A faunal survey of the elateroidea of Montana
by Catherine Elaine Seibert

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Entomology
Montana State University

Abstract:
The beetle family Elateridae is a large and taxonomically difficult group of insects that includes many economically important species of cultivated crops. Elaterid larvae, or wireworms, have a history of damaging small grains in Montana. Although chemical seed treatments have controlled wireworm damage since the early 1950's, it is- highly probable that their availability will become limited, if not completely unavailable, in the near future. In that event, information about Montana's elaterid fauna, particularity which species are present and where, will be necessary for renewed research efforts directed at wireworm management.

A faunal survey of the superfamily Elateroidea, including the Elateridae and three closely related families, was undertaken to determine the species composition and distribution in Montana. Because elateroid larvae are difficult to collect and identify, the survey concentrated exclusively on adult beetles. This effort involved both the collection of Montana elateroids from the field and extensive borrowing of the same from museum sources.

Results from the survey identified one artematopid, 152 elaterid, six throscid, and seven eucnemid species from Montana. County distributions for each species were mapped. In addition, dichotomous keys, and taxonomic and biological information, were compiled for various taxa. Species of potential economic importance were also noted, along with their host plants.

Although the knowledge of the superfamily' has been improved significantly, it is not complete. It is concluded that the Elateroidea of Montana includes at least 166 species.

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of

Master of Science

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Entomology

MONTANA STATE UNIVERSITY
Bozeman, Montana

July 1993

APPROVAL

of a thesis submitted by

Catherine Elaine Seibert

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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Date 28 July 1993

ACKNOWLEDGEMENTS

I wish to thank Professors Robert Nowierski, William Kemp, Matthew Lavin, and Michael Ivie for their interest and support regarding this project. I am very grateful to Dr. Edward C. Becker, Paul Johnson, and Samuel Wells for identification work. Additionally, I would like to thank Professors Daniel Gustafson and J. Gordon Edwards for providing this project with a rich assortment of Montana elateroid specimens. I would also like to thank the following Montana landowners who so graciously allowed me to collect elateroid material from their properties; Clark and Gail Brevig near Lewistown, Jewel Harper at Two Dot, Allan Underdal near Shelby, and Harold and Etoile Ziolkowski at Lewistown.

I extend my appreciation to the following individuals who so kindly helped me attend to my traps during the 1988 field season; Carol Engle at Philipsburg, Bruce Evans at Shelby, Greg Kushnak at Conrad, and John McCarthy at Augusta. Lastly, I would like to thank my husband, Harold Ziolkowski, Jr., for his continual support throughout this project, in addition to his help in the field and expert technical assistance mapping Montana elateroid species.

This research was funded in part by MONB grant 101156 of the Montana Agriculture Experiment Station.

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LIST OF ABBREVIATIONS

1. CES - author's personal collection
2. CUIC - Cornell University Insect Collection
3. DLG - D. L. Gustafson's personal collection
4. F.I.T. - Flight intercept trap
5. GNP - Glacier National Park Insect Collection
6. GNPP - Glacier National Park - 1988 Red Bench Fire study
7. JGE - J. Gordon Edwards' personal collection
8. L. funnel - Lindgren funnel trap
9. MTEC - Montana State University Entomology Collection
10. NDSU - North Dakota State University Insect Collection
11. OSU - Oregon State University Entomological Museum
12. PES - P. E. Skelley's personal collection
13. SNOW - Snow Entomological Museum
14. USNM - National Museum of Natural History
15. uv light - ultraviolet light trap

ABSTRACT

The beetle family Elateridae is a large and taxonomically difficult group of insects that includes many economically important species of cultivated crops. Elaterid larvae, or wireworms, have a history of damaging small grains in Montana. Although chemical seed treatments have controlled wireworm damage since the early 1950's, it is highly probable that their availability will become limited, if not completely unavailable, in the near future. In that event, information about Montana's elaterid fauna, particularily which species are present and where, will be necessary for renewed research efforts directed at wireworm management.

A faunal survey of the superfamily Elateroidea, including the Elateridae and three closely related families, was undertaken to determine the species composition and distribution in Montana. Because elateroid larvae are difficult to collect and identify, the survey concentrated exclusively on adult beetles. This effort involved both the collection of Montana elateroids from the field and extensive borrowing of the same from museum sources.

Results from the survey identified one artematopid, 152 elaterid, six throscid, and seven eucnemid species from Montana. County distributions for each species were mapped. In addition, dichotomous keys, and taxonomic and biological information, were compiled for various taxa. Species of potential economic importance were also noted, along with their host plants.

Although the knowledge of the superfamily has been improved significantly, it is not complete. It is concluded that the Elateroidea of Montana includes at least 166 species.

INTRODUCTION

The beetle family Elateridae is a large, diverse, and taxonomically difficult group of insects which includes many economically important species of cultivated crops worldwide (Britton 1970, Keaster et al. 1988, Arnett 1990). Elaterid larvae, commonly known as wireworms, typically attack germinating seed or seedlings and have been reported as damaging wheat in Montana. Chemical treatment of seed has controlled wireworm damage since the early 1950's, but the future availability of the primary chemical, lindane, is uncertain. Without lindane, or a comparable and effective alternative, wireworm damage to cereal crops could again become widespread (Morrill 1983, 1984). Therefore, knowledge of the elaterid fauna present in the State will provide baseline information necessary for renewed research efforts directed at wireworm ecology and management.

The Elateridae is a family where no recent revision of the North American species is available and the identification of adults and larvae of many genera is quite difficult, if not impossible (Bousquet 1991). Taxonomic confusion associated with this group is in large part why there has never been a checklist of Montana elaterids. The short-lived adult and long-lived larval biology of these insects, in addition to the large size and low population density of the State, have also

been limiting factors in compiling an accurate faunal picture.

Not surprisingly, few taxonomic works are available which contribute to the determination of Montana's elaterid fauna. Mank (1934) published a list of beetles of Glacier National Park which included twenty-two elaterids. Russell (1968) listed thirty-seven elateroid species as occurring west of the Continental Divide. Lastly, Lane (1941, 1965, 1971) recorded sixteen mostly western species from the State. A few Montana specimens were recorded in taxonomic studies by LeConte (1861a, 1866), Horn (1871, 1891), Blanchard (1889), Van Dyke (1932), Fall (1934), Brown (1935a,b), Glen (1950), Arnett (1952), Becker (1956a, 1974), Quate and Thompson (1967), Lanchester (1971), Stibick (1976b, 1991), Ramberg (1979), and Wells (1989, 1991). All records, excluding recent papers by Wells, summed to only seventy species (see APPENDIX B). From a regional perspective this figure appeared low in comparison to 131 species known in British Columbia, excluding Vancouver Island (Lane 1952), and at least 113 in Idaho (Scott 1985).

The aforementioned discrepancy suggested the known number, composition, and distribution of Montana Elateridae was woefully incomplete and in 1987 the author initiated a faunal survey of the Elateridae, and three closely related families, as part of Montana Agricultural Experiment Station project 101156. The objectives of the survey were to gather as much compositional and distributional information as possible on the elateroid species occurring in Montana. The

intended results were to include as complete a species list as possible and dichotomous keys to species where possible, or to more inclusive taxonomic groupings, eg. genus or tribe.

The superfamily Elateroidea includes the Artematopidae, Elateridae (click beetles), Throscidae, and Eucnemidae (false click beetles). These four families were formerly associated within the Elateroidea by Lawrence (1982). Unlike the Elateridae, few if any members of the other families are economically important. They may however resemble elaterids, and because of this were included in the faunal survey.

Montana's elateroid fauna was determined from borrowed specimens, collected in Montana, and from bettle specimens collected from the field using a variety of sampling techniques. Although wireworms are commonly collected by bait trapping (Ward and Keaster 1977, Toba and Turner 1983, Kirfman et al. 1986, Bynum and Archer 1987), this study concentrated on the collection and identification of adults and therefore utilized other techniques.

Pitfall traps are known to collect elaterids (Doane 1961, 1977b; Brown and Keaster 1986) and are easy to construct, inexpensive, and inconspicuous. Lindgren funnel traps were designed to collect bark beetles (Lindgren 1983), but were also known to collect elateroids (M. A. Ivie, per. comm.). Flight intercept traps have also been used to capture both elaterids and eucnemids (Perry and Arias 1982). These traps, in addition to light and hand collecting, provided the

majority of field-collected material.

The combination of borrowing specimens and collecting Montana click beetles yielded 6,105 elateroid specimens for examination. This material, in addition to compiled literature records, has greatly increased the present knowledge base of this State's elateroid number, composition, and distribution. At least 166 species of elateroid beetles are now known to inhabit the State (see APPENDIX B) and known distributions are presented for each (see APPENDIX F). In addition, dichotomous keys are presented for Montana 1) families and subfamilies of Elateroidea, 2) species within the Throscidae and Eucnemidae, and 3) species within the Pyrophorinae, Hypnoidinae, Elaterinae, and Melanotinae subfamilies of the Elateridae.

MATERIALS AND METHODS

Montana Elateroidea Material

Elateroid beetle specimens utilized in this faunal survey included material from three sources and, with few exceptions, material collected through 1991. The primary source of specimens was the Montana Entomology Collection (MTEC) at Montana State University, Bozeman, Montana. Secondary sources of Montana elateroid specimens came from other institutions, universities, or private collections and included specimens examined while visiting the United States National Museum, Washington, DC, in June, 1990, and specimens examined between 1990 and 1992 from the following sources: Catherine E. Seibert, Montana State University, (CES); Cornell University Insect Collection, Ithaca, New York (CUIC); Daniel L. Gustafson, Montana State University, (DLG); Glacier National Park Insect Collection, Glacier National Park, Montana (GNP); Michael A. Ivie, Glacier National Park Project, Montana State University, (GNPP); J. Gordon Edwards, San Jose State University, San Jose, California (JGE); North Dakota State University Insect Collection, Fargo, North Dakota, (NDSU); Oregon State University Entomological Museum, Corvallis, Oregon, (OSU); Paul E. Skelley, Florida State at Gainesville, Florida, (PES); Snow Entomological Museum, Lawrence, Kansas

(SNOW); and National Museum of Natural History, Washington, District of Columbia, (USNM).

The third source of adult elateroid material was generated through this survey's trapping efforts, conducted primarily between April 5 and November 3, 1988.

Trap Collection of Montana Elateroidea

The field collection of adult elateroids in this survey utilized three trapping methods, in addition to occasional hand and ultraviolet light collecting. Trapping methods included the use of pitfall, Lindgren funnel (L. funnel), and flight intercept (F.I.T.) traps.

Pitfall traps were constructed from plastic, two-liter soda bottles. The top one-third of each bottle was cut off and inserted upside down into the remaining lower portion after the latter was placed in a hole dug into the ground and filled with approximately one-half liter of preservative (see recipe below). A 6" square piece of 1/2" hardware cloth was placed over the set pitfall trap to exclude small rodents. Traps were typically placed beneath rocks or wood debris.

Eight- and sixteen-unit Lindgren funnel traps were hung from tree branches in forested or wooded locations. A lidless, glass jar was placed inside each funnel trap's collecting receptacle to allow collection of insects into the liquid preservative.

Each flight intercept trap was constructed by stretching

a 30" x 68" piece of olive-green mosquito netting between two wooden posts driven into the ground. A tent-like, rain roof was constructed of clear plastic and secured above the mosquito netting and wooden posts. Three aluminum roasting pans, each 16.5" x 12" x 2.5", were positioned next to each other, directly beneath the netting. Each pan was filled to approximately one-half full with liquid preservative.

Individual traps were checked every four to eight weeks and their insect-laden contents labeled and exchanged with fresh preservative composed of approximately one-third antifreeze (ethylene glycol) and two-thirds Kahle's solution as specified in Borror et al. (1989).

Trap residue materials were stored in glass jars until their contents could be sorted. Sorting of trap residues was performed using a Wild 3A dissecting microscope. Arthropod material from the trap residues was sorted to order and/or family, with most retained material being transferred to seventy percent ethanol in stoppered, glass vials for indefinite storage in the MTEC. Elateroid specimens sorted from trap residues were pinned, labeled, and identified to genus before being housed in the MTEC until further identification to species was accomplished.

Traps were placed in eleven Montana counties, at twenty-six different sites (see APPENDIX D, fig. 61) in the spring of 1988. They were set up between April 5 and June 18, and dismantled between July 20 and November 3, 1988. Forty-six

pitfall, nineteen Lindgren funnel, and four flight intercept traps were used during the 1988 field season.

The specific sites where traps were positioned fell into four broad categories; forest (f), grassland (g), adjacent to or within a wheat field (w), and woodland located within grassland habitat (x). The majority of traps were located in riparian areas. Montana counties within which traps were set, trap site codes indicating number within county and type of habitat, site locations, number and kinds of traps used at each location, and corresponding collection dates are listed in APPENDIX E.

Elateroidea Identification and Data Analysis

Adult Elateroidea specimens were identified to species using dichotomous keys. This process occasionally involved the examination of internal organs of reproduction, or genitalia, usually of male specimens. When genitalia were examined, the dry, pinned specimens were first rehydrated in hot water. Male genitalia were removed from relaxed specimens with fine forceps and then, if necessary, cleared in lactic acid for twenty minutes to one hour.

Female genitalia were taken from relaxed specimens by first removing the entire abdomen. The soft tergites were then cut along the margins and lifted away to reveal the internal organs. These were removed using dull forceps and the reproductive organs were then separated from the other

organs, principally digestive, with the latter being discarded. After examination, genitalia of both sexes were stored in polyethyene microvials containing glycerin. Each microvial was secured to the pin beneath the specimen whose genitalia it contained.

All adult elateroids identified to species were entered into a database file using the software program dBASE III Plus. Each databased specimen was provided with a determination label, produced using HPLABEL software (Darling and Plowright 1990), which stated the species name under which they were entered into the database and the corresponding date. The database file was used for each species to summarize 1) material examined, 2) elevation records, 3) percentage of total specimens collected by each method, and 4) collection dates. A collection date within parentheses represents the endpoint date of a trapped specimen, where the actual day of collection is unknown. All trapped specimens with a date of collection range greater than three months, and some additional specimens with ranges between two and three months, were not considered when the species collection dates were summarized.

SUPERFAMILY ELATEROIDEA

Introduction

The Elateroidea superfamily classification used here is based on Lawrence (1982) in which he included the following seven families; Artematopidae, Cerophytidae (rare click beetles), Elateridae (click beetles), Cebrionidae, Throscidae, Perothopidae, and Eucnemidae (false click beetles). Britton (1970) estimated the number of known Elateroidea in the world at 8,200 species.

The most characteristic elateroid features are the usually acute and produced posterior angles of the pronotum and the form of the prosternum which is prolonged posteriorly into a median process that is received into a groove on the mesosternum. The latter characteristic provides the specialized mechanism by which most elateroid members leap, or "click". This snapping response, sometimes referred to as elasis (Allen 1951), is used to startle predators or adjust body position and has been observed in elaterids, eucnemids, and throscids (Lawrence 1982, Lawrence and Newton 1982). In addition, elateroids usually possess five visible abdominal sternites and all are pentamerous (Arnett 1968).

The Elateroidea generally are found in riparian areas, have a long-lived larval/short-lived adult life cycle, and are

mostly phytophagous. Predation has developed in some elateroids, particularly within the Elateridae (Crowson 1960, Lawrence and Newton 1982).

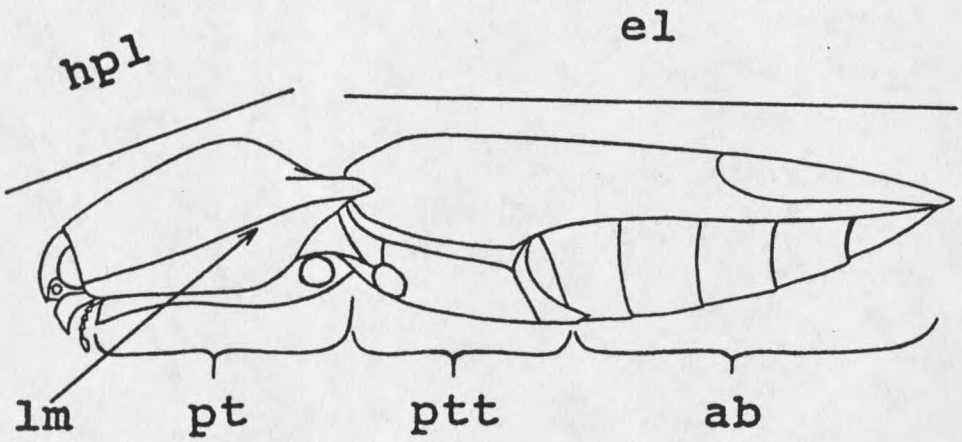
The Elateroidea of Montana includes the following four families; Artematopidae, Elateridae, Throscidae, and Eucnemidae (see APPENDIX A). Although all species that occur in the State are probably not known at present, the total number of Montana elateroid species is at least 166. A key is provided to all families of Elateroidea known to occur in Montana (see below).

Taxonomic Characters

A brief review of characters utilized in the taxonomy of the superfamily Elateroidea is provided here to facilitate the use of this paper's dichotomous keys. Abbreviations for morphological parts refer to figures 1 through 4.

Adult beetle members of the Elateroidea share the following diagnostic morphological features; five-segmented tarsi (fig. 3, ts), five visible abdominal sternites (fig. 4, st), trilobed aedeagus (figs. 32, 33), elytra typically with nine or ten striae (fig. 3, str), pronotal angles prolonged posteriorly (fig. 3, ppa), and prosternum also prolonged posteriorly into a median process (fig. 4, ps) which is received in the mesosternum (fig. 4, ms).

The elateroid head (fig. 3, hd) is oval or flattened, with visible or concealed labrum (fig. 2, lab), generally with



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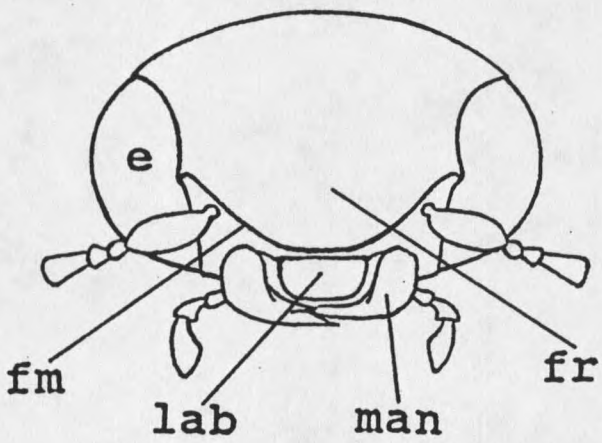
bl = el + hpl



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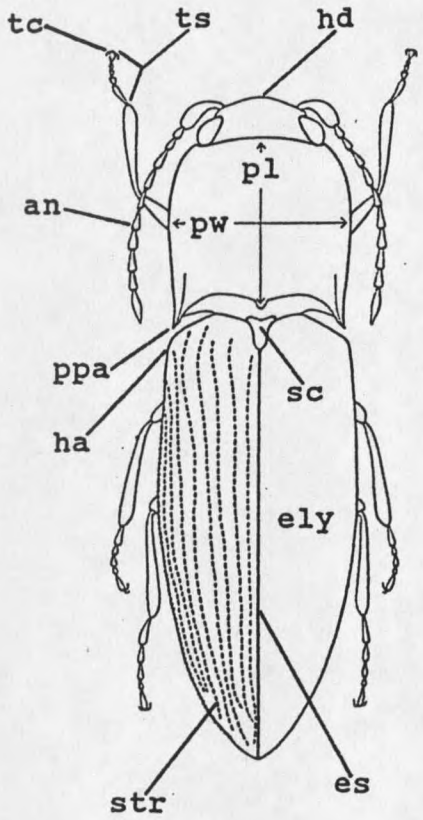
Figures 1-2. Fig. 1, lateral habitus, *Ampedus apicatus*. Fig. 2, head, cephalic view, *Megapenthes angularis*. ab, abdomen; bl, body length; e, eye; el, elytral length; fm, frontal margin; fr, frons; hpl, head and pronotal length; lab, labrum; lm, lateral margin; man, mandible; pt, prothorax; ptt, pterothorax.

well-developed mandibles (fig. 2, man), and antennae (fig. 3, an) various, arising on the frons (fig. 2, fr) near or between the eyes (fig. 2, e) and frequently inserting underneath a frontal margin (fig. 2, fm). Antennal segments are counted beginning basally.

The elateroid thorax is an important area taxonomically, both between families and between genera of Elateridae. The posterior angles (ppa) of the prothorax (fig. 1, pt) are typically carinate and the lateral margin (figs. 1, 4, lm) of the prothorax may or may not be complete. The hypomeron (fig. 4, h) extends medioventrally from the lateral margin (lm) to the prosternopleural suture (fig. 4, pps). The prosternum (fig. 4, p) is usually lobed anteriorly and positioned ventrally between the prosternopleural sutures (pps). The prosternal spine (figs. 4, 6, ps) is variable between families, broad and flat in throscids, usually narrow and tapering in elaterids.

Pronotal length (fig. 3, pl) and width (fig. 3, pw) are frequently measured for identification purposes and the presence, type, and arrangement of the setae and punctation, particularily that of the prothorax, are often utilized for determining species within the Elateridae.

The procoxa (figs. 1, 4, pc) and mesocoxa (figs. 1, 4, mc) of an artematopid have an exposed and visible trochantin (fig. 5, tr) while trochantins of other elateroids are highly reduced and concealed. The shape of the metacoxal plate



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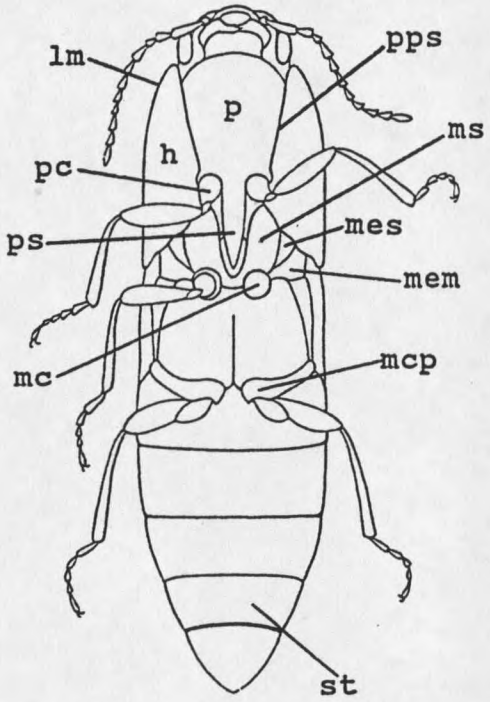

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Figures 3-4, habitus. Fig. 3, dorsal view, *Glyphonyx* sp. (redrawn from Smith and Balsbaugh, 1984). Fig. 4, ventral view, *Agriotes* sp. (redrawn from Borror et al., 1989). an, antenna; ely, elytron; es, elytral suture; h, hypomeron; ha, humeral angle; hd, head; lm, lateral margin; mc, mesocoxa; mcp, metacoxal plate; mem, mesepimeron; mes, mesepisternum; ms, mesosternum; p, prosternum; pc, procoxa; pl, pronotal length; ppa, posterior pronotal angle; pps, prosternopleural suture; ps, prosternal spine; pw, pronotal width; sc, scutellum; st, sternite; str, stria; tc, tarsal claws; ts, tarsal segments.

(figs. 1, 4, mcp) is sometimes diagnostic while the position and arrangement of the mesosternum (ms), mesepisternum (fig. 4, mes), and mesepimeron (fig. 4, mem) are quite important for determining subfamily placement within the Elateridae.

The meso- and metathorax are collectively referred to as the pterothorax (fig. 1, ptt) and bear the wings. The elytra (fig. 3, ely) may have diagnostic maculations and elytral length (fig. 1, el) is often of taxonomic relevance. In addition, the first four or five sternites (st) of the abdomen (fig. 1, ab) are connate. Tarsal claws (fig. 3, tc) vary in their general type or shape, which sometimes can be important diagnostically. Tarsal segments (fig. 3, ts) are counted beginning basally.

The measurement body length (fig. 1, bl) is referred to frequently and is the sum of the head and pronotal length (fig. 1, hpl) and the elytral length (fig. 1, el) (Crowson 1955, Arnett 1968, Lawrence 1982, Lawrence and Newton 1982).

Key to Families of Adult Elateroidea

(adapted from Arnett 1968, Crowson 1955, Lane 1971, Lawrence and Newton 1982)

1 Pro- and mesocoxa with exposed, visible trochantin (fig. 5); prosternal spine weak, not or hardly received in the mesosternal fossa; antennae long, extending posteriorly to middle of elytra at least in males; very uncommon; montane

.....Artematopidae, *Macropogon piceus* LeConte

1′ Pro- and mesocoxa with highly reduced and concealed trochantin; prosternal spine received in mesosternal fossa (fig. 4); antennae long or short, never extending beyond middle of elytra.....2

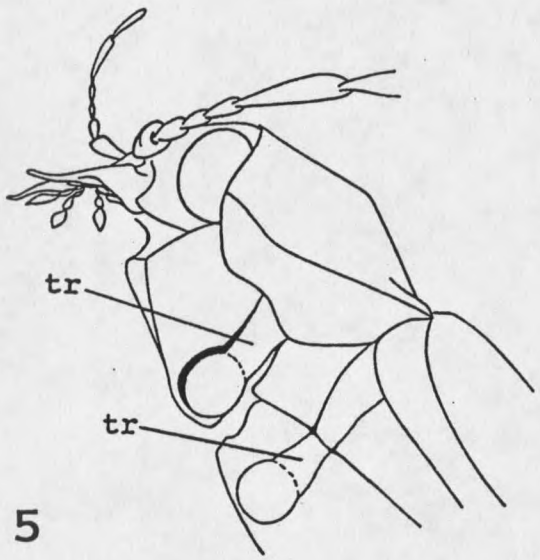
2 Prothorax firmly attached, immobile; prosternum short; procoxa partly covered laterally by broad, flat prosternal spine (fig. 6); antennae often with last three segments clavate (fig. 7).....Throscidae

2′ Prothorax loosely joined to mesothorax, freely moveable; prosternum usually long; procoxa laterad of narrow, usually tapering prosternal spine (fig. 4); antennae never with last three segments clavate, although occasionally the last are distinctly longer than the preceding segments.....3

3 Labrum concealed; antennae inserted on frons between eyes and received in transverse grooves (fig. 8); abdomen usually with all five visible sternites more or less connate; prosternum not lobed anteriorly, the margin straight or nearly so.....Eucnemidae

3′ Labrum visible; antennae arising near eyes under frontal margin (fig. 9); abdomen with first three or four visible sternites more or less connate, the ultimate sternite freely moveable and connected by a membranous suture; prosternum usually lobed in front (fig. 4)

.....Elateridae



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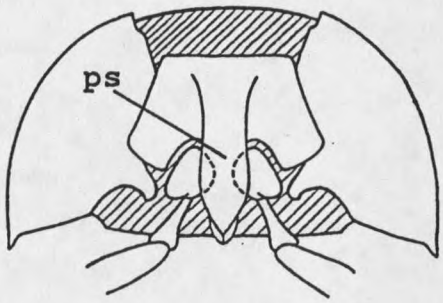

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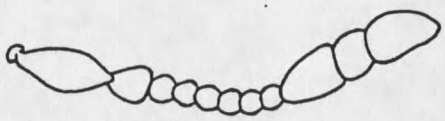

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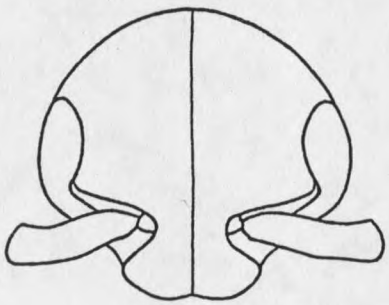

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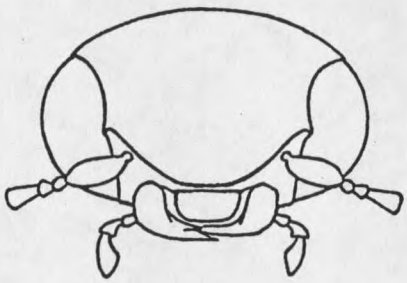

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Figures 5-9. Fig. 5, head and thorax, lateral view, *Macropogon piceus*. Fig. 6, prothorax, ventral view, throscid sp. (redrawn from Arnett, 1968). Fig. 7, left antenna, *Trixagus carinicollis*. Figs. 8-9, head, cephalic view. Fig. 8, *Hylis terminalis*. Fig. 9, *Megapenthes angularis*. ps, prosternal spine; tr, trochantin.

FAMILY ARTEMATOPIDAE

Introduction

The taxonomic placement of the family Artematopidae within the Elateroidea is based on Lawrence (1982). Prior to that, artematopid taxa were usually considered members of the Dascillidae (LeConte 1861a, Horn 1880, Leng 1920, Blackwelder 1939, Arnett 1968), a non-elateroid beetle family that is still recognized. Crowson (1955) considered artematopids as belonging to a separate family, the Eurypogonidae, but placed them in the Dryopoidea.

The family Artematopidae is comprised of three subfamilies, eight genera, and approximately sixty species worldwide. One subfamily occurs in North America, the Macropogoninae (Lawrence 1982), where it is comprised of three genera and at least eight species (Arnett 1968, Bousquet 1991). Nearctic *Macropogon* were revised by Hopping (1936) following Brown's (1929) revision of the Canadian species. The Artematopidae of Montana includes only one species, *Macropogon piceus*.

Macropogoninae larvae are found in moss mats, particularly those growing on granitic boulders near streams, or in open woods that possess ample moisture in early spring. The larvae tunnel through the moss rhizoids and sod and are pre-

sumed phytophagous (Cooper 1991).

Subfamily Macropogoninae

Macropogon piceus LeConte

(figs. 5, 62)

Montana county records: FLATHEAD, GALLATIN.

Material examined: 3 specimens.

Elevation records: 4800'.

Collecting method: hand, 2 specimens, 66.7 %

L. funnel, 1 specimen, 33.3 %

Collection dates: 20 June - 12 July (11 August).

Remarks: The occurrence of this rarely collected species in Montana was reported by LeConte (1861a), Horn (1880), and Hopping (1936), although no specific collection locations within the State were given.

FAMILY ELATERIDAE

Introduction

The family Elateridae is the largest family of elateroids and a major family of Coleoptera with approximately twelve subfamilies, 400 genera, and 9000 species worldwide (Lawrence 1982, Stibick 1979). In North America, there are about sixty genera and 885 elaterid species (White 1983, Arnett 1990).

This thesis follows Stibick's (1979) classification of the Elateridae into subfamilies and tribes (see APPENDIX B), which he based on elaterid adults and larvae, incorporating the works of Hyslop (1917), Crowson (1961), Ohira (1962), and Gurjeva (1969, 1974). In general, Stibick postulated that the Cardiophorinae-Negastriinae lineage separated early from the ancestral stock, and that this line again branched into what are now two subfamilies. The original lineage, what is believed to be the Pyrophorinae et al., diverged again with the splitting off of the Elaterinae-Denticollinae ancestral stock. This lineage gave rise to two large and important groups, the Denticollinae-Hypnoidinae and the Elaterinae-Melanotinae.

LeConte (1853) last revised the United States species and other major workers of North American Elateridae included Say (1823, 1825, 1839), Eschscholtz (1829, 1830, 1833), Germar

(1844), Melsheimer (1846, 1853), Mannerheim (1853), Candeze (1859, 1860, 1863, 1881, 1889), Horn (1871, 1872, 1874, 1884, 1891), Blanchard (1889), Van Dyke (1932, 1943), Brown (1933a-b, 1934, 1935a-c, 1936a-e, 1939), Lane (1941, 1948a, 1948b, 1949, 1952, 1953, 1965, 1971), Becker (1956a, 1956b, 1971, 1973b, 1974, 1979a, 1979b), and Stibick (1971, 1975, 1976b, 1991). There has been no recent taxonomic revision of the Nearctic species beyond that of a few subfamilies (Bousquet 1991).

Adult elaterids, or click beetles, are diverse in terms of morphology and life history. Life cycles range from one to three or more years (Becker and Dogger 1991) and the majority of that time is spent in the larval stage. Adults may or may not feed depending on the species (Hyslop 1915, 1916; Doane 1961; Borror et al. 1989; Bousquet 1991) but in general, little is known of the adult food habits. Adults usually are capable of flight (Lane 1925, Hawkins 1936, Zacharuk 1962a, Doane 1977a, Crowson 1981, White 1983, Brown and Keaster 1986) and are collected on foliage, flowers, the ground, under bark, in decomposing wood, and at lights (Arnett 1968, Lawrence 1982, White 1983, Bousquet 1991). Although elaterids occur in a variety of habitats across North America, they are usually found in riparian areas (Lawrence and Newton 1982).

Elateridae usually overwinter as adults or immature larvae, the adults emerging in spring, often having spent the entire winter within the pupal cell where they underwent

eclosion the late summer before. Some species however, notably those within the genera *Athous* and *Hemicrepidius*, overwinter only as larvae, with mature larvae pupating in spring and emerging as adults in mid to late summer (Glen 1950, Zacharuk 1958b, Becker 1979b, Becker and Dogger 1991).

The majority of elaterids are bisexual, and in at least one species a spermatophore is transferred from the male to the female at the time of mating (Zacharuk 1958a). However, at least two species are known to be, or have populations known to be, parthenogenetic (Jewett 1942, Brooks 1960). Further, female beetles of some species are known to utilize sex pheromones for the attraction of males (Doane 1961, Zacharuk 1962a, Jacobson 1972, Oleschenko et al. 1976, Kamm et al. 1983, Keaster et al. 1987).

The larvae, commonly referred to as wireworms, usually have three instars (Becker and Dogger 1991), but up to thirteen instars have been reported (Stone 1941). Larvae are found in decomposing wood, under bark, rocks, dung and other debris, and in soil, litter, mushrooms, and moss (Glen et al. 1943, Van Emden 1945, Glen 1950, Lawrence 1982, Bousquet 1991). Many references claim that most wireworm species, eg. those inhabiting soil, are phytophagous while some species, primarily those inhabiting decomposing wood and litter, are predaceous, particularly on the larvae of other insects or wireworms (Arnett 1968, White 1983, Toth 1984, Becker and Dogger 1991, Bousquet 1991). Zachaurk (1963) and Lawrence

(1982) included saprophagy as another feeding habit of the larvae and Doane et al. (1975) refers to wireworm food preference as omnivorous.

Many phytophagous species are of economic importance in both North America and Europe (Comstock and Slingerland 1891; Hyslop 1915, 1916; Lane 1925; Hawkins 1936; Glen et al. 1943; Lanchester 1946; Eidt 1953; Wilkinson 1963 Apablaza et al. 1977; Doane 1977b Coghill 1978; Dolin 1978; Toba and Turner 1983; Toth 1984; Toba et al. 1985; Keaster et al. 1988; McKinlay 1992).

The natural mortality factors affecting wireworms include diseases, parasites, and predators (Zacharuk 1962a). Bacterial diseases are known to kill larvae, pupae, and adults both in the laboratory and in humid soils. Fungal diseases, which are more prevalent under lab than field conditions and usually attack the larval stage, are caused by several species of fungi including *Metarrhizium anisopliae* and *Beauveria bassiana* (Thomas 1932, Zacharuk 1962a). Parasites include mites, which are ectoparasitic and not fatal to their host, nematodes, Diptera, and Hymenoptera of the families Proctotrupidae and Bethylidae (Thomas 1929, 1931; Zacharuk 1962a). Principal predators of elaterid larvae, pupae, and adults include spiders, Hemiptera (Reduviidae), Coleoptera (Cicindelidae, Staphylinidae, Elateridae, and Carabidae), Diptera (Asilidae and Therevidae), occasionally some Hymenoptera (eg. ants), and birds (Strickland 1926, Thomas

1931, Zacharuk 1962a).

The Elateridae of Montana includes at least 152 species comprising seven subfamilies. The family is treated here in subfamilial sections and a key is provided to all subfamilies of adult Elateridae known to occur in the State.

Key to Subfamilies of Adult Elateridae

(adapted from Arnett 1968, Smith and Enns 1977)

1 With one or more setae on tarsal claw near base, not between claws where other setae may be present; and/or body profusely covered with scales .....Pyrophorinae

1′ Without setae on tarsal claw near base, but setae may be present between claws; vestiture hair-like, not composed of scales.....2

2 Scutellum cordate or cordate-like (figs. 56, 57); pronotum usually orbicular.....Cardiophorinae

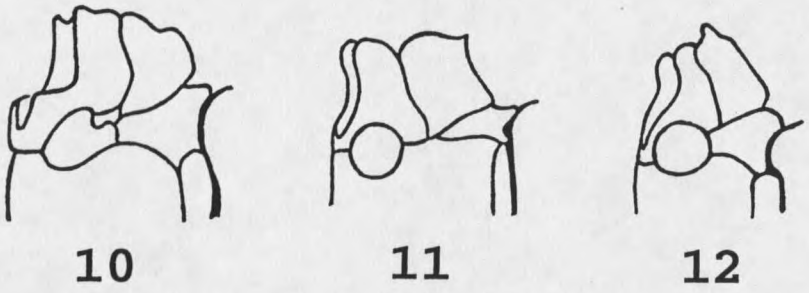
2′ Scutellum not definitely cordate; pronotum not orbicular.....3

3 Mesepisternum reaching mesocoxa and at least touching mesotrochantin (fig. 10).....6

3′ Mesepisternum not reaching mesocoxa (figs. 10, 11).....4

4 Mesepimeron small and does not touch mesocoxa (fig. 11) .....Negastriinae

4′ Mesepimeron reaches mesocoxa (fig. 12).....5



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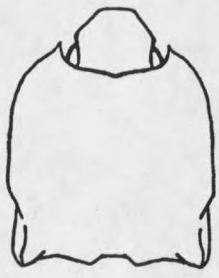

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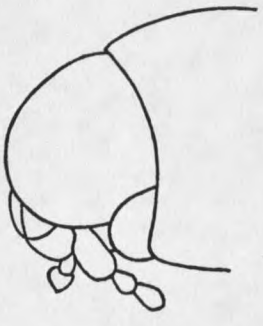

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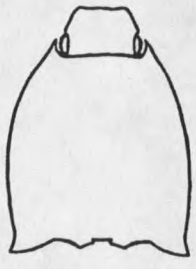

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Figures 10-16. Figs. 10-12, mesosternum, lateral view (redrawn from Arnett, 1968). Fig. 10 , *Orthostethus unifuscatus*. Fig. 11, *Oedostethus femoralis*. Fig. 12, *Melanotus similis*. Figs. 13-14, head, dorsolateral view (redrawn from Matthews, 1985). Fig. 13, denticolline sp. Fig. 14, elaterine sp. Figs. 15-16, head and prothorax, dorsal view. Fig. 15, *Danosoma brevicornis*. Fig. 16, *Lacon rorulenta*.

5 Tarsal claws pectinate; prosternopleural sutures double .....Melanotinae

5′ Tarsal claws simple; prosternopleural sutures single .....Hypnoidinae

6 Head capsule flattened; mouthparts prognathous (fig. 13) .....Denticollinae

6′ Head capsule remaining oval; deflexed mouthparts hypognathous, inferior (fig. 14).....Elaterinae

Subfamily Pyrophorinae Candeze

The Pyrophorinae subfamily classification used here is based on Stibick's (1979) classification of the Elateridae into subfamilies and tribes. Previous to his work, many of the tribes within the Pyrophorinae were considered of subfamily taxonomic ranking by other authors.

The Pyrophorinae is a large and variable subfamily of elaterids including ten tribes, nine of which are extant, ninety-one genera, and over twenty-three thousand species worldwide. Members of the subfamily display the following adult diagnostic characteristics: head capsule various, but generally oval and deflexed with hypognathous mouthparts, frons various; prosternum normally arcuate anteriorly; scutellum shield-shaped, never cordate; mesocoxae open or closed to mesepimeron and mesepisternum; claws simple, with one or more basal setae (Stibick 1979).

The Pyrophorinae of Montana includes three tribes, six

genera, and eight species. The tribes Agrypnini and Chalcolepidiini include relatively large species with predaceous larvae that are typically found in decomposing wood and under bark (Hyslop 1915, Becker and Dogger 1991). The Conoderini includes relatively small, phytophagous species which may display predaceous habits and are generally found in soil (Hyslop 1915; Tenhet 1939; Jewett 1942, 1944; Becker and Dogger 1991). A key is provided to all species of adult Pyrophorinae known to occur in Montana.

Key to Tribes, Genera, and Species of Adult Pyrophorinae

(adapted from Arnett 1952, 1968; Brooks 1960; Hatch 1930; Smith and Enns 1977)

1 Antennae received in deep, prothoracic, sternopleural grooves.....Agrypnini,2

1′ Antennae not received in prothoracic, sternopleural grooves.....3

2 Tarsal claws without setae at base; hypomeron without tarsal groove; posterior pronotal angles obtuse and convergent; prothoracic outline broad, narrowing in anterior fourth or less (fig. 15); widespread in forested areas.....*Danosoma brevicornis* (LeConte)

2′ Tarsal claws with basal setae; hypomeron with indistinct tarsal groove; posterior pronotal angles acute and divergent; prothoracic outline narrowing in anterior half (fig. 16); west of Continental Divide .....*Lacon rorulenta* (LeConte)

3 Prothorax with two velvety eye spots .....Chalcolepidiini, *Alaus*, 4

3′ Prothorax without velvety eye spots.....Conoderini, 5

4 Prothoracic eye spots large, distance between spots subequal to width of one spot; pronotum and elytra with prominent patches of white scales; eastern Montana .....*Alaus oculatus* (Linnaeus)

4′ Prothoracic eye spots smaller, distance between spots much greater than width of one spot; pronotum and elytra dark, without or with obsolete white scales; western Montana.....*Alaus melanops* LeConte

5 Posterior pronotal angle with distinct carina.....6

5′ Posterior pronotal angle without carina .....*Drasterius debilis* LeConte

6 Fourth tarsal segment broadened, without ventral lobe; pronotum light colored, with median, piceous maculation of varying size.....*Aeolus mellillus* (Say)

6′ Fourth tarsal segment with distinct ventral lobe; median of pronotum light colored, with darker, piceous maculation on either side.....*Conoderus*, 7

7 Size small, body less than 7 mm in length; elytra contiguous to apex.....*Conoderus auritus* (Herbst)

7′ Size large, body length 7 mm or more; elytra dehiscent posteriorly.....*Conoderus vespertinus* (Fabricius)

Tribe Agrypnini Candeze

Danosoma brevicornis (LeConte)

(figs. 15, 63)

Montana county records: CARBON, FLATHEAD, GALLATIN, GLACIER, JEFFERSON, JUDITH BASIN, LAKE, MINERAL, MISSOULA, RAVALLI, SANDERS.

Material examined: 69 specimens.

Elevation records: 2500′ - 7800′.

Collecting method: hand, 56 specimens, 81.2 %
L. funnel, 3 specimens, 4.3 %
F.I.T., 2 specimens, 2.9 %
unknown, 8 specimens, 11.6 %

Collection dates: 4 April - 14 September.

Biology: *Danosoma brevicornis* has been collected from both Douglas fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*) in Montana.

Remarks: The collection of this species in Montana was reported by both Russell (1968) and Lane (1971) under the species name *Lacon profusa* Candeze.

Lacon rorulenta (LeConte)

(figs. 16, 64)

Montana county records: FLATHEAD, LAKE, MISSOULA, RAVALLI.

Material examined: 8 specimens.

Elevation records: 3200′ - 3600′.

Collecting method: hand, 6 specimens, 75.0 %

unknown, 2 specimens, 25.0 %

Collection dates: 3 March - 16 September.

Biology: Similar to the previous species, *L. rorulenta* has also been collected from both Douglas fir and ponderosa pine.

Remarks: This species was reported as occurring in western Montana by Arnett (1952).

Tribe Chalcolepidiini Lacordaire

Alaus melanops LeConte

(fig. 65)

Montana county records: FLATHEAD, LAKE, LEWIS AND CLARK, LINCOLN, MINERAL, MISSOULA, RAVALLI, SANDERS.

Material examined: 28 specimens.

Elevation records: 3400'.

Collecting method: hand, 14 specimens, 50.0 %

unknown, 14 specimens, 50.0 %

Collection dates: 15 May - 28 June.

Remarks: *Alaus melanops*, sometimes referred to as the western eyed click beetle, was recorded from Montana by both Russell (1968) and Lane (1971).

Alaus oculatus (Linnaeus)

(fig. 66)

Montana county records: CUSTER, RICHLAND, ROSEBUD, YELLOWSTONE.

Material examined: 6 specimens.

Collecting method: hand, 4 specimens, 66.7 %
reared, 2 specimens, 33.3 %

Collection dates: 26 June - 12 July.

Remarks: *Alaus oculatus*, the eyed elater or eyed click beetle, represents a new state record for Montana.

Tribe Conoderini Fleutiaux

Aeolus mellillus (Say)

(fig. 67)

Montana county records: BIG HORN, BROADWATER, CARTER, CUSTER, FERGUS, GALLATIN, HILL, JEFFERSON, LAKE, MUSSELSHELL, PETROLEUM, RAVALLI, ROSEBUD, SANDERS, SILVER BOW, TOOLE, TREASURE, VALLEY, WHEATLAND, YELLOWSTONE.

Material examined: 227 specimens.

Elevation records: 2500′ - 5000′.

Collecting method: pitfall, 135 specimens, 59.5 %
hand, 82 specimens, 36.1 %
uv light, 2 specimens, 0.9 %
emergence trap, 2 specimens, 0.9 %
L. funnel, 1 specimen, 0.4 %
unknown, 5 specimens, 2.2 %

Collection dates: 27 March - 29 October (10 November).

Biology: *Aeolus mellillus* is a very common and widespread species of fields and pastures in Montana. In addition to being parthenogenetic, this species requires only

one year to complete its life cycle (Stirrett 1936, Jewett 1942).

Eggs are laid from spring to late summer and incubate from seven to eighteen days before hatching. Because the adults have a long egg laying period, larvae of different sizes can typically be found in the soil throughout the year. Larvae are highly active and display predaceous, as well as phytophagous, feeding habits (Jewett 1942).

Both larvae and adults overwinter and pupation occurs in spring and summer, usually taking between one and three weeks to complete. Adult beetles may live for several months (Jewett 1942).

Aeolus mellillus is an economically important species on a variety of crops in both the United States and Canada. Stirrett (1936), calling the larvae flat wireworms, reported *A. mellillus* as being injurious to corn (*Zea mays*), sugar beets (*Beta vulgaris*), and especially tobacco (*Nicotiana tabacum*) in Ontario. Glen et al. (1943) and Brooks (1960) stated this species was a minor pest of cereals in western Canada and Doane (1977b) said it was known to cause severe damage to wheat (*Triticum aestivum*) in Saskatchewan and Alberta. However, Wilkinson (1963) did not consider it a pest species in British Columbia, where it was found in potato (*Solanum tuberosum*) fields.

Aeolus mellillus has been collected from corn fields in Indiana (Hyslop 1915) and Missouri (Brown and Keaster 1986),

and from wheat fields in Indiana (Hyslop 1915), Montana (Morrill 1984), and Idaho (Toba et al. 1985). Jewett (1942) claimed this species was injurious to tobacco, corn, wheat, grasses, vegetables, and other crops in Kentucky and it has also been reported as a root pest of sainfoin (*Onobrychis viciaefolia*) in Montana (Hewitt and Burleson 1976).

The degree of damage to crops caused by *A. mellillus*, versus other wireworms, is uncertain. Although it is undoubtedly injurious to some degree and under certain conditions, it is often associated with populations of *Ctenicera destructor*, the prairie grain wireworm, and *Hypnoidus bicolor*, the two most damaging species to grain crops in the prairie provinces of Canada (Doane 1977b). In addition, *A. mellillus* larvae are highly active and under certain conditions predaceous, perhaps actually reducing egg and larval populations of other destructive species in the soil community (Glen et al. 1943, Doane 1977b).

Remarks: *Aeolus mellillus* adults are readily collected using pitfall traps. This species was recorded from Montana by Russell (1968), Lane (1971), Hewitt and Burleson (1976), and Morrill (1984).

Conoderus auritus (Herbst)

(fig. 68)

Montana county records: CUSTER, GALLATIN, JEFFERSON, MISSOULA, PETROLEUM.

Material examined: 17 specimens.

Collecting method: hand, 12 specimens, 70.6 %
pitfall, 4 specimens, 23.5 %
unknown, 1 specimen, 5.9 %

Collection dates: 26 April - 25 June (12 July).

Biology: *Conoderus auritus* overwinter as adults and females lay eggs from early spring to summer. Eggs incubate for one to two weeks before hatching. The larvae are quite active and for the most part phytophagous, however more mature larvae may attack one another or other larvae they encounter in the soil. Mature larvae pupate in mid to late summer in soil and pupation takes between nine and twenty days to complete. Adults may live for several months following spring emergence and the entire life cycle takes one to two years to complete (Jewett 1944).

This species was reported by Jewett (1944) as being injurious to tobacco, corn, small grains, some vegetables and legúmes, and the roots of strawberry (*Fragaria x Ananassa*) plants.

Remarks: *Conoderus auritus* represents a new state record for Montana.

Conoderus vespertinus (Fabricius)

(fig. 69)

Montana county records: DAWSON.

Material examined: 1 specimen.

Collecting method: uv light, 1 specimen, 100.0 %

Collection dates: 27 June.

Biology: The larvae of *C. vespertinus* have been reported as injurious to wheat in Kansas, corn in Kansas, Oklahoma, South Carolina, and Texas, cotton (*Gossypium* sp.) in Alabama and South Carolina, tobacco in North Carolina, beans (*Phaseolus* sp.) in New Jersey, and alfalfa (*Medicago sativa*) in New Mexico (Eagerton 1914, Hyslop 1915, Morrill 1978). Larvae have also been reported as feeding on little bluestem grass (*Andropogon scoparius*) (Hyslop 1915) and on the larvae of other elateridae (Tenhet 1939). The life cycle of this species takes one to two years to complete (Eagerton 1914).

Remarks: *Conoderus vespertinus* provides a new species record for Montana and the collection of a single individual by ultraviolet light trapping supports Eagerton's (1914) assertation that the adults of this species do not fly freely before sunset.

Conoderus vespertinus adults are sometimes called spotted click beetles (Eagerton 1914) and the larvae have been referred to under the vernacular names southern corn wireworm (Hyslop 1915) and tobacco wireworm (Jaques 1951, Swan and Papp 1972).

Drasterius debilis LeConte

(fig. 70)

Montana county records: GALLATIN, JUDITH BASIN.

Material examined: 14 specimens.

Elevation records: 6200′ - 7200′.

Collecting method: F.I.T., 9 specimens, 64.3 %

L. funnel, 4 specimens, 28.6 %

hand, 1 specimen, 7.1 %

Collection dates: (27 May) 8 June - 8 August (8 Sept.).

Remarks: *Drasterius debilis* is a forest species that is collected infrequently by hand and most readily by flight intercept trap. Lane (1971) reported this species as occurring in western Montana.

Subfamily Hypnoidinae Schwarz

The Hypnoidinae subfamily classification used here is based on the work of Stibick (1975, 1976b, 1977, 1978, 1979, 1980). He refers to a close, derivative relationship this subfamily has with the Melanactinae, and in turn how their relationship to the Denticollinae is uncertain due to a lack of knowledge about the tribes and subtribes of the latter subfamily. Therefore, until such information is available, Stibick recommends using the taxon Hypnoidinae, instead of Hypnoidini within the Denticollinae, for the classification of members within this group.

The Hypnoidinae is a small, relatively homogeneous subfamily of elaterids. It includes eleven genera, one fossil (Matthews 1977), and sixty-four extant species worldwide. Click beetles in this subfamily display the following adult diagnostic characteristics: head capsule dorsoventrally flattened, mouthparts prognathous, frons carinate above and between antennae; prosternum normally arcuate anteriorly;

scutellum various, never cordate; mesocoxae open to mesepimeron but closed to mesepisternum; tarsi simple, without lobes; claws simple, without basal setae (Stibick 1975, 1979).

The Hypnoidinae of Montana includes three genera and eight species, all within one tribe, the Hypnoidini. Hypnoidini species inhabit cold to temperate regions of Eurasia and the Western Hemisphere (Stibick 1976b). Keys are provided to all known species of adult Hypnoidinae in Montana.

Hypnoidinae larvae are generally found in moist soil and may be phytophagous or carnivorous. Adults are especially abundant in riparian zones, particularly beneath rocks near water. They become active in early spring after overwintering as adults within the pupal cell, usually located in soil. Eggs laid during the spring usually hatch within a few weeks and feed into the summer. Life cycles probably take between one and three years for most species to complete. Mature larvae undergo a short prepupal stage before beginning their ten to fifteen day pupation to the adult form (Stibick 1975).

Key to Genera and Species of Adult Hypnoidinae

(adapted from Stibick 1976b)

1 Prothorax very rugose and opaque, with course, deep punctures, never with scale-like setae on abdomen .....*Ligmargus funebris* (Candeze)

1′ Prothorax shining and variously punctate, or if rugose, then with scale-like setae on abdomen.....2

2 Pronotum longer than wide, with posterior pronotal angles

slender and divergent, about half as broad as long (fig. 19); never with scale-like setae on scutellum .....*Margaiostus glacialis* (Van Dyke)

2′ Pronotum as wide as long, or usually wider, with posterior pronotal angles short and stout, about three fifths as broad at base as long, and scarcely divergent (figs. 17, 18, 20, 21); scutellum sometimes with scale-like setae.....*Hypnoidus* Dillwyn

Genus *Hypnoidus* Dillwyn, 1829

Elater Linnaeus 1758 : Fabricius 1792 : 232. Say 1823 : 173. Gyllenhal 1827 : 35. LeConte 1853 : 507. Lane 1948b : 222, 223.

Hypolithus Eschscholtz 1829 : 33, 34. Dejean 1833 : 93-105. LeConte 1859b : 18. 1863 : 45. Hyslop 1921 : 650. Dietrich 1945 : 30-32. Lane 1948b : 221-223. Blackwelder 1948 : 19. Knowlton and McComb 1949 : 5. Lane 1952 : 66. Becker 1956b : 203-205. Zacharuk 1958 : 567, 568. Dogger 1959 : 106, 108-111, 114, 115. Brooks 1960 : 5-8, 24-26, 57, 58, 60. Wilkinson 1963 : 3, 8, 10, 11, 13. Lane 1965 : 187, 188. Becker 1966 : 204-206. Arnett 1968 : 500, 508. Stibick 1969 : 191, 192. Lane 1971 : 20, 21. Kirk and Balsbaugh 1975 : 67. Stibick 1975 : 148-153. Matthews 1977 : 304. Stibick 1979 : 165. Becker and Dogger 1991 : 411, 413, 414.

