark forest and old field flora/ Hiltrud M. Webber, 2-VI-1986, at U. V. light (1, FSCA). **Montana:** [No data] (2, INHS830255, INHS830392); [No data], Morrison (1, BMNH); Big Horn Co. Deadend Rd near I90 exit 510, small ash grove, elev 910m, 45.5792°N, 107.4560°W, 18-June[19-Jul]-17-Sep-2010/ Kraus, Taravati, Etzler, baited LF (5, MTEC; DNA–MTEC018138); Hwy212, S. Crow Agency, 45.5792°N, 107.4560°W, 18-June-19-July-2010, 3050ft, P. Kraus, baited LF (3, MTEC; DNA–MTEC018142); Hardin, 45.7567°N, 107.5660°W, 20-July-30-Aug-2010, 2870ft, USDA, L. funnel w/ AP and EtOH (3, MTEC); Blaine Co., Chinook, 8-7-[19]75 (1, MTEC); [Carbon Co.], Fromberg, June-26-1942, H. B. Mills (1, MTEC); Red Lodge, Lions Camp, 24-VI-1957, R. Banfill, leg (1, MTEC); Carter Co., 5 mi W of Alzada @ uv light, 18-July-1990, D. L. Gustafson col (7, MTEC); Long Pines, Tri Point Sta blt, 30-Jun-10-Jul-1994, K. Wittenhagen colr (5, MTEC); Lantis Spring CG, 45.6304°N, 104.1775°W, 15-Jul-2015, 3825ft, A. C. Dolan, P. Amaral (1, MTEC); Chouteau Co., Judith Landing @ blt, 11-13-July-1994, D. J. Megargle colr (5, MTEC); [Custer Co.], Miles City, 17-July-1929, 18-July-1929, 19-July-1929 (3, MTEC); Dawson Co., Intake diversion, 27-June-1988, UV light, D. L. Gustafson col. (9, MTEC); Stream by Rd 242 off I94 exit 206, elev. 673m, 47.0420°N, 104.8292°W, 27-June-19-Sept-2010/ Kraus, Taravati, Etzler, baited LF (15, MTEC; DNA–MTEC018141); Fergus Co., Lewistown, July-15-1957, S. Vanhorn (2, MTEC); Lewistown, 17-July-1974, G. Roemhild colr. (1, MTEC); 9 mi NW Lewistown, Spring Ck pitfall, elev. 3800ft, 2-Jul-14-Aug-1988, C. E. Seibert colr (3, MTEC); Missouri R.-

FRB, 09-Aug-1991, 18-20-Aug-1993, D. L. Gustafson (5, MTEC); Fred Rob. Br. Blt, 30-June-1994, C. L. Gustafson colr (1, MTEC); Sand Cr., hillside pitfall traps, 20-May-31-July-1995, C. L. Gustafson colr (1, MTEC); Saline Pond S of FRB, pitfall trap, 30-Jul-29-Oct-1995, D. L. Gustafson colr (1, MTEC); Gallatin Co., Bozeman, at UV light, 24-July-1989, D. L. Gustafson colr (1, MTEC); [Phillips Co.] Malta, 15-July-1928, C. M. Gjullin (1, MTEC); Malta, 7-18-[19]29 (1, MTEC); Prairie Co., Powder R. mouth, 46.7411°N, 105.4337°W, 676m, 23-July-1998, D. L. Gustafson (1, MTEC); Ravalli Co., near Florence, 7-June-1980, Douglas Yanega (1, SEMC); Richland Co., near Fairview at FIT, 47.8223°N, 104.0705°W, 31-July-19-Aug-1992, R. G. Bramblett colr (1, MTEC); Missouri River at Culbertson, 7-Aug-1993, D. L. Gustafson col. (4, MTEC); Yellowstone R., Elk Island, 06-Aug-2002, D. L. Gustafson, W1726 (2, MTEC); Deb's Farm, Co. Rd. 480, 47.74°N, 105.07°W, 16-Jun-28-July-2011, 28-July-18-Aug-2011, 2432ft, Hart, Etzler, Ivie, baited LF (7, MTEC); Roosevelt Co., Missouri R at Wolf Point Pk, pit trap, 12-Jun-8-Aug-1991, D. L. Gustafson colr (2, MTEC); Bainville, 48.1429°N, 104.2224°W, 26-May-19-July-2010, 1964ft, USDA, LF, AP and EtOH (1, MTEC); Hwy 16, mi 86, 48.1922°N, 104.4984°W, 27-July-19-Aug-2011, 2281ft, Hart and Staven, baited LF (1, MTEC); Rosebud Co., Tongue R., Ashland, 29-Aug-1989, 16-July-1990, UV light, D. L. Gustafson col. (6, MTEC); Tongue R., Ashland, pitfall trap, 6-Jun-4-Aug-1991, D. L. Gustafson (1, MTEC); Rosebud Area, 18-Jul-1990, blt, D. L. Gustafson, col (5, MTEC); MDFWP Far West site, pitfall traps, 10-Aug-11-Oct-1991, D. L. Gustafson col (3, MTEC); E Lame Deer, Hwy212, mi 47, far side of Dam, elev. 1159m, 45.6345°N, 106.5760°W, 18-Jun-17-Sept-2010/ Kraus, Taravati, Etzler, baited LF (2,

MTEC); Stillwater Co., Columbus, 17-VI-1957, R. Banfill, leg (1, MTEC); Treasure Co.,
 Yellowstone R., Myers Br., 04-Aug-2002, 804m, D. L. Gustafson W1716 (4, MTEC);
 Yellowstone R., Myer's Br. 46.2579°N, 107.3406°W, 06-Aug-2004, 804m, D. L.
 Gustafson, A0100 (3, MTEC); I94 exit 94, in pine, elev. 915m, 46.1482°N, 107.4200°W,
 21-July-20-Sept-2010/ Kraus, Taravati, Etzler, baited LF (2, MTEC); I94 Rest stop,
 46.2176°N, 107.2327°W, 23-May-14-Aug-2015, 2926ft, F. Etzler, LF PSB (2, MTEC);
 Valley Co., Bjornberg Br. FAS, pitfall traps, 20-May-01-July-1995, D. L. Gustafson (3,
 MTEC); Town of Fort Peck, 48.0104°N, 106.4514°W, 27-July-19-Aug-2011, 2146ft,
 Hart and Etzler, baited LF (1, MTEC); Wibaux Co., Wibaux, Yates Rd., 46.9608°N,
 104.2369°W, 19-July-2012, 2805ft, C. J. Hart, blacklight (3, MTEC); Yellowstone Co.,
 J[un]e-30-1926/ collector H. C. Donohoe (3, MTEC); Billings, July-10-1912, VI-28-
 [19]31 (2,MTEC); Billings, 45.7633°N, 108.4805°W, 26-June-22-July-2010, 22-July-19-
 Sept-2010, 3118ft, USDA, LF EtOH (4, MTEC; DNA-MTEC018139); Bighorn R.,
 Manuel Lisa, 46.1457°N, 107.4648°W, 28-Jun-1997, 823m, D. L. Gustafson, G0071 (2,
 MTEC); Huntley, August-23-1915 (1, MTEC); Huntley, light trap, 25-June-1979, 6-July-
 1979, Aug-10-1979, coll. Wendell Morrill (2, MTEC; 1, SEMC[?]). **Nebraska:** [No data]
 (1, MCZC); Dawson Co., Gothenburg, 6-VII-2001, C. W. Wendlandt (4, BYUC); Keith
 Co., Lake McConaughy, Rt. 61 off Rt. 80, 7-29-[19]74 PSB (1, CASC); [Lancaster
 Co.], Malcolm, VII-15-09 (2, CASC); Malcolm, VII-17-[19]09, R. Oertel (2, MCZC);
 Malcolm, VII-14-[19]09, VII-15-1909, VII-30-1909, C. R. Oertel (4, CASC); Lincoln
 Co., Sutherland, 9-VII-2000, S. M. Clark, at light (1, BYUC); [County?], Orion [?], 7-19-
 [19]29 (1, MCZC); [Otoe Co.], Dunbar, 7-15-[19]37, W. W. Wirth (1, LSAM); Phelps

Co., Holdrege, 13-VII-1951, P. C. Hutchison, at light (1, CASC); Sioux Co., 6-22-[19]26, L. A. Stephenson (1, SEMC). **Nevada:** Dodge Co. [?]/ E. A. Dodge collector (1, CASC). **New Hampshire:** [Carroll Co.], Tamworth, VIII-2-1923, P. J. Darlington (1, MCZC); [Grafton Co.], Campton, Putnam Coll. (1, MCZC); East Hebron, August-1950, donated by E. L. Klee (1, CASC); [Hillsborough Co.], Manchester, [no date], 7-4 (3, INHS830511, INHS830537, INHS830538); [Merrimack Co.], Franklin, vii-1951, E. C. Zimmerman, B.M.1951–394 (1, BMNH); [Rockingham Co.], Sagamore Hill, July-[19]33 (1, MCZC); [Strafford Co.], Farmgtn, 7-25-[19]13 (1, MCZC). **New Jersey:** [No data] (1, INHS830236; 3, MCZC); [County?] W. Gap. (1, MCZC); [Atlantic Co.] Atlantic City (1, INHS830243); Mullica, B/L, 7-8-1971, coll. G. Ekis (1, CASC); Oceanville, July-9-1968, coll. Lloyd R. Davis, Jr. (1, FSCA); Bergen Co., Woodcliff, 8-8-[19]70, 8-9-[19]70, D. A. Wright (2, PMNH); Rutherford, VII-23-1973, VII-25-1973, VII-28-1973, R. L. Jacques, Jr. (11, FSCA); [Burlington Co.] Masonville, June-1970, G. Ekis coll. (1, CASC); Cape May Co., Eldora, 3-9-vii-1983, red maple-sweet gum swamp, D. F. Schweltzer/ window trap (1, MCZC); [Camden Co.], Camden, G. Ekis, col, 7-16-[19]69 (1, CASC); [Cumberland Co.] Vinland (1, OSAC0000541750); Monmouth Co., VII-8-1970, VII-12-1970, R. L. Jacques (9, FSCA); Spring Lake, VI-28-1975, R. L. Jacques, Jr. (4, FSCA); Ocean Co., Lakehurst, 19-July-1947, leg. S. A. Hessel (1, PMNH); Somerset Co., Watchung, VII-13-1966, H. Ewing, at light (1, CASC); Martinsville, June-1970, G. Ekis Coll. (1, CASC); [Warren Co.], Phillipsburg, VII-27-1925/ L. S. Slevin collection (1, CASC). **New Mexico:** [Bernallilo Co.], Albuquerque, Snow, August-1894 (1, SEMC); Catron Co., #4, San Francisco R, 5 mi N Glenwood, at light, 2-August-1965,

George W. Byers (1, SEMC); [Lincoln Co.], Carrizozo, 7-26-1923, K. C. Doering (1, SEMC); McKinley Co., Ramah Recr. Area, 2-August-1970/ V. P. Gapund collector (1, SEMC); [Otero Co.], Cloudcroft, 7-14-[19]36, R. H. Beamer (1, SEMC); Cloudcroft, 30-July-1971 (1, CASC); [San Miguel Co.], Las Vegas (1, INHS830197); Las Vegas, Dr. A. Fenyés (2, CASC); Las Vegas, July-1-[18]99, CKUS (1, MCZC). **New York:** [No data] (1, INHS830404; 1, MCZC; 1, WSUC); [No data]/ United States 1907–156 / ex Coll. Wickahm (2, BMNH); Red rectangle/ New York/ Ex. Deyrolle, Coll. Janson/ *Asaphes memnonius* Herbst, Am. B. / *Dicrepidius picicornis*, Amer. Bor., Guis(?) (1, BMNH); Albany Co., Rensselaerville Huyck Preserve/ July-18-31-1974, August-1-1975, Ross H. Arnett, Jr. Collector (2, FSCA); [Dutchess Co.], Poughkeepsie, August-15-1936, J. G. Franclemont (1, FSCA); [Erie Co.], Buffalo (3, INHS830225, INHS830252, INHS830514); Buffalo / W. G. Dietz Coll. (1, MCZC); Essex Co., Wilmington, 7-10-VII-1991, J. Huether (1, FSCA); Ticonderoga, July-27-1929/ J. C. Listman (1, PMNH); Nassau Co., Plainview, 10-July-1978, Mike Huybensz (1); Roslyn, L. I., July-7-1930, July-8-1930, July-9-1930, J. N. Belkin (6, FSCA); Roslyn, L. I., July-7-1937, K. V. Krombein (1, FSCA); Sea Cliff, L. I., June, July (2, MCZC); [County?] Long Is. (1, MCZC); Long Island (3, PMNH); N. Y. City & vcty., (1, INHS830245); N.Y.C., 2-Aug-1956, I. Friedman (1, SEMC); [Queens County] Flushing, L.I., Queens, VII-2-1930/ collection of N. L. Rumpp (2, CASC); [Rockland Co.?], Palisades Interstate Park, Lake Kanarule, 3-4-August-1956, Saul Frommer (1, SEMC); [Sullivan Co.], Tusten, August-[19]34 (1, FSCA); Tusten, Aug-1934, E. J. Gerberg (1, FSCA); [Tompkins Co.] Ithaca, 6-Aug-[18]86, B. C. Cole Collector (1, CASC); Ithaca, 12-July-[18]97/ F. L. Washburn

collector (1, CASC); Ithaca, 1-Aug-[19]17, 21-July-[19]38 (1, INHS830512; 1, FSCA);
 Ithaca (1, MCZC); Ithaca, 22-July-1937, 27-July-1937, 29-July-1937, 14-Aug-1937, 24-
 Aug-1937, 24-July-1938, 29-July-1939, 10-August-1939, 27-July-1940, 11-Aug-1940, J.
 G. Franclemont (17, FSCA); Ithaca, VII-24-1940, J. N. Belkin (5, FSCA); Ithaca, 20-
 July-1980, J. Pakaluk (1, SEMC); Ithaca-Cayuga Heights, 22-June-1991, M. F. Whiting
 (1, BYUC); [Ulster Co.], Boiceville, July-8-1936, July-10-1936, July-11-1936, July-12-
 1936, J. G. Franclemont (4, FSCA); Ellenville, 16-18-July-1937, E. J. Gerberg (1,
 FSCA); [Westchester Co.], Bedford, 15-VII-[19]34/ K. L. Maehier collection (1, CASC);
 Mt. Kisco, VI-17-[19]26 (1, BYUC); Scarsdale, July-7-1957, G. R. Furguson (2, FSCA);
 Somers, Wm. C. Wood, VII-24-[19]25 (1, PMNH). **North Carolina:** [No data] (1,
 CASC; 4, MCZC); [Green disc] / Coll. Janson, Ex. Laferte (1, BMNH); Avery Co.,
 Altamont, Blue Ridge Parkway, 30-VI-1998, M. D. Terry (1, BYUC); Banner Elk, VII-6-
 [19]49, M. M. L. Pearson (1, FSCA); Banner Elk, VII-16-18-[19]49, J. F. W. Pearson (1,
 FSCA); [Buncombe Co.], Asheville, VII-13, Garnett (3, CASC); Black Mtns, J. C.
 Huguenin (1, CASC); Black Mts, VII-10-1912, VII-20-1912, VII-22-1912, VII-30-1912
 (5, CASC); Craven Co., North Harlowe, June-7-1990, 30-VI-1990, 18-VII-1990, 29-VII-
 1990, J. B. Sullivan (4, FSCA); Pinecliff, June-17-1983, J. B. Sullivan (1, FSCA);
 [Haywood Co.], Lake Junaluska, 29-VI-[19]59, 1-VII-[19]59, 6-VII-[19]61, 12-VII-
 1983, 13-VII-1983, 16-17-VII-1983, H. V. Weems, Jr., ultraviolet light (12, FSCA); Lake
 Junaluska, 3-VII-[19]59, Debra Weems (2, FSCA); GRSM, Cataloochee, MT10,
 311401E, 3939854N, 2-20-Aug-2001, C. R. Parker & I. C. Stocks (4, LSAM010457,
 LSAM0104164, LSAM0104165, LSAM0129685); as previous except, 30-July-20-Aug-

2002, J. & D. Lowe (7, LSAM0104135-LSAM0104138, LSAM0104140, LSAM0104141, LSAM014152); GSMNP, Purchase Knob, ATBI Plot, Malaise, MT0720010820, 2-20-Aug-2001, C. Parker & I. Stocks (1, LSAM0129684); GSMNP, ATBI Plot, Purchase Knob, 313346E, 3940433N/ Malaise Trap MT07, 17-30-Jul-2002, 30-Jul-20-Aug-2002, J. & D. Lowe (14, LSAM, LSAM0104129, LSAM0104130); GSMNP, 1 mi SW Double Gap, 35.716°N, 83.092°W, elev 970m, 6-VII-2004, S. M. Clark (1, BYUC; DNA–MTEC023696); Iredell Co., Statesville, 22-VII-1988, M. C. Thomas, at light (1, FSCA); [Macon Co.], Franklin, 8-15-[19]39, D. E. Hardy (1, SEMC); Franklin, 8-17-[19]39, R. H. Beamer (1, SEMC); 10mi SW Franklin, 16-20-VII-2000/ B. K. Dozier collector (4, FSCA); Swain Co., GSMNP, Oconaluftee maintenance/ housing area, 17 S 0290850 3932090, 6-Jul-2005, J. Bedoya (1, LSAM0129600); Highlands, June-[18?]88 (2, MCZC); Wake Co., Raleigh St. Road 1371/ SW of Raleigh, 15-VII-1987, S. P. Whitney/ at ultraviolet light (1, FSCA). **North Dakota:** 7-18-[19]50 (2, WSUC); [Emmons Co.], Linton, 7-23-[19]37, C. L. Johnston (1, SEMC); Stark Co., Heart River, Hwy 22, Dickinson, 46°47'N, 102°46'W, 14-July-1997, R. W. Baumann (3, BYUC). **Ohio:** [No Data] (1, CASC; 1, WSUC); Champaign Co., Urbana, R. E. Woodruff/ 6-2-[19]50, J.W. (1, FSCA); Urbana, R. E. Woodruff/ Johnson's, VI-11-[19]50 (1, FSCA); Urbana, R. E. Woodruff/ Peck's Mkt, 6-23-[19]53/ at light (1, FSCA); Clark Co., Springfield Fen, 27-June-1989, R. S. Miller colr/ 10 m. NE Fen (1, MTEC); Cuyahoga Co., Shaker Heights, Spetember-1960, July-1962, leg. D. G. Furth (2, PMNH); Delaware Co., Jct. Deer Creek & Scioto River, 21-July-1984, S. M. Clark (1, BYUC); Franklin Co., Columbus, 06-Jul-1981, 27-Jul-1982, M. A. Ivie colr (2, MTEC); Hocking

Co., Sheick Hollow, 8-23-July-1989, R. S. Miller family/ Malaise trap in riparian woods (2, MTEC); Jackson Co., Lake Katherine, 2-15-July-1989, R. S. Miller family/ Malaise trap in riparian woods (2, MTEC); Knox Co., VII-15-1941 (1, FSCA); Gambier, VII-22-1940 (1, FSCA); Licking Co., Newark R. R. S. , VIII-1963, Brivio (1, PMNH); Portage Co., Aurora, at light, 9-July-1976, leg. D. G. Furth (1, PMNH); Prebble Co., 5 mi. SW Camden, 25-June-1986, N. K. Miller colr (1, MTEC); Ross Co., Tar Hollow S. F., 2-23-July-1988, R. S. Miller fam./ Malaise trap in hillside woods (4, MTEC). **Oklahoma:** Latimer Co., July 1982, VI-1984, VI-1986, VII-1986, VI-1987, VII-1987, IV-1988, VI-1988, VII-1988, VI-1989, VII-1989, VI-1991 K[arl] Stephan (38, FSCA; DNA—MTEC023697); 2-July-1987, K. E. M. Galley, at black light (1, FSCA); 5mi W. Red Oak, 11-VI-[19]77, 2-VII-[19]77, 16-VII-[19]77, VII-[19]80, Karl H. Stephan (6, FSCA); Leflore Co., Cavanal Mtn, 35°04.22'N, 94°40.76W, UV light, 23-Jul-2005, M. Gimmel (1, LSAM); Cavanal Mt, N35.07°, W94.68°, 23-Jul-2005, N. L. Rasmussen, attracted to blacklight (1, SEMC); [Oklahoma Co.], Luther, Beck & Call coll., June 1931 (1, BYUC); Pott[awatomie] Co., June-20-1931, at elec. light, not frosted, night cool, dark, E. B. Webster (1, OSAC0000541857). **Pennsylvania:** [No Data] (4, INHS830214, INHS830229, INHS830257, INHS830305; 8, MCZC); July/ A. Fenyes collection (1, CASC); Am. Bor U.S. / *Asaphes memnonius* Hbst, Cand. Cdze, ex coll. D. Lacordaire, D. Candeze / *Asaphes memnonius* Pennsylvania / Coll. Janson (1, BMNH); [Allegheny Co.], Pittsburg[h], 7-28-1924, Chermock (1, SEMC); Pittsburgh, VII-16-[19]25, VII-12, VII-14, VII-24, VIII (1, BYUC; 5, OSAC0000569401, OSAC0000569403, OSAC0000569410-OSAC0000569412); PGH, Aug-1925 (2, MTEC); West View, VII-

28/ H. L. Chermock (4, CASC); [Berks Co.], Stony Crk Mills, VIII-3-[19]49, D. G. Kissinger (1, FSCA); Columbia Co., 25-June-1969, leg. Thomas Manley (2, PMNH); Dauphin Co., VII-10-[19]27, VIII-4-[19]27, VIII-15-[19]27, IX-3-[19]27/ J. N. Knull collector (4, CASC); Harrisburg, VII-15-[19]10 (1, MCZC); Delaware Co., Chadds Ford, 15-21-July-1991, J. E. Wappes (1, FSCA); [Franklin Co.], Mt. Alto, VII-9/J. N. Knull coll. (1, ASUC); [Montgomery Co.], Gladwyn, VII-6-[19]35/ D. G. Kelley collection (1, CASC); [Northampton Co.], Easton, VII-10-[19]29, VII-20-[19]39, VII-20-[19]34, VIII-10-[19]36, VII-26-[19]45, J. W. Green (7, CASC); Wind Gap, VII-8-[19]41, VII-16-[19]41, VII-18-[19]41, VII-19-[19]41, July-1946, J. W. Green (4, OSAC0000569405, OSAC0000569406, OSAC0000569408, OSAC0000569413; 1, CASC; 4, WSUC); [Philadelphia Co.], Phil[adelphia], VI-28/ L. S. Slevin collection (1, CASC); Phila[delphia], VII (1, MCZC); Angora, VII-4 (1, MCZC); Mt. Airy, [no date], 7-15, 7-27 (4, MCZC); Oak Lane, IV-1 (1, MCZC); Wisahickn [*sic*] Cr., VIII-3 (1, MCZC); [Westmoreland Co.], Jeannette (1, MCZC); Jeanlite [?], 6-30/ Hinton Coll. B.M.1939–538 (1, BMNH); Jeanette, VII (1, OSAC0000569402). **Rhode Island:** [Providence Co.], Cranston, Dyers, 7-29-[19]15, J. V. Nylén (1, PMNH); [Washington Co.], Block Island, Mouwnee Hill, el. 180, 4-5-July-1974, leg Dorothy L. duPont (1, PMNH). **South Carolina:** Pickens Co., “Dovehaven”, 7mi NE of Pickens, 6-21-1979, 8-25-1981, Annie Dozier (2, FSCA); “Dovehaven”, 7 mi N. E. of Pickens, 2-VIII-1980, VII-25-1981, H. L. Dozier (2, FSCA); 7 mi NE Pickens, VI-17-1995, H. L. Dozier (1, FSCA; DNA–MTEC023695). **South Dakota:** [Brookings Co.], Volga/ Truman/ A. Fenyes collection (2, CASC); Day Co., Sect. 5, Racine Twn, attracted to UV/ 3-August-1966, leg. J. S.

Nordin (1, FSCA); Gregory Co., Buryanek GPA, 02-August-1996, blacklight, G. M. Marrone (1, BMNH); [Marshall Co.], Veblen, 7-21-[19]37, H. T. Peters (1, SEMC); Moody Co., Egan/ G. E. Thomas coll. (2, CASC); [Pennington Co.], Hill City, VIII-8-1935, A. Thrupp (1, CASC); [Union Co.], Elk Pt., J[ul]y-1915 (1, MCZC). **Tennessee:** [No data]/ Van Dyke Collection (1, CASC); Benton Co., VI-27-1948, I. Walker, P. White (1, FSCA); VII-4-1950, VII-9-1950, VI-21-1952, VII-1-1952, VII-7-1952, VII-17-1952, T. J. Walker, Jr. (5, FSCA); Carter Co., 5mi N Hampton, VII-24-31-1969, Ted Helseth leg, U. V. light Trap (1, SEMC); Cocke Co., GSMNP, ATBI Plot, Albright Grove, 35°43'60"N, 83°16'50"W/ Lindgren 18, 21-Jul-1-Aug-2001, Parker, Stocks, & Petersen (1, LSAM0188302); GSMNP, Albright Grove, ATBI Plot, MT-1820010814, 1-14-August-2001, C. R. Parker & I. C. Stocks (1, LSAM0129150); GSMNP, ATBI Plot, Albright Grove, 293741E, 3956563N/ Malaise MT17, 5-20-Jul-2002, B. Merritt (1, LSAM); GSMNP, ATBI Plot, Albright Cove[sic], MT18, 293741E, 3956563N, 5-20-Jul-2002, B. Merritt (5, LSAM0104123-LSAM0104127); GRSM, ATBI Plot, Albright Cove [sic], MT18, 293741E, 3956563N, 20-Jul-1-Aug-2002, C. R. Parker (4, LSAM0104166-LSAM0104169); GSMNP Cosby, 17-Jul-2003, W. D. Merritt (2, LSAM0076663, LSAM0076664); GSMNP, ATBI Plot, Snakeden Ridge, 299256E 3957561N/ Malaise Trap MT20, 4-19-Jun-2001, I. C. Stocks (4, LSAM); as previous except, Malaise Trap, MT19, 2-16-Jul-2001, I. C. Stocks (1, LSAM); GRSM, ATBI Plot, Snakeden Ridge, MT19, 299256E 3957561N, 2-Jul-1-Aug-2002, C. R. Parker (1, LSAM0104128); [Decatur Co.], Perryville, 7-20-1926, T. E. White (1, SEMC); Sevier Co., GSMNP, Greenbriar Cove cemetery, 35°42'21"N, 83°22'56"W, 16-Jul-2003,

MVLT, V. M. Bayless (1, LSAM0076759); GSMNP, Greenbriar Cove cemetery, 35°42'21"N, 83°22'56"W, elev. 1700', UV/MVLT, 16Jul2003, A. Mayor, V. M. Bayless, C. E. Carlton, M. K. Dean, S. A. Gil (1, LSAM0077298); GSMNP, Greenbriar, Plemons Cemetery, UV/MV lights, 17-June-2005, S. Gil (1, LSAM0129674); GSMNP, Goshen Prong, ATBI Plot, Malaise Trap MT-2220010717, 2-17-June-2001, M. Williams (9, LSAM0128963, LSAM0128964, LSAM0128970-LSAM0128972, LSAM 0128974-LSAM0128977); GSMNP, Goshen Prong, ATBI Plot, Pitfall 103, 17-30-July-2001, Parker, Stocks, & Petersen (1, LSAM0104174); GSMNP, Goshen Prong, ATBI Plot, Malaise Trap, MT-2120010730, 17-30-July-2001, J. & R. Saczawa (4, LSAM012564-LSAM0129567); GSMNP, Goshen Prong, ATBI Plot, Lindgren funnel #22, 13-30-August-2001, Parker, Stocks, & Petersen (1, LSAM0102967); GSMNP, Goshen Prong, ATBI Plot, Malaise Trap MT-2220010813, 30-July-13-Aug-2001, I. C. Stocks (2, LSAM0129562, LSAM0129563); GSMNP, Goshen Prong, 269680E 3943539N, 20-Jun-9-Jul-2002, B. Merritt, MT2120020709 (2, LSAM0156431, LSAM0156443); As previous except, MT22, 9-17-July-2002, B. Merritt (12, LSAM0104134, LSAM0104139, LSAM0104142-LSAM0104148, LSAM0104150, LSAM0104151, LSAM0104158); as previous except, 17-July-5-Aug-2002, J. & R. Saczawa (8, LSAM0104153-LSAM0104156, LSAM0104159-LSAM0104162); GSMNP, Goshen Prong, ATBI Plot, Malaise Trap, MT-2220010730, 17-30-July-2002, I. C. Stocks (4, LSAM0103095-LSAM0103098); GRSM, ATBI Plot, Goshen Prong, MT22, 269680E 3943539N, 5-19-Aug-2002, J. & R. Saczawa (1, LSAM0104163); GSMNP, Porter's Creek, 35°40.790'N, 83°23.855'W, 1-8-July-2007, FIT, M. Ferro (2, LSAM0167727, LSAM0168191);

GSMNP, nr. Jct. Hwy 321 & Greenbriar Rd, 35°44.258'N, 83°25.007'W, 420m, mesic hardwood, LF20060627, Sokolov, Sokolova, Rusin, 17-27-VI-2006 (1, LSAM0100393); GSMNP, Snakeden Ridge, ATBI Plot, MT-1920010801, 16-July-1-Aug-2001, I. C. Stocks & K. Pitz (3, LSAM0134995-LSAM0134997); GSMNP, Tween [*sic*] Creeks ATBI Plot, MT-0119990721, 6-21-July-1999, Parker, Stocks, & Petersen (2, LSAM0129081, LSAM0129082); GSMNP, Twin Creeks ATBI plot, MT-0119990817, 9-17-August-1999, Parker, Stocks, & Petersen (1, LSAM0103598); GSMNP, Twin Creeks ATBI plot, MT-0220000718, 3-18-July-2000, Parker, Stocks, & Petersen (17, LSAM0128888-LSAM0128890, LSAM0128892, LSAM0128895, LSAM0128896, LSAM0128914-LSAM0128919, LSAM0129029, LSAM0129030, LSAM0129032-LSAM0129034); GSMNP, Twin Creeks ATBI Plot, MT-0120000802, 18-July-2-August-2000, Parker, Stocks, & Petersen (2, LSAM0103669, LSAM0103675); GSMNP, Twin Creeks ATBI Plot, Malaise Trap, MT-0220010706, 21-June-6-Jul-2001, I. C. Stocks (2, LSAM0129768, LSAM0129770); as previous except, MT-0120010716, 6-16-July-2001 (6, LSAM0129303, LSAM0129304, LSAM0129766, LSAM0129767, LSAM0129769, LSAM0129771); as previous except, MT-0120010730, 16-20-Jul-2001 (8, LSAM0128509, LSAM0128510, LSAM0128512, LSAM0128530, LSAM0128749, LSAM0128757, LSAM0128759, LSAM0128762); as previous except, MT-0220010716, 14-29-August-2001 (1, LSAM0128810); GSMNP, Twin Creeks, MT-01, 273810E 3951793N, 16-31-July-2002, I. C. Stocks (3, LSAM0104131-LSAM0104133); GSMNP, Twin Creeks ATBI Plot, 273810E 3951793N, 31-Jul-15-Aug-2002, B. Merritt, MT0120020815 (1, LSAM0156883); Sullivan Co., vic. Indian Springs, Chestnut Ridge

Summit, 1600' 4-VII-[20]02, J. Hyatt (1, FSCA). **Texas:** [No data] (2, MCZC); July-1930/ H. C. Fall Collection (2, MCZC); Harris Co., R. Oertel (1, MCZC). **Utah:** Utah Co., BYU campus, Provo, 16-VII-2001, M. Price (1, BYUC; DNA-MTEC023693).

Vermont: [No data] (1, INHS830222). **Virginia:** [No data] (6, INHS830205, INHS830217, INHS830223, INHS830224, INHS830535, INHS830536); [No data]/ J. Smart / Fry Coll., 1905, 100 (1, BMNH); Prince George Co., James River NWR, Fines Road, N37.28007°, W077.11555°, 24-June-1-July-2016, 1-8-July-2016, A. V. Evans, C. W. Brame, baited lindgren funnel trap (2, BMNH); Augusta Co., slopes of Elliott Knob, 16-VIII-1963/ D. C. & K. A. Rentz collectors (4, CASC); [County?] Arlington, July 8-12-1946, J. G. Franclemont (2, FSCA); [County?] Shenandoah N'tl Park, Sexton Knoll, VII-28-1937/ N. L. Rumpp (3, CASC). **Washington:** Yakima Co., 6-23-[19]76, at light, F. Howell (1, WSUC); Outlook, BL[ight] trap June-27-1976, July-6-1976, July-9-1976, July-11-1976, July-23-1976, July-27-1976, Sept-3-1976, 7-10-[19]78, J. F. Howell (15, WSUC). **Washington D. C.:** Rock Creek Park, 8-7-[19]22, D. H. Brannon (1, WSUC).

West Virginia: Pocahontas Co., Watoga St. Park, 15-17-VII-1986, Howard V. Weems, Jr., at fluorescent light (3, FSCA). **Wisconsin:** [No data] (1, INHS830232; 1, MCZC); [No data]/ Aug, Sept (3, WSUC); [Bayfield Co.] Bayfield, Wickham/ A. Fenyes collection (2, CASC); [Dane Co.] Madison, July-1927, leg. Henry Bunting (1, PMNH); Madison, [No date], 7-7-[19]28, 7-21-1928, July-11-1929, VII-15-1929, VII-20-1929, VII-24-1930/ C. E. Woodworth collector/ at sugar (51, WSUC); Madison, 6-VII-1962, J. K. Lawton col/ light (1, SEMC); [Dodge Co.] Beaver Dam, Vi-27-[19]09/ Van Dyke collection (1, CASC); [Milwaukee Co.], Milwaukee, 31-7-[to]-2-8-[19]35, Harry van

Emden / Ex. Van Emden Coll., B.M.1939–75 (2, BMNH); Racine Co., Burlington, VII-22-[19]67, VI-29-[19]71, VII-21-[19]72, VII-24-[19]72, D. Brzoska (4, SEMC); Sauk Co., Hemlock Draw, 43°21'07"N, 89°57'08"W, July-1-10-2000, col. Alistair Ramsdale/ flight intercept trap, mesic hardwood forest (1, MTEC); Pine Hollow S. N. A., 42°22'13"N, 89°54'11"W, 20-30-July-2000, A. S. Ramsdale colr., F.I.T. mesic *Acer* Forest (1, MTEC; DNA–MTEC018137); [Waukeshau Co.], Waukashau [*sic*] VI-10-[19]25 (1, CASC). **Wyoming:** Crook Co., Bear Lodge Mountains, Beaver Creek, 1 mi SW Hwy 24, 8-VIII-2015, S. M. Clark/ 44.6433°N, 104.3797°W, elev. 1322m (5, BYUC130109, BYUC131377, BYUC131619, BYUC131650, BYUC131705); [Goshen Co.], Torrington, July-7-1948/ R. E. Pfadt collector (1, CASC); [Sheridan Co.], Sheridan, Metz (2, CASC; 1, MCZC). **Unknown state:** Diamond Island, T., [Winnefsiaory?], 1869 (1, MCZC). **No Locality info:** (3, INHS830516, INHS830518, INHS830532; 2, OSAC0000541748, OSAC0000541749; 4, MCZC; 1, WSUC); 310 / EntClub (1, BMNH); Sharp Collection (1, BMNH); sec. Cdz. Coll. (1, BMNH); Coll Janson, ex. Candeze (1, BMNH); Coll. Janson, Ex Laferte / *Asaphes memnonius* Herbst/ *Eremita* (nobis) carolina Reiche (1, BMNH); Leng (1, MCZC).

