

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

TERRY L. ERWIN

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## 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*, *Loricera*, 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 carábidos 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 Méjico 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*, *Loricera*, 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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# Contents

	<i>Page</i>
Introduction . . . . .	1
Acknowledgments . . . . .	1
Methods . . . . .	2
Materials . . . . .	3
Key to Tribes and Some Genera of Neotropical Carabidae . . . . .	3
Classification of Caraboidea . . . . .	9
Tribe NOTIOPHILINI . . . . .	10
Checklist of Notiophilini of Central America . . . . .	11
Genus <i>Notiophilus</i> Duméril . . . . .	11
<i>Notiophilus specularis</i> Bates . . . . .	12
Tribe LORICERINI . . . . .	12
Checklist of Loricerini of Central America . . . . .	12
Genus <i>Loricera</i> Latreille . . . . .	12
<i>Loricera rotundicollis</i> Chaudoir . . . . .	15
Tribe CARABINI . . . . .	15
Checklist of Carabini of Central America . . . . .	17
Genus <i>Calosoma</i> Weber . . . . .	17
Key to the <i>Calosoma</i> of Central America . . . . .	17
<i>Calosoma fulgens</i> Chaudoir . . . . .	18
<i>Calosoma alternans</i> (Fabricius) . . . . .	18
<i>Calosoma sayi</i> Dejean . . . . .	20
<i>Calosoma abbreviatum</i> Chaudoir . . . . .	23
<i>Calosoma scrutator</i> (Fabricius) . . . . .	23
<i>Calosoma aurocinctum</i> Chaudoir . . . . .	24
<i>Calosoma angulatum</i> Chevrolat . . . . .	26
<i>Calosoma marginalis</i> Casey . . . . .	26
<i>Calosoma glabratum</i> Dejean . . . . .	26
<i>Calosoma ampliator</i> Bates . . . . .	28
Literature Cited . . . . .	29

### 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

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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. Stork, 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, B<sup>b</sup>, 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 (MNHP); 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 *ebineous*, 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

(.000). 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.

**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.

- 1 Scutellum concealed by median lobe of posterior margin of pronotum. Intercostal process of prosternum very broad, covering mesosternum. Body almost circular in outline . . . . . **OMOPHRONINI, *Omophron* Latreille**
- 1' Scutellum visible. Intercostal process of prosternum not enlarged. Shape of body various . . . . . 2
- 2(1') 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 . . . . . **PSEUDOMORPHINI, *Pseudomorpha* Kirby**
- 2' Antenna with scape visible from above. Head with or without short deep antennal sulcus . . . . . 3
- 3(2') 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 . . . . . **BRACHININI**
- 3' Abdomen with six sterna normally exposed . . . . . 4
- 4(3') Clypeus broader than distance between sockets of antennae (**CICINDELITAE**) . . . . . 5
- 4' Clypeus narrower than distance between antennal sockets . . . . . 7
- 5(4) Metepisternum narrow, sulcate for entire length. Mesepisternum short. Lacinia of maxilla without articulated tooth . . . . . **CTENOSTOMATINI, *Ctenostoma* Klug**
- 5' Metepisternum plate-shaped, not entirely sulcate. Mesepisternum elongate. Lacinia with articulated tooth . . . . . 6
- 6(5') Anterior angles of pronotum more advanced than anterior margin of prosternum. Anterior sulcus of pronotum separated or not from anterior sulcus of prosternum (as well as from prosternal-episternal sulcus). True ornamental pubescence absent. Terminal palpomere of maxillary palpus shorter or not than penultimate palpomere . . . . . **MEGACEPHALINI**
- 6' Anterior angles of pronotum not more advanced than anterior margin of prosternum. Anterior sulcus continuous from pronotum to prosternum. True ornamental pubescence present in members of most taxa. Terminal

- 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 (PAUSSITAE) . . . . . 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 . . . . . **SCARITITAE**
- 20' Elytron with scutellar stria extended to apex, parallel to elytral suture. Body not pedunculate (in form nebrioid, amaroid, pterostichoid, elongate, or ovoid) . . . . . **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 palpomere much shorter and more slender than penultimate palpomere. Elytron with base margined. Tarsomeres with dorsal surfaces sulcate longitudinally, or not . . . . . **BEMBIDIINI**
- 26' Terminal maxillary palpomere 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 . . . . . POGONINI
- 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 . . . . . PANAGAEINI
- 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-Mèneville
- 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 . . . . . PTEROSTICHINI, *Cyrtolaus* Bates
- 36' Body average, elytra normal. Striae of elytra average. Mouthparts not as above . . . . . 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 . . . . . PTEROSTICHINI, *Cratocerus* Dejean
- 37' Terminal maxillary and labial palpomeres similar in size and proportions. Antennomeres of flagellum slender, elongate, antenna filiform . . . . . HARPALINI
- 38(34') Surface of elytra and pronotum finely and densely punctate, with fine pubescence. Scutellar stria normal . . . . . CALLISTINI
- 38' Dorsal surface not densely punctate, without fine pubescence. Scutellar interneur short or absent . . . . . 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 . . . . . 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 . . . . . PELECIINI, *Pelecium* 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 . . . . . 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 . . . . . 41
- 41(40') Elytron with internal plica . . . . . 42
- 41' Elytron without internal plica . . . . . 43
- 42(41) Penultimate labial palpomere plurisetose . . . . . ZABRINI, *Amara* Bonelli
- 42' Penultimate labial palpomere bisetose . . . . . PTEROSTICHINI (part)
- 43(41') Pronotum narrow, distinctly longer than wide, at apex as wide as posterior part of head . . . . . 44
- 43' Pronotum not distinctly longer than wide, and/or wider at apex than posterior part of head . . . . . 47
- 44(43) Terminal maxillary and/or labial palpomere trianguloid. Tarsomere 4 notched, bilobed . . . . . 45
- 44' Terminal maxillary and labial palpomeres cylindrical, normal. Tarsomere 4 bilobed or entire . . . . . 46
- 45(44) Terminal labial palpomere trianguloid. Antenna with scape and antennomere 3 of about same length. Tarsal claws pectinate . . . . . LEBIINI, *Agra* Fabricius
- 45' Terminal maxillary and labial palpomeres trianguloid. Scape of antenna very large, longer than antennomere 3. Tarsal claws smooth . . . . . 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 . . . . . 48
- 47' Posterior tibia with spurs more or less equal and shorter than 0.5 length of hind basitarsus . . . . . 50
- 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 . . . . . 49
- 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 . . . . . CYCLOSOMINI
- 49' Pronotum with sides rounded or nearly straight, not sinuate. Dorsum of elytra uniformly rufous, rufo-piceous, or piceous, same color as head and pronotum. Spurs of middle and hind tibia with margins smooth. Each mandible basally with dorsal margin extended laterally as broad, shelf-like projection. Flagellomeres 5-10 each not more than 1.25 times as long as wide . . . . . MASOREINI
- 50(47') Labrum appearing elongate (actually about quadrate). 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 . . . . . 51
- 51(50') Elytron with apical margin truncate . . . . . 52
- 51' Elytron with apical margin entire, sinuate or not . . . . . 58
- 52(51) Tarsal claws pectinate . . . . . LEBIINI (part)
- 52' Tarsal claws with inner margins smooth, not pectinate . . . . . 53
- 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 . . . . . 54
- 53' Dorsal surface finely pubescent. Antennomeres 1-3 pubescent . . . . . 56
- 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
- 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)

- 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 . . . . . GALERTINI
- 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') Elytral 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 Systolosomini
- II. Family Carabidae
  - Division Nebriiformes
    - A. Subfamily Carabinae
      - a. Supertribe Nebriitae
        - 01. Tribe Nebriini
        - 02. Tribe Notiokasiini
        - 03. Tribe Opisthiini
        - 04. Tribe Cicindisini
        - 05. Tribe *Notiophilini*
      - b. Supertribe Loricitae
        - 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 Scaritinae
    - f. Supertribe Migadopitae
      - 17. Tribe Amaratypini
      - 18. Tribe Migadopini
    - g. Supertribe Elaphritae
      - 19. Tribe Elaphrini
    - h. Supertribe Promecognathitae
      - 20. Tribe Promecognathini

- i. Supertribe Siagonitae
  - 21. Tribe Enceladini
  - 22. Tribe Siagonini
- j. Supertribe Hiletitae
  - 23. Tribe Hiletini
- k. Supertribe Pseudomorphitae
  - 24. Tribe *Pseudomorphini*
- l. Supertribe Scarititae
  - 25. Tribe Cnemacanthini
  - 26. Tribe *Scaritini*
  - 27. Tribe *Clivinini*
- C. Subfamily Paussinae
  - m. Supertribe Metriitae
    - 28. Tribe Metriini
  - n. Supertribe Paussitae
    - 29. Tribe Nototylini
    - 30. Tribe Mystropomini
    - 31. Tribe *Ozaenini*
    - 32. Tribe Protopaussini
    - 33. Tribe *Paussini*
  - o. Supertribe Brachinitae
    - 34. Tribe Crepidogastrini
    - 35. Tribe *Brachinini*
- Division Melaeniformes
- D. Subfamily Broscinae
  - p. Supertribe Melaenitae
    - 36. Tribe Melaenini
    - 37. Tribe Cymbionotini
  - q. Supertribe Broscitae
    - 38. Tribe Broscini
  - r. Supertribe Apotomitae
    - 39. Tribe Apotomini
- Division Psydriformes
- E. Subfamily Psydrinae
  - s. Supertribe Psydritae
    - 40. Tribe Gehringiini
    - 41. Tribe Psydrini
    - 42. Tribe Melisoderini
    - 43. Tribe Tropidopterini
    - 44. Tribe Meonidini
    - 45. Tribe Patrobini
    - 46. Tribe Amblytelini
  - t. Supertribe Rhysoditae
    - 47. Tribe *Rhysodini*
  - u. Supertribe Trechitae
    - 48. Tribe *Trechini*
    - 49. Tribe Zolini
    - 50. Tribe *Pogonini*
    - 51. Tribe *Bembidiini*
- F. Subfamily Harpalinae
  - v. Supertribe Pterostichitae
    - 52. Tribe *Morionini*
    - 53. Tribe *Pterostichini*
    - 54. Tribe *Zabrini*
  - w. Supertribe Panagaeitae
    - 55. Tribe Bascanini
    - 56. Tribe *Panagaeini*
    - 57. Tribe Agonicini
    - 58. Tribe Disphaericini
    - 59. Tribe *Peleciini*
  - x. Supertribe Callistitae
    - 60. Tribe Cuneiptectini
    - 61. Tribe *Callistini*
    - 62. Tribe Chaetogenyini
    - 63. Tribe *Oodini*
    - 64. Tribe *Licinini*
  - y. Supertribe Harpalitae
    - 65. Tribe *Harpalini*
  - z. Supertribe Dryptitae
    - 66. Tribe Dryptini
    - 67. Tribe *Zuphiini*
    - 68. Tribe *Galeritini*
  - a'. Supertribe Anthiitae
    - 69. Tribe *Helluonini*
    - 70. Tribe Anthiini
    - 71. Tribe Helluodini
  - b'. Supertribe Orthogoniitae
    - 72. Tribe Idiomorphini
    - 73. Tribe Amorphomerini
    - 74. Tribe Orthogoniini
    - 75. Tribe *Catapiesini*
  - c'. Supertribe Ctenodactylitae
    - 76. Tribe Hexagoniini
    - 77. Tribe *Ctenodactylini*
  - d'. Supertribe Platynitae
    - 78. Tribe *Platynini*
  - e'. Supertribe Lebiitae
    - 79. Tribe *Perigonini*
    - 80. Tribe *Lachnophorini*
    - 81. Tribe Graphipterini
    - 82. Tribe *Cyclosomini*
    - 83. Tribe *Masoreini*
    - 84. Tribe *Odacanthini*
    - 85. Tribe *Lebiini*

#### 05 Tribe NOTIOPHILINI

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 northern most 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

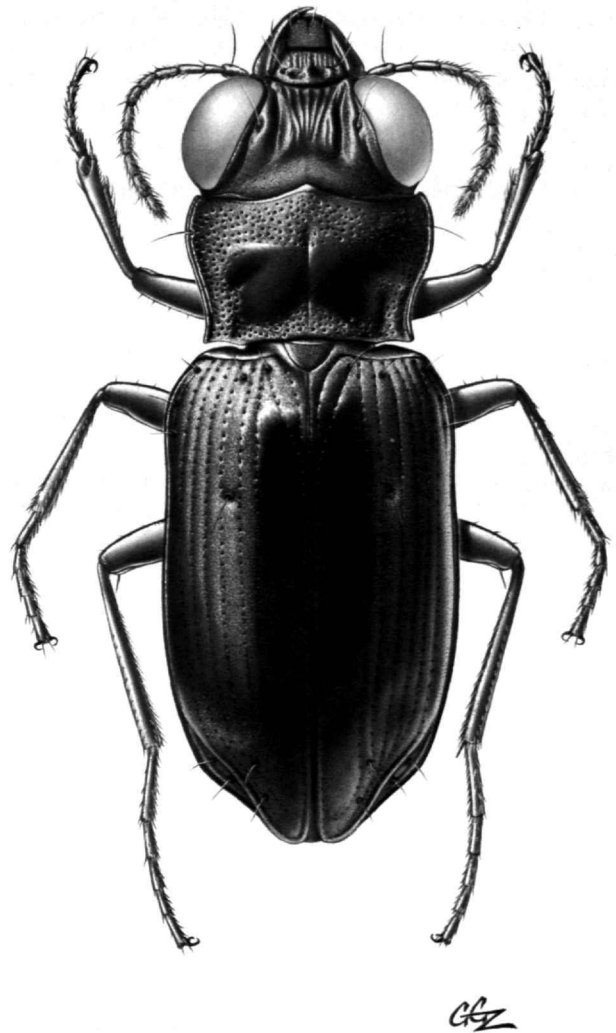


FIGURE 1.—Habitus of *Notiophilus specularis* Bates, dorsal aspect, female from 12.8 mi (20.6 km) E Sta. Catarina Juquila, Oaxaca, Mexico.

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 chihuahuae* 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, (Höge)(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.

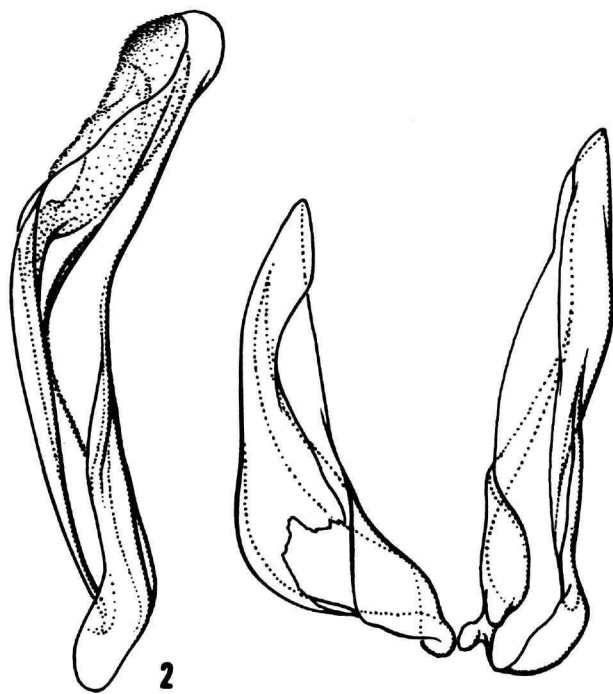


FIGURE 2.—Medium lobe of male genitalia, left lateral aspect, of *Notiophilus specularis* Bates, from 21.8 mi (35.1 km) N Juchatengo, 7100' (2164 m), Oaxaca, Mexico.

**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

*Loricera* Latreille, 1802:88. [Type species: *Carabus pilicornis* Fabricius, 1775:243. Monotypy.]

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.

Location	Elevation (m)	Original deposit	Month collected	Number specimens
near San Geronimo, Guatemala (15°08'N, 90°11'W)	0990-1010	BMNH		1
near Haceinda Montecristo, El Salvador (14°25'N, 89°22'W)	2300	CAVERD	Oct	2
		Total specimens examined		3

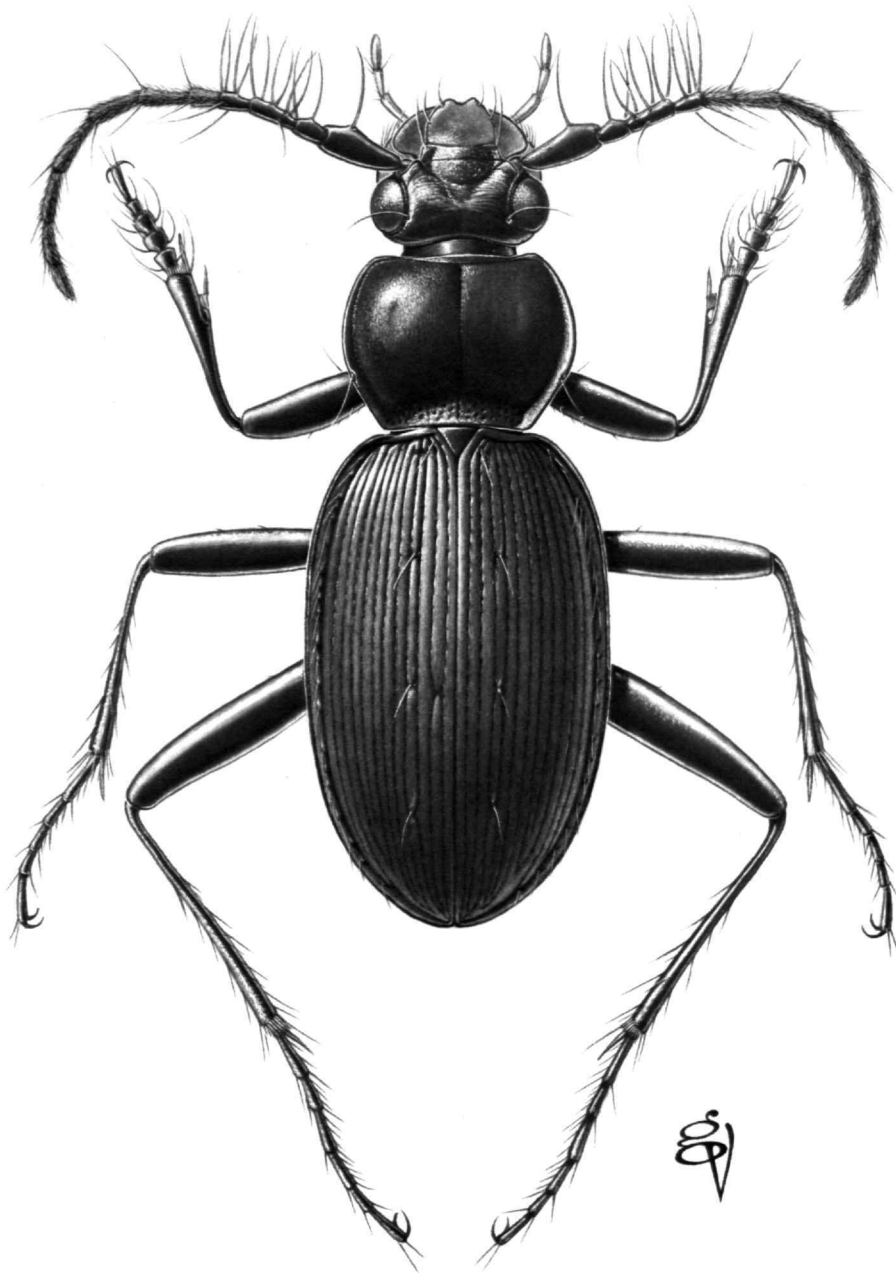


FIGURE 4.—Habitus of *Loricera rotundicollis* Chaudoir, dorsal aspect, male from 27.0 km NW San Marcos, 2800–2900 m, San Marcos, Guatemala.

markedly large setae; antennomeres 2–4 irregular in shape. Head with two large foveae and deep transverse sulcus behind eyes. Elytra 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, (Sallé) (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

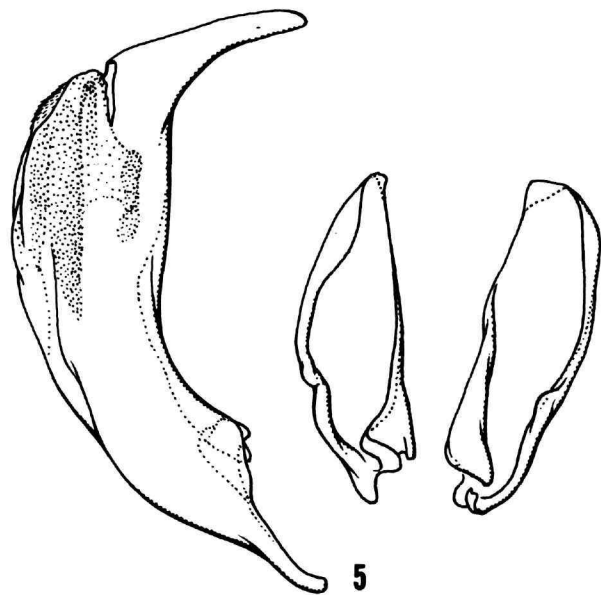


FIGURE 5.—Medium lobe of male genitalia, left lateral aspect, of *Loricera rotundicollis* Chaudoir, left lateral aspect, male from 27.0 km NW San Marcos, 2800–2900 m, San Marcos, Guatemala.

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 Cicindelinae. 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.

Location	Elevation (m)	Original deposit	Month collected	Number specimens
near San Marcos, Guatemala (15°04'N, 91°52'W)	2800–2900	USNM	May	6
Total specimens examined				6

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* Chaudoir, 1869:370)
    - 07.01.001 *C. alternans* Fabricius (1792:146)
    - 07.01.002 *C. sayi* Dejean (1826:198)
      - (*C. abbreviatum* Chaudoir, 1869:371)
    - Calodrepa* Motschulsky (1865:310)
      - 07.01.003 *C. scrutator* Fabricius (1775:239)
      - 07.01.004 *C. aurocinctum* Chaudoir (1850:420)
    - Carabosoma* Géhin (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.]

- Calodrepa* Motschulsky, 1865:310. [Type species: *Calosoma scrutator* Fabricius, 1775:239.]
  - Carabosoma* Géhin, 1885:32. [Type species: *Calosoma angulatum* Chevrolat, 1834, fasc. 2:44.]
  - Camegonia* Lapouge, 1924:38. [Type species: *Calosoma prominens* LeConte, 1853:400.]
- See Gidaspow (1959, 1963) and Lindroth (1961) for complete synonymies and modern revisions of the New World species. Old World nomenclature is not covered here.

DIAGNOSTIC COMBINATION.—Very large, robust beetles with broadly inflated elytra and narrow forebody (Figure 7). Color somber black or piceous, or metallic often with contrasting marginal stripes and/or elytral foveae; appendages piceous or black, or with faint metallic reflections if not solid metallic. Mandibles unisetose. Antennal comb terminal, transverse, between slightly offset terminal spurs. Anterior coxae open behind; middle coxae disjunct; hind coxae contiguous. Elytra with 15 or 16 interneurs, often obliterated by macrosculpture; intervals 4, 8, and 12 with several, often metallic, foveae. All Central American species fully winged. Anterior tarsal articles of male 1 + 2, or 1–4 dilated and pubescent beneath. Male parameres asetose, nearly symmetric. Female with spatulate, ventrally setiferous styli; coxites densely setiferous; ovipositor oriented vertically. ABL = 18.5 to 35.0 mm in Central American species.

NATURAL HISTORY.—The species of this genus are diverse in their habitat preference. Many species occur in open woodland, hardwood forests, prairie, acacia scrub, and riverine forests. They are highly vagile and move around to areas of caterpillar outbreaks where both adults and larvae feed ravenously on the caterpillars. Many *Calosoma* are semiariboreal and will climb the trees for their meal; the larvae are not generally good climbers, however. Adults hibernate and often live more than one year. Sex of adults can be determined by reference to the anterior tarsal articles, some of which will be dilated and pubescent beneath in males.

Key to the *Calosoma* of Central America

(adapted from Gidaspow, 1963)

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

- 4(1') Pronotum without basal seta at hind angle . . . . . 5  
 4' Pronotum with basal seta at hind angle (if broken, setigerous pore easily visible)  
 . . . . . 7  
 5(4) Venter black or piceous, no metallic reflections . . . . . 07.01.008 *C. ampliator*  
 5' Venter brilliant metallic . . . . . 6  
 6(5') Pronotum metallic green, not contrasting with elytra; femur bluish green  
 . . . . . 07.01.004 *C. aurocinctum*  
 6' Pronotum dully metallic blue or black with cupreous, green, or purple margins,  
 markedly contrasting with green elytra; femur reddish brown with blue or purple  
 luster . . . . . 07.01.003 *C. scrutator*  
 7(4') Elytral intervals 3, 7, and 11 each with a serial row of smooth spots, not contrasting  
 with elytral color; elytra brassy or capreous; apex of male median lobe sharply  
 bent . . . . . *C. fulgens*  
 (Colombia, Ecuador, Paraguay)  
 7' Elytral intervals 3, 7, and 11 each with a serial row smooth spots of highly  
 contrasting with elytral color, each about equal in width to interval; elytra green  
 or black; apex of male median lobe straight or slightly arcuate . . . . . 8  
 8(7') Base of pronotum evenly arcuate, hind angles not produced posteriorly [Figure 13]  
 . . . . . *C. abbreviatum*  
 (Colombia, Ecuador, Peru)  
 8' Base of pronotum lobed medially, sinuate laterally so that hind angles are more or  
 less produced posteriorly. [Figures 11, 12] . . . . . 9  
 9(8') Elytra with intervals 2, 6, and 10 of equal or slightly narrower width than adjacent  
 ones . . . . . 07.01.002 *C. sayi*  
 9' Elytra with intervals 2, 6, and 10 much narrower than adjacent ones  
 . . . . . 07.01.001 *C. alternans*

### *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, metapisternum 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-

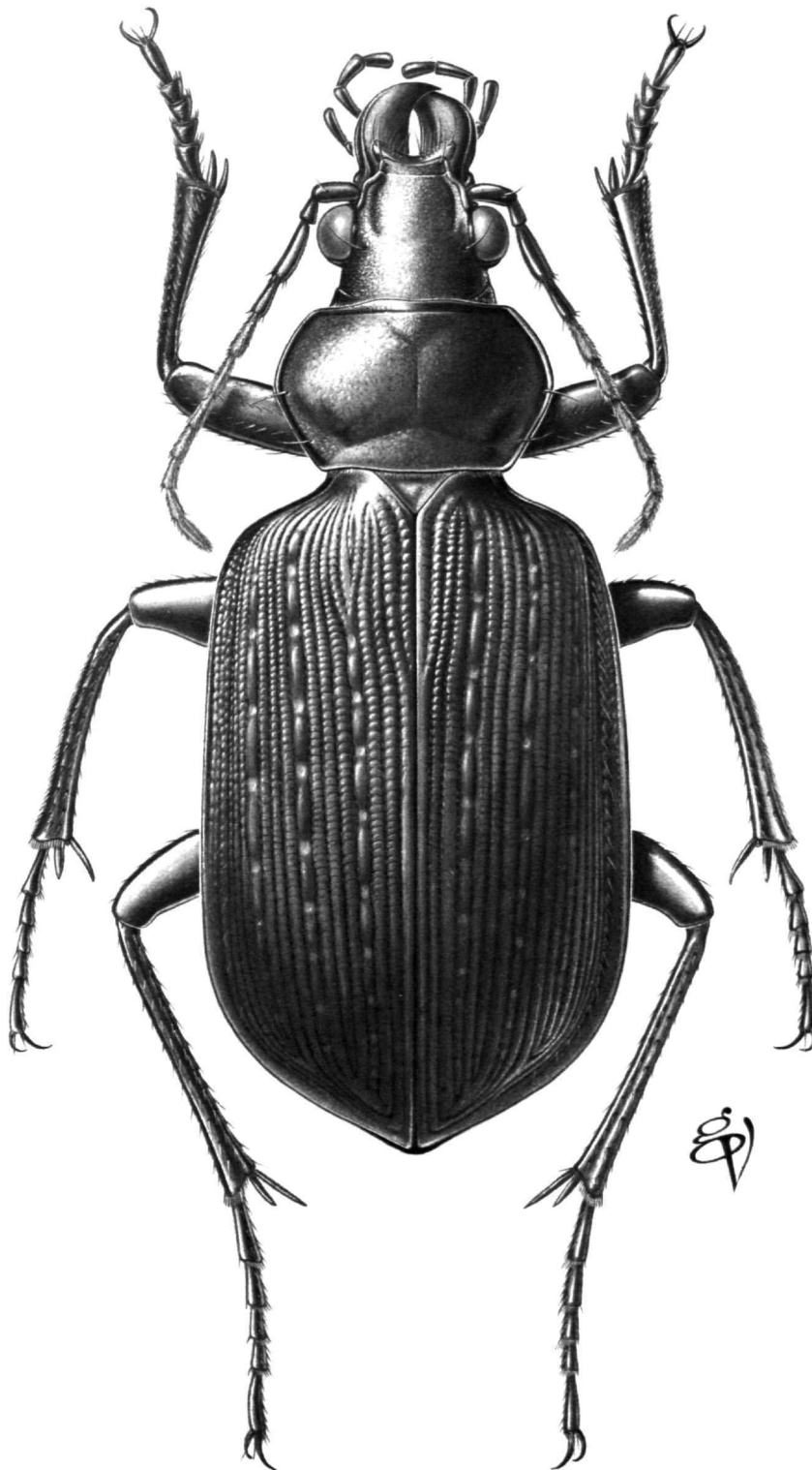


FIGURE 7.—Habitus of *Calosoma sayi* Dejean, dorsal aspect, male from Cayuga, Guatemala.



FIGURES 8, 9.—Right middle tibia, male, lateral aspect: 8, *C. angulatum* Chevrolat, San Jose, Costa Rica; 9, *C. fulgens* 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 apicomediaally, 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 armata* LaPorte, 1835:156. [Lectotype male, MEXICO (Gory) (MNHP), herein selected.]

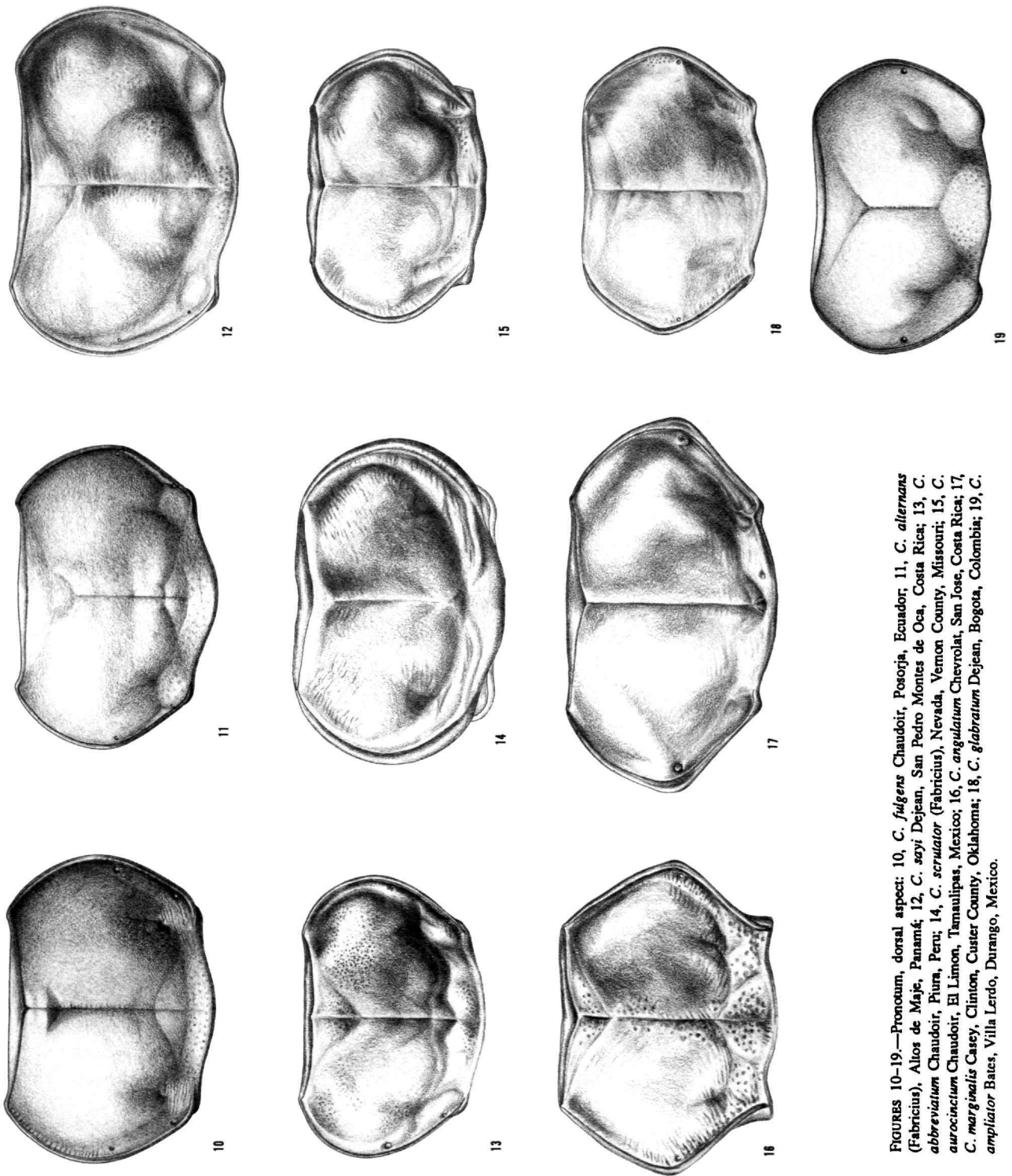
*Calosoma sayi abdominale* Géhin, 1885:58. [Lectotype male, MEXICO (MNHP), herein selected.]

*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 apicomediaally; metatrochanter ventrally hooked apically; and male median lobe moderately bent laterally near apex. Female





FIGURES 10-19.—Pronotum, dorsal aspect: 10, *C. fulgens* Chaudoir, Posorja, Ecuador; 11, *C. alternans* (Fabricius), Altos de Maje, Panamá; 12, *C. sayi* Dejean, San Pedro Montes de Oca, Costa Rica; 13, *C. abbreviatum* Chaudoir, Piura, Peru; 14, *C. scrutator* (Fabricius), Nevada, Vernon County, Missouri; 15, *C. aurocinctum* Chaudoir, El Limon, Tamaulipas, Mexico; 16, *C. angulatum* Chevrolat, San Jose, Costa Rica; 17, *C. marginalis* Casey, Clinton, Custer County, Oklahoma; 18, *C. glabratum* Dejean, Bogota, Colombia; 19, *C. ampliator* Bates, Villa Lerdo, Durango, Mexico.

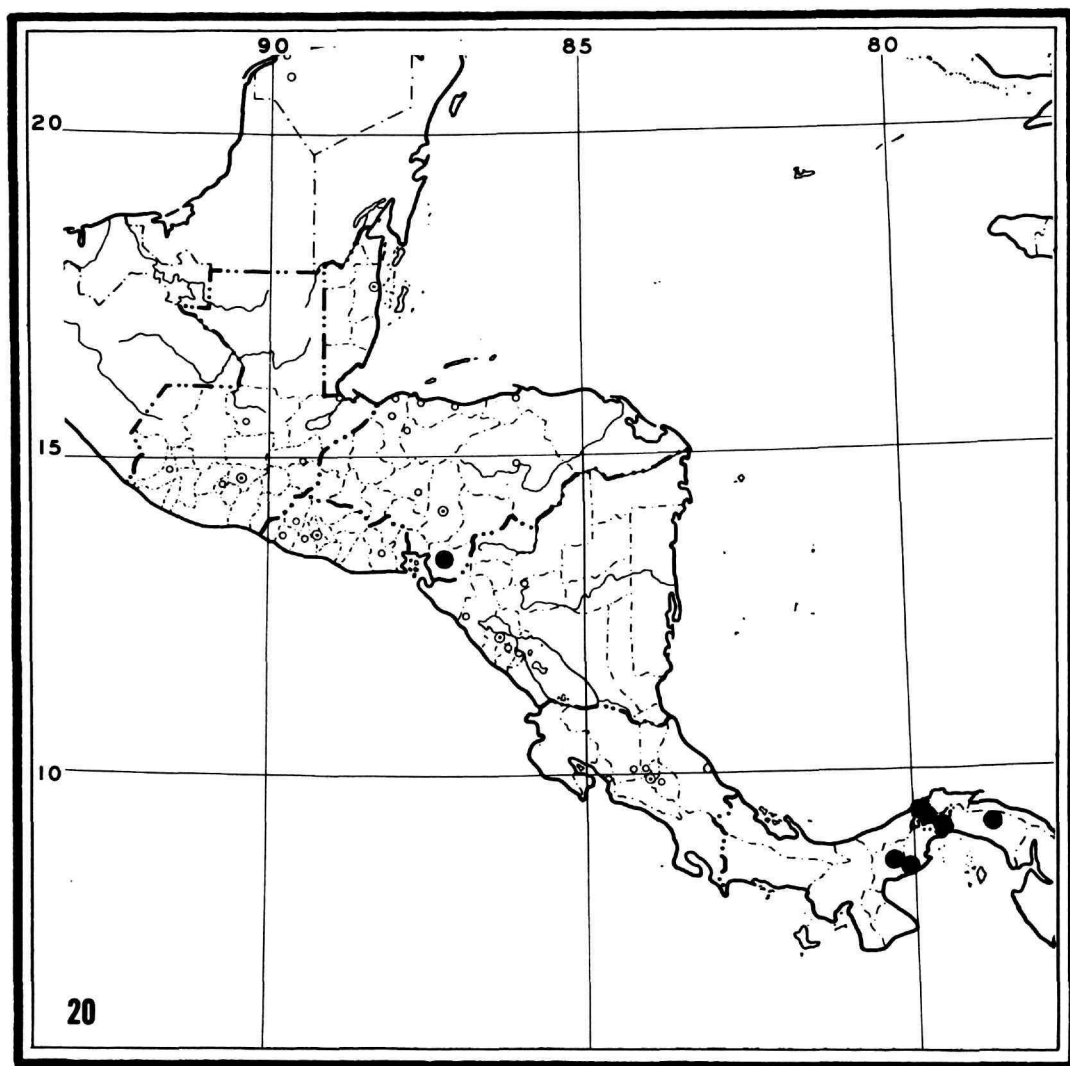


FIGURE 20.—Geographical distribution map of *Calosoma alternans* (Fabricius) in Central America.

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.

Location	Elevation (m)	Original deposit	Month collected	Number specimens
near Choluteca, Honduras (13°18'N, 87°12'W)	0030–0041	USNM	Jun	1
near Margarita, Panama (9°21'N, 79°53'W)	0000–0010	STOCHP	May	1
near Madden Dam, Panama (9°13'N, 79°37'W)	0076–0082	MCZ	May	1
near Altos de Maje, Panama (9°10'N, 78°49'W)	– 0050	STOCHP	May	1
near Diablo, Panama (8°58'N, 79°34'W)	0000–0010	USNM	May	1
near Ancon, Panama (8°58'N, 79°33'W)	0020–0160	USNM	Apr	2
near Anton, Panama (8°24'N, 80°16'W)	0025	USNM	May	1
near Rio Hato, Panama (8°23'N, 80°6'W)	0020–0050	STOCHP	Aug	1
near La Sabanas, Panama (uncertain locality)	–	USNM	Aug	1
Total specimens examined				10

*Calosoma abbreviatum* Chaudoir

FIGURE 13

*Calosoma abbreviatum* Chaudoir, 1869:371. [Holotype male, PERU or BOLIVIA (*LaFerté-Sénéctère*) (MNHP).]

DIAGNOSTIC COMBINATION.—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 apicomediaally; 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 Dariën (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 (Dariën) 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).]

DIAGNOSTIC COMBINATION.—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 bicolored 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

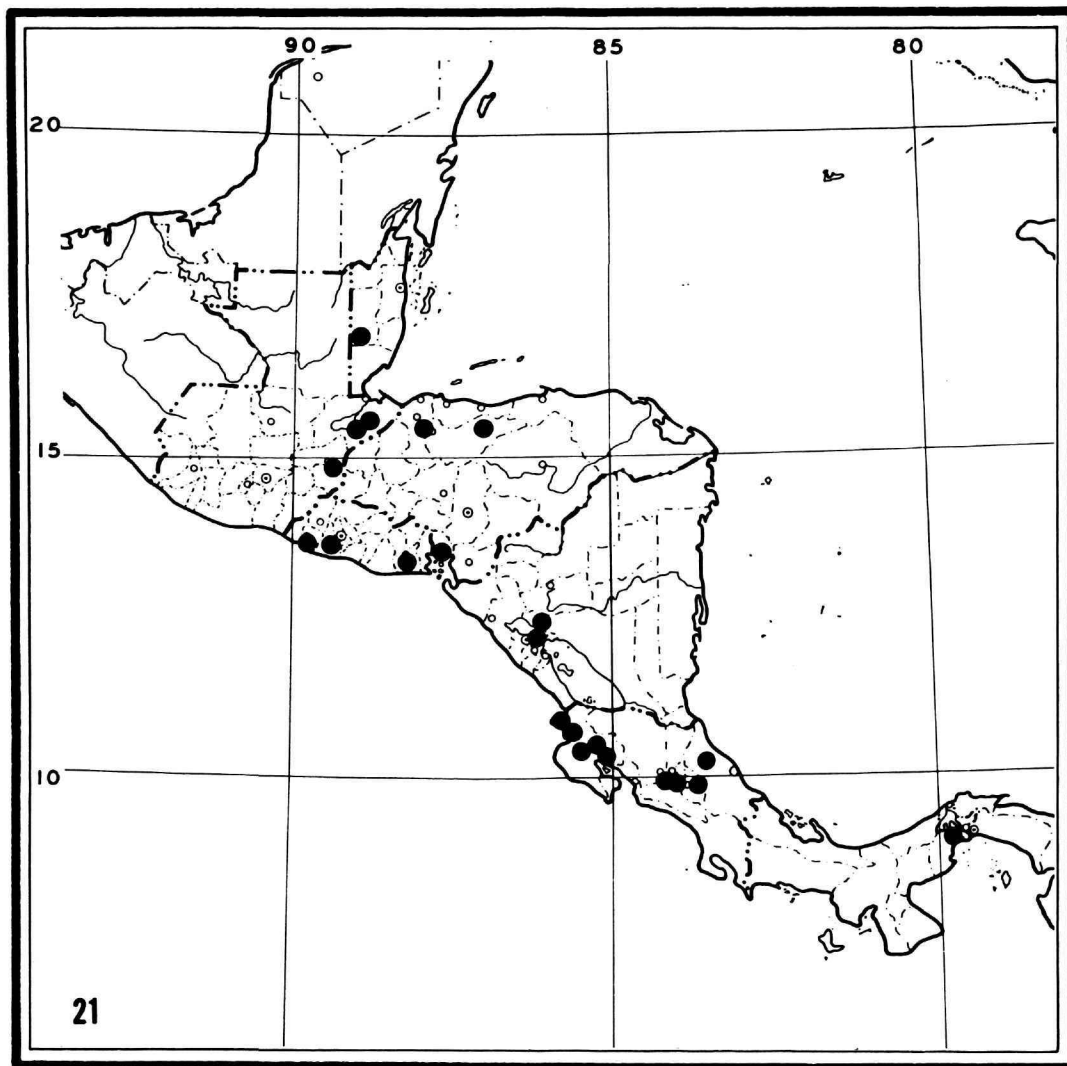


FIGURE 21.—Geographical distribution map of *Calosoma sayi* Dejean in Central America.

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.

Location	Elevation (m)	Original deposit	Month collected	Number specimens
near Western Hwy Belize (17°15'N, 089°01'W)	0000–0300	UASM	Jun	2
near Western Hwy, Belize (17°14'N, 089°02'W)	0000–0300	FDAG	–	1
near Cayuga, Guatemala (15°32'N, 088°42'W)	0030	USNM	Jun	1
near Coyoles, Honduras (15°27'N, 086°41'W)	0140–0160	USNM	Aug	1
near La Lima, Honduras (15°26'N, 087°55'W)	0020	UASM	Jun	1
near Quirigua, Guatemala (15°17'N, 89°04'W)	0070–0100	USNM	May	1
near Acajutla, El Salvador (13°36'N, 089°50'W)	0000–0010	UASM	May	1
near Jicaro, Honduras (13°33'N, 087°28'W)	0100	USNM	Jun	3
near San Diejo, El Salvador (13°28'N, 089°15'W)	0005	CAVERD	May	2
near Nancuchiname, El Salvador (13°24'N, 088°42'W)	–	CAVERD	May	1
near Managua, Nicaragua (12°23'N, 086°03'W)	0122	USNM	Jun	1
near Tipitapa, Nicaragua (12°12'N, 086°06'W)	0039–0060	USNM	Jul	6
near Santa Elene, Costa Rica (10°54'N, 085°57'W)	0000–0010	USNM	Jun	1
near Santa Rosa National Park, Costa Rica (10°50'N, 085°37'W)	0280–0317	USNM	May	4
near Santa Rosa National Park, Costa Rica (10°50'N, 085°37'W)	0280–0317	USNM	Jun	4
near Santa Rosa National Park, Costa Rica (10°50'N, 085°37'W)	0280–0317	USNM	Jul	2
near Rio Carana, Costa Rica (10°34'N, 085°24'W)	0091	USNM	Jun	1
near Palmira, Costa Rica (10°31'N, 085°35'W)	0020–0030	USNM	–	1
near Canas, Costa Rica (10°26'N, 085°08'W)	0030–0040	CAVERD	Jun	1
near Las Canas, Costa Rica (10°25'N, 085°07'W)	0090	UASM	Jul	3
near Las Canas, Costa Rica (10°25'N, 085°07'W)	0090	USNM	Jul	1
near Hamburg Farm, Costa Rica (10°15'N, 083°28'W)	0010	USNM	May	1
near Hamburg Farm, Costa Rica (10°15'N, 083°28'W)	0010	USNM	Feb	1
near San Antonio de Belen, Costa Rica (09°59'N, 084°11'W)	0820–0840	CAS	Jul	1
near San Pedro, Costa Rica (09°56'N, 084°03'W)	1200–1210	USNM	–	1
near San Jose, Costa Rica (09°56'N, 084°05'W)	1000–1200	USNM	Apr	1
near Turrialba, Costa Rica (09°54'N, 83°41'W)	0640	USNM	Jan	2
near Las Cumbus, Panama (09°05'N, 079°32'W)	0090–0100	OSU	Jan	1
		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.

#### 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 (*Lesueur*) (MNHP).]

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

*Calosoma uniforme* Géhin, 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 deeply striatopunctate interneurs, punctures connected by scaly cross lines, intervals convex; middle tibia not arcuate in males or females; male foretarsi with three dilated articles, each with spongy pubescence beneath. ABL = 25.0 to 33.0 mm; TW = 9.0 to 12.0 mm (from Gidaspow, 1959).

**GEOGRAPHICAL DISTRIBUTION** (Figure 22).—Gidaspow (1959, 1963) indicates that this so called polytypic species has a range extending from the southern United States from Arizona to Texas to Colombia and Venezuela. I do not believe that subspecies are warranted given the present level of study on the material at hand especially from Central America, thus I regard *C. angulatum* Chaudoir and *C. angulicolle* Chaudoir as synonyms. 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.

**NATURAL HISTORY.**—These beetles have been collected from 280 to 317 m elevation and from 1000 to 1300 m elevation in PREMONTANE MOIST FOREST in Costa Rica and are often found flying around lights at night. It is likely that they occur in cultivated land as well. They have been found in May through October.

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

#### 07.01.006 *Calosoma marginalis* Casey

FIGURE 17

*Calosoma lugubre* LeConte, 1853:400. [Holotype male, TEXAS, Braunfels (*Lindheimer*) (MCZ).]

*Calosoma marginalis* Casey, 1897:340. [Holotype male, ?ARIZONA (*Levette*) (USNM).]

*Calosoma lecontei* Csiki, 1927:21. [New name for *Calosoma lugubre* LeConte, 1853:400; not *C. lugubre* Motschulsky.]

**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 Cuemavaca, 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; 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 30 specimens from the United States and Mexico.

#### 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).]





FIGURE 22.—Geographical distribution map of *Calosoma angulatum* Chevrolat in Central America.

**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.

Location	Elevation (m)	Original deposit	Month collected	Number specimens
near Santa Rosa, Costa Rica (10°50'N, 085°37'W)	0280–0317	USNM	May	1
near Santa Rosa, Costa Rica (10°50'N, 085°37'W)	0280–0317	USNM	Jun	5
near Santa Rosa, Costa Rica (10°50'N, 085°37'W)	0280–0317	USNM	Jul	2
near La Caja, Costa Rica (09°58'N, 084°07'W)	1020–1300	USNM	Aug	1
near San Jose, Costa Rica (09°56'N, 084°05'W)	1000–1200	USNM	Sep	2
near San Jose, Costa Rica (09°56'N, 084°05'W)	1000–1200	USNM	Oct	1
Total specimens examined				12

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 seta 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 striatopunctate 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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