Hypnoidus Dillwyn 1829 : 32. Stephens 1830 : 260-262. Horn 1894 : 6, 7. Hyslop 1917 : 241, 253, 262. 1921 : 650.

Bradley 1930 : 123. Van Dyke 1932 : 325-327, 333. Leng 1933 : 85. Lane 1933 : 531. Thomas 1941 : 247, 248. Van Emden 1945 : 16, 26, 33, 36. Blackwelder 1948 : 19. Lane 1948b: 221-223. 1952 : 66. Russell 1968 : 141, 142. Stibick 1968 : 98-100. 1969 : 191-193. Lane 1971 : 20. Stibick 1975 : 148-154, 156-158, 160, 161, 163, 166, 167, 175-177, 179, 188, 189, 192-194, 196, 197, 201, 204-206. 1976b : 309, 342-386. 1977 : 226, 263-307. 1978 : 247, 248, 250-273. Dolin 1978 : 42, 45-50. Stibick 1979 : 165. 1979-1980 : 249, 251, 252.

Cryptohypnus Eschscholtz 1830 : 17. 1833 : 93. Germar 1844 : 134. Mannerheim 1853 : 225, 227. LeConte 1853 : 487, 488. 1859b : 18. Candeze 1860 : 62-73. LeConte 1861b : 166. 1863 : 45. 1869 : 371. Horn 1891 : 1-12, 28-30. Comstock and Slingerland 1891 : 270-272. Horn 1894 : 6, 7. Blatchley 1910 : 722, 723. Hyslop 1915 : 19, 23. 1917 : 247, 253, 262. Leng 1920 : 171. Hyslop 1921 : 637, 650. Leonard 1928 : 347. Van Dyke 1932 : 325, 333. Mank 1934 : 78. Hawkins 1936 : 10, 12, 54, 56-61, 93, 117, 118, 134, 135, 140. Thomas 1941 : 247. Glen 1941 : 58. Glen et al. 1943 : 359, 363, 369, 374, 375, 381, 383, 385. Van Emden 1945 : 13, 14, 16, 18, 19, 26, 31, 36. Blackwelder 1948 : 19. Lane 1948b : 222, 223. Glen 1950 : 183-186. Lane 1952 : 66. 1971 : 20. Stibick 1975 : 148-153. 1979 : 165.

The genus *Hypnoidus* is the largest and best known member

of the tribe Hypnoidini, occurring in both North America and Eurasia. Seven species are known from Montana, one having been introduced to North America from Europe.

Taxonomic History: Fabricius (1792) described the first species under the generic name *Elater*, that being *E. riparius*, a European hypnoidine. Both *Hypolithus* Eschscholtz (1829) and *Hypnoidus* Dillwyn (1829) were proposed as replacement names for *Elater*. Eschscholtz (1830) apparently substituted the generic name *Cryptohypnus* for his *Hypolithus* the following year. This created substantial generic confusion between the three names, a condition that persisted until Stibick (1975) revised the world Hypnoidinae.

In addition, elaterid species within the Negastriinae were not taxonomically separated into a different subfamily than the Hypnoidinae until the former subfamily was established by Nakane and Kishii (1956). Before Lane (1948) placed hypnoidines into the genus *Hypolithus* and negastriines into *Negastrius*, species of *Hypnoidus* were usually treated one of three different ways. They were grouped with negastriines into the genus *Cryptohypnus* (Melsheimer 1853; LeConte 1853, 1859b, 1861b, 1863, 1866, 1869; Horn 1871, 1891; Comstock and Slingerland 1891; Hyslop 1915), grouped with negastriines into the genus *Hypnoidus* (Stephens 1830, Bradley 1930, Van Dyke 1932, Thomas 1941), or considered species of *Cryptohypnus* while negastriines were incorrectly referred to as species of *Hypnoidus* (Horn 1894, Blatchley 1910, Leng 1920, Leonard 1928,

Mank 1934, Hawkins 1936, Glen et al. 1943).

After 1948, and until Stibick's first Hypnoidinae paper was available in 1968, *Hypnoidus* species were usually cited under the generic name *Hypolithus* and negastriines under *Negastrius* (Lane 1948b, Knowlton and McComb 1949, Dogger 1959, Arnett 1968, Kirk and Balsbaugh 1975). The two other genera of Montana Hypnoidinae, *Ligmargus* and *Margaiostus*, were erected by Stibick (1975, 1976).

Ecology/Habitat: *Hypnoidus* larvae typically live in soil (Van Emden 1945, Becker and Dogger 1991). Some species may be predaceous for at least part of their larval stage, however most are thought to be primarily phytophagous on the roots of various grasses, including wheat. Adults may be phytophagous on herbaceous plants. The biology of most species is unknown (Stibick 1976b).

Key to Species of Adult *Hypnoidus*

(adapted from Brooks 1960, Stibick 1976b)

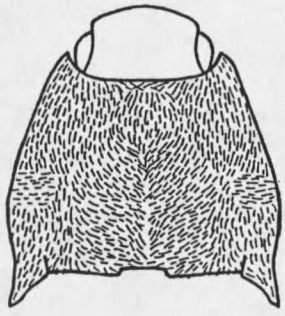
1 Body opaque, dull; prothorax coarsely and closely punctate, rugose; western Montana.....*squalidus* (LeConte)

1′ Body shining; prothorax more sparsely punctate, smooth 2

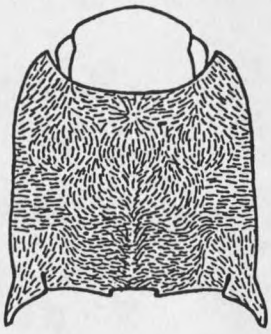
2 Scutellum conspicuously clothed with pale pubescence, elytral vestiture somewhat scale-like.....3

2′ Scutellum not as above, pubescence sparse on scutellum and body, not scale-like.....4

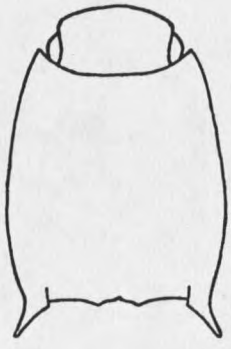
3 Pronotum narrowed on anterior two-thirds, the sides often



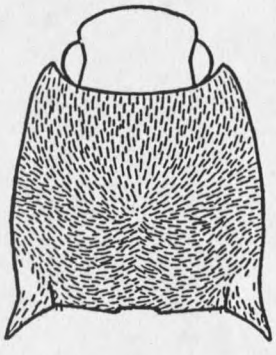
17



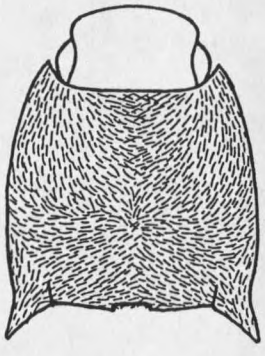
18



19



20



21

Figures 17-21, head and prothorax, dorsal view. Fig. 17, *Hypnoidus abbreviatus*. Fig. 18, *H. impressicollis*. Fig. 19, *Margaiostus glacialis*. Fig. 20, *Hypnoidus rivularius*. Fig. 21, *H. bicolor*.

obtusely subangulate in front of the angular sinuation (fig. 17).....*abbreviatus* (Say)

3′ Pronotum narrowed on anterior fourth, arcuate near the apex only, the sides nearly straight and parallel (fig. 18).....*impressicollis* (Mannerheim)

4 Length of elytra almost always 4 mm or more; color dark; east of Continental Divide.....*leei* Stibick

4′ Length of elytra under 4 mm; color dark to light, often distinctly bicolored; widespread.....5

5 Pronotum with setae of anterior half arranged longitudinally caudad to oblique (fig. 20); pronotal setae short, fine, appressed and usually more ruber in appearance .....*rivularius* (Gyllenhal)

5′ Pronotum with setae of anterior half lying transversely and longitudinally, usually crisscrossing each other along median of thorax (fig. 21); pronotal setae long, coarse, erect and often niveus laterally .....*bicolor* (Eschscholtz)

Hypnoidus abbreviatus (Say)

(figs. 17, 71)

Elater abbreviata Say 1823 : 173. LeConte 1853 : 507.

Cryptohypnus abbreviatus (Say) : Eschscholtz 1830 : 17. LeConte 1863 : 45. Horn 1891 : 7-9, 28. Comstock and Slingerland 1891 : 270-272. Horn 1894 : 7. Blatchley 1910 : 722, 723. Hyslop 1915 : 19, 23. Leng 1920 : 171. Leonard 1928 : 347. Boving and Craighead 1931 : 258,

259. Hawkins 1936 : 10, 12, 54, 56-61, 93, 117, 118, 134, 135, 140. Glen et al. 1943 : 363, 369, 373-375, 383, 385. Glen 1950 : 6, 184-186, 197, 244.

Hypnoidus abbreviatus (Say) : Thomas 1941 : 247. Stibick 1969 : 192. 1975 : 157, 160, 161, 176. 1976b : 346, 347, 381-386. 1979-1980 : 251, 264, 265, 267, 270, 285.

Hypolithus abbreviatus (Say) : Dietrich 1945 : 30-32, 63, 76, 77. Lane 1948b : 223. 1952 : 66. Becker 1956b : 204. Dogger 1959 : 106, 108-111, 114, 115. Brooks 1960 : 6, 8, 24-26, 60. Lane 1971 : 20. Kirk and Balsbaugh 1975 : 67.

Distribution: U.S.A.: Alaska, Connecticut, Illinois, Indiana, Iowa, Maine, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, Ohio, Oregon, Pennsylvania, South Dakota, Tennessee, Vermont, Washington, Wisconsin. CANADA: Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland, Nova Scotia, Ontario, Quebec, Saskatchewan.

Montana records: GALLATIN CO: Bridger Cr., 1 - 14 IV 1987 (MTEC), ibid., 14 - 26 IV 1987 (MTEC), ibid. (CES). HILL CO: Assiniboine, 9 V (USNM).

Material examined: 4 specimens.

Elevation records: 4800'.

Collecting method: pitfall, 3 specimens, 75.0 %
hand, 1 specimen, 25.0 %

Collection dates: (1 April) 14 April - 9 May.

Biology: *Hypnoidus abbreviatus* is an important pest of fields and gardens. The larvae, sometimes referred to as abbreviated wireworms, may attack corn, wheat, potato, onion and chives (*Allium* spp.), and cabbage (*Brassica oleracea*). In some parts of its range, eg. parkland areas of southern Manitoba, this species has been reported as only a minor pest, sometimes of local importance. In addition, larvae are thought to be partly predaceous. Mature larvae pupate in mid to late summer in soil. Pupation takes approximately nine days, with the new adult beetles overwintering in their pupal cells and emerging the following spring.

Remarks: *Hypnoidus abbreviatus* is a newly collected species for Montana and adults are most readily collected in pitfall traps. Even though this species is economically important in other parts of its range, it is uncommon and not prevalent in this State.

Hypnoidus bicolor (Eschscholtz)

(figs. 21, 72)

Hypolithus bicolor Eschscholtz 1829 : 33. LeConte 1863 : 45. Dietrich 1945 : 30, 32, 70, 71. Knowlton and McComb 1949 : 5. Lane 1952 : 66. Zacharuk 1958c : 567, 568. 1959 : 699-702. Brooks 1960 : 5, 8, 24, 25, 57, 58. Doane 1961 : 636, 637, 641-644. Wilkinson 1963 : 3, 8, 10, 11, 13. Burrage 1963 : 306-310. Lane 1971 : 21. Kirk and Balsbaugh 1975 : 67. Doane 1977a : 807-810, 812-817, 820, 821. 1981 : 335-338, 342.

Cryptohypnus bicolor (Eschscholtz) : Eschscholtz 1830 : 17. Germar 1844 : 134. LeConte 1863 : 45. Leng 1920 : 171.

Cryptohypnus lacustris LeConte 1853 : 486. 1863 : 45. Horn 1891 : 8. Leng 1920 : 171. Stibick 1976b : 353, 363.

Cryptohypnus picescens LeConte 1853 : 486. 1863 : 45. Horn 1891 : 10. Leng 1920 : 171. Stibick 1976b : 353, 362, 363.

Cryptohypnus nocturnus bicolor (Eschscholtz) : Horn 1891 : 9, 10, 29. Leonard 1928 : 347. Mank 1934 : 78. Glen 1935 : 231. 1941 : 57. Glen et al. 1943 : 359, 363, 369, 374, 375, 381, 385. Glen 1950 : 184, 197, 216. Wilkinson 1963 : 3.

Hypolithus lacustris (LeConte) : Lane 1948b : 223.

Hypolithus picescens (LeConte) : Lane 1948b : 223.

Hypolithus nocturnus bicolor (Eschscholtz) : Lane 1948b : 223. Becker 1956b : 204.

Hypnoidus bicolor (Eschscholtz) : Russell 1968 : 142. Stibick 1969 : 192. 1975 : 160, 176, 192. 1976b : 347, 352-366. 1979-1980 : 251, 264-267, 270, 283.

Distribution: U.S.A.: Alaska, Arizona, California, Colorado, Idaho, Illinois, Indiana, Maine, Massachusetts, Michigan, Minnesota, Montana, Nevada, New Hampshire, New Mexico, New York, North Dakota, Ohio, Oregon, South Dakota, Utah, Washington, Wisconsin, Wyoming. CANADA: Alberta, British Columbia, Labrador, Manitoba, Newfoundland, Northwest Territory, Ontario, Quebec, Saskatchewan, Yukon Territory.

Montana records: BEAVERHEAD CO: P & O Ranch, 9 VI 1936 (MTEC). BROADWATER CO: Toston Big Spring, 14 IV - 20 X 1990 (MTEC), Canyon Ferry W. M. A., 27 IV - 25 V 1988 (MTEC), Confederate Gulch, 27 III 1990 (MTEC). CARBON CO: Beartooth - Absaroka Wilderness, 7 VIII 1979 (MTEC), [no loc.] 29 V 1977 (MTEC). FERGUS CO: 9 mi. NW Lewistown, 28 V - 2 VII 1988 (MTEC), Judith Mtns. - Color Cr., 29 V 1988 (MTEC). FLATHEAD CO: Hungry Horse Res., 28 V 1987 (MTEC), Glacier N. P., 19 VII 1967 (OSU), ibid., 8 VII 1991 (DLG), ibid., 15 - 22 VII 1991 (GNPP), ibid., 17 - 24 VII 1991 (GNPP), ibid., 29 V - 19 VI 1991 (GNPP), ibid., 19 - 26 VI 1991 (GNPP), ibid., 26 V - 17 VI 1991 (GNPP), ibid., 28 V - 19 VI 1991 (GNPP). FLATHEAD/ GLACIER CO: Glacier N. P., 17 VII 1924 (CUIC), ibid., 30 VII 1924 (CUIC), ibid., 8 VIII 1924 (CUIC), ibid., 20 VII 1974 (JGE), ibid., 5 VIII 1924 (CUIC), ibid., 30 VII 1929 (CUIC), ibid., 22 VII 1967 (OSU), ibid., 22 VIII 1939 (USNM), ibid. (OSU), ibid., 20 VII 1967 (OSU), ibid., 19 VII 1924 (CUIC), ibid., 11 IX 1957 (CUIC). GALLATIN CO: [no loc.] V 1954 (MTEC), ibid., 27 VI 1900 (MTEC), ibid., 20 V 1912 (MTEC), ibid., 12 V 1931 (USNM), ibid., 22 V 1956 (MTEC), Hyalite Canyon, 26 VI 1960 (MTEC), Logan, 27 IV 1988 (MTEC), Bozeman, 21 VI 1989 (MTEC), ibid., 9 VII 1902 (USNM), Belgrade 19 VI 1991 (CES), Gallatin R., 18 VII - 13 IX 1989 (MTEC), ibid., 5 V 1987 (MTEC), ibid., 5 - 12 V 1987 (MTEC), ibid., 13 VI - 15 VII 1987 (DLG), ibid. (MTEC), ibid., 25 V - 13 VI 1987 (MTEC), Bridger Cr., IX 1988 - VI 1989 (MTEC), ibid., 14 - 26 IV 1987

(MTEC), ibid., 7 - 20 VI 1987 (MTEC), ibid., 20 - 30 VI 1987 (MTEC), ibid., 8 VII 1987 (MTEC), ibid., 17 VI - 9 X 1989 (DLG), ibid. (MTEC), ibid., 26 IV - 10 V 1987 (CES), Bozeman Cr., 7 VI - 24 VII 1988 (MTEC), Hyalite Reservoir, 19 VII 1986 (MTEC), Blackmore Cr., 8 VI - 26 IX 1989 (MTEC), Brackett Cr., 18 V - 28 VI 1988 (MTEC). Cache Cr., 28 VI - 26 VII 1988 (MTEC), Sacajawea Mtn., 19 VIII 1938 (MTEC). GLACIER CO: 14 mi. N. Cutbank, 27 IV - 13 VI 1988 (MTEC), S. Fork Milk R., 6 VI - 4 VIII 1989 (MTEC), Glacier N. P., 24 V 1940 (GNP), ibid., 8 VII 1962 (JGE), ibid., 19 VII 1963 (JGE), ibid., 8 VIII 1968 (JGE), ibid., 9 VII 1987 (JGE), ibid., 14 VII 1977 (JGE), ibid., 30 VII 1967 (JGE), ibid., 15 IX 1971 (JGE), ibid., VII 1988 (JGE), ibid., 22 VII 1974 (JGE), ibid., 1 VII 1961 (JGE). GRANITE CO: So. Boulder Cr., 21 V - 25 VI 1988 (MTEC), ibid., 25 VI - 24 VII 1988 (MTEC). JUDITH BASIN CO: Little Belt Mtns., 30 V - 1 VII 1988 (MTEC), ibid., 1 VII - 13 VIII 1988 (MTEC). LAKE CO: Arlee, 29 VII 1967 (OSU), 14 mi. S. Swan L., 14 VI 1967 (OSU), St. Mary Pk. - Mission Range, 17 VII 1964 (JGE). MADISON CO: Tobacco Root Mtns. - Potosi, 5 VII 1986 (MTEC), ibid., 16 VI 1988 (MTEC). MEAGHER CO: 10 mi. S. Niehart, 12 - 17 VI 1989 (MTEC), 0.5 mi. SW Lennep, 18 V - 28 VI 1988 (MTEC). MINERAL CO: Lookout Pass, 9 VI 1967 (OSU). PARK CO: Cooke City, 17 VIII 1962 (JGE), ibid., 16 VIII 1931 (USNM). RAVALLI CO: 5 mi. SW Florence, 27 VI 1967 (OSU). SWEET GRASS CO: Big Timber Canyon, 4 VIII 1990 (MTEC). TOOLE CO: 5 mi. S. Shelby, 23 IV - 19 V 1988 (MTEC).

WHEATLAND CO: 14 mi. S. Harlowton, 30 V - 4 VII 1988 (MTEC), Two Dot, 30 V - 28 VI 1988 (MTEC). YELLOWSTONE CO: [no loc.] 22 IV 1919 (USNM).

Material examined: 188 specimens.

Elevation records: 2700′ - 9000′.

Collecting method: hand, 121 specimens, 64.4 %
pitfall, 66 specimens, 35.1 %
F.I.T., 1 specimen, 0.5 %

Collection dates: (14 April) 22 April - 15 September.

Biology: *Hypnoidus bicolor* beetles emerge in April or May after overwintering in their pupal soil cells and adults of both sexes are then active on the soil surface. Eggs laid in spring hatch in approximately two weeks and although the number of instars is unknown, the larval period ranges between five months and two or more years. Larvae prefer soil temperatures near 64 degrees Fahrenheit and soil moisture content between 19.4 and 22.8 percent. They apparently suffer from abnormal ecdysis when molting in nearly air-dry soil and subsequently die. The entire life cycle may be completed in as little as one year, but probably averages three years in more northern parts of its range, including Montana. The larva of this species is illustrated in detail by Glen et al. (1943) and Wilkinson (1963).

Parthenogenetic and bisexual forms of *H. bicolor* have been reported from Saskatchewan. Apparently this species reproduces by parthenogenesis in the forested northern and

western parts of its range and by sexual reproduction in most of the remainder. There is also a zone of integration between the two, where males are commonly collected, but are always outnumbered by females. Montana lies within the latter zone, but is likely to include the parthenogenetic forms in the mountainous and forested western parts of the State.

Hypnoidus bicolor is considered one of two principal economic species of wireworm on wheat in western Canada. It is destructive to both field and garden crops in grasslands and parklands of Canada's prairie provinces. In addition to wheat, the larvae of this species feed on the roots of other cereals and potato.

Remarks: *Hypnoidus bicolor* has a widespread distribution in North America and was first recorded from Montana by Horn (1891). Mank (1934) recorded this species from Glacier National Park and Russell (1968) collected *H. bicolor* in Flathead County. Stibick (1976b) recorded additional collections from Gallatin and Yellowstone Counties.

Hypnoidus impressicollis (Mannerheim)

(figs. 18, 73)

Cryptohypnus impressicollis Mannerheim 1853 : 225. LeConte 1859b : 18. 1863 : 45. Horn 1891 : 8, 9, 28. 1894 : 7. Leng 1920 : 171.

Hypolithus impressicollis (Mannerheim) : Lane 1948b : 223. 1952 : 66. Becker 1956b : 204. Brooks 1960 : 24-26, 60. Wilkinson 1963 : 8, 10, 11, 13. Lane 1971 : 20.

Hypnoidus impressicollis (Mannerheim) : Stibick 1969 : 192. 1975 : 161, 176. 1976b : 346, 347, 377-381. 1979-1980 : 252, 264, 270, 285.

Distribution: U.S.A.: Alaska, Colorado, Idaho, Montana, New Mexico, Oregon, Utah, Washington, Wyoming. CANADA: Alberta, British Columbia, Manitoba, Northwest Territory, Quebec.

Montana records: BROADWATER CO: Deepdale - Missouri R., 11 - 25 V 1988 (MTEC), ibid., 25 V - 22 VI 1988 (MTEC), ibid. (CES), ibid. (DLG), 22 VI - 20 VII 1988 (MTEC). FLATHEAD CO: Essex, 23 VII 1967 (OSU). GALLATIN CO: [no loc.] 30 V 1952 (MTEC), Gallatin R., 11 VI 1987 (MTEC), ibid., 21 IV - 5 V 1987 (MTEC), ibid. (DLG), ibid., 5 V 1987 (MTEC), ibid., 13 VI 1987 (MTEC), ibid., 15 VII 1987 (MTEC), Bridger Cr., 1 VI - 13 VII 1988 (MTEC), ibid., 26 IV 1987 (MTEC), ibid., 10 V 1987 (MTEC), ibid., 19 V - 7 VI 1987 (MTEC), E. Gallatin R., 22 VI 1987 (MTEC). LAKE CO: Swan R., 27 VI 1989 (MTEC). MEAGHER CO: 0.5 mi. SW Lennep, 28 VI - 26 VII 1988 (MTEC). MINERAL CO: St. Regis, 16 VI 1967 (OSU), Alberton, 16 VI 1967 (OSU). PARK CO: Cooke City, 16 VIII 1931 (USNM). POWELL CO: Blackfoot R., 26 VI 1989 (MTEC). RAVALLI CO: Hamilton, 28 VI 1967 (OSU). WHEATLAND CO: Two Dot, 8 - 30 V 1988 (MTEC).

Material examined: 78 specimens.

Elevation records: 3000′ - 9000′.

Collecting method: hand, 44 specimens, 56.4 %

pitfall, 34 specimens, 43.6 %

Collection dates: (21 April) 26 April - 16 August.

Biology: *Hypnoidus impressicollis* larvae may cause damage to seed potato pieces in spring, but do not usually affect the mature crop. Larvae have also been taken from roots of locoweed (*Lupinus* sp. and/or *Oxytropis* sp.).

Remarks: Stibick (1976b) recorded *H. impressicollis* as having been collected in both Hill and Park Co., Montana.

Hypnoidus leei Stibick

(fig. 74)

Hypnoidus leei Stibick 1968 : 98-100. 1975 : 176. 1976b : 375-377. 1979-1980 : 252, 266, 270, 284.

Distribution: U.S.A.: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming. CANADA: Alberta.

Montana records: FERGUS CO: 9 mi. NW Lewistown, 8 - 28 V 1988 (MTEC). GALLATIN CO: Bozeman, 27 VI 1907 (MTEC), ibid., 17 V 1984 (CES), Belgrade, 8 VI 1991 (CES), Gallatin R., VIII 1987 (MTEC), Bridger Cr., X 1987 - V 1988 (MTEC), ibid., 1 VI - 13 VII 1988 (DLG), ibid. (MTEC), ibid., 14 - 26 IV 1987 (MTEC), ibid., 26 IV - 10 V 1987 (MTEC), [no loc.] 18 VI 1900 (MTEC), Bozeman Cr., 20 VI 1990 (MTEC), jct. Meadow Cr. & Jackson Cr., 21 V 1988 (MTEC). JUDITH BASIN CO: Little Belt Mtns., 30 V - 1 VII 1988 (MTEC). LEWIS AND CLARK CO: Canyon Cr., 19 VIII 1987 (MTEC). MEAGHER CO: 0.5 mi. SW Lennep, 18 V - 28 VI 1988 (MTEC). TETON CO: 3 mi. S. Choteau, 24 VI 1955 (MTEC). WHEATLAND CO: Two Dot, 30 V - 28 VI 1988 (MTEC), ibid. (CES), ibid. (DLG), ibid., 28 VI - 24

VII 1988 (MTEC), ibid. (CES), ibid., 8 - 30 V 1988 (MTEC).

Material examined: 33 specimens.

Elevation records: 3800′ - 6200′.

Collecting method: pitfall, 24 specimens, 72.7 %
hand, 9 specimens, 27.3 %

Collection dates: (14 April) 17 May - 19 August.

Remarks: *Hypnoidus leei* is a new state record for Montana and is most readily collected using pitfall traps in riparian areas.

Hypnoidus rivularius (Gyllenhal)

(figs. 20, 75)

Elater riparius Panzer (*nec* Fabricius 1792, preoccupied) 1796 : 12.

Elater rivularius Gyllenhal 1827 : 35.

Hypolithus rivularius (Gyllenhal) : Eschscholtz 1829 : 33.

Cryptohypnus rivularius (Gyllenhal) : Eschscholtz 1830 : 17. Dejean 1833 : 93. Germar 1844 : 134. Candeze 1860 : 72.

Hypnoidus rivularius (Gyllenhal) : Stephens 1830 : 261. Stibick 1969 : 192. 1975 : 161, 176, 210. 1976b : 346, 347, 366-371. 1979-1980 : 252, 264, 270, 284.

Cryptohypnus lucidulus Mannerheim 1853 : 227. LeConte 1859b : 18. LeConte 1863 : 45. Leng 1920 : 171.

Hypolithus nocturnus lucidulus (Mannerheim) : Horn 1891 : 9, 29. Lane 1948b : 223.

Hypolithus lucidulus (Mannerheim) : Lane 1952 : 66. 1971 : 21.

Distribution: Palearctic (introduced to North America). U.S.A.: Alaska, Maine, Michigan, Minnesota, Montana, New Hampshire, North Dakota, Utah, Washington, Wyoming. CANADA: British Columbia, Labrador, Manitoba, Northwest Territory, Quebec, Saskatchewan, Yukon Territory.

Montana records: BROADWATER CO: Townsend - Missouri R., 7 VI 1989 (MTEC). CARBON CO: Beartooth - Absaroka Wild., 15 VIII 1978 (MTEC), ibid., 31 VII 1979 (MTEC), ibid. (DLG), ibid., 7 VIII 1979 (MTEC). FERGUS CO: Judith Mtns. - Color Cr., 29 V 1988 (MTEC). FLATHEAD/GLACIER CO: Glacier N. P., 10 VII 1924 (CUIC). GALLATIN CO: Gallatin R., 13 VI 1987 (MTEC), ibid., VIII 1987 (MTEC), ibid., 13 VI - 15 VII 1987 (MTEC), ibid. (DLG), Sourdough Cr., 19 IV 1988 (CES), Bozeman, 5 VII 1989 (MTEC), Bridger Cr., VII 1987 (MTEC), ibid., 17 VI - 9 X 1989 (MTEC). GRANITE CO: Boulder Cr., 20 V - 25 VI 1988 (MTEC), ibid., 20 V - 24 VII 1988. MADISON CO: Tobacco Root Mtns. - Potosi, 8 VII 1988 (MTEC), ibid., 5 VII 1988 (MTEC). MINERAL CO: St. Regis, 16 VI 1967 (OSU). MISSOULA CO: 24 mi. E. Missoula, 16 VI 1967 (OSU). PONDERA CO: Conrad, 26 IV 1974 (MTEC). WHEATLAND CO: 14 mi. S. Harlowton, 6 - 30 V 1988 (MTEC).

Material examined: 25 specimens.

Elevation records: 3600′ - 6200′.

Collecting method: pitfall, 14 specimens, 56.0 %
hand, 10 specimens, 40.0 %
uv light, 1 specimen, 4.0 %

Collection dates: 19 April - 15 August.

Remarks: *Hypnoidus rivularius* was introduced into North America from Europe in the ballast of ships during the 1800's. It is a widespread species across Canada, northern United States, and Rocky Mountains. Stibick (1976b) recorded this species as having been collected in the following Montana counties; Flathead, Gallatin, Lewis and Clark, and Lincoln.

Hypnoidus squalidus (LeConte)

(fig. 76)

Cryptohypnus squalidus LeConte 1853 : 487. 1859b : 18. 1863 : 45. Horn 1891 : 10-12, 29. 1894 : 7. Leng 1920 : 171.

Hypolithus squalidus (LeConte) : Lane 1948b : 223. Knowlton and McComb 1949 : 5. Lane 1952 : 66. Becker 1956b : 203, 204. Brooks 1960 : 7, 24. Lane 1965 : 188. 1971 : 20.

Hypnoidus squalidus (LeConte) : Russell 1968 : 141, 142. Stibick 1975 : 157, 177, 187, 204. 1976b : 346, 347, 349-352. 1979-1980 : 252, 266, 267, 270, 282.

Distribution: U.S.A.: California, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming. CANADA: Alberta, British Columbia.

Montana records: BEAVERHEAD CO: [no loc.] 11 VII 1928 (MTEC). FLATHEAD CO: Hungry Horse, 18 VII 1967 (OSU), Glacier N. P., 19 VII 1967 (OSU). LAKE CO: Ravalli, 19 VII 1937 (OSU), Arlee, 29 VII 1967 (OSU), 10 mi. E. Arlee, 30 VII

1967 (OSU). LINCOLN CO: Troy - Kootenai R., 24 VII 1967 (OSU), ibid. (MTEC). MINERAL CO: Lookout Pass, 14 VII 1967 (OSU). RAVALLI CO: Darby - Bitterroot R., 2 VII 1991 (MTEC). SANDERS CO: 13 mi. NE St. Regis, 19 VI 1967 (OSU), ibid. (CES), 2 mi. W. Ravalli, 17 VII 1967 (OSU).

Material examined: 14 specimens.

Elevation records: 2000′ - 4200′.

Collecting method: hand, 14 specimens, 100.0 %

Collection dates: 19 June - 30 July.

Biology: *Hypnoidus squalidus* is a riparian species collected at lower elevations in western Montana.

Remarks: *Hypnoidus squalidus* has only been collected by hand in Montana. It was recorded from the State by both Lane (1971) and Russell (1968), where the latter collected *H. squalidus* from the following Montana counties; Lake, Mineral, and Sanders.

Ligmargus funebris (Candeze)

(fig. 77)

Cryptohypnus funebris Candeze 1860 : 62. LeConte 1863 : 45. 1869 : 371. Horn 1891 : 11, 29. 1894 : 7. Leng 1920 : 171. Glen 1950 : 184, 185, 197, 244. Stibick 1975 : 212.

Hypolithus funebris (Candeze) : Lane 1948b : 223. Knowlton and McComb 1949 : 5. Lane 1952 : 66. Becker 1956b : 203, 204. Brooks 1960 : 8, 24. Lane 1965 : 188. 1971 : 20.

Hypnoidus funebris (Candeze) : Russell 1968 : 141.

Ligmargus funebris (Candeze) : Stibick 1975 : 161, 212, 213, 216-220. 1978 : 250. 1979-1980 : 252, 264, 266, 267, 269, 279.

Distribution: U.S.A.: Alaska, California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming. CANADA: Alberta, British Columbia, Northwest Territory.

Montana records: BROADWATER CO: Confederate Gulch, 27 III 1990 (MTEC). FERGUS CO: Judith Mtns. - Color Cr., 29 V 1988 (CES), Big Snowy Mtns., 3 VII 1989 (CES), ibid. (MTEC). FLATHEAD CO: Kalispell, 13 VI 1966 (USNM), ibid., 13 - 20 VI 1965 (USNM), LaSalle, 3 VII 1938 (USNM), Glacier N. P., 19 VII 1967 (OSU), ibid., 2 VI 1991 (GNPP), ibid., 8 VII 1991 (GNPP). FLATHEAD/GLACIER CO: Glacier N. P., 11 IX 1957 (CUIC). GALLATIN CO: Bozeman, 30 VII 1930 (MTEC), ibid., 31 V 1960 (MTEC), [no loc.] 20 IV 1955 (MTEC), ibid., 7 V 1956 (MTEC), ibid., 17 V 1956 (MTEC), ibid., V 1955 (MTEC), W. Hyalite Cr., 23 VI 1988 (MTEC), E. Gallatin R., 22 VI 1987 (MTEC), Hyalite Res., 19 VII 1986 (MTEC), Bozeman Cr., 4 VI 1987 (MTEC), Gallatin R., 5 V 1987 (DLG), ibid. (MTEC), ibid., 3 V 1988 (DLG), ibid. (MTEC), ibid., 21 IV 1987 (MTEC), ibid., 13 VII 1989 (MTEC), ibid., 15 VII 1987 (MTEC), Bridger Cr., 14 III 1987 (MTEC), ibid., 14 - 26 IV 1987 (DLG), ibid. (MTEC), ibid., 26 IV 1987 (MTEC), ibid., 1 VI - 13 VII 1988 (MTEC), ibid., 7 - 20 VI 1987 (MTEC), ibid., 26 IV - 10 V 1987 (MTEC), ibid., 1 - 14 IV 1987 (MTEC). GLACIER CO: Glacier N. P., 8

VII 1961 (JGE), ibid., 2 VII 1962 (JGE), ibid., 27 VI 1968 (JGE), ibid., 14 VII 1972 (JGE), ibid., 5 VIII 1973 (JGE), ibid., 25 VII 1982 (JGE), ibid., 29 VII 1965 (JGE), ibid., 18 VII 1972 (JGE), ibid., 21 VII 1983 (JGE), ibid., 1 VII 1961 (JGE). GRANITE CO: Nimrod Warm Spring, 5 V 1990 (MTEC). LAKE CO: Ravalli, 19 VII 1937 (OSU), Polson, 20 VIII 1939 (USNM), St. Mary Pk. - Mission Range, 17 VII 1964 (JGE), Arlee, 29 VII 1967 (OSU). LEWIS AND CLARK CO: East Helena, 9 V 1989 (MTEC). MINERAL CO: Haugan, 9 VIII 1931 (SNOW), Lookout Pass, 14 VII 1967 (OSU). MISSOULA CO: 24 mi. E. Missoula, 16 VI 1967 (OSU). POWELL CO: Clark Fork - Goldcreek, 5 V 1990 (MTEC). RAVALLI CO: Hamilton, 28 VI 1967 (OSU), Bitter Root Mtns., 1956 (USNM). SANDERS CO: 13 mi. NE St. Regis, 19 VI 1967 (OSU), 12 mi. NE St. Regis, 19 VI 1967 (OSU). SWEET GRASS CO: Big Timber Canyon, 4 VIII 1990 (CES), ibid. (MTEC).

Material examined: 176 specimens.

Elevation records: 2500′ - 9000′.

Collecting method: hand, 152 specimens, 86.4 %
pitfall, 21 specimens, 11.9 %
unknown, 3 specimens, 1.7 %

Collection dates: 14 March - 11 September.

Biology: *Ligmargus funebris* is a strictly riparian species that is typically collected from underneath rocks and debris adjacent to a watercourse.

Remarks: *Ligmargus funebris* is a commonly collected

species and was reported as occurring in Montana by both Mank (1934) and Russell (1968) with Mank incorrectly citing this species as *Cryptohypnus lecontei* Leng. Russell collected *L. funebris* from the following Montana counties; Flathead, Lake, Mineral, and Sanders.

Cryptohypnus funebris Candeze is the type species of the genus *Ligmargus*, which Stibick (1975) erected.

Margaiostus glacialis (Van Dyke)

(figs. 19, 78)

Hypnoidus glacialis Van Dyke 1932 : 326, 327. Leng 1933 : 85. Russell 1968 : 141.

Hypolithus glacialis (Van Dyke) : Lane 1948b : 223. 1952 : 66. Becker 1956b : 204. Brooks 1960 : 7, 24, 25. Lane 1971 : 20.

Ligmargus glacialis (Van Dyke) : Stibick 1975 : 157.

Margaiostus glacialis (Van Dyke) : Stibick 1976b : 323, 324, 326-328. 1979-1980 : 253, 264, 266, 269, 281.

Distribution: U.S.A.: Montana, Oregon, Washington, Wyoming. CANADA: Alberta, British Columbia.

Montana records: CASCADE CO: Monarch - Belt Cr., 9 VI 1988 (MTEC). FERGUS CO: Crystal Lake, 29 VIII 1990 (MTEC). FLATHEAD CO: Hungry Horse, 28 V 1987 (MTEC), ibid. (CES), ibid., 19 VII 1967 (OSU), Glacier N. P., 19 VII 1967 (OSU), ibid., 6 VIII 1934 (OSU), ibid., 31 VIII 1950 (OSU). FLATHEAD /GLACIER: Glacier N. P., 10 - 12 VII 1929 (CUIC). GLACIER CO: Glacier N. P., 21 VII 1983 (JGE). LAKE CO: St. Mary Pk.

- Mission Range, 17 VII 1964 (JGE). LINCOLN CO: PARATYPE, Eureka, 9 VII 1930 (USNM). MINERAL CO: Lookout Pass, 25 VI 1967 (OSU), ibid., 19 VII 1967 (OSU).

Material examined: 15 specimens.

Elevation records: 3800′ - 8600′.

Collecting method: hand, 15 specimens, 100.0 %

Collection dates: 28 May - 31 August.

Remarks: The holotype of *M. glacialis* was collected in Montana at Lake MacDonald, Flathead Co., Glacier National Park, July 7, 1930. Van Dyke (1932) also cited eight paratypes from Montana, collected near Eureka, Lincoln Co., July 9, 1930. Mank (1934) included this species in her list of Glacier National Park Coleoptera as *Cryptohypnus* sp. near *hyperboreus* Gyllenhal.

Subfamily Denticollinae Reitter

The subfamily Denticollinae is a taxon in serious need of systematic work. It has been referred to as the tribe Lepturoidini, within either the subfamily Pyrophorinae (Hyslop 1917, Leng 1920) or the subfamily Elaterinae (Glen 1950), and as the tribe Athoini within the subfamily Pyrophorinae (Becker and Dogger 1991). The classification used here is based on Stibick's (1979) classification of the Elateridae into subfamilies and tribes.

The composition of the Denticollinae has included species now considered to be in the subfamilies Hypnoidinae,

Negastriinae, Melanactinae, and Elaterinae (Glen 1950, Lane 1971). Stibick (1979) has acknowledged the disagreement as to the status of various taxa within the Denticollinae, and as such, most genera within this subfamily need revisionary work. The generic composition of the Denticollinae used here is based on Bousquet (1991).

In Montana, three of five Denticollinae genera, *Limonius, Hemicrepidius,* and *Ctenicera*, need revisions. *Ctenicera* is the largest genus in Montana with thirty-nine species. Although incomplete, the best taxonomic references for Nearctic species of *Ctenicera* include those by Brown (1935a-c, 1936a-d, 1939), Van Dyke (1932), and Lane (1971). Nearctic *Eanus* were treated by Brown (1930, 1936e), Nearctic *Oxygonus* by Roache (1963), and Becker (1974, 1979b) first revised eastern, then western, Nearctic species of *Athous*.

The Denticollinae is a very large subfamily of elaterids which includes three tribes, over two-hundred genera, and thousands of species worldwide. Members of the subfamily display the following adult diagnostic characteristics: head capsule flattened with prognathous mouthparts, frons usually carinate, sometimes obsolete medially; prosternum normally arcuate anteriorly but sometimes truncate; scutellum various, never cordate; mesocoxae open to both mesepimeron and mesepisternum; tarsi various, with or without ventral lobes; claws simple, without basal setae (Stibick 1979).

The Denticollinae of Montana includes two tribes, the

Denticollini and Ctenicerini, and is the most speciose subfamily of Elateridae occurring in the State with sixty-four species. The larvae are found in soil, ground litter, wood, mosses, mushrooms, and under bark, rocks, and dung (Van Emden 1945, Glen 1950, Becker 1979b, Becker and Dogger 1991). Little is known about the life history of most taxa within this subfamily (Stibick 1979), but the Denticollinae does contain a number of economically important agricultural pest species, those wireworms being primarily phytophagous (Hyslop 1915, 1916; Lane 1925, 1933; Strickland 1933; Glen 1935, 1950; Lanchester 1939, 1946; Glen et al. 1943; Jones 1951; Zacharuk 1958a, 1958b, 1962a; Wilkinson 1963; Burrage 1963, 1964; Doane et al. 1975; Doane 1977a, 1981; Toba et al. 1985).

The majority of Denticollinae species overwinter as immature larvae or as adults, which pupate in late summer and emerge the following spring. However, most species of *Athous* and *Hemicrepidius* overwinter as larvae, with mature larvae pupating in spring and emerging as adults in mid to late summer (Glen 1950, Zacharuk 1958b, Becker 1979b). In addition, many species within this subfamily are known to use pheromones for the attraction of males (Jacobson 1972).

Tribe Denticollini Reitter

Athous nigropilis Motschulsky

(fig. 79)

Montana county records: FLATHEAD, GALLATIN, MADISON,

MISSOULA, MUSSELSHELL, POWELL, RAVALLI, ROSEBUD, SANDERS, TOOLE.

Material examined: 53 specimens.

Elevation records: 2600′ - 3720′.

Collecting method: uv light, 30 specimens, 56.6 %
hand, 16 specimens, 30.2 %
L. funnel, 7 specimens, 13.2 %

Collection dates: 2 July - 10 August (7 September).

Biology: Brooks (1960) reported that *A. nigropilis* larvae live in decomposing logs of cottonwood (*Populus* sp.).

Remarks: This species was first recorded from Montana in by LeConte (1866), but cited under the synonym *Athous montanus* LeConte. Additional Montana citations were made by Leng (1920) and Becker (1974).

Athous rufiventris (Eschscholtz)

(fig. 80)

Montana county records: FERGUS, FLATHEAD, GALLATIN, GLACIER, MADISON, MISSOULA, PARK, POWELL, RAVALLI, SWEET GRASS.

Material examined: 126 specimens.

Elevation records: 3164′ - 8100′.

Collecting method: hand, 63 specimens, 50.0 %
L. funnel, 27 specimens, 21.4 %
F.I.T., 19 specimens, 15.1 %
uv light, 15 specimens, 11.9 %
pitfall, 2 specimens, 1.6 %

Collection dates: (28 May) 30 May - 18 Aug. (9 Sept.).

Biology: Brooks (1960) reported *A. rufiventris* has been collected on lodgepole pine.

Remarks: This species was first recorded as occurring in Montana by Becker (1974).

Athous sierrae varius Lane

(fig. 81)

Montana county records: BIG HORN, GALLATIN, MADISON.

Material examined: 63 specimens.

Collecting method: hand, 55 specimens, 87.3 %
uv light, 4 specimens, 6.3 %
F.I.T., 4 specimens, 6.3 %

Collection dates: (28 May) 15 June - 31 July (8 Sept.).

Remarks: Although specimens were not recorded from Montana, Becker (1974) predicted the distributional range of *A. sierrae varius* to include western and southwestern Montana.

Hemicrepidius brevicollis (Candeze)

(fig. 82)

Montana county records: DAWSON, ROSEBUD.

Material examined: 2 specimens.

Collecting method: uv light, 1 specimen, 50.0 %
hand, 1 specimens, 50.0 %

Collection dates: 27 June - 19 July.

Biology: This parkland species represents a new state record for Montana.

Hemicrepidius sp. A nr. *carbonatus* (LeConte)

(fig. 83)

Montana county records: BEAVERHEAD, BROADWATER, FLATHEAD(?), GALLATIN, MADISON, PARK, TOOLE, WHEATLAND.

Material examined: 24 specimens.

Elevation records: 3060′ - 7400′.

Collecting method: hand, 18 specimens, 75.0 %
pitfall, 5 specimens, 20.8 %
L. funnel, 1 specimen, 4.2 %

Collection dates: 16 June - 12 August (1 September).

Hemicrepidius sp. B nr. *carbonatus* (LeConte)

(fig. 84)

Montana county records: DANIELS, GALLATIN, MADISON, ROSEBUD.

Material examined: 6 specimens.

Elevation records: 4050′ - 5200′.

Collecting method: hand, 3 specimens, 50.0 %
pitfall, 3 specimens, 50.0 %

Collection dates: (22 June) 6 July - 10 Aug. (11 Oct.).

Hemicrepidius memnonius (Herbst)

(fig. 85)

Montana county records: BLAINE, CARBON, CARTER, CUSTER, DAWSON, FERGUS, GALLATIN, PHILLIPS, RAVALLI, ROSEBUD, STILLWATER, YELLOWSTONE.

Material examined: 68 specimens.

Elevation records: 3800′.

Collecting method: uv light, 34 specimens, 50.0 %
hand, 30 specimens, 44.1 %
pitfall, 3 specimens, 4.4 %
L. funnel, 1 specimen, 1.5 %

Collection dates: 7 June - 29 August.

Biology: Glen (1950) reported that larvae of *H. memnonius* were soil-inhabiting and rarely found in forest litter. Brooks (1960) added that this species is found in mixed prairie and parklands from Manitoba to Alberta and that the larvae are often abundant in garden soil.

Hemicrepidius memnonius adults were reported to fly to light(s) in July and August by Brooks (1960). In Montana, this species is collected readily by ultraviolet light trapping from early June through August. *H. memnonius* adults have also been collected from spruce (*Picea* sp.) and fir (*Abies* sp.) (Morris 1951).

Remarks: This species, although widespread, large in size, and easily collected, has not previously been recorded as occurring in Montana.

Hemicrepidius montanus Lane

(fig. 86)

Montana county records: FLATHEAD, LAKE.

Material examined: 20 specimens.

Collecting method: uv light, 17 specimens, 85.0 %
hand, 3 specimens, 15.0 %

Collection dates: 27 July - 15 August.

Remarks: *Hemicrepidius montanus* was reported as occurring in western Montana by both Russell (1968) and Lane (1971).

Hemicrepidius pallidipennis (Mannerheim)

(fig. 87)

Montana county records: FLATHEAD, MISSOULA.

Material examined: 16 specimens.

Elevation records: 3560′ - 4080′.

Collecting method: uv light, 8 specimens, 50.0 %
L. funnel, 6 specimens, 37.5 %
F.I.T., 1 specimen, 6.3 %
hand, 1 specimen, 6.3 %

Collection dates: (4 July) 15 July - 14 Aug. (21 Aug.).

Remarks: *Hemicrepidius pallidipennis* is a Pacific Northwest species that represents a new state record for western Montana. It is infrequently caught by hand and much more likely to be collected by Lindgren funnel traps or at light.

Hemicrepidius sp. C

(fig. 88)

Montana county records: CARTER.

Material examined: 1 specimen.

Collecting method: uv light, 1 specimen, 100.0 %

Collecting dates: 18 July.

Limonius aeger LeConte

(fig. 89)

Montana county records: DEER LODGE, FLATHEAD, GALLATIN, GLACIER, JUDITH BASIN, LAKE, MADISON, MEAGHER, MINERAL, MISSOULA, POWELL.

Material examined: 81 specimens.

Elevation records: 3000′ - 7400′.

Collecting method: hand, 52 specimens, 64.2 %
L. funnel, 16 specimens, 19.8 %
F.I.T., 12 specimens, 14.8 %
uv light, 1 specimen, 1.2 %

Collection dates: (20 May) 27 May - 7 Aug. (9 Sept.).

Biology: Brooks (1960) noted that *L. aeger* was found in parkland and forest habitats in Alberta, Saskatchewan, and Manitoba and that the species was most abundant in mixed shrub and poplar (*Populus* sp.) groves and adjacent tall grass. The larvae are found in moist leaf litter (Glen et al. 1943).

Remarks: This species represents a new State record.

Limonius californicus (Mannerheim)

(fig. 90)

Montana county records: CARBON, JEFFERSON, LEWIS AND CLARK, STILLWATER.

Material examined: 4 specimens.

Collecting method: hand, 4 specimens, 100.0 %

Collection dates: 3 May - 2 August.

Biology: *Limonius californicus* adults emerge in spring,

when large numbers of male beetles are attracted by pheromone to newly emerged females (Doane 1961, Jacobson 1972). These adult beetles overwintered in their pupal chambers after pupating in mid to late summer the year before (Glen 1950). The larvae are soil-inhabiting and may go through as many as ten to thirteen instars. The entire life cycle takes three to four years (Hyslop 1915, 1916; Stone 1941; Swan and Papp 1972).

Limonius californicus larvae, or sugar beet wireworms, are considered important pests of irrigated land throughout the western United States and Canada (Lane 1933, Stone 1941, Lanchester 1946, Glen 1950, Brooks 1960, Onsager 1969, Toba et al. 1985, Williams et al. 1992). They have been reported as injurious to sugar beets, potato, alfalfa, corn, and bean crops, and various ornamental flowers in the western United States (Hyslop 1915, Lanchester 1946, Peterson 1960, Onsager 1969, Swan and Papp 1972, Williams et al. 1992) and have been collected from fields of wheat in the Pacific Northwest (Toba and Turner 1983, Toba et al. 1985). Doane et al. (1975) demonstrated that *L. californicus* larvae were attracted to germinating seeds of barley (*Hordeum vulgare*), rye (*Secale cereale*), smooth brome (*Bromus inermis*), timothy (*Phleum pratense*), rape (*Brassica napus*), white sweet clover (*Melilotus alba*), common sunflower (*Helianthus annuus*), alfalfa, and wheat.

Limonius californicus larvae require moist soil

conditions (Lane 1933, Campbell 1937, Lanchester 1946, Glen 1950, Jones 1951, Toba et al. 1985), are capable of tolerating a wide range in soil pH (Lane 1933), and are often found in alkaline soils (Lane 1933, Brooks 1960).

Remarks: This species was not previously recorded from Montana.

Limonius canus LeConte

(fig. 91)

Montana county records: CARBON, CASCADE, FLATHEAD, GALLATIN, MINERAL, MISSOULA, PARK, POWELL, RAVALLI, SANDERS.

Material examined: 56 specimens.

Elevation records: 2500′ - 3560′.

Collecting method: hand, 52 specimens, 92.9 %
reared, 4 specimens, 7.1 %

Collection dates: 12 April - 23 August.

Biology: *Limonius canus* has a life history very similar to that of *L. californicus*, including the production of a pheromone in the spring by newly emerged females for the attraction of males (Hyslop 1916, Glen 1950, Jacobson 1972, Swan and Papp 1972). In addition, *L. canus* typically has a sex ratio of males to females of 1.0 and males may mate with and fertilize up to five females (Zacharuk 1958a, Brown and Keaster 1986).

Limonius canus larvae, or Pacific Coast wireworms, are economically important in the Pacific Northwest and along the Pacific Coast of North America where they feed on the roots

and seed of potato, wheat, and other crops (Lane 1933; Lanchester 1939, 1946; Glen et al. 1943; Wilkinson 1963; Onsager 1969; Toba and Turner 1983; Toba et al. 1985). In addition, the adults may occasionally inflict considerable damage to the blossoms of fruit trees (Hyslop 1915).

Similar to *L. californicus*, the larvae of *L. canus* require moist soil conditions (Lane 1933, Lanchester 1946, Jones 1951, Toba et al. 1985) and tolerate a wide range in soil pH (Lane 1933).

Remarks: *Limonius canus* appears to be more widespread in Montana than the closely related species, *L. californicus*, and was recorded as occurring in western Montana by both Russell (1968) and Lane (1971).

Limonius fulvipilis seminudus Van Dyke

(fig. 92)

Montana county records: FLATHEAD, LAKE, MINERAL, MISSOULA, SANDERS.

Material examined: 32 specimens.

Elevation records: 2400′ - 3000′.

Collection method: hand, 32 specimens, 100.0 %

Collection dates: 28 May - 27 June.

Remarks: *Limonius fulvipilis seminudus* is found west of the Continental Divide and was reported to occur in western Montana by Russell (1968) and Lane (1971).

Limonius infuscatus Motschulsky

(fig. 93)

Montana county records: BROADWATER, FERGUS, FLATHEAD, GALLATIN, GRANITE, JEFFERSON, JUDITH BASIN, LAKE, LEWIS AND CLARK, LINCOLN, MADISON, MINERAL, MISSOULA, PARK, PHILLIPS, POWELL, RAVALLI, SANDERS.

Material examined: 267 specimens.

Elevation records: 2400′ - 5800′.

Collecting method: hand, 264 specimens, 98.9 %
pitfall, 2 specimens, 0.7 %
L. funnel, 1 specimen, 0.4 %

Collection dates: 27 March - 28 June.

Biology: The larvae of *L. infuscatus*, also known as western field wireworms, are usually found under moist soil conditions in western North America (Lane 1933, Lanchester 1946). They have been reported as serious pests of agricultural crops (Wilkinson 1963, Swan and Papp 1972), but may only be important in limited areas in parts of the Pacific Northwest (Lanchester 1946, Toba et al. 1985).

Remarks: *Limonius infuscatus* was recorded from western Montana by Russell (1968) and Lane (1971).

Limonius lanei Van Dyke

(fig. 94)

Montana county records: BIG HORN, CARBON, CARTER, GALLATIN, JUDITH BASIN, PARK, PETROLEUM.

Material examined: 35 specimens.

Collecting method: hand, 18 specimens, 51.4 %
F.I.T., 13 specimens, 37.1 %
unknown, 4 specimens, 11.4 %

Collection dates: 13 May - 14 June.

Remarks: Brooks (1960) said *L. lanei* inhabited the dry, mixed prairie of Alberta and Saskatchewan. Although this species was not previously recorded from Montana, it is relatively widespread in the State east of the Continental Divide.

Limonius nitidulus Horn

(fig. 95)

Montana county records: FERGUS, FLATHEAD, GALLATIN, GLACIER, LAKE, LINCOLN, MADISON, MEAGHER, MINERAL, MISSOULA, POWELL, RAVALLI, SANDERS, STILLWATER.

