

VOLUME 2

AMERICAN BEEETLES

Polyphaga:
Scarabaeoidea through Curculionoidea



ROSS H. Arnett, Jr. • Michael C. Thomas
Paul E. Skelley • J. Howard Frank

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**Polyphaga:
Scarabaeoidea through Curculionoidea**

Edited by
the late Ross H. Arnett, Jr., Ph.D.
Michael C. Thomas, Ph.D.
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and
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COVER FIGURES: Center - Coccinellidae, *Harmonia axyridus* (Palles) [Photo by Fred J. Santana]. Outer rim, clockwise from top: Ripiphoridae, *Macrosiagon cruentum* (Germar) [by Fred J. Santana]; Meloidae, *Lytta magister* Horn [by Charles L. Bellamy]; Carabidae, *Rhadine exilis* (Barr and Lawrence) [by James C. Cokendolpher]; Melyridae, *Malachius mirandus* (LeConte) [by Max E. Badgley]; Lampyridae, *Microphotus angustus* LeConte [by Arthur V. Evans].

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To Ross H. Arnett, Jr.
1919-1999

and

Mary Arnett
1919-2002

Preface

It has been nearly 40 years since Ross H. Arnett, Jr. published the first fascicle of *The Beetles of the United States: A Manual for Identification*. It quickly became an indispensable tool for professional and amateur coleopterists, general entomologists, and naturalists. Although there were four additional printings it has long been out of print and difficult to obtain. It was prepared to replace Bradley's *A Manual of the Genera of Beetles of America, North of Mexico*, which itself was some 30 years out of date in 1960. *American Beetles* is, in turn, designed to replace *The Beetles of the United States*. It is hoped that it will prove to be as useful as its predecessor.

Ironically, much of the preface to the original edition applies today as well as it did 40 years ago:

Many genera have since been described and reported within the area concerned, and many families have been revised. Extensive changes have been made in the family classification of the beetles of the United States during this period.

The aim of this series of fascicles is to provide a tool for the identification of adult beetles of the United States to family and genus with the aid of illustrations, keys, descriptions, and references to sources for keys and descriptions of the species of this area. All of the genera known to inhabit this area are included in the keys and lists of genera which follow.

The design and format of this work follow closely that of the original edition, but the way it was put together was quite different. Its predecessor was very much the work of one man, Ross H. Arnett, Jr. With a few exceptions (George Ball wrote the carabid treatment for both the 1960 edition and for this one), Dr. Arnett wrote the family treatments of *The Beetles of the United States*. Many specialists reviewed those chapters, but they were almost entirely Dr. Arnett's work.

When Dr. Arnett announced plans to prepare a work to replace *The Beetles of the United States*, coleopterists literally lined up to volunteer their time and expertise in preparing the family treatments. Ultimately, more than 60 coleopterists participated in the preparation of *American Beetles*. This has truly been a community project.

Due to the size of the ensuing work, *American Beetles* is being printed in two volumes. Volume 1 includes the introductory material, and family treatments for the Archostemata, Myxophaga, Adepaga, and Polyphaga: Staphyliniformia. The remainder of the Polyphaga and the keys to families appear here in Volume 2.

Sadly, although Dr. Arnett initiated this project and was instrumental in its planning, he did not live to see its fruition. He became seriously ill in late 1998 and died on July 16, 1999 at the age of 80. We hope he would be pleased with the outcome.

Michael C. Thomas, Ph.D.
Gainesville, Florida
April 3, 2002

Acknowledgments for Volume II

Originally, Ross Arnett was to have authored many of the family treatments, especially for those families with no specialists available. His death in 1999 left many families without an author. Several volunteers stepped forward, but Dan Young of the University of Wisconsin took responsibility for more than his fair share and got several of his enthusiastic graduate students involved in the project also. The members of the Editorial Board, listed in the Introduction, provided guidance, advice, and constructive criticism, but J. Howard Frank of the University of Florida has been outstanding in his unwavering demands for scholarship and proper English, and joined Paul E. Skelley and Michael C. Thomas, both of the Florida Department of Agriculture and Consumer Services, as an editor of Volume II. John Sulzycki of CRC Press has been more than helpful throughout some trying times.

Many of the excellent habitus drawings beginning the family treatments were done by Eileen R. Van Tassell of the University of Michigan for *The Beetles of the United States*, and for Volume 2 of *American Beetles* she produced excellent new ones for families 100, 108, and 119.

Authors of the family treatments often have acknowledgments in their respective chapters throughout the body of the text.

Ross Arnett's widow, Mary, was always his support staff throughout his long and productive career. After Ross' death, she helped by providing free and gracious access to Ross' files, and by her steady encouragement and quiet conviction that we would indeed be able to finish this, Ross Arnett's last big project. Unfortunately, Mary Arnett did not live to see Volume II published. She became ill in the fall of 2001 and died on January 3, 2002.

And I would like to again acknowledge my wife, Sheila, for her patience and forbearance during the long and sometimes difficult path that led to this volume.

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92. ENDOMYCHIDAE Leach 1815

by Paul E. Skelley and Richard A. B. Leschen

Family common name: The handsome fungus beetles**Family synonyms:** Mycetacidae DuVal 1859; Merophysidae Seidlitz 1872; Mychothenidae Sasaji 1978

The two longitudinal sulci or sublateral lines on the pronotum (lacking in some Anamorphinae), absence of internal antennal vesicles, presence of a frontoclypeal suture, 4-4-4 tarsal formula, and absence of subcoxal lines on abdominal ventrite I in most taxa will distinguish this family from other members of the cerylonid series of Cucujoidea.

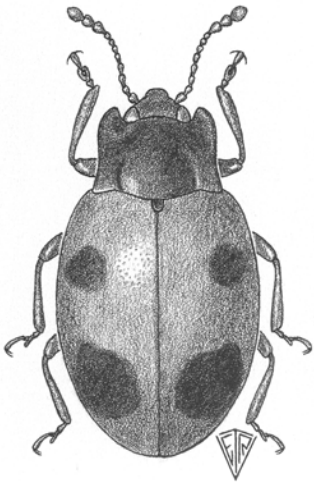


FIGURE 1.92. *Endomychus biguttatus* Say

Description: Oval to elongate-oval or round; size 1.0 to 10 mm, mostly 4 to 8 mm in length; color piceous with reddish or pale markings; vestiture fine or reduced, moderately dense, recumbent to suberect setae. Head slightly deflexed and prognathous; frontoclypeal suture present, vertex with or without a stridulatory file, labrum well-developed. Antennae with 11 antennomeres (in a few, 4, 5, or 8 to 10), with a club of one to three antennomeres (internal vesicles absent), which is enlarged or dimorphic in some; insertions

exposed (concealed in Merophysinae). Clypeus trapezoidal, narrow; labrum small, quadrate, apically arcuate; mandibles moderate, curved, the apices acute, dentate; maxillary palpi with four palpomeres, the apical palpomere securiform, oval, or triangular; gular region broad, mentum transverse, triangular, or rhomboidal; ligula membranous apically; labial palpi with three palpomeres, these short, slender, the apical one larger, cylindrical, or triangular.

Pronotum mostly much broader than the head; shape irregularly trapezoidal, explanate; without internal glandular ducts; borders margined; surface mostly with a transverse, subbasal groove and two longitudinal impressions or pair of basal pits with short sulci extending up to half the distance to the apex (absent in some Anamorphinae and *Eidoreus*); surface finely punctate; pleural region broad; anterior portion sometimes with a stridulatory membrane; prosternum moderate to long in front of coxae and with a narrow to moderate posterior process reaching the mesosternum; procoxal cavities open behind and closed internally. Mesosternum short; mesocoxal cavities laterally open or closed by the metasternum. Metasternum with subcoxal fovea in many species. Legs moderately long; trochantins not exposed; procoxae globose, or slightly transverse, not prominent, separate; mesocoxae rounded to globose, only slightly projecting, widely separated; metacoxae transverse, widely separated; trochant-

ers small to moderate; tibiae slender, apical spurs obscure; tarsal formula 4-4-4 or 3-3-3, the third tarsomere may be minute, tarsomeres I or I-II may be broad and lobed slender; claws simple. Scutellum small to moderate, subtriangular, or arcuate. Elytra entire, apically rounded; surface punctate; epipleuron well developed; without internal glandular ducts, narrowing apically, mostly reaching apex. Abdomen with five or six ventrites, ventrite I mostly longer and mostly without subcoxal lines.

Larva (modified from Lawrence 1982, 1991): Body of various shapes, some are elongate or fusiform, subcylindrical, with dorsal scoli and verrucae; others are onisciform or flattened dorsally with roughened lateral and dorsal protuberances; others are cryptosomatic with numerous fan-shaped setae; size 2 to 10 mm, mostly 5 to 8 mm in length; vestiture various, mostly with setae. Head exerted, mostly prognathous, narrower than the thorax; epicranial suture, when present, U or V-shaped, without coronal suture. Antennae three-segmented, second segment greatly elongate, third inconspicuous. Clypeus transverse or absent; labrum lobe-like; mandibles mostly unidentate to tridentate, mola and membranous protheca present, the latter sometimes very large, concealing the molar area; maxillae with the cardo triangular, palpi three-segmented, stripes fused, mala setiferous or spiny; labium with fused submentum and mentum, ligula, and two-segmented palpi. Most with four stemmata on each side of head. Thorax with the prothorax longer and narrower than the meso- and metathorax; legs four-segmented, with apical tarsunguli. Abdomen ten-segmented with scoli, verrucae, roughened tubercles, or fan-shaped setae dorsally. Spiracles small, annular on the mesothorax and abdominal segments one to eight. Urogomphi present or absent on A9.

Habits and habitats. These beetles are typically mycophagous on spores and hyphae of microfungi (Anamorphinae, Eupsilobiinae, Merophysinae, Holoparamecinae) or on large Basidiomycetes (remaining subfamilies). The most effective way to collect the smaller species is by sifting leaf litter and rotting wood, while other taxa may be collected from their host fungi under bark or on rotting wood. Some species of anamorphines are collected in flight intercept traps while other taxa may come to lights (e.g., *Danae*) or can be collected in cantharidin-baited traps (*Xenomycetes*) (Young 1989). The genus *Lycoperdina* is a specialist on puffballs (Pakaluk 1984). Debris-cloaking behavior has been

reported in Anamorphinae (Leschen and Carlton 1993). Some species reflex bleed (*Endomychus*, *Lycoperdina*, *Rhanidea*), while others apparently do not (*Bystus*, *Clemmus*). *Mycetaea subterranea* (Fab.) is an incidental stored product pest (Bousquet 1990). Information on immatures is scattered and includes Beutel *et al.* (2000), Boving and Craighead (1931), Johnson (1986), Lawrence *et al.* (1999b), Leschen and Carlton (1993), Pakaluk (1984), and Burakowski and Slipinski (2000).