Hemicrepidius niger (Linnaeus, 1758)

Records in North America: Douglas 2011b: 12.

Synonyms in Cate 2007

Figs. 5.23a–5.23e.

Diagnosis

Hemicrepidius niger can be distinguished from all other *Hemicrepidius* by the combination of a curved prosternal process; a nearly straight posterior margin of the hypomeron; dense, nearly touching, simple punctation on the pronotal disc; and serrate antennae with the third antennomere triangular and similar in shape to the fourth antennomere. It will most likely be confused with *H. decoloratus* and *H. hemipodus*, two species which never have serrate antennae and never have the third antennomere triangular like in *H. niger*.

Description

Due to being an introduced species from Europe, and the due to types of European species not being examined, no description is provided. The diagnosis and key above should be used to identify this species in North America. The provided figures will also help in identifying this introduced species.

Distribution

In North America specimens have only been collected in New Brunswick and Ontario, Canada (Douglas 2011b).

Notes

The identity of the Canadian specimens as *H. niger* was confirmed by Hume Douglas (pers. comm.). It is likely that this species has expanded its range from the

known localities, and it wouldn't be surprising if this species was found in bordering states of the USA. All recorded North American specimens appear to be the unicolorous dark form of the species.

Hemicrepidius obscurus (LeConte, 1853) – New Combination

Corymbites obscurus LeConte, 1853: 442; Candeze 1863: 107.

Ludius obscurus (LeConte, 1853): Schenkling 1927: 392; Van Dyke 1932: 409.

Brown 1935: 213 [see note].

Asaphes dilaticollis Motschulsky, 1859: 368; Horn 1880: 72. **New synonymy.**

Hemicrepidius dilaticollis (Motschulsky, 1859): Knowlton 1934: 82; Becker 1979: 407; Arias-Bohart and Elgueta 2015: 7.

Asaphes coracinus Candeze, 1863: 214, 1891: 181. **New synonymy.**

Asaphes coracinus as synonym of *H. carbonatus*: Horn 1875: 149; Horn 1880: 71.

Figs. 5.24a–5.24e.

Diagnosis

Hemicrepidius obscurus can be distinguished from all other *Hemicrepidius* by the dense, nearly cribrate, pronotal punctation, and the straight pronotal process.

Hemicrepidius obscurus can be confused with *H. californicus*, *H. carbonatus*, and possibly *H. montanus*. The differences with the previous two species are diagnosed under their entries above. *Hemicrepidius obscurus* differs from *H. montanus* by having very

dense pronotal punctation on the disc and by having less serrate antennae where antennomere 3 is not the same shape as antennomere 4.

Description

Length 10.5–21.0mm, width 2–5mm; color uniformly dark brown to piceous, elytra not contrasting pronotum, sometimes parts of ventral side lighter, particularly edges of segments, hind angles sometimes subtly lighter; integument shining. Setae moderate, suberect, piceous. **Head:** punctures subumbilicate, nearly contiguous; frons weakly concave anteromedially, some with slight triangular impression medial; frontal carina usually complete, broad v-shape to broadly curved, sometimes interrupted medially by a few punctures, confluent with medial posterior margin of clypeal edge, at most weakly projecting; eyes moderately bulging; antennae serrate, antennomere 2 subcylindrical, antennomere 3 subtriangular and around $2\times$ length of 2, antennomere 3 subequal in length to 4 and with intermediate setation between 2 and 4, antennomeres 4 to 11 about $2\times$ longer than wide, becoming narrower apically, each with subtle medial line bearing less setae than edges, antennomere 11 with tip constricted as pseudosegment, antennae reaching pronotal posterior edge to passing by up to three antennomeres.

Thorax: Pronotum as wide as long to $1.3\times$ wider than long, with males being generally narrower than females, widest at hind angles or just anterior of midlength; sides weakly (males) to broadly arcuate (females), evenly narrowing anteriorly, lateral carina complete; hind angles slightly divergent due to sinuate edge anterior of hind angle, dorsal carina present, usually broad and shining, suparallel to lateral margin; punctures similar

in size to punctures on head, appearing simple to subumbilicate, separated by one to two diameters of a puncture to nearly contiguous on disc, punctures closer and larger laterally, nearly contiguous and clearly subumbilicate; posterior edge with sublateral incisures present. Hypomeron with subumbilicate punctures, nearly contiguous throughout; posterior margin emarginate with hind angle visible ventrally and truncate at tip, medial margin without impunctate line. Prosternum punctuation smaller than punctuation on hypomeron, appearing simple, nearly contiguous laterally and rapidly becoming very sparse medially; anterior lobe slightly deflexed, broadly rounded and partially covering ventral mouthparts; prosternal process straight, thickend dorso-ventrally, impunctate between procoxae. Mesosternal fossa with lateral edges raised ventrally in an almost 90-degree angle, posterior edge of fossa truncate. Metaventrite with punctures simple, smaller than punctures on hypomeron, dense laterally, nearly touching, becoming much sparser medially, separated by two to three diameters of a puncture. Scutellar shield elongate, about twice as long as wide, narrowly rounded posteriorly, lateral margins sinuate, dorsal surface weakly convex, anterior margin nearly straight, punctuation small, setae radiating from midline, similar to setae on pronotum and elytra. Elytral striae moderately impressed basally; interstriae flat to slightly convex, evenly and densely punctured; basal carina crenulate. Legs with tarsomere lobes on tarsomere 3 and tarsomere 2 subequal in size, narrow so difficult to see dorsally, lobe on tarsomere 1 small, slightly larger than lobe on tarsomere 4 smallest, both visible laterally.

Abdomen: Punctures small, simple, a bit smaller than punctures on metaventrite, very dense, nearly contiguous laterally, sparser medially separated by a puncture diameter or a

bit more; fifth ventrite narrowly rounded; lateral edge of each ventrite with distinct microserrations. **Male genitalia:** Figs 5.24d and 5.24e. Parameres subparallel laterally on basal four-fifths, sinuate laterally on apical one fifth basad of apical expansion, which is narrowly hooked; apex of paramere broadly pointed, slightly membranous, setose ventrally. Medially lobe moderate, gradually narrowing apically, apex strongly constricted; basal struts gradually curved latero-basally.

Distribution

Specimens have been examined from the following provinces and states; Canada: BC. USA: CA, NV, UT, WA (Fig. 5.25b).

Notes

This species will be known in most works under the name *H. dilaticollis*. The name of *H. obscurus* will be unusual for most individuals comfortable with the group, but examinations of types and limited published works means the oldest name must be used. The recognition of *Corymbites obscurus* as belonging in *Hemicrepidius* was first noted by Brown (1935), where he stated the generic transfer should be done, and was missed due to the type lacking legs. However, he never officially made the transfer, so the combination of *Hemicrepidius obscurus* never appeared in print until this work.

I also move *Asaphes coracinus* from synonymy with *H. carbonatus* to this species. The type specimen of *A. coracinus* is a typical *H. obscurus* in all regards. Cand  ze did not know of *A. dilaticollis* at the time of writing his manuscript in 1863,

leading him to describe the species as new. Specimens in the MCZC labeled *A. coracinus* are typical *H. carbonatus*, and not like the type, likely leading to Horn's mistaken synonymy.

Larvae have not been associated for this species.

Specimens Examined

Types Examined. Of *Corymbites obscurus*: **Holotype**: [gold disk] (= California)/ *C. obscurus* LeC./ Type #2568; male; type locality California, in MCZC. Of *Asaphes dilaticollis*: **Holotype**: not examined; type locality California, supposedly in ZMUM but not located in Motschulsky collection. Of *Asaphes coracinus*: **Holotype**: California / Coll. Janson; Female; type locality California, in BMNH.

LeConte Collection (MCZC), 1. Cal./ *dilaticollis* #1.

Horn Collection (MCZC), 4. In *H. dilaticollis* tray: Cal., Cal., Cal. In *H. morio* tray: Cal., morio #5.

Other Specimens Examined, 317. **CANADA: British Columbia:** Merritt, 8-3-[19]31, R. H. Beamer (1, SEMC). **USA: California:** [No data] (3, BMNH; 9, MCZC, MCZ-ENT00641958, MCZ-ENT00641962, MCZ-ENT00641985); [No data]/ Coll. Janson (1, BMNH); Alameda Co. (1, MCZC); Oakland (1, CASC); Pleasanton, 7-1-[19]32, 5-16-[19]35 (3, CASC); Pleasanton, VI-7-1938, V-21-[19]39, B. E. White

collector (4, CASC); Calaveras Co., Mokel Hill, [no date], V/ F. E. Blaisdell collector (7, CASC); Angelus Camp, VI-28-1952/ R. H. & L. D. Reamer, W. LaBerge, A. Welf, C. Liang, C. Welner (1, SEMC); 4.8km S. West Point, 16-VII-1980, 26-VII-1980, 27-VII-1980, 31-VII-1980, 3-5-VII-1981, Stanley C. Williams (13, CASC); Palomay/ 05-3-Aug/ field/ A. Fenyes collection (1, CASC); Contra Costa Co., VIII-26-[19]44, E. R. Leach (1, CASC); El Dorado Co. (1, MCZC); VI-25-[19]12/ coll'd by F. W. Nunenmacher (1, CASC), Van Dyke Collection (1, CASC); Fallenleaf Lake, V-1909/ Van Dyke collection (1, CASC); 1 mi E of Pacific House, 23-VII-1992, C. B. Barr, seining El Dorado Ditch (2, EMEC; DNA-MTEC023714); 1 mi. E of Pacific House, 16-VII-2016, C. B. Barr, & W. D. Shepard collrs./ seining El Dorado Ditch, 38.7595°N, 120.4922°W, 1180m elevation (1, EMEC; DNA-MTEC023715); Pinecrest, VIII-16-1952, E. W. Erickson/ 6500' elev. (1, FSCA); Placerville/ 6-1-[19]16, Hopk. U. S./ E. T. Armstrong col (1, OSAC, WFIC0000353514); Pollock Pines, VIII-1-1936, VII-21-1938, VII-27-1939/ A. T. McClay collector (3, FSCA); Riverton, VII-17-[19]31, VII-18-[19]31/ Van Dyke Collection (8, CASC); Riverton, [no date], VII-17-1931/ A. T. McClay collector (2, OSAC0000567989, OSAC0000567996); Riverton, 7-1-[19]34, 7-4-[19]34 (9, CASC); Riverton, VII-4/ R. Wagner collector (8, CASC); Riverton, 7-30, 3000ft / H. E. Hinton Coll (5, BMNH); Fresno Co., Huntington Lake, July-16-[19]19/ 7,000ft/ E. P. Van Duzee collector (1, CASC); Inyo Co., Big Pine Cr., VIII-1929/ Glacier Ldg., 8-11000 ft/ McCracken collector (1, CASC); Big Pine Cnl, VIII-5-[19]57/ C. H. Martin coll (1, CASC); Big Pine, alt 4000ft, at ultraviolet light, June 1970, D. Giuliani (1, CASC); Bishop/ Van Dyke Collection (1, CASC); Bishop, June-21-1929/ E. P. Van Duzee

collector/ at light (1, CASC); Independence/ 05-7-June/ A. Fenyes collection (1, CASC);
 Independence, 7-V-1937, B. E. White (1, CASC); Independence, VI-14-1937/ L. R.
 Gillogly collector (1, CASC); Lone Pine, VI-20-1937/ Whitney Road/ Van Dyke
 collection (1, CASC); Owens Valley, Little Black Rock Spring, 14-V-1973, Derham
 Giuliani (1, CASC); Lake Co., Adams Sps., VI-18-[19]11/ F. E. Blaisdell collector (1,
 CASC); Anderson Springs, 7-VI-1952, W. R. Bower (1, CASC); L[os] A[ngeles] Co.,
 Benedict Cyn., May-28-1969, E. Glesbert col. (1, FSCA); Big Pines Rec. Area, July-12-
 19-1958/ collected by V. Reaves (1, FMNH); Chantry Flats, Arcadia, 6-22-[19]64/ M. W.
 Stone collector (1, CASC); Claremont, VII-25-[19]67, B. Streit (1, FSCA); Cold Water
 Cn., VII-1908/ Van Dyke Collection (1, CASC); Glendale, VI-30-1950, VII-4-1950,
 VIII-25-1954/ E. I. Schlinger collector (1, BMNH; 1, CASC; 1, OSAC0000567992);
 Glendale, VII-11-1952, VII-27-1952, VII-18-1955, W. M. Schlinger collector (2,
 BMNH; 4, CASC); Glendora, VII-5-1950/ K. G. Whitesell collector (1, CASC);
 Glendora, VII-8-1950/ A. T. McClay (1, CASC); Hollywood Hills, Griffith Park, 7-4-
 [19]58, Coll. of G. Nelson (1, FMNH); Mt. Wilson/ 05-22-June/ A. Fenyes collection (1,
 CASC); Mt. Wilson, VII-22-[19]05 (1, MCZC); Pyramid Ranger Station/ 8-9-[19]14,
 Hopk. U.S./ H. E. Burke collector (1, OSAC, WFIC0000353510); S. Madre/ June/ A.
 Fenyes collection (1, CASC); South Fork P. C., VII-1967, A. Hardy (1, CASC); Tanbark
 Flat, VI-30-[19]50, VII-8-[19]50, VII-9-[19]50, VII-12-[19]50, VII-14-[19]50, VII-23-
 [19]52/ A. T. McClay collector (1, BMNH; 10, CASC); Tanbark Flat, VII-23[?]-[19]52/
 E. M. Evans collector (1, OSAC0000567991); Tanbark Flat, VI-28-1956/ collector J. I.
 Stage (1, CASC); Marin Co., Fairfax, VI-24-1906/ Van Dyke Collection (1,CASC);

Fairfax Canyon, 17-IV-1954, Derham Giuliani (1, CASC); Mill Valley, VI-[19]48/ E. S. Ross collector (1, CASC); Novato, 4-VI-[19]49, E. L. Kessel (1, CASC); Mariposa Co., Miami Ranger Sta., 7-25-1946/ H. P. Chandler, elev. 5000 (1, CASC); Miami Ranger Station, 4 mi S, 19-VII-1946/ H. Chandler collection (1, CASC); Mendocino Co., VI-[19]06/ Coll'd by F. W. Nunenmacher (1, CASC); Hopland, May-9-1925/ E. P. Van Duzee Collector (1, CASC); Yosemite Val., VII-16-1921/ Van Dyke collection (1, CASC); Mono Co., Cottonwood Cr, 9300ft, VII-10-1961/ collector J. S. Buckett (2, CASC); Monterey Co., Junipero Serra Pk., Santa Lucia Mts/ on Peak ca. 5800 ft, Aug-15-1956, Hugh B. Leech (1, CASC); Chualar, V-19-1961/ W. H. Lange collector (1, CASC); Napa Co. (1 CASC; 1, MCZC); N. Side Howell Mt., 2 mi NNE Angwin, 1300ft, H. B. Leach, 22-V-1977, 21-VI-1977, 13-IV-1979, 4-VII-1980, Oct-1986 (5, CASC); N. Side Howell Mt, 3km NNE of Angwin, 396m, Hugh B. Leach, 16-VI-1984/ at 15 watt black light, ultra violet (1, CASC); Rutherford/ Van Dyke collection (1, CASC); Placer Co./ Van Dyke Collection (1, CASC); Colfax, July 1893, Miss Hardy (1, CASC); Emigrant Gap, VIII-27, R. Wagner (4, CASC); Plumas Co., VII-1911, alt 4500, collector Léon Munier (1, CASC); Meadow Valley, 3500-4000ft alt., VI-13-1924/ E. C. Van Dyke collector (1, CASC); 4 mi W Quincy, VII-3-[19]49, VII-20-[19]49 (2, CASC); Thompson's Crk, July-25-1953, F. X. Williams (1, CASC); Riv[erside] Co., San Jacino Mtns, Tahquitz mdw/ E. L. Sleeper, VII-10-[19]58 (1, CASC); Idyllwild, 8-27-1968, M. W. Stone coll. (1, CASC); [Sacramento Co.] Sacramento, V-10-1932/ H. H. Keifer collector (1, CASC); Sacramento, V-22-[19]43/ A. T. McClay collector (1, CASC); Sacramento, 5-22-1957/ M. W. Stone coll (1, CASC); Sacramento, American R., 18-VI-

1985, blk.lt., C. B. Barr and W. D. Shepard (2, LSAM); [San Bernardino Co.], 0.5mi SE Cedar Glen/ R. E. Somerby Collr. (1, CASC); Bear Lake, 7-5-1937, M. W. Stone col (1, CASC); Forest Home, VI-20-[19]28/ Van Dyke Collection (1, CASC); Forest Home, 7-20-1966, M. W. Stone Collr. (3, CASC); Lake Arrowhead, VII-28-1932, VII-30-1932, VIII-4-1932/ R. P. Allen Collector (5, CASC); Lake Arrowhead, VIII-1-[19]64, E. I. Schlinger, at black light (1, CASC); N. Shore P. C./ R. E. Somerby collr (3, CASC); Oak Glen, 7-26-1967, M. J. Wargo (1, CASC); Oak Glen/ 8-14-1967, M. W. Stone collr (1, CASC); S. Antonio Canyon, 8-12-[19]67, B. Streit (1, FSCA); S. B. Mts., Aug-[18]91, 7-22-[18]92, 9-[18]92 (3, MCZC); Sky Forest/ R. E. Somerby collr (1, CASC); San Diego Co., Cayumaca [?] Pk, VII-20-[19]62 (1, CASC); Julian, L. E. K.[R?], 8-VII/ Frederick Blanchard collection (3, MCZC, MCZ-ENT00641959); [San Francisco Co.], VI-16-1947 (1, CASC); San Francisco, IV-30-1911, V-7-1911, V-10-1911, V-11-1911, V-14-1911, V-26-1911/ Van Dyke Collection (13, CASC); San Francisco, V/ F. E. Blaisdell collector (1, CASC); San Francisco/ D. Giuliani collector (1, CASC); S. F. Bay Area/ D. Giuliani collector (1, CASC); San Joaquin Co., Stockton/ F. E. Blaisdell collector (1, CASC); [San Mateo Co.], Burlingame, May-1950, L. R. Weitz (1, CASC); [Santa Barbara Co.], 1 mi. NE San Marcos Pass, 1500', VII-7-1965/ R. W. Gear collector (1, CASC); [Santa Clara Co.], Gilroy H. Spgs, V-27-[19]25, V-28-[19]25/ coll by L. S. S[levin] (2, CASC); Palo Alto/ 5-24-[19]17, Hopk. U. S./ F. B. Herbert colr (1, OSAC, WFIC0000353513); San Jose, IV-20-[19]40/ G. S. Mansfield (1, CASC); Stan[ford] U, May 1925 (1, CASC); [Santa Cruz Co.] Big Basin, VII-21-[19]28/ Van Dyke Collection (1, CASC); Shasta Co. (1, MCZC); VIDIT, E. D. Qsflr (1, MCZC, MCZ-ENT00641961); Echo Lake/ July/

collected by J. E. Cottle (1, FSCA); Project City, VI-22-1969/ R. P. Allen collector (1, CASC); 10 mi North Redding Mountiangate, 1000ft, May-15-[19]81, June-5-[19]81, R. B. Miller (2, FSCA); Redding, 1954/ Joe Willis collector (1, CASC); [Siskiyou Co.], Dunsmuir/ 04-7-July/ A. Fenyes collection (1, CASC); Etna, VI-20-1970/ F. D. Horn collector (1, CASC); Solano Co., Cold Canyon, 14-June-2008, W. C. Taylor, W. Ericson (1, FEEC; DNA–MTEC023716); Sonoma Co., Sobre Vista, VI-19-1910, VI-24-1910/ Van Dyke collection (2, CASC); S. Sonoma Co., VI-28-1922/ Van Dyke Collection (1, CASC); [Tehama Co.], Millcreek, 14mi NE Redlands, 4000', VI-21-1958, G. H. Nelson/ *Quercus wislizenii* (1, FSCA); Trinity Co., VI-16-[19]18, E. R. Leach coll. (1, CASC); Stoddard C., VI-25-[19]24/ Thos. Craig Collector (1, CASC); Tulare Co./ F. T. Scott collector (1, CASC); Camp Nelson, VIII-14-[19]83/ Coll. D. J. Burdick (1, CASC); Camp Nelson, 2-7-Aug-[19]84/ Coll. J. Shelton (2, CASC); Kaweah, 6-10-[19]34 (4, SEMC); Kaweah, Hopping (1, CASC); Kaweah Power House Reservior #3, VI-14-1973/ E. A. Kane collector (1, CASC); Kaweah Ash Mtn, PWRH #3, 7-3-[19]82, J. A. Halstead (8, CASC); Kaweah Oaks, NE Farmersville, VI-12-[19]83/ coll. D. J. Burdick (4, CASC); Sequoia Natl. Park, Alt. 2000-3000ft, VI-15-1929/ A. T. McClay collector (1, CASC); Sequoia Natl. Park, Alt. 2000-5000ft/ Potwisha, VI-2-[19]29, VI-10-[19]29, June-13-1929, VI-20-[19]29, VII-16-[19]31/ Van Dyke Collection (19, CASC); Sequoia Nat. Park, 6-1935 (4, CASC); Sequoia N. Pk, Potwisha, VII-1-[19]41/ Van Dyke collection (2, CASC); Hammond, Sequoia N. Pk, VI-18-1947/ V. S. & F. M. Beers Collrs/ J. N. Knull Collection (1, FMNH); Tuolumne Co., Twain-Harte, 4000ft, July 1937/ F. E. Blaisdell collector (2, CASC); Twain Harte, June-25-1961, M. Lundgren coll.

(1, FSCA); Twaine Harte, VII-11-1982, VII-15-1982, VII-20-1982, VII-24-1982, VII-28-1982/ M. R. Lundgren collector (6, CASC); [Yolo Co.], Clarksburg, VII-2-[19]31, VII-10-[19]31/ Van Dyke Collection (5, CASC); Davis, VI-1933 (1, CASC); Davis, 5-20-[19]47/ Brad Stevens collector (1, CASC); Winters, VI-8-1962/ light trap collecting/ P. M. Marsh collector (1, CASC). **Nevada:** Carson City, VII-7-[19]34/ Summit, Clear Creek Grade/ E. P. VanDuzee collector (1, CASC). **Utah:** [Sanpete Co.], Milburn, 7-1920/ Vasco M. Tanner collector (1, BYUC). **Washington:** [Walla Walla Co.], Walla Walla, 6-21-1933, L. T. Turner coll. (1, WSUC). **No locality:** F. T. Scott collection (2, CASC).

Hemicrepidius pallidipennis (Mannerheim, 1843)

Athous pallidipennis Mannerheim, 1843: 244.

Hemicrepidius pallidipennis (Mannerheim, 1843): Lane 1971: 25; Becker 1979: 410.

Asaphes oregonus LeConte, 1861: 348, 1869: 371; Candeze 1863: 224, 1891:181; Horn 1880: 72.

Hemicrepidius oregonus (LeConte, 1861): Leng 1920: 170; Schenkling 1927: 415; Lane 1952: 66; Hatch and Kincaid 1958: 14.

As synonym of *H. pallidipennis*: Lane 1971: 25.

Figs. 26a–26e.

Diagnosis

Hemicrepidius pallidipennis can be distinguished from all other species of *Hemicrepidius* by the combination of a bicolored body with the elytra lighter and contrasting with the pronotum, a curved pronotal process, a broadly V-shaped frontal carina, and an emarginate posterior margin of the hypomeron. It is quite unique for *Hemicrepidius* in the region and will likely not be confused with any other species.

Description

Length 7–11mm, width 2–3mm; body color dark brown to piceous, elytra contrasting pronotum, yellow brown, legs, basal antennomeres, posterior edge of pronotum, ventral edges of elytra, and edges of abdominal segments often lighter; integument shining. Setae moderate, suberect, grey or gold. **Head:** punctures subumbilicate, nearly contiguous to separated by half diameter of puncture; frons weakly concave anteromedially; frontal carina broadly v-shaped, often interrupted medially by punctures, confluent with medial posterior margin of clypeal edge, at most weakly projecting; eyes moderate, rounded and bulging; antennae weakly serrate, antennomere 2 subcylindrical, antennomere 3 subcylindrical, 1.5× length of 2 and with similar punctation, antennomere 3 subequal in length to 4, antennomeres 4 to 11 about 3× longer than wide, each densely setose, antennomere 11 oval, antennae passing pronotal posterior edge by one to three antennomeres. **Thorax:** Pronotum as wide as long, widest at hind angles or just anterior of midlength; sides weakly arcuate to broadly arcuate, gradually narrowing on anterior half, lateral carina complete; hind angles almost subparallel in

females, slightly divergent in males with sinuate lateral edge anterior of hind angle, dorsal carina variable, present, thin, subparallel to lateral edge to very faint and appearing absent; punctures on disc smaller than punctures on head, appearing simple, separated by one to two diameters of a puncture on disc in females, nearly touching in males, punctures closer laterally, nearly contiguous, larger and often clearly subumbilicate; posterior edge with sublateral incisures present, but often reduced and difficult to see. Hypomeron with moderate, vaguely subumbilicate punctures, usually nearly contiguous anteriorly and becoming much less dense posteriorly towards large impunctate area on posterior one-fourth to one-third; posterior margin emarginate with hind angle visible ventrally, well projecting and truncate at tip (Fig. 5.26c), medial margin with impunctate line limited to just anterad procoxae. Prosternum punctuation slightly smaller than matching on hypomeron, appearing simple, separated by half to one diameter of puncture throughout; anterior lobe slightly deflexed, short, almost truncate, not covering to partially covering ventral mouthparts; prosternal process slightly curved dorsally between procoxae, narrow and sinuate past procoxae. Mesosternal fossa with lateral edges sinuate, posterior edge of fossa narrowly truncate. Metaventrite with punctures simple, much smaller than punctures on hypomeron, separated by one to two puncture diameters throughout. Scutellar shield elongate to roughly triangular, about twice as long as wide, broadly rounded posteriorly, lateral margins weakly sinuate, dorsal surface weakly convex, anterior margin nearly straight, punctuation small, setae radiating from midline, similar to setae on pronotum and elytra. Elytral striae weakly impressed basally; interstriae flat to slightly convex, punctures small and dense giving wrinkled appearance;

basal carina not crenulate. Legs with tarsomere lobe on tarsomere 3 largest, wider than tarsomere, lobe on tarsomere 2 moderate and narrow, lobes on tarsomeres 1 and 4 minute, visible only ventrally. **Abdomen:** Punctures small, simple, similar to punctures on metaventrite, dense, separated by half puncture diameter throughout; fifth ventrite broadly rounded; lateral edge of each ventrite with distinct microserrations. **Male genitalia:** Figs. 5.26d and 5.26e. Parameres broadly and shallowly rounded laterally, apical expansion acutely pointed laterally; apex of paramere broadly pointed, weakly membranous, setose ventrally. Medial lobe narrow, subparallel, with narrowed apex; basal struts straight, directed laterally at 135-degree angle. Basal piece with membranous area broadly rounded medially.

Distribution

Specimens have been examined from the following provinces and states;
CANADA: BC; USA: AK, CA, OR, WA (Fig. 5.28a).

Notes

The type of *Athous pallidipennis* was not examined, but I have no doubt about the identity of this species. The type is located in the Mannerheim collection in what was once known as Zoological Institute, Helsinki, Finland (now Finnish Natural History Museum) (Becker 1979). It was previously examined by Lane before he made the synonymy of *A. oregonus* with *H. pallidipennis* (Lane 1971, Becker 1979). I have no

reason to doubt this synonymy, and the species concept here matches the type of the synonym *Asaphes oregonus* in the MCZC.

Hemicrepidius pallidipennis is quite similar morphologically to *Hemicrepidius inornata* (Lewis) from Japan. These two species are likely sister species.

No larvae have been associated with *H. pallidipennis*.

Specimens Examined

Types Examined: Of *Athous pallidipennis*: **Holotype:** type not examined; type locality Sitkha; type in Zoological Institute, Helsinki, Finland. Of *Asaphes oregonus*: **Holotype:** blue disk/ *A. oregonus* Lec./ type 2612/ oregonus #1; female; type locality Oregon; in MCZC. **Syntype:** blue disk/ oregonus #2; male; in MCZC.

LeConte Collection (MCZC), 1. Van./ oregonus #3.

Horn Collection (MCZC), 5. In *A. oregonus* tray: Vanc., #1; W.T., #2; W.T., #3; W.T., #4; W. T., #5.

Other Specimens Examined, 158. **Canada: British Columbia:** Dean River, 59°49'N, 126°46'W, Aug 20-25 1988, W. W. Middlekauf (1, CASC); Ft. Langley, VII-4-1986, N. M. Downie (1, FSCA); Fraz Val (1, MCZC); Growlers C., VIII-7-[19]29, D. Beall (1 FMNH); Massett, 1948, Graham Id[Island], Mrs. Clark (2, MCZC); Midday Val., Merritt/ VII-9-1921, Wm. Mathers (1, MCZC); Midday Val., Merritt, 23-VII-1924

(1, MCZC); Midday Val., Merritt, VII-15-[19]23, R. Hopping/ *Pinus ponderosa* (2, CASC; 1, SEMC); Midday Val., Merritt/ VII-28-[19]24, K. F. Auden/ *Pinus ponderosa* (1, CASC); Midday Val., Merritt/ VIII-2-1924, N. Cutler / *Pinus ponderosa* (1, MCZC); Midday Val., Merritt, VIII-4-1924/ *Pinus ponderosa* (1, MCZC); Midday Val., Merritt, VII-14-1925, VII-17-1925, VII-22-[19]25, VII-24-1925, VII-14-1926, VII-25-1926, VII-31-1926, Wm. Mathers/ *Pinus ponderosa* (2, CASC; 2, MCZC; 3, SEMC); New Westminster, Aug-1-1929, Owen Bryant (2, CASC); New Westminster, 14-VII-[19]32, G. Hopping (1, CASC); Pender Harbor, VII-14-1920, R. T. Turner (1, CASC); Restmore, Hunter Cr., VII-20-1938/ Van Dyke Collection (1, CASC); Stanley, VII-28-1932, W. Mathers (1, CASC); Steelhead, 17-VII-1933, 26-VII-1933, 9-VIII-1933, H. B. Leech (3, CASC); North Vancouver, July-15-1952, A. Guppy (2, OSAC0000551314, OSAC0000551315); Vancouver, 14-VII-1932, G. R. Hopping & H. B. Leech (4, CASC); Vancouver, 8-30/ C. C. Hinte coll (1, BMNH); Vanc[ouver]; VII-2-[19]30, H. Leech (1, CASC); Vancouver, July 1954, W. Lassorko leg. (1, FSCA); Van. I. (1, MCZC); Wigwam Inn, Burrard Inlet, VIII-2-[19]29, G. R. Hopping (1, CASC). **USA: Alaska:** [Ketchikan Gateway Borough], Ketchikan, VIII-1-[19]24 (1, MCZC); Ketchikan, July-20-1959, Aug-8-1959, July-25-1960, July-28-1960, Frances Baker (6, OSAC0000342223, OSAC0000342225-OSAC0000342228, OSAC0000342230); [Borough?], Dolomi, 7-[19]02 (1, MCZC); [City and Borough of Wrangell], Wrangell, 7-30-[19]24 (1, MCZC). **California:** Humboldt Co., Orick, VII-24-[19]34/ Van Dyke Collection (1, CASC); Humboldt Co., Redwood Gorge/ Prairie Crk, VII-28-[19]35/ Van Dyke Collection (1, CASC). **Oregon:** [No data] (3, MCZC); Alder Ck./ Hood Loot, VII-

9-[19]27, Darlington (1, MCZC); [Benton Co.], Corvalis, Aug-17-[19]25 (1, CASC); [Clatsop Co.], Astoria, August-6-1938, coll. K. Grey and J. Schuh (2, FSCA); Cannon Beach, VII-17-[19]37/ Van Dyke collection (1, CASC); Gronnel Road, Elsie, Aug-1-1969 (1, OSAC0000850957); [Gilliam Co.], Arlington, 7-15-[19]31, M. W. Sanderson (1, SEMC); [Clackamas Co.], Colton, 7-[19]33/ coll. by E. S. Ross (1, CASC); Coos Co, Empire/ B. Mulvin, VIII-9-[19]41 (1, CASC); Eel Creek Forest Camp, Aug-12-1948, F. M. Fender (1, OSAC0000836974); Lane-Linn Co, H. J. Andrews Exp. For., 11 mi NE Blue River, July-31-1986, Aug-14-1986/ Log Decomp study (3, OSACV0000445039-OSACV0000445041); [Lincoln Co.], Depoe Bay, V-[19]39/ K. Fender (1, CASC); Polk Co., Monmouth, Weibe, 20-Aug-1998, ca. 300ft, K. Wetheril, beat sheet (1, OSAC0000836984); [Marion Co.], Silver Creek, VIII-1-[19]49 (1, OSAC0000551327); Tillamook Co., Cape Lookout, Sept-10-1955, M. H. Hatch (1, OSAC0000836973); Barview, 23-Aug-[19]61 (1, SEMC); Upper Ten Mile, Aug-2-1931 (1, OSAC0000836982); [Yamhill Co.], Dayton, 23-VIII-1941, K. M. & D. M. Fender (1, OSAC0000551319). **Washington:** [Clallam Co.], Bogachiel, Fst. Camp, Hwy 101 July-17-1956/ collector J. H. Butler (1, FSCA); Forks, VII-23-1933, J. Wilcox, col.(3, CASC); Olympic National Park, Hoh Ranger Sta., 22-VII-1961, E. S. Ross & D. Q. Cavagnaro, flying in low swarms over Hoh River (1, CASC); Olympic Nat. Forest Res., VIII-5-1911/ coll. by J. R. Slevin (1, CASC); [Grays Harbor Co.], Montesano, July-16-1929/ Sweet from potato/ R. L. Webster collector (2, WSUC); Montesano, alt. 65 ft, July-15-1928, A. J. Hanson, colr. (4, WSUC); Hoquiam, 7-23-[19]31, R. H. Beamer (1, SEMC); Hoquiam, Aug-9-1944, M. J. Forsell (1, OSAC0000551284); [Jefferson Co.], Quilcene/ 16 Au

[19]10 (1, WSUC); Quilcene, July-25-1935 (1, OSAC0000551273); King Co., West Tiger Mtn NRCA, Tradition Plateau, 600 ft, 47°31'48"N, 121°59'26"W, 25-July-5-Aug-2003, 5-26-Aug-2003, A. S. Ramsdale collr., F.I.T., *Thuja-Acer-Pseudotsuga* forest (8, MTEC; DNA–MTEC023690, MTEC023691); Bothell, VII-20-1939 (1, OSAC0000551243); Cedar Falls, 6-28-[19]31, Art Crews (1, WSUC);); Issaguah, M. Braun No., VII-20-1969, VII-29-1969 (2, WSUC); Kirkland, July-17-1938, M. H. Hatch (1, OSAC0000551253); Northbend, July-10-1920/ Van Dyke Collection (3, CASC); N. Bend, VII-28-[19]27, Darlington (2, MCZC); 14 mi E. Northbend, VII-28-1968/ R. L. Westcott collector (1, CASC); Seattle, Thornton Ck., 30-8-1985, Don Frechin (1, WSUC); Seattle, 5-28-1 (1, OSAC0000551241); [Mason Co.], Lk. Cushman, 9-Aug-1922, P. G. Putnam (1, WSUC); Pierce Co., Electron, VII-21-[19]36/ Van Dyke Collection (5, CASC); Mt Ranier NP, pool, 3.2 mi NESunshine Pt Cmpgrd, VII-18-1979, R. S. Zack collr. (2, WSUC); Longmires, Ranier N. Pk, VII-27-1920, VII-12-[19]36, VII-13-[19]36/ Van Dyke Collection (6, CASC); Paradise Park, Alta. 6000ft/ Mt. Ranier, VII-14-31-[19]05, Coll. by Van Dyke (1, CASC); Tacoma (1, MCZC); Tacoma/ Van Dyke Collection (1, CASC); Tacoma/ U. S., 1907–156. / Ex Coll. Wickham (1, BMNH); [Pacific Co.], Ilwaco, North Head, Aug-11-1954, M. H. Hatch (1, OSAC0000551290); Nahcotta, August-18-1953 (1, OSAC0000551298); South Bend/ 8-1-[19]57, J. Keefe (1, CASC); [Skagit Co.], Conway, 7-28-[19]31, J. Nottingham (1, SEMC); Snohomish Co., Alderwood Manor, Jul-16-1949, M. H. Hatch (1, OSAC0000551256); Everett, Jul, July-12, Wickham (2, CASC; 1, MCZC); Everett, Lk. Stephens, Aug-3-1917, A. L. Melander (2, WSUC); Everett, Jul-[19]12, Wickham (7, MCZC); Index, Aug-2-1917, A. L.

