The Ground-Beetles of Central America (Carabidae), Part II: Notiophilini, Loricerini, and Carabini

TERRY L. ERWIN

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Terry L. Erwin
ABSTRACT

Erwin, Terry L. The Ground-Beetles of Central America (Carabidae), Part II: Notiophilini, Loricerini, and Carabini. Smithsonian Contributions to Zoology, number 501, 30 pages, 22 figures, 5 tables, 1991. This paper is the second in a planned series designed to cover the ground-beetles of Central America both taxonomically and biogeographically. The area, for purposes of this series, extends from the northern border of Guatemala south to the border between the Republic of Panama and Colombia, including the near shore islands of both oceans. Species that are known to occur now in either Mexico or Colombia in the vicinity of the borders shared with Central American countries, and that may someday be found in Central America, are discussed as well. Included here is part of the subfamily Carabinae, tribes Notiophilini, Loricerini, and Carabini. Other tribes of Carabinae will be covered in another fascicle. Also included herein is a key to the presently described genera of the New World tropics, a classification scheme of the world fauna, and introductory material pertinent to both the series and the present contribution. The following genera are discussed: Notiophilus, Loriceria, and Calosoma. All species, none of which are new, are redescribed and some structural parts of each are illustrated. Notes are provided on natural history and distribution for each species; dot maps illustrate the known Central American range of each taxon; and line or shaded drawings depict diagnostic characters.

SUMARIO

Este fascículo es el segundo de una serie planeada con el fin de cubrir los carabidos de América Central, tanto taxonómica como bio-geográficamente. El área en relación a esta serie se extiende desde la frontera norte de Guatemala hacia el sur en el área limítrofe entre Panamá y Colombia, incluyendo las islas cercanas a las costas de ambos océanos. También son consideradas las especies que han sido encontradas en México o Colombia, muy cerca a las fronteras compartidas con los países de América Central y que alguna vez podrían ser halladas en esta zona. Se incluye en la Parte I la sub-familia Carabinae, las tribus Notiophilini, Loricerini, y Carabini. Otras tribus de la misma sub-familia serán tratadas en la Parte II. También se incluye en la Parte II una clave para la genera del Nuevo Mundo hasta ahora descrita, un esquema de clasificación de la fauna mundial y material y métodos pertinentes a ambas series. En la Parte I, la siguiente genera es tratada: Notiophilus, Loriceria, y Calosoma. Todas las especies aunque descritas anteriormente, son redescritas y algunas partes estructurales ilustradas. Se dan a conocer notas sobre historia natural y distribución para cada taxon; mapas de localizamiento ilustran el alcance de distribución de cada especie en América Central y diferentes dibujos representan características específicas a cada una.
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Dedication

To those who saw the forests before and marveled at their beauty, to those who knew not mass extinction, and to those who still appreciate a mountain, a brook, a beetle; especially to my professor and mentor George E. Ball, upon his retirement from the formality of a classroom; may he never give up teaching.
The Ground-Beetles of Central America (Carabidae), Part II: Notiophilini, Loricerini, and Carabini

Terry L. Erwin

Introduction

One day long ago, George E. Ball asked me to accompany him on a field trip to Mexico. I was a graduate student and had never been to the tropics; I was obviously excited! We were collecting carabids by hand each day and by light on most nights. While the ultraviolet collecting lamp was running, we prepared the previous day’s catch in the back of George’s “El Escarabajo-I” (a large well-stocked camper truck). George wrote up the notes and I struggled to sort all the collected specimens to the morpho-species level for him. Two months of personal tutoring from George during that trip gave me tropical carabid fever and the initial background necessary to devote my career to the fascinating Neotropics and the wealth of hidden evolutionary treasures dwelling there. Since that first introduction, 16 years of organizing specimens (over 100,000) and their accompanying data, studying types, and accumulating literature has taken place. As a result, this fascicle, actually the second of a planned series (see Erwin, 1982a), which will cover faunistically all Central American carabid species, begins to provide a systematic foundation for future ground-beetle studies not only of Central America, but of the West Indies and South America as well. This series then, I dedicate to George—his enthusiasm, his inspiration, and his leadership.

Carl Lindroth’s monumental, 6-part “Ground-Beetles of Canada and Alaska” (1961–1969) appeared beginning with Part 2. Darlington’s equally important “Carabid Beetles of New Guinea” (1952–1971) began with Part 2 also, although for different reasons. In any large-scale serialized monographic treatment of a major fauna, one never knows initially what to include in the preliminary or introductory part. Lindroth published the taxonomy first (Parts 2 through 6) then provided Part 1 (1969), which described methods, procedures, and a historical account of work done on the group for the area of coverage. Darlington, on the other hand, began with his favorite taxon, the Agonini, and provided a quite complete introductory foreword for it and all the subsequent parts, although he also wrote smaller, separate introductions to each of them too. I have chosen here to provide a terse introduction, then proceed with the taxonomy. A complete separate introduction and analysis will be published last. This last part will include methods, procedures, and other standard items (e.g., see Erwin, 1970, 1973, 1974, 1975, 1982a); however most of these have been covered in one way or another in my previous papers.

Because the most important first step in studying any fauna or flora is identification of the taxa, I herein provide a provisional key to all tribes and some genera known presently in the fauna. A more extensive key will accompany the last part. Arrangement of taxa follows that of Erwin (1985). New taxa and additional data pertaining to species covered herein, but discovered after this volume was prepared, will be included in a later supplement. Taxa that I predict may be found in the fauna with additional collecting are keyed and described, but these are not numbered as are the known Central American species.

Lindroth (1969) provided useful data for those becoming acquainted with ground beetles, and these data are especially applicable here. For a general synthesis of knowledge about ground-beetles, the reader is referred to Erwin et al. (1979); for more specifics concerning Neotropical Carabidae see Reichardt (1977) and Erwin and Sims (1984).

The main purpose of this coverage of Central American ground-beetles is to provide the user with an efficient yet simple tool for identification of taxa. It will also lead the user to an accumulated digest of all that is presently known about the taxa, including ecologic and geographic ranges, phylogenetic relationships, and natural history.

Acknowledgments

There is little doubt that I could not have begun this series of papers without many discussions with my mentor and friend.
George E. Ball, with whom such discussions still continue, and to the late Carl H. Lindroth and Philip Darlington Jr., my mentors earlier in my career, who set such a fine examples with their faunal treatments discussed below. I also acknowledge with great appreciation the interchanges, both verbal and written, with David H. Kavanaugh, Gerald R. Noonan, Nigel E. Stok, and Donald R. Whitehead. I thank, for the present paper, George Venable, Gloria Gordon Zimmer, and Sophie Allington for the illustrations, Linda Sims for general assistance in preparation of the manuscript and management of the computerized data base, Gloria N. House for managing the specimens, Leslie Schimmel and Jeannine Weaver for measuring them, Dora Rios for translation of the abstract to Spanish, and the Fluid Research and Environmental Sciences Programs of the Smithsonian Institution and the National Museum of Natural History for providing funding for extensive field work and museum visits over the years. James Liebherr, Lee Herman, Ronald McGinley, and Donald Whitehead provided excellent reviews of the manuscript and contributed significantly to its final form and for that I am grateful, but I take full responsibility for any remaining problems should there be any.

I also very much appreciate the efforts made by several museum curators who loaned material or allowed me to study type specimens in their charge: L. Herman, American Museum of Natural History, New York (AMNH); British Museum (Natural History), London, England (BMNH); David H. Kavanaugh, California Academy of Sciences, San Francisco, California (CAS); Ronald D. Cave, Department of Entomology, Auburn University, Auburn, Alabama (CAVERD); Robert Woodruff, Florida Department of Agriculture, Gainesville, Florida (FDAG); L. Watrous (retired), Field Museum of Natural History, Chicago, Illinois (FMNH); G.R. Noonan, Milwaukee Public Museum, Milwaukee, Wisconsin (GRNO); J. Nègre (deceased), 78 Versailles, 9, Bp, De Lesseps, France (JNEG); A. Newton (now at FMNH), Museum of Comparative Zoology, Cambridge, Massachusetts (MCZ); H. Perrin, J. Menier, Muséum National d’Histoire Naturelle, Paris, France (MNHN); C.A. Triplehorn, Department of Entomology, Ohio State University, Columbus, Ohio (OSU); Henry P. Stockwell, Gorgas Memorial Hospital, Canal Zone, Republic of Panama (STOCHP); George E. Ball, Strickland Museum, University of Alberta, Edmonton, Canada (UASM); R.T. Allen, University of Arkansas, Fayetteville, Arkansas (UAIC); R. Fisher, University of Michigan, Ann Arbor, Michigan (UMA A); and Department of Entomology, Smithsonian Institution, Washington, D.C. (USNM).

Methods

General procedural methods for the series are those that I used before (Erwin, 1970, 1973, 1974, 1975; Erwin and Kavanaugh, 1981). Measures for various body dimensions are coded as follows and are presented in the species descriptions as single specimen measures (if that is all I saw) or as ranges based on the smallest and largest of all specimens studied. All specimens were measured with an electronic measuring device (Erwin, 1978) and measures are presented in millimeters. ABL = apparent body length, that length used by most previous authors as total length as measured by holding up a ruler alongside the specimen (see Erwin and Kavanaugh, 1981). TW = total width across the widest portion of the elytra, actually measured as the left elytron (WE) and doubled to obtain value. All label, specimen measurement, and field data about specimens are computerized (L.J.M. Erwin, 1976), and these records formed the base for study and analysis. Data concerning all Central American material examined are presented in tables and maps (ranges are for Central America only); tables summarize data deduced from specimen labels. In the tables, most localities are presented as latitude/longitude junctures; but for type specimens, place names are cited in the text. Elevations are given in meters even though specimen labels may have them in English units; occasionally, specimen labels give imprecise altitudinal data or none at all, thus in these cases tables include the approximation symbol (−) to indicate approximate altitude derived from topographic maps. When known, a descriptor of the general habitat is given in terms of the Holdridge classification of the Central American environment. Under “Natural History” notes, below, the Holdridge life zones are capitalized. Microsculpture micrographs will be made only for species where sufficient study material allowed coating of body parts and where such character states are necessary for identification.

At present, a problem exists in accurately describing colors in ground-beetles, especially those hues ranging from white-yellow through brown to black. Blues, reds, and greens can, more or less, be described using the English words. Until such time as an international color standard chart is adopted, I am using the following Latin-based terms: BROWN—brunneous; dusky dark brown with blackish overtones; castaneous, rich chestnut; testaceous, brownish yellow. YELLOW—flavous, golden yellow; fulvous, reddish yellow. RED—rufous, reddish brown; ferrugineous, rust red. BLACK—fuscous, dusky black with brown overtones; piceous, black with reddish overtones; and ebeneous, pure black.

As in all large-scale faunal coverages, new material constantly trickles in to the scientist doing the study. Such material received by me after the completion of each fascicle will be covered in a series of supplements. The main series will be published in the present monographic serial; thus future binding of the entire series will be facilitated by a constant style and format.

For ease of finding taxa throughout the series, a numbering system is used as in Erwin (1982b). Tribes are given a number (00) in the list of classified tribes below. Within each tribe, each genus is given a number (.00) and within genera, each species
Reference between keys and descriptions is thus facilitated.

**Materials**

This paper is based on examination of 78 specimens from Central America. I also studied numerous specimens from adjacent areas, of Mexico and Colombia, as well as numerous specimens from other parts of Latin America. These specimens are not formally listed, but are covered under the heading “Geographical Distribution” under each species description. Under “Acknowledgments” are listed the depositories for these materials. Acronyms for personal or institutional collections based on Erwin (1970) are given following each entry.

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**Key to Tribes and Some Genera of Neotropical Carabidae**

(Modified from G.E. Ball in Reichardt, 1977)

**Notes on Use of Keys:** The following key-steps lead either to tribes with a single listed genus (for which discussions can be found in the following pages) or to tribes with several genera. In the latter case, these genera are keyed elsewhere (for the location, see Contents and previous or subsequent parts of the series). Because it is possible that groups occurring in Mexico and South America may yet be discovered in Central America, I have presented a key here to all tropical groups now known from the Western Hemisphere. Illustrations for general carabid characteristics can be found in Ball (1960) and Lindroth (1969) and will be elaborated in the faunal fascicle of this series.

<table>
<thead>
<tr>
<th>Key Step</th>
<th>Description</th>
<th>Tribe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Scutellum concealed by median lobe of posterior margin of pronotum.</td>
<td><strong>OMOPHRONINI</strong>, <em>Omophron</em> Latreille</td>
</tr>
<tr>
<td>1'</td>
<td>Scutellum visible. Intercoxal process of pro sternum not enlarged. Shape of body various</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Scape of antenna not evident from dorsal aspect. Head with short, deep antennal sulcus ventrally between eyes and mouthparts. Labium without suture between submentum and mentum</td>
<td></td>
</tr>
<tr>
<td>2'</td>
<td>Antenna with scape visible from above. Head with or without short deep antennal sulcus</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Abdomen with seven or eight sterna normally exposed. Mandible with at least one setigerous puncture in scrobe. Head with one pair of supraorbital setigerous punctures</td>
<td><strong>BRACHININI</strong></td>
</tr>
<tr>
<td>3'</td>
<td>Abdomen with six sterna normally exposed</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Clypeus broader than distance between sockets of antennae (<strong>CICINDEUTAE</strong>).</td>
<td></td>
</tr>
<tr>
<td>4'</td>
<td>Clypeus narrower than distance between antennal sockets</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Metepisternum narrow, sulcate for entire length. Mesepisternum short. Lacinia of maxilla without articulated tooth</td>
<td><strong>CTENOSTOMATINI</strong>, <em>Ctenostoma</em> Klug</td>
</tr>
<tr>
<td>5'</td>
<td>Metepisternum plate-shaped, not entirely sulcate. Mesepisternum elongate. Lacinia with articulated tooth</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Anterior angles of pronotum more advanced than anterior margin of pro sternum. Anterior sulcus of pronotum separated or not from anterior sulcus of pro sternum (as well as from pro sternal-episternal sulcus). True ornamental pubescence absent. Terminal palpomere of maxillary palp shorter or not than penultimate palpomere</td>
<td><strong>MEGACEPHALINI</strong></td>
</tr>
<tr>
<td>6'</td>
<td>Anterior angles of pronotum not more advanced than anterior margin of pro sternum. Anterior sulcus continuous from pronotum to pro sternum. True ornamental pubescence present in members of most taxa. Terminal</td>
<td></td>
</tr>
</tbody>
</table>
article of maxillary palpus longer than penultimate palpomere in members of most taxa ........................................... CICINDELINI

7(4') Metasternum without antecoxal suture, almost as long as combined length of abdominal sterna. Front tibia without apical spur (but with pair of prominent apical spines). Antenna moniliform. Head and pronotum deeply grooved ......................................................... RHYSODINI

7' Metasternum with antecoxal suture, and shorter in length. Front tibia with one or two apical spurs .................................................. 8

8(7') Front tibia with two spurs terminal and ventral, independent of antenna cleaner (latter present or absent) ............................................. 9

8' Front tibia with one spur apical, one displaced distally, toward antenna cleaner ...................................................... 13

9(8) Tarsal claws unequal, anterior longer and stronger than posterior. Hind coxae contiguous. Elytron with base marginate to scutellum. Scutellar stria short ................................................................. CICINDISINI, Cicindis Bruch

9' Tarsal claws equal. Hind coxae separate. Base of elytron not marginated, or marginated only to lateral constriction ............................................. 10

10(9') Hind coxa extended laterally to elytral epipleuron (TRACHYPACHIDAE) .............................................................. SYSTOLOSOMINI, Systolosoma Solier

10' Hind coxa normal, not in contact laterally with elytral epipleuron ................................................................. 11

11(10') Elytron without subapical fold at outer edge. Anterior tibia simple, without longitudinal sulcus or antenna cleaner ....................................................... NOTOTYLINI, Nototylus Schaum

11' Elytron with subapical fold at outer edge. Anterior tibia with antenna cleaner (PAUSSTAE) ................................................................. 12

12(11') Antenna of 11 clearly visible antennomeres, antennomere 2 distinct, slightly shorter than 3, antennomeres 3-11 free, clearly separated and articulated. Anterior coxae not much projected, separated from each other by normal process ............................................................... OZAENINI

12' Antenna of 10 clearly visible antennomeres, antennomere 2 markedly reduced, indistinct. Anterior coxae prominent, contiguous, separated at base, or not, by narrow process ................................................ PAUSSINI

13(8') Anterior coxal cavities open posteriorly ........................................ 14

13' Anterior coxal cavities closed posteriorly ........................................ 17

14(13) Head with two pairs of supraorbital setigerous punctures. Scape of antenna as long as antennomeres 2-6 together. Head with short, deep sulcus beneath, between eye and gular region. Mandibles spoon-shaped, each with several teeth .............................................................. HILETINI, Eucamaragnathus Jeannel

14' Head with single pair of supraorbital setigerous punctures. Scape of antenna normal, less in length than length of antennomeres 2-6 together. Mandibles average ................................................................. 15

15(14') Frons with series of longitudinal costae. Middle coxal cavities conjunct (entirely enclosed by sterna). Head very broad. Eyes large. Body flat. Size small, length less than 7.0 mm ................................................ NOTIOPHILINI, Notiophilus Duméril

15' Frons without series of parallel carinae. Middle coxal cavities disjunct (not entirely enclosed by sterna). Size large, length greater than 10.0 mm ................................................. 16

16(15') Head across eyes very narrow (less than half as wide as pronotum at apex). Mandibles elongate, each with two sharp teeth near apex. Labrum long, deeply notched, bilobed ........................................... CYCHRINI, Scaphinotus Latreille
16’ Head average. Mandibles of normal length, without large teeth near apex. 
Labrum of normal proportions, apical margin sinuate, but not deeply 
notched ............................................. CARABINI, Calosoma Weber

17(13’) Middle coxal cavities disjunct (not entirely enclosed by sterna) 18
17’ Middle coxal cavities conjunct (entirely enclosed by sterna) 21