Material examined: 202 specimens.

Elevation records: 2200′ - 7500′.

Collecting method: hand, 197 specimens, 97.5 %
F.I.T., 2 specimens, 1.0 %
L. funnel, 2 specimens, 1.0 %
uv light, 1 specimen, 0.5 %

Collection dates: 9 May - 9 September.

Remarks: *Limonius nitidulus* is a widely distributed and variable species (Brooks 1960) that was recorded from Glacier National Park by Mank (1934) and from western Montana by Russell (1968) and Lane (1971).

Limonius sp. nr. *nitidulus* Horn

(fig. 96)

Montana county records: PETROLEUM.

Material examined: 13 specimens.

Collecting method: unknown, 13 specimens, 100.0 %

Collection dates: 24 May - 14 June.

Limonius rufihumeralis Lane

(fig. 97)

Montana county records: BEAVERHEAD, FLATHEAD, GALLATIN, GLACIER, JEFFERSON, JUDITH BASIN, LAKE, LEWIS AND CLARK, MADISON, MISSOULA, PARK, POWELL, RAVALLI.

Material examined: 78 specimens.

Elevation records: 3400′ - 7400′.

Collecting method: hand, 78 specimens, 100.0 %

Collection dates: 13 May - 31 July.

Remarks: *Limonius rufihumeralis* is a montane or submontane species that was recorded from Gallatin, Jefferson, Lake, Missoula, and Ravalli Co., Montana by Lane (1941) when it was described. Russell (1968) also recorded the collection of this species from western Montana.

Limonius snakensis Lane

(fig. 98)

Montana county records: GALLATIN, JEFFERSON, LAKE, MINERAL, MISSOULA.

Material examined: 6 specimens.

Elevation records: 3000′.

Collecting method: hand, 6 specimens, 100.0 %

Collection dates: 1 May - 20 June.

Remarks: *Limonius snakensis* was recorded from Jefferson Co., Montana by Lane (1965) when he described the species.

Limonius subauratus LeConte

(fig. 99)

Montana county records: MINERAL.

Material examined: 2 specimens.

Elevation records: 2500′.

Collecting method: hand, 2 specimens, 100.0 %

Collection dates: 10 June.

Remarks: *Limonius subauratus* was recorded from western Montana by Russell (1968) and Lane (1971). The larvae, or Columbia Basin wireworms, may be economically important in irrigated or naturally moist areas in the Pacific Northwest (Lane 1933, Lanchester 1946, Swan and Papp 1972, Toba et al. 1985).

Limonius ursinus Van Dyke

(fig. 100)

Montana county records: BIG HORN, CUSTER, PETROLEUM, RICHLAND, YELLOWSTONE.

Material examined: 5 specimens.

Collecting method: hand, 3 specimens, 60.0 %

pitfall, 1 specimen, 20.0 %

unknown, 1 specimen, 20.0 %

Collection dates: 24 May - 14 June.

Remarks: The collection of this grassland species in eastern Montana has not been previously recorded. Although not known to be economically important, *L. ursinus* larvae may be injurious to corn in Alberta (Glen et al. 1943).

Tribe Ctenicerini Fleutiaux

Ctenicera aeripennis (Kirby)

(fig. 101)

Montana county records: CARBON, DEER LODGE, FLATHEAD, GALLATIN, GLACIER, JUDITH BASIN, LAKE(?), LEWIS AND CLARK, MADISON, MISSOULA, PARK, POWELL, RAVALLI, SILVER BOW, SWEET GRASS.

Material examined: 85 specimens.

Elevation records: 3000′ - 7400′.

Collecting method: hand, 47 specimens, 55.3 %
pitfall, 30 specimens, 35.3 %
F.I.T., 4 specimens, 4.7 %
L. funnel, 3 specimens, 3.5 %
unknown, 1 specimen, 1.2 %

Collection dates: 23 April - 26 September.

Biology: *Ctenicera aeripennis* overwinter as immature larvae or as adults within the pupal cell in which they underwent eclosion the previous summer. *C. aeripennis* larvae are long-lived, but mature wireworms will move up to within

two inches of the soil surface to pupate if and when soil moisture and temperature are suitable. Pupation to adult is usually completed within one month and adults emerge in spring (Strickland 1933).

Ctenicera aeripennis larvae, or Puget Sound wireworms, have been reported as widespread and destructive pests on wheat, other grains, and vegetable crops along the Pacific Coast, in inland mountain valleys, and across large parts of Canada from British Columbia east through western Manitoba where it inhabits montane, subalpine, and northern boreal forests (Glen 1950, Brooks 1960, Wilkinson 1963, Swan and Papp 1972).

Remarks: Mank (1934) recorded this species from Glacier National Park and Russell (1968) listed the collection of *C. aeripennis* from the following Montana counties; Flathead, Mineral, Missoula, Ravalli, Sanders, and Silver Bow.

Ctenicera angusticollis (Mannerheim)

(fig. 102)

Montana county records: FLATHEAD, GLACIER, RAVALLI.

Material examined: 5 specimens.

Elevation records: 3520'.

Collecting method: hand, 4 specimens, 80.0 %

L. funnel, 1 specimen, 20.0 %

Collection dates: 23 May - 23 June.

Remarks: *Ctenicera angusticollis* is a new state record for Montana and would only be expected to occur west of the

Continental Divide.

Ctenicera barri Lane

(fig. 103)

Montana county records: MISSOULA.

Material examined: 2 specimens.

Elevation records: 5187′.

Collecting method: hand, 2 specimens, 100.0 %

Collection dates: 28 June.

Remarks: This species, collected at the summit of Lolo Pass between Idaho and Montana by Russell (1968), is known only from wet, subalpine meadows.

Ctenicera bombycina (Germar)

(fig. 104)

Montana county records: BEAVERHEAD, CASCADE, FLATHEAD, GALLATIN, GLACIER, GRANITE, JUDITH BASIN, LAKE, LEWIS AND CLARK, MADISON, MEAGHER, MINERAL, MISSOULA, PARK, POWELL, RAVALLI, SANDERS, SILVER BOW, WHEATLAND.

Material examined: 221 specimens.

Elevation records: 2400′ - 9000′.

Collecting method: hand, 211 specimens, 95.5 %
L. funnel, 3 specimens, 1.4 %
pitfall, 1 specimen, 0.4 %
unknown, 6 specimens, 2.7 %

Collection dates: 14 April - 15 September.

Biology: *Ctenicera bombycina* prefers the montane and

subalpine forests of the Rocky Mountains and has been collected on spruce, fir, and pine (*Pinus* sp.) (Brooks 1960).

Remarks: This species was recorded from Glacier National Park by Mank (1934) under the species name *Ludius fallax*. Russell (1968) reported this species from the following Montana counties; Flathead, Granite, Lake, Mineral, Missoula, Ravalli, Sanders, and Silver Bow.

Ctenicera sp. nr. *bombycina* (Germar)

(fig. 105)

Montana county records: BROADWATER, GALLATIN, JEFFERSON, RAVALLI.

Material examined: 7 specimens.

Collecting method: hand, 7 specimens, 100.0 %

Collection dates: 22 May - 1 July.

Ctenicera callida (Brown)

(fig. 106)

Montana county records: FERGUS, GALLATIN, GRANITE, LAKE, MINERAL, MISSOULA, RAVALLI, SANDERS, SILVER BOW, STILLWATER.

Material examined: 23 specimens.

Elevation records: 2400′ - 6800′.

Collecting method: hand, 13 specimens, 56.5 %

L. funnel, 10 specimens, 43.5 %

Collection dates: (2 May) 4 June - 7 August (14 August).

Remarks: The collection of *C. callida* in western Montana was recorded by Russell (1968).

Ctenicera carbo (LeConte)

(fig. 107)

Montana county records: GALLATIN(?).

Material examined: None.

Remarks: This species, or one near it, was reported to have been collected at Bozeman, Montana by Brown (1935b), however, its occurrence in this state is suspect at present.

Ctenicera sp. nr. *conjungens* (LeConte)

(fig. 108)

Montana county records: BROADWATER, GALLATIN, LAKE, LEWIS AND CLARK, MISSOULA, SANDERS.

Material examined: 15 specimens.

Collecting method: hand, 14 specimens, 93.3 %

unknown, 1 specimen, 6.7 %

Collection dates: 24 April - 29 July.

Remarks: *Ctenicera conjungens* s.l. was previously recorded from the Bitter Root Valley, Montana by Horn (1871) and from Sanders Co., Montana by Russell (1968).

Ctenicera crestonensis (Brown)

(fig. 109)

Montana county records: FLATHEAD, GLACIER, MINERAL, MISSOULA.

Material examined: 21 specimens.

Elevation records: 3000′ - 5187′.

Collecting method: hand, 20 specimens, 95.2 %

L. funnel, 1 specimen, 4.8 %

Collection dates: 21 May - 28 June.

Biology: *Ctenicera crestonensis* is a forest species that has been collected on pine and spruce (Brooks 1960).

Remarks: This species was collected in western Montana by Russell (1968).

Ctenicera cruciatus festivus (LeConte)

(fig. 110)

Montana county records: FERGUS, FLATHEAD, GALLATIN, GLACIER, MINERAL, MISSOULA.

Material examined: 23 specimens.

Elevation records: 3000′ - 5450′.

Collecting method: hand, 14 specimens, 60.9 %
pitfall, 3 specimens, 13.0 %
L. funnel, 3 specimens, 13.0 %
F.I.T., 3 specimens, 13.0 %

Collection dates: (2 May) 15 May - 27 July.

Biology: Brooks (1960) said that in Canada, *C. cruciatus festivus* is widely distributed in forests, parklands, and parklands with mixed prairie.

Remarks: Russell (1968) collected this species in western Montana.

Ctenicera destructor (Brown)

(fig. 111)

Montana county records: CARTER, DAWSON, DEER LODGE,

FERGUS, GALLATIN, HILL, JEFFERSON, LIBERTY, MEAGHER, SWEET GRASS, WHEATLAND.

Material examined: 20 specimens.

Collecting method: hand, 14 specimens, 70.0 %
pitfall, 2 specimens, 10.0 %
F.I.T., 2 specimens, 10.0 %
L. funnel, 1 specimen, 5.0 %
unknown, 1 specimen, 5.0 %

Collection dates: 26 April - 4 July.

Biology: *Ctenicera destructor* adults emerge in spring after overwintering in their pupal chambers from the late summer before. Males emerge earlier than, and are strongly attracted to, the larger females which produce a sex pheromone (Zacharuk 1958a, 1958b, 1962a, Doane 1961, 1977a, Jacobson 1972). The marking behavior of this species was first observed by Strickland (1926). *C. destructor* adults do not fly (Lane 1925, Zacharuk 1962a, Doane 1977a), but the adult beetles are known to feed (Doane 1961). The sex ratio of males to females is 1.5 (Zacharuk 1958a, 1962a, Brown and Keaster 1986), and both male and female adults mate only once, during which time the male transfers a spermatophore to the female. After mating, females undergo an inactive period of up to ten days before beginning an oviposition period that averages six weeks (Zacharuk 1958a).

Ctenicera destructor larvae, commonly referred to as prairie grain wireworms, are widespread and serious pests in

wheat-growing areas in prairie and parkland regions of western Canada and the United States (Brown 1935b; Glen 1935, 1950; Glen et al. 1943; Zacharuk 1958a; Brooks 1960; Burrage 1964; Doane 1977a, 1977b; Toba and Turner 1983). Prairie grain wireworms have a larval period that probably averages three years (Strickland 1926, Zacharuk 1962a). They normally develop through ten instars (Zacharuk 1958b) and are attracted to a variety of germinating seeds (Burrage 1964, Doane et al. 1975).

Remarks: *Ctenicera destructor* was recorded from Hill Co., Montana by Morrill (1984).

Ctenicera funerea (Brown)

(fig. 112)

Montana county records: FLATHEAD, MISSOULA.

Material examined: 5 specimens.

Collecting method: hand, 5 specimens, 100.0 %

Collection dates: 13 May - 5 June.

Remarks: The collection of *C. funerea* in Montana has not been previously recorded.

Ctenicera glauca (Germar)

(fig. 113)

Montana county records: BIG HORN, BROADWATER, CARBON, CARTER, FALLON, FERGUS, FLATHEAD, GALLATIN, GLACIER(?), GRANITE, JEFFERSON, JUDITH BASIN, LAKE, LEWIS AND CLARK, MADISON, MEAGHER, MINERAL, MISSOULA, PARK, PETROLEUM, POWDER

RIVER, POWELL, RAVALLI, ROSEBUD, SANDERS, SILVER BOW, STILLWATER, SWEET GRASS, WHEATLAND, YELLOWSTONE.

Material examined: 532 specimens.

Elevation records: 2400′ - 7400′.

Collecting method: hand, 521 specimens, 97.9 %
L. funnel, 2 specimens, 0.8 %
emergence, 2 specimens, 0.4 %
unknown, 5 specimens, 0.9 %

Collection dates: 27 March - 15 September.

Biology: *Ctenicera glauca* is a common, widespread, prairie and parkland species. The adults feed on a variety of plants, sometimes causing damage to alfalfa, and bean foliage (Brooks 1960). The life cycle may average three years (Hyslop 1915, 1916).

Ctenicera glauca larvae, also known as dryland or inflated wireworms, have been reported as economically important on wheat in parkland and dry farming regions of the Pacific Northwest (Hyslop 1915, 1916; Lane 1925, 1933; Brown 1936c; Wilkinson 1963).

Remarks: This species was recorded from Montana by Glen (1950), Russell (1968), and Morrill (1984).

Ctenicera hoppingi (Van Dyke)

(fig. 114)

Montana county records: FLATHEAD, GLACIER.

Material examined: 2 specimens.

Elevation records: 7000′ - 8000′.

Collecting method: hand, 2 specimens, 100.0 %

Collection dates: 12 July - 6 August.

Biology: *Ctenicera hoppingi* has been collected on spruce and occurs in subalpine and boreal forests from the Pacific Northwest east into western Manitoba (Van Dyke 1932, Brooks 1960).

Remarks: The collection of this species in northwest Montana represents a new state record.

Ctenicera insidiosa (LeConte)

(fig. 115)

Montana county records: FLATHEAD, GALLATIN, GLACIER, GRANITE, LAKE, RAVALLI.

Material examined: 51 specimens.

Elevation records: 3275′ - 8100′.

Collecting method: hand, 26 specimens, 51.0 %
F.I.T., 9 specimens, 17.6 %
L. funnel, 9 specimens, 17.6 %
pitfall, 4 specimens, 7.8 %
malaise, 2 specimens, 3.9 %
uv light, 1 specimen, 2.0 %

Collection dates: 7 May - 6 August (26 September).

Biology: *Ctenicera insidiosa* inhabits subalpine and boreal forests of Canada and the western United States and has been collected on spruce and fir (Morris 1951, Brooks 1960).

Remarks: The occurrence of this species in Montana was recorded by Van Dyke (1932) and in Glacier National Park by

Mank (1934).

Ctenicera laricis (Brown)

(fig. 116)

Montana county records: FERGUS, GALLATIN, GRANITE.

Material examined: 5 specimens.

Elevation records: 2000′ - 6200′.

Collecting method: L. funnel, 5 specimens, 100.0 %

Collection dates: (21 May) - (2 July).

Remarks: *Ctenicera laricis* is an infrequently collected species that in Montana has only been collected by Lindgren funnel trap. This species has been collected from bark of western larch (*Larix occidentalis*) at 2000 ft. (Brown 1939, Brooks 1960) and represents a new species record for the State.

Ctenicera lobata (Eschscholtz)

(fig. 117)

Montana county records: FLATHEAD, GALLATIN, GLACIER, JUDITH BASIN, LAKE, LEWIS AND CLARK, LINCOLN, MINERAL, MISSOULA, POWELL, RAVALLI.

Material examined: 235 specimens.

Elevation records: 3100′ - 7200′.

Collecting method: hand, 220 specimens, 93.6 %
pitfall, 11 specimens, 4.7 %
L. funnel, 1 specimen, 0.4 %
F.I.T., 1 specimen, 0.4 %

unknown, 2 specimens, 0.9 %

Collection dates: 28 April - 25 July.

Biology: *Ctenicera lobata* prefers low, moist places near poplar and/or willow (*Salix* sp.) groves (Brooks 1960) and is common in western Montana forests and parklands.

Remarks: Mank (1934) listed this species as occurring in Glacier National Park under the synonym *Ludius caricinus*, and Russell (1968) collected this species from Lolo Pass, Montana.

Ctenicera mendax (LeConte)

(fig. 118)

Montana county records: MEAGHER, MINERAL.

Material examined: 4 specimens.

Elevation records: 3600'.

Collecting method: hand, 4 specimens, 100.0 %

Collection dates: 9 - 12 June (17 June).

Biology: *Ctenicera mendax* is an infrequently encountered, forest-inhabiting species that has been collected on spruce, pine, and larch (*Larix* sp.) (Brooks 1960).

Remarks: This species collection in Montana represents a new state record.

Ctenicera moerens (LeConte)

(fig. 119)

Montana county records: FLATHEAD.

Material examined: 2 specimens.

Elevation records: 3480' - 3720'.

Collecting method: L. funnel, 2 specimens, 100.0 %

Collection dates: (20 May) - (28 May).

Remarks: *Ctenicera moerens* is a Pacific Northwest species that represents a new State record and has only been caught in Montana by Lindgren funnel trap.

Ctenicera montana (Brown)

(fig. 120)

Montana county records: FLATHEAD, GLACIER, SILVER BOW.

Material examined: 18 specimens.

Elevation records: 4100′ - 8000′.

Collecting method: hand, 14 specimens, 77.8 %

pitfall, 4 specimens, 22.2 %

Collection dates: (27 April) 25 May - 1 August.

Remarks: *Ctenicera montana* has not previously been recorded from Montana. Brown (1935b) thought that this species may be limited in distribution to high altitudes.

Ctenicera sp. nr. *montana* (Brown)

(fig. 121)

Montana county records: FLATHEAD/GLACIER, MADISON.

Material examined: 13 specimens.

Elevation records: 7400′.

Collecting method: pitfall, 7 specimens, 53.8 %

hand, 4 specimens, 30.8 %

L. funnel, 1 specimen, 7.7 %

F.I.T., 1 specimen, 7.7 %

Collection dates: (20 May) 4 June - 23 July (9 Sept.).

Ctenicera monticola (Horn)

(fig. 122)

Montana county records: FLATHEAD/GLACIER.

Material examined: 1 specimen.

Collecting method: hand, 1 specimen, 100.0 %

Collection dates: 13 July.

Remarks: The single Montana specimen of *C. monticola* was collected in Glacier National Park, by Hidden Lake, Hidden Pass of the Continental Divide, on the border between Flathead and Glacier counties. It is a new State species record.

Ctenicera morula (LeConte)

(fig. 123)

Montana county records: FLATHEAD, MISSOULA.

Material examined: 4 specimens.

Elevation records: 3400′ - 3600′.

Collecting method: hand, 3 specimens, 75.0 %

L. funnel, 1 specimen, 25.0 %

Collection dates: 23 May - 15 June (19 June).

Remarks: *Ctenicera morula* is a common forest species of the Pacific Northwest and western Canada (Brown 1935a, Brooks 1960). It was first recorded from the State by LeConte (1866), and later from Missoula Co. by Russell (1968).

Ctenicera nebraskensis (Bland)

(fig. 124)

Montana county records: CARBON, CARTER, CHOUTEAU, FERGUS, FLATHEAD, GALLATIN, GRANITE, JEFFERSON, LAKE, MADISON, MINERAL, MISSOULA, POWDER RIVER, RAVALLI, SANDERS.

Material examined: 102 specimens.

Elevation records: 2400′ - 9000′.

Collecting method: L. funnel, 55 specimens, 53.9 %
hand, 28 specimens, 27.4 %
F.I.T., 16 specimens, 15.7 %
pitfall, 1 specimen, 1.0 %
unknown, 2 specimens, 2.0 %

Collection dates: (7 May) 16 May - 1 August (30 August).

Remarks: The type specimen, *Corymbites nebraskensis* Bland (1863), is a female collected from Ft. Benton, Montana (Brown 1936b). This species is readily collected by Lindgren funnel traps.

Ctenicera nigricollis (Bland)

(fig. 125)

Montana county records: FERGUS, FLATHEAD, GALLATIN, GLACIER, JUDITH BASIN, MADISON, MISSOULA, POWELL.

Material examined: 56 specimens.

Elevation records: 3480′ - 7600′.

Collecting method: L. funnel, 32 specimens, 57.1 %
F.I.T., 12 specimens, 21.4 %
hand, 6 specimens, 10.7 %
pitfall, 3 specimens, 5.4 %
uv light, 2 specimens, 3.6 %

malaise, 1 specimen, 1.8 %

Collection dates: (19 May) 17 June - 23 July (8 Sept.).

Remarks: *Ctenicera nigricollis* is a forest and woodland species which is most readily caught by Lindgren funnel trap, but also collected easily by flight intercept trap. This species has not previously been recorded from Montana.

Ctenicera propola (LeConte)

(fig. 126)

Montana county records: CARTER, FERGUS, FLATHEAD, GALLATIN, GLACIER, GRANITE, JUDITH BASIN, LAKE, LEWIS AND CLARK, LINCOLN, MADISON, MINERAL, PARK, RAVALLI, SANDERS.

Material examined: 132 specimens.

Elevation records: 3150′ - 9600′

Collecting method: L. funnel, 64 specimens, 48.5 %
hand, 43 specimens, 32.6 %
F.I.T., 23 specimens, 17.4 %
malaise, 1 specimen, 0.8 %
pitfall, 1 specimen, 0.8 %

Collection dates: (1 May) 10 May - 11 Oct. (21 Oct.).

Remarks: *Ctenicera propola* is common in forested areas and is readily collected using Lindgren funnel traps. It was recorded from Glacier National Park by Mank (1934), and later from western Montana by Russell (1968), under the species name *Ctenicera columbianus*.

Ctenicera pudica (Brown)

(fig. 127)

Montana county records: BEAVERHEAD, BROADWATER, CARBON, FERGUS, FLATHEAD, GALLATIN, GLACIER, GRANITE, JEFFERSON, JUDITH BASIN, LAKE, LEWIS AND CLARK, LIBERTY, MADISON, MINERAL, MISSOULA, PARK, POWELL, RAVALLI, SANDERS, STILLWATER, WHEATLAND.

Material examined: 67 specimens.

Elevation records: 3000′ - 7400′.

Collecting method: hand, 54 specimens, 80.6 %
L. funnel, 7 specimens, 10.4 %
pitfall, 4 specimens, 6.0 %
F.I.T., 1 specimen, 1.5 %
unknown, 1 specimen, 1.5 %

Collection dates: 6 May - 29 July (14 August).

Biology: *Ctenicera pudica* has been collected on birch (*Betula* sp.), poplar, and willow (Brooks 1960).

Remarks: Russell (1968) reported *C. pudica* as occurring in the following Montana counties; Flathead, Granite, Lake, Mineral, Powell, Ravalli, and Sanders.

Ctenicera resplendens (Eschscholtz)

(fig. 128)

Montana county records: FLATHEAD, GALLATIN, GLACIER, JUDITH BASIN, LAKE, MADISON, MINERAL, MISSOULA, RAVALLI, SANDERS.

Material examined: 122 specimens.

Elevation records: 2500′ - 8800′.

Collecting method: hand, 95 specimens, 77.9 %
L. funnel, 12 specimens, 9.8 %
F.I.T., 10 specimens, 8.2 %
pitfall, 2 specimens, 1.6 %
unknown, 3 specimens, 2.5 %

Collection dates: 9 May - 28 July (3 August).

Biology: *Ctenicera resplendens* prefers wooded habitats and has been collected on poplar and willow (Brooks 1960).

Remarks: Mank (1934) recorded this species from Glacier National Park under the species name *Ludius breweri* and Russell (1968) recorded the collection of *C. resplendens* from Mineral Co., Montana.

Ctenicera sp. nr. *rotundicollis* (Say)

(fig. 129)

Montana county records: FLATHEAD, GALLATIN, GLACIER, MADISON, RAVALLI.

Material examined: 16 specimens.

Elevation records: 3164′ - 7600′.

Collecting method: L. funnel, 9 specimens, 56.2 %
hand, 3 specimens, 18.7 %
F.I.T., 2 specimens, 12.5 %
Berlase, 1 specimen, 6.2 %
pitfall, 1 specimen, 6.2 %

Collection dates: (30 June) 5 Aug. - 9 Sept. (21 Sept.).

Remarks: This forest species is primarily active as an

adult during the month of August and is most likely to be collected by Lindgren funnel trap.

Ctenicera rupestris (Germar)

(fig. 130)

Montana county records: FLATHEAD, MISSOULA, RAVALLI.

Material examined: 4 specimens.

Collecting method: hand, 2 specimens, 50.0 %
uv light, 1 specimen, 25.0 %
unknown, 1 specimen, 25.0 %

Collection dates: 2 - 24 July.

Biology: The larvae of *C. rupestris* are found in decomposing wood, where they are likely predaceous (Knull 1932).

Remarks: *Ctenicera rupestris* has not previously been recorded from Montana.

Ctenicera semimetallica (Walker)

(fig. 131)

Montana county records: CARBON, FERGUS, FLATHEAD, GALLATIN, GLACIER, GRANITE, LAKE, LEWIS AND CLARK, LINCOLN, MADISON, MEAGHER, MINERAL, MISSOULA, RAVALLI, SANDERS, SILVER BOW.

Material examined: 66 specimens.

Elevation records: 2400′ - 7400′.

Collecting method: hand, 54 specimens, 81.8 %
pitfall, 5 specimens, 7.6 %
L. funnel, 3 specimens, 4.5 %

F.I.T., 1 specimen, 1.5 %

unknown, 3 specimens, 4.5 %

Collection dates: 1 May - 17 August.

Remarks: This forest and woodland species was recorded from Maiden (Fergus Co.) and Helena (Lewis and Clark Co.) by Brown (1935b).

Ctenicera semivittata (Say)

(fig. 132)

Montana county records: GALLATIN.

Material examined: 6 specimens.

Elevation records: 4800'.

Collecting method: hand, 6 specimens, 100.0 %

Collection dates: 27 April - 12 May.

Remarks: *Ctenicera semivittata* was not previously known from Montana. Brown (1935c) considered this species limited in distribution to the eastern flanks of the Rocky Mountains and also noted its rarity in collections.

Ctenicera sexualis (Brown)

(fig. 133)

Montana county records: GALLATIN.

Material examined: 1 specimen.

Collecting method: hand, 1 specimen, 100.0 %

Collection dates: 24 April.

Biology: *Ctenicera sexualis* is a dry, mixed prairie, grassland species that has been associated with silverberry

(*Elaeagnus* sp.) and snowberry (*Symphoricarpos* sp.). It can persist in the soil for years after cultivation of such grassland and is sometimes of local economic importance (Glen et al. 1943, Brooks 1960).

Remarks: This species represents a new State record.

Ctenicera silvatica (Van Dyke)

(fig. 134)

Montana county records: BEAVERHEAD, FLATHEAD, GLACIER, LAKE, MINERAL, MISSOULA, RAVALLI, SANDERS.

Material examined: 167 specimens.

Elevation records: 2400′ - 9600′.

Collecting method: hand, 161 specimens, 96.4 %
F.I.T., 3 specimens, 1.8 %
L. funnel, 1 specimen, 0.6 %
pitfall, 1 specimen, 0.6 %
unknown, 1 specimen, 0.6 %

Collection dates: 26 May - 6 August.

Biology: Adult *C. silvatica* females produce a pheromone which attracts the male beetles (Jacobson 1972).

Remarks: This forest species was recorded from Glacier National Park by Mank (1934), but was cited as *Ludius protractus*. Russell (1968) collected *C. silvatica* from the following Montana counties; Flathead, Lake, and Mineral.

Ctenicera stricklandi (Brown)

(fig. 135)

Montana county records: FERGUS, GALLATIN, MADISON.

Material examined: 32 specimens.

Elevation records: 5450′ - 7200′.

Collecting method: hand, 17 specimens, 53.1 %

L. funnel, 13 specimens, 40.6 %

F.I.T., 2 specimens, 6.2 %

Collection dates: (2 May) 3 May - 26 June (3 August).

Biology: *Ctenicera stricklandi* is a forest species that has been associated with poplar, willow, and birch (Brooks 1960).

Remarks: *Ctenicera stricklandi* has not previously been recorded from Montana.

Ctenicera triundulata (Randall)

(fig. 136)

Montana county records: CARTER, POWDER RIVER.

Material examined: 15 specimens.

Collecting method: L. funnel, 15 specimens, 100.0 %

Collection dates: (7 June) - (4 August).

Remarks: *Ctenicera triundulata* represents a new State record.

Ctenicera umbricola (Eschscholtz)

(fig. 137)

Montana county records: FLATHEAD, GALLATIN, GLACIER, JUDITH BASIN, LAKE, MADISON, MINERAL, RAVALLI.

Material examined: 44 specimens.

Elevation records: 3560′ - 10,020′.

Collecting method: hand, 30 specimens, 68.2 %
F.I.T., 7 specimens, 15.9 %
L. funnel, 6 specimens, 13.6 %
pitfall, 1 specimen, 2.3 %

Collection dates: 12 May - 7 August (4 September).

Biology: *Ctenicera umbricola* is a forest species that has been collected on spruce and pine (Brooks 1960).

Remarks: Russell (1968) recorded the collection of this species from western Montana.

Ctenicera umbripennis (LeConte)

(fig. 138)

Montana county records: FLATHEAD, LAKE, MINERAL, RAVALLI, SANDERS.

Material examined: 57 specimens.

Elevation records; 2400′ - 3800′.

Collecting method: hand, 52 specimens, 91.2 %
F.I.T., 3 specimens, 5.3 %
L. funnel, 2 specimens, 3.5 %

Collection dates: 9 May - 15 July.

Remarks: *Ctenicera umbripennis* is a Pacific Northwest species that was collected in Lake Co., Montana by Russell (1968).

Ctenicera vidua (Brown)

(fig. 139)

Montana county records: BROADWATER, FERGUS, GALLATIN, LEWIS AND CLARK, MISSOULA, SANDERS.

Material examined: 30 specimens.

Elevation records: 3500′.

Collecting method: hand, 30 specimens, 100.0 %

Collection dates: 27 March - 15 June.

Remarks: The collection of *C. vidua* in Montana has not previously been recorded.

Eanus albertanus Brown

(fig. 140)

Montana county records: MISSOULA.

Material examined: 5 specimens.

Elevation records: 5200′.

Collecting method: hand, 5 specimens, 100.0 %

Collection dates: 27 June.

Remarks: Brown (1936) stated that *E. albertanus* is only known from the Rocky Mountains, while a species closely resembling it, *E. granicollis*, occurs only in the Cascade Range. The collection of *E. albertanus* in Montana was recorded by Russell (1968) and Lane (1971), but both incorrectly cited it as the similar species *E. granicollis*. In Montana, this species is known only from the Lolo Pass area of the Bitterroot Range.

Eanus sp. A

(fig. 141)

Montana county records: FLATHEAD/GLACIER.

Material examined: 1 specimen.

Collecting method: hand, 1 specimen, 100.0 %

Collection dates: 6 August.

Remarks: This specimen was collected on the Continental Divide, Ahern Pass, between Flathead and Glacier counties.

Oxygonus obesus (Say)

(fig. 142)

Montana county records: CARTER.

Material examined: 10 specimens.

Collecting method: L. funnel, 10 specimens, 100.0 %

Collection dates: (20 June) - (31 August).

Remarks: *Oxygonus obesus* is a new State record and its collection in southeastern Montana, where it has only been collected by Lindgren funnel trap, is a range extension (20 June) - (31 August).

Remarks: *Oxygonus obesus* is a new State record and its collection in southeastern Montana, where it has only been collected by Lindgren funnel trap, is a range extension westward for the species.

Subfamily Elaterinae Leach

The Elaterinae subfamily classification used here is based on Stibick's (1979) classification of the Elateridae into subfamilies and tribes. The differences to note between Stibick's and previous classifications are the removal of

Melanotus from the Elaterinae and its placement within the Melanotinae, the reduction of Adrastinae to a tribe within the Elaterinae, and the transfer of both the Denticollini and Ctenicerini into the Denticollinae.

The Elaterinae is the largest subfamily of elaterids in the world and members display the following adult diagnostic characteristics: head capsule oval, deflexed, mouthparts hypognathous, frons various; scutellum various, never cordate; mesocoxae open to both mesepimeron and mesepisternum; tarsi various, with or without lobes; claws simple or serrate, without basal setae (Stibick 1979).

The Elaterinae of Montana is represented by six tribes and forty-five species, the predominant tribes being the Ampedini, with twenty-two species, and the Agriotini, with at least eighteen. Keys are provided for all known species of adult Elaterinae (except the genus *Dalopius*) in Montana.

Key to Tribes and Genera of Adult Elaterinae
(adapted from Lane 1971, Smith and
Enns 1977, Stibick 1979)

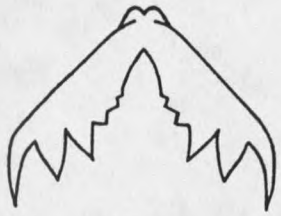
1 Tarsal segment three with membranous lobe beneath .....Physorhinini, *Anchastus*

1′ Tarsal segments without membranous lobes beneath.....2

2 Tarsal claws serrate, with several teeth (fig. 22) .....Adrastini, *Glyphonyx*

2′ Tarsal claws simple (fig. 23).....3

3 Carina of frons arcuate, bending forward between



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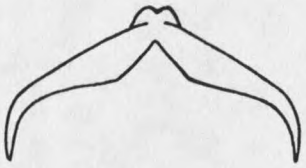

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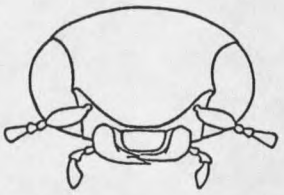

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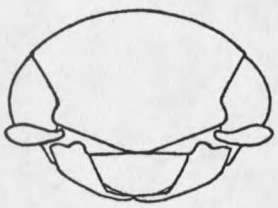

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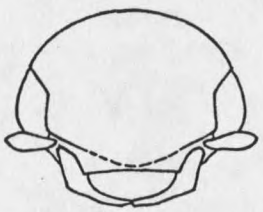

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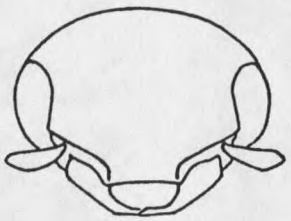

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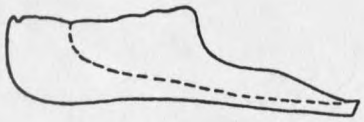

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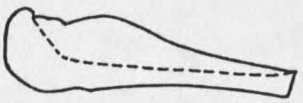

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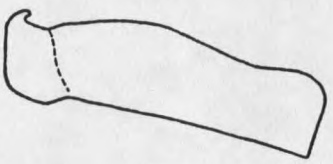

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Figures 22-30. Figs. 22-23, tarsal claws. Fig. 22, *Glyphonyx recticollis*. Fig. 23, *Agriotes ferrugineipennis*. Figs. 24-27, head, cephalic view. Fig. 24, *Megapenthes angularis*. Fig. 25, *Agriotella occidentalis*. Fig. 26, *Dalopius* sp. Fig. 27, *Agriotes ferrugineipennis*. Figs. 28-30, left metacoxal plate. Fig. 28, *Agriotes opaculus*. Fig. 29, *Agriotes ferrugineipennis*. Fig. 30, *Sericus incongruus*.

antennae and meeting labrum (fig. 24).....4

3′ Carina of frons, if present, not complete between the eyes (figs. 26, 27) or with sides oblique (fig. 25).....5

4 Prosternopleural suture excavated anteriorly; antennal segments two and three combined equal to segment four in length; elytral apex tapered.....Ampedini, *Ampedus*

4′ Prosternopleural suture not excavated anteriorly; antennal segments two and three combined shorter than segment four; elytral apex truncate .....Megapenthini, *Megapenthes*

5 Metacoxal plate usually distinctly dilated medially (figs. 28, 29) tarsal claws simple or toothed .....Agriotini

5′ Metacoxal plate of nearly same width throughout; (fig. 30) tarsal claws simple.....Elaterini, *Sericus*

Tribe Ampedini Fleutiaux

Genus *Ampedus* Dejean, 1833

Elater Linnaeus 1758 : 404. Eschscholtz 1829 : 33. Herbst 1784 : 114. Say 1823 : 167, 176, 177. 1825 : 253-268. 1839 : 165-185. Melsheimer 1853 : 70, 71. LeConte 1853 : 463-472. 1859b : 18, 47. 1861b : 165. 1863 : 45, 46. 1869 : 371, 378. 1884 : 8-15. Horn 1871 : 306, 307. 1874 : 22, 23. Blatchley 1910 : 730-735. Leng 1920 : 173. Leonard 1928 : 349-351. Boving and Craighead 1931 : 258, 259. Van Dyke 1932 : 301-310. Leng 1933 : 84.

Van Emden 1945 : 13, 17, 21-24, 30-33, 35, 36. Lane 1948a : 179-182. Van Emden 1956 : 167-188.

Ampedus Dejean 1833 : 92. Germar 1844 : 153-175. Hyslop 1921 : 626. Bradley 1930 : 123. Brown 1933a : 134-138. Blackwelder 1939 : 41. Thomas 1941 : 252-256. Glen et al. 1943 : 362, 365, 375, 383. Dietrich 1945 : 43-52, 66. Jewett 1946 : 6, 12-15, 32, 33. Lane 1948a : 179-182. Knowlton and McComb 1949 : 6. Glen 1950 : 35. Dogger 1950 : 102-104, 109-112. Morris 1951 : 134, 137-139, 142, 143. Lane 1952 : 67. Van Emden 1956 : 168. Dogger 1959 : 106-108, 110, 111, 114, 115, 117, 120. Brooks 1960 : 48-53. Peterson 1960 : 178, 179. Arnett 1968 : 499, 502, 505. Lane 1965 : 190, 191. 1971 : 11-15. Tostowaryk 1972 : 1141. Zacharuk 1963 : 161-163. Kirk and Balsbaugh 1975 : 65, 66. Stibick 1976a : 7. Ramberg 1979 : 1-422. Becker and Dogger 1991 : 411, 414, 417.

Ectamenogonus Buysson 1893 : Leng 1920 : 173. Hyslop 1921 : 642. Van Dyke 1932 : 301.

The genus *Ampedus* is the largest and best known in the tribe Ampedini (Stibick 1979). It is the only genus of the tribe represented in Montana, where twenty-two species are known to occur.

Taxonomic History: The first species described were European, under the genus *Elater* (Linnaeus 1758). *Ampedus* was later proposed as a replacement name for *Elater* (Dejean 1833).

Although some Europeans followed Dejean's usage (Germar 1844), others did not (Candeze 1859).

The generic confusion continued with the description of North American species. European (Herbst 1784, Eschscholtz 1829) and North American (Say 1823, 1825, 1839; Randall 1838; Melsheimer 1846; LeConte 1853, 1859b, 1884; Horn 1871, 1874; Van Dyke 1932) workers continued to use *Elater* incorrectly. Brown (1933a) was the first North American worker to use *Ampedus* in the correct nomenclatural sense for the genus following Bradley's (1930) usage of *Ampedus* in his key to North America genera of beetles. Subsequent descriptions and faunal treatments in North America correctly used *Ampedus*. The most comprehensive treatment of the genus in North America is Ramberg's (1979) revision of Nearctic *Ampedus*.

Ecology/Habitat: *Ampedus* species live in decomposing wood and forest litter. The larvae are known from both evergreen and deciduous trees (Van Emden 1945, 1956; Brooks 1960). The biology of North American species is largely unknown, but it is generally believed the larvae are carnivorous and that the larval stage lasts from one to four years. Pupation usually occurs in wood or under bark in mid to late summer (Ramberg 1979).

Adult *Ampedus* often reside in their larval tunnels (Brooks 1960) and are primarily found in forested or riparian areas where trees are available. Adults overwinter in the pupal cell and emerge the following spring. Eggs are

typically laid in wood (Ramberg 1979). Larvae are found in wood and under bark (Becker and Dogger 1991). No species is known to be of economic importance in the United States, however, some *Ampedus* wireworms have been reported as damaging cultivated crops in Canada (Glen et al. 1943).

Key to Species of Adult *Ampedus*

(adapted from Ramberg 1979)

1 Pronotum appearing short in relation to elytra, ratio of pronotal length to elytral length close to 0.30; elytra somewhat elongate, giving the body a slender appearance (fig. 31).....2

1′ Pronotum not appearing as short in relation to elytra, ratio of pronotal length to elytral length close to 0.40; elytra less elongate in appearance, body robust (figs. 37-42).....3

2 Elytra black; pronotum piceous with red or red-yellow basal coloring; body length 6 to 8 mm; widespread .....*atripennis* (Horn) (in part)

2′ Elytra bicolored, piceous with yellow-brown markings (fig. 31); pronotum light yellow-brown; body length usually less than 6 mm; eastern Montana...*areolatus* (Say)

3 Pronotum and elytra piceous, the same color, without pattern.....4

3′ Pronotum not the same color as elytra; pronotum or elytra often bicolored, with pattern.....10

4 Pronotal pubescence piceous.....6

4′ Pronotal pubescence yellow.....5

5 Legs brown-red, dark red, or piceous, contrast with ventral body color not distinct; body length usually greater than 9 mm; eastern Montana....*luctuosus* (LeConte)

5′ Legs bright yellow-red or brown, contrasting distinctly with piceous to black ventral body color; body length usually less than 9 mm; widespread east of Continental Divide.....*subtilis* (LeConte)

6 Posterior angle of pronotum bicarinate; widespread .....*rhodopus* (LeConte)

6′ Posterior angle of pronotum unicarinate.....7

7 Body length 10 mm or greater; widespread .....*moerens* (LeConte)

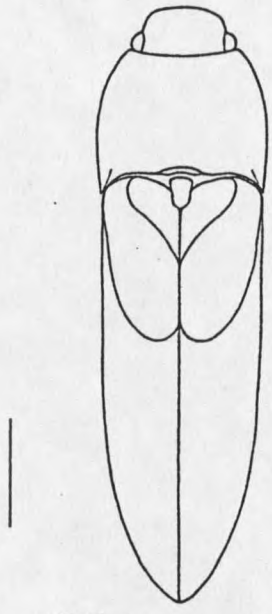
7′ Body length 9 mm or less.....8

8 Pronotum weakly convex, narrowed gradually anteriorly to narrowly truncate apex, the sides weakly rounded (fig. 34); apex of paramere acute, outer angle slightly convex; median lobe of aedeagus with narrow and angled basal lobes (fig. 32); montane....(males) *anthracinus* (LeConte)

8′ Pronotum convex, varying in shape but not narrowed anteriorly, sides more strongly rounded (fig. 35); in males apex of paramere obtuse, outer angle concave; basal lobes of median lobe broad and rounded (fig. 33).....9

9 Body length greater than 8 mm; dorsal surface often dull; montane.....(females) *anthracinus* (LeConte)

9′ Body length usually 6 to 8 mm; dorsal surface shining;



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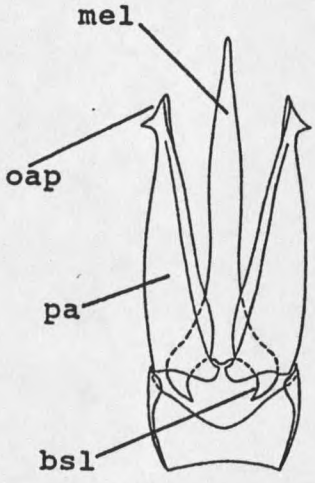

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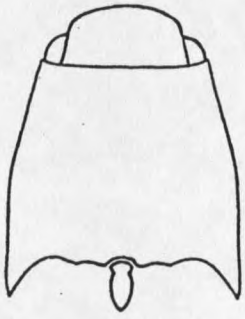

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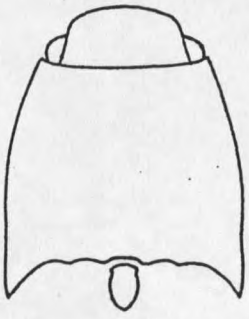

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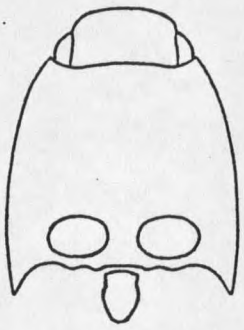

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Figures 31-36. Fig. 31, dorsal habitus, *Ampedus areolatus*. Figs. 32-33, male genitalia. Fig. 32, *A. anthracinus*. Fig. 33, *A. nigrinus*. Figs. 34-36, head and prothorax, dorsal view. Fig. 34, *A. anthracinus*. Fig. 35, *A. nigrinus*. Fig. 36, *A. phelpsi*. bsl, basal lobe; mel, median lobe; oap, outer angle of paramere; pa, paramere.

widespread.....*nigrinus* (LeConte)

10 Head, thorax, scutellum, and body red-brown to piceous; pronotum shiny, the sides subparallel; elytra bright yellow-red or yellow-brown, sides of elytra subparallel; pubescence yellow; northwest Montana .....sp. nr. *melinus* (LeConte)

10′ Not with above combination of characters.....11

11 Pronotum red or red-yellow, without piceous markings on disk; east of Rocky Mtns.....*collaris* (Say)

11′ Pronotum piceous or bicolored.....12

12 Pronotum piceous, without pattern except for occasional specimens with red or red-yellow posterior pronotal angles; elytra unicolorous or bicolored.....14

12′ Pronotum bicolored; elytra unicolorous or bicolored....13

13 Pronotum piceous with red or red-yellow basal coloring; elytra black; widespread.....*atripennis* (Horn) (in part)

13′ Pronotum red or red-yellow on sides and posterior angles, with most of disk piceous; elytra usually bicolored, piceous with red or red-yellow humeral markings; montane .....*brevis* (Van Dyke)

14 Elytra unicolorous.....15

14′ Elytra bicolored.....17

15 Pronotal pubescence yellow.....16

15′ Pronotal pubescence piceous; pronotum shiny; northwest Montana.....*bakeri* Lane

16 Elytral pubescence entirely yellow; pronotum dull; Rocky

Mtns.....*phoenicopterus* Germar

16′ Elytral pubescence bicolored, mostly picous with yellow areas basally; pronotum shiny; northwest Montana .....sp. nr. *occidentalis* Lane (in part)

17 Elytra red-yellow or yellow-red, with black or piceous maculation on apical third to half of each elytron, often forming a subcordate apical spot (figs. 38-42).....18

17′ Elytra mostly piceous to black, with yellow or red-yellow marginal vittae (fig. 37); eastern Montana .....*sellatus* (Dejean)

18 Basal half (or slightly less) of elytra red-yellow, apical half piceous (fig. 38); body length under 6 mm; widespread.....*pullus* Germar

18′ Basal two-thirds of elytra red-yellow, apical third (or less) piceous (figs. 39-42); body length greater than 6 mm.....19

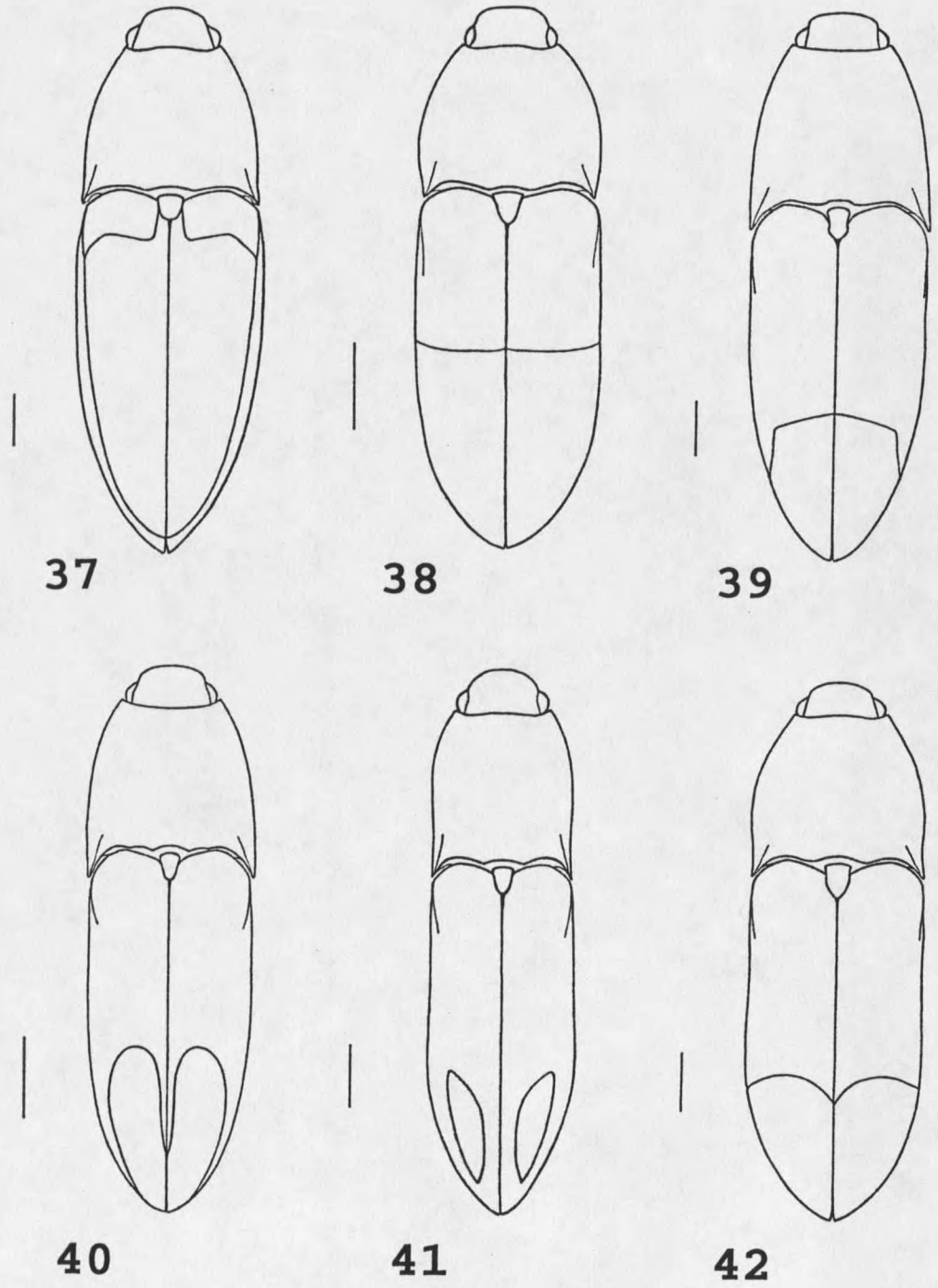
19 Pronotal pubescence yellow.....22

19′ Pronotal pubescence piceous.....20

20 Apical elytral spot slightly convex along anterior edge, not or slightly indented along suture (fig. 39); pronotum shiny; body length 9.5 mm or greater; western Montana.....*behrensi* (Horn)

20′ Apical elytral spot cordate or subcordate (figs. 40, 42); pronotum shiny or dull; body length 9.5 mm or less.....21

21 Pronotum and elytra appearing flattened, only slightly convex; apical elytral spot variable, but usually



Figures 37-42, dorsal habitus. Fig. 37, *Ampedus sellatus*. Fig. 38, *A. pullus*. Fig. 39, *A. behrensi*. Fig. 40, *A. varipilis*. Fig. 41, *A. occidentalis*. Fig. 42, *A. cordatus*.

subcordate and often in contact with elytral suture and sides for most of its length; prothorax broadly rounded in outline and dull, punctures umbilicate and contiguous on sides; montane.....*phelpsi* (Horn) (in part)

21′ Pronotum and elytra convex, not appearing flattened; apical elytral spot subcordate with red-yellow color at elytral suture and sides penetrating apically almost to elytral apex (fig. 40); prothorax less broadly rounded, gradually narrowed to broadly truncate apex, shiny, pronotal punctures at sides simple to umbilicate and clearly separated; northwest Montana .....*varipilis* (Van Dyke) (in part)

22 Apical elytral spots reduced to two faint, elongate spots on posterior third to half of elytra, spots not in contact with sides of elytra; northwestern Montana .....sp. nr. *occidentalis* Lane (in part)

22′ Apical elytral spots either in contact with elytral sides and apex or not faint, clearly visible and defined.....23

23 Apical elytral spots either not in contact with elytral sides and suture or only in contact with sides at elytral apex (fig. 41); widespread....*occidentalis* Lane (in part)

23′ Apical elytral spots in contact with elytral sides and suture at least at apex.....24

24 Pronotum and elytra appearing flattened, only slightly convex; pronotal pubescence yellow except for two circular areas basally where hairs are piceous to black

(fig. 36); montane.....*phelpsi* (Horn) (in part)

24′ Pronotum and elytra convex, not appearing flattened; pronotal pubescence entirely yellow.....25

25 Antenna reaching or exceeding apex of posterior pronotal angle; apical elytral spots in contact with elytral sides and suture for considerable distance anterior of elytral apex (fig. 42); northwest Montana .....*cordatus* (Horn)

25′ Antenna usually not, but occasionally just, reaching apex of posterior pronotal angle; apical elytral spots variable.....26

26 Elytral pubescence piceous to black, dark setae are visible against light colored areas of elytron; red-yellow color at elytral suture and/or sides penetrating apical spot almost to elytral apex (fig. 40); body length rarely greater than 9 mm; northwest Montana .....*varipilis* (Van Dyke) (in part)

26′ Elytral pubescence yellow except on black elytral spots; red-yellow color at elytral suture and sides usually penetrating only one-quarter to one-third length of apical spot; body length usually greater than 9 mm; widespread.....*apicatus* (Say)

Ampedus anthracinus (LeConte)

(figs. 32, 34, 143)

Elater anthracinus LeConte 1869 : 371, 378. 1884 : 13. Leng 1920 : 173. Dogger 1950 : 112.

Ampedus anthracinus (LeConte) : Lane 1952 : 67. 1971 : 14. Ramberg 1979 : 72-74.

Diagnosis: Small size, immaculate piceous coloring, and piceous vestiture distinguish *A. anthracinus* from all other species except *A. nigrinus*. Prothoracic shape and genitalia are used to separate males, while female *A. anthracinus* are greater than 8 mm in body length.

Length: 6.8 - 9.0 mm.

Distribution: U.S.A.: California, Montana, Oregon, Washington. CANADA: British Columbia.