Melander (1, WSUC); Monroe, VII-4-15-[19]05/ Van Dyke collection (1, CASC); Sultan, Aug-1-1917, A. L. Melander (1, WSUC); [Thurston Co.], Olympia (1, MCZC); [Whatcom Co.], Birch Bay, VIII-2-1964 (1, OSAC0000302825); Glacier, VII-26-1964 (1, OSAC0000302823); Silver Lake, VIII-16-1964, L. Russell (2, OSAC0000302821, OSAC0000302822); [Yakima Co.], Horsetail Falls, VIII-9-[19]48 (1, OSAC0000551320). **Washington Territory:** [No data] (2, MCZC).

Hemicrepidius palpalis (Fall, 1907)

Athous palpalis Fall, 1907: 229; Van Dyke 1932: 366; Lane 1971: 28.

Hemicrepidius palpalis (Fall, 1907): Becker 1979: 409.

Figs. 5.27a–5.27d.

Diagnosis

Hemicrepidius palpalis can be distinguished from all other *Hemicrepidius* by the straight to ear-like posterior margin of the hypomeron, the moderate and dense setae on the pronotum, the dense, simple punctures on the pronotum, and an incomplete frontal carina. It is most similar to *H. falli* and the key characters to separate the two are given under the diagnosis of that species.

Description

Length 8.5–12.0mm, width 2–3mm; color light brown to dark brown, elytra contrasting pronotum, yellow-brown to brown, legs, antennae and sometimes posterior

edge of pronotum, ventral edges of elytra, and edges of abdominal segments often lighter; integument shining. Setae moderate, suberect, grey or gold. **Head:** punctures subumbilicate, nearly contiguous; integument shining; frons concave anteromedially forming triangular impression; frontal carina broadly rounded, interrupted medially by punctures, confluent with medial posterior margin of clypeal edge, at most weakly projecting; eyes large and strongly bulging; antennae weakly serrate, antennomere 2 subcylindrical, antennomere 3 subcylindrical, $1.5\times$ length of 2 and with similar setation, antennomere 3 subequal in length to 4, antennomeres 4 to 11 about $3\times$ longer than wide, densely setose throughout, antennomere 11 oval, at most with tip subtly constricted, antennae passing pronotal posterior edge by 1.5 to 2.5 antennomeres. **Thorax:** Pronotum as wide as long, widest at hind angles or just anterior of midlength; sides weakly arcuate, almost subparallel laterally, narrowing at anterior one fourth, lateral carina complete; hind angles subparallel to weakly divergent, dorsal carina absent to very thin and low to appear absent; punctures on disc smaller than punctures on head, simple, nearly touching throughout, punctures larger and shallower laterally, subumbilicate; posterior edge with sublateral incisures. Hypomeron with simple to subumbilicate punctures, nearly contiguous anteriorly, rarely separated by one puncture diameter, posterior one-fourth with semicircular impunctate area; posterior margin straight to ear-like so hind angle not visible ventrally, medial margin with impunctate line nearly complete throughout. Prosternum punctuation matching punctuation on hypomeron, nearly touching to separated by half puncture diameter throughout; anterior lobe slightly deflexed, broadly rounded, partially covering ventral mouthparts; prosternal process curved dorsally

between procoxae, narrow and sinuate past procoxae. Mesosternal fossa with lateral edges sinuate, posterior edge of fossa truncate. Metaventrite with punctures simple, smaller than punctures on hypomeron, moderately dense throughout, separated by half to one diameter of puncture. Scutellar shield elongate, about twice as long as wide, narrowly rounded posteriorly, lateral margins sinuate, dorsal surface flat, anterior margin broadly rounded, punctuation small, setae radiating from midline, similar to setae on pronotum and elytra. Elytral at most weakly impressed basally; interstriae flat, punctures small and dense giving wrinkled appearance; basal carina not crenulate. Legs with tarsomere lobe on tarsomere 3 largest, wide, lobe on tarsomere 2 small and narrow, lobe on tarsomere 4 minute, usually visible only ventrally, lobe on tarsomere 1 smallest, barely visible ventrally. **Abdomen:** Punctures small, simple, a bit smaller than punctures on metaventrite, moderately dense, separated by one puncture diameter throughout; fifth ventrite narrowly rounded; lateral microserrations small, sometimes not visible on ventrite 5. **Male genitalia:** Figs. 5.27c and 5.27d. Parameres subparallel laterally on basal two-thirds, strongly sinuate on apical third basad of apical expansion, apical expansion narrow and strongly pointed laterally; apex of paramere narrowly pointed, membranous, setose ventrally. Medial lobe narrow, gradually narrowing apically, basal struts broadly curved latero-basally. Basal piece with membranous area forming 'w'-shape medially.

Distribution

Specimens have been examined from the following states; USA: CA, OR, WA (Fig. 5.28b).

Notes

This species is apparently rarely collected. It appears to be limited to the northern Pacific coast, as far north as Queets, Washington, USA.

I have only examined males of this species. Larvae have not been associated.

Specimens Examined

Types Examined. Of *Athous palpalis*: **Holotype:** Medford, Or./ not in Lec coll./ palpalis Type/ H. C. Fall Collection/ M.C.Z. Type #24370; male; type locality Medford, Oregon; in MCZC. **Paratype:** Humbolt Co., Cal.; male; in MCZC.

Other Specimens Examined, 14. **USA: California:** [Del Norte Co.], Crescent City, 25-VII-[1936]/ S.M. Williams Col (1, MCZC); Jebidiah Smith, Redwoods St. Park, VII-12-1968/ R. L. Westcott collector (1, CASC); Humboldt Co., Eureka, Elk River Road, 19-VII-1970, Brunson P. Bliven (2, CASC); Prairie Ck Redwoods, VIII-5-1975, F. G. Andrews (1, CASC); Prarie Cr., State Prk./ VIII-2-1950, C.P. Alexander (1, MCZC). **Oregon:** [Douglas Co.], Camas Valley, 6-17-[19]36/ F. Lawrence coll. (1, CASC); [Tillamook Co.], Boyer, VII-23-[19]41, Fender (2, MCZC); [Marion Co.] Woodburn, July-25-1966, Blk Light trap, Kenneth Goeden (1, CASC). **Washington:** Jefferson Co., 2 mi N. Queets, VI-26-[19]66, F. G. Andrews (1, CASC). **Washington Territory:** [No data] (2, MCZC); [no data]/ [male symbol]/ F. Blanchard collection (1, MCZC).

Hemicrepidius ruficornis (Kirby, 1837) – Status Resurrected

Pedetes (Asaphes) ruficornis Kirby, 1837: 146.

As synonym of *H. nemnonius*: LeConte 1853: 450; Candeze 1863: 211

Asaphes brevicollis Candeze, 1863: 212. **New Synonymy.**

Hemicrepidius brevicollis (Candeze, 1863): Brooks 1960: 31.

H. brevicollis as synonym of *H. nemnonius*: Horn 1880: 74.

Figs. 5.29a–5.29e.

Diagnosis

Hemicrepidius ruficornis can be distinguished from all other *Hemicrepidius* species by the combination of moderately long and suberect setae, a curved prosternal process, an emarginate posterior margin of the hypomeron with a narrowly truncate tip, and punctuation on the pronotal disc that is smaller than the punctuation on the head. The only species it can be confused with is *H. nemnonius*. Characters to distinguish the two species in given in the diagnosis of the latter species above.

Description

Length 11.5–19.0mm, width 3–5mm; color red-brown to dark red-brown, elytra not contrasting pronotum, often legs, antennae and posterior edge of pronotum, ventral edges of elytra, and edges of abdominal segments lighter; integument shining. Setae moderate, erect, gold. **Head:** punctures subumbilicate, separated by half puncture

diameter to nearly contiguous; frons weakly concave anteromedially, some with slight triangular impression medial; frontal carina broadly rounded, complete, not confluent with medial posterior margin of clypeal edge and weakly projecting; eyes large and strongly bulging; antennae serrate, antennomere 2 subcylindrical, antennomere 3 subtriangular, $1.5\times$ length of 2, setation intermediate between antennomeres 2 and 4, antennomere 3 three-fourths to subequal in length to 4, antennomeres 4 to 11 gradually getting narrower apically, basally $2\times$ longer than wide to about $3\times$ longer than wide apically, antennomeres 4–11 with medial line bearing less setae than edges, antennomere 11 with tip constricted as a pseudosegment, antennae passing pronotal posterior edge by one to two antennomeres. **Thorax:** Pronotum $1.1\times$ to $1.3\times$ wider than long (females), widest at hind angles or just anterior of midlength; sides weakly arcuate, almost subparallel laterally, gradually narrowing at anterior half, lateral carina complete and slightly dorso-ventrally compressed anteriorly; hind angles nearing subparallel, sometimes with sinuate lateral edge anterior of hind angle, dorsal carina present, moderate, directed antero-medially; punctures on disc smaller than punctures on head, simple to vaguely subumbilicate, nearly touching to separated by two puncture diameters, punctures closer and larger laterally, nearly contiguous, subumbilicate; posterior edge with sublateral incisures. Hypomeron with large, subumbilicate punctures, nearly contiguous anteriorly, less so towards large semicircular impunctate area on posterior one-third to one-fourth; posterior margin emarginate with hind angle visible ventrally and narrowly truncate at tip (Fig. 5.29c), medial margin with impunctate line limited to basal half or less. Prosternum punctuation smaller than punctuation on hypomeron, simple,

nearly touching laterally, less dense medially; anterior lobe slightly deflexed, broadly rounded, partially covering ventral mouthparts; prosternal process curved dorsally between procoxae, narrow and straight to slightly sinuate past procoxae. Mesosternal fossa with lateral edges sinuate, posterior edge of fossa broadly pointed. Metaventrite with punctures simple, smaller than punctures on hypomeron, moderately dense throughout, separated by one puncture diameter. Scutellar shield elongate, about twice as long as wide, narrowly rounded posteriorly, lateral margins sinuate, dorsal surface flat to weakly concave, anterior margin nearly straight, punctuation small, setae directed posteriorly, similar to setae on pronotum and elytra. Elytral striae weakly impressed basally; interstriae flat to slightly convex, punctures small, scattered, giving wrinkled appearance; basal carina crenulate. Legs with lobes on tarsomeres 2 and 3 wide, visible dorsally, lobe on tarsomere 3 largest, lobe on tarsomere 2 second largest, lobe on tarsomere 1 small, narrow, visible laterally, lobe on tarsomere 4 smallest, often only visible ventrally. **Abdomen:** Punctures small, simple, a bit smaller than punctures on metaventrite, moderately dense, separated by one puncture diameter, less dense medially; fifth ventrite broadly rounded; lateral edge of each ventrite with distinct microserrations.

Male genitalia: Figs. 5.29d and 5.29e. Parameres subparallel laterally on basal four-fifths, weakly sinuate on apical one-fifth basad of apical expansion, apical expansion narrowly pointed laterally; apex of paramere narrowly pointed, weakly membranous, setose ventrally. Medial lobe moderate, gradually narrowing anteriorly, more noticeable at apex; basal struts forming 90-degree angle latero-basally. Basal piece with membranous area majority and broadly rounded medially.

Distribution

Specimens have been examined from the following states and provinces;
CANADA: MB, NS, ON, PE, QC; USA: GA, IL, IN, IA, KS, ME, MD, MA, MI, MN,
MT, NH, NY, NC, OH, PA, TN, VT, WV, WI (Fig. 5.31a).

Notes

The name *Asaphes ruficornis* has historically been synonymized with *H. nemnonius*, following LeConte (1853). After examining Kirby's type in the BMNH, I discovered that it was the same species as Candéze's type of *Asaphes brevicollis*, also in the BMNH, hence the revised synonymy presented here. The confusion about the name *A. ruficornis*, beginning with LeConte, likely led Candéze to accidentally redescribe the species. All literature records of *H. brevicollis* should be changed to *H. ruficornis* due to the synonymy

An additional layer of confusion was added by Horn (1880) when he synonymized *A. brevicollis* with *H. nemnonius*, stating it was a "less developed form". This synonymy was troublesome for many, as *A. brevicollis* was often recognized as valid by later authors (Blatchley 1910, Brooks 1960). Blatchley (1910) stated that *H. nemnonius* and *A. brevicollis* could be separated by ratios of the antennomeres with *H. nemnonius* having antennomere 3 subequal to 4 and *A. brevicollis* having antennomere 3 less than 4. After extensive examination, this character proved too variable to be of use, varying even between sexes within *H. ruficornis*.

Molecular data also supports the recognition of *H. ruficornis* as a valid species from *H. nemnonius* (Fig. 5.1). Because of the historic confusion with *H. nemnonius*, it is unclear if larvae have been described for *H. ruficornis*. However, larvae have been associated (Etzler et al. 2014). A description of the larvae will be done in a later work.

Specimens Examined

Types Examined. Of *Asaphes ruficornis*: **Holotype:** Nova Scotia/ *Asaphes ruficornis* Kirby, N. scotia, 5852, new with Kirby; female; type locality Nova Scotia; in BMNH. Of *Asaphes brevicollis*: **Lectotype:** [yellow disk]/ Coll. Janson, ex. Candeze/ *Asaphes brevicollis* Et. Unis LeC.; male (?); type locality United States, not further limited; in BMNH. **Syntype:** West Canada / Coll. Janson/ *Asaphes brevicollis* Cand.

LeConte Collection (MCZC), 7. Can./ memnonius #4; [green disk]/ memnonius #5; [yellow disk]/ A. brevicollis Cand./ memnonius #8; [yellow disk]/ memnonius #9; [yellow disk]/ memnonius #11; Pen./ memnonius #12; Can./ memnonius #13.

Horn Collection (MCZC), 3. In species nr. memnonius tray: N.Y., #4; [5 label], #7. In unidentified *Hemicrepidius* tray: Lowell, Mass, 1890/ n. P. Atwood.

Melsheimer Collection (MCZC), 1. [green disk]/ mel#2. Under *H. memnonius*.

Zeigler Collection (MCZC), 4. Labeled as *H. memnonius*; [green disk]/ Zeig#2, Zeig#6, Zeig#7; [green rectangle]/ Zeig#3.

Other Specimens Examined, 201. **NORTH AMERICA:** Amer. Bor. (4, BMNH); Coll. Janson, Ex Dejean/ *A. melanophthalmus* Melsh, *Ath. fastiditus* Dej. (pars), Amer. Bor., LeConte (2, BMNH); Coll. Janson, Ex Dejean / *Athous moethus* Amer. Bor. (2, BMNH). **CANADA:** [No data] (1, BMNH); Cachise [?] (1, BMNH); West Canada, Ex. Janson (2, BMNH). **Manitoba:** Winnipeg, Bred VII-[19]20, J. B. Wallis (1, MCZC); Winnipeg, VI-[19]21, J. B. Wallis (1, MCZC). **Nova Scotia:** [No data] (4, BMNH); Redman/ [dark green diamond]/ [green rectangle] (1, BMNH). **Ontario:** Barrie, 8-6-[19]11 (1, CASC); Chatham, 10-VII-[19]30, Geof. Beall (1, FMNH); Muskoka Co., Gull Lake, VI-21-1921, VII-4-1921, VII-11-1921, H. S. Parish (3, OSAC0000537360, OSAC0000537370, OSAC0000537371); W. H. H., Ottawa / Sharp Col., 1905–313 (1, BMNH); Strathroy, July-1915, J. R. Gareau (1, INHS830360); Toronto, VII-[19]30 (1, MCZC); Wiarton, 1913–117 (1, BMNH). **Prince Edward Island:** [No data]/ O. S. Wescott collection (1, WSUC). **Quebec:** Montreal/ Van Dyke Collection (3, CASC); Ste-Foy, C. Queb, 20-VII-[19]67, 8-VII-[19]70, Claude Chantel (2, FSCA); Ste-Foy, 17-VII-[19]64, C. Chantel/ Light trap (1, FSCA). **Dubious locality: British Columbia:** ?Vancouver I., North America, Coll. Janson (2, BMNH). **USA: Georgia:** Clarke Co., Whitehall forest, 2-8-VI-1979, R. H. Turnbow, Jr, Insect Flight Trap (1, FSCA); Dekalb Co., VI-6-[19]69 (1, FSCA); Stephens Co., VII-4-[19]64, L. A. Cambre (1, FMNH); Towns Co., 180 spur, 0.4 mi from/below parking lot of Brasstown Bald, at blacklight, 19-

VI-2010/ 34°52.162'N, 83°48.401'W, coll. E. G. Chapman & J. M. Leavengood, Jr (1, JMLC, DNA–MTEC018135). **Illinois:** [No data] (10, INHS830263, INHS830297, INHS830303, INHS830306, INHS830307, INHS830346, INHS830347, INHS830414, INHS830432, INHS830530); Ill./ [4509] (2, INHS830345, INHS830411); N. Ill (2, INHS830382, INHS830398); N. Ill./ [4509] (4, INHS830356, INHS830380, INHSS830430, INHS830445); N. Ill./ [4510](2, INHS830353, INHS830422); [Cook Co.], Chicago, [No date], July, A. I. Melander (2, WSUC); Oak Park, July [2, WSUC]; [Lake Co.], Deep L., Aug-8-[19]06 (1, INHS830497); [McHenry Co.], Algonquin, [No date], July-2-[19]09, July-9-[19]09, July-16-[19]09, July-20-[19]09, July-29-[19]09, Nason (10, INHS830219, INHS830227, INHS830231, INHS830240, INHS830256, INHS830261, INHS830296, INHS830371, INHS830439, INHS830503); Putnam Co., June-21-1933, M. C. Glenn (1, INHS830498); [Vermilion Co.], Oakwood, July-6-1927, at light, coll R. C. & T. F. (1, INHS830373). **Indiana:** Allen Co., New Haven, 7-15-1982, N. M. Downie (1, FSCA); Bear Wallow, July-7-1966, July-11-1966, Charles E. White, blacklight trap (3, FSCA); Harrison Co., April-17-June-9-2013, Lindgren funnel trap, Kyle E. Schnepf (1, FSCA/ KESC); Montgomery Co., Shades State Park, July-1-25-2013, Lindgren funnel trap, Kyle E. Schnepf (1, FSCA/ KESC); Morgan Co., May-19-July-27-2013, Lindgren funnel trap, Kyle E. Schnepf (1, FSCA/ KESC); Porter Co., Indiana Dunes State Park, 15-VII-1947, P. S. Bartholomew (1, CASC); Tippecanoe Co., Lafayette, 6-27-1981, 6-29-1981, VII-3-1981, 8-Jul-1982, VII-9-1982, 7-15-1982, 7-15-1983, 7-18-1983, 6-19-1984, VII-4-1987, 4-Jul-1990, N. M. Downie, U-V light (16, FSCA); [Wells Co.], Bluffton, 29-8-[19]06 / G.A.K. Marshall, 1908–212 (1, BMNH).

Iowa: Linn Co., 3.0mi N Viola, VI-27-[19]72, black lite, E. L. Sleeper (1, CASC).

Kansas: Douglas Co., F. H. Snow (1, SEMC); Breidenthal Res., 2 mi W. Baldwin, 1-12-Jul-1984, window trap, J. Pakaluk #253 (1, SEMC); Jackson Co., Mayetta, 6.5kmW on 158th Rd., 39°19.828N, 96°36.687°W, 5-12-VI-2006, A. Cruz, ex. canopy trap, KAN1S06 056 (1, SEMC, SM0796004). **Maine:** [No data] (1, MCZC); [Androscoggin Co.], Lewiston, S. Stebbins (1, MCZC); [Cumberland Co.], N. Bridgeton [*sic*], VII-15-1963 (1, PMNH); [County?] Packard (1, MCZC). **Maryland:** Anne Arundel Co., Edgewater, 23-27-VI-1983, C. L. Staines, Jr, at blacklight (1, FSCA). **Massachusetts:** [No data] (2, MCZC); Middlesex Co., Lincoln, 27-vii.-10-viii-[19]82, window trap, E. T. Armstrong (1, MCZC); Framingham, Mass, 5-VII-1934 / C. E. Tottenham Coll., B.M.1963-414 (1, BMNH); Framingham, VII-5-[19]50, C. A. Frost/ at Light (1, MCZC); Lowell, Jul-[18]90 (1, MCZC); Wakefield, 7-27 (1, MCZC); Winchester, VII-2-[19]02 (1, MCZC); [Nantucket Co.], Nantucket B., 7-21-[19]24 (1, MCZC); Nantucket, VII-21-[19]24 (1, ASUC); Garden, 6-22-[18]77/ Frederick Allen Eddy Collection (1, MCZC).

Michigan: [Charlevoix Co.], Advance, Lake Charlevoix, VII-21-1956, G. H. Nelson/ collected at light (1, FSCA); [Oakland Co.], Birmingham, July-14-1936, M. H. Hatch (2, OSAC0000566839, OSAC0000566840); Rochester, July-10-1936, M. H. Hatch (2, OSAC0000566841, OSAC0000566842); Washtenaw Co., VIII-1-1922, M. H. Hatch , AA40 (1, OSAC0000551176). **Minnesota:** [No data] (1, MCZC); [Ramsey Co.], St. Paul (1, INHS830412); [Saint Louis Co.], Duluth (1, INHS830304). **Montana:** Bighorn Co., Hardin, elev. 875m, 45.7567°N, 107.5660°W, 20-Jul-30-Aug-2010, L. funnel with AP & EtOH, USDA (1, MTEC); Dawson Co., Intake diversion, 19 July 1990, D. L. Gustafson

col. (1, MTEC); Stream by Rd 242 off I-94 exit 206, elev. 673m, 47.0420°N, 104.8192°W, July-19 Sept 2010/ Kraus, Taravati, Etzler, LF trap (3, MTEC, DNA—MTEC007667, MTEC007668); Custer Co., Miles City Cemetery, 46.3961°N, 105.8252°W, 20-Jun-21-Jul-2010; 2400ft, P. Kraus, baited LF (1, MTEC); Fallon Co., W of Ekalaka, Hwy 323, elev. 981m, 46.2259°N, 104.3981°W, July-28-Oct-2010, Kraus, USDA, baited LF (1, MTEC); Richland Co., Sidney USDA/MSU Ext, 47.7256°N, 104.1463°W, 28-Jul-19-Aug-2011, 1693ft, Hart, Etzler, Ivie, LF (1, MTEC; DNA—MTEC023689); Rosebud Co, Rosebud- far west, 19-July-1990, D. L. Gustafson col. (1, MTEC); Rosebud- Far West, pitfall trap, 14-June-10-Aug-1991, 10-Aug-11-Oct-1991, D. L. Gustafson (8, MTEC); Treasure Co., Yellowstone R.-Myers Br., 46.2579°N, 107.3406°W, 6-Aug-2004, 804m, D. L. Gustafson, A0100 (1, MTEC); Valley Co., Milk R., @ Bjornberg Br., pitfall trap, 12-Jun-8-Aug-1991, D. L. Gustafson col. (4, MTEC); Wibaux Co., Ash Crk ner Hwy 7, 914m, 46.6447°N, 104.22822°W, July-18-Sept-2010, baited LF, Kraus, Taravati, Etzler (1, MTEC). **New Hampshire:** [No Data]/ A. Fenyes Collection (1, CASC); [Merrimack Co.], Concord, 7-8 (1, INHS830522). **New York:** [No Data]/ Van Dyke Collection (1, CASC); Albany Co., Rennselaerville, Huyck Preserve/ Ross H. Arnett, Jr., collector, July-5-1975, July-6-1975, July-7-13-1975, July-17-1975 (6, FSCA); [Erie Co.], Buffalo (1, MCZC); Essex Co., Wilmington, 7-10-VII-1991, J. Huether (1, FSCA); [Greene Co.], New Balt., 7-7-1893, E. B. Southwick (1, BMNH); [Oneida Co.], E. Doubleday, Trenton Falls '3; 2-"434", 1-"435", 228/ Ent Club (1, BMNH); St. Lawrence Co., Grass Lake, VII-9-1988, N. M. Downie (2, FSCA); Cranberry Lake, [No date], 7-18-[19]19; VII-20-[19]19, 7-21-[19]20 (6,

OSAC0000537352–OSAC0000537355, OSAC0000537357, OSAC0000537359); Boiceville, July-10-1937, J. G. Franclemont (1, FSCA); [Tompkins Co.], Ithaca (1, MCZC); Ithaca, 29-July-1937, J. G. Franclemont (2, FSCA); Ithaca, 4-VII-[19]80, at lights, J. Pakaluk (3, SEMC); Ithaca, 8-July-1980, 15-July-1980, 16-July-1980, J. Pakaluk (3, SEMC). **North Carolina:** Haywood Co., Lake Junaluska, 15-VI-1984, H. V. Weems, Jr., ultraviolet light (1, FSCA); Lk Junaluska/ H. V. Weems Jr, 6-VII-[19]61/ at black light (1, FSCA); GRSM ATBI Plot, Cataloochee, MT09 311401E 3939854N, 5-19-July-2001, L. C. Stocks and M. Peterson (1, LSAM0104149). **Ohio:** Hocking Co., Sheick Hollow, 8-23-July-1989, R. S. Miller family/ Malaise trap in riparian woods (1, MTEC); Jackson Co., Lake Katherine, 15 June-17 July 1989, R. S. Miller family/ Malaise trap in woods below spillway; assoc. with *Magnolia macrophylla* (1, MTEC); [Knox Co.], Gambler, VII-20-1940 (1, FSCA); Ross Co., Tar Hollow St. For., 14-22-June-1988, 20-30-June-1988, R. S. Miller family/ Malaise trap in riparian woods (3, MTEC).

Pennsylvania: [No data] (1, MCZC); [Allegheny Co.], West View, VII-28/ from H. L. Chermeck (1, CASC); [Dauphin Co.], Harrisburg, VII-11-[19]10, VII-26-[19]10 (2, MCZC); Hummelstown, VI-8, VI-22, VI-23-[19]33, 6-23-[19]33, J. N. Knull (1, FSCA; 2, CASC; 3, SEMC); [Perry Co.], Perdix, VI-10-[19]11(1, MCZC). **Tennessee:** Blount Co., GSMNP, Chilhowee Lake, 0229045 3934549, 7-Jun-2005, J. E. Hudson (1, LSAM0108254); GSMNP, Whiteoak Sink, Sante, canopy, trap, upper, at 35°38.120'N, 83°44.980'W, 640m, LSAM team, 30-Jun-12-Aug-2007 (1, LSAM0115343); Cocke Co., GSMNP, ATBI Plot, Snakeden Ridge, 299256E 3957561N/ Malaise Trap MT20, 4-19-Jun-2001, I. C. Stocks (1, LSAM); GSMNP, Snakeden Ridge, ATBI Plot, Malaise Trap,

MT-2020010716, 2-16-July-2001, I. C. Stocks (1, LSAM0103490); GSMNP, Cosby Crk. Valley, Gunter Cemetery, 35°46.274N, 83°12.773W/ UV light, site 11, 22-Jun-2006, J. Ciegler, P. Harpootlian (1, LSAM0159057); [Davidson Co.], Nashville, 23-6/ Collection H. Soltau (1, FSCA); Sevier Co., GSMNP ATBIplot: Twin Creeks, Malaise Trap 01/ 35°41.10'N, 83°29.94'W, Parker, Stocks, & Peterson, 21-Jun-6-Jul-1999 (1, LSAM0102958); GSMNP, ATBI Plot Twin Creeks MT01, 35°41.10'N, 83°29.94'W,, 19-Jun-3-Jul-2000, malaise trap, Parker, Stocks, & Petersen (1, LSAM0059968); GSMNP, Tween [Twin?] Creeks ATBI Plot, MT-0120000718, 3-18-July-2000, Parker, Stocks, & Petersen (2, LSAM0128887, LSAM0128894); GSMNP, Twin Creeks ATBI Plot, MT-0120000802, 18-July-2-August-2000, Parker, Stocks, & Petersen (1, LSAM0103673); GSMNP, Goshen Prong ATBI Plot, Malaise Trap, MT-2220010717, 2-17-June-2001, M. Williams (1, LSAM0128962); GSMNP, ATBI Plot Twin Creeks, 35°41.10'N, 83°29.94'W, malaise trap 2, 5-21-Jun-2001, I. Stocks & L. Collins, MT0220010621 (1, LSAM0129673); GSMNP, Twin Creeks ATBI Plot, Malaise Trap MT-0220010706, 21-June-6-Jul-2001, I. C. Stocks (1, LSAM0129730); GSMNP, Tween [Twin?] Creeks ATBI Plot, Lindgren #01, 21-June-6-July-2001, Parker, Stocks, & Petersen (1, LSAM0129168); GSMNP, Goshen Prong ATBI Plot, Lindgren Funnel #22, 2-17 July 2001, Parker, Stocks, & Petersen (1, LSAM0103938). **Vermont:** [Chittenden co.], Burlington, July-7-1928/ In meadow sweeping, F. C. Lutman (1, PMNH). **Virginia:** Bath Co., #1 9 mi W. Warm Springs, 1800ft, 1-July-1967 (1, SEMC); Grayson Co., Jefferson Natl. Forest, Mt. Rogers Rec. Area, Grindstone campground, VA 603, 14-VII-1984, Howard V. Weems, Jr., & Camilla B. Weems, at propane lantern (1, FSCA). **West**

Virginia: Pocahontas Co., Watoga St. Park, 15-17-VII-1986, Howard V. Weems, Jr., at fluorescent light (1, FSCA). **Wisconsin:** [No data] (2, MCZC); [No data]/ [4509] (1, INHS830450); [Bayfield Co.], Bayfld, Wickham (4, MCZC); [Dane Co.], Madison, 7-7-[19]25, 7-3-1928/ C.E. Woodworth collector/ at Sugar (2, WSUC); [Milwaukee Co.], Milwaukee (1, MCZC). **Unknown Locality:** Peadbody Coll'n (1, INHS830524); 310/ Ent Club (1, BMNH).

Hemicrepidius simplex (LeConte, 1876)

Athous simplex LeConte, 1876: 516; Van Dyke 1932: 371; Fall 1934: 173; Lane 1971: 28.

Hemicrepidius simplex (LeConte, 1876): Becker 1979: 408.

Figs. 5.30a–5.30e.

Diagnosis

Hemicrepidius simplex can be distinguished from all other *Hemicrepidius* by the combination of weakly serrate antennae, a straight to ear-like posterior margin of the hypomeron, a curved prosternal process, large, scattered, subumbilicate punctures on the pronotal disc, and slightly divergent hind angles. It is most similar to *H. audreyae* and *H. falli*, and characters to distinguish the species are given in the diagnoses for each of those species above.

Description

Length 7.5–12.0mm, width 2–3mm; color red-brown to brown, elytra not contrasting pronotum, legs, antennae and ventral side lighter, yellow-brown; integument shining. Setae moderate, suberect, gold. **Head:** punctures subumbilicate, nearly contiguous; frons weakly concave anteromedially, some with slight triangular impression medial; frontal carina broadly rounded to roughly v-shaped, complete, not confluent with medial posterior margin of clypeal edge, weakly projecting; eyes large and strongly bulging; antennae weakly serrate, antennomere 2 subcylindrical, antennomere 3 subcylindrical, slightly longer than 2 and with similar setation, antennomere 3 half length of 4, antennomeres 4 to 11 about 3× longer than wide, often with subtle medial line bearing less setae than edges, antennomere 11 oval or with tip weakly constricted, antennae passing pronotal posterior edge by one to three antennomeres. **Thorax:** Pronotum 1.1× to 1.3× wider than long, widest at hind angles or just anterior of midlength; sides weakly to broadly arcuate, gradually narrowing on anterior half, lateral carina complete, dorso-ventrally flattened anteriorly; hind angles subparallel to slightly divergent with lateral edge sinuate anterior of hind angle, dorsal carina variable, usually absent, sometimes present, thin and directed antero-medially; punctures on disc large, same size as punctures on head, subumbilicate, scattered, some nearly touching to separated up to three puncture diameters, punctures closer laterally, nearly touching; posterior edge with small, weak sublateral incisures. Hypomeron with subumbilicate punctures, nearly touching anteriorly and becoming less dense posteriorly, often with impunctate area on posterior one-fourth; posterior margin straight to ear-like so hind angle

not visible ventrally (Fig. 5.30c), medial margin with impunctate line nearly complete, some punctures medially. Prosternum punctuation smaller than punctuation on hypomeron, nearly touching laterally, less dense medially; anterior lobe slightly deflexed, short, nearly truncate to broadly rounded, not covering ventral mouthparts; prosternal process curved dorsally between procoxae, narrow and sinuate past procoxae. Mesosternal fossa with lateral edges sinuate, posterior edge of fossa narrowly truncate. Metaventrite with punctures simple, smaller than punctures on hypomeron, separated by one to two puncture diameters throughout. Scutellar shield elongate, about twice as long as wide, narrowly rounded posteriorly, lateral margins sinuate, dorsal surface flat, anterior margin nearly straight, punctuation small, setae radiating from midline, similar to setae on pronotum and elytra. Elytral striae at most weakly impressed basally; interstriae flat to slightly convex, punctures small, even, giving wrinkled appearance; basal carina straight. Legs with tarsomere lobe on tarsomere 3 largest, narrow, lobe on tarsomere 2 small, narrow, lobes on tarsomeres 1 and 4 minute, visible only ventrally. **Abdomen:** Punctures small, simple, a bit smaller than punctures on metaventrite, moderately dense, separated by one puncture diameter throughout; fifth ventrite narrowly rounded; lateral microserrations small, difficult to see, not visible on ventrite 5. **Male genitalia:** Figs. 5.30d and 5.30e. Parameres broadly and shallowly curved laterally, apical expansion weakly pointed laterally; apex of paramere broadly pointed, membranous, and setose ventrally. Medial lobe narrow, subparallel on basal four-fifths and gradually narrowing towards apex; basal struts forming 90-degree angle directed latero-basally. Basal piece with membranous area majority and broadly rounded medially.

Distribution

Specimens have been examined from the following localities; USA: CO, MT, NM, UT (Fig. 5.31b). Becker (1979) examined 12 specimens of this species, only one of which is among those I have examined, and that is the Holotype. Becker's remaining 11 specimens are from two localities in British Columbia, two additional localities in Colorado, and a locality each in Idaho, New Mexico and Washington. These are included in the distribution map as state and province records only (stars).

Notes

The relatively small number of specimens known for this species suggests it is rarely collected. However, targeted, long term collecting, such as has been done in Montana, will increase the number of specimens for this apparently uncommon species throughout its range.

Larvae have not been associated with this species.

Specimens Examined

Types Examined. Of *Athous simplex*: **Holotype:** Col/ A. simplex Lec/ Type 2546; male; type locality Colorado; in MCZC.

Horn Collection (MCZC), 4. N.M./ *Athous simplex* Lec. (1); Leadville, Col., H. F. Wickham, July-7-14-[18]96, 10,000-11,000ft (3).

Other Specimens Examined, 30. USA: Montana: Cascade Co., Great Falls Super Site, 47.5016°N, 111.2065°W, May-19-July-2011, USDA, EtOH LnfNl (1, MTEC); Flathead Co., Glacier National Park, N. Fork Flathead area, 1988 Red Bench Fire Study, M. A. Ivie colr./ Hidden Mdw Rdg, 4080ft, old growth hard burn, T35N, R20W, Sec19, 09-Jul-02-Aug-1989/ Lidgren funnel trap (1, MTEC); Glacier National Park, N. Fork Flathead area, 1988 Red Bench Fire Study, M. A. Ivie colr/ S. Big Prairie, 3560ft, old growth unburned, T35N, R21W, Sec16, 01-Aug-[19]89, 31-Jul-07-Aug-[19]90/ Lindgren funnel trap, center light trap (2, MTEC); Glacier National Park, N. Fork Flathead area, 1988 Red Bench Fire Study, M. A. Ivie colr/ Sullivan old growth, unburned, 3560', T34N, R20W, Sec21, 03-Aug-[19]89, 14-21-Aug-[19]91, 12-19-Aug-1993/ Lidgren funnel trap (3, MTEC); Glacier National Park, N. Fork Flathead area, 1988 Red Bench Fire Study, M. A. Ivie colr/ Bowman Lake Road, lodgepole hard burn, T35N, R21W, Sec14, 16-23-Jul-1991 (1, MTEC); Glacier National Park, N. Fork Flathead area, 1988 Red Bench Fire Study, M. A. Ivie colr/ Bowman-Akokola inst., old growth hard burn, T35N, R21W, Sec15, 3600ft, 15-23-Jul-1992/ Lindgren funnel trap (2, MTEC); Glacier National Park, W. Glacier Head Qtr., 04-15-Jul-1991, 02-14-Aug-1991, M. A. Ivie, colr/ UV light trap (6, MTEC); S. Whitefish, MR11PD07001, 48.3478°N, 114.3303°W, 07-Sept-2011, 3160ft, USDA, LnfNl Sirex (1, MTEC); Lincoln Co., Lk. Koocanusa, Sutton Rd, 48.4651°N, 115.2653°W, 26-July-02-Oct-2010, 2736ft, Kraus et al., FIT, alder (1, MTEC; DNA-MTEC023707); Granite Co., 1-90 Rest, mi143, 46.7040°N, 113.3375°W, 07-Jul-26-Aug-2011, 3816ft, Hart, Staven, Bait LnfNl (1, MTEC); Missoula Co., Seeley

Lake, Aug-11-1965, B. Wiegand (1, MTEC); Salmon Lake, 7.5mi N. Jct 200 and 83, 24-VII-1988, P. Skelley, blacklight trap (2, MTEC); Ravalli Co., Sula Rang. Sta. site, funnel traps, pitfall traps, 26-June-31-July-1994, D. L. Gustafson colr. (4, MTEC); Warm Springs Cr. Camp, 45.8427°N, 114.0407°W, D. L. Gustafson G1776 (1, MTEC; DNA—MTEC023705); Silver Bow Co., Divide Cr. Rd, Beaver Dam cpg, 45.8829°N, 112.7816°W, 28-Jul-2016, 6545ft, L. C. Seelye, blacklight (2, MTEC; DNA—MTEC023706). **Wyoming:** [Albany Co.?], Medicine Bow N. For., VII-31-[19]58/ D. J. and J. N. Knull collrs (1, FMNH); Carbon Co., Riverside, 5 mi S Black Hall Mtn. Rd, 8-Aug-1986/ under bark lodgepole pine, D. M. Field (1, BYUC).

Hemicrepidius soccifer (LeConte, 1876)

Asaphes soccifer LeConte, 1876: 516; Horn 1880: 73.

Hemicrepidius soccifer (LeConte, 1876): Van Dyke 1932: 445.

Figs. 5.32a–5.32e.

Diagnosis

Hemicrepidius soccifer can be distinguished from all other *Hemicrepidius* by the combination of a sinuate posterior margin of the hypomeron with a short truncate hind angle projection, a slightly curved pronotal process, and serrate antennomeres with dense setation so there is not a clear medial line on the antennomeres. It is most similar to *H. brooksi*, *H. carbonatus*, and *H. mescalero*, and the characters to separate these species can be found under the diagnoses of those species above. Historically, some specimens

have been mis-identified as *H. decoloratus* or *H. tumescens*, but these two species are not likely to be confused with *H. soccifer* with the new key to species.

Description

Length 10–18mm, width 2.5–5.0mm; color variable, red-brown to piceous, usually elytra not contrasting pronotum, sometimes elytra lighter than piceous pronotum, brown, sometimes legs, posterior edge of pronotum, and edges of ventral segments lighter; integument dull to shining. Setae short, depressed, gold, rarely piceous. **Head:** punctures subumbilicate, nearly contiguous; frons weakly concave anteromedially; frontal carina broadly rounded to roughly v-shaped, complete, confluent with medial posterior margin of clypeal edge, at most weakly projecting; eyes moderate, rounded, bulging; antennae serrate, antennomere 2 weakly subcylindrical, slightly longer than wide, antennomere 3 subtriangular and $2\times$ length of 2, setation intermediate between antennomeres 2 and 4, antennomere 3 subequal in length to 4, antennomeres 4 to 11 getting narrower apically, $2\times$ longer than wide basally to about $3\times$ longer than wide apically, antennomeres 4-11 with subtle medial line bearing less setae than edges, appearing completely densely setose in some specimens, antennomere 11 with tip constricted, antennae reaching pronotal posterior edge to passing by three antennomeres. **Thorax:** Pronotum as wide as long to $1.1\times$ wider than long, widest at hind angles or at midlength; sides weakly arcuate, gradually narrowing on anterior half, lateral carina complete, sometimes slightly dorso-ventrally compressed apically; hind angles usually slightly divergent, sinuate laterally just anterior of hind angle, sometimes subparallel,

dorsal carina present, thin, sometimes interrupted by punctures, subparallel to lateral margin or slightly directed antero-medially; punctures on disc usually equal in size to punctures on head, subumbilicate, rarely smaller, appearing simple, separated by one puncture diameter to nearly touching, punctures closer and larger laterally, subumbilicate, nearly contiguous; posterior edge with sublateral incisures. Hypomeron with subumbilicate punctures, nearly contiguous anteriorly and becoming less dense posteriorly, presence of impunctate area variable, sometimes large, semicircular, on posterior one-fourth to no impunctate area, intermediates common; posterior margin straight to sinuate, sometimes hind angle visible only at tip, which is weakly projecting and truncate; medial margin with impunctate line limited to just anterad procoxae. Prosternum punctuation smaller than punctuation on hypomeron, simple, nearly touching laterally, less dense medially; anterior lobe straight to weakly deflexed, short, broadly rounded, not covering ventral mouthparts; prosternal process curved dorsally between procoxae, moderate and straight past procoxae. Mesosternal fossa with lateral edges sinuate, posterior edge of fossa truncate. Metaventrite with punctures simple, smaller than punctures on hypomeron, dense throughout, nearly touching. Scutellar shield elongate, about twice as long as wide, narrowly rounded posteriorly, lateral margins sinuate, dorsal surface weakly convex, anterior margin nearly straight, punctuation small, setae radiating from midline, similar to setae on pronotum and elytra. Elytral striae weakly impressed basally; interstriae flat to slightly convex, punctures small, even, giving wrinkled appearance; basal carina not crenulate. Legs with lobes on tarsomeres 2 and 3 subequal, narrow, or with lobe on 2 slightly smaller than 3, lobe on tarsomere 4 minute, visible only

ventrally, lobe on tarsomere 1 smallest, barely visible ventrally. **Abdomen:** Punctures small, simple, smaller than punctures on metaventrite, dense, nearly touching, less dense medially; fifth ventrite narrowly to broadly rounded; lateral edge of each ventrite with distinct microserrations. **Male genitalia:** Figs. 5.32d and 5.32e. Parameres subparallel laterally, at most weakly sinuate just basad of apical expansion, apical expansion forming sharp hook laterally; apex pointed, slightly membranous, setose ventrally. Medial lobe narrow, subparallel for most of length before narrowing at apex; basal struts forming 90-degree angles directed latero-basally. Basal piece with membranous area majority and broadly rounded medially.

Distribution

Specimens have been examined from the following provinces and states; Canada: AB; USA: AZ, CA, CO, MT, NE, NM, SD, WA (Fig. 5.34a).

Notes

The distribution presented here expands the range of this species much farther north than previously recognized. Brooks' (1960) concept of *H. carbonatus* likely represents *H. soccifer* based on the Montana specimens examined. These Montana specimens always came out with typical *H. soccifer* specimens in molecular analyses (Fig. 5.1). True *H. carbonatus* will also never have gold setae, a character mentioned by Brooks, which is quite common in *H. soccifer*.

There is some variation within this species, especially the size and density of pronotal punctation and the color of the setation. However, other characters, such as the posterior edge of the hypomeron, the antennae, and male genitalia are consistent.

Some specimens even recall specimens of *H. decoloratus*, with Becker (undated label) wondering if one specimen was mislabeled. The antennae of these specimens are much more serrate relative to true *H. decoloratus* and the prosternal process is also curved.

I have also seen some specimens identified as *H. tumescens*. This may result from the fact that some specimens of *H. soccifer* lack a clear impunctate area on the posterior area of the hypomeron, and would have keyed out wrong in Horn (1880). These two species are quite distinct from one another and with the key above and figures provided here, should no longer be confused.

Larvae have not been associated for this species.

Specimens Examined

Types Examined. Of *Asaphes soccifer*: **Holotype:** N.M./ A. soccifer Lec./ Type 2613; male; type locality New Mexico; in MCZC.

Horn Collection (MCZC), 2. N.M. (2).

Other Specimens Examined, 181. **CANADA:** West Canada/ coll. Janson (2, BMNH). **Alberta:** Edmonton, 10-VII-1918, VIII-1-[19]18, F. S. Carr (1, CASC; 1,

MCZC, MCZ-ENT00641967). **British Columbia or Saskatchewan:** VII-20/ C. A. Frost collection (2, MCZC, MCZ-ENT00641965, MCZ-ENT00641969). **USA: Arizona:** Apache Co., Lukachukai Creek, 4.6miles NE of Lukachukai, 2190m, 2-July-1984, Stop#84-9, D. H. & J. L. Kavanaugh (1, CASC); Big Lake, 22 mi SW Eager, 2700m, 15-VII-1976/ P. M. Hammond (1, BMNH); Chuska Mts, 2600m, 11-VII-1976/ P. M. Hammond (1, BMNH); Chuska Mts, 2250m, Wagonwheel Cmpgrnd., 11-12-VII-1976/ at light/ P. M. Hammond (2, BMNH); Springrvil, 8-7-[19]33, E. D. Ball (1, CASC); White Mts, 25mi W Springerville, elev. 10000', 25-VII-[19]30, Meadows, E. R. Tinkham (1, CASC); White Mts, July-8-1933, July-13-1933, July-7-1945, Parker (8, CASC; 6, FSCA); White Mts, Strayhorse For. Cp., Aug-9-1975, K. Stephens leg. (1, FSCA); [Cochise Co.,] Chiricahua Mts., Aug-6-1933, Bryant, Lot 211 (1, CASC); Chiricahua Mts, 7-36, E. S. Ross (1, CASC); Chiricahua Mts, 8600ft, July-15-1942, July-16-1942, H. A. Scullen, col. (3, OSAC0000836985– OSAC0000836987); Chiricahua Mts, VII-15-[19]42/ Van Dyke collection (1, CASC); Chiricahua Mts, 7-3-1947, Roger Olmsted (2, SEMC); Chiricahua M., VII-22-[19]52, VIII-2-[19]52, VIII-12-[19]52, VII-9-[19]59/ D. J. & J. N. Knull (5, FMNH); Chiricahua Mts, el. 8000ft/ July-16-1964, R. H. Arnett, Jr., and E. R. Van Tassell (1, FSCA); Chiricahua Mts, 6 mi above SWRA, 24-VII-1969, G. H. Nelson/ beating *Quercus hypoleuca* (1, FSCA); Chiricahua Mts, near Portal, July-28-Aug-7-1966 (1, FSCA); Chiricahua Mts, 9000ft, July-29-1927/ Barfoot Park/ J. A. Kusche collector (1, CASC); Chiricahua Mts, Barfoot park, Aug-1-1971, K. Stephens leg (2, FSCA); Barefoot [*sic*] Park, 29-July-1988, N. K. and R. S. Miller (3, MTEC); Chiricahua Mts, Barfoot Cmpg, 31°55.1'N, 109°16.8'W, elev. 8320ft, 24-VII-2003, S.

M. Clark (5, BYUC); Barefoot ridge, 8500ft, VIII-4-1927/ J. A. Kusche collector (1, CASC); Chiricahua Mts, Flys Pk, 9500ft, VII-9-1927/ J. A. Kusche collector (4, CASC); Chiricahua Mts, Long Pk., 31°53.5'N, 109°17'W, 2800m, 19-July-2001, A. Tishenkin (2, LSAM); Chiricahua Mts, 8-9000ft, July-27-1927/ Rustler Park/ J. A. Kusche collector (2, CASC); Chiricahua Mts., Rustler Park, 8200ft, 14-VIII-[19]52/ H. B. Leech, J. W. Green collectors (2, CASC); Rustler Park, Chiricahua Mts, 8500', VII-12-1957/ F. X. Williams collector (1, CASC); Chiricahuas, Rustlers Park, 7-18-[19]63, PSB (1, CASC); Chiricahua Mts, Rustler Park, 8800', 2-Aug-1985, J. & D. Pakaluk (2, SEMC); Chiricahua Mts, Rustlers Pk, VII-14-1989/ collector G. H. Nelson (1, FSCA); Chiricahua Mts, Onion Saddle, 24-VII-1969, G. H. Nelson (1, FSCA); Chiricahuas, July-8-2013, on tree at night, 6930ft, Kyle E. Schnepf/ Pinery Canyon Capground 31°56.020'N, 109°16.365'W (1, KESC; DNA-MTEC023709); Chiricahuas, July-8-2013, 6930ft, at light, Kyle E. Schnepf/ Pinery Canyon Capground 31°56.020'N, 109°16.365'W (1, KESC; DNA-MTEC023710); Chiricahuas, July-9-2013, on downed pine log, 6930ft, Kyle E. Schnepf/ Pinery Canyon Capground 31°56.020'N, 109°16.365'W (1, KESC; DNA-MTEC023708); Huachuca Mts., 8-1-1927, 7-8-[19]32, R. H. Beamer (2, SEMC); Huachuca Mts, 8-1-1927, P. A. Readio (1, SEMC); Huachuca Mts, Carr Cyn. VII-7-[19]30/ J. C. Martin collector (3, CASC); Huachuca Mts, Upper Carr Cn., 7500ft, 6-10-VIII-[19]52/ H. B. Leech, J. W. Green collectors (6, CASC); Huachuca Mts, Miller Canyon, 6000ft, 5-VIII-[19]52/ H. B. Leech, J. W. Green collectors (1, CASC); [Coconino Co.] Flagstaff, 7-27-[19]36, R. H. Beamer (1, SEMC); Graham Co., Hospital Flat, 9050ft, Graham Mts., 19-VIII-1952/ H. B. Leech, J. W. Green collectors (3, CASC);

Camo Gr., Graham mts., 7000ft, VI-22-[19]66/ J. M. Davidson, M. A. Cazier collectors (1, SEMC); Mt Graham, 10000-10500ft, 19-VIII-[19]52/ H. B. Leech, J. W. Green collectors (1, CASC); Graham Mt, 7300ft, Aug-5-1960/ S. L. Wood, J. S. Karren, H. Shurtieff (1, BYUC); [Gila Co.], Pinal Mts, VIII-12-1933, VIII-21-1933, VIII-22-1933, VII-30-1954, Parker (3, CASC; 1, FMNH); Navajo Co., Navajo Mt, VII-14-[19]33/ H. N. Hultgren collector (1, CASC); Show Low, 8-6-[19]33, E. D. Ball (3, CASC); [Pima Co.], Mt. Lemon, 7000ft, July-25-1927/ Santa Catalina Mts/ Van Dyke collector (1, CASC); same locality as previous/ J. O. Martia collector (1, CASC); Mt. Lemon, Bear Wallow area/ VII-6-1959, R. H. Arnett, Jr. (1, FSCA); Santa Catalina Mts, VII-1936, VII-15-1938, Jun-1940, Jun-28-1940, Bryant (4, CASC); Catalina Mts, VII-21-[19]42/ Van Dyke collection (2, CASC); Santa Catalina Mts, VII-16-1950, L. D. Beamer (1, SEMC).

California: [Riverside Co.], Tahquitz Cn, VI-30-[19]28/ Van Dyke Collection (4, CASC); San Bernardino Co., Bluff Lake, VII-26, 7500'/ C. A. Frost Collection (1, MCZC, MCZ-ENT00641970). **Colorado:** [No data], Snow (2, SEMC); [Fremont Co.] Phantom Canyon, 4-VIII-1964, Benj. H. Banta/ Fremont co Station no. 32, el 8650ft (2, CASC); La Plata Co., Vicinity of Durango, 55-7000ft, July-23-Aug-8-1885/ F. C. Bowditch (1, MCZC, MCZ-ENT00641980); [County?], Parkmen [?] Lake, Vannmin [?] col. (1, CASC); [Routt Co.] Steamboat Springs, VIII-15-[19]45, O[tto] B[ryant] (1, CASC); [Teller Co.] Florissant, Expedition 1906/ H. C. Fall collection (2, MCZC, MCZ-ENT00641989, MCZ-ENT00641990); Florissant, July-[19]07, July-15-[19]07, S. A. Rohwer (2, MCZC, MCZ-ENT00641991, MCZ-ENT00641992). **Montana:** Daniels Co., W. of Scobey, Jul-16-1957, R. C. Froeschner (1, MTEC); Fergus Co., Missouri R. at

FRB, 18-20-Aug-1993, D. L. Gustafson col (1, MTEC); Gallatin Co., 1mi W Four Corners, Sheds Brdg, Gall. R., 5200ft, 26-Jul-1986, D. L. Gustafson col (1, MTEC); 3 mi NE Three Forks, Madison River overflow pitfall, 4050ft, 22-Jun-20-July-1988/ C. E. Seibert colr (1, MTEC); Jefferson Co., Whitehall, KG11PD51004, 45.8766°N, 112.1013°W, Jul-27-Sept-2011, 4380ft, USDA, LF, a-pinene, ETOH (1, MTEC; DNA–MTEC023712); [Lewis and Clark Co.], Helena, July/ 1915, W. M. Mann (1, MCZC, MCZ-ENT00641968); Madison Co., 7-6-[19]40, Bliler (1, MTEC); Jefferson R.-Hells Canyon FAS, 22-July-2007, 45.6326°N, 112.3187°W, 1383m, D. L. Gustafson colr 10608 (1, MTEC; DNA–MTEC023717); Roosevelt Co., Wolf Point river park pitfall trap, 8-Aug-1991-20-Aug-1992, D. L. Gustafson (1, MTEC); Rosebud Co., Tongue R., Ashland, pitfall trap, 6-Jun-4-Aug-1991, D. L. Gustafson (1, MTEC); Toole Co., Marias River Shelby City Camp, 48.4242°N, 111.8729°W, 15-July-28-Aug-2015, 3106ft, C. Hart, F. Etzler (2, MTEC; DNA–MTEC023718, MTEC023719). **Nebraska:** Sioux Co., Warbonnet Canyon, VII-20-1927, F. H. Shoemaker (1, CASC). **New Mexico:** [No data] (1, MCZC); [Grant Co.], Pinos Altos, July-4-1975, K. Stephens, leg (7, FSCA); [Sandoval Co.], Jemez Spring, J. Woodgate (1, MCZC); [Santa Fe Co.], Santa Fe Cn., 8000ft, July-23-1926/ E. C. Van Dyke collector (2, CASC). **South Dakota:** [Custer Co.], Custer, VI-10-18-1935, A. Thrupp (1, CASC); [Pennington Co.], Hill City, VIII-1-5-1935, A. Thrupp (1, CASC). **Washington:** [Whitman Co.], Pullman, 27-July-[18]94 (1, WSUC). **Wyoming:** [Fremont Co.], Lander, 7-22-[19]53, R. R. Dreisbach (1, FMNH); Yellowstone N. P., 44°55'N, 110°24'W, Lamar Valley, 1993 ungulate study, D. L. Sikes Colr./ 90m from SE corner Trumpeter Lake, 6080', 49.73.045N, 5.50.005E/ site 7

control, pitfall trap, 20-27-Jul-1993, 27-Jul-3-Aug-1993 (17, MTEC); as previous except, bison carcass, pitfall trap, 20-27-Jul-1993, 27-Jul-3-Aug-1993, 2-10-Aug-1993, 10-17-Aug-1993 (4, MTEC); Yellowstone Nat'l Park, Slough Creek Camp, 23-VII-[19]83/ R. M. and M. A. Brown collectors (1, CASC); Yellowstone Nat'l Park, Madison River/ Ellen Beck collector (1, CASC).

Hemicrepidius tumescens (LeConte, 1861)

Asaphes tumescens LeConte, 1861: 348; Candeze 1863: 224; Horn 1880: 72.

Hemicrepidius tumescens (LeConte, 1861): Van Dyke 1932: 444; Lane 1952: 66;

Hatch and Kincaid 1958: 14.

Figs. 33a–33e.

Diagnosis

Hemicrepidius tumescens can be distinguished from all other species of *Hemicrepidius* by the posterior margin of the hypomeron emarginate and with the ventral hind angle projecting, narrow, and truncate; small tarsal lobes; and moderately long, grey or gold setae. It is very close in appearance to *H. californicus* and *H. mescalero*, and characters to distinguish *H. tumescens* from these species is given in their respective diagnoses above.

Description:

Length 11–17mm, width 3–5mm; color red-brown to piceous, elytra not contrasting pronotum, legs, antennae and ventral surface often lighter than dorsal side; integument shining. Setae moderate, suberect, grey, rarely gold. **Head:** punctures subumbilicate, nearly contiguous; integument shining; frons flat to very weakly concave anteromedially; frontal carina roughly v-shaped, incomplete medially, confluent with medial posterior margin of clypeal edge; eyes small and weakly bulging; antennae serrate, antennomere 2 subcylindrical, antennomere 3 subtriangular, $2\times$ length of 2, and with setation intermediate between 2 and 4, antennomere 3 subequal in length to 4, antennomeres 4 to 11 gradually getting narrower apically, $2\times$ longer than wide basally to about $3\times$ longer than wide apically, antennomeres 4 to 11 densely setose throughout, antennomere 11 with tip slightly constricted, antennae reaching midlength of pronotum (females) to passing pronotal posterior edge by one to two antennomeres (males).

Thorax: Pronotum as wide as long to $1.2\times$ wider than long, widest at hind angles or just anterior of midlength; sides weakly to broadly arcuate, almost subparallel laterally, narrowing on anterior half to one-third, lateral carina complete; hind angles divergent, lateral edge sinuate anterior of hind angle, dorsal carina present, moderate, directed antero-medially, nearly confluent with lateral carina posteriorly; punctures on disc smaller than to subequal to punctures on head, simple to vaguely subumbilicate, nearly touching to separated by one puncture diameter, punctures closer and larger laterally, nearly contiguous; posterior edge with sublateral incisures. Hypomeron with subumbilicate punctures, nearly contiguous anteriorly and becoming less dense

posteriorly; posterior margin emarginate with hind angle visible ventrally, well projecting, narrow, and truncate at tip, medial margin without impunctate line medially. Prosternum punctuation smaller than punctuation on hypomeron, simple, nearly touching laterally, much less dense medially, separated by up to two puncture diameters; anterior lobe straight to weakly deflexed, short, truncate to broadly rounded, not covering or partially covering ventral mouthparts; prosternal process straight to weakly curved dorsally between procoxae, moderate and straight past procoxae. Mesosternal fossa with lateral edges raised in near 90-degree angle, posterior edge of fossa narrowly truncate. Metaventrite with punctures simple to vaguely subumbilicate, smaller than punctures on hypomeron, dense throughout, nearly touching. Scutellar shield elongate, about twice as long as wide, broadly rounded posteriorly, lateral margins weakly sinuate, dorsal surface flat to weakly convex, anterior margin nearly straight, punctuation small, setae radiating from midline, similar to setae on pronotum and elytra. Elytral striae weakly impressed basally; interstriae flat to slightly convex, punctures small, random, giving wrinkled appearance; basal carina weakly crenulate, appearing not crenulate on small specimens. Legs with tarsomere lobes narrow, and relatively small, lobe on tarsomere 3 largest, small, narrow, only one visible laterally, lobe on tarsomere 2 second largest, small, narrow, lobes on tarsomeres 1 and 4 minute, visible only ventrally, often difficult to see.

Abdomen: Punctures smaller than punctures on metaventrite, simple to vaguely subumbilicate, very dense, nearly touching laterally, less dense medially; fifth ventrite narrowly rounded; lateral edge of each ventrite with distinct microserrations. **Male genitalia:** Figs. 5.33d and 5.33e. Parameres subparallel on basal three-fourths, sinuate on

apical one-fourth basad of apical expansion; apex narrowly pointed, membranous, setose ventrally. Medial lobe narrow, subparallel most of length, narrowing at apex; basal struts mostly straight, directed latero-basally at 135-degree angle, and curved just at apex. Basal piece with membranous area majority and broadly curved basally.

Distribution

Specimens have been examined from the following provinces and states;
CANADA: BC; USA: CA, OR, WA (Fig. 5.34b).

Notes

Hemicrepidius tumescens is very similar in appearance to *H. californicus* and has also been collected along the coast. These two species are likely sister species, with *H. tumescens* more common in the north, and *H. californicus* more common in the south.

Larvae have not been associated for this species.

Specimens Examined

Types Examined. Of *Asaphes tumescens*: **Holotype:** [gold disk]/ *A. tumescens* Lec/ Type #2611; male; type locality Santa Cruz Island, California; in MCZC. **Syntype:** [gold disk]; female; in MCZC.

Other Specimens Examined, 159. **Canada: British Colombia:** Queen Charlotte Islands, Graham Island, mouth of Tlell River, sea level, 17-July-1981, stop #81-35, D. H.

Kavanaugh collector (2, CASC); Queen Charlotte Islands, Graham Island Tlell, 1 km S of Tlell River Mouth, 3-5m, 17-July-1983, Stop# 83-43, D. H. and M. D. Kavanaugh (3, CASC). **USA: California:** [No data]/ Coll. Janson / *A. hirtus* (female), *dilaticollis* Motsch (1, BMNH); Humboldt Co., 12-IV-1927/ E. R. Leach, Brit. Mus. 1927-457 (3, BMNH); 11-V-1927, E.R. Leach (2, MCZC); Samoa, VI-21-[19]16/ F. E. Blaisdell collector (3, CASC); Somoa [*sic*], 23-5/ H.S. Barber (2, MCZC); Santa Barbara Co., Santa Cruz Island, vicinity Pila Christi, 2-VIII-1969, D. C. Rentz and D. Weisman (1, CASC).

Oregon: Baker Creek, 4-26-1939, K. M. and D. M. Fender (1, OSAC0000551359); [Clatsop Co.], Cannon Beach, June-9-1927/ E. C. Van Dyke collector (2, CASC); Gearhart, June-12-1933, M. C. Lane col (1, WSUC); [Curry Co.], Gold Beach, VI-10-[19]36/ Van Dyke collection (7, CASC); Lincoln Co., VI-8-[19]41/ coll'd by F. W. Nunenmacher (5, FMNH); VI-8-[19]41, E. R. Leach (18, CASC); Burntwood [*sic*], VIII-6-1933/ S. C. Jones coll. (1, CASC); Waldport, June-7-1925, VI-13-[19]36, VII-24-1938/ E. C. Van Dyke collector (38, CASC); Waldport, 6-6-[19]26/ J. E. Davies collector (1, OSAC0000836988); [Tillamook Co.], Pacific City, 5-16-[19]34, 6-26-[19]38, 9-8-[19]38, VI-6-[19]48, VI-30-[19]49 (2, MCZC; 8, OSAC0000551345-OSAC0000551348, OSAC0000551350-OSAC0000551353); Pacific City, VII-18-1952, K. M. and D. M. Fender (1, OSAC0000551354); Sandlake, 6-13-1939, K. M. and D. M. Fender (3, OSAC0000551355, OSAC0000551356, OSAC0000551360); Seaside, Sept-15-1932 (1, OSAC0000551358); Tillamook, VIII-15-1937, Dan Bonnell (2, OSAC0000551349, OSAC0000551357); Woods, 7-25-1940, K. M. and D. M. Fender (1, OSAC0000551361). **Washington:** 27-VII-2-VIII-[20]02, P. M. Hammond/ Ocean

shores, dunes, beach/ Hammond, P. M., BMNH(E) 2002-133 (1, BMNH); Gray's Harbor Co., Grayland, June-3-1951, Ruth Beresford (1, OSAC0000551337); Capalis [*sic*] Beach, VI-13-[19]36/ Van Dyke collection (1, CASC); Twin Harb. Beach St. Pk., July-10-1949, M. H. Hatch (7, OSAC0000551328-OSAC0000551334); Pacific Co., Long Beach, July-4-1931, VII-15-[19]36 (1, OSAC0000551338; 6, CASC); Ilwaco, July 1918, O. E. Miner (1, WSUC); Ocean Park, June-19-1930, July-4-1935 (5, OSAC0000551339, OSAC0000551340, OSAC0000551342-OSAC0000551344) Ocean Park, July-9-1948, R. P. Owen (1, OSAC0000551341); Ocean Park, July-12-1954, Helen B. James (1, WSUC); Ocean Park, June-22-1956, June-23-1956, June-29-1957, M. T. James (23, WSUC); Seaview, July-2-1929, July-18-[19]35 (2, OSAC0000551335, OSAC0000551336).

Locality Information for Non-North American *Hemicrepidius* in Molecular Tree

Athous deceptor (Candéze, 1863)

Mexico: Chiapas, 37 km by air SE Villaflores, 16.1499°N, 93.6076°W, 1350m, 11-VIII-2015, M. A. Johnson (1, FEEC; DNA–MTEC023720).

Hemicrepidius hirtus (Herbst, 1784)

Italy: Carpineto Romano, Johnnys Farm, Chestnut grove, 41.5986°N, 13.0961°E, 2493ft, 6-2006, Ivie, Foley, Martinsen (2, MTEC; DNA–MTEC023668, MTEC023669).

New World Species Formerly in *Hemicrepidius*

Most of the Central American species of *Hemicrepidius* are moved herein to *Athous*. These moves are supported by the female internal genitalia of Central American species (Fig. 5.35b) matching the internal female genitalia of the type species of *Athous*. Preliminary molecular data (Fig. 5.1) also support this transfer. *Hemicrepidius*, as currently defined, is not known to occur in the Neotropics.