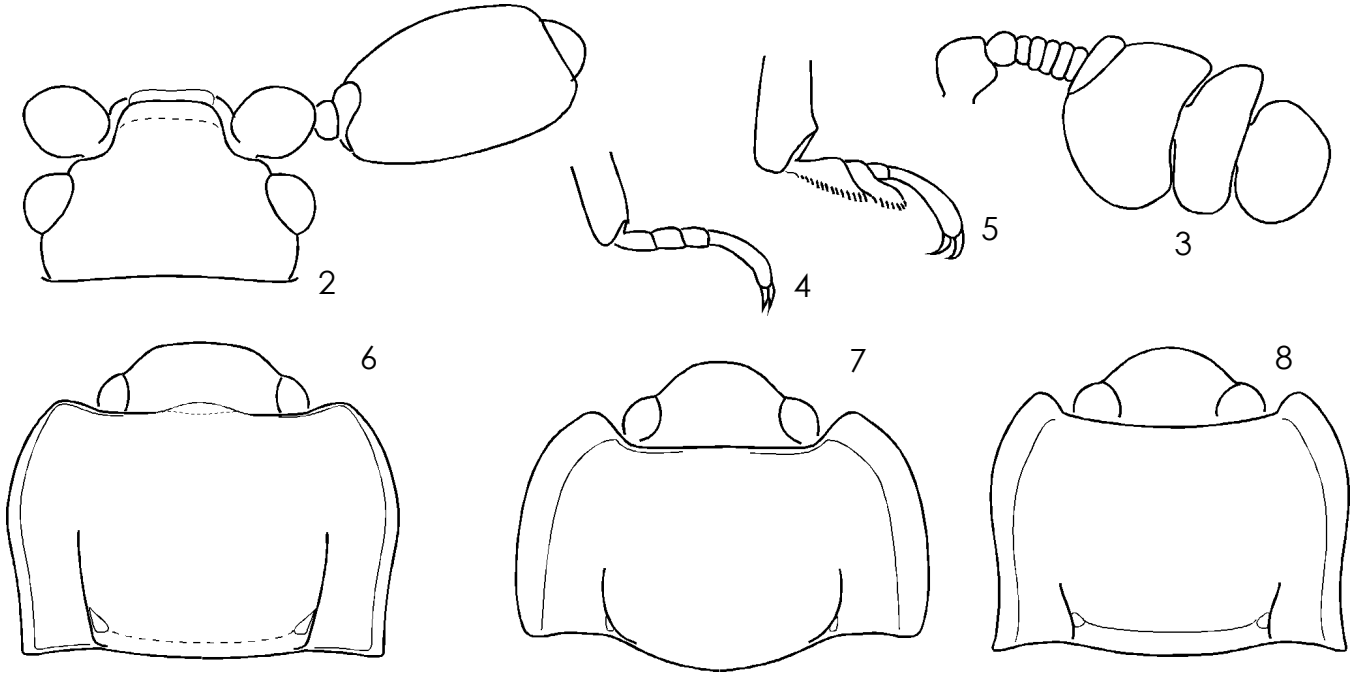
Status of the classification. The Endomychidae are part of the cerylonid series of Cucujoidea (see reviews by Slipinski 1990, Tomaszewska 2000b). The higher classification of the family is in need of revision because the inclusion of some taxa, such as the Epsilobiinae and Anamorphinae, suggest that the group is not monophyletic (Slipinski and Pakaluk 1991). The systematics of the family for the United States is relatively well known while there are numerous undescribed species in Mexico. There is one undescribed species of epipocine from northern United States and Canada (Bousquet and Leschen 2001, 2002), and other anamorphine and holoparamesine taxa that are undescribed from the southeastern United States. Catalogs containing information on the Endomychidae include Blackwelder (1945), Crotch (1873), Leng (1920), and Strohecker (1986). There are also many regional or specialty works with valuable information and keys to taxa, some of these include Downie and Arnett (1996), Hinton (1945), Lawrence *et al.* (1999a), Leschen and Carlton (2000), and Strohecker (1953). In addition to all of the references mentioned above several others are of systematic importance, and include Lawrence and Newton (1995), Pakaluk and Slipinski (1995), Pakaluk *et al.* (1995), Sasaji (1978, 1987, 1990), and Tomaszewska (2000a). Tomaszewska (2000b) reviews the subfamilial classification and presents a key to the subfamilies of the world. That classification is followed here.

Distribution. There are approximately 1300 described species (Strohecker 1986) known from all areas, of which 45 species occur in the United States.

KEY TO THE NEARCTIC GENERA

1. Antennae with 5 antennomeres; terminal 2 antennomeres greatly enlarged in both sexes, appearing fused (Fig. 2) *Trochoideus*
- Antennae with more than 5 antennomeres; club with 1-3 distinct antennomeres, enlarged only on males of some genera and not appearing fused (Fig. 3) 2
- 2(1). Antennal club consists of 1-2 antennomeres 3
- Antennal club consists of 3 antennomeres 4
- 3(2). Body elongate; pronotum with basal grooves
..... *Holoparamesus*
- Body oval; pronotum lacking basal grooves
..... *Eidoreus*
- 4(2). Tarsi linear, with 3-4 tarsomeres; penultimate tarsomere exposed (Fig. 4) 8

- Tarsi pseudotrimerous, with 4 tarsomeres; tarsomere III minute and fused to tarsomere IV; tarsomere II lobed (Fig. 5) 5
- 5(4). Front margin of pronotum with stridulatory membrane (Fig. 6) 18
- Front margin of pronotum without membrane (Figs. 7, 8) 6
- 6(5). Elytra distinctly pubescent 20
- Elytra glabrous or minutely setose 7
- 7(6). Mesosternum with strong median carina
..... *Xenomycetes*
- Mesosternum flat medially *Endomychus*
- 8(4). Form coccinelloid, strongly arched in long axis . 9
- Form long-oval to somewhat elongate 13
- 9(8). Pronotum without sulci 10
- Pronotum with lateral sulci 11
- 10(9). Antenna 9-segmented; dorsal surfaces with vestiture of short sparse fine hairs; tarsal claws basally dentate *Rhymbomicrus*
- Antenna 8-segmented; dorsal surfaces without vestiture of short sparse fine hairs; tarsal claws basally smooth *Micropsephodes*
- 11(9). Tarsal claws basally dentate *Anamorphus*
- Tarsal claws basally smooth 12
- 12(11). Tarsi with 3 tarsomeres; antennae 11-segmented
..... *Clemmus*
- Tarsi with 4 tarsomeres; antennae 10-segmented
..... *Bystus*
- 13(8). Pubescence long, rather dense, and suberect; form oval 14
- Pubescence, if present, fine, short, and decumbent; form more elongate 15
- 14(13). Side margins of pronotum with long, coarse setae; margin broad, raised side margin defined by a complete sublateral line *Mycetaea*
- Side margins of pronotum with fine setae; pronotum with deep groove near each lateral margin at anterior 3/4, lacking sublateral lines *Symbiotes*
- 15(13). Pronotum with groove on each side of mid-line in addition to short lateral sulci *Rhanidea*
- Pronotum without discal grooves 16
- 16(15). Base of pronotum with four distinct pits; body subglabrous *Hadromyachus*
- Base of pronotum with two pits; body glabrous
..... 17
- 17(16). Males without modified antennal club; size 2-3 mm
..... *Stethorhanis*
- Males with swollen antennal club (Fig. 3); size 4-6 mm
..... *Phymaphora*
- 18(5). Prosternum narrow, not prolonged behind; coxae contiguous or nearly so 19
- Prosternum broader, prolonged behind and spatulate; coxae well separated *Mycetina*



FIGURES 2.92-8.92. 2. *Trochoideus desjardinsi* Guérin, head and antenna; 3. *Phymaphora pulchella* Newman, male antenna; 4. *Phymaphora pulchella* Newman, hind tarsus; 5. *Lycoperdina ferruginea* LeConte, hind tarsus; 6. *Lycoperdina ferruginea* LeConte, head and pronotum; 7. *Stenotarsus bispidus* (Herbst), head and pronotum; 8. *Danae testacea* (Ziegler), head and pronotum.

- 19(18). Procoxae globular, distinctly separated *Aphorista*
- Procoxae subcylindrical, contiguous *Lycoperdina*
- 20(6). Pronotum with broad, raised side margins (Figs. 7, 8) 21
- Pronotum with narrow margins *Epipocus*
- 21(20). Short-oval, basal sulcus of pronotum feeble or absent (Fig. 7) *Stenotarsus*
- Long-oval, basal sulcus of pronotum distinct (Fig. 8) *Danae*

Phymaphora Newman 1838, 2 spp., *P. californica* Horn in western United States, *P. pulchella* Newman in eastern United States.

Rhanidea Strohecker 1953, 1 sp., *R. unicolor* (Ziegler), central and eastern United States.

Rhanis LeConte 1854, not Heyden 1837, not Koch 1846

Stethorbanis Blaisdell 1931, 2 spp., California and British Columbia.

Epsilobiinae Casey 1895
(review Pakaluk and Slipinski 1990)

CLASSIFICATION OF THE NEARCTIC GENERA

Endomychidae Leach 1815

Merophysyiinae Seidlitz 1872

Holoparamecinae Seidlitz 1888

Holoparamecus Curtis 1833, 6 spp., widespread. Specimens have been collected in leaf litter or in flight intercept traps.

Calyptobium Aubé 1843

Leiestinae C. G. Thomson 1863
(review by Tomaszewska 2000a)

Eidoreus Sharp 1885, 1 sp., *E. politus* (Casey), Florida.

Epsilobius Casey 1895

Pseudalexia Kolbe 1910

Endomychinae Leach 1815

Endomychus Panzer 1795, 2 spp., *E. biguttatus* Say in the eastern United States, *E. limbatus* (Horn) in the western United States. Larvae and biology of *E. biguttatus* are described by Leschen and Carlton (1988). A hymenopterous parasite of *E. biguttatus* is described by Leschen and Allen (1987).

Eudomychus Latreille 1796

Cyanauges Gorham and Lewis 1874

Cyanauges Gemminger and Harold 1876

Caenomychus Lewis 1893

Stenotarsinae Chapuis 1876

- Danae* Reiche 1847, 1 sp., *D. testacea* (Ziegler), eastern United States.
Oediarthrus Gerstaecker 1858
Coniopoda Gorham 1873
Rhabduchus Gorham 1873

Stenotarsus Perty 1832, 2 spp., eastern United States.

- Quirinus* Thomson 1857
Systaechea Gorham 1890
Stenotarsoides Csiki 1900

Epipocinae Gorham 1873

Epipocus Germar 1943, 6 spp., widely distributed in eastern and southern United States (revision by Strohecker 1977).

Hadromychnus Bousquet and Leschen 2002, 1 sp., *H. chandleri* Bousquet and Leschen, Nova Scotia, Ontario, Quebec, New Hampshire. An undescribed species is also known from Idaho and Montana.

[*Epopterus* Chevrolat 1844, not in North America. Review by Strohecker (1997)]

Lycoperdininae Redtenbacher 1844

Aphorista Gorham 1873, 3 spp., generally distributed throughout the United States. Hoebeke *et al.* (1987) comment on host associations and biology.

Lycoperdina Latreille 1907, 1 sp., *L. ferruginea* LeConte 1824, eastern United States and New Mexico. Larvae and biology are described by Pakaluk (1984).

Mycetina Mulsant 1846, 3 spp., generally distributed throughout the United States. Hoebeke *et al.* (1987) comment on host associations and biology.

Mycetaeinae Jacquelin du Val 1857

Mycetaea Stephens 1830, 1 sp., *M. subterranea* (Fabricius), widespread, adventive.

Anamorphinae Strohecker 1953

Anamorphus LeConte 1878, 2 spp., eastern United States.
Trichopsephus Arrow 1920

Bystus Guérin 1857, 1 sp., *B. ulkei* (Crotch), eastern United States. Larvae and biology of a tropical species described by Leschen and Carlton (1993).

Rhymbus Gerstaecker 1858

Clemmus Hampe 1850, 1 sp., *C. minor* (Crotch), eastern United States.

Clemmus Redtenbacher 1858
Clemmys Seidlitz 1888

Microsephodes Champion 1913, 1 sp., *M. lundgreni* Leschen and Carlton (2000), southeastern United States.

Rhymbomicrus Casey 1916, 3 spp., District of Columbia, Oklahoma and Kansas. Revision by Pakaluk (1987).

Symbiotes Redtenbacher 1849, 3 spp., widely distributed (primarily eastern United States), includes one introduced species.

Microchondrus Wollaston 1854
Eponomastus Buysson 1891

Pleganophorinae Jacquelin du Val 1858

Trochoideinae Chapuis 1876

Trochoideus Westwood 1833, 1 sp., *T. desjardinsi* Guérin, southern Florida, apparently with ants or termites, immigrant from southeast Asia (Skelley and Burgess 1995).

Xenomycetinae Strohecker *in* Arnett 1962

Xenomycetes Horn 1880, 2 spp., California, Nevada, and Washington. Larvae and hosts of *X. laversi* Hatch described by Johnson (1986). Habits of *X. morrisoni* Horn described by Young (1989).

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