Montana records: FLATHEAD CO: Glacier N. P., 28 V - 14 VI 1991 (GNPP), ibid., 24 VI 1960 (JGE). GALLATIN CO: Hyalite Res., 19 VII 1986 (MTEC), Bozeman Cr., 7 VI - 24 VII 1988 (MTEC). GLACIER CO: Glacier N. P., 22 VII 1954 (JGE). JUDITH BASIN CO: Little Belt Mtns., 27 V - 1 VII 1988 (MTEC), ibid. (CES), ibid., 1 VII - 13 VIII 1988 (MTEC). MADISON CO: Hidden Lake Bench, 22 VII - 9 IX 1989 (MTEC), ibid., 4 VI - 22 VII 1989 (MTEC).

Material examined: 11 specimens.

Elevation records: 3600′ - 7400′.

Collecting method: F.I.T., 5 specimens, 45.4 %
hand, 3 specimens, 27.3 %
L. funnel, 3 specimens, 27.3 %

Collection dates: (27 May) 14 June - 22 July (9 Sept.).

Remarks: *Ampedus anthracinus* has had an uncertain taxonomic relationship with *A. nigrinus*. LeConte (1884), Leng

(1920), Dogger (1950), and Lane (1952) considered them conspecific. Each was later recognized as a valid species by Lane (1971), and Ramberg (1979).

Ampedus anthracinus represents a new state record for Montana and its collection in Judith Basin Co. is an unexpected range extension eastward for a presumed Pacific Northwest species.

Ampedus apicatus (Say)

(fig. 144)

Elater apicatus Say 1839 : 170. Melsheimer 1853 : 70. LeConte 1853 : 466. Candeze 1859 : 439. LeConte 1861a : 347. 1863 : 45. 1869 : 371. Horn 1871 : 307. LeConte 1884 : 11, 14. Leng 1920 : 173. Leonard 1928 : 350. Van Dyke 1932 : 304, 305. Hawkins 1936 : 13.

Ampedus melanopygus Germar 1844 : 161. LeConte 1853 : 466. 1863 : 45. Dogger 1950 : 109. Lane 1971 : 13.

Elater melanopygus (Germar) : Melsheimer 1853 : 70. LeConte 1884 : 14. Leng 192er 1959 : 106. Brooks 1960 : 8, 49-51, 62. Lane 1971 : 13. Tostowaryk 1972 : 1141. Ramberg 1979 : 74-79.

Diagnosis: Large size; piceous head, thorax, and body; yellow-red elytra with piceous spots in contact with apical end of elytra and suture; antennae not reaching posterior pronotal angles; and vestiture almost entirely yellow help to differentiate this species.

Length: 9.0 - 12.2 mm.

Distribution: U.S.A.: Alaska, California, Colorado, Idaho, Iowa, Maine, Massachusetts, Michigan, Minnesota, Montana, New Hampshire, New York, North Dakota, Oregon, Pennsylvania, South Dakota, Vermont, Washington, Wisconsin, Wyoming. CANADA: Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland, Ontario, Prince Edward Island, Quebec, Saskatchewan.

Montana records: DAWSON CO: 16 VII 1931 (MTEC). GALLATIN CO: Bozeman, 20 V 1924 (MTEC), ibid., 31 V 1961 (MTEC), [no loc.] 25 V 1978 (MTEC), ibid., 28 IV 1983 (MTEC), ibid., 26 V 1984 (MTEC), nr. Belgrade, 6 VI 1988 (CES), Gallatin R., 18 VII 1989 (MTEC), ibid., 17 VI 1987 (MTEC), Stone Cr., 28 V 1988 (MTEC). LEWIS AND CLARK CO: nr. Bean Lake, 24 V 1988 (MTEC). ROSEBUD CO: Rosebud - Far West, 13 VII 1991 (MTEC).

Material examined: 16 specimens.

Elevation records: 4600′ - 5450′.

Collecting method: hand, 16 specimens, 100.0 %

Collection dates: 28 April - 18 July.

Biology: *Ampedus apicatus* has been reared from balsam poplar (*Populus balsamifera*) logs, decomposing wood of oak (*Quercus* sp.), and forest litter under jack pine (*Pinus banksiana*). It has been collected by beating spruce (*Picea* sp.) and fir (*Abies* sp.) foliage.

Remarks: Ramberg (1979) recorded *A. apicatus* from Lake Co., Montana.

Ampedus areolatus (Say)

(figs. 31, 145)

Elater areolatus Say 1823 : 167. 1839 : 174. LeConte 1853 : 471. Melsheimer 1853 : 71. Candeze 1859 : 471. LeConte 1884 : 13. Blatchley 1910 : 731, 734, 735. Osborn 1939 : 196.

Elater obliquus Say 1839 : 174. LeConte 1853 : 470, 471. Melsheimer 1853 : 71. Candeze 1859 : 469, 470. LeConte 1863 : 46. 1884 : 11, 13, 14. Blatchley 1910 : 735. Leonard 1928 : 350.

Ampedus scitulus Germar 1844 : 168. LeConte 1853 : 470. 1863 : 46. 1884 : 14.

Elater scitulus (Germar) : Melsheimer 1853 : 71.

Elater obliquus areolatus Say : LeConte 1863 : 46. Leng 1920 : 173. Leonard 1928 : 350.

Elater obliquus scitulus (Germar) : Leng 1920 : 173.

Ampedus areolatus (Say) : Brown 1933a : 135. Blackwelder 1939 : 41. Dietrich 1945 : 49. Dogger 1950 : 103, 110, 111. 1959 : 106. Kirk and Balsbaugh 1975 : 66. Ramberg 1979 : 306-310.

Ampedus obliquus areolatus (Say) : Thomas 1941 : 255. Jaques 1951.

Ampedus obliquus (Say) : Kirk and Balsbaugh 1975 : 65.

Diagnosis: In addition to its eastern distribution and small size, *A. areolatus* is the only Montana species with red-yellow unicolorous pronotum and elongate, bicolored elytra.

Length: 5.8 mm, males are smaller.

Distribution: U.S.A.: Connecticut, Georgia, Illinois, Indiana, Iowa, Kentucky, Massachusetts, Maryland, Michigan, Mississippi, Missouri, Montana, New Hampshire, New York, North Carolina, Pennsylvania, South Dakota, Tennessee, Virginia, Wisconsin. CANADA: Ontario.

Montana Records: DAWSON CO: Intake diversion, 27 VI 1988 (MTEC). ROSEBUD CO: Rosebud - Far West, 13 VII 1991 (MTEC).

Material examined: 2 specimens.

Collecting method: uv light, 1 specimen, 50.0 %
hand, 1 specimen, 50.0 %

Collection dates: 27 June - 13 July.

Biology: *Ampedus areolatus* has been collected from maple (*Acer* sp.).

Remarks: The larva of *A. areolatus* is unknown even though it is a commonly collected species in much of eastern North America. The single specimen collected in eastern Montana via an ultraviolet light trap is a new state record and a considerable range extension westward for *A. areolatus*.

Ampedus atripennis (Horn)

(fig. 146)

Elater atripennis Horn 1871 : 306. LeConte 1884 : 11, 14. Leng 1920 : 173.

Elater violaceipennis Candeze 1881 : 62, 63. LeConte 1884 : 14. Leng 1920 : 173.

Elater nevadensis LeConte 1884 : 11, 13, 14. Leng 1920 : 173. NEW SYNONYMY by Ramberg 1979 : 311.

Elater oregonus Schaeffer 1916 : 258. Leng 1920 : 173. Lane and Fisher 1941 : 121. NEW SYNONYMY by Ramberg 1979 : 311.

Ampedus violaceipennis (Candeze) : Lane 1971 : 13.

Ampedus oregonus (Schaeffer) : Lane and Fisher 1941 : 121. Knowlton and McComb 1949 : 6. Lane 1952 : 67. 1971 : 14.

Ampedus atripennis (Horn) : Ramberg 1979 : 311-316.

Diagnosis: Bicolored pronotum piceous with red coloring along basal margin, legs and antennae yellow-red, and black elongate elytra are distinguishing features of *A. atripennis*.

Length: 7.0 - 7.1 mm.

Distribution: U.S.A.: California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming. CANADA: British Columbia.

Montana records: FERGUS CO: 9 mi. NW Lewistown, 28 V 1988 (MTEC). MINERAL CO: Alberton, 25 VI 1967 (OSU). SANDERS CO: 13 mi. NE St. Regis, 19 VI 1967 (OSU), ibid. (MTEC).

Material examined: 5 specimens.

Elevation records: 2500′ - 3800′.

Collecting method: hand, 5 specimens, 100.0 %

Collection dates: 28 May - 25 June.

Biology: *Ampedus atripennis* has been collected from decomposing wood of lodgepole pine and ponderosa pine.

Remarks: Ramberg (1979) recorded *A. atripennis* from Lewis and Clark Co., Montana.

Ampedus bakeri Lane

(fig. 147)

Ampedus bakeri Lane 1965 : 190, 191. Lane 1971 : 12. Ramberg 1979 : 81-85.

Diagnosis: Black head and pronotum, piceous antennae not reaching posterior pronotal angles, immaculate yellow-red elytra, and piceous pronotal pubescence distinguish *A. bakeri* from other Montana *Ampedus* species.

Length: 10.0 mm.

Distribution: U.S.A.: California, Idaho, Montana, Oregon, Washington.

Montana records: FLATHEAD CO: Glacier N. P., 18 VII 1969 (MTEC).

Material examined: 1 specimen.

Elevation records: 8000'.

Collecting method: hand, 1 specimen, 100.0 %

Collection dates: 18 July.

Biology: *Ampedus bakeri* develops under the bark of decomposing stumps and logs of pine.

Remarks: The collection of *A. bakeri* in Flathead Co. provies a new state species record for Montana.

Ampedus behrensi (Horn)

(figs. 39, 148)

Elater behrensi Horn 1871 : 306. LeConte 1884 : 9, 13. Leng 1920 : 173. Van Dyke 1932 : 305. Mank 1934 : 78.

Ampedus behrensi (Horn) : Brown 1933a : 137. Lane 1952 : 67. 1971 : 12. Ramberg 1979 : 85-89.

Diagnosis: Piceous pubescence and distinctive apical elytral pattern separate *A. behrensi* from others with black head, pronotum, and body, yellow-red elytra, and black apical elytral spots.

Length: 10.9 mm.

Distribution: U.S.A.: California, Montana, Nevada, Oregon, Washington. CANADA: British Columbia.

Montana records: RAVALLI CO: Bitterroot R. - Darby, 02 VII 1991 (MTEC).

Material examined: 1 specimen.

Collecting method: hand, 1 specimen, 100.0 %

Collection dates: 2 July.

Biology: *Ampedus behrensi* has been collected from water birch (*Betula occidentalis*), black cottonwood (*Populus trichocarpa*), and alder (*Alnus* sp.).

Remarks: Although *A. behrensi* was listed by Mank (1934) as occurring in Glacier National Park, all four of her specimens are/were actually *A. phelpsi*. Therefore, *A. behrensi* was not actually collected in Montana until 1991, from Ravalli Co.

Ampedus brevis (Van Dyke)

(fig. 149)

Elater brevis Van Dyke 1932 : 309, 310. Leng 1933 : 84.

Ampedus brevis (Van Dyke) : Lane 1952 : 67. 1971 : 14. Ramberg 1979 : 89-91.

Diagnosis: Entire prothorax piceous to black except for red-yellow lateral markings and each elytron piceous, with yellow-red coloring which varies from a small area limited to the humeral angle to a large vitta starting at the base and extending laterally to the apex distinguish *A. brevis*. It is the only Montana species of *Ampedus* with both bicolored pronotum and elytra.

Length: 6.0 - 7.5 mm.

Distribution: U.S.A.: California, Idaho, Montana, Oregon, Washington. CANADA: British Columbia.

Montana records: FLATHEAD CO: Glacier N. P., 27 V - 17 VI 1991 (GNPP), ibid., 15 - 22 VII (GNPP), ibid., 1 - 8 VIII 1989 (GNPP), ibid., 26 V - 17 VI 1991 (GNPP), 29 V - 19 VI 1991 (GNPP), ibid., 7 - 14 VII 1989 (GNPP), ibid., 26 V - 18 VI 1991 (GNPP). FLATHEAD/GLACIER CO: Glacier N. P., 15 VII 1931 (CUIC). GALLATIN CO: Hyalite Cr., 14 VI - 3 VIII 1989 (MTEC), Bozeman Cr., 7 VI - 24 VII 1988 (MTEC), ibid., 8 VII - 8 IX 1990 (CES). GRANITE CO: Boulder Cr., 6 IV - 8 V 1988 (MTEC), So. Boulder Cr., 21 V - 25 VI 1988 (MTEC). MADISON CO: Hidden Lake Bench, 4 VI - 22 VII 1989 (MTEC). RAVALLI CO: 5 mi. SW Florence, 27 VI 1967 (OSU).

Material examined: 27 specimens.

Elevation records: 3560′ - 7400′.

Collecting method: L. funnel, 22 specimens, 81.5 %
F.I.T., 3 specimens, 11.1 %
hand, 2 specimens, 7.4 %

Collection dates: (6 April) 8 May - 1 Aug. (8 Sept.).

Biology: *Ampedus brevis* has been collected from dead wood of water birch and cedar (*Thuja* sp.).

Remarks: This boreal species is uncommonly collected by hand and most readily collected by Lindgren funnel traps. Ramberg (1979) recorded the collection of *A. brevis* from Glacier National Park, Glacier Co., Montana.

Ampedus collaris (Say)

(fig. 150)

Elater collaris Say 1825 : 268. Melsheimer 1853 : 71. LeConte 1853 : 470. Candeze 1859 : 436. LeConte 1863 : 46. Horn 1871 : 306. 1879 : 16. LeConte 1884 : 11, 14. Blatchley 1910 : 731, 734. Leng 1920 : 173. Leonard 1928 : 350. Van Dyke 1932 : 315.

Ampedus collaris (Say) : Germar 1844 : 172. Thomas 1941 : 254. Dietrich 1945 : 44, 47. Brooks 1960 : 7, 48, 49. Dillon and Dillon 1961 : 322, 323, 328, 329. Swan and Papp 1972 : 386. Ramberg 1979 : 94-98.

Diagnosis: *Ampedus collaris* is a distinctive bicolored species with red-yellow prothorax, abdomen, legs, and antennae and piceous head, elytra, meso-, and metathorax. Pubescence

is either piceous or yellow, consistently matching the color of the sclerite where it is located.

Length: 6.8 - 7.5 mm.

Distribution: U.S.A.: Connecticut, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Missouri, Montana, New Jersey, New York, North Carolina, Pennsylvania, Vermont, West Virginia. CANADA: Manitoba, Quebec.

Montana records: CARTER CO: Medicine Rocks St. Pk., 16 VI 1989 (MTEC), 5 mi. W. Alzada, 20 VI - 31 VIII 1989 (MTEC). LEWIS AND CLARK CO: Helena, V 1974 (MTEC). POWDER RIVER CO: Camps Pass, 7 VI - 4 VIII 1991 (MTEC).

Material examined: 6 specimens.

Collecting method: hand, 3 specimens, 50.0 %
malaise, 2 specimens, 33.3 %
L. funnel, 1 specimen, 16.7 %

Collection dates: 31 May - 20 June (31 August).

Biology: *Ampedus collaris* has been collected from flowers of barberry (*Berberis* sp.), oak, apple/pear (*Pyrus* sp.), and viburnum (*Viburnum* sp.) and from decomposing wood of hickory (*Carya* sp.), white spruce (*Picea glauca*), and white pine (*Pinus strobus*).

Remarks: *Ampedus collaris* is commonly collected in eastern North America. The red-necked click beetle is the only *Ampedus* species with a published common name and is a new state record for Montana.

Ampedus cordatus (Horn)

(figs. 42, 151)

Elater cordatus Horn 1871 : 306, 307. LeConte 1884 : 9, 13. Leng 1920 : 173. Leonard 1928 : 349. Van Dyke 1932 : 305, 307, 308.

Elater affinis LeConte 1884 : 11, 13, 14. Leng 1920 : 173. Van Dyke 1932 : 305, 308. Fall 1934 : 14, 15.

Ampedus affinis (LeConte) : Brown 1933a : 137. Lane 1971 : 13.

Ampedus cordatus (Horn) : Lane 1971 : 13. Ramberg 1979 : 98-102.

Diagnosis: *Ampedus cordatus* is characterized by pronotal and elytral vestiture yellow; antennae reaching or exceeding posterior pronotal angles; head, thorax, and body piceous; elytra yellow-red with piceous apical spots in contact with sides and suture for most of their length. *A. cordatus* is not distinctly dorsoventrally flattened.

Length: 9.0 mm.

Distribution: U.S.A.: California, Montana, Oregon, Washington. CANADA: British Columbia.

Montana records: FLATHEAD CO: Glacier N. P., 1 - 8 VIII 1989 (GNPP).

Material examined: 1 specimen.

Elevation records: 3560′.

Collecting method: L. funnel, 1 specimen, 100.0 %

Collection dates: (1 - 8 August).

Biology: *Ampedus cordatus* has been collected from Douglas fir and decomposing wood of ponderosa pine and buckthorn (*Rhamnus* sp.).

Remarks: This species is a new state record for Montana.

Ampedus luctuosus (LeConte)

(fig. 52)

Elater luctuosus LeConte 1853 : 466. Candeze 1859 : 478, 479. LeConte 1859b : 47. 1861a : 347. 1884 : 11, 14. Leng 1920 : 173. Leonard 1928 : 351.

Elater manipularis Candeze 1859 : 478, 479. LeConte 1863 : 46. 1884 : 9, 13. Blatchley 1910 : 730, 732. Leng 1920 : 173. Leonard 1928 : 350. Van Dyke 1932 : 308, 309. NEW SYNONYMY by Ramberg 1979 : 143.

Ampedus manipularis (Candeze) : Brown 1933a : 134. Thomas 1941 : 255. Dietrich 1945 : 43, 49, 50. Jewett 1946 : 6, 12, 13. Dogger 1950 : 103, 111. 1959 : 106. Kirk and Balsbaugh 1975 : 66.

Ampedus luctuosus (LeConte) : Brown 1933a : 134. Thomas 1941 : 256. Dietrich 1945 : 43, 51. Dogger 1950 : 103, 114. 1959 : 106. Brooks 1960 : 8, 49, 52. Tostowaryk 1972 : 1141. Ramberg 1979 : 143-147.

Diagnosis: *Ampedus luctuosus* is readily identified by its southeastern Montana distribution, large size, short but dense yellow vestiture, and entirely black color except for piceous antennae and red tarsi.

Length: 11.9 mm.

Distribution: U.S.A.: Indiana, Iowa, Kentucky, Maine, Massachusetts, Michigan, Minnesota, Montana, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Dakota, Vermont, Wisconsin. CANADA: Alberta, Manitoba, Newfoundland, Nova Scotia, Ontario, Quebec, Saskatchewan.

Montana records: CARTER CO: 5 mi. S. Ekalaka, 16 VI 1989 (MTEC).

Material examined: 1 specimen.

Collecting method: hand, 1 specimen, 100.0 %

Collection dates: 16 June.

Biology: *Ampedus luctuosus* has been collected from fir by beating and has been reared from decomposing wood of oak and forest litter under jack pine. It has been reported as widespread in predominantly poplar forests and parklands of Canada.

Remarks: The collection of *A. luctuosus* in Montana represents a new state record.

Ampedus sp. nr. *melinus* (LeConte)

(fig. 153)

Diagnosis: Long yellow pubescence, fusco-testaceous head, prothorax and body, and flavotestaceous elytra and legs separate this species from other Montana *Ampedus*.

Length: 8.5 mm.

Montana records: LAKE CO: [no loc.] 20 VI 1927 (MTEC).

Material examined: 1 specimen.

Collecting method: hand, 1 specimen, 100.0 %

Collecting dates: 20 June.

Ampedus moerens (LeConte)

(fig. 154)

Elater moerens LeConte 1861a : 347. LeConte 1884 : 11, 14. Leng 1920 : 173.

Ampedus moerens (LeConte) : Knowlton and McComb 1949 : 6. Lane 1952 : 67. Brooks 1960 : 7, 49, 53. Lane 1971 : 14. Ramberg 1979 : 159-164.

Diagnosis: *Ampedus moerens* is a large, black species with short, piceous to black pubescence, piceous antennae never reaching posterior pronotal angles, and red tarsi.

Length: 10 - 12.6 mm.

Distribution: U.S.A.: Arizona, California, Colorado, Idaho, Montana, New Mexico, Oregon, Utah, Washington, Wyoming. CANADA: Alberta, British Columbia.

Montana records: FERGUS CO: 16.5 mi. NE Winifred, 13 V 1983 (MTEC). FLATHEAD CO: Glacier N. P., 8 VI 1990 (MTEC), ibid., 7 - 14 VII 1990 (GNPP), ibid., 26 V - 18 VI 1991 (GNPP), ibid., 28 V - 19 VI 1991 (GNPP), ibid., 18 - 25 VI 1991 (GNPP), ibid., 27 V - 17 VI 1991 (GNPP), ibid., 17 - 24 VI 1991 (GNPP), ibid., 1 VII 1950 (GNP), Hungry Horse Res., 28 V 1987 (MTEC). GALLATIN CO: Bozeman, 27 VI 1906 (MTEC), [no loc.] 15 V 1927 (MTEC), ibid., 18 V 1927 (MTEC), ibid., 28 V 1978 (MTEC), Hyalite Cyn., 6 VI 1988 (MTEC), Battle Ridge Cmpgd., 4 VII 1988 (MTEC), Bozeman Cr., 8 VI 1987 (MTEC), ibid. (DLG), ibid., 20 VI 1990 (MTEC), Hyalite Res., 19 VII

1986 (MTEC). GLACIER CO: Glacier N. P., 28 VI 1962 (JGE). JUDITH BASIN CO: Little Belt Mtns., 27 V - 1 VII 1988 (MTEC), ibid. (CES). LAKE CO: Flathead L. Biol. Sta., 8 VII 1965 (OSU), Lost Cr., 28 VI 1989 (MTEC). MADISON CO: Hidden Lake Bench, 4 VI - 22 VII 1989 (MTEC). MINERAL CO: Lookout Pass, 9 VI 1967 (OSU). MISSOULA CO: 10 mi. W Ovando, 15 VI 1967 (OSU). POWELL CO: Ovando, 15 VI 1967 (OSU).

Material examined: 34 specimens.

Elevation records: 3150′ - 7400′.

Collecting method: hand, 25 specimens, 73.5 %
F.I.T., 6 specimens, 17.6 %
L. funnel, 3 specimens, 8.8 %

Collection dates: 13 May - 19 July (22 July).

Biology: *Ampedus moerens* has been collected from poplar, willow, decomposing wood of ponderosa pine, and from under bark of Douglas fir.

Remarks: Ramberg (1979) recorded the collection of *A. moerens* from the following Montana counties; Flathead, Glacier, Lewis and Clark, Missoula, and Ravalli.

Ampedus nigrinus (Herbst)

(figs. 33, 35, 155)

Elater nigrinus Herbst 1784 : 114. Stephens 1829 : 255. Candeze 1859 : 475, 476. LeConte 1859b : 6, 18. 1869 : 378. 1884 : 10, 13. Leng 1920 : 173. Notman 1921 : 160. Mank 1934 : 78. Van Emden 1945 : 21. Dogger 1950 : 112. Van Emden 1956 : 168, 178, 180, 181.

Elater carbonicolor Eschscholtz 1829 : 3. Melsheimer 1853 : 71. LeConte 1859b : 18. Candeze 1859 : 476, 477. LeConte 1863 : 46. 1869 : 378. 1884 : 9, 13. Leng 1920 : 173. NEW SYNONYMY by Ramberg 1979 : 174.

Ampedus carbonicolor (Esch.) : Germar 1844 : 175. Lane 1952 : 67. 1971 : 14.

Ampedus nigrinus (Herbst) : Germar 1844 : 175. Brown 1933a : 135. Dietrich 1945 : 43, 50. Dogger 1950 : 103, 112. Lane 1952 : 67. Dogger 1959 : 107. Brooks 1960 : 7, 49, 52, 53. Zacharuk 1963 : 161-163. Lane 1971 : 14, 15. Tostowaryk 1972 : 1141. Ramberg 1979 : 174-179.

Diagnosis: Small size, piceous pubescence, and color entirely piceous separate *A. nigrinus* from all other species except *A. anthracinus*. Shape of the pronotum and genitalia are used to differentiate males, while female *A. nigrinus* are smaller than female *A. anthracinus*.

Length: 6.5 - 8.2 mm.

Distribution: Holarctic. U.S.A.: Alaska, Colorado, Idaho, Montana, Oregon, Utah, Washington, Wyoming. CANADA: Alberta, British Columbia, Northwest Territory.

Montana records: FLATHEAD CO: Whitefish, 13 VII 1990 (JGE), Glacier N. P., 26 V 1991 (DLG), ibid., 27 V 1991 (DLG), ibid., 30 V 1991 (GNPP), ibid., 2 VIII - 3 IX 1991 (GNPP), ibid., 28 V - 19 VI 1991 (GNPP), ibid., 7 VII - 1 VIII 1989 (GNPP), ibid., 15 - 22 VII 1991 (GNPP), ibid., 10 - 31 VII 1990 (GNPP), 9 - 14 VII 1989 (GNPP), ibid., 23 VII - 13

VIIIitory.

Montana records: FLATHEAD CO: Whitefish, 13 VII 1990 (JGE), Glacier N. P., 26 V 1991 (DLG), ibid., 27 V 1991 (DLG), ibid., 30 V 1991 (GNPP), ibid., 2 VIII - 3 IX 1991 (GNPP), ibid., 28 V - 19 VI 1991 (GNPP), ibid., 7 VII - 1 VIII 1989 (GNPP), ibid., 15 - 22 VII 1991 (GNPP), ibid., 10 - 31 VII 1990 (GNPP), 9 - 14 VII 1989 (GNPP), ibid., 23 VII - 13 VIII 1991 (GNPP), ibid., 27 V - 18 VI 1991 (GNPP), ibid., 29 V 1991 (DLG), ibid., 20 VII 1967 (OSU), Bigfork, 13 VI 1967 (OSU), Hungry Horse Res., 28 - 29 V 1987 (MTEC). FLATHEAD/GLACIER CO: Glacier N. P., 18 VII 1924 (CUIC), ibid., 30 VII 1924 (CUIC), ibid., 9 VII 1929 (CUIC), ibid., 29 VII 1929 (CUIC), ibid., 20 VII 1974 (JGE), ibid., 3 VIII 1978 (JGE). GALLATIN CO: Bozeman, 18 V 1927 (MTEC), Squaw Cr., 15 VI - 12 VII 1988 (MTEC), ibid., 8 V - 11 VI 1988 (CES), ibid., 11 VI - 12 VII 1988 (MTEC), ibid. (CES), Chestnut Mtn., 24 VI 1988 (MTEC), Battle Ridge Cmpgd., 4 VII 1988 (MTEC), Hyalite Cr., 14 VI - 3 VIII 1989 (MTEC), Bridger Cr., 24 VII 1987 (MTEC), Stone Cr., 2 - 28 V 1988 (MTEC), ibid., 28 V -30 VI 1988 (MTEC), Bozeman Cr., 4 VI 1987 (MTEC), ibid., 7 VI - 24 VII 1988 (MTEC), ibid., 1 XI 1988 - 30 VI 1989 (MTEC), ibid., 20 VI 1990 (MTEC), Hyalite Res., 19 VII 1986 (MTEC), Blackmore Cr., 8 VI 1989 (MTEC), ibid., 8 VI - 26 IX 1989 (MTEC). GLACIER CO: Glacier N. P., 23 VII 1952 (JGE), ibid., 9 VIII 1971 (JGE). JUDITH BASIN CO: Little Belt Mtns., 27 V - 1 VII 1988 (MTEC), ibid., 1 VII - 13 VIII 1988 (MTEC). LAKE CO: Swan

L., 14 VI 1967 (OSU), ibid., 13 VII 1967 (OSU). MADISON CO: Tobacco Root Mtns. - Potosi, 8 VII 1988 (MTEC), Hidden Lake Bench, 4 VI - 22 VII 1989 (MTEC). MEAGHER CO: 10 mi. S. Niehart, 12 - 17 VI 1987 (MTEC). MINERAL CO: Lookout Pass, 9 VI 1967 (OSU), ibid., 27 VII 1967 (OSU). RAVALLI CO: nr. Florence, 6 VI 1980 (SNOW), 5 mi. SW Florence, 27 VI 1967 (OSU).

Material examined: 92 specimens.

Elevation records: 3000′ - 10000′.

Collecting method: hand, 40 specimens, 43.5 %
F.I.T., 30 specimens, 32.6 %
L. funnel, 22 specimens, 23.9 %

Collection dates: (2 May) 18 May - 9 Aug. (3 Sept.).

Biology: In North America, *A. nigrinus* has been collected from pine, spruce, and fir, and from decomposing wood of Engelmann spruce (*Picea engelmannii*), western hemlock (*Tsuga heterophylla*), and birch. In Europe, this species has been collected under bark and/or in wood of decomposing spruce, pine, birch, alder, and plum/cherry (*Prunus* sp.).

Remarks: *Ampedus nigrinus* is a Holarctic species with a western/Rocky Mountain distribution in North America. Records of this species occurring in the midwest and northeastern United States are incorrect.

Mank (1934) recorded the collection of *A. nigrinus* from Glacier National Park. In addition, Ramberg (1979) recorded specimens of *A. nigrinus* collected from Ravalli Co., Montana.

Ampedus occidentalis Lane

(figs. 41, 156)

Elater bimaculatus Van Dyke (*nec* Rossi 1790, preoccupied) 1932 : 305, 307. Leng 1933 : 84.

Ampedus bimaculatus (Van Dyke) : Brown 1933a : 138. Knowlton and McComb 1949 : 6. Lane 1952 : 67. 1971 : 13.

Ampedus occidentalis Lane 1971 : 12, 13. Ramberg 1979 : 179-185.

Diagnosis: *Ampedus occidentalis* has yellow pronotal pubescence; antennae not or just reaching posterior pronotal angles; piceous head, prothorax, and body; and red-yellow elytra with piceous apical spots either not in contact with or only touching elytral sides at apex.

Length: 8.5 - 10.9 mm.

Distribution: U.S.A.: California, Idaho, Montana, Oregon, Utah, Washington, Wyoming. CANADA: Alberta, British Columbia.

Montana records: FERGUS CO: Lewistown, 30 V - 2 VII 1988 (MTEC). FLATHEAD CO: Glacier N. P., 13 - 20 VIII 1991 (GNPP), ibid., 12 VII - 3 VIII 1989 (GNPP), Hungry Horse Res., 28 - 29 V 1987 (MTEC). FLATHEAD/GLACIER CO: Glacier N. P., 9 VII 1950 (GNP). GALLATIN CO: Squaw Cr., 15 VI - 12 VII 1988 (MTEC), [no loc.] 2 V 1924 (MTEC). LAKE CO: [no loc.] 22 IV 1936 (MTEC). MINERAL CO: St. Regis, 19 VI 1967 (OSU). MISSOULA CO: Missoula, 18 V 1904 (MTEC), 10 mi. W. Ovando, 15 VI 1967 (OSU). POWDER RIVER CO: Camps Pass, 7 VI - 4 VIII

1991 (MTEC). POWELL CO: Blackfoot R., 26 VI 1989 (MTEC). RAVALLI CO: nr. Florence, 8 VI 1980 (SNOW), 5 mi. SW Florence, 26 VI 1967 (OSU). SANDERS CO: Thompson Falls, 22 VI 1967 (OSU).

Material examined: 19 specimens.

Elevation records: 2400′ - 6700′.

Collecting method: hand, 13 specimens, 68.4 %

L. funnel, 6 specimens, 31.6 %

Collection dates: 22 April - 13 August (20 August).

Biology: *Ampedus occidentalis* has been collected from decomposing wood of white balsam fir (*Abies concolor*), ponderosa pine, Douglas fir, and western hemlock.

Remarks: Ramberg (1979) recorded the collection of *A. occidentalis* from Flathead, Lewis and Clark, and Powell counties of Montana.

Ampedus sp. nr. *occidentalis* Lane

(fig. 157)

Diagnosis: Head, prothorax, and body piceous; elytra red-yellow with two very faint apical spots not in contact with elytra sides or suture; and pronotum with long, yellow pubescence distinguish *A.* sp. nr. *occidentalis*. This species is very similar to *A. occidentalis* except for its barely visible apical elytral spots.

Length: 9.7 mm.

Montana records: GLACIER CO: Glacier N. P., 10 VII 1967 (MTEC).

Material examined: 1 specimen.

Elevation records: 5000′.

Collecting method: hand, 1 specimen, 100.0 %

Collecting dates: 10 July.

Ampedus phelpsi (Horn)

(figs. 36, 158)

Elater phelpsi Horn 1874 : 22, 23. LeConte 1884 : 9, 13. Leng 1920 : 173. Van Dyke 1932 : 304, 306.

Elater phelpsi hoppingi Van Dyke 1932 : 306. Leng 1933 : 84.

Ampedus hoppingi (Van Dyke) : Knowlton and McComb 1949 : 6. Lane 1952 : 67. Brooks 1960 : 7, 49, 50. Lane 1971 : 12.

Ampedus phelpsi (Horn) : Lane 1971 : 12. Ramberg 1979 : 191-197.

Diagnosis: *Ampedus phelpsi* has head, prothorax, and body piceous to black; elytra yellow-red with piceous apical spots usually in contact with elytral sides and suture for much of their length; pronotal pubescence yellow with two basal piceous areas or entirely piceous; and elytral pubescence yellow on basal half to two-thirds. Useful characters for identifying *A. phelpsi* also include its dorsoventrally compressed or flattened appearance and dull, broad pronotum with dense, shallow, umbilicate punctures, especially laterally.

Length: 7.3 - 9.0 mm.

Distribution: U.S.A.: Arizona, California, Colorado,

Idaho, Montana, New Mexico, Oregon, Utah, Washington, Wyoming. CANADA: Alberta, British Columbia.

Montana records: FLATHEAD CO: Glacier N. P., 25 VI 1962 (JGE), ibid., 3 - 10 VII 1990 (GNPP), ibid., 2 - 9 VIII 1990 (GNPP), ibid., 18 - 25 VI 1991 (GNPP), ibid., 16 - 23 VII 1991 (GNPP), ibid., 7 VII - 1 VIII 1989 (GNPP). FLATHEAD/GLACIER CO: Glacier N. P., 10 - 12 VII 1929 (CUIC), ibid., 12 VII 1929 (CUIC), ibid., 6 VII 1929 (CUIC). GALLATIN CO: W. Gallatin, 17 VI 1918 (MTEC), Bozeman, 5 VI 1931 (MTEC), [no loc.] 27 IV 1933 (MTEC), Bridger Cyn. - Olson Cr., 19 V 1988 (MTEC), Bozeman, 30 VI 1900 (MTEC), Bozeman Cr., 8 VI 1987 (MTEC), ibid., 4 VI 1987 (MTEC), ibid., 25 VI 1987 (MTEC), Hyalite Cyn., 1 VI 1986 (MTEC). JUDITH BASIN CO: Little Belt Mtns., 27 V - 1 VII 1988 (MTEC), ibid. (CES). LAKE CO: Lake Ronan, 10 VI 1932 (MTEC). MINERAL: St. Regis, 19 VI 1967 (OSU), 8 mi. N. St. Regis, 19 VI 1967 (OSU). RAVALLI CO: Darby, 26 IV 1936 (MTEC), nr. Florence, 16 VI 1980 (SNOW), ibid., 17 VI 1980 (SNOW).

Material examined: 37 specimens.

Elevation records: 2500′ - 7000′.

Collecting method: hand, 25 specimens, 67.6 %
F.I.T., 9 specimens, 24.3 %
L. funnel, 3 specimens, 8.1 %

Collection dates: 26 April - 2 August (9 August).

Biology: *Ampedus phelpsi* has been collected from decomposing wood of ponderosa pine.

Remarks: Ramberg (1979) recorded Montana specimens of *A. phelpsi* collected in Glacier National Park, Glacier Co.

Ampedus phoenicopterus Germar

(fig. 159)

Ampedus phoenicopterus Germar 1844 : 161. LeConte 1853 : 466. 1863 : 45. Brown 1933a : 138. Knowlton and McComb 1949 : 6. Lane 1952 : 67. 1965 : 191. 1971 : 12. Ramberg 1979 : 197-205.

Elater phoenicopterus (Germar) : Melsheimer 1853 : 71. LeConte 1853 : 466. Candeze 1859 : 448. LeConte 1859b : 6, 18. 1863 : 45. 1869 : 371. Van Dyke 1932 : 305.

Elater apicatus phoenicopterus (Germar) : LeConte 1884 : 14. Leng 1920 : 173.

Ampedus apicatus phoenicopterus (Germar) : Thomas 1941 : 255.

Diagnosis: *Ampedus phoenicopterus* is a large species with entirely yellow vestiture; antennae always failing to reach posterior pronotal angles; black head, prothorax, and body; and immaculate yellow-brown to red-brown elytra.

Length: 9.0 - 12.00 mm.

Distribution: U.S.A.: California, Idaho, Montana, Nevada, Oregon, Utah, Washington. CANADA: British Columbia.

Montana records: FLATHEAD CO: Glacier N. P., 25 VI 1962 (JGE), ibid., 29 V - 19 VI 1991 (GNPP), ibid., 30 V 1991 (GNPP), Hungry Horse Res., 28 V 1987 (MTEC). GLACIER CO: Glacier N. P., 20 VII 1956 (JGE). LAKE CO: [no loc.] 24 V 1927 (MTEC). MINERAL CO: Lookout Pass, 9 VI 1967 (OSU).

RAVALLI CO: Darby, V 1922 (MTEC), ibid., 26 VI 1922 (MTEC), ibid., 28 VI 1922 (MTEC); Stevensville, VI 1923 (MTEC).

Material examined: 13 specimens.

Elevation records: 3560′ - 8100′.

Collecting method: hand, 12 specimens, 92.3 %

L. funnel, 1 specimen, 7.7 %

Collection dates: 24 May - 20 July.

Biology: *Ampedus phoenicopterus* has been collected from decomposing wood of white balsam fir, Engelmann's spruce, ponderosa pine, Douglas fir, and plum/cherry.

Remarks: Ramberg (1979) recorded *A. phoenicopterus* as having been collected from the following Montana counties; Flathead, Glacier, Lewis and Clark, Ravalli, and Sanders.

Ampedus pullus Germar

(figs. 38, 160)

Ampedus pullus Germar 1844 : 162. LeConte 1853 : 507. 1863 : 46. Thomas 1941 : 252. Dietrich 1945 : 44. Morris 1951 : 139. Lane 1952 : 67. Brooks 1960 : 7, 49, 50. Lane 1971 : 14. Tostowaryk 1972 : 1141. Ramberg 1979 : 213-218.

Elater lacustris LeConte 1853 : 468. Candeze 1859 : 454. LeConte 1863 : 46. Horn 1879 : 16. LeConte 1884 : 14. Leng 1920 : 173.

Elater pullus (Germar) : Melsheimer 1853 : 71. Candeze 1859 : 454. LeConte 1863 : 46. Horn 1879 : 16. LeConte 1884 : 10, 14. Leng 1920 : 173. Leonard 1928 : 349. Van

Dyke 1932 : 304, 310. Hawkins 1936 : 13.

Diagnosis: This small species has red-brown legs and antennae; piceous head, thorax (except for yellow-red anteriolateral corners of prothorax), and body; and long, piceous to black pubescence. *A. pullus* has a distinctive elytral pattern where the basal half is yellow-red and apical half piceous.

Length: 5.5 - 6.2 mm.

Distribution: U.S.A.: Alaska, Colorado, Idaho, Maine, Michigan, Minnesota, Missouri, Montana, New Hampshire, New York, Oregon, Pennsylvania, South Dakota, Vermont, Washington. CANADA: Alberta, British Columbia, Manitoba, New Brunswick, Northwest Territory, Nova Scotia, Ontario, Quebec, Saskatchewan, Yukon Territory.

Montana records: FERGUS CO: Lewistown, 28 V - 2 VII 1988 (MTEC). FLATHEAD CO: Hungry Horse Res., 29 V 1987 (MTEC), Glacier N. P., 13 VI - 3 VII 1990 (GNPP), ibid., 26 V - 18 VI 1991 (GNPP), ibid., 3 - 10 VIII 1989 (GNPP). GALLATIN CO: [no loc.] 18 V 1927 (MTEC), ibid., 15 VI 1931 (MTEC), ibid., 2 V 1954 (MTEC), 3.5 mi. W. Bozeman, 6 VI 1989 (CES), Bozeman Cr., 8 VII 1990 (MTEC). JUDITH BASIN CO: Little Belt Mtns., 27 V - 1 VII 1988 (MTEC). LAKE CO: Swan L., 14 VI 1967 (OSU). MINERAL CO: St. Regis, 19 VI 1967 (OSU). MISSOULA CO: Clark Fork R., 4 VI 1988 (MTEC). POWDER RIVER CO: Camps Pass, 7 VI - VIII 1991 (MTEC). POWELL CO: 10 mi. E. Ovando, 15 VI 1967 (OSU). RAVALLI CO: 5 mi. SW Florence, 26 VI 1967 (OSU).

Material examined: 19 specimens.

Elevation records: 2500′ - 6600′.

Collecting method: hand, 13 specimens, 68.4 %
L. funnel, 5 specimens, 26.3 %
F.I.T., 1 specimen, 5.3 %

Collection dates: 2 May - 3 August (10 August).

Biology: *Ampedus pullus* has been collected from willow, pear, spruce, and fir, from decomposing wood of Douglas fir, ponderosa pine, and white poplar (*Populus alba*), and from both decomposing wood of, and forest litter underneath, jack pine.

Remarks: Even though *A. pullus* has a very widespread distribution and is commonly collected in timbered areas, it represents a new state record for Montana.

Ampedus rhodopus (LeConte)

(fig. 161)

Elater rhodopus LeConte 1859b : 18, 47. Candeze 1859 : 488, 489. LeConte 1863 : 46. 1884 : 9, 13. Van Dyke 1932 : 302, 303.

Ectamenogonus rhodopus (LeConte) : Leng 1920 : 173.

Elater ursinus Van Dyke 1932 : 301, 302. Leng 1933 : 84. NEW SYNONYMY by Ramberg 1979 : 292.

Elater fenyesi Van Dyke 1932 : 301, 302. Leng 1933 : 84. NEW SYNONYMY by Ramberg 1979 : 292.

Ampedus rhodopus (LeConte) : Knull 1938 : 98. Knowlton and McComb 1949 : 6. Lane 1952 : 67. 1971 : 13, 14. Ramberg 1979 : 292-299.

Ampedus ursinus (Van Dyke) : Lane 1952 : 67. 1971 : 13.

Diagnosis: *Ampedus rhodopus* has short, dense, piceous pubescence, and body color piceous above and red or red-tinged piceous below. The most distinctive feature is the bicarinate posterior pronotal angles. All other species of *Ampedus* in Montana have unicarinate posterior pronotal angles.

Length: 8.9 - 10.5 mm.

Distribution: U.S.A.: California, Idaho, Montana, Oregon, Utah, Washington. CANADA: British Columbia.

Montana records: BROADWATER CO: Toston Big Spring, 14 IV - 20 X 1990 (MTEC), ibid., 9 III 1991 - 13 I 1992 (MTEC), ibid. (CES), ibid. (DLG). FERGUS CO: 9 mi. NW Lewistown, 2 VII - 14 VIII 1988 (MTEC). GALLATIN CO: [no loc.] 18 V 1927 (MTEC), Bozeman Cr., 2 VII - 4 IX 1989 (MTEC). GRANITE CO: 34 mi. E. Missoula, 16 VI 1967 (OSU). LAKE CO: Moiese - Nat. Bison Range, 25 VI 1967 (OSU). MINERAL CO: 6 mi. SE St. Regis, 10 VI 1967 (OSU). MISSOULA CO: Seeley L., 15 VI 1967 (OSU), 10 mi. W. Ovando, 15 VI 1967 (OSU). POWDER RIVER CO: Camps Pass, 7 VI - 4 VIII 1991 (MTEC), ibid. (CES). RAVALLI CO: 5 mi. SW Florence, 26 VI 1967 (OSU), ibid., 27 VI 1967 (MTEC), ibid., 28 VI 1967 (OSU), ibid., 27 VI 1967 (OSU).

Material examined: 32 specimens.

Elevation records: 2500′ - 6200′.

Collecting method: hand, 13 specimens, 40.6 %
pitfall, 14 specimens, 43.8 %
L. funnel, 5 specimens, 15.6 %

Collection dates: 18 May - 2 July (4 September).

Remarks: *Ampedus rhodopus* is a northern Rocky Mountain species found in a variety of habitats and represents a new state record for Montana.

Ampedus sellatus (Dejean)

(figs. 37, 162)

Elater discoideus Fabricius 1801 (*nec* Weber 1801) : 240. LeConte 1853 : 464. Melsheimer 1853 : 71. Candeze 1859 : 461. LeConte 1863 : 45. 1884 : 10, 14. Blatchley 1910 : 730, 732. Leng 1918 : 206. 1920 : 173.

Elater sellatus Dejean 1833 : 104. Leng 1918 : 206. 1920 : 173. Leonard 1928 : 350. Knull 1932 : 44.

Ampedus discoideus (Fab.) : Thomas 1941 : 253.

Ampedus sellatus (Dejean) : Thomas 1941 : 253. Dietrich 1945 : 44, 45. Brooks 1960 : 8, 48, 50, 62 (incorrectly cited as *A. sellatus* Germar). Ramberg 1979 : 240-244.

Diagnosis: In addition to having long, dense, decumbent, and yellow vestiture, this large, black, southeastern Montana species is easily recognized by its black elytra with yellow to yellow-red vitta along the basal and lateral margins.

Length: 9.5 - 10.5 mm.

Distribution: U.S.A.: Connecticut, District of Columbia, Georgia, Illinois, Indiana, Iowa, Kansas, Massachusetts, Michigan, Minnesota, Montana, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, Tennessee, Vermont, Virginia, Wisconsin.

CANADA: Alberta, Manitoba, New Brunswick, Ontario, Quebec, Saskatchewan.

Montana records: CARTER CO: 5 mi. W. Alzada, 20 VI - 31 VIII 1989 (MTEC).

Material examined: 3 specimens.

Collecting method: L. funnel, 3 specimens, 100.0 %

Collection dates: (20 June - 31 August).

Biology: *A. sellatus* has been collected from flowers of viburnum and from decomposing wood of pine, maple (*Acer* sp.), tulip tree (*Liriodendron tulipifera*), hackberry (*Celtis occidentalis*), and pitch pine (*Pinus rigida*).

Remarks: This handsome and easily identified species has only been collected in Montana from the southeastern corner of the state in Lindgren funnel traps.

Ampedus subtilis (LeConte)

(fig. 163)

Elater subtilis LeConte 1884 : 10, 12, 14. Blatchley 1910 : 731, 733. Leng 1920 : 173. Ramberg 1979 : 344.

Ampedus subtilis (LeConte) : Dietrich 1945 : 43, 51. Brooks 1960 : 8, 49, 52.

Diagnosis: *Ampedus subtilis* has red to piceous antennae not or just reaching posterior pronotal angles, yellow pubescence, body piceous to black, and red to yellow-red legs which contrast distinctly with piceous to black ventral body surface.

Length: 6.5 - 10.5 mm.

Distribution: U.S.A.: Indiana, Michigan, Montana, New York. CANADA: Alberta, Manitoba, Saskatchewan.

Montana records: CARTER CO: 5 mi. W. Alzada, 17 VII 1990 - 7 VI 1991 (DLG), ibid., 20 VI - 31 VIII 1989 (MTEC), ibid., 31 XII 1989 - 17 VII 1990 (MTEC). FERGUS CO: Lewistown, 22 VI 1942 (MTEC), ibid., 28 V - 2 VII 1988 (MTEC), 9 mi. NW Lewistown, 28 V - 2 VII 1988 (MTEC). GALLATIN CO: Bozeman, 1 - 10 VI 1988 (MTEC), ibid., 2 VII 1989 (MTEC), 6 mi. SE Manhattan, 9 VI 1991 (CES), Madison R. - Greycliff, 14 VI 1989 (CES). POWDER RIVER CO: Camps Pass, 7 VI - 4 VIII 1991 (CES). ROSEBUD CO: Rosebud - Far West, 13 July 1991 (MTEC), Tongue R. - Ashland, 6 VI 1991 (MTEC), ibid. (CES). WHEATLAND CO: Two Dot, 30 V - 28 VI 1988 (MTEC).

Material examined: 45 specimens.

Elevation records: 3800′ - 4600′.

Collecting method: L. funnel, 35 specimens, 77.8 %
hand, 6 specimens, 13.3 %
pitfall, 2 specimens, 4.4 %
malaise, 1 specimen, 2.2 %
uv light, 1 specimen, 2.2 %

Collection dates: (28 May) 9 June - 2 July (4 August).

Biology: *Ampedus subtilis* has been collected from balsam poplar.

Remarks: The identification of this species as *A. subtilis* needs further confirmation. Ramberg (1979) stated that *A. subtilis* is actually a species of *Megapenthes*. The

Montana species in question is definitely not a state record for Montana.

Ampedus varipilis (Van Dyke)

(figs. 40, 164)

Elater varipilis Van Dyke 1932 : 305-307. Leng 1933 : 84.

Ampedus varipilis columbianus Brown 1933a : 136. Blackwelder 1939 : 41.

Ampedus columbiana Brown : Lane 1952 : 67. 1971 : 12.

Ampedus varipilis (Van Dyke) : Brown 1933a : 135, 136. Blackwelder 1939 : 41. Lane 1952 : 67. 1971 : 12. Ramberg 1979 : 254-260.

Diagnosis: *Ampedus varipilis* has pronotal pubescence yellow or piceous but elytral pubescence always piceous; pronotum shiny; head, thorax, and body piceous; elytra yellow-red with piceous apical spots in contact with elytral sides and suture for a short distance.

Length: 7.2 - 9.0 mm.

Distribution: U.S.A.: California, Colorado, Idaho, Montana, Nevada, Oregon, Washington, Wyoming. CANADA: British Columbia, Northwest Territory, Yukon Territory.

Montana records: FLATHEAD CO: Hungry Horse Res., 19 VII 1967 (OSU), Hungry Horse, 10 V 1988 (MTEC), 4 mi. W. Hwy. 486, 2 VII 1988 (MTEC), Glacier N. P., 14 VII 1989 (MTEC), ibid., 21 - 24 V 1990 (MTEC), ibid., 7 - 14 VI 1990 (GNPP), ibid., 5 - 12 VII 1990 (GNPP), ibid., 16 - 23 VII 1991 (GNPP), 3 - 10 VII 1990 (GNPP), ibid., 10 - 31 VII 1990 (GNPP), ibid., 7 - 28

VIII 1990 (GNPP), ibid., 27 V - 18 VI 1991 (GNPP), ibid., 18 - 25 VI 1991 (GNPP). GLACIER CO: Glacier N. P., 25 VII 1959 (JGE). LAKE CO: Moiese - Nat. Bison Range, 21 - 22 V 1988 (MTEC), ibid., 25 VI 1967 (OSU). MINERAL CO: Saltese, 10 VI 1967 (OSU), 8 mi. N. St. Regis, 19 VI 1967 (OSU), Lookout Pass, 19 VI 1967 (OSU), St. Regis, 19 VI 1967 (OSU).

Material examined: 23 specimens.

Elevation records: 2500′ - 9293′.

Collecting method: hand, 13 specimens, 56.5 %
L. funnel, 7 specimens, 30.4 %
F.I.T., 3 specimens, 13.0 %

Collection dates: 10 May - 7 August (28 August).

Biology: *Ampedus varipilis* has been collected from decomposing wood of ponderosa pine.

Remarks: The collection of this species in western Montana represents a new state record.

Tribe Megapenthini Gurjeva

Genus *Megapenthes* Kiesenwetter, 1863

Elater Linnaeus 1758 : LeConte 1859a : 85. 1863 : 46. Lane 1971 : 18.

Dolopiosomus Motschulsky 1859 : 380. Hyslop 1921 : 641.

Ludius Latreille 1834 : LeConte 1863 : 46.

Megapenthes Kiesenwetter 1863 : 353. LeConte 1861b : 165. 1863 : 46. 1866 : 390. Horn 1871 : 309-311. Schaeffer 1916 : 258-261. 1917 : 42. Hyslop 1917 : 247, 262.

Leng 1920 : 173, 174. Hyslop 1921 : 651, 655. Bradley 1930 : 123. Van Dyke 1932 : 310-318. Brown 1933a : 138-141. Thomas 1941 : 257. Van Emden 1945 : 17, 33, 36. Morris 1951 : 139. Dogger 1959 : 107, 120. Arnett 1968 : 502, 505. Becker 1971 : 145-167. Stibick 1976a : 7. Becker and Dogger 1991 : 411, 414.

The genus *Megapenthes* is one of thirteen genera worldwide in the tribe Megapenthini (Stibick 1979) and is the only genus of the tribe represented in Montana. There are twenty-nine Nearctic species of *Megapenthes* (Becker 1971) and two species are known to occur in Montana.

Taxonomic History: The first species described was by Motschulsky (1859). *Dolopiosomus aterrimus* Motschulsky was a new genus and species from California. Becker (1971) considered the genus *Dolopiosomus* a *nomen oblitum* due to its nonuse for more than fifty years. Becker suggested the continued use of *Megapenthes*, which he stated was a well-known and cosmopolitan genus.

Van Dyke (1932) provided a key to the twenty Nearctic species known at that time. The most comprehensive key to Nearctic species of *Megapenthes* is Becker's (1971) key to twenty-nine species where he states the genus is in need of a revision.

Ecology/Habitat: The life history of species in this genus are largely unknown, however, adults undoubtedly emerge in (late) spring after overwintering in the pupal cell, this

following a (late) summer pupation. The larvae are known from decomposing wood and/or under bark (Van Emden 1945, Becker and Dogger 1991). No species of *Megapenthes* are known to be of economic importance.

Key to Species of Adult *Megapenthes*

1 Color brown; posterior pronotal angle bicarinate; pubescence yellow; pronotum shiny, punctures dense, but not contiguous; eastern Montana.....*angularis* LeConte

1′ Color black; posterior pronotal angle unicarinate; pubescence black; pronotum dull, with large, coarse, contiguous punctures; western Montana .....*tartareus* (LeConte)

Megapenthes angularis LeConte

(figs. 2, 9, 24, 165)

Megapenthes angularis LeConte 1866 : 390. 1884 : 7, 8. Leng 1920 : 174. Van Dyke 1932 : 314, 316, 319. Becker 1971 : 149, 165.

Distribution: U.S.A.: Missouri, Montana; Great Plains east of Continental Divide and west of Mississippi River.