Athous acuminatus (Champion, 1897) (*Hemicrepidius*) – **new combination**.

Sharon amoenus (Phillippi, 1861) (*Asaphes*) (moved in Arias and Eugleta 2015).

Athous chiacamensis Etzler – **new replacement name** for *Hemicrepidius biformis*

Champion, 1897, a secondary homonymy of *Athous biformis* Redtenbacher, 1859, currently a synonym of *Athous zebei* Back, 1852. Named for Chicam, Guatemala, where this species is found.

Athous bivittatus (Champion, 1897) (*Hemicrepidius*) – **new combination**.

Athous candezei (Champion, 1897) (*Hemicrepidius*) – **new combination**.

Athous consanguineus (Champion, 1897) (*Hemicrepidius*) – **new combination**.

Athous consobrinus (Champion, 1897) (*Hemicrepidius*) – **new combination**.

Athous cruciatus (Champion, 1897) (*Hemicrepidius*) – **new combination**.

Athous deceptor Candéze, 1863 (*Asaphes*) – **new combination, status resurrected**.

Athous flavipes (Candéze, 1863) (*Asaphes*) – **new combination**.

Athous germanus (Champion, 1897) (*Hemicrepidius*) – **new combination**.

Athous instabilis (Candéze, 1863) (*Asaphes*) – **new combination**.

Asaphes lecostigma Candéze, 1863 – syn of *Athous instabilis*.

Athous lecontei (Candéze, 1889) (*Hemicrepidius*)

Asaphes longicollis Candéze, 1863 – **reduced to synonymy** with *Athous deceptor*, the next available name, to prevent secondary homonymy with *Elater longicollis* Olivier, 1790, currently a synonym of *Athous bicolor* (Goeze, 1777), and sometimes recognized as a valid species in *Athous*. Champion (1897) used this name in preference to *A. deceptor* when he synonymized the two species.

Athous chiriqui Etzler– **new replacement name** for *Hemicrepidius longicornis*

Champion, 1897 a secondary homonymy of *Athous longicornis* Candéze, 1865.

The name is a noun in apposition for the Chiriqui province in Panama, where two of the type specimens were collected.

Pomachilus longipennis (Candéze, 1863) (*Asaphes*) – **new combination**.

Athous nitidus (Champion, 1897) (*Hemicrepidius*) – **new combination**.

Athous parvulus (Champion, 1897) (*Hemicrepidius*) – **new combination**.

Athous patruelis (Champion, 1897) (*Hemicrepidius*) – **new combination**.

Athous pictipes (Chevrolat, 1843) (*Agrypnus*) – **new combination**.

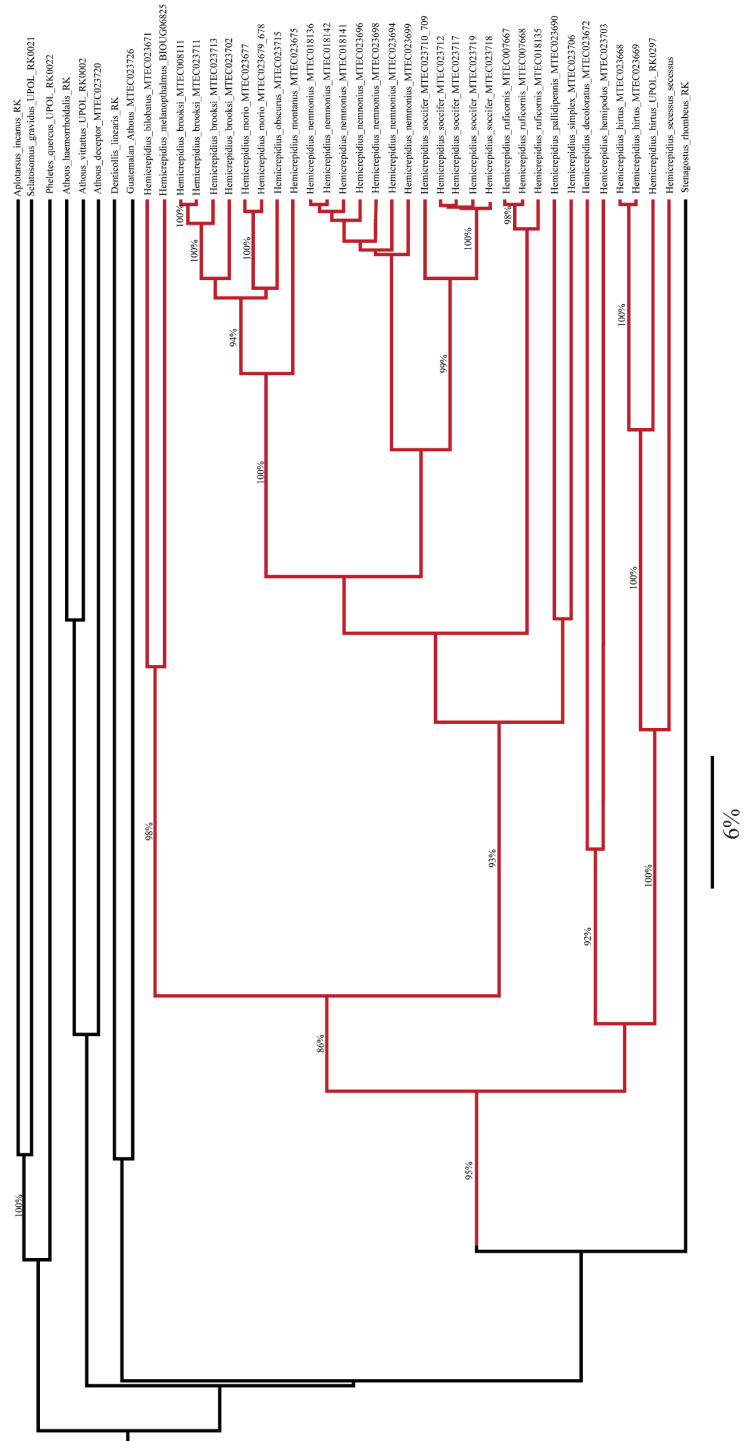


Figure 5.1. Bayesian tree of *Hemicrepidius* species, which are highlighted in red. *Aplotarsus* and *Selatosomus* set as outgroups. Genes amplified are two loci on CO1 and two loci on 28S. Only posterior probabilities greater than 85% are shown.

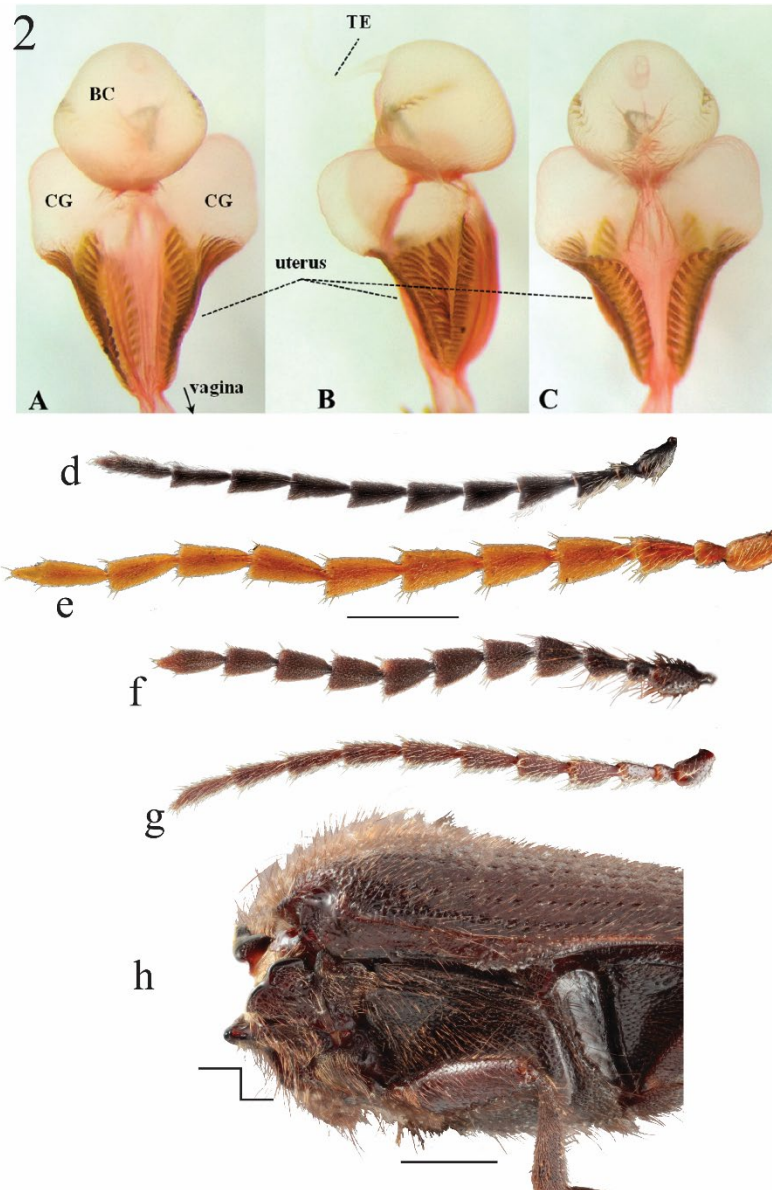


Figure 5.2. Morphological characters of *Hemicrepidius*. Female internal genitalia of *Hemicrepidius nemnonius* a) dorsal, b) lateral, c) ventral. Antennae types, all to scale: d) strongly serrate, with triangular third antennomere, *H. niger*; e) serrate, with impunctate medial line of antennomeres, *H. nemnonius*; f) serrate, lacking medial line, *H. californicus*; g) weakly serrate, *H. hemipodus*. Scale bar below e = 1mm. Mesothorax: h) lateral edges of mesothorax raised in near 90-degree angle, *H. californicus*. Stepped line to highlight character, scale bar below body = 1mm.

3

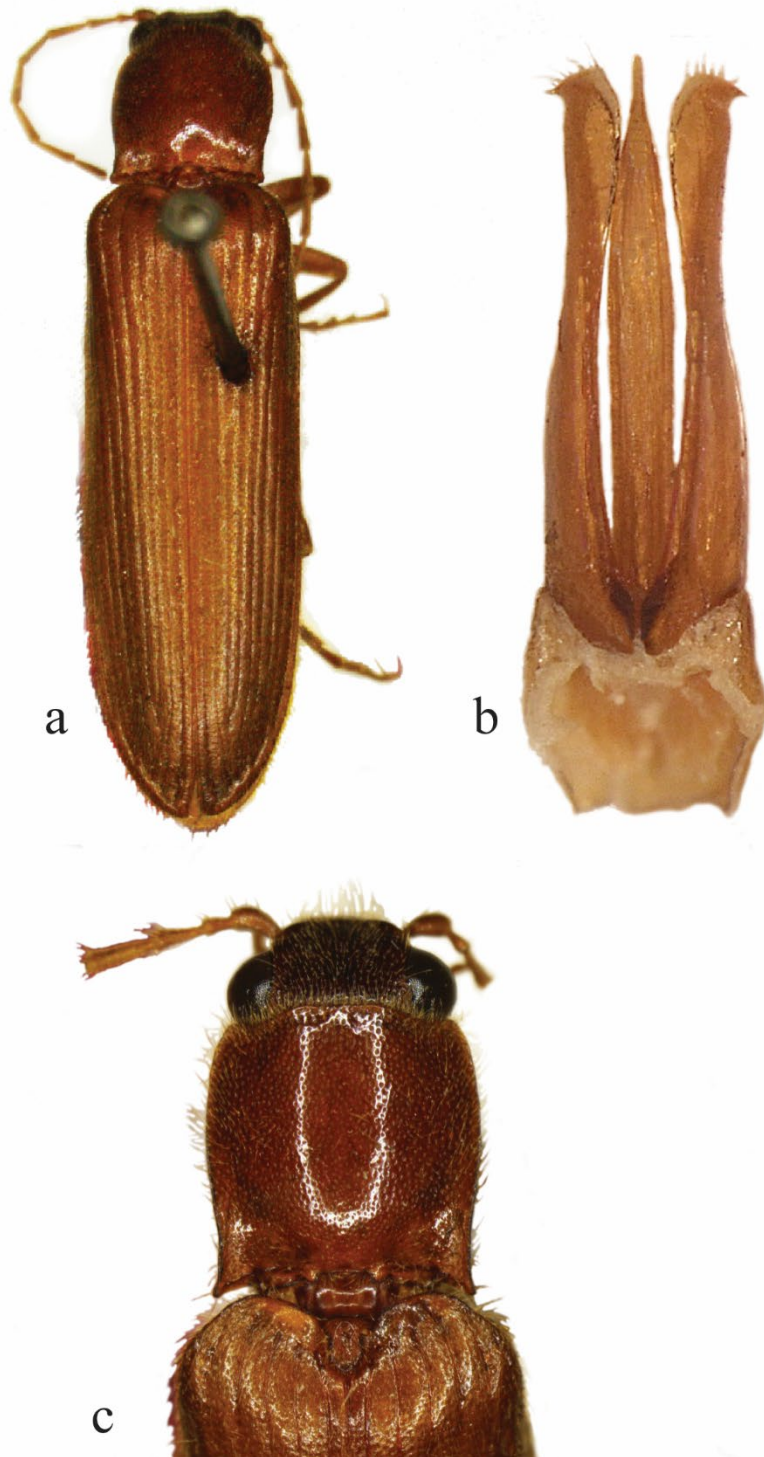


Figure 5.3. *Hemicrepidius audreyae* a) male dorsal habitus, b) male genitalia, dorsal view, c) pronotum, dorsal view.

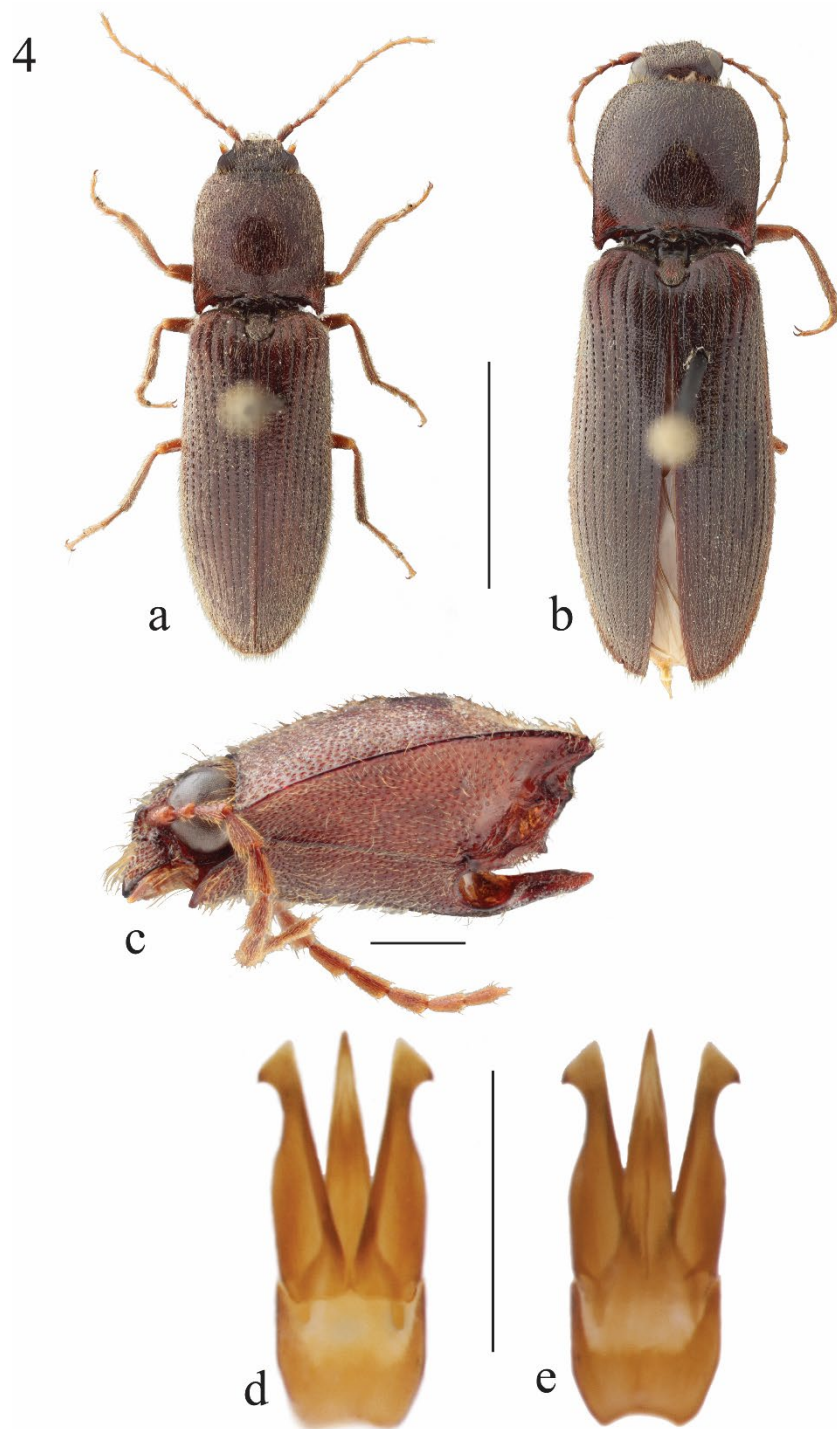


Figure 5.4. *Hemicrepidius bilobatus* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

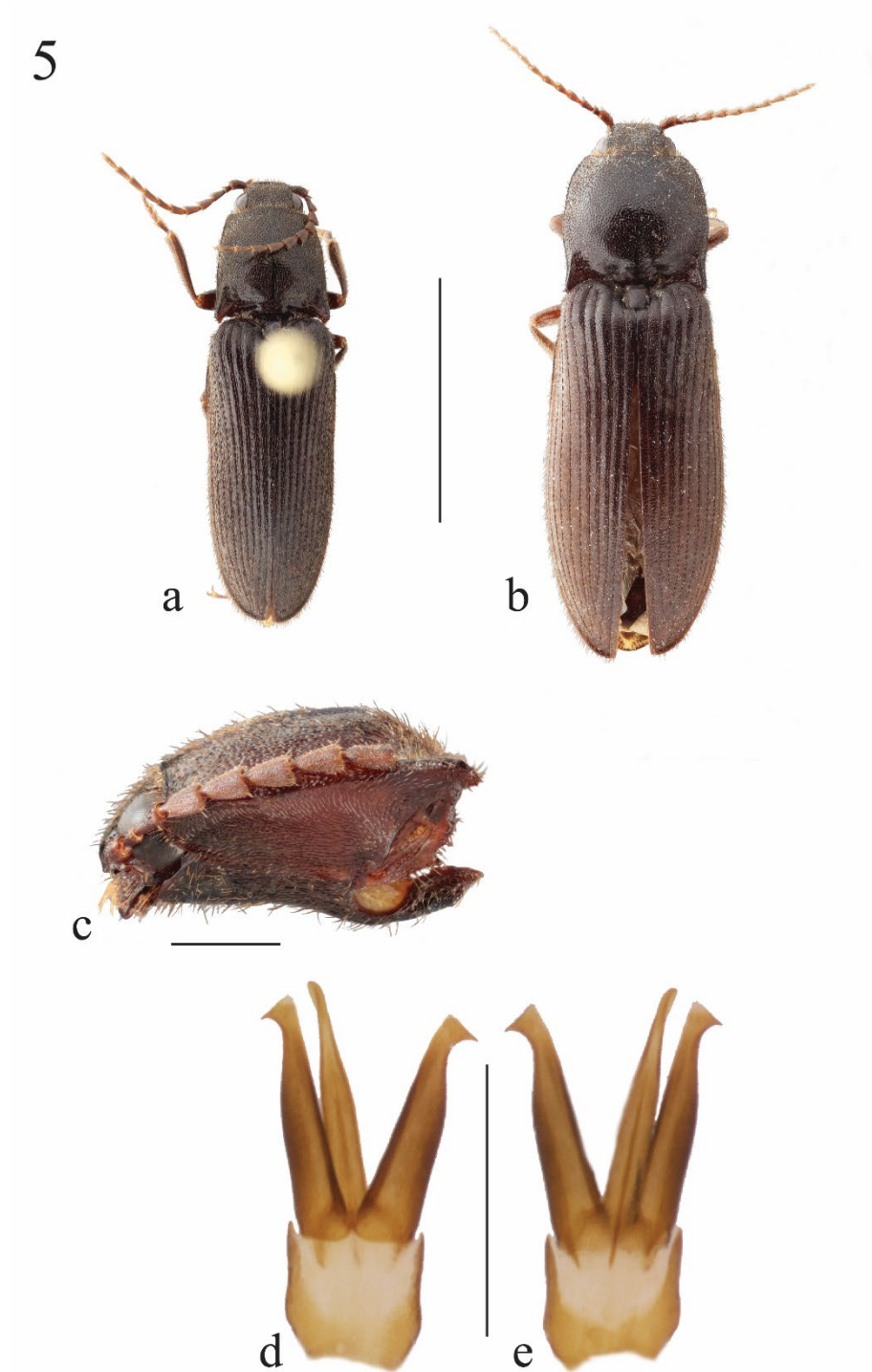


Figure 5.5. *Hemicrepidius brooksi* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

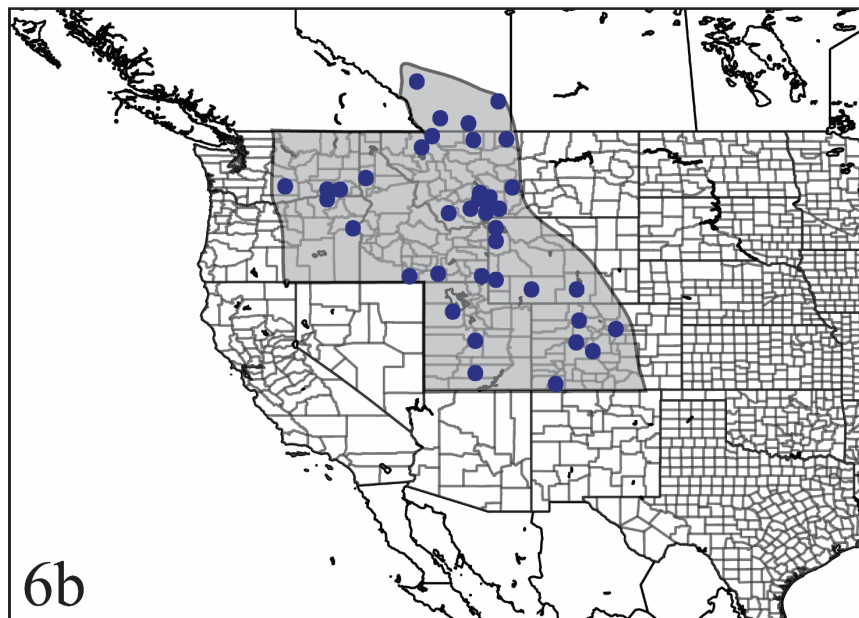
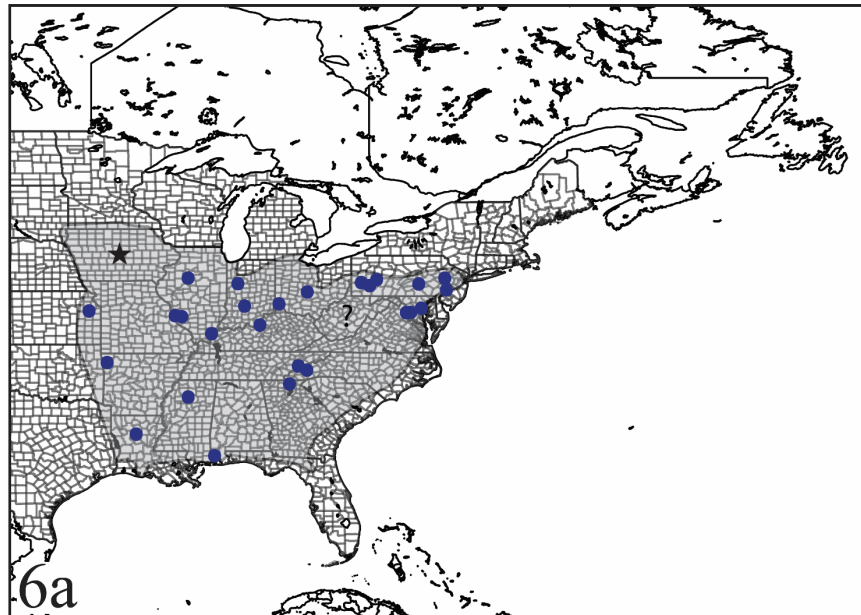


Figure 5.6. Distribution maps a) *H. bilobatus*, b) *H. brooksi*.

7

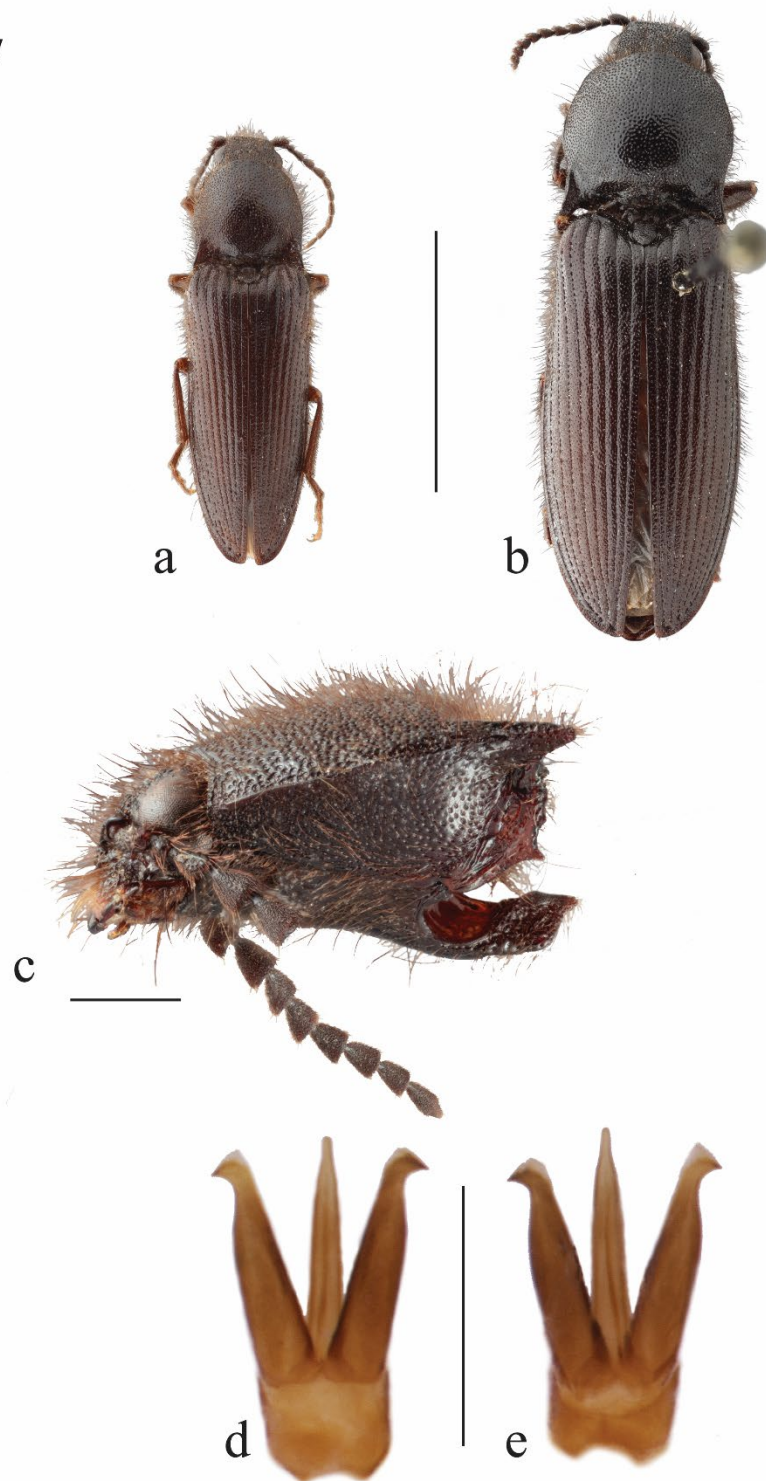


Figure 5.7. *Hemicrepidius californicus* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

8

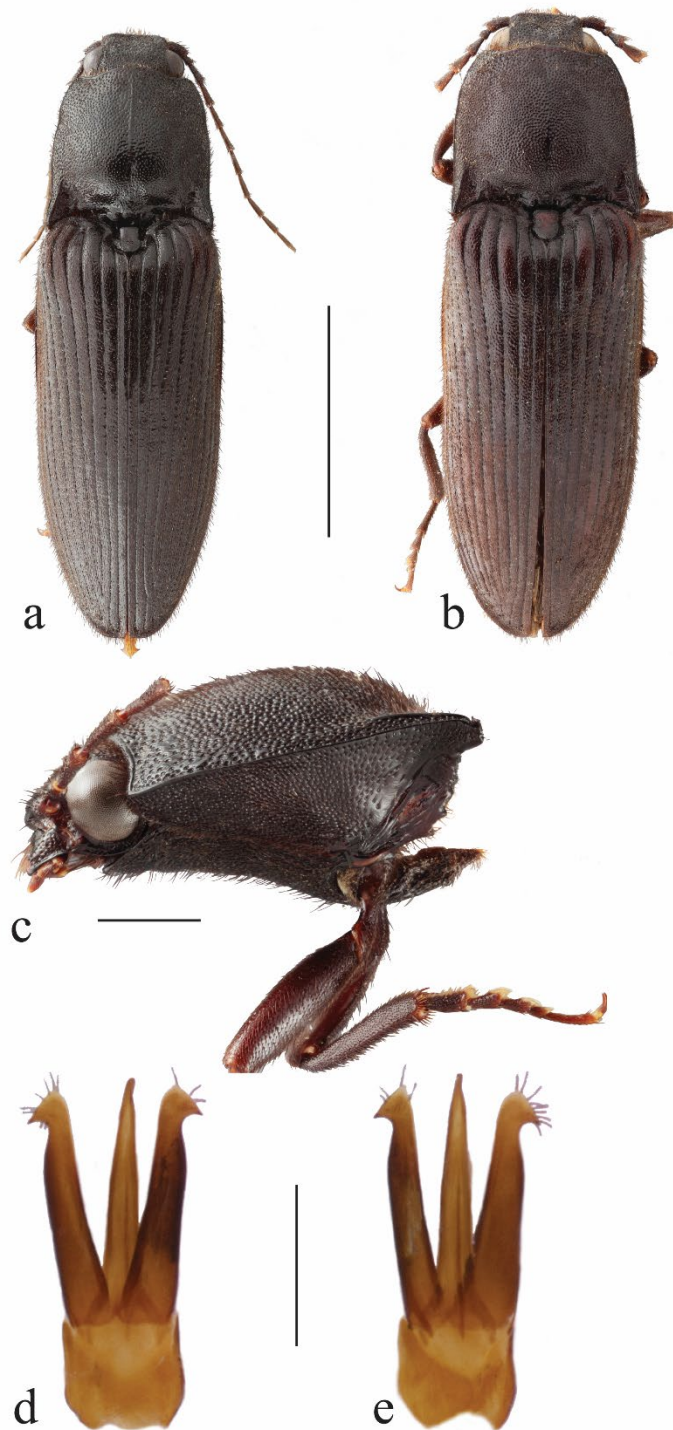


Figure 5.8. *Hemicrepidius carbonatus* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

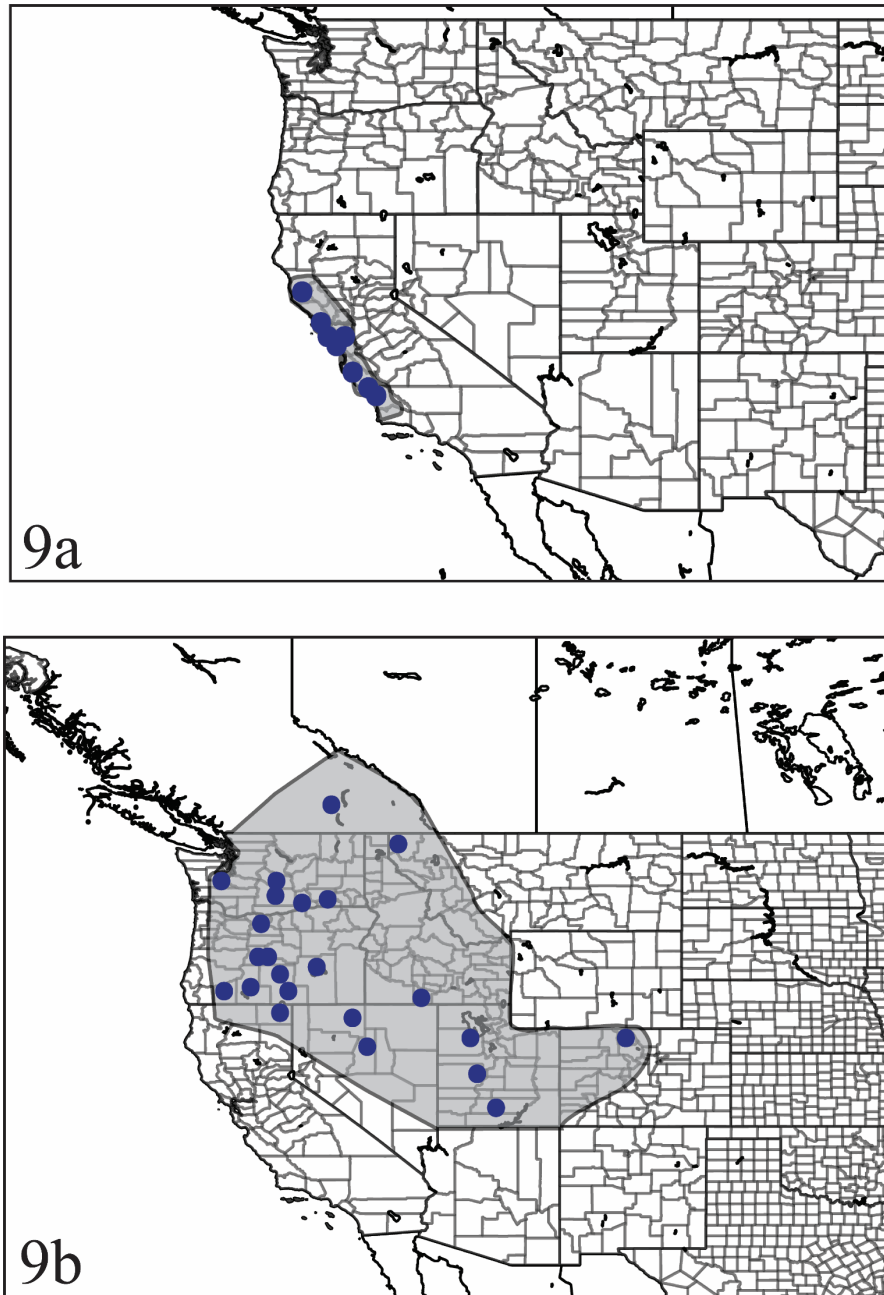


Figure 5.9. Distribution maps a) *H. californicus*, b) *H. carbonatus*.

