BIOSYSTEMATICS OF THE NORTH AND CENTRAL AMERICAN SPECIES OF *GIBBOBRUCHUS* (COLEOPTERA: BRUCHIDAE: BRUCHINAE)

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INTRODUCTION

In a previous paper (Kingsolver and Whitehead 1974) we discussed the biosystematics of *Caryedes,* one of a series of closely related New World tropical seed beetle genera whose larvae feed on seeds of leguminous plants. We now proceed to a related genus, *Gibbobruchus,* to supply data needed in ecological studies by D. H. Janzen and in systematic studies of the caesalpiniaceous genus *Bauhinia* by R. P. Wunderlin. In the New World, the genus *Bauhinia* includes all known host species for all but one species of *Gibbobruchus,* and for members of the *stenocephalus* Group of *Caryedes,* but for no other bruchids. The only other known host genus for *Gibbobruchus* is *Cercis,* which is attacked by *G. mimus* in temperate North America.

We distinguish six species groups within *Gibbobruchus.* Four groups are South American, though one is represented in Panama by one species. Our taxonomic treatment for the South American groups includes a diagnosis of each group and notes on included species. Our treatment of the two Middle American groups, which form a convenient biogeographic unit, is more detailed. One group is monobasic, while the other includes five known species. The latter group includes one Nearctic species, whose principal host is *Cercis* rather than *Bauhinia,* and another species which extends from Middle America to the West Indies and into northwestern South America.

Our respective contributions to the study are as in our *Caryedes* paper, except that the non-genital drawings were prepared by K. Conway.

Materials and methods. — We examined approximately 1850

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specimens in the United States National Museum and from sources acknowledged below. All American specimens of the host plant genera *Bauhinia* and *Cercis* available in the United States National Herbarium were examined for further data and records of the bruchids and their host plants.

Methods are as described by Kingsolver and Whitehead (1974) except for the following. Information cited under "material examined" is more extended: records from herbarium material are so indicated so that host records can be reconfirmed if necessary. Maps are given of the known distributions of the 5 North and Central American *Gibbobruchus* species for which host records are available. Distribution maps are also given for most of the reported host species, based on records in the United States National Herbarium. For convenience, we use informal designations for "species groups", "lineages" of related species groups, and "assemblages' of related genera.

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Kingsolver examined type material of most of the names assigned to *Gibbobruchus*: these specimens are housed in the British Museum (Natural History), London; Muséum National d'Histoire Naturelle, Paris; and Naturhistoriska Riksmuseum, Stockholm. Types of new species described by us are deposited in the United States National Museum, Washington (USNM).

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TAXONOMY

Genus GIBBOBRUCHUS Pic

Pachymerus subg. *Gibbobruchus* Pic 1913a: 110 (included *Bruchus speculifer* Gyllenhal and *B. polycoccus* Fåhraeus but did not designate type-species); type-species by subsequent designation *Bruchus speculifer* Gyllenhal (Bridwell 1932).

Pseudopachymerus subg. *Gibbobruchus:* Pic 1913b: 10.

Gibbobruchus: Bridwell 1932: 105; Blackwelder 1946: 762; Bottimer 1968b: 1022.

Diagnostic combination. — *Gibbobruchus* is distinguished from other American genera of Bruchinae that have the hind tibia strongly arcuate and the pronotum campaniform and with conspicuous gibbosites or tubercles by the following combination of characters: abdominal sterna and/or pygidium with large polished areas (from *Merobruchus* and *Caryedes* and their relatives); and pronotal disc gibbous and with conspicuous median sulcus, basal gibbosity of elytron prominent, and ventral sulcus of hind femur not polished (from *Penthobruchus* and *Pygiopachymerus*).

Females of all but one species, and males of some, have a large centrally placed glabrous area on the pygidium here termed a "speculum". This feature is distinctive of the genus in the Americas but is shared by *Specularius,* an unrelated Old World genus.

Description. — Body depressed, metasternum not or slightly prominent; length from pronotal apex to pygidial apex 2.3-5.0 mm, about 1.5-1.7 times greater than maximum width; width across both elytra 1.4-3.0 mm, nearly equal to maximum length of elytron. Head short, strongly constricted be-

hind eye, postocular lobe short. Eye moderate, not sex-dimorphic, interocular ratio about 0.17-0.35; ocular sinus moderate to deep, 6-8 rows of facets behind sinus. Frons with median carina prominent, greatly so in *polycoccus* Group, polished or alutaceous, narrow basally. Frontoclypeal region broad, pentagonal; sides slightly convergent basally, strongly so anteriorly; distance from apex of clypeus to apex of superior lobe of eye 1.0-1.8 times length of eye from apex of superior lobe to base. Gena between base of mandible and antennal fossa about half as long as diameter of antennal fossa, glabrous. Antennae sex-dimorphic in *polycoccus* Group only, outer articles strongly transverse in female and flabellate in male; in other groups outer articles transverse. Pronotum campaniform, sides slightly to deeply concave in dorsal aspect; median and lateral basal gibbosities low to high, median sulcus shallow to deep; median anterior gibbosities low to moderate, shallowly to deeply sulcate between; median basal lobe shallowly emarginate; lateral carina obsolete. Scutellum small, square, bidentate. Intercoxal process of prosternum narrow, acute. Metasternum shallow, flat or slightly rounded in profile, not prominent. Mesosternal lobe broad, flat, apex rounded or truncate. Elytra together subquadrate; striae deep, finely punctate, in some species obscured by vestiture; striae 3 and 4 slightly to strongly deflected laterad before base, stria 3 ended by basal gibbosity, basal gibbosity high or flattened; striae 4 and 5 abbreviated apically, coalescent or not; striae 7, 8, and 9 limited basally by low to prominent humeral gibbosity; interval 9 not carinate, with or without terminal gibbosity; disc slightly concave to slightly convex between basal gibbosities. Front and middle legs slender, not sex-dimorphic; front coxae contiguous apically, middle coxae widely separated. Hind coxa densely punctate, finely pubescent. Hind femur incrassate; external ventral margin carinate, strongly toothed; ventral sulcus slightly to strongly developed basally, punctate-pubescent; internal ventral margin with two or more small teeth before pecten, carina obsolete to moderately developed; pecten with 3-7 teeth, deeply dissected, varied in spacing. Hind tibia strongly carinate, arcuate, flanged ventrally from near middle to mucro, or not; mucro much shorter than apical width of tibia; external apical margin truncate to slightly oblique, lateral coronal tooth absent or weakly developed, dorsolateral coronal teeth present or absent. Hind basitarsus about as long as or longer than outer four articles together. Abdominal sterna not strongly telescoped in male; male with or without median patch of velvety pubescence on basal sternum; last sternum slightly to strongly emarginate in male, entire in female; sterna with or without lateral polished areas. Pygidium various, with glabrous speculum at least in female in all except some members of *scurra* Group, structurally sex-dimorphic or not. Male genitalia with median lobe broad, not fractured before apex, not strongly arched, with or without patch of setae above apical orifice, basal hood broad; internal sac various, with or without distinctive sclerites, and without hinge sclerites; lateral lobes arcuate,

deeply divided, basal strut of tegmen broad, without median keel, or (in *peculifer* Group) with remnant of ventral keel in basal half.

Distribution. — *Gibbobruchus* ranges wholly within tropical America except for one species which is widely distributed in temperate parts of eastern North America. Three species groups are known from Brazil, one from Argentina to Panama, one from Mexico and Central America, and one from temperate North America to Venezuela and Jamaica.