Montana Records: CARTER CO: 5 mi. W. Alzada, 18 VII 1990 (MTEC). DAWSON CO: Intake diversion, 27 VI 1988 (MTEC). FERGUS CO: Missouri River, 9 VIII 1991 (MTEC), ibid. (CES), ibid. (DLG). ROSEBUD CO: Tongue R. - Ashland, 16 VII 1990 (MTEC).

Material examined: 11 specimens.

Collecting method: uv light, 11 specimens, 100.0 %

Collection dates: 27 June - 9 August.

Remards: *Megapenthes angularis* is a grassland species and its collection only by ultraviolet light suggests nocturnal activity. The collection of this species in eastern Montana represents a new State record.

Megapenthes tartareus (LeConte)

(fig. 166)

Elater tartareus LeConte 1859a : 85. 1863 : 46. Lane 1971 : 18.

Ludius tartareus (LeConte) : LeConte 1863 : 46.

Megapenthes tartareus (LeConte) : Horn 1884 : 45. LeConte 1884 : 6, 7. Schaeffer 1916 : 261. Leng 1920 : 173. Van Dyke 1932 : 311, 312, 318. Brown 1933a : 140, 141. Knowlton and McComb 1949 : 6. Lane 1952 : 67. Becker 1971 : 145, 146, 150, 151.

Dolopiosomus tartareus (LeConte) : Hyslop 1921 : 641, 679.

Distribution: U.S.A.: Arizona, California, Montana, Oregon, Utah, Washington. CANADA: British Columbia.

Montana records: POWELL CO: Blackfoot R., 26 VI 1989 (MTEC).

Material examined: 1 specimen.

Collecting method: hand, 1 specimen, 100.0 %

Collection dates: 26 June.

Remarks: *Megapenthes tartareus* has not previously been recorded from Montana.

Tribe Physorhinini Candeze

Genus *Anchastus* LeConte, 1853

Monocrepidius Eschscholtz 1829 : 32.

Cryptohypnus Eschscholtz 1830 : Mannerheim 1843 : 240. Melsheimer 1853 : 72. LeConte 1859b : 18. 1861b : 167. Hyslop 1921 : 637.

Anchastus LeConte 1853 : 459. 1859b : 18. 1861b : 167. 1863 : 46. 1866 : 390. Horn 1871 : 311. 1884 : 49. Hyslop 1917 : 256, 262. Leng 1918 : 206. 1920 : 174. Hyslop 1921 : 627. Bradley 1930 : 123. Van Dyke 1932 : 319. Knull 1938 : 98, 99. Thomas 1941 : 257. Stone 1941 : 10, 12-14. Brooks 1960 : 8, 41. Arnett 1968 : 501, 505. Lane 1971 : 10. Arnett 1983 : 18. Becker and Dogger 1991 : 414.

Crepidotritus LeConte 1861b : 167. 1863 : 46. Hyslop 1921 : 637.

Eschscholtz (1829) described *Anchastus cinereipennis* under the genus *Monocrepidius*. Mannerheim (1843) redescribed the species under Eschscholtz's genus *Cryptohypnus*. When LeConte (1853) authored the genus *Anchastus*, he mentioned that *Cryptohypnus cinereipennis* Mannerheim might be better placed within his new genus. Candeze (1859) reduced *Cryptohypnus* to synonymy under *Anchastus* LeConte and the type to synonymy under *Anchastus cinereipennis* (Esch.) (Hyslop 1921).

North American species of *Anchastus* are probably in need

of a taxonomic revision. The best reference at present is Van Dyke's (1932) key to thirteen Nearctic species, supplemented with new species descriptions from Fall (1934) and Knull (1938, 1965).

Ecology/Habitat: There is little biological information available about *Anchastus* and the larvae are still unknown for most species (Stone 1941, Becker and Dogger 1991). These beetles probably overwinter as adults inside the pupal cell, within which they pupated the previous summer, becoming active the following spring.

Anchastus cinereipennis (Eschscholtz)

(fig. 167)

Monocrepidius cinereipennis Eschscholtz 1829 : 32. LeConte 1853 : 460. Van Dyke 1932 : 300, 324.

Cryptohypnus cinereipennis Mannerheim 1843 : 240. LeConte 1853 : 460, 489, 507. Melsheimer 1853 : 72. LeConte 1859b : 18. 1861b : 167. 1863 : 46. Hyslop 1921 : 637. Van Dyke 1932 : 324.

Crepidotritus cinereipennis (Mannerheim) : LeConte 1863 : 46.

Anchastus cinereipennis (Eschscholtz) : Leng 1920 : 174. Hyslop 1921 : 637. Van Dyke 1932 : 300, 319, 324. Stone 1941 : 10, 12-14. Knowlton and McComb 1949 : 4. Brooks 1960 : 8, 41. Knull 1965 : 219. Lane 1971 : 10.

Distribution: U.S.A.: California, Montana, Oregon, Utah, Washington. CANADA: Alberta.

Montana records: TOOLE CO: 5 mi. S. Shelby, 19 V - 18

VI 1988 (MTEC).

Material examined: 1 specimen.

Elevation records: 3060'.

Collecting method: pitfall, 1 specimen, 100.0 %

Collection dates: (19 May) - (18 June).

Biology: This western North America species is known to inhabit short mixed prairie habitat in Montana and Alberta, Canada. *A. cinereipennis* is probably phytophagous during most of its larval stage and may be economically important. The larvae have been reported as pestiferous in California (Stone 1941) and Oregon (Lane 1971). The single adult known from Montana was collected in a pitfall trap adjacent to a field of winter wheat.

Tribe Adrastini Candeze

Genus *Glyphonyx* Candeze, 1863

Elater Linnaeus 1758 : Say 1823 : 109. 1839 : 184.

Adrastus Eschscholtz 1829 : LeConte 1853 : 459. 1861b : 169.

Glyphonyx Candeze 1863 : 451. Horn 1874 : 23. Schaeffer 1916 : 264-266. Hyslop 1917 : 262. Leng 1920 : 172. Hyslop 1921 : 647, 657. Leonard 1928 : 349. Bradley 1930 : 121. Thomas 1941 : 252. Dogger 1959 : 106, 120. Becker 1963 : 125-128. Arnett 1968 : 500, 508. Smith and Balsbaugh 1984 : 1-78. Becker and Dogger 1991 : 411, 413.

The genus *Glyphonyx* is the largest in the tribe Adrastini

(Stibick 1979) and at least one fossil species has been described (Becker 1963). There are seventeen Nearctic species (Smith and Balsbaugh 1984), while only one species is known to occur in Montana.

Taxonomic History: Species in this genus were described under the generic names *Elater* and *Adrastus* before Candeze (1863) erected *Glyphonyx*. The most comprehensive treatment of the genus in North America is Smith and Balsbaugh's (1984) revision of the Nearctic species.

Ecology/Habitat: The biology of most species in North America is unknown (Smith and Balsbaugh 1984). The larvae live in soil (Becker and Dogger 1991).

Glyphonyx recticollis (Say)

(figs. 22, 168)

Elater recticollis Say 1823 : 168. 1839 : 184.

Adrastus recticollis (Say) : LeConte 1853 : 459.

Cratonychus recticollis (Say) : Melsheimer 1853 : 68.

Glyphonyx recticollis (Say) : Blatchley 1910 : 743, 744. Leng 1920 : 172. Leonard 1928 : 349. Thomas 1941 : 252. Dietrich 1945 : 42. Kulash and Monroe 1955 : 11, 17, 18. Dogger 1959 : 106. Kirk and Balsbaugh 1975 : 67. Smith and Balsbaugh 1984 : 3, 4, 11, 14, 31, 34, 41-43, 55, 61, 63, 64, 67, 70, 74, 75, 77, 78.

Distribution: U.S.A.: Arkansas, Florida, Indiana, Iowa, Kansas, Maine, Massachusetts, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Jersey, New York, North

Carolina, North Dakota, Oklahoma, Pennsylvania, South Dakota, Texas, Wisconsin.

Montana records: ROOSEVELT CO: Missouri R., 11 VI 1991 (MTEC), ibid. (CES). ROSEBUD CO: Tongue R. - Ashland, 16 VII 1990 (MTEC), ibid. (CES), ibid. (DLG).

Material examined: 39 specimens.

Collecting method: uv light, 39 specimens, 100.0 %

Collection dates: 11 June - 16 July.

Biology: *Glyphonyx recticollis* is the only species in the genus for which the larva is known. The life cycle is one year long. *G. recticollis* is known as an economically important pest on corn in North Carolina.

Remarks: This species has been collected only by ultraviolet light in both Montana and South Dakota.

Tribe Agriotini Champion

Key to Genera of Adult Agriotini

(adapted from Becker 1956a)

1 Frontal carina raised above labrum and complete, extending from above one antennal fossa to the other (fig. 43) .....*Agriotella*

1′ Frontal carina not raised above labrum and incomplete, either directed toward meson and becoming indistinct in middle (fig. 44), or directed downward toward labrum, frequently becoming indistinct before reaching labrum (fig. 45).....2

2 Lateral margin of prothorax joining anterior edge of prothorax laterad from prosternopleural suture (fig. 46); anterior portion of prosternopleural suture not excavated, although slightly concave; frontal carina directed toward meson (fig. 44).....*Dalopius*

2′ Lateral margin of prothorax joining anterior edge of prothorax at prosternopleural suture (fig. 47); anterior portion of prosternopleural suture sharply excavated; frontal carina usually directed toward labrum (fig. 45) .....*Agriotes*

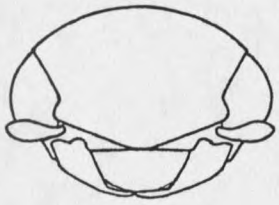
Genus *Agriotella* Brown, 1933b

Elater Linnaeus 1758 : Randall 1838 : 37. LeConte 1853 : 458. Brown 1933b : 179, 180. Arnett 1955 : 602.

Dolopius (*sic*) Eschscholtz 1829 : LeConte 1853 : 458.

Betarmon Kiesenwetter 1863 : LeConte 1863 : 47. Schaeffer 1917 : 42, 43. Leng 1920 : 172. Leonard 1928 : 349. Boving and Craighead 1931 : 258, 259. Van Dyke 1932 : 451. Brown 1933b : 179, 181. Mank 1934 : 78. Hawkins 1936 : 13. Thomas 1941 : 252. Lane 1952 : 67. Dolin 1978 : 203, 230.

Agriotella Brown 1933b : 179-182. Blackwelder 1939 : 41. Thomas 1941 : 252. Glen 1941 : 58. 1944 : 81. Dietrich 1945 : 42. Morris 1951 : 139. Lane 1952 : 67. Arnett 1955 : 602. Becker 1956a : 20, 25. 1956b : 201, 202. Dogger 1959 : 106, 117, 119. Brooks 1960 : 8, 47, 48, 60. Arnett 1968 : 502, 505. Lane 1971 : 11. Becker and



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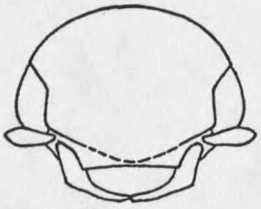

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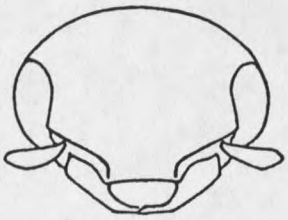

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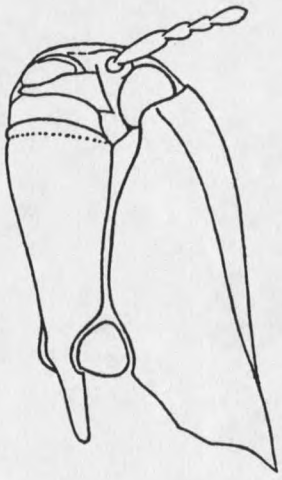

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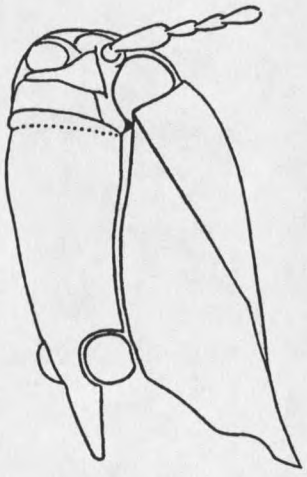

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Figures 43-47. Figs. 43-45, head, cephalic view. Fig. 43, *Agriotella occidentalis*. Fig. 44, *Dalopius* sp. Fig. 45, *Agriotes ferrugineipennis*. Figs. 46-47, prothorax, latero-ventral view. Fig. 46, *Dalopius* sp. Fig. 47, *Agriotes ferrugineipennis*.

Dogger 1991 : 411, 413.

The genus *Agriotella* includes five species in North America (Arnett 1983). One species is known from Montana.

Taxonomic History: Brown (1933b) erected the genus *Agriotella* and included within it Randall's (1838) eastern North America and Schaeffer's (1917) California species of *Betarmon*, in addition to two new species.

The most comprehensive treatment of *Agriotella* in North America is Brown's (1933) key to Nearctic species. The only known species not included in that key is Lane's (1965) species, *A. fusca*.

Ecology/Habitat: *Agriotella* larvae live in a wide variety of habitats which include wood, soil, litter, and moss (Becker and Dogger 1991). No species are known to be of economic importance.

Agriotella occidentalis Brown

(figs. 25, 43, 169)

Agriotella occidentalis Brown 1933b : 180, 181. Blackwelder 1939 : 41. Lane 1952 : 67. Brooks 1960 : 8, 47, 48, 60. Lane 1971 : 11.

Distribution: U.S.A.: Montana, Oregon, Washington. CANADA: Alberta, British Columbia.

Montana records: BROADWATER CO: Jefferson R. - Hwy. 287, 25 V 1988 (MTEC), Confederate Gulch, 27 III 1990 (MTEC). DEER LODGE CO: 8 mi. W. Anaconda, 25 VII 1956 (MTEC). FLATHEAD CO: 3 mi. S/SE Tally Lake, 8 V 1989 (CES), West

Glacier, 15 VII 1964 (JGE). FLATHEAD/GLACIER CO: Glacier N. P., 15 VII 1929 (CUIC). GALLATIN CO: nr. Bozeman, 30 VI 1988 (MTEC), Battle Ridge Cmpgd., 4 VII 1988 (MTEC), Bridger Cr., 9 VIII 1987 (MTEC). GLACIER CO: Glacier N. P., 24 VII 1972 (JGE), ibid., 27 VII 1966 (JGE), ibid., 6 VII 1991 (GNPP). LAKE CO: Big Arm, 27 VI 1989 (MTEC). LEWIS AND CLARK CO: Dearborn R. - nr. Bean L., 24 V 1988 (MTEC). LINCOLN CO: Libby, 3 VII 1957 (MTEC). RAVALLI CO: 5 mi. SW Florence, 27 VI 1967 (OSU). SANDERS CO: Thompson Falls, 21 VI 1967 (OSU).

Material examined: 23 specimens.

Elevation records: 2400′ - 7000′.

Collecting method: hand, 23 specimens, 100.0 %

Collection dates: 27 March - 9 August.

Remarks: This species was recorded from Glacier National Park by Mank (1934), but incorrectly cited as *Betarmon bigeminatus* Randall.

Genus *Agriotes* Eschscholtz, 1829

Elater Linnaeus 1758 : 405, 406. 1767 : 653. Say 1823 : 171, 172. 1839 : 168, 169.

Agriotes Eschscholtz 1829 : 34. Melsheimer 1846 : 216-218. 1853 : 73. LeConte 1859b : 18. 1861b : 169. 1863 : 47. Horn 1871 : 317. 1872 : 148. LeConte 1884 : 15, 16, 18, 19. Blatchley 1910 : 739-742. Schaeffer 1916 : 264. Hyslop 1917 : 255, 262. Leng 1920 : 172. Hyslop 1921 : 624, 634, 643, 663. Strickland 1926 : 4. Leonard 1928 : 348, 349. Bradley 1930 : 125. Van Dyke 1932 :

446-450, 452. Brown 1933b : 176-179. Glen 1935 : 232, 237, 238. Brown 1936e : 249-251. Lanchester 1939 : 39. Blackwelder 1939 : 41. Thomas 1941 : 250, 251. Glen et al. 1943 : 362, 365, 366, 368, 373-375, 380, 382, 384. Glen 1944 : 73-85. Dietrich 1945 : 39-42, 66, 67, 76, 77. Van Emden 1945 : 13, 14, 18, 23-25, 32, 34-37. Morris 1951 : 134, 137, 139, 142. Lane 1952 : 66. Eidt 1954 : 481-493. Becker 1956a : 1-101. 1956b : 201-205. Dogger 1959 : 106, 108, 109, 114, 115, 117, 120. Knull 1959b : 356, 357. Brooks 1960 : 6-8, 44-47, 57. Wilkinson 1963 : 4, 5, 7, 9-13, 16. Arnett 1968 : 503, 507. Lane 1971 : 15-17. Kirk and Balsbaugh 1975 : 67. Dolin 1978 : 200, 203, 207-225, 241. Toth 1984 : 13-29. Becker and Dogger 1991 : 411, 413, 414, 416.

Dolopius (*sic*) Eschscholtz 1829 : LeConte 1853 : 455-458, 505, 506. 1884 : 19. Leng 1920 : 172. Hyslop 1921 : 638, 641.

Catophagus Stephens 1830 : 245, 247-250.

The genus *Agriotes* is the largest in the tribe, with over two-hundred described species in the world. It occurs on all continents except Australia. The majority of species are Palearctic in distribution (Becker 1956a) and at least two species of fossil *Agriotes* are known (Leng 1920, Becker 1963). Becker (1956a) reported twenty-four species in North America and Knull (1959) described two others. Eleven species of *Agriotes* are known to occur in Montana.

Taxonomic History: The first *Agriotes* species described were those by Linnaeus (1758) under the generic name *Elater*. The genus *Agriotes* was erected by Eschscholtz (1829) when several more European species were described. In North America, Say (1823) persisted in using *Elater* when he described the wheat wireworm adult, *Agriotes mancus*. Following that, with the exception of LeConte (1853) using *Dolopius*, there has been little taxonomic confusion involving the genus *Agriotes*. The most comprehensive treatment of *Agriotes* in North America is Becker's (1956a) revision of the Nearctic species.

Ecology/Habitat: Although the life history is known for only one North American species of *Agriotes*, in general, adults of most species probably emerge in spring after overwintering as adults in the soil where they pupated the preceding summer. Females of some *Agriotes* species are known to produce pheromones to attract males (Oleschenko et al. 1976, Kamm et al. 1983). Mating occurs in late spring to early summer and eggs are probably laid in early summer. Life cycles for most species probably require between two and five years to complete (Becker 1956a).

Larvae are typically found in soil, moss, and litter (Van Emden 1945, Morris 1951, Becker and Dogger 1991). Although not much is known about the food habits of *Agriotes* (Becker 1956a), a number of species are known to be of economic importance in Europe and North America. Dolin (1978) reported

Agriotes as among the more harmful wireworm genera in the former U.S.S.R. In North America, *Agriotes* includes species potentially harmful to a variety of crops (Comstock 1888; Comstock and Slingerland 1891; Hyslop 1915, 1916, 1917; Hawkins 1936; Glen et al. 1943; Glen 1944; Eidt 1953; Becker 1956a; Wilkinson 1963; Ward and Keaster 1977; Coghill 1978; McKinlay 1992). These pestiferous species are phytophagous for at least most of their larval stage. Other species are probably predaceous and/or scavengers (Morris 1951).

Key to Species of Adult *Agriotes*

(adapted from Becker 1956a)

1 Frontal carina directed toward meson (fig. 44); size small, body length less than 6 mm.....*criddlei* Van Dyke

1′ Frontal carinae directed downward toward labrum (fig. 45); size large, body length 6 to 13 mm.....2

2 Pronotal punctures shallow, umbilicate, especially on side of pronotum; hypomeral punctures very shallow, umbilicate, close, with interspaces reticulated, dull; metasternal and abdominal punctures noticeably finer than those of hypomeron; several bicolored forms .....*limosus* group, 4

2′ Pronotal punctures deep, simple, interspaces frequently shiny; hypomeron shiny; metasternal and abdominal punctures nearly as coarse as those on hypomeron; unicoloredforms.....3

3 Body robust, pronotum approximately as broad as long,

pronotal width 2 mm or greater; side margin of prothorax usually not interrupted in middle.....*sputator* group, 10

3′ Body elongate, pronotum longer than wide, pronotal width 1.5 mm or less; side margin of prothorax often interrupted in middle.....*sparsus* group, *oregonensis* Becker

4 Elytra bicolored, apex darker than base.....5

4′ Elytra unicolored, never with a distinctly darker apex..6

5 Interspaces on pronotum reticulated, dull; apical fourth or less of elytra distinctly darker in color than remainder (fig. 48); western Montana.....*apicalis* LeConte

5′ Interspaces on pronotum shiny; apical third to half of elytra distinctly darker in color than remainder (fig. 49); western Montana.....*thevenetii* Horn (in part)

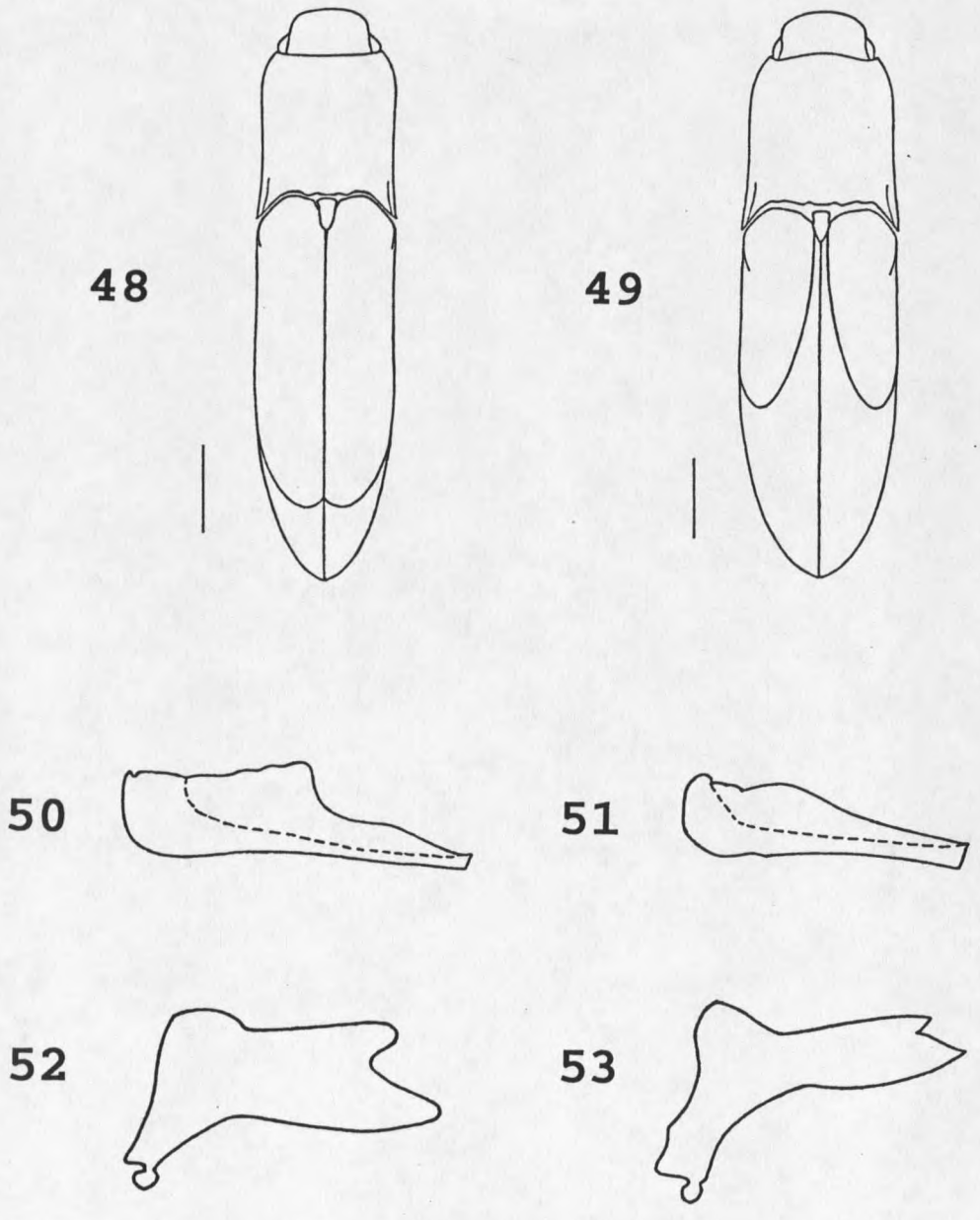
6 Metacoxal plate very abruptly enlarged inwardly, free angle slightly greater than 90 degrees (fig. 50); body length 6 to 7.5 mm.....*opaculus* (LeConte)

6′ Metacoxal plate only slightly enlarged inwardly, free angle much greater than 90 degrees (fig. 51); body length 7 to 13 mm.....7

7 Pronotal pubescence glittering golden; elytra light brown to red brown, pronotum and head black; body length 8 to 11 mm.....9

7′ Pronotal pubescence white or yellow, never glittering golden; variously colored; body length 7 to 13 mm.....8

8 Size small, body length 7 to 8 mm; uniformly brown; western Montana.....*thevenetii* Horn (in part)



Figures 48-53. Figs. 48-49, dorsal habitus. Fig. 48, *Agriotes apicalis*. Fig. 49, *A. thevenetii*. Figs. 50-51, left metacoxal plate. Fig. 50, *A. opaculus*. Fig. 51, *A. ferrugineipennis*. Figs. 52-53, right adult mandible (redrawn from Becker, 1956a). Fig. 52, *A. mancus*. Fig. 53, *A. pubescens*.

8′ Size large, body length 8.5 to 13 mm; elytra usually lighter in color than pronotum or uniformly very dark brown; widespread.....*ferrugineipennis* (LeConte)

9 Pronotal punctures coarse, contiguous on disk; body length 9 to 11 mm; Rocky Mountains.....*tardus* Brown

9′ Pronotal punctures moderate in size, separated by half their diameter on disk; body length 8 to 10 mm; only occasionally west of Continental Divide .....*limosus* (LeConte)

10 Elytral striae in definite pairs, odd intervals wider, lighter in color, and generally with twice as much pubescence than even intervals; western Montana .....*lineatus* (L.)

10′ Elytral striae evenly spaced, or at most vaguely appearing in pairs; eastern Montana.....11

11 Form robust, pronotum slightly wider than long; pronotal punctures course, very crowded; mandible very broad, chisel-like (fig. 52); color brown; body length 6.5 to 9 mm.....*mancus* (Say)

11′ Form less robust, pronotum approximately 1.2 times as long as wide; pronotal punctures moderate in size, separated by about half their diameters; mandible not as broad, tapering (fig. 53); color dark brown or black; body length 8 to 10 mm.....*pubescens* Melsheimer

Agriotes apicalis LeConte

(figs. 48, 170)

Agriotes apicalis LeConte 1884 : 16, 18, 19. Leng 1920 : 172. Van Dyke 1932 : 448. Lane 1952 : 66. Becker 1956a : 9, 19, 22, 33-35, 96, 98. Lane 1971 : 15.

Distribution: U.S.A.: California, Montana, Oregon, Washington. CANADA: British Columbia.

Montana records: LAKE CO: Swan L., 14 VI 1967 (OSU).

Material examined: 1 specimen.

Elevation records: 3200'.

Collecting method: hand, 1 specimen, 100.0 %

Collection dates: 14 June.

Remarks: This species represents a new state record for Montana.

Agriotes criddlei Van Dyke

(fig. 171)

Agriotes criddlei Van Dyke 1932 : 448, 449. Leng 1933 : 85. Brown 1934 : 33. Glen et al. 1943 : 362, 365, 366, 374, 375, 384. Glen 1944 : 73-79, 81, 83-85. Knowlton and McComb 1949 : 6. Lane 1952 : 66. Becker 1956a : 9, 19, 21, 29-32, 96, 98, 100, 101. 1956b : 202. Brooks 1960 : 6, 8, 44, 45, 57. Wilkinson 1963 : 4, 11. Russell 1968 : 142. Lane 1971 : 15.

Distribution: U.S.A.: Colorado, Idaho, Montana, Nebraska, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming. CANADA: Alberta, British Columbia, Manitoba, Saskatchewan.

Montana records: BIG HORN CO: Big Horn R. - Ft. Smith,

25 V 1988 (DLG), ibid. (MTEC). BROADWATER CO: Confederate Gulch, 27 III 1990 (MTEC). FALLON CO: 16 mi. N. Baker, 16 VI 1989 (MTEC). FERGUS CO: Straw, 8 VI 1914 (USNM), 5 mi. NW Lewistown, 4 VIII 1957 (MTEC), Lewistown, 7 - 28 V 1988 (MTEC), ibid., 30 V - 2 VII 1988 (MTEC), ibid., 16 IV 1988 (MTEC), ibid. (CES). FLATHEAD CO: Glacier N. P., 6 VI 1990 (MTEC), ibid., 27 V 1991 (GNPP). GALLATIN CO: Bozeman, 20 V 1928 (USNM), [no loc.] 13 V 1979 (MTEC), ibid., 26 IV 1902 (USNM), Bridger Cr., 20 V 1987 (MTEC), ibid., 10 V 1987 (MTEC), Squaw Cr., 15 VI 1988 (MTEC). JUDITH BASIN CO: [no loc.] 8 VI 1914 (USNM), ibid., 10 VI 1914 (USNM), 8 mi. S. Raynesford, 31 V 1991 (MTEC), 10 mi. S. Raynesford, 13 VI 1991 (MTEC), ibid. (CES). LAKE CO: [no loc.] 20 VI 1927 (USNM). LEWIS AND CLARK CO: Helena, 30 IV (USNM), ibid., 5 V (USNM). MADISON CO: Beartrap Canyon, 25 IV 1987 (MTEC), Tobacco Root Mtns. - Potosi, 16 VI 1988 (MTEC), ibid., 5 VII 1986 (MTEC). MINERAL CO: Alberton, 10 VI 1967 (OSU). MISSOULA CO: Missoula, 6 VI 1916 (USNM), ibid., 20 IX 1916 (USNM). PETROLEUM CO: 1.5 mi. S., 5 mi. W. Winnett, 27 V 1970 (USNM), ibid., 2 IX 1970 (MTEC), ibid., 24 V 1971 (MTEC), ibid. (USNM). RAVALLI CO: Florence, 22 VI 1912 (USNM). SWEET GRASS CO: 35 mi. N. Big Timber, 22 VII 1971 (MTEC), ibid., 8 VII 1971 (MTEC), ibid., 29 IX 1971 (MTEC). WHEATLAND CO: Harlowton, 20 V 1932 (MTEC).

Material examined: 61 specimens.

Elevation records: 3000′ - 6200′.

Collecting method: hand, 44 specimens, 72.1 %
pitfall, 5 specimens, 8.2 %
L. funnel, 1 specimen, 1.6 %
F.I.T., 1 specimen, 1.6 %
reared, 1 specimen, 1.6 %
unknown, 9 specimens, 14.8 %

Collection dates: 27 March - 29 September.

Biology: *Agriotes criddlei* is a widespread prairie and mountain meadow species. The larva was described in detail by Glen (1944). The larval stage probably averages three years. Mature larvae typically pupate in early to mid August.

Remarks: Although Brooks (1960) considered this species a minor pest, sometimes of local importance, *A. criddlei* is reported to be an important grain crop pest by Glen et al. (1943), Glen (1944), Becker (1956a), and Wilkinson (1963).

Becker (1956a) recorded *A. criddlei* collections from the following Montana counties; Gallatin, Lake, and Lewis and Clark. In addition, Lane (1971) recorded *A. criddlei* as having been collected in western Montana.

Agriotes ferrugineipennis (LeConte)

(figs. 23, 27, 29, 45, 47, 51, 172)

Dolopius ferrugineipennis LeConte 1861 : 348.

Agriotes ferrugineipennis (LeConte) : LeConte 1863 : 47. 1884 : 15, 16, 19. Leng 1920 : 172. Van Dyke 1932 : 452. Brown 1933b : 177, 178. Hawkins 1936 : 13. Knowlton and McComb 1949 : 6. Becker 1956a : 10, 15, 17, 19, 22, 29,

34, 36, 40-45, 51, 97, 98, 101. 1956b : 203. Brooks 1960 : 8, 44, 46. Wilkinson 1963 : 4, 11, 16. Russell 1968 : 142. Lane 1971 : 16. Jacobson 1972 : 13, 194.

Agriotes fucosus ferrugineipennis (LeConte) : Van Dyke 1932 : 446, 447. Lane 1952 : 66.

Distribution: U.S.A.: California, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming. CANADA: Alberta, British Columbia.

Montana records: BROADWATER CO: Canyon Ferry W. M. A., 27 IV - 25 V 1988 (MTEC), ibid., 9 V 1989 (CES), Deep Dale - Missouri R., 11 V 1988 (MTEC), ibid., 22 VI 1988 (MTEC), Confederate Gulch, 27 III 1990 (MTEC). CARBON CO: E. Rosebud Canyon, 11 VI 1973 (MTEC). CASCADE CO: 3 mi. S. Belt, 24 VI 1954 (MTEC), Hwy. 89 - Albuck Memorial Park, 9 VI 1988 (MTEC). FERGUS CO: 16.5 mi. NE Winifred, 13 V 1983 (MTEC). FLATHEAD CO: Hungry Horse, 13 V 1987 (CES), ibid., 18 VII 1967 (OSU), Hungry Horse Res., 29 V 1987 (MTEC), ibid. (DLG), ibid., 28 - 29 V 1987 (MTEC), Whitefish Lake, 16 V 1989 (CES), ibid. (MTEC), Bigfork, 13 VI 1967 (OSU), Essex, 25 VII 1967 (OSU), Glacier N. P., 6 - 8 VI 1990 (MTEC), ibid., 6 - 13 VI 1990 (GNPP), ibid., 13 VI - 8 VII 1990 (GNPP), ibid., 27 V - 17 VI 1991 (GNPP), ibid., 4 - 11 VII 1990 (GNPP), ibid., 27 V - 18 VI 1991 (GNPP), ibid., 29 V 1991 (GNPP), ibid., 6 VI 1990 (MTEC), ibid., 27 V 1991 (DLG). GALLATIN CO: Gallatin R., V - IV 1988 (MTEC), ibid., 9 VI 1989 (MTEC), ibid., 5 V 1987 (DLG), ibid. (MTEC), ibid., 25 V - 13 VI 1987 (MTEC), ibid.,

13 VI 1987 (DLG), ibid. (MTEC), ibid., 17 VI 1987 (MTEC), Gallatin Canyon, 21 VI 1988 (MTEC), Bozeman, 26 II 1928 (MTEC), ibid., 4 IV 1947 (MTEC), [no loc.] 10 V 1954 (MTEC), ibid., 14 V 1957 (MTEC), ibid., 3 VI 1957 (MTEC), ibid., 28 V 1984 (MTEC), 3.5 mi. W. Bozeman, 6 VI 1989 (CES), Three Forks, 22 VI - 20 VII 1988 (MTEC), 1 mi. S. Belgrade, 30 V 1987 (MTEC). JEFFERSON CO: 10 mi. W. Whitehall, 25 V 1988 (MTEC). LAKE CO: Flathead L. Biol. Sta., 19 VI 1965 (OSU), ibid., 12 VI 1967 (OSU), Lost Cr. - Swan Range, 9 V 1989 (MTEC), Arlee, 11 VI 1967 (OSU), Swan Lake, 14 VI 1967 (OSU). LEWIS AND CLARK CO: Dearborn R. - nr. Bean L., 24 V 1988 (MTEC). MINERAL CO: 5 mi. W. Alberton, 20 V 1986 (MTEC), Alberton, 25 VI 1967 (OSU), ibid., 10 VI 1967 (OSU), 6 mi. SE St. Regis, 10 VI 1967 (OSU). MISSOULA CO: 24 mi. E. Missoula, 10 VI 1967 (OSU). PARK CO: [no loc.] 15 V 1956 (MTEC). POWELL CO: Blackfoot R., 26 VI 1989 (MTEC), ibid., 11 VII 1989 (MTEC). RAVALLI CO: Hamilton, V 1936 (MTEC), Canyon Creek, 23 V 1934 (MTEC), [no loc.] 20 V 1934 (MTEC). SANDERS CO: Camas Prairie, 15 VI 1927 (MTEC), Thompson Falls, 21 VI 1967 (OSU), ibid., 22 VI 1967 (OSU), 5 mi. N. Plains, 20 VI 1967 (OSU), 5 mi. S. Hot Springs, 23 VI 1967 (OSU).

Material examined: 145 specimens.

Elevation records: 2400′ - 5800′.

Collecting method: hand, 133 specimens, 91.7 %
L. funnel, 6 specimens, 4.1 %
pitfall, 6 specimens, 4.1 %

Collection dates: 26 February - 25 July.

Biology: Females of this species produce a pheromone to attract males.

Remarks: The larva of *A. ferrugineipennis* was described as *Agriotes* sp. by Glen (1944). The wireworms may occur in gardens, but have not been found in large numbers or recorded as damaging crops.

Lane (1971) recorded *A. ferrugineipennis* as having been collected in western Montana.

Agriotes limosus (LeConte)

(fig. 173)

Dolopius limosus LeConte 1853 : 457, 458, 506.

Agriotes limosus (LeConte) : LeConte 1863 : 47. 1884 : 15, 19. Leng 1920 : 172. Leonard 1928 : 349. Hawkins 1936 : 13. Glen 1941 : 57-62. Glen et al. 1943 : 362, 365, 366, 374, 375, 382, 384. Glen 1944 : 74-76, 78, 79, 81. Dietrich 1945 : 39, 41. Morris 1951 : 134, 137, 139, 142. Becker 1956a : 10, 17, 19, 22, 29, 34, 40, 43, 50-53, 97, 98, 100, 101. 1956b : 202, 203. Dogger 1959 : 106. Brooks 1960 : 6, 7, 44, 46. Russell 1968 : 142. Lane 1971 : 16. Tostowaryk 1972 : 1141. Kirk and Balsbaugh 1975 : 67.

Distribution: U.S.A.: Maine, Michigan, Minnesota, Montana, New Hampshire, New York, North Dakota, Oregon, South Dakota, Vermont, Wisconsin. CANADA: Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland, Northwest

Territory, Nova Scotia, Ontario, Quebec, Saskatchewan.

Montana records: FERGUS CO: Sahara, 30 VI 1957 (MTEC), Judith Mtns. - Color Cr., 29 V 1988 (CES). GALLATIN CO: Bozeman, 31 V 1960 (MTEC), Hyalite Reservoir, 19 VII 1986 (MTEC), Blackmore Cr., 8 VI - 26 IX 1989 (MTEC).

Material examined: 5 specimens.

Elevation records: 6800′ - 7200′.

Collecting method: hand, 4 specimens, 80.0 %

F.I.T., 1 specimen, 20.0 %

Collection dates: 29 May - 19 July.

Biology: *Agriotes limosus* is a relatively rare, yet widely distributed click beetle. It is a woodland species inhabiting northern coniferous forests from the Continental Divide east to the Atlantic coast.

Agriotes limosus has been collected by beating foliage of spruce and fir. Glen (1941, 1944) stated the larvae prefer soils under aspen poplar (*Populus tremuloides*). Adults have been reared from larvae collected in forest litter under jack pine, white spruce, and black spruce (*Picea mariana*). The length of the larval period is unknown, even though the larva of *A. limosus* was described by Glen (1941).

Remarks: This species may be of minor, local economic importance in forest or parkland areas that have been cleared and kept under cultivation for a number of years. Becker (1956a) recorded *A. limosus* as having been collected in Granite Co., Montana.

Agriotes lineatus (L.)

(fig. 174)

Elater lineatus Linnaeus 1767 : 653.

Agriotes lineatus (Linnaeus) : Eschscholtz 1829 : 34. Hawkins 1936 : 1, 72, 114. Tenhet 1939 : 23. Glen 1944 : 74, 80. Van Emden 1945 : 23, 34-37. Lane 1952 : 66. Eidt 1953 : 408-414. 1954 : 481, 488-493. Becker 1956a : 5, 11, 14-17, 19, 23, 28, 29, 64, 67, 71, 73-77, 96, 99, 101. Wilkinson 1963 : 4, 5, 11, 12. Lane 1971 : 15, 16. Oleshchenko et al. 1976 : 23, 24. Coghill 1978 : 2. Harde 1984 : 172, 173. Toth 1984 : 13-15, 25, 26, 28. McKinlay 1992 : 33-35.

Catophagus lineatus (Linnaeus) : Stephens 1830 : 250.

Distribution: Palearctic (introduced to North America). U.S.A.: Montana. CANADA: British Columbia, Newfoundland, Nova Scotia.

Montana records: RAVALLI CO: Stevensville, 26 VI 1967 (OSU).

Material examined: 1 specimen.

Elevation records: 3400'.

Collecting method: hand, 1 specimen, 100.0 %

Collection dates: 26 June.

Biology: *Agriotes lineatus* females utilize a sex pheromone to attract males. In late spring, eggs are laid just below the soil surface of grass-covered ground. Eggs hatch within approximately one month and the larvae feed on

living and dead plant tissue. The larval stage lasts between three and five years. Mature larvae pupate in mid to late summer. Adult beetles usually remain in their pupal cells through the winter, emerging the following spring.

Remarks: Eidt (1954) provides a key to, in addition to detailed comparison of, *A. lineatus* and closely related species of economic importance.

Agriotes lineatus is one of Europe's most destructive agricultural insect pest species. It was introduced into North America on both the east and west coast in Canada, probably in the ballast of ships, sometime after 1859. This species has been reported to cause considerable damage to crops, eg. cereals, potato, and many root vegetable crops, in both Nova Scotia and British Columbia.

The single specimen collected in Stevensville represents both a new State record and possibly the first record in North America south of the Canadian border.

Agriotes mancus (Say)

(figs. 52, 175)

Elater mancus Say 1823 : 171, 172. 1839 : 168, 169. LeConte 1863 : 47.

Agriotes striatulus Melsheimer 1846 : 217. Thomas 1941 : 251.

Dolopius mancus (Say) : LeConte 1853 : 455, 456, 506.

Agriotes mancus (Say) : LeConte 1863 : 47. Pettit 1872 : 3-6. LeConte 1884 : 15, 19. Comstock 1888 : 35. Comstock and Slingerland 1891 : 251-258. Blatchley 1910 : 739, 740.

Hyslop 1915 : 2, 4-7, 34. 1916 : 1, 3-5. 1917 : 255. Leng 1920 : 172. Hyslop 1921 : 660. Leonard 1928 : 348. Lane 1933 : 531. Hawkins 1936 : 2, 10, 13, 56, 60, 61, 64, 65, 72-75, 77-81, 93, 96, 99, 102, 114, 118, 120-122, 130-140. Thomas 1941 : 250, 251. Glen 1941 : 57-59, 61. Glen et al. 1943 : 362, 365, 366, 368, 373-375, 380, 382, 384. Stone and Howland 1944 : 14. Glen 1944 : 74-76, 78, 80. Dietrich 1945 : 39, 40, 66, 67, 76, 77. Jaques 1951 : 167. Eidt 1953 : 408-414. 1954 : 481-493. Becker 1956a : 5, 9, 10, 12, 15-17, 19, 23, 28, 64, 67, 69, 72-77, 81, 99-101. 1956b : 202, 203. Dogger 1959 : 106, 114, 115. Peterson 1960 : 178, 179. Brooks 1960 : 6, 7, 44, 47. Dillon and Dillon 1961 : 327, 330, 331. Zacharuk 1963 : 164. Swan and Papp 1972 : 387. Kirk and Balsbaugh 1975 : 67.

Distribution: U.S.A.: Connecticut, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, South Dakota, Vermont, Wisconsin. CANADA: Manitoba, New Brunswick, Nova Scotia, Ontario, Quebec, Saskatchewan.

Montana records: CUSTER CO: 7 mi. WNW Miles City, 12 VI 1984 (MTEC).

Material examined: 1 specimen.

Collecting method: pitfall, 1 specimen, 100.0 %

Collection dates: 12 June.

Biology: *Agriotes mancus* is a native, phytophagous, grassland species. Adults emerge in spring after overwintering in the pupal cell. They mate and the females lay eggs in (late) spring. The larval stage is thought to last three years. Mature larvae pupate in mid to late summer. Pupation to adult takes approximately two weeks.

Remarks: This species is commonly known as the wheat wireworm and is considered the most important wireworm pest in both eastern Canada and the northeastern United States. The larva of *A. mancus* was described in detail by Hawkins (1936) and Eidt (1954) and is reported to attack corn, wheat, other grains, and potato. This species represents a new state record for Montana and its collection in Custer Co. is a northwesterly extension of the species known range.

Agriotes opaculus (LeConte)

(figs. 28, 50, 176)

Dolopius opaculus LeConte 1859a : 85.

Agriotes montanus LeConte 1884 : 16, 18, 19. Leng 1920 : 172. Van Dyke 1932 : 449. Brown 1936e : 249. Blackwelder 1939 : 41. Lane 1971 : 16.

Agriotes opaculus (LeConte) : LeConte 1863 : 47. 1884 : 16, 19. Leng 1920 : 172. Brown 1936e : 249. Blackwelder 1939 : 41. Lane 1952 : 66. Becker 1956a : 12, 19, 22, 27, 33, 62, 63, 97, 99, 100. Brooks 1960 : 7, 44, 45. Wilkinson 1963 : 4, 10, 11, 16. Lane 1971 : 15, 16.

Distribution: U.S.A.: California, Idaho, Montana,

Nevada, Oregon, Utah, Washington, Wyoming. CANADA: Alberta, British Columbia.

Montana records: BROADWATER CO: Toston Big Spring, 14 IV - 20 X 1990 (MTEC). GALLATIN CO: Bozeman, 11 V 1920 (USNM), Bozeman - Spring Hill, 15 V 1938 (MTEC). LEWIS AND CLARK CO: Sun River Game Range, 17 VI 1988 (CES). SANDERS CO: Plains, 20 VI 1967 (OSU), Thompson Falls, 22 VI 1967 (OSU). SILVER BOW CO: Butte, 30 V 1933 (OSU).

Material examined: 8 specimens.

Elevation records: 2400′ - 4500′.

Collecting method: hand, 6 specimens, 75.0 %
pitfall, 2 specimens, 25.0 %

Collection dates: 11 May - 22 June.

Remarks: Wilkinson (1963) provided a brief description of the larva and included *A. opaculus* in his key to wireworms of cultivated land in British Columbia. Becker (1956a) recorded *A. opaculus* as having been collected in Gallatin Co., Montana.

Agriotes oregonensis Becker

(fig. 177)

Agriotes oregonensis Becker 1956a : 19, 78, 85-90, 100. 1956b : 204. Lane 1971 : 17.

Distribution: U.S.A.: California, Idaho, Montana, Oregon, Utah, Washington, Wyoming.

Montana records: GALLATIN CO: Bridger Cr., 20 V 1987 (MTEC), Story Mill Rd. - NE Bozeman, 17 V 1989 (CES), Bridger

Range, 5 VI 1986 (MTEC). LAKE CO: Ronan, 11 VI 1967 (OSU). PARK CO: 10 mi. SE Livingston, 28 V 1988 (MTEC). SANDERS CO: 5 mi. S. Hot Springs, 23 VI 1967 (OSU), ibid. (MTEC).

Material examined: 7 specimens.

Elevation records: 2700′ - 7000′.

Collecting method: hand, 7 specimens, 100.0 %

Collection dates: 17 May - 23 June.

Remarks: *Agriotes oregonensis* represents a new State record and its collection in Montana results in a northeasterly range extension for the species.

Agriotes pubescens Melsheimer

(figs. 53, 178)

Agriotes pubescens Melsheimer 1846 : 217, 218. 1853 : 73. LeConte 1853 : 457. 1863 : 47. 1884 : 15, 19. Comstock 1888 : 35. Blatchley 1910 : 739, 741, 742. Leng 1920 : 172. Leonard 1928 : 349. Van Dyke 1932 : 446. Brown 1933b : 177. Hawkins 1936 : 13. Glen 1941 : 57. Thomas 1941 : 251. Glen et al. 1943 : 366. Glen 1944 : 74, 76, 78. Dietrich 1945 : 39, 41, 66. Jaques 1951 : 167. Becker 1956a : 19, 23, 38, 45, 64, 67-70, 99, 100. 1956b : 203. Dogger 1959 : 106. Brooks 1960 : 7, 45-47. Kirk and Balsbaugh 1975 : 67.

Dolopius pubescens (Melsheimer) : LeConte 1853 : 457, 506.

Distribution: U.S.A.: Illinois, Indiana, Iowa, Maine, Massachusetts, Michigan, Minnesota, Montana, Nebraska, New Hampshire, New Jersey, New York, North Dakota, Ohio,

Pennsylvania, South Dakota, Wisconsin. CANADA: Manitoba, Ontario, Quebec.

Montana records: McCONE CO: above Ft. Peck Dam, 15 VI 1989 (MTEC).

Material examined: 1 specimen.

Collecting method: hand, 1 specimen, 100.0 %

Collection dates: 15 June.

Biology: *Agriotes pubescens* has been collected on viburnum flowers.

Remarks: The larvae have been reported to occur in corn fields. This species represents a new Montana state record.

Agriotes tardus Brown

(fig. 179)

Agriotes tardus Brown 1933b : 177, 178. Blackwelder 1939 : 41. Lane 1952 : 66. Becker 1956a : 9, 10, 19, 22, 34, 43, 49-51, 53. 1956b : 203. Brooks 1960 : 7, 44, 46. Lane 1971 : 16.

Distribution: U.S.A.: Idaho, Montana, Oregon, Washington. CANADA: Alberta, British Columbia.

Montana records: FLATHEAD CO: Marias Pass, 23 VII 1967 (OSU), Hungry Horse Res., 28 - 29 V 1987 (MTEC), Glacier N. P., 12 VII - 1 VIII 1989 (GNPP). FLATHEAD/GLACIER CO: Glacier N. P., 20 VII 1974 (CES). GALLATIN CO: Sourdough Cr., 15 VI 1988 (CES). GLACIER CO: Glacier N. P., 26 VII 1956 (JGE). MEAGHER CO: 10 mi. S. Niehart, 12 - 17 VI 1989 (MTEC).

Material examined: 8 specimens.

Elevation records: 3560′ - 4800′.

Collecting method: hand, 7 specimens, 87.5 %

F.I.T., 1 specimen, 12.5 %

Collection dates: (28 May) 15 June - 26 July (1 Aug.).

Biology: *Agriotes tardus* is a forest/woodland species and has been collected on pine and spruce, especially when the conifers border a mountain meadow.

Remarks: There are no published records of *A. tardus* having been collected in Montana, however, the distribution map in Becker's (1956a) revision indicated this species would occur in the northwest corner of the State.

Agriotes thevenetii Horn

(figs. 49, 180)

Agriotes thevenetii Horn 1872 : 148. LeConte 1884 : 16, 19. Brown 1934 : 33. Lane 1952 : 66. Becker 1956a : 7, 19, 22, 33, 34, 54-57, 97, 98, 100. 1956b : 202, 203. Lane 1971 : 15.

Dolopius thevenetii (Horn) : Leng 1920 : 172.

Distribution: U.S.A.: California, Idaho, Montana, Oregon, Washington. CANADA: Alberta, British Columbia.

Montana records: RAVALLI CO: 5 mi. SW Florence, 27 VI 1967 (OSU).

Material examined: 1 specimen.

Elevation records: 3700′.

Collecting method: hand, 1 specimen, 100.0 %

Collection dates: 27 June.

Biology: *Agriotes thevenetii* has been collected by beating low shrubs, including manzanita/bearberry (*Arctostaphylos* sp.).

Remarks: Although there are two color forms of this species, the single specimen from Montana is of the form with bicolored elytra. This same specimen from Ravalli Co. is a new State record.

Genus *Dalopius* Eschscholtz, 1829

Dalopius Eschscholtz 1829 : 34. Hyslop 1921 : 638, 641. Brown 1934 : 30-39, 66-72, 87-96, 102-110. Blackwelder 1939 : 41. Glen 1941 : 58. Thomas 1941 : 250. Glen et al. 1943 : 362, 365-367, 373-375, 380, 382, 384. Glen 1944 : 73, 74,, 76, 81-83. Dietrich 1945 : 37, 38. Blackwelder 1948 : 19. Knowlton and McComb 1949 : 5, 6. Morris 1951 : 134, 137-139, 142. Lane 1952 : 66. Arnett 1955 : 607, 608. Becker 1956a : 7. 1956b : 201, 202. Dogger 1959 : 106. Brooks 1960 : 6-8, 41-44, 61. Dillon and Dillon 1961 : 326, 330, 331. Wilkinson 1963 : 3, 4, 8-11, 16. Lane 1971 : 17. Dolin 1978 : 203, 225-230. Toba et al. 1985 : 372, 376. Becker and Dogger 1991 : 411, 413, 414.

Dolopius (*sic*) Eschscholtz : Melsheimer 1846 : 218, 219. LeConte 1853 : 455, 505, 506. 1859a : 72. 1859b : 18. 1861b : 169. 1863 : 47. 1884 : 19. Blatchley 1910 : 742. Hyslop 1917 : 255, 256, 262. Leng 1920 : 172.

Hyslop 1921 : 638, 641. Leonard 1928 : 348. Bradley 1930 : 125. Van Dyke 1932 : 451. Hawkins 1936 : 13. Van Emden 1945 : 17, 18, 24, 32, 35, 36.

Agriotes Eschscholtz : LeConte 1884 : 16. Leng 1920 : 172. Van Dyke 1932 : 447, 448, 450.

The genus *Dalopius* is the most speciose in the tribe Agriotini in North America, where it includes at least forty-nine described species. It is a commonly collected genus, particularly in riparian areas, and species are difficult to identify without examining the male genitalia. Females are typically identified by their association with males (Brown 1934). *Dalopius* was not reviewed in this paper because of the abundance of specimens both difficult and time consuming to identify, however, a few *Dalopius* specimens that were determined to species are included below. Montana's elaterid fauna undoubtedly includes more species of *Dalopius* than the six reported here.

Taxonomic History: There has been much confusion concerning the differences between the adult species of *Agriotes* and *Dalopius* in North America. LeConte (1853) included all known species of both genera in *Dolopius* (*sic*) Eschscholtz, then later (1884) recognized and attempted to segregate species of the two genera. Van Dyke (1932) also segregated the two genera, but considered the distinguishing character, form of the lateral margin of the prothorax, "weak" and incorrectly included LeConte's *Dalopius nevadensis* under the

genus *Agriotes*. Brown's (1934) revision of Nearctic *Dalopius* ended most of the taxonomic confusion surrounding the generic name and remains the most comprehensive work done on the North American species.

Ecology/Habitat: *Dalopius* larvae inhabit moist, rich soil, mosses, and decomposing leaf litter. They have not been collected from typical open prairie country. In general, these wireworms are phytophagous and sometimes become pestiferous to grain crops for many years when land they occupy is put under cultivation (Glen 1944). *Dalopius* larvae have also been reported as causing damage to potato and strawberry crops (Wilkinson 1963).

For most species of *Dalopius*, length of the larval period is unknown, however, mature larvae typically pupate between mid-July and mid-August. Pupation to adult usually takes up to two weeks and the adults are assumed in most situations to remain in the pupal cell through the winter, emerging the next spring (Glen 1944).

Dalopius fucatus Brown

(fig. 181)

Dalopius fucatus Brown 1934 : 34, 38, 91, 92, 105-107. Blackwelder 1939 : 41. Knowlton and McComb 1949 : 6. Lane 1952 : 66. Brooks 1960 : 8, 43, 61. Wilkinson 1963 : 9. Lane 1971 : 17.

Distribution: U.S.A.: Montana, Utah. CANADA: Alberta, British Columbia.

Montana records: GALLATIN CO: 6 mi. SE Bozeman, 28 VII 1987 (CES), Squaw Cr., 15 VI 1988 (CES).

Material examined: 2 specimens.

Collecting method: hand, 2 specimens, 100.0 %

Collection dates: 15 June - 28 July.

Remarks: *Dalopius fucatus* is a new state record for Montana.

Dalopius gartrelli Brown

(fig. 182)

Dalopius gartrelli Brown 1934 : 32, 36, 37, 88-90, 107. Blackwelder 1939 : 41. Lane 1952 : 66. Wilkinson 1963 : 9. Lane 1971 : 17.

Distribution: U.S.A.: Montana. CANADA: British Columbia.

Montana records: GALLATIN CO: Bozeman [no date] (USNM), W. Bozeman - Gallatin R., 15 VII 1987 (CES).

Material examined: 2 specimens.

Collecting method: hand, 1 specimen, 50.0 %
unknown, 1 specimen, 50.0 %

Collection dates: 15 July.

Remarks: *Dalopius gartrelli* is a new state record for Montana.

Dalopius sp. nr. *manipularis* Brown

(fig. 183)

Montana records: FLATHEAD CO: Whitefish [no date]

(USNM).

Material examined: 1 specimen.

Collection method: unknown, 1 specimen, 100.0 %

Dalopius plutonicus Brown

(fig. 184)

Dalopius plutonicus Brown 1934 : 34, 37, 95, 96, 108. Blackwelder 1939 : 41. Knowlton and McComb 1949 : 5.

Distribution: U.S.A.: California, Montana, Utah.

Montana records: GALLATIN CO: E. Gallatin R., 23 VI 1987 (CES).

Material examined: 2 specimens.

Elevation records: 4600'.

Collecting method: hand, 2 specimens, 100.0 %

Collection dates: 23 June.

Remarks: *D. plutonicus* represents a new state record for Montana.

Dalopius suspectus Brown

(fig. 185)

Dalopius suspectus Brown 1934 : 34, 37, 92, 104, 105. Blackwelder 1939 : 41. Lane 1952 : 66. Wilkinson 1963 : 9. Lane 1971 : 17.

Distribution: U.S.A.: Montana. CANADA: British Columbia.

Montana records: FLATHEAD CO: Glacier N. P., 12 VII 1950 (GNP).

Material examined: 1 specimen.

Elevation records: 3150′.

Collecting method: hand, 1 specimen, 100.0 %

Collection dates: 12 July.

Remarks: *Dalopius suspectus* is a new state record for Montana.

Dalopius tristis Brown

(fig. 186)

Dalopius tristis Brown 1934 : 34, 38, 89, 103, 105-108. Blackwelder 1939 : 41. Knowlton and McComb 1949 : 6. Lane 1952 : 66. Wilkinson 1963 : 9. Lane 1971 : 17.

Distribution: U.S.A.: Montana, Utah. CANADA: British Columbia.

Montana records: GLACIER CO: Glacier N. P., 20 V 1940 (GNP), ibid., 24 V 1940 (GNP).

Material examined: 2 specimens.

Collecting method: hand, 2 specimens, 100.0 %

Collection dates: 20 - 24 May.

Remarks: *D. tristis* is a new state record for Montana.

Tribe Elaterini Leach

Genus *Sericus* Eschscholtz, 1829

Elater Linnaeus 1758 : 404. Say 1825 : 257, 258. Randall 1838 : 9.

Sericus Eschscholtz 1829 : 34. Blatchley 1910 : 762. Leng 1920 : 172. Hyslop 1921 : 630, 641, 669. Leonard 1928

: 348. Bradley 1930 : 125. Van Dyke 1932 : 452. Thomas 1941 : 250. Van Emden 1945 : 18, 24, 34-36. Dietrich 1945 : 38. Morris 1951 : 135, 137, 139, 142. Lane 1952 : 66. Dogger 1959 : 106. Brooks 1960 : 7, 41. Roache 1960 : 278, 310-319. Peterson 1960 : 178, 179. Arnett 1968 : 503, 507. Lane 1971 : 10, 17, 18. Becker and Dogger 1991 : 411, 413, 416.

Sericosomus Dejean 1833 : 96. LeConte 1853 : 505. 1861b : 170, 171. 1863 : 48. 1869 : 371. Hyslop 1915 : 3. 1917 : 247, 253, 258, 262. 1921 : 643, 669, 675. Lane 1952 : 66. Roache 1960 : 310. Arnett 1968 : 507.

Atractopterus LeConte 1853 : 422, 454, 455, 505. 1863 : 48. Candeze 1889 : 56. Roache : 1960 : 310, 315. Arnett 1968 : 507. Lane 1971 : 18.

Dolerosomus Motschulsky 1859 : 383. Arnett 1968 : 507.

Sericus is one of six genera included within the tribe Elaterini in North America and is the only genus of Elaterini found in Montana. It is a relatively small genus, with only four Nearctic species (Roache 1960). Montana *Sericus* includes one widely distributed species.

Taxonomic History: The type species of the genus *Sericus* was described by Linnaeus (1758) as *Elater brunneus*. The genus *Sericus* was later erected by Eschscholtz (1829). North American workers (Say 1825, Randall 1838) described species of *Sericus* under the generic name *Elater* until LeConte (1853) erected the genus *Atractopterus*. Motschulsky (1859) described

two species from California under the genus *Dolerosomus*. LeConte (1869) synonymized his genus under Dejean's (1833) *Sericosomus*. Although most North American authors correctly used *Sericus*, some (Hyslop 1915, 1917, 1921) continued to use *Sericosomus*. The taxonomic confusion was laid to rest with Roache's (1960) revision of the Nearctic Elaterini.

Ecology/Habitat: Very little is known about the biology of this genus. The larvae are probably carnivorous (Morris 1951) and have been collected from soil, forest litter, and moss in both North America (Hyslop 1915, Morris 1951, Peterson 1960) and Europe (Van Emden 1945). In addition, *Sericus* larvae are known to occur in wood and under bark (Becker and Dogger 1991).

Sericus incongruus (LeConte)

(figs. 30, 187)

Atractopterus incongruus LeConte 1853 : 454, 455, 505.

Sericosomus incongruus (LeConte) : LeConte 1863 : 48. 1869 : 371.

Atractopterus behrensi Candeze 1889 : 56. Roache 1960 : 315.

Sericus behrensi (Candeze) : Leng 1920 : 172.

Sericus incongruus (LeConte) : Leng 1920 : 172. Leonard 1928 : 348. Van Dyke 1932 : 452. Dietrich 1945 : 38. Lane 1952 : 66. Dogger 1959 : 106. Brooks 1960 : 41. Roache 1960 : 312, 315, 316, 323, 324, 327, 329. Lane 1971 : 17, 18.

Distribution: U.S.A.: California, Idaho, Michigan,

Montana, New Hampshire, New York, Oregon, South Dakota, Washington, Wisconsin. CANADA: Alberta, British Columbia, Labrador, Manitoba, Newfoundland, Quebec, Saskatchewan.

Montana records: FERGUS CO: Judith Mtns. - Color Cr., 29 V 1988 (CES), ibid. (MTEC). FLATHEAD CO: Glacier N. P., 29 V 1991 (DLG), ibid. (GNPP). GALLATIN CO: Hyalite Res., 9 VI 1988 (MTEC), Squaw Cr., 11 VI 1988 (CES), ibid., 15 VI 1988 (MTEC), Bozeman Cr., 25 VI 1987 (MTEC), Blackmore Cr., 8 VI 1989 (DLG), ibid. (MTEC), Specimen Cr., 2 VII 1939 (MTEC). JUDITH BASIN CO: Little Belt Mtns., 27 V - 1 VII 1988 (MTEC). MADISON CO: Tobacco Root Mtns. - Potosi, 16 VI 1988 (MTEC). MINERAL CO: Lookout Pass, 9 VI 1967 (OSU), ibid., 16 VI 1967 (OSU), ibid., 25 VI 1967 (OSU).

Material examined: 30 specimens.

Elevation records: 3600′ - 7200′.

Collecting method: hand, 28 specimens, 93.3 %
F.I.T., 2 specimens, 6.7 %

Collection dates: 29 May - 2 July.

Remarks: *Sericus incongruus* is a widespread, yet infrequently collected elaterid that represents a new state species record for Montana.

Subfamily Melanotinae Candeze

The recognition of the Melanotinae as a distinct subfamily is based on Stibick's (1979) classification of the Elateridae into subfamilies and tribes. Previous to Stibick's

classification, taxa within the Melanotinae were often considered members of the Elaterinae.

The Melanotinae is a relatively small, morphologically homogeneous subfamily of elaterids. It includes eight genera and approximately 300 species worldwide. Click beetles in this subfamily display the following adult diagnostic characteristics: head capsule oval, deflexed, mouthparts hypognathous, frons carinate above and between antennae (occasionally obsolete in middle); scutellum various, never cordate; mesocoxae open to mesepimeron but closed to mesepisternum; tarsi simple, without lobes; claws pectinate, without basal setae (Stibick 1979).

The Melanotinae of Montana is represented by one genus and three species. A key is provided to species of adult *Melanotus* known to occur in the State.

Genus *Melanotus* Eschscholtz, 1829

Elater Linnaeus 1758 : Paykull 1800 : 23. Say 1825 : 267. 1839 : 183-185. Herbst 1806 : 26. LeConte 1863 : 47. Hyslop 1921 : 636. Arnett 1955 : 612.

Melanotus Eschscholtz 1829 : 32. Melsheimer 1846 : 152, 153. LeConte 1861a : 347. 1863 : 47. 1866 : 390, 391. Comstock and Slingerland 1891 : 262-267. Blatchley 1910 : 744-755. Hyslop 1915 : 3. 1916 : 3, 5, 6. 1917 : 247, 257, 261, 262. Leng 1920 : 174, 175. Hyslop 1921 : 623, 636, 640, 656, 663. Kirk 1922 : 239. Van Zwaluwenburg 1922 : 12-29. Leonard 1928 : 351, 352.

Bradley 1930 : 121. Van Dyke 1932 : 331, 332, 334. Knull 1932 : 44. Lane 1933 : 530. Fall 1934 : 23-25. Hawkins 1936 : 13, 51-55. Blackwelder 1939 : 42. Thomas 1941 : 257-261. Van Dyke 1943 : 51. Glen et al. 1943 : 362, 367, 373, 374, 376, 380, 383. Stone and Howland 1944 : 1-30. Dietrich 1945 : 52-59, 72, 73. Van Emden 1945 : 17, 21, 25, 30, 33, 36. Jewett 1946 : 5, 9, 10, 26-28. Blackwelder 1948 : 19. Knowlton and McComb 1949 : 6. Morris 1951 : 139. Jaques 1951 : 162. Lane 1952 : 67. Arnett 1955 : 612. Dogger 1959 : 107. Knull 1959a : 280, 281. Brooks 1960 : 6, 7, 40. Peterson 1960 : 178, 179. Dillon and Dillon 1961 : 322, 323, 332, 333. Knull 1962 : 34, 35. Wilkinson 1963 : 9-11, 16. Quate and Thompson 1967 : 1-83. Arnett 1968 : 500, 508. Lane 1971 : 10. Tostowaryk 1972 : 1141. Swan and Papp 1972 : 388, 389. Becker 1973a : 454-458. Kirk and Balsbaugh 1975 : 68. Oleshchenko et al. 1976 : 23, 24. Smith and Enns 1977 : 436, 437, 440, 441. 1978 : 42, 44-46, 49-54, 58, 68. Dolin 1978 : 181-200, 241. Riley and Keaster 1979 : 408-414. Stibick 1979 : 179. Riley 1983 : 999-1001. Toba et al. 1985 : 372. Brown and Keaster 1986 : 127-132. Keaster et al. 1987 : 577-579. Becker and Dogger 1991 : 411, 413, 416.

Ctenocychus Stephens 1830 : 272, 273. Melsheimer 1846 : 150-152. Leng 1920 : 174. Hyslop 1921 : 638.

Perimecus Stephens 1830 : 263. Kirby 1837 : 147, 148.

LeConte 1853 : 481. Leng 1920 : 174. Hyslop 1921 : 663.

Cratonychus Dejean 1833 : 87. Melsheimer 1846 : 150, 152. 1853 : 67, 68. LeConte 1853 : 473-481. 1859b : 18. 1861b : 170. Leng 1920 : 174. Hyslop 1921 : 636, 640. Van Dyke 1932 : 331. Arnett 1968 : 508. Lane 1971 : 10.

The genus *Melanotus* is the largest in the Melanotinae and has predominantly an eastern distribution of species in North America. While only three species are known to occur in Montana, there are a total of forty-six species in North America (Quate and Thompson 1967).

Taxonomic History: Eschscholtz (1829) erected the genus *Melanotus*. The type species was described under the name *Elater fulvipes* by Herbst (1806). Most North American workers experienced little taxonomic confusion at the generic level, correctly using Eschscholtz's genus *Melanotus*. Exceptions include Say's (1839) description of new species under the genus *Elater*, Melsheimer's (1846) recognition of two genera, *Ctenonychus* and *Melanotus*, and Melsheimer's (1853) and LeConte's (1853, 1859b) usage of Dejean's *Cratonychus*.

The most comprehensive treatment of *Melanotus* in North America is Quate and Thompson's (1967) revision of the Nearctic species. In addition, Van Zwaluwenburg (1922) published a detailed study of the external anatomy of adult *Melanotus*.

Ecology/Habitat: *Melanotus* larvae live in decaying wood, under bark, in soil (Hawkins 1936, Becker and Dogger 1991),

ground litter (Tostowaryk 1972, Swan and Papp 1972), and mushrooms (Van Emden 1945) and are apparently able to exist under diverse conditions of soil moisture (Lane 1933). Many species are phytophagous and are important pests of crops, particularly corn (Hyslop 1916, Lane 1933, Glen et al. 1943, Stone and Howland 1944, Brooks 1960, Riley et al. 1974, Riley and Keaster 1975 and 1979, Apablaza et al. 1977, Ward and Keaster 1977, Riley 1983, Brown and Keaster 1986, Keaster et al. 1987).

Adult *Melanotus* pupate in late summer and overwinter as adults, usually within the pupal cell, emerging the following spring (Hyslop 1916, Knull 1932, Stone and Howland 1944). However, some adults have been observed hibernating in groups beneath the bark of old logs and in galleries of other woodboring insects (Blatchley 1910, Kirk 1922).

As adults, some female *Melanotus* are known to produce a pheromone that attracts males (Oleschenko et al. 1976) and move principally by crawling, as opposed to males, which often fly (Brown and Keaster 1986). Many *Melanotus* species are known to be strong fliers (Hawkins 1936) and major flight activity of males has been known to precede that of females (Keaster et al. 1987).

Some species of adult *Melanotus* are commonly collected on flowers and foliage (Hawkins 1936), while others are relatively inactive during the day (Stone and Howland 1944) and are typically collected after sunset at light sources to which

they are attracted (Thomas 1941, Smith and Enns 1978).

Females oviposit in spring, shortly after mating, and eggs laid in soil hatch in four to six weeks (Stone and Howland 1944). The larval stage probably lasts between three and five years (Hyslop 1916), while adults generally live for three to six weeks following spring emergence (Stone and Howland 1944).

Key to Species of Adult *Melanotus*

(adapted from Quate and Thompson 1967)

1 Mandible without pit on lateral, exposed margin.....2

1′ Mandible with pit on lateral margin; widespread .....*longulus oregonensis* (LeConte)

2 Antennal segment 3 small, subequal to segment 2 or at least much nearer size of 2 than 4; widespread .....*castanipes* (Paykull)

2′ Antennal segment 3 intermediate in size between segments 2 and 4, clearly larger than 2 and usually close to subequal with 4; eastern Montana.....*similis* (Kirby)

Melanotus castanipes (Paykull)

(fig. 188)

Elater castanipes Paykull 1800 : 23. Kirby 1837 : 148. LeConte 1863 : 47. Hyslop 1921 : 636.

Cratonychus castanipes (Paykull) : Erichson 1842 : 95. Melsheimer 1853 : 67. LeConte 1853 : 481.

Melanotus paradoxus Melsheimer 1846 : 152, 153. LeConte 1853

: 481. Leng 1920 : 175. Van Zwaluwenburg 1922 : 20. Thomas 1941 : 261.

Cratonychus paradoxus (Melsheimer) : LeConte 1853 : 480, 481. Melsheimer 1853 : 67.

Cratonychus scrobicollis LeConte 1853 : 476.

Cratonychus inaequalis LeConte 1853 : 476.

Melanotus castanipes (Paykull) : LeConte 1863 : 47. Blatchley 1910 : 745, 746. Leng 1920 : 174. Leonard 1928 : 351. Hawkins 1936. Thomas 1941 : 257, 258. Dietrich 1945 : 54, 55, 72, 73. Jaques 1951 : 162. Dogger 1959 : 107. Brooks 1960 : 6, 7, 40. Dillon and Dillon 1961 : 322, 323, 332. Quate and Thompson 1967 : 21-24. Swan and Papp 1972 : 389. Tostowaryk 1972 : 1141. Kirk and Balsbaugh 1975 : 68. Smith and Enns 1978 : 45, 46, 54, 68.

Melanotus inaequalis (LeConte) : Leng 1920 : 174. Thomas 1941 : 258.

Melanotus scrobicollis (LeConte) : Leng 1920 : 174. Van Zwaluwenburg 1922 : 20. Thomas 1941 : 258.

Distribution: Holarctic. U.S.A.: Arizona, California, Colorado, Illinois, Indiana, Maine, Massachusetts, Michigan, Michigan, Minnesota, Missouri, Montana, New Hampshire, New Mexico, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Dakota, Texas, Utah, Vermont, Wisconsin. CANADA: Manitoba, Newfoundland, Nova Scotia, Quebec. MEXICO.

Montana records: CARTER CO: 5 mi. W. Alzada, 31 XII

1989 - 17 VII 1990 (MTEC). GALLATIN CO: 2 mi. N. Manhattan, 9 VII 1990 (CES). MADISON CO: [no loc.] 21 VI 1940 (MTEC), Hidden Lake Bench, 30 VI 1990 (MTEC).

Material examined: 4 specimens.

Elevation records: 7400′.

Collecting method: hand, 2 specimens, 50.0 %
uv light, 1 specimen, 25.0 %
L. funnel, 1 specimen, 25.0 %

Collection dates: 21 June - 9 July.

Biology: Adult *M. castanipes* display a noticeable sexual dimorphism in size, with females being larger and more robust. Adult *M. castanipes* are typically collected under the loose bark of pine and in forest litter. Adults and larvae are also found underneath dry manure in pastures and larvae have been collected from forest litter underneath jack pine.

Remarks: *Melanotus castanipes* is a widespread, yet infrequently collected elaterid that represents a new state record for Montana.

Melanotus longulus oregonensis (LeConte)

(fig. 189)

Cratonychus oregonensis LeConte 1853 : 480. 1859b : 18. Van Dyke 1932 : 331.

Cratonychus longulus LeConte 1853 : 473, 480. Van Dyke 1932 : 331.

Melanotus oregonensis (LeConte) : Candeze 1860 : 373. LeConte 1861a : 347. 1863 : 47. Leng 1920 : 175. Fall 1934 :

23, 24. Blackwelder 1939 : 42. Stone and Howland 1944 : 4, 5. Blackwelder 1948 : 19. Knowlton and McComb 1949 : 6. Lane 1952 : 67. Wilkinson 1963 : 9-11, 16. Lane 1971 : 10. Riley and Keaster 1979 : 408.

Melanotus longulus (LeConte) : Candeze 1860 : 339. LeConte 1861a : 347. 1863 : 47. Leng 1920 : 175. Van Dyke 1932 : 331, 334. Fall 1934 : 23-25. Blackwelder 1939 : 42. Stone 1941 : 10, 12-14. Van Dyke 1943 : 51. Stone and Howland 1944 : 1-30. Blackwelder 1948 : 19.

Melanotus variolatus LeConte 1861a : 347. 1863 : 47. Leng 1920 : 175. Van Dyke 1932 : 331. Fall 1934 : 23-25. Blackwelder 1939 : 42. Stone and Howland 1944 : 4. Quate and Thompson 1967 : 61.

Melanotus longulus oregonensis (LeConte) : Van Dyke 1932 : 331, 332. Quate and Thompson 1967 : 61-64. Riley and Keaster 1979 : 408. Toba et al. 1985 : 372.

Melanotus longulus variolatus (LeConte) : Van Dyke 1932 : 331.

Melanotus longulus franciscanus Van Dyke 1932 : 332. Quate and Thompson 1967 : 61.

Melanotus franciscanus Van Dyke : Leng 1933 : 85. Fall 1934 : 24. Blackwelder 1939 : 42.

Melanotus oregonus (LeConte) : Van Dyke 1943 : 51. Blackwelder 1948 : 19.

Distribution: U.S.A.: California, Idaho, Montana, Nevada, Oregon, Utah, Washington. CANADA: British Columbia.

Montana records: BROADWATER CO: Toston Big Spring, 14

IV - 20 X 1990 (DLG), ibid. (MTEC). CUSTER CO: Miles City, 9 VII 1985 (MTEC). GALLATIN CO: Bozeman "M" Hill, 24 VI 1990 (MTEC), 2 mi. N. Manhattan, 9 VII 1990 (CES). LAKE CO: Moiese - Nat. Bison Range, 29 VII 1967 (OSU). VALLEY CO: Ft. Peck Res., 17 VII 1957 (MTEC).

Material examined: 9 specimens.

Elevation records: 4000'.

Collecting method: hand, 4 specimens, 44.4 %
pitfall, 4 specimens, 44.4 %
uv light, 1 specimen, 11.1 %

Collection dates: 24 June - 29 July.

Biology: The larva of *M. longulus oregonensis* was described in detail by Wilkinson (1963). These larvae, sometimes referred to as Oregon wireworms, are not considered serious pests in British Columbia, but may be economically important on wheat in other areas of the Pacific Northwest and have been reported as common in sugar beet fields of southern California (Stone 1941).

Remarks: Quate and Thompson (1967) recorded *M. longulus oregonensis* as having been collected from Lewis and Clark Co., Montana.

Melanotus similis (Kirby)

(figs. 190)

Perimecus similis Kirby 1837 : 149. LeConte 1853 : 481. LeConte 1863 : 47.

Elater fissilis Say 1839 : 183. Quate and Thompson 1967 : 14.

Melanotus similis (Kirby) : Erichson 1842 : 116. Candeze 1860 : 363. LeConte 1863 : 47. Leng 1920 : 175. Leonard 1928 : 352. Quate and Thompson 1967 : 14-18. Riley et al. 1974 : 793. Kirk and Balsbaugh 1975 : 68. Riley and Keaster 1975 : 503. Smith and Enns 1977 : 441. 1978 : 44-46, 49-54, 58, 68. Riley and Keaster 1979 : 408-411, 413. Brown and Keaster 1986 : 127, 128. Keaster et al. 1987 : 577-579.

Cratonychus laticollis Erichson 1842 : 102. LeConte 1853 : 477. Melsheimer 1853 : 68. LeConte 1863 : 47.

Ctenocychus ochraceipennis Melsheimer 1846 : 150.

Ctenocychus sphenoidalis Melsheimer 1846 : 150.

Cratonychus similis (Kirby) : Melsheimer 1853 : 68.

Cratonychus exuberans LeConte 1853 : 477, 478. Quate and Thompson 1967 : 14.

Cratonychus ochraceipennis (Melsheimer) : LeConte 1853 : 477. Melsheimer 1853 : 68. LeConte 1863 : 47.

Cratonychus sphenoidalis (Melsheimer) : Leconte 1853 : 477. Melsheimer 1853 : 68. LeConte 1863 : 47.

Cratonychus fissilis (Say) : LeConte 1853 : 477.

Melanotus fissilis (Say) : Candeze 1860 : 352. LeConte 1863 : 47. Blatchley 1910 : 748, 750. Hyslop 1915 : 17. Leng 1920 : 174. Van Zwaluwenburg 1922 : 12-29. Leonard 1928 : 352. Knull 1932 : 44. Hawkins 1936 : 13, 51. Thomas 1941 : 259. Dietrich 1945 : 56, 57, 72, 73. Jaques 1951 : 162. Dogger 1959 : 107, 110, 111. Brooks

1960 : 6, 7, 40. Dillon and Dillon 1961 : 322, 323, 333. Arnett 1968 : 501. Swan and Papp 1972 : 388. Riley and Keaster 1979 : 408.

Melanotus exuberans (LeConte) : Candeze 1860 : 354. LeConte 1863 : 47. Leng 1920 : 174. Thomas 1941 : 260.

Melanotus laticollis (Erichson) : Leng 1920 : 174.

Melanotus ochraceipennis (Melsheimer) : Leng 1920 : 174. Thomas 1941 : 259.

Melanotus sphenoidalis (Melsheimer) : Leng 1920 : 174. Thomas 1941 : 260.

Distribution: U.S.A.: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, West Virginia, Wisconsin. CANADA: Manitoba, Nova Scotia, Ontario, Quebec, Saskatchewan. MEXICO.

Montana records: CUSTER CO: 7 mi. WNW Miles City, 9 VII 1985 (MTEC). ROSEBUD CO: Forsyth, 20 VI 1956 (MTEC), Rosebud area, 18 VII 1990 (CES).

Material examined: 3 specimens.

Collecting method: hand, 1 specimen, 33.3 %
pitfall, 1 specimen, 33.3 %

uv light, 1 specimen, 33.3 %

Collection dates: 20 June - 18 July.

Biology: Adult *M. similis* are attracted to light and have been captured in pheromone traps. The major flight activity of males precedes that of females. Adult *M. similis* have been found in their pupal cells in decomposing pitch pine during the winter months, but have also been observed hibernating close together, in groups of three to twelve, beneath loose bark.

The larvae of *M. similis* are economically important pests of corn over much of their range, attacking both germinating seed and young seedlings. These corn wireworms are thought to have a larval stage of between two and five years in the soil.

Remarks: The genitalia of both male and female *M. similis* were illustrated in detail by Smith and Enns (1978).

This species has an extremely widespread distribution in North America and was recorded from Montana by Quate and Thompson (1967) and Riley and Keaster (1979).

Subfamily Negastriinae Nakane & Kishii

The Negastriinae subfamily classification used here is based on the works of Nakane and Kishii (1956) and Stibick (1971, 1979, 1991). The Nearctic Negastriinae were revised by Horn (1891), where he included them with the Hypnoidinae as species in the genus *Cryptohypnus*. Stibick (1971) treated the generic classification of the subfamily and later (1991) the

Negastriinae of eastern North America. Although some genera have recently been revised, eg. *Negastrius* and *Neohypdonus* (Wells 1989, 1991), others, notably *Paradonus* of western North America, are in need of a revision.

The Negastriinae is a moderately sized subfamily of fifteen genera and over 260 species worldwide. Click beetles in this subfamily display the following adult diagnostic characteristics: head capsule dorsoventrally flattened, mouthparts prognathous, frons carinate above and between antennae; prosternum usually prominently arcuate anteriorly but sometimes truncate; scutellum various, usually oval, never cordate; mesocoxae closed to both mesepimeron and mesepisternum; tarsi various, simple or lobed; claws various, but without basal setae (Stibick 1971, 1979).

The Negastriinae of Montana includes at least seven genera and twelve species. Little is known about the life history of these beetles, but many are riparian, collected in lake- and streamside habitats and the larvae are probably soil-inhabiting. No species are known to be of economic importance in Montana (Stibick 1971, 1979, 1991; Wells 1991).

Fleutiauxellus manki (Fall)

(fig. 191)

Montana county records: FLATHEAD, GALLATIN, GLACIER, JEFFERSON, MINERAL, POWELL, SWEET GRASS.

Material examined: 27 specimens.

Elevation records: 3600′ - 8100′.

Collecting method: hand, 27 specimens, 100.0 %

Collection dates: 21 June - 11 September.

Remarks: *Fleutiauxellus manki* was described from Glacier National Park by Fall (1934).

Microhypnus dubius (Horn)

(fig. 192)

Montana county records: FLATHEAD, GALLATIN, GLACIER, PETROLEUM, POWELL, SILVER BOW, SWEET GRASS, TREASURE, WHEATLAND.

Material examined: 19 specimens.

Elevation records: 3480′ - 3520′.

Collecting method: hand, 15 specimens, 78.9 %
pitfall, 1 specimen, 5.3 %
F.I.T., 1 specimen, 5.3 %
unknown, 2 specimens, 10.5 %

Collection dates: 16 June - 27 August.

Biology: *Microhypnus dubius* is a widespread species in Montana that has been collected in sandy, loam soil of prairie sections and in cultivated fields of Canada (Glen et al. 1943).

Remarks: The collection of *M. dubius* in Glacier National Park was recorded by Mank (1934), but the species was cited as *Hypnoidus striatulus*.

Negastrius colon (Horn)

(fig. 193)

Montana county records: BEAVERHEAD, FLATHEAD, GALLATIN, POWELL.

Material examined: 12 specimens.

Elevation records: 3420′ - 4800′.

Collecting method: hand, 7 specimens, 58.3 %

pitfall, 5 specimens, 41.7 %

Collection dates: (26 April) 5 May - 26 August.

Remarks: This species, which has not previously been recorded from Montana, appears susceptible to collection by pitfall trap, otherwise, it is collected most readily by streamside washing.

Negastrius stibicki Wells sp.nov.

(fig. 194)

Montana county records: BEAVERHEAD, RAVALLI.

Material examined: 4 specimens.

Collecting method: hand, 4 specimens, 100.0 %

Collection dates: 10 - 12 July.

Remarks: *Negastrius stibicki* specimens from Montana were cited by Wells (1989).

Neohypdonus gentilis (LeConte)

(fig. 195)

Montana county records: BEAVERHEAD, BROADWATER, FLATHEAD, GALLATIN, MISSOULA, SANDERS, TETON.

Material examined: 56 specimens.

Elevation records: 2400′ - 5700′.

Collecting method: hand, 48 specimens, 85.7 %
pitfall, 6 specimens, 10.7 %
F.I.T., 1 specimen, 1.8 %
L. funnel, 1 specimen, 1.8 %

Collection dates: (25 May) 13 June - 4 August.

Biology: Wells (1991) stated that *N. gentilis* was usually collected by sweeping tall grass near slow first or second order streams.

Remarks: The occurrence of this species in Montana was recorded by Wells (1991).

Neohypdonus nibleyi Wells

(fig. 196)

Montana county records: BROADWATER, FLATHEAD, GALLATIN, GLACIER, MADISON, MEAGHER, PARK, SANDERS, WHEATLAND.

Material examined: 99 specimens.

Elevation records: 2600′ - 7200′.

Collecting method: pitfall, 69 specimens, 69.7 %
hand, 29 specimens, 29.3 %
F.I.T., 1 specimen, 1.0 %

Collection dates: (10 May) 17 May - 8 August (22 Sept.).

Biology: Wells (1991) stated that *N. nibleyi* is found on the banks of third or fourth order streams. This species is most readily collected in pitfall traps placed in riparian areas like those described by Wells.

Remarks: Montana specimens of *N. nibleyi* from Bridger Cr., Gallatin Co. were cited as paratypes by S. A. Wells

(1991).

Neohypdonus recavus Wells

(fig. 197)

Montana county records: BROADWATER, GALLATIN, GLACIER.

Material examined: 4 specimens.

Elevation records: 3875′ - 4150′.

Collecting method: pitfall, 3 specimens, 75.0 %

hand, 1 specimen, 25.0 %

Collection dates: (5 April) 27 April - 20 July.

Biology: Wells (1991) stated that *N. recavus* is usually collected under rocks and debris in moist, sandy soil along the banks of streams and rivers. This species is most readily collected in pitfall traps placed in riparian areas similar to those described by Wells.

Remarks: Wells (1991) cited paratype specimens collected in both Broadwater and Gallatin Co., Montana. These specimens were all collected by pitfall traps positioned within twenty feet of a large river, either the Jefferson or the Missouri, at relatively low elevations.

Neohypdonus tumescens (LeConte)

(fig. 198)

Montana county records: FLATHEAD, GALLATIN, GLACIER, MADISON, POWELL.

Material examined: 91 specimens.

Elevation records: 3520′ - 7400′.

Collecting method: F.I.T., 61 specimens, 67.0 %
L. funnel, 12 specimens, 13.2 %
hand, 9 specimens, 9.9 %
pitfall, 8 specimens, 8.8 %
uv light, 1 specimen, 1.1 %

Collection dates: (25 May) 27 May - 9 August (7 Sept.).

Remarks: *Neohypdonus tumescens*, cited as *Hypnoidus tumescens*, was recorded from Glacier National Park by Mank (1934). This species is most readily collected by flight intercept traps.

Oedostethus femoralis LeConte

(figs. 11, 199)

Montana county records: FERGUS, RICHLAND, WHEATLAND, YELLOWSTONE.

Material examined: 4 specimens.

Elevation records: 3800′ - 4600′.

Collecting method: hand, 3 specimens, 75.0 %
L. funnel, 1 specimen, 25.0 %

Collection dates: (28 May) 28 June - 15 July.

Remarks: *Oedostethus femoralis* is the only native North American species of the Old World genus *Oedostethus*. It is widespread in North America between the latitudes of thirty and fifty-two degrees (Stibick 1991), but has not previously been recorded from Montana.

Paradonus beckeri Stibick

(fig. 200)

Montana county records: DAWSON.

Material examined: 1 specimen.

Collecting method: unknown, 1 specimen, 100.0 %

Collection dates: September.

Biology: Stibick (1991) stated that *P. beckeri* appears to use bluegrass (*Poa* sp.) as a host plant. This species has also been collected on cordgrass (*Spartina* sp.), timothy, and corn.

Remarks: The collection of this species from Glendive, Montana was recorded by Stibick (1991).

Paradonus pectoralis (Say) s.l.

(fig. 201)

Montana county records: BLAINE(?), BROADWATER, CARTER, CHOUTEAU(?), CUSTER, DAWSON, FERGUS, FLATHEAD, GALLATIN, GLACIER, HILL(?), LAKE, LINCOLN, MINERAL, MISSOULA, RAVALLI, ROSEBUD, SANDERS.

Material examined: 185 specimens.

Elevation records: 2000′ - 4900′.

Collecting method: hand, 77 specimens, 41.6 %
pitfall, 55 specimens, 29.7 %
uv light, 53 specimens, 28.6 %

Collection dates: 12 March - 27 August.

Remarks: *Paradonus pectoralis* s.l. represents more than one species, probably does not include *P. pectoralis* s.s.

(Stibick 1991), and is a taxonomically unworkable group at present for lack of a recent revision of the western species. This species, cited as *Hypnoidus pectoralis*, was recorded from Lake Co., Montana by Russell (1968).

Zorochrus caurinus (Horn)

(fig. 202)

Montana county records: FERGUS, FLATHEAD, GALLATIN, GLACIER, LAKE, LINCOLN, POWELL, RAVALLI, SANDERS, SWEET GRASS.

Material examined: 151 specimens.

Elevation records: 2000′ - 5200′.

Collecting method: pitfall, 76 specimens, 50.3 %
hand, 72 specimens, 47.7 %
F.I.T., 2 specimens, 1.3 %
L. funnel, 1 specimen, 0.7 %

Collection dates: 31 March - 26 August (22 September).

Remarks: *Zorochrus caurinus* is readily collected using pitfall traps in riparian locations and was recorded from Glacier National Park by Mank (1934) and from Lake Co., Montana by Russell (1968). In both cases, the species was cited as *Hypnoidus caurinus*.

Subfamily Cardiophorinae Candeze

The Cardiophorinae taxa have been treated as a distinct subfamilial unit by most North American elaterid workers since the beginning of this century (Hyslop 1917, Leng 1920, Glen 1950, Crowson 1960, Lane 1971, Stibick 1979, Arnett 1983,

Becker and Dogger 1991). This subfamily includes seven genera in North America, Central America, and the West Indies (Arnett 1983), and includes thirty-eight genera and approximately 1000 species worldwide (Stibick 1979).

The Cardiophorinae is a poorly known group in need of a revision (Becker 1973). The principal genus, *Cardiophorus* (Stibick 1979), was last revised in North America by Blanchard (1889), and the other genus found in Montana, *Horistonotus*, was similarly revised by Horn (1884). Lanchester (1971) revised the Pacific Northwest species of *Cardiophorus*, however, his key to species is so difficult to use, even some elaterid experts find it unworkable (E. C. Becker, per. comm.).

Cardiophorinae species display the following adult diagnostic characteristics: head capsule generally oval and deflexed with hypognathous mouthparts, frons carinate above and between antennae; prosternum variable, but usually prominent; scutellum usually cordate; mesocoxae closed to mesepimeron and mesepisternum, separated by meso- and metasternum, mesepimeron reduced in size; claws variable, but without basal setae (Stibick 1979).

The Cardiophorinae of Montana includes at least two genera and twelve species. Adult beetles are generally found in riparian areas underneath rocks or other debris. Larvae are typically found in moist, sandy soils and to a lesser extent in light loam soils (Glen et al. 1943, Peterson 1960,

Becker and Dogger 1991). Larvae are generally thought to be predaceous, although at least one species, *Horistonotus uhlerii* Horn, is of considerable economic importance in the United States (Glen et al. 1943). The larvae of *H. uhlerii*, commonly called sand wireworms, are injurious to corn, cotton, and cowpeas (*Vigna unguiculata*) in many areas of the southeastern U. S. (Conradi and Eagerton 1914; Hyslop 1915, 1916; Gibson 1916; Tenhet 1939, 1941).

The Cardiophorinae of Montana includes no economically important species. An illustrated key is provided for both genera of adult Cardiophorinae known to occur in the State.

Key to Genera of Adult Cardiophorinae

(adapted from Brooks 1960, Lane 1971)

1 Lateral margin of prothorax without carina, submarginal suture of prothorax present (fig. 54); scutellum distinctly cordate (fig. 56); widespread and common .....*Cardiophorus*

1′ Lateral margin of prothorax with distinct carina, submarginal suture absent (fig. 55); scutellum cordate-like (fig. 57); northwestern Montana, rare.....*Horistonotus*

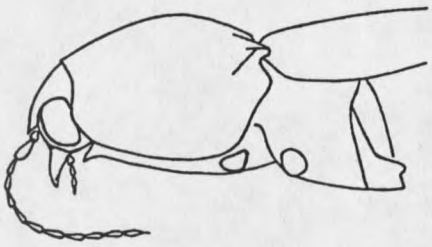
Cardiophorus amplicollis Motschulsky

(fig. 203)

Montana county records: GALLATIN.

Material examined: 22 specimens.

Elevation records: 4700′ - 4800′.



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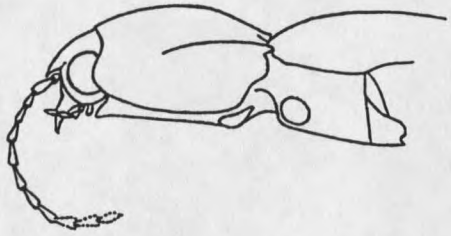

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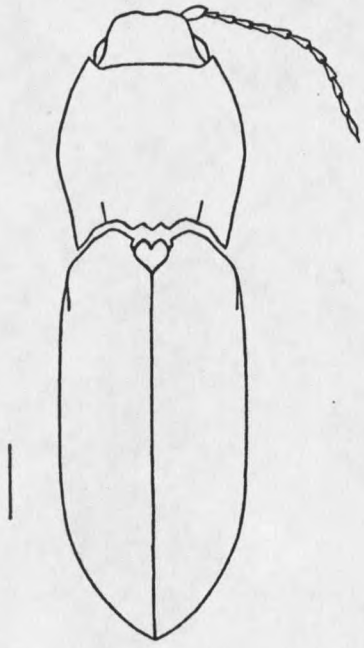

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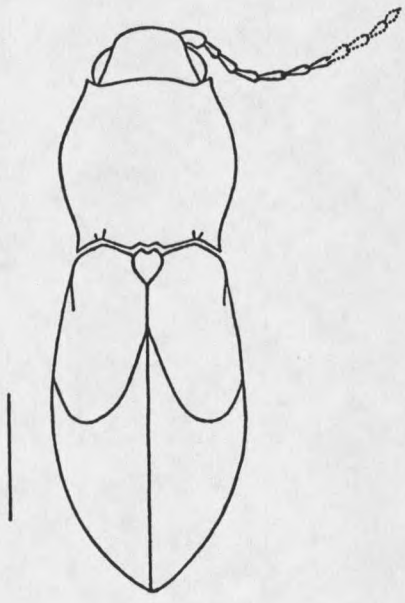

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Figures 54-57. Figs. 54-55, head and prothorax, lateral view. Fig. 54, *Cardiophorus* sp. nr. *tenebrosus*. Fig. 55, *Horistonotus* sp. nr. *transfugus*. Figs. 56-57, dorsal habitus. Fig. 56, *Cardiophorus* sp. nr. *tenebrosus*. Fig. 57, *Horistonotus* sp. nr. *transfugus*.

Collecting method: pitfall, 21 specimens, 95.5 %
hand, 1 specimen, 4.5 %

Collection dates: (14 Apr.) 26 Apr. - 17 June (13 July).

Remarks: In Montana, *C. amplicollis* has only been collected from the Bridger Creek drainage, with the majority of specimens being collected by pitfall trap. This species is a new State record.

Cardiophorus fenestratus LeConte

(fig. 204)

Montana county records: BEAVERHEAD, BROADWATER, CASCADE, FLATHEAD, GALLATIN, LAKE, LEWIS AND CLARK, MEAGHER, MINERAL, MISSOULA, PARK, PONDERA, POWELL, RAVALLI, SANDERS.

Material examined: 124 specimens.

Elevation records: 2400′ - 4960′.

Collecting method: hand, 117 specimens, 94.4 %
pitfall, 2 specimens, 1.6 %
unknown, 5 specimens, 4.0 %

Collection dates: 27 March - 9 November.

Remarks: *Cardiophorus fenestratus* is a common, maculate, Rocky Mountain species that was recorded from Montana by Blanchard (1889).

Cardiophorus latiusculus Eschscholtz

(fig. 205)

Montana county records: FLATHEAD, GALLATIN, RAVALLI(?).

Material examined: 3 specimens.

Elevation records: 3600′.

Collecting method: hand, 2 specimens, 66.7 %

unknown, 1 specimen, 33.3 %

Collection dates: 11 - 29 May.

Remarks: This species is a new state record for Montana.

Cardiophorus longior LeConte

(fig. 206)

Montana county records: BEAVERHEAD, BROADWATER, CARTER, FERGUS, GALLATIN, GRANITE, LAKE, MADISON.

Material examined: 20 specimens.

Elevation records: 3600′ - 4200′.

Collecting method: hand, 16 specimens, 80.0 %

L. funnel, 4 specimens, 20.0 %

Collection dates: 25 April - 15 July (31 August).

Remarks: LeConte (1861a) described *C. longior* from type specimens collected in "Bitter Root Valley", Montana. This State record was cited again by Blanchard (1889), Leng (1920), and Lanchester (1971). In addition, this is the only species of *Cardiophorus* in Montana that has been collected by Lindgren funnel trap.

Cardiophorus pubescens Blanchard

(fig. 207)

Montana county records: GALLATIN.

Material examined: 1 specimen.

Collecting Method: hand, 1 specimen, 100.0 %

Collection dates: 30 June.

Remarks: *Cardiophorus pubescens* represents a new State record.

Cardiophorus sp. nr. *robustus* LeConte

(fig. 208)

Montana county records: LEWIS AND CLARK, MINERAL, SANDERS.

Material examined: 9 specimens.

Elevation records: 2500′ - 3000′.

Collecting method: hand, 9 specimens, 100.0 %

Collection dates: 20 May - 23 June.

Cardiophorus tenebrosus LeConte

(fig. 209)

Montana county records: BROADWATER, CARBON, CASCADE, GALLATIN, JEFFERSON, LAKE, MEAGHER, PARK, POWELL, SANDERS.

Material examined: 19 specimens.

Elevation records: 2400′ - 3000′.

Collecting method: hand, 17 specimens, 89.5 %
pitfall, 1 specimen, 5.3 %
unknown, 1 specimen, 5.3 %

Collection dates: 21 April - 26 June.

Remarks: The collection of this species in Montana was noted by Blanchard (1889).

Cardiophorus sp. nr. *tenebrosus* LeConte

(figs. 54, 56, 210)

Montana county records: BIG HORN, BROADWATER, GALLATIN.

Material examined: 5 specimens.

Elevation records: 6200′.

Collecting method: hand, 4 specimens, 80.0 %
pitfall, 1 specimen, 20.0 %

Collection dates: 27 March - 7 June (24 July).

Cardiophorus tumidicollis LeConte

(fig. 211)

Montana county records: BROADWATER, FERGUS, GRANITE, LEWIS AND CLARK, MISSOULA, RAVALLI(?), SANDERS, YELLOWSTONE.

Material examined: 11 specimens.

Elevation records: 3200′ - 3600′.

Collecting method: hand, 8 specimens, 72.7 %
pitfall, 2 specimens, 18.2 %
unknown, 1 specimen, 9.1 %

Collection dates: 6 April - 21 June.

Remarks: This widespread species is recorded as occurring in western Montana by Lanchester (1971).

Cardiophorus sp. A

(fig. 212)

Montana county records: GALLATIN.

Material examined: 1 specimen.

Collecting method: hand, 1 specimen, 100.0 %

Collection dates: 14 May.

Cardiophorus sp. B

(fig. 213)

Montana county records: GALLATIN, LEWIS AND CLARK.

Material examined: 3 specimens.

Collecting method: hand, 3 specimens, 100.0 %

Collection dates: 16 - 24 May.

Horistonotus sp. nr. *transfugus* LeConte

(figs. 55, 57, 214)

Montana county records: GLACIER.

Material examined: 1 specimen.

Collecting method: uv light, 1 specimen, 100.0 %

Collection dates: 4 July.

Remarks: The species of *Horistonotus* collected at Glacier National Park is uncertain, however, it will be a new state record regardless, because this species also represents a new genus record for Montana.

FAMILY THROSCIDAE

Introduction

The family Throscidae, in North America, includes three genera and approximately thirty species (Blanchard 1917, Arnett 1968, Yensen 1975a, Becker 1991a, Bousquet 1991). Bonvouloir (1859) published a worldwide monographic revision of this family. Horn (1885a) revised the United States species and Blanchard (1917) revised the North American species. More recently, Yensen (1975a, 1975b, 1980) revised Nearctic *Pactopus* and *Trixagus*.

The biology of this family is poorly known. The larvae, once thought to be predaceous (Arnett 1968), but more recently considered fungivorous (Becker 1991a), live in decomposing wood or in soil and litter near decaying wood or tree stumps (Arnett 1968, Yensen 1975a, Becker 1991a). Adult throscids are small, compact beetles usually collected at light, sweeping foliage, or in Lindgren funnel traps.

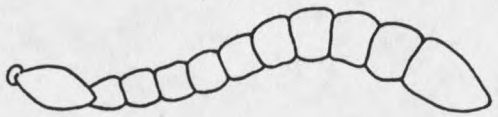
The Throscidae of Montana includes six species placed in three genera and probably represents a complete list. A key is provided to all species of adult Throscidae known to occur in the State.

Key to Species of Adult Throscidae

(adapted from Blanchard 1917; Yensen 1975a, 1980)

1 Antenna fusiform, with three apical segments slightly enlarged (fig. 58); first two visible abdominal sternites with grooves for reception of metatarsi .....*Pactopus horni* LeConte

1′ Antenna with a distinct three-segmented club (fig. 59); without grooves on abdomen for reception of metatarsi 2



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Figures 58-59, left antenna. Fig. 58, *Pactopus horni*. Fig. 59, *Trixagus carinicollis*.

2 Metasternum with deep, oblique groove for reception of mesotarsi extending two-thirds or more the distance across metasternum.....*Aulonothroscus validus* (LeConte)

2′ Metasternum with shallow tarsal groove extending less than one-third the distance across metasternum *Trixagus*,3

3 Eyes large, with more than forty facets anterior to eye sclerite; prosternal carinae complete anteriorly; pubescence usually of two lengths.....4

3′ Eyes small, with fewer than forty facets anterior to eye

sclerite; prosternal carinae variable; pubescence short, appressed.....5

4 Elytra widest at middle; scutellum about as long as wide; color light, reddish brown; size small, body length 2.5 mm or less in males and 2.7 mm or less in females; males with dense lateral fringe of perpendicular elytral setae.....*T. chevrolati* (Bonvouloir)

4′ Elytra widest at base; scutellum longer than wide; color dark, reddish brown; size large, body length 2.5 mm or more in males and 2.9 mm or more in females; without dense lateral fringe of perpendicular elytral setae .....*T. carinicollis* (Schaeffer)

5 Prosternal carinae complete anteriorly, although faint in some specimens; western Montana.....*T. mendax* (Horn)

5′ Prosternal carinae incomplete anteriorly; widespread .....*T. sericeus* (LeConte)

Aulonothroscus validus (LeConte)

(fig. 215)

Montana county records: FERGUS, FLATHEAD, GALLATIN, MADISON.

Material examined: 8 specimens.

Elevation records: 3520′ - 7400′.

Collecting method: F.I.T., 3 specimens, 37.5 %
pitfall, 2 specimens, 25.0 %
L. funnel, 2 specimens, 25.0 %
hand, 1 specimen, 12.5 %

Collection dates: (28 May) 25 June - 6 July (22 July).

Remarks: *Aulonothroscus validus* is a rarely collected species by hand and has not previously been recorded from Montana.

Pactopus horni LeConte

(figs. 58, 216)

Montana county records: FERGUS, FLATHEAD, GALLATIN, LAKE, MISSOULA.

Material examined: 56 specimens.

Elevation records: 3100′ - 6200′.

Collecting method: uv light, 32 specimens, 57.1 %
F.I.T., 13 specimens, 23.2 %
hand, 6 specimens, 10.7 %
pitfall, 3 specimens, 5.4 %
L. funnel, 2 specimens, 3.6 %

Collection dates: (14 Apr.) 26 Apr. - 10 Aug. (8 Sept.).

Remarks: *Pactopus horni* is a large, sexually dimorphic throscid, 2.7 - 6.0 mm in total length (Yensen 1975b), that is readily collected at ultraviolet light and represents a new State species record.

Trixagus carinicollis Schaeffer

(figs. 7, 59, 217)

Montana county records: FLATHEAD, GALLATIN, LAKE.

Material examined: 15 specimens.

Elevation records: 3100′ - 4700′.

Collecting method: hand, 8 specimens, 53.3 %
F.I.T., 5 specimens, 33.3 %
pitfall, 2 specimens, 13.3 %

Collection dates: 12 May - 8 August (5 September).

Remarks: *Trixagus carinicollis* was recorded as occurring in Montana by Blanchard (1917).

Trixagus chevrolati (Bonvouloir)

(fig. 218)

Montana county records: CARTER, FERGUS, GALLATIN, ROSEBUD.

Material examined: 51 specimens.

Collecting method: uv light, 43 specimens, 84.3 %
L. funnel, 5 specimens, 9.8 %
F.I.T., 3 specimens, 5.9 %

Collection dates: (20 June) 3 July - 31 August.

Remarks: *Trixagus chevrolati* has not previously been recorded from the State.

Trixagus mendax (Horn)

(fig. 219)

Montana county records: FLATHEAD.

Material examined: None.

Remarks: Yensen (1975a) recorded the collection of *T. mendax* from Kalispell, Montana.

Trixagus sericeus (LeConte)

(fig. 220)

Montana county records: CARTER, FERGUS.

Material examined: 7 specimens.

Elevation records: 4200'.

Collecting method: L. funnel, 7 specimens, 100.0 %

Collection dates: (17 April) 7 May - 31 August.

Remarks: This western North America species represents a new state record for Montana.

FAMILY EUCNEMIDAE

Introduction

The family Eucnemidae is comprised of two subfamilies, the Eucneminae and Melasinae, both of which are represented in North America. It includes at least 190 genera and 1500 described species worldwide, and at least 85 Nearctic species (Muona 1981, Lawrence 1982).

Bonvouloir (1875) published a worldwide, monographic revision of this family. LeConte (1852) reviewed the Eucnemidae of temperate North America and Horn (1885b) revised the United States species but in general, the taxonomy of the Nearctic Eucnemidae has been poorly studied (Bousquet 1991).

Eucnemid adults, or false click beetles, are difficult to collect, are often found under tree bark, and are thought to be relatively short-lived. They can be difficult to rear from larvae and are rare in collections (Van Horn 1909, Mosher 1919, Arnett 1968, Muona 1981, Becker 1991b). Adult beetles emerge in spring and summer, usually after overwintering as adults (Hopping 1926, Knull 1932), however, Van Horn (1909) stated that some mature larvae do not pupate in autumn, but instead overwinter as larvae and pupate the following spring/summer.

The habits and larvae of most eucnemid species are

unknown. There is even disagreement as to whether they are carnivorous, phytophagous, or fungivorous (Van Horn 1909, Arnett 1968, Lawrence 1982b, Becker 1991b). Eggs are probably oviposited into cracks and crevices of tree bark where, after hatching, the larvae tunnel directly into dead wood which ranges in degree of decomposition from solid, recently killed to moist, advanced decay. No species are known to be economically important and host trees are usually deciduous (White 1983, Borror et al. 1989), however eucnemids have also been reared from western hemlock, white balsam fir, and Virginia pine (*Pinus virginiana*) (Van Horn 1909; Mosher 1919; Hopping 1926; Knull 1932, 1946, 1947; Arnett 1968, Lawrence 1982b, Becker 1991b). The larval period ranges in duration from one year (Van Horn 1909) to three years (Mosher 1919).

The Eucnemidae of Montana includes seven species, comprising six genera. The use of ultraviolet light, Lindgren funnel, and flight intercept traps greatly facilitated the collection of adult eucnemids in this survey. A key is provided to all species of adult Eucnemidae known to occur in Montana.

Key to Species of Adult Eucnemidae

(adapted from Arnett 1968, Lane 1971)

1 Prothorax without marginal antennal grooves; body length 4 mm or greater.....Melasinae, 2

1′ Prothorax with sharply limited antennal grooves close to

lateral margin; body length less than 4 mm; southeast Montana.....Eucneminae, *Deltometopus amoenicornis* Say

2 Prosternopleural suture and side margin more or less parallel; northwest Montana.....*Isorhipis obliqua* (Say)

2′ Prosternopleural suture and side margin distinctly convergent.....3

3 Metacoxal plates parallel or wider laterally; antennal segments 3 - 10 biserrate in females, bipectinate in males; central and southwest Montana .....*Sarpedon scabrosus* Bonvouloir

3′ Metacoxal plates narrower laterally; antennae filiform ormoniliform.....4

4 Body length 7 mm or less.....5

4′ Body length 7.5 mm or greater.....6

5 Mandibles stout, rugose; frons without prominent, longitudinal carina; antennal segments 4 - 10 subequal; central and northwest Montana .....*Hylis terminalis* (LeConte)

5′ Mandibles slender, not rugose; frons with distinct and prominent, longitudinal carina; antennal segments 4 - 7 subequal and distinctly shorter than segments 8 - 10, especially in males; western Montana .....*Epiphanis cornutus* Eschscholtz

6 Total body length greater than 10 mm; western Montana .....*Anelastes druryi* Kirby

6′ Total body length less than 10 mm; eastern Montana

.....*Anelastes* sp. nr. *druryi* Kirby

Subfamily Eucneminae

Deltometopus amoenicornis Say

(fig. 221)

Montana county records: CARTER.

Material examined: 2 specimens.

Collecting method: L. funnel, 2 specimens, 100.0 %

Collection dates: (7 June) - (4 August).

Biology: *Deltometopus amoenicornis* has been reared from American beech (*Fagus grandifolia*) logs in an advanced stage of decomposition and are thought to overwinter as larvae (Knull 1947).

Remarks: The collection of *Deltometopus amoenicornis* by Lindgren funnel trap in southeast Montana provides a new genus and species record for the State and a substantial westerly range extension for the species.

Subfamily Melasinae

Anelastes druryi Kirby

(fig. 222)

Montana county records: FLATHEAD/GLACIER, GALLATIN, RAVALLI, SILVER BOW.

Material examined: 9 specimens.

Collecting method: hand, 5 specimens, 55.6 %

uv light, 1 specimen, 11.1 %

unknown, 3 specimens, 33.3 %

Collection dates: 12 July - 16 August.

Remarks: The collection of *A. druryi* in Glacier National Park was recorded by Mank (1934).

Anelastes sp. nr. *druryi* Kirby

(fig. 223)

Montana county records: ROSEBUD.

Material examined: 7 specimens.

Collecting method: uv light, 7 specimens, 100.0 %

Collection dates: 16 July.

Epiphanis cornutus Eschscholtz

(fig. 224)

Montana county records: FLATHEAD, GALLATIN, GLACIER.

Material examined: 14 specimens.

Elevation records: 3164′ - 7200′.

Collecting method: F.I.T., 10 specimens, 71.4 %

hand, 3 specimens, 21.4 %

L. funnel, 1 specimen, 7.1 %

Collection dates: (7 July) 23 July - 14 Aug. (3 Sept.).

Remarks: *Epiphanis cornutus* is a widespread, forest species in North America (Horn 1885b, Lane 1971) and is most readily collected in flight intercept traps. Although the species has not previously been recorded from the State, it appears that *E. cornutus* may be widespread across western Montana.

Hylis terminalis (LeConte)

(figs. 8, 225)

Montana county records: FLATHEAD, JUDITH BASIN.

Material examined: 6 specimens.

Elevation records: 3760′ - 6600′.

Collecting method: F.I.T., 6 specimens, 100.0 %

Collection dates: (27 May) 1 - 14 July (13 August).

Biology: *Hylis terminalis* has been reared from moist, decomposing logs of American beech (Knull 1946) and from small branches of hickory (Lane 1971).

Remarks: This species has not previously been recorded from Montana and has only been collected in the State with flight intercept traps.

Isorhipis obliqua (Say)

(fig. 226)

Montana county records: FLATHEAD.

Material examined: 2 specimens.

Elevation records: 3560′.

Collecting method: F.I.T., 2 specimens, 100.0 %

Collection dates: (16 June) - (23 June).

Biology: *Isorhipis obliqua* has been reared from sugar maple (*Acer saccharum*) and American beech. The adults are reported to feign death when disturbed and this species is thought to be the host for the parasitic wasp *Vanhornia eucnemidarum* (Crawford 1909, Knull 1946).

Remarks: *Isorhipis obliqua*, a new species for Montana,

has only been collected in this state by flight intercept traps in Glacier National Park.

Sarpedon scabrosus Bonvouloir

(fig. 227)

Montana county records: FERGUS, GALLATIN.

Material examined: 2 specimens.

Elevation records: 3800′ - 4700′.

Collecting method: pitfall, 1 specimen, 50.0 %
hand, 1 specimen, 50.0 %

Collection dates: (28 May) 2 - 15 July.

Biology: Both specimens of *S. scabrosus* collected in Montana were associated with large cottonwood trees or logs in riparian areas.

Remarks: This species, considered very rare in eastern North America by Horn (1885b) and rare in western North America by Lane (1971), has not previously been recorded from Montana.

SUMMARY

The results of this faunal survey are significant in that we now know at least 166 species of Elateroidea, 152 of those species in the family Elateridae, are known to occur within the borders of Montana. This is a substantial increase from the seventy species known before this survey began.

The Artematopidae is a small beetle family and the one species known to inhabit Montana, *Macropogon piceus*, is rarely collected, although it has been known to occur here since 1861.

The species composition of Montana Throscidae presented here is probably a complete list with three genera and six species known. Of those six species, four are new state records. Although three species were collected by a variety of methods, two were caught primarily by light trapping and one, *Trixagus sericeus*, was collected exclusively by Lindgren funnel traps (see APPENDIX I).

The Eucnemidae known from Montana has increased from one to seven species. Those eucnemids, one as yet unnamed, comprise six genera. This is a family of relatively widespread species which are uncommonly collected. Two additional eucnemid genera, *Dromaeolus* and *Melasis*, are likely to occur in northwest Montana.

It is notable that most of the eucnemid species collected

in Montana, and almost all the species previously unknown from the State, were collected exclusively by one kind of trap. Ultraviolet light, Lindgren funnel, and flight intercept traps each selectively collected one or more eucnemid species (see APPENDIX I). This suggests the various species, which are typically of different genera, have different habits, at least as adults. These results also suggest that productive eucnemid collecting includes the use of Lindgren funnel, light, and flight intercept traps.

The Elateridae is a large and diverse family and it follows that its representatives in Montana are numerous and taxonomically complex. Sixty-six species were known from the State before this survey was initiated, as compared to the 152 species now identified. Montana's elaterid species comprise seven subfamilies and thirty three genera presently, but the list is not complete, although much improved.

Elaterids are collected by a variety of means, but typically by hand, and often with a sweep net. Flight intercept traps were not the predominant means of collection of any elaterid species. Pitfall traps collected many species well; a few species were collected exclusively using this approach (see APPENDIX I). These traps also collected half of the potentially important economic species (see APPENDIX H), the other economic species were typically collected by hand. Lindgren funnel traps were extremely productive in terms of overall species caught, with six species exclusively collected

by them (see APPENDIX I). Lindgren funnel traps work particularly well on many species of *Ampedus* and *Ctenicera*, collecting over fifty percent of the known *Ampedus* species and two-thirds of the known species of Montana *Ctenicera*. In addition, five species have only been collected at light traps (see APPENDIX I).

Several species of elaterid larvae are economically important on a variety of crops, including wheat and potato, and many of these pestiferous species are now known to inhabit Montana (see APPENDIX H). The most notable are *Ctenicera destructor*, the prairie grain wireworm, *Ctenicera aeripennis*, the Puget Sound wireworm, *Agriotes mancus*, the wheat wireworm, *Limonius canus*, the Pacific Coast Wireworm, *Limonius californicus*, the sugar beet wireworm, and *Hypnoidus bicolor*. The distributional knowledge of these species and others has been greatly improved (see APPENDIX F) and the best methods of collection for adults of potentially pestiferous species is becoming more clear. For instance, hand/sweep collecting is most effective for *Ctenicera aeripennis, C. destructor, C. glauca, Dalopius* spp., and *Limonius* spp., while pitfall traps work particularly well collecting *Aeolus mellillus, Agriotes mancus, Anchastus cinereipennis, Hypnoidus bicolor,* and *H. rivularius*, in addition to picking up *Ctenicera aeripennis* and *C. destructor*.

The pitfall, Lindgren, and flight intercept traps at twenty-six sites during the 1988 field season yielded at least

353 specimens and sixty-one species of adult elateroid beetles (see APPENDIX G). Representatives of all four Montana elateroid families were collected, including one artematopid, fifty-five elaterid, three throscid, and two eucnemid species. These same specimens represent twenty-three state species records and 113 county records (see APPENDIX J).

The 1988 traps were located in a variety of habitats with most sites being located in either forest or grassland areas. The majority of both specimens and species were collected from the forest sites. However, while the forest sites combined produced 148 individuals and thirty-three species, one site, 4-2x in Fergus Co., a ponderosa pine/grassland area, yielded eighty individuals and seventeen species by itself (see APPENDIX G). Only four species of elateroid were collected at both forest and grassland sites, but they include the economically important species *Hypnoidus bicolor* and *H. rivularius*. In addition, the pestiferous species *H. bicolor* and *Aeolus mellillus* were collected in both grassland areas and adjacent to wheat or barley fields.

During the course of this study, over 6000 Montana elateroid beetle specimens were examined, however, sixty of the 166 species were represented by less than five specimens. The Artematopidae and Throscidae species lists for this State are probably now complete, but the Eucnemidae and Elateridae species compositions are most likely not completely known at this point in time, and the distributions of all elateroids is

undoubtedly incomplete.

In conclusion, at least 166 species of Elateroidea inhabit the state of Montana and although this is more than double the number known previously, there may be as many as 200 elateroid species in Montana. In addition, the composition and distribution of all elateroid species is not yet complete, particularly that of the Elateridae.

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APPENDICES

APPENDIX A

MONTANA ELATEROIDEA CLASSIFICATION

Superfamily Elateroidea:

Artematopidae:		
Macropogoninae:		*Macropogon*
Elateridae:		
Pyrophorinae:	Agrypnini:	*Danosoma, Lacon*
	Chalcolepidiini:	*Alaus*
	Conoderini:	*Aeolus, Conoderus, Drasterius*
Hypnoidinae:	Hypnoidini:	*Hypnoidus, Ligmargus, Margajostus*
Denticollinae:	Denticollini:	*Athous, Limonius, Hemicrepidius*
	Ctenicerini:	*Ctenicera, Eanus, Oxygonus*
Elaterinae:	Ampedini:	*Ampedus*
	Megapenthini:	*Megapenthes*
	Physorhinini:	*Anchastus*
	Adrastini:	*Glyphonyx*
	Agriotini:	*Agriotella, Agriotes, Dalopius*
	Elaterini:	*Sericus*
Melanotinae:		*Melanotus*
Negastriinae:		*Fleutiauxellus, Microhypnus, Negastrius, Neohypdonus, Oedostethus, Paradonus, Zorochrus*
Cardiophorinae:	Cardiophorini:	*Cardiophorus, Horistonotus*
Throscidae:		
Throscinae:		*Aulonothroscus, Pactopus, Trixagus*
Eucnemidae:		
Eucneminae:		*Deltometopus*
Melasinae:		*Anelastes, Epiphanis, Hylis, Isorhipis, Sarpedon*

APPENDIX B

MONTANA ELATEROIDEA SPECIES LIST

Artematopidae:
Macropogoninae: *Macropogon piceus* LeConte!

Elateridae:
Pyrophorinae:
Agrypnini: *Danosoma brevicornis* (LeConte)!
Lacon rorulenta (LeConte)!
Chalcolepidiini: *Alaus melanops* LeConte!
A. oculatus (Linnaeus)
Conoderini: *Aeolus mellillus* (Say)!
Conoderus auritus (Herbst)
C. vespertinus (Fabricius)
Drasterius debilis LeConte!
Hypnoidinae:
Hypnoidini: *Hypnoidus abbreviatus* (Say)
H. bicolor (Eschscholtz)!
H. impressicollis (Mannerheim)
H. leei Stibick!
H. rivularius (Gyllenhal)
H. squalidus (LeConte)!
Ligmargus funebris (Candeze)!
Margaiostus glacialis (Van Dyke)!
Denticollinae:
Denticollini: *Athous nigropilis* Motschulsky!
A. rufiventris (Eschscholtz)!
A. sierrae varius Lane
Hemicrepidius brevicollis (Candeze)
H. sp.A nr. *carbonatus* (LeConte)
H. sp.B nr. *carbonatus* (LeConte)
H. memnonius (Herbst)
H. montanus Lane!
H. pallidipennis (Mannerheim)
H. sp. C
Limonius aeger LeConte
L. californicus (Mannerheim)
L. canus LeConte!
L. fulvipilis seminudus VanDyke!
L. infuscatus Motschulsky!
L. lanei Van Dyke
L. nitidulus Horn!
L. sp. nr. *nitidulus* Horn
L. rufihumeralis Lane!
L. snakensis Lane!
L. subauratus LeConte!
L. ursinus Van Dyke
Ctenicerini: *Ctenicera aeripennis* (Kirby)!
C. angusticollis (Mannerheim)
C. barri Lane!
Ctenicera bombycina (Germar)!
C. sp. nr. *bombycina* (Germar)

C. callida (Brown)!
C. carbo (LeConte)!
C. sp. nr. conjungens (LeConte)!
C. crestonensis (Brown)!
C. cruciatus festivus (LeConte)!
C. destructor (Brown)!
C. funerea (Brown)
C. glauca (Germar)!
C. hoppingi (Van Dyke)
C. insidiosa (LeConte)!
C. laricis (Brown)
C. lobata (Eschscholtz)!
C. mendax (LeConte)
C. moerens (LeConte)
C. montana (Brown)
C. sp. nr. *montana* (Brown)
C. monticola (Horn)
C. morula (LeConte)!
C. nebraskensis (Bland)!
C. nigricollis (Bland)
C. propola (LeConte)!
C. pudica (Brown)!
C. resplendens (Eschscholtz)!
C. sp. nr. *rotundicollis* (Say)
C. rupestris (Germar)
C. semimetallica (Walker)!
C. semivittata (Say)
C. sexualis (Brown)
C. silvatica (Van Dyke)!
C. stricklandi (Brown)
C. triundulata (Randall)
C. umbricola (Eschscholtz)!
C. umbripennis (LeConte)!
C. vidua (Brown)
Eanus albertanus Brown!
E. sp. A
Oxygonus obesus (Say)

Elaterinae:
Ampedini:

Ampedus anthracinus (LeConte)
A. apicatus (Say)!
A. areolatus (Say)
A. atripennis (Horn)!
A. bakeri Lane
A. behrensi (Horn)!
A. brevis (Van Dyke)!
A. collaris (Say)
A. cordatus (Horn)
A. luctuosus (LeConte)
A. sp. nr. *melinus* (LeConte)
A. moerens (LeConte)!
Ampedus nigrinus (Herbst)!
A. occidentalis Lane!

A. sp. nr. *occidentalis* Lane
A. phelpsi (Horn)!
A. phoenicopterus Germar!
A. pullus Germar
A. rhodopus (LeConte)
A. sellatus (Dejean)
A. subtilis (LeConte)
A. varipilis (Van Dyke)

Megapenthini: *Megapenthes angularis* LeConte
M. tartareus (LeConte)

Physorhinini: *Anchastus cinereipennis* (Esch.)

Adrastini: *Glyphonyx recticollis* (Say)

Agriotini: *Agriotella occidentalis* Brown!
Agriotes apicalis LeConte
A. criddlei Van Dyke!
A. ferrugineipennis (LeConte)!
A. limosus (LeConte)!
A. lineatus (Linnaeus)
A. mancus (Say)
A. opaculus (LeConte)!
A. oregonensis Becker
A. pubescens Melsheimer
A. tardus Brown
A. thevenetii Horn
Dalopius fucatus Brown
D. gartrelli Brown
D. sp. nr. *manipularis* Brown
D. plutonicus Brown
D. suspectus Brown
D. tristis Brown

Elaterini: *Sericus incongruus* (LeConte)

Melanotinae: *Melanotus castanipes* (Paykull)
M. longulus oregonensis (LeC.)!
M. similis (Kirby)!

Negastriinae: *Fleutiauxellus manki* (Fall)!
Microhypnus dubius (Horn)
Negastrius colon (Horn)
N. stibicki Wells sp.nov.!
Neohypdonus gentilis (LeConte)!
N. nibleyi Wells
N. recavus Wells!
N. tumescens (LeConte)!
Oedostethus femoralis LeConte
Paradonus beckeri Stibick!
P. pectoralis (Say) s.l.!
Zorochrus caurinus (Horn)!

Cardiophorinae:

Cardiophorini: *Cardiophorus amplicollis* Mots.
Cardiophorus fenestratus LeConte!

C. latiusculus Eschscholtz
C. longior LeConte!
C. pubescens Blanchard
C. sp. nr. *robustus* LeConte
C. tenebrosus LeConte!
C. sp. nr. *tenebrosus* LeConte
C. tumidicollis LeConte!
C. sp. A
C. sp. B
Horistonotus sp. nr. *transfugus* LeConte

Throscidae:
Throscinae:
Aulonothroscus validus (LeConte)
Pactopus horni LeConte
Trixagus carinicollis (Schaeffer)!
T. chevrolati (Bonvouloir)
T. mendax (Horn)!
T. sericeus (LeConte)

Eucnemidae:
Eucneminae:
Deltometopus amoenicornis Say
Melasinae:
Anelastes druryi Kirby!
A. sp. nr. *druryi* Kirby
Epiphanis cornutus Eschscholtz
Hylis terminalis (LeConte)
Isorhipis obliqua (Say)
Sarpedon scabrosus Bonvouloir

!= Species with published and/or unpublished Montana records.

APPENDIX C

MONTANA COUNTY MAP

Figure 60. Map of Montana counties.

APPENDIX D

MAP OF 1988 TRAP SITE LOCATIONS AND TYPE

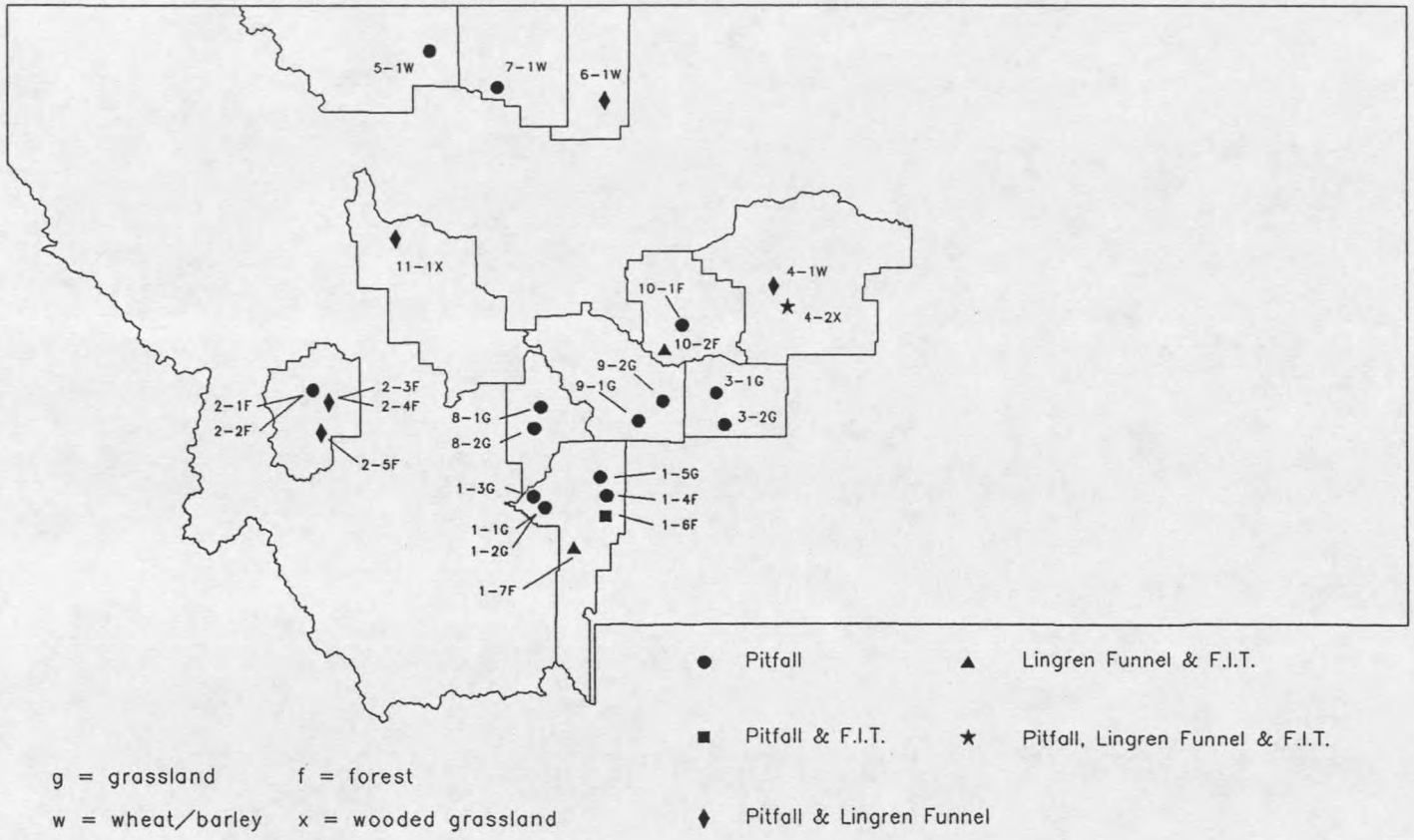


Figure 61. Map of 1988 trap site locations and type.

APPENDIX E

LIST OF 1988 TRAP SITE LOCATIONS, DATES, AND NUMBERS AND KINDS OF TRAPS

1. Gallatin Co.:

1-1g = E. Three Forks, Talc Rd., fish ponds; elev. ca. 4050 ft.; T2N, R2E, S30.
a) 5 - 27 April b) 27 April - 25 May
c) 25 May - 22 June d) 22 June - 20 July
1 pitfall trap

1-2g = ca. 3 mi. NE Three Forks on Headwaters St. Park Rd., Madison R. overflow; elev. ca. 4050 ft.; T2N, R2E, S29.
a) 5 - 27 April b) 27 April - 25 May
c) 25 May - 22 June d) 22 June - 20 July
2 pitfall traps

1-3g = Jefferson R., Williams Bridge fishing access; elev. ca. 4150 ft.; T1N, R1W, S26.
a) 5 - 27 April b) 27 April - 25 May
c) 25 May - 22 June d) 22 June - 20 July
1 pitfall trap

1-4f = Brackett Cr., Bridger Mtns., junction of Brackett Cr. Rd. and Hwy. 86; elev. ca. 5850 ft.; T1N, R7E, S8.
a) 28 April - 18 May b) 18 May - 28 June
c) 28 June - 26 July
1 pitfall trap

1-5g = Cache Cr., Hwy. 86, mile marker 23; elev. ca. 5920 ft.; T2N, R7E, S16.
a) 28 April - 18 May b) 18 May - 28 June
c) 28 June - 26 July
1 pitfall trap

1-6f = Stone Cr., Bridger Mtns.; elev. ca. 5450 ft.; T1S, R7E, S16.
a) 2 May - 9 June b) 9 June - 9 July
c) 9 July - 24 Aug. d) 24 Aug. - 3 Oct.
1 pitfall trap, 1 F.I.T.

1-7f = Squaw Cr., Spire Rock Campgd., Gallatin Canyon; T4S, R4E, S35.
a) 15 June - 12 July b) 12 July - 11 Aug.
c) 11 Aug. - 21 Sep. d) 21 Sep. - 3 Nov.
1 L. funnel trap, 1 F.I.T.

2. Granite Co.:

2-1f = Flint Cr., 4 mi. N. Philipsburg; elev. ca. 5000 ft.; T7N, R14W, S2.
a) 6 April - 8 May b) 8 - 20 May
c) 20 May - 25 June d) 25 June - 24 July

1 pitfall trap

2-2f = Boulder Cr., 0.5 mi. NW Maxville, 11 mi. N. Philipsburg, Deerlodge Nat. For.; elev. ca. 4800 ft.; T8N, R13W, S4.
a) 6 April - 8 May b) 8 - 20 May
c) 20 May - 25 June d) 25 June - 24 July
1 pitfall trap

2-3f = Boulder Cr., 2 mi. SE Maxville, Wyman Gulch Rd., Flint Creek Range, Deerlodge Nat. For.; elev. ca. 5050 ft.; T8N, R13W, S15.
a) 6 April - 8 May b) 8 - 20 May
c) 20 May - 24 July
1 pitfall trap, 4 L. funnel traps

2-4f = So. Boulder Cr., 4 mi. SE Maxville, Wyman Gulch Rd., Flint Creek Range, Deerlodge Nat. For.; elev. ca. 5400 ft.; T8N, R13W, S27.
a) 21 May - 25 June b) 25 June - 24 July
2 pitfall traps, 2 L. funnel traps

2-5f = near (NW of) Echo Lake, Flint Creek Range, Deerlodge Nat. For.; elev. ca. 6750 ft.; T6N, R13W, S30.
a) 21 May - 25 June b) 25 June - 24 July
2 pitfall traps, 2 L. funnel traps

3. Wheatland Co.:

3-1g = Two Dot, Musselshell R.; elev. ca. 4600 ft.; T8N, R13E, S27.
a) 14 April - 8 May b) 8 - 30 May
c) 30 May - 28 June d) 28 June - 24 July
4 pitfall traps

3-2g = Fish Cr., 14 mi. S. Harlowton; T6N, R15E, S31.
a) 17 April - 6 May b) 6 - 30 May
c) 30 May - 4 July d) 4 July - 15 Aug.
1 pitfall trap

4. Fergus Co.:

4-1w = Spring Cr., 9 mi. NW Lewistown; elev. ca. 3800 ft.; T16N, R17E, S21.
a) 16 April - 8 May b) 8 - 28 May
c) 28 May - 2 July d) 2 July - 14 Aug.
5 pitfall traps, 1 L. funnel trap

4-2x = Lewistown (E. edge); elev. ca. 4200 ft.; T15N, R18E, S14.
a) 17 April - 7 May b) 7 - 28 May

c) 8 - 28 May d) 28 May - 2 July
e) 30 May - 2 July f) 2 July - 14 Aug.
3 pitfall traps, 4 L. funnel traps, 1 F.I.T.

5. Glacier Co.:

5-1w = 14 mi. N. Cutbank; elev. ca. 4100 ft.; T36N, R5W, S32.
a) 27 April - 13 June b) 25 May - 30 June
c) 13 June - 15 Aug. d) 30 June - 15 Aug.
4 pitfall traps

6. Liberty Co.:

6-1w = 10 mi. S. Chester, winter wheat plot; T30N, R6E, S18.
a) 22 April - 24 May b) 24 May - 18 June
2 pitfall traps

7. Toole Co.:

7-1w = 5 mi. S. Shelby, Marias R.; elev. ca. 3060 ft.; T31N, R2W, S36.
a) 23 April - 19 May b) 19 May - 18 June
c) 18 June - 19 July d) 18 June - 21 July
e) 19 July - 23 Aug. f) 21 July - 23 Aug.
2 pitfall traps, 2 L. funnel traps

8. Broadwater Co.:

8-1g = Canyon Ferry Wildlife Management Area, N. of Townsend; elev. ca. 3850 ft.; T7N, R2E, S12.
a) 27 April - 25 May b) 25 May - 22 June
c) 22 June - 20 July
2 pitfall traps

8-2g = Missouri R., Deepdale fishing access, 3 mi. S. Townsend; elev. ca. 3875 ft.; T6N, R2E, S17.
a) 11 - 25 May b) 25 May - 22 June
c) 22 June - 20 July
2 pitfall traps

9. Meagher Co.:

9-1g = So. Fork Musselshell R., Hwy. 294, 0.5 mi. SW Lennep, mile marker 16; elev. ca. 5480 ft.; T8N, R9E, S36.
a) 28 April - 18 May b) 18 May - 28 June
c) 28 June - 26 July
2 pitfall traps

9-2g = So. Fork Musselshell R., Martinsdale; elev. ca.

4960 ft.; T8N, R11E, S11.
a) 28 April - 18 May b) 18 May - 28 June
c) 28 June - 24 July
2 pitfall traps

10. Judith Basin Co.:

10-1f = Little Belt Mtns., So. Fork Judith R., ca. 0.25 mi. E. Indian Hill Water Gap; elev. ca. 5200 ft.; T12N, R11E, S23.
a) 6 - 30 May b) 30 May - 1 July
c) 1 July - 13 Aug.
2 pitfall traps

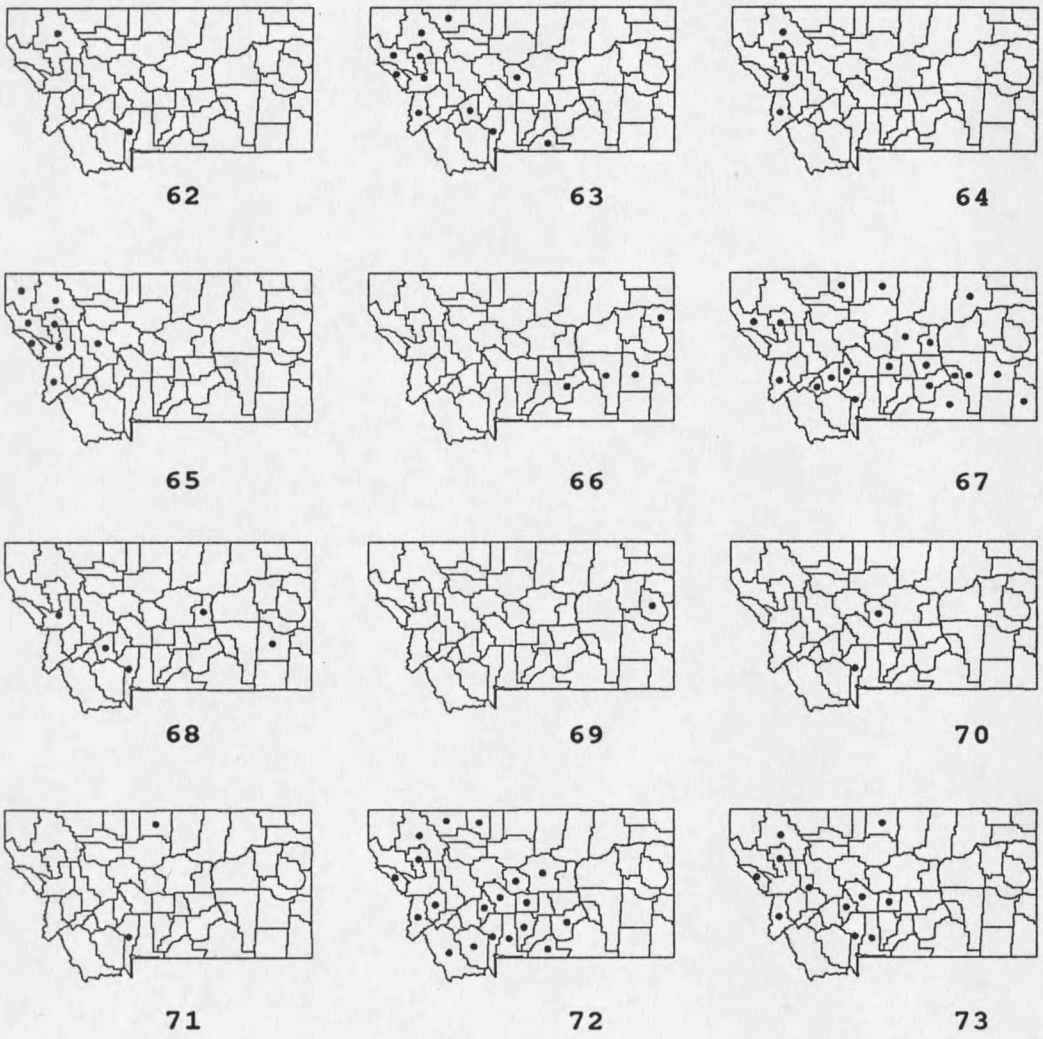
10-2f = Little Belt Mtns., 0.5 mi. S. Deadhorse Cr.; elev. ca. 6600 ft.; T11N, R10E, S21.
a) 27 May - 1 July b) 1 July - 13 Aug.
2 L. funnel traps, 1 F.I.T.

11. Lewis & Clark Co.:

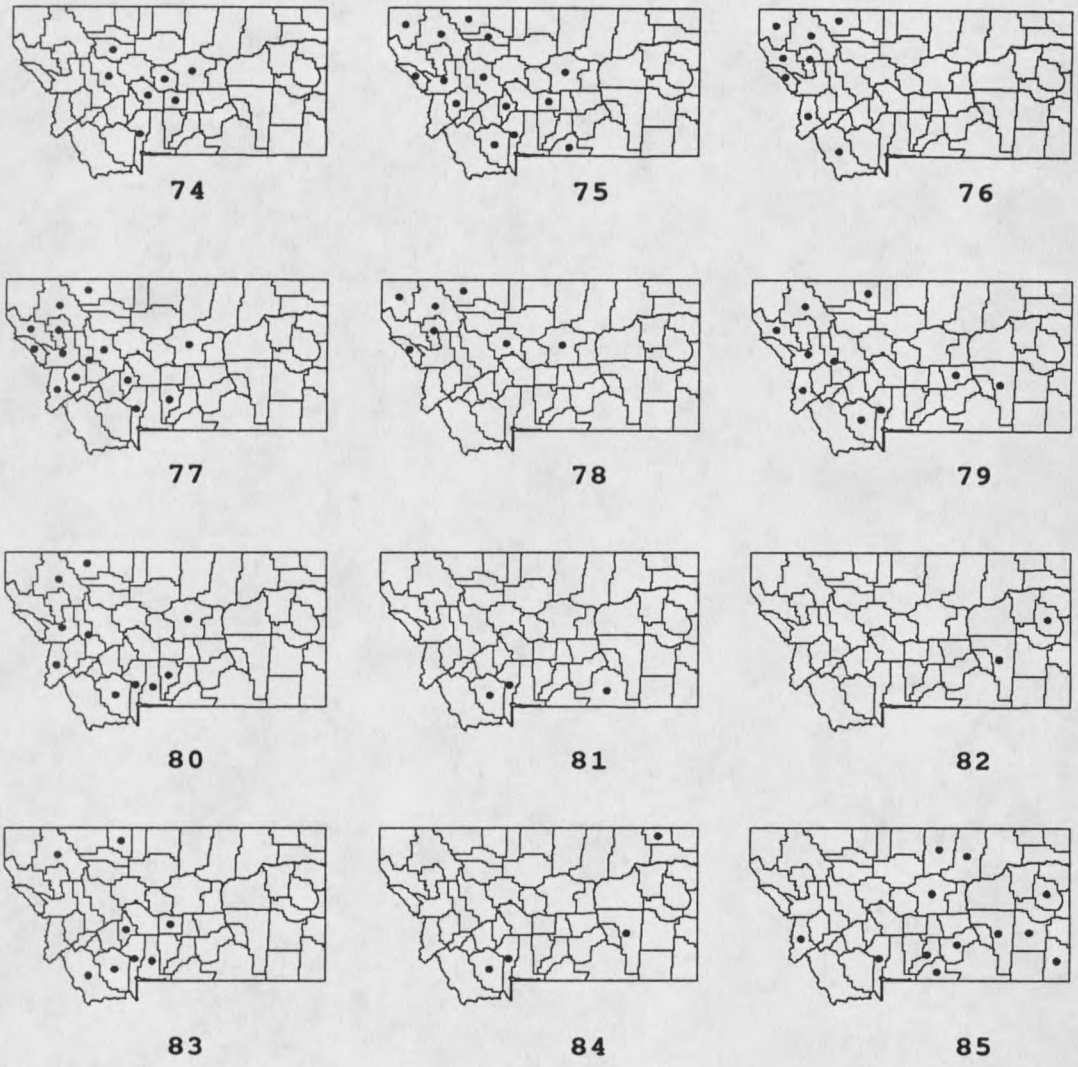
11-1x = Sun River Game Range (south end), near Rose Cr., ca. 12 mi. NW Augusta; elev. ca. 4500 ft.; T21N, R8W, S26.
a) 17 June - 19 July b) 19 July - 26 Aug.
1 pitfall trap, 1 L. funnel trap

APPENDIX F

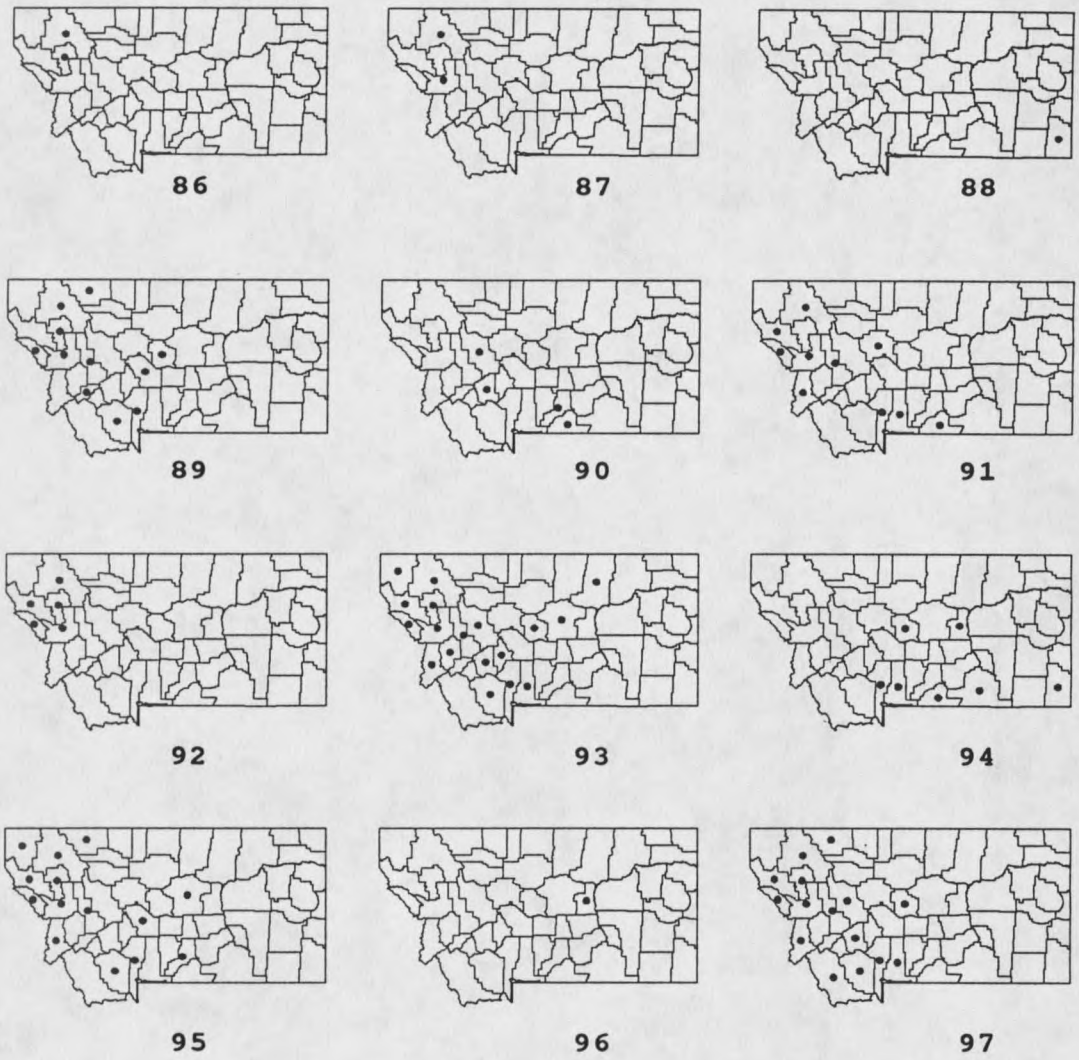
MONTANA ELATEROIDEA SPECIES COUNTY DISTRIBUTION MAPS



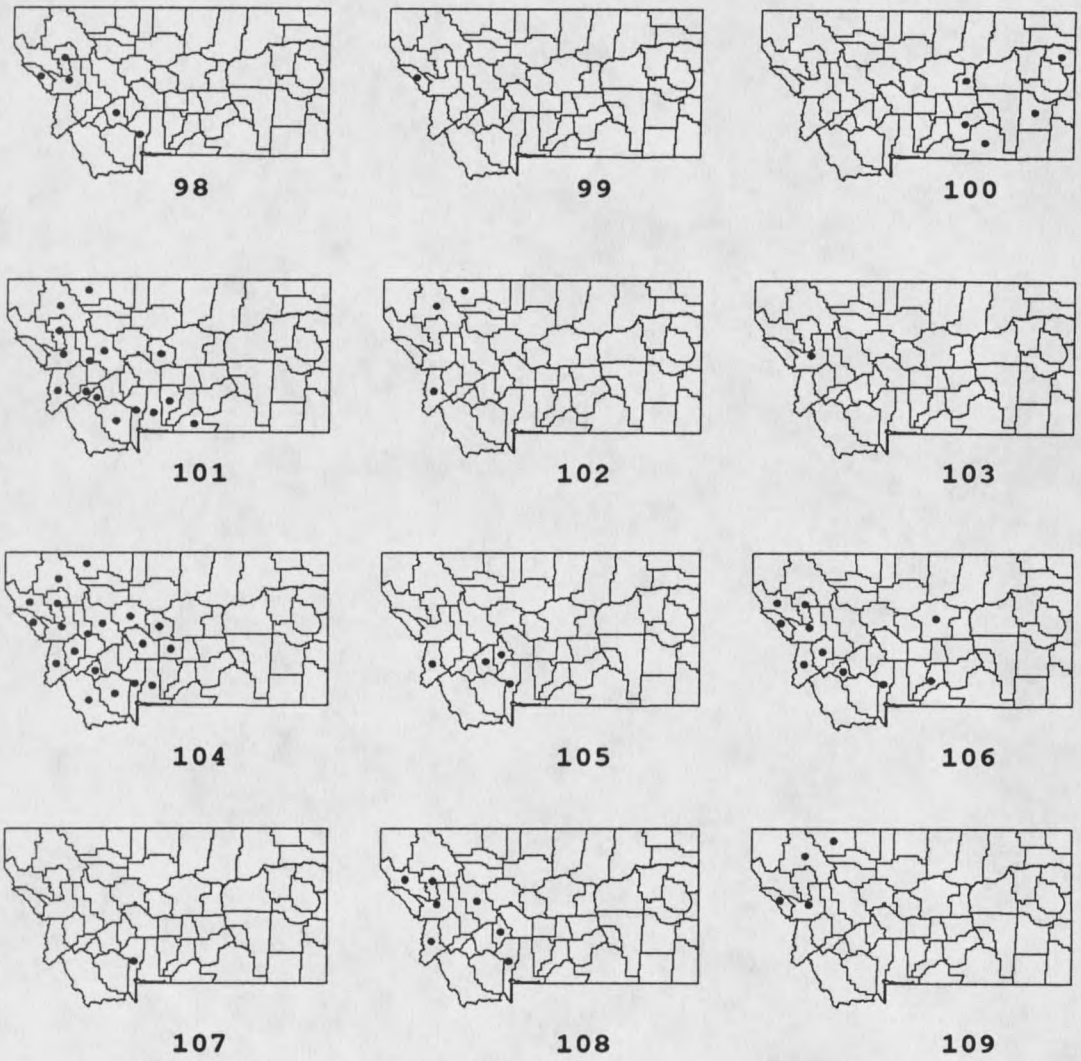
Figures 62-73. Elateroidea species distribution. Fig. 62, Artematopidae, *Macropogon piceus*. Figs. 63-73, Elateridae. Figs. 63-70, Pyrophorinae. Fig. 63, *Danosoma brevicornis*. Fig. 64, *Lacon rorulenta*. Fig. 65, *Alaus melanops*. Fig. 66, *A. oculatus*. Fig. 67, *Aeolus mellillus*. Fig. 68, *Conoderus auritus*. Fig. 69, *C. vespertinus*. Fig. 70, *Drasterius debilis*. Figs. 71-73, Hypnoidinae. Fig. 71, *Hypnoidus abbreviatus*. Fig. 72, *H. bicolor*. Fig. 73, *H. impressicollis*.



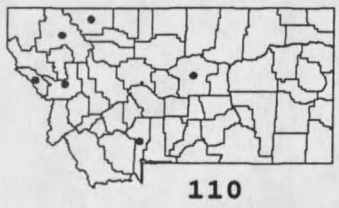
Figures 74-85. Elateridae species distribution. Figs. 74-78, Hypnoidinae. Fig. 74, *Hypnoidus leei*. Fig. 75, *H. rivularius*. Fig. 76, *H. squalidus*. Fig. 77, *Ligmargus funebris*. Fig. 78, *Margaiostus glacialis*. Figs. 79-85, Denticollinae. Fig. 79, *Athous nigropilis*. Fig. 80, *A. rufiventris*. Fig. 81, *A. sierrae varius*. Fig. 82, *Hemicrepidius brevicollis*. Fig. 83, *H.* sp. A nr. *carbonatus*. Fig. 84, *H.* sp. B nr. *carbonatus*. Fig. 85, *H. memnonius*.

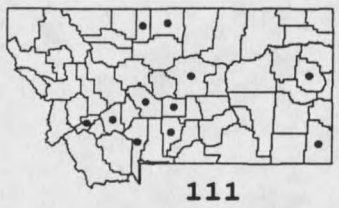


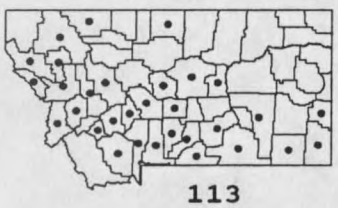
Figures 86-97. Elateridae species distribution. Figs. 86-97, Denticollinae. Fig. 86, *Hemicrepidius montanus*. Fig. 87, *H. pallidipennis*. Fig. 88, *H.* sp. C. Fig. 89, *Limonius aeger*. Fig. 90, *L. californicus*. Fig. 91, *L. canus*. Fig. 92, *L. fulvipilis seminudus*. Fig. 93, *L. infuscatus*. Fig. 94, *L. lanei*. Fig. 95, *L. nitidulus*. Fig. 96, *L.* sp. nr. *nitidulus*. Fig. 97, *L. rufihumeralis*.

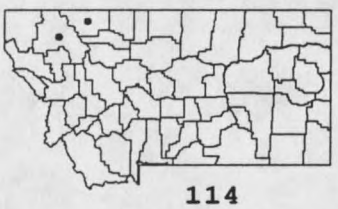


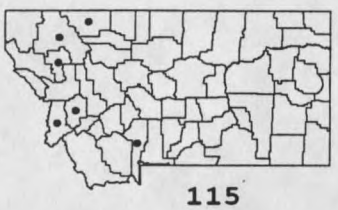
Figures 98-109. Elateridae species distribution. Figs. 98-109, Denticollinae. Fig. 98, *Limonius snakensis*. Fig. 99, *L. subauratus*. Fig. 100, *L. ursinus*. Fig. 101, *Ctenicera aeripennis*. Fig. 102, *C. angusticollis*. Fig. 103, *C. barri*. Fig. 104, *C. bombycina*. Fig. 105, *C.* sp. nr. *bombycina*. Fig. 106, *C. callida*. Fig. 107, *C. carbo*. Fig. 108, *C.* sp. nr. *conjungens*. Fig. 109, *C. crestonensis*.

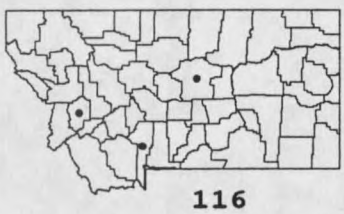


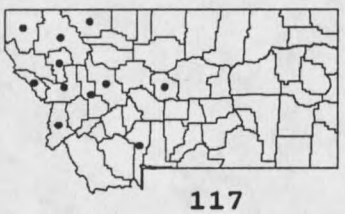


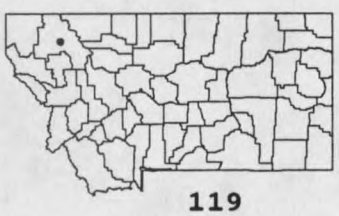


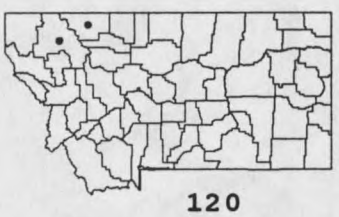


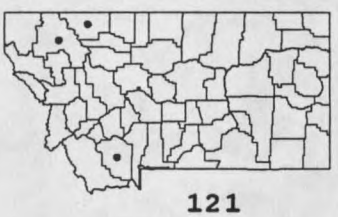




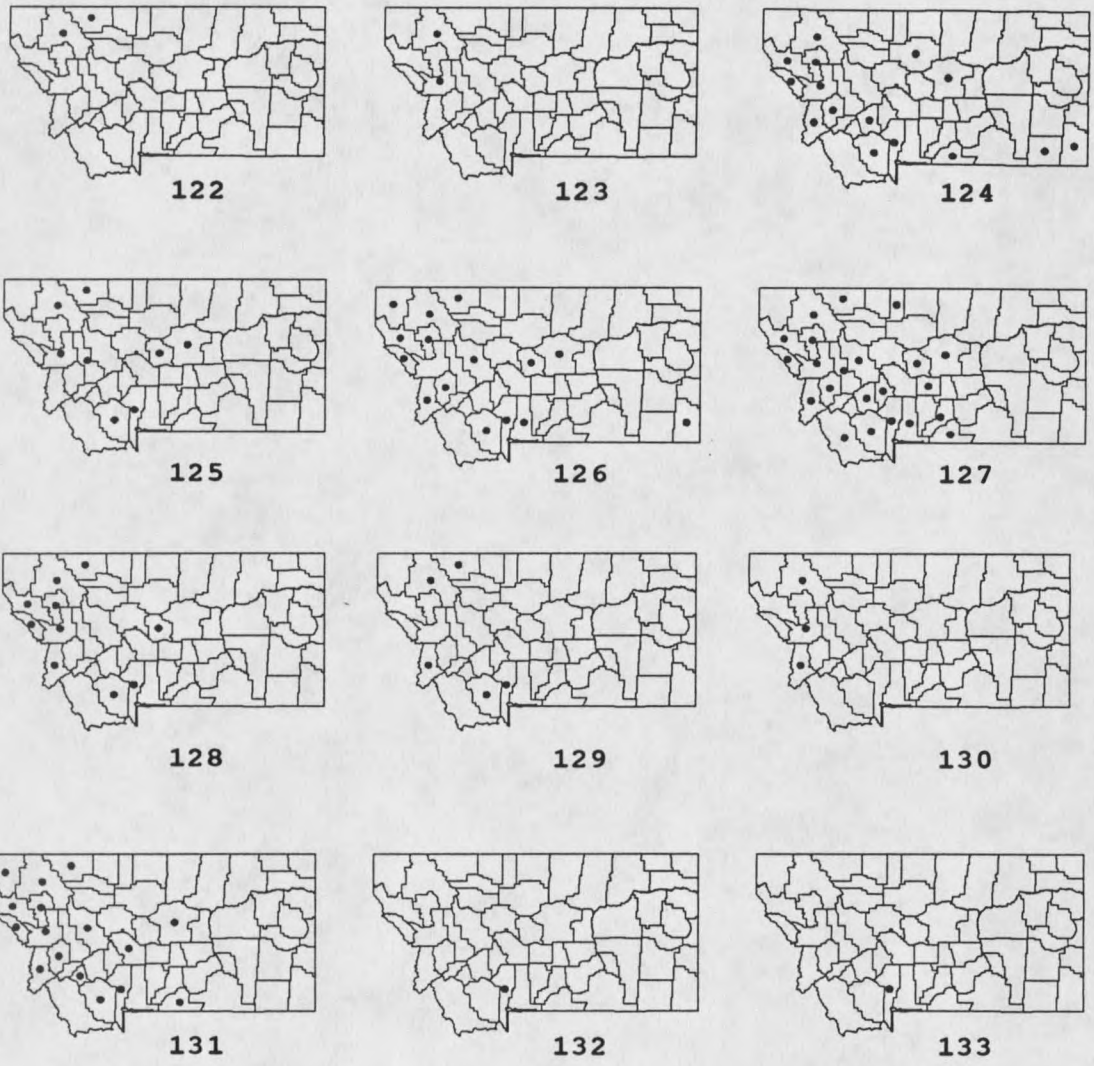




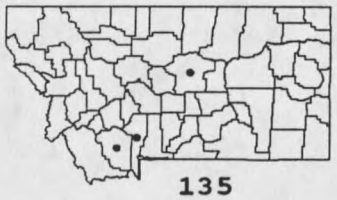


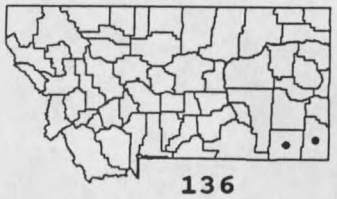


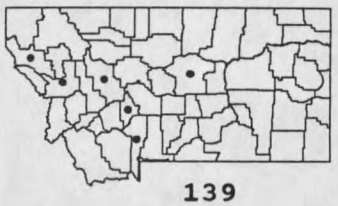
Figures 110-121. Elateridae species distribution. Figs. 110-121, Denticollinae. Fig. 110, *Ctenicera cruciatus festivus*. Fig. 111, *C. destructor*. Fig. 112, *C. funerea*. Fig. 113, *C. glauca*. Fig. 114, *C. hoppingi*. Fig. 115, *C. insidiosa*. Fig. 116, *C. laricis*. Fig. 117, *C. lobata*. Fig. 118, *C. mendax*. Fig. 119, *C. moerens*. Fig. 120, *C. montana*. Fig. 121, *C.* sp. nr. *montana*.

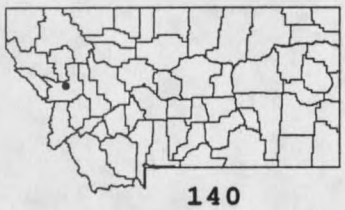


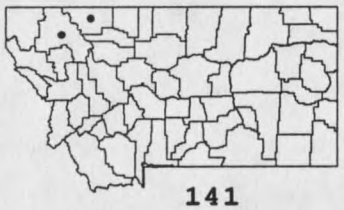
Figures 122-133. Elateridae species distribution. Figs. 122-133, Denticollinae. Fig. 122, *Ctenicera monticola*. Fig. 123, *C. morula*. Fig. 124, *C. nebraskensis*. Fig. 125, *C. nigricollis*. Fig. 126, *C. propola*. Fig. 127, *C. pudica*. Fig. 128, *C. resplendens*. Fig. 129, *C.* sp. nr. *rotundicollis*. Fig. 130, *C. rupestris*. Fig. 131, *C. semimetallica*. Fig. 132, *C. semivittata*. Fig. 133, *C. sexualis*.

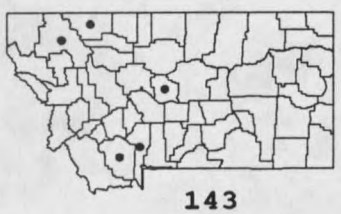




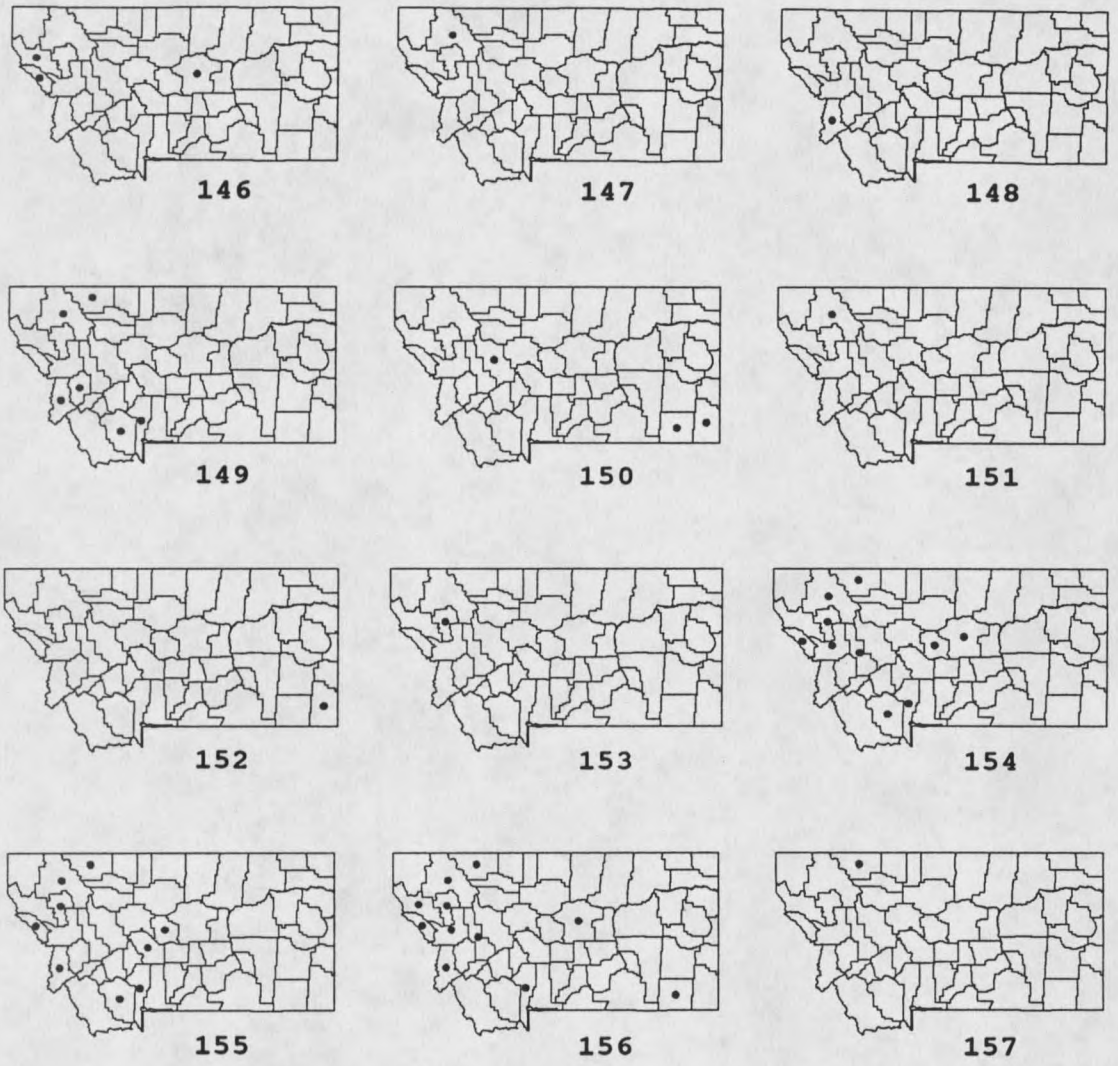




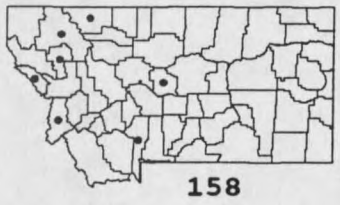


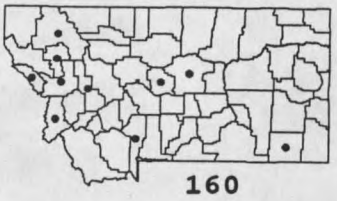


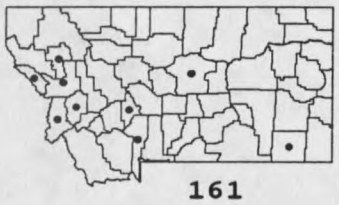
Figures 134-145. Elateridae species distribution. Figs. 134-142, Denticollinae. Fig. 134, *Ctenicera silvatica*. Fig. 135, *C. stricklandi*. Fig. 136, *C. triundulata*. Fig. 137, *C. umbricola*. Fig. 138, *C. umbripennis*. Fig. 139, *C. vidua*. Fig. 140, *Eanus albertanus*. Fig. 141, *E.* sp. A. Fig. 142, *Oxygonus obesus*. Figs. 143-145, Elaterinae. Fig. 143, *Ampedus anthracinus*. Fig. 144, *A. apicatus*. Fig. 145, *A. areolatus*.

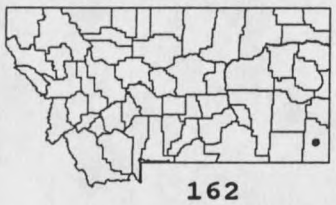


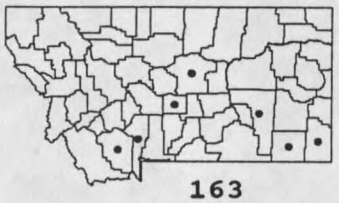
Figures 146-157. Elateridae species distribution. Figs. 146-157, Elaterinae. Fig. 146, *Ampedus atripennis*. Fig. 147, *A. bakeri*. Fig. 148, *A. behrensi*. Fig. 149, *A. brevis*. Fig. 150, *A. collaris*. Fig. 151, *A. cordatus*. Fig. 152, *A. luctuosus*. Fig. 153, *A.* sp. nr. *melinus*. Fig. 154, *A. moerens*. Fig. 155, *A. nigrinus*. Fig. 156, *A. occidentalis*. Fig. 157, *A.* sp. nr. *occidentalis*.

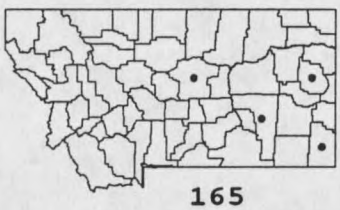


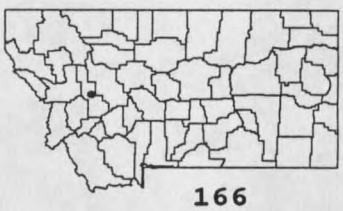


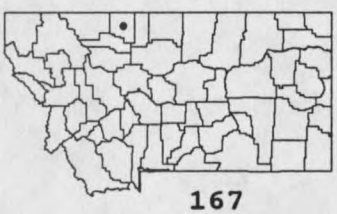


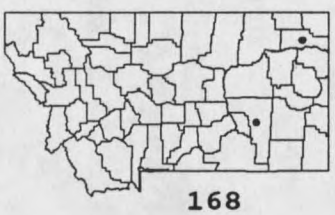


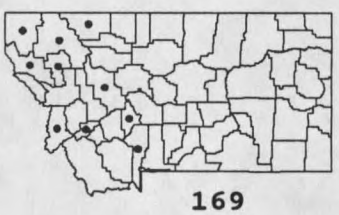




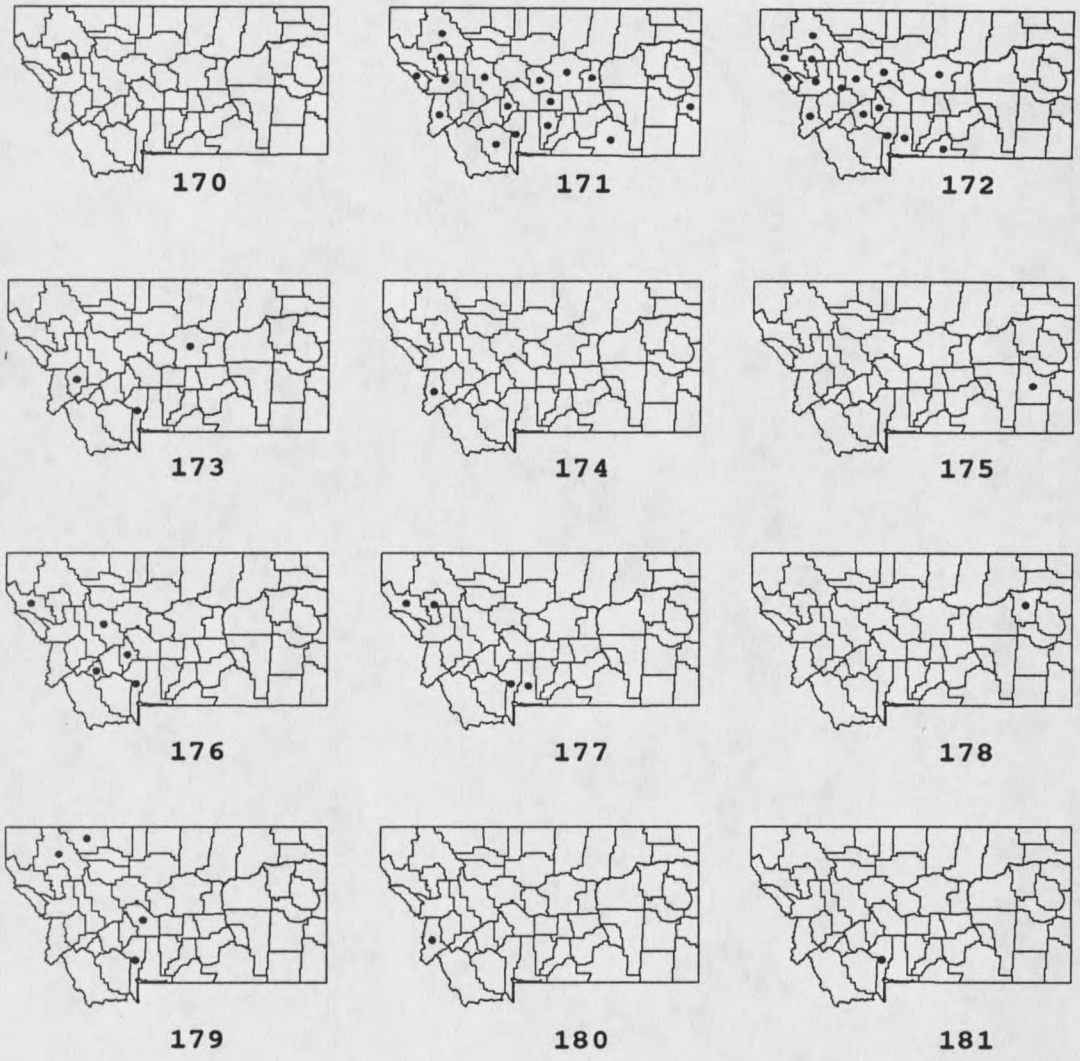




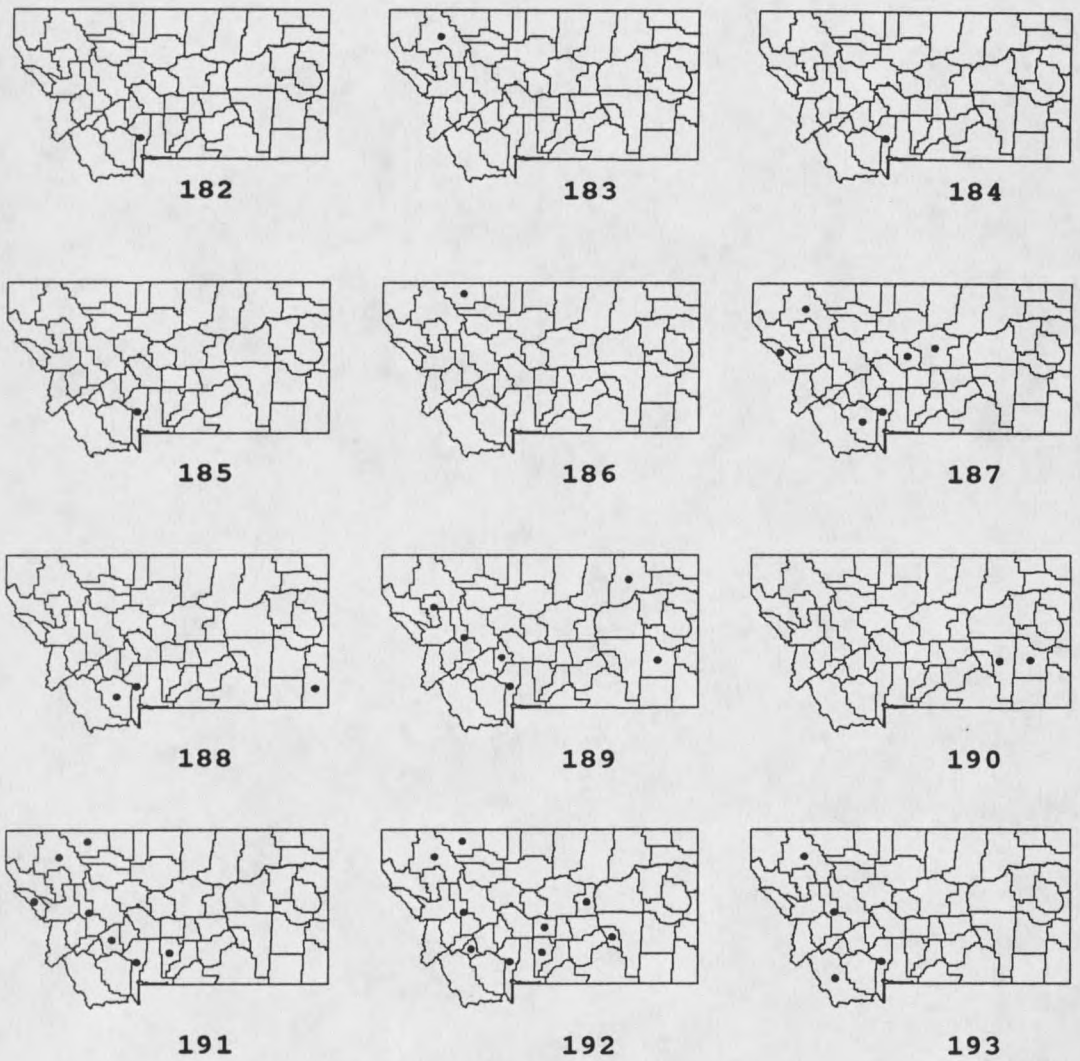




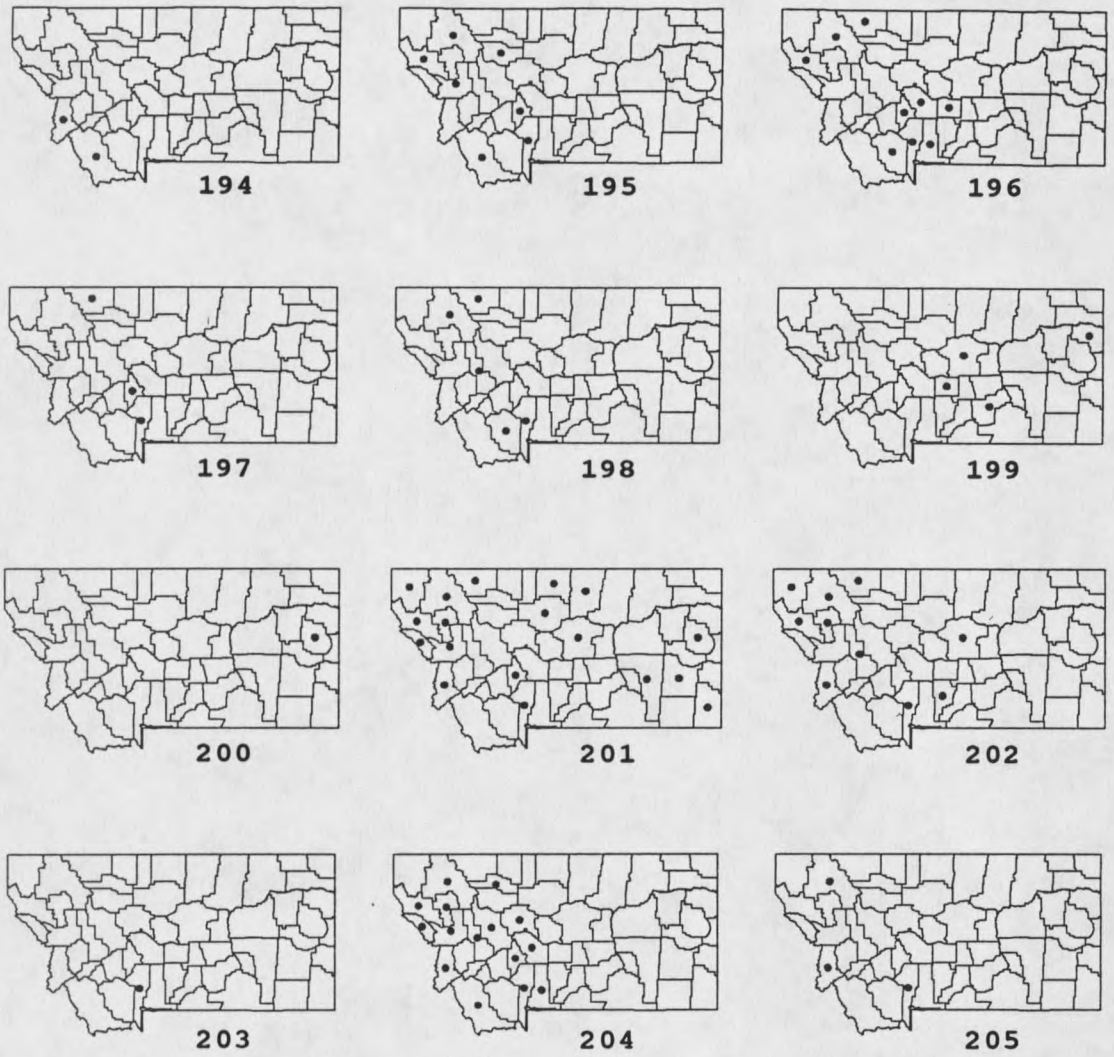
Figures 158-169. Elateridae species distribution. Figs. 158-169, Elaterinae. Fig. 158, *Ampedus phelpsi*. Fig. 159, *A. phoenicopterus*. Fig. 160, *A. pullus*. Fig. 161, *A. rhodopus*. Fig. 162, *A. sellatus*. Fig. 163, *A. subtilis*. Fig. 164, *A. varipilis*. Fig. 165, *Megapenthes angularis*. Fig. 166, *M. tartareus*. Fig. 167, *Anchastus cinereipennis*. Fig. 168, *Glyphonyx recticollis*. Fig. 169, *Agriotella occidentalis*.



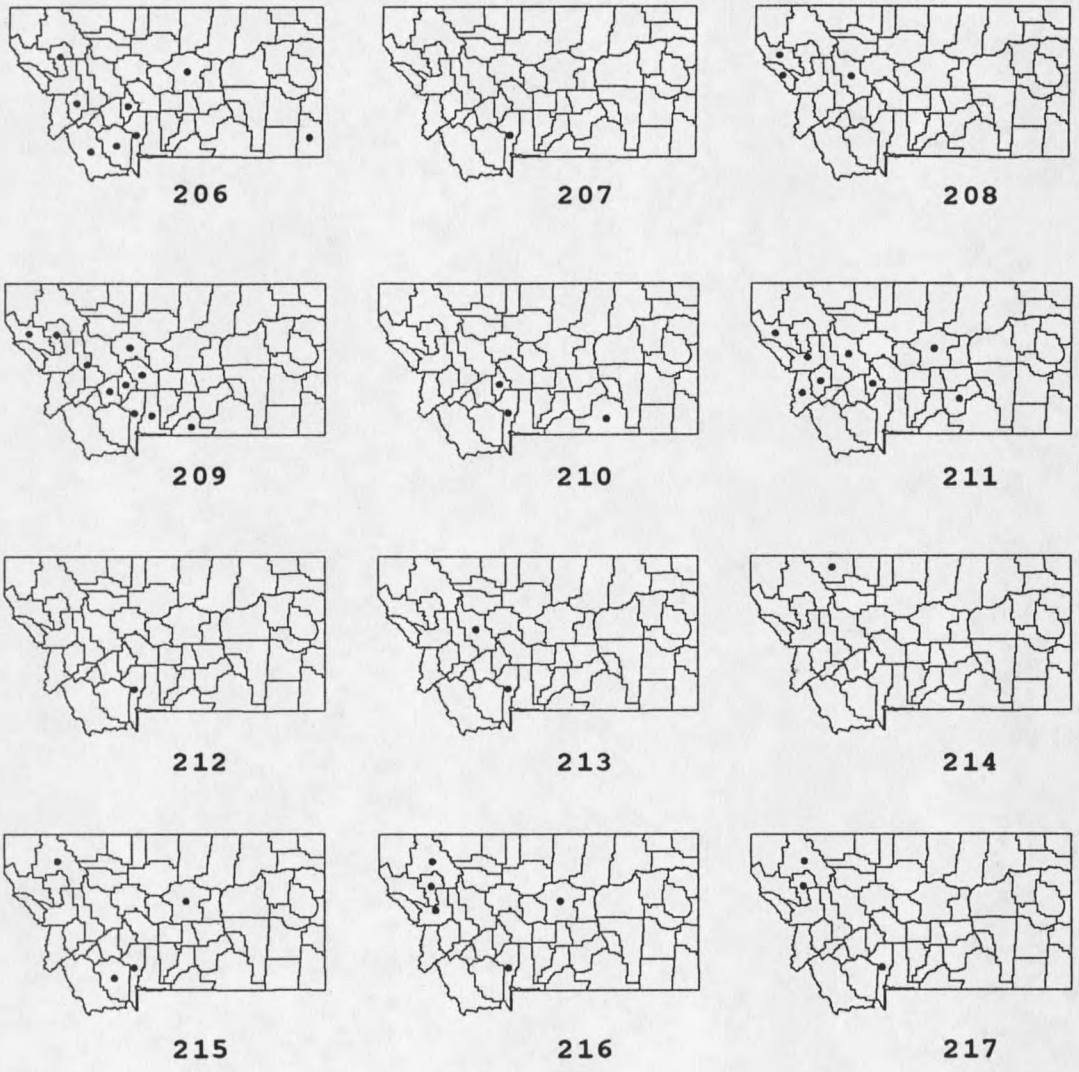
Figures 170-181. Elateridae species distribution. Figs. 170-181, Elaterinae. Fig. 170, *Agriotes apicalis*. Fig. 171, *A. criddlei*. Fig. 172, *A. ferrugineipennis*. Fig. 173, *A. limosus*. Fig. 174, *A. lineatus*. Fig. 175, *A. mancus*. Fig. 176, *A. opaculus*. Fig. 177, *A. oregonensis*. Fig. 178, *A. pubescens*. Fig. 179, *A. tardus*. Fig. 180, *A. thevenetii*. Fig. 181, *Dalopius fucatus*.



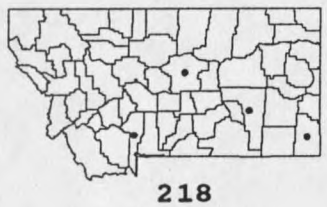
Figures 182-193. Elateridae species distribution. Figs. 182-187, Elaterinae. Fig. 182, *Dalopius gartrelli*. Fig. 183, *D.* sp. nr. *manipularis*. Fig. 184, *D. plutonicus*. Fig. 185, *D. suspectus*. Fig. 186, *D. tristis*. Fig. 187, *Sericus incongruus*. Figs. 188-190, Melanotinae. Fig. 188, *Melanotus castanipes*. Fig. 189, *M. longulus oregonensis*. Fig. 190, *M. similis*. Figs. 191-193, Negastriinae. Fig. 191, *Fleutiauxellus manki*. Fig. 192, *Microhypnus dubius*. Fig. 193, *Negastrius colon*.



Figures 194-205. Elateridae species distribution. Figs. 194-202, Negastriinae. Fig. 194, *Negastrius stibicki*. Fig. 195, *Neohypdonus gentilis*. Fig. 196, *N. nibleyi*. Fig. 197, *N. recavus*. Fig. 198, *N. tumescens*. Fig. 199, *Oedostethus femoralis*. Fig. 200, *Paradonus beckeri*. Fig. 201, *P. pectoralis* s.l. Fig. 202, *Zorochrus caurinus*. Figs. 203-205, Cardiophorinae. Fig. 203, *Cardiophorus amplicollis*. Fig. 204, *C. fenestratus*. Fig. 205, *C. latiusculus*.



Figures 206-217. Elateroidea species distribution. Figs. 206-214, Elateridae, Cardiophorinae. Fig. 206, *Cardiophorus longior*. Fig. 207, *C. pubescens*. Fig. 208, *C.* sp. nr. *robustus*. Fig. 209, *C. tenebrosus*. Fig. 210, *C.* sp. nr. *tenebrosus*. Fig. 211, *C. tumidicollis*. Fig. 212, *C.* sp. A. Fig. 213, *C.* sp. B. Fig. 214, *Horistonotus* sp. nr. *transfugus*. Figs. 215-217, Throscidae. Fig. 215, *Aulonothroscus validus*. Fig. 216, *Pactopus horni*. Fig. 217, *Trixagus carinicollis*.



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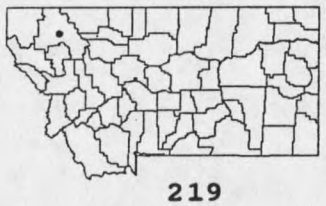

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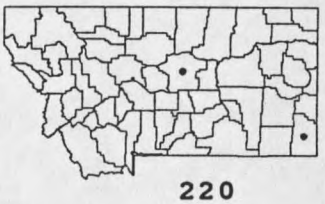

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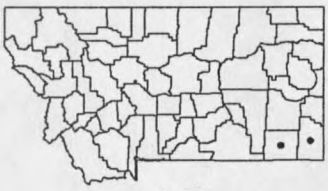

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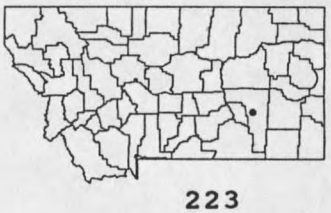

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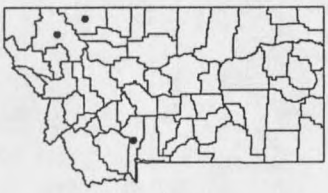

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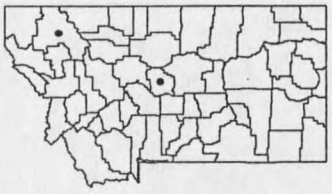

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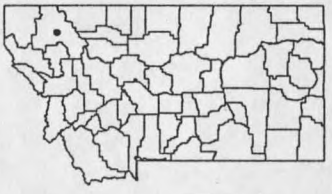

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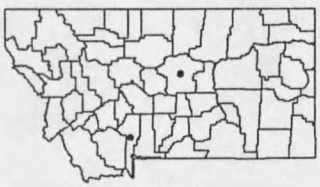

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Figures 218-227. Elateroidea species distribution. Figs. 218-220, Throscidae. Fig. 218, *Trixagus chevrolati*. Fig. 219, *T. mendax*. Fig. 220, *T. sericeus*. Figs. 221-227, Eucnemidae. Fig. 221, *Deltometopus amoenicornis*. Fig. 222, *Anelastes druryi*. Fig. 223, *A.* sp. nr. *druryi*. Fig. 224, *Epiphanis cornutus*. Fig. 225, *Hylis terminalis*. Fig. 226, *Isorhipis obliqua*. Fig. 227, *Sarpedon scabrosus*.

APPENDIX G

ELATEROIDEA SPECIES COLLECTED AT 1988 TRAP SITES

Site:	Species:	No.:	Sub-Total:
1-1g	*Agriotes ferrugineipennis*	1	
	Hemicrepidius sp. A nr. *carbonatus*	1	2
1-2g	*Aeolus mellillus*	1	
	Cardiophorus fenestratus	1	
	Hemicrepidius sp. A nr. *carbonatus*	1	
	H. sp. B nr. *carbonatus*	1	4
1-3g	*Neohypdonus nibleyi*	1	
	N. recavus	2	
	Zorochrus caurinus	3	6
1-4f	*Hypnoidus bicolor*	1	1
1-5g	*Hypnoidus bicolor*	3	3
1-6f	*Ampedus apicatus*	1	
	A. nigrinus	2	
	Athous sierrae varius	1	
	Ctenicera cruciatus festivus	1	
	C. propola	1	
	C. resplendens	1	
	C. stricklandi	1	
	Hemicrepidius sp. A nr. *carbonatus*	1	9
1-7f	*Ampedus nigrinus*	10	
	A. occidentalis	1	
	Athous sierrae varius	1	
	Ctenicera aeripennis	1	
	C. insidiosa	5	
	C. nebraskensis	5	
	C. nigricollis	2	
	C. propola	5	
	C. sp. nr. *rotundicollis*	1	
	Danosoma brevicornis	1	
	Drasterius debilis	1	
	Limonius aeger	13	
	Macropogon piceus	1	
	Neohypdonus gentilis	1	
	Sericus incongruus	4	52
2-2f	*Hypnoidus rivularius*	1	1
2-3f	*Ampedus brevis*	1	
	Ctenicera insidiosa	1	
	C. nebraskensis	1	
	Hypnoidus rivularius	1	
	Limonius infuscatus	1	5

Site:	Species:	No.:	Sub-Total:
2-4f	*Ampedus brevis*	1	
	Ctenicera callida	2	
	C. laricis	1	
	C. nebraskensis	2	
	C. propola	1	
	C. semimetallica	1	
	Hypnoidus bicolor	7	15
2-5f	*Ctenicera insidiosa*	2	
	C. propola	3	5
3-1g	*Ampedus subtilis*	2	
	Hemicrepidius sp. A nr. *carbonatus*	2	
	Hypnoidus bicolor	5	
	H. impressicollis	1	
	H. leei	13	
	Neohypdonus nibleyi	2	
	Oedostethus femoralis	1	26
3-2g	*Aeolus mellillus*	1	
	Hypnoidus bicolor	1	
	H. rivularius	1	3
4-1w	*Aeolus mellillus*	1	
	Ampedus atripennis	1	
	A. rhodopus	2	
	A. subtilis	2	
	Aulonothroscus validus	2	
	Hemicrepidius memnonius	4	
	Hypnoidus bicolor	1	
	H. leei	1	
	Oedostethus femoralis	1	
	Sarpedon scabrosus	1	
	Zorochrus caurinus	1	17
4-2x	*Agriotes criddlei*	2	
	Ampedus occidentalis	1	
	A. pullus	1	
	A. subtilis	3	
	Athous rufiventris	1	
	Aulonothroscus validus	2	
	Cardiophorus longior	1	
	Ctenicera callida	8	
	C. glauca	1	
	C. laricis	2	
	C. nebraskensis	30	
	C. nigricollis	12	
	C. propola	6	

Site:	Species:	No.:	Sub-Total:
4-2x (cont.)	*Ctenicera pudica*	6	
	Limonius infuscatus	1	
	Pactopus horni	1	
	Trixagus sericeus	2	80
5-1w	*Ctenicera montana*	4	
	Hypnoidus bicolor	2	6
6-1w	*Ctenicera destructor*	1	1
7-1w	*Aeolus mellillus*	6	
	Anchastus cinereipennis	1	
	Athous nigropilis	1	
	Hemicrepidius sp. A nr. *carbonatus*	1	
	Hypnoidus bicolor	1	10
8-1g	*Agriotes ferrugineipennis*	2	
	Cardiophorus fenestratus	3	
	Hemicrepidius sp. A nr. *carbonatus*	1	
	Hypnoidus bicolor	1	
	Neohypdonus gentilis	3	10
8-2g	*Agriotes ferrugieipennis*	2	
	Hypnoidus impressicollis	23	
	Neohypdonus gentilis	2	
	N. nibleyi	1	
	N. recavus	1	29
9-1g	*Hypnoidus bicolor*	3	
	H. impressicollis	1	
	H. leei	1	5
10-2f	*Ampedus anthracinus*	4	
	A. moerens	2	
	A. nigrinus	12	
	A. phelpsi	4	
	A. pullus	1	
	Ctenicera aeripennis	2	
	C. nigricollis	5	
	C. propola	8	
	C. resplendens	2	
	C. umbricola	4	
	Danosoma brevicornis	1	
	Drasterius debilis	6	
	Hylis terminalis	5	
	Limonius aeger	2	
	Sericus incongruus	2	60

Site:	Species:	No.:	Sub-Total:
11-1x	*Agriotes opaculus*	1	
	Ctenicera glauca	1	
	C. pudica	1	3

Total specimens = 353

APPENDIX H

MONTANA ELATERIDAE OF POTENTIAL ECONOMIC IMPORTANCE

Species:	Wheat:	Potato:	Other:
Aeolus mellillus	x		sugar beets, sainfoin, etc.
Conoderus auritus			corn, sm. grains, vegetables, etc.
Conoderus vespertinus	x		corn, alfalfa, beans, etc.
Hypnoidus abbreviatus	x	x	corn, etc.
Hypnoidus bicolor	x	x	cereals
Hypnoidus impressicollis		x	
Limonius californicus	x	x	barley, rye, sugar beets, alfalfa, corn, beans, etc.
Limonius canus	x	x	
Limonius infuscatus	x		
Limonius ursinus			corn
Ctenicera aeripennis	x		other grains, vegetables
Ctenicera destructor	x		other grains
Ctenicera glauca	x		alfalfa, beans
Anchastus cinereipennis	x		
Glyphonyx recticollis			corn
Agriotes criddlei			grain crops
Agriotes lineatus		x	cereals, root vegetable crops
Agriotes mancus	x	x	other grains, corn
Agriotes pubescens			corn
Dalopius spp.		x	strawberry

Species:	Wheat:	Potato:	Other:
Melanotus longulus oregonensis	x		sugar beets
Melanotus similis			corn
Paradonus beckeri			corn

APPENDIX I

Elateroid Species Collected Exclusively by One Trapping Technique

Species:	Trapping Method*:	Total No. Specimens:
Conoderus vespertinus	uv light	1
Hypnoidus squalidus	hand	14
Margaiostus glacialis	hand	15
Hemicrepidius sp. C	uv light	1
Limonius fulvipilis seminudus	hand	32
L. rufihumeralis	hand	78
L. snakensis	hand	6
Ctenicera sp. nr. *bombycina*	hand	7
C. funerea	hand	5
C. laricis	L. funnel	5
C. moerens	L. funnel	2
C. semivittata	hand	6
C. triundulata	L. funnel	15
C. vidua	hand	30
Eanus albertanus	hand	5
Oxygonus obesus	L. funnel	10
Ampedus apicatus	hand	16
A. atripennis	hand	5
A. cordatus	L. funnel	1
A. sellatus	L. funnel	3
Megapenthes angularis	uv light	11
Anchastus cinereipennis	pitfall	1
Glyphonyx recticollis	uv light	39
Agriotella occidentalis	hand	23
Agriotes mancus	pitfall	1
Agriotes oregonensis	hand	7
Fleutiauxellus manki	hand	27
Cardiophorus sp. nr. *robustus*	hand	9
Horistonotus sp. nr. *transfugus*	uv light	1
Trixagus sericeus	L. funnel	7
Deltometopus amoenicornis	L. funnel	2
Anelastes sp. nr. *druryi*	uv light	7
Hylis terminalis	F.I.T.	6
Isorhipis obliqua	F.I.T.	2

*The trapping category of hand is included only when five or more specimens were collected of a given species.

APPENDIX J

COMPOSITE ELATEROID SPECIES LIST REPRESENTING 1988 TRAPPING EFFORTS

Species:	State Record:	Montana County Record(s):
Macropogon piceus		Gallatin
Danosoma brevicornis		Gallatin, Judith Basin
Aeolus mellillus		Fergus, Toole, Wheatland
Drasterius debilis		Gallatin, Judith Basin
Hypnoidus bicolor		Broadwater, Fergus, Granite, Judith Basin, Meagher, Toole, Wheatland
H. impressicollis		Broadwater, Meagher, Wheatland
H. leei	Yes	Fergus, Judith Basin, Meagher, Wheatland
H. rivularius		Granite, Wheatland
Athous nigropilis		Toole
A. rufiventris		Fergus, Gallatin
A. sierrae varius	Yes	Gallatin
Hemicrepidius memnonius	Yes	Fergus
H. sp. A nr. *carbonatus*		Broadwater, Gallatin, Toole, Wheatland
H. sp. B nr. *carbonatus*		Gallatin
Limonius aeger	Yes	Gallatin, Judith Basin
L. infuscatus		Fergus, Granite
Ctenicera aeripennis		Gallatin, Judith Basin
C. callida		Fergus, Granite
C. cruciatus festivus		Gallatin
C. destructor		Liberty
C. glauca		Fergus, Lewis & Clark
C. insidiosa		Gallatin, Granite
C. laricis	Yes	Fergus, Granite
C. montana	Yes	Glacier
C. nebraskensis		Fergus, Gallatin, Granite
C. nigricollis	Yes	Fergus, Gallatin, Judith Basin
C. propola		Fergus, Gallatin, Granite, Judith Basin
C. pudica		Fergus, Judith Basin, Lewis & Clark
C. resplendens		Gallatin, Judith Basin
C. sp. nr. *rotundicollis*		Gallatin
C. semimetallica		Granite
C. stricklandi	Yes	Gallatin
C. umbricola		Judith Basin

Species:	State Record:	Montana County Record(s):
Ampedus anthracinus	Yes	Judith Basin
A. apicatus		Gallatin
A. atripennis		Fergus
A. brevis		Gallatin, Granite
A. moerens		Judith Basin
A. nigrinus		Gallatin, Judith Basin
A. occidentalis		Fergus, Gallatin
A. phelpsi		Judith Basin
A. pullus	Yes	Fergus, Judith Basin
A. rhodopus	Yes	Fergus
A. subtilis	Yes	Fergus, Wheatland
Anchastus cinereipennis	Yes	Toole
Agriotes criddlei		Fergus
A. ferrugineipennis		Broadwater, Gallatin
A. opaculus		Lewis & Clark
Sericus incongruus	Yes	Gallatin, Judith Basin
Neohypdonus gentilis	Yes*	Broadwater, Gallatin
N. nibleyi	Yes*	Broadwater, Gallatin, Meagher, Wheatland
N. recavus	Yes*	Broadwater, Gallatin
Oedostethus femoralis	Yes	Fergus, Wheatland
Zorochrus caurinus		Fergus, Gallatin
Cardiophorus fenestratus		Broadwater, Gallatin, Meagher
C. longior		Fergus
Aulonothroscus validus	Yes	Fergus
Pactopus horni	Yes	Fergus
Trixagus sericeus	Yes	Fergus
Hylis terminalis	Yes	Judith Basin
Sarpedon scabrosus	Yes	Fergus

*These specimens were state species records at the time of collection and were included in Wells' (1991) revision of the genus *Neohypdonus*.

APPENDIX K

GLOSSARY OF TERMS

abdomen. The third or posterior division of the insect body; consists normally of five visible segments in adult Elateridae.

acute. Pointed; terminating in or forming less than a right angle.

aedeagus. In male insects, the intromittent organ, including the penis, and enclosed in a sheath.

alkaline. Having a basic reaction, neutralizes acid, turns red litmus paper blue when in solution.

antenna (pl. **antennae**). The paired, segmented, sensory organs on each side of the head.

antennal fossa. A groove or cavity in which antennae are located or originate.

anterior. In front, before.

apex. That part of any joint of segment opposite the base by which it is attached.

apical. At, near or pertaining to the apex of any structure.

appressed. Closely applied to.

arcuate. Arched, bow-like.

artematopid. A member of the beetle family Artematopidae.

ballast. Heavy material carried in the hold of a ship to enhance stability.

basal. At or pertaining to the base or point of attachment to or nearest the main body.

bicarinate. With two carinae or keels.

bicolored. With two colors that contrast to some extent.

bipectinate. Twice pectinate; having comb-like teeth or processes on each side of each joint.

biserrate. Doubly saw-toothed; with a tooth on each side of each antennal joint.

bisexual. Having two sexes distinct and separate.

body length. In Elateridae, the summation of the head and pronotal length with elytral length.

boreal. From or belonging to the north.

Cantharoidea. The superfamily of beetles which includes the Cantharidae (soldier beetles), Lampyridae ("fireflies"), and Lycidae, in addition to others.

carina (pl. **carinae**). An elevated ridge or keel, not necessarily high or acute.

carinate. Keeled; having keels or carinae.

carnivorous. Flesh-eating; preying or feeding upon animals.

caudad. Toward or in the direction of the tail end of the insect body along the median line.

cephalic. Belonging to or attached to the head; directed toward the head.

clavate. Clubbed; thickening gradually toward the tip.

coarse. Large, as opposed to fine.

Coleoptera. The largest order of insects, the order which includes the beetles.

concave. Having a curved, depressed surface.

coniferous. Producing or bearing cones; composed of cone-bearing trees.

connate. United at base, or along the whole length.

conspecific. Belonging to the same species.

contiguous. So near together as to touch; adjacent to; in contact with; adjoining.

convergent. Coming together; approaching each other toward the tip.

convex. Having a curved, rounded exterior surface, as that of a sphere.

cordate. Heart-shaped.

coxa (pl. **coxae**). The basal segment of the leg, by means of which it is articulated to the body.

Cretaceous. The third and final geological period of the Mesozoic era.

deciduous. Falling off or shed at maturity; shedding foliage at the end of the growing season.

deflexed. Abruptly bent downward.

dehiscent. Open or standing open; separating toward the tip.

diagnosis. An extremely abridged description of an insect, containing only a limited number of outstanding differential characters.

diagnostic. A distinguishing characteristic; of value for a diagnosis.

dichotomous. In taxonomic keys, dividing into opposite couplets.

dilated. Widened, expanded.

dimorphism. A difference in form, color, etc., between individuals of the same species, characterizing two distinct types; may be seasonal, sexual, or geographic.

Diptera. The order of insects which includes the true flies.

disk. The central upper surface of any part.

distal. Near or toward the free end of any appendage; that part of a segment farthest from the body.

divergent. Moving or spreading apart from a common base or a central point.

dorsoventral. In a line from the upper to the lower surface.

ecdysis. The process of casting the skin; molting.

elasis. The specialized leaping mechanism characteristic of most Elateroids and enabled by the reception of the prosternal spine within a mesosternal cavity.

elaterid. A member of the beetle family Elateridae.

elateroid. A member of the beetle superfamily Elateroidea.

elytron (pl. **elytra**). Anterior leathery or chitinous wing of a beetle, serving to cover the hind wing.

epimeron. The posterior division of a thoracic pleuron; usually small, narrow or triangular.

episternum. The anterior and larger lateral thoracic sclerite

between the sternum and the notum; the anterior sclerite of the pleuron.

erect. Standing upright; not necessarily perpendicular.

eucnemid. A member of the beetle family Eucnemidae.

Eurasia. Land mass made up of the continents of Europe and Asia.

evergreen. A tree which retains its leaves through the year, as various conifers.

excavate. Hollowed out, with a scoop-like depression.

extant. Now living or existing.

exuviae. The cast skin of larvae or nymphs at metamorphosis.

facet. A small face or surface; one of the parts, areas or lens-like divisions of the compound eye.

filiform. Thread-like; slender and of approximate equal diameter.

flavotestaceous. Light, yellow-brown; almost luteous or clay color.

fossa. A pit, cavity, or deep sulcus.

frons. The upper anterior portion of the head capsule.

frontal. Referring to the front of the head.

fungivorous. Fungus-eating.

fusco-testaceous. Dull, reddish brown.

genus (pl. **genera**). An assemblage of species agreeing in some one character or series of characters; usually considered as arbitrary and opinionative, though some consider it a natural assemblage.

generic name. The name of a genus.

genitalia. All the genital or copulatory structures collectively.

habitat. The area within which an organism is found.

habitus. The aspect; the general appearance.

Hemiptera. The insect order which includes the true bugs.

hibernate. To pass the winter in a dormant or lethargic condition.

Holarctic Realm. A faunal region comprising the whole of Europe, Northern Africa as far south as the Sahara, Asia, down to the Himalaya Mountains and North America south to Mexico.

Holotype. The single specimen selected by the author of a species as its type, or the only specimen known at the time of description.

homogeneous. Similar in texture or parts; of the same kind or nature.

humeral. Relating to the shoulder or humerus.

humeral angle. In Coleoptera, the outer anterior angle of an elytron.

humid. To be moist; contain a large amount of water or water vapor.

Hymenoptera. The order of insects which includes the sawflies, ants, wasps, and bees.

hypognathous. Having the head vertical and the mouth directed ventrad.

hypomeron (pl. **hypomera**). The inflexed edge of the pronotum in Coleoptera.

immaculate. Without spots or other markings.

incubate. To brood; to cause to develop, as an egg.

inferior. Beneath, below or behind.

instar. The period or stage between molts in the larva.

Jurassic. The middle geological period of the Mesozoic era.

labrum. The upper lip, which covers the base of the mandible and forms the roof of the mouth.

larva (pl. **larvae**). An immature form of insects which undergo complete metamorphosis.

lateral. Relating, pertaining, or attached, to the side.

legume. A member of the plant family Fabaceae.

lineage. A line of descent with reference to either the offspring or progeny of a single ancestor or the succession of ancestors from which an individual has descended.

loam. Soil containing considerable organic material.

longitudinal. In the direction of the long axis.

maculate. Spotted or marked with figures of any shape, of a color differing from the ground.

maculation. The ornamentation or pattern of markings.

mandibles. The first pair of jaws in insects, stout and tooth-like in chewing insects; the lateral upper jaws of a biting insect.

marginal. Of, belonging to, or near the margin.

median. In or at the middle; of or pertaining to the middle.

mesepimeron. The epimeron of the mesothorax.

mesepisternum. The episternum of the mesothorax.

mesocoxa. The middle coxa.

meson. An imaginary middle plane dividing the insect body into right and left parts.

mesotrochantin. The trochantin associated with the mesocoxa.

mesosternal fossa. In Elateridae, the opening into which the prosternal spine or mucro is fitted.

mesosternum. The underside or breast of the mesothorax.

metacoxal plate. The expanded coxal sclerite of the metathorax.

molting. The act or process of shedding the outer covering of the body or a part of it, see **ecdysis.**

moniliform. Composed of bead-like joints or segments.

monograph. A descriptive taxonomic work similar to a revision but usually more elaborate and complete and also generally covering a larger group of organisms.

montane. Pertaining to the fauna and flora of the mountains.

morphological. Relating to form and structure as opposed to function.

native. Occurring in a region at the time of its discovery.

Nearctic Region or **Realm.** That part of the Holarctic Realm occupying almost the entire continent of North America, including Greenland.

niveus. Snow-white; a pure white with a azure under-tint.

nocturnal. Insects that fly or are active at night.

oblique. Slanting; any direction between perpendicular and horizontal.

obsolete. Almost or entirely absent; indistinct; not fully developed.

obtuse. Not pointed; at an angle greater than a right angle; opposed to acute.

Old World. The Eastern Hemisphere; Europe, Asia, and Africa.

omnivorous. Feeding on both animal and plant food.

opaque. Without any surface luster; not transparent.

orbicular. Round and relatively flat.

oviposit. To deposit or lay eggs or ova.

Pacific Northwest. A geographical area including all of the state of Washington, the northern half of Oregon, Idaho north of the Snake River Plains, the mountainous part of Montana, and an indefinite fringe of southern British Columbia.

Palearctic Realm or **Region.** That part of the Holarctic Realm including Europe, Africa north of Sahara, and Asia as far south as the southern edge of the Yangtse-kiang watershed and the Himalayas, and west to the Indus River.

parameres. Two lateral processes or lobes of the aedeagus in Coleoptera; a pair of appendages forming the distal part of the tegmen and usually protruding on either side of the penis.

paratype. A specimen which has been compared with the type; any specimen in a series from which a description has

been drawn up, other than the one specified as the type specimen of the species, when not otherwise designated.

parthenogenesis. The development of an ovum without fertilization; reproduction by direct growth of germ cells from egg cells without fertilization by the male element.

parthenogenetic. Asexual.

pectinate. Comb-like; with even processes like the teeth of a comb.

pentamerous. Having five-jointed tarsi.

pH. A symbol for expressing the concentration of hydrogen (H+) ions or hydroxyl (OH-) ions.

pheromone. An ectohormone; a substance produced and discharged by an organism which induces a physiological response in another of the same species.

phylogeny. The evolution or development of a genus, family, tribe, or class; the genealogy of the species.

phytophagous. Plant-feeding.

piceous. Pitchy black; black with a reddish tinge.

pleuron (pl. **pleura**). The lateral region of any segment of the insect body, commonly of the thoracic segments.

posterior. Hinder or hindmost; opposed to anterior.

predaceous. Predatory; preying upon other animals.

prepupal stage. A short, typically inactive time preceding the change to pupa.

prognathous. Having the head horizontal with the jaws directed forward.

pronotum. The upper or dorsal surface of the prothorax.

prosternum. The fore-breast; the sclerite between the fore-legs.

prosternopleural suture. That suture of the prothorax which separates the sternum from the pleural pieces.

prothorax. The first, most anterior, thoracic segment, bearing the anterior legs but no wings.

pterothorax. The closely fused meso- and metathorax in certain winged insects.

pubescence. The fine hairy covering of the bodies of certain animals, as insects.

punctate. Set with impressed points or punctures.

punctation. Being marked with punctures or very small pits or deep depressions.

puncture. A small impression on the hard outer parts of the insect body, like that made by a needle.

pupa (pl. **pupae**). The resting inactive instar in all holometabolous insects; the intermediate stage between the larva and the adult.

pupate/pupation. To become/the act of becoming a pupa.

reticulated. Covered with a network of lines; meshed; netted.

revision. Descriptive taxonomic work which usually includes a redescription of all previously known species as well as all new ones. Also see **monograph.**

rhizoid. A slender, rootlike filament which attaches the mycelium of some fungi or the gametophyte of mosses, liverworts, and ferns to the substrate.

riparian. Frequenting rivers or their shores; pertaining to the bank or shore of a river, lake, or stream.

ruber. Clear, unmixed red.

rugose. Wrinkled.

saprophagous. Feeding on decaying matter.

scale. A flat unicellular outgrowth of the body wall of insects, of various shapes and probably a modified seta.

sclerite. Any piece of the insect body wall bounded by sutures.

scutellum. The posterior division of the notum; the third dorsal sclerite of the meso- and metathorax; in Coleoptera, the triangular piece between the elytra.

serrate. Saw-like; with notched edges like the teeth of a saw.

setae (sing. **seta**). Macrotrichia; commonly known as hairs.

sinuate/sinuation. Wavy, specifically of edges or margins.

species. Forms deemed to be discrete because of a consensus of structural (morphological) characters; the primary biological unit; an aggregation of individuals alike in appearance and structure, mating freely and producing young that themselves mate freely and bear fertile offspring resembling each other and their parents.

speciose. Consisting of more than one species.

spermatophore. A covering or capsule containing the spermatozoa.

spermatozoa. The male cell or cells which, by uniting with the ova, fertilize them; the mature sperm cell.

stria (pl. **striae**). In Coleoptera, a longitudinal depressed line or furrow, frequently punctured, extending from the base to the apex of the elytra.

subalpine. Immediately below the timberline.

subangulate. Nearly forming an angle; two margins or lines not quite meeting in an angle.

subequal. Similar, but not equal in size, form or other characters.

submontane. Pertaining to the fauna and flora of the lower mountains and mountain valleys.

sulcus (pl. **sulci**). A furrow or groove; a groove-like excavation.

suture. A seam or impressed line indicating the division of the distinct parts of the body wall; the line of juncture of the elytra in Coleoptera.

synopsis. A brief statement or outline of a subject.

taxonomic. Systematic; relating to classification.

taxonomy. The arranging of species and groups thereof into a system which shall exhibit their relationship to each other and their places in a natural classification.

taxon (pl. **taxa**). A taxonomic group of any rank or size.

tarsal segment. See **tarsus.**

tarsus (pl. **tarsi**). The foot; the jointed appendage attached at the apex of the tibia, bearing the claws; the distal part of the insect leg, consisting of from one to five segments or joints.

temperate. Moderate; in reference to climate, neither very hot nor very cold. In reference to North America, the area between the tropics and the Arctic Circle.

transverse. Running across; cutting the longitudinal axis at right angles.

tribe. A taxonomic category between family and genus, ending in -ini.

trochantin. The basal part of the trochanter when it is two-jointed; in Coleoptera, a piece often present on the outer side of, and sometimes moveable on, the coxa.

truncate. Having a square end; cut off squarely at tip.

type. The single specimen or any one of a series of specimens from which a species is described; the species upon which a genus is founded, or which is selected as the type of a genus.

type species. That species which is the type of a genus.

ultraviolet. The rays of the solar spectrum beyond the violet end.

umbilicate. Naval shaped, or resembling a naval.

unicarinate. Having one carina.

unicolorous. Of one color throughout.

ventral. Of or pertaining to the under surface; abdominal.

vernacular name. The common or local name of an animal or plant.

vestiture. Clothing; the general surface covering of insects, as scales, hairs, etc.

vitta (pl. **vittae**). A broad, longitudinal stripe.

wireworm. The larva of a beetle in the family Elateridae.

(adapted from Blackwelder 1967, Tuxen 1970, Steen 1971, Hitchcock and Cronquist 1973, Guralnik 1974, Torre-Bueno 1985)

APPENDIX L

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