10

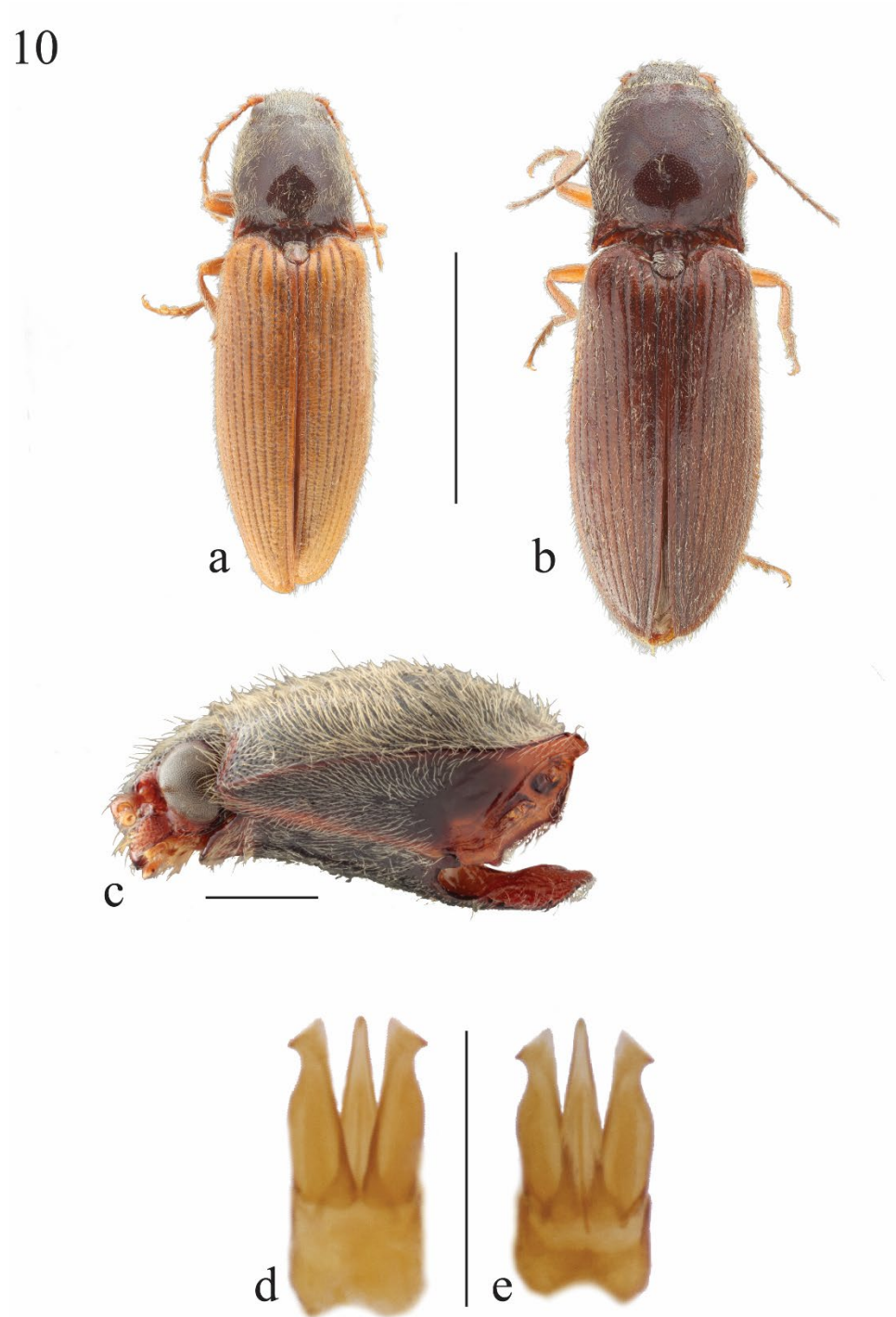


Figure 5.10. *Hemicrepidius decoloratus* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

11

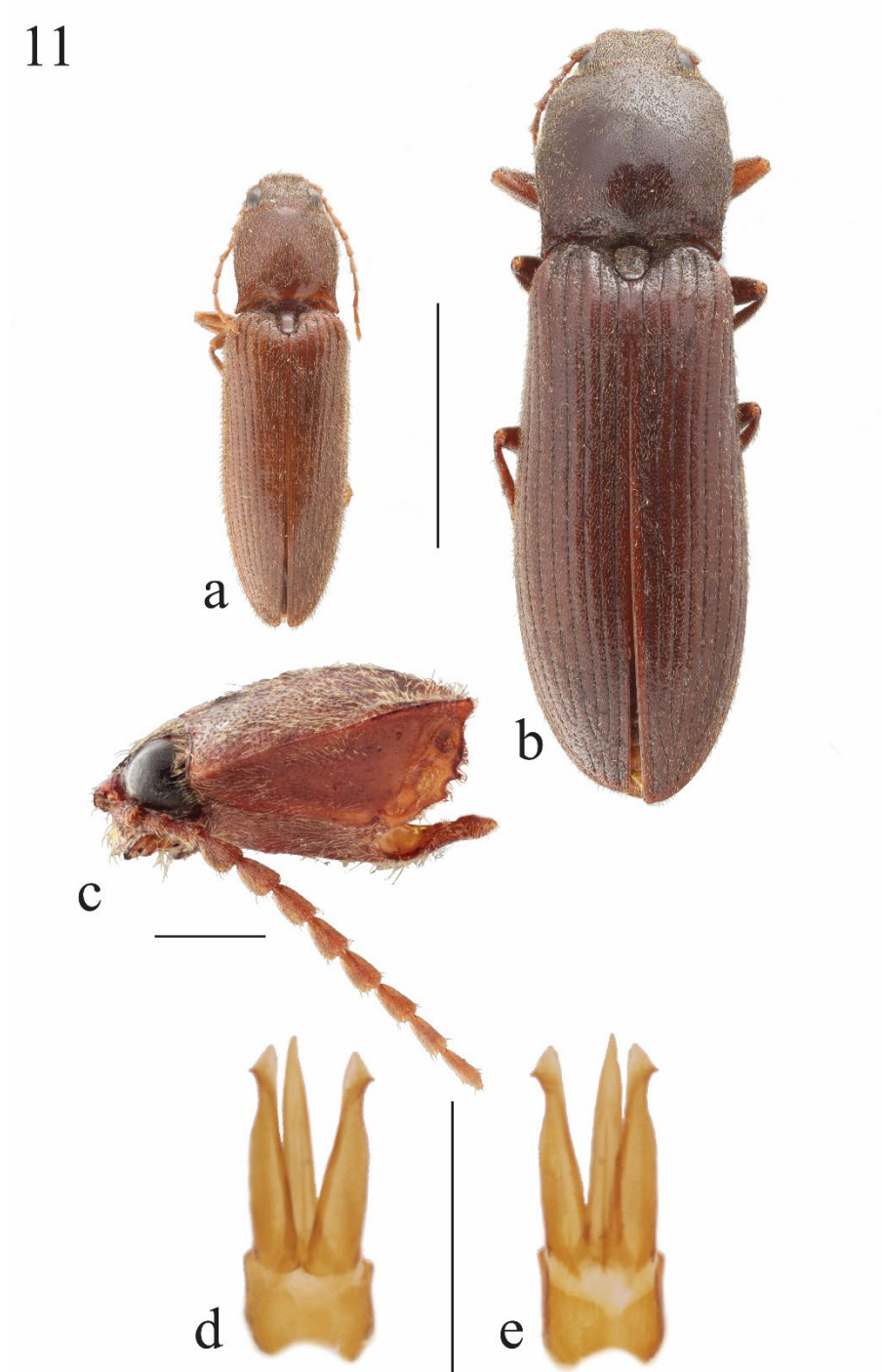


Figure 5.11. *Hemicrepidius falli* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

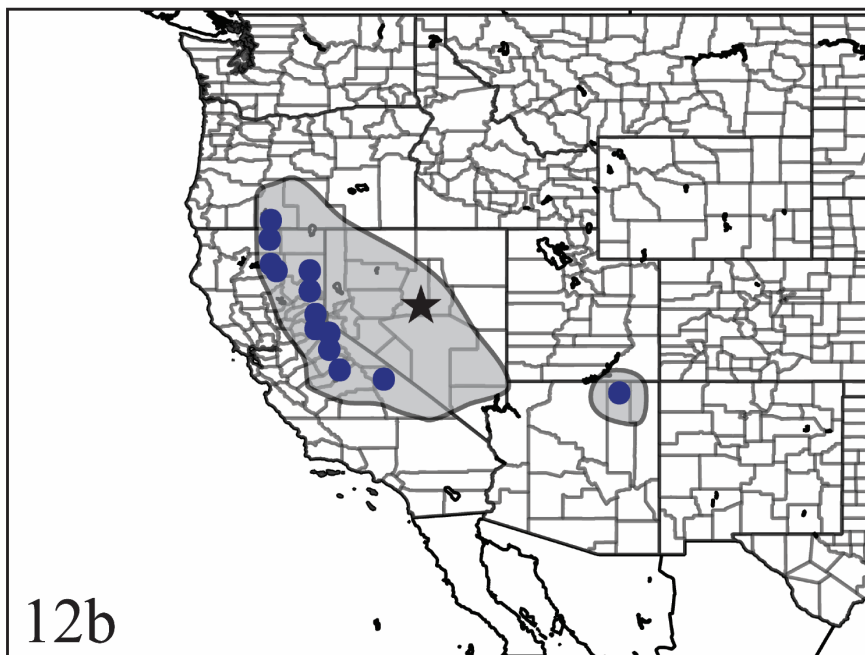
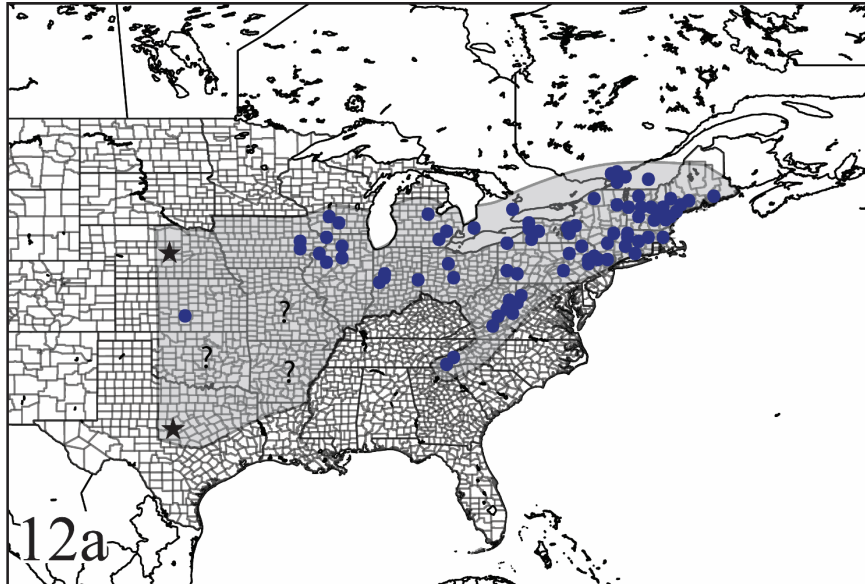


Figure 5.12. Distribution maps a) *H. decoloratus*, b) *H. falli*.

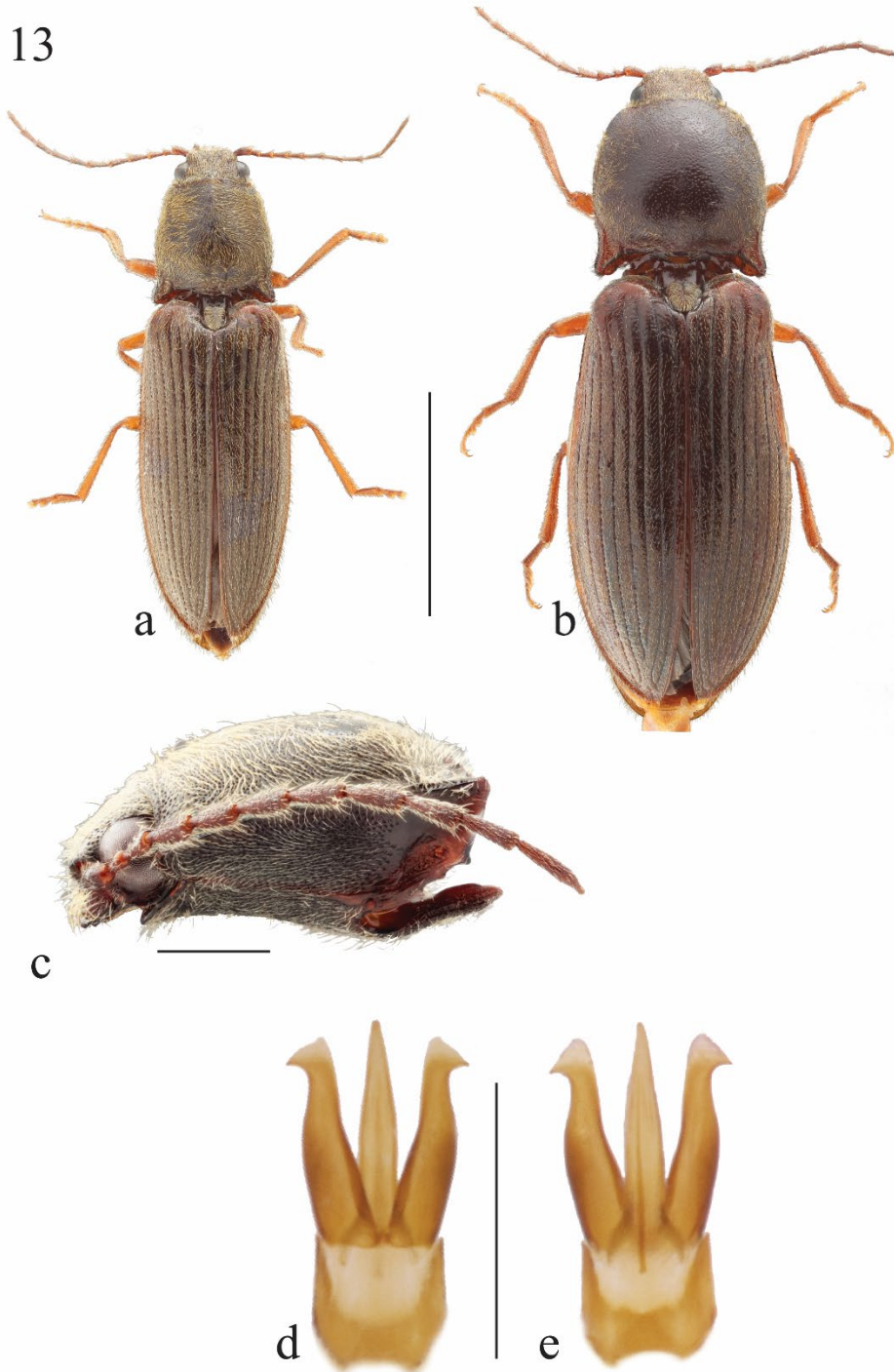


Figure 5.13. *Hemicrepidius hemipodus* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

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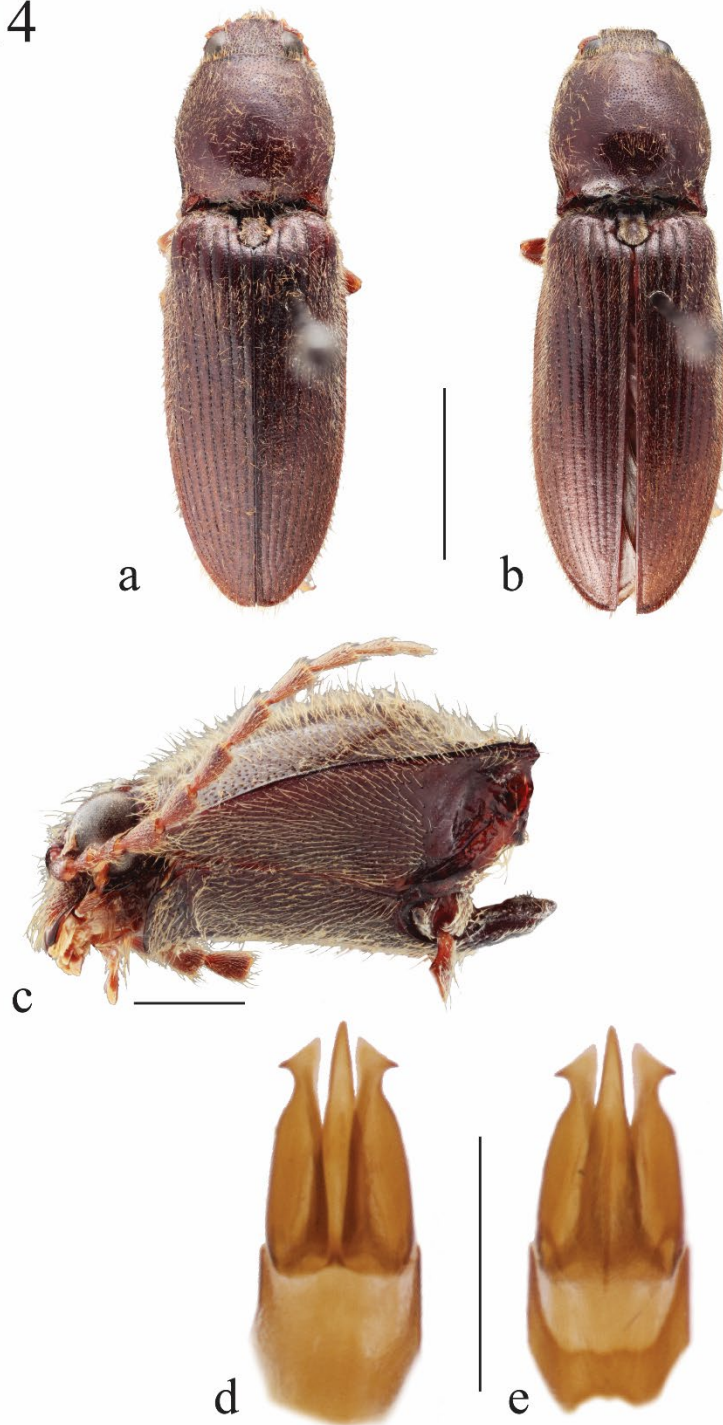


Figure 5.14. *Hemicrepidius indistinctus* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

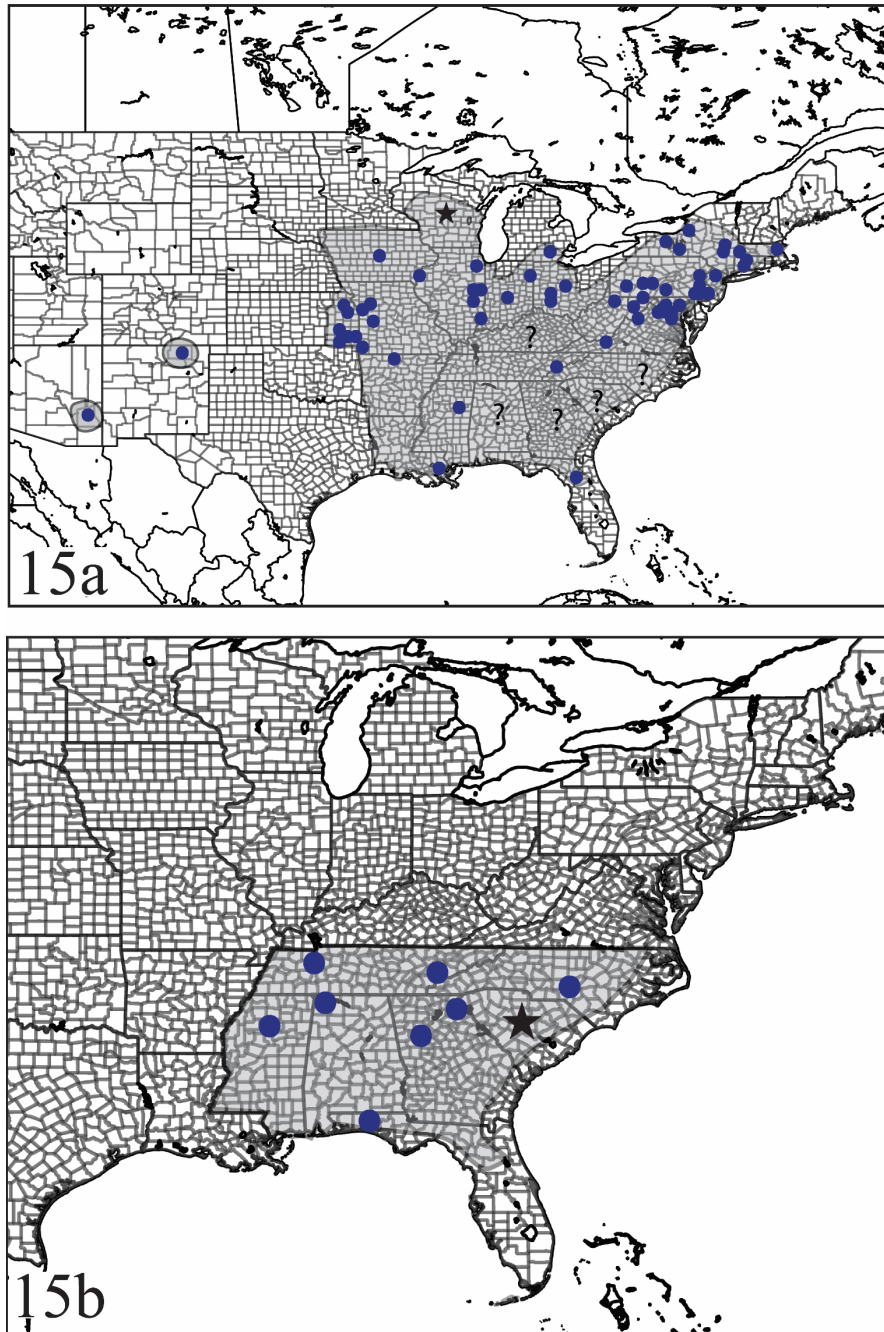


Figure 5.15. Distribution maps a) *H. hemipodus*, b) *H. indistinctus*.

16

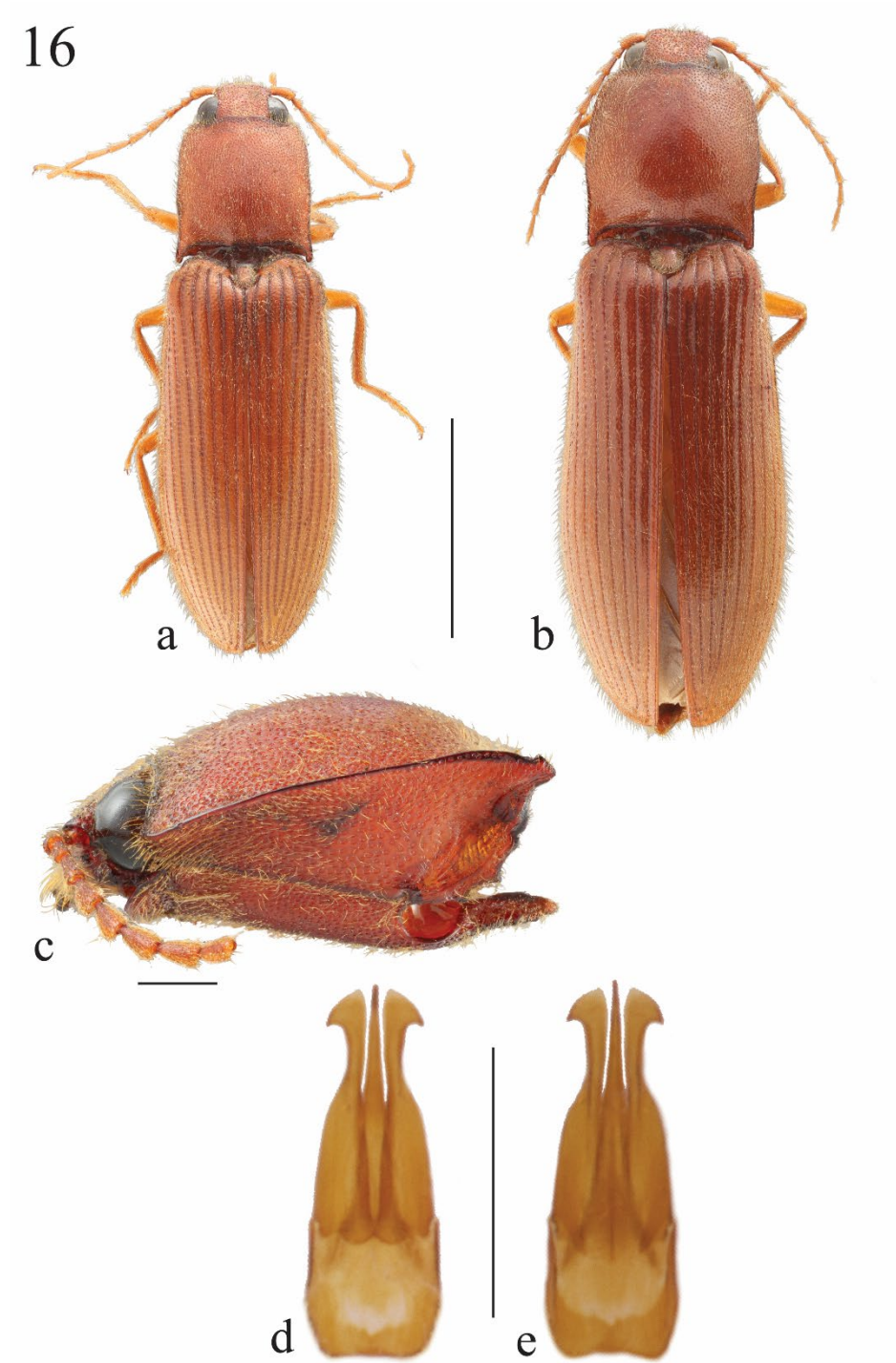


Figure 5.16. *Hemicrepidius melanophthalmus* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

17

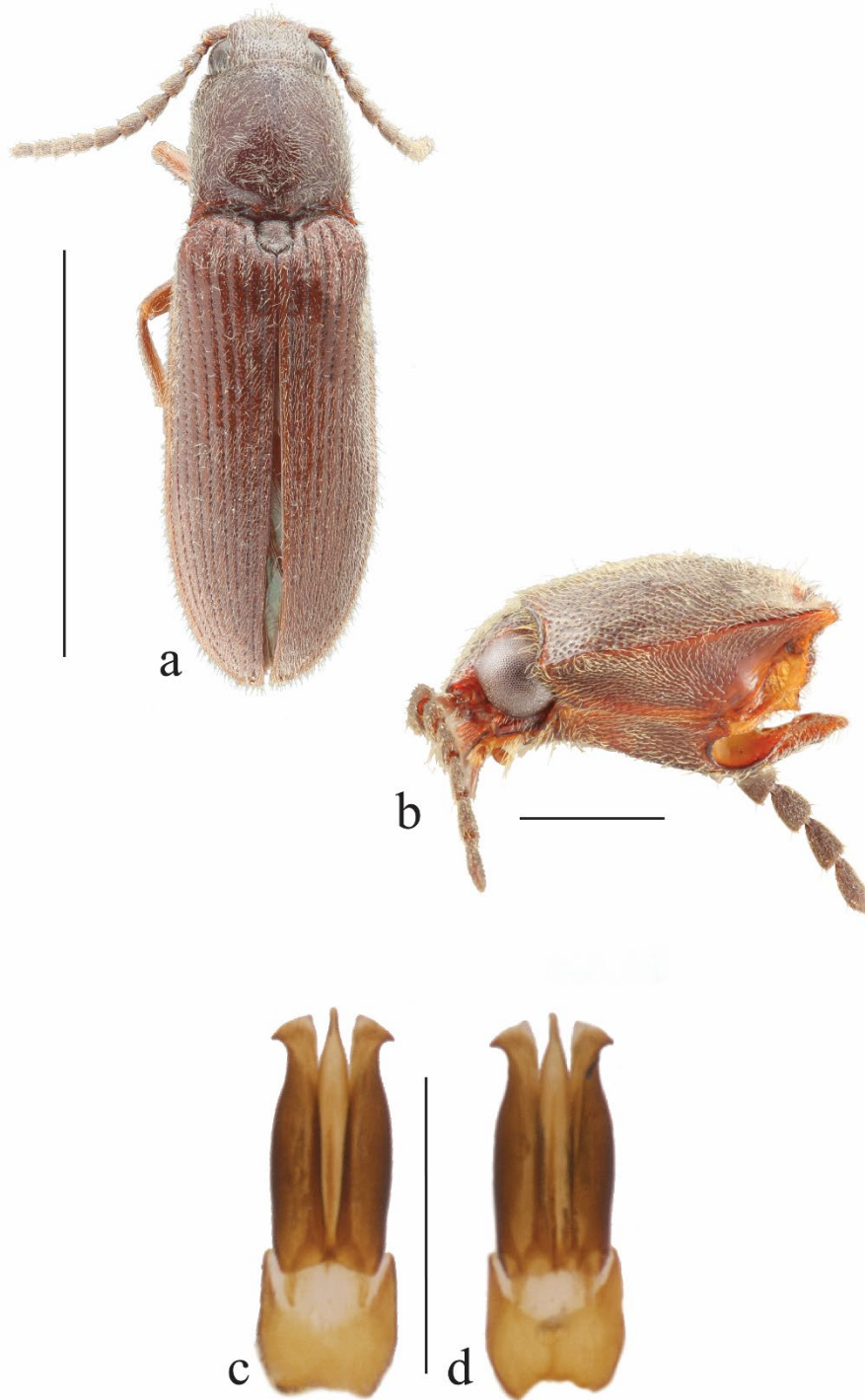


Figure 5.17. *Hemicrepidius mescalero* a) male dorsal habitus, b) pronotum, lateral view, c) male genitalia, dorsal view, d) male genitalia, ventral view. Scale bar left of 'a' equals 5mm. Scale bars below 'b' and between 'c' and 'd' equal 1mm.

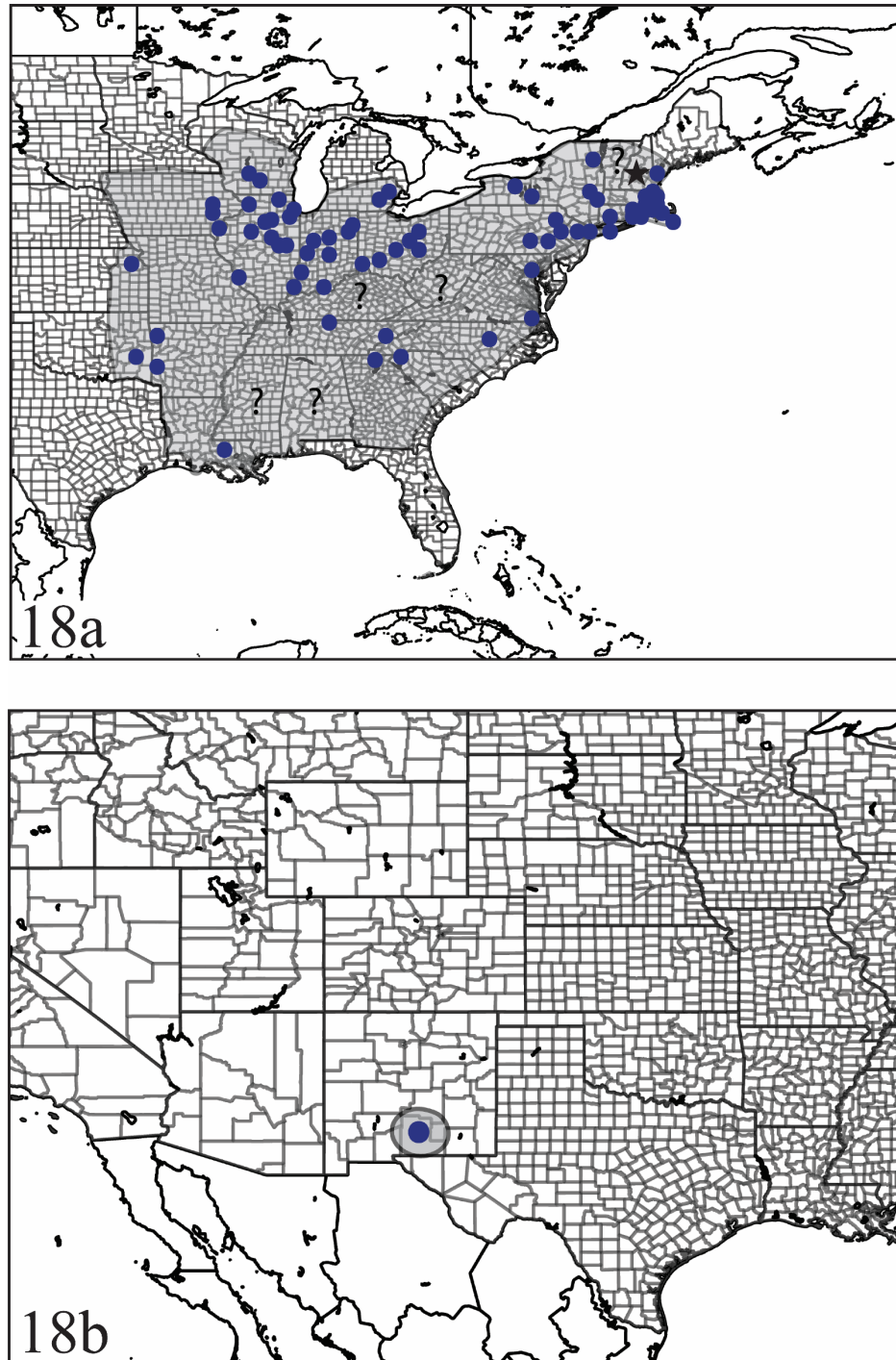


Figure 5.18. Distribution maps a) *H. melanophthalmus*, b) *H. mescalero*.

19

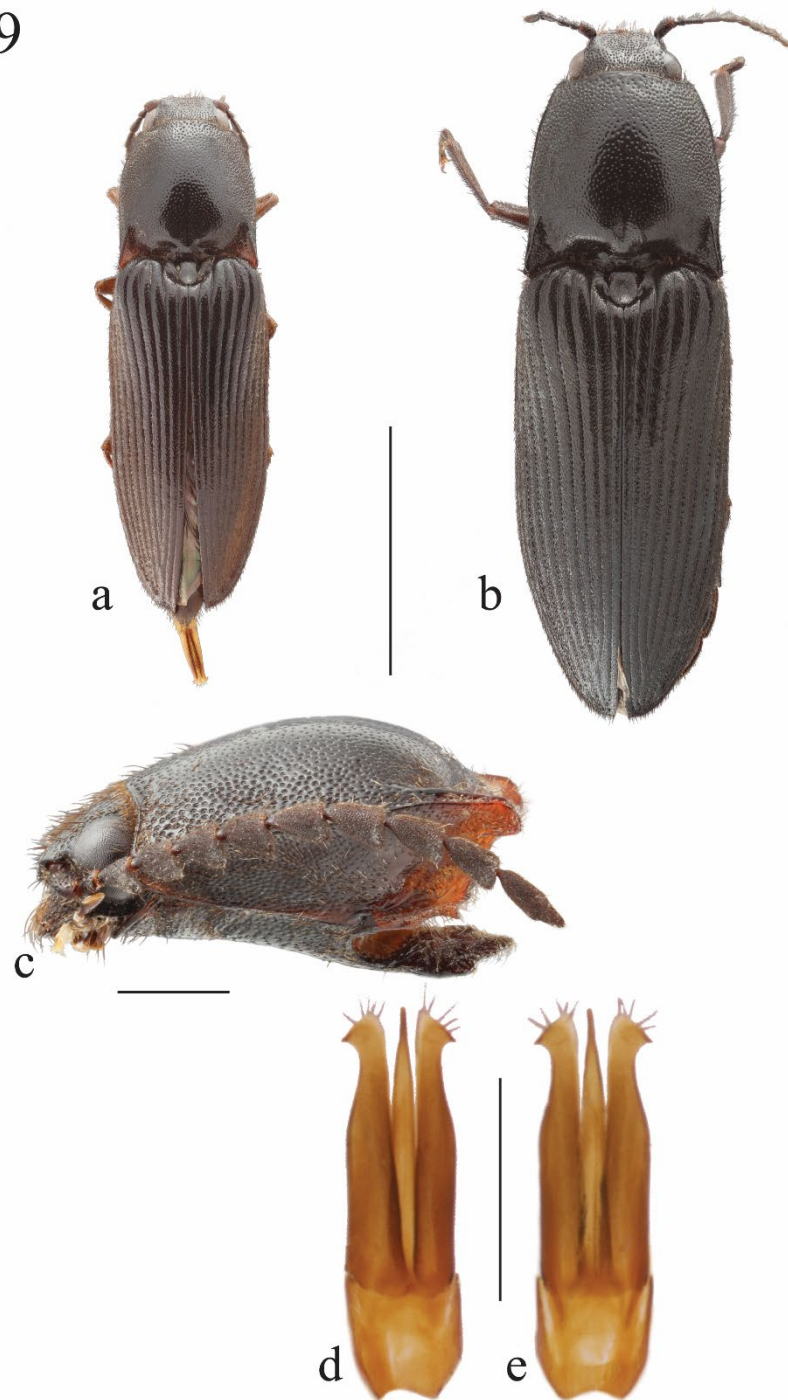


Figure 5.19. *Hemicrepidius montanus* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

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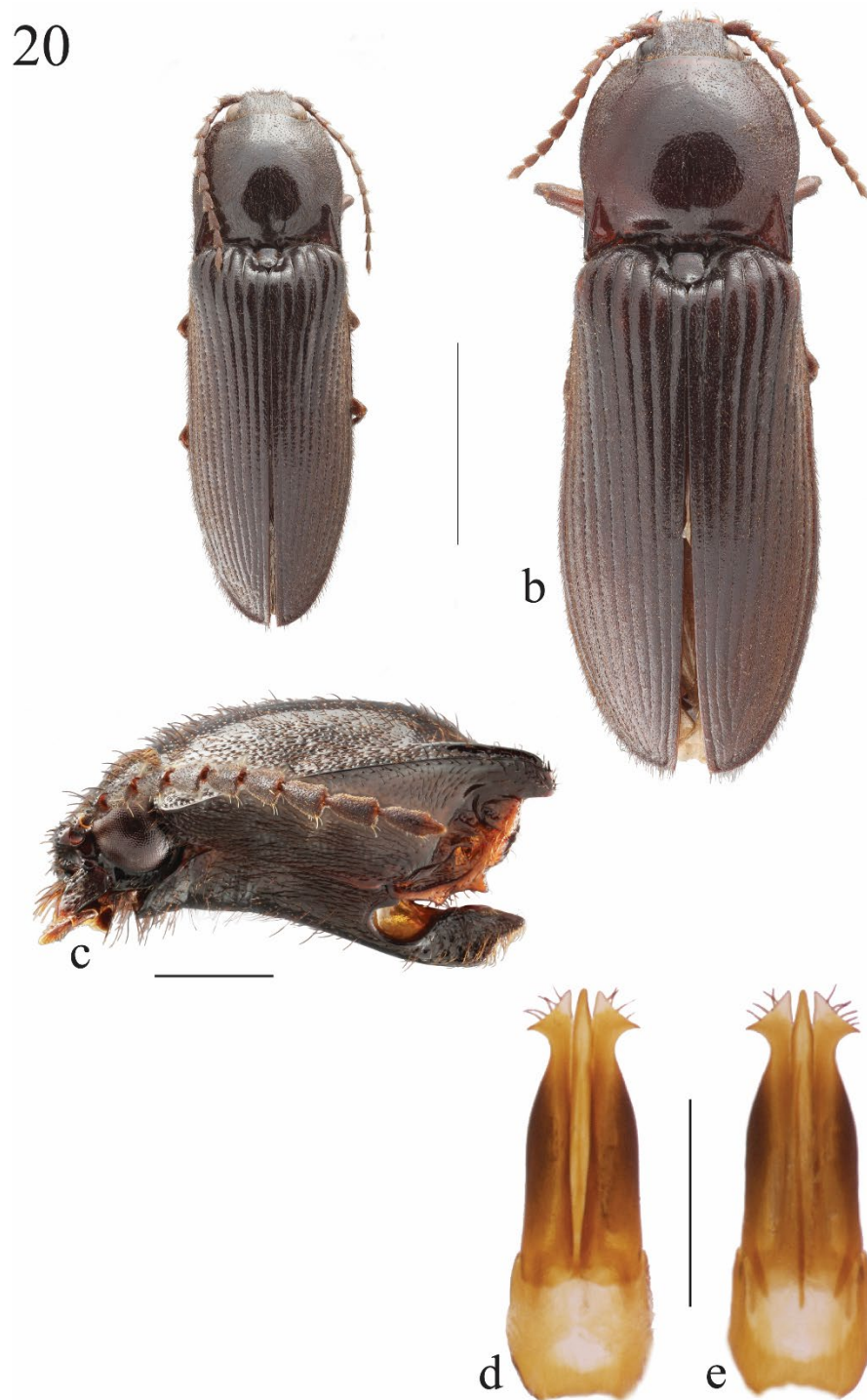


Figure 5.20. *Hemicrepidius morio* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

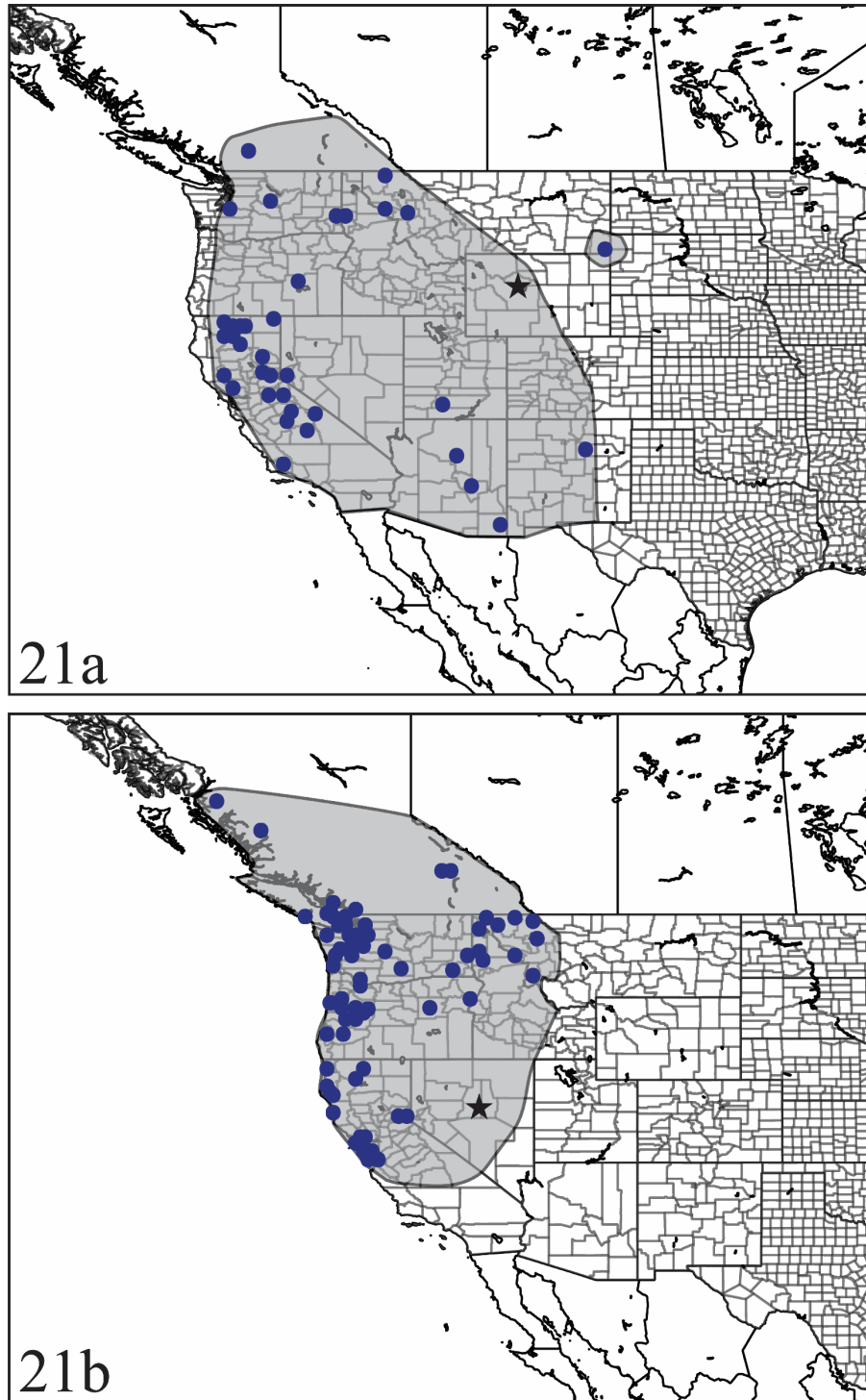


Figure 5.21. Distribution maps a) *H. montanus*, b) *H. morio*.

22

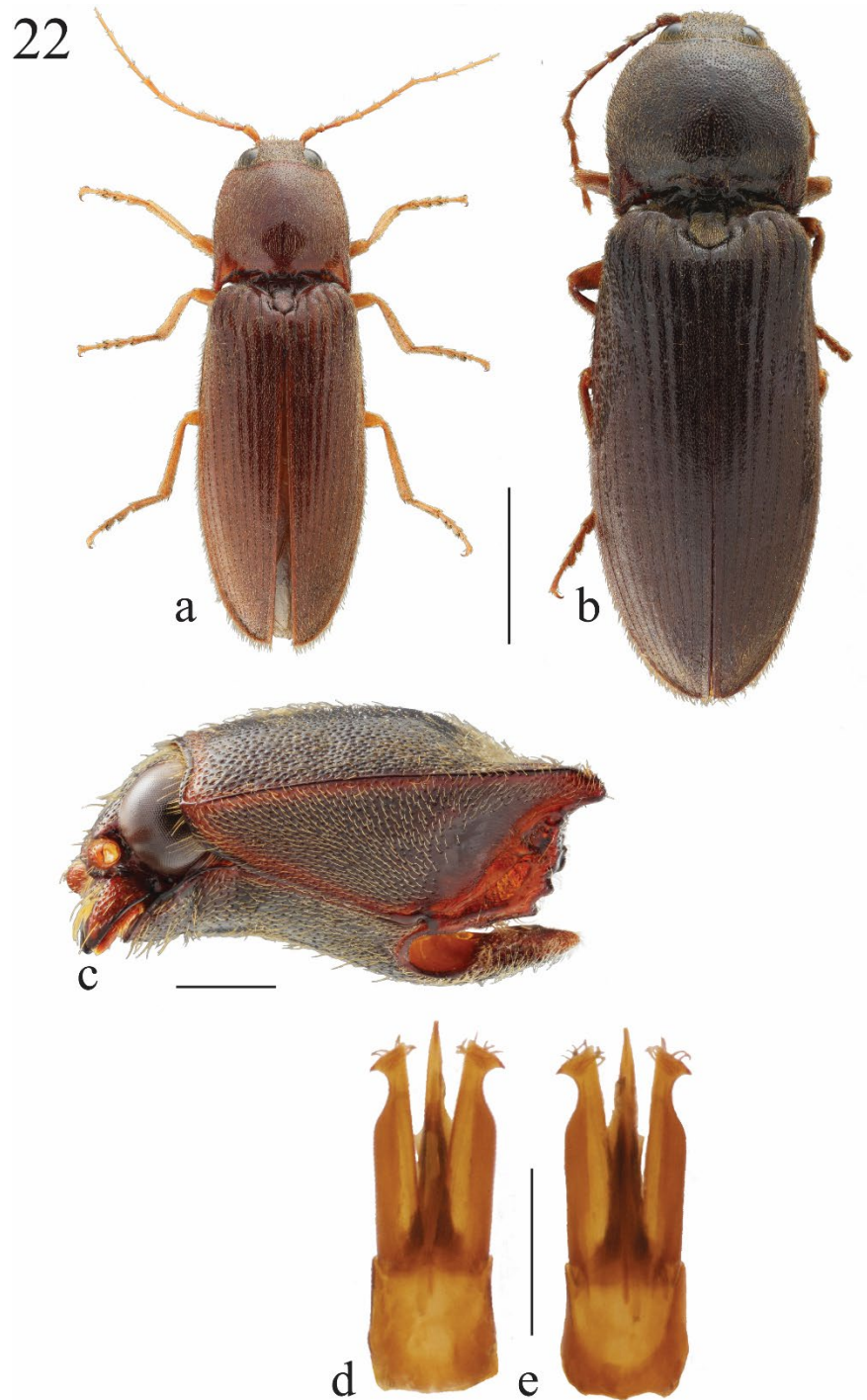


Figure 5.22. *Hemicrepidius nemnonius* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

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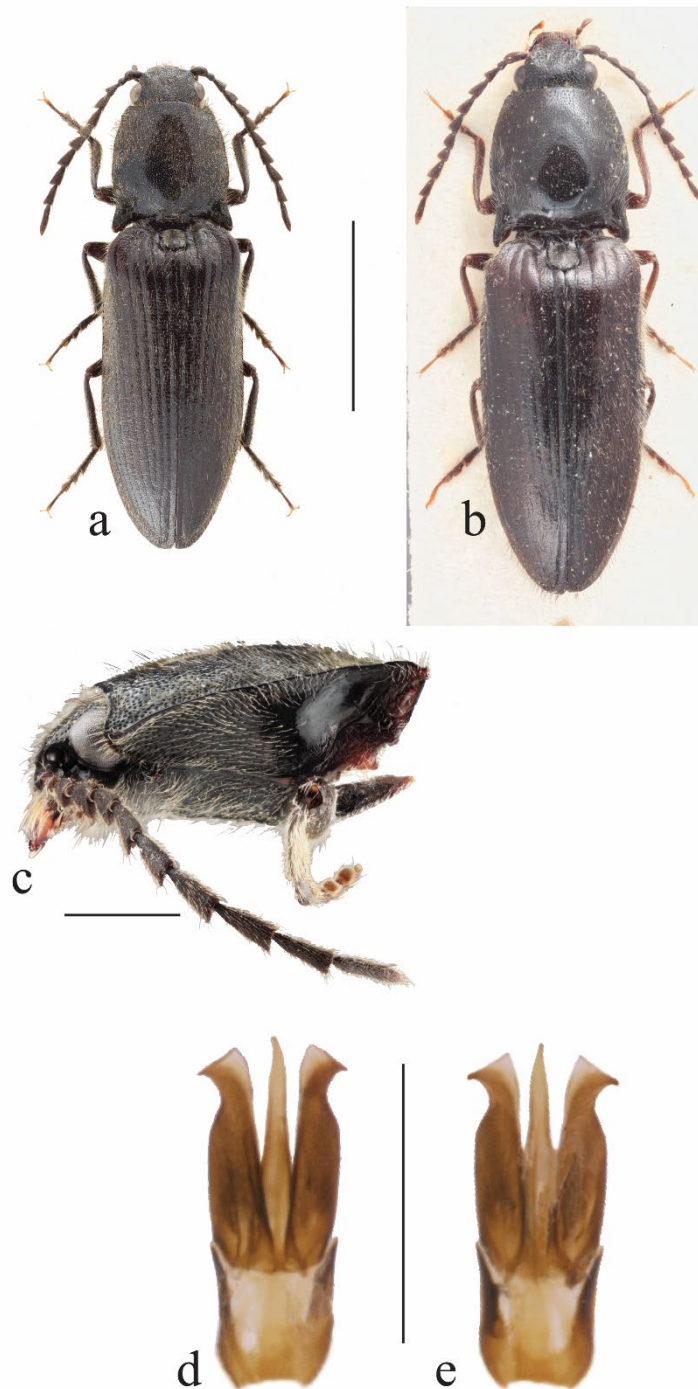


Figure 5.23. *Hemicrepidius niger* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

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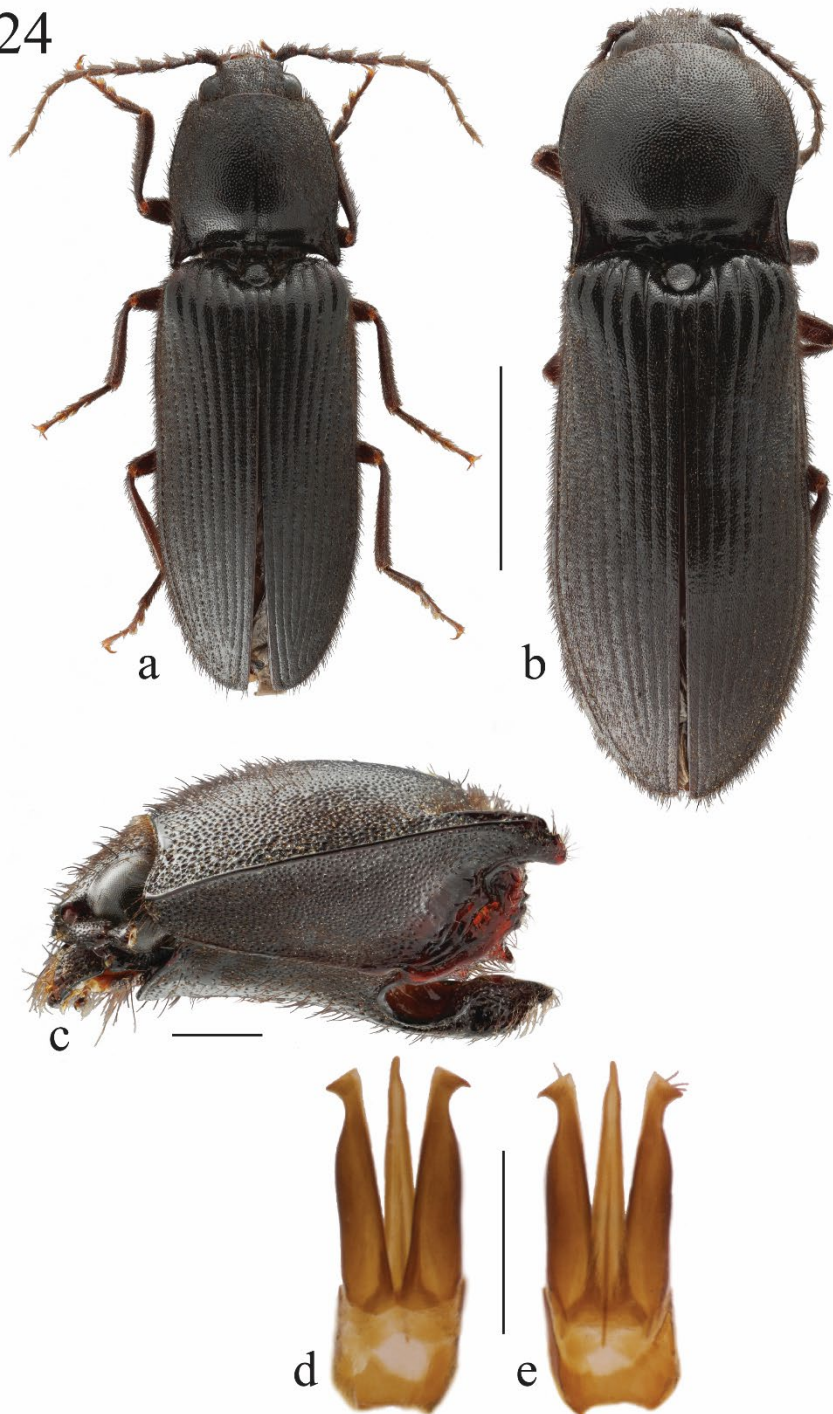


Figure 5.24. *Hemicrepidius obscurus* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

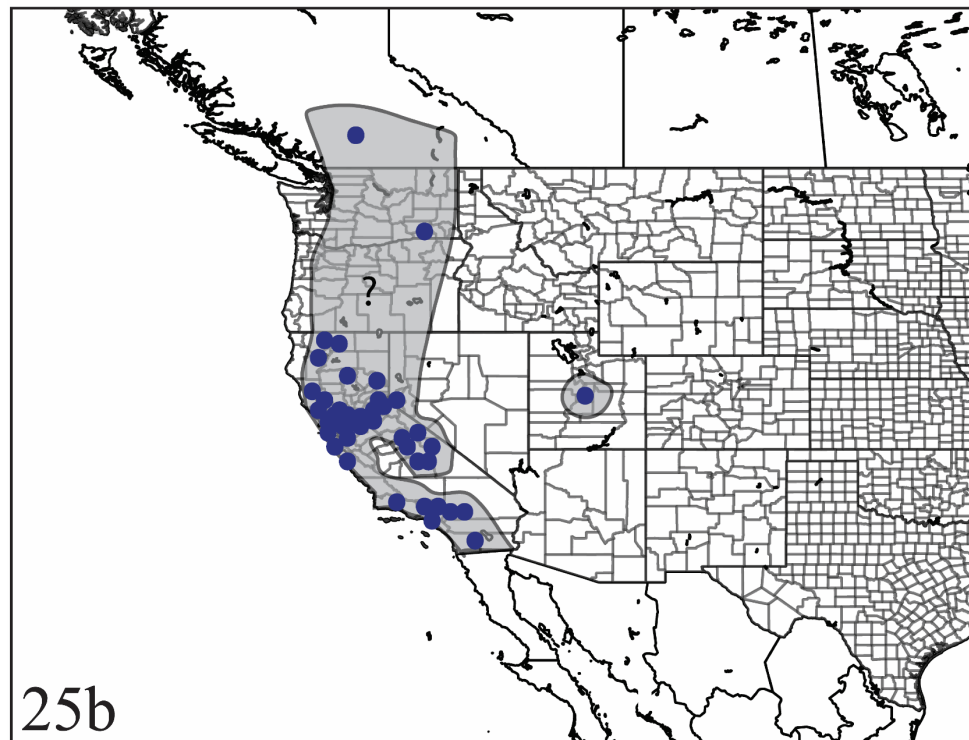
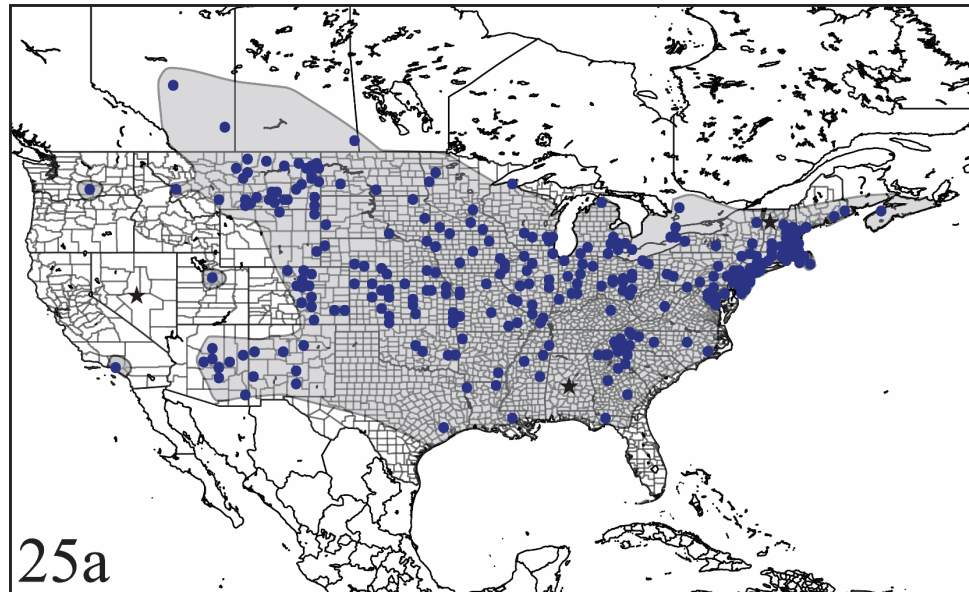


Figure 5.25. Distribution maps a) *H. nemnonius*, b) *H. obscurus*

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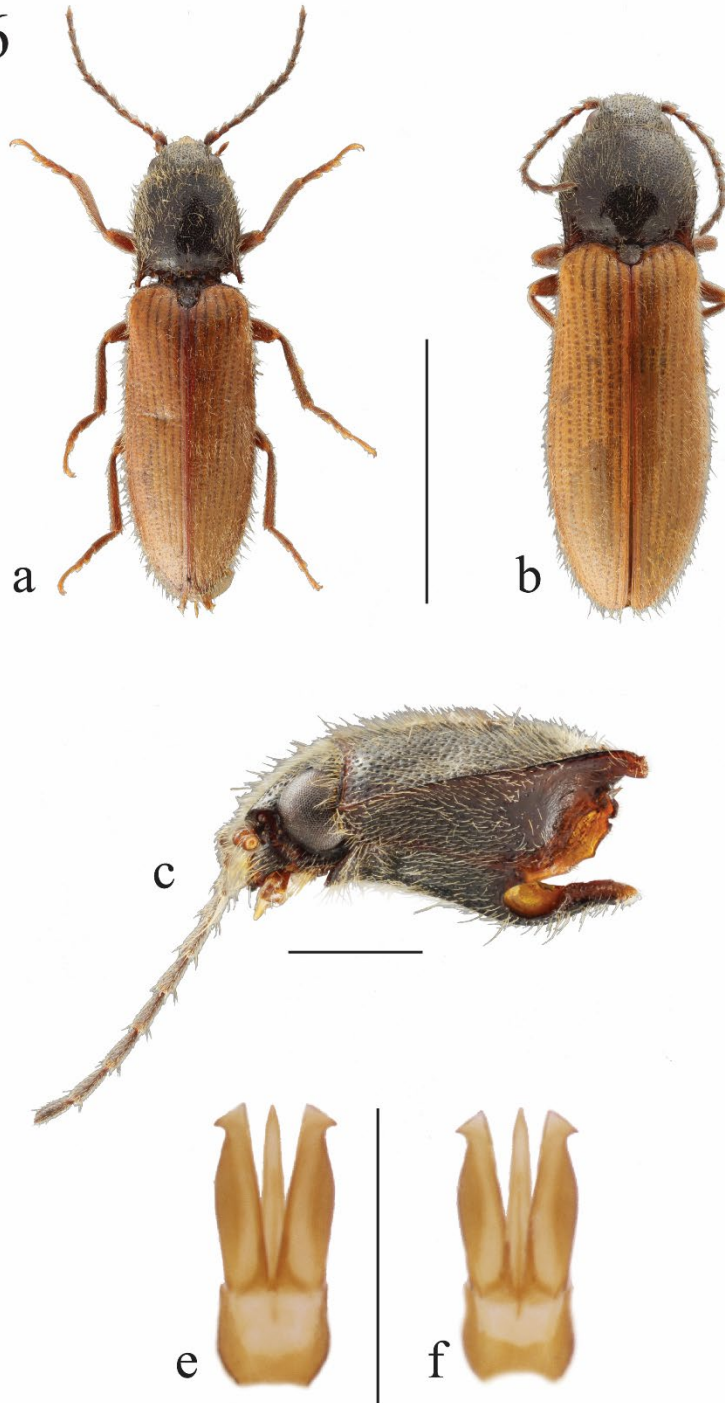


Figure 5.26. *Hemicrepidius pallidipennis* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

27

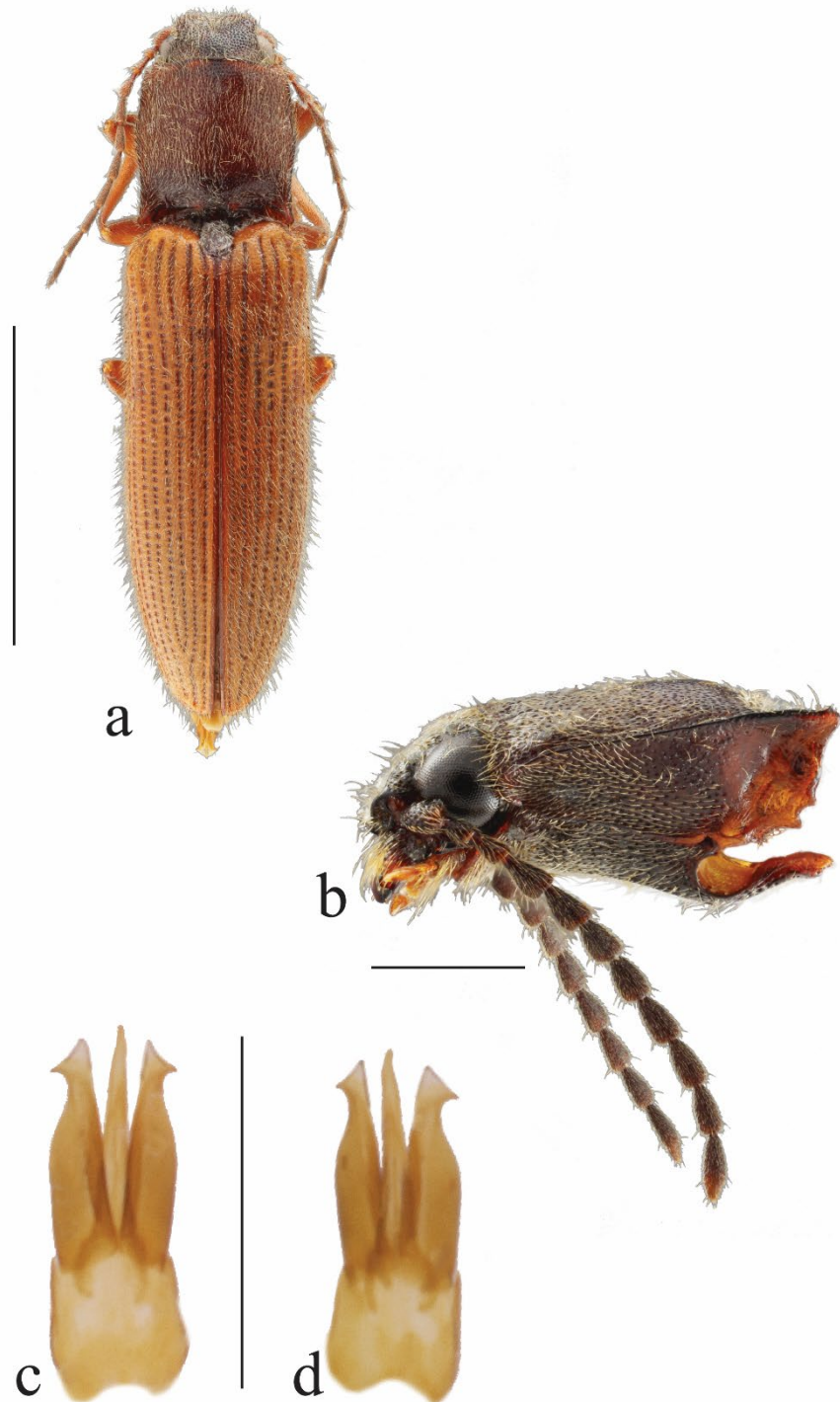


Figure 5.27. *Hemicrepidius palpalis* a) male dorsal habitus, b) pronotum, lateral view, c) male genitalia, dorsal view, d) male genitalia, ventral view. Scale bar to the left of 'a' equals 5mm. Scale bars below 'b' and between 'c' and 'd' equal 1mm.

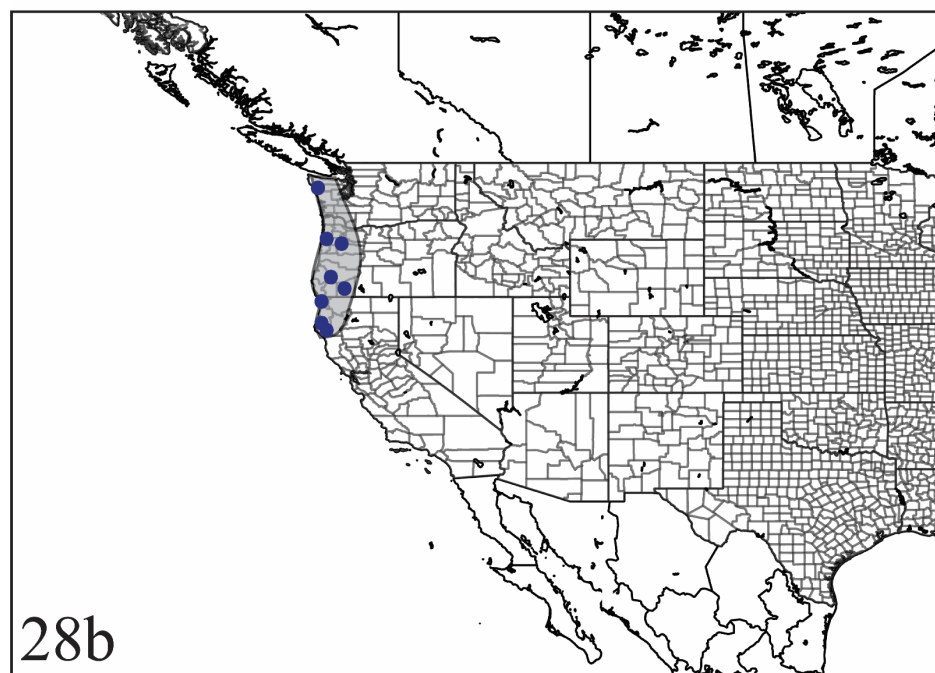
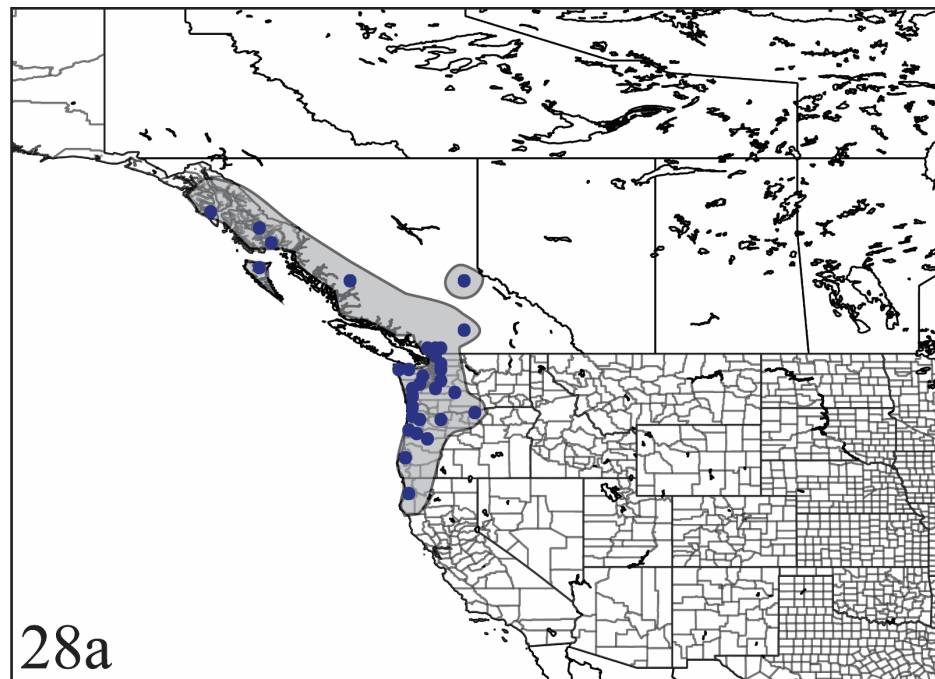


Figure 5.28. Distribution maps a) *H. pallidipennis*, b) *H. palpalis*.

29

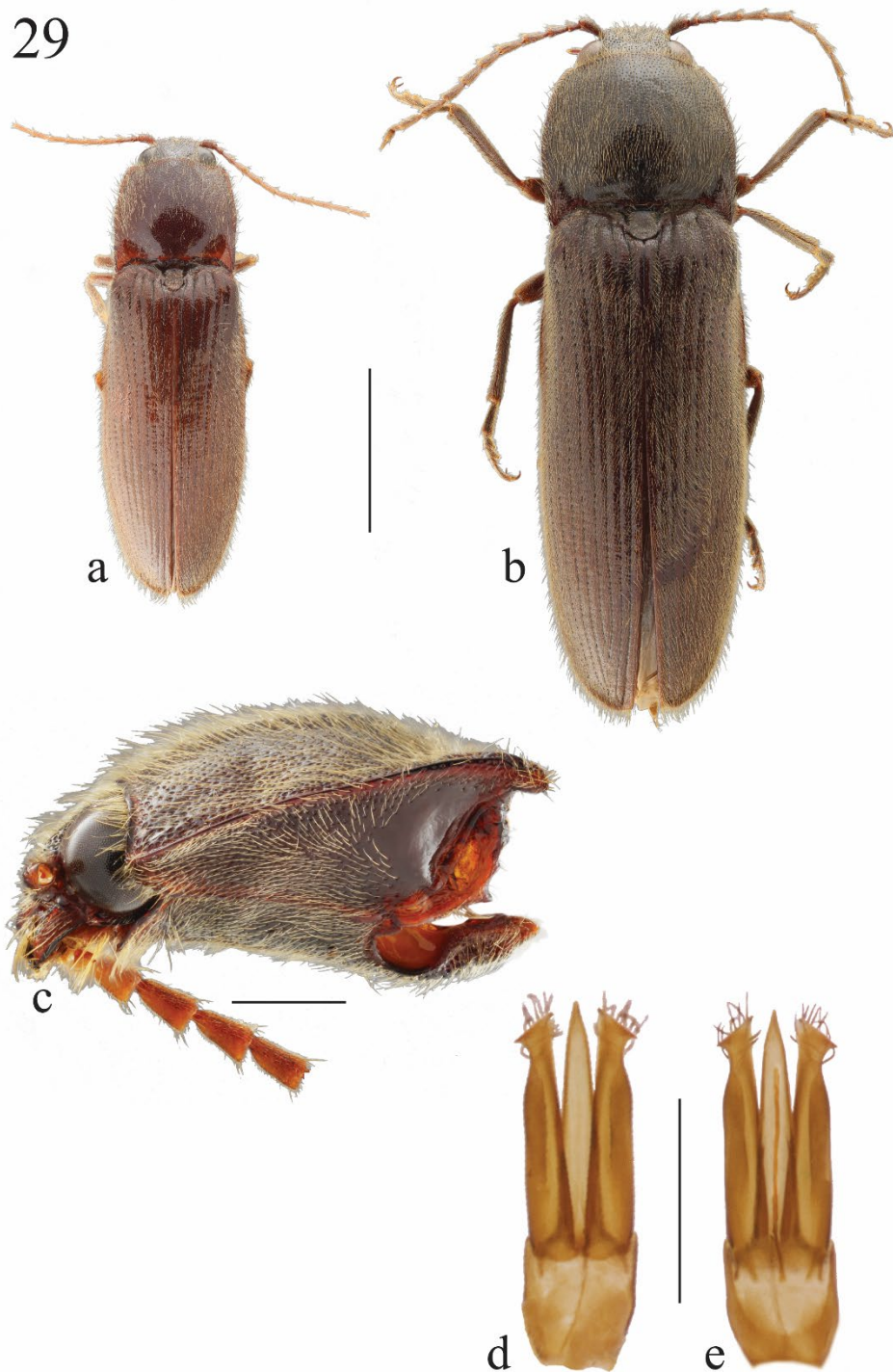


Figure 5.29. *Hemicrepidius ruficornis* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

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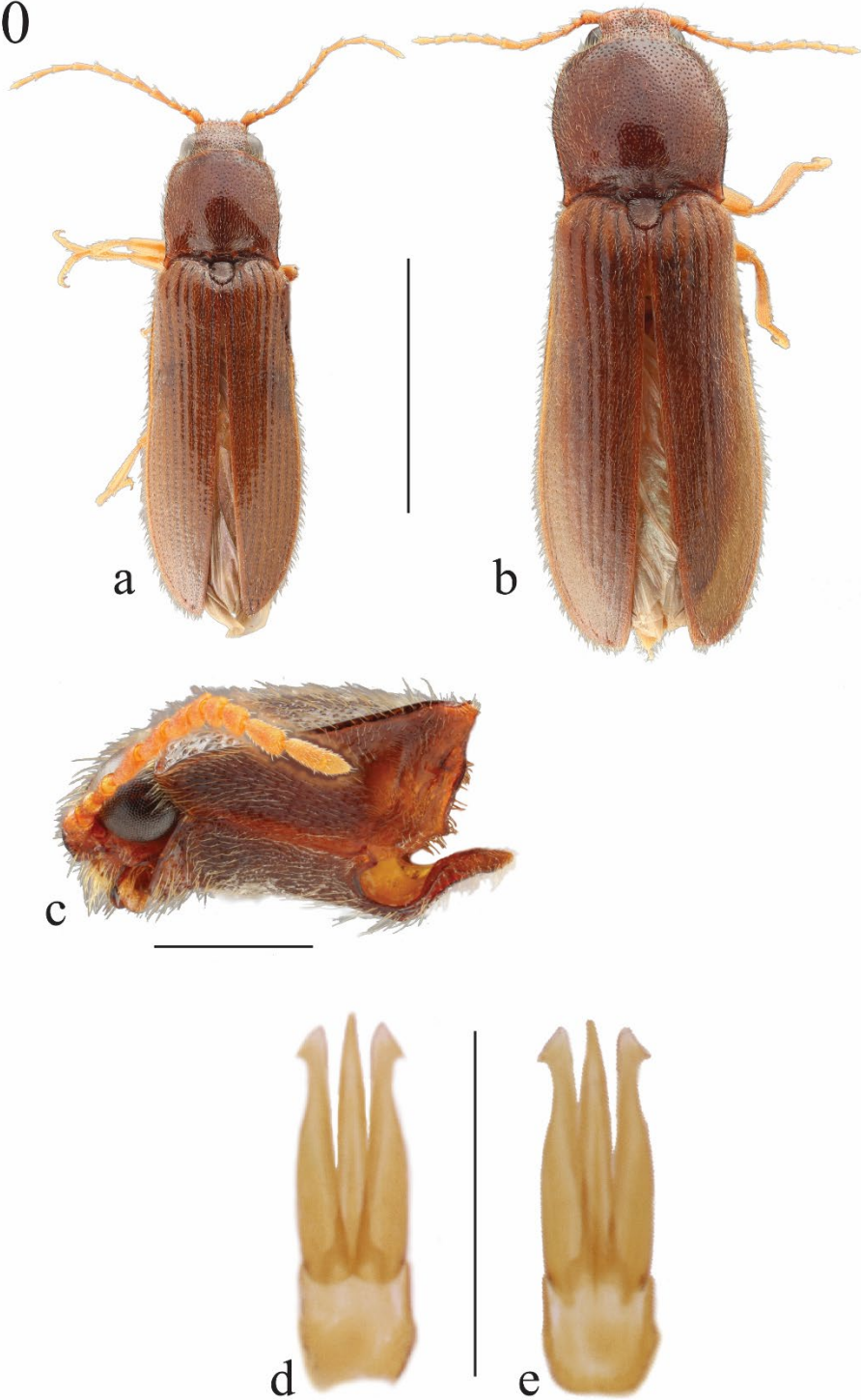


Figure 5.30. *Hemicrepidius simplex* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

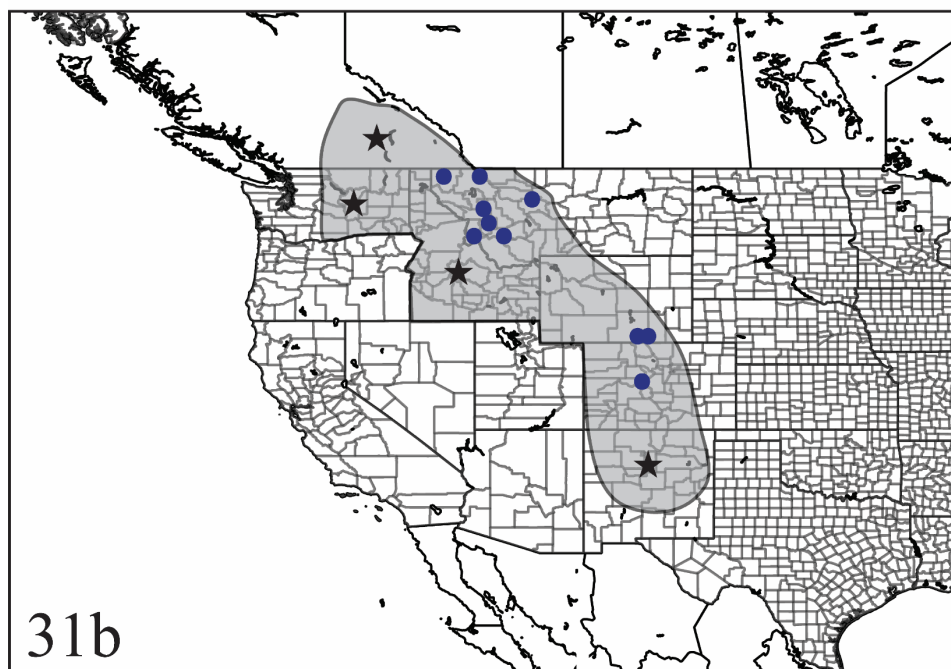
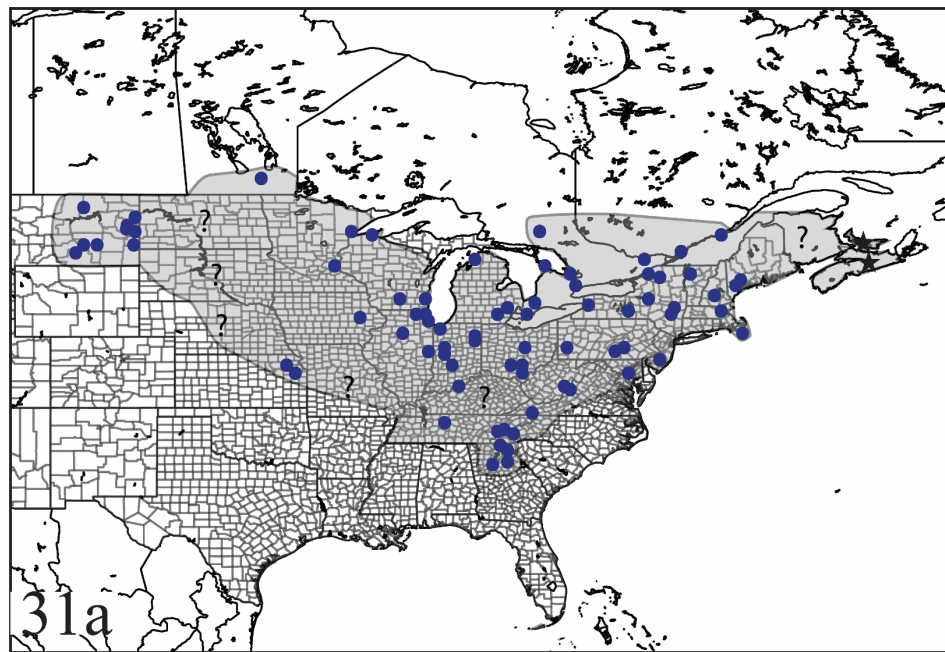


Figure 5.31. Distribution maps a) *H. ruficornis*, b) *H. simplex*.

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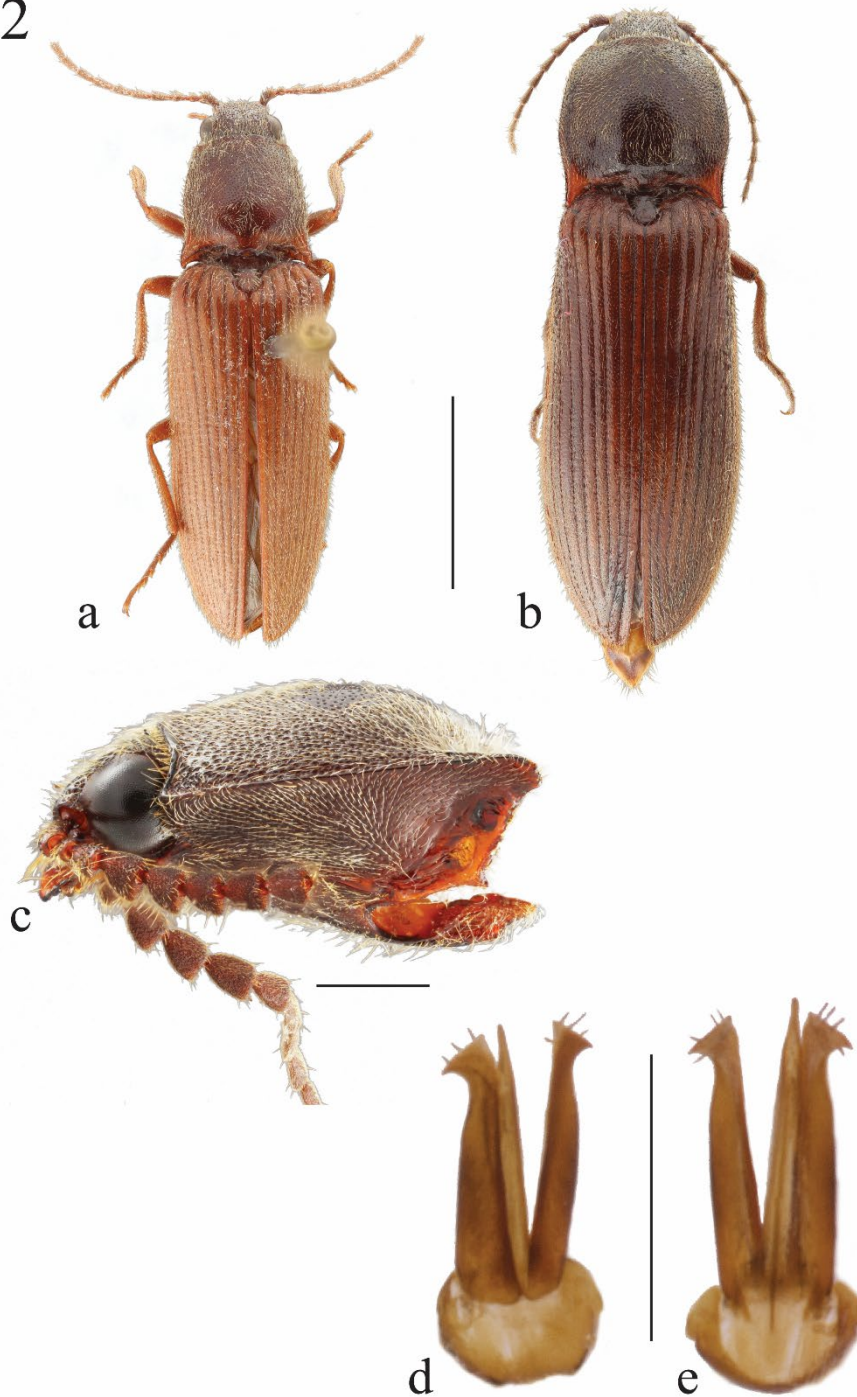


Figure 5.32. *Hemicrepidius soccifer* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

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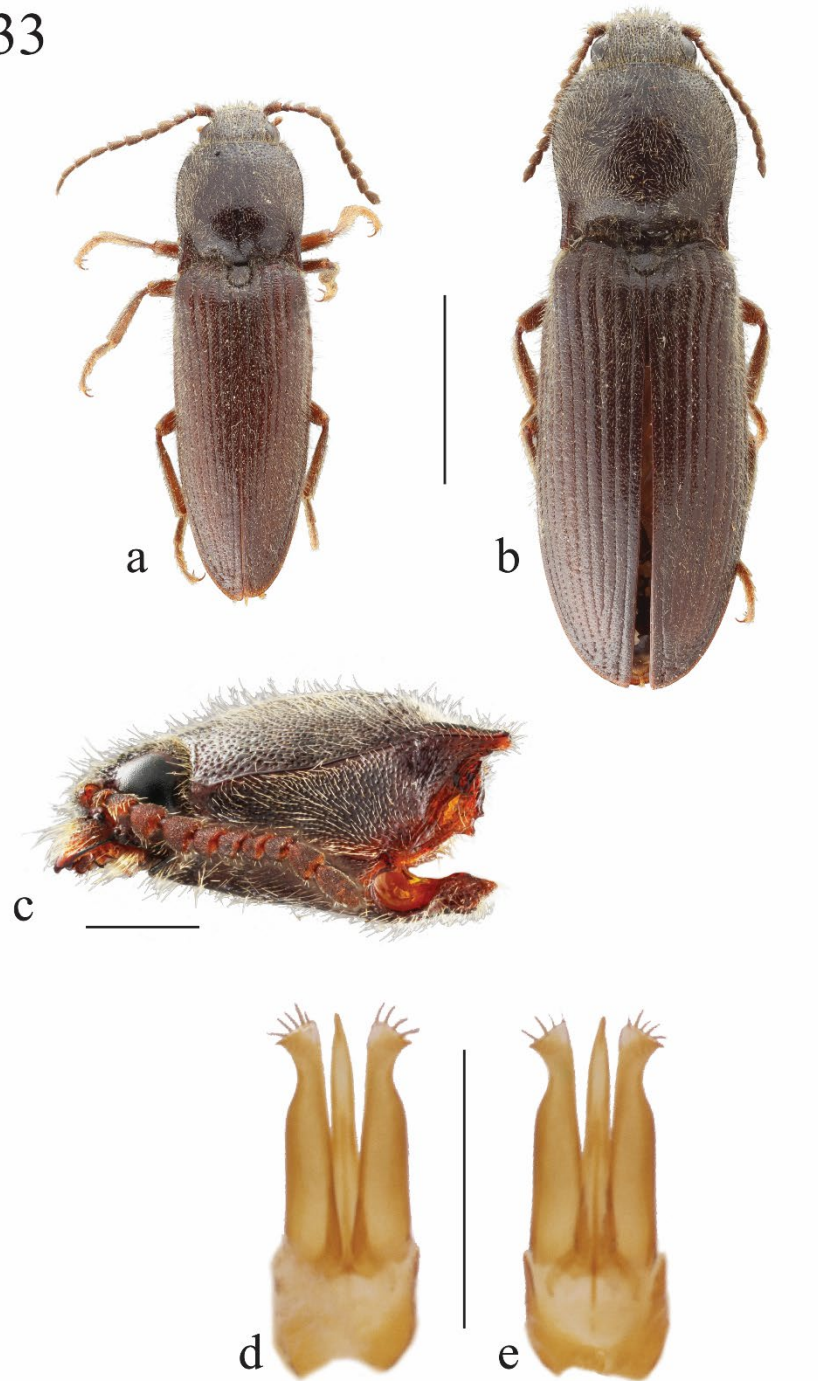


Figure 5.33. *Hemicrepidius tumescens* a) male dorsal habitus, b) female dorsal habitus, c) pronotum, lateral view, d) male genitalia, dorsal view, e) male genitalia, ventral view. Scale bar between 'a' and 'b' equals 5mm. Scale bars below 'c' and between 'd' and 'e' equal 1mm.

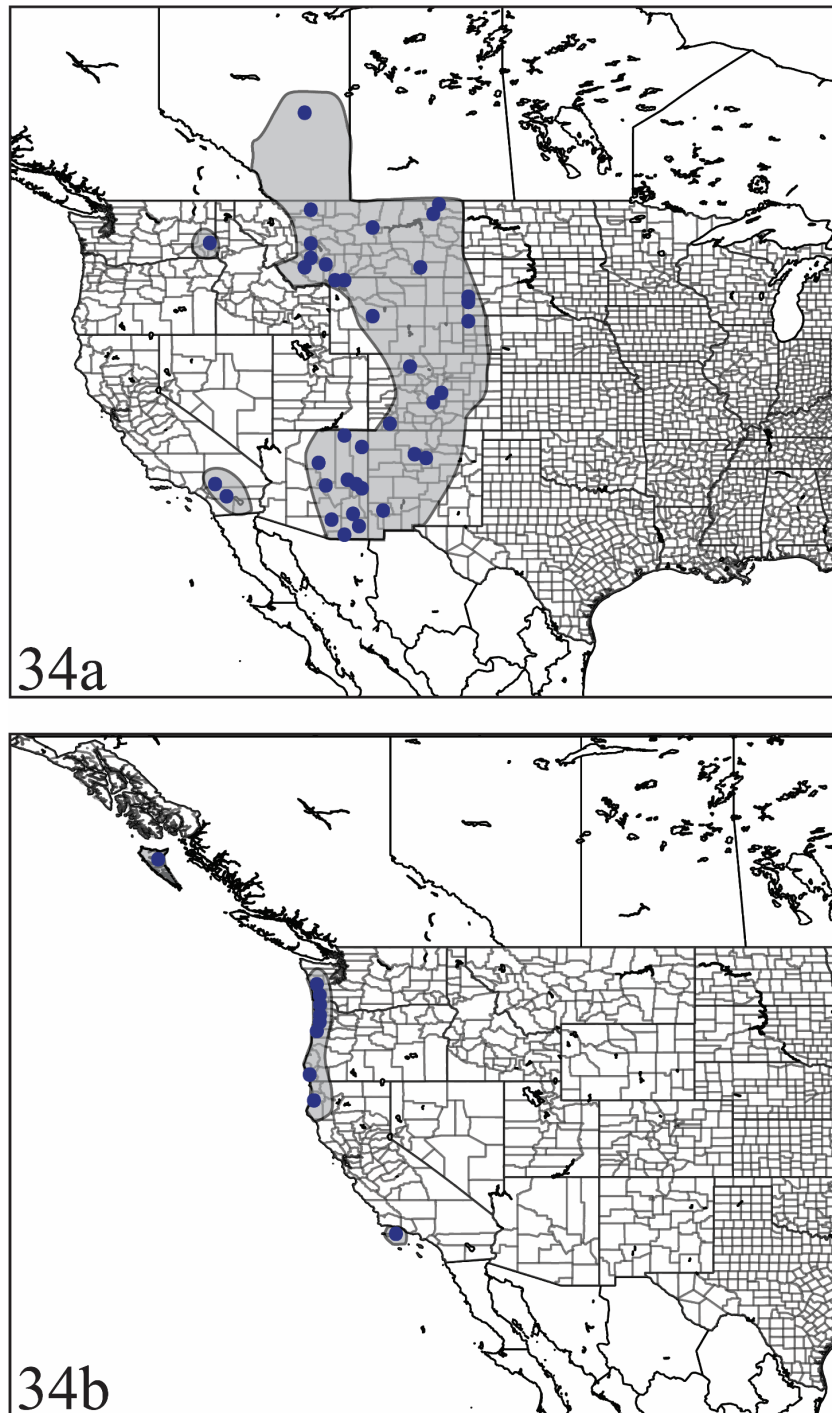


Figure 5.34. Distribution maps a) *H. soccifer*, b) *H. tumescens*.

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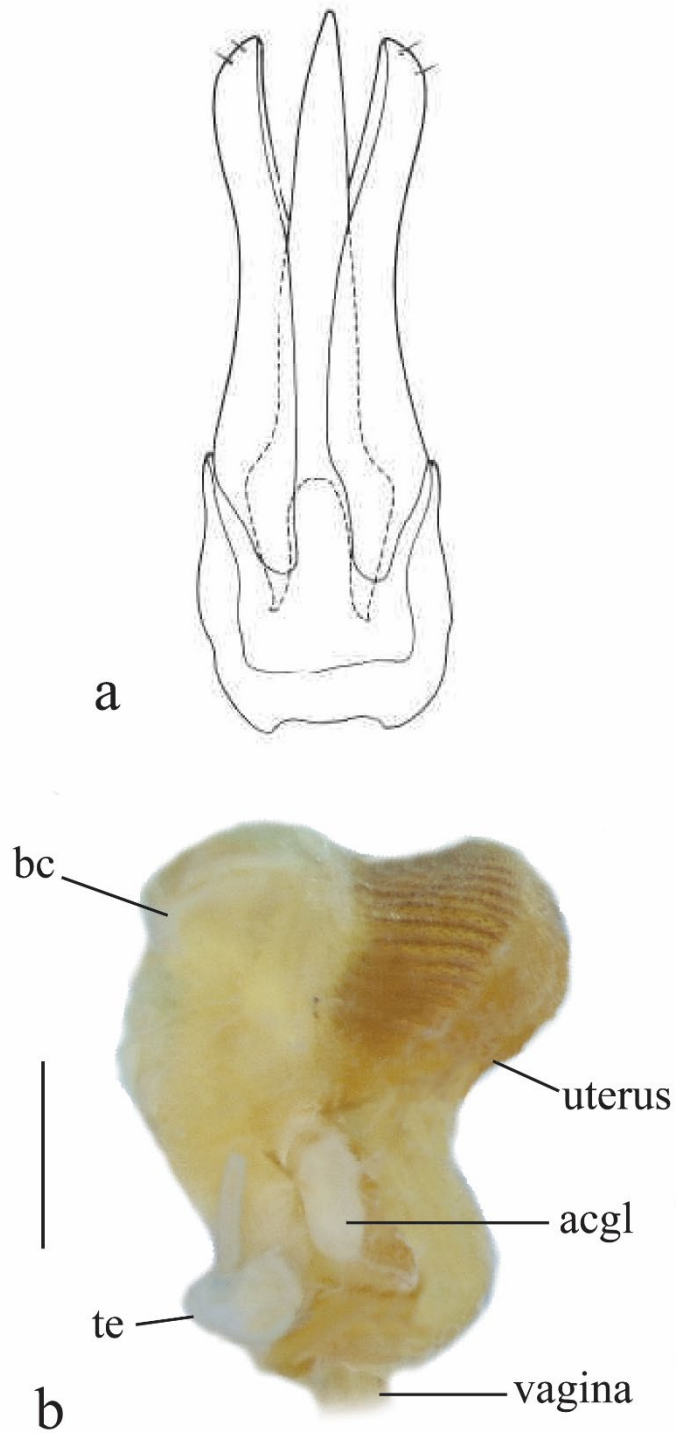


Figure 5.35. Genitalia of related genera; a) male genitalia of *Stenagostus*, b) female internal genitalia of Central American *Athous*.

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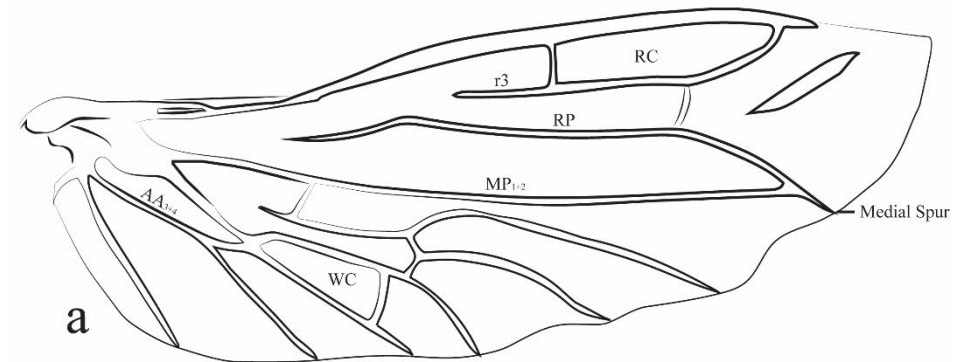


Figure 5.36. Morphological characters of *Hemicrepidius*; a) hind wing, b) lateral microserrations on abdominal ventrites.

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CHAPTER SIX

CONCLUSION

The previous four chapters cover the description or revision of different elaterid genera. However, all four work towards forming global generic concepts in order to improve communication. By laying these foundational morphological works, future studies can be conducted with clear hypotheses in mind.

The second chapter covered the description of the genus *Athoplastus* Johnson and Etzler, placed in the tribe Prosternini subfamily Dendrometrinae. Two of the species were moved from the broad concept of *Ctenicera* Latrielle, 1829, which now has a limited concept which only one North American species fits. Out of the 187 North American species once placed in *Ctenicera*, 106 have been moved to 17 other genera. The description of *Athoplastus* increases the total genera to 18, with 108 previously described species moved. Two additional species, *Athoplastus lochsa* Etzler and Johnson and *Athoplastus palouse* Etzler and Johnson were also described from material examined during the description of the genus. With the description of the adult characters as well as associated larvae, we gain a clearer picture of the diversity present in this group.

The third chapter covered the genus *Paradonus* Stibick, 1971, in the subfamily Negastrinae. Here, the type species *Paradonus pectoralis* Say, 1839 is redefined to be a common widespread species, which better matches the original description. Three new species are also described *Paradonus gallatinensis*, *Paradonus gustafsoni*, and *Paradonus stibicki*. In addition to these descriptions and reclassifications, a key to all

described North American species north of Mexico is provided, and all species are illustrated, both of which are firsts. An additional first is a list of all included species included in the genus. This work enables accurate identification of species in the majority of the USA and Canada, and also provides a framework for the discovery of new species.

The fourth chapter is quite intensive, covering species formerly in *Limonius* Eschscholtz, 1829. This is an attempt to rectify the different classifications used in the Nearctic and Palearctic, and determine how the many Nearctic species in the broad concept of *Limonius* relate to the limited definition and seven other genera used in the Palearctic. A total of five genera are now recognized and defined for the entire Holarctic region, being *Elathous*, *Gambrinus*, *Limonius*, *Pheletes*, and the new genus *Tetralimonius*. A total of 83 new combinations are also made as species were moved into these genera. The first key to separate these species that was written to work at the global level was also constructed to enable easier identification of these genera.

The fifth chapter deals with a revision of the genus *Hemicrepidius* Germar, 1839 in the New World, in the subfamily Dendrometrinae. The genus is defined for the first time for the entire world, and a list of all included species is provided. A total of 22 species is recognized for the New World, with *Hemicrepidius brooksi* and *Hemicrepidius mescalero* described as new. All Central American species are moved to *Athous*, and the two South American species are moved or have been moved to other subfamilies (Elaterinae and Parablacinae). The key to species provided is the first key to species since Horn (1880), and all species are illustrated for the first time.

While these four chapters cover different genera, all focus on putting these groups into a global framework. Chapter two helps identify unique, cold-flying beetles, and lays the foundation to explore other click-beetles with similar behaviors in other regions. Chapter three, lays the foundation for *Paradonus*, so a more thorough revision for the entire Americas can be done. Chapter four, solidifies and defines the concept of *Limonius*. This genus has a synonym, *Dendrometrus*, which is the type genus of the subfamily Dendrometrinae and the tribe Dendrometrini. By having a clear understanding of the type genus now, we can begin to examine morphological characters that can be used to define the tribe and subfamily. The same goes for chapter five with the revision of *Hemicrepidius*. By having an accurate definition for the genus, researchers can begin exploring how it relates to other genera in the tribe Dendrometrini. All four of these chapters lay the foundation for future studies, particularly at the tribal and subfamilial levels. These also help to alleviate lots of the previous frustrations discussed in the introduction of this dissertation.

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