Remarks. — Except for the temperate North American species, whose larvae feed principally on seeds of *Cercis*, and secondarily on seeds of *Bauhinia, Gibbobruchus* larvae feed only on seeds of various species of *Bauhinia.* Nine species of *Bauhinia* are known hosts for *Gibbobruchus* larvae between southern Texas and Costa Rica. Two species of *Gibbobruchus* are each known from as many as five or six *Bauhinia* species, all of which are members of the subgenus *Bauhinia. Bauhinia glabra,* a member of the subgenus *Schnella,* is attacked by various species of the *stenocephalus* Group of *Caryedes* in Central America (Kingsolver and Whitehead 1974) but is not known to be a host of *Gibbobruchus* there. In South America, however, *B. glabra* is attacked by a form of one of the Central American species of *Gibbobruchus,* though perhaps secondarily.

Key to Species Groups of Gibbobruchus

1. Abdominal sterna uniformly pubescent, without polished lateral areas; pygidium not sex-dimorphic, in each sex with large flat speculum; male antenna not flabellate ..... *speculifer* Group

1′ Abdominal sterna not uniformly pubescent, at least sternum 1 with polished lateral areas; pygidium sex-dimorphic; male either without distinct pygidial speculum or with flabellate antenna 2

2 (1′) Antenna strongly flabellate in male, less in female; pygidium with speculum developed in both sexes but sharply bituberculate in female, flat in male ..... *polycoccus* Group

2′ Antenna not flabellate; male without distinct pygidial speculum, female with speculum at most biconvex 3

3 (2′) Vestiture of abdomen, pygidium, and hind femur dense, white; pygidial speculum of female small, alutaceous, and bilobate, or obsolete ..... *scurra* Group

3′ Vestiture not as above; female pygidial speculum large, not bilobate 4

4 (3') Male pygidium nearly evenly clothed in pale vestiture, surface not tuberculate; female pygidial speculum strongly emarginate apically, not alutaceous or strongly convex ..... *wunderlini* Group
4' Male pygidium variegated in vestiture or sculpture or both; female pygidial speculum not distinctly emarginate apically 5
5 (4') Male abdominal sternum 1 without median patch of velvety pubescence; female pygidial speculum alutaceous ..... *cavillator* Group
5' Male abdominal sternum 1 with median patch of velvety pubescence; female pygidial speculum not alutaceous ..... *mimus* Group

The SPECULIFER Group

Diagnostic combination. — Members of the *speculifer* Group differ from all other *Gibbobruchus* by the following: pygidium not sex-dimorphic, flat, with large polished speculum; and abdominal sterna without polished lateral areas. Additional characteristics of members of this group: eyes large, interocular ratio about 0.21-0.24; ocular sinus moderate, about 6 rows of facets behind sinus; antenna not sex-dimorphic, not flabellate; median frontal carina normal, not strongly elevated behind; frontoclypeal region short, distance from apex of clypeus to apex of superior lobe of eye about 1.1 times longer than eye from apex of superior lobe of eye to base; pronotum with median gibbosities strongly raised, approximate, shallowly sulcate between, lateral gibbosities low; mesosternal lobe narrow, apex truncate or emarginate; pecten of hind femur with 5-7 teeth; hind tibia with lateral and dorsolateral coronal teeth obsolete; elytral sculpture not strongly developed, basal gibbosities not raised above plane of humeral gibbosities, striae 3 and 4 not strongly deflected laterad basally; abdominal sternum 1 without median patch of velvety pubescence in male, not sex-dimorphic; last sternum not strongly emarginate in male; median lobe slender, with or without conspicuous sclerites; lateral lobes caliper shaped; and basal strut of tegmen with small median keel in basal half.

Distribution. — The *speculifer* Group, with two known species, is restricted to South America. We examined 51 specimens.

Gibbobruchus speculifer (Gyllenhal)

Bruchus speculifer Gyllenhal 1833: 87. Type-locality: Brazil, type in Riksmuseum, Stockholm.

Pachymerus speculifer: Schrottky 1906: 99.
Pachymerus (Gibbobruchus) speculifer: Pic 1913a: 110.
Pseudopachymerus speculifer: Pic 1913b: 12.
Gibbobruchus speculifer: Bridwell 1938: 74; Blackwelder 1946: 762.
Caryedes speculifera: Blackwelder 1946: 758.
Gibbobruchus atromaculatus Pic 1931: 24; Blackwelder 1946: 762. Type-locality: Bahía, Bahía, Brazil, type in Muséum National d'Histoire Naturelle, Paris. **New synonymy.**
Pseudopachymerus atromaculatus: Bondar 1931: 421; Bondar 1937: 23.

Remarks. — *Gibbobruchus speculifer* ranges in length from 3.0-4.2 mm; antenna as in Fig. 15, antennal articles 5, 7, and 9 slightly infuscated, pygidial speculum (Fig. 31) large and nearly entirely impunctate, and male genitalia as in Figs. 49, 50. We examined 44 specimens from various localities in Bolivia, Brazil, and Uruguay. These specimens are largely rufous in color but vary in extent of dark maculation. Pic distinguished *G. atromaculatus* from *G. speculifer* because of dark elytral maculation.

Reared specimens of *G. speculifer* are from Montevideo, Uruguay, 4.V-19.VI.1944, *ex Bauhinia* sp.; Rio Grande do Sul, Brazil, 22.V.1958, *ex Bauhinia* sp.; Santa Maria, Rio Grande do Sul, Brazil, 25.VIII.1971, reared *ex Bauhinia forficata* var. *pruinosa* (Vog.) Hassl. by D. Link; and intercepted at Washington, D.C. from Brazil, 29.X.1952, *ex B. forficata* var. *pruinosa* (Vog.) Hassl. Additional specimens of *G. speculifer* have been collected in October, November, December, and January.

Gibbobruchus ornatus Pic

Gibbobruchus ornatus Pic 1931: 24; Blackwelder 1946: 762. Type-locality: Jatahy, Goiás, Brazil, type in Muséum National d'Histoire Naturelle, Paris.

Remarks. — *Gibbobruchus ornatus* ranges in length from 2.6 to 3.3 mm; antenna as in Fig. 16, antennal articles 8, 9, and 10 slightly to strongly infuscated, pygidial speculum (Fig. 32) small and densely punctate-pubescent apically, and male genitalia as in Figs. 51, 52. We examined 7 specimens from various localities in the Brazilian states of Mato Grosso, Pará, and Rio Grande do Sul. We have no host record for *G. ornatus,* specimens of which were collected in May, July, October, and November.

The POLYCOCCUS Group

Diagnostic combination. — Members of the *polycoccus* Group differ from all other *Gibbobruchus* by the following: pygidium sex-dimorphic but with large polished speculum in both sexes, speculum flat in male and strongly bituberculate in female; and antenna sex-dimorphic, strongly flabellate in male, weakly flabellate in female. Additional characteristics: eyes large, interocular ratio about 0.17-0.20; ocular sinus moderate, about 6-7 rows of facets behind sinus; median frontal carina strongly elevated behind; frontoclypeal region short, distance from apex of clypeus to apex of superior lobe of eye about 1.0-1.2 times longer than eye from apex of superior lobe of eye to base; pronotum with median gibbosities strongly raised, deeply sulcate between, lateral gibbosities strongly raised; mesosternal lobe broad, truncate at apex; pecten of hind femur with 3 widely spaced teeth, distal tooth bifid in most specimens; hind tibia with lateral coronal tooth obsolete, dorsolateral coronal teeth small to obsolete; elytral sculpture strongly developed, intervals 3, 5, 7, and 9 each with 3 strongly raised tubercles, basal gibbosities raised high above plane of humeral gibbosities, striae 3 and 4 strongly deflected laterad toward basal gibbosities; abdominal sternum 1 without median patch of velvety pubescence in male, not sex-dimorphic; sterna 1-3 or 4 with polished lateral areas; last sternum strongly emarginate in male; median lobe elongate, slender, without conspicuous sclerites; lateral lobes slender, proximate; and basal strut of tegmen broad, without median keel.

Distribution. — The *polycoccus* Group is restricted to South America and includes one known species. We examined 14 specimens from various localities in southeastern Brazil.

Gibbobruchus polycoccus (Fåhraeus), new combination

Bruchus polycoccus Fåhraeus 1839: 121. Type-locality: Brazil, type in Riksmuseum, Stockholm.

Pachymerus polycoccus: Schrottky 1906: 101.

Pachymerus (Gibbobruchus) polycoccus: Pic 1913a: 110.

Pseudopachymerus polycoccus: Pic 1913b: 11.

Caryedes polycoccus: Blackwelder 1946: 758.

Pachymerus (Gibbobruchus) bituberculatus Pic 1913a: 115. Type-locality: Rio Grande do Sul, Brazil, type in Muséum National d'Histoire Naturelle, Paris. **New synonymy.**
Caryedes bituberculata: Blackwelder 1946: 757.

Remarks. — Adults of *G. polycoccus* range in length from 2.9 to 4.1 mm. We illustrate the antenna (Fig. 17, females; Fig. 18, male), pygidium (Fig. 33, male; Fig. 34, female), and male genitalia (Figs. 53-54). The pygidial speculum is rufous in some specimens, black in others. We also observed minor variation in the prominence of the tubercles of the female pygidium.

Reared specimens of *G. polycoccus* are from Caldas, Minas Gerais, Brazil, 15.V.1845, *ex* herbarium specimen of *Bauhinia longicuspis* Spruce. Additional specimens were collected in April, September, October, November, and December.

The SCURRA Group

Diagnostic combination. — Members of the *scurra* Group differ from members of the *speculifer* and *polycoccus* Groups by the following combination: antennae not sex-dimorphic and not flabellate; male pygidium without speculum; and abdominal sterna 1-3 or 4 with polished lateral areas. They differ from members of the *wunderlini* and *mimus Groups* by having the female pygidial speculum microsculptured, in one species covered by fine vestiture. And they differ from members of the *cavillator* Group by: female pygidial speculum reduced, bilobate or obsolete; vestiture of male pygidium regular; pecten with at least 4 distinct teeth, distal tooth bifid or trifid; and patches of dense lateral vestiture of sterna large. Additional characteristics: eyes moderate, interocular ratio about 0.31-0.32; ocular sinus moderate, about 6 rows of fine facets behind sinus; median frontal carina normal, not strongly elevated behind; frontoclypeal region moderately long, distance from apex of clypeus to apex of superior lobe of eye about 1.3-1.6 times longer than eye from apex of superior lobe of eye to base; pronotum with median gibbosities strongly raised, deeply sulcate between, lateral gibbosities strongly raised; mesosternal lobe narrow, apex truncate or emarginate; hind tibia with lateral coronal tooth obsolete, dorsolateral coronal teeth small; elytral sculpture moderately developed, basal gibbosities raised high above

plane of humeral gibbosities; abdominal sternum 1 without median patch of velvety pubescence in male, sternum 5 strongly emarginate in male; median lobe short, broad, without sclerites on internal sac, spines of pygidial sac weakly developed; lateral lobes divergent from base, slightly convergent apically; and basal strut of tegmen without median keel.

Distribution. — The *scurra* Group is restricted to South America, and includes one described species and at least one undescribed species. We examined 31 specimens from Brazil and Paraguay.

Gibbobruchus scurra (Boheman), new combination

Bruchus scurra Boheman 1833: 86. Type-locality: Brazil, type in Riksmuseum, Stockholm, not seen but photograph examined.
Pseuodpachymerus scurra: Pic 1913b: 12.
Caryedes scurra: Blackwelder 1946: 758.
Pachymerus ruficornis Chevrolat 1877: xc. Type-locality: Mexico (probably erroneously labeled since the species is known only from South America), type in Riksmuseum, Stockholm. **New Synonymy.**
Bruchus ruficornis: Sharp 1885: 442.
Pseudopachymerus ruficornis: Pic 1913b: 11.

Remarks. — *Gibbobruchus scurra* ranges in length from 3.3 to 5.4 mm, and the female pygidial speculum is distinct. We illustrate the antenna (Fig. 19), pygidium (Fig. 35, male; Fig. 36, female), and male genitalia (Figs. 55-56). We examined 30 specimens from the Brazilian federal district and states of Goiás, Mato Grosso, and São Paulo. *Pachymerus ruficornis* Chevrolat, cited erroneously from Mexico, is conspecific with *G. scurra* (Boheman).

We have the following host records: Atibaia, São Paulo, Brazil, 22.VI.1960, G. & T. L. Eiten, *ex* herbarium specimen of *Bauhinia rufa* (Bong.) Steud.; Rio Torto, ca. 10 km. n. Brasilia, Distrito Federal, Brazil, 8.VIII.1966, Irwin *et al.*, *ex* herbarium specimen of *Bauhinia rufa* (Bong.) Steud.; 35 km. s. Brasilia, Distrito Federal, Brazil, 5.IX.1964, Irwin *et al.*, *ex* herbarium specimen of *Bauhinia rufa* (Bong.) Steud. Seeds may have circular exits or be abraded on one or both sides. All 18 infested seeds examined had one predator per seed. Additional specimens

have been collected in March, April, October, November, and December.

A female of an undescribed species is smaller (3.1 mm) and is unique among known *Gibbobruchus* by lacking a pygidial speculum: this area is faintly differentiated and agrees in shape with the speculum of *G. scurra* but is uniformly clothed with vestiture nearly as dense as on the rest of the pygidium. This specimen is from Paraguay, 1890, T. Morong, *ex* herbarium specimen of *Bauhinia bauhinioides* (Mart.) Macbride. Pods of *B. bauhinioides* are indehiscent, and the beetles emerge through circular exits cut through the pod wall.

The CAVILLATOR Group

Diagnostic combination. — Members of the *cavillator* Group differ from members of the *speculifer* and *polycoccus* Groups by the following combination: antennae not sex-dimorphic and not flabellate; male pygidium without speculum, though with apex glabrous or sparsely pubescent; and abdominal sterna 1-3 or 4 with polished lateral areas. They differ from members of the *scurra* Group by: female pygidial speculum not bilobate; vestiture of male pygidium irregular, sparse at apex; pecten in most species with only 4 distinct teeth; and patches of dense lateral vestiture of sterna small. They differ from members of the *wunderlini* Group by having the female pygidial speculum microsculptured, and from members of the *mimus* Group by this characteristic and by lacking a median patch of velvety pubescence on male sternum 1. Additional characteristics: length 2.3-4.6 mm; eyes moderate, interocular ratio about 0.26-0.34; ocular sinus moderate, 6-7 rows of facets behind sinus; median frontal carina normal, not strongly elevated behind; frontoclypeal region moderately long, distance from apex of clypeus to apex of superior lobe of eye about 1.3-1.8 times longer than eye from apex of superior lobe of eye to base; pronotum with median gibbosities low to strongly raised, shallowly to deeply sulcate between, lateral gibbosities low to strongly raised; mesosternal lobe broad, apex truncate or emarginate; hind tibia with lateral coronal tooth obsolete, dorsolateral coronal teeth small or obsolete; elytral sculpture moderately developed, basal gibbosities raised high above plane of humeral gibbosities; sternum 5

strongly emarginate in male; median lobe short, broad, without sclerites on internal sac, spicules of internal sac weakly developed in most species; lateral lobes divergent from base, strongly convergent apically; and basal strut of tegmen without median keel.

Distribution. — The *cavillator* Group is restricted to South America and Panama. It includes 3 named species and several undescribed species. We examined 85 specimens of this group from Panama, Colombia, Venezuela, Brazil, Bolivia, Peru, Argentina, and Uruguay.

Remarks. — The *cavillator* and *mimus* Groups probably are quite old natural assemblages but are not strongly differentiated structurally. Females of members of the *cavillator* Group have the pygidial speculum microsculptured and dull, not shiny as in members of the *mimus* Group. Males of the *mimus* Group generally have a patch of differentiated velvety pubescence at the middle of sternum 1, though in some individuals of *G. cristicollis* this feature is inconspicuous. In all members of the *mimus* Group, the polished areas of sterna 1 and 2 are widely separated by a punctate-pubescent band at the base of sternum 2, whereas these polished areas are nearly contiguous in all except one undescribed species of the *cavillator* Group. Ranges of the two groups overlap in Panama and northwestern South America.

Gibbobruchus cavillator (Fåhraeus), *G. nigronotatus* (Pic), and *G. triangularis* (Pic) refer to closely related members of the *cavillator* Group and may be synonymous. We have insufficent representation of this group to attempt to define the species.

We have host records for what probably are 4 species. Species 1: 8 km. nw. Maranguape, Ceará, Brazil, 1.VIII.1944, *ex Bauhinia ungulata* L. Species 2: Minas Gerais, Brazil, 21.V.1846, *ex Bauhinia rufa* (Bong.) Steud.; Santander, Colombia, *ex Bauhinia monandra* Kurz (probably not correctly identified). Species 3: Guanai-Pipuani, Bolivia, IV-VI.1892, *ex Bauhinia ungulata* L. Species 4 (probably *G. cavillator*): La Paragua, Bolívar, Venezuela, IV.1943, *ex Bauhinia aculeata* L.; La Paragua, Bolívar, Venezuela, 9.III.1940, *ex Bauhinia ungulata* L.; w. Shapaja, San Martín, Peru, *ex Bauhinia aculeata* L.; Buenavista, Bolívar, Colombia, 21.I.1918, *ex Bauhinia ungulata* L.

Gibbobruchus cavillator (Fåhraeus), new combination

Bruchus cavillator Fåhraeus 1839: 118. Type-locality: Brazil, type in Riksmuseum, Stockholm.

Pseudopachymerus cavillator: Pic 1913b: 10; Bondar 1931: 419; Bondar 1937: 22.

Caryedes cavillator: Blackwelder 1946: 758.

Gibbobruchus nigronotatus (Pic), new combination

Pseudopachymerus nigronotatus Pic 1931: 24; Bondar 1931: 422; Bondar 1937: 23. Type-localities: Minas and Jatahy, Brazil, type material in Muséum National d'Histoire Naturelle, Paris.

Caryedes nigronotata: Blackwelder 1946: 758.

Gibbobruchus triangularis (Pic), new combination

Pseudopachymerus (*Falsobruchus*) *triangularis* Pic 1926: 2. Type-locality: Brazil, type in Muséum National d'Histoire Naturelle, Paris.

Caryedes triangularis: Blackwelder 1946: 758.

The WUNDERLINI Group

Diagnostic combination. — Members of the *wunderlini* Group differ from members of the *speculifer* and *polycoccus* Groups by the following combination: antennae not sex-dimorphic and not flabellate; male pygidium without speculum, vestiture evenly and densely distributed; and abdominal sterna 1-3 with contiguous polished lateral areas. They differ from members of the *scurra* Group by having the female pygidial speculum not bilobate, from members of the *scurra* and *cavillator* Groups by having the female pygidial speculum polished, and from members of the *mimus* Group by lacking a median patch of velvety pubescence on male sternum 1. Additional characteristics: length 2.8-4.6 mm; eyes moderate, interocular ratio about 0.32-0.34; ocular sinus moderate, 6-7 rows of facets behind sinus; median frontal carina normal, not strongly elevated behind; frontoclypeal region moderately long, distance from apex of clypeus to apex of superior lobe of eye about 1.3-1.4 times longer than eye from apex of superior lobe of eye to base; pronotum with anterior median gibbosities strongly raised and deeply sulcate between, posterior median gibbosities less strongly raised and shallowly sulcate between, lateral gibbosities strongly raised; mesosternal lobe broad, apex truncate; hind

tibia with lateral coronal tooth blunt, dorsolateral coronal teeth small; pecten of hind femur with 3 widely separated teeth, last tooth bifid or trifid; elytral sculpture moderately developed, basal gibbosities raised slightly above plane of humeral gibbosities; abdominal sternum 5 strongly emarginate in male; median lobe short, broad, without sclerites on internal sac, spicules of internal sac strongly developed; lateral lobes divergent from base, not convergent apically; and basal strut of tegmen without median keel.

Distribution. — The *wunderlini* Group, so far as is known, includes one species in southern Mexico and Guatemala; 12 specimens were examined.

Remarks. — Specimens of the *wunderlini* Group were extracted from herbarium sheets of *Bauhinia dipetala* var. *deserti* (Britt. & Rose) Wunderlin from the Mexican states of Oaxaca and Puebla, and from a Guatemalan specimen of *Bauhinia divaricata* L.

The *wunderlini* and *mimus* Groups are sympatric, related, and perhaps are sister groups. The single species of the *wunderlini* Group is readily distinguished by the dorsal color pattern. Males of the *wunderlini* Group differ from most males of the *mimus* Group by lacking a conspicuous patch of velvety pubescence on sternum 1, and by having evenly dense pygidial vestiture. Females of the *wunderlini* Group differ from those of the *mimus* Group by having the pygidial speculum flat and emarginate apically, inversely heart shaped.

Gibbobruchus wunderlini Whitehead and Kingsolver, new species

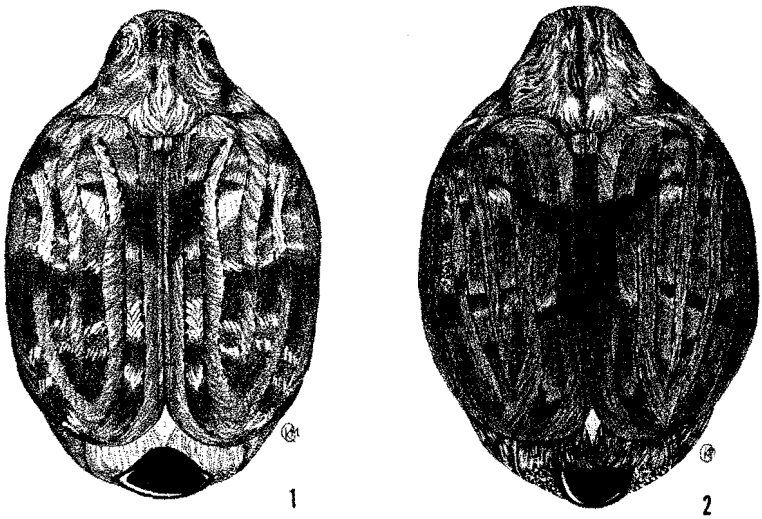
Description. — *Gibbobruchus, wunderlini* Group. Length 2.8-4.6 mm. Width 1.8-3.0 mm. Integument varied from about 50% rufous to largely piceous; antennal articles 8-10 infuscated; body areas with dense vestiture tend to be rufous, e.g., dorsal surface of hind femur. Vestiture variegated in color and density, colors white, tan, brown, and black; pattern of dorsum (Fig. 1) strongly variegated; pronotum without basal patch of intense white; scutellar vestiture pale but not white; vestiture of venter sparse, white; vestiture of metepisternum dense, largely tan; front and middle femora and tibiae banded; hind femur with dense dorsal vestiture, largely tan, banded, median area darker; male pygidial vestiture nearly uniform, dense, light tan; female pygidial speculum surrounded by dense white and light tan vestiture. Head (Fig. 8); antenna (Fig. 20); pronotum and elytra (Fig. 1), gibbosities and elytral tubercles not strongly developed; hind leg (Fig. 25), pecten with 3 widely spaced teeth, last tooth bifid; male pygidium (Fig. 37), evenly

convex; female pygidium (Fig. 38), speculum inversely heart shaped, nearly flat, with few scattered small punctures; male genitalia (Figs. 57, 58).

Type-material. — Holotype male, "MEX. Puebla nr. Tehuacan 30.VIII-8.IX.05 J. N. Rose et al" and "B. dipetala v. deserti (B & R) det RPW '67 USNM herb."; in United States National Museum, Washington; type number 72802.

Paratypes, Mexico to Guatemala (Fig. 71), 11, including fragments and immatures; in USNM. MEXICO. Oaxaca: Cerro San Antonio, 12.X.1907, C. Conzatti, *ex* herbarium specimen of *Bauhinia dipetala* var. *deserti* (Britt. & Rose) Wunderlin. Puebla: Tehuacan, 30.VIII-8.IX.1905, J. N. Rose, *ex* herbarium specimen of *Bauhinia dipetala* var. *deserti* (Britt. & Rose) Wunderlin; Tehuacan, 7.XI.1903, *ex* herbarium specimen of *Bauhinia dipetala* var. *deserti* (Britt. & Rose) Wunderlin. GUATEMALA. Jutiapa: El Progreso, between Tulumajillo and Finca Montanita, 3.II.1942, Steyermark, *ex* herbarium specimen of *Bauhinia divaricata* L.

Remarks. — We are pleased to name this elegant new species,



FIGURES 1-2. — *Gibbobruchus* spp., habitus: 1, *G. wunderlini;* 2, *G. divaricatae.*

the only member of its group, for Dr. Richard P. Wunderlin to acknowledge his assistance in botanical matters and provision of numerous *Gibbobruchus* specimens with full host records.

Gibbobruchus wunderlini is reported from three collections of *Bauhinia dipetala* var. *deserti* and from one collection of *B. divaricata.* Distributions of these host species are mapped in Figs. 77, 78. We have no other records of *Gibbobruchus* from *B. dipetala* and its varieties but do have records of several species of the *cristicollis* Group from *B. divaricata.*

Larval *G. wunderlini* utilize nearly all food material within the seed, occur one per seed, and may abrade the seed wall on one or both sides.

The MIMUS Group

Diagnostic combination. — Members of the *mimus* Group differ from members of the *speculifer* and *polycoccus* Groups by the following combination: antennae not sex-dimorphic and not flabellate; male pygidium without speculum, with or without small glabrous area mesially; and abdominal sterna 1-2 or 1-3 with polished lateral areas. They differ from members of the *scurra* Group by having the female pygidial speculum not bilobate, from members of the *scurra* and *cavillator* Groups by having the female pygidial speculum polished, and from members of the *wunderlini* Group by having a median patch of velvety pubescence on male sternum 1. Additional characteristics: length 2.4-4.7 mm; eyes moderate, interocular ratio about 0.25-0.34; ocular sinus moderate, 6-8 rows of facets behind sinus; median frontal carina normal, not strongly elevated behind; frontoclypeal region moderately long, distance from apex of clypeus to apex of superior lobe of eye about 1.3-1.4 times longer than eye from apex of superior lobe of eye to base; pronotal and elytral gibbosities slightly to strongly raised; mesosternal lobe broad, apex truncate; hind tibia with lateral coronal tooth blunt, dorsolateral coronal teeth small; pecten of hind femur with 4-5 teeth, spacing varied; elytral sculpture slightly to strongly developed, basal gibbosities raised well above plane of humeral gibbosities; abdominal sternum 5 deeply emarginate in male; median lobe short, broad, without sclerites on internal sac, spines of internal sac strongly developed in most species; lateral lobes

divergent from base, moderately to strongly convergent apically; and basal strut of tegmen of male genitalia without median keel.

Distribution. — We distinguish 5 species in the *mimus* Group, with one in temperate North America and 4 in tropical Middle America. One tropical species extends into northwestern South America and the West Indies, but the group is otherwise restricted to North and Central America.

Remarks. — The temperate species attacks primarily seeds of *Cercis*, while the tropical species attack seeds of various species of *Bauhinia*.

Key to Species of Mimus Group

1 Dorsum of hind femur with extensive pale pattern (Figs. 28, 29) .. 2
1′ Dorsum of hind femur with reduced pale pattern (Figs. 27, 30) 3
2 (1) Pecten of hind femur with teeth regularly spaced, no large gap behind first or second teeth; female pygidial speculum strongly emarginate basally (Fig. 48) ..... *Gibbobruchus mimus* (Say)
2′ Pecten of hind femur with large gap behind first tooth; female pygidial speculum not deeply emarginate basally (Fig. 44) .... *Gibbobruchus guanacaste* n. sp.
3 (1′) Female pygidial speculum flat, with scattered setaceous punctures; coloration pale, elytral pattern without large dark sutural marking ..... *Gibbobruchus iturbidensis* n. sp.
3′ Female pygidial speculum convex, without scattered setaceous punctures; elytral pattern with large dark sutural marking 4
4 (3′) Dark sutural mark of elytra elongate (Fig. 2), elytron without conspicuous pale pattern; base of pronotal crest not conspicuously pale ..... *Gibbobruchus divaricatae* n. sp.
4′ Dark sutural mark of elytra short (Fig. 4), elytron with conspicuous pale pattern or not; base of pronotal crest with conspicuous pale vestiture in most specimens ..... *Gibbobruchus cristicollis* (Sharp)

Gibbobruchus divaricatae Whitehead and Kingsolver, new species

Description. — *Gibbobruchus, mimus* Group. Length 2.6-4.1 mm. Width 1.8-2.6 mm. Integument largely piceous, elytra with indistinct rufopiceous variegation; antennae pale, articles 7-10 slightly to moderately infuscated; tarsi pale, hind basitarsus slightly infuscated; front and middle femora and tibiae banded. Vestiture mostly sparse, dark, faintly variegated, orange to black; pattern of dorsum (Fig. 2) with characteristic elongate velvety black sutural mark, variegation otherwise inconspicuous; pronotum without basal patch of intense white vestiture; scutellar vestiture sparse; posterior margin

of mesepisternum and posterior angles of metepisternum with conspicuous orange vestiture; front and middle femora and tibiae banded; hind femur with vestiture largely sparse, white, small distal patches of dense orange vestiture dorsally and anteriorly; hind tibia with faint band of white vestiture at apical third; vestiture of pygidium largely sparse, dark, small triangular patch of dense white on midline at base, male with vague white or orange lateral patches near middle. Head (Fig. 9); antenna (Fig. 21); pronotum and elytra (Fig. 2), gibbosities and elytral tubercles strongly raised; hind leg (Fig. 27), pecten with 3-4 closely spaced posterior teeth separated from large anterior tooth by large gap; male pygidium (Fig. 39) with apical half gibbous, small mesial area polished and sparsely punctate; female pygidium (Fig. 41) with speculum large, round, convex, distinctly micropunctate, fringed apically by narrow punctate-pubescent border; sternum 1 of male with median patch of velvety pubescence conspicuous; male genitalia (Figs. 59, 60).

Type material. — Holotype male, "10 mi. E. Acayucan, Ver., Mex. VI-15-68", "reared seeds #111-68", "emerged by VII-18-68", "reared seeds Bauhinia divaricata", "C. D. Johnson collector": in United States National Museum, Washington; type number 72803.

Paratypes, Texas to Honduras (Fig. 73), 91; in CNC, FMNH, NAUF, TAMC, UKSM, USNM. UNITED STATES. Texas: Cameron County, Brownsville, 13.IX, 1948, G. A. Pfaffman, *ex Bauhinia divaricata* L. MEXICO. Intercepted at Brownsville, 23.I.1950, *ex Bauhinia divaricata* L. Guerrero: Acapulco, X.1894-III.1895, E. Palmer, *ex* herbarium specimen of *Bauhinia pes-caprae* Cav. Mexico: San Antonio Tlatlaya, 25.I.1953, E. Matuda *et al., ex* herbarium specimen of *Bauhinia ungulata* L. Nayarit: Acaponeta, 12.IV.1910, J. N. Rose *et al., ex* herbarium specimen of *Bauhinia ungulata* L.; 10 mi. e. San Blas, 5.I.1973, C. D. Johnson, reared *ex Bauhinia ungulata* L., emerged by 1-9.II. 1973. Oaxaca: Yaveo, 29.III.1938, Y. Mexia, *ex* herbarium specimen of *Bauhinia divaricata* L. Quintana Roo: San Miguel, Cozumel Island, 1.VII.1959, N. L. H. Krauss; San Miguel, Cozumel Island, 24-28.XII.1967, W. H. Lewis, *ex* herbarium specimen of *Bauhinia divaricata* L. San Luis Potosí: Tamazunchale, 15-18.VII.1963, Davis and Duckworth; Tamazunchale, 5.VIII.1963, McCutchan & Bottimer; Tamazunchale, 9.VII.1966, J. A. Mears, *ex* herbarium specimen of *Bauhinia divaricata* L.;

21 mi. n. Tamazunchale, 23.VII.1954. Tabasco: 15 mi. ne. & 5 mi. s. Villahermosa, 13.VI.1965, Burke *et al.* Tamaulipas: Ciudad Victoria, 1.V-13.VI.1907, E. Palmer, *ex* herbarium specimen of *Bauhinia divaricata* L.; 2 mi. se. Gomez Farias, 20.VII. 1970, Murray *et al.;* Tampico, 5-18.XII.1909, E. A. Schwarz. Veracruz: 10 mi. e. Acayucan, 15.VI.1968, C. D. Johnson, reared *ex Bauhinia divaricata* L., emerged by 18.VII.1968; Atoyac, 14.VII.1941, H. S. Dybas; Remudadero, XII.1923, C. A. Purpus, *ex* herbarium specimen of *Bauhinia divaricata* L.; e. Tuxpam, 15.IX.1965, *ex* herbarium specimen of *Bauhinia divaricata* L. HONDURAS. Yoro: 12 km. w. Olanchito, 14.VII.1949. E. C. Becker.

Remarks. — We name *Gibbobruchus divaricatae* for its probable principal host species, *Bauhinia divaricata* L.

Gibbobruchus divaricatae is here reported from 3 host species: *Bauhinia divaricata* L., 9 records; *B. pes-caprae* Cav., 1 record; and *B. ungulata* L., 3 records. The known distribution of *G. divaricatae* (Fig. 73) approximates that of its probable principal host species, *B. divaricata* (Fig. 78).

Other species of *Gibbobruchus* known to attack seeds of *Bauhinia divaricata* are *G. wunderlini, G. cristicollis,* and *G. guanacaste;* a herbarium specimen of *B. divaricata* from San Miguel yielded two specimens of *G. divaricatae* and one of *G. guanacaste.* The only other species of *Gibbobruchus* known from *B. pes-caprae* is *G. guanacaste. Gibbobruchus guanacaste* as well as *G. divaricatae* attacks seeds of *B. ungulata.*

Infested seeds of *B. divaricatae* and *B. ungulata* are each almost entirely hollowed out by one larva and the seed coat is abraded on both sides. The one seed associated with the *B. pes-caprae* record is thicker and has a circular exit. The adult beetle exits through a circular exit cut through the seed coat or through the abraded area which may be reduced to a membranous covering. It may emerge from the pod either through a similar exit cut through the pod wall or after pod dehiscence.

Gibbobruchus iturbidensis Whitehead and Kingsolver, new species

Description. — *Gibbobruchus, mimus* Group. Length 2.7-4.3 mm. Width 2.2-2.7 mm. Integument largely rufous, elytra with rufopiceous variegation;

antennae pale, articles 7-10 slightly infuscated; tarsi pale; front and middle femora and tibiae not banded. Vestiture mostly sparse, variegated, white to orange to black; pattern of dorsum (Fig. 3) faint, no distinctive black sutural mark; pronotum without basal patch of intense white vestiture; scutellar vestiture sparse; dorsal posterior angle of metepisternum with conspicuous orange vestiture; hind femur with vestiture largely sparse, mostly white, small indistinct distal patches of white vestiture dorsally and anteriorly; vestiture of pygidium sparse, white, small triangular patch of dense white on midline at base. Head (Fig. 10); pronotum and elytra (Fig. 3), pronotal gibbosities moderately raised, elytral gibbosities and tubercles weakly developed; hind leg (Fig. 26), pecten with raised cluster of 3 posterior teeth separated from large anterior tooth by large gap; female pygidium (Fig. 40) with speculum large, round, weakly convex, sparsely macropunctate, fringed apically by wide punctate-pubescent border.

Though male and host(s) are unknown, female characteristics, particularly of the pygidium, are sufficiently distinctive to warrant recognition of this form as a distinct species.

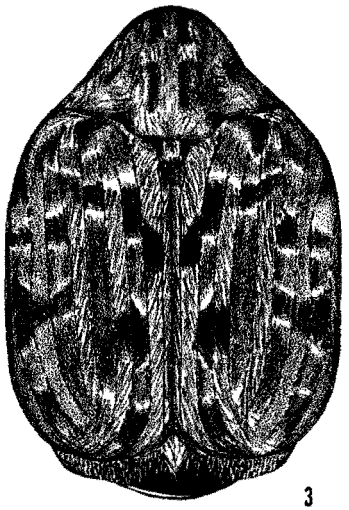
Type material. — Holotype female, "MEX.: N.L. Iturbide interc. Sep. 5 1972 Bauhinia sp." and "Laredo 4310 72-16004"; in United States National Museum, Washington; type number 72804.

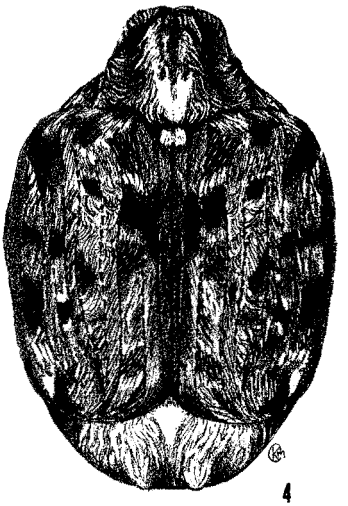
Paratypes, Mexico, 2; in CNC, USNM. MEXICO. Nuevo Leon: Chipinque Mesa, 26-29.VIII.1960, H. F. Howden. Veracruz: intercepted at Brownsville, 12.X.1959, ex "palm seed?".

Remarks. — We name *Gibbobruchus iturbidensis* for the type locality, Iturbide, Nuevo Leon, Mexico. The record from "palm seed" is doubtless in error.

Gibbobruchus guanacaste Whitehead and Kingsolver, new species

Description. — *Gibbobruchus, mimus* Group. Length 2.4-3.6 mm. Width 1.6-2.4 mm. Integument color sex-dimorphic, largely rufous (male) or piceous (female), elytra variegated; antennae pale, articles 7-9 infuscated; tarsi pale; front and middle femora and tibiae banded. Vestiture variegated in density and color, white to brown or black; pattern of dorsum (Figs. 5, 7) sharply developed, no elongate velvety sutural dark mark; pronotum with basal patch of intense white vestiture absent or slightly developed; scutellar vestiture sparse or, if moderate, not white; metepisternum variegated, dark centrally and dorsally; front and middle femora and tibiae banded; hind femur with strongly developed dorsal pattern; hind tibia with faint pale band dorsally at apical third; vestiture of pygidium of female (Fig. 44) white, sparse except in dense basal triangle; vestiture of pygidium of male





FIGURES 3-4. — *Gibbobruchus* spp., habitus: 3, *G. iturbidensis;* 4, *G. cristicollis.*

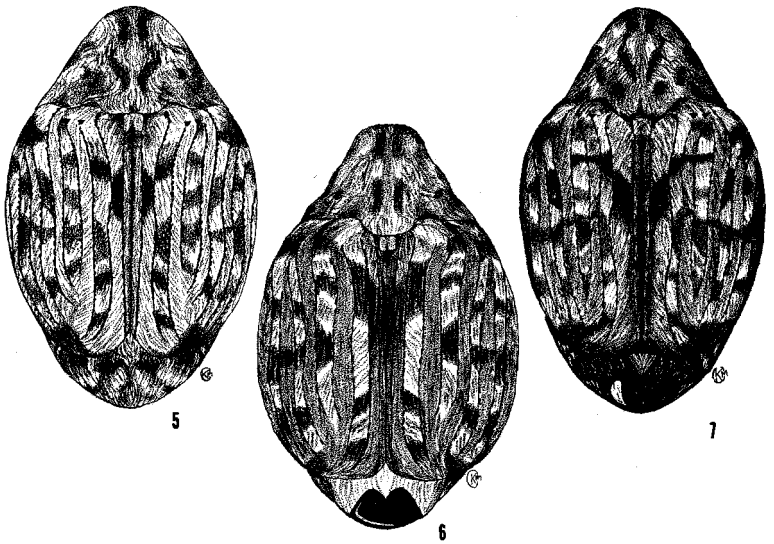
(Fig. 42) dense except small bare areas, mostly yellowish or brownish except white basal triangle and white spots in transverse median band. Head (Figs. 11, 12); antenna (Fig. 22); pronotum and elytra (Figs. 5, 7), gibbosities and elytral tubercles weakly developed; hind leg (Fig. 28), pecten with 3-4 well-spaced posterior teeth separated from large anterior tooth by moderate gap; male pygidium (Fig. 42) with apical two-thirds convex, small mesial area punctate but sparsely pubescent; female pygidium (Fig. 44) with speculum large, nearly round, convex, truncate or slightly emarginate basally, distinctly micropunctate, fringed apically by narrow punctate-pubescent border; sternum 1 of male with median patch of velvety pubescence conspicuous; male genitalia (Figs. 61-64).

Type material. — Holotype male, "1 km W Cañas Guanacaste Prov. COSTA RICA 10 Feb 1971" and "in seeds of *Bauhinia pauletia* #444 Janzen"; in United States National Museum, Washington; type number 72805.

Paratypes, Jamaica and Mexico to Venezuela (Fig. 72), 669, in CNC, FMNH, NAUF, USNM. JAMAICA. Hanover Parish: 2.2 mi. w. Sandy Bay P. O., 5.I.1972, R. P. Wunderlin #5097, *ex* herbarium specimen of *Bauhinia divaricata* L. Trelawney Par-

ish: Barbecue Bottom, 13.VIII.1966, A. T. Howden. MEXICO. Intercepted at San Francisco, 2.VI.1951, *ex* "Orquidea silvestre" seed. Guerrero: Acapulco, 28.IV.1903, E. W. Nelson, *ex* herbarium specimen of *Bauhinia pes-caprae* Cav.; Acapulco, X.1894-III.1895, E. Palmer, *ex* herbarium specimen of *Bauhinia ungulata* L. Jalisco: Guadalajara, 7.XI.1888, C. G. Pringle, *ex* herbarium specimen of *Bauhinia pringlei* S. Watson; Guadalajara, 23.V.1889, C. G. Pringle, *ex* herbarium specimen of *Bauhinia pringlei* S. Watson. Sinaloa: 3 mi. s. Rosario, 27.II.1973, C. D. Johnson, *ex Bauhinia pauletia* Pers. emerged by 15.III-20.VI.1973. Veracruz: Cotaxtla, 25.VI.1962, D. H. Janzen. EL SAVADOR. La Union: Volcan Conchagua, 27-29.V.1958, L. J. Bottimer. NICARAGUA. Granada: Granada, 2.VII.1923, W. R. Maxon, *ex* herbarium specimen of *Bauhinia pauletia* Pers.; Granada, 23.VI.1963, L. J. Bottimer #114Y, *ex Bauhinia pauletia* Pers. COSTA RICA. Guanacaste: 1 km. w. Cañas, 10.II.1971, D. H. Janzen, *ex Bauhinia pauletia* Pers.; 1 km. w. Cañas, 27.II.1972, D. H. Janzen, *ex Bauhinia pauletia* Pers., emerged by 20.VI.1972; 7 km. n. Cañas, La Pacifica, 2.II.1969, D. H. Janzen, *ex Bauhinia ungulata* L.; 7 km. n. Cañas, La Pacifica, 4.I.1972, D. H. Janzen, *ex Bauhinia ungulata* L.; Cañas-Bebedero road, 27.II.1972, D. H. Janzen, *ex Bauhinia pauletia Pers.;* Santa Rosa, 9.II.1972, D. H. Janzen, *ex Bauhinia ungulata* L., emerged by 19.VI.1972; Taboga, 27.II.1972, D. H. Janzen, *ex Bauhinia pauletia* Pers., emerged by 20.VI.1972; Taboga, 31.I.1972, R. Carroll, *ex Bauhinia pauletia* Pers. VENEZUELA. Carabobo: Las Trincheras, VI.1922, L. R. Reynolds. Distrito Federal: El Valle, VI.1922. Lara: Bejuco de Cadenas, I.1938, E. Delgado, *ex* herbarium specimen of *Bauhinia glabra* Jacq.

Variation. — Females from Jamaica are darker than those from elsewhere, and the male vestiture is a brighter orange. The male genitalia of the specimen for Bejuco, Venezuela have the lateral lobes less deeply divided and less convergent apically than in other specimens. Otherwise, there are minor variations in form of ventral valve of male median lobe and in color and distribution of pygidial vestiture; these variations form no obvious geographic or host-related pattern.



FIGURES 5-7. — *Gibbobruchus* spp., habitus: **5**, ***G. guanacaste,*** **male; 6,** ***G. mimus;*** **7,** ***G. guanacaste,*** female.

Remarks. — We name *Gibbobruchus guanacaste* for the type-locality, in Guanacaste Province, Costa Rica.

We report *G. guanacaste* from 6 host species: *Bauhinia divaricata* L., 1 record (West Indies); *B. glabra* Jacq., 1 record (South America); *B. pauletia* Pers., 8 records; *B. pes-caprae* Cav., 1 record; *B. pringlei* S. Wats., 2 records; and *B. ungulata* L., 4 records. Ranges of all of these host species except *B. glabra,* which is widespread in tropical America and which is in a subgenus separate from the other species, are mapped in Figs. 76-80. Only *B. divaricata* and *G. guanacaste* represent their respective groups in the West Indies; we have no records of *G. guanacaste* from *B. divaricata* on the mainland. Even more curious is the record of *G. guanacaste* from *B. glabra* in Venezuela; B. glabra is not in the same subgenus as other *Bauhinia* species attacked by *Gibbobruchus.* It is possible that the *B. divaricata* (Jamaica) and *B. glabra* (Venezuela) forms are not really conspecific with Central American representatives of *G. guanacaste.* If they are, then *G. guanacaste* is the only member of the genus known from the West Indies and

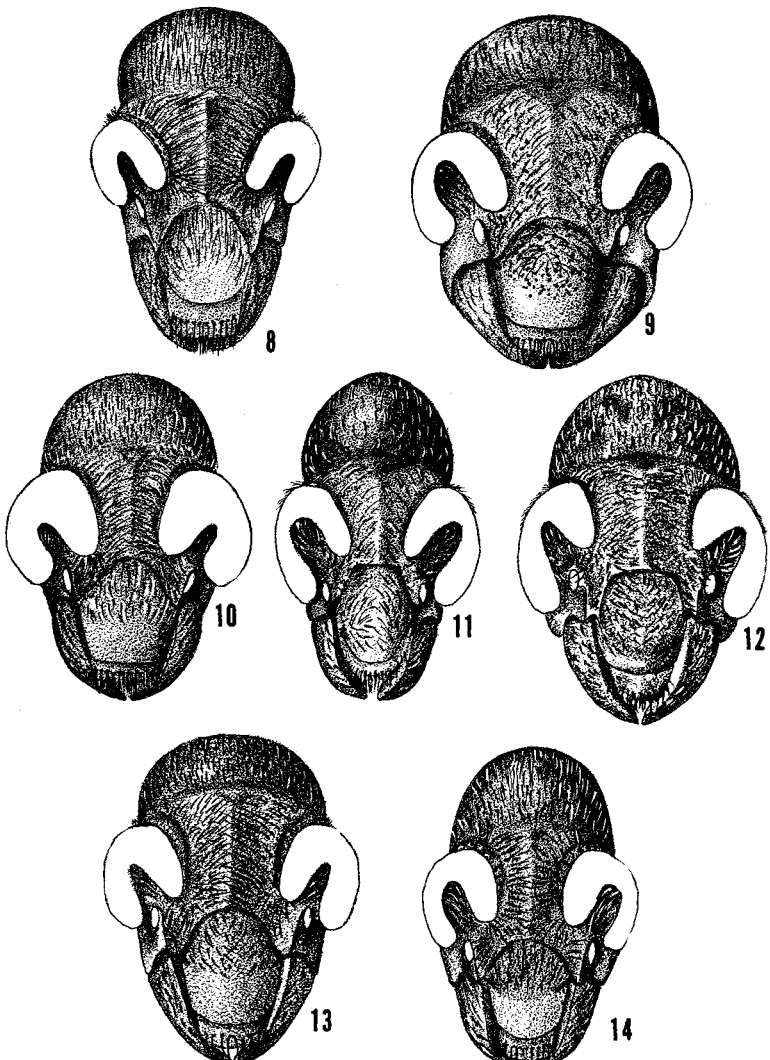
the only member of the *mimus* Group known to enter South America.

Other species of *Gibbobruchus* known to attack seeds of *Bauhinia divaricata* are *G. wunderlini, G. cristicollis,* and *G. divaricatae.* One herbarium specimen from San Miguel yielded specimens of both *G. guanacaste* and *G. divaricatae. Bauhinia pauletia* is attacked by *G. cristicollis* as well as by *G. guanacaste,* in Central America. No bruchids other than *G. guanacaste* are known from *Bauhinia pes-caprae* or *B. pringlei.* A member of the *cavillator* Group is known from *B. ungulata* in Venezuela, and *G. divaricatae* attacks this host species in Mexico and Central America. Except for the single record of *G. guanacaste* from *B. glabra* in Venezuela, neither *B. glabra* nor other members of the subgenus *Schnella* are known to be attacked by species of *Gibbobruchus,* but *B. glabra* and at least one other species of the subgenus are attacked by various species of the *stenocephalus* Group of the related genus *Caryedes* (Kingsolver and Whitehead 1974).

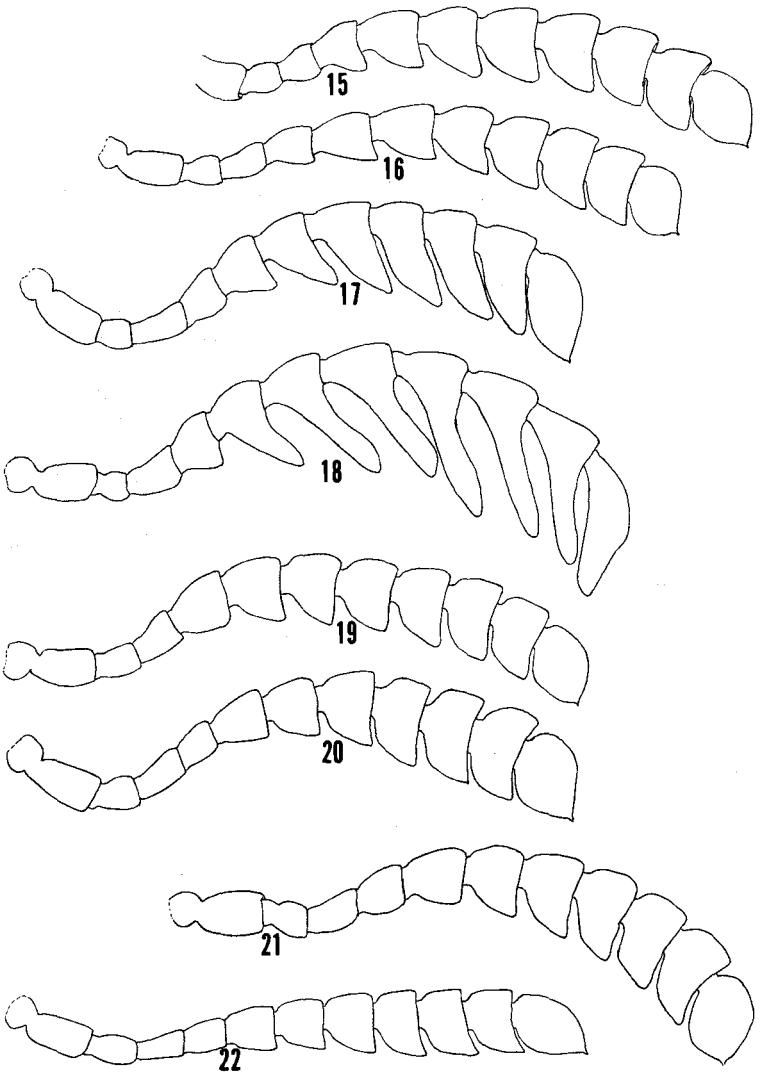
The few seeds preserved with *Gibbobruchus guanacaste* material yield the following information about types of seed damage. *Bauhinia divaricata*: 5 seeds, 2 with 2 beetles and 3 with 1 beetle, seed coat abraded on one or both sides, seeds large but flat. *Bauhinia glabra*: 1 seed with 3 beetles or exits, large flat seed with circular exits. *Bauhinia pauletia*: Cañas, 2 seeds, 1 with 2 circular exits, 1 with seed wall abraded on both sides. *Bauhinia pes-caprae*: 2 seeds, each with 2 circular exits, seeds large and thick. *Bauhinia pringlei*: 2 seeds each with 1 circular exit, seeds large and thick. *Bauhinia ungulata*: Acapulco, 11 seeds, 1 with 2 and 10 with 1 circular exits, seeds small but thick. Thus, seed size and shape govