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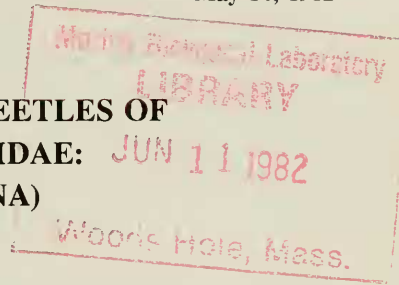
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SMALL TERRESTRIAL GROUND-BEETLES OF  
CENTRAL AMERICA (CARABIDAE:  
BEMBIDIINA AND ANILLINA)

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**ABSTRACT:** This paper provides a synopsis of the tribe Bembidiini with an overview of the three included subtribes, Bembidiina, Tachyina, and Anillina for Central America. Anillina is thought to be a polyphyletic grade derived from genus *Paratachys* of the Tachyina, but no formal classificatory action on this hypothesis is taken. Based on structural characters, *Horologion*, previously classified as Psydrini or Trechini, probably also belongs to this grade. Thirteen new species of *Bembidion* are described from the following type-localities: *purulha*, 22.0 km south of Purulha, Baja Verapaz, Guatemala; *lavernae*, Cerro Buenavista, San José Province, Costa Rica; *quetzal*, 20.0 km west of San Pedro Sacatepéquez at Río Nahuala, Quezaltenango, Guatemala; *diabola*, Volcán Irazú, Cartago Province, Costa Rica; *edwardsi*, Cerro Buenavista, San José Province, Costa Rica; *aeger*, Cerro de la Muerte, Cartago Province, Costa Rica; *chiriqui*, 8.0 km west of Boquete, Chiriquí Province, Panama; *nahuala*, 27.0 km northwest of San Marcos, San Marcos, Guatemala; *franiae*, 4.8 km east of San Mateo Ixtatán, Huehuetenango, Guatemala; *cortes*, La Lima, Cortés, Honduras; *armuelles*, Puerto Armuelles, Chiriquí Province, Panama; *barrensis*, Barro Colorado Island; *ixtatan*, 4.8 km east of San Mateo Ixtatán, Huehuetenango, Guatemala. Four new species of *Geocharidius* are described from the following type-localities: *romeoi*, 13.0 km south of Purulha, Baja Verapaz, Guatemala; *gimlii*, 7.7 km south of San Juan Ixcoy, Huehuetenango, Guatemala; *phineus*, 1.6 km south of Pantín, Baja Verapaz, Guatemala; *tagliantii*, Totonicapán, Totonicapán, Guatemala. The 22 *Bembidion* species presently known from Central America are arrayed in nine species groups. Corresponding groups for the five known *Geocharidius* species are not used because of the small size of the fauna and their questionable relationships with poorly known northern taxa. Distribution and relationships are discussed in general, but detailed analysis is deferred until species-group taxonomy is undertaken on a broader geographic scale. Notes are provided on natural history and distribution for each species; dot maps illustrate the known range of each taxon.

INTRODUCTION

Nearly 100 years have passed since the last comprehensive paper on Central American *Bembidion* was produced by H. W. Bates. Darlington (1934) described a single species. Other than these two contributions, the genus has received no taxonomic attention for Central America. Presently, 22 species are known from the area, an increase of 17 since the time of

Bates's papers. The anilline genus *Geocharidius* was discussed more recently by Taglianti (1973), but his coverage did not add new species for Central America. Presently, five species are known from the area, an increase of four since Bates's contributions to *Biologia Centrali-Americana* (Bates 1882, 1884). It therefore can be assumed that after nearly 100 years the *Bembidion* fauna of Central America (defined here

as the mainland and coastal islands from Guatemala to Panama) is still not completely known; the anilline fauna is essentially untouched, probably a result of their living in deep soil humus, thus hard to collect except by special means. The tachyine fauna, here discussed at the generic level only, is huge (Erwin 1974b) and is presently under revision (e.g., Erwin 1973, 1974a, 1975, 1977).

In order to provide data for a series of studies now underway by D. H. Kavanaugh and me on the genus *Bembidion* (Erwin and Kavanaugh 1980, 1981), I am publishing here an extract from my "Ground Beetles of Central America" in advance of the volume in which it belongs. The present study is a faunal documentation which will provide data for future analyses. Comments pertaining to biogeography are given below, but since the Central American bembidiine fauna represents the "tail-ends" of more northerly or southerly distributed groups, phylogenetic and detailed biogeographic analyses will be discussed elsewhere (e.g., Erwin and Kavanaugh 1981).

#### MATERIALS

This paper is based on examinations of 1002 specimens of *Bembidion* and 44 specimens of *Geocharidius* from Central America, as well as numerous specimens of other Bembidiini from other parts of the world. Following is a list of depositories for these materials; acronyms based on Erwin (1970) are given preceding each entry: CAS—California Academy of Sciences, San Francisco, California 94118, D. H. Kavanaugh; MCZ—Museum of Comparative Zoology, Cambridge, Massachusetts, M. Thayer, A. Newton; MNHP—Museum National d'Histoire Naturelle, Paris, H. Perrin, J. Menier; UASM—Strickland Museum, University of Alberta, Edmonton, Canada, G. E. Ball; BMNH—British Museum (Natural History), London, P. Hammond, M. Bacchus; HPST—Canal Zone, Henry P. Stockwell; AMNH—American Museum of Natural History, New York, L. Herman; FMNH—Field Museum of Natural History, Chicago, H. Dybas; FDAG—Florida Department of Agriculture Insect Collection, Gainesville, Florida, R. Woodruff; UMAA—University of Michigan, Ann Arbor, R. D. Ward; UAIC—University of Arkansas, Fayetteville, R. T. Allen; GRNO—Milwaukee Public Mu-

seum, Wisconsin, G. R. Noonan; JNEG—78 Versailles, 9, B<sup>b</sup> De Lesseps, France, J. Nègre.

#### METHODS

General procedural methods are as I used before (Erwin 1970, 1973, 1974a, 1975; Erwin and Kavanaugh 1981). Measures for various body parts are coded as follows and are presented in the species descriptions as single specimen measures, if that is all I saw, or ranges based on the smallest and largest of all specimens studied—all specimens were measured with an electronic measuring device (Erwin 1978) and measures are presented in millimeters. *ABL* = apparent body length, that length used by most previous authors as total length as measured by holding up a ruler alongside the specimen (see Erwin and Kavanaugh 1981). *SBL* = standardized body length, that length introduced by Ball (1972) and modified by Kavanaugh (1979), and equal here to the sum of *LH*, *LP*, and *LE*. *TW* = total width across the widest portion of the elytra, actually measured as the left elytron (*WE*) and doubled to obtain value. *LH* = length of head from front edge of clypeus to base of head at point of cervical constriction and taken along midline. *LP* = length of pronotum from base to apex along midline. *LE* = length of elytron, longest one, along suture from apex of scutellum to apex of sutural projection. *WE* = width of elytron at widest portion. All label, specimen measurement, and field data about specimens are computerized (L. J. M. Erwin 1976), and these records formed the base for study and analysis. Data concerning material examined are presented in tables and maps; tables summarize data deduced from specimen labels, however, localities are presented as latitude and longitude except in the case of types where place names are also used. Elevations are given in meters even though specimen labels may have them in English units; occasionally, specimen labels give imprecise altitudinal data or none at all, thus, in these cases tables include the abbreviation 'ca.' to indicate approximate altitude derived from topographic maps. Chaetotaxy reference follows that of Erwin (1974a) and the term 'interneur,' used for the structure between elytral intervals, is described in Erwin (1974a). Microsculpture micrographs were made only for species where sufficient study material allowed coating of body parts.



FIGURE 1. Habitus of *Bembidion vernale* Bates, dorsal aspect, female from Cerro Punta, Chiriquí, Panama.

## TRIBE BEMBIDIINI

The bembidiines are a diverse lot of mostly small beetles distributed worldwide and whose primary apotypic feature is the subulate apical palpomere. The tribe is represented by three subtribes in Central America: Bembidiina, Tachyina, and Anillina.

Bembidiinas are much larger, as a rule, than members of the other subtribes, often are colorful, almost always have large eyes, and do not possess an elytral recurrent groove (however, the apex of interneur 5 is often depressed). *Bembidion* includes hundreds, if not thousands, of species worldwide, but most of these are distributed in the Holarctic and South Temperate regions. In Central America, there are only 22 species known, but undoubtedly some more-alticolous species will be discovered with additional collecting in remote upland areas. These beetles live in such diverse habitats as sea beaches and mountain tops above timber line. They are particularly common and diverse along gravelly streams and rivers and in upland forest above 2000 meters. The major taxonomic problem remaining in this genus is to segregate and define its components on a worldwide basis. Neltowitzky (1942, 1943) and Lindroth (1963) provided an excellent foundation with which to start; D. H. Kavanaugh and I have taken up the task. The former authors have shown beyond doubt that male genitalic characteristics are of great value in several Holarctic groups for determining relationships. Erwin and Kavanaugh (1981) showed the same to be true for the female reproductive system. Reclassification of this complex and diverse genus will require a world overview, reevaluation of character systems, and close scrutiny of geographic ranges. Much more collecting will need to be done, especially in the western United States, South American Andes, and Palearctic Asia. The larval stages of many groups of Bembidiina are known (see Lindroth 1963); these will aid systematic studies because taxonomically useful characters are present (Erwin 1975).

Tachyinas are small to medium-sized bembidiines with much greater diversity and richness than bembidiinas. Tachyinas almost always have eyes, many are colorful (some metallic), and most possess a recurrent groove near the elytral apex. Most Central American genera are composed of numerous species. This subtribe

constitutes one of the two largest groups of the Central American fauna (the other being Agonina, *Platynus*, and its relatives). Tachyina beetles live in diverse habitats, from intertidal zones to rain forest canopy; they are extremely diverse along riparian systems, and some have adapted to living with ants. They are a lowland faunal component and have not become true alticoles as have *Bembidion* and other carabid groups such as the trechines, indicating that they are a later taxon pulse element of the fauna than are the Bembidiina (Erwin 1979, 1981; Erwin and Adis 1982). Erwin (1973, 1974a, 1974b, 1975) has begun a world revisionary study of this group of beetles. As with bembidiinas, reclassification of this complex and diverse tribe will require a world overview, reevaluation of character systems, and close scrutiny of geographic ranges. Much more collecting will need to be done, especially in the tropics. The larval stages of Tachyina are mostly unknown (see Erwin 1975).

Anillinas are minute, apterous, blind beetles which inhabit deep humus in upland forests and are also found in caves and fissures. Difficulty in finding these beetles prevents accumulation of enough material to adequately revise most genera. Undoubtedly, more species will be discovered in upland forests by use of special collecting techniques (e.g., Berlese funnel). Anillinas, as currently classified, are easily recognized by their small size, pale coloration, and lack of eyes. Some cave-dwelling Ardistomina (Scaritini) have also lost eyes, but remain easily recognized by body shape (pedunculate). Some trechines in Middle America have also adapted to caves and become blind, but they can be immediately recognized by their long apical palpomeres and sulcate head. There are a few wingless, pale, nearly blind *Mioptachys* (Tachyina) in the same habitat with *Geocharidius* (the only genus of Central American Anillina); the former always have some eye facets, however, and possess a deeply engraved and sulcate recurrent groove on the lateroapical portion of the elytron. Jeannel (1937, 1963a, 1963b) attempted a phylogenetic and biogeographic synthesis of this group, however, he was partially thwarted by lack of material, his assumption that the group is monophyletic, and the 'reduction' of most character suites leaving poorly defined taxa. Recent discovery of an apparently eyed Anillina from lowland Brazil suggests a relationship of



the subtribe to the tachyina group "*Polyderidius*." Possibly, Anillina represents a grade of numerous parallel lineages derived from *Paratichys* and allies, each of which adapted independently to deep-humus environments. This possibility would explain several puzzles. For example, all anillinas have the anterior tibia notched obliquely—an apotypic trend found among all the higher tachyinas, which reaches its ultimate development in *Micratopus* and *Lymnastis*. Also explained would be the occurrence of these small, blind, wingless beetles on remote islands and all continents (except Antarctica). At present, the only explanation is that they are an ancient group predating the initial rift of Pangaea. This explanation is not concordant with many other aspects of carabid evolution and radiation. It seems to me that a polyphyletic origin hypothesis now best fits observations, and *Paratichys* and allies are the source of the anillina grade, as they are also the probable source of "Lymnastine" radiation.

*Horologion*, a monotypic genus (known from only one specimen) from West Virginia represented by *H. speokoites*, has long troubled classifiers (Valentine 1932; van Emden 1936; Ball 1963). Considering the evidence presented above and the fact that many character states are shared among *Horologion* and Anillinas, and especially, that these share the derived tibial configuration mentioned above, I here suggest that *Horologion* belongs in the anillina grade and that its origin lies in the Tachyina.

For recent treatments of Bembidiini or its components see Basilewsky (1968, 1972—Madagascan and St. Helena Bembidiini), Darlington (1962—New Guinea Bembidiini), Erwin (1973, 1974a, 1974b, 1975, 1976, 1977—Tachyina), Erwin and Kavanaugh (1980, 1981—North American *Bembidion*), Kryzhanovskiy (1970—U.S.S.R. Tachyina), Lindroth (1963, 1966, 1975, 1976, 1980—North American, Australian, and Asian Bembidiini), de Miré (1976—African Tachyina), Pawlowski (1974—Polish Bembidiini).

### Genus *Bembidion* Latreille

*Bembidium* LATREILLE, 1802:82. [Type-species *Cicindela quadrimaculata* Linné, 1761:211, subsequent designation by Andrewes (1935:17).]

For detailed generic synonymies see Andrewes (1935:92), Ball (1963), Lindroth

(1963:206), Müller (1918), and Netolitzky (1942, 1943).

DIAGNOSTIC COMBINATION.—Small to medium-sized, more or less depressed beetles with broad elytra, narrow forebody, and long slender appendages. Color various, often with metallic luster, elytra sometimes spotted. Terminal palpomere subulate; eyes moderate to large, antennomeres 3–11 entirely pubescent, mentum with well-developed tooth; mandibles unisetose. Pronotum with two midlateral and usually two basilateral setae; elytron with two or more discal setae in third interval or adjacent interneur. Elytron without recurrent groove, although apex of fifth interneur usually sulcate. Microsculpture various. Female stylus small, spatulate, unisetose. Male parameres 2- or 3-setose. Flight wings present, absent, or dimorphic; reduction in size and length of various degrees. ABL = 2.43–6.11 mm in Central American species.

NATURAL HISTORY.—Species of this genus live on sea beaches, along streams and rivers, and in forests; they can be found during their quiescent periods under leaf litter, logs, or stones. Several species in Central America are true alticoles; most of these are wingless. The larvae of many European and some North American species are known and described, but none in Central America have been discovered in either larval or pupal stages. Adults of *Bembidion* species are carnivorous; in addition to small arthropods, they also eat arthropod eggs (Frank 1971). Their usual life cycle requires one year; larvae are present in the fauna in summer for the most part, however, some species overwinter in this stage in the north (Lindroth 1963). *Bembidion* species are dominant members of most northern riparian, alpine, and lake shore communities. In the tropics, this dominance does not exist at lower elevations, however, I have seen it in upland riparian habitats in Panama and in the Subparamo habitat in Costa Rica.

NOTES.—*Bembidion* of the southern United States, Mexico, and South America are in need of a detailed taxonomic study. Therefore, I have restricted coverage here to only Central America within the limits set forth in the Introduction. The North American *Bembidion* fauna consists of more than 200 species (Lindroth 1967), that of Central America 22! This drastic reduction in species numbers occurs in Mexico, most dramatically at the southern edge of the Transverse

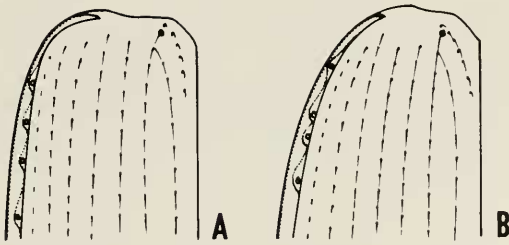


FIGURE 2. Elytron, left, dorsal aspect of (a) *Bembidion rogersi* Bates, alate form, 7.5 km south of Ojo de Agua, Cartago, Costa Rica, male; (b) same, brachypterous form, same locale, male.

Volcanic Belt and Isthmus of Tehuantepec. From this line southward, *Bembidion* is never as diverse as it is in North America, although species are found as far south as Tierra del Fuego (Darlington 1965).

The *Bembidion* fauna of North America is very complex and difficult to work with because of many closely related species in most species groups. That of Central America, however, is quite the contrary because there are only a few species in each of the nine represented groups, the tail-ends of otherwise diverse northern and southern groups. Male genitalic character states are excellent for delimiting species and species groups, female genitalic characteristics for species groups; both these suites usually correlate well with external structure (Erwin and Kavanaugh 1981) which then can be utilized for diagnostic features. Externally, the beetles differ in states of the frontal furrows, metasternal process, dorsal elytral chaetotaxy and structure of the interneurs, microsculpture, and pronotal shape, even though the beetles themselves are similar in habitus. In Central America, two habitus types occur: the winged type (Fig. 2a) with large square humeri and narrow forebody and head, and the brachypterous type (Fig. 2b) with rounded and narrow humeri, arcuate-sided elytra, and more robust forebody and head. These two types occur among different individuals of the same population of wing-dimorphic species such as *B. rogersi* and *B. nahuala*.

Adults can easily be sexed in two ways. Males have two basal tarsomeres of the anterior leg dilated and with modified setae beneath, forming a loosely biserrate "spongy" pad, and two setae along the caudal edge of sternum VI; females have no "spongy" pad or dilated tarsomeres and have four setae on sternum VI.

ARRANGEMENT OF TAXA: *BEMBIDION*.—I here follow Lindroth's arrangement of species groups and add the *rogersi*, *vernale*, *nahuala*, *franiae*, and *cognatum* groups, none of which were covered by him. Arrangement of taxa within groups is based on complexity of male genital structure, from simple to complex. Although this may not be phylogenetically accurate, it suits the purpose of this paper in its attempt to simply document the fauna for further study. Such further study must necessarily be based on revisionary work with a much broader geographic base than Central America.