18(17) Antennomeres 2–6 with markedly large setae; antennomeres 2–4 irregular in 
shape. Head with two large foveae and deep transverse sulcus behind eyes. 
Elytron with 12 regular striae .................. LORICERINI, Loricera Latreille
18’ Antennomeres 2–6 without markedly elongate setae. Combination of other 
characters not as above .......................... 19

19(18’) Anterior tibia with both spurs nearly apical. Antenna cleaner sulcate, confined 
to posterior surface of tibia, not visible from anterior surface. Body 
pedunculate ........................................ ENCELADINI
19’ Anterior tibia with one spur markedly preapical, above groove of antenna 
cleaner, latter in form of notch in antero-lateral surface, visible anteriorly. 
Body pedunculate or not. Size various ................ 20

20(19’) Elytron with scutellar stria short (or absent). Body pedunculate 
....................................................... SCARITTAE
20’ Elytron with scutellar stria extended to apex, parallel to elytral suture. Body 
not pedunculate (in form nebrioid, amaroid, pterostichoid, elongate, or 
ovoïd) ............................................. MIGADOPINI

21(17’) Scrobe of mandible with one or more setigerous punctures ............. 22
21’ Mandibular scrobe asetose ................................ 29

22(21) Head with single pair of supraorbital setigerous punctures ............. 23
22’ Head with more than one pair of supraorbital setae .......................... 24

23(22) Body pubescent. Size small, length of body less than 6.0 mm. Color rufous 
.......................................................... APOTOMINI, Apotomus Illiger
23’ Body glabrous except for usual fixed setae. Length more than 10.0 mm. Color 
various, black, coppery, green, but not rufous .......... BROSCINI (part)

24(22’) Head with three or more pairs of supraorbital setigerous punctures. Dorsal 
surfaces of posterior tarsomeres glabrous. Size larger, length of body more 
than 10.00 mm ......................................... BROSCINI (part)
24’ Head with two pairs of supraorbital setae. Dorsal surfaces of posterior 
tarsomeres each with two or more setae. Size various .......... 25

25(24’) Penultimate maxillary palpomere pubescent. Frontal grooves more widely 
separated at middle than at anterior part, and terminated before posterior 
margins of eyes. Anophthalmous specimens with penultimate maxillary 
palpomere tumid ................................. 26
25’ Penultimate maxillary palpomere glabrous ........................................ 28

26(25) Terminal maxillary palpmere much shorter and more slender than penulti-
mate palpomere. Elytron with base margined. Tarsomeres with dorsal 
surfaces sulcate longitudinally, or not ................ BEMBIDIINI
26’ Terminal maxillary palpmere normal ............................................. 27

27(26’) Elytron with plica posterior to epipleuron. Antennomere 2 pubescent. Base of 
elytron margined or not. Each tarsomere with dorsal surface grooved 
longitudinally or not ......................... ZOLINI
| 27' | Elytron with internal fold (= plica) not interrupting lateral margin. Antennomere 2 with tuft of setae, only. Base of elytron margined. Dorsal surface of each tarsomere smooth, without longitudinal groove. | POGONININI |
| 28(25') | Elytron without internal plica behind epipleuron. Frontal grooves curved; at middle, distance between eye and adjacent groove subequal to distance between grooves, then expanded to genae and ventral side. Glossal sclerite ("ligula") with six or more setae. Male with front tarsomeres 1-2 expanded and with tooth apically at inner side. | TRECHINI |
| 28' | Elytron with internal plica. Frontal grooves at middle more distant from each other than from eyes; grooves not extended behind eyes. Glossal sclerite ("ligula") with two or three setae. Three or four basal front tarsomeres of male slightly and symmetrically expanded and rounded to apex (or simple) | PSYDRINI |
| 29(21') | Terminal maxillary palpomere articulated obliquely with penultimate palpomere. Integument markedly punctate. Head and pronotum either with pubescence thick and long, or completely glabrous, and surface brilliant, metallic. Elytron with well-developed plica. | PANAGAENI |
| 29' | Terminal and penultimate maxillary palpomeres articulated in straight line, at apex of penultimate palpomere. Integument punctate or not, setose or not. Elytron with or without plica. | 30 |
| 30(29') | Head with more than two pairs of supraorbital setigerous punctures. Lateral edge of pronotum with several setae. Anterior tibia extended latero-apically as prominent, thick tooth-like projection. | Cnemacanthini, Cnemalobus Guérin-Méneville |
| 30' | Head without, or with one or two pairs of supraorbital setigerous punctures. Number of pronotal setae various. Form of front tibia various. | 31 |
| 31(30') | Antennomeres 3-10 each with apical ring of long setae, each seta longer than antennal scape. Labrum elongate, anterior margin projected as broadly rounded lobe. Mentum and submentum fused, mental suture not evident; mentum-submentum bilobed posteriorly, each lobe with three or more long setae. Penultimate labial palpomere long, with numerous setae. Glossal sclerite slender, projected well beyond apices of paraglossae, with four or more apical setae. | Chaetogenyini, Camptotoma Reiche |
| 31' | Antennomeres 3-10 with apical setae shorter than scape. Combination of characters other than above. | 32 |
| 32(31') | Head without or with one pair of supraorbital setigerous punctures. | 33 |
| 32' | Head with two pairs of supraorbital setigerous punctures. | 40 |
| 33(32) | Elytron with apical margin truncate. Body glabrous and shining, depressed. Head without or with one pair of supraorbital setigerous punctures. Pronotum without, or with one pair of setigerous punctures at posterior angles. | CATAPIESINI |
| 33' | Elytron with apical margin not truncate. Body various. Head with one pair of supraorbital setigerous punctures. Pronotum with one or two pairs of setigerous punctures. | 34 |
| 34(33') | Elytron without internal plica near apex. | 35 |
| 34' | Elytron with internal plica. | 38 |
| 35(34) | Antennomere 3 with few setae only, not pubescent; antennomere 4 pubescent in apical 0.33. | 36 |
| 35' | Antennomere 3 pubescent in apical 0.33, antennomere 4 pubescent throughout. | 37 |
36\(35, 60\)  Body rotund, elytra vaulted. Elytron with deep interneurs. Mandibles and maxillae elongate. Mentum of labium shallowly bisinuate, with short tooth

\[\text{PTEROSTICHINI, Cyrtolaus Bates}\]

36'  Body average, elytra normal. Striae of elytra average. Mouthparts not as above

\[\text{PLATYNINI, (part)}\]

37\(35^*\)  Terminal maxillary palpomere elongate, more than twice length of penultimate palpomere. Terminal labial palpomere glabrous, not elongate. Antennomeres of flagellum quadrate

\[\text{PTEROSTICHINI, Cratocerus Dejean}\]

37'  Terminal maxillary and labial palpomeres similar in size and proportions. Antennomeres of flagellum slender, elongate, antenna filiform

\[\text{HARPALINI}\]

38(34')  Surface of elytra and pronotum finely and densely punctate, with fine pubescence. Scutellar stria normal

\[\text{CALLISTINI}\]

38'  Dorsal surface not densely punctate, without fine pubescence. Scutellar interneur short or absent

\[\text{39}\]

39(38')  Elytron with interval 9 almost absent; interneur 8 in form of deep, rugose groove, especially from middle to apex; scutellar interneur short; epipleuron gradually tapered to apex. Terminal palpomere (maxillary or labial) normal

\[\text{OODINI}\]

39'  Elytron with interval 9 normal, wider or narrower; interneur 8 normal, similar to others; scutellar interneur absent; epipleuron expanded near mesothoracic region, then tapered gradually posteriorly

\[\text{PELECIINI, Pelectum Kirby}\]

40(32')  Antennomeres 5–10 submoniliform, short or slightly depressed. Margin of pronotum with approximately seven pairs of setae. Interneur 8 in form of zigzag sulcus, with numerous scattered setigerous punctures. Body subpedunculate. Legs flattened

\[\text{MORIONINI}\]

40'  Antennomeres 5–10 slender, antenna distinctly filiform; or submoniliform and pronotum with single pair of lateral setae; and/or other character states different from above

\[\text{41}\]

41(40')  Elytron with internal plica

\[\text{42}\]

41'  Elytron without internal plica

\[\text{43}\]

42(41)  Penultimate labial palpomere plurisetose

\[\text{ZABRINI, Amara Bonelli}\]

42'  Penultimate labial palpomere bisetose

\[\text{PTEROSTICHINI, (part)}\]

43(41')  Pronotum narrow, distinctly longer than wide, at apex as wide as posterior part of head

\[\text{44}\]

43'  Pronotum not distinctly longer than wide, and/or wider at apex than posterior part of head

\[\text{47}\]

44(43)  Terminal maxillary and/or labial palpomere trianguloid. Tarsomere 4 notched, bilobed

\[\text{45}\]

44'  Terminal maxillary and labial palpomeres cylindrical, normal. Tarsomere 4 bilobed or entire

\[\text{46}\]

45(44)  Terminal labial palpomere trianguloid. Antenna with scape and antennomere 3 of about same length. Tarsal claws pectinate

\[\text{LEBIINI, Agra Fabricius}\]

45'  Terminal maxillary and labial palpomeres triangularoid. Scape of antenna very large, longer than antennomere 3. Tarsal claws smooth

\[\text{DRYPTINI, Neodrypta Basilewsky}\]

46(44')  Tarsomere 4 deeply notched at apex, bilobed, lobes more than 0.5 length of tarsomere 5. Elytra entire, abdominal terga completely covered
CTENODACTYLINI

46' Tarsomere 4 simple or only slightly emarginate apically. Elytron with apex truncate.

ODACANTHINI

47(43') Posterior tibia with inner spur more than 0.5 length of hind basitarsus inner spur longer than outer spur. Tarsal claws pectinate or not.

47' Posterior tibia with spurs more or less equal and shorter than 0.5 length of hind basitarsus.

48(47) Labrum elongate, length more than 0.5 width at base. Head markedly constricted posteriorly, in form of neck. Pronotum widest at base, narrowed anteriorly.

LEBIINI, Nemotarsus LeConte

48' Labrum average, length less than 0.5 width at base. Head not constricted posteriorly in form of neck. Pronotum either widest anteriorly, with sides slightly sinuate before base, or base and apex about equal, and sides rounded.

CYCLOSOMINI

49(48') Pronotum with sides sinuate posteriorly. Dorsum of elytra variegated, or predominantly dark with pale spots. Spurs of middle and hind tibia with serrate margins, each tibia with spines of average length. Each mandible with dorsal and ventral margins basally projected laterally about equally. Antenna with each of flagellomeres 5-10 about twice as long as wide.

MASOREINI

50(47') Labrum appearing elongate (actually about quadrato). Head with one pair of setae ventrally, posterior to submentum. Elytron with penultimate umbilicate seta nearer margin than those adjacent.

LEBIINI, Pericalina

50' Labrum transverse, distinctly wider than long. Head without or with one pair of setae ventrally, posterior to submentum. Elytron with penultimate umbilicate seta in various positions.

LACHNOPHORINI

51(50') Elytron with apical margin truncate.

51' Elytron with apical margin entire, sinuate or not.

52(51) Tarsal claws pectinate.

LEBIINI (part)

52' Tarsal claws with inner margins smooth, not pectinate.

53(52') Dorsal surface glabrous, except for normal fixed setae. Antennomeres 1-3 glabrous, except one long seta on scape, and ring of setae near apex of antennomeres 2 and 3.

53' Dorsal surface finely pubescent. Antennomeres 1-3 pubescent.

54(53) Labial palpomere 3 acuminate apically. Elytron with dorsal surface markedly iridescent. Legs flavous.

LACHNOPHORINI, Eucaerus LeConte

54' Labial palpomere 3 subtruncate to truncate apically, not acuminate. Elytron with dorsal surface iridescent or not. Legs flavous or darker.

55(54') Pronotum approximately pentagonal in shape, with sides sharply constricted posteriorly. Head markedly constricted posteriorly. Mentum and submentum fused, mental suture not evident.

ODACANTHINI, Pentagonica Schmidt-Goebel

55' Pronotum with sides not markedly constricted posteriorly. Head markedly constricted or not posteriorly. Mentum and submentum fused or separated by distinct suture.

LEBIINI (part)
Number 501

56(53°) Size small, length of body about 6.0 mm or less. Scape of antenna longer than combined length of antennomeres 2 plus 3 .......................... ZUPHIINI

56° Size larger, length of body 10.0 mm or more. Antennal scape shorter or longer than combined length of antennomeres 2 plus 3 .......................... 57

57(56°) Antennomeres 5–11 more or less flattened, finely pubescent, central area on each side generally triangular and more or less glabrous ........................ HELLUONINI

57° Antennomeres 5–11 not flattened, uniformly pubescent . . . . . GALERITINI

58(51°) Plane of clypeus sloped downward, surface more or less concave, emarginate anteriorly. Labrum deeply notched .......................... LICININI

58° Plane of clypeus plane not sloped, anterior margin straight or slightly emarginate. Labrum with anterior margin truncate or slightly concave .......................... 59

59(58°) Elytron with interneur 8 impressed and obliquely extended almost to apical sutural angle. Posterior trochanter almost 0.5 length of posterior femur ........................ PERIGONINI

59° Interneur 8 normal. Length of posterior trochanter various .......................... 60

60(59°) Dorsal surface glabrous, except for some scattered setae .................................. 36

60° Dorsal surface more or less pubescent .................................. 61

61(60°) Elytron with odd-numbered intervals setose .................................. PTEROSTICHINI, Agonina (part)

61° All elytral intervals setose .................................. 62

62(61°) Elytron interneurs more deeply impressed on anterior half; and/or anterior half of interneurs coarsely punctate and posterior half finely punctate or impunctate. Setae erect and at least a few longer, as on scape .................................. LACHNOPHORINI (part)

62° Elytron with interneurs equally punctate, impressed or not. Body with short, dense and decumbent, pubescence .................................. PLATYNINI (part)

Classification of Caraboidea
(Italicized taxa occur in Central America)

SUPERFAMILY CARABOIDEA

I. Family Trachypachidae
   01. Tribe Trachypachini
   02. Tribe Systosomini

II. Family Carabidae

Division Nebriiformes

A. Subfamily Carabinae
   a. Supertribe Nebritae
      01. Tribe Nebriini
      02. Tribe Notiokasini
      03. Tribe Opistani
      04. Tribe Cicindisini
      05. Tribe Notophilini
   b. Supertribe Loriceritae
      06. Tribe Loricerini
   c. Supertribe Carabitae
      07. Tribe Carabini

08. Tribe Ceroglossini
09. Tribe Pamborini
10. Tribe Cychrini

d. Supertribe Cicindelitae
   11. Tribe Collyrini
   12. Tribe Megacephalini
   13. Tribe Ctenostomatini
   14. Tribe Mantichorini
   15. Tribe Cicindelini

e. Supertribe Omophronitae
   16. Tribe Omophronini

Division Loxomeriformes

B. Subfamily Scariitae
   f. Supertribe Migadopitae
      17. Tribe Amarotopyini
      18. Tribe Migadopini
   g. Supertribe Elaphritae
      19. Tribe Elaphrini
   h. Supertribe Promecognathitae
      20. Tribe Promecognathini
The notiophilines are highly distinctive terrestrial beetles. They have a large head relative to the narrow prothorax, huge hemispherical eyes, and numerous frontal carinae; many species possess shiny elytral intervals as well. These small beetles are predominantly Holarctic in distribution, with the exception of the single Central American species, which is widespread in Mexico and occurs in Guatemala and El Salvador only at higher elevations. The group is ancient and contains presently but one genus, Notiophilus. As in the loricerines, amarines, and trechines, this group is but a small
element in the Central American fauna; however, the species is important in zoogeographic perspective because it represents a southward extension of a widespread temperate group.

The notiophilines, by most analyses, are primitive carabids; however, because of their unique body form and peculiar character states, it has not been possible to determine sister group relationships. The male parameres are nebrioid, but the median lobe is as peculiar as the external habitus. A single clue to the relationship of these beetles might lie in an observed, but so far unnoted character state of the middle tarsal articles. Adults of *Omophron, Trachypachus, Notiophilus*, and Hiletini have the basitarsomere of the middle legs slightly dilated with squamate setae beneath. This feature is apotypic in the family and occurs nowhere else among the more primitive lineages. The question is whether it is synapotypic or convergent.

For the most recent treatment of this tribe, see Lindroth (1961).

Checklist of Notiophilini of Central America

05.01 *Notiophilus* Duméril (1806:194)

05.01.001 *N. specularis* Bates (1881:19)

05.01 Genus *Notiophilus* Duméril

*Notiophilus* Duméril, 1806:194. [Type species, *Carabus aquaticus* Linné, 1758:408; subsequent designation by Westwood, 1840, 2:6.]

**DIAGNOSTIC COMBINATION.**—Small to medium-small beetles, somewhat depressed and rectangulate in form; forebody and head broad; appendages slender and of medium length in proportion to body, eyes large. Color black with brassy luster, often appendages or part of elytron paler. Frons with series of longitudinal carinae. Middle coxal cavities conjunct (entirely enclosed by sterna). Size small, length less than 7.0 mm.

**NATURAL HISTORY.**—*Notiophilus* usually live in forested habitats among conifer needles, mosses, or in broadleaf tree litter. Some species have adapted to gardens around human residences. Adults are carnivorous, feeding on gnats and spiders, which they capture during their diurnal activities; larvae are also carnivorous, but their diet needs study. The huge eyes of adults, like tiger beetles and certain log-running carabids, are adapted for visual hunting. Most species are “heliophilous and rather xerophilous” (Lindroth, 1961:91). Although wing dimorphism is common in the more northern species, *N. specularis* are apparently always fully winged. Larval stages are known for two northern species but, according to Lindroth (1961:91), “most species probably hibernate as adults.”

In the New World there are 16 species belonging to this genus, only one of which reaches Central America in the northernmost portion. Its characteristic habitus (Figure 1) makes it easily identified, even in the field. The males have three narrowly dilated basal anterior tarsal articles with squamate setae beneath, and one basal middle tarsal article also with squamate setae. In addition, male palpi are generally more dilated than in the females, thus sex determination is easily done with a hand lens in the field.

**TAXONOMY.**—Casey (1913:47) described *Notiophilus chihuahucae* from the Sierra Madre Mountains, Chihuahua, Mexico (lectotype, a male, No. 46839, herein selected, in USNM). This species is apparently valid and keys to *N. biguttatus* in Lindroth (1961) except that individuals are concolorous. It is unrelated to the more southern *N. specularis*, which appears to be sister species of *N. obscurus* Fall of California’s Sierra Nevada and San Bernardino mountains.

**NOTES.**—Lindroth (pers. comm.) stated that he often entertained the notion to work on this interesting genus, but it would require great amounts of material because of intraspeci-
fic variation over the range of wide-ranging species. He never got around to the task, but it should be done, for the biogeography of this ancient lineage might prove instructive, as well as interesting, in shedding light on early Tertiary events.

05.01.001 **Notiophilus specularis** Bates

**Figures 1-3**

*Notiophilus specularis* Bates, 1881:19. [Lectotype female, MEXICO, Vera Cruz, Las Vigas, (Hoge) (BMNH), herein selected.]

**Diagnostic Combination.**—Frons with series of longitudinal costae, eyes large and hemispherical. *Color and luster:* black with metallic luster; appendages rufopiceous except testaceous venter of antennal articles 1 and 2. *Form:* size small, head very broad, eyes large, body flat. *Structure:* dorsal microsculpture isodiametric and granulate, absent from disc of pronotum and elytra, these very shiny. Male median lobe (Figure 2). Female styli small, trianguloid, with ventral seta. ABL = 5.3 to 6.5 mm; TW = 1.3 to 2.4 mm.

**Geographical Distribution** (Figure 3).—The range of this species extends from the highlands of middle Mexico south to El Salvador.

**Natural History.**—*Notiophilus specularis* is generally found, in Mexico, in pine-oak forests and cloud forests above 2000 m, and has been found in El Salvador at 2300 m.

**Notes.**—The Central American species is unique among all other carabids in the fauna in having the disc of the elytra shiny and mirror-like contrasted against dull marginal areas. As in the following tribe, these beetles are not likely to be confused with any others in Central America.

**Material Examined.**—Type (see above), 9 paralectotypes (BMNH), and 25 specimens from Mexico (UASM), 2 from El Salvador (USNM); one of the paralectotypes is from San Geronimo, Guatemala (BMNH) (Table 1).

06 **Tribe LORICERINI**

The loricerines are a lineage of medium-sized and peculiar ground beetles whose autapotypic features include numerous thickened setae on the antennae and mouthparts and 12 striate elytral interneurs. Most species are north temperate in distribution, except the single species discussed below, whose range extends into the Neotropical region at middle to high altitudes. A few other species occur in temperate habitats in the northern portions of the Oriental Region. The group is ancient and contains presently but one genus, *Loricera*, which contains two subgenera. As in the notiophilines, amarines, and trechines, this group is but a small element in the Central American fauna; however, the species is important in zoogeographic perspective because it represents a southward extension of a widespread temperate group.

The loricerines, by most analyses, are primitive carabids; however, because of their unique and peculiar character states, Ball and Erwin (1969) did not discover the sister group of Loricerini nor did they place the loricerines in any new place in the carabid classification of the time. I can do little better today. Although it is generally agreed that the group is ancient and related to the caraboid/nebrioid lineages (the male parameres are nebrioid, but the median lobe is peculiar in that it resembles the form found in more derived carabids), it must remain a group unto itself, and perhaps that is where it belongs, as a sister to the caraboid lineage.

For recent treatments of this tribe, see Lindroth (1961) and Ball and Erwin (1969).

**Checklist of Loricerini of Central America**

06.01 *Loricera* Latreille (1802:88)

06.01.001 *L. rotundicollis* Chaudoir (1863:115)

06.01 **Genus Loricera** Latreille


See Ball and Erwin, 1969, for species groups and another Old World subgenus.

**Diagnostic Combination.**—Antennomeres 2–6 with
**FIGURE 3.** Geographical distribution map of *Notiophilus specularis* Bates in Central America.

**TABLE 1.** Central American locality data deduced from specimen labels; 05.01.001 *Notiophilus specularis* Bates; see Figure 3.

<table>
<thead>
<tr>
<th>Location</th>
<th>Elevation (m)</th>
<th>Original deposit</th>
<th>Month collected</th>
<th>Number specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>near San Gerónimo, Guatemala (15°08'N, 90°11'W)</td>
<td>0990-1010</td>
<td>BMNH</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>near Hacienda Montecristo, El Salvador (14°25'N, 89°22'W)</td>
<td>2300</td>
<td>CAVERD</td>
<td>Oct</td>
<td>2</td>
</tr>
<tr>
<td>Total specimens examined</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>
markedly large setae; antennomeres 2–4 irregular in shape. Head with two large foveae and deep transverse sulcus behind eyes. Elytron with 12 regular striate interneurs.

Natural History.—This genus is composed of 10 species, only one of which enters Central America in the north. Its characteristic habitus (Figure 4) makes it easily identified, even in the field. The males have three quite broadly dilated basal anterior tarsal articles with squamate setae beneath, thus can be easily recognized as males in the field.

The peculiar setal patterns of the adult head, mouthparts, and
antennae indicate a specialized predaceous mode of living, however their prey is unknown. Adults are nocturnal and can be found at night walking over the surface of the soil or litter. During the day, individuals hide under the litter or forest floor debris. Larvae have been found under large stones.

**NOTES.**—Although Ball and Erwin (1969) recently reviewed this group, they did not fully revise it, determine the sister group, nor plot actual distributions of the species. These tasks remain to be done, especially for the Old World.

**06.01.001 Loricera rotundicollis** Chaudoir

**FIGURES 4–6**

Loricera rotundicollis Chaudoir, 1863:115. [Lectotype female, MEXICO, Oaxaca, Capulapam, (Sallt) (MNHP), herein selected.]

**DIAGNOSTIC COMBINATION.**—Antennomeres 2–6 with markedly large setae; antennomeres 2–4 irregular in shape; elytron with 12 regular striate interneurs. Color and luster: mostly black, shining iridescent except head, with rufous or rufopiceous labrum, antennal articles 2, 4–11, mouthparts except palpi, coxae, trochanters, and tibiae; tarsal articles rufoflavous; palpi flavous, antennal articles 1 and 3 piceous. Form: size medium, head round with constricted neck, eyes small but prominent, body flat. Structure: dorsal microsculpture of small, well-impressed transverse meshes. Male median lobe (Figure 5). Female styli small and spatulate with single ventral setae; coxite densely setiferous. ABL = 7.5 to 8.2 mm; TW = 2.9 to 3.4.

**GEOGRAPHICAL DISTRIBUTION (Figure 6).**—The one species is widespread in Mexico from the southern portion of the Sierra Madre Oriental south through Chiapas; in Central America, it currently is known only from the northwest portion of Guatemala, at middle to high elevation.

**NATURAL HISTORY.**—In Mexico, Loricera rotundicollis is generally found in oak and pine forests above 6000 feet in montane moist forest, sometimes as high as 11,000 feet. I expect that this will also be true for the northern parts of Guatemala, although this species is now known from only a few scattered localities there. The larvae are probably specialized predators and can be found under large stones where they also pupate (see Ball and Erwin, 1969, for descriptions of immature stages). All specimens seen by me from Guatemala are brachypterous, with the flight wing developed only to the stigma. Ball and Erwin (1969) point out that of 131 specimens seen by them, 119 were brachypterous and that fully winged individuals were found only in large population samples. I have no large samples from Guatemala at present, but expect winged individuals to be found there.

**MATERIAL EXAMINED.**—Type (see above) and 6 specimens (Table 2).

**07 Tribe CARABINI**

The carabines are a numerous and diverse group of small to large beetles found in most regions of the world. The male genitalia of the Carabini, sensu stricto, Cychrini, Pamborini, Ceroglossini, the so-called “Cicindelinae,” and several other minor groups are virtually identical in their ground plan structure. In addition, these groups possess the primitive antennal comb and thoracic structures, as well as vertically oriented female gonocoxites (apotypically, carabid gonocoxites are horizontally oriented) of early carabid evolution. These groups form the Carabinae, of which only two subgroups are found in Central America—Carabini (Calosoma) and Cicindelitae. The former is covered below, while I shall treat the latter in another fascicle of the series. Many authors (Breuning, 1927–1931; Jeannel, 1940; Gidaspow, 1959, 1963; Lindroth, 1961) have discussed parts of this large group, but as yet no one has dealt with generic relationships in a modern way, for the world. Although this task would be horrendous because of excessive taxonomic splitting in Carabus, it is important that it be done because of the subfamily’s interesting, and perhaps instructive, distribution.

The carabine complex alone should elucidate patterns of continental drift with regard to early carabid dispersal patterns. Jeannel (1940) discussed Calosoma distribution in relation to shifting continents, but he presented no clear evidence of group relationships, although the essence of his conclusions is probably very good. This plateau of carabid evolution was probably the last or next to last major pre-rift radiation in the
FIGURE 6.—Geographical distribution map of *Loricera rotundicollis* Chaudoir in Central America.

TABLE 2.—Central American locality data deduced from specimen labels; 06.01.001 *Loricera rotundicollis* Chaudoir; see Figure 6.

<table>
<thead>
<tr>
<th>Location</th>
<th>Elevation (m)</th>
<th>Original deposit</th>
<th>Month collected</th>
<th>Number specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>near San Marcos, Guatemala (15°04'N, 91°52'W)</td>
<td>2800-2900</td>
<td>USNM</td>
<td>May</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td>Total specimens examined</td>
</tr>
</tbody>
</table>
family (Erwin, 1979, 1985; Kavanaugh and Nègre, 1983). Inclusive taxa derived from this plateau dispersed perhaps across relatively narrow water gaps, but nevertheless were subject to an oceanic filter effect. Still later groups arose, dispersed in the fashion described by Darlington (1957) and Erwin (1985), and gave us the complex caraboid distribution pattern seen today.

Checklist of Carabini of Central America

07.01 Calosoma Weber (1801:20)
   Castrida Motschulsky (1865:300)
   —(C. fulgens Chaudor, 1869:370)
   07.01.001 C. alternans Fabricius (1792:146)
   07.01.002 C. sayi Dejean (1826:198)
   —(C. abbreviation Chaudoir, 1869:371)
   Calodrepa Motschulsky (1865:310)
   07.01.003 C. scrutator Fabricius (1775:239)
   07.01.004 C. aurocinctum Chaudoir (1850:420)
   Carabosoma Gehin (1885:32)
   07.01.005 C. angulatum Chevrolat (1834, fasc. 2:44)
   Camegonia Lapouge (1924:38)
   07.01.006 C. marginalis Casey (1897:340)
   Camedula Motschulsky (1865:303)
   07.01.007 C. glabratum Dejean (1831:565)
   Chrysostigma Kirby, 1837:19
   07.01.008 C. ampliator Bates (1891:223)

07.01 Genus Calosoma Weber

Calosoma Weber, 1801:20. [Type species: Carabus sycophanta Linné, 1758:414; subsequent designation by Latreille, 1810:426.]
Chrysostigma Kirby, 1837:19. [Type species: Carabus calidum Fabricius, 1775:237.]
Castrida Motschulsky, 1865:300. [Type species: Calosoma sayi Dejean, 1826:198.]
Camedula Motschulsky, 1865:303. [Type species: Calosoma glabratum Dejean, 1831:565.]

Key to the Calosoma of Central America
(adapted from Gidaspow, 1963)

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Choices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Middle tibia straight [Figure 8]; pronotum with angulate lateral margins, basal seta absent</td>
<td>2</td>
</tr>
<tr>
<td>1'</td>
<td>Middle tibia arcuate [Figure 9]; pronotum not angulate, but may be markedly arcuate, basal seta present or absent</td>
<td>4</td>
</tr>
<tr>
<td>2(1)</td>
<td>Elytral intervals convex, interneurs finely punctate, punctures of adjacent interneurs connected with transverse grooves, especially basally, causing a scaly appearance</td>
<td>07.01.005 C. angulatum</td>
</tr>
<tr>
<td>2'</td>
<td>Elytral intervals flat, interneurs shallowly striatopunctate or with large coarse punctures connected with transverse grooves basally</td>
<td>3</td>
</tr>
<tr>
<td>3(2)</td>
<td>Metatrochanter asetose; head coarsely punctate</td>
<td>07.01.006 C. marginalis</td>
</tr>
<tr>
<td>3'</td>
<td>Metatrochanter unisetose; head finely and densely punctate</td>
<td>07.01.007 C. glabratum</td>
</tr>
</tbody>
</table>
Calosoma fulgens Chaudoir

**Figures 8, 10**

*Calosoma fulgens* Chaudoir, 1869:370. [Holotype male, PARAGUAY (Bonpland) (MNHP), as originally given by Chaudoir.]

**Diagnostic combination.**—Color a cupreous sheen with non-contrasting elytral foveae in intervals 3, 7, and 11; middle tibia markedly arcuate; hind angle of pronotum setigerous. *Color and luster:* dark, metallic green, disc of elytra bright cupreous, mouthparts, appendages, and most of the venter dark piceous, metapistemum with metallic reflections. *Form:* medium-sized and narrow, females with apparently inflated elytra; eyes large and prominent. *Structure:* elytral intervals moderately convex; head finely punctulate on disc of frons, more coarsely punctate and rugose laterally. Male with 3 dilated basal protarsal articles each with setiferous pad beneath, metatrochanter ventrally hooked apically, and with median lobe sharply bent laterally near apex. Female without tarsal pads, trochanter hooks, but with multiple setae on sternum VI. Microsculpture mostly effaced from dorsal surface, finely isodiametric where present. ABL = 24.0 to 28.0 mm; TW = 10.0 to 11.0 mm (from Gidaspow, 1963).

**Geographical distribution.**—Gidaspow (1963) stated that these beetles are distributed from Paraguay to Colombia.

**Natural history.**—According to Gidaspow (1963), this species occurs in grasslands, prairies, and savannas amongst herbaceous vegetation. This kind of habitat results from agricultural practices of mankind, and it is likely that species occurring in northern South America will invade Panama as the forests are cut away to make pastures and croplands. *Calosoma fulgens* is known from Cali, Colombia, and should be looked for in eastern Panama and on the Azuero Peninsula.

**Material examined.**—Type (see above), 3 specimens from Ecuador (USNM).

07.01.001 *Calosoma alternans* (Fabricius)

**Figures 11, 20**

*Carabus alternans* Fabricius, 1792:146. [Holotype in ZMC according to Gidaspow (1963).]

*Carabus armatum* Reiche, 1842:377. [Lectotype, male, in MNHP, herein selected.]

*Callistriga coxale* Motschulsky, 1865:307. [New name for *Calosoma armatum* Reiche, 1842:377 (not *armata* Laporte, see below.).]

**Diagnostic combination.**—These beetles are at once recognized by their dull, blackish elytra with alternating rows of wide and narrow intervals, the 3, 7, and 11 each with large contrasting foveae. In addition, the middle tibia is markedly arcuate and the basally lobed pronotum has latero-basal setae, one near each hind angle. *Color and luster:* blackish with faint cupreous reflections, somewhat greenish on head and pro-
FIGURE 7.—Habitus of Calosoma sayi Dejean, dorsal aspect, male from Cayuga, Guatemala.
FIGURES 8, 9.—Right middle tibia, male, lateral aspect: 8, *C. angulatum* Chevrolat, San José, Costa Rica; 9, *C. fidgens* Chaudoir, Posorja, Ecuador.

notum, mouthparts, appendages and venter dark piceous. *Form:* medium-sized and narrow, females with more apparently inflated elytra; eyes large and prominent. *Structure:* elytral intervals convex, 3, 7, and 11 catenate with large deep foveae; all intervals with transversely arranged scales; head with moderately coarse punctulae. Microsculpture finely isodiametric, effaced from surface of pronotum. Male with 3 dilated basal protarsal articles each with setiferous pad beneath, middle tibia with small brush of setae apicomedially, metatrochanter ventrally hooked apically, and median lobe moderately bent laterally near narrowed apex. Female without tarsal pads, trochanter hooks, with multiple setae on Setae VI. ABL = 23.0 to 30.0 mm; TW = 10.0 to 12.0 mm (from Gidaspow 1963).

**GEOGRAPHICAL DISTRIBUTION** (Figure 20).—The range of this species extends from northern Argentina to Mexico.

**NATURAL HISTORY.**—According to Gidaspow (1963), these beetles have a broad habitat range, including dense lowland forests, deciduous scrub forest, grasslands, and cultivated fields throughout the tropical and subtropical regions of its distribution. In Central America, they occur in both TROPICAL DRY and MOIST FOREST. All specimens I studied were fully winged; the species is a highly vagile dispersant.

**TAXONOMY.**—Gidaspow (1963) discussed at length the taxonomic problems involved with this species and its sister species, *C. sayi*. I agree with her conclusion that there are two species involved and her application of names is correct; however I do not believe that subspecies are warranted given the present level of study on the material at hand; thus I regard *C. granulatum* a junior synonym of *C. alternans*. Various other names have been associated with *alternans* at the subspecific level or less. It appears to me all these are based on a few specimens from different places and that no one has had good enough series to show separately evolving populations. Until this kind of study is done, I prefer to regard the species as monotypic, treating the various proposed names as synonyms.

**MATERIAL EXAMINED.**—Types (see above) and 10 specimens (Table 3).

**07.01.002 Calosoma sayi Dejean**

**FIGURES 7, 12, 21**

*Calosoma sayi* Dejean, 1826:198. [Lectotype female, "Amérique septentrionale" (Say) (MNHP), herein selected.]

*Calosoma arnota* LaPorte, 1835:156. [Lectotype male, MEXICO (Gory) (MNHP), herein selected.]

*Calosoma sayi abdominale* Gehin, 1885:58. [Lectotype male, MEXICO (MNHP), herein selected.]

*Calosoma sayi virginica* Casey, 1897:344. [Lectotype male, USA, Virginia, Norfolk (Casey) (USNM), herein selected.]

*Calosoma cuprascens* Roeschke, 1900:71. [Holotype male, probably Greater Antilles (depository unknown).]

**DIAGNOSTIC COMBINATION.**—These beetles are very similar to the preceding species except the elytral costae are more or less equally wide and only moderately raised. The males have two basal tarsal articles of the anterior leg clothed beneath with spongy pubescence. *Color and luster:* blackish with cupreous or greenish reflections; blackish to green on head and pronotum, mouthparts, appendages, and venter dark piceous. *Form:* size medium, narrow, females not wider than males; eyes large and prominent. *Structure:* elytral intervals moderately convex, 3, 7, and 11 catenate with large, deep foveae, all transversely scaly; head rugosely punctate. Microsculpture finely isodiametric or on pronotum slightly transverse. Male with 2 dilated basal tarsal articles on foreleg, each with setiferous pad beneath; middle tibia with large brush of setae apicomedially; metatrochanter ventrally hooked apically; and male median lobe moderately bent laterally near apex. Female
without tarsal pads, trochanter hooks; with multiple setae on sternum VI. ABL = 22.0 mm to 30.0 mm; TW = 9.0 to 12.0 mm (from Gidaspow, 1959).

**GEOGRAPHICAL DISTRIBUTION** (Figure 21).—The range of this species extends from the northeastern United States south to Panama and throughout the Greater Antilles.

**NATURAL HISTORY.**—In Central America, these beetles are found in TROPICAL DRY and VERY DRY FORESTS, TROPICAL MOIST FOREST, PREMONTANE MOIST, and WET FORESTS in cultivated lands, along streams and rivers, and in scrub lands, from sea level to 1210 m. All specimens studied are fully winged; the species is a highly vagile dispersant. They may be found in January, February, April, May, June, July, and August.

**TAXONOMY.**—Gidaspow (1963) discusses at length the taxonomic problems involved with this species and its sister species, *C. alternans*. I discuss the problem under that species (see above). I do not believe that subspecies are warranted given the present level of study on the material at hand; thus I regard *C. abdominale* Géhin and *C. virginica* Casey as junior synonyms of *C. sayi*. It appears to me all these are based on a few specimens from different places and that no one has had good enough series to show separately evolving populations. Until this kind of study is done, I prefer to regard the species as monotypic, treating all the various proposed names as synonyms.

**MATERIAL EXAMINED.**—Types (see above) and 47 specimens (Table 4).
Table 3.—Central American locality data deduced from specimen labels; 07.01.001 Calosoma alternans (Fabricius); see Figure 20.

<table>
<thead>
<tr>
<th>Location</th>
<th>Elevation (m)</th>
<th>Original deposit</th>
<th>Month collected</th>
<th>Number of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>near Choluteca, Honduras (13°18'N, 87°12'W)</td>
<td>0030-0041</td>
<td>USNM</td>
<td>Jun</td>
<td>1</td>
</tr>
<tr>
<td>near Margarita, Panama (9°21'N, 79°53'W)</td>
<td>0000-0010</td>
<td>STOCHP</td>
<td>May</td>
<td>1</td>
</tr>
<tr>
<td>near Madden Dam, Panama (9°13'N, 79°37'W)</td>
<td>0076-0082</td>
<td>MCZ</td>
<td>May</td>
<td>1</td>
</tr>
<tr>
<td>near Altos de Maje, Panama (9°10'N, 78°49'W)</td>
<td>0020-0010</td>
<td>USNM</td>
<td>Apr</td>
<td>2</td>
</tr>
<tr>
<td>near Diablo, Panama (8°58'N, 79°34'W)</td>
<td>0020-0160</td>
<td>USNM</td>
<td>Aug</td>
<td>1</td>
</tr>
<tr>
<td>near Ancon, Panama (8°58'N, 79°33'W)</td>
<td>0025</td>
<td>USNM</td>
<td>May</td>
<td>1</td>
</tr>
<tr>
<td>near Rio Hato, Panama (8°23'N, 80°16'W)</td>
<td>0020-0050</td>
<td>STOCHP</td>
<td>Aug</td>
<td>1</td>
</tr>
<tr>
<td>near La Sabanas, Panama (uncertain locality)</td>
<td>–</td>
<td>USNM</td>
<td>Aug</td>
<td>1</td>
</tr>
</tbody>
</table>

Total specimens examined 10

Calosoma abbreviatum Chaudoir

Figure 13

Calosoma abbreviatum Chaudoir, 1869:371. [Holotype male, PERU or BOLIVIA (LaFerri-Sénécire)(MNHP).]

Diagnosis.—Among our species with foveate elytral intervals 3, 7, and 11, this species is easily recognized by its metallic green color, non-contrasting elytral foveae, and blunt metatrochanters. Color and luster: brassy green, forebody more green; mouthparts, appendages, and venter dark piceous. Form: size small to medium, relatively broad; female elytra expanded; eyes large and prominent. Structure: elytral intervals shallowly convex, 3, 7, and 11 catenate with large foveae, all transversely scaly; head finely rugosely punctate. Microsculpture finely isodiametric, effaced from pronotum, pronotum with finely and coarsely punctate surface. Male with 3 dilated basal tarsal articles on foreleg, each with setiferous pad beneath; middle tibia with large brush of setae apicomically; metatrochanter apically truncate; and male median lobe apex straight and broadly rounded. Female without tarsal pads; with blunt metatrochanter; and with multiple setae on sternum VI. ABL = 22.0 to 25.0 mm; TW = 8.5 to 10.0 mm (from Gidaspow 1963).

Geographical Distribution.—The range of this species extends from about 15°S to 3°N latitude along the west coast of South America. It can be expected to occur on the Azuero Peninsula or in the Darien (when the latter is cut over for agriculture.)

Natural History.—According to Gidaspow (1963), these beetles live in cotton-growing regions of Peru, on the brush-covered plains of Colombia, and in sandy areas between the coast and oak covered foothills of Ecuador and Peru. Should the west coast of Panama (Darien) be opened to agriculture, it is possible these beetles could expand their range northward. These beetles are fully winged and no doubt fly quite well.

Material Examined.—Type (see above) and 4 specimens from Peru.

07.01.003 Calosoma scrutator (Fabricius)

Figure 14

Carabus scrutator Fabricius, 1775:239. [Holotype, sex unknown, USA, Virginia (Banks) (BMNH).]

Diagnosis.—These large, metallic blue and green beetles with broad, inflated elytra are easily recognized on color alone, differing from members of C. aurocinctum by the former’s bicolorous pronotum. Color and luster: black, with golden green spots near eyes, pronotum with dark blue or black disc and golden green or purplish margins, elytra metallic or dark green, venter with blue luster, appendages brown with blue luster. Form: size large, head and pronotum narrow relative to broadly inflated elytra; eyes large and prominent. Structure: pronotum with sides evenly arcuate, small rounded hind angles, without basal setae; elytra serrate near humerus, with striatopunctate interneurs, punctures connected by scaly cross lines, intervals convex; middle tibia markedly arcuate, in male with dense brush of reddish setae; male foretarsi with four dilated articles, each with spongy pubescence beneath. ABL = 25.0 to 35.0 mm; TW = 11.0 to 16.0 mm (from Gidaspow, 1959).

Geographical Distribution.—Although I have not seen
FIGURE 21.—Geographical distribution map of *Calosoma aryi* Dejean in Central America.

any specimens, Gidaspow (1959, 1963) indicates that these beetles were found in Guatemala and Venezuela. They are relatively common also in Mexico.

**Natural History.**—Lindroth (1960) indicates that these beetles are found in hardwood forests where they feed on tent and noctuid caterpillars. They are fully winged and fly to lights at night.

**Material Examined.**—Type (see above) and 20 specimens from the eastern United States.

07.01.004 *Calosoma aurocinctum* Chaudoir

**FIGURE 15**

*Calosoma splendidum* Perbosc, 1839:261. [Holotype female, MEXICO, Santa Domingo (MNHP).]

*Calosoma aurocinctum* Chaudoir, 1850:420. [New name for *C. splendidum* Perbosc, 1839:261, not Dejean.]

**Diagnostic Combination.**—Pronotum without basal seta at hind angle; venter brilliant metallic, pronotum bluish green, not contrasting with elytra. **Color and luster:** bluish green, elytra often dark green with purple or golden margin, femur blue, tibiae and tarsi black. **Form:** size medium large, head and pronotum narrow relative to broadly inflated elytra; eyes large and prominent. **Structure:** pronotum with sides evenly and markedly arcuate, small pointed hind angles, without basal setae; elytra serrate or not near humerus, with striatopunctate interneurs, punctures connected by shallow scaly cross lines, intervals convex; middle tibia markedly arcuate in male,
TABLE 4.—Central American locality data deduced from specimen labels; 07.01.002 Calosoma sayi Dejean; see Figure 21.

<table>
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<tr>
<th>Location</th>
<th>Elevation (m)</th>
<th>Original deposit</th>
<th>Month collected</th>
<th>Number specimens</th>
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<td></td>
<td></td>
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<tr>
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<td>FDAG</td>
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<td>USNM</td>
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<td>Jun</td>
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<td>USNM</td>
<td>Jan</td>
<td>2</td>
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<td>OSU</td>
<td>Jan</td>
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</tbody>
</table>

Total specimens examined 47
slightly arcuate in female; male foretarsi with four dilated articles, each with spongy pubescence beneath. ABL = 22.0 to 30.0 mm; 10.0 to 14.0 mm (from Gidaspow, 1959).

**GEOGRAPHICAL DISTRIBUTION.**—Although Gidaspow (1963) reported this species from Nicaragua, I have seen no specimens from there and she does not give, in her paper, a list of depositories associated with each species. As several southern Mexican records are available, I have no doubt that this species could inhabit Central America.

**NATURAL HISTORY.**—Unknown.

**MATERIAL EXAMINED.**—Type (see above) and 10 specimens from Mexico.

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**07.01.005 Calosoma angulatum Chevrolat**

FIGURES 9, 16, 22

*Calosoma angulatum* Chevrolat, 1834, fasc. 2:44. [Holotype male, MEXICO, Vera Cruz, Boca del Monte (Lezuer) (MNHP).]

*Calosoma angulicolle* Chaudoir, 1869:377. [Lectotype female, COLOMBIA, Santa Marta (Fontanian) (MNHP), herein selected.] [See also Breuning, 1928a:103.]

*Calosoma uniforme* G6hin, 1885:63. [Type, sex unknown, MEXICO, Mazatlan (MNHP).] [See also Breuning, 1928a:101.]

*Calosoma forreri* Géhin, 1885:64. [Type, male, ARIZONA (MNHP).] [See also Jeannel, 1940:203.]

**DIAGNOSTIC COMBINATION.**—Middle tibia straight (as in Figure 8); pronotum with angulate lateral margins, basal seta absent; elytral intervals convex, interneurs finely punctate, punctures of adjacent interneurs connected with transverse grooves especially basally causing a markedly scaly appearance. **Color and luster:** black, base of pronotum and elytral margin with bluish or metallic green luster, venter black, shiny. **Form:** size medium large, elongate and narrow, head and pronotum narrow relative to broadly inflated elytra; eyes large and prominent. **Structure:** pronotum with sides evenly and markedly arcuate, small pointed hind angles, without basal setae; elytra serrate near humerus, with fine striatopunctate interneurs, punctures connected by shallow scaly cross lines, intervals flat; middle tibia nearly straight in male and female; male foretarsi with four dilated articles, each with spongy pubescence beneath. ABL = 23.0 to 32.0 mm; TW = 9.5 to 13 mm (from Gidaspow 1959).

**GEOGRAPHICAL DISTRIBUTION.**—Gidaspow (1959, 1963) indicates that this so called polytypic species has a known range extending from Colorado south to Colombia and Venezuela. It is likely they have become adapted to the margins of cultivated lands as well. They often fly to lights at night.

**MATERIAL EXAMINED.**—Types (see above) and 12 specimens (Table 5).

---

**07.01.006 Calosoma marginalis Casey**

**DIAGNOSTIC COMBINATION.**—Middle tibia straight (as in Figure 8); pronotum with angulate lateral margins, basal seta absent; elytral intervals flat, interneurs shallowly striatopunctate; metatrochanter asetose; head coarsely punctate. **Color and luster:** black, shiny, often with green luster on head, sides of pronotum, and elytral margin and foveae. **Form:** size large, head and pronotum narrow relative to broadly inflated elytra; eyes large and prominent. **Structure:** pronotum with sides obtusely angulate, small triangular hind angles, without basal setae; elytra serrate near humerus, with fine striatopunctate interneurs, punctures connected by shallow scaly cross lines, intervals flat; middle tibia nearly straight in male and female; male foretarsi with four dilated articles, each with spongy pubescence beneath. ABL = 23.0 to 32.0 mm; TW = 9.5 to 13 mm (from Gidaspow 1959).

**GEOGRAPHICAL DISTRIBUTION.**—Gidaspow (1963) indicated she saw two specimens from Costa Rica. However, I could not locate these specimens, and I have seen no other records of this species from Central America. Otherwise the species has a known range extending from Colorado south to Cuernavaca, Mexico.

**NATURAL HISTORY.**—Members of this species can be found near wet or damp areas with shrubby vegetation or small trees in the high deserts of the American southwest and Mexico; they occur in cultivated land as well. They fly to lights at night.

**MATERIAL EXAMINED.**—Types (see above) and 30 specimens from the United States and Mexico.

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**07.01.007 Calosoma glabratum Dejean**

**FIGURE 18**

*Calosoma glabratum* Dejean, 1831:565. [Lectotype male, COLOMBIA (Goudot) (MNHP), herein selected.] *Calosoma bolivianum* Géhin, 1885:65. [Type, male, “Bolivia” as originally given by Géhin (MNHP).]
DIAGNOSTIC COMBINATION.—Middle tibia straight (as in Figure 8); pronotum with angulate lateral margins, angles rounded, basal seta absent; elytral intervals flat, interneurs shallowly striatopunctate; metatrochanter unisetose, round at tip; head finely and densely punctate. Color and luster: black, venter dark brown. Form: size small, head and pronotum narrow relative to broadly inflated elytra; eyes large and prominent. Structure: pronotum with sides obtusely angulate, small pointed hind angles, without basal setae; elytra serrate near humerus, with fine striatopunctate interneurs, punctures connected by shallow scaly cross lines at base, intervals flat; middle tibia straight in male and female; male foretarsi with three dilated articles, each with spongy pubescence beneath.

ABL = 18.5 mm; TW = 8.0 to 10.5 mm (from Gidaspow, 1963).

GEOGRAPHICAL DISTRIBUTION.—Gidaspow (1963) indicated that she saw specimens from Panama; however, I could not locate these specimens, and I have seen no other records of this species from Central America. Otherwise, the species has a known range extending from Bolivia north to Colombia.

NATURAL HISTORY.—Members of this species are found in cultivated lands and in natural grasslands. They are fully winged and probably are strong flyers as are other members of the genus.

MATERIAL EXAMINED.—Types (see above) and 4 specimens from Colombia.
TABLE 5.—Central American locality data deduced from specimen labels; 07.01.005 Calosoma angulatum Chevrolat; see Figure 22.

<table>
<thead>
<tr>
<th>Location</th>
<th>Elevation (m)</th>
<th>Original deposit</th>
<th>Month collected</th>
<th>Number specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>near Santa Rosa, Costa Rica</td>
<td>0280–0317</td>
<td>USNM</td>
<td>May</td>
<td>1</td>
</tr>
<tr>
<td>near Santa Rosa, Costa Rica</td>
<td>0280–0317</td>
<td>USNM</td>
<td>Jun</td>
<td>5</td>
</tr>
<tr>
<td>near Santa Rosa, Costa Rica</td>
<td>0280–0317</td>
<td>USNM</td>
<td>Jul</td>
<td>2</td>
</tr>
<tr>
<td>near La Caja, Costa Rica</td>
<td>1020–1300</td>
<td>USNM</td>
<td>Aug</td>
<td>1</td>
</tr>
<tr>
<td>near San Jose, Costa Rica</td>
<td>1000–1200</td>
<td>USNM</td>
<td>Sep</td>
<td>2</td>
</tr>
<tr>
<td>near San Jose, Costa Rica</td>
<td>1000–1200</td>
<td>USNM</td>
<td>Oct</td>
<td>1</td>
</tr>
<tr>
<td>Total specimens examined</td>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

07.01.008 Calosoma ampliator Bates

FIGURE 19

Calosoma ampliator Bates, 1891:223. [Lectotype female, MEXICO, Durango, Villa Lerdo (Höge) (BMNH), herein selected.]

DIAGNOSTIC COMBINATION.—Pronotum without basal setae at hind angle; venter black or piceous, no metallic reflections. Color and luster: black, venter black or dark brown, shiny. Form: size medium large, head and pronotum narrow relative to broadly inflated elytra; eyes large and prominent. Structure: pronotum with sides markedly arcuate, small rounded hind angles, without basal setae; elytra serrate near humerus, with fine striaopunctate interneurs, punctures connected by shallow scaly cross lines, intervals flat or slightly convex; middle tibia straight in male and female; male foretarsi with three dilated articles, each with spongy pubescence beneath. ABL = 21.0 to 27.0 mm; 8.5 to 11.0 mm (from Gidaspow, 1959).

GEOGRAPHICAL DISTRIBUTION.—Gidaspow (1959) indicates she saw specimens from Chiriquí, Panama; however, I could not locate these specimens, and I have seen no other records of this species from Central America. Otherwise the species has a known range extending from Chihuahua to Veracruz in Mexico.

NATURAL HISTORY.—Although unknown for sure, members of this species likely can be found near wet or damp areas with shrubby vegetation or small trees in the Chihuahuan Desert of Mexico; it is possible they will or have become adapted to the margins of cultivated lands as have other species in the genus.

MATERIAL EXAMINED.—Type (see above) and 11 specimens from Mexico.
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