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**The Geotrupinae of  
North and Central America**

*by*

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### INTRODUCTION

The present paper is a continuation of my work on the "Biology and Taxonomy of North American Beetles of the Subfamily Geotrupinae" (1955, pp. 151-319). It is divided into two sections, the first being a taxonomic review of all of the Geotrupinae occurring in Mexico and Central America and the second including supplementary notes and descriptions of Canadian and United States Geotrupinae, with a complete revision of the genus *Eucanthus*.

Since an adequate review of the literature and a discussion of the methods used for collecting and studying specimens were presented in my 1955 paper (pp. 154-161), they are not repeated here. Additional references are cited in appropriate places in the text. Location of place names in Mexico and Central America was accomplished largely through use of the "Index to Map of Hispanic America" (American Geographical Society; see Hanson, 1945, pp. 1-923) and "A Gazetteer to accompany the Insecta Volumes of the 'Biologia Centrali-Americana'" (Selander and Vaurie, 1962, pp. 1-70).

Three of the four tribes of Geotrupinae occur in the New World. The tribe Athyreini, occurring largely in tropical areas, attains its greatest development in South America. The tribe is represented by 14 species in two genera in Mexico and Central America, and does not extend into the United States.

The tribe Bolboceratini, occurring largely in xeric or arid areas, is best represented in Australia and Africa. In North and Central America, 48 species and subspecies are known. Of these, six species in three genera find their northern limits in Canada; 40 species in seven genera occur in the United States; 17 species in five genera are found in Mexico; and only one species, *Bolbelasmus arcuatus* (Bates), occurs in Central America.

The tribe Geotrupini does not extend south of El Salvador in the New World, being essentially Holarctic in distribution. In the Americas the tribe, occurring largely in mesic, temperate, forested areas, contains 34 species and subspecies in four genera. Five of these species, all in the genus *Geotrupes*, occur in Canada; 18 species in three genera are found in the United States; 14 species in two genera occur in Mexico; two species of *Geotrupes* occur in Guatemala, and one of these ranges into the highlands of El Salvador. The United States and Mexican faunas in the tribe apparently have been disjunct for a long period of time, since there is neither overlap of species nor really close relationships exhibited between the species of the two faunas.

### ACKNOWLEDGMENTS

This project would not have been completed without the generous assistance of a number of individuals and institutions.

During the summer of 1962, I was able to examine the types housed in several of the European Museums. I am greatly indebted to Dr. E. B. Britton, British Museum (Natural History), London; to Dr. A. Descarpentries, Muséum National d'Histoire Naturelle, Paris; and to Professor George C. Varley, Hope Department of Entomology, Oxford, for the use of their facilities and for the loan of specimens.

Field work in Mexico was done with the assistance of Dr. R. B. Selander, University of Illinois, Urbana, in 1958; with Mr. G. B. Vogt, United States National Museum, Washington, D.C., in 1960; with Mr. J. E. H. Martin, Entomology Research Institute, Ottawa, in 1961; and with Dr. Ross H. Arnett, Jr., The Catholic University of America, Washington, D.C., in 1963. Dr. W. W. Gibson, Nacogdoches, Texas, and Dr. C. O. Morse, Guadalajara, Jalisco, Mexico, were also helpful during some phases of the Mexican work. Some records of 1964 fieldwork in northwestern Mexico are included in the text but are not recorded on the maps.

In 1961 the facilities of the Southwestern Research Station of the American Museum of Natural History, Portal, Arizona, were made available to me through the kindness of Dr. Mont Cazier, and in 1963, with the permission of Dr. Clarence Cottam, I utilized the facilities of the Welder Wildlife Refuge, Sinton, Texas.

During the last five years most of the major North American collections were studied and many of the institutions visited. In the list that follows, the abbreviations in parentheses are used in the text when citing material studied; the names of the curators responsible for loans of specimens follow the abbreviations:

- American Museum of Natural History (AMNH), Mrs. Patricia Vaurie.
- British Museum [Natural History] (BM), Dr. E. B. Britton.
- California Academy of Sciences (CAS), Mr. H. B. Leech.
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## MEXICAN AND CENTRAL AMERICAN GEOTRUPINAE

Adults of the subfamily Geotrupinae have the antennae 11-segmented, with the club of three segments; mandibles not hidden by the clypeus; clypeus sharply delimited from the vertex, often with a tubercle or horn; pygidium largely hidden by the elytra; abdominal spiracles on the membrane between sclerites; and the male genital armature enclosed in a definite, sclerotized genital capsule.

## KEY TO THE AMERICAN TRIBES OF GEOTRUPINAE

1. Antennal club large, about as long as the basal eight segments; mentum not noticeably emarginate at apex ..... 2  
    Antennal club small, about half as long as the basal eight segments; mentum deeply emarginate at apex ..... (III) Geotrupini p. 10
2. Right mandible with two or three lateral lobes; middle coxae separated by a distance greater than width of labrum; scutellum very narrow and elongate; disc of elytra with many conspicuous setae .....  
    ..... (I) Athyreini p. 7
- Right mandible with not more than one lateral lobe; middle coxae separated by a distance of half, or less, the width of labrum; scutellum triangular; disc of elytra glabrous or with a few setae in large punctures ..... (II) Bolboceratini p. 8

## I. KEY TO THE GENERA AND SPECIES OF MEXICAN AND CENTRAL AMERICAN ATHYREINI

1. Elytra with at least five or six intervals distinctly indicated; margin bordering anterior coxal cavity lacking spine on posterior-lateral edge; large species, usually over 15 mm. in length; sexes dissimilar in pronotal armature ..... *Athyreus championi* Bates p. 14  
    Elytra with not more than three intervals indicated; margin bordering anterior coxal cavity with spine on posterior-lateral edge; small species, usually under 15 mm.; sexes with similar pronotal armatures (*Neoathyreus*) ..... 2
2. Fore tibia with four teeth on outer edge (Fig. 7), in worn specimens only three may be evident ..... 3  
    Fore tibia with five or more teeth on outer edge (Fig. 6) ..... 4
3. Median tubercle of clypeal-frontal carina connected to each anterior angle by an oblique carina; dorsal color brown to dark brown .....  
    ..... *Neothyreus quadridentatus*, n. sp. p. 17  
    Transverse clypeal-frontal carina lacking anterior carina; dorsal color black or brownish black ..... *Neothyreus lanei* (Martinez) p. 16
4. Median spine or tubercles situated behind anterior pronotal margin\* (anterior base of spine often contiguous with margin) ..... 5  
    Median tubercles (sometimes indistinct) on or slightly behind anterior pronotal margin ..... 6
5. Anterior-median pronotal spine often bifurcate at tip; carina on each side of pronotal excavation sharply, inwardly angulate at middle .....  
    ..... *Neoathyreus fissicornis* (Harold) p. 20  
    Anterior-median pronotal spine sharply pointed at tip, not bifurcate; carina on each side of pronotal excavation evenly, outwardly arcuate .....  
    ..... *Neoathyreus mixtus*, n. sp. p. 17

\*The term "margin" as used in this paper with reference to the pronotum or elytra, refers to the narrowly delimited, often cariniform area along the edge of the pronotum or at the base of the elytra.

6. Carina on each side of pronotal excavation sharply, angulately elevated at middle ..... 7  
 Carina on each side of pronotal excavation evenly arcuate or slightly sinuate, but not sharply elevated at middle ..... 9
7. Pronotal excavation approximately as wide as distance between inner margins of eyes; clypeus with carina extending from each anterior angle onto median clypeal-frontal horn, carina sometimes indistinct .. 8  
 Pronotal excavation unusually wide and shallowly concave, approximately as wide as distance between eyes exteriorly; clypeus with arcuate anterior carina extending its width; clypeal-frontal carina with small median horn or tubercle .. *Neoathyreus planatus*, n. sp. p. 22
8. Posterior pronotal angle with small, contiguous pit internally; carinae at sides of pronotal excavation with median angulation not curved inwardly ..... *Neoathyreus tridenticeps* (Bates) p. 24  
 Posterior pronotal angle lacking internal pit; carinae at sides of pronotal excavation with median angulations curved inwardly .....  
 ..... *Neoathyreus panamensis* (Robinson) p. 21
9. Pronotal margin unbroken just anterior to posterior angle (adjacent to elytral humerus), only moderately excavate (Fig. 15); margin at anterior edge of excavation not thickened, lacking tubercle ..... 10  
 Pronotal margin obsolete just anterior to posterior angle and deeply excavate (Fig. 14); margin at anterior edge of excavation thickened or with small tubercle ..... *Neoathyreus interruptus*, n. sp. p. 22
10. Posterior pronotal angle lacking distinct, contiguous pit internally; brown to dark brown species ..... 11  
 Posterior pronotal angle with small, contiguous pit internally; brownish-black species ..... 12
11. Lateral pronotal margin anterior to median angulation distinctly emarginate, margin usually obsolete; posterior termination of carina on sides of pronotal excavation separated from posterior margin by a distance equal to two or more times width of carina .....  
 ..... *Neoathyreus mexicanus* (Klug) p. 26  
 Lateral pronotal margin anterior to median angulation shallowly emarginate, unbroken; posterior termination of carina on sides of pronotal excavation separated from posterior margin by distance approximately equal to width of carina ..... *Neoathyreus granulicollis*, n. sp. p. 29
12. Anterior clypeal carina transverse or indistinct; median pronotal tubercle extending behind anterior margin a distance equal to width of margin .....  
 ..... *Neoathyreus hamifer* (Boucomont) p. 25  
 Anterior clypeal carinae extending from anterior angles to base of median clypeal-frontal tubercle, sometimes indistinct except at tubercle; median pronotal tubercle very small, extending only slightly behind margin (females or poorly developed males) .....  
 ..... *Neoathyreus tridenticeps* (Bates) p. 24

## II. KEY TO THE GENERA AND SPECIES OF MEXICAN AND CENTRAL AMERICAN BOLBOCERATINI

1. Eye not completely divided by ocular canthus; elytra unicolored ..... 3  
 Eye entirely divided by ocular canthus; elytra bicolored (*Bolbo-  
 cerosoma*) ..... 2

2. Elytron with black spot separated from both sutural stripe and lateral margin; discal punctures of elytra usually setate .....  
..... *Bolbocerosoma ritcheri* Howden p. 31
- Elytron with large distal black area confluent with posterior half of black sutural stripe; discal punctures of elytra lacking setae .....  
..... *Bolbocerosoma pusillum townesi* Howden p. 32
3. Middle coxae nearly contiguous; metasternum narrowly cariniform, linear between coxae ..... 4  
Middle coxae distinctly separated; anterior lobe of metasternum flat or concave between coxae ..... 10
4. Elytron with five striae between suture and humeral umbone (*Eucanthus*) ..... 5  
Elytron with seven striae or rows of punctures between suture and humeral umbone (*Bolbelasmus*) ..... 6
5. Pronotal carina not indented at midline; at least three-fourths of pronotal disc coarsely punctate; states of Durango, Puebla and Mexico .....  
..... *Eucanthus mexicanus*, n. sp. p. 75  
Pronotal carina indented at midline; less than one-half of pronotal disc coarsely punctate; Chihuahua ..... *Eucanthus impressus*, n. sp. p. 72
6. Punctures near apical margins of elytra not noticeably enlarged and deepened; Baja California ..... 7  
Punctures near apical margins of elytra larger and deeper than discal punctures; mainland Mexico and southward ..... 8
7. Meso- and meta-tibial apices greatly expanded, hind tibia three times as long as apical width; male with exterior edge of gena rounded, pronotal protuberance inclined posteriorly .....  
..... *Bolbelasmus bajaensis*, n. sp. p. 44  
Meso- and meta-tibial apices moderately expanded; hind tibia four times as long as apical width; male with exterior edge of gena acutely angulate, pronotal protuberance vertical or overhanging anterior margin ..... *Bolbelasmus hornii* (Rivers) p. 44
8. Occurring north of Isthmus of Tehuantepec; male genitalia with tips blunt or widely rounded; vertex of female behind frontal carina normally with fine punctures with a few large punctures intermixed ..... 9  
Occurring from coastal Veracruz, Mexico, southward to Panama; male genitalia narrow at apex, sharply rounded (Fig. 57); vertex of female behind frontal carina normally with only scattered, fine punctures .....  
..... *Bolbelasmus arcuatus* (Bates) p. 39
9. Elytral striae distinct between punctures; posterior pronotal margin fine, margin if obsolete consisting of a continuous row of punctures; base of frontal horn of male closely, coarsely punctate; male genitalia (Fig. 56) with tips evenly, broadly arcuate .....  
..... *Bolbelasmus rotundipennis*, n. sp. p. 43  
Elytral striae obsolete between punctures; posterior pronotal margin broken (if punctures are present at margin they are widely separated); base of frontal horn of male with only scattered, shallow punctures; male genitalia (Fig. 58) with tips slightly flattened, not evenly arcuate .....  
..... *Bolbelasmus variabilis*, n. sp. p. 41
10. Base of elytra margined; first elytral stria terminating at apex of scutellum; metasternal plate pyriform in outline (*Bolbocerastes*) ..... 11  
Base of elytra not margined; first two elytral striae terminating at scutellum; metasternal plate rhomboid in outline (*Bolborhombus*) ..... 14



11. Anterior clypeal horn of male narrowly truncate or rounded; anterior horn narrower than median horn in female, disc punctate behind median horn ..... 12  
 Anterior clypeal horn of male widely truncate; anterior and median horns of female usually equal in width, disc smooth behind median horn; Sonora ..... *Bolbocerastes regalis* Cartwright p. 37
12. Strial punctures obsolete; striae evident but only very faintly impressed; species occurring in northwestern Mexico and Baja California ..... 13  
 Strial punctures distinct; striae shallowly but distinctly impressed; occurring in northeastern Mexico in Nuevo Leon and Coahuila ..... *Bolbocerastes serratus* (LeConte) p. 37
13. Reddish brown; well-developed males with median clypeal horn only moderately advanced, more nearly in line with well-developed lateral horns than in following species; Baja California ..... *Bolbocerastes peninsularis* (Schaeffer) p. 38  
 Tan to reddish brown; well-developed males with the median clypeal horn well advanced; Sonora ..... *Bolbocerastes i. imperialis* Cartwright p. 37
14. Pronotum, on each side, with short carina extending from near anterior margin posteriorly in direction of humeral umbone ..... 15  
 Pronotum lacking lateral, posteriorly directed carina; Michoacan ..... *Bolborhombus nitidus*, n. sp. p. 36
15. Male lacking distinct swelling just behind clypeal carina (sometimes with faint swellings on vertex between eyes); female with vertex nearly equally rough behind and in front of swelling ..... 16  
 Male with distinct swelling behind clypeal carina, swelling usually arcuate in same direction as carina; female with vertex distinctly smoother behind corresponding swelling than in front of it; Baja California ..... *Bolborhombus parvulus* Cartwright p. 35
16. Male with distinct carina extending from each anterior clypeal angle toward adjacent clypeal horn; mainland Mexico and Baja California ..... *Bolborhombus s. sallaei* (Bates) p. 33  
 Male lacking carina between anterior clypeal angle and clypeal horn, females unknown; Tamaulipas to southeastern Texas ..... *Bolborhombus sallaei manus*, n. subsp. p. 34

### III. KEY TO THE GENERA AND SPECIES OF MEXICAN AND CENTRAL AMERICAN GEOTRUPINI

1. Pronotum anteriorly with horn in male, and with a slight, rounded, anterior postmarginal protrusion in female (*Ceratotrupes*) ..... 2  
 Pronotum in both sexes evenly convex or excavated behind anterior pronotal margin, never with horn or protrusion on disc (*Geotrupes*) ..... 4
2. External face of terminal antennal segment lacking a distinct U-shaped furrow; mesosternum between and in front of middle coxae not elevated into sharp, pointed carina ..... 3  
 External face of terminal antennal segment with a distinct U-shaped furrow; mesosternum ridged between middle coxae and raised into sharp, pointed carina at anterior edge of coxae ..... *Ceratotrupes bolivari* Halffter and Martinez p. 46

3. Posterior pronotal margin usually complete; elytral striae shallowly punctate at least laterally; well-developed males with anterior edge of clypeal horn starting at anterior margin of clypeus .....  
*Ceratotrupes fronticornis* (Erichson) p. 45
- Posterior pronotal margin incomplete; elytral striae impunctate, well-developed males with anterior edge of clypeal horn starting well behind anterior margin of clypeus ... *Ceratotrupes sturmi* Jekel p. 47
4. Pronotum at most only shallowly indented behind anterior margin; second segment of antennal club with ventral edge of approximately uniform thickness, not hidden by first and third segments when club is closed ..... 5
- Pronotum with distinct concavity behind anterior margin, margin thickened and elevated in front of concavity; second segment of antennal club with ventral edge narrowed, largely hidden by first and third segments when club is closed; mountains of northwestern Mexico ..... *Geotrupes (Geotrupes) cavicollis* Bates p. 49
5. Elytral striae distinct ..... 6
- Elytral striae obsolete, indicated only by rows of fine punctures, mountains of northwestern Mexico .....  
*Geotrupes (Cnemotrupes) cnephosa*, n. sp. p. 60
6. Antennal club dark, grayish or brownish black; ventral portions of prothorax and legs usually with distinct violaceous iridescence ..... 7
- Antennal club yellowish brown to brown; ventral portions of prothorax and legs brownish black or iridescent, iridescence usually subdued .... 8
7. Male with fore tibia and mouthparts elongated (Fig. 43); clypeus V-shaped, narrowly arcuate anteriorly; elytra mostly black; Guatemala and El Salvador ..... *Geotrupes (Onthotrupes) onitidipes* Bates p. 61
- Male with fore tibia and mouthparts not elongated; clypeus U-shaped, fairly evenly arcuate; elytra green, sometimes only laterally; mountains in central Mexico ... *Geotrupes (Cnemotrupes) herbea* Jekel p. 57
8. Dorsally shining, often green or blue; elytral intervals convex ..... 9
- Dorsally dull black; elytral intervals flattened centrally; large species with males having the fore femora ventrally excavated near the coxae; mountains in central Mexico .....  
*Geotrupes (Cnemotrupes) sallei* Jekel p. 59
9. Shallow pronotal indentation lacking behind anterior margin or, if present, no wider than margin and not noticeably wider on each side of midline ..... 10
- Shallow pronotal indentation behind anterior margin approximately as wide as eyes, expanded on each side of midline; male frontal horn with sides parallel, tip truncate (Fig. 39); fore femur of male slightly excavated ventrally near coxa; dorsal color black with no metallic reflection; mountains of Guerrero, Mexico .....  
*Geotrupes (Cnemotrupes) truncaticornis*, n. sp. p. 59
10. Posterior femur with line of setigerous punctures normally extending transversely at least half way across posterior third of femur; pronotal punctures extending from lateral margins onto disc further than length of antennal club ..... 11
- Posterior femur with only three or four setigerous punctures near tibia on posterior third of ventral surface; pronotal punctures extending from lateral margins onto disc no further than length of antennal club; Hidalgo, Mexico ... *Geotrupes (Cnemotrupes) sobrina* Jekel p. 56

11. Posterior pronotal margin fine but distinct except in front of scutellum; occurring on transverse volcanic belt in latitude of Mexico City and on eastern escarpment ..... 12  
 Posterior pronotal margin indistinct or lacking in front of third to seventh elytral striae; occurring from Guerrero and Oaxaca, Mexico, southward ..... 13
12. Clypeus V-shaped, abruptly arcuate anteriorly; usually bright green or blue dorsally; third to seventh elytral striae largely impunctate ..... *Geotrupes (Cnemotrupes) rufoclavata* Jekel p. 55  
 Clypeus U-shaped, evenly arcuate; very dark bluish-black to black dorsally; third to seventh elytral striae finely but distinctly punctate ..... *Geotrupes (Cnemotrupes) nebularum*, n. sp. p. 53
13. Epipleura of elytra with single row of erect setae near inner margin; male with anterior external tooth of fore tibia distinctly expanded ..... 14  
 Epipleura of elytra with several rows of erect or semierect setae; male with anterior external tooth of fore tibia not distinctly expanded; Guatemala ..... *Geotrupes (Phelotrupes) guatemalensis* Bates p. 51
14. Elytral striae finely punctate or crenulate except near suture; elytra normally greenish black, sometimes with reddish tint; Oaxaca, Mexico ..... *Geotrupes (Cnemotrupes) viridiobscura* Jekel p. 52  
 Elytral striae virtually impunctate, at most vaguely crenulate; elytra greenish or bluish black; Guerrero, Mexico ..... *Geotrupes (Cnemotrupes) guerreroensis*, n. sp. p. 54

#### TRIBE ATHYREINI

The tribe Athyreini, recently characterized by Howden and Martinez (1963, p. 346), contains four genera, only two of which occur in Mexico and Central America. Members of the tribe in the area under consideration can be characterized as follows: head and pronotum as long as or longer than elytra; right mandible with two lateral lobes; scutellum very elongate, twice as long as wide or longer; elytra lacking distinctly impressed, narrow striae; scattered setae present on pronotum and elytra; middle coxae very widely separated by meso-metasternum, which is approximately one-third as wide as the body at that point; pygidium bent forward, concealing most of the abdomen, tip nearly contiguous to the hind trochanters.

In the above description, and in the subsequent descriptions of the genera and species in the tribe, I have limited the discussion of the characters to those pertaining to the Mexican and Central American forms. In the few cases where the Central American species are conspecific or are closely related to described South American forms, I have mentioned the most closely related South American form briefly. A discussion of the more general relationships between the various Central American species and the complex South American fauna must be postponed until more adequate material becomes available from northern South America.

In the descriptions I have omitted such characters as the size of metasternal punctures, length of ventral setae, characters of the normally obscured abdominal segments, number of spinules on the carinae of the meso- and meta-thoracic tibiae, and a number of others that may be useful in separating some of the difficult South American species complexes, but which do not appear essential to the present study.

A few of the terms used in the key or in the descriptions should be mentioned here. The pronota of species in the Athyreini actually have three angles on each

side. The anterior angle is obvious, being sharply angulate in *Neoathyreus* and more rounded in *Athyreus*. The posterior angle is often widely obtuse, and, as used herein, refers to the area of the pronotum just anterior to the elytral humerus. At the middle of the lateral pronotal margin is an obvious, abruptly rounded angulation which I refer to as the median angulation.

The carinae associated with the clypeus are also very useful. The carina delimiting the posterior edge of the clypeus, which usually is ornamented with three distinct tubercles or horns, is referred to as the clypeal-frontal carina. Near the anterior edge of the clypeus there is usually a carina, referred to as the anterior carina. This either extends partly or completely across the clypeus, or extends from the anterior clypeal angles toward the base of the median tubercle of the clypeal-frontal carina. In very worn specimens, the anterior carina may be indistinct or completely absent.

The number of teeth on the outer margins of the fore tibiae is a character that should be used with caution. Species with four teeth have the teeth widely separated and this character, which appears to be constant, can be used even in badly worn specimens. The number of teeth on the fore tibiae varies somewhat in species having more than four teeth. In some species the males normally have five teeth and the females six. As the basal sixth or seventh tooth is small, abrasion precludes the use of the character for the separation of species except as used to distinguish them from the group having four teeth.

Genitalic characters of the males appear to be excellent, but it is necessary to use caution in comparing specimens because the apical lobes are often soft and become distorted when dried.

Little is known about the habits of the Athyreini. They are usually found in rather open areas in semitropical or tropical country. All of the specimens that I have collected were either attracted to light or were taken flying a foot or two above the ground in the early evening. As many of the specimens have the clypeus and fore tibia worn, I assume they construct burrows and have habits similar to those of some genera of the Bolboceratini, such as *Eucanthus* (see Howden, 1955).

#### ATHYREUS MACLEAY

*Athyreus* MacLeay, 1819, p. 123; Klug, 1845, p. 21; Lacordaire, 1856, p. 140; Boucomont, 1911, p. 337; Howden and Martinez, 1963, p. 350.

TYPE-SPECIES. *Athyreus bifurcatus* MacLeay, designated by Howden and Martinez (1963).

The genus *Athyreus* is composed of species having the following characters anterior pronotal margin with a fovea usually present on each side behind the head; lateral pronotal margins entire, fovea or deep indentations lacking; elytra lacking basal margin, shining or dully alutaceous and finely tuberculate; each elytron with at least six distinct, smooth intervals between suture and humeral umbone; under surface of fore tibia slightly to distinctly punctate, a small carina present at ventral base of apical tooth, a carina also usually present at base of penultimate tooth; fore coxa not extending to pronotal margin, rounded laterally, lacking a spine at outer posterior margin of coxal cavity; metasternum flat medially with impressed or carinate longitudinal line, upper edge of anterior declivity distinctly pointed or "prow-shaped"; hind tarsus moderately thickened, first segment with one or two longitudinal, internal carinae; longest tibial spur of hind tarsus approximately as long as the first two tarsal segments; sexes dissimilar, the males usually with horns or large raised carinae on head or pronotum or both; female with reduced carinae in a different pattern, making proper association of the sexes difficult.

The genus *Athyreus* is represented in Central America by a single very distinct species. The genus is most common in South America and does not occur, as far as is known, north of Costa Rica.

*Athyreus championi* Bates

Figs. 1, 2, 25; Map 1

*Athyreus championi* Bates, 1887, p. 108.

TYPE. Holotype, male, V. de Chiriqui (Panama), 3000-4000 feet, Champion (BM).

MALES. Length 17 to 20 mm.; greatest width 10 to 11 mm. Color dorsally dark brown to dull black, often with faint purplish tinge; ventral surfaces black, partly concealed with long, reddish setae. Head with long, erect, clypeal horn; anterior edge of horn arising from anterior clypeal margin; horn triangular in shape, sharp in front and near anterior base bifurcating into two carinae; carinae extending to proximate anterior angles. Posterior flattened surface of clypeal horn faintly carinae; basally, on each side of horn, a carina extending to margin of eye. Sides of horn and surface of clypeus irregularly punctate. Surface of frons largely impunctate, with only scattered punctures posteriorly and laterally. Vertex nearly flat and setate-punctate. Disc of pronotum (Fig. 1) with conspicuous, central, trifurcate horn; posterior prong of horn much higher than two anterior prongs (length of horn, as well as degree of trifurcation, varying considerably in the four males). Surface of pronotum finely setate-punctate, many punctures with small, distinct granules at anterior margins; area anterior to horn sometimes impunctate. Carina on either side of the central horn of pronotum indistinct, often indicated by smooth area paralleling lateral posterior margin. Posterior pronotal angle near elytral humerus poorly indicated; medial pronotal angle almost forming a right angle; margin in front slightly sinuate. Elytra with striae indicated by six or seven shallow, triserially punctate-granulate depressions; intervals between depressions arcuately elevated, smooth and dully shining; majority of setae arising from the striae punctures short and semierect, but occasionally long, erect setae (flying hairs) intermixed. Pygidium arcuate to shallowly emarginate. Metasternum in front of middle coxae medially forming a sharply pointed spine. Anterior tibia with five teeth; ventrally rough and with distinct carina running down onto base of apical tooth and with vague carina extending onto penultimate tooth. Male genitalia as in Fig. 25.

FEMALES. Length 20 to 22 mm.; greatest width 11.5 to 12.5 mm. Color dorsally dark reddish brown to dull black, occasionally with faint purplish tinge. Clypeus anteriorly with sharp, arcuately raised, transverse carina; clypeal surface in front of carina largely impunctate, with few scattered setae; surface behind carina distinctly, irregularly rugose or punctate. Clypeus posteriorly delimited by transverse, tridentate carina; middle tubercle of carina more anteriorly placed than lateral ones, normally more elongated than lateral tubercles. Frons and vertex distinctly punctate-setate; punctures sometimes with small granules at anterior margins. Pronotum with central, shining, shallowly bifurcate protrusion (Fig. 2); on either side of central protrusion, and joining anterior pronotal margin, a distinct carina forms an inverted "U" around median projection; distinct oval impression present medially, just behind anterior margin; midline shallowly, distinctly impressed near posterior margin; on each side posteriorly, between U-shaped carina and posterior lateral pronotal margin, an indistinct, short, slightly elevated carina occupying the same position as in males. Pronotal outline and setate punctures as in males, but with granules before the punctures slightly larger; pronotum dull except for median swelling and carinae. Elytra similar to those described in the males. Pygidium broadly arcuate and much shorter than in males. Fore tibia as in males, except for small sixth tooth usually evident basally.

SPECIMENS EXAMINED. 4 males, 4 females.

## COSTA RICA

**Cartago:** Monte Redondo, 15 June 1893, Zeledon; Turrialba, K. W. Cooper.

**San Jose:** San Jose, 1000-1200 m., F. Nevermann, at light.

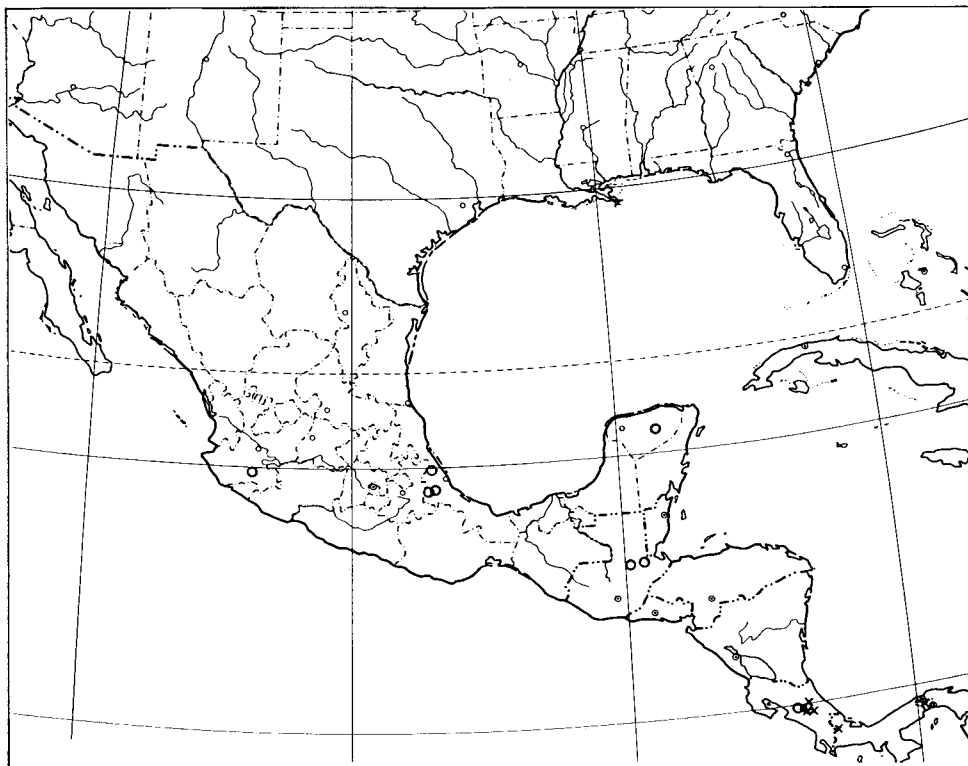
## PANAMA

**Canal Zone:** Barro Colorado Island, July 1938, C. E. Williams.

**Chiriqui:** Volcan de Chiriqui, 3000-4000 ft., Champion.

Specimens are in the following collections: BM, CNC, CNHM, USNM.

REMARKS. Except for the variation noted in the description in the development of the male pronotal horn, the eight specimens examined are very uniform. The large size and distinctive pronotal armature (Figs. 1, 2) will separate *Athyreus*



Map 1. Distribution of: [X] *Athyreus championi* Bates and [O] *Neoathyreus fissicornis* (Harold).

*championi* from any of the other Central American Athyreini. The dull, largely punctate-tuberculate surface of the pronotum and the trifurcate central horn will separate the males of *A. championi* from the known South American species. The females, however, are very similar to the females of some of the South American species of *Athyreus*, particularly females of *A. bellator* Westwood, and can be separated only by the smaller and denser punctures and granules of the vertex and pronotum and by slight differences in the inverted U-shaped carina.

#### NEOATHYREUS HOWDEN AND MARTINEZ

*Neoathyreus* Howden and Martinez, 1963, p. 350.

TYPE-SPECIES. *Athyreus tridentatus* MacLeay, designated by Howden and Martinez (1963).

The genus *Neoathyreus* is composed of species having the following characters: anterior pronotal margin with small fovea present on each side behind head; lateral pronotal margin entire or briefly interrupted just before median angulation; elytra lacking complete, distinct basal margin; striae or distinct intervals usually lacking, or, if present, not more than four intervals distinct; under surface of fore tibia smooth, in a few species moderately, irregularly punctate; small carina present at ventral base of apical tooth, indistinct carina usually present at base of penultimate tooth; fore coxa not extending to pronotal margin; coxal cavity rounded laterally and with spine at outer posterior margin; metasternum flat or slightly convex medially, with faint median line; upper edge of anterior declivity of metasternum bluntly to sharply pointed; hind tarsi moderately thickened, not densely punctate; single longitudinal carina present on first, usually second, and rarely third tarsal segments, never present on fourth; largest tibial spur variable in length, extending from middle to beyond second tarsal segment; sexes generally similar.

Several non-generic characters, shared by the group of species included here, are omitted from the description unless a species exhibits a noticeable departure from the norm. The vertex between the eyes is closely granulate unless otherwise specified. The pronotal concavity is usually smooth or very sparsely punctate or granulated posteriorly. The midline of the concavity often is marked by a distinct sulcus, but this varies from deep to obsolete intraspecifically and is not mentioned unless it is unusually well marked and constant.

There are 11 species of *Neoathyreus* known to occur in Mexico and Central America.

***Neoathyreus lanei* (Martinez), new combination**

Figs. 3, 26

*Athyreus lanei* Martinez, 1952, p. 110.

TYPE. Holotype, male, Venezuela, Distrito Federal, July 1943 (in coll. A. Martinez).

MALE. Length 9.3 mm.; greatest width 6.2 mm. Color dorsally black; setae on head, pronotum, and elytra reddish. Anterior clypeal carina distinct only on each side, extending posteriorly toward base of median clypeal-frontal tubercle. Clypeal-frontal carina with median tubercle small, moderately advanced beyond lateral tubercles. Vertex flat to slightly concave, irregularly, closely punctate-granulate. Pronotum (Fig. 3) with small median tubercle on anterior margin; shallowly concave on anterior, median portion of disc; carinae on each side of concavity low, wide, slightly arcuate, converging to top of concavity, then parallel posteriorly to termination; posterior end of each carina separated from posterior margin by a distance equal to maximum width of carina; short, arcuate, lateral carina present on each side, almost equidistant between carina of concavity and pronotal margin just before posterior angle. Lateral pronotal margin obsolete, distinctly indented just anterior to median angulation. Posterior pronotal angles very obtuse, indistinct. Elytra with three striae very vaguely indicated basally; disc very irregularly punctate-granulate, almost rugose; setae intermixed, erect and semirecumbent. Pygidium abruptly arcuate at apex. Fore tibia with four distinct, well-separated teeth. Male genitalia as in Fig. 26.

FEMALE. Similar to male except in the following respects: color dark reddish brown to black; anterior clypeal carina extending completely across clypeus; clypeal-frontal carina distinctly lower than in male; pronotal excavation shallower than in male, but with carinae nearly identical; pygidium broad, widely arcuate except for very shallowly emarginate apex.

SPECIMENS EXAMINED. 1 male, 1 female.

PANAMA

**Canal Zone:** Pacific side, June 1961, C. E. Yunker.

**Panama:** Panama City, 31 July 1940, M. Eggleston.

Specimens are in the following collections: CNC, USNM.

REMARKS. The two Central American specimens examined and described above differ slightly from topotypical Venezuelan specimens that I have seen. Specimens from Venezuela have the dorsal apical lobe of the genitalia larger and the elytra lack most of the conspicuously erect setae of the Panamanian specimens. The genitalia and setae of one male from St. Lucia, B.W.I., resemble those of the Panamanian male, and, from the material at hand, I can only conclude that the differences noted in specimens from different localities probably represent variations of one species.

*N. lanei* is easily separated from other Central American species by the following combination of characters: black to dark reddish-brown color; quadridentate fore tibia; shallow pronotal excavation; pronotal margin broken anterior to the median angle; and the shape of the male genitalia.

*Neothyreus mixtus*, new species

Figs. 4, 5

**HOLOTYPE.** Female, length 10.5 mm.; greatest width 7.0 mm. Color dorsally reddish brown. Clypeus with anterior transverse carina approximately 0.3 mm. behind anterior clypeal edge; carina highest on either side of shallow, median emargination, not connected to median tubercle of clypeal-frontal carina; clypeal-frontal carina vaguely trituberculate, median tubercle advanced. Frons and vertex nearly flat, setate-granulate. Pronotum with small, acutely pointed median spine behind anterior margin (Figs. 4, 5); pronotal excavation behind horn moderately deep anteriorly, setate-granulate on anterior four-fifths. Carinae bordering pronotal concavity gradually, inwardly arcuate to top of concavity, carinae behind concavity nearly straight, slightly convergent, continuing almost to posterior pronotal margin; on each side, between carina bordering concavity and posterior pronotal angle, with short, distinct carina curving toward posterior angle and terminating posteriorly near the margin. Pronotal margin just anterior to posterior angle moderately excavate; margin before median angle unbroken, slightly sinuate. Elytra with two intervals faintly indicated; surface finely, irregularly granulate; conspicuously setate, most setae short and semirecumbent, a few longer, erect setae intermixed. Pygidium broadly arcuate. Fore tibia with six teeth on outer edge.

**MALE.** Unknown.

**TYPE MATERIAL.** Holotype, female, El Salto de Agua, S.L.P., Mexico, 23-24 VIII 1960, H. Howden (CNC No. 8430). Paratype, female, Mexico, Veracruz, Papantla, 900 ft., 1-VIII 1955, P. and C. Vaurie collectors (AMNH).

**REMARKS.** The single female paratype is 13.5 mm. in length and 9.0 mm. is greatest width. The frons and vertex are slightly concave and the pronotal concavity is deeper than in the holotype. The fore tibia has seven teeth on its outer edge. In other respects it is similar to the holotype.

While I hesitated to describe a species in this difficult genus from two females, the combination of characters exhibited by *mixtus* almost precluded the possibility that it was an unusual variant of one of the other species discussed here. The complete, transverse, anterior clypeal carina, the median horn behind the anterior pronotal margin, and both sets of pronotal carinae terminating near the posterior margin, are all characters that are also found in *fissicornis*. However, *mixtus* differs conspicuously from *fissicornis* by lacking the sharp, inwardly directed angulations of the carinae bordering the pronotal concavity and by having all dorsal surfaces more closely and distinctly granulate, particularly so on the elytra.

*N. mixtus* also shows distinct affinities to *interruptus*. The median spine behind the pronotal margin is larger in *mixtus* and more distinctly disassociated from the margin, but this in itself could be attributed to variation. Likewise, the moderate pronotal excavation anterior to the posterior angle and the unbroken margin could be interpreted as unusual variations but not when considered in conjunction with the fact that both pairs of pronotal carinae terminate almost at the posterior margin. Also *interruptus* does not have a complete, transverse, anterior clypeal carina.

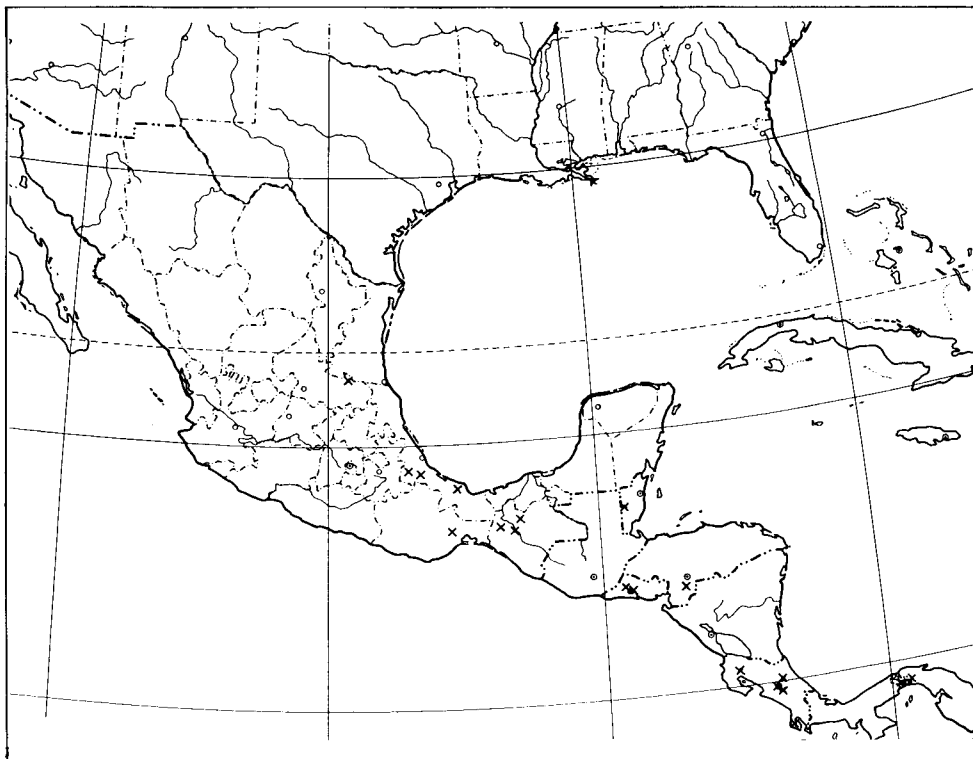
The third species that *mixtus* resembles is *granulicollis*. Here the complete, transverse, anterior clypeal carina, the distinct, anterior, median pronotal tubercle behind the pronotal margin, and the size of the granulations of the dorsal surface separate *mixtus* from *granulicollis*.

*Neothyreus quadridentatus*, new species

Figs. 7, 8, 27; Map 2

**HOLOTYPE.** Male, length 12.6 mm.; greatest width 7.5 mm. Color dorsally reddish brown with elytra slightly darker than head and pronotum. Clypeus with anterior carinae extending from anterior angles to base of the median clypeal-frontal tubercle. Clypeal-frontal carina with lateral tubercles poorly defined, median tubercle moderately advanced and distinct. Vertex flat to shallowly concave; surface irregularly punctate-granulate. Pronotum with small median tubercle on anterior margin; excavation of disc rather shallow and more broadly





Map 2. Distribution of *Neoathyreus quadridentatus*, new species.

oval than in related species. Carina on each side of pronotal excavation arcuate; behind excavation nearly straight, slightly convergent, terminating well before posterior pronotal margin, being separated from it by a distance of almost twice the width of carina; short lateral carina on each side distinct and closer to carina of concavity than to posterior angle. Posterior pronotal angles widely obtuse, indistinct; median angles abrupt, margin before broken and indented; anterior angles slightly obtuse. Elytra punctate-granulate, granules separated by one or two diameters; surface between relatively smooth, shining; punctures with semirecumbent setae, a few scattered, erect setae intermixed on posterior half of elytra. Pygidium wider than long, sides slightly arcuate and convergent to shallowly emarginate apex. Fore tibia with four distinct, well-separated teeth. Male genitalia as in Fig. 27.

**ALLOTYPE.** Female, length 12.1 mm.; greatest width 7.1 mm. Very similar to male, differing only in the following respects: clypeal-frontal carina lower; vertex more narrowly concave; pronotal concavity shallower, with surrounding carinae slightly more arcuate; pygidium shorter, apex narrowly truncate, sides arcuate.

**TYPE MATERIAL.** Holotype, male, Lake Catemaco, Veracruz, Mexico, 8-16 VIII 1960, H. F. Howden (CNC No. 8431). Allotype, female, Tuxtla Gutierrez, Chiapas, Mexico, 6-10 VII 1955, P. and C. Vaurie (AMNH). Paratypes, 16 males, 24 females.

#### BRITISH HONDURAS

**Cayo:** Benque Viejo, Father Stanton.

#### COSTA RICA

**Cartago:** Cache, H. Rogers; Monte Redondo; Turrialba.

**Guanacaste:** Las Canas, Pacific Slope, 50 ft., 13 June 1923, A. Smith.

**Puntarenas:** S. Pedro de Montes de Osa, 18 June 1939.

**San José:** La Caja, July 1932, H. Schmidt; Lola de Bolinda; San José, 1000-1200 m., Aug.-Sept. 1921, 11 Oct. 1928, F. Nevermann.

#### EL SALVADOR

**San Salvador:** San Salvador, 19 May to 18 June 1958, at light, O. L. Cartwright, 24 May, 8 June 1958, L. J. Bottimer, 15 June, Oct. 1960, N. Virkki.

**Santa Ana:** Monte Christo, 20 July 1960, N. Virkki; San Jacinto, 2200 ft., 27 June 1925.

#### HONDURAS

**Francisco Morazan:** Zamorano, 2600 ft., 22 July 1948, light, T. H. Hubbell.

#### MEXICO

**Chiapas:** 12 mi. W. Ocozocoautla, 26 July 1952, Gilbert and MacNeil; Santo Domingo, 15 mi. SE. Simojovel, 8 July 1958, J. Chemsak; Tuxtla, Dr. Berendt.

**Oaxaca:** Tehuantepec, Sallé.

**San Luis Potosi:** El Salto [de Agua], 1600 ft., 24 Aug. 1954.

**Veracruz:** Cordoba, Höge; Cotaxtla, 14 Aug. 1957, D. Janzen.

#### PANAMA

**Canal Zone:** Balboa; Ft. Clayton, 1 May to 4 June 1945, 12 Aug. 1949, Frick.

**Panama:** Panama City, 31 June 1940, M. Eggleston.

Paratypes are deposited in the following collections: BM, CAS, CNC, Frey, MCZ, UnCal, UnKans, USNM, Bottimer.

Other specimens referred to this species: 1 male, St. Augustine, **Trinidad**, B.W.I., 23 II 1935, N. A. Weber (MCZ); 1 female, Trinidad, B.W.I. (CNC).

REMARKS. Variation in the type series occurs in several characters. Size of the males varies from 10.0 to 14.1 mm. in length and from 6.6 to 8.5 mm. in greatest width; females vary from 10.5 to 14.5 mm. in length and from 6.5 to 8.8 mm. in greatest width. Color varies from tan to dark brown. In both sexes the anterior clypeal carinae may vary from obsolete to very distinct, but they are usually evident near the anterior angles. The lateral tubercles of the clypeal-frontal carina are usually represented by a thickening of the angulation, but they are sometimes obsolete. There is some variation in the width and depth of the pronotal concavity, but it is always broadly oval. The excavation in front of the median pronotal angle varies slightly in width and depth, but the margin is broken in all specimens examined. The apex of the pygidium in the female may be truncate or shallowly emarginate. Granules on the pronotal and elytral discs vary slightly in size and density, as do the number of erect setae on the elytra. In other respects, including the number of teeth on the fore tibia, the species appears constant.

In the *Biologia Centrali-Americana* (vol. 2, pt. 2, p. 110) Bates calls *N. quadridentatus* the "form typica" of *Athyreus excavatus* Cast. The type of *excavatus* is from French Guiana and is in the Oberthur Collection in the Muséum National d'Histoire Naturelle in Paris. I examined the type and found that it differed from *quadridentatus* in the following characters: fore tibia with six teeth; anterior clypeal carina transverse, interrupted medially; median tubercle on anterior pronotal margin large; pronotal excavation more concave, narrower; short, lateral pronotal carinae less arcuate; and pygidium of females arcuate apically. Male genitalia of Brazilian specimens that I consider to be *excavatus* are distinctly different from any of the Mexican and Central American species that I examined. In most characters *excavatus* appears closely related to *mexicanus* Klug.

*Neothyreus quadridentatus* is a fairly common, widely distributed species. It can be distinguished by the following combination of characters: tan to dark brown; fore tibia with four teeth; pronotal excavation shallow and broadly oval; lateral pronotal margin broken before median angulation. Also the shape of the male genitalia is characteristic.

***Neothyreus fissicornis* (Harold), new combination**

Figs. 9, 10, 28; Map 1

*Athyreus fissicornis* Harold, 1880, p. 45; Bates, 1887, p. 108.

TYPE. Location unknown to me.

MALES. Length 10.5 to 11.5 mm.; greatest width 7.2 to 7.7 mm. Head and sides of pronotum tan to brown; pronotal excavation and elytra darker, reddish brown to brownish black. Clypeus with anterior carina transverse, occasionally indistinct medially. Clypeal-frontal carina distinctly trituberculate, median tubercle often lower than lateral ones and only slightly advanced. Vertex distinctly concave, bottom of concavity very sparsely punctate-granulate. Pronotum with large median horn behind anterior margin; horn typically thick, with apex bifurcate, occasionally slender with apex transversely truncate or vaguely emarginate. Pronotal concavity, behind horn, moderately deep, narrow; carina on either side of concavity sharply, inwardly, and upwardly angulate midway between anterior and posterior margins; carina behind angulation lower and inwardly arcuate at posterior margin of concavity, with a short, straight extension posteriorly almost to pronotal margin; posterior fourth of concavity varying in width, occasionally punctate-granulate, with the posterior edge truncate or posteriorly or anteriorly arcuate; on each side of pronotum with distinct, short lateral carina, equidistant between posterior angle and carina of concavity, posterior termination of lateral carina normally almost contiguous to posterior margin. Posterior pronotal angle widely obtuse, distinct; median angle abruptly rounded, margin just anterior to angle indented, unbroken; anterior angle sharp, almost right-angled. Elytra punctate-granulate, surface between slightly irregular, shining. Most elytral punctures with semierect setae. Pygidium about three-fifths as long as wide, apex sharply rounded. Fore tibia with six or seven teeth on outer margin. Male genitalia as in Fig. 28, but with some variation in the width of the apical, slender, recurved process.

FEMALES. Length 9.5 to 13.5 mm.; greatest width 6.0 to 8.5 mm. Generally similar to males except in the following respects; anterior clypeal carina very distinct, complete; clypeal-frontal carina lower than in males, median tubercle slightly higher than lateral ones; median, anterior pronotal horn apically bifurcate or blunt, often slightly reduced in size; pronotal concavity usually not as deep; concavity sometimes completely punctate-granulate; pygidium shorter, apex broadly arcuate.

SPECIMENS EXAMINED. 6 males, 8 females.

**COSTA RICA**

**San Jose:** San Jose, 25 Aug. 1921.

**GUATEMALA**

**Alta Verapaz:** Coban, 4000 ft., 10 July 1947, C. and P. Vaurie; Panzos, Conradt.

**MEXICO**

**Jalisco:** December.

**Veracruz:** Cordoba; Fortin, 1 Sept. 1960, C. O. Morse; Jalapa.

**Yucatan:** Chichen Itza, 29 July 1937, J. Van Tyne.

Specimens are in the following collections: AMNH, BM, CNC, Paris, USNM, Howden, Woodruff.

REMARKS. This species exhibits an unusual amount of variation in the pronotal characters. The occasionally slender, non-bifurcate, anterior, median pronotal horn and the variation in the shape of the posterior portion of the concavity do not appear to be correlated either with each other or with geographic location. The genitalia of the few males examined are very similar and, unless

additional material indicates otherwise, I believe *fissicornis* to be merely an unusually variable species.

The authorship of the name *fissicornis* has been attributed to Bates by Boucomont (1912, p. 5) and Blackwelder (1944, p. 219). However, Harold (1880, p. 45), following the description of *Athyreus vulpinus*, used the name *fissicornis*, described the bifurcate pronotal horn, and mentioned that the species occurred in Mexico. As the bifurcate pronotal horn is not found in any other Mexican or Central American species, Harold's description appears adequate for the recognition of the species. I can only concur with Bates (1887, p. 108) that the name should be attributed to Harold.

*N. fissicornis* can be identified by the following combination of characters: median pronotal horn distinctly behind anterior margin, tip often bifurcate; carinae bordering pronotal concavity sharply, upwardly, inwardly angulate in anterior one-third of their lengths; fore tibia with six or seven teeth. The male genitalia are also distinctive.

***Neothyreus panamensis* (Robinson), new combination**

Figs. 11, 29

*Athyreus panamensis* Robinson, 1946, p. 57.

TYPE. Holotype, male, Corozal, Canal Zone, 8 June 1937, R. Bliss (USNM).

MALES. Length 13.5 to 16.0 mm.; greatest width 8.3 to 10.2 mm. Color dorsally reddish tan to black, lateral portions of pronotum often lighter in color than pronotal concavity. Anterior clypeal carina extending from each anterior angle onto base of median clypeal-frontal tubercle. Clypeal-frontal carina trituberculate; median tubercle pronounced, with base advanced to middle of clypeus, distinctly higher than lateral tubercles. Vertex flat to slightly concave. Median pronotal tubercle on anterior margin small or obsolete; pronotal concavity narrow, posteriorly smooth or punctate, medially with an unusually pronounced sulcus running its length. Carina on each side of pronotal concavity arcuate and raised inwardly to middle, middle sharply angulate; carina behind angulation low, gradually wider, then curved abruptly inwardly at posterior edge of concavity; behind concavity carina on each side extends posteriorly almost to pronotal margin, this short extension often triangular in shape; distinct, slightly arcuate, lateral carina on each side midway between carinae of concavity and posterior angles. Posterior pronotal angles broadly obtuse; median angles abruptly rounded, margin before complete and slightly to moderately indented, occasionally with small marginal tubercle at anterior end of indentation; anterior angles sharply angulate, obtuse. Elytra with three or four faint striae visible basally; surface punctate-granulate, area between finely alutaceous; most punctures bearing semierect setae, a few punctures with very long, erect setae or flying hairs (some specimens are often badly worn and the dorsal setae may be badly abraded or absent). Pygidium approximately twice as wide as long, apex briefly truncate or arcuate. Fore tibia, in unabraded specimens, with five or six teeth on outer margin. Male genitalia as in Fig. 29.

FEMALES. Length 13.2 to 15.5 mm.; greatest width 9.1 to 9.6 mm. Similar to males except in the following respects: clypeal-frontal carina low, sometimes obsolete between tubercles; median tubercle well advanced, scarcely higher than lateral tubercles; fore tibia with only five teeth on outer margin, fifth tooth smaller than in the two unabraded males seen.

SPECIMENS EXAMINED. 4 males, 6 females.

**COSTA RICA**

(one male — no other data)

**PANAMA**

**Canal Zone:** Corozal, 8 June 1937, R. Bliss; Curundu, July 1958.

**Chiriqui:** Volcan de Chiriqui.

Specimens are in the following collections: BM, CNC, Frey, Paris, USNM.

REMARKS. Except for the variation in the clypeal-frontal carina and the associated tubercles, *N. panamensis* exhibits few external differences between the

sexes. The species can be identified by the male genitalia and by the following combination of characters: anterior clypeal carina extending arcuately from each anterior angle to base of median clypeal-frontal tubercle; median pronotal tubercle on anterior margin small or obsolete; carina on each side of concavity sharply, inwardly, and upwardly angulate at middle, low and flattened behind angulation; posterior pronotal angle lacking a distinct, contiguous dorsal pit; lateral pronotal margin complete; fore tibia with five or six teeth on outer margin.

***Neoathyreus planatus*, new species**

Figs. 12, 13, 30; Map 3

**HOLOTYPE.** Male, length 14.1 mm.; greatest width 8.9 mm. Color dorsally black; setae of head, pronotum, and elytra brown. Clypeus with anterior carina transverse, complete. Clypeal-frontal carina with three well-developed tubercles or horns; median tubercle very pronounced, base extending anteriorly approximately half the length of the clypeus. Vertex between eyes flat. Median pronotal tubercle on anterior margin short but distinct. Median pronotal concavity very shallow and wide; carina on each side of concavity abruptly elevated anteriorly, forming right angle at summit, low and inwardly arcuate behind to posterior edge of concavity, then parallel and distinctly elevated to posterior margin where each carina abruptly drops to margin; short, unusually narrow, slightly arcuate carina on each side, midway between carina of concavity and posterior angle. Posterior pronotal angle distinct, dorsally with contiguous, small, circular pit; median pronotal angle moderately rounded, margin anteriorly unbroken, shallowly indented, with small tubercle at anterior end of indentation; anterior pronotal angles moderately obtuse. Elytra with striae only vaguely indicated basally; surface punctate-tuberculate, tubercles often obsolete; punctures bearing erect or semierect setae; surface between punctures uneven, finely alutaceous. Pygidium over two-thirds as long as wide, apex abruptly arcuate. Fore tibia with seven teeth on outer margin, seventh tooth minute. Genitalia as in Fig. 30.

**ALLOTYPE.** Female, length 14.3 mm.; greatest width 9.0 mm. Color dorsally reddish black. Differing from male in the following respects: clypeal-frontal carina lower, three tubercles distinctly smaller, particularly median one; pronotal concavity identical to that of male except surrounding carinae slightly less elevated; pygidium shorter, more broadly arcuate.

**TYPE MATERIAL.** Holotype, male, Turrialba, Costa Rica, 28 IX, F. Nevermann (USNM). Allotype, female, Turrialba, Costa Rica, Museum Paris, Coll. A Boucomont (Paris). Paratypes, 2 males.

**COSTA RICA**

**Cartago:** Turrialba, K. W. Cooper (CNHM).

**NICARAGUA**

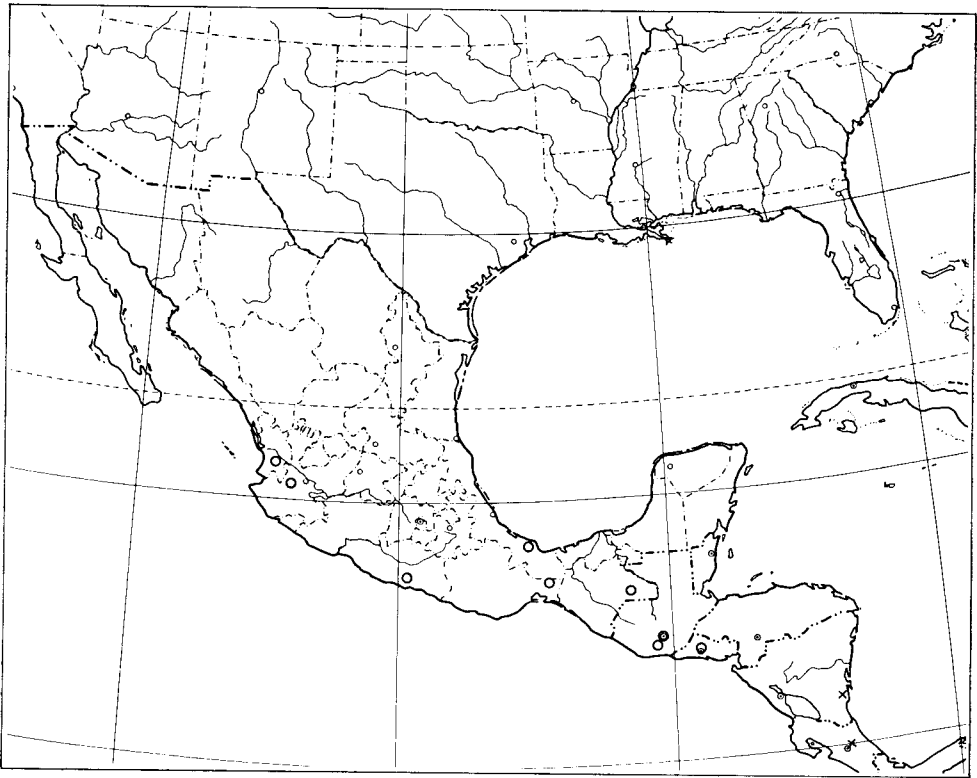
**Zelaya:** Bluefields, 3 July 1897, C. W. Richmond (CNC No. 8432).

**REMARKS.** The four specimens show little variation. The species can be readily distinguished by its wide, shallow, pronotal concavity and by the bi-angulate carinae on either side of the concavity. Other characters are given in the key. The male genitalia are very distinctive.

***Neoathyreus interruptus*, new species**

Figs. 14, 31; Map 3

**HOLOTYPE.** Male, length 13.4 mm.; greatest width 8.5 mm. Color dorsally reddish brown, sides of pronotum and elytral humeri tan. Anterior clypeal carina obsolete except near anterior angles. Face of clypeus behind anterior carina nearly vertical, heavily punctate. Clypeal-frontal carina overhanging clypeus, median tubercle moderately advanced in front of indistinct lateral tubercles. Vertex shallowly concave; evenly, closely granulate. Median pronotal tubercle on anterior margin distinct, margin elevated. Pronotal concavity broadly concave, closely granulate except for small smooth area near posterior midline; carina on each side of concavity evenly, inwardly arcuate posteriorly; posterior ends of carinae parallel behind concavity, terminating approximately 0.5 mm. before the posterior margin; lateral carina on



Map 3. Distribution of: [X] *Neoathyreus planatus*, new species, and [O] *N. interruptus*, new species.

each side slightly closer to carina of concavity than to posterior angle. Posterior pronotal angle obsolete, angle and area immediately in front deeply excavated and immarginate (Fig. 14); lateral pronotal margin beginning as small tubercle immediately anterior to excavation; median pronotal angle broadly, obtusely rounded, margin in front shallowly indented; anterior angles sharp, slightly obtuse. Elytra with three faint striae indicated basally; surface with rugose appearance, punctate-granulate; most setae semirecumbent, a few long, erect setae intermixed. Pygidium approximately three-fifths as long as wide, apex narrowly, shallowly emarginate. Fore tibia with six teeth on outer margin. Genitalia as in Fig. 31.

**ALLOTYPE.** Female, length 11.6 mm.; greatest width 7.0 mm. Similar to male except in the following respects: clypeal-frontal carina reduced in height, not overhanging clypeus; face of clypeus not vertical; granules of vertex and pronotum larger; pronotal concavity not as wide, less concave; pygidium wider, shorter, apex truncate.

**TYPE MATERIAL.** Holotype, male, Lake Catemaco, Veracruz, Mexico, 8-16 VIII 1960, H. F. Howden (CNC No. 8433). Allotype, female, Dos Arroyos, Guerrero, Mexico, 1000 ft., IX, H. H. Smith (BM). Paratypes, 4 males, 5 females.

#### EL SALVADOR

**San Salvador:** San Salvador, 7 June 1958, L. J. Bottimer.

#### GUATEMALA

**Escuintla:** Escuintla, Conradt, F. Knab.

**Guatemala:** Las Victorias, 22 May 1929, in banana roots, C. Heinrich.

## MEXICO

**Chiapas:** La Esperanza, April-May 1940, H. M. Smith.

**Jalisco:** Highway to Ameca, 2 mi. W. Junction, C. and P. Vaurie.

**Nayarit:** Compostela, 28 July 1953, C. and P. Vaurie.

**Oaxaca:** Isth. of Tehuantepec, F. Sumichrast.

**Veracruz:** Playa Azul, L. Catemaco, 6 July 1957, R. B. Selander.

Paratypes are deposited in the following collections: AMNH, BM, CNC, CNHM, MCZ, Bottimer.

**REMARKS.** Variation occurs in several characters. Males range from 9.0 to 13.4 mm. in length and from 6.0 to 8.5 mm. in greatest width. Females range from 9.2 to 11.7 mm. in length and from 5.7 to 7.0 mm. in greatest width. Males exhibit considerable variation in the height of the clypeal-frontal carina, in some cases having the carina similar to those of the females. One male has one fore tibia with five teeth, the other with six, the latter number being typical. In both sexes the width and depth of the pronotal concavity varies. Also the midline of the concavity usually has an indented, non-granulate sulcus, but in some specimens it is only faintly indicated. The smooth, non-granulate area near the posterior margin of the concavity occasionally is greatly reduced in size, being absent in one female. The deep excavation anterior to the posterior pronotal angle is always present; the margin normally is broken by the excavation, but several females have a fine marginal line indicated. Usually the anterior clypeal carina is obsolete medially; occasionally in females there is a faint carina on each side extending upward to the base of the median clypeal-frontal tubercle.

Despite the relatively large amount of variation, *N. interruptus* is easily distinguishable. The male genitalia are characteristic and the deep excavation contiguous to, and often obscuring, the posterior pronotal angle is unique for the group of species considered here. Other useful characters for identifying *interruptus* are the five or six teeth on the fore tibia, the unbroken margin anterior to the median pronotal angle, the evenly arcuate carinae bordering the pronotal concavity, and the close, often confluent, elytral punctures which give the elytra a rugose appearance.

***Neothyreus tridenticeps* (Bates), new combination**

Figs. 16, 17, 32

*Athyreus tridenticeps* Bates, 1887, p. 109.

**TYPE.** Lectotype here designated, male, labeled lectotype, *tridenticeps* Bates, V. de Chiriqui, 2500-4000 feet, Champion (BM).

**MALES.** Length 11.8 to 13.8 mm.; greatest width 8.5 to 8.8 mm. Color dorsally dark reddish brown or black with lateral portions of pronotum reddish brown. Anterior clypeal carinae extending arcuately from anterior angles up to base of median clypeal-frontal tubercle. Clypeal-frontal carina with three very distinct tubercles, median tubercle advanced, twice as high as lateral ones. Vertex almost flat, evenly punctate-granulate. Median tubercle on anterior pronotal margin small or obsolete. Pronotal concavity narrow, usually deep behind anterior margin; median portion of concavity narrowed by lateral swellings, becoming wider again near posterior termination; carina on each side of concavity rising to a small sharp angulation in first third of its length, then low and slightly, inwardly arcuate to posterior edge of concavity, thence extending for short distance posteriorly, terminating well in front of posterior pronotal margin (Figs. 16, 17); short lateral carina present on each side just anterior to posterior angle and closer to margin than to carina of concavity, carina terminating posteriorly just above pit near posterior angle. Posterior pronotal angles distinct, with elongate, contiguous pit dorsally; median angulations abruptly rounded, the margin just anterior to angulation shallowly indented; anterior angles sharp, slightly obtuse. Elytra with faint striae indicated basally; surface punctate-granulate, granules distinct, usually separated by distance

equal to two diameters; surface between granules slightly uneven, finely alutaceous; setae mostly semirecumbent, with a few very long, erect setae or flying hairs. Pygidium approximately twice as wide as long, sides shallowly arcuate, tip briefly truncate. Fore tibia with five, distinct teeth on outer margin. Genitalia as in Fig. 32.

FEMALES. Length 10.1 to 13.5 mm.; greatest width 6.5 to 8.7 mm. Similar to males except in the following respects: clypeal-frontal carina lower, the three tubercles often half the size; pronotal concavity shallower, lacking distinct median constriction; sharp angulation of carinae bordering concavity lower or obsolete; pygidium broader, apex rather widely, shallowly emarginate; vague sixth tooth sometimes present at base of fore tibia.

SPECIMENS EXAMINED. 3 males, 8 females.

## COSTA RICA

**Cartago:** Turrialba, Sept. 1928, Coll. F. Nevermann.

**San Jose:** San Jose, 1000-1200 m., 31 June, L. De Poiss.

## PANAMA

**Chiriqui:** Volcan de Chiriqui, 2500-4000 ft., Champion.

Specimens are in the following collections: BM, CNC, Paris, UnCal, USNM, Howden.

REMARKS. The four females from Costa Rica differ somewhat from Panamanian specimens. Originally I had placed them with *hamifer*, since they lack the sharp angulation of the carinae bordering the pronotal concavity. However, in other respects they resemble *tridenticeps*: the median tubercle on the anterior pronotal margin is very small; the carinae of the head are similar to those of *tridenticeps*; and the fore tibiae have five or six teeth on the outer margin (seven in *hamifer*). In typical Panamanian *tridenticeps* the elytra are distinctly granulate; in *hamifer* they are closely, irregularly punctate, giving the surface a rugose appearance. The elytra of the Costa Rican *tridenticeps* seem intermediate between the two. The lack of the angulation of the pronotal carinae of the concavity, the poorly granulate elytra, and the rather small size (10 mm.), may indicate a distinct form, but until males can be examined I can only consider the Costa Rican specimens depauperate *tridenticeps*.

*N. tridenticeps* can be recognized by the following combination of characters: anterior clypeal carinae extending arcuately onto base of median clypeal-frontal tubercle; carinae surrounding narrow pronotal concavity upwardly angulate in anterior third (except in some females); small, deep, oblong pit contiguous dorsally to posterior pronotal angle; lateral margins of pronotum entire; lateral portions of pronotum lighter in color; fore tibia with five (occasionally six) distinct teeth on outer margin. The male genitalia have very distinctive apical lobes, which are structurally unlike the other Central American species.

### *Neothyreus hamifer* (Boucomont), new combination

Figs. 18, 33

*Athyreus hamifer* Boucomont, 1932, p. 262.

TYPE. Holotype, male, Tumbador, Guatemala, Coll. A. Boucomont (Paris).

MALES. Length 10.0 to 11.1 mm.; greatest width 6.3 to 6.8 mm. Color dorsally dark reddish black to black, sides of pronotum slightly lighter in color than concavity. Anterior clypeal carina close to anterior edge, complete, often poorly defined; clypeus, behind anterior carina, concave in lateral aspect, rising almost vertically to clypeal-frontal carina; clypeal-frontal carina similar to carina of *interruptus*, lateral tubercle often poorly developed. Vertex slightly convex beside eyes, almost flat medially. Median pronotal tubercle with base on anterior margin, extending backwards and upwards for a distance equal to the median width of the margin. Pronotal concavity abruptly, deeply concave behind anterior margin, becoming narrower and shallow posteriorly; carina on each side of concavity straight to slightly sinuate, feebly convergent posteriorly (Fig. 18); posterior edge of concavity distinct, forming



a widely oblique "V" approximately 1.0 mm. before posterior margin; carina of concavity continuing posteriorly, terminating about 0.3 mm. in front of margin; short lateral carina on each side with posterior end almost contiguous to posterior angle. Posterior pronotal angle almost obscured by a deep, contiguous, oblong, dorsal pit; margin in front of angle distinctly indented, approaching some females of *interruptus* in this respect; median pronotal angle rounded, adjacent indentation moderate to deep, margin in indentation fine to obsolete; anterior angle sharp, almost forming right angle. Elytra punctate-rugose; setae semirecumbent, with a few longer, erect setae intermixed. Pygidium twice as wide as long, sides bowed inwardly, apex abruptly rounded. Fore tibia with seven teeth on outer margin. Genitalia as in Fig. 33.

FEMALE. Length 11.2 mm.; greatest width 7.6 mm. Similar to males except in the following respects: dorsally black; clypeal-frontal carina slightly reduced in height, not as noticeably overhanging clypeus; pygidium shorter, sides almost straight, apex abruptly arcuate.

SPECIMENS EXAMINED. 4 males, 1 female.

## GUATEMALA

**Quezaltenango:** (El) Tumbador, 1000 m., Jan. 1909, 15 May 1911, C. Riedel.

Specimens are in the following collections: CNC, Paris, USNM.

REMARKS. *N. hamifer* can be identified by the following combination of characters: color dorsally reddish black to black; fore tibia normally with seven teeth; anterior clypeal carina transverse, sometimes obsolete medially; median pronotal tubercle on anterior margin, tubercle extending posteriorly approximately width of margin; pronotal concavity narrow, deeply concave immediately behind anterior margin; carina on each side of concavity low, slightly sinuate; posterior pronotal angle with distinct, contiguous, oblong, dorsal pit; margin fine to obsolete just anterior to median angulation, shallowly indented; elytra irregularly punctate, having rugose appearance. Also the male genitalia are distinctive.

Females of *hamifer* and *tridenticeps* may be confused; a discussion of the major differences between the two is given under the description of *tridenticeps*.

### *Neothyreus mexicanus* (Klug), new combination

Figs. 15, 19, 34; Map 4

*Athyreus mexicanus* Klug, 1845, p. 29; Bates, 1887, p. 110.

TYPE. Holotype, female, Mexico (No. 25645, Zoologisches Museum der Universität, Berlin).

MALE. Length 10.1 to 16.0 mm.; greatest width 6.5 to 9.5 mm. Color dorsally tan to dark brown. Anterior clypeal carinae usually extending from each anterior angle upwards to base of median clypeal-frontal tubercle; occasionally with carina transverse, obsolete medially, or, rarely, evident only at base of median clypeal-frontal tubercle. Clypeal-frontal carina trituberculate; the median tubercle thick, moderately advanced; face of clypeus below almost vertical; small males with clypeal-frontal carina reduced in height, tubercles small, not noticeably thickened. Vertex between eyes flat to shallowly concave. Median pronotal tubercle on anterior pronotal margin small, sometimes indistinct. Pronotal concavity deeply concave and wide on large specimens, shallower and narrower on small males; carina on each side of concavity low, slightly sinuate, converging posteriorly (Fig. 19); carinal termination separated from posterior margin by distance equal to two or three times width of carina; short lateral carina, midway between posterior pronotal angle and carina of concavity, straight to slightly arcuate; ends of lateral carina distinctly separated from pronotal margin. Posterior pronotal angle widely oblique (Fig. 15); median pronotal angle abruptly rounded, excavated anteriorly, margin lacking in excavation; anterior angle sharp, oblique. Elytra granulate, surface between granules irregular, shining; small puncture behind each granule bearing semirecumbent seta; occasional long, erect setae intermixed, particularly on posterior half of elytra. Pygidium approximately two-thirds as long as wide, sides feebly sinuate, apex abruptly rounded. Fore tibia usually with six teeth on outer margin, one specimen with five teeth. Genitalia as in Fig. 34; broad apical lobe of each paramere semimembranous (distortion due to drying is frequent).



Map 4. Distribution of *Neoathyreus mexicanus* (Klug).

**FEMALES.** Length 10.5 to 15.5 mm.; greatest width 6.6 to 9.6 mm. Similar to males except in the following respects: anterior clypeal carina transverse, often obsolete medially, rarely carinae indicated at base of median clypeal-frontal tubercle; clypeal-frontal carina never as high as in large males, clypeal face never vertical; pronotal concavity varying in width, never as deeply concave as male of similar size; pygidium shorter, broadly arcuate; outer edge of fore tibia normally with six teeth, two specimens examined having five teeth.

**SPECIMENS EXAMINED.** 48 males, 77 females.

#### COSTA RICA

**Alajuela:** San Carlos, Schild and Burgdorf.

**Cartago:** Azahar; Cachi, Rogers.

**Limon:** Santa Clara Prov. (see Selander and Vaurie, 1962, p. 55), Hamburg Farm, 31 July 1926.

**San Jose:** San Isidro del General, 16 Sept. 1957, C. F. Dowling, Jr.; San Jose, 1000-1200 m., 1 June-20 Sept., Nevermann, 24 June 1924, at light, 20 Aug. 1926.

#### EL SALVADOR

**Chalatenango:** Las Ceibas, Vera Williams.

**San Salvador:** San Salvador, (4) May, (13) June, (2) October, Bottimer, Cartwright, Virkki.

**Santa Ana:** Monte Christo, 20 July 1960, Virkki.

## GUATEMALA

**Alta Verapaz:** Panzos.

**El Quiche:** Sacapulas, 4500 ft., 12 Aug. 1947, C. and P. Vaurie.

**Quezaltenango:** Coatepeque, 1300 ft., Champion; (El) Tumbador, 1000 m., 1909, Riedel; El Reposo, 800 ft., Champion.

**Retalhuleu:** San Sebastian, 1925, L. Thief.

## MEXICO

**Guerrero:** 1 mi. N. Chilpancingo, 27 Aug. 1958, H. Howden; Rincon, 2800 ft., H. H. Smith.

**Oaxaca:** Oaxaca, 5000 ft., 20 July 1937, 6 July 1958, Chemsak; Peras (=San Miguel); 63 mi. W. Tehuantepec, 21 July 1952, Gilbert and MacNeil.

**Puebla:** Tehuacan.

**Veracruz:** Jalapa, Höge.

## NICARAGUA

**Chontales:** (no exact locality), Janson.

## PANAMA

**Canal Zone:** Ft. Clayton, July 1961, C. E. Yunker.

**Chiriqui:** Volcan de Chiriqui, 4000-6000 ft., Champion.

Specimens are in the following collections: AMNH, BM, CAS, CNC, Frey, MCZ, Parish, UnCal, Bottimer, Howden, Woodruff.

REMARKS. *N. mexicanus* appears to be the most common and widely distributed species of the Mexican-Central American Athyreini. It may be identified by the following combination of characters: tan to dark brown; anterior clypeal carinae normally extending to base of median clypeal-frontal tubercle in males, transverse, often obsolete medially in females; median pronotal tubercle on anterior margin small; pronotal concavity usually broadly concave and moderately deep; carina on each side of concavity low, slightly sinuate, converging posteriorly; pronotal carinae terminating approximately 0.5 mm. before posterior margin; posterior pronotal angle widely obtuse, not modified by pit or deep excavation; median pronotal angle abruptly rounded, excavate anteriorly with margin lacking in excavation; elytra granulate; fore tibia normally with six teeth. The male genitalia are characteristic, but the shape of the large, semimembranous anterior lobes varies due to distortion.

Through the kindness of Mr. Fritz Hieke, Institut für spezielle Zoologie und Zoologisches Museum, Humboldt-Universität, Berlin, I was able to examine the female type of *mexicanus* Klug. The specimen is 12.3 mm. long and has five distinct teeth on the fore tibia. It is undoubtedly conspecific with the specimens described above.

Mr. Hieke also sent me one of the cotypes of *lanuginosa* Klug. The specimen is from Bahia and is closely related to the Mexican species described herein as *quadridentatus*, having four teeth on the fore tibia. I suspect the Colombian specimen mentioned by Klug is a different species, since he clearly states that the fore tibia has six teeth. I have seen specimens from Colombia that match Klug's description, but neither the Colombian specimens nor the cotype from Bahia match any of the species considered in the present study.

*Neothyreus granulicollis*, new species

Figs. 6, 20, 35; Map 5

**HOLOTYPE.** Male, length 14.7 mm.; greatest width 10.0 mm. Color dorsally light brown. Anterior clypeal carina transverse, broadly interrupted medially. Clypeal-frontal carina with edge thickened, trituberculate, tubercles poorly developed. Vertex nearly flat. Median pronotal tubercle on anterior margin small. Pronotal concavity broadly, shallowly concave; central portion of concavity with large granules and scattered rugose patches; concavity posteriorly lacking extensive smooth area; carina on each side of concavity arcuate, approaching to within 1.0 mm. of opposite carina at posterior edge of concavity, both carinae thence parallel to termination approximately 0.4 mm. before posterior pronotal margin (Fig. 20); lateral carina on each side approximately equidistant between margin and carina of concavity, posterior termination about 0.5 mm. before posterior pronotal margin; on each side posterior termination of lateral carina and carina of concavity connected by feebly raised, rugose band; rugose area also present between lateral carina and adjacent posterior pronotal angle. Posterior pronotal angle widely obtuse; median angle broadly rounded, margin anteriorly complete, very shallowly indented; anterior angle sharp, obtuse. Elytra punctate, punctures often with small granules anteriorly; surface between punctures irregular, shining; punctures bearing semi-recumbent setae, a few long, erect seta intermixed. Pygidium approximately two-thirds as long as wide, sides nearly straight, tip sharply arcuate. Fore tibia with five teeth on outer margin (Fig. 6). Genitalia as in Fig. 35.

**ALLOTYPE.** Female, length 15.5 mm.; greatest width 9.5 mm. Similar to male except in the following respects: transverse, anterior clypeal carina briefly interrupted medially; clypeal-frontal carina with edge not greatly thickened, median tubercle only slightly advanced in front of lateral ones; pronotal concavity slightly narrower, shallower; carina on each side of concavity feebly sinuate in anterior half; concavity heavily granulate except for small smooth area posteriorly; rugose band on each side between carinae lacking; pygidium shorter, tip briefly truncate; fore tibia with five distinct teeth and an indistinct sixth tooth on outer margin.

**TYPE MATERIAL.** Holotype, male, Guadalajara, Jalisco, Mexico, 19 VII 1960, C. O. Morse (CNC No. 8434). Allotype, female, 12 mi. E. Morelia, 6350 ft., Michoacan, Mexico, 17 VII 1953, ex. Howden coll. (CNC No. 8434). Paratypes, 8 males, 15 females.

## MEXICO

(?) **Coahuila:** Saltillo, E. Palmer [no state given on labels, locality in doubt].

**Guanajuato:** 11 mi. SW. Acombaro, 17 Aug. 1954, Linsley, MacSwain, Smith.

**Guerrero:** Amula, 6000 ft., Aug., H. H. Smith.

**Jalisco:** Guadalajara, Aug. 1960, Arnaud, Ross, Rentz; 8 mi. S. Guadalajara, Sept. 1954, F. X. Williams; 15 km. S. Mazamitla, 5500 ft., 29 July 1952, F. W. and F. G. Werner.

**Michoacan:** (N. of ?) Mazamitla, 24 July 1953, C. and P. Vaurie; Uruapan, 10 Aug. 1949, L. J. Bottimer.

**Morelos:** Cuernavaca, June, W. Schaus, July, V. D. Roth, 9 July 1961, R. and K. Dreisbach.

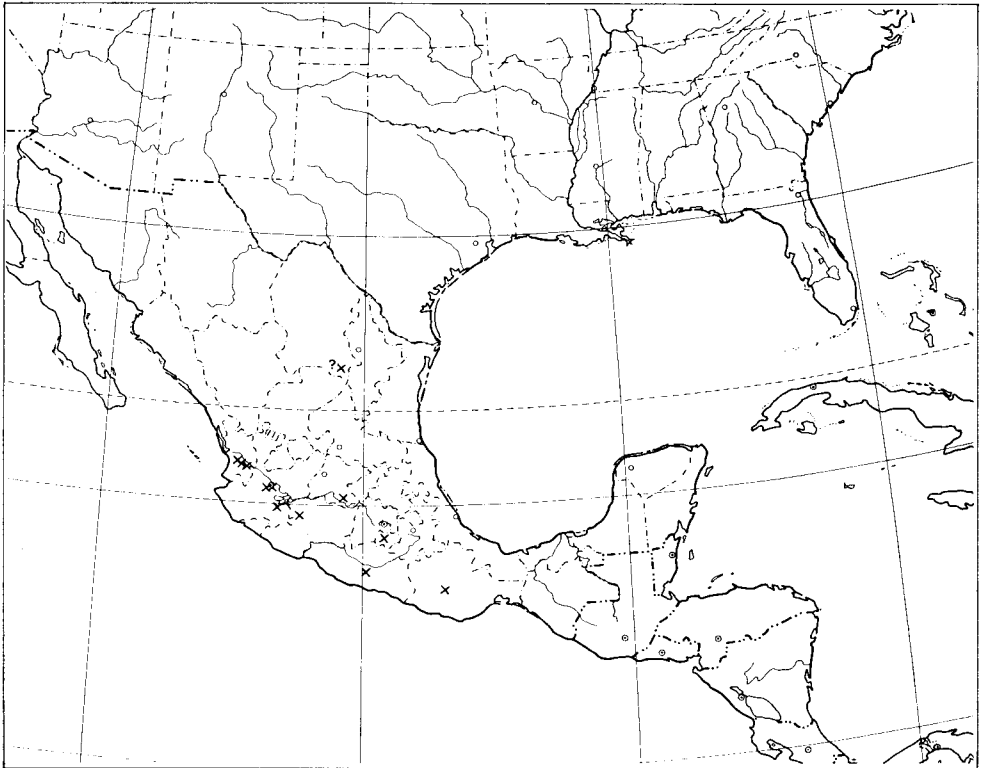
**Nayarit:** Jalisco, 23 Aug. 1954, J. Keef; Tepic, 22 Aug. 1905, P. H. Goldsmith; 24 mi. SE. Tepic, 16 Aug. 1960, Arnaud, Ross, Rentz.

**Oaxaca:** Juquilla, Sallé.

**Sinaloa:** 8 mi. W. El Palmito, 19 July 1964, Chemsak, Howden and Powell.

Paratypes are in the following collections: AMNH, BM, CAS, CNC, MCZ, Paris, UnCal, USNM, Bottimer, Dreisbach, Howden, Woodruff.

**REMARKS.** Variation in the specimens examined is as follows: Males range from 12.5 to 14.7 mm. in length and from 8.0 to 10.0 mm. in greatest width; females range from 10.9 to 15.5 mm. in length and from 7.3 to 9.5 mm. in greatest width. Color varies from tan to brown. None of the males has the clypeal-



Map 5. Distribution of *Neothyreus granulicollis*, new species.

frontal carina as greatly thickened as in the holotype, in one small male the carina approaches the condition described for the allotype. The pronotal concavity varies in both sexes in width, depth, and in amount and extent of the heavy, central granulation or rugosity. The rugose band connecting the posterior ends of the pronotal carinae on each side is usually present on large specimens regardless of sex, and is reduced or absent on small specimens. The marginal indentation just before the median pronotal angle is never deep, and is lacking in two specimens. The fore tibia usually has five distinct teeth on the outer margin, occasionally a minute sixth tooth is present basally. The shape of the male genitalia seems relatively constant.

*N. granulicollis* can be distinguished by the following combination of characters: tan to brown, anterior clypeal carina transverse, interrupted medially; pronotal concavity broadly, moderately concave; central portions of concavity with large granules or rugose; carinae of concavity narrowly separated behind concavity, extending to within 0.4 mm. of posterior pronotal margin; lateral pronotal margin unbroken, only slightly indented in front of median angle; elytra punctate-granulate, fore tibia with five or six teeth on outer margin; male genitalia as in Fig. 35.

#### TRIBE BOLBOCERATINI

Mexican and Central American species in the tribe Bolboceratini have the following characteristics: elytra usually longer than length of head and pronotum combined; right mandible with no more than one distinct lateral lobe; scutellum approximately as wide as long; elytral striae narrow, impressed or indicated by

even rows of punctures; pronotum and elytra glabrous except in a few species of *Bolbocerosoma*, which have scattered setae, but lack numerous setae along elytral suture characteristic of Athyreini; middle coxae contiguous to moderately separated, meso- and metasternum between coxae no more than one fifth as wide as the body at that point; pygidium not concealing abdomen, a few ventral abdominal segments normally visible.

The tribe is comprised, in the area under consideration, of five genera and 16 species, 15 of which do not occur south of Mexico. The distribution of many of the species extends into the United States, and these have been treated in detail in other publications (Cartwright, 1953; Howden, 1955). In order to deal with the two Mexican species of *Eucanthus*, the United States and Canadian species also had to be considered and a revision of the genus for all of North America is included in the section on United States and Canadian Geotrupidinae at the end of this work.

#### **BOLBOCEROSOMA SCHAEFFER**

*Bolbocerosoma* Schaeffer, 1906, p. 254; Boucomont, 1911, pp. 332-350; Blatchley, 1910, p. 937, 1928, p. 29; Dawson, 1922, p. 194; Dawson and McColloch, 1924, pp. 9-15; Brown, 1928, pp. 192-196, 1929, p. 213; Robinson, 1941, p. 132; Ritcher, 1947, pp. 11-12; Howden, 1955, pp. 163-190.

TYPE-SPECIES. *Scarabaeus farctus* Fabricius, designated by Schaeffer (1906).

The genus *Bolbocerosoma* is characterized by: color dorsally yellow- to red-brown, with black markings; eye completely divided by canthus; metasternum between middle coxae narrow, with tooth-like elevation; pronotal carina no wider than head; base of elytra not margined; vertex with conical horn in males, with transverse carina in females.

The bicolored dorsum readily separates the two Mexican species of *Bolbocerosoma* from the other endemic species. Both species also occur in the United States. Since they were included and described in my revision of the genus (1955), only a brief description is given here.

#### ***Bolbocerosoma ritcheri* Howden**

*Bolbocerosoma ritcheri* Howden, 1955, p. 186.

TYPE. Holotype, male, Brownsville, Texas, 8 Sept. 1947, Alexander (USNM No. 61681).

MALES. Length 7.7 to 10.1 mm.; greatest width 5.5 to 7.2 mm. Color dorsally yellow-brown to red-brown marked with black as follows: head except clypeus at base of tubercle, apical pronotal margin behind head, pronotal tubercles and often fovea, spot on either side of base of pronotum between outer edge of scutellum and elytral margin, scutellum, extreme base of elytra to humeri, elytral margins, sutural intervals, and postmedian, oblong spot extending from third to ninth striae. Horn of vertex slender, conical from posterior view, tip pointed, not bifid. Vertex sparsely punctate behind horn. Pronotal disc with numerous coarse punctures and very fine secondary punctures. Each elytron with five distinct striae between suture and humeral umbone. Numerous punctures on prothorax, scutellum and elytra with small, erect, yellow setae; setae scattered and easily overlooked.

FEMALES. Length 9.5 to 10.0 mm.; greatest width 6.8 to 7.2 mm. Marked as males except that transverse pronotal carina black along its length, small lateral tubercles occasionally black in some specimens.

SPECIMENS EXAMINED. 4 males, 2 females.

#### **MEXICO**

**Nuevo Leon:** Monterey, 14 Sept., 6, 8 Oct. 1958, J. Hernandez and J. Mathieu.

Specimens are in the following collections: Inst. Tecnológico de Monterrey, CNC.

REMARKS. The species is readily identified by the black markings of the pronotum and elytra and by the presence of the fine dorsal setae. All of the Mexican specimens were taken at light on the campus of the Instituto Tecnológico de Monterrey.

***Bolbocerosoma pusillum townesi* Howden**

Map 6

*Bolbocerosoma pusillum townesi* Howden, 1955, p. 183.

TYPE. Holotype, male, St. Johns, Apache County, Ariz., 28 May 1931 (USNM No. 61680).

MALES. Length 10.5 to 11.0 mm.; greatest width 7.2 mm. Color dorsally yellow-brown to red-brown marked with black as follows: head except portion of clypeus, apical pronotal margin behind head, lateral grooves and all or apical portions of tubercles, band on pronotal base narrowing medially and extending no farther than elytral margin, scutellum, extreme base of elytra, suture intervals, and entire apical two-fifths of elytra extending from sutural interval almost to margin; black area reaching margin of elytron only in apical fourth. Vertex coarsely, moderately punctured; horn, viewed from posterior, thickly conical, with blunt tip. Pronotum coarsely, irregularly punctate, slightly less so than in typical *pusillum*. Fine secondary punctures distributed over pronotum. Each elytron with five distinct striae between suture and humeral umbone. Dorsal setae (which are characteristic of typical *pusillum*) absent.

FEMALES. Length 8.6 to 9.5 mm.; greatest width 6.1 to 6.4 mm. Marked as males except that transverse pronotal carina black along its length, small lateral tubercles usually indistinctly marked.

SPECIMENS EXAMINED. 3 males, 5 females.

MEXICO

**Chihuahua:** Valle de Olivos, 5500 ft., 20 July 1947.

**Coahuila:** Mesa de la Eucnotada (?), 7000 ft., Sierra del Carmen, 28 July 1938; 33 mi. SE. Saltillo, near Jamé, 7000 ft., 18, 25 July 1963, Arnett, H. and A. Howden, Van Tassell.

Specimens are in the following collections: CNC, USNM, Howden.

REMARKS. The pattern of the dorsal, black markings and the lack of dorsal setae distinguish this subspecies of *pusillum* from the one other Mexican species, *B. ritcheri*.

**BOLBORHOMBUS CARTWRIGHT**

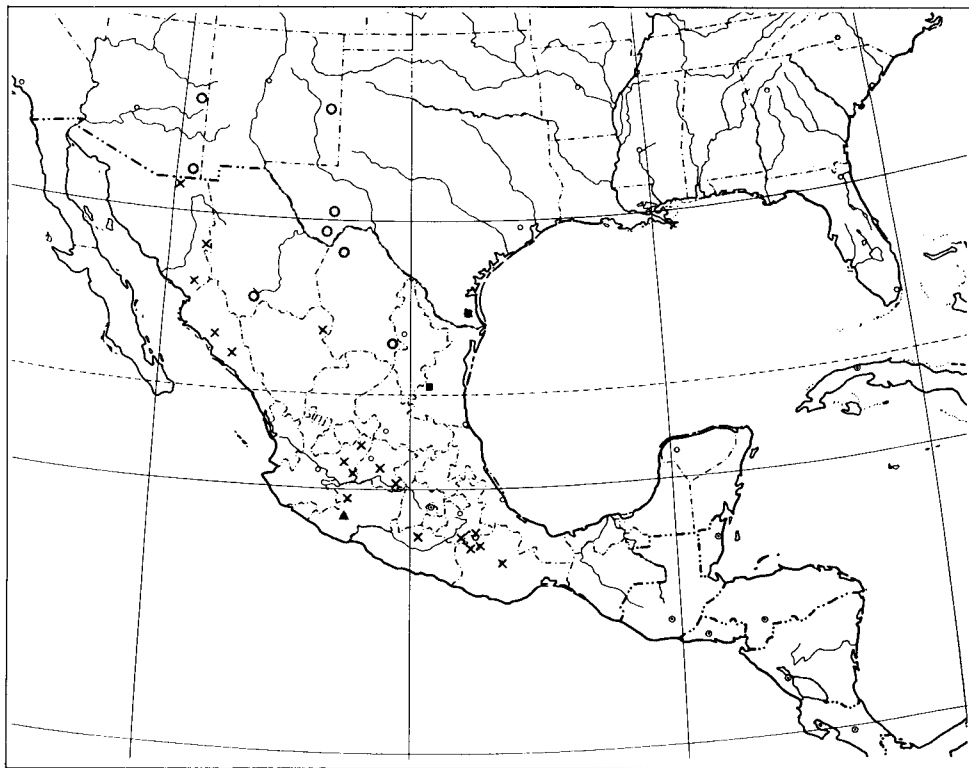
*Bolborhombus* Cartwright, 1953, p. 116; Howden, 1955, p. 195.

TYPE-SPECIES. *Bolboceras sallaei* Bates (= *Bradycinetus carinatus* Schaeffer), designated by Cartwright (1953).

Generic limitations taken from Cartwright (1953, pp. 116-117) except for the few modifications placed in brackets, are as follows:

"Mandibles arcuate externally. Head, male and female, without median frontal horn. Pronotum serrate laterally; apex with [at least an indication of] a carina paralleling anterior margin, the interspace interrupted behind each eye by a distinct rather deep foveola [which is sometimes obsolete]. Scutellum triangular, with base straight, sides arcuate. Elytra not margined at base; seven discal striae, the first two interrupted by the scutellum, the second sometimes indistinctly forked opposite the apex of scutellum. Two prosternal spines in tandem behind anterior coxae [sometimes poorly defined], the posterior more or less hastate. Metasternal plate rhomboid in shape, the posterior angle acute and with adjacent edges cariniform, the lateral angles with adjacent edges rounded; the intercoxal lobe deeply concave and with strong cariniform lateral edges."

Three of the four species presently included in the genus occur in Mexico. The fourth species, *Bolborhombus angulus* Robinson, has been collected near the Mexican border in the Huachuca Mts. of Arizona and near the Rio Grande River



Map 6. Distribution of: [O] *Bolbocerosoma pusillum townesi* Howden, [X] *Bolborhombus s. sallaei* (Bates) in Mexico, [■] *Bolborhombus s. magnus*, new subspecies, and [▲] *Bolborhombus nitidus*, new species.

in Brewster County, Texas. It can be recognized by the presence of a distinct tubercle on the vertex beside each eye. Additional collecting will almost certainly add this species to the Mexican list.

***Bolborhombus sallaei sallaei* (Bates), new combination**

Map 6

***Bolboceras sallaei*** Bates, 1887, p. 111; 1889, p. 394; Boucomont, 1912, p. 13; Blackwelder, 1944, p. 220.

***Bradycinetus carinatus*** Schaeffer, 1906, p. 251. **New synonymy.**

***Bolboceras schaefferi*** Boucomont, 1911, p. 347.

***Bolborhombus schaefferi*** (Boucomont), Cartwright, 1953, p. 119.

***Bolborhombus carinatus*** (Schaeffer), Howden, 1955, p. 195.

**TYPE.** Lectotype here designated, male, Vallé Réal (Sallé Coll.), [Mex.], labeled *Bolboceras sallaei* Bates, with B.M. type label (BM).

**TYPE.** *Bradycinetus carinatus* Schaeffer, lectotype, male, Palmerlee, Cochise County, Arizona, designated by Cartwright (1953) (USNM No. 42569).

**MALES.** Length 11.5 to 18.0 mm.; greatest width 7.3 to 11.0 mm. Color varying from light to dark reddish brown. Clypeus anteriorly truncate, flat surface sloping posteriorly upwards to wide, binodose carina; carina varying in width, in some specimens anteriorly arcuate, lateral terminations of carina connected by small, straight carina to each anterior clypeal angle. Rugose frons behind clypeal carina nearly flat, with low, transverse tumosity medially between genae. Pronotum with distinct carina behind anterior margin terminating



laterally behind and slightly beyond anterior angles; behind this carina, on each side, a short, posteriorly directed carina. Disc of pronotum in anterior third with at least a faintly indicated, trisinate, transverse swelling; numerous coarse punctures present anteriorly and laterally, fine secondary punctures often present medially on and behind the transverse swelling. Elytral disc usually finely alutaceous; striae fine, shallowly but distinctly impressed. Tips of genitalia variable in shape; genital capsule with approximately five uneven rows of setigerous punctures around apex.

**FEMALES.** Length 11.0 to 18.6 mm.; greatest width 6.6 to 12.3 mm. Similar to males except in the following characters: clypeus anteriorly with transverse carina; posteriorly on each side, above the mandibular insertion, with small distinct tubercle; low carina often connecting tubercles; a slight to distinct median swelling usually present posteriorly on the frons.

**SPECIMENS EXAMINED.** 21 males, 32 females.

## MEXICO

**Durango:** Tlahualilo, 30 Aug. 1932.

**Guanajuato:** 11 mi. SW. Acombaro, 17 Aug. 1954; 2 mi. N. Irapuato, 18 Aug. 1954.

**Guerrero:** 8 mi. E. Iguala, 22-26 Aug. 1958.

**Jalisco:** Lagos de Moreno (= Lagos), 19 Aug. 1954; 22 mi. NW. La Piedad, 23 July 1954; 20 mi. SW. Tepatitlan, 19 Aug. 1954; 21 mi. NE. Tepatitlan, 18 Aug. 1960.

**Michoacan:** Uruapan, 10 Aug. 1949.

**Oaxaca:** 10 mi. S. Chila (Puebla?), 5 July 1956; Huajuapán de León, 18 July 1955; Oaxaca, 24 July 1937.

**Puebla:** 34 mi. SE. Acatlan, 9 July 1952; Tehuacan, 23 June 1951.

**Sinaloa:** Culiacan, 8 Nov. 1958; 26 mi. N. Pericos, 13 Aug. 1960.

**Sonora:** Naco, 15 Aug. 1949; Rio Mayo; Yecora, 12 July 1961.

Specimens are in the following collections: AMNH, BM, CAS, CNC, UnCal, UnKans, USNM, Bottimer, Howden.

**REMARKS.** The characters on the head and the short, posteriorly directed, lateral pronotal carinae will distinguish *sallaei* from related species. The range of *sallaei* extends from Arizona to Oaxaca in southern Mexico.

Cartwright (1953, p. 120) records the species from Santa Rosa, Baja California, but I have not seen specimens from this locality. *B. sallaei sallaei* may represent a complex of forms as there is a great range of size and a considerable variation in the characters of the head, pronotum, and in parts of the male genitalia. This variation, coupled with habitats where specimens have been collected, which vary from subtropical coastal areas in Sinaloa to oak-pine forests at 7000 feet at Yecora, Sonora, seems to indicate a problem, but more material is needed before it can be properly assessed.

### *Bolborhombus sallaei magnus*, new subspecies

#### Map 6

**HOLOTYPE.** Male, length 18.6 mm.; greatest width 12.0 mm. Similar to typical *sallaei* except in the following characters: clypeus lacking carina between anterior angle and edge of horn; frons behind clypeal horn nearly flat; entire pronotum with fine secondary punctures, coarse punctures as in typical *sallaei*; elytral surface between striae smooth and with luster similar to pronotum, not dull as in typical *sallaei*.

**FEMALE.** Unknown.

**TYPE MATERIAL.** Holotype, male, Tlahualilo, Mexico, July 1905, A. W. Morrill (USNM). Paratypes, 3 males.

## UNITED STATES

**Texas:** 10 Dec. 1900 (Howden); Kingsville, C. T. Reed (CNC No. 8435, USNM).

REMARKS. There is little variation evident in the four specimens. Size ranges from 17.6 to 20.0 mm. in length and from 10.5 to 12.0 mm. in greatest width. Color varies from light to dark reddish brown. All the specimens have the clypeal horn anteriorly arcuate medially, less so in the type than in the paratypes.

The subspecies *magnus* can be differentiated from typical *sallaei* by its normally larger size and the lack of a carina between the clypeal horn and the anterior clypeal angles. Also the shining elytra are not typical of *s. sallaei*, although some specimens from Sonora have this character.

The type locality of Tlahualilo, Mexico, may be in either Tamaulipas or Nuevo Leon. Tlahualilo, N. L., is approximately 40 miles north of Linares, or 10 miles north of Gral Teran. Tlahualilo, Tam., is approximately 35 miles south of Linares, N. L., or about 10 miles south of Villagran, Tam. Both areas are roughly similar ecologically, being in the arid, thorn-scrub area. The Tamaulipas locality seems to be the most probable one, since it is just off the main highway to Cd. Victoria, while Tlahualilo, N. L., is not near any major road.

***Bolborhombus parvulus* Cartwright**

*Bolborhombus parvulus* Cartwright, 1953, p. 118; Howden, 1955, p. 196.

TYPE. Holotype, male, Triunfo, Baja California, Mexico, 7 August 1938, Michelbacher and Ross (CAS).

MALES. Length 8.5 to 13.0 mm.; greatest width 6.0 to 7.5 mm. Dorsally shining, dark reddish brown. Clypeus anteriorly extending obliquely upward to slightly binodose transverse carina or horn; oblique surface flat; either end of transverse carina connected to adjacent anterior clypeal angle by distinct, straight carina or ridge. Frons behind horn with short, elevated, slightly anteriorly arcuate carina that is midway between and almost exactly in line with anterior edges of eye canthi. Sides of frons and vertex delimited on each side by distinct carina, carina much more strongly developed above eye canthus than it is in the related *sallaei*. Pronotum with sharp postapical carina and distinct lateral carina on each side; in other respects as in *sallaei*. Elytra with finely punctate striae more feebly impressed than in *sallaei*, similar in other respects. Genitalia as illustrated by Cartwright (1953, fig. 14, a).

FEMALES. Length 9.0 to 12.5 mm.; greatest width 6.0 to 7.3 mm. Similar to males except for the following characters of the head: anterior edge of clypeus abruptly, transversely carinate; posterior edge of clypeus on each side, above mandibular insertion, with distinct tubercle; carina between tubercles low, very obtusely angulate anteriorly; short, distinct, anteriorly arcuate carina behind posterior clypeal carina on frons; surface between two carinae coarsely punctate-reticulate; vertex much lower, smooth behind the frontal carina with only scattered fine punctures (*sallaei* has vertex coarsely punctate behind indistinct or obsolete frontal carina).

SPECIMENS EXAMINED. 4 males, 2 females.

## MEXICO

**Baja California:** 25 mi. W. La Paz, 30 August 1959; 6 mi. SW. Santiago, 31 August 1959; Santa Rosa; San Venancio, 8 October 1941; Triunfo, 7 August, 1938.

Specimens are in the following collections: CAS, CNC, USNM, UnAriz.

REMARKS. In the characters of the head *parvulus* shows a closer relationship to *sallaei* than to *angulus* Robinson. The finer elytral striae of *parvulus* and the characters given in the key will separate it from *sallaei*. Specimens of *angulus* usually have a distinct tubercle beside each eye on the vertex and both sexes have the anterior edge of the clypeus transversely carinate.

***Bolborhombus nitidus*, new species**

Fig. 21; Map 6

**HOLOTYPE.** Male, length 12.0 mm.; greatest width 8.0 mm. Dorsally shining, reddish brown. Clypeus curving upward to low, transverse, binodose carina on posterior third (the carina similar to that of *sallaei*, but usually lower, and laterally not connected by carina to anterior clypeal angles, as is typical in *sallaei* and *parvulus*). Frons nearly flat, densely, almost rugosely, punctate. Pronotum similar in shape to *sallaei*. Anterior pronotal carina, behind pronotal margin, feebly developed, indicated medially by row of punctures; lateral, posteriorly directed carinae absent. Transverse, trisinate tumosity or swelling more poorly developed than in *sallaei*; pronotal punctures sparse, less conspicuous than in *sallaei*. Elytral disc with very fine, scarcely impressed striae; striae punctures minute. Legs and ventral surfaces not differing greatly from *sallaei*. Genitalia slender, similar in that respect to genitalia of *angulus* (see Cartwright 1953, fig. 14, b); genital capsule with long, acutely pointed lobe with dense setigerous punctures covering approximately apical fourth of capsule.

**ALLOTYPE.** Female, length 13.7 mm.; greatest width 8.5 mm. Similar to holotype except in the following respects: clypeus with anterior edge almost vertically, transversely carinate; posterior portion of clypeus with tubercle on each side above mandibular insertion, tubercles connected by feeble, anteriorly arcuate carina; frons nearly flat, closely, coarsely, almost rugosely, punctate; pronotum as in male but with numerous fine punctures on anterior third and with tumosities reduced in size.

**TYPE MATERIAL.** Holotype, male, 11 mi. E. Apatzingan, Michoacan, Mexico, 20 Aug. 1954, E. G. Linsley, J. W. MacSwain, and R. F. Smith (CAS). Allotype, female, same data as holotype. Paratypes: 29 males, 39 females, same data as holotype.

Paratypes are in the following collections: AMNH, BM, CNC (No. 8436), MCZ, USNM, UnCal.

**REMARKS.** Variation in the type series is evident mainly in size, density of punctures, and in the development of the carinae on the head. In males length ranges from 10.8 to 14.1 mm. and greatest width from 6.5 to 9.0 mm. In females length varies from 10.4 to 14.4 mm. and greatest width from 6.1 to 9.0 mm. In large males the transverse clypeal carina or horn is higher and nearer the middle of the clypeus. Also in large specimens the punctures of the frons are often less numerous. The size, number, and depth of the pronotal and striae punctures show some variation, but rarely are they as deep and distinct as those in *sallaei*. Females vary in a similar fashion. In small specimens the posterior clypeal carina may be obsolete medially.

The lack of the lateral, posteriorly directed, pronotal carinae will distinguish *Bolborhombus nitidus* from the other species in the genus. Also the shining, polished dorsum is quite distinctive.

**BOLBOCERASTES CARTWRIGHT**

*Bolbocerastes* Cartwright, 1953, p. 105; Howden, 1955, p. 196.

**TYPE-SPECIES.** *Bolbocerastes regalis* Cartwright, designated by Cartwright (1953).

The genus *Bolbocerastes* can be separated from the other genera of Bolboceratini covered here by the following characters: mandibles sharply arcuate anteriorly, median tumosity of pronotum rounded, lateral tumosities carinate, base of elytra margined, only first elytral stria terminated near apex of scutellum, prosternal spine behind anterior coxae transverse, spine doubly pointed and remote from acutely angled intercoxal piece, apices of tibiae of mid and hind legs obliquely truncate.

Species of *Bolbocerastes* are known only from the southwestern United States and northern Mexico. All of the Mexican species are included in Cartwright's excellent revision of the genus (1953, p. 105), and only a brief summary is presented here. For additional records and for a list of collections containing specimens, the reader should refer to Cartwright's paper (1953).

***Bolbocerastes regalis* Cartwright**

*Bolbocerastes regalis* Cartwright, 1953, p. 106; Howden, 1955, p. 197.

TYPE. Holotype, male, 3206, Colo. R. bottom. Monument 204, Mex. Bd. line, 20-31 Mar. '94 (USNM No. 61076).

MALES. Length 16.5 to 21.0 mm.; greatest width 10.0 to 12.8 mm. Anterior clypeal horn wider than one-half the width of clypeus, apex truncate or slightly emarginate. Inner pronotal carina on either side of median tumosity biangulate in well-developed specimens. Elytral striae very fine, minutely punctate. Ventral setae very long, dense in fresh specimens.

FEMALES. Length 15.5 to 20.0 mm.; greatest width 9.4 to 12.4 mm. Differing from males as follows: anterior face of clypeus elevated, but lacking a distinct horn; on each side a carina extends from anterior angle to side of elevation, thence posteriorly to sharp tubercle above mandibular insertion; vertex medially, between the genae, with a wide, truncate horn approximately twice the height of anterior face of clypeus; pronotum with lateral carinae much less developed than in males.

SPECIMENS EXAMINED. 3 males, 3 females.

## MEXICO

**Sonora:** Choya Bay, 27 March 1949; 30 mi. SW. Sonoyta, 31 March 1949; Puerto Libertad, 15 March 1939.

REMARKS. This species appears to be most common in parts of the California desert. A number of specimens have been seen from the vicinity of Thousand Palms, mostly taken in light traps. I have collected a few specimens 15 mi. E. of Calexico, Calif., on 5, 6 June 1961, within a mile of the Baja California border. The specimens were in 18-inch, vertical burrows in damp sand under a large mesquite thicket.

***Bolbocerastes serratus* (LeConte)**

*Athyreus serratus* LeConte, 1854, p. 80; Boucomont, 1902, p. 8.

*Amechanus serratus* (LeConte), Horn, 1870, p. 48.

*Bradycinetus serratus* (LeConte), Horn, 1894, p. 334; Schaeffer, 1906, p. 251.

*Bradycinetulus serratus* (LeConte), Cockerell, 1906, p. 242.

*Bolboceras serratus* (LeConte), Boucomont, 1911, p. 341.

*Bolbocerastes serratus* (LeConte), Cartwright, 1953, p. 113; Howden, 1955, p. 197.

TYPE. Holotype, female, Mexican Boundary, Laredo to Ringgold Barracks, LeConte Collection (MCZ).

MALES. Length 13.5 to 16.0 mm.; greatest width 9.1 to 9.8 mm. Anterior clypeal horn well in front of lateral tubercles, a line from one tubercle to clypeal horn to the other tubercle almost forming a right angle. Elytral striae fine, with small but distinct punctures. Genitalia figured by Cartwright (1953, fig. 14, f).

FEMALES. Length 12.0 to 15.5 mm.; greatest width 7.2 to 10.1 mm. Similar to males except for characters of head: anterior clypeal horn reduced, horn of vertex between genae twice as high, truncate and wider than clypeal horn.

SPECIMENS EXAMINED. 3 males, 2 females (size range given above includes Texas specimens).

## MEXICO

**Coahuila:** La Gloria, South of Monclova.

**Nuevo Leon:** Rancho Preso; Monterrey.

REMARKS. This species is easily confused with *imperialis*. The more eastern range of *serratus*, the small but distinct punctures of the elytra, and the characters of the male genitalia will serve to distinguish it.

***Bolbocerastes imperialis imperialis* Cartwright**

*Bolbocerastes i. imperialis* Cartwright, 1953, p. 109; Howden, 1955, p. 197.

TYPE. Holotype, male, Imperial County, Calif., "on the Experiment Farm," June 1912, J. C. Bridwell (USNM No. 61077).

**MALES.** Length 12.0 to 15.5 mm.; greatest width 7.5 to 9.8 mm. Similar to males of *serratus* except for the very fine stria punctures of elytra and the genitalia. In well-developed specimens the clypeal horn is often longer than in *serratus* and has the anterior face inclined forward over the labrum.

**FEMALES.** Length 11.1 to 18.5 mm.; greatest width 7.8 to 10.6 mm. Similar to females of *serratus* except for the finer striae and obsolete stria punctures.

**SPECIMENS EXAMINED.** 2 males, 3 females (size range given above includes Arizona specimens).

## MEXICO

**Baja California:** 10 mi. S. Catavina, 29 July 1938.

**Sonora:** Agua Caliente, 26 Aug. 1954; 36 mi. N. Hermosillo, 13 July 1962.

**REMARKS.** In addition to the characters given above for the separation of *serratus* and *imperialis*, the latter species tends to be a lighter brown, but since old specimens of both species are dark brown the character is unreliable. Most specimens of *imperialis* have been taken at light, but I have collected one specimen from a 15-inch burrow in sandy soil under the same mesquite thicket in which I took *regalis*, 15 mi. E. of Calexico, Calif.

### *Bolbocerastes peninsularis* (Schaeffer)

*Bradycinetus serratus* var. *peninsularis* Schaeffer, 1906, p. 252.

*Bolboceras serratus* var. *peninsularis* (Schaeffer), Boucomont, 1912, p. 13.

*Bolbocerastes peninsularis* (Schaeffer), Cartwright, 1953, p. 116; Howden, 1955, p. 198.

**TYPE.** Male, Santa Rosa, Baja California, Mexico (USNM No. 42568).

**MALES.** Length 14.0 to 15.5 mm.; greatest width 8.6 to 10.0 mm. Color dorsally light to dark reddish brown, elytra dull. Anterior clypeal horn rising almost vertically anteriorly; tubercles on each side behind horn nearly at middle of sides of clypeus, being much further forward than in related species. A line extending from one tubercle to anterior horn and then to opposite tubercle forms a distinctly obtuse angle. Characters of the pronotum and elytra similar to those of *imperialis* except for the dull appearance of the elytra.

**FEMALES.** Length 13.5 to 14.7 mm.; greatest width 9.0 to 9.8 mm. Similar to the males except that the characters of the head are similar to those described for females of *serratus*. Horn of vertex is higher and approximately twice as wide as anterior clypeal horn, and lateral tubercles occasionally better developed than in most *imperialis* or *serratus*.

**SPECIMENS EXAMINED.** 10 males, 3 females.

## MEXICO

**Baja California:** La Paz; La Paz airport, 3 January 1959; San Felipe; 4 mi. W. San Ignacio, 26 August 1959; San Ignacio.

**REMARKS.** The "uniform very dark red-brown color" mentioned by Cartwright (1953, p. 116) is not a reliable character. In many of the *Bolboceratini* newly emerged specimens are light brown and these darken gradually with age. Since some species are in the adult stage for more than a year, light and dark brown specimens occasionally occur together. In *peninsularis*, the specimen taken in January is light tan in color and with tibiae and carinae unworn. The specimens taken during July and August are dark and show signs of abrasion on the fore tibia and carinae of the head. Some of the recent specimens were collected in light traps.

### **BOLBELASMUS BOUCOMONT**

*Bolbelasmus* Boucomont, 1911, p. 335; Cartwright, 1953, p. 97; Howden, 1955, p. 198.

*Kolbeus* Boucomont, 1911, p. 335; Lucas, 1920, p. 356; Chapin, 1946, p. 79; Cartwright, 1953, p. 97; Howden, 1955, p. 198.

TYPE-SPECIES. Of *Bolbelasmus*: *Scarabaeus gallicus* Mulsant, designated by Cartwright (1953, p. 97).

TYPE-SPECIES. Of *Kolbeus*: *Bolboceras coreanus* Kolbe, designated by Lucas (1920, p. 356).

The genus *Bolbelasmus* can be characterized as follows: clypeus arcuate, often with small tubercle on each side above mandibular insertion; frons with conical horn in males and with a transverse carina in females; eyes not completely divided by canthus; inner segment of antennal club with large, denuded area; pronotum with or without posterior margin; scutellum as long as wide or longer; elytra with seven striae between suture and humeral umbone; first stria terminated by scutellum; middle coxae contiguous or very slightly separated by linear metasternum.

The synonymy given above was suspected by Cartwright (1953, p. 97) but because he had not seen the type of the genus *Kolbeus*, *B. coreanus* Kolbe, he deferred making a decision. Recently I have had the opportunity to examine a number of specimens of *coreanus*. The major differences between it and *gallicus* are that it lacks the posterior pronotal margin, has a more elongate scutellum, and has slight differences in the shapes of the meso- and meta-sterna. These differences are not sufficiently constant to warrant the retention of the genus *Kolbeus*. The posterior pronotal margin of various species shows all degrees of development, and the scutellum varies greatly in shape in some of the North American species of *Bolbelasmus*.

Five species in the genus occur in Mexico and Central America and one other, *minor* (Linell), is known only from the United States. Since *minor* has been taken at Brownsville, Texas, additional collecting will probably add the species to the Mexican fauna. *B. minor* is related to the species in the *arcuatus* group, particularly *rotundipennis*. It can be distinguished from these species by its small size, complete posterior pronotal margin, numerous fine secondary pronotal punctures, very large stria punctures, and by the shape of the genitalia (see Cartwright 1953, fig. 14, n).

#### ***Bolbelasmus arcuatus* (Bates)**

Fig. 57; Map 7

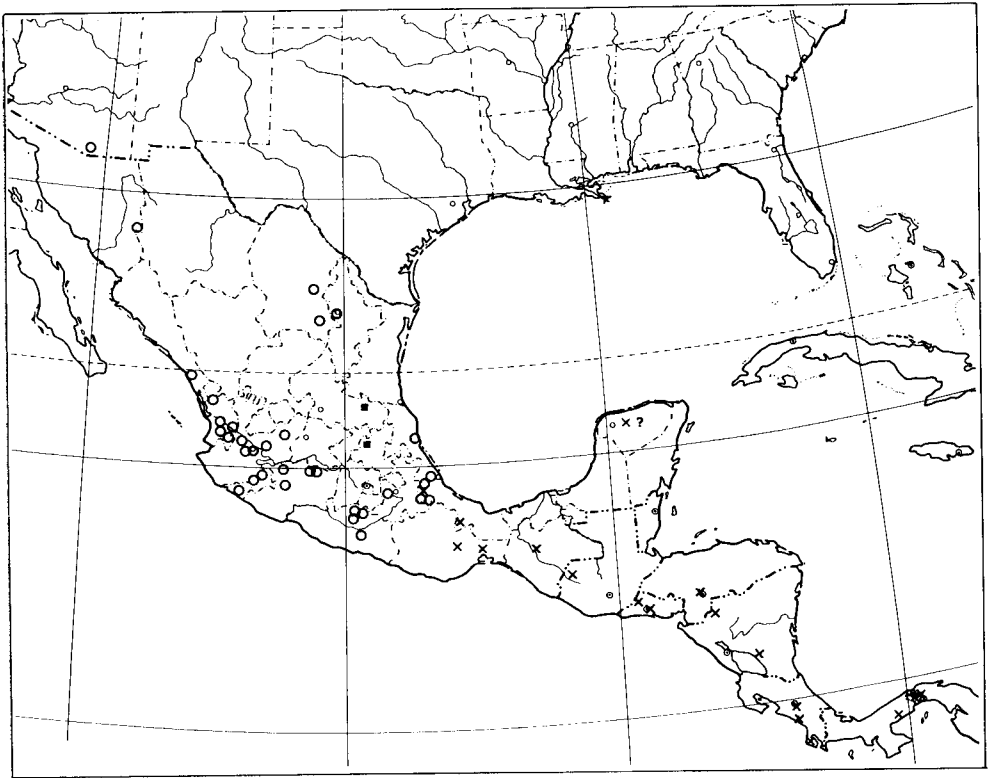
*Bolboceras arcuatus* Bates, 1887, p. 111; 1889, p. 395.

*Kolbeus arcuatus* (Bates), Boucomont, 1911, p. 336; Chapin, 1946, p. 79.

*Bolbelasmus arcuatus* (Bates), Cartwright, 1953, p. 98; Howden, 1955, p. 198.

TYPE. Lectotype here designated, male, Chontales, Nicaragua (Janson), labeled as type and specimen figured (BM).

MALES. Length 7.6 to 8.5 mm.; greatest width 4.5 to 5.1 mm. Color dorsally uniform light to dark reddish brown. Clypeus broadly arcuate, often with poorly defined tubercle on margin on each side near eye canthus; surface closely, irregularly punctate, usually with part or all of disc transversely rugose, slightly tumid medially. Dorsal surface of eye canthus irregularly punctate or rugose. Frons with a nearly vertical, conical, median horn; area surrounding base of horn smooth, with only scattered punctures. Pronotum with anterior margin behind eyes; pronotum widest posteriorly, arcuately narrow to anterior angles; posterior margin broken, distinct in front of elytral humeri, indicated by vague impression and row of punctures in front of scutellum; margin normally lacking on pronotum before third to seventh elytral striae. Disc of pronotum anteriorly with transverse tumosity, tumosity often terminating on each side by small tubercle; tumosity never as wide as distance between eyes; pronotum slightly concave on either side of tumosity; lateral, indistinct swellings usually present on each side of concavities. Surface of pronotum with scattered groups of coarse punctures; occasionally with fine secondary punctures. Scutellum very slightly longer than wide, surface finely, sparsely punctate. Elytral striae shallow, stria punctures deep, usually separated by a distance equal to one diameter or more. Fore tibia normally with nine teeth on outer margin; posterior tibia usually with one complete transverse carina on outer surface below flattened apex, rarely a second carina present. Prosternum rounded at apex; medially, behind fore coxae, with small vertical spine or tooth; metasternum narrow, linear, slightly



Map 7. Distribution of: [X] *Bolbelasmus arcuatus* (Bates), [O] *B. variabilis*, new species, and [■] *B. rotundipennis*, new species.

raised between middle coxae. Genitalia (Fig. 57) with parameres tapering from base to apex, tips sharply rounded.

**FEMALES.** Length 7.2 to 8.2 mm.; greatest width 4.4 to 5.1 mm. Similar to males except in the following respects: clypeal surface almost entirely transversely rugose; frons with a vaguely trituberculate transverse carina, median tubercle higher than lateral ones; surface behind carina with scattered coarse punctures, between punctures largely smooth and shining; transverse tumosity of pronotum replaced by slightly bow-shaped carina, lateral concavities and tumosities obsolete; surface immediately behind carina with scattered coarse punctures, approximately similar in size to elytral punctures; scutellum approximately equal in length to width.

**SPECIMENS EXAMINED.** 18 males, 10 females.

#### COSTA RICA

**San Jose:** San Jose, 1000-1200 m., 20 June, 15 Aug., 12 Sept.

**Puntarenas:** Dominical, 28 May 1943; San Pedro de Montes de Osa, 14 June 1934, Ballou.

#### EL SALVADOR

**San Salvador:** San Salvador, 20, 21 May 1958, Cartwright, 15 June 1958, Bottimer, 20 July 1959, Virkki.

**Santa Ana:** San Jacinto, 2200 ft., 27 June 1925.

#### GUATEMALA

**Huehuetenango:** (San Marcos, or Retalhuleu), San Sebastian (the three divisions listed each have a "San Sebastian").

## HONDURAS

**Francisco Morazan** (= Tegucigalpa): Zamorano, 10 Aug. 1948, Hubbell.

## MEXICO

**Chiapas**: El Zapota, 2 mi. S. Tuxtla Gutierrez, 5 July 1957, 1 Aug. 1957, Chemsak.

**Oaxaca**: Ixtepec, 11 Sept. 1947, Malkin; 5 mi. N. Rio Hondo (near Totolapam), 10 Aug. 1957, Chemsak, Hannelis.

**Veracruz**: 38 mi. NE. Cordoba, 400 ft., 30 June 1953; Playa Vicente, Sallé.

**Yucatan**: "N. Yucatan", Gaumer.

## NICARAGUA

**Chontales**: (no exact locality).

**Madriz**: Somoto, 3000 ft., 25 July 1958, Neff, Matthews.

## PANAMA

**Canal Zone**: Corozal, Aug. 1912.

**Coclé**: Rio Hato, 22 May 1960, at light, Tipton.

Specimens are in the following collections: AMNH, BM, CNC, Paris, USNM, UnCal, Bottimer, Howden.

REMARKS. *Bolbelasmus arcuatus*, as described by Bates, apparently represented a complex of forms. Typical *arcuatus* is difficult to separate from related forms except by the male genital characters (Fig. 57). The following external characters are quite constant (but difficult to interpret without specimens of the related species): clypeus transversely rugose, at least medially; vertex behind horn or carina sparsely punctate; pronotal tubercles or carina normally more poorly developed than in related species; coarse pronotal punctures approximately same size as stria punctures; posterior pronotal margin usually indicated in front of scutellum; vertical spine on apex of prosternum small to minute. Because of variation in the above characters occasional specimens can easily be confused with other forms unless the genitalia are examined.

No typical *arcuatus* have been seen from areas north of the Isthmus of Tehuantepec except for specimens occurring in coastal Veracruz; all other American species in the genus are seemingly restricted to areas north of the Isthmus.

*Bolbelasmus variabilis*, new species

Fig. 58; Map 7

HOLOTYPE. Male, length 9.5 mm.; greatest width 6.5 mm. Similar to males of *arcuatus* except in the following characters: clypeus very coarsely punctate, but not distinctly, transversely rugose; frons with numerous coarse punctures on either side and before horn, only scattered punctures behind horn; posterior pronotal margin lacking, indicated by a few punctures before scutellum; anterior, median, transverse tumosity distinctly bituberculate, tubercles and surrounding concavities more pronounced than in *arcuatus*; punctures of pronotal disc distinctly larger than punctures of elytral striae; elytral intervals very slightly convex, striae between punctures obsolete; outer margin of fore tibia with eight teeth; hind tibia with two transverse carinae on outer surface below apex; prosternum with distinct, vertical, median spine near posterior edge; male genitalia (Fig. 58) with sides of parameres slightly converging to unevenly rounded apices.

ALLOTYPE. Female, length 9.5 mm.; greatest width 6.0 mm. Differing from the male only in the characters of the head and pronotum, similar in these characters to females of *arcuatus*: pronotal carina slightly higher than in female of *arcuatus*; discal pronotal punctures approximately twice diameter of those in elytral striae; fine secondary punctures evenly distributed over pronotal disc; outer margin of fore tibia with minute ninth tooth at proximal end; prosternal spine shorter than in holotype.



TYPE MATERIAL. Holotype, male, Guadalajara, Jalisco, Mexico, 23 July 1939, C. H. Townes (ex Howden collection) (CNC No. 8437). Allotype, female, 20 mi. SW. Tepatitlan, 5500 ft., Jalisco, Mexico, 19 Aug. 1954, J. G. Chillcott (CNC No. 8437). Paratypes: 36 males, 63 females.

#### MEXICO

**Coahuila** (?): Monclova, E. Palmer; Saltillo, E. Palmer (no State given on Palmer labels).

**Colima**: Colima, Conradt, Höge; Colima City, Höge.

**Guanajuato**: 11 mi. SW. Acombaro, 17 Aug. 1954, Linsley, MacSwain, Smith.

**Guerrero**: Amula, 6000 ft., August, H. H. Smith; El Gavilan, 13 km. N. Taxco, 5390 ft., 21 June 1948, Nutting, Werner; 8 mi. E. Iguala, 22 Aug. 1958, H. F. Howden; Tepetlapa, 3000 ft., October, H. H. Smith.

**Jalisco**: Guadalajara, 7 July 1953, C. and P. Vaurie, 19 July 1955, R. B. and J. M. Selander; 14 mi. NW. Guadalajara, 5000 ft., 19 July 1953; 15 km. S. Mazamitla, 5500 ft., 29 July 1952, F. W. and F. G. Werner; 10 mi. S. Plan de Barrancas, 3500 ft., 17 July 1952, F. W. and F. G. Werner; 8 mi. SW. San Juan de Los Lagos, R. F. Smith; 20 mi. SW. Tepatitlan, 5500 ft., 19 Aug. 1954, J. G. Chillcott; Tuxpan, 3 Sept. 1903.

**Michoacan**: El Sabino, Uruapan, 20 July 1936, H. D. Thomas; 3 mi. W. Jacona, 5300 ft., 18 July 1953; Morelia, 9 Aug. 1953, C. and P. Vaurie; 12 mi. E. Morelia, 6850 ft., 17, 19 July 1953.

**Nayarit**: Acaponeta, 4 Aug. 1953, C. and P. Vaurie; Arroyo Canaveral, near Jesus Maria, 15 July 1955, B. Malkin; (Vic.) Compostela, 20 Sept. 1933, 1937, E. Rosenbauer; 6 mi. N. Compostela, at blacklight; 8.3 mi. E. San Blas, 16 Aug. 1963, blacklight; Tepic, 22 Aug. 1905, P. H. Goldsmith, 20 July 1952, F. W. and F. G. Werner, 28 July 1953, C. and P. Vaurie, 20 July 1955, at light, R. B. and J. M. Selander; 22.3 mi. SE. Tepic, Loomis, Maris; 24 mi. SE. Tepic, 3 July 1962, 12 Aug. 1963, Sleeper, Anderson, Hardy.

**Nuevo Leon**: Monterrey, 3 June 1938.

**Puebla**: 12 mi. S. Atlixco, 4900 ft., 2 July 1953; 34 mi. S. Atlixco, 27 June 1957.

**Sinaloa**: 14 mi. N. Culiacan, blacklight; Mazatlan, 15 Sept. 1917 (18), Kusche; 5 mi. N. Mazatlan, 10 Aug. 1963, 27 July, 9 Aug. 1964, H. F. Howden.

**Sonora**: La Aduana, 24 Aug. 1963, blacklight; Yecora, 7-8000 ft., 12 July 1961, W. W. Gibson.

**Veracruz**: Cordova (= Cordoba), Sallé; Fortin de las Flores, 28 June 1958; Huatusco, 4 Aug. 1958, O. J. Sexton; Puente Nacional, 17 Aug. 1960, H. F. Howden; Toxpam (= Tuxpan, see Selander and Vaurie, 1962), Sallé.

#### UNITED STATES

**Arizona**: Canelo, 31 July, 3 Aug. 1956, G. D. Butler.

Paratypes are deposited in the following collections: AMNH, BM, CAS, CNC, LBSC, MCZ, USNM, UnAriz, UnCal, UnKans, UnMich, Gibson, Howden, Selander.

REMARKS. Variation in the species, as the name implies, is considerable. In males, length ranges from 7.1 to 10.7 mm., and greatest width from 5.1 to 6.5 mm. In females, length varies from 6.9 to 10.6 mm. Punctures of the clypeus may be distinctly separated to close and confused; in occasional specimens the clypeus may be transversely rugose. The size and number of the punctures on the head and pronotum vary, a few specimens being similar to *arcuatus* in this respect.

Actually any character mentioned, except the genitalic ones, may occasionally be identical with the character as described for *arcuatus*.

In general *variabilis* is often larger than typical *arcuatus*, has larger pronotal punctures, less indication of a posterior pronotal margin, shallower strial punctures, larger, apical prosternal spine, and usually two outer transverse carinae below the apex of the hind tibia. In addition, the ranges of the two species are seemingly allopatric.

***Bolbelasmus rotundipennis*, new species**

Figs. 22, 56; Map 7

**HOLOTYPE.** Male, length 10.7 mm.; greatest width 7.4 mm. Generally similar in form and color to *arcuatus* and *variabilis*. Clypeus closely, confluent punctate. Frons and vertex around base of horn closely, coarsely punctate. Transverse pronotal tumosity distinctly bituberculate, lateral concavities pronounced, lateral tumosity on each side of concavity distinctly tuberculate (the pronotal armature in this respect much better developed than in *arcuatus*). Posterior pronotal margin present medially, indicated laterally by line of punctures. Coarse punctures of pronotal disc more numerous than in *arcuatus*, usually larger than punctures of elytral striae; fine secondary punctures scattered over disc. Elytra striae distinct, punctures separated by approximately two diameters; intervals distinctly convex. Prosternal spine larger than those of *arcuatus* and *variabilis*. Fore tibia with eight teeth on outer margin, two basal teeth very small; hind tibia with two complete carinae below apex on one side, basal carina incomplete on other side. Genitalia with parameres broad (Fig. 56), apices evenly rounded.

**ALLOTYPE.** Female, length 10.3 mm.; greatest width 7.3 mm. Generally similar in form to females of *arcuatus* and *variabilis*. Differing from holotype in the following characters: clypeus very coarsely, confluent punctate or rugose; head coarsely, closely punctate before and behind transverse carina; transverse carina trituberculate, lateral tubercles almost as high as median one; anterior, transverse pronotal carina with shallow concavity on each side, beyond this a distinct, rounded tubercle; pronotal disc behind carina with numerous coarse punctures having at least twice the diameter of punctures of elytral striae; other external characters as described for holotype.

**TYPE MATERIAL.** Holotype, male, Jacala, Hidalgo, Mexico, 31 Aug. 1960, taken at light, H. F. Howden (CNC No. 8438). Allotype, female, same data as holotype. Paratypes, 2 males.

**MEXICO**

**Hidalgo:** Jacala, 31 Aug. 1960, H. F. Howden.

**San Luis Potosi:** El Salto de Agua, 28-30 July 1960, H. F. Howden.

Paratypes are deposited in the CNC.

**REMARKS.** Variation in the four specimens seen is slight. The smallest male measures 9.1 mm. in length and 6.3 mm. in greatest width. Development of the frontal horn and pronotal armature shows some variation, but the four pronotal tubercles are distinctly evident on all of the males. The degree of expansion of the parameres of the genitalia varies somewhat. The parameres showing the least expansion (Fig. 56) were illustrated.

The species can be separated from *arcuatus* and *variabilis* by the genitalic characters, by the heavily punctate head, by the distinct elytral striae, and by the convex intervals. *B. rotundipennis* is most closely related to *minor* Linell from the United States. Its larger size, reduced pronotal and strial punctures, and the rounded parameres of the genitalia will separate it from *minor*.

The habitat of *rotundipennis* is seemingly restricted to rather dry subtropical areas on the eastern escarpment of Mexico between 2000 and 4000 ft. All the specimens collected were attracted to a 40-watt blacklight.

***Bolbelasmus hornii* (Rivers)**

*Bradycinetus hornii* Rivers, 1886, p. 61.

*Bolboceras hornii* (Rivers), Schaeffer, 1906, p. 253.

*Bradycinetulus hornii* (Rivers), Cockerell, 1906, p. 242.

*Kolbeus hornii* (Rivers), Chapin, 1946, p. 79.

*Bolbelasmus hornii* (Rivers), Cartwright, 1953, p. 100; Howden, 1955, p. 199.

TYPE. Sonora, Tuolumne County, Calif. (Present location of type unknown).

MALES. Length 10.0 to 13.5 mm.; greatest width 7.0 to 8.6 mm. Color dorsally uniform, light to dark reddish brown. Clypeal margin unevenly arcuate, often almost truncate anteriorly, with distinct tubercle on each side near eye canthus; surface of clypeus closely, irregularly punctate; posterior edge of clypeus delimited by indistinct, vaguely arcuate carina. Exterior angle of eye canthus sharply angulate. Frons and vertex usually with large vertical, central, cylindrical horn, occasionally reduced to conical tubercle in male minors. Pronotum normally quadrituberculate, two inner tubercles more anterior in position than lateral ones; anterior pronotal face below inner tubercles vertical or inclined forward over margin; pronotal disc with scattered fine and coarse punctures, more numerous laterally than dorsally; posterior pronotal margin complete, often accompanied by vague row of shallow punctures. Scutellum slightly longer than wide, surface often finely punctate. Elytral striae distinct, with evenly spaced, small punctures. Fore tibia with six, rarely seven, teeth on outer margin; middle and hind tibiae with apices moderately expanded. Genitalia as illustrated by Cartwright (1953, fig. 14, m).

FEMALES. Length 9.5 to 14.0 mm.; greatest width 6.0 to 8.9 mm. Similar to males except in the following respects: tubercle on clypeal margin near gena often vague; frontal horn replaced by non-tuberculate transverse carina; outer angle of gena occasionally rounded, never as sharply angulate as in males; lateral pronotal tubercle reduced in size, rounded; the two median pronotal tubercles replaced by an anteriorly arcuate carina.

SPECIMENS EXAMINED. 1 female.

## MEXICO

**Baja California:** Hamilton Ranch, 2 Aug. 1938, Michelbacher and Ross (CAS).

REMARKS. The above description was based largely from California specimens of *hornii*. The single specimen from Baja California is a very small, rather atypical female. All other specimens of *hornii* that I have seen were collected in northern or central California. The Hamilton Ranch specimen represents either a disjunct southern population of *hornii*, or possibly an undescribed species.

*Bolbelasmus hornii* is readily identified by its angulate gena, shape of the pronotal armature, finely to moderately punctate elytral striae, and by the shape of the male genitalia.

***Bolbelasmus bajaensis*, new species**

Figs. 23, 24

HOLOTYPE. Male, length 16.5 mm.; greatest width 10.4 mm. Similar in form and color to *Bolbelasmus hornii* (Rivers). Clypeus medially truncate, laterally arcuate and with large tooth on each side above mandibular insertion; disc of clypeus confluent punctate and rugose; middle, between the horns, transversely convex; posterior edge of clypeus delimited by small, nearly straight carina. Outer edge of eye canthus evenly arcuate, not sharply angulate or rounded as in *hornii*. Frons and vertex with a large, vertical, central, cylindrical horn. Pronotum quadrituberculate, tip of two lateral tubercles more anterior in position than those of two inner tubercles (in *hornii* males the tips of the four tubercles are almost in line or the inner two are slightly advanced); anterior pronotal face below tubercles inclined slightly posteriorly, not inclined forward over anterior margin as in *hornii*; pronotal disc with coarse punctures largely restricted to lateral areas adjacent to tubercles, punctures irregularly confluent between outer tubercles and lateral pronotal margins; posterior pronotal margin complete and with row of fine punctures, punctures obsolete in front of scutellum. Scutellum and elytra as in *hornii*, striae distinct and with relatively small punctures. Fore tibia with six distinct teeth on outer margin; middle and hind tibiae with apices widely expanded, flattened area

below apex almost as wide as long (in *hornii* distance between flattened apex and first outer carina is distinctly longer than wide). Parameres of genitalia as in *hornii*, but with inner edge of each apex sharply angulate, not rounded as in *hornii*.

FEMALE. Unknown.

TYPE MATERIAL. Holotype, male, Mexico, Baja California, Scammons Lagoon, 21 Feb. 1962, I. L. Wiggins (CAS).

REMARKS. *Bolbelasmus bajaensis* can be readily separated from other North American members of the genus by the following characters: large size, edge of eye canthus arcuate, shape of pronotal armature (Figs. 23, 24), and apex and carina of middle and hind tibia greatly expanded.

### TRIBE GEOTRUPINI

The American representatives of the tribe can be recognized by the following combination of characters: body shape generally oval; antennal club not evenly convex on both sides, small, three segmented; club about half as long as basal eight segments; eyes divided by canthus; color dark iridescent blue or green to dark brown or black; front femora with conspicuous hairy spot on anterior internal surface; elytra usually striate; middle and hind tibia with apical transverse carina complete.

In Mexico and Central America the tribe is composed of only two genera, *Ceratotrupes* and *Geotrupes*. None of the Central American or Mexican species in either genus occurs north of Mexico, and conversely none of the species in the tribe occurring in the United States and Canada ranges south of the United States border.

### CERATOTRUPES JEKEL

*Ceratotrupes* Jekel, 1865, p. 540; Boucomont, 1912, p. 20; Blackwelder, 1944, p. 220; Howden, 1955, p. 162; Halffter and Martinez, 1962, p. 149.

*Ceratophyus* (*Ceratotrupes*) Boucomont, 1902, p. 11.

TYPE-SPECIES. *Geotrupes fronticornis* Erichson, designated by Jekel (1865).

The genus *Ceratotrupes* can be separated from other American Geotrupini by the following characters: clypeus V-shaped with anteriorly directed horn ( $\delta$ ) or indistinct, median, longitudinal carina ( $\varphi$ ); pronotum with median, anteriorly projecting horn ( $\delta$ ) or with anterior, postmarginal protrusion ( $\varphi$ ).

An excellent revision of the three species in the genus was published by Halffter and Martinez (1962) and, because of this, only brief descriptions are included here. Complete distributional data were given by Halffter and Martinez, therefore only the Mexican states in which the species occur are given herein; complete data are given for states where the species has not been previously recorded.

### *Ceratotrupes fronticornis* (Erichson)

*Geotrupes fronticornis* Erichson, 1847, p. 727; Bates, 1887, p. 112.

*Geotrupes* (*Ceratotrupes*) *fronticornis* Erichson, Jekel, 1865, p. 541.

*Ceratophyus* (*Ceratotrupes*) *fronticornis* (Erichson), Boucomont, 1902, p. 11.

*Ceratotrupes fronticornis* (Erichson), Boucomont, 1912, p. 20; Halffter and Martinez, 1962, p. 151.

TYPE. Location unknown to me.

MALES. Length 16.0 to 21.0 mm.; greatest width 8.9 to 12.0 mm. Color dorsally black, sometimes with purplish reflections in striae and punctures. Antennal club brownish black; outer face of 11th segment lacking distinct furrow. Clypeus in well-developed males with longitudinal horn rising gradually to sharp, cylindrical tip above anterior margin, tip often bent slightly toward posterior; in small minor males clypeal horn reduced to longitudinal

carina, highest just anterior to middle of clypeus. Pronotum of male majors with anteriorly directed horn usually extending slightly beyond anterior margin, apex of horn emarginate; pronotum of male minors with merely an anterior pronotal swelling, similar to that of female. Posterior pronotal margin complete. Elytral striae moderately to obsoletely punctate. Mesosternum not elevated in front of middle coxae.

FEMALES. Length 16.8 to 20.2 mm.; greatest width 9.0 to 11.8 mm. Similar to males except in the following respects: longitudinal clypeal carina poorly developed, highest near posterior end; pronotum with low, rounded, anteriorly arcuate protrusion behind anterior margin, protrusion slightly wider than distance between eyes.

SPECIMENS EXAMINED. 22 males, 14 females.

## MEXICO

### Districto Federal.

#### Mexico.

#### Michoacan.

#### Morelos.

#### Queretaro.

Specimens are in the following collections: AMNH, BM, CAS, CNC, Paris, USNM, UnAriz, UnCal, Gibson, Halffter, Howden.

REMARKS. *Ceratotrupes fronticornis* can be separated from the other species of *Ceratotrupes* by the following combination of characters: antennal club brownish black, lacking furrow on outer face of 11th segment; posterior pronotal margin complete; mesosternum not elevated in front of middle coxae.

According to Halffter and Martinez (1962, pp. 145-149) *fronticornis* is found in pine-oak woods in the transverse volcanic system in Central Mexico. Specimens were collected in vertical burrows 15 to 30 cm. deep under horse dung.

### *Ceratotrupes bolivari* Halffter and Martinez

*Ceratotrupes bolivari* Halffter and Martinez, 1962, p. 153.

TYPE. Holotype, male, Km. 60.5 carretera federal Mexico — Cuernavaca, Municipio de Huitzilac, Morelos (Halffter collection, Mexico, D. F.).

MALES. Length 14.1 to 21.1 mm.; greatest width 8.5 to 11.1 mm. Color dorsally black with greenish or purplish reflections in punctures and along lateral margins of pronotum and elytra. Antennal club reddish, with distinct furrow on the outer face of 11th segment. Horns of head and pronotum as in *fronticornis* except in large males clypeal horn slanted anteriorly and occasionally extending beyond mandibular apices; pronotal horn extending over and terminating above clypeal base. Posterior pronotal margin complete. Elytral striae finely, closely punctate. Mesosternum elevated and forming crest in front of middle coxae.

FEMALES. Length 15.2 to 18.8 mm.; greatest width 8.6 to 10.5 mm. Differing from females of *fronticornis* mainly in the characters of the antennal club, elytral punctures and mesosternum.

SPECIMENS EXAMINED. 9 males, 5 females.

## MEXICO

**Chihuahua:** Mesa del Huracan, 21-25 July 1964, J. E. H. Martin.

### Districto Federal.

**Durango:** Coyotes, 8300 ft., 8 Aug. 1947; 6 mi. NE. El Salto, 8500 ft., 10 Aug. 1947; Navios, 14 mi. W. El Pino, 21 Sept. 1950, Ray F. Smith.

#### Morelos.

#### Queretaro.

**Sonora:** Yecora, 20, 22 May 1961, Gibson, Howden, Martin.

Specimens are in the following collections: AMNH, BM, CNC, MCZ, Paris, USNM, Halffter, Howden.

REMARKS. This species can be identified by the following combination of characters: greenish or purplish iridescence of punctures and lateral margins, reddish antennal club with distinct furrow on outer face of terminal segment, complete pronotal margin, finely punctate elytral striae, and by mesosternum being elevated in front of middle coxae.

The species is active in the late summer and fall. All of the specimens taken in May in Sonora were found dead under stones. The Durango and Sonora specimens differ slightly from the more southern specimens by having the eye canthus less produced, the anterior pronotal angles sharper, slightly shallower elytral striae, and a more sharply ridged mesosternum. At present, with the small number of specimens on hand, it is not possible to assess these differences.

***Ceratotrupes sturmi* (Jekel)**

Fig. 36

*Geotrupes* (*Ceratotrupes*) *sturmi* Jekel, 1865, p. 543; Bates, 1887, p. 112.

*Ceratophyus* (*Ceratotrupes*) *sturmi* (Jekel), Boucomont, 1902, p. 11.

*Ceratotrupes sturmi* (Jekel), Boucomont, 1912, p. 20; Halffter and Martinez, 1962, p. 155.

*Geotrupes* (*Ceratotrupes*) *mniszewski* Jekel, 1865, p. 544.

*Ceratophyus* (*Ceratotrupes*) *mniszewski* (Jekel), Boucomont, 1902, p. 11.

*Ceratotrupes mniszewski* (Jekel), Boucomont, 1912, p. 20; Halffter and Martinez, 1962, p. 155.

TYPE. *Geotrupes sturmi* Jekel, holotype, male, Juquila (Oaxaca), Mexico, Sallé coll. (BM).

TYPE. *Geotrupes mniszewski* Jekel, holotype, male, Mexico, ex. Mniszewski coll. (Paris).

MALES. Length 17.0 to 18.5 mm.; greatest width 9.5 to 10.5 mm. Color dorsally black with greenish or coppery cast. Antennal club reddish yellow to reddish brown, outer face of 11th segment with furrow indistinct or lacking. Genitalia with right ventral paramere variable; one male from Guerrero with pronounced groove near apex on this paramere (Halffter and Martinez (1962, fig. 7) did not indicate any groove on this paramere); also Guerrero male and type of *sturmi* each with upper lateral side of paramere with distinct, posteriorly curving spine. Clypeal and pronotal horns as shown in Fig. 36. From dorsal view, the clypeal horn wider than in related species; apex truncate. Pronotal horn with shallowly emarginate apex extending slightly beyond anterior margin; posterior pronotal margin lacking. Elytral striae lacking distinct punctures; intervals with numerous very fine punctures. Mesosternum not elevated in front of middle coxae.

FEMALES. Length 17.0 to 18.2 mm.; greatest width 8.9 to 11.1 mm. Differing from females of *fronticornis* in the following major characters: color dorsally black with greenish cast, width of pronotal protuberance equal to distance between eyes, posterior pronotal margin incomplete, elytral striae impunctate,

SPECIMENS EXAMINED. 3 males, 2 females.

**MEXICO**

**Guerrero.**

**Oaxaca.**

Specimens are in the following collections: BM, Paris, USNM.

REMARKS. During the summer of 1962, I was able to examine the types of *sturmi* and *mniszewski*, and agree with the conclusions of Halffter and Martinez (1962, p. 155) that only one species is represented. Both types are rather poorly developed males. In the Oberthur collection in Paris there is one well-developed male (Fig. 36), labelled Guerrero, Mexico, ex. Bates collection. The two females examined are in the the Casey collection (USNM).

The species can easily be separated from *fronticornis* or *bolivari* by the following characters: indistinct or obsolete furrow on outer face of 11th antennal segment; wide, blunt clypeal horn of male; lack of posterior pronotal margin; largely impunctate elytral striae.

#### GEOTRUPES LATREILLE

*Geotrupes* Latreille, 1796, p. 6; 1802, p. 142; 1807, pp. 91-94; 1810, p. 428; Kirby, 1818, p. 461; Mulsant, 1842, p. 353; Jekel, 1865, p. 513; Horn, 1868, p. 313; 1880, p. 144; LeConte and Horn, 1883, p. 243; Bates, 1887, p. 112; Blanchard, 1888, p. 103; Boucomont, 1902, p. 1; 1906, p. 1; 1911, p. 344; 1912, p. 19; Blackwelder, 1944, p. 220; Howden, 1955, p. 228.

*Geotrupes* Fabricius (not Latreille), 1798, p. 1; Walckenaer, 1802, p. 1.

*Scarabaeus* Linné, 1758, p. 345; Fabricius, 1775, p. 17; 1798, p. 23; Olivier, 1789, p. 55; Marsham, 1802, p. 8.

TYPE-SPECIES. *Scarabaeus stercorarius* Linné, designated by the International Commission on Zoological Nomenclature, Opinion 346, see Hemming (1955). This opinion also stated that the name *Geotrupes* was feminine in gender. Previously the name had been considered masculine by most authors.

American species in the genus *Geotrupes* can be separated from the related genus *Ceratotrupes* by the following combination of characters: clypeus U- or V-shaped, posteriorly with a small, cylindrical or conical tubercle or horn; pronotum usually similar in males and females, lacking horn or distinctly raised protuberance.

Jekel (1865, p. 521) established a number of subgenera in the genus *Geotrupes*. In my work on the United States and Canadian species (1955, p. 228) I mentioned that many of the North American species did not readily fit into Jekel's subgenera. While many of the species seem to comprise natural groups, Jekel based his groups on a few characters which, in some cases, are inconsistent.

In this present work I have rather arbitrarily assigned the Mexican species to various subgenera, partly because of usage by previous authors. For one species I have established a new subgenus and I believe others should probably be delimited in the future. I have not attempted to do this at present, since it involves a study of the world fauna.

#### THE MEXICAN AND CENTRAL AMERICAN SUBGENERA OF GEOTRUPES

##### 1. *Geotrupes* Latreille. Type-species: *Scarabaeus stercorarius* Linné.

Jekel used the following characters to delimit the subgenus: ventral portion of second segment of antennal club partly enclosed by first and third segments; fore femora not armed in males; apical tooth of anterior tibia simple in both sexes; posterior pronotal margin entire; inferior surface of fore tibia in males carinate and toothed; mesosternum feebly carinate between middle coxae.

One Mexican species, *Geotrupes cavicollis* Bates, can be referred to this subgenus. It differs from the more typical European members of the subgenus in the following respects: mandible with one external tooth near apex, pronotum deeply excavated behind anterior margin, ocular canthus sharply angulate, hind femora only vaguely toothed, mesosternum not carinate or elevated in front of middle coxae.

##### 2. *Phelotrupes* Jekel. Type-species: *Geotrupes orientalis* Westwood.

The characters used by Jekel are: second joint of antennal club free, not enclosed ventrally by first and third joints; pronotum similar in both sexes; apical tooth of anterior tibia similar in both sexes, unmodified; elytra free, wings normal.

One Guatemalan species, *Geotrupes guatemalensis* Bates has been placed in this subgenus. The species has, in addition to the above characters, a small

external tooth on the mandible, a slightly elevated and carinate mesosternum, four transverse carinae on hind tibia, and small tooth on hind femora of male. In many respects *guatemalensis* shows a closer affinity to some Mexican species placed in the subgenus *Cnemotrupes* than it does to the Oriental species of *Phelotrupes*.

**3. *Cnemotrupes* Jekel. Type-species: *Geotrupes blackburnii* Fabricius.**

The characters used by Jekel are: second joint of antennal club free, not enclosed ventrally by first and third joints; pronotum similar in both sexes; middle tarsi similar in both sexes; apical tooth of anterior tibia enlarged, often obliquely truncate, emarginate or prolonged internally; elytra free, wings normal.

Nine Mexican species have been placed in this subgenus. There are several species, *viridiobscura* for example, that have the apical tooth of the male fore tibia only slightly enlarged, and in some respects they could easily be referred to the subgenus *Phelotrupes*. The species placed in *Cnemotrupes* by Jekel, Boucomont, and others, do not represent a natural group; the entire complex needs further study.

**4. *Onthotrupes* new subgenus. Type-species: *Geotrupes onitidipes* Bates.**

Second joint of antennal club free, not enclosed ventrally by first and third joints. Ocular canthus with edge arcuate. Clypeus elongate, V-shaped, apex bent slightly upward, extending almost to apex of labrum. Posterior pronotal margin lacking. Elytra striate, normal, with first stria extending half way around scutellum; wings well developed. Hind tibia with four transverse carinae, flattened apex of hind tibia with very small area exposed around bases of tarsus and tibial spurs. Mesosternum not carinate in front of middle coxae.

Males (Fig. 43) differing from females in the following respects: fore legs, particularly tibiae, slender and greatly elongated in well-developed specimens; anterior external tooth of fore tibia expanded, inner portion directed inwardly (*onitidipes* was placed in *Cnemotrupes* by Bates because of this character); mandibles elongated, sides in basal half almost parallel; pronotum with sides relatively narrower, particularly anteriorly, making pronotum appear more elongate than in females; hind femora with small, distinct tooth near the apex of hind trochanter.

The one species in this subgenus, *onitidipes* Bates, occurs at high elevations in Guatemala and El Salvador. The elongation of the legs and mouthparts in the male *onitidipes* are seemingly unique in the Geotrupini and would almost seem to warrant a distinct genus. The female, however, except for the unusual clypeus and slightly elongated mouthparts, is essentially a typical *Geotrupes* as the genus now stands.

***Geotrupes (Geotrupes) cavicollis* Bates**

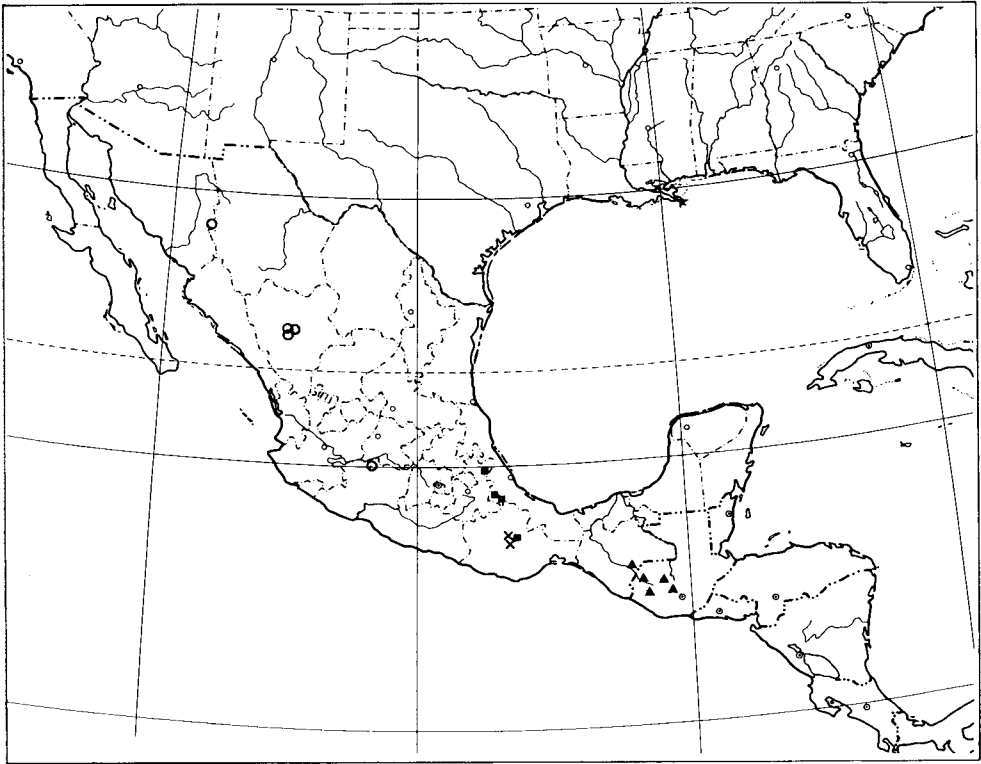
Figs. 37, 38, 44, 75-80; Map 8

*Geotrupes cavicollis* Bates, 1887, p. 115.

**TYPE.** Lectotype here designated, female, Ciudad, Durango, Höge, labeled B. C. A. collection, *G. cavicollis* Bates (BM).

**MALES.** Length 18.5 to 28.5 mm.; greatest width 10.6 to 16.2 mm. Color dorsally shining black. Antennal club reddish, second segment ventrally emarginate and reduced in thickness, largely hidden by first and third segments of club in closed position. Clypeus V-shaped, with lateral edges reflexed and usually with small tubercle anteriorly and at each side posteriorly; disc of clypeus punctate, rugose, with a large, laterally compressed, median tubercle. Ocular canthus sharply angulate anteriorly. Pronotum strongly concave behind anterior margin, concavity almost as wide as head; angles rounded; posterior margin complete; punctures almost entirely restricted to marginal areas. Scutellum triangular, sides sometimes sinuate, medially vaguely indented and occasionally coarsely punctate. Elytra striate; first stria extending almost to base around scutellum; striae very finely to obsoletely punctate. Fore tibia (Fig. 38) with apical tooth as in female, penultimate tooth reduced in size, third tooth shifted to ventral position; three basal teeth small, occasionally only two present; middle and hind tibiae each with two complete, transverse carinae on outer surface; hind femur with indistinct tooth near trochanter. Mesosternum not elevated or carinate in front of middle coxae. Genitalia as in Fig. 44.





Map 8. Distribution of: [O] *Geotrupes cavicollis* Bates, [▲] *G. guatemalensis* Bates, [X] *G. viridiobscura* Jekel, and [■] *G. nebularum*, new species.

**FEMALES.** Length 21.1 to 27.5 mm.; greatest width 11.9 to 16.0 mm. Differing from the males in the following respects: median clypeal tubercle smaller; pronotal concavity longitudinally narrower, not as deep; pronotum less convex, coarse punctures extending further onto disc; fore tibia with six unmodified teeth on outer margin; hind femur lacking any indication of tooth.

**SPECIMENS EXAMINED.** 58 males, 41 females.

#### MEXICO

**Durango:** Coyotes, 8300 ft., 8 Aug. 1947, M. Cazier; La Ciudad, 8100 ft., Forrer, Höge; El Salto, 25-2600 m., 18-20 Sept. 1961, C. and S. Bolivar; 6 mi. NE. El Salto, 8500 ft., 10 Aug. 1947, M. Cazier.

**Michoacan:** Sta. Clara del Cobre, 12 Oct. 1953, Bolivar and Carranza.

**Sonora:** Yecora, 20-22 May 1961, H. F. Howden (taken as pupa, adult on 6 June 1961); Yecora, 7-8000 ft., 12 July 1961, W. W. Gibson.

Specimens are in the following collections: AMNH, BM, CAS, CNC, CNHM, MCZ, USNM, UnCal, Gibson, Halffter, Howden.

**REMARKS.** *G. cavicollis* Bates is easily identified by the following combination of characters: dorsally shining black; antennal club with ventral portion of second segment largely hidden by first and third segments; pronotum with a deep concavity behind anterior margin.

A female was chosen for the lectotype because the single male (labeled "sp. figured") had the abdomen badly damaged, the genitalia missing, and most of the legs broken off on one side.

The species is apparently rather common in the high oak-pine forests of Durango and Sonora. Dr. Gibson collected a long series under cow dung at Yecora. In May 1961 I was able to find four cells and one living pupa. The cells, composed of horse or cow dung, were situated at the end of winding burrows, six to eight inches long and three to four inches deep. All of the cells were associated with old horse or cow dung, and all were in shaded areas under oak or pine trees. The cells were three to three and a half inches long by approximately one inch wide.

The description of the third stage larva is based on the following material: two cast skins, one of these from a reared specimen. Both were collected at Yecora, Sonora. Unfortunately the skins were partly damaged by mold, so that it is impossible to describe setal patterns of the body or the configuration of the anal lobes and endoskeletal figure.

LARVA. Head capsule fragmented, approximate width 6 mm. Anterior clypeal width 2.5 mm. Antenna three-segmented, the last segment reduced in diameter and .29 times as long as the second segment (Fig. 78). Mandibles (Fig. 75) worn, but with configuration typical on genus. Stipes with 11 or 12 small conical teeth along posterior margin. Hypopharynx (Fig. 76) with two asymmetrical oncyli. Transverse row of 14 to 16 sensilla present anterior to oncyli, anterior to this row a median cluster of 7 or 8 sensilla. Anterior edge of glossa arcuate, not emarginate. Epipharynx (Fig. 79) with distinct tormae united medially. Anterior epitorma distinctly longer than posterior epitorma. Irregular double row of 11 or 12 short, stout setae anterior to pedium. Terminal segment of mesothoracic leg (Fig. 77) with a large tubercle (or worn claw) at tip (setae conspicuously longer than those of *blackburnii* or other described United States species).

While it is unfortunate that the larval material of *cavicollis* is fragmented, the long setae on the terminal segments of the legs, the very short, stout setae above the pedium on the hypopharynx, the shape of the tormae, and the configuration of the oncyli of the hypopharynx will separate *cavicollis* from any described North American *Geotrupes*. In these characters *cavicollis* appears to be more closely related to European species, such as *G. spiniger* Marsh; a relationship shown also in the antennal characters of the adults.

***Geotrupes (Phelotrupes) guatemalensis* Bates**

Fig. 45; Map 8

*Geotrupes guatemalensis* Bates, 1887, p. 114.

TYPE. Lectotype here designated, male, Totonicapam, 85-10, 500 ft., Champion, labeled *guatemalensis* Bates, sp. figured (BM).

MALES. Length 16.2 to 21.0 mm.; greatest width 8.8 to 11.7 mm. Color dorsally black with bluish or purplish reflections. Antennal club reddish brown, unmodified. Clypeus sharply arcuate anteriorly, almost V-shaped in some specimens; surface closely, confluent, finely punctate, almost reticulate in appearance; clypeus posteriorly with median, conical tubercle. Side of eye canthus usually rounded, sometimes slightly angulate anteriorly. Pronotum feebly concave behind anterior margin; angles rounded, posterior margin lacking; disc with coarse punctures largely restricted to area near lateral margins; fine secondary punctures usually laterally and behind anterior margin, particularly in shallow concavity. Scutellum smooth, vaguely indented medially, sides slightly, outwardly arcuate. Elytra striate, first stria extending only as far as apical third of scutellum; striae very finely to obsolete punctate. Fore tibia with six teeth along outer margin, apical tooth not or very slightly enlarged and essentially similar to apical tooth in female; ventral flattened surface with distinct tooth at apical third and one or two small teeth in basal half; middle and hind tibiae each usually with four complete, transverse carinae on outer surface, occasionally basal carina of middle tibia broken; hind femur with small tooth near trochanter. Mesosternum with small, sharp carina in front of middle coxae. Genitalia as in Fig. 45.

FEMALES. Length 16.8 to 20.2 mm.; greatest width 9.1 to 11.8 mm. Generally similar to males except lacking distinct teeth on flattened, ventral surface of fore tibia and tooth on hind femur.

SPECIMENS EXAMINED. 8 males, 8 females.

## GUATEMALA

**Chimaltenango:** Tepan (= Tecpán), Conradt.

**Quezaltenango:** Chuipache, Richardson.

**San Marcos:** El Rincon, Richardson.

**Totonicapám:** Totonicapám, 8500-10,500 ft., Champion.

## MEXICO

**Chiapas.**

Specimens are in the following collections: AMNH, BM, CNC, USNM, Howden.

REMARKS. This species can be recognized by the following combination of characters: apical tooth of male fore tibia unmodified; epipleuron of elytron with more than a single row of setae on basal half; vague concavity behind anterior pronotal margin; fine secondary punctures on sides of pronotum and in concavity; posterior pronotal margin lacking; elytra striate, stria punctures minute. Also the male genitalia are distinctive. *G. guatemalensis* occurs further south than any other species of *Geotrupes* with the exception of *G. onitidipes*.

***Geotrupes (Cnemotrupes) viridiobscura* Jekel**

Fig. 46; Map 8

*Geotrupes viridiobscurus* Jekel, 1865, p. 599; Bates, 1887, p. 113; 1889, p. 395.

*Geotrupes saundersii* Jekel, 1865, p. 598; Bates, 1887, p. 113.

?*Geotrupes felschei* Nonfried, 1894, p. 114. **New synonymy.**

TYPE. Lectotype here designated, male, Oaxaca, Mexico, Sallé, labeled type and with Jekel and Sallé labels — *Cnemotrupes viridiobscurus* Jekel (BM).

TYPE. *G. saundersii* Jekel, female, Oberthur collection (Paris).

TYPE. *G. felschei* Nonfried, unknown to me, probably lost.

MALES. Length 17.1 to 21.3 mm.; greatest width 9.5 to 10.4 mm. Color dorsally dark greenish black with purple reflections particularly near margins and in elytral striae; occasional specimens almost black. Antennal club reddish brown, unmodified. Clypeus abruptly arcuate anteriorly; disc rugose and with small, conical tubercle posteriorly. Edge of ocular canthus obtusely angulate anteriorly. Pronotum with small, punctate depression by midline just behind anterior margin; posterior margin vaguely indicated in front of scutellum, otherwise absent; disc coarsely punctate laterally, occasionally coarse punctures in slightly indented midline. Scutellum impunctate, midline slightly impressed, sides arcuate on anterior third. Elytra distinctly striate, first stria terminated by scutellum, extending basally no more than one-third length of scutellum; striae shallowly, finely punctate, crenate. Fore tibia with apical tooth expanded inwardly, apex shallowly emarginate; other five teeth on outer margin unmodified; flattened ventral or inner surface with two distinct conical teeth on apical half, apical tooth slightly smaller; a third minute tooth often evident on the basal side of the larger proximal tooth; middle tibia with three complete, transverse carinae on outer surface; hind tibia with four complete, transverse carinae on outer surface; hind femur with tooth near trochanter lacking or poorly defined. Mesosternum with small, distinct carina in front of middle coxae. Genitalia as in Fig. 46.

FEMALES. Length 15.8 to 19.1 mm.; greatest width 8.9 to 9.9 mm. Similar to males except in the following respects: fore tibia with six unmodified teeth on outer edge, ventral surface lacking the two conical teeth; pronotum less convex, with at least a few, coarse punctures scattered over disc; punctures in elytral striae often more pronounced; hind femur lacking any indication of tooth.

SPECIMENS EXAMINED. 10 males, 9 females.

## MEXICO

**Oaxaca:** Durasnal; Oaxaca, Höge; (La) Parada.

Specimens are in the following collections: BM, CNC, Oxford, Paris, USNM, Howden.

REMARKS. This species has several close allies which were sometimes included with *viridiobscura* by both Jekel and Bates. Typical *viridiobscura* is most easily recognized by the genital characters of the male and the fact that the species seems to be restricted to the state of Oaxaca in Mexico. The species can usually be recognized by the following combination of characters: dorsal color dark greenish black with purple reflections along margins and in striae; antennal club reddish brown, unmodified; clypeus abruptly arcuate anteriorly, disc rugose; pronotum with shallow, narrow, medial, punctate depression behind anterior margin; posterior pronotal margin absent except where faintly indicated in front of scutellum; elytral striae finely punctate, crenate at least laterally; flattened, inner surface of male fore tibia with two conical teeth, apical marginal tooth expanded in males; mesosternum carinate in front of middle coxae.

The above characters, plus locality, will separate the majority of specimens of *viridiobscura* from closely related species. The description of *felschei* by Nonfried could easily refer to a female of *viridiobscura*. However, I know of no species of *Geotrupes* that occurs in Honduras (although it is possible that *viridiobscura* may be found there) and if Nonfried's specimen was mislabeled, his description could be applied to any number of species. Unless his type can be located, the synonymy will remain in doubt. The name *saundersii* Jekel was correctly placed in synonymy by Bates, but other names, such as *rufoclavata* Jekel, which were placed under *viridiobscura*, appear to represent distinct species.

***Geotrupes (Cnemotrupes) nebulorum*, new species**

Fig. 47; Map 8

HOLOTYPE. Male, length 18.9 mm.; greatest width 10.3 mm. Color dorsally black with a faint bluish sheen. Antennal club reddish brown, unmodified. Clypeus U-shaped, sides slightly reflexed; disc finely rugose, posteriorly with indistinct, conical tubercle. Edge of ocular canthus slightly angulate anteriorly. Pronotum with vaguely indented group of coarse punctures medially just behind anterior margin; areas adjacent to anterior and lateral margins with numerous, coarse punctures; approximately two-thirds of discal surface with at least a few, coarse punctures; midline indicated posteriorly by row of punctures; posterior margin complete, except where indicated by row of punctures in front of scutellum. Scutellum with sides arcuate; median line impressed, with several small punctures. Elytra deeply striate, first stria extending basally only to scutellum; striae finely but distinctly punctate, crenate. Fore tibia with apical tooth expanded slightly inwardly, apex shallowly emarginate; flattened, inner surface with two conical teeth on apical half (shape, number, and size of modified tibial teeth very similar to those described for males of *viridiobscura*); outer surfaces of middle and hind tibiae each with four complete, transverse carinae; fore femur not excavated or modified; hind femur with minute tooth on posterior edge near apex of trochanter. Mesosternum with minute tooth (indicative of carina in other species) in front of middle coxae. Genitalia as in Fig. 47.

ALLOTYPE. Female, length 23.1 mm.; greatest width 13.5 mm. Similar to holotype except in the following respects: pronotum less convex and with some fine secondary punctures, in addition to coarse punctures, in vague concavity behind anterior margin; fore femora with all six teeth on outer margin unmodified, conical teeth lacking on flattened inner or ventral surface; hind femur lacking small posterior tooth; mesosternum with small but distinct carina in front of middle coxae.

TYPE MATERIAL. Holotype, male, 6 mi. W. Teziutlan, Puebla, Mexico, 4-6 Aug. 1960, H. F. Howden (CNC No. 8441). Allotype, female, same locality as holotype, 19 Aug. 1958, H. F. Howden (CNC No. 8441). Paratypes, 5 males, 8 females.

MEXICO

**Oaxaca:** Oaxaca, Höge (Bates collection).

**Puebla:** 6 mi. W. Teziutlan, 19 Aug. 1958, 4-6 Aug. 1960, H. F. Howden.

**Veracruz:** Acultzingo, 27 Oct. 1961, Halffter and Pereira; Orizaba, Sallé coll.

Paratypes are deposited in the following collections: BM, CNC, Paris, USNM, Halffter, Howden.

REMARKS. The species shows little variation except in size; the males vary in length from 18.5 to 22.3 mm. and in width from 9.9 to 12.0 mm.; the females vary in length from 19.2 to 24.1 mm. and in width from 11.5 to 13.5 mm.

In several specimens the scutellum is impunctate, the mesosternum has a small carina, and either the middle or the hind tibiae may have the proximal (fourth) transverse carina incomplete. There is little variation in the other characters described.

*G. nebularum* has been confused with *viridiobscura* but can be distinguished by the following combination of characters: dorsally black with a bluish cast; antennal club reddish brown; clypeus U-shaped; posterior margin of pronotum complete except in front of scutellum where it is represented by a line of punctures; elytral striae finely but distinctly punctate. The characters of the male genitalia and fore tibia are also diagnostic.

The species occurs at 6000-7000 feet in pine-oak areas just above the cloud forest formation on the eastern escarpment of the Sierra Madre Oriental in Puebla, Veracruz, and Oaxaca. I have found specimens in vertical burrows, four to seven inches deep, beneath deposits of human feces.

***Geotrupes (Cnemotrupes) guerreroensis*, new species**

Fig. 48; Map 9

HOLOTYPE. Male, length 19.2 mm.; greatest width 10.4 mm. Color dorsally black with a dark blue sheen. Antennal club reddish tan, unmodified. Clypeus U-shaped, margin more arcuate anteriorly than laterally; disc rugose-punctate, with sharp, conical tubercle posteriorly. Edge of eye canthus vaguely angulate anteriorly. Pronotum as described for *viridiobscura*, with small anterior excavation behind anterior margin; posterior margin lacking, vaguely indicated in front of scutellum; midline represented by row of punctures. Scutellum as described for *viridiobscura*. Elytra distinctly striate; striae appearing impunctate, but under 40 or more magnifications very minute punctures evident. Characters of legs as described under *viridiobscura*. Mesosternum with small, sharply pointed carina in front of middle coxae. Genitalia as in Fig. 48.

ALLOTYPE. Female, length 18.6 mm.; greatest width 10.2 mm. Color dorsally black with a greenish-blue cast. Similar to the holotype except in the following respects: pronotum less convex, tibia and femora lacking modified teeth.

TYPE MATERIAL. Holotype, male, Omilteme, Guerrero, 8000 ft. (Mexico), August, H. H. Smith (BM). Allotype, female, same data as holotype except collected in July (BM). Paratypes: 3 males, 2 females.

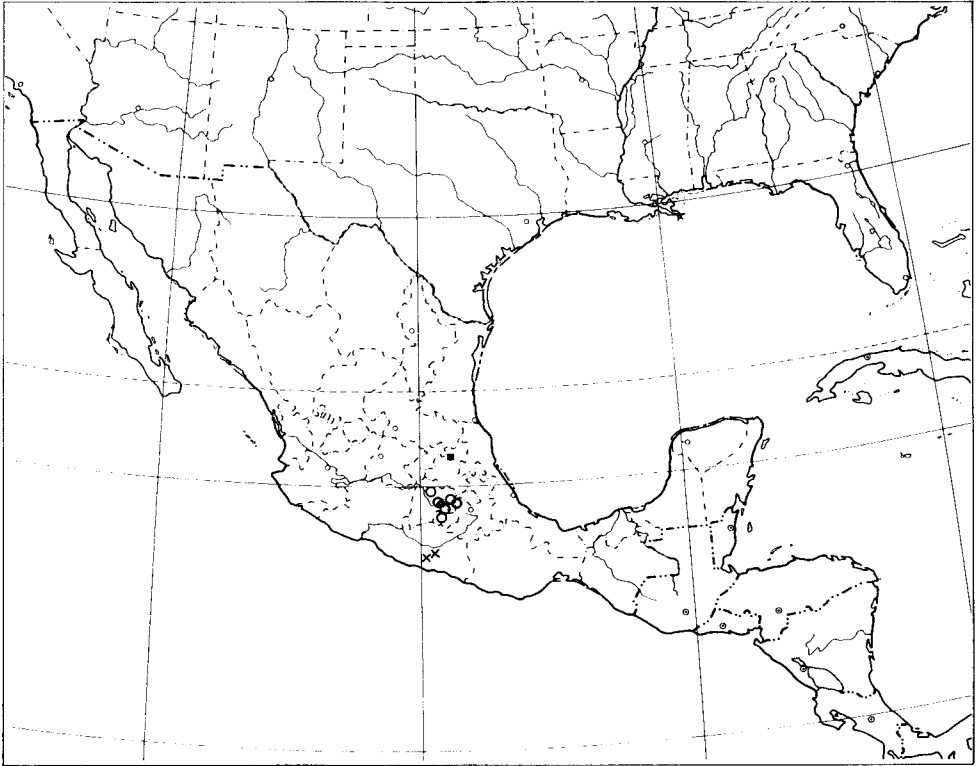
MEXICO

**Guerrero:** (3 ♂♂ state label only); Mochitlan, Baron; Omilteme, 8000 ft., August, H. H. Smith.

Paratypes are deposited in the following collections: BM, Paris, USNM, Howden.

REMARKS. Variation in the seven specimens seen is slight. Size ranges from 17.0 to 20.3 mm. in length, and the greenish luster is more common than the blue sheen of the holotype. One male paratype has three conical teeth on the flattened, ventral surface of the fore tibia. The hind tibia may have the upper (fourth) transverse carina complete or interrupted.

*G. guerreroensis* is closely related to *viridiobscura* and was confused with that species by Bates. However, the lack of punctures (or with only very minute ones) in the elytral striae will distinguish *guerreroensis*. The greenish or bluish cast of *guerreroensis* lacks the coppery tints usually present on *viridiobscura*, and



Map 9. Distribution of: [X] *Geotrupes guerreroensis*, new species, [O] *G. rufoclavata* Jekel, and [■] *G. sobrina* Jekel.

the male genitalia are very distinctive. *G. guerreroensis* can be separated from other Mexican *Geotrupes* by the following combination of characters: dorsal surface shining black with greenish or bluish cast; antennal club reddish tan, unmodified; clypeus U-shaped; posterior pronotal margin lacking except faintly indicated in front of scutellum; elytral striae well developed, obsoletely punctate.

The species is apparently restricted to the high elevations of the Sierra Madre del Sur.

***Geotrupes (Cnemotrupes) rufoclavata* Jekel**

Fig. 49; Map 9

*Geotrupes rufoclavatus* Jekel, 1865, p. 601; Bates, 1887, p. 114.

TYPE. Male, Mexico; location unknown to me.

MALES. Length 14.5 to 21.1 mm.; greatest width 8.1 to 11.1 mm. Color dorsally shining green to dark greenish black, rarely bluish or purplish. Antennal club reddish tan, occasionally reddish brown; unmodified. Clypeus V-shaped, apex abruptly rounded, sides slightly reflexed; disc rugose-punctate, with small, conical tubercle posteriorly. Sides of eye canthus rounded or vaguely angulate anteriorly. Pronotum with poorly punctate depression behind anterior margin, depression extending behind margin no further than thickness of margin at midline, depression usually no wider than distance between eyes; posterior margin shallowly indicated except lacking in front of scutellum (the reverse of *viridiobscura*); disc with at least posterior half of midline indented; lateral surface with numerous coarse punctures, a few punctures often present on midline and along anterior and posterior margins. Scutellum impunctate, sides arcuate on anterior third, disc flat or with vaguely impressed midline. Elytra distinctly striate, first stria terminated by scutellum as in *viridiobscura*; first five striae usually impunctate basally, finely punctate apically; lateral striae usually finely to distinctly punctate; often one

or more of first seven discal striae broken, adjacent intervals joined by transverse flattened area of varying size (*G. herbea* is the only other Mexican species in which this interruption of striae is frequent). Fore tibia with apical tooth expanded but not to the degree usually found in *viridiobscura*, apex shallowly emarginate, remaining five to seven teeth on the outer margin unmodified; flattened ventral or inner surface with two distinct, conical teeth in apical half, teeth close together, the smaller, apical tooth one third to one half the size of the larger, proximal tooth; middle and hind tibiae each with three or four complete, transverse carinae on outer surface; fore femur usually shallowly but distinctly excavate on ventral surface near fore coxa; hind femur with an obtusely angulate, vague tooth on hind margin near trochanter. Mesosternum with small, distinct carina in front of middle coxae. Genitalia as in Fig. 49.

**FEMALES.** Length 14.9 to 19.4 mm.; greatest width 8.6 to 11.6 mm. Similar to males except in the following respects: fore tibia with six or seven unmodified teeth on outer edge, ventral surface lacking the two conical teeth; fore femur not excavated near coxa; hind femur lacking tooth near trochanter; pronotum usually less convex.

**SPECIMENS EXAMINED.** 46 males, 30 females.

## MEXICO

**Distrito Federal:** D. de los Leones, 6 Sept. 1948, 21 Oct. 1951, J. Hendrichs; Telapón (= Tlalpan<sup>2</sup>), 9 June 1957, J. Hendrichs.

**Mexico:** Cerro Teponaztle (?), 25 June 1950, G. Halffter; Rio Frio, 9 June 1957, J. Hendrichs; Salazar, 6 Sept. 1948, J. Hendrichs; San Felipe, Aug. 1929; San Rafael, 2 June 1957, J. Hendrichs; Tenango del Valle; Tlaloc, 12 June 1949, J. Hendrichs; Valle Grande, 20 Nov. 1952, J. Hendrichs.

**Morelos:** Tres Cumbres, 28 Aug. 1955, J. Hendrichs.

**Puebla:** Papayo (locality also given as in Mexico), 28 June 1946, 7 July 1957, J. Hendrichs.

Specimens are in the following collections: BM, CNC, Oxford, Paris, Halffter, Hendrichs, Howden.

**REMARKS.** *G. rufoclavata* can be separated from the related species by the following combination of characters: color dorsally green, rarely bluish or blackish; antennal club reddish tan to reddish brown, unmodified; clypeus V-shaped; posterior pronotal margin shallowly defined, absent only in front of scutellum; midline of pronotal disc indented in posterior half; discal elytral striae impunctate to feebly punctate. The characters of the male genitalia, fore tibia, and fore femur are also diagnostic.

This species has been included under *viridiobscura* in most collections and has not been recognized since Jekel's description. While I was unable to locate the type, I believe that there is little doubt that Jekel's name *rufoclavata* refers to the species described above. The species occurs rather commonly in the mountainous areas near Mexico City. Many of the specimens found by Mr. Hendrichs were taken in burrows, 5 to 15 cm. deep, under cow or horse dung. Another green species, *G. herbea*, occurs in the same areas and has been taken along with *rufoclavata* by Mr. Hendrichs. The blackish antennal club of *G. herbea* allows it to be readily distinguished from *rufoclavata*.

## *Geotrupes (Cnemotrupes) sobrina* Jekel

Fig. 50; Map 9

*Geotrupes sobrinus* Jekel, 1865, p. 602; Bates, 1887, p. 114.

**TYPE.** Lectotype here designated, male, Jacala, Mexico, Sallé coll., labeled type, *G. sobrinus* and with folded label *Cn. picitarsis* (BM).

**MALE (LECTOTYPE).** Length 16.6 mm.; greatest width 9.7 mm. Color dorsally green, with traces of blue green around margins of pronotum and elytra. Antennal club reddish brown, unmodified. Clypeus U-shaped, more arcuate anteriorly; disc punctate-rugose, with

small, conical tubercle posteriorly. Edge of ocular canthus evenly arcuate. Pronotum lacking concavity behind anterior margin; posterior margin absent (Jekel mentioned a margin — which is vaguely indicated in one female he included in *sobrina*; however, this specimen is actually *herbea*); disc largely impunctate, a few, coarse punctures present along lateral margins; midline not impressed. Scutellum flat, sides arcuate on anterior third. Elytral striae distinct, first stria terminated by scutellum, extending basally no more than one-fifth the length of scutellum; striae shallowly punctate, distinctly crenate. Fore tibia with apical tooth expanded inwardly, apex emarginate; remaining five or six teeth on outer margin unmodified; flattened ventral or inner surface with three distinct, conical teeth on apical half, teeth nearly equal in size; middle and hind tibiae each with four complete, transverse carinae on outer surface; femora unmodified; hind femur with only three setate punctures representing the setigerous line of punctures present in related species of *Geotrupes* (this line in all other Mexican *Geotrupes* extends across most of the posterior portion of the femur). Mesosternum slightly elevated and distinctly carinate in front of middle coxae. Genitalia as in Fig. 50.

FEMALE. Length 16.1 mm.; greatest width 9.6 mm. Similar to male except for slightly less convex pronotum and unmodified fore tibia.

SPECIMENS EXAMINED. 1 male, 1 female.

## MEXICO

### Hidalgo: Jacala.

REMARKS. Only two specimens of this species have been seen. The male (lectotype) is in the British Museum and the female, also from Jacala and labeled "*sobrinus*, type" is in the Paris Museum. Another female in the British Museum, also labeled "*sobrinus* type", is actually a female of *herbea*. The fact that Jekel himself apparently confused the females of the two species has probably contributed to the subsequent listing by Boucomont (1912, p. 28) of *herbea* as a synonym of *sobrina*.

The two species, while superficially alike, are quite distinct. In addition to the difference in the color of the antennal club, *herbea* averages smaller, is more heavily punctate, and often has only two conical teeth on the underside of the fore tibia in the male.

*G. sobrina* can be identified by the following combination of characters: dorsally green; antennal club reddish brown, unmodified; pronotum impunctate except along lateral margins; posterior pronotal margin lacking; elytral striae shallowly punctate, crenate; apical half of fore tibia of male with three distinct, conical teeth on flattened ventral or inner surface. The male genitalia are also distinctive.

### *Geotrupes (Cnemotrupes) herbea* Jekel

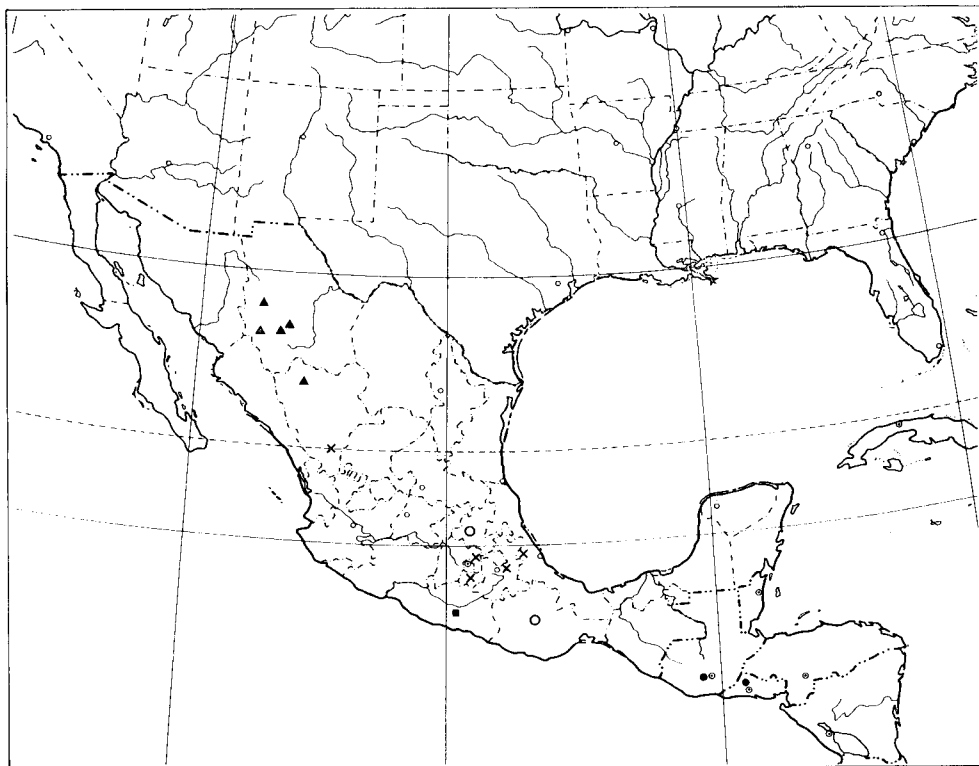
Fig. 51; Map 10

*Geotrupes herbeus* Jekel, 1865, p. 604; Bates, 1887, p. 114; Boucomont, 1912, p. 28.

TYPE. Holotype, female, Mexico, ex. Mus. Sturm, Sallé coll. (BM).

MALES. Length 12.2 to 15.5 mm.; greatest width 7.5 to 9.0 mm. Color dorsally bright green, occasionally greenish black; pronotum often with a coppery tinge. Antennal club brownish or grayish black, unmodified. Clypeus U-shaped, usually more abruptly arcuate anteriorly; disc punctate-rugose, median area rising gradually to a low, conical, posterior tubercle. Sides of eye canthus arcuate to vaguely angulate. Pronotum with anterior margin slightly raised medially, concavity lacking behind margin; posterior margin obsolete, indicated by row of small punctures; scattered, coarse punctures on sides of disc, along anterior pronotal margin, and occasionally on midline. Scutellum nearly flat, sides arcuate on anterior third. Elytra distinctly striate, striae moderately punctate, crenate; intervals occasionally transversely connected, briefly interrupting striae. Fore tibia with apical tooth expanded inwardly, remaining five or six teeth unmodified; flattened under surface with two or three conical teeth on distal half; middle tibia with three, hind tibia with four transverse carinae on outer surface; fore and hind femora unmodified. Mesosternum expanded and carinate in front of middle coxae. Genitalia as in Fig. 51.





Map 10. Distribution of: [X] *Geotrupes herbea* Jekel, [■] *G. truncaticornis*, new species, [O] *G. sallei* Jekel, [▲] *G. cnephosa*, new species, and [●] *G. onitidipes* Bates.

FEMALES. Length 12.8 to 15.2 mm.; greatest width 7.7 to 9.2 mm. Similar to males except in the following respects: pronotum slightly less convex; fore tibia with six or seven unmodified teeth on outer margin, under surface lacking the three conical teeth.

SPECIMENS EXAMINED. 13 males, 16 females.

**Durango:** Sierra de Durango.

**Mexico:** Cerro Teponaztle, 11 July 1949, in 20 cm. burrow, G. Halfpter; Salazar, Höge, Wickham, Aug. 1957, Halfpter, 5 May 1945, J. Hendrichs.

**Morelos:** Tres Cumbres, 28 Aug. 1955, J. Hendrichs.

**Puebla:** Mt. Diabola (= Diablo), 24 July 1901, R. H. Hay.

**Veracruz:** Jalapa, Las Rigas (= Vigas) Höge.

Specimens are in the following collections: BM, CNC, Oxford, Paris, USNM, Halfpter, Hendrichs, Howden.

REMARKS. *G. herbea* has been confused with *sobrina* and was listed as a synonym of that species by Boucomont (1912, p. 28). It is undoubtedly closely related to *sobrina* but differs by having the antennal club blackish; the pronotal disc laterally and anteriorly with scattered, coarse punctures; and a differently shaped male genitalia.

The following combination of characters should separate *G. herbea* from the other Mexican species in the genus: usually bright green; antennal club brownish or grayish black, unmodified; pronotum lacking anterior concavity; posterior pronotal margin obsolete, indicated by row of small punctures; elytral striae punctate; male fore tibia with two or three conical teeth on apical half of ventral

flattened surface. The size is also useful, *herbea* being, on the average, the smallest of the greenish species having distinct elytral striae.

In Jekel's description of the species (1865, p. 604) he says, "L'individu ♀ sur lequel j'établis cette espèce" — and mentions that the specimen is "ex Mus. Sturm, Mus. D. Salle ♀." The Sallé collection is in the British Museum (Natural History) and contains a female labeled "*herbeus*, type," and "Mus. Sturm, Sallé coll." I believe this is undoubtedly the type, but there is also a female correctly identified as *herbeus* in the Paris Collection labeled as "type" but not "ex. Mus. Sturm." Since Jekel stated he had only one specimen, I suspect the Paris specimen was labeled after the completion of the description.

The habits of *herbea* are similar to those of *G. rufoclavata*. Mr. Hendrichs collected both species in the same area under horse dung.

***Geotrupes (Cnemotrupes) truncaticornis*, new species**

Figs. 39, 52; Map 10

**HOLOTYPE.** Male, length 19.7 mm.; greatest width 10.5 mm. Color dorsally black, clypeus and pronotum laterally with vague traces of dark brown. Antennal club reddish tan, unmodified. Clypeus U-shaped, edge evenly arcuate and shallowly reflexed; disc punctate-rugose, posteriorly with distinct, transversely compressed horn (Fig. 39); sides of horn vertical, tip truncate. Edge of ocular canthus obtusely angulate anteriorly. Pronotum with shallow but distinct, impunctate depression behind anterior margin; depression expanded and more obviously concave on either side of midline; posterior margin absent except vaguely indicated in front of scutellum; disc impunctate except near lateral margins; midline slightly indented in posterior half. Scutellum almost flat, sides arcuate on anterior third. Elytra distinctly striate, first stria extending one-third of distance around scutellum; striae indistinctly, finely punctate, vaguely crenate. Fore tibia with apical tooth flattened and slightly expanded, apex rounded; other five teeth on outer margin unmodified; flattened ventral or inner surface with one large, conical tooth on apical half (a second minute tooth present near apex on one tibia, absent on other); middle tibia with three, hind tibia with four, transverse carinae on outer surface; fore femur shallowly excavate, a carina present at the apical end of excavation; hind femur not modified, tooth on posterior edge absent. Mesosternum with small, distinct carina in front of middle coxae. Genitalia as in Fig. 52.

**ALLOTYPE.** Female, length 18.2 mm.; greatest width 9.5 mm. Similar to the holotype except in the following respects: clypeal horn represented by low conical tubercle; pronotum distinctly less convex, anterior concavity not greatly different from male; fore tibia with six unmodified teeth on outer margin, large, conical tooth on inner surface absent; fore femur not excavate or distinctly carinate.

**TYPE MATERIAL.** Holotype, male, Omilteme, Guerrero, 8000 ft., (Mexico), August, H. H. Smith (BM). Allotype, female, same data as holotype (BM).

**REMARKS.** *G. truncaticornis* can be identified by the following combination of characters: dorsally shining black, clypeus U-shaped, antennal club unmodified, anterior pronotal concavity shallow and wider than margin, posterior pronotal margin lacking except medially, pronotum punctate only near lateral margins, distinct elytral striae obsoletely punctate. In addition, the male has a distinctive clypeal horn, characteristic modifications of the fore tibia and femur, and easily recognized genitalic characters.

The male specimen described above is, I believe, the specimen that Bates (1889, p. 395) referred to as an unusually developed *G. viridiobscura*. His reference to the anterior tibia being bifid does not refer to the apical tooth, but includes the second tooth which, being unusually near the apical tooth, gives the tibial apex a bifid appearance.

***Geotrupes (Cnemotrupes) sallei* Jekel**

Figs. 40, 41, 53; Map 10

*Geotrupes sallei* Jekel, 1865, p. 596; Bates, 1887, p. 113.

*Geotrupes sallei* var. *falsus* Jekel, 1865, p. 598; Bates, 1887, p. 113.

TYPE. *Geotrupes sallei* Jekel. Lectotype here designated, male, Durasnal, (Oaxaca), Mexico, Sallé coll., labeled *C. sallei* Jekel, type, and "sp. figured" in BCA (BM).

TYPE. *Geotrupes sallei* var. *falsus* Jekel. Holotype, female, Peru (?), Oberthur coll. (Paris).

MALES. Length 23.8 to 26.0 mm.; greatest width 12.5 to 14.1 mm. Color dorsally dull black. Antennal club reddish brown, unmodified. Clypeus U-shaped, usually more arcuate anteriorly; disc punctate, surface between punctures finely granulate; posterior clypeal tubercle poorly developed, represented by low, rounded swelling. Edge of ocular canthus obtusely angulate anteriorly. Pronotum very convex, not concave behind anterior margin; disc with scattered, rather small, coarse punctures; surface between punctures alutaceous, with scattered, small, annular, shining spots or secondary punctures; midline vaguely indented, usually with a row of coarse punctures; posterior margin fine or indicated by single or double row of punctures. Scutellum with scattered, coarse and fine punctures, midline depressed. Sides arcuate on anterior third. Elytral striae shallow, distinct, striae usually crenate; stria punctures often vague. Fore tibia with apical tooth expanded inwardly and inflexed, apical margin sinuate or arcuate, not emarginate; remaining four teeth on outer margin unmodified in shape, second and third distal teeth widely separated; flattened, inner or ventral surface of fore tibia on apical half with one large, conical tooth and one minute tooth on each side; middle and hind tibiae each with three complete, transverse carinae on outer surface; fore femur excavate near coxa, with an overhanging carina present on distal side of excavation; hind femur with distinct tooth on posterior edge near trochanter. Mesosternum in front of middle coxae slightly elevated, midline vaguely tumid, not carinate. Genitalia as in Fig. 53.

FEMALES. Length 21.1 to 23.8 mm.; greatest width 12.1 to 14.3 mm. Similar to males except in the following respects: pronotum much less convex, sides slightly flared; pronotal disc with fine secondary punctures deeper and more numerous particularly anteriorly; punctures and crenation of striae occasionally obsolete; fore tibia unmodified, outer margin occasionally with minute, sixth tooth basally; fore femur not excavated or noticeably carinate; hind femur lacking tooth on posterior edge.

SPECIMENS EXAMINED. 7 males, 9 females.

## MEXICO

**Hidalgo:** Guerrero Mill, 9000 ft., Mann and Skewes; San Miguel, Mann.

**Oaxaca:** Durasnal, Oaxaca.

Specimens are in the following collections: BM, CNC, MCZ, Paris, USNM.

REMARKS. *Geotrupes sallei* can be identified by: large size; dull black dorsum; reddish brown, unmodified antennal club; pronotum without an anterior concavity; elytral striae shallow but distinct; and mesosternum not distinctly carinate. In males the modifications of the fore tibia, the excavated fore femora, the toothed hind femora, and the genitalic characters are all very distinctive.

I examined the type of the variety *falsus* Jekel and concur with Bates that it is conspecific with *sallei*, and that the "Peru" locality label almost certainly is incorrect.

### *Geotrupes (Cnemotrupes) cnephosa*, new species

Figs. 42, 54; Map 10

*Geotrupes* ? (No. 12) Bates, 1887, p. 115.

HOLOTYPE. Male, length 13.8 mm.; greatest width 8.8 mm. Color dorsally black, pronotal and elytral margins bluish or purplish. Antennal club grayish black, unmodified. Clypeus U-shaped, slightly more arcuate anteriorly than laterally; disc rugose-punctate, distinctly granulate; clypeal tubercle obsolete, indicated by vague, post-median swelling. Edge of eye canthus evenly arcuate. Pronotum lacking any anterior concavity, moderately convex, completely margined; disc with punctures concentrated along margins, scattered punctures present on most of disc; midline faintly impressed. Scutellum almost flat, scattered, large and small punctures present basally; sides abruptly arcuate on anterior third. Elytral striae obsolete, indicated by vague lines and rows of small punctures; surface of clytra slightly irregular, alutaceous and with scattered minute punctures. Fore tibia with apical tooth

expanded inwardly, bifid, apex emarginate; remaining five teeth on outer margin unmodified; flattened ventral or inner surface with three or four small teeth near middle of tibia; middle and hind tibiae each with three complete, transverse carinae on outer surface; fore and hind femora unmodified. Mesosternum vaguely carinate in front of middle coxae. Genitalia as in Fig. 54.

ALLOTYPE. Female, length 13.7 mm.; greatest width 8.9 mm. Similar to the holotype except in the following respects: clypeus more evenly arcuate; pronotal disc more heavily punctate; margins of elytra on apical third more broadly arcuate; fore tibia with six unmodified teeth on outer margin, teeth on flattened ventral or inner surface as in male.

TYPE MATERIAL. Holotype, male, between Bacoyna and Creel, Chihuahua, Mexico, 7 Aug. 1934, W. F. Foshag (USNM). Allotype, female, Sabinal, Chihuahua, Mexico, 18 Aug. 1934, W. F. Foshag (USNM). Paratypes: 27 males, 13 females.

## MEXICO

**Chihuahua:** between Bacoyna and Creel, 7 Aug. 1934, W. F. Foshag; 1 mi. N. Creel, 30 Aug. 1950, Ray F. Smith; Guerrero, 1934, W. F. Foshag; P. Cusarare, 17 July 1957, R. H. Pine; Mesa del Huracan, 21-25 July 1964, J. E. H. Martin.

**Durango:** Refugio, Höge.

Paratypes are deposited in the following collections: AMNH, BM, CNC (No. 8442), USNM, Gibson.

REMARKS. Variation in the type series is evident mainly in size. Males vary from 12.3 to 15.6 mm. in length and from 8.3 to 10.3 mm. in greatest width. Females range from 11.9 to 16.7 mm. in length and from 8.5 to 11.0 mm. in greatest width. The majority of specimens are dully alutaceous, only a few being feebly shining. Occasional specimens have the punctures greatly reduced in numbers and size, the pronotum being almost impunctate centrally and with elytral punctures minute and limited to the obsolete striae lines.

The lack of distinct elytral striae will immediately separate *G. cnephosa* from the other Mexican *Geotrupes*. The species is most closely related to *G. opacus* Haldeman which occurs in the United States from Michigan to Texas. *G. opacus* is similar in form and size to *cnephosa* but is much more heavily punctate, more opaque, has the elytral striae indicated by regular rows of large punctures, and differs in the characters of the male genitalia.

### *Geotrupes (Onthotrupes)*<sup>1</sup> *onitidipes* Bates

Figs. 43, 55; Map 10

*Geotrupes onitidipes* Bates, 1887, p. 115.

TYPE. Lectotype here designated, male, Guatemala, Sallé coll., labeled: type, sp. figured (BCA), and with Candeze ms. name "*Geotrupes onitidipes*" (BM).

MALES. Length 14.8 to 18.0 mm.; greatest width 8.5 to 9.3 mm. Head and pronotum dorsally dull black with greenish cast, elytra black with coppery cast. Antennal club grayish-black, unmodified. Mandibles unusually elongate. Clypeus V-shaped, apex abruptly rounded, slightly reflexed, sides almost straight; disc punctate, vaguely rugose; posterior tubercle low, rounded. Edge of ocular canthus arcuate, more strongly so anteriorly. Pronotum lacking anterior concavity; strongly, transversely convex, more so anteriorly than posteriorly; posterior margin obsolete, indicated by an irregular row of punctures; disc punctate only near lateral margins and along anterior margin, midline not indented. Scutellum flat, sides abruptly arcuate just before middle. Elytral striae distinct, first stria terminated by scutellum; striae not punctate or crenate basally, very shallowly punctate and crenate laterally and apically. Fore tibia very slender and elongate, apical tooth with slender, apical projection extending as far as distal tarsal segment, outer apical side of bifurcate tooth inwardly arcuate; remaining five or six teeth on outer edge small and widely spaced; ventral or inner surface of fore tibia

<sup>1</sup>*Onthotrupes*, new subgenus; the description is included in the discussion of the subgenera of *Geotrupes*. p. 49.

with row of four or five small, evenly spaced, conical teeth beginning at basal third of tibia; middle tibia with three, hind tibia with four, complete, transverse carinae on outer surface; fore femur slender, elongated, distal end extending well beyond lateral pronotal margin; hind femur with small tooth on posterior edge near trochanter. Mesosternum not carinate in front of middle coxae. Genitalia as in Fig. 55.

**FEMALES.** Length 14.1 to 17.1 mm.; greatest width 8.5 to 10.5 mm. Similar to males except in the following respects: color of pronotum and elytra similar, varying from almost completely black to distinctly greenish or purplish; mouthparts and clypeus less elongate; pronotum less convex, posterior line of punctures representing margin often absent; fore tibia and femur not elongate, apical tibial tooth not modified; inner or ventral surface of fore tibia with row of five or six conical teeth, teeth often larger than similar teeth in male; posterior femur lacking tooth on posterior margin.

**SPECIMENS EXAMINED.** 7 males, 10 females.

## EL SALVADOR

**Chalatenango:** Montecristo, 7-9 May 1958, under cow dung, O. L. Cartwright.

## GUATEMALA

**Sacatapéquez:** Capetillo, G. C. Champion.

Specimens are in the following collections: BM, CNC, MCZ, USNM, Howden.

**REMARKS.** *Geotrupes (Onthotrupes) onitidipes* is easily distinguished from other Central American *Geotrupes* by the following combination of characters: black with metallic reflections; antennal club grayish black, unmodified; clypeus elongate, V-shaped; pronotum punctate only near margins, posterior margin obsolete; fore femur with row of four to six conical teeth on ventral or inner surface in both sexes; mesosternum not carinate in front of middle coxae. In the larger males the greatly elongated front legs are very distinctive.

Mr. Cartwright collected this species in and under cow dung in thick, second growth, deciduous forest at elevations above 7,000 feet.

## CANADIAN AND UNITED STATES GEOTRUPINAE

This section is largely a supplement to my paper on the Geotrupinae of Canada and the United States (1955, pp. 151-319). It includes a revision of the genus *Eucanthus*; descriptions of the larvae of *Bolboceras obesus* (LeConte), *Geotrupes opaca* Haldeman, and *Geotrupes semiopaca* Jekel; and distributional records which represent significant extensions of the recorded ranges. Treatment of the species follows the order established in my 1955 paper, and page numbers in brackets without other citations refer to that paper.

### BOLBOCEROSOMA SCHAEFFER

*Bolbocerosoma tumefactum* (Palisot de Beauvois) [p. 172]. New records:—**Tennessee:** Burrville, Knoxville, Marion County, Springfield.

*Bolbocerosoma hamatum* Brown [p. 177]. New records:—**Alabama:** Coden, Springhill.

*Bolbocerosoma lepidissimum* Brown [p. 179]. New records:—**Missouri:** Nevada (Vernon County).

### BRADYCINETULUS COCKERELL

*Bradycinetulus rex* Cartwright [p. 195]. Cartwright's description of the species was based on three males. Recently through the kindness of Mr. P. A. Glick, Brownsville, Texas, I have been able to obtain a female of *rex* collected at Raymondville, Texas, in August 1962. The salient features of the female are as follows.

Length 21 mm.; greatest width 13 mm. Color and form as in females of *ferruginous* (P. de B.) and *fossatus* (Hald.). Clypeal-frontal carina terminating on each side in small tubercle above mandibular insertion, curving anteriorly to a low, bituberculate horn, horn approximately two-fifths as wide as clypeus; low carina extends from each side of bituberculate horn to proximate anterior clypeal angle. Horn of vertex transversely conical, apex truncate; horn at apex one-third as wide as vertex between eyes. Pronotum contiguously punctate anteriorly, laterally, and between low, rounded protrusions; distinctly less punctate than in *fossatus*. Scutellum nearly impunctate. Elytra as in *fossatus*.

The female of *rex* may be separated from females of the related species by the shape of the clypeal-frontal carina, by the distinctly advanced clypeal-frontal horn, and by the large size of the horn on the vertex. The shape of the pronotum of *rex* resembles that of *fossatus* very closely, but the surface is much less heavily punctate.

#### BOLBOCERASTES CARTWRIGHT

*Bolbocerastes imperialis imperialis* Cartwright [p. 197]. New record:—Utah: Washington County.

#### BOLBELASMUS BOUCOMONT

*Bolbelasmus arcuatus* (Bates) [p. 198]. Not in the United States. See description of *Bolbelasmus variabilis*, new species, in the preceding section.

#### EUCANTHUS WESTWOOD

*Eucanthus* Westwood, 1848, p. 387; 1852, p. 26 (additional references, Howden, 1955, p. 199).

TYPE-SPECIES. *Scarabaeus meliboeus* Fabricius (= *lazarus* Fab.), by monotypy in Westwood (1948).

*Eucanthus* is characterized by: color uniform tan to black; eye only partially divided by canthus; clypeus and vertex each with transverse carina or horn, the one on vertex greatly reduced in height in male; middle coxae nearly contiguous; metasternum narrowly acute and linear between coxae; pronotum with median, transverse carina, this sometimes interrupted at midline, on each side with lateral tubercle or rounded swelling; each elytron with five striae or rows of distinct punctures between suture and umbone; humeral angles abruptly rounded, usually with small tubercle on margin.

*Eucanthus* presents a number of interesting and difficult problems. In 1955, when I revised the genus for the United States and Canada, I found the large amount of geographic variation puzzling. Subsequently enough material has become available to clarify some of the problems.

Four of the six species in North America are rather easily recognized and, because of rather restricted ranges, do not exhibit the extreme variation found in *lazarus* (Fabricius) and a new species, *impressus*. *Eucanthus alutaceus* Cartwright lacks the shining luster of the other species and has the most restricted range, occurring in areas of deep sand in Alabama, Florida, Georgia, and Mississippi. *Eucanthus subtropicus* Howden was described as a subspecies of *lazarus* and was confused with some specimens of *impressus*. I now consider it a distinct species largely restricted to sandy areas in the coastal plain from Mississippi to New Jersey. *Eucanthus greeni* Robinson, normally a very large species, occurs mainly in the plains east of the Rocky Mountains from Alberta and Manitoba southward to New Mexico and Arizona. The fourth species, described below as *Eucanthus mexicanus*, occurs in the transverse volcanic belt in the Mexican states of Durango, Mexico, Michoacan, and Puebla and is the only species of the six with a completely allopatric distribution.

The remaining two species vary greatly over a wide geographic range. *Eucanthus lazarus* (Fabricius) occurs from northern Georgia to southern Ontario and westward to Arizona. In parts of its range it is sympatric with *subtropicus*,

*greeni*, and *impressus*. In general *lazarus* occurs in clay-soil, sparsely-treed habitats. Specimens from the southeastern United States average larger, the males have better developed pronotal and clypeal carinae, the punctures are deeper, the size of the eye and the antennal club is larger, and the color is darker than in more northern or western specimens. The majority of specimens from Arizona can be distinguished from the majority of Michigan or southeastern specimens, but there are no clear-cut clines and the variation is not concordant. Specimens taken from a single colony exhibit remarkable uniformity, varying mainly in size, as is often the case with species of Scarabaeidae where the adults provide the larval food.

Variation in *Eucanthus impressus* is perhaps more pronounced than in *lazarus*. This is perhaps due to more restricted habitat requirements. The species occurs in sandy, coastal areas from New York to Texas, northward along the Mississippi drainage to Nebraska and in sandy areas of New Mexico and Chihuahua. As in *lazarus*, specimens from the southeast are darker and have deeper punctures than those from Nebraska, New Mexico, and Chihuahua. On the other hand, western specimens are larger, have a differently shaped eye canthus and have the sides of the pronotum more strongly explanate, approaching *greeni* in this respect. Specimens from Texas to Kansas seem to be intermediate, but again there are no definite clinal areas and no concordance in the variation.

Brown and Wilson (1956), in their paper on character displacement, postulated that where two closely allied species were sympatric, they tended to be more dissimilar morphologically than in allopatric areas. This does not seem to be the case in *Eucanthus*. In some areas of the southeast, *lazarus*, *subtropicus*, and *impressus* may be taken in the same light trap. Since they are strong fliers, they probably come from different habitats, but essentially they can be said to be sympatric. In color and depth of punctures the three are more nearly similar than are representatives of one species from the south and west. In New Mexico both *lazarus* and *impressus* have the sides of the pronotum more strongly explanate and the elytral punctures shallower than in southeastern specimens, resembling the sympatric species, *greeni*, in these respects.

Even with the tendency toward the convergence of certain characters in some areas, the majority of specimens can be readily segregated to species, particularly if males are represented. The characters of the male genitalia are both useful and confusing. The parameres and phallobase are poorly sclerotized and subject to distortion, but the spines of the internal sac, if the sac is everted, can be used to separate sympatric populations of various species. While the internal sac is useful in separating species in a restricted area, this is not true over larger areas, for the number and size of the spines vary intraspecifically from one area to another. Western specimens of *lazarus* have smaller and more numerous spines than do eastern *lazarus* and in this character may resemble eastern *impressus* more closely than eastern *lazarus*. Because of the complex variation, and still inadequate series from many localities, the present review attempts to briefly delimit the readily definable species and indicate the major population differences in the highly variable ones. Descriptions are based on reasonably constant external characters which appear to be useful in identification of the species.

#### KEY TO THE NORTH AMERICAN SPECIES OF EUCANTHUS

1. Entire dorsal surface, between punctures, smooth and shining ..... 2  
   Entire dorsal surface, between punctures, alutaceous; dull, dark brown;  
   Georgia and Florida ..... *Eucanthus alutaceus* Cartwright

2. Anterior edge of eye canthus almost straight, outer angle not produced anteriorly; antennal club large, longer than ventral portion of eye; color brown to dark brown ..... 3  
 Anterior edge of eye canthus not straight, the outer angle produced; antennal club small, usually shorter than ventral portion of eye; color usually brownish black; in sand hill habitats from Mississippi and central Florida northward to New Jersey .....  
 ..... *Eucanthus subtropicus* Howden
3. Pronotum, before the median swelling, not distinctly impressed and with punctures on declivity not concentrated on midline; pronotal punctures behind lateral tubercles irregularly contiguous or with only one band of punctures extending toward midline; pronotum of males (except in depauperate specimens) with median swelling and lateral tubercles better developed than in females (only slightly so in *greeni*) ..... 4  
 Pronotum with punctures, and sometimes impression of midline, extending almost to apical margin; pronotal punctures behind lateral tubercles mostly discrete, extending on each side in two indented bands toward the midline; pronotal armature of both sexes similar .....  
 ..... *Eucanthus impressus*, n. sp.
4. Pronotum with coarse punctures largely restricted to marginal and impressed areas; approximately one-half of pronotal disc impunctate or with only five secondary punctures ..... 5  
 Pronotum coarsely punctate except near posterior margin and on either side of posterior half of depressed midline; at least three-fourths of pronotum coarsely punctate; Mexican states of Durango, Mexico, Michoacan, and Puebla ..... *Eucanthus mexicanus*, n. sp.
5. Outer third of anterior pronotal margin arcuate or sinuate (Figs. 59, 60); anterior pronotal angle sharp, subacute; striae punctures of elytra deep, circular; well-developed males with pronotal swelling raised and with fovea on each side; males with vertex in front of carina with scattered coarse punctures; southern Ontario and eastern United States to South Dakota and Arizona ..... *Eucanthus lazarus* (Fabricius)  
 Outer third of anterior pronotal margin virtually straight (Fig. 61); anterior pronotal angle broadly obtuse; striae punctures of elytra shallow, often poorly delimited; males with pronotal swelling only slightly more developed than females, shallowly foveate on each side; males with vertex in front of carina impunctate or with a few fine punctures; southern Manitoba and Alberta to Utah, New Mexico and Arizona ..... *Eucanthus greeni* Robinson

***Eucanthus lazarus* (Fabricius) [p. 200]**

Figs. 59, 60, 66, 68; Map 11

TYPE. *Scarabaeus lazarus* Fabricius, location unknown to me.

TYPE. *Scarabaeus meliboeus* Fabricius, female, Hope Museum, Oxford University.

MALES. Length 9.3 to 13.1 mm.; greatest width 6.1 to 7.5 mm. Color light to dark reddish brown. Clypeal horn usually with height equal to width. Frons distinctly but sparsely punctate. Eye canthus as in Fig. 66, surface coarsely, often confluent, punctate. Antennal club yellowish to brownish red; distinctly longer than ventral length of eye. Pronotum (Fig. 68) with large, median swelling, anterior face abruptly, transversely declivous, ridge-like; crest of declivity not distinctly indented at midline; median swelling delimited on each side by shallow to deep fossa, with distinct, conical tubercle at lateral anterior edge of



fossa; transverse, shallowly indented band of large punctures posterior to fossa, punctures contiguous in lateral portions of band, becoming discrete medially; midline deeply indented and heavily punctate behind declivity, obsolete at crest and on declivity, punctures on declivity scattered, more numerous on lower half; anterior angles (Figs. 59, 60) acute; anterior margin arcuate on outer third; lateral margins more strongly reflexed anteriorly than posteriorly. Flytra with stria punctures large, usually separated by approximately one diameter; second and fourth intervals wider than third and fifth, often with median row of minute punctures.

**FEMALES.** Length 6.4 to 12.8 mm.; greatest width 4.5 to 7.5 mm. Females (and male minors) differ from males mainly in the characters of the pronotum and in the height of the carinae on the head. Carinae on clypeus and vertex almost of equal height, about one-third to one-half height of frontal carina in well-developed males. Pronotum more evenly convex, median swelling reduced to transverse ridge or low carina; lateral fossa obsolete, being replaced by an irregular band of punctures extending just behind transverse ridge almost to midline, posterior to this a second, impressed, transverse band of punctures equivalent to one behind fossa in male; midline similar to that of male, becoming obsolete just behind the transverse ridge; tubercle, on each side of transverse ridge, small and rounded; punctures on face of declivity usually more numerous than in males.

**SPECIMENS EXAMINED:** 258 males, 261 females.

## CANADA

**Ontario:** Fisher Glen (8 mi. SW. Port Dover); (1) June.

## UNITED STATES

**Alabama:** Langdale, Monte Sano; (1) June.

**Arizona:** Arivaca, Cochise Co., Forestdale, Huachuca Mts., Nogales, Patagonia Mts., SW. Res. Station (Portal), Wilcox; (1) July, (4) Aug., (26) Sept., (4) Oct.

**Arkansas:** Benton Co., Hope, Nashville, Springdale; (11) April, (4) June, (2) Oct.

**Colorado:** Denver; (2) July.

**District of Columbia:** (1) Aug.

**Georgia:** Atlanta, Madras, Raburn Co., Roswell, 15 mi. S. Wadley; (1) March, (2) July, (1) Sept.

**Illinois:** Chicago, Edgebrook, Galena, Havana, Urbana, Willow Springs; (1) June, (4) July, (1) Aug., (1) Sept.

**Indiana:** Lafayette, Osborn; (2) June, (1) July.

**Iowa:** Ames, Denison (Crawford Co.), Decorah, Iowa City, Salix; (45) June, (1) July, (1) Aug.

**Kansas:** Atchison, Douglas Co., Ellsworth, Goodland, Lawrence, Leavenworth Co., Lucas, Manhattan, Medora, Osborne Co., Riley Co., Scott City, Topeka, Trego Co., Wallace, Wichita; (4) May, (11) June, (11) July, (3) Aug., (1) Sept.

**Kentucky:** Morehead; (1) July.

**Louisiana:** Vowell's Mill; (1) March.

**Maryland:** Hyattsville.

**Massachusetts:** Chicopee, West Springfield; (7) June.

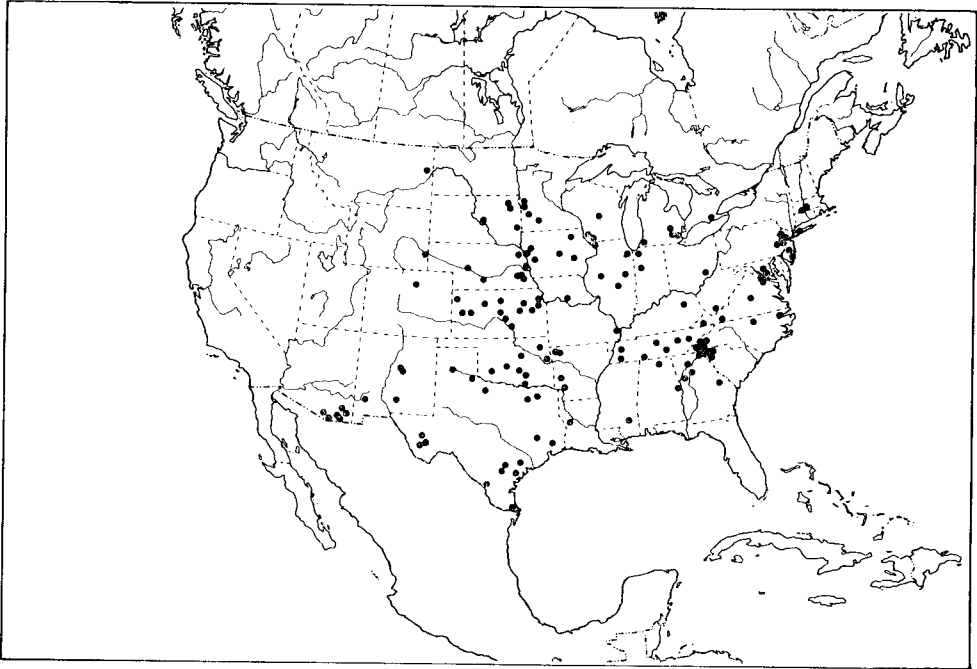
**Michigan:** Ann Arbor, Berrien Co., Livingston Co., Oakland Co., Rochester; (6) June, (3) July.

**Minnesota:** Big Stone Co., Buffalo, Butterfield, Granite Falls, Ortonville; (7) June, (2) July, (2) Aug., (1) Sept.

**Mississippi:** Camp Shelby (near Hattiesburg); (1) April, (2) June.

**Missouri:** Charleston, Columbia; (3) May, (1) June.

**Montana:** Poplar; (2) July.



Map 11. Distribution of *Eucantbus lazarus* (Fabricius).

**Nebraska:** Bennet, Fairmont, Imperial, Lincoln, Malcolm, North Platte, Omaha, West Point; (2) May, (9) June, (10) July, (4) Sept.

**New Jersey:** Burlington Co., Chester, Frenchtown, New Brunswick, New Lisbon, Ocean City, Passaic Junction, Rancocas, Riverton, Westwood; (2) June, (3) July, (10) Aug., (3) Sept.

**New Mexico:** Estancia, Gran Quivira, Silver City, White Sands; (1) May, (2) Aug., (5) Sept.

**New York:** Bellport (L.I.); (1) July.

**North Carolina:** Asheville, Black Mts., Balsam, Edenton, Hendersonville, Little Switzerland, New River, Oxford; (1) May, (3) June, (3) July, (3) Aug., (1) Sept.

**Ohio:** Athens; (1) July.

**Oklahoma:** Ardmore, Claremore, Hinton, Norman, Payne Co., Sulphur, Tahlequah, Wichita Nat. Forest, Wyandotte; (3) May, (14) June, (1) Sept., (1) Oct.

**Pennsylvania:** Easton; (6) May.

**South Carolina:** Clemson College, Table Rock, Walhalla; (1) April, (1) May, (5) June, (3) July, (1) Aug.

**South Dakota:** Blunt, Columbia, Stratford, Volga; (1) July.

**Tennessee:** Deer Lodge, Dyer Co., Jackson, Knoxville, Loretto, Morrison, Springfield; (1) April, (6) May, (1) June, (1) July.

**Texas:** Abilene, Alpine, Brownsville, Canyon, College Station, Comal Co., Conroe, Cypress Mill, Dallas, Dimmit Co., Fedor, Ft. Davis, Hall Co., Hallettsville, Larned, Marfa, Victoria, Wills Point, Winter Haven; (1) Jan., (3) Feb., (1) March, (12) April, (4) May, (4) June, (3) July, (6) Sept., (2) Oct., (2) Nov.

**Virginia:** Bristol, Clifton, Falls Church, Haywood, Pipers Gap; (3) July, (1) Sept.

**West Virginia:** Talcott; (1) July.

**Wisconsin:** Lake Ripley, Lancaster, Platteville, Wood Co.; (2) June, (1) July.

**Wyoming:** Torrington; (1) July.

REMARKS. Variation in various populations of *lazarus* is considerable. In any one population there is a considerable size difference. Small specimens are usually lighter in color, have the pronotal punctures reduced in number, and in small males the characters of the head and pronotum become similar to those of the females. The major geographic population differences are as follows:—

Southeastern United States: Color usually dark reddish brown; antennal club large; clypeal horn and pronotal characters of male strongly developed, differing distinctly from those of female; lateral pronotal margins reflexed, not strongly explanate, usually as in Fig. 59; punctures of elytral striae large; average size large, 10 to 13 mm.

Ontario and North Central United States: Color usually tan to reddish brown; clypeal horn of males one-half to two-thirds as high as wide; antennal club only slightly longer than eye; median swelling and lateral tubercles of males less pronounced; pronotal difference between the sexes not as great as in southeastern specimens; lateral fossa shallow or obsolete, in the latter case the area heavily punctate as in females; median line behind declivity often shallowly impressed, still heavily punctate; diameter and depth of pronotal and striae punctures usually less than in southeastern specimens.

Southwestern United States: Color reddish brown; antennal club only slightly longer than eye; frontal horn usually well developed, often approximately as high as wide; anterior, outer edge of eye canthus more abruptly rounded than in eastern specimens, less reflexed; pronotum laterally more strongly explanate; anterior pronotal angles (Fig. 60) less acute; median pronotal swelling of males wider and not as abruptly declivous as in well-developed, southeastern males; lateral fossa shallow to moderately deep; lateral tubercles usually strongly developed; pronotal punctures reduced in size and depth; elytral punctures and striae usually shallower than in southeastern specimens.

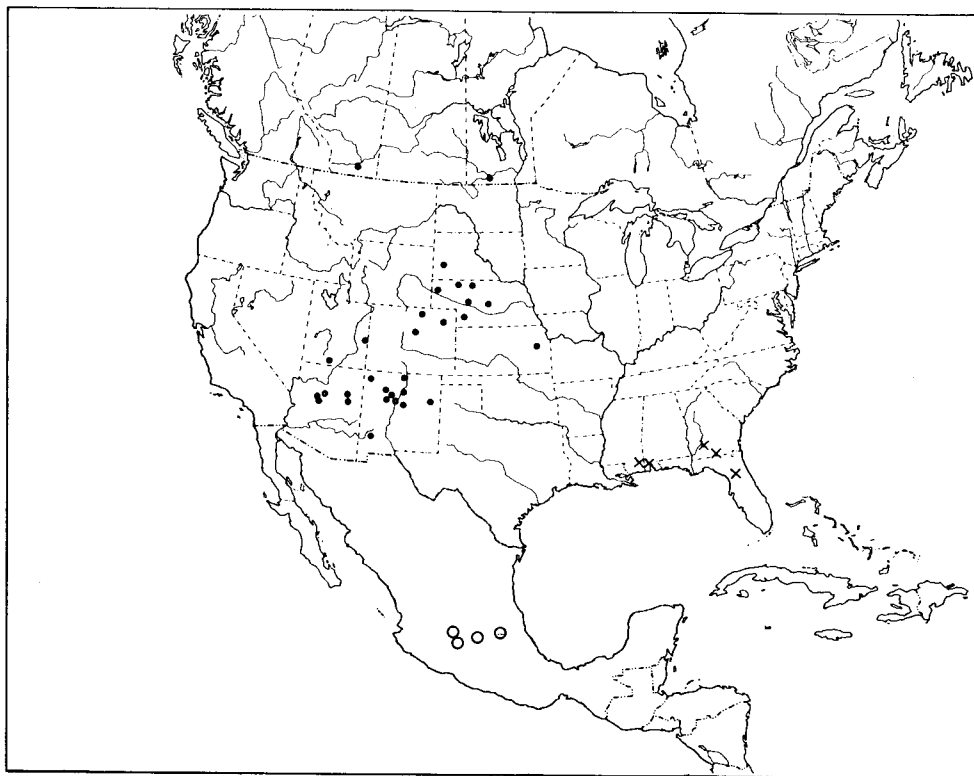
The following combination of characters will usually permit identification of specimens of *lazarus* from any locality: pronotal characters of the sexes distinctly dimorphic; antennal club longer than eye; anterior pronotal angles acute; anterior margin near the angle arcuate or sinuate (Figs. 59, 60); eye canthus (Fig. 66) coarsely punctate; pronotum with crest of median swelling or transverse ridge not distinctly indented or broken by indentation of midline; pronotum coarsely punctate anteriorly, laterally, in one (♂♂) or two (♀♀) bands behind the tubercles, and on the midline posteriorly, surface between coarse punctures shining, occasionally with fine secondary punctures.

### *Eucanthus alutaceus* Cartwright [p. 210]

Fig. 69; Map 12

TYPE. Holotype, male, Lucedale, Mississippi, 4 Oct. 1931, H. Dietrich (USNM).

MALES. Length 11.0 to 14.1 mm.; greatest width 6.5 to 7.3 mm. Color dorsally dull, dark reddish brown; elytra, and to a lesser degree the pronotum, alutaceous, giving dorsum an oily appearance. (This character is unique in the genus, all other species have the dorsum smooth and shining between the punctures.) Clypeal horn higher than wide, narrower in width than in specimens of equivalent development in other species. Antennal size, eye canthus, and frons as in *lazarus*. Pronotum and median swelling more distinctly raised



Map 12. Distribution of: [X] *Eucanthus alutaceus* Cartwright, [●] *E. greeni* Robinson, and [O] *E. mexicanus*, new species.

anteriorly and wider than in *lazarus*, lateral fossae shallow, lateral tubercles sharply conical; configuration of pronotum, bands of punctures, etc., except for slightly wider and anteriorly ridged, median swelling, as in well-developed males of *lazarus* from the southeast; coarse punctures fewer in number than in *lazarus*, usually discrete in transverse band. Elytra with striae less impressed than in *lazarus*, punctures large, similar to *lazarus*; intervals almost flat, noticeably more so than in *lazarus*; second and fourth intervals wider than third and fifth; minute line of punctures in second and fourth intervals often obsolete.

FEMALES. Length 10.1 to 13.5 mm.; greatest width 6.3 to 7.8 mm. Differing from the description of the female of *lazarus* in the following respects: dorsum alutaceous; pronotal punctures in the transverse bands discrete and reduced in numbers; punctures anterior to transverse ridge reduced in number, usually separated by distance greater than one diameter; elytral characters as described for male *alutaceus*.

SPECIMENS EXAMINED. 14 males, 10 females.

#### UNITED STATES

**Alabama:** Grand Bay, Aug. 1906.

**Florida:** Gainesville, 13 Feb. 1935; Oneco, 22 March 1955.

**Georgia:** Emory Univ. Field Station, Baker Co., Aug., Sept., Oct., Dec., Jan; Thomasville, 1 April 1939.

**Mississippi:** Lucedale, 7 April 1932.

REMARKS. Variation in the specimens examined is slight. Color and size are usually constant in relation to other species in the genus. No male minors have been seen, although they almost certainly occur. The lack of variation probably can be attributed to the restricted range of *alutaceus*.

*Eucanthus alutaceus* can be readily identified by the dull appearance of the pronotum and distinctly alutaceous elytra.

***Eucanthus subtropicus* Howden [p. 204]**

Figs. 62, 70; Map 13

**TYPE.** Holotype, male, Emory University Field Station, Newton, Baker County, Georgia, 12 Aug. 1952, light (USNM 61683).

**MALES.** Length 6.5 to 11.3 mm.; greatest width 4.3 to 6.6 mm. Color usually dark reddish brown, occasionally teneral specimens light tan. Clypeal horn short, rarely two-thirds as high as wide. Frons with occasional, widely separated, coarse punctures. Eye canthus laterally broadly reflexed, with anterior edge inwardly arcuate (Fig. 62); surface heavily, often confluent, punctate near eye. Antennal club brown, small, no longer than ventral length of eye. Pronotum (Fig. 70) with median, transverse ridge or carina (equivalent to median swelling of ♂ *lazarus*) not indented at midline, terminated laterally by punctate indentation extending inwardly in band behind carina; indentation delimited laterally by low, conical tubercle; a second indented, heavily punctate, band extending medially from near base of tubercle; this band almost equidistant between first band and posterior pronotal margin; band distinctly impressed and containing two or three irregular rows of punctures; midline behind transverse ridge of carina deeply indented, containing two irregular rows of punctures; declivity anterior to carina not indented, with coarse, scattered punctures not concentrated on or near midline; anterior angles usually slightly obtuse; anterior margin feebly arcuate on outer third; lateral margins narrowly reflexed. Elytra with punctures of striae large, often separated by less than one diameter; second and fourth intervals scarcely wider than, or equal in width to, third and fifth intervals; rows of minute punctures on second and fourth intervals obsolete.

**FEMALES.** Length 7.2 to 12.0 mm.; greatest width 4.6 to 7.0 mm. Very similar to males, differing in the following respects: carinae of frons and vertex of almost equal height; transverse carina and tubercles of pronotum usually more poorly developed, tubercles rounded, not sharply conical; transverse bands on pronotum usually more deeply impressed and with more numerous punctures.

**SPECIMENS EXAMINED.** 141 males, 155 females.

**UNITED STATES**

**Alabama:** Florala, Grand Bay, Langdale, Monte Sano, Pine Apple, 6 mi. S. Jackson, Selma; (2) May, (1) June, (2) Aug., (1) Oct.

**District of Columbia:** (2) June.

**Florida:** Archbold Biological Station (Lake Placid), Cedar Key, Crescent City, Daytona Beach, Dunnellon, Ft. Lauderdale, Gainesville, Greenville, Immokalee, Interlachen, Jacksonville, La Belle, Largo, Miami, Monticello, Okeechobee, Oneco, Orlando, Port Sewall, Punta Gorda, Sanford, Stuart, Tarpon Springs, Venice, Welaka, Winter Park; (1) Jan., (5) Feb., (10) March, (20) April, (9) May, (15) June, (14) July, (4) Aug., (23) Sept., (10) Oct., (3) Nov., (4) Dec.

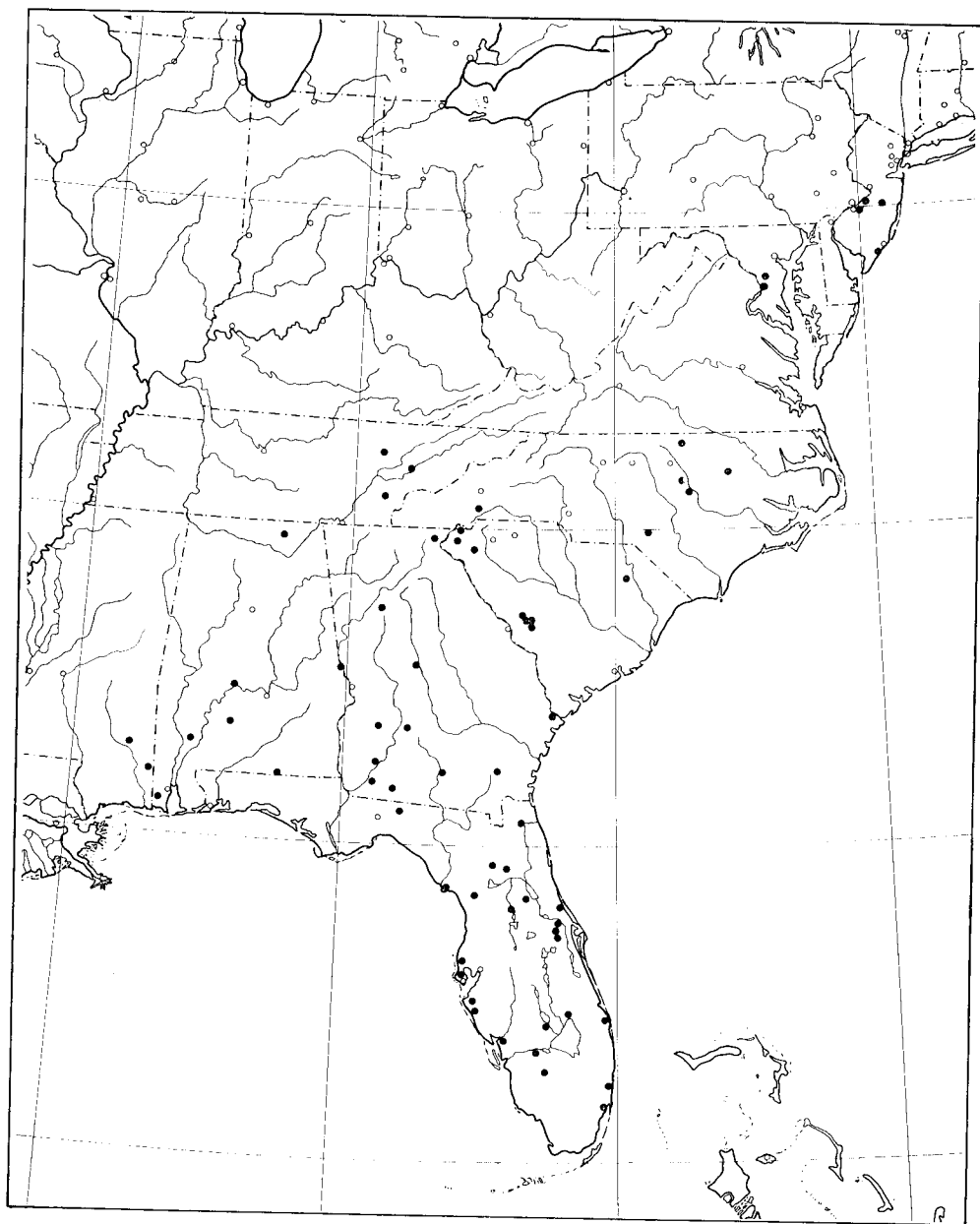
**Georgia:** Americus, Atlanta, Bainbridge, Cordele, Emory Univ. Field Station (Baker Co.), Macon, Rabun, Savannah, Sparks, Thomasville, Waycross; (7) June, (11) July, (10) Aug., (4) Sept., (4) Oct.

**Maryland:** College Park; (1) July.

**Mississippi:** Camp Shelby (near Hattiesburg), Lucedale; (2) April, (4) May, (2) June, (7) Aug., (1) Sept., (2) Oct.

**New Jersey:** Atison, Brown's Mills, Merchantville, Mt. Misery, Ocean City, Riverton; (3) June, (10) July, (2) Aug., (5) Sept.

**North Carolina:** Clayton, Hendersonville, Oxford, Raleigh, Rocky Mount, Southern Pines; (2) March, (10) May, (5) June, (5) July, (7) Aug., (5) Sept., (1) Nov.



Map 13. Distribution of *Eucanthus subtropicus* Howden.

**South Carolina:** Aiken, Blackville, Clemson College, Florence, Jocassee, Rocky Bottom, Walhalla, White Pond, Windsor; (1) April, (6) May, (3) June, (4) July, (2) Aug., (4) Sept.

**Tennessee:** Athens, Deer Lodge, Knoxville; (1) May, (2) June, (2) July.

REMARKS. Variation in *subtropicus*, other than in size, is not great. Originally I considered *subtropicus* a subspecies of *lazarus*, considering as intergrades the species *impressus*, which is described below. I now consider *subtropicus* a distinct species which can be readily separated from all of the other species except

sympatric specimens of *impressus* by its dark shining color, size, lack of sexual dimorphism in the pronotal characters, and very small antennal club. It can be separated from *impressus* by the shape of the eye canthus; by the more sharply raised, transverse pronotal carina; and by the transverse, impressed, heavily punctate bands on the pronotum, which in eastern *impressus* usually contain only a single, irregular row of punctures. *E. impressus* also has a larger antennal club, but in some cases specimens of both species are needed before this character can be appreciated.

In my 1955 work on *Eucanthus* (p. 201) a specimen bearing the label "Alpine, California" was mentioned as being similar to typical *subtropicus*. Further study has convinced me that it is *subtropicus* and is, in all likelihood, incorrectly labeled.

### *Eucanthus impressus*, new species

Figs. 63, 64, 65, 71; Map 14

**HOLOTYPE.** Male, length 11.4 mm.; greatest width 6.6 mm. Color reddish brown. Clypeal horn only two-thirds as high as wide. Frons, between carinae, with only 10 or 11 widely scattered, coarse punctures. Eye canthus as in Fig. 64, surface with coarse, usually distinctly separated, punctures. Antennal club tan, slightly longer than ventral length of eye, intermediate in size between *lazarus* and *subtropicus*. Pronotum (Fig. 71) with poorly developed, median swelling, with crest shallowly indented at midline; anterior face slightly indented, with midline indicated by single row of coarse punctures; posterior-lateral portions of median swelling delimited on each side by shallow indentation containing discrete punctures, a low, conical tubercle present on marginal side of indentation; a second, posterior, more deeply indented, transverse band extending medially, punctures in band usually discrete and in irregular, single or double row; midline deeply indented, heavily punctate behind crest of median swelling; anterior angles almost right angled; anterior margin shallowly arcuate in outer third; lateral margins narrowly reflexed. Elytra with strial punctures moderate in size, usually separated by slightly more than one diameter; second and fourth intervals equal to or very slightly wider than third and fifth; intervals lacking rows of secondary punctures present in *lazarus*.

**ALLOTYPE.** Female, length 10.9 mm.; greatest width 6.8 mm. Similar to holotype except in the following respects: frontal and clypeal carinae approximately equal in height; pronotum with top of tubercles more rounded; transverse bands of punctures less impressed and with fewer but larger punctures; sides of pronotum more strongly explanate; punctures of elytral striae larger, separated by approximately one diameter.

**TYPE MATERIAL.** Holotype, male, Claremore, Okla., 20 June 1939, Kaiser-Nailon (CNC No. 8439). Allotype, female, Douglas Co., Kansas, 29 May 1921, W. J. Brown (CNC No. 8439). Paratypes, 125 males, 146 females.

#### MEXICO

**Chihuahua:** Samalayuca; (10) Aug.

#### UNITED STATES

**Alabama:** Alabaster, Auburn, National Forest; (1) June, (1) July.

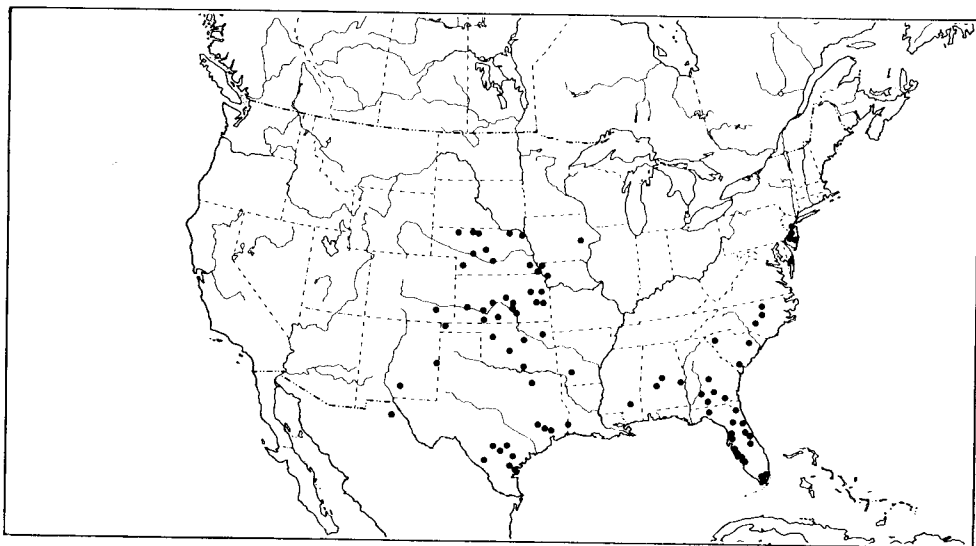
**Arkansas:** Hope; (1) April.

**Colorado:** Rocky Ford; (1) June.

**Florida:** Alachua Co., Broward Co., Buena Vista, Captiva Island, Charlotte Harbor, Coral Gables, Crescent City, Dade Co., Enterprise, Gunntown, Haulover, Homestead, Indian River, Jacksonville, Kissimmee, Manatee Co., Marineland, Miami, Monticello, Paradise Key, Punto Gorda, Royal Palm Park, Sarasota, Stanford, Tampa, Venice, Weeki Watchi (Hernando Co.), Winter Park; (3) Feb., (4) March, (9) April, (4) May, (12) June, (1) July, (3) Aug., (3) Sept., (2) Oct.

**Georgia:** Emory Univ. Field Station (Baker Co.), Macon, Okefenokee Swamp, Thomasville, Tifton; (1) May), (2) June, (1) July, (1) Aug.

**Iowa:** Iowa City; (1) July.



Map 14. Distribution of *Eucanthus impressus*, new species.

**Kansas:** Clark Co., Coffee Co., Dodge City, Douglas Co., Ellsworth, Garrison, Hutchinson, Kendall, Larned, Lawrence, Manhattan, Medora, Mt. Hope, Osage, Pratt Co., Reno Co., Riley Co., Topeka, Wichita; (10) May, (15) June, (18) July, (2) Aug.

**Louisiana:** Orange (Texas?).

**Maryland:** Dorchester Co. (near Lloyds); (1) July.

**Mississippi:** Camp Shelby (near Hattiesburg); (1) Oct.

**Missouri:** Langdon, St. Joseph; (1) June, (1) July, (1) Aug.

**Nebraska:** Bennet, Brownville, Cottonwood Lake (near Merriman), Halsey, Imperial, Kearney, Meadville, Niobrara, North Platte, Ponca, Valentine; (7) June, (5) July, (10) Aug., (1) Sept.

**New Jersey:** Barnegat, Brigantine, New Brunswick, Ocean City, Rancocas; (3) July, (25) Aug.

**New Mexico:** Pep, White Sands Nat. Monument (Otero Co.); (1) Aug., (2) Sept.

**North Carolina:** Eastwood, Oxford, Raleigh, Southern Pines; (2) July, (1) Aug.

**Oklahoma:** Ardmore, Claremore, Hinton, Kenton, Stillwater, Woodward; (2) May, (6) June, (1) July.

**South Carolina:** Clemson College, Florence, North Landing, Summerville; (2) June, (1) Sept.

**Texas:** Aransas Nat. Wildlife Ref., Beeville, Brazos Co., College Station, Columbus, Comal Co., Conroe, Dallas, Dimmit Co., Fedor, Giddings, Gillespie Co., Hallettsville, Lee Co., Sharpsburg, Smith Point; (12) April, (16) May, (6) June, (2) Aug., (1) Sept., (1) Oct., (1) Nov.

Paratypes are deposited in the majority of collections studied.

REMARKS. Variation in *impressus* is considerable. Midwestern specimens range from 8.1 to 12.2 mm. in length and from 4.6 to 7.3 mm. in greatest width. Except for some variation in the shape of the eye canthus, characters are essentially similar to those of the holotype and allotype.



Southeastern specimens from the coastal plain east of the Mississippi River are usually separable from the more western populations. However, except for color, the characters show discordant intergradation over a wide area and it does not seem advisable, at present, to attempt to subdivide the various populations. Usually specimens east of the Mississippi River vary from midwestern specimens in the following characters: color dark reddish brown; eye canthus often as in Fig. 63; frons often with 10 to 15 coarse punctures; antennal club larger in specimens of equal size; crest of median swelling usually not distinctly indented at midline; pronotal punctures, particularly in indentations, larger and reduced in number; punctures of striae large, usually separated by approximately one-half diameter. The punctures attain maximum size in Floridian specimens, decreasing in size northward as well as westward. Many of the above characters occur in various combinations in specimens from east Texas and to a lesser degree in all of the midwestern populations.

Southwestern specimens from New Mexico and Chihuahua differ from midwestern specimens in the following characters: frons occasionally with only one or two coarse punctures; eye canthus usually as in Fig. 65; median swelling of pronotum feebly developed even in large males, midline distinctly impressed almost to anterior margin; sides of pronotum more strongly explanate; anterior angles obtuse; anterior margin behind eye only very slightly arcuate or sinuate; second and fourth elytral intervals sometimes distinctly wider than third and fifth, rarely with minute punctures on second and fourth intervals. These characters appear in various combinations in some of the midwestern populations; as there is relatively little material available from some areas, the amount of concordance, if any, in the variable characters could not be properly assessed.

*Eucanthus impressus* can usually be identified by the punctate, indented midline which extends over the median swelling either as a distinctly punctate impression or as a line of punctures. The moderate sized antennal club and the similarity of the sexes in the pronotal characters are also diagnostic. In the southeastern United States *impressus* may be confused with *subtropicus*, but its larger antennal club, the shape of the eye canthus, and the reduced number of pronotal punctures will serve to separate it from *subtropicus*. In some parts of the western states *impressus* is sympatric with *greeni*, and in these areas its more shining pronotum, with few fine secondary punctures, and the indented crest of the median swelling will serve for identification. *Eucanthus lazarus* which is sympatric with *impressus* in many areas, has a more heavily punctate pronotum, is distinctly sexually dimorphic and lacks the definite line of punctures on the midline anterior to the median swelling.

***Eucanthus greeni* Robinson [p. 211]**

Figs. 61, 67, 72; Map 12

TYPE. Holotype, male, Jemez Mountains, New Mexico, 26 July, J. Woodgate (USNM).

MALES. Length 9.6 to 14.6 mm.; greatest width 5.5 to 8.1 mm. Color tan to reddish brown. Clypeal horn strongly developed in large males, frequently as high or higher than wide. Frons with a few widely scattered, fine punctures. Eye canthus as in Fig. 67, margins only shallowly reflexed, surface with punctures usually discrete. Antennal club tan to brown, longer than ventral length of eye. Pronotum (Fig. 72) with median swelling low, wider than in *lazarus*, delimited laterally by vague fossae; lateral tubercles small, conical; two transverse bands of punctures as described for females of *lazarus* except bands not impressed, punctures becoming small and discrete toward the median; midline punctate and feebly impressed behind median swelling, line of punctures not present on anterior declivity; anterior half often with many fine, secondary punctures; anterior angles (Fig. 61) obtuse; anterior margin virtually straight on outer third; lateral margins more strongly explanate than in

*lazarus*. Elytra with striae crenate or with small punctures usually separated by two or more diameters; second and fourth intervals wider than third and fifth, frequently with median row of minute punctures. Margin of elytral humerus usually with tooth small or obsolete.

FEMALES. Length 10.2 to 13.1 mm.; greatest width 5.8 to 8.3 mm. Similar to males except in the following respects: carinae of clypeus and vertex approximately equal in height, frons more distinctly punctate; median pronotal swelling reduced to very low, frequently arcuate, transverse ridge; fossae obsolete and tubercles reduced to rounded swellings; punctures of transverse bands usually more numerous, bands vaguely impressed.

SPECIMENS EXAMINED. 56 males, 54 females.

#### CANADA

**Alberta:** Scandia; (3) July.

**Manitoba:** Aweme<sup>1</sup>, Onah<sup>1</sup>; (19) July, (7) Aug.

#### UNITED STATES

**Arizona:** Flagstaff, Granado, Granito Mt. (Yavapai Co.), Joseph City, Pinedale, Prescott; (8) Aug., (4) Sept.

**Colorado:** Akron, Denver, Greeley, Orlas; (1) June, (2) July.

**Kansas:** Douglas County.

**Nebraska:** Cottonwood Lake (near Merriman), Halsey, Imperial, Mitchell, North Platte, Valentine; (12) June, (2) July, (5) Aug.

**New Mexico:** Albuquerque, Corqua, Estancia, Farmington, Jemez Mts., Jemez Springs, La Lara, San Juan Valley (Taos Co.), Sante Fe, Silver City, Tucumcari; (1) May, (14) July, (7) Aug., (2) Sept.

**South Dakota:** 5 mi. S. Hot Springs; (1) July.

**Utah:** Kanab, Moab; (1) July, (2) Aug.

REMARKS. Specimens of *greeni* exhibit only moderate variation. Pronotal characters of small males are sometimes similar to those of females. Specimens from northern localities, particularly in Canada, have larger and more numerous pronotal punctures and larger elytral punctures. Other characters show little variation.

The average size of *greeni* is larger than any other species of *Eucanthus*, with the possible exception of *mexicanus*. In portions of its range, *greeni* is sympatric with *lazarus* and *impressus*. It can be separated from *lazarus* by its less punctate frons, by the feebly impressed, transverse bands of pronotal punctures, and by the shapes of the eye canthus and anterior pronotal angles. Large males are separable by the median swelling and fossae of the pronotum which are less developed than in *lazarus*. *Eucanthus greeni* does not have the median swelling distinctly indented, a character which readily separates it from sympatric specimens of *impressus*.

#### *Eucanthus mexicanus*, new species

Fig. 73; Map 12

HOLOTYPE. Female, length 11.0 mm.; greatest width 6.1 mm. Color reddish brown. Clypeal and frontal carinae approximately equal in height. Frons largely, coarsely, contiguously punctate. Eye canthus similar to *lazarus* in outline, margins less broadly reflexed; surface coarsely, contiguously punctate to margins. Antennal club longer than ventral length of eye, smaller than usual for southwestern specimens of *lazarus*. Pronotum (Fig. 73) with median swelling indicated by low, rounded transverse ridge, arcuate anteriorly on either side of midline; lateral fossae obsolete; tubercle on either side of transverse ridge represented by a low, rounded swelling; entire surface coarsely punctate except for transverse ridge, a transverse area near posterior margin, and narrow strip on either side of indented midline. No

<sup>1</sup>"Aweme" and "Onah" are names for different parts of the Criddle farm which is three miles from Treesbank. Souris, Manitoba, is 30 miles to the west.

distinct, transverse, indented bands of punctures behind transverse ridge (as is the case in the females of all other North American species); coarse punctures largely contiguous, distinctly larger than in *lazarus*; entire disc between punctures with numerous distinct, secondary punctures; pronotal angles and margins similar in outline to southwestern specimens of *lazarus* (Fig. 60). Elytra with striae punctures large, usually separated by a distance equal to one or two diameters; second and fourth intervals wider than third and fifth; median row of minute punctures on second and fourth intervals obsolete.

MALE. Unknown.

TYPE MATERIAL. Holotype, female, 8500 ft., Atlatomulco, Mexico, Mexico, 18 Aug. 1954, J. G. Chillcott (CNC No. 8440). Paratypes: 6 females.

## MEXICO

**Durango:** 25 mi. W. Durango, 20 July 1964, Chemsak, Howden and Powell; 24 mi. E. El Salto, 17 July 1964, J. E. H. Martin.

**Guanajuato** (?): San Cayetano, June and Sept. 1961, light trap (No state given—the locality in Guanajuato seems most likely, based on the range of other specimens).

**Michoacan:** 11 mi. E., 20 mi. S. Morelia, 5 June 1954, A. A. Alcorn.

**Puebla:** 14 mi. W. Huachinango, 17 June 1951, P. D. Hurd.

Paratypes are deposited in: CNC, USNM, UnCal, UnKans.

REMARKS. Variation in the seven female specimens is mainly evident in size, length ranges from 11.0 to 15.1 mm. and width ranges from 6.1 to 8.5 mm. In other characters, size of punctures, pronotal configuration, etc., variation is slight.

The species is probably most closely related to *lazarus*, but males are needed before the relationship can be established. The range of *mexicanus*; the extremely heavily punctate pronotum; and the obtusely angulate, anterior pronotal angles will serve to distinguish it from other species.

## BOLBOCERAS KIRBY

### *Bolboceras obesus* (LeConte) [p. 214]

Figs. 74, 87, 88

Two third-stage larvae of this west coast species were collected by Mr. Hugh B. Leech and bear the following data: 427 Rose Ave., Mill Valley, Marin County, California, 15 May 1955, in soil under shrub and grass roots.

The characters of the larvae are, in general, similar to those described for the eastern species. The legs lack claws and are similar in shape and setal pattern. The setal placement on the head and labrum show only slight differences to those described for *simi* by Ritcher (1947, p. 13) and body form is not unlike the eastern species. However, *B. obesus* has a number of external characters that will separate it from any of the described eastern species.

LARVA. Body of third instar stout (Fig. 74); maximum width of head capsule 2.9 to 3.1 mm.; setae of head and dorsum shorter than in eastern species; dorsum of first thoracic segment (Fig. 87) with anterior edge sinuate, with small lateral protuberance on each side. Epipharynx (Fig. 88) with configurations of tormae and chaetoparia differing conspicuously from other known species.

In the three described eastern species the size of the third instar is smaller and the anterior edge of the dorsum of the first thoracic segment is straight. These characters, should suffice for identification. Dr. P. O. Ritcher, who kindly loaned me one of the larvae and furnished the drawing of the epipharynx, intends to publish a more detailed larval description in the near future.

***Bolboceras thoracicornis* (Wallis) [p. 216]**

Previously, information on this species was restricted to a note by Blatchley (1910, p. 938), under the name *cornigerus*. He stated that he collected a male in September from "beneath a partly burned log in upland, sandy woods." On 9 April 1955 at Monte Sano, Alabama, I collected a male of this rare species one foot above ground level under the bark of a partly rotted oak stump. Other specimens were collected in Tennessee at light and in malt traps.

New records:—**Alabama:** Monte Sano State Park (near Huntsville); **Tennessee:** Burrville, Loretto, Springfield.

***Bolboceras cornigerus* Melsheimer [p. 217]**

Specimens of this species were occasionally collected in malt traps at Burrville, Gatlinburg, and Knoxville in eastern Tennessee.

***Bolboceras liebecki* (Wallis) [p. 218]**

New records:—**Ontario:** Apple Hill, Homer; **Quebec:** Clarenceville; **Nova Scotia:** Ingramport, Marshalltown.

***Bolboceras filicornis* (Say) [p. 221]**

New records:—**Missouri:** Nevada (Vernon County).

***Bolboceras darlingtoni* (Wallis) [p. 224]**

New records:— **Tennessee:** Burrville.

***Bolboceras alabamensis* (Wallis) [p. 227]**

This species was collected in fair numbers in malt traps at Mobile and Hartford, Alabama, by Mr. B. K. Dozier and the writer.

New records:—**Mississippi:** Camp Shelby, near Hattiesburg.

**GEOTRUPES LATREILLE*****Geotrupes opaca* Haldeman [p. 223]**

Figs. 81-83

I am indebted to Dr. W. W. Gibson, Nacogdoches, Texas, for the biological information on *opaca* and for the larval material described below. Dr. Gibson, using a screened enclosure containing a dozen or more adults, reported (in litt.) that the adults constructed brood cells of cow dung. Egg laying occurred in January and pupation in May. This pattern of development is similar to other species of southeastern *Geotrupes* having a one year life cycle, such as *blackburnii* or *splendida*.

The description of the third instar of *opaca* is based on the following material: three cast skins and one prepupa all reared in cages at Nacogdoches, Texas, by W. W. Gibson.

LARVA. Maximum width of head capsule 4.1 to 4.3 mm. Frons on each side with one posterior frontal seta, two or three setae at anterior angle, one exterior and one anterior frontal seta. Epicranium with three setae on left side, six on right. Antenna (Fig. 83) three segmented, third segment greatly reduced in diameter, 0.58 to 0.62 times as long as second segment. Mandibles similar to those of *blackburnii*. Left maxilla with stridulatory area bearing nine conical teeth on stipes and four teeth on palpifer, right maxilla with six or seven teeth on stipes and two teeth on palpifer. Hypopharynx (Fig. 82) with asymmetrical oncyli resembling the oncyli of *hornii*, but with lateral patches of setae more oval in outline than in *hornii*. Glossa shallowly emarginate medially. Epipharynx similar to *hornii*, with anterior epitorma longer than posterior epitorma. Median lobe anterior to pedium with 10 or 11 short, stout setae. Setae of chaetoparia similar in size to those of *hornii*, 16 setae on left side (as viewed), 14 on right. Legs typical for genus. Prothoracic and mesothoracic legs (Fig. 81) each with terminal segment bearing small tubercle surrounded by circle of setae. Meta-

thoracic leg with nine or ten stridulatory teeth on fused trochanter-femur and one or two teeth on tibiotarsus. Tibiotarsus less elongate than in *blackburnii*, similar to tibiotarsus of *hornii* but with more numerous apical setae. Body shape and anal lobes somewhat distorted due to prepupal condition. Endoskeletal figure not differing greatly from that of *blackburnii*, angles seemingly less sharply delimited.

In my 1955 key (p. 232) the larva of *opaca* will key out to *hornii*. It can be distinguished from *hornii* by the shape of the patches of setae on either side of the oncyli of the epipharynx and by the arrangement and number of setae on the mesothoracic legs.

***Geotrupes ulkei* Blanchard [p. 235]**

A colony of this rare species was discovered by Dr. A. C. Cole, University of Tennessee, near the summit of the north end of the Chilhowee Mountains in eastern Tennessee. Adults were collected in malt traps and a few were found in shallow 2 to 4 inch burrows along the sides of a woodland path. In mid June 1954 two first stage larvae were collected, but I was unable to rear them. The larval cells, 2 to 2½ inches deep in the rocky soil, were composed of leaf litter and were approximately 1½ inches in length.

The habitat requirements of this flightless species are apparently very restrictive, with known colonies limited to small, widely separated localities. I suspect that these colonies represent relict populations and that they have been disjunct for a long period of time. Despite this, I have found little morphological variation between populations from Virginia, Tennessee and Alabama.

New records:—**Tennessee**: Chilhowee Mountains (3000 ft.).

***Geotrupes egeriei* Germar [p. 247]**

On 18 August 1961 I collected a specimen of this species at Buxton, North Carolina, a small town on Cape Hatteras Island. The specimen was taken in a malt trap set in a dense stand of pine and oak trees. This represents the first record of a *Geotrupes* occurring on the offshore islands (or outer banks) of the southeastern United States. Since *Geotrupes egeriei* is a rather sedentary species, its presence near Cape Hatteras is an indication that the forested area at Buxton has been established over a considerable period of time as a fairly stable habitat (see Howden, 1963, for a discussion of *Geotrupini* distributions in sand hill habitats).

***Geotrupes hornii* Blanchard [p. 253]**

New records:—**Ontario**: Belleville, Constance Bay (30 mi. W. of Ottawa), Kirkwood; **Quebec**: Ste-Foy (Quebec), Stoneham; **Arkansas**: Bentonville; **Missouri**: Williamsville; **South Dakota**: 2 mi. N. Legion Lake (Custer St. Pk.).

***Geotrupes balyi* Jekel [p. 258]**

New records:—**Manitoba**: Red Rock Lake, Victoria Beach; **Nova Scotia**: Ohio; **Ontario**: Chalk River, Constance Bay, Marmora, One Sided Lake, Port Arthur.

***Geotrupes stercoraria* (Linnaeus) [p. 262]**

New records:—**Newfoundland**: Jeffries, St. Georges.

***Geotrupes semiopaca* Jekel [p. 274]**

Figs. 84-86

Four male and four female adult *G. semiopaca* were collected by R. W. Woodruff near Columbus, Ohio, and shipped alive to me at Knoxville, Tennessee. The specimens were placed in a screen-covered wooden enclosure (for description

of cage see Howden, 1955, p. 160). The enclosure was situated in undisturbed soil and was partially shaded by small oak trees. Cow dung, grass, and leaves were placed in the cage, which then was left undisturbed for five weeks. On 17 July 1955 all of the adults were found dead; on the same day excavation of the cage yielded three larval cells at depths of six, seven, and eight inches. The cells, composed of a mixture of cow dung, grass, and leaves, measured approximately 3 inches long by  $1\frac{1}{4}$  inches in width. Only one cell contained a living larva, a well-developed third instar. The description that follows is based on this individual.

LARVA. Maximum width of head capsule 5.2 mm. Frons on each side with one posterior frontal seta, three setae in each anterior angle, one exterior and one anterior frontal seta. Antenna (Fig. 86) with third segment greatly reduced in diameter, 0.6 times as long as second segment. Maxillae, labium, and hypopharynx similar to those of *G. splendida splendida* (Howden, 1955, pl. 8, fig. 3). Maxillary stridulating area with row of six to eight conical teeth on stipes and two to three teeth along posterior margin of palpifer. Glossa evenly arcuate, not emarginate as in *splendida* and *blackburnii*. Oncyli similar in outline to those of *splendida*. Epipharynx (Fig. 85) very similar to that of *splendida*, but with slightly differently shaped tormae and fewer chaetoparia. Anterior epitorma shorter than posterior epitorma. Median lobe anterior to pedium with 10 or 11 short, stout setae. Legs three segmented, metathoracic legs reduced in size as is typical in the genus. Metathoracic legs with eight or nine stridulatory teeth on inner surface of fused trochanter-femur and one or two small teeth on inner surface of tibiotarsus. Terminal segment of prothoracic and mesothoracic (Fig. 84) legs each with distinct claw surrounded by circle of setae. Shape of body, spiracles, anal lobes, and endoskeletal figure not differing greatly from those of *splendida*.

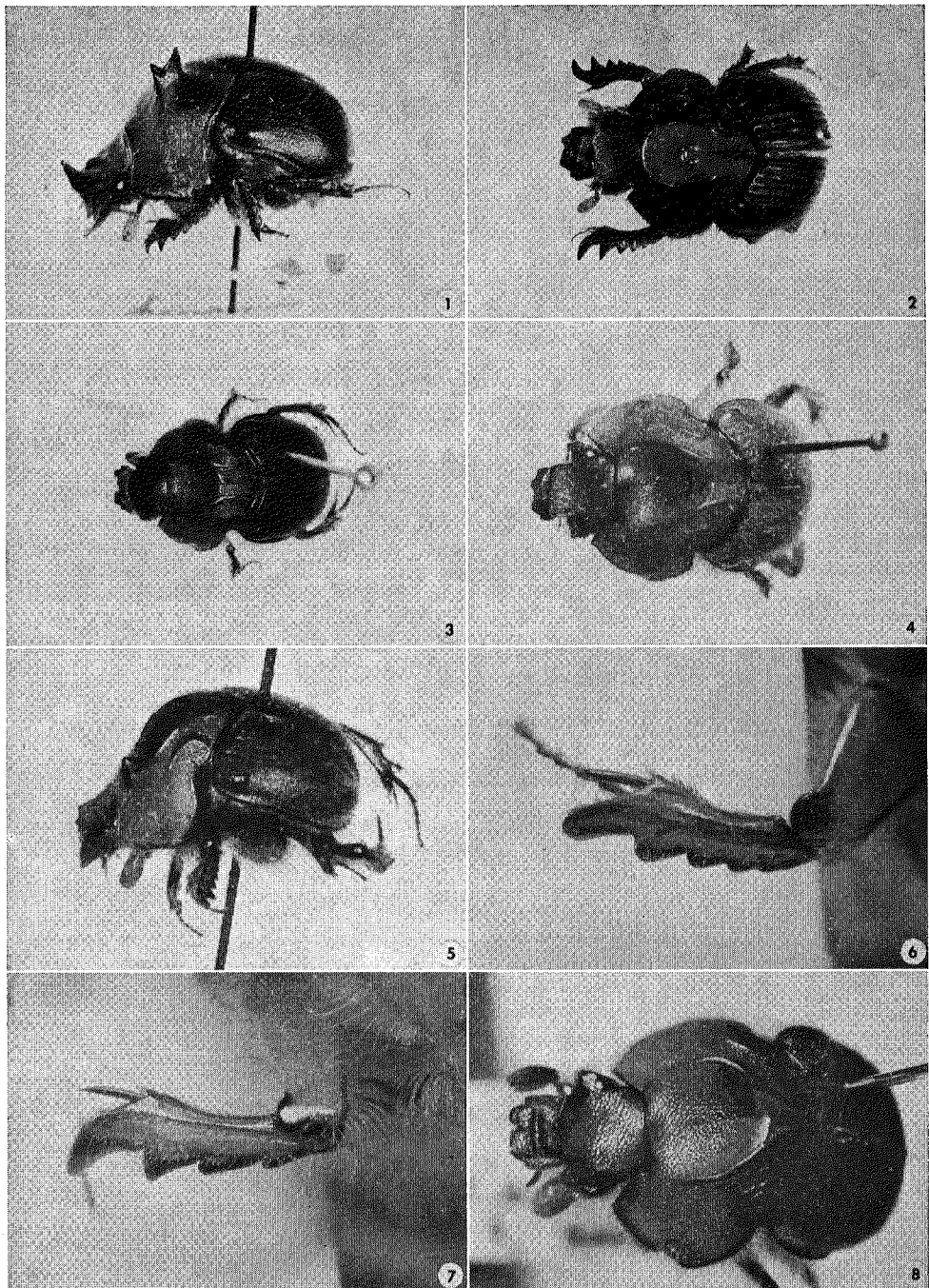
The larva of *semiopaca* will key out to *splendida* (Howden, 1955, p. 232), to which it is closely allied. Size and number of the chaetoparia and the shape of the tormae of the epipharynx should separate the two species. Also larvae of *splendida* have eight or more setae on the disc of the labrum (excluding marginal setae), while the single *semiopaca* larva has only six setae on the disc.

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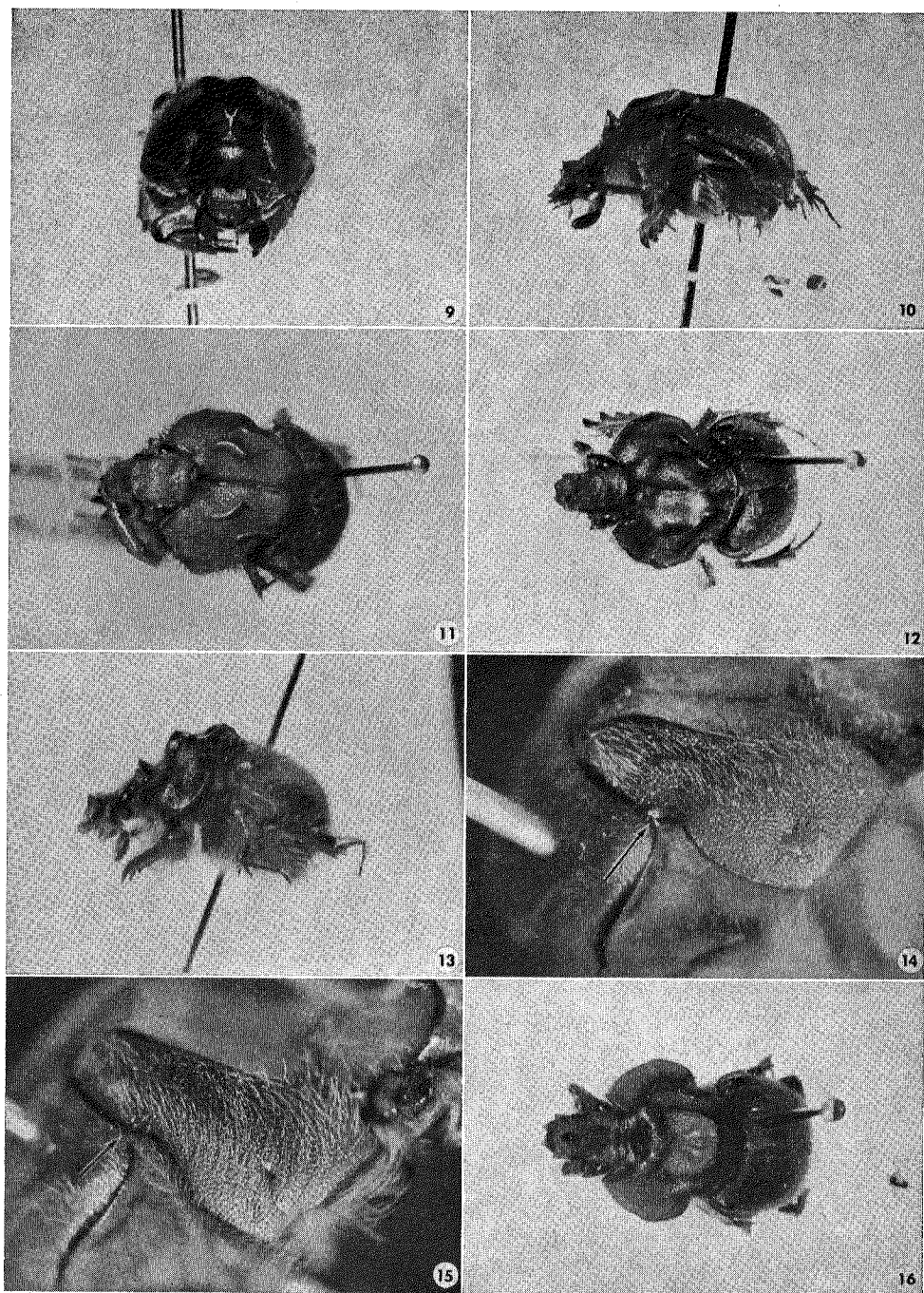
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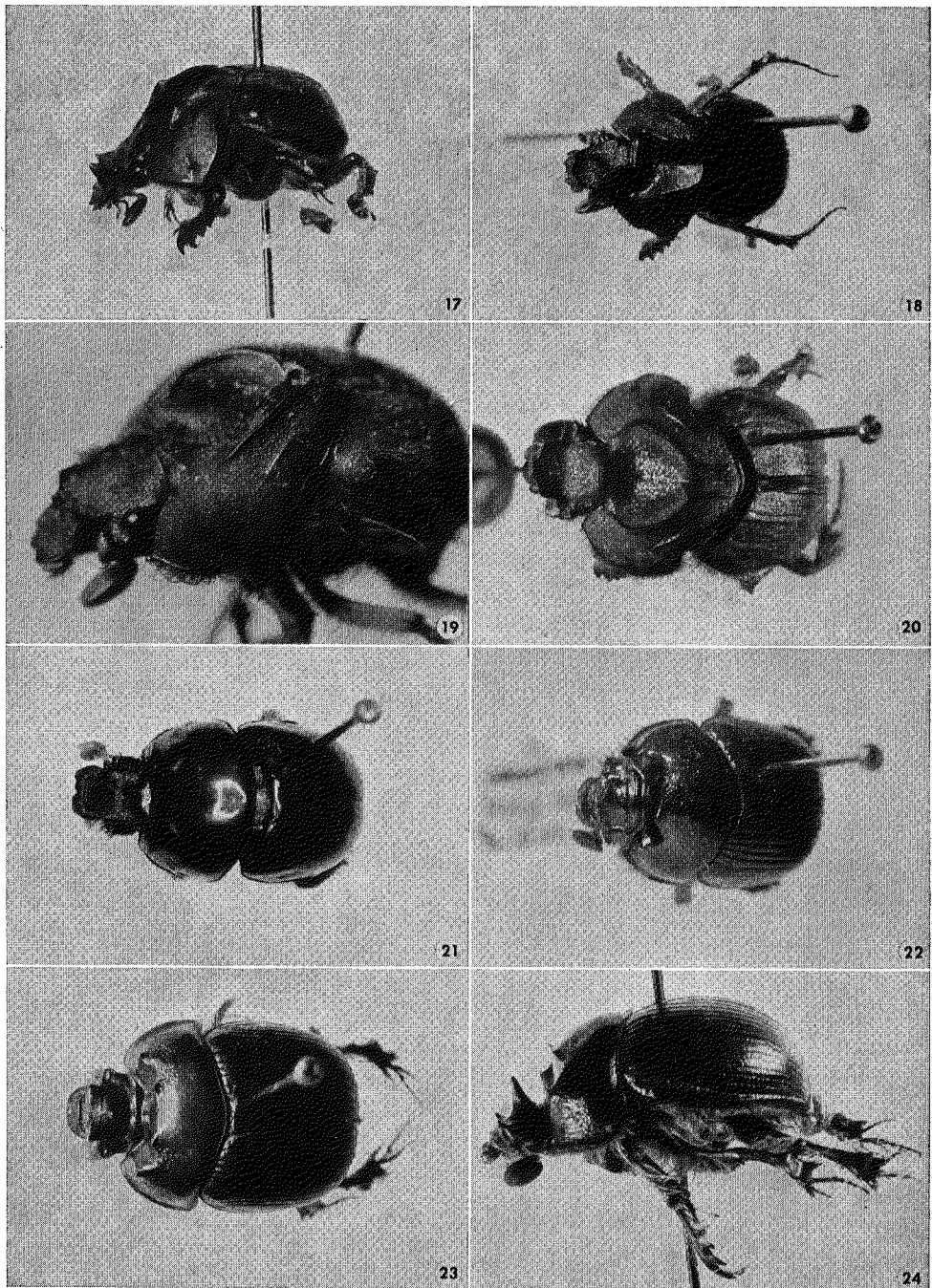




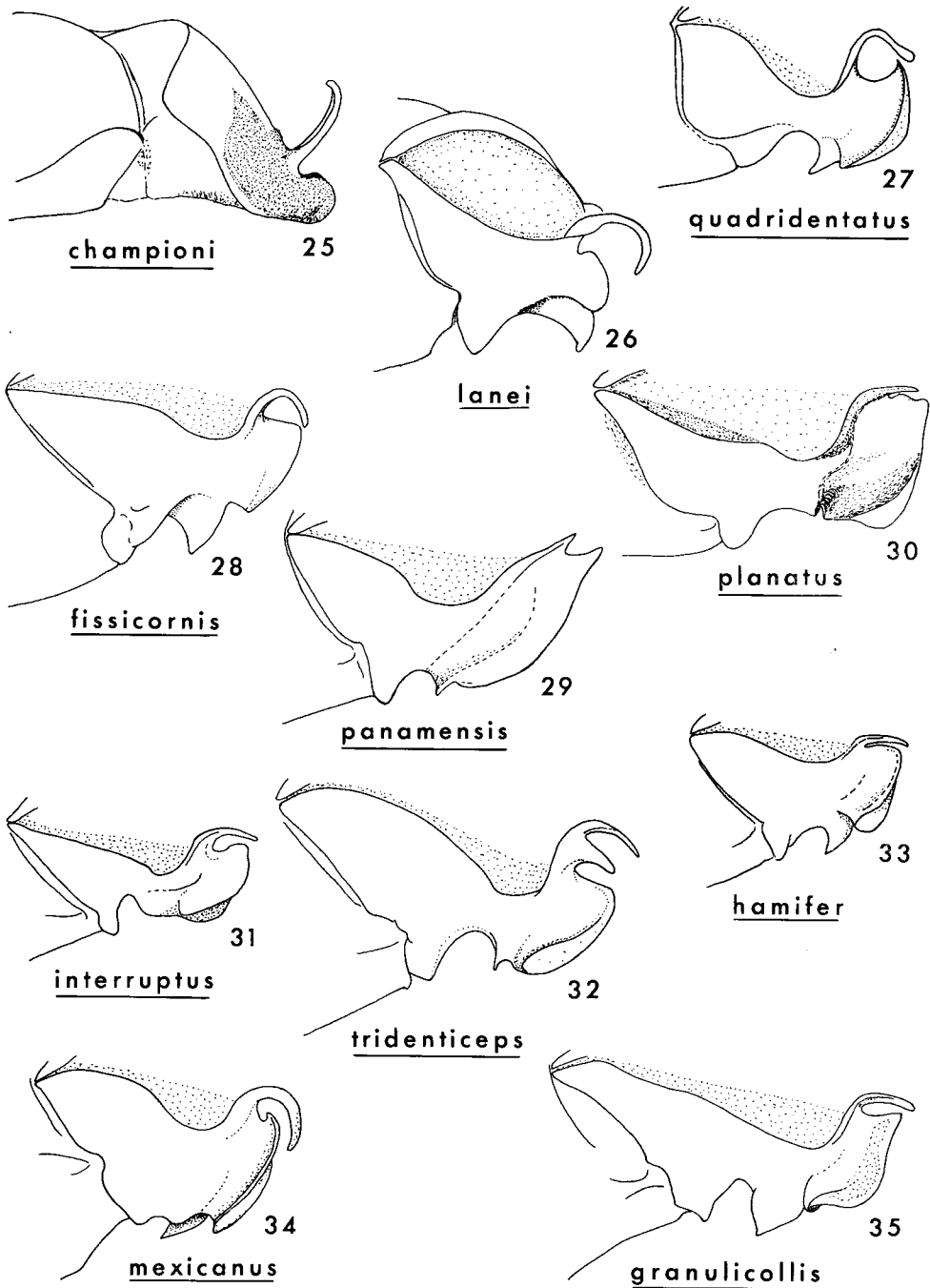
Figs. 1-8. 1, *Athyreus championi* Bates, male; 2, *A. championi* Bates, female; 3, *Neothyreus lanei* (Martinez); 4, 5, *N. mixtus*, new species; 6, *N. granulicollis*, new species, left fore tibia showing five teeth; 7, *N. quadridentatus*, new species, left fore tibia showing four teeth; 8, *N. quadridentatus*, new species.



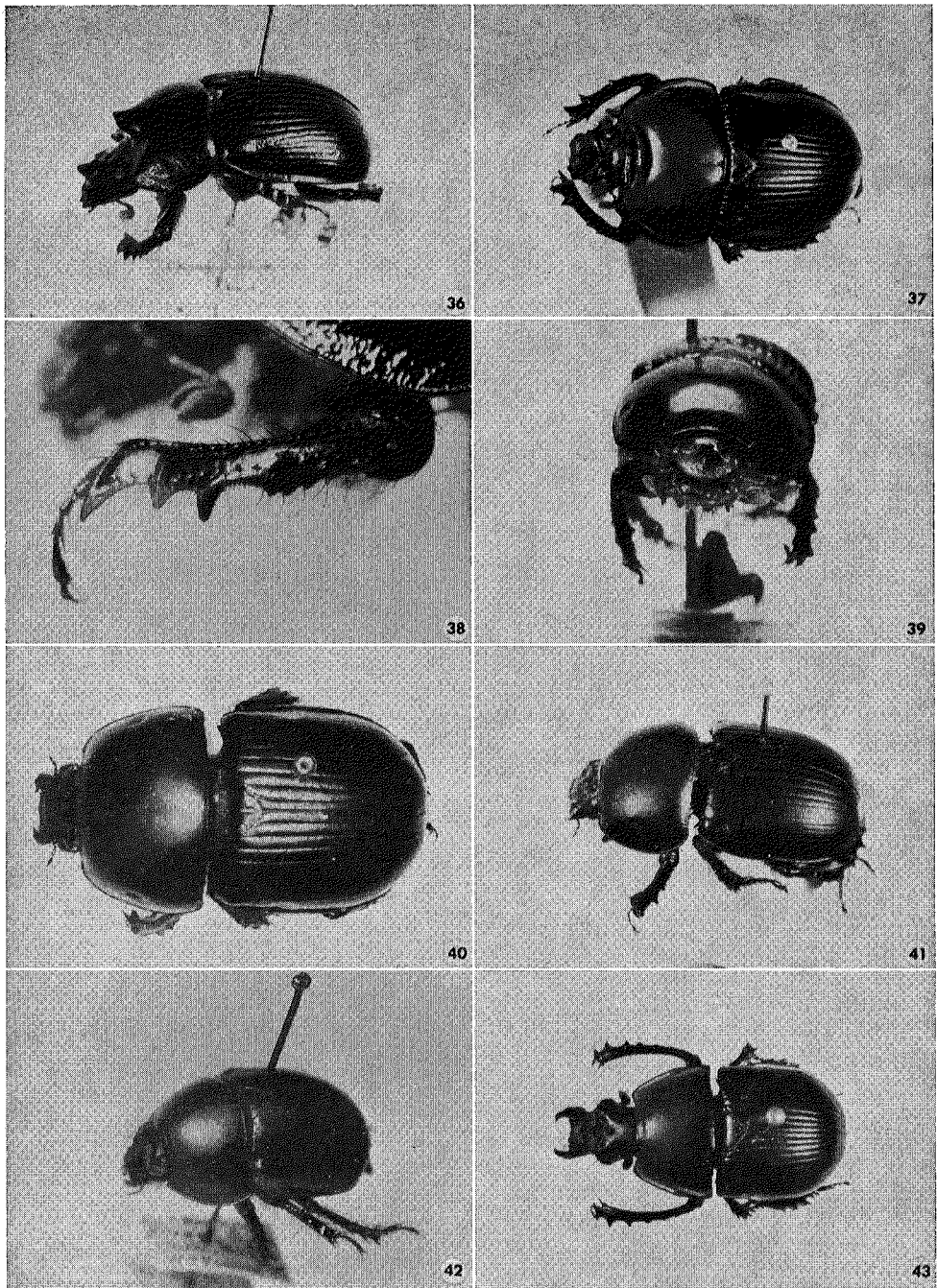
Figs. 9-16. 9, 10, *Neoathyreus fissicornis* (Harold); 11, *N. panamensis* (Robinson); 12, 13, *N. planatus*, new species; 14, *N. interruptus*, new species, posterior pronotal angle; 15, *N. mexicanus* (Klug), posterior pronotal angle; 16, *N. tridenticeps* (Bates).



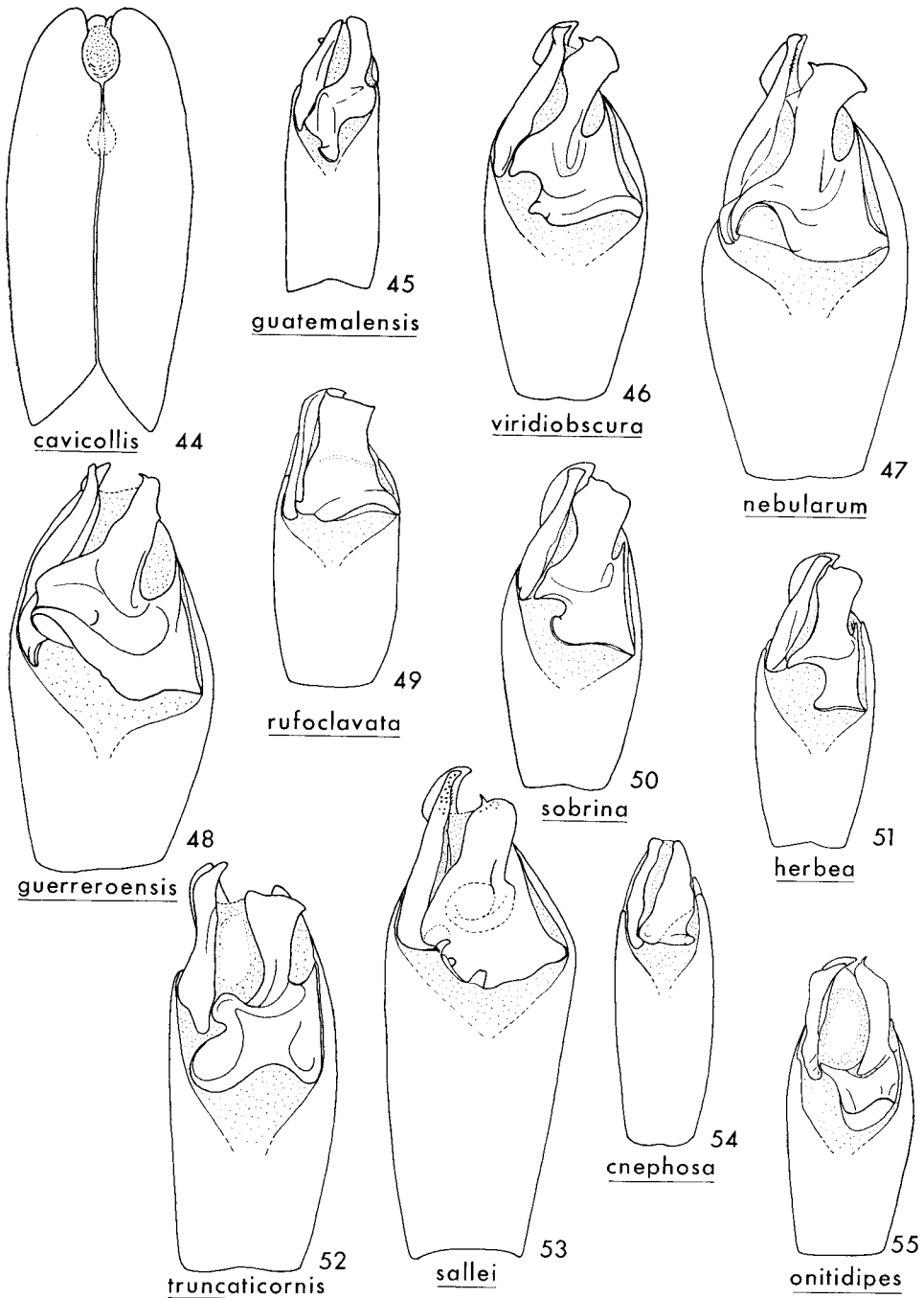
Figs. 17-24. 17, *Neoathyreus tridenticeps* (Bates); 18, *N. hamifer* (Boucomont); 19, *N. mexicanus* (Klug); 20, *N. granulicollis*, new species; 21, *Bolborbombus nitidus*, new species; 22, *Bolbelasmus rotundipennis*, new species; 23, 24, *B. bajaensis*, new species.



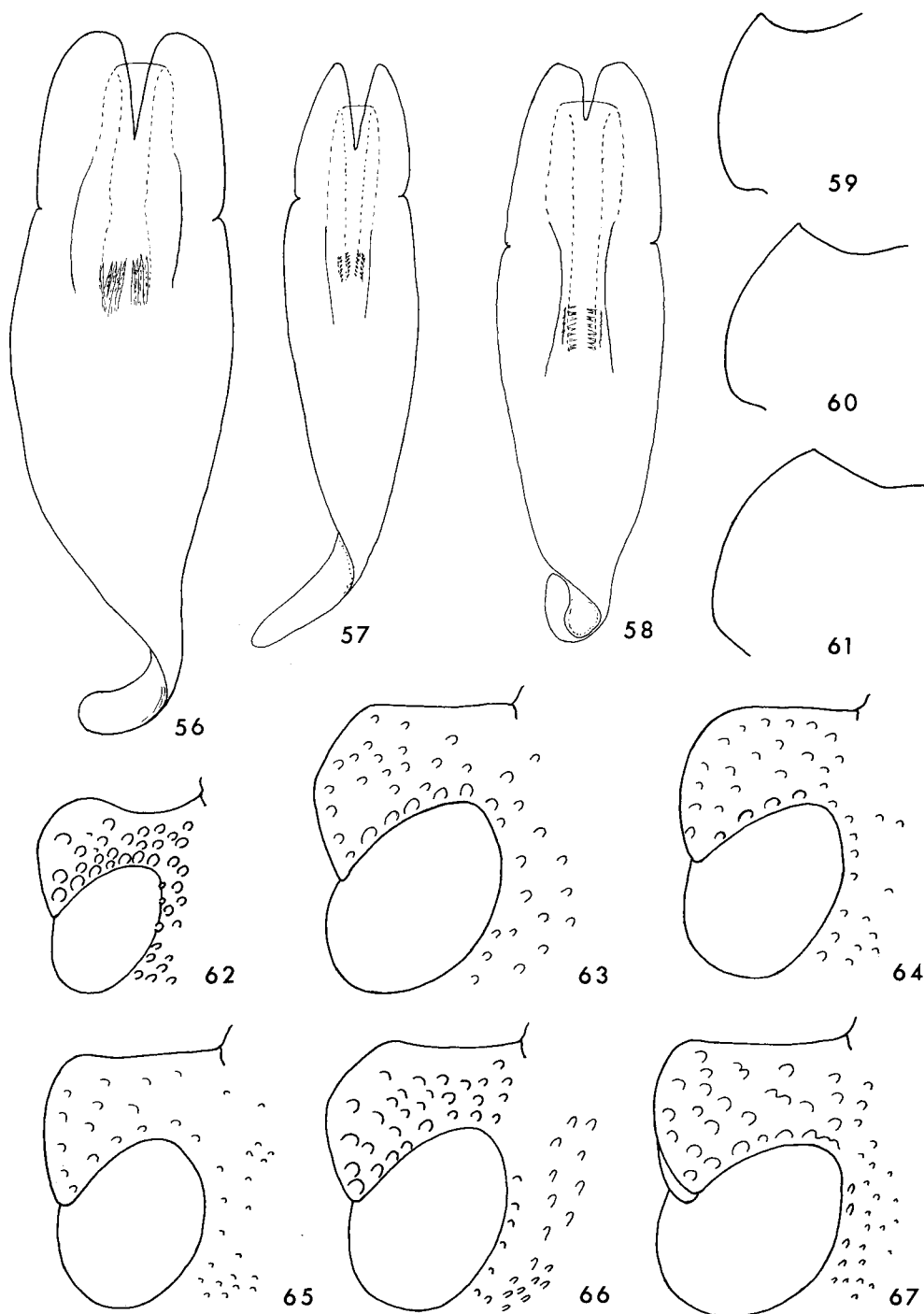
Figs. 25-35. Right lateral lobe of male genitalia. 25, *Athyreus championi* Bates; 26, *Neoatbyreus lanei* (Martinez); 27, *N. quadridentatus*, new species; 28, *N. fissicornis* (Harold); 29, *N. panamensis* (Robinson); 30, *N. planatus*, new species; 31, *N. interruptus*, new species; 32, *N. tridenticeps* (Bates); 33, *N. hamifer* (Boucomont); 34, *N. mexicanus* (Klug); 35, *N. granulicollis*, new species.



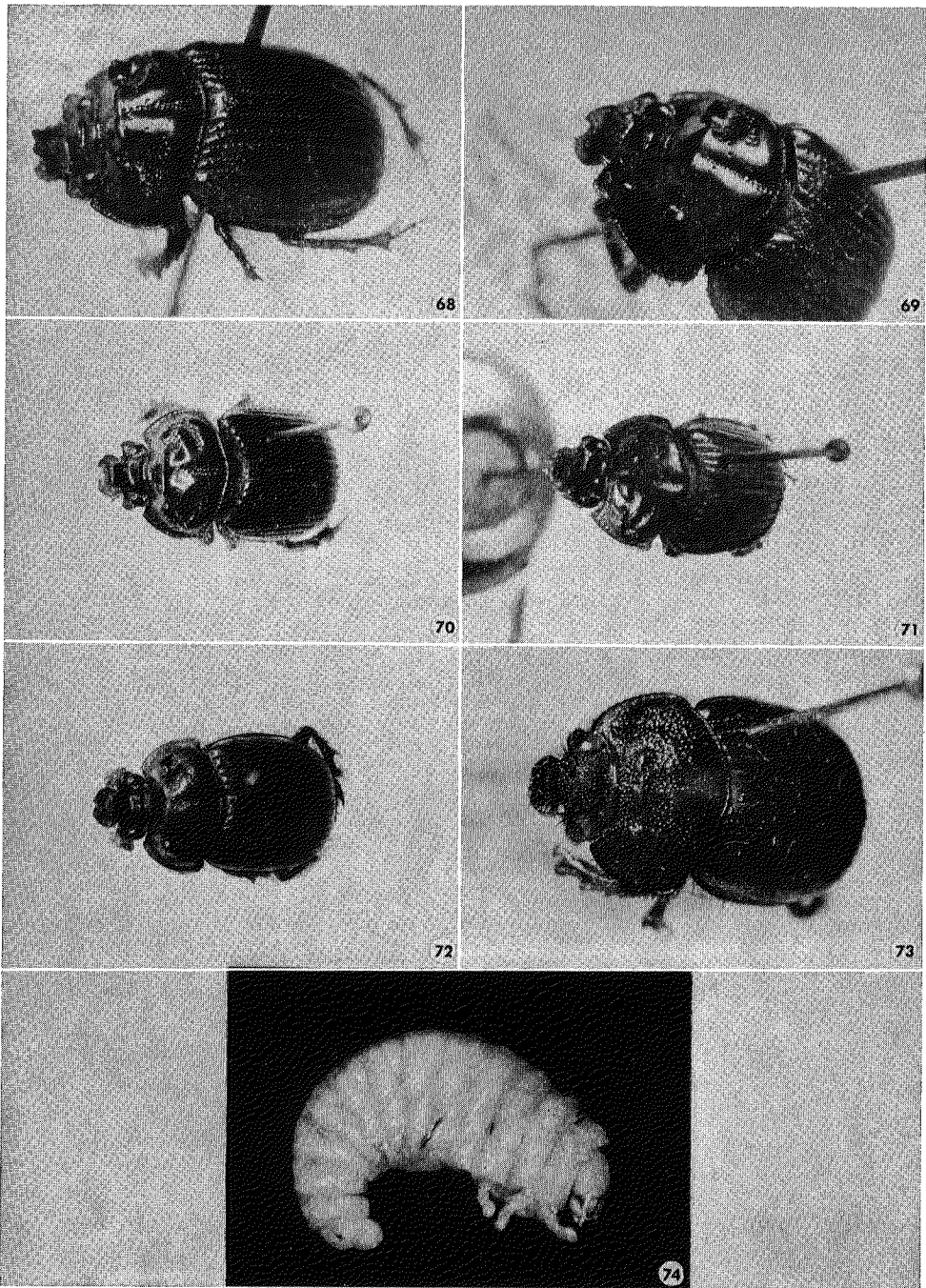
Figs. 36-43. 36, *Ceratotrupes sturmi* (Jekel); 37, *Geotrupes cavi-collis* Bates; 38, *G. cavi-collis*, left fore tibia of male; 39, *G. truncaticornis*, new species; 40, 41, *G. sallei* Jekel; 42, *G. cnephosa*, new species; 43, *G. omitidipes* Bates.



Figs. 44-55. Male genitalia of *Geotrupes* spp. 44, *G. cavicollis* Bates; 45, *G. guatemalensis* Bates; 46, *G. viridiobscura* Jekel; 47, *G. nebularum*, new species; 48, *G. guerreroensis*, new species; 49, *G. rufoclavata* Jekel; 50, *G. sobrina* Jekel; 51, *G. herbea* Jekel; 52, *G. truncaticornis*, new species; 53, *G. sallei* Jekel; 54, *G. cnephosa*, new species; 55, *G. onitidipes* Bates.

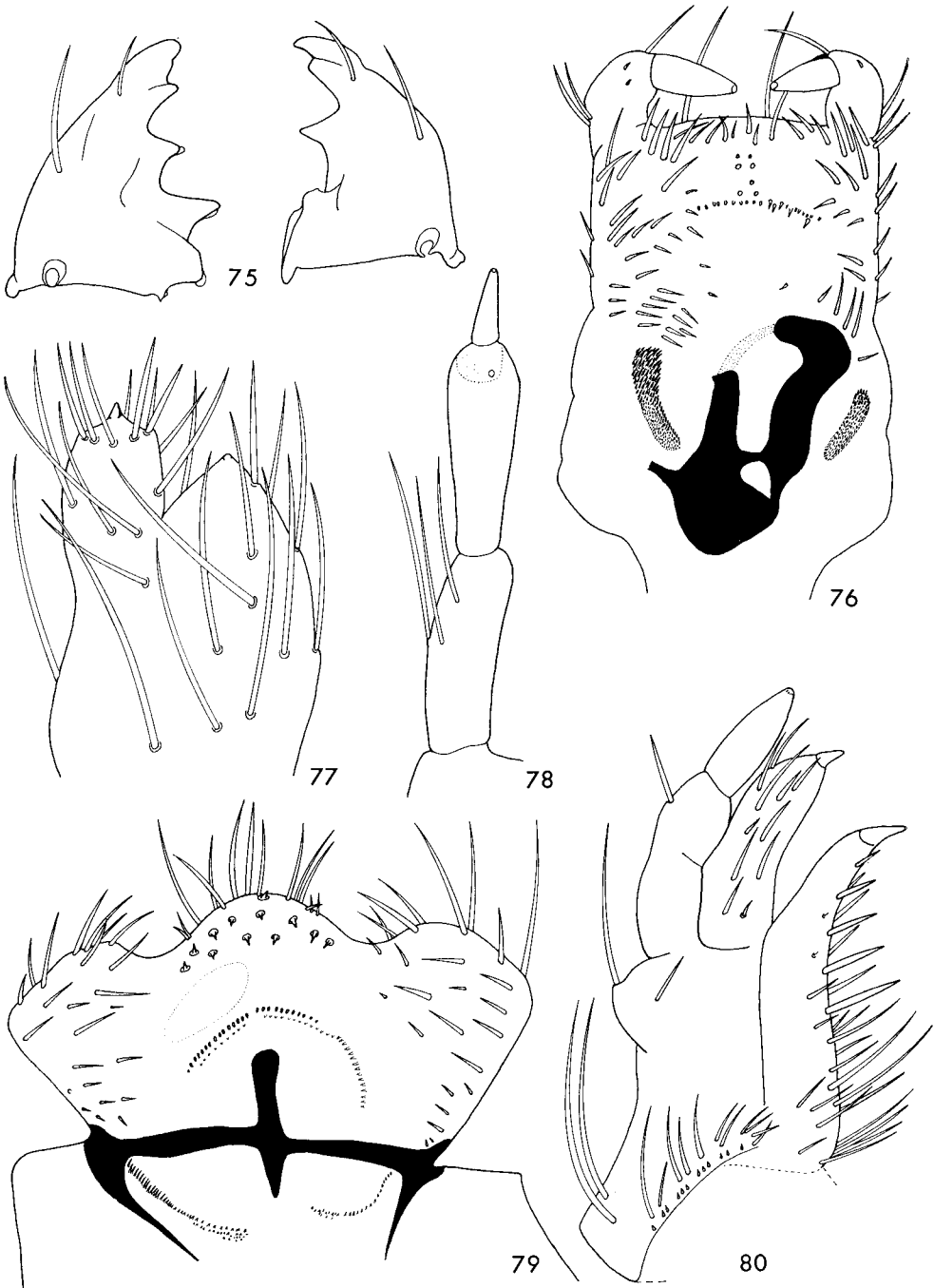


Figs. 56-67. 56-58, male genitalia of *Bolbelasmus* spp. 56, *B. rotundipennis*, new species; 57, *B. arcuatus* (Bates); 58, *B. variabilis*, new species. 59-61, lateral pronotal margin and anterior angle of *Eucanthus* spp. 59, *E. lazarus* (Fabricius) from Oxford, N.C.; 60, *E. lazarus* (Fabricius) from Portal, Ariz.; 61, *E. greeni* Robinson from Jemez Mts., N. Mex. 62-67, left eye canthi of *Eucanthus* spp. 62, *E. subtropicus* Howden; 63, *E. impressus*, new species, from Homestead, Fla.; 64, *E. impressus*, new species, holotype; 65, *E. impressus*, new species, from Chihuahua, Mex.; 66, *E. lazarus* (Fabricius) from Oxford, N.C.; 67, *E. greeni* Robinson from Valentine, Nebr.

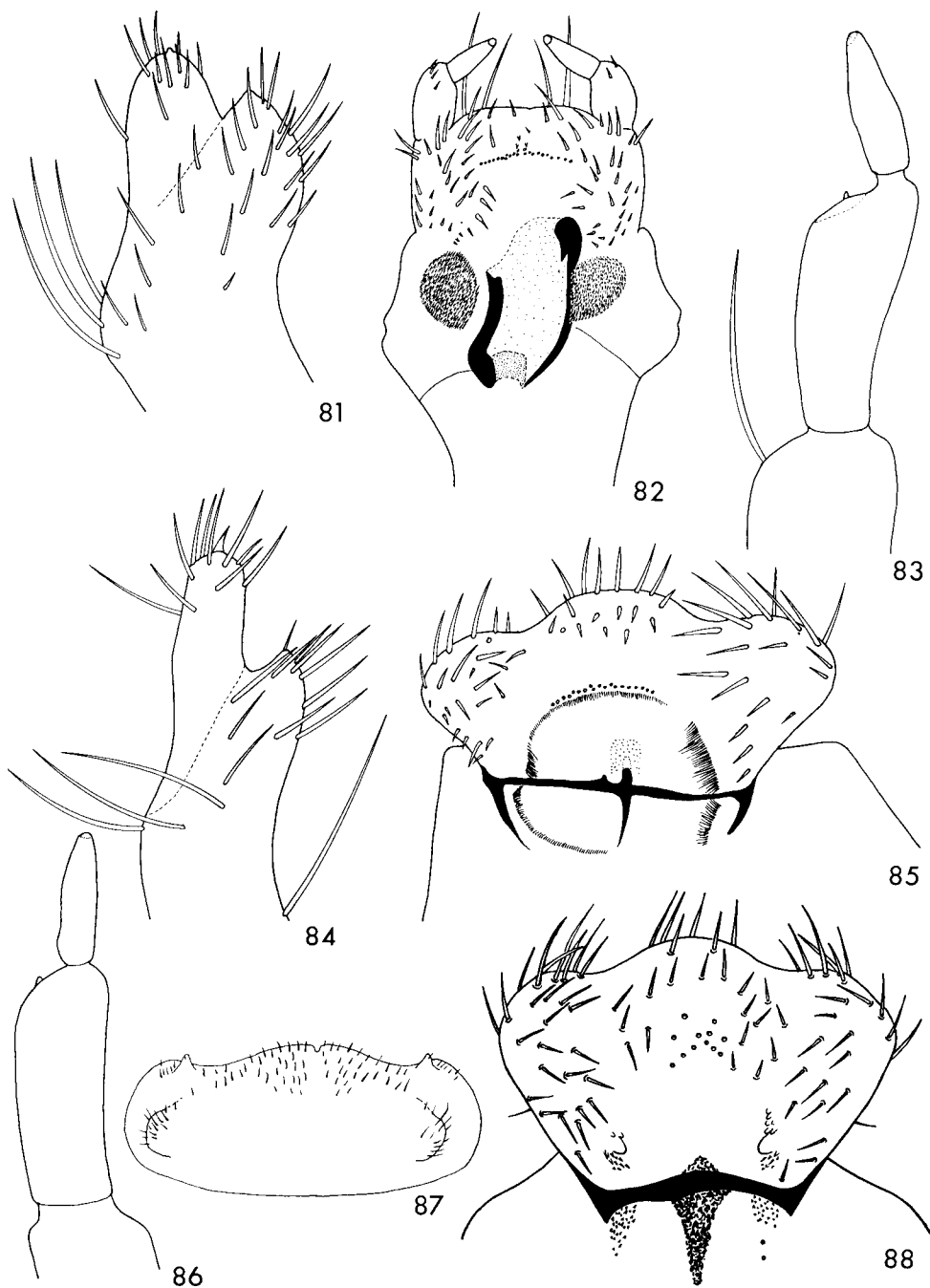


Figs. 68-74. 68, *Eucanthus lazarus* (Fabricius), male; 69, *E. alutaceus* Cartwright, male; 70, *E. subtropicus* Howden, male; 71, *E. impressus*, new species, male; 72, *E. greeni* Robinson, male; 73, *E. mexicanus*, new species, female; 74, *Bolboceras obesus* (LeConte), third stage larva.





Figs. 75-80. *Geotrupes cavicollis* Bates, third stage larva. 75, mandibles; 76, labium and hypopharynx; 77, apex of mesothoracic leg; 78, left antenna; 79, epipharynx; 80, maxilla.



Figs. 81-88. 81-83. *Geotrupes opaca* Haldeman, third stage larva. 81, apex mesothoracic leg; 82, labium and hypopharynx; 83, left antenna, ventral view. 84-86. *Geotrupes semiopaca* Jekel, third stage larva. 84, apex mesothoracic leg; 85, epipharynx; 86, left antenna, ventral view. 87-88. *Bolboceras obesus* (LeConte), third stage larva. 87, anterior segment of pronotum, dorsal view; 88, epipharynx (after P. O. Ritcher).