#### CHECKLIST OF *BEMBIDION* SPECIES OF CENTRAL AMERICA.

##### The *semistriatum* group

1. *B. purulha*, new species

##### The *rogersi* group

2. *B. rogersi* Bates, 1878:602

##### The *vernale* group

3. *B. mexicanum* Dejean, 1831:126
4. *B. vernale* Bates, 1882:149
5. *B. satellites* Bates, 1884:291
6. *B. lavernae*, new species
7. *B. quetzal*, new species
8. *B. diabola*, new species
9. *B. vulcanium* Darlington, 1934:157
10. *B. edwardsi*, new species
11. *B. aeger*, new species
12. *B. chiriqui*, new species

##### The *nahuala* group

13. *B. nahuala*, new species

##### The *franiae* group

14. *B. franiae*, new species

##### The *incrementatum* group

15. *B. aratum* LeConte, 1852:189

##### The *dorsale* group

16. *B. cortez*, new species
17. *B. sparsum* Bates, 1882:151
18. *B. armuelles*, new species

##### The *affine* group

19. *B. barrensis*, new species

##### The *championi* group

20. *B. cyclodes* Bates, 1884:290
21. *B. championi* Bates, 1882:148

##### The *cognatum* group

22. *B. ixtatan*, new species

#### Key to Species of *Bembidion* of Central America

1. Pronotum with hind angles completely rounded, base markedly lobed as in Figure 21 .....

TABLE 1. NUMBERS AND PERCENTAGES OF WINGED VERSUS NON-WINGED INDIVIDUALS IN THREE POPULATIONS OF (A) *Bembidion rogersi* BATES AND (B) *Bembidion nahuala*, NEW SPECIES.

Locality	- Wing female	+ Wing female	% Female - wing	- Wing male	+ Wing male	% Male - wing	% Total - wing
(A)							
Cerro de la Muerte	54	7	88%	99	20	83%	85%
Volcán Irazú	4	4	50%	7	1	87%	69%
Volcán de Chiriquí	6	4	60%	3	2	60%	60%
(B)							
Río Nahuala	5	1	83%	0	0	—	83%
San Marcos	26	9	74%	16	2	89%	79%
Cerro Zunil	1	0	100%	0	0	—	100%
Finca San Rafael	1	0	100%	0	0	—	100%

- Pronotum with hind angles acute or square, base not lobed ..... 3
- 2(1). Elytron with interneur 7 absent, interneur 6 extended to at least middle ..... 19. *B. cyclodes* Bates
- Elytron with interneurs 6 and 7 present, short, not extended beyond basal sixth ..... 20. *B. championi* Bates
- 3(1). Frontal furrows doubled on clypeus and behind posterior supraorbital seta, furrows moderately or markedly convergent; humerus somewhat paler than disc of elytron; small beetles, less than 3.0 mm ..... 4
- Frontal furrows not doubled, not convergent; humerus various; larger beetles, usually more than 3.0 mm ..... 5
- 4(3). Frontal furrows deeply impressed and convergent, doubled throughout their length ..... 22. *B. ixtatan*, new species
- Frontal furrows shallow and single between eyes, nearly parallel except on clypeus where they converge and are doubled ..... 19. *B. barrensis*, new species
- 5(3). Metasternal process between mesocoxae entirely unmarginated ..... 6
- Metasternal process clearly margined, margin removed from apex and abruptly or gradually raised ..... 8
- 6(5). Dorsal surface without microsculpture, surfaces shiny ..... 13. *B. nahuala*, new species
- Dorsal surface with well-developed microsculpture, surfaces dull ..... 7
- 7(6). Elytron bifoveate, foveae around setae deep and wide, each extended across about three intervals; elytral microsculpture of wide meshes, on head and pronotum variously effaced or nearly isodiametric ..... 2. *B. rogersi* Bates
- Elytron bipunctate, punctures around dorsal setae deep and small, not extended beyond middle of adjacent interval; elytral microsculpture of finely impressed lines or wide meshes, surface subiridescent, on head clearly and evenly isodiametric, slightly granular, more evenly transverse and less impressed on pronotum ..... 14. *B. franiae*, new species
- 8(5). Elytron with setae Ed3 and Ed5 in interval 3 and not touching adjacent interneurs ..... 9
- Elytron with these setae in or touching interneur 3 ..... 12
- 9(8). Elytron without microsculpture, markedly shiny ..... 15. *B. aratum* LeConte
- Elytron with perfectly isodiametric and well-engraved microsculpture, surfaces dull ..... 10
- 10(9). Pronotum (Fig. 19) narrow, about as wide as head across eyes; length 3.47 to 4.23 mm ..... 17. *B. sparsum* Bates
- Pronotum broad, much wider than head across eyes; length 3.75 to 4.41 mm ..... 11
- 11(10). Pronotum (Fig. 20) markedly convex

TABLE 2. VARIATION IN TOTAL LENGTH (SBL in mm) WITHIN AND AMONG *Bembidion* SPECIES OF CENTRAL AMERICA.

	Sex	(n)	Minimum	Maximum	Mean	±SE	SD	CV
01. <i>B. purulha</i>	m	1	4.19	4.19	—	—	—	—
	f	1	4.53	4.53	—	—	—	—
02. <i>B. rogersi</i>	m	135	3.78	4.26	4.25	0.02	0.22	5.24
	f	88	3.60	4.63	4.20	0.02	0.24	5.69
03. <i>B. mexicanum</i>	m	33	5.04	6.11	5.50	0.05	0.29	5.36
	f	29	4.95	5.95	5.41	0.05	0.26	4.88
04. <i>B. vernale</i>	m	182	4.39	5.64	5.06	0.02	0.24	4.72
	f	113	4.43	5.66	5.14	0.02	0.24	4.68
05. <i>B. satellites</i>	m	30	4.20	5.12	4.61	0.04	0.24	5.25
	f	25	4.22	5.17	4.79	0.05	0.23	4.87
06. <i>B. lavernae</i>	m	X	—	—	—	—	—	—
	f	1	4.18	4.18	—	—	—	—
07. <i>B. quetzal</i>	m	9	4.74	5.59	5.21	0.09	0.27	5.26
	f	18	4.77	5.53	5.23	0.06	0.24	4.61
08. <i>B. diabola</i>	m	31	3.56	4.38	3.71	0.04	0.22	5.47
	f	22	3.64	4.49	4.10	0.05	0.24	5.93
09. <i>B. vulcanium</i>	m	18	3.73	4.49	4.12	0.05	0.20	4.75
	f	15	3.11	4.36	4.02	0.08	0.32	7.85
10. <i>B. edwardsi</i>	m	X	—	—	—	—	—	—
	f	3	3.77	4.00	3.87	0.07	0.12	3.09
11. <i>B. aeger</i>	m	18	3.05	3.74	3.49	0.04	0.18	4.19
	f	16	3.26	3.75	3.44	0.03	0.12	3.38
12. <i>B. chiriqui</i>	m	34	3.42	4.15	3.84	0.03	0.19	4.89
	f	10	3.68	4.25	3.98	0.05	0.17	4.22
13. <i>B. nahuala</i>	m	19	2.87	3.77	3.24	0.06	0.27	8.28
	f	41	3.04	4.00	3.50	0.03	0.21	5.93
14. <i>B. franiae</i>	m	1	4.12	—	—	—	—	—
	f	1	3.98	—	—	—	—	—
15. <i>B. aratum</i>	m	2	4.03	5.03	4.53	0.50	0.71	15.61
	f	3	4.24	4.48	4.35	0.07	0.12	2.77
16. <i>B. cortes</i>	m	10	3.75	4.41	4.17	0.04	0.13	3.22
	f	22	3.75	4.40	4.13	0.04	0.19	4.67
17. <i>B. sparsum</i>	m	9	3.47	4.10	3.74	0.08	0.23	6.16
	f	8	3.52	4.23	3.82	0.08	0.24	6.20
18. <i>B. armuelles</i>	m	X	—	—	—	—	—	—
	f	1	4.32	4.32	—	—	—	—
19. <i>B. barreensis</i>	m	1	2.94	2.94	—	—	—	—
	f	X	—	—	—	—	—	—
20. <i>B. cyclodes</i>	m	X	—	—	—	—	—	—
	f	1	3.05	3.05	—	—	—	—
21. <i>B. championi</i>	m	X	—	—	—	—	—	—
	f	X	—	—	—	—	—	—
22. <i>B. ixtatan</i>	m	3	2.43	2.90	2.70	0.01	0.24	9.03
	f	4	2.54	2.85	2.69	0.07	0.14	5.06

"X" = sex not available for measurement.



TABLE 3. VARIATION IN TOTAL WIDTH (TW in mm) WITHIN AND AMONG *Bembidion* SPECIES OF CENTRAL AMERICA.

	Sex	(n)	Minimum	Maximum	Mean	±SE	SD	CV
01. <i>B. purulha</i>	m	1	1.79	1.79	—	—	—	—
	f	1	1.82	1.82	—	—	—	—
02. <i>B. rogersi</i>	m	135	1.58	2.13	1.82	0.01	0.22	5.24
	f	88	1.57	1.98	1.80	0.01	0.11	5.93
03. <i>B. mexicanum</i>	m	33	2.07	2.80	2.44	0.02	0.14	5.62
	f	29	2.09	2.80	2.42	0.02	0.13	5.52
04. <i>B. vernale</i>	m	182	1.89	2.61	2.18	0.01	0.12	5.45
	f	113	1.80	2.51	2.22	0.01	0.12	5.47
05. <i>B. satellites</i>	m	30	1.64	2.12	1.96	0.02	0.11	5.50
	f	26	1.77	2.30	2.04	0.02	0.11	5.18
06. <i>B. lavernae</i>	m	X	—	—	—	—	—	—
	f	1	1.78	1.78	—	—	—	—
07. <i>B. quetzal</i>	m	9	2.04	2.38	2.24	0.04	0.11	4.72
	f	18	2.08	2.45	2.24	0.03	0.13	5.72
08. <i>B. diabola</i>	m	31	1.52	1.89	1.74	0.02	0.10	5.59
	f	22	1.52	1.93	1.76	0.02	0.11	6.26
09. <i>B. vulcanium</i>	m	18	1.63	2.00	1.89	0.02	0.08	4.48
	f	15	1.58	2.04	1.89	0.03	0.13	6.67
10. <i>B. edwardsi</i>	m	X	—	—	—	—	—	—
	f	3	1.59	1.66	1.62	0.02	0.04	2.34
11. <i>B. aeger</i>	m	18	1.28	1.65	1.51	0.02	0.09	5.82
	f	16	1.34	1.81	1.50	0.03	0.11	7.45
12. <i>B. chiriqui</i>	m	34	1.54	1.83	1.70	0.01	0.08	4.58
	f	10	1.65	1.94	1.77	0.03	0.09	5.25
13. <i>B. nahuala</i>	m	19	1.20	1.78	1.45	0.03	0.16	11.18
	f	41	1.28	1.94	1.58	0.02	0.12	7.40
14. <i>B. franiae</i>	m	1	1.85	1.85	—	—	—	—
	f	1	1.83	1.83	—	—	—	—
15. <i>B. aratum</i>	m	2	1.68	1.98	1.83	0.15	0.21	11.59
	f	3	1.62	1.85	1.77	0.08	0.13	7.21
16. <i>B. cortes</i>	m	10	3.98	4.14	4.17	0.02	0.07	3.79
	f	22	1.65	1.99	1.84	0.02	0.08	4.29
17. <i>B. sparsum</i>	m	9	1.50	1.74	1.62	0.03	0.09	5.42
	f	8	1.53	1.89	1.71	0.05	0.13	7.84
18. <i>B. armuelles</i>	m	X	—	—	—	—	—	—
	f	1	1.80	1.80	—	—	—	—
19. <i>B. barrensis</i>	m	1	1.21	1.21	—	—	—	—
	f	X	—	—	—	—	—	—
20. <i>B. cyclodes</i>	m	X	—	—	—	—	—	—
	f	1	1.39	1.39	—	—	—	—
21. <i>B. championi</i>	m	X	—	—	—	—	—	—
	f	X	—	—	—	—	—	—
22. <i>B. ixtatan</i>	m	3	1.20	1.26	1.24	0.02	0.03	2.60
	f	4	1.07	1.21	1.14	0.03	0.06	5.21

"X" = sex not available for measurement.

TABLE 4. VARIATION IN TOTAL DEPTH (TD in mm) WITHIN AND AMONG *Bembidion* SPECIES OF CENTRAL AMERICA.

	Sex	(n)	Minimum	Maximum	Mean	±SE	SD	CV
01. <i>B. purulha</i>	m	1	1.04	1.04	—	—	—	—
	f	1	1.12	1.12	—	—	—	—
02. <i>B. rogersi</i>	m	135	0.81	1.19	0.95	0.01	0.08	8.49
	f	88	0.74	1.16	0.96	0.01	0.09	9.02
03. <i>B. mexicanum</i>	m	33	1.18	1.54	1.33	0.02	0.10	7.17
	f	29	1.15	1.47	1.31	0.01	0.08	6.14
04. <i>B. vernale</i>	m	182	0.86	1.40	1.10	0.01	0.01	8.63
	f	113	0.89	1.37	1.10	0.01	0.10	9.32
05. <i>B. satellites</i>	m	30	0.87	1.21	1.04	0.01	0.07	7.04
	f	26	0.88	1.21	1.03	0.02	0.09	8.26
06. <i>B. lavernae</i>	m	X	—	—	—	—	—	—
	f	1	0.83	0.83	—	—	—	—
07. <i>B. quetzal</i>	m	9	1.01	1.38	1.19	0.04	0.12	10.37
	f	18	0.94	1.39	1.16	0.03	0.11	9.50
08. <i>B. diabola</i>	m	31	0.76	1.15	0.96	0.02	0.10	9.88
	f	22	0.82	1.20	0.96	0.02	0.10	10.17
09. <i>B. vulcanium</i>	m	18	0.86	1.14	1.00	0.02	0.08	7.51
	f	15	0.78	1.09	0.96	0.02	0.09	8.90
10. <i>B. edwardsi</i>	m	X	—	—	—	—	—	—
	f	3	0.84	0.87	0.85	0.01	0.02	1.79
11. <i>B. aeger</i>	m	18	0.52	0.84	0.73	0.02	0.09	12.11
	f	16	0.65	0.88	0.76	0.02	0.07	9.18
12. <i>B. chiriqui</i>	m	34	0.80	1.05	0.90	0.01	0.06	7.00
	f	10	0.78	1.03	0.90	0.03	0.09	10.15
13. <i>B. nahuala</i>	m	19	0.60	0.95	0.72	0.02	0.10	13.97
	f	41	0.64	0.95	0.81	0.01	0.07	8.52
14. <i>B. franiae</i>	m	1	0.93	0.93	—	—	—	—
	f	1	0.85	0.85	—	—	—	—
15. <i>B. aratum</i>	m	2	0.92	0.94	0.93	0.01	0.01	1.52
	f	3	0.82	0.89	0.86	0.02	0.04	4.39
16. <i>B. cortes</i>	m	10	0.92	1.12	1.00	0.02	0.07	6.81
	f	22	0.84	1.13	1.00	0.02	0.07	7.36
17. <i>B. sparsum</i>	m	9	0.76	0.98	0.89	0.02	0.07	8.06
	f	8	0.89	1.02	0.95	0.02	0.05	4.88
18. <i>B. armuelles</i>	m	X	—	—	—	—	—	—
	f	1	1.08	1.08	—	—	—	—
19. <i>B. barreensis</i>	m	1	0.71	0.71	—	—	—	—
	f	X	—	—	—	—	—	—
20. <i>B. cyclodes</i>	m	X	—	—	—	—	—	—
	f	1	0.80	0.80	—	—	—	—
21. <i>B. championi</i>	m	X	—	—	—	—	—	—
	f	X	—	—	—	—	—	—
22. <i>B. ixtatan</i>	m	3	0.58	0.62	0.60	0.01	0.02	3.49
	f	4	0.48	0.60	0.55	0.03	0.05	9.52

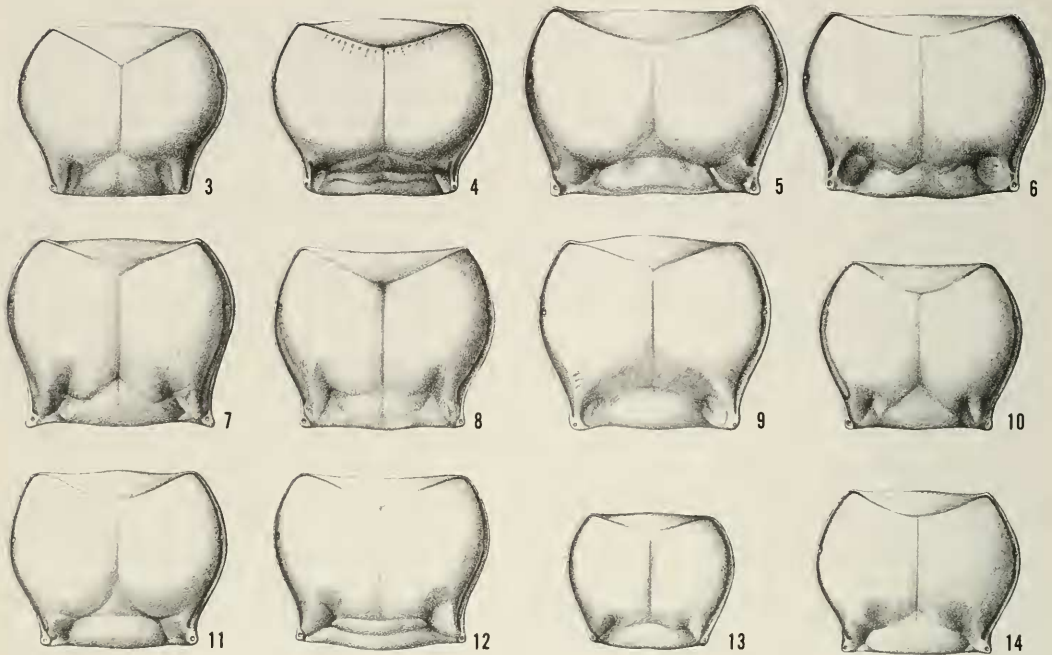
"X" = sex not available for measurement.

- with arcuate side margins, markedly convergent behind and abruptly sinuate just before hind angles .....  
 ..... 18. *B. armuelles*, new species
- Pronotum (Fig. 18) moderately convex, side margins not markedly arcuate nor much convergent behind, shallowly sinuate before hind angle .....  
 ..... 16. *B. cortes*, new species
- 12(8). Elytra with pale spots contrasting against dark background ..... 13
- Elytra concolorous ..... 14
- 13(12). Pronotum (Fig. 5) broad, wider than head across eyes; elytral pale spot extended to apex in most specimens; interneur punctures coarsely impressed and large; pronotum with fine and feeble carina at hind angle .....  
 ..... 3. *B. mexicanum* Dejean
- Pronotum (Fig. 9) narrow, about as wide as head across eyes; elytral pale spot isolated; interneur punctulae finely impressed, medium-sized; pronotum with well-developed carina delimiting deep basal fovea .....  
 ..... 7. *B. quetzal*, new species
- 14(12). Elytral interneurs coarsely punctate basally, absent behind middle, dorsal surface without microsculpture, shiny .....  
 ..... 1. *B. purulha*, new species
- Elytral interneurs finely punctate or not, extended to near apex; dorsal surface with or without microsculpture, if without, hind wings absent ..... 15
- 15(14). Pronotum (Fig. 6) with short, sharp, well-developed carina at hind angle; dorsal surface with metallic-blue cast; flight wings fully developed .....  
 ..... 4. *B. vernale* Bates
- Pronotum with rudimentary or no carina at hind angle; dorsal surface non-metallic brown or black; flight wings reduced or virtually absent ..... 16
- 16(15). Elytron with interneurs 7 and 8 virtually absent (a few minute punctulae present in some individuals); small beetles with narrow ovoid elytra and narrow pronotum .....  
 ..... 11. *B. aeger*, new species
- Elytron with all interneurs present, though finer laterally, all easily traceable beyond disc; larger beetles, with broadly ovoid elytra and broad pronotum ..... 17
- 17(16). Form short, broad, and subconvex; pronotum abruptly sinuate, sides straight for only a short distance, hind angles acute or square ..... 18
- Form long, narrow, and depressed; pronotum with lateral margins nearly straight in basal fifth, hind angles acute ..... 21
- 18(17). Metasternum with intercoxal process narrowly margined, bead well developed and of even width .....  
 ..... 8. *B. diabola*, new species
- Metasternum with intercoxal process broadly margined, bead widely removed from apex medially, narrowed laterally ..... 19
- 19(18). Eyes flattish, not produced much beyond outline of head capsule (range: Cerro Buenavista, Costa Rica) .....  
 ..... 10. *B. edwardsi* new species
- Eyes prominent, produced well beyond outline of head capsule ..... 20
- 20(19). Range: central cordillera of Costa Rica; male aedeagus as in Figure 30 .....  
 ..... 9. *B. vulcanium* Darlington
- Range: Volcán de Chiriquí, Panama; male aedeagus as in Figure 33 .....  
 ..... 12. *B. chiriqui*, new species
- 21(17). Elytron with interneurs markedly striatopunctulate, intervals subconvex ..... 5. *B. satellites* Bates
- Elytron with interneurs shallowly striatopunctulate, intervals flat .....  
 ..... 6. *B. lavernae*, new species

#### The *semistriatum* group

(Subgenus *Hydromicrus* Casey, 1918:87. Type-species *Bembidium semistriatum* Haldeman, 1843:303, by subsequent designation of Lindroth 1963:305.)

DIAGNOSTIC COMBINATION.—Metasternal process completely bordered; elytral interneurs effaced in apical half, markedly punctulate in basal half; microsculpture absent; male genital sclerites as in or similar to Figure 23.



FIGURES 3 TO 14. Pronotum, dorsal aspect. 3. *Bembidion purulha* n.sp., 66.4 km south of Cobán, Alta Verapaz, Guatemala, male. 4. *B. rogersi* Bates, 7.5 km south of Ojo de Agua, Cartago, Costa Rica, male. 5. *B. mexicanum* Dejean, 22.0 km west of San Pedro Sacatepéquez at Río Nahuala, male. 6. *B. vernale* Bates, San Isidro de Coronado, San José, Costa Rica, male. 7. *B. satellites* Bates, Chomogo area, 10°18'N, 084°47'W, Alajuela, Costa Rica, male. 8. *B. lavernae* n.sp., Cerro Buenavista, San José, Costa Rica, female. 9. *B. quetzal* n.sp., 20.0 km west of San Pedro Sacatepéquez at Río Nahuala, male. 10. *B. diabolus* n.sp., Volcán Irazú, Cartago, Costa Rica, male. 11. *B. vulcanium* Darlington, 7.5 km south of Ojo de Agua, Cartago, Costa Rica, male. 12. *B. edwardsi* n.sp., Cerro Buenavista, San José, Costa Rica, male. 13. *B. aeger* n.sp., Cerro Buenavista, San José, Costa Rica, male. 14. *B. chiriqui* n.sp., 8.0 km west of Boquete, Chiriquí, Panama, male.

These beetles are hygrophilous, occurring along streams in fine gravel and sand, or in *Sphagnum* bogs. Previously, this group of five species was known from only North America; the Central American one described below extends the group's range considerably. All species are fully winged and occur in the lowland or adjacent low hills. The male median lobe of the species covered herein lacks the pigmented ostium flag characteristic of Central American *Bembidion* (*Peryphus*) species, yet the endophallus strongly suggests relationship with this group.

### 1. *Bembidion purulha*, new species

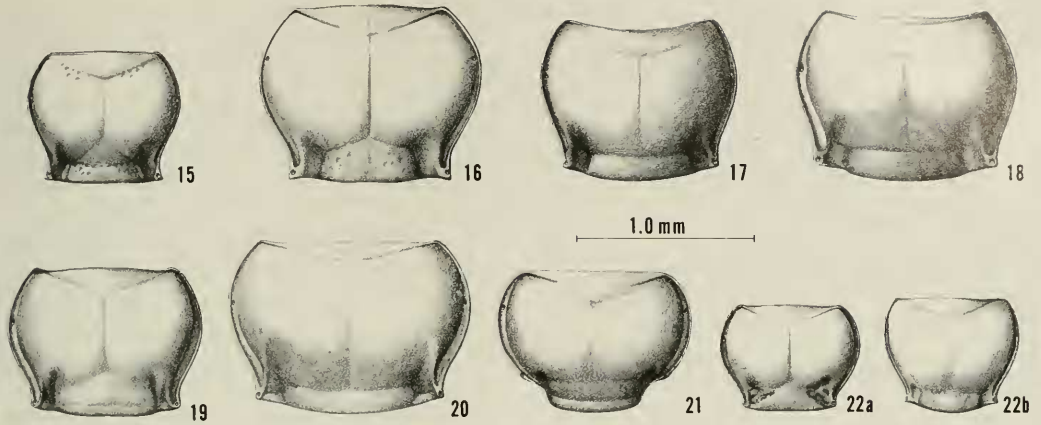
(Figures 3, 23, 64)

DIAGNOSTIC COMBINATION.—Interneurs with large, coarse, sparse punctulae; pronotum markedly constricted with small basal punctiform fovea; dorsal surface without microsculpture; male median lobe without pigmented ostium

flags. *Color and luster*: piceous; appendages testaceous; venter and dorsum of forebody rufopiceous; surface very shiny. *Form*: medium-sized for genus with narrow forebody and broad elytra; pronotum (Fig. 3) slightly wider than head or elytron; eyes large and prominent. *Structure*: frontal furrows deeply sulcate and arcuate between eyes, shallower where prolonged on clypeus. Hind angles of pronotum finely and abruptly carinate, carinae very short; basal fovea deep, extended to lateral margin. Interneurs effaced apically; except first which is striate in apical third, otherwise coarsely punctulate, punctures deep and large, separated by their own diameter or more. Dorsal microsculpture absent. Male median lobe as in Figure 23. *Size*: see Tables 2, 3, and 4.

GEOGRAPHICAL DISTRIBUTION.—Figure 64. Known only from the Sierra de las Minas in east-central Guatemala. I have seen specimens from localities listed in Table 5.





FIGURES 15 to 22. Pronotum, dorsal aspect. 15. *Bembidion nahuala* n.sp., 27.0 km northwest of San Marcos, San Marcos, Guatemala, male. 16. *B. franiae* n.sp., 4.8 km east of San Mateo Ixtatán, Huehuetenango, Guatemala, male. 17. *B. aratum* LeConte, La Lima, Cortés, Honduras, male. 18. *B. cortés* n.sp., La Lima, Cortés, Honduras, male. 19. *B. sparsum* Bates, Tikal, Del Petén, Guatemala, male. 20. *B. armuelles*, n.sp., Puerte Armuelles, Chiriquí, Panama, female. 21. *B. championi* Bates, 8.6 miles [13.8 km] east of San Cristóbal, Chiapas, Mexico, female. 22a. *B. ixtatán* n.sp., 27.0 miles [43.5 km] west of Sololá, Sololá, Guatemala, male. 22b. *B. barrensis* n.sp., Barro Colorado Island, Panama, male.

**NATURAL HISTORY NOTES.**—These beetles were collected in May and August at elevations of 1372 m and 1420 m in Lower Montane Wet and Subtropical Wet forests, respectively; neither is teneral. The holotype was collected from oak leaf litter near a stream; the paratype was collected by splashing fine silty gravel at the edge of a small brook in pine-oak forest. Both specimens are fully winged.

**TYPE-MATERIAL.**—**Holotype** ♀, GUATEMALA, Baja Verapaz, 22.0 km S of Purulha, 15°07'N, 090°12'W, Aug. (*Ball, Frania, & Whitehead*) (USNM), ADP 026375. **Paratype:** 1♂, GUATEMALA, Alta Verapaz, 66.4 km S Cobán, 15°12'N, 090°18'W, May (*Erwin & Erwin*) (USNM), ADP 013626. See also Table 5.

**DERIVATION OF TAXON NAME.**—Spanish, *Purulha*, after the town near which the holotype was collected.

#### The *rogersi* group

**DIAGNOSTIC COMBINATION.**—Metasternal process without border; elytral interval 3 bifoveate, fovea broad and depressed; male median lobe with broad lobe on ventral face.

These beetles are independent of running or standing water and occur in Subparamo grasslands of volcanic highlands. Two Colombian species belong to this group: *B. subapterum* Darlington and *B. sanctaemarthae* Darlington. The three species are either wing-dimorphic or

brachypterous and form a group closely related to the *vernale* group. The *vernale* group is northern and islandic in distribution while the *rogersi* group is southern; *B. rogersi* is the northernmost representative of the group.

#### 2. *Bembidion rogersi* Bates

(Figures 2, 4, 24, 40, 64)

*Bembidium rogersi* BATES, 1878:602. [Lectotype ♂, COSTA RICA, Volcán de Irazú, 09°58'N, 083°53'W (BMNH), here designated.]

**DIAGNOSTIC COMBINATION.**—Interneur 3 catenate, constrictions at large unisetose foveae; color black. *Color and luster:* black; appendages and venter piceous; surface of elytron dull, forebody shiny. *Form:* medium-sized for genus with narrow forebody and elytra; elytra either with square humeri or sloped; pronotum (Fig. 4)

TABLE 5. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 01. *Bembidion purulha* n.sp.; map Figure 64.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
15°07'N 90°12'W	1420	USNM	Aug	1
15°12'N 90°18'W	1372	USNM	May	1
Total specimens examined:				2

TABLE 6. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 02. *Bembidion rogersi* n.sp.; map Figure 64.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
10°11'N 84°13'W	2600	USNM	Mar	1
09°59'N 83°53'W	3000-3030	USNM	?	1
09°58'N 83°53'W	3364	UASM	Aug	6
09°58'N 83°53'W	3440	MCZ	Jan	2
09°58'N 83°53'W	3350	USNM	May	9
09°55'N 84°02'W	1400-1500	USNM	Feb	2
09°54'N 83°41'W	0640	USNM	May	1
09°54'N 83°41'W	0640	MCZ	Jun, Jul	3
09°35'N 83°48'W	2682	USNM	Jun	182
09°33'N 83°44'W	2700	UAIC	Jul	1
09°32'N 83°46'W	?	MCZ	Dec	2
09°32'N 83°46'W	?	UAIC	Mar	1
08°51'N 82°33'W	2240	USNM	Jun	4
08°51'N 82°34'W	2134	UAIC	May	1
08°51'N 82°34'W	2134-2438	UAIC	May	5
08°51'N 82°36'W	1848-2464	USNM	May	5
08°47'N 83°30'W	2220	USNM	Jun	1
Total specimens examined:				227

wider than head, about equal in width to elytron; eyes moderately large and prominent. *Structure*: frontal furrows moderately well impressed, diffuse, rugose, parallel, prolonged on clypeus; anterior supraorbital pore well impressed. Hind angles of pronotum markedly carinate; basal fovea deep, rather small, extended to base; side slightly sinuate. Elytron (Figs. 2a, b) either long, humerus squared, sides slightly arcuate, or short, humerus rounded/sloped, sides markedly arcuate; interneurs entire, much shallower apicolaterally and striate; interneurs 2 and 3 ctenate at Ed3a and Ed5b. Dorsal microsculpture (Fig. 40) of rather large, coarse, transverse

meshes, effaced from center of pronotum. Male median lobe as in Figure 24. *Size*: see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 64: known from the Cordillera Central of Costa Rica from Volcán Irazú, Volcán Poás, and in the area of Turrialba, south along the Cordillera de Talamanca to Volcán de Chiriquí in Panama.

**NATURAL HISTORY NOTES.**—These beetles are commonly collected above 1600 m in life zones from Lower Montane Wet Forest up and into Subparamo. They occur as high as 3350 m; are found independent of running water; and have been collected in January, February, March, May through August, and December. Very teneral beetles were found in late May on Volcán de Chiriquí, indicating that larvae and pupae may be found just prior to that time, that is, in the early rainy season. Great numbers of specimens were collected at night on fine-textured wet soil among bunch grass at the edge of dwarf Montane Rain Forest on Cerro de la Muerte, Costa Rica (2682 m), and among flood debris and under stones during the day near Cerro Punta, Chiriquí, Panama. Individuals of this species may be long-winged and presumably fly, or brachypterous, having only a small veinless pad in place of the flight wing. Table 1 illustrates the distribution of these character states at several localities.

**MATERIAL EXAMINED.**—Lectotype (see above) and 227 specimens (Table 6).

#### The *vernale* group

(Subgenus *Peryphus* Stephens, 1828:2. [Type-species *Carabus litorale* auct. = *Bembidium tetracolum* Say, 1823:89, by subsequent designation of Westwood 1840:7.]

**DIAGNOSTIC COMBINATION.**—Metasternal process completely bordered; elytron with discal setae contiguous with or in interneur 3; parameres trisetose or bisetose; endophallus as in Figures 25 to 33; elytral microsculpture of transverse lines or meshes, effaced from head and pronotum; interneurs shallow or effaced laterally and apically.

A study of the life histories of these beetles would add much to test the theory of taxon pulses (Erwin 1979, 1981a). It is readily apparent that the group is plesiotypically hygrophilous. With development of aptery and movement to montane habitats, there is a corresponding shift away from water into forest-floor litter or open

dry spots in the forest or above treeline, thus the species become mesophilous alticoles. In Central America, this shift was accomplished by three separate lineages of the *vernale* group. The plesiotypic parent stock was probably a middle altitude riparian species which radiated and is now represented by four widespread species at middle altitudes one of which is wing-dimorphic and six brachypterous alticoles.

As suggested by Lindroth (1963:312), a worldwide revision of this group would be desirable. Only then will we know the subgroup relationships, and these can be recognized only by the structure of the endophallus in combination with other characters. The median lobe of all species in this group has one or two ostium flags extending from near the apical orifice to the median area on the left surface. In addition, three Central American forms have a nonsclerotized patch ventrally on the median lobe. These apotypic features should assist in discovering relationships in revisions with wider geographic coverage (e.g., Erwin and Kavanaugh 1981).

Widespread species exhibit considerable variation in pronotal shape and elytral coloration. *Bembidion mexicanum* and *B. vernale* exemplify this in part in regard to pronotal variation, and the former is paler in the north, darker in the south.

### 3. *Bembidion mexicanum* Dejean

(Figures 5, 25, 41, 65)

*Bembidium mexicanum* DEJEAN, 1831:126. [Lectotype ♂, MEXICO (MNHP) selected and so labelled by G. E. Ball.]  
*Bembidium sallaei* BATES, 1882:148. [Lectotype ♂, MEXICO (MNHP) selected and so labelled by G. E. Ball.]

DIAGNOSTIC COMBINATION.—Pronotum (Fig. 5) broad, wider than head across eyes; elytral pale spot extended to apex in most specimens; interneur punctures coarsely impressed and large; pronotum with fine and feeble carina at hind angle. *Color and luster*: dorsum piceous; appendages and at least part of elytron testaceous; venter piceous anteriorly, abdomen rufous posteriorly; surfaces shiny, elytron slightly iridescent. *Form*: large beetles with broad head and pronotum, and broad elytra; pronotum (Fig. 5) wider than head, about equal to width of elytron; eyes large and prominent. *Structure*: frontal furrows well impressed, bowed medially around frontal callus, prolonged on clypeus, generally parallel. Hind angle of pronotum finely

carinate, carina curved posteriolaterally; basal fovea well impressed, narrowed anteriorly. Interneurs effaced apicolaterally, 7 virtually absent, 1 to 3 striatopunctulate, 4 to 6 punctulate. Dorsal microsculpture of extremely fine and dense transverse lines on elytron (Fig. 41), effaced from head and pronotum. Male median lobe as in Figure 25. *Size*: see Tables 2, 3, and 4.

GEOGRAPHICAL DISTRIBUTION.—Figure 65. At present, this species is known from Colorado south to middle Costa Rica.

NATURAL HISTORY NOTES.—These beetles are commonly found at middle elevations in Lower Montane Wet, Premontane Moist, Tropical Dry, and Subtropical Dry forests in the pine zone between 1300 m and 2400 m. Specimens were collected in March, May, June, and August; a teneral specimen from Guatemala collected in May indicates that larvae and pupae may be found just prior to that time, that is, in the early rainy season. They are found at the edge of small to medium-sized streams in gravel and under stones where there is some silt and at least some sparse vegetation. All known specimens are fully winged; P. J. Spangler collected two individuals at UV light traps near Guatemala City indicating that the beetles fly.

MATERIAL EXAMINED.—Lectotypes (see above) and 62 specimens (Table 7).

TAXONOMIC NOTES.—Bates's *B. sallaei* is a color variety of the widespread and variable *B. mexicanum*, and was recognized as such by Bates (1882:148).

### 4. *Bembidion vernale* Bates

(Figures 1, 6, 26, 42, 66)

*Bembidium vernale* BATES, 1882:149. [Lectotype ♂, PANAMA, Peña Blanca, 08°27'N, 081°41'W (BMNH), here designated.]

DIAGNOSTIC COMBINATION.—Elytra blue, nonspotted; length more than 4.2 mm. *Color and luster*: dorsum submetallic blue; penultimate palpomeres and antennomeres 2 to 11 infuscated, otherwise appendages testaceous; venter piceous; surface shiny. *Form*: large-sized beetles for genus with narrow forebody and slightly broad elytra. Pronotum (Fig. 6) slightly wider than head, about equal to width of elytron; eyes large and prominent. *Structure*: frontal furrows well impressed, rugose, slightly convergent anteriorly, extended on clypeus. Hind angle of





FIGURES 23 to 39. Median lobe of male genitalia, left lateral aspect. 23. *Bembidion purulha* n.sp., 66.4 km south of Cobán, Alta Verapaz, Guatemala. 24. *B. rogersi* Bates, 7.5 km south of Ojo de Agua, Cartago, Costa Rica. 25. *B. mexicanum* Dejean, 22.0 km west of San Pedro Sacatepéquez at Río Nahuala. 26. *B. vernale* Bates, San Isidro de Coronado, San José, Costa Rica. 27. *B. satellites* Bates, Chomogo area, 10°18'N, 084°47'W, Alajuela, Costa Rica. 28. *B. quetzal* n.sp., 25.0 km south of Totonicapán, Huehuetenango, Guatemala. 29. *B. diabola* n.sp., Volcán Irazú, Cartago, Costa Rica. 30. *B. vulcanium* Darlington, 7.5 km south of Ojo de Agua, Cartago, Costa Rica. 31. *B. edwardsi* n.sp., Cerro Buenavista, San José, Costa Rica. 32. *B. aeger* n.sp., Cerro Buenavista, San José, Costa Rica. 33. *B. chiriquí* n.sp., 8.0 km west Boquete, Chiriquí, Panama. 34. *B. nahuala* n.sp., 27.0 km northwest of San Marcos, San Marcos, Guatemala. 35. *B. franiae* n.sp., 4.8 km east of San Mateo Ixtatán, Huehuetenango, Guatemala. 36. *B. aratum* LeConte, La Lima, Cortés, Honduras. 37. *B. cortés* n.sp., La Lima, Cortés, Honduras. 38. *B. sparsum* Bates, Tikal, Del Petén, Guatemala. 39a. *B. ixtatan* n.sp., 27.0 miles [43.5 km] west of Sololá, Sololá, Guatemala. 39b. *B. barrensis* n.sp., Barro Colorado Island, Panama.



pronotum markedly carinate; basal fovea large and deep. Interneurs entire, shallow laterally and apically, punctulate throughout length. Dorsal microsculpture of extremely fine and dense transverse lines or meshes (more on female than male) on elytron (Fig. 42), effaced from head and pronotum. Male median lobe as in Figure 26. *Size*: see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 66; the range of this species extends in the north from at least Guatemala, south to western Panama; no specimens from Mexico were examined.

**NATURAL HISTORY NOTES.**—These beetles are found in large numbers at middle altitudes along rivers with stony and gravelly banks where there is little or no vegetation. Altitudinal range extends from 1700 m to 2600 m in Pre-montane Wet, Lower Montane Moist, Lower Montane Wet, and Montane Wet forests. Specimens were collected in April, May, and June; teneral ones collected in May indicate that larvae and pupae may be found just prior to that time, that is, in the early rainy season. Individuals occur at the edge of the water, hiding under stones during the day. All individuals studied were fully winged and numerous collection records indicate capture at UV lights; these beetles are probably good fliers.

**MATERIAL EXAMINED.**—Lectotype (see above) and 295 specimens (Table 8).

**TAXONOMIC NOTES.**—Bates, in his original description, gave as type-locality of this species, "Mexico (Sallé)," however, he specifically mentioned later (Bates 1884:291) that additional material from Peña Blanca, Panama, was identifiable as *B. vernale*. The type-specimen from the Sallé collection is apparently lost, therefore, I selected one of the Peña Blanca specimens as lectotype, thereby restricting the type-locality.

##### 5. *Bembidion satellites* Bates

(Figures 7, 27, 43, 67)

*Bembidium satellites* BATES, 1884:291. [Lectotype ♀, PANAMA, Peña Blanca, 08°27'N, 081°41'W (BMNH), here designated.]

**DIAGNOSTIC COMBINATION.**—Form long, narrow, and depressed; pronotum with lateral margins nearly straight in basal fifth, hind angles acute. Elytron with interneurs markedly striatopunctulate, intervals subconvex. Dorsal sur-

TABLE 7. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 03. *Bembidion mexicanum* Dejean; map Figure 65.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
15°20'N 91°26'W	ca. 1900	USNM	Jun	5
15°12'N 90°18'W	1372	USNM	May	20
15°07'N 91°32'W	ca. 2000	USNM	Jun	2
15°02'N 90°27'W	1400	USNM	Jun	1
14°58'N 91°46'W	2200	USNM	May	24
14°49'N 91°02'W	2370	USNM	Aug	1
14°37'N 90°30'W	1479	MCZ, UAIC	?	3
14°37'N 90°30'W	1479	USNM	?	1
14°37'N 90°30'W	1525	USNM	?	1
14°33'N 90°35'W	ca. 1300	USNM	Aug	2
09°55'N 84°02'W	1000–1200	USNM	Feb–Mar	1
09°55'N 84°02'W	1000–1200	USNM	Jun	1
Total specimens examined:				62

face without metallic-blue cast. *Color and luster*: dorsum flavous; antennomeres 3 to 11 infuscated, otherwise appendages testaceous; venter piceous; surface shiny, elytra slightly iridescent. *Form*: medium-sized beetles with narrow forebody and very narrow, depressed elytra; pronotum (Fig. 7) convex, slightly wider than head and elytron; eyes large and prominent. *Structure*: frontal furrows well impressed, arcuate medially, extended on clypeus. Hind angle of pronotum markedly carinate; basal fovea large and deep. Interneurs effaced apicolaterally, or nearly so; interneur 7 with small number of widely spaced minute punctulae, 1 to 6 striatopunctulate. Dorsal microsculpture of extremely fine and dense transverse lines or meshes on elytron (Fig. 43), effaced from head and pronotum. Male median lobe as in Figure 27. *Size*: see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 67; the range of this species extends from Monte-

TABLE 8. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 04. *Bembidion vernalis* Bates; map Figure 66.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
15°15'N 91°27'W	2560	USNM	Aug	1
10°15'N 83°28'W	0010	USNM	Jun	1
09°59'N 84°00'W	1524	UASM	Jun	13
08°51'N 82°36'W	2240	USNM	Jun	4
08°51'N 82°36'W	1848-2464	USNM	May	112
08°51'N 82°36'W	1720	UASM	May	14
08°51'N 82°36'W	1720	HPST	Apr, May	9
08°51'N 82°36'W	1700	USNM	Jun	35
08°51'N 82°34'W	2134-2438	UAIC	May	5
08°51'N 82°34'W	2134-2438	UAIC	May	13
08°51'N 82°34'W	2134-2438	USNM	May	12
08°47'N 82°26'W	1848	UAIC	Jun	5
08°47'N 82°26'W	1848	USNM	Jun	69
08°47'N 82°26'W	1100	USNM	Jun	1
08°46'N 82°38'W	1360	HPST	May	1
Total specimens examined: 295				

TABLE 9. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 05. *Bembidion satellites* Bates; map Figure 67.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
10°18'N 84°48'W	1300-1600	USNM	Mar	4
10°18'N 84°47'W	1620	USNM	Jun	7
08°51'N 82°35'W	1848-2464	USNM	May	32
08°51'N 82°35'W	1848-2464	USNM	May	5
08°51'N 82°34'W	2134-2438	UAIC	May	6
08°51'N 82°34'W	2134-2438	USNM	May	2
Total specimens examined: 56				

membrane. Within populations the length of the wing membrane varied from a small veined pad to a longer veined membrane one-third the length of the elytron, to a fully developed wing with reflexed apex. Such variation was noted from both Monteverde, Costa Rica, and Chiriquí, Panama.

MATERIAL EXAMINED.—Lectotype (see above) and 56 specimens (Table 9).

#### 6. *Bembidion lavernae*, new species (Figures 8, 67)

DIAGNOSTIC COMBINATION.—Elytral intervals flat; elytra elongate and spatulate; pronotum with lateral margins nearly straight in basal fifth, hind angles acute. *Color and luster*: rufo-piceous; head, prothorax, venter flavous, in part infuscated; appendages flavotestaceous, in part infuscated; surfaces shiny. *Form*: medium-sized for genus with head and prothorax robust; elytra long and spatulate, with markedly sloped humeri and markedly arcuate sides; pronotum (Fig. 8) markedly narrowed basally, slightly wider than head, much wider than elytron; eyes medium-sized, slightly prominent. *Structure*: frontal furrows well impressed, rugose, parallel, ended abruptly at frontoclypeal line; clypeus convex. Hind angle of pronotum noncarinate, square; fovea broad and deep; side margins straight in basal fifth. Interneurs 1 and 2 entire, striate, 3 to 6 abbreviated before apex, 7 and 8 effaced. Dorsal microsculpture of moderately transverse

verde, Costa Rica, south along the Cordillera de Talamanca to Volcán de Chiriquí, Panama.

NATURAL HISTORY NOTES.—These beetles are found at middle altitudes along slow, small streams with silty and gravelly banks where there is little or no vegetation. Altitudinal range extends from 1600 m to 2500 m in Premontane Rain and Lower Montane Wet forests. Specimens were collected in March, May, and June; teneral ones collected in May and mid-June at Chiriquí indicate that larvae and pupae may be found just prior to that time, that is, in the early rainy season. Individuals occur at the edge of the water, hiding among small stones during the day. Individuals studied were either fully winged or with some state of reduction of the wing

meshes. Male unknown. *Size*: see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 67; known only from the type-locality.

**NATURAL HISTORY NOTES.**—These beetles live microsympatrically with *B. edwardsi* on Cerro Buenavista at high elevation (3416 m) in the Subparamo plant association (Janzen 1973), Montane Rain Forest of Holdridge (1971). The type is brachypterous, as are no doubt the rest of the members of the species since humeral reduction is more marked than in any other species studied except *B. aeger*.

**TYPE-MATERIAL.**—**Holotype** ♀, COSTA RICA, San José Province, Cerro Buenavista, 09°33'N, 083°45'W, Mar. (*Edwards*) (USNM), ADP 055189.

**DERIVATION OF TAXON NAME.**—I take great pleasure in naming this species in honor of La Verne J. Magarian who trudged up many mountains in search of carabid beetles, and who designed the computerized system employed in this and my other carabid studies.

### 7. *Bembidion quetzal*, new species

(Figures 9, 28, 44, 67)

**DIAGNOSTIC COMBINATION.**—Pronotum narrow, about as wide as head across eyes; elytral pale spot preapical and isolated; interneur punctulae finely impressed, medium-sized; hind angle of pronotum with well-developed straight carina delimiting deep basal fovea; antennomeres 2 to 11 darkly infuscated. *Color and luster*: dorsum piceous; antennomeres 2 to 11, palpomeres, tibiae, and tarsomeres infuscated, otherwise testaceous; venter rufopiceous; surfaces shiny. *Form*: moderately large beetles with narrow head and pronotum and rather long, almost parallel-sided elytra; pronotum (Fig. 9) slightly wider than head, about equal to width of elytron; eyes large and prominent. *Structure*: frontal furrows well impressed, rugose, almost parallel, and extended on clypeus. Hind angle of pronotum markedly carinate; basal fovea large and deep. Interneurs effaced apicolaterally or nearly so; interneur 7 with small number of widely spaced, minute punctulae, 1 to 6 striatopunctulate, at least basally. Dorsal microsculpture of extremely fine and dense transverse lines or meshes on elytron (Fig. 44), effaced from head and pronotum. Male median lobe as in Figure 28. *Size*: see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 67; known only from west-central Guatemala.

**NATURAL HISTORY NOTES.**—These beetles are found commonly at middle altitudes along small rivers with stony and gravelly banks where there is little or no vegetation. Altitudinal range extends from 2200 m to 2900 m in Lower Montane Wet and Montane Moist forests. Specimens were collected in May and August, none were teneral. Individuals occur at the edge of water, hiding under stones during the day. All individuals studied were fully winged.

**TYPE-MATERIAL.**—**Holotype** ♂, GUATEMALA, Quezaltenango, 20.0 km w San Pedro Sacatepéquez at Río Nahuala and Hwy 1, 14°48'N, 091°46'W, May (*Erwin & Erwin*) (USNM), ADP 012345. **Paratypes**: 8♂, 18♀, same data as holotype or as listed in Table 10 and deposited as USNM-12, UASM-2, CAS-2, MCZ-2, AMNH-2, BMNH-2, MNHP-2, JNEG-2.

**DERIVATION OF TAXON NAME.**—Mayan, *Quetzal*, after the beautiful Guatemalan bird, *Pharomachrus mocinno*, with which these beetles share the forest.

### 8. *Bembidion diabola*, new species

(Figures 10, 29, 45, 68)

**DIAGNOSTIC COMBINATION.**—Form short, broad, and subconvex; eyes small and flattish; pronotum abruptly sinuate, sides straight for only a short distance, hind angle acute or square, carina feebly developed; metasternum with intercoxal process narrowly margined, bead well developed and of even width. *Color and luster*: dorsum rufopiceous; scape testaceous, otherwise appendages partially infuscated; venter rufopiceous; surfaces shiny. *Form*: small, rather robust beetles with large head, small eyes, markedly cordate pronotum, ovate elytra; pronotum (Fig. 10) much wider than head or elytron; eyes flattish. *Structure*: frontal furrows well impressed, slightly rugose, almost parallel, angularly prolonged on clypeus. Hind angle of pronotum with feebly developed carinae or no carinae; basal fovea large and deep; side margins abruptly and markedly sinuate. Interneurs entire, though much shallower apicolaterally, striatopunctulate, punctulae small and sparse. Dorsal microsculpture of large transverse meshes on elytra (Fig. 45), effaced from head and pronotum. Male median lobe as in Figure 29. *Size*: see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 68;

TABLE 10. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 07. *Bembidion quetzal* n.sp.; map Figure 68.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
15°07'N 91°32'W	ca. 2000	USNM	Jun	2
15°04'N 91°52'W	2800-2900	USNM	May	1
14°58'N 91°46'W	2200	USNM	May	23
14°49'N 91°02'W	2370	USNM	Aug	1
Total specimens examined:				27

TABLE 11. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 08. *Bembidion diabola* n.sp.; map Figure 68.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
09°58'N 83°53'W	3440	MCZ	Jan	3
09°58'N 83°53'W	3350	USNM	May	37
09°58'N 83°53'W	2850	UMAA	Feb	1
09°58'N 83°53'W	2850	UASM	Sep	3
09°58'N 83°53'W	2844	AMNH	Nov	1
? [Costa Rica]	?	UAIC	?	2
? [Costa Rica]	?	UMAA	Jul	6
Total specimens examined:				53

these beetles occur only in the Cordillera de la Talamanca, Costa Rica.

**NATURAL HISTORY NOTES.**—These beetles live microsympatrically with *B. vulcanium* on Volcán Irazú at high elevations in the Subparamo plant association (Janzen 1973), Montane Wet Forest of Holdridge (1971), between 2800 m and 3500 m. They were collected in January, May, September, and November; teneral specimens were found in all those months except November, indicating a nonseasonal life cycle. These beetles are found independent of water among bunch grasses on finely textured soil. All individuals studied have small nonveined pads in place of flight wings.

**TYPE-MATERIAL.**—**Holotype** ♂, COSTA RICA, Volcán Irazú, 09°58'N, 083°53'W, May (Cartwright), ADP 003062. **Paratypes:** 30♂, 22♀, same data as holotype or as listed in Table 11 and deposited as USNM-27, UASM-6, CAS-4, MCZ-3, AMNH-3, BMNH-2, MNHP-2, JNEG-2, UAIC-2, UMAA-1.

**DERIVATION OF TAXON NAME.**—Latin, *diabolus*, meaning the devil, whose lair lay in the caldera of Volcán Irazú near which these beetles live.

### 9. *Bembidion vulcanium* Darlington

(Figures 11, 30, 46, 68)

*Bembidion vulcanium* DARLINGTON, 1934:157. [Holotype ♂, COSTA RICA, Volcán Irazú, 09°58'N, 083°53'W, Jan. (Nevermann) (MCZ), ADP 003145.]

**DIAGNOSTIC COMBINATION.**—Eyes prominent, produced well beyond outline of head capsule; pronotum robust, very broad; elytral microsculpture shallowly engraved, surface very shiny. *Color and luster:* dorsum rufopiceous or piceous; scape and femora testaceous, other-

wise appendages infuscated; venter rufopiceous or piceous; surfaces shiny. *Form:* moderately small beetles with broad head and markedly broad pronotum, elytra ovoid; pronotum (Fig. 11) much wider than head or elytron, markedly convex and cordiform; eyes large and prominent. *Structure:* frontal furrows moderately well impressed, broad, parallel, extended on clypeus. Hind angle of pronotum feebly carinate, carinae not extended to base; basal fovea deep, extended to side margin; side margins abruptly and markedly sinuate. Interneurons entire, though much shallower laterally and apically, almost effaced in some individuals, striatopunctulate medially, punctulate laterally, punctulae rather large and coarse on disc, widely separated. Dorsal microsculpture of shallowly engraved transverse meshes on elytra (Fig. 46), effaced from head and pronotum. Male median lobe as in Figure 30. *Size:* see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 68; known only from the three high volcanos of Costa Rica: Poás, Irazú, and Cerro de la Muerte.

**NATURAL HISTORY NOTES.**—These beetles live microsympatrically with *B. diabola* on Volcán Irazú and at high elevations in the Subparamo plant association (Janzen 1973), Montane Rain and Montane Wet forests of Holdridge (1971), between 2600 m and 3400 m on other Costa Rican volcanos. They were collected in January, February, March, June, July, and Au-



gust; teneral specimens were not found. These beetles are found independent of water among bunch grasses on finely textured soil under stones and pieces of wood. All individuals studied have small nonveined pads in place of flight wings.

**MATERIAL EXAMINED.**—Holotype (see above) and 32 specimens (Table 12).

#### 10. *Bembidion edwardsi*, new species

(Figures 12, 31, 68)

**DIAGNOSTIC COMBINATION.**—Eyes small and nearly flat; metasternal process broadly margined; elytra very short and narrow in proportion to head and pronotum. *Color and luster:* dorsum of elytron rufopiceous, forebody piceous; antennomeres 1, 2, and base of 3, legs, and base of palpomeres testaceous; venter piceous; surface shiny. *Form:* medium-sized for genus with large robust forebody, small elytra; pronotum (Fig. 12) broader than head, much broader than elytron; eyes small, flattish. *Structure:* frontal furrows well impressed, rugose, markedly delimited laterally by convex carina; anterior supraorbital seta in deep fovea. Hind angle of pronotum without carina, slightly obtuse; basal fovea and base markedly rugose; side margins markedly sinuate at basal third. Elytron short, with slightly sloped humerus, and arcuate side margin. Interneurons 1 and 2 entire, 3 to 8 abbreviated before apex, shallower laterally, all striatopunctulate. Dorsal microsculpture of elytron transverse, not regularly formed of meshes, effaced from head and pronotum. Male median lobe as in Figure 31. *Size:* see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 68; known only from the type-locality.

**NATURAL HISTORY NOTES.**—These beetles live microsympatrically with *B. lavernae* on Cerro Buenavista at 3416 m elevation in the Sub-ramo plant association (Janzen 1973). They were collected in March. These beetles are found independent of water among bunch grasses on finely textured soil under stones. All individuals studied have small nonveined pads in place of flight wings.

**TYPE-MATERIAL.**—Holotype ♂, COSTA RICA, San José Province, Cerro Buenavista, 09°33'N, 083°45'W, Mar. (*Edwards*) (USNM), ADP 055177. Paratypes: 2♀, same data as holotype and deposited as CAS-1, USNM-1.

**DERIVATION OF TAXON NAME.**—I take great

TABLE 12. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 09. *Bembidion vulcanium* Darlington; map Figure 68.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
10°11'N 84°13'W	2400	UASM	Aug	7
09°58'N 83°53'W	2200	USNM	Jan–Feb	1
09°58'N 83°53'W	2800–3000	USNM	Jan	7
09°58'N 83°53'W	2800–3000	MCZ	Jan	4
09°35'N 83°48'W	2682	USNM	Jun	1
09°33'N 83°44'W	2700	USNM	Jul	3
09°33'N 83°42'W	2900–3000	GRNO	Aug	1
09°32'N 83°46'W	?	UAIC	Mar	3
09°32'N 83°46'W	3203	USNM	Mar	1
09°32'N 83°46'W	3355	USNM	Jun	5
Total specimens examined:				33

pleasure in naming this species in honor of J. Gordon Edwards, who first showed me a ground beetle and who collected the type-series.

#### 11. *Bembidion aeger*, new species

(Figures 13, 32, 47, 69)

**DIAGNOSTIC COMBINATION.**—Pronotum with rudimentary or no carina at hind angle; dorsal surface nonmetallic brown or black; flight wings reduced or virtually absent; elytron with interneurons 7 and 8 virtually absent (a few minute punctulae present in some individuals); small beetles with narrow ovoid elytra and narrow pronotum. *Color and luster:* dorsum piceous; scape and legs testaceous or slightly infuscated, other appendages darkly infuscated; venter piceous. *Form:* small, rather cylindrical beetles with broad forebody in proportion to elytra; pronotum (Fig. 13) slightly wider than head or elytron; eyes small and slightly prominent. *Structure:* frontal furrows shallow, slightly convergent, extended on clypeus. Hind angle of pronotum noncarinate; basal fovea small, shallow; side margins shallowly sinuate. Interneurons effaced apicolaterally and laterally, striatopunc-

TABLE 13. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 11. *Bembidion aeger* n.sp.; map Figure 69.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
09°35'N 83°45'W	3335	GRNO	Jan	10
09°33'N 83°45'W	3416	USNM	Mar	24
09°32'N 83°46'W	3141	USNM	Mar	1
09°32'N 83°46'W	3203	USNM	Mar	6
09°32'N 83°46'W	3355	USNM	Jun	2
09°32'N 83°46'W	?	UAIC	Mar	1
Total specimens examined:				44

tulate, punctulae small and sparse. Dorsal microsculpture of shallowly engraved transverse meshes, nearly effaced from elytra (Fig. 47), effaced from head and pronotum. Male median lobe as in Figure 32. *Size*: see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 69; known only from the upper slopes of Cerro de la Muerte and adjacent ridges.

**NATURAL HISTORY NOTES.**—These beetles live microsympatrically with *B. vulcanium*, *B. lavernae*, and *B. edwardsi*, on Cerro de la Muerte and its adjacent ridges at high elevations in the Subparamo plant association (Janzen 1973), Montane Rain Forest of Holdridge (1971), between 3200 m and 3400 m. They were collected in January, March, and June; teneral specimens were not found. All individuals studied have small nonveined pads in place of flight wings.

**TYPE-MATERIAL.**—**Holotype** ♂, COSTA RICA, Cartago, Cerro de la Muerte, 09°32'N, 083°46'W, June (*Erwin & Erwin*) (UASM), ADP 017224. **Paratypes**: 25♂, 18♀, same data as holotype or as listed in Table 13 and deposited as USNM-22, UASM-2, CAS-2, MCZ-2, AMNH-2, BMNH-2, MNHP-2, JNEG-2, UAIC-1, GRNO-6.

**DERIVATION OF TAXON NAME.**—Latin, *aeger*, meaning sick or troubled, in reference to the small slight form of these beetles.

## 12. *Bembidion chiriqui*, new species

(Figures 14, 33, 48, 69)

**DIAGNOSTIC COMBINATION.**—Eyes prominent, produced well beyond outline of head cap-

sule; form short and subconvex; elytron with all interneurs present, though finer laterally, all easily traceable beyond disc, broadly ovoid; pronotum broad, with abruptly sinuate side margins, sides straight for only a short distance, hind angle acute; metasternum with intercoxal process broadly margined, bead widely removed from apex. *Color and luster*: dorsum piceous, nearly black; scape and legs testaceous, otherwise appendages infuscated; venter piceous; surfaces shiny. *Form*: moderately small beetles with moderately broad head and pronotum; elytra with arcuate sides; pronotum (Fig. 14) slightly wider than head and about equal to width of elytron, markedly convex and cordiform, base prolonged apically with sides straight before acute hind angle; eyes large and prominent. *Structure*: frontal furrows moderately well impressed, slightly convergent on clypeus. Hind angle of pronotum moderately carinate, carina not extended to base; basal fovea deep, extended to side margin. Interneurs entire, impressed laterally, striatopunctulate, punctulae small, shallowly impressed, widely spaced. Dorsal microsculpture of elytron (Fig. 48) of moderately impressed, dense, transverse lines, on head of shallowly engraved slightly transverse meshes, effaced from pronotum. Male median lobe as in Figure 33. *Size*: see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 69; known only from the type-locality.

**NATURAL HISTORY NOTES.**—These beetles were found commonly at 2220 m altitude in Lower Montane Wet Forest where there was sparse ground vegetation. Specimens were collected in June; teneral specimens were not found. These beetles are found independent of water in oak forest on finely textured soil under leaf litter. All individuals studied have small nonveined pads in place of flight wings.

**TYPE-MATERIAL.**—**Holotype** ♂, PANAMA, Chiriquí, 8.0 km w Boquete, near Quebrada Emporio, 08°47'N, 082°30'W, June (*Erwin & Erwin*) (USNM), ADP 017618. **Paratypes**: 33♂, 10♀, same data as holotype and deposited as USNM-29, UASM-2, CAS-2, MCZ-2, AMNH-2, BMNH-2, MNHP-2, JNEG-2.

**DERIVATION OF TAXON NAME.**—Spanish, *Chiriquí*, after the Volcán de Chiriquí on which these beetles live.

### The *nahuala* group

**DIAGNOSTIC COMBINATION.**—Metasternal process without border; elytral interval 3 non-

foveate; male median lobe without ostium flags; dorsal microsculpture absent.

These beetles are independent of running or standing water and occur in Subparamo grasslands of volcanic highlands. The single species included in this group and the one in the *franiae* group are externally quite dissimilar, although both are similar to diverse members of the subgenus *Peryphus* or *vernale* group discussed above. However, males of both *nahuala* and *franiae* have very similar genitalia. Further study of these forms and other related ones from outside the geographic area of this coverage will need to be undertaken to resolve their relationships.

### 13. *Bembidion nahuala*, new species

(Figures 15, 34, 49, 70)

**DIAGNOSTIC COMBINATION.**—Metasternal process unmarginated; dorsal microsculpture effaced; pronotum small. *Color and luster:* dorsum piceous; tibiae, tarsomeres, and antennomeres 1 to 3 testaceous, otherwise appendages infuscated; venter piceous; surfaces shiny. *Form:* small beetles with narrow, small head and pronotum, and broad elytra; pronotum (Fig. 15) about equal to head in width, both slightly narrower than elytron; elytron either long with squared humerus and slightly arcuate sides, or short with rounded humerus and markedly arcuate sides; eyes large and prominent. *Structure:* frontal furrows well impressed, rugose, parallel, prolonged on clypeus. Hind angle of pronotum acute, markedly carinate; basal fovea large, deep, extended to basal margin; lateral margin evenly sinuate. Interneurs nearly effaced laterally, represented by minute punctulae, effaced apically, discally finely striatopunctulate. Dorsal microsculpture absent (Fig. 49). Male median lobe as in Figure 34. *Size:* see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 70; known only from the Guatemalan highlands.

**NATURAL HISTORY NOTES.**—These beetles are independent of running or standing water and occur in Subparamo grasslands of volcanic highlands in Lower Montane Wet Forest between 2100 m and 3100 m. Specimens were collected in May, June, and August; teneral specimens were not found. At the type-locality these beetles were found among bunch grass where there was little remaining forest due to activities of man. Specimens were collected from beneath

TABLE 14. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 13. *Bembidion nahuala* n.sp.; map Figure 70.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
15°12'N 90°18'W	3052	USNM	May	3
15°04'N 91°52'W	2800–2900	USNM	May	50
14°58'N 91°46'W	2200	USNM	May	6
14°46'N 91°28'W	2170	USNM	Aug	1
14°20'N 90°31'W	2105	USNM	Jun	1
Total specimens examined:				61

stones along the roadway. The species is dimorphic with respect to wing length; brachypterous individuals have only a small veinless pad in place of the flight wing and constitute a large percentage of the populations sampled (Table 1).

**TYPE-MATERIAL.**—**Holotype** ♂, GUATEMALA, San Marcos, 27.0 km NW San Marcos, 15°04'N, 091°52'W, May (Erwin & Erwin) (USNM), ADP 013024. **Paratypes:** 18♂, 42♀, same data as holotype or as listed in Table 14 and deposited as USNM-40, UASM-2, CAS-4, MCZ-4, AMNH-2, BMNH-2, MNHP-2, JNEG-2, FMNH-2.

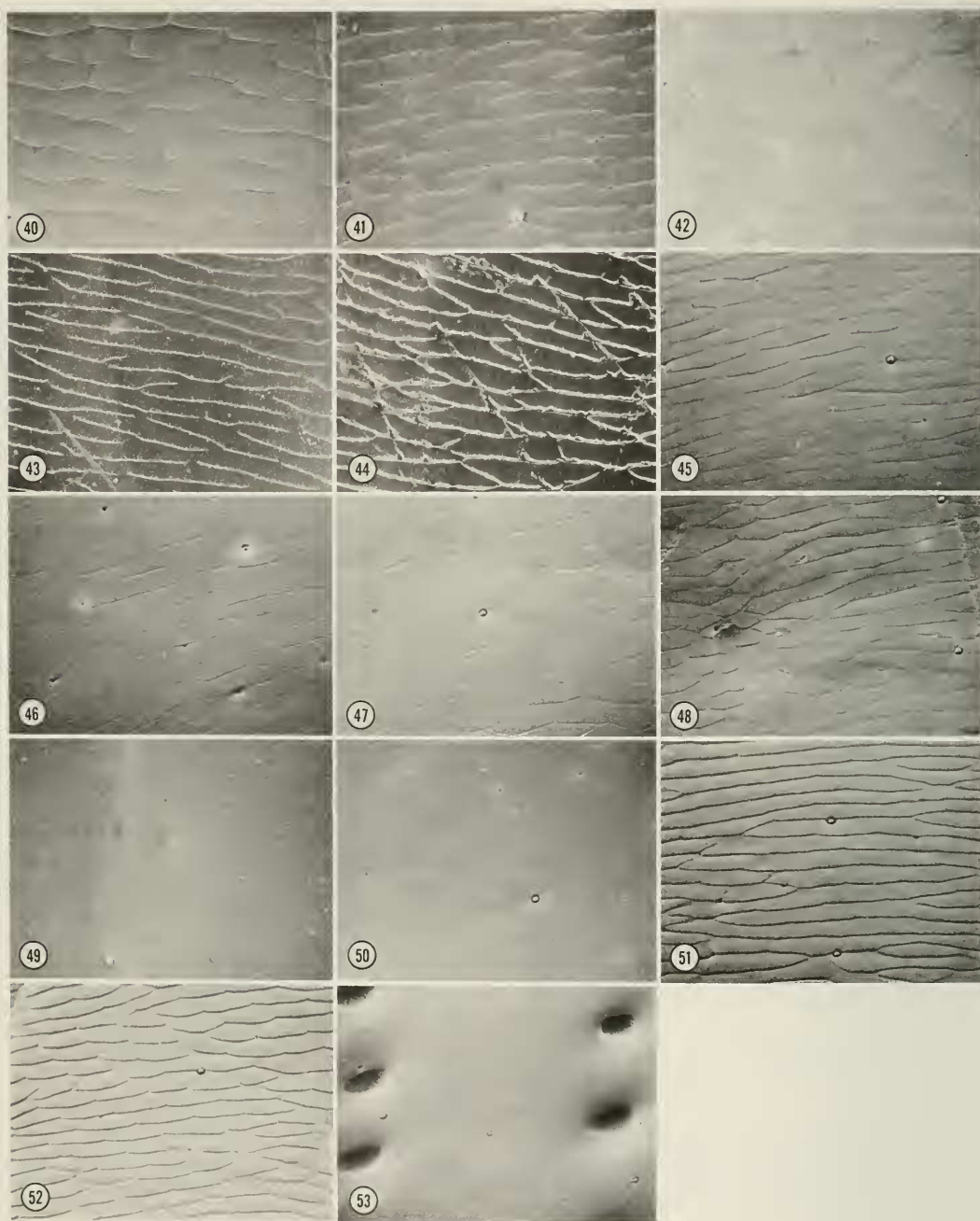
**DERIVATION OF TAXON NAME.**—Uto-aztec, *Nahuala*, after the Río Nahuala where the type-series was collected; the word derives from the general name for the indigenous peoples of the region, the Nahuatl, of which the Aztecs were part.

#### The *franiae* group

**DIAGNOSTIC COMBINATION.**—Metasternal process without border; elytral interval 3 nonfoveate; male median lobe with ostium flags; dorsal microsculpture present.

These beetles are independent of running or standing water and occur in litter in Lower Montane Moist Forest. The single species included in this group and the one in the *nahuala* group are externally quite dissimilar, although both are similar to diverse members of the subgenus *Peryphus* or *vernale* group discussed above. However, males of both *nahuala* and *franiae* have very similar genitalia. Further study of these forms and other related ones from outside the geographic area of this coverage will need to be undertaken to resolve their relationships.





FIGURES 40 to 53. Microsculpture of elytron, left, dorsal aspect posterior to Ed3, 3rd interval, ca. 1000 $\times$ , males. 40. *B. rogersi* Bates, 7.5 km south of Ojo de Agua, Cartago, Costa Rica. 41. *B. mexicanum* Dejean, 22.0 km west of San Pedro Sacatepéquez at Río Nahuala. 42. *B. vernale* Bates, San Isidro de Coronado, San José, Costa Rica. 43. *B. satellites* Bates, Chomogo area, 10°18'N, 084°47'W, Alajuela, Costa Rica. 44. *B. quetzal* n.sp., 25.0 km south of Totonicapán, Huehuetenango, Guatemala. 45. *B. diabola* n.sp., Volcán Irazú, Cartago, Costa Rica. 46. *B. vulcanium* Darlington, 7.5 km south of Ojo de Agua, Cartago, Costa Rica. 47. *B. aeger* n.sp., Cerro Buenavista, San José, Costa Rica. 48. *B. chiriqui* n.sp., 8.0 km west of Boquete, Chiriquí, Panama. 49. *B. nahuala* n.sp., 27.0 km northwest of San Marcos, San Marcos, Guatemala. 50. *B. aratum* LeConte, La Lima, Cortés, Honduras. 51. *B. cortés* n.sp., La Lima, Cortés, Honduras. 52. *B. sparsum* Bates, Tikal, Del Petén, Guatemala. 53. *B. ixtatan* n.sp., 27.0 miles [43.5 km] west of Sololá, Sololá, Guatemala.



14. *Bembidion franiae*, new species

(Figures 16, 35, 70)

**DIAGNOSTIC COMBINATION.**—Metasternal process between mesocoxae entirely unmarginated; elytron bipunctate, punctures around dorsal setae deep and small, not extended beyond middle of adjacent interval; dorsal surface with well-developed microsculpture, that of elytra of finely impressed lines or wide meshes, surface subiridescent, on head clearly and evenly isodiametric, slightly granular, more evenly transverse and less impressed on pronotum. *Color and luster:* dorsum piceous; outer antennomeres and penultimate palpomeres infuscated, otherwise appendages testaceous; venter piceous; surfaces shiny, elytra subiridescent. *Form:* moderately small beetles for genus, with large head and pronotum in proportion to elytra; pronotum (Fig. 16) wider than head and elytron; eyes large and prominent. *Structure:* frontal furrows shallow and broad, prolonged on clypeus; anterior supraorbital pore deeply foveate. Hind angle of pronotum markedly carinate; basal fovea large and deep; lateral margins sinuate, straight for some distance behind situation. Interners of large punctulae laterally, effaced at extreme apex; disc markedly striatopunctulate, punctulae wide-spaced, not coarsely impressed. Dorsal microsculpture of elytra finely engraved, markedly transverse meshes, of head isodiametric, slightly granular meshes, and on pronotum well-engraved transverse meshes. *Size:* see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 70; known only from the type-locality.

**NATURAL HISTORY NOTES.**—These beetles are independent of running or standing water and occur in oak forests in volcanic highlands in Lower Montane Wet Forest at 2500 m and 2600 m. Specimens were collected in August; the paratype is teneral. At the type-locality these beetles were found in oak leaf litter. The species is probably flightless, judging from the markedly developed state of brachyptery in the two known individuals which have only a small veinless pad in place of the flight wing.

**TYPE-MATERIAL.**—**Holotype** ♂, GUATEMALA, Huehuetenango, 4.8 km E San Mateo Ixtatán, 15°50'N, 091°27'W, Aug. (Ball, Frania, & Whitehead) (USNM), ADP 026917. **Paratype:** 1♀, same data as type (UASM).

**DERIVATION OF TAXON NAME.**—I take pleasure in naming this species in honor of one of the collectors of the types, Henry Frania.

The *incrematum* group

(Subgenus *Eupetedromus* Netolitzky, 1911:190. Type-species *Carabus dentellus* Thunberg, 1787:50, by subsequent designation of Lindroth 1963:348.)

**DIAGNOSTIC COMBINATION.**—Metasternal process not bordered; elytra iridescent from densely transverse microsculpture or microsculpture absent; male genitalia similar to those in members of subgenus *Nothaphus* (Fig. 36; see also Lindroth 1963:367).

These beetles are hygrophilous, occurring along streams or standing water in fine gravel and sand, or on silt. Previously, this group was regarded as Holarctic; the addition to the group of *B. aratum* of the southwestern United States, Mexico, and Central America extends the group's range considerably. All species are fully winged and occur in the lowland or adjacent low hills. The male median lobe of the species covered herein has the pigmented ostium flag characteristic of North and Central American *Bembidion* (*Nothaphus*) species, and the endophallus strongly suggests relationship with this group.

15. *Bembidion aratum* LeConte

(Figures 17, 36, 50, 71)

*Bembidium aratus* LECONTE, 1852:189. [Lectotype ♀, ARIZONA, Gila River Valley (MCZ), designated by Erwin 1982.]

*Bembidium scintillans* BATES, 1882:150. [Lectotype ♀, MEXICO, Capulapam, 17°18'N, 096°27'W (BMNH), designated by Erwin 1982.]

*Bembidium vinnulum* CASEY, 1918:116. [Lectotype ♀, ARIZONA (Southern) (USNM), designated by Erwin 1982.]

*Bembidion definitum* CASEY, 1918:166. [Holotype ♂, ARIZONA, Tucson, 32°13'N, 110°57'W (USNM).]

**DIAGNOSTIC COMBINATION.**—Elytron with setae Ed3 and Ed5 in interval 3 and not touching adjacent interneurs; elytron without microsculpture, markedly shiny. *Color and luster:* dorsum piceous; elytra maculate, tibial base, femur apex, distal antennomeres, penultimate palpomeres infuscated, otherwise appendages testaceous; venter piceous; surfaces markedly shiny, elytra with faint metallic cast. *Form:* medium-sized beetles for genus with narrow head and pronotum and long-tapered elytra; pronotum (Fig. 17) slightly wider than head, markedly convex, about equal to width of elytron; eyes large and prominent. *Structure:* frontal furrows shallow, broad, parallel, extended to clypeus. Hind angle of pronotum markedly carinate; basal fovea small, deep, extended to basal margin; lateral margins shallowly sinuate. Interners en-

TABLE 15. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 15. *Bembidion aratum* LeConte; map Figure 71.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
15°30'N 86°35'W	0140-0160	UAIC	Jun	1
15°26'N 87°55'W	0020	FDAG	Jun	2
15°26'N 87°55'W	0020	UASM	Jun	1
15°25'N 91°43'W	1440	USNM	Aug	2
Total specimens examined:				6

TABLE 16. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 16. *Bembidion cortes* n.sp.; map Figure 71.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
15°26'N 87°55'W	0020	FDAG	Jun	18
15°26'N 87°55'W	0020	UASM	Jun	14
Total specimens examined:				32

tire, deeply impressed, striatopunctulate anteriorly, striate posteriorly. Dorsal microsculpture of head of shallowly impressed, moderate-sized, slightly transverse meshes, effaced from pronotum and elytron (Fig. 50). Male median lobe as in Figure 36. *Size*: see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 71; southwestern United States to Honduras along the central and eastern parts of the continent.

**NATURAL HISTORY NOTES.**—These beetles are found from sea level to middle elevations in Tropical Dry, Tropical Very Dry, and Subtropical Dry forests up to 1500 m. Specimens were collected in June and August; no teneral specimens were found. These beetles occur at the edge of moderately large streams in gravel and under stones where there is some silt and at least some sparse vegetation. All known specimens are fully winged; they were attracted to UV light traps in Mexico, Honduras, and Guatemala, indicating that the beetles fly.

**MATERIAL EXAMINED.**—Types (see above) and 6 specimens (Table 15).

#### The *dorsale* group

(Subgenus *Notaphus* Stephens, 1828:2. Type-species *Carabus varius* Olivier, 1795:110, by subsequent designation of Westwood 1840:7.)

**DIAGNOSTIC COMBINATION.**—Metasternal process completely bordered; elytra and forebody with isodiametric microsculpture; elytra with light-colored mosaic pattern on dark background; male genitalia uniform and similar to those in members of subgenus *Eupetedromus* (Fig. 36, see also Lindroth 1963:367).

These beetles are hygrophilous, occurring

along streams or standing water in fine gravel and sand or among stones, or on sea beaches. Previously, this group was regarded as predominantly Holarctic, however, several species occur in the Tropics and in South Temperate regions, mainly on beaches. All species are fully winged and occur in the lowland or adjacent low hills. The male median lobes of the species covered herein have the pigmented ostium flag characteristic of North American *Bembidion* (*Notaphus*) species.

#### 16. *Bembidion cortes*, new species

(Figures 18, 37, 51, 71)

**DIAGNOSTIC COMBINATION.**—Elytron with setae Ed3 and Ed5 in interval 3, not touching adjacent interneurs, and with perfectly isodiametric and well-engraved microsculpture; pronotum broad, moderately convex, much wider than head across eyes, side margins not markedly arcuate nor much convergent behind, shallowly sinuate before hind angle. *Color and luster*: dorsum of elytron with mosaic color pattern, head and pronotum dark green; distal antennomeres infuscated, otherwise appendages flavous or testaceous; venter rufopiceous or piceous, in some specimens apex of abdomen paler; surface of elytra shiny, forebody metallic. *Form*: medium-sized beetles for this genus with head, pronotum, and elytra broad; pronotum (Fig. 18) somewhat wider than head and elytron; eyes large and prominent. *Structure*: frontal furrows very shallow and broad, extended on clypeus. Hind angle of pronotum markedly carinate; basal fovea broad and deep; lateral margins shallowly sinuate. Interneurs entire, deeply impressed throughout their length, striatopunctulate anteriorly, striate posteriorly. Dorsal microsculpture of elytron nearly isodiametric, with some transverse meshes (Fig. 51), that of head and pronotum perfectly isodiametric.

slightly granulate, deeply engraved. Male median lobe as in Figure 37. *Size*: see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 71; southern Mexico north at least to Vera Cruz, south to Honduras.

**NATURAL HISTORY NOTES.**—These beetles are found at low elevations in Tropical Dry Forests at 20 m. Specimens were collected in June and December; no teneral specimens were found. All known specimens are fully winged; they were attracted to UV light traps in Mexico and Honduras, indicating that the beetles fly.

**TYPE-MATERIAL.**—**Holotype** ♂, HONDURAS, Cortés, La Lima, 15°26'N, 087°55'W, June (Blanton, Broce, & Woodruff) (FDAG), ADP 047025. **Paratypes**: 9♂, 22♀, same data as holotype or as listed in Table 16 and deposited as USNM-12, UASM-2, CAS-2, MCZ-2, BMNH-2, MNHP-2, JNEG-2, FDAG-7.

**DERIVATION OF TAXON NAME.**—Spanish, *Cortés*, after the sea-faring explorer from Spain who touched the Middle American coast and Caribbean islands in so many places; in reference to the probable habitat and distribution of these beetles.

### 17. *Bembidion sparsum* Bates

(Figures 19, 38, 52, 71)

*Bembidium sparsum* BATES, 1882:151. [Lectotype ♂, MEXICO, Oaxaca (BMNH), designated by Erwin 1982.]

**DIAGNOSTIC COMBINATION.**—Elytron with setae Ed3 and Ed5 in interval 3 and not touching adjacent interneurs, and with perfectly isodiametric and well-engraved microsculpture; pronotum narrow, about as wide as head across eyes, markedly constricted behind. *Color and luster*: dorsum of elytron with mosaic color pattern, head and pronotum dark green; distal antennomeres infuscated, otherwise appendages flavous or testaceous; venter rufopiceous or piceous, in some specimens apex of abdomen paler; surface of elytra shiny, forebody metallic. *Form*: medium-sized beetles for this genus with head, pronotum, and elytra broad; pronotum (Fig. 19) narrow, equal in width to head and elytron; eyes large and prominent. *Structure*: frontal furrows very shallow and broad, extended on clypeus. Hind angle of pronotum markedly carinate; basal fovea broad and deep; lateral margins deeply sinuate. Interneurs entire, deeply impressed throughout their length, striatopunctulate anteriorly, striate posteriorly. Dor-

sal microsculpture of elytron nearly isodiametric, with some transverse meshes (Fig. 52), that of head and pronotum perfectly isodiametric, slightly granulate, deeply engraved. Male median lobe as in Figure 38. *Size*: see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 71; most of Middle America from Sonora, Mexico, south to at least Nicaragua and along the east coast at Vera Cruz, Mexico, as well as on the islands of Jamaica and Hispaniola (Haiti), and in Colombia. Curiously, there are no records from Costa Rica or Panama.

**NATURAL HISTORY NOTES.**—These beetles are found at low elevations in Tropical Dry, Tropical Very Dry, and Tropical Moist forests between 20 m and 500 m. Specimens were collected in June, July, August, and September on the mainland, February on Jamaica, and September on Hispaniola; some teneral specimens were found on Jamaica and Hispaniola, and some of the September mainland specimens were also teneral. These beetles frequent low-lying areas on dry sand which are adjacent to intermittently wet streams; the general vegetation is thorn scrub. All known specimens are fully winged; they were attracted to UV light traps in many localities, indicating that the beetles fly. This together with their occurrence in the Greater Antilles and their preference for intermittently wet areas indicate they are highly vagile dispersants.

**MATERIAL EXAMINED.**—Lectotype (see above) and 17 specimens (Table 17).

### 18. *Bembidion armuelles*, new species

(Figures 20, 71)

**DIAGNOSTIC COMBINATION.**—Elytron with setae Ed3 and Ed5 in interval 3 and not touching adjacent interneurs, and with perfectly isodiametric and well-engraved microsculpture; pronotum very broad and convex with abruptly sinuate lateral margins basally, much wider than head across eyes, markedly constricted behind. *Color and luster*: dorsum of elytron with mosaic color pattern, head and pronotum dark green; distal antennomeres infuscated, otherwise appendages flavous or testaceous; venter rufopiceous or piceous, in some specimens apex of abdomen paler; surfaces of elytra shiny, forebody metallic. *Form*: medium-sized beetles for this genus with head, pronotum, and elytra



TABLE 17. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 17. *Bembidion sparsum* Bates; map Figure 71.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
17°25'N 88°29'W	0000-0300	USNM	Jun	1
17°20'N 89°39'W	0250	USNM	Jun	3
17°20'N 88°33'W	0000-0300	USNM	Jun	1
17°15'N 88°45'W	0000-0300	USNM	Jun	1
15°44'N 87°27'W	0000-0020	UMAA	Mar	2
15°26'N 87°55'W	0020	UASM	Jun	4
13°52'N 90°05'W	0030-0040	USNM	Jul	2
13°36'N 89°50'W	0000-0010	UASM	May	1
12°36'N 86°02'W	0457	USNM	Jul	1
12°23'N 86°03'W	0122	USNM	Jun	1
Total specimens examined:				17

broad; pronotum (Fig. 20) very broad and convex, wider than head and elytron; eyes large and prominent. *Structure*: frontal furrows very shallow and broad, extended on clypeus. Hind angle of pronotum markedly carinate; basal fovea broad and deep; lateral margins deeply sinuate. Interneurs entire, deeply impressed throughout their length, striatopunctulate anteriorly, striate posteriorly; intervals convex. Dorsal microsculpture of elytron nearly isodiametric, with some transverse meshes, that of head and pronotum perfectly isodiametric, slightly granulate, deeply engraved. Male unknown. *Size*: see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 71; known only from the type-locality.

**NATURAL HISTORY NOTES.**—The town of Armuelles is a port on the Pacific Ocean with extensive sea beach; behind the town lies Tropical Moist Forest. I do not know the habitat in which the unique specimen was collected; however, it is fully winged, it was collected in June, and it is not teneral.

**TYPE-MATERIAL.**—**Holotype** ♀, PANAMA, Chiriquí, Puerto Armuelles, 08°17'N, 082°52'W, June (*Bierig*) (MCZ), ADP 003142.

**DERIVATION OF TAXON NAME.**—Spanish, *Armuelles*, the name of the town near which the holotype was collected.

#### The *affine* group

(Subgenus *Furcacampa* Netolitzky, 1931:158. Type-species *Bembidium affine* Say, 1823:86, by original designation.)

**DIAGNOSTIC COMBINATION.**—Metasternal process completely bordered, margin removed from apex; elytra and forebody with isodiametric microsculpture; elytra with light-colored mosaic pattern on dark background; male genitalia similar to those in members of *versicolor* group (fig. 191 in Lindroth 1963:379).

These beetles are hygrophilous, occurring along streams or standing water on fine clay or sand, at the margins of marshy pools, or on lake beaches. Previously, this group was regarded as Nearctic, however, the new species described below from Panama extends the range considerably. Both species of the group are fully winged and occur in the lowland or adjacent low hills.

#### 19. *Bembidion barrenis*, new species

(Figures 22*b*, 39*b*, 74)

**DIAGNOSTIC COMBINATION.**—Frontal furrows shallow, single, and nearly parallel between eyes, convergent and doubled on clypeus. *Color and luster*: dorsum of elytron with mosaic color pattern, head and pronotum dark piceous; appendages testaceous (on holotype, outer antennomeres missing, palpomeres missing); venter piceous; surfaces of elytra shiny, forebody slightly metallic. *Form*: small-sized for genus with narrow forebody and elytra; elytra with square humeri; pronotum (Fig. 22*b*) narrower than head, about equal in width to elytron; eyes large and prominent. *Structure*: frontal furrows well impressed, slightly rugose, almost parallel between eyes, angularly prolonged and doubled on clypeus. Hind angle of pronotum acute, with feebly developed, short, sharp carinae; basal fovea large and deep; side margins abruptly and markedly sinuate. Interneurs entire, though much shallower or effaced apicolaterally, striatopunctulate, punctulae medium-sized, coarse, and close-spaced. Dorsal microsculpture of large transverse meshes on apex of elytron, head and pronotum, effaced from disc of elytron. Male median lobe as in Figure 39*b*. *Size*: see Tables 2, 3, and 4.



**GEOGRAPHICAL DISTRIBUTION.**—Figure 74; known only from the type-locality.

**NATURAL HISTORY NOTES.**—The single specimen was found in Tropical Moist Forests at 28 m. It was collected in October and is not teneral. It is fully winged. The habitat consists of marshy lake shore (on the back side of the island opposite the Canal) with rich growth of *Calathea* and other emergent broadleaf plants growing in shallow, but rich, organic soil on top of red laterite. The marsh is heavily shaded in this area. The beetle was in a thin layer of leaves less than a meter from the water.

**TYPE-MATERIAL.**—Holotype ♂, PANAMA, Canal Zone, Barro Colorado Island, 09°10'N, 079°51'W, Oct. (Erwin & Erwin) (USNM), ADP 041711.

**DERIVATION OF TAXON NAME.**—Spanish, *barro*, meaning clay or mud and part of the name of the place where the holotype was collected.

#### The *championi* group

(Subgenus *Cyclotlopha* Casey, 1918:144. Type-species *Bembidium sphaeroderum* Bates, 1882:147, here designated.)

**DIAGNOSTIC COMBINATION.**—Metasternal process completely bordered, margin not removed from apex; pronotum markedly lobed basally, hind angle absent or markedly obtuse; frontal furrows deep, markedly convergent, prolonged on clypeus.

Little is known regarding the life history and habits of these beetles. Few specimens are available for study. I collected one individual of the group in Mexico from beneath a rosette of prostrate grasses on a volcanic hillside in the Transverse Volcanic Belt. There was no water close by. A partially complete manuscript by G. G. Perrault (in litt.) indicates there are eight species in the group, distributed from Colorado, USA, to Guatemala.

### 20. *Bembidium cyclodes* Bates

(Figure 72)

*Bembidium cyclodes* BATES, 1884:290. [Lectotype ♀, MEXICO, Oaxaca (BMNH), selected and labelled by Perrault, herewith designated.]

*Bembidium aztecanum* CASEY, 1918:145. [Lectotype ♂, MEXICO, Cuernavaca (USNM), selected and labelled by Perrault, here designated.]

**DIAGNOSTIC COMBINATION.**—Pronotum with hind angle rounded with small angle along mar-

TABLE 18. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 20. *Bembidium cyclodes* Bates; map Figure 72.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
[Types from Mexico]	?	BMNH, USNM	?	2
15°23'N 91°02'W	1829	AMNH	Aug	1
Total specimens examined:				3

gin at posterior seta, base markedly lobed; elytron with interneur 7 absent, interneur 6 extended to at least middle. *Color and luster:* dorsum of elytra and propleura rufous; distal antennomeres infuscated, otherwise appendages testaceous; head, pronotum, and venter piceous; surfaces markedly shiny. *Form:* small beetles with broad forebody and elytra; pronotum slightly wider than head or elytron; eyes markedly large and prominent. *Structure:* frontal furrows sulcate, narrow, convergent, extended to clypeal setigerous pore. Hind angle of pronotum markedly obtuse, nearly absent; dorsum markedly convex; lateral margins markedly arcuate posteriorly; base prominently lobed. Interneurs 1 to 6 each a row of punctulae in basal half of elytron, 7 absent, 1 striatopunctulate, in apical half 2 to 6 absent; punctulae separated by their own diameter. Dorsal microsculpture absent. *Size:* see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 72; known specifically from only one locality in Guatemala; older records give only "Guat." Perrault recorded this species from localities in Mexico, north as far as Cuernavaca.

**NATURAL HISTORY NOTES.**—These beetles are found at middle elevations in Lower Montane Moist Forests between 1450 m and 1900 m. Specimens were collected in August and October; no teneral specimens were found. All known specimens are fully winged.

**MATERIAL EXAMINED.**—Types (see above) and 1 specimen (Table 18).

### 21. *Bembidium championi* Bates

(Figures 21, 72)

*Bembidium championi* BATES, 1882:148. [Lectotype ♂, GUATEMALA, Quiché Mountains (MNHP), selected and labelled by Perrault, here designated.]

TABLE 19. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 21. *Bembidion championi* Bates; map Figure 72.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
[Type from Guatemala]	?	BMNH	?	1
[Mexico, Chiapas, 8.6 mi. E San Cristobal]		UASM		2
Total specimens examined:				3

TABLE 20. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 22. *Bembidion ixtatan* n.sp.; map Figure 72.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
15°50'N 91°27'W	2460	USNM	Aug	6
14°47'N 91°15'W	ca. 2400	USNM	Aug	1
Total specimens examined:				7

DIAGNOSTIC COMBINATION.—Pronotum with hind angle rounded, without small angle along margin at posterior seta, base markedly lobed; elytron with interneurs 6 and 7 present, short, not extended beyond basal sixth. *Color and luster*: dorsum of elytra and propleura rufous; distal antennomeres infuscated, otherwise appendages testaceous; head, pronotum, and venter piceous; surface markedly shiny. *Form*: small beetles with broad forebody and elytra; pronotum slightly wider than head or elytron; eyes markedly large and prominent. *Structure*: frontal furrows sulcate, narrow, convergent, extended to clypeal setigerous pore. Hind angle of pronotum markedly obtuse, nearly absent; dorsum markedly convex; lateral margins markedly arcuate posteriorly; base prominently lobed. Interneurs 1 to 7 each a row of punctulae in basal half of elytron, 1 striatopunctulate, in apical half 2 to 7 absent; punctulae separated by more than their own diameter. Dorsal microsculpture absent. *Size*: see Tables 2, 3, and 4.

GEOGRAPHICAL DISTRIBUTION.—Figure 72; known specifically from only the type-locality in Guatemala; other records give only "Guat." Perrault recorded this species from localities in Mexico, north as far as Jalisco.

NATURAL HISTORY NOTES.—These beetles are found at middle elevations in Lower Montane Moist Forests between 2100 m and 2700 m. Specimens were collected in June, August, and September; no teneral specimens were found. All known specimens have the wings reduced to small pads, each of which retains the bases of two major veins.

MATERIAL EXAMINED.—Lectotype (see above) and 2 specimens (Table 19).

### The *cognatum* group

DIAGNOSTIC COMBINATION.—Metasternal process completely bordered, margin not removed from apex; pronotum not lobed basally, hind angles nearly square; frontal furrows deep, markedly convergent, prolonged on clypeus; microsculpture effaced from pronotum and elytra.

These beetles are hygrophilous, occurring along streams in fine gravel and sand, or in mosses. Previously, this group of two species was known from only North America and Mexico; the Central American one described below extends the group's range considerably. Both species are fully winged and occur at middle elevations. The male median lobe of the species covered herein has two pigmented ostium flags.

This group has not been assigned to subgenus. Its members are intermediate between *transparens* group (head structure) and *versicolor* group (body structure and color pattern). The unique male genitalia does not indicate relationship to either of these mentioned groups. Placement must await revisions of the several species groups with convergent frontal furrows (see Erwin and Kavanaugh 1981).

### 22. *Bembidion ixtatan*, new species

(Figures 22a, 39a, 53, 72)

DIAGNOSTIC COMBINATION.—Pronotum with hind angle squared; base not lobed; elytron with all interneurs coarsely punctulate well beyond middle; frontal furrows markedly convergent; microsculpture effaced from elytra and pronotum. *Color and luster*: elytra piceous, obscurely maculate, maculae not well defined; forebody and venter piceous; appendages infuscated; surfaces markedly shiny. *Form*: small beetles for the genus with head large, pronotum narrow,

elytra convex and narrow; pronotum (Fig. 22a) slightly wider than head and elytron; eyes moderately large and prominent. *Structure*: frontal furrows well impressed, markedly convergent toward clypeus, doubled on clypeus. Hind angle of pronotum nearly square, finely carinate, carinae markedly short; basal fovea small and deep; lateral margins shallowly, abruptly sinuate. Interneurs effaced apicolaterally, markedly and coarsely punctulate on disc. Dorsal microsculpture effaced (Fig. 53). Male median lobe as in Figure 39a. *Size*: see Tables 2, 3, and 4.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 72; known only from the Guatemalan highlands.

**NATURAL HISTORY NOTES.**—These beetles are found at upper to middle elevations in Lower Montane Moist Forests at 2500 m. Specimens were collected in August; no teneral specimens were found. These beetles live near mountain streams where they can be found during the day by washing mosses. All known specimens are fully winged.

**TYPE-MATERIAL.**—**Holotype** ♂, GUATEMALA, Huehuetenango, 4.8 km E San Mateo Ixtatán, 15°50'N, 091°27'W (Ball, Frania, & Whitehead) (USNM) ADP 026911. **Paratypes**: 2♂, 4♀, same data as for holotype or as listed in Table 20 and deposited as USNM-2, UASM-2, CAS-2.

**DERIVATION OF TAXON NAME.**—Probably Uto-Aztecan, *Ixtatan*, from the name of the town near which the type-series was collected.

### Genus *Geocharidius* Jeannel

*Geocharidius* JEANNEL, 1963a:107. [Type-species *Anillus integripennis* Bates, 1882:145, by original designation.]

For details on related groups see Jeannel (1937, 1960, 1963a), and Taglianti (1973).

**DIAGNOSTIC COMBINATION.**—Small-sized, more or less depressed or markedly convex beetles with narrow or broad elytra, narrow forebody, and with medium-length, slender appendages. Color pale rufotestaceous. Terminal palpomere subulate; eyes absent; antennomeres 2 to 11 entirely pubescent and with numerous long setae, mentum with well-developed but small tooth; mandibles unisetose. Pronotum with two midlateral and usually two basilateral setae; elytron without discal setae, with scattered pubescence. Elytron without recurrent groove. Microsculpture various. Female stylus small, spatulate, unisetose. Male parameres as in Taglianti (1973). Flight wings absent, meta-

thorax markedly reduced in size, elytra fused along midline. ABL = 1.0–1.5 mm in Central American species.

**NATURAL HISTORY.**—Species of this genus live in deep humus and decaying leaf litter or under deeply embedded stones in forests; they can be found by the use of sifting and Berlese funnel techniques. All species in Central America are true alticoles; all are wingless. The larvae are unknown.

**NOTES.**—The *Geocharidius* fauna of Middle America is very complex and difficult to work with because of the lack of a firm taxonomic base with which to start and the lack of representatives of the majority of the fauna. New collecting methods are turning up these small hypogean or deep-litter forms in great numbers. Of the five species treated below, four were discovered as recently as 1974. Use of these new collecting methods and new tools for revisionary studies (e.g., scanning electron micrographs) should allow detailed studies and a subsequent reconstruction of the phylogeny soon. Externally, the beetles differ in states of the frontal furrows, body form, pronotum shape, dorsal elytral chaetotaxy and structure of the interneurs, and microsculpture even though the beetles themselves are similar in habitus. In Central America, two habitus types occur: the depressed body form type such a *G. integripennis* and the globose type (Figs. 54, 55).

Adults can easily be sexed in two ways. Males have three basal tarsomeres of the anterior leg dilated and with modified setae beneath, forming a loosely biserrate row, and two setae along the caudal edge of sternum VI; females have no specially modified setae or dilated tarsomeres and have four setae on sternum VI.

**ARRANGEMENT OF TAXA: GEOCHARIDIUS.**—The Anillina are in need of a worldwide review and revision. No system heretofore proposed is adequate to reflect true relationships. Therefore, the arrangement of taxa below is strictly arbitrary.

### CHECKLIST OF *GEOCHARIDIUS* SPECIES OF CENTRAL AMERICA.

1. *G. integripennis* (Bates 1882:145)
2. *G. romeoi*, new species
3. *G. gimlii*, new species
4. *G. phineus*, new species
5. *G. tagliantii*, new species

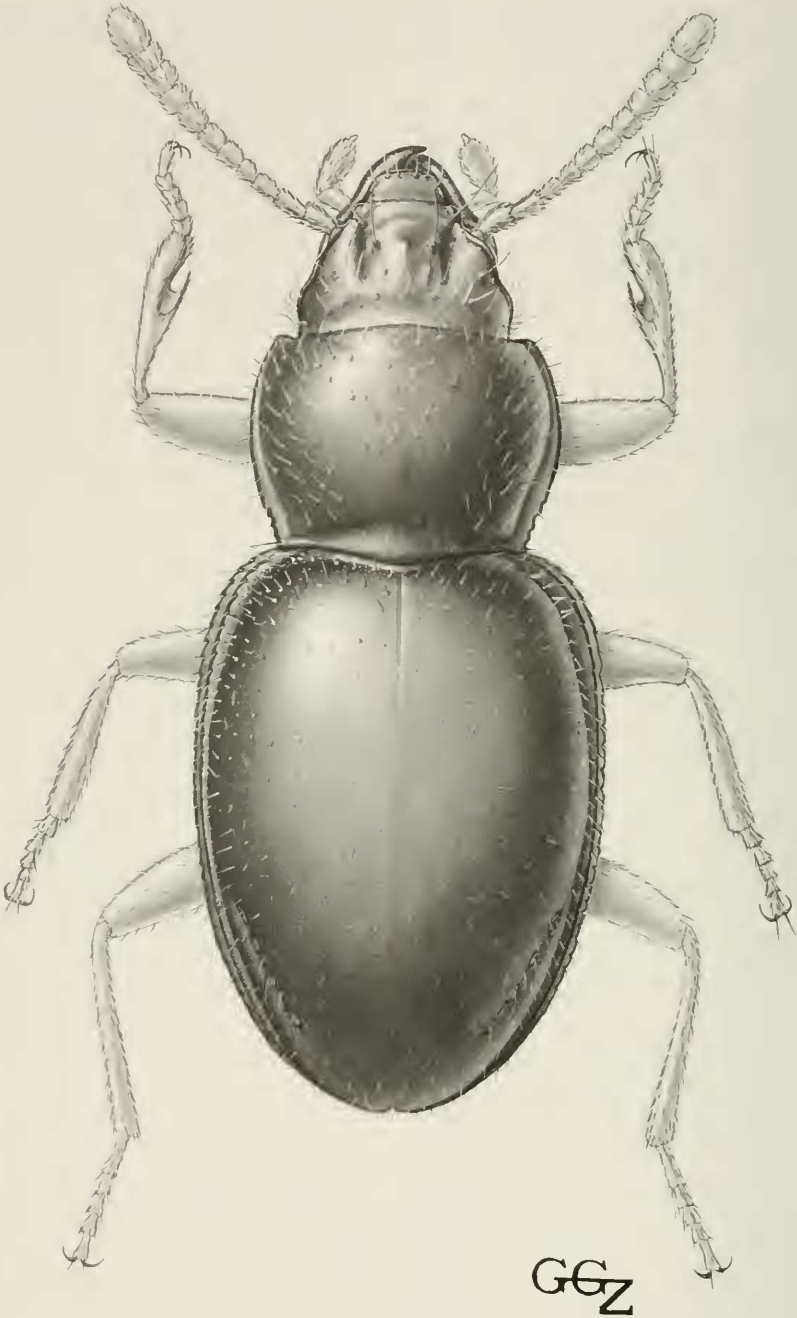


FIGURE 54. Habitus of *Geocharidius phineus* n.sp., dorsal aspect, male from 1.6 km south of Pantin, Baja Verapaz, Guatemala.



Key to Species of *Geocharidius* of  
Central America

1. Pronotum with lateral edge in front of hind angle multidentate .....  
..... 5. *G. tagliantii*, new species
- Pronotum with lateral edge unidentate or smooth ..... 2
- 2(1). Pronotum and elytra highly convex (lateral aspect), especially elytra which appear to be 'inflated' to a higher plane than pronotum ..... 3
- Pronotum and elytra much less convex, dorsum of elytra on same plane with pronotum (lateral aspect) ..... 4
- 3(2). Pronotum with markedly obtuse hind angle, side margin in front of them not sinuate; small beetles, SBL = 1.3 mm ..... 2. *G. romeoi*, new species
- Pronotum with slightly obtuse hind angle, side margin in front of them sinuate; larger beetles, SBL = 1.5 mm .....  
..... 4. *G. phineus*, new species
- 4(2). Pronotum with small denticle on side margin in front of hind angle; body long, narrow, and depressed .....  
..... 1. *G. integripennis* Bates
- Pronotum without denticle, side margin entire; body broader and less depressed .....  
..... 3. *G. gimlii*, new species

1. *Geocharidius integripennis* (Bates)

(Figure 73)

*Anillus integripennis* BATES, 1882:145. [Lectotype ♂, GUATEMALA, Tonicapán, Tonicapán, 14°54'N, 091°22'W (*Champion*) (BMNH), here designated.]

DIAGNOSTIC COMBINATION.—Pronotum with lateral edge unidentate; pronotum and elytra slightly convex, dorsum of elytra on same plane with pronotum in lateral aspect; body long, narrow, and depressed. *Color and luster*: body dark testaceous; appendages pale testaceous. *Form*: medium-sized beetles for this genus with narrow and depressed forebody and elytra; pronotum wider than head and elytron; eyes absent. *Structure*: frontal furrows moderately well impressed anteriorly, smooth. Hind angle of pronotum sharp, with secondary denticle anterior to it; side margin sinuate. Elytron with side margin narrowly flanged in basal third, flange microser-

ulate, humerus evenly rounded; surface with scattered setae, striae absent. Dorsal microsculpture of head and scutellum isodiametric, sculpticells large and well impressed; effaced elsewhere. Male lectotype not dissected. *Size*: see Tables 2, 3, and 4.

GEOGRAPHICAL DISTRIBUTION.—Figure 73; known only from the type-locality.

NATURAL HISTORY NOTES.—The type-locality is located in Lower Montane Wet Forest in the Guatemalan highlands at about 2800 m.

MATERIAL EXAMINED.—Lectotype (see above) and 3 paralectotypes (BMNH).

TAXONOMIC NOTES.—Bates (1882) described this species from specimens collected by Champion. Four of these were deposited at BMNH and labelled with "Biologia Centrali-Americana" labels; another specimen with the printed Champion collector label but without a "BC-A" label was found in MNHP by Taglianti (1973). Taglianti also found a specimen with a handwritten label indicating it was from Tonicapán, Guatemala. Both specimens found in MNHP had handwritten labels (believed by Taglianti to be in Jeannel's handwriting) determining the specimens as "integripennis Bates." Bates (1882:145) did not indicate how many specimens he studied, but he provided a description and a handpainted illustration of a specimen of his new species.

Bates's description and illustration agree with the specimens labelled "BC-A" in BMNH: ". . . flavo-testaceus, subnitidus; frontalibus elongatis, sat profundis, interspatio subangusto convex." Bates's illustration indicates that the specimen(s) he described was uniformly flavo-testaceous as well.

Unfortunately, Taglianti obtained two specimens from MNHP that were probably studied by Jeannel and selected them as lectotype and paralectotype, and he used a page of text describing how the specimens did not match Jeannel's 1963 redescription of the species. Taglianti apparently did not study the "BC-A" material at BMNH.

The MNHP specimens are not Bates's *integripennis* (and probably are not what Jeannel studied earlier). Since the specimens do not match Bates's description (e.g., Taglianti states that they have a darkly colored head and shal-

TABLE 21. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 01. *Geocharidius romeoi* n.sp.; map Figure 73.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
15°14'N 90°12'W	1600	USNM	Aug	21
15°10'N 90°12'W	1500	USNM	Aug	8
Total specimens examined:				29

lowly impressed frontal furrows with "flattened forehead"), I consider Taglianti's selection of lectotype null and void. The two MNHP specimens are further considered under *G. tagliantii*, below.

It is likely that Jeannel studied "4 femelles" either from the BMNH collection (although he writes the type is in MNHP) or his material has been lost. It is clear that from his description and drawings he was describing the same species as Bates (note frontal furrows in drawings and his statement that the pronotum "les cotés faiblement argués, sans sinuosité postérieure, non crénelés . . ."). It is no wonder that Taglianti could not match Jeannel's description with the specimens at MNHP.

Reconstruction of the probable chain of events is that part of Champion's material (representing two species) went to BMNH, part to MNHP. Only the BMNH material was used by Bates in the original description. Jeannel probably only studied MNHP material, but the material represented the same species Bates studied, i.e., *integripennis*. Perhaps Jeannel overlooked the fact that he had two species represented. Taglianti saw only the second species and misapplied the name.

## 2. *Geocharidius romeoi*, new species

(Figure 73)

**DIAGNOSTIC COMBINATION.**—Elytra and pronotum highly convex; pronotum with obtuse hind angle, and nonsinuate side margin. *Color and luster*: body and head bright rufotestaceous; appendages pale testaceous. *Form*: small beetles for this genus with broad forebody and inflated elytra; pronotum highly convex, narrower than elytra; eyes absent. *Structure*: frontal furrows obsolete, front with moderate-sized tubercle at middle. Hind angle of pronotum doubled, each denticle sharp; side margin evenly

arcuate, not sinuate. Elytron highly convex, short, side margin arcuate, narrowly flanged in basal third, flange microserrulate, humerus evenly rounded. Elytron surface with numerous scattered setae, striae absent. Dorsal microsculpture of head and scutellum isodiametric, sculpticells large and well impressed; effaced elsewhere. Male holotype not dissected. SBL = 1.002–1.282 mm; TW = 0.403–0.590 mm.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 73; known only from the type-locality.

**NATURAL HISTORY NOTES.**—These beetles are found commonly at lower to middle altitudes in leaf litter with Berlese techniques. Altitudinal range extends from 1500 m to 1600 m in Tropical Wet Forests. Specimens were collected in August; several were teneral.

**TYPE-MATERIAL.**—**Holotype** ♂, GUATEMALA, Baja Verapaz, 13.0 km s Purulha, 15°10'N, 090°12'W, Aug. (Ball, Fran-  
cia, & Whitehead) (USNM, ADP 026533. **Paratypes**: 17♂, 11♀, same data as holotype or as listed in Table 21 and deposited as USNM-14, UASM-4, CAS-4, MCZ-2, BMNH-2, MNHP-2.

**DERIVATION OF TAXON NAME.**—*Romeoi*, after Shakespeare's Romeo, who in Act I told Benvolio, "He that is stricken blind cannot forget the precious treasure of his eyesight lost," in reference to the demise of the Central American forests and its probable impact on these blind beetles, which are restricted to deep forest humus and litter.

## 3. *Geocharidius gimlii*, new species

(Figure 73)

**DIAGNOSTIC COMBINATION.**—Pronotum and elytra in lateral aspect on same plane; posterior angle of the pronotum without denticle. *Color and luster*: body and head flavotestaceous; appendages pale testaceous. *Form*: medium-sized beetles for this genus with narrow forebody and elytra; pronotum wider than head, narrower than elytron; eyes absent. *Structure*: frontal furrows shallowly impressed anteriorly, smooth. Hind angle of pronotum slightly obtuse, not denticulate; side margins straight and markedly convergent behind middle. Elytron moderately long and narrow, subdepressed, disc somewhat convex; side margin moderately flanged in basal third, flange strongly microserrulate, humerus evenly rounded. Elytral surface with scattered setae, striae absent. Dorsal microsculpture of large isodiametric meshes on head, base of

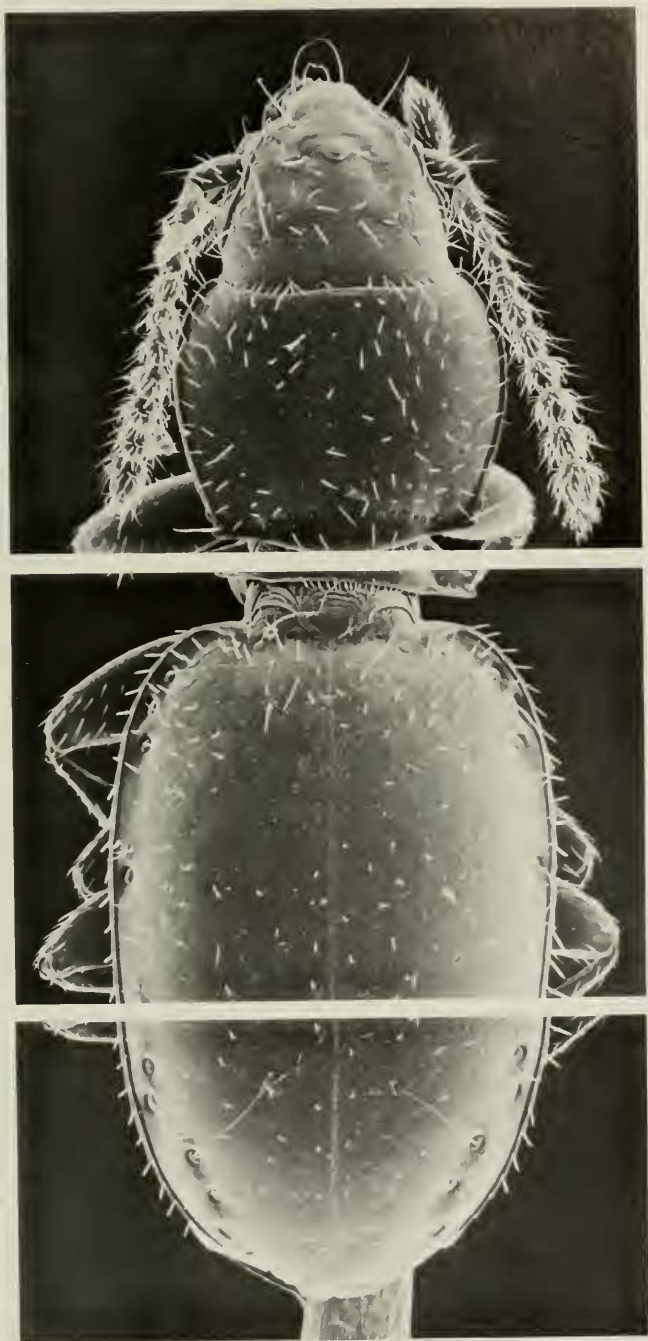
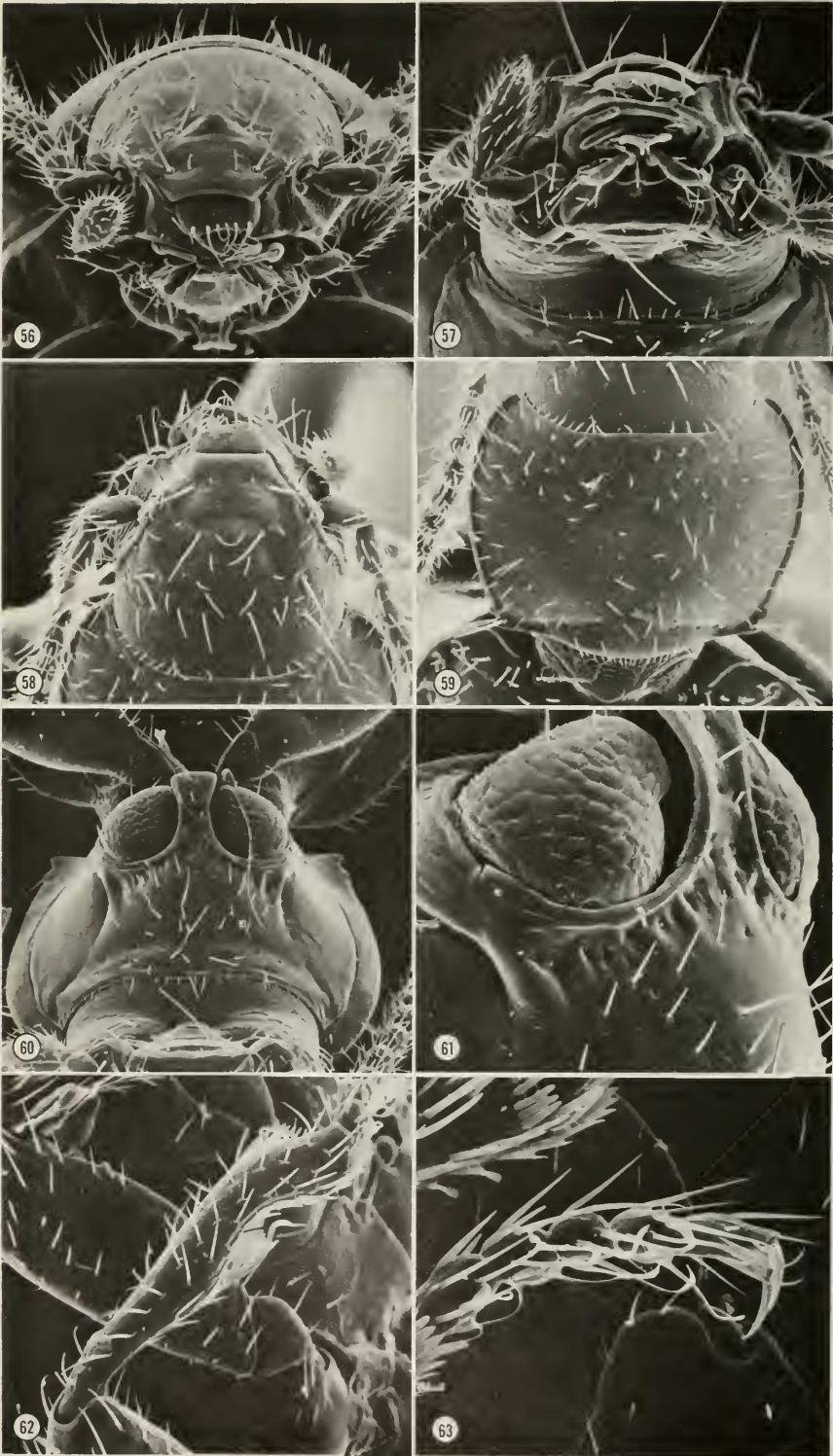


FIGURE 55. Habitus of *Geocharidius phineus* n.sp., dorsal aspect, male from 1.6 km south of Pantin, Baja Verapaz, Guatemala, SEM composite ca. 120 $\times$ .







pronotum, and elytra. Male holotype not dissected. SBL = 1.319 mm; TW = 0.590 mm.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 73; known only from the type-locality.

**NATURAL HISTORY NOTES.**—The unique type was found in leaf litter with Berlese techniques at an altitude of 2780 m in Lower Montane Wet Forest. It was collected in August and was not teneral.

**TYPE-MATERIAL.**—Holotype ♂, GUATEMALA, Huehuetenango, 7.7 km s San Juan Ixcay, 15°35'N, 091°27'W, Aug. (Ball, Frania, & Whitehead) (USNM), ADP 026556.

**DERIVATION OF TAXON NAME.**—*Gimlilii*, after the dwarf Gimli, son of Gloin (one of the 12 companions of Thorin Oakenshield), who accompanied the Hobbit, Frodo, on his trip south, in Book I of *The Lord of the Rings* by Tolkien, in reference to the small size of these beetles.

#### 4. *Geocharidius phineus*, new species

(Figures 54–63, 74)

**DIAGNOSTIC COMBINATION.**—Pronotum and elytra highly convex, elytra inflated to higher plane than pronotum; lateral margin of pronotum with denticle before hind angle; front of head with tubercle. *Color and luster*: body rufotestaceous; appendages pale testaceous. *Form*: large beetles for this genus with highly convex pronotum and elytra; pronotum very broad, much wider than head and elytron; eyes absent. *Structure*: frontal furrows well impressed, front tuberculate at middle. Hind angle of pronotum sharp, margin in front of angle denticulate and sinuate. Elytron moderately long, narrow, high-

TABLE 22. LOCALITY DATA DEDUCED FROM SPECIMEN LABELS. 02. *Geocharidius phineus* n.sp.; map Figure 73.

Lat./Long.	Elev. (m)	Orig. deposit.	Month coll.	No. spec.
15°16'N 90°14'W	1680	USNM	Aug	8
15°14'N 90°12'W	1600	USNM	Aug	2
15°10'N 90°12'W	1500	USNM	Aug	1
Total specimens examined:				11

ly convex; side margin broadly flanged in basal third, flange markedly microserrulate, humerus evenly rounded. Elytral surface with scattered setae, striae absent. Dorsal microsculpture of large isodiametric meshes, restricted to head, effaced elsewhere. Male holotype not dissected. SBL = 1.194–1.517 mm; TW = 0.561–0.675 mm.

**GEOGRAPHICAL DISTRIBUTION.**—Figure 74; known only from the Sierra de Las Minas of central Guatemala.

**NATURAL HISTORY NOTES.**—These beetles were collected from leaf litter with Berlese techniques at altitudes between 1500 m and 1700 m in Subtropical Wet Forest. They were collected in August; one was teneral.

**TYPE-MATERIAL.**—Holotype ♂, GUATEMALA, Baja Verapaz, 1.6 km s Pantin, 15°16'N, 090°14'W, Aug. (Ball, Frania, & Whitehead) (USNM), ADP 026665. **Paratypes**: 4♂, 6♀, same data as holotype or as listed in Table 22 and deposited as USNM-6, UASM-2, CAS-2.

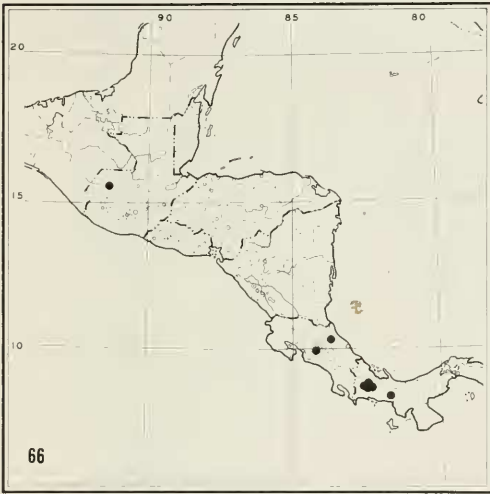
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FIGURES 56 to 63. *Geocharidius phineus* n.sp., male from 1.6 km south of Pantin, Baja Verapaz, Guatemala. 56. Head, anterior aspect, 240×. 57. Mouthparts, oblique ventral aspect, 240×. 58. Head, dorsal aspect, 210×. 59. Pronotum, oblique dorsal aspect, 210×. 60. Prosternum, oblique anterior aspect, 230×. 61. Anterior coxae, left lateral aspect, 560×. 62. Tibia, left, anterior aspect, 380×. 63. Tarsomeres, left anterior, oblique ventral aspect, 690×.

→

FIGURES 64 to 69. Geographical distribution maps. 64. *Bembidion purulha* n.sp., squares; *B. rogersi* Bates, circles. 65. *B. mexicanum* Dejean. 66. *B. vernale* Bates. 67. *B. satellites* Bates, squares; *B. lavernae* n.sp., circles; *B. quetzal* n.sp., triangles. 68. *B. diabola* n.sp., squares; *B. vulcanium* Darlington, circles; *B. edwardsi* n.sp., triangles. 69. *B. aeger* n.sp., squares; *B. chiriqui* n.sp., circles.

FIGURES 70 to 74. Geographical distribution maps. 70. *B. nahuala* n.sp., squares; *B. franiae* n.sp., circles. 71. *B. aratum* LeConte, squares; *B. cortes* n.sp., circles; *B. sparsum* Bates, triangles; *B. armuelles* n.sp., arrow; 72. *B. cyclodes* Bates, squares; *B. championi* Bates, circles; *B. ixtatan* n.sp., triangles. 73. *Geocharidius integripennis* Bates, squares; *G. romeoi* n.sp., circles; *G. gimlilii* n.sp., triangles. 74. *G. phineus* n.sp., squares; *G. tagliantii* n.sp., circles; *B. barrensis* n.sp., triangle.





DERIVATION OF NAME.—*Phineus*, mythical prophet struck blind by Zeus, in reference to the lost eyesight of members of this species.

##### 5. *Geocharidius tagliantii*, new species

(Figure 74)

DIAGNOSTIC COMBINATION.—Pronotum in basal third with multidentate lateral margins. *Color and luster*: head and body dark rufous; appendages pale testaceous. *Form*: large beetles for this genus with broad forebody and elytra; pronotum wider than head and elytron; eyes absent. *Structure*: frontal furrows not well impressed, rough due to coarse microsculpture. Hind angle of pronotum denticulate, side margin in front of it multidentate and sides straight. Elytron medium-sized, narrow; side margin narrowly flanged in basal third, flange microserrulate, humerus squared, side margins nearly parallel. Elytral surface with scattered setae, striae absent. Dorsal microsculpture restricted to head and scutellum, of coarse isodiametric meshes. Male aedeagus figured by Taglianti (1973). SBL = 1.44–1.47 mm.

GEOGRAPHICAL DISTRIBUTION.—Figure 74; known only from the type-locality.

NATURAL HISTORY NOTES.—The type-locality is located in Lower Montane Wet Forest in the Guatemalan highlands at about 2800 m.

MATERIAL EXAMINED.—None; this description is based on that of Taglianti (1973).

TYPE-MATERIAL.—**Holotype** ♂, GUATEMALA, Totonicapán, Totonicapán, 14°54'N, 091°22'W (*Champion*) (MNHP).

DERIVATION OF TAXON NAME.—Named in honor of Augusto Vigna Taglianti of Italy who revised the *Anillina* of Mexico and Guatemala, and who mistakenly regarded this new species as Bates's *G. integripennis*.

##### ACKNOWLEDGMENTS

I thank La Verne Jean Magarian for her foresight and creativity in developing a computerized data base and its underlying philosophy with which I have begun production of a Central American faunal study on ground beetles, this being the first contribution even though it is not part of the series. She also participated in collecting most of the specimens upon which this study is based. In addition, I warmly thank all those curators and assistants from whose museums specimens were borrowed and which are listed under methods.

I heartily thank George Venable and Gloria Gordon Zimmer for their excellent illustrative efforts and Linda L. Sims, Gloria N. House, Jeannine Weaver, and Noreen Connell for their efforts in compiling these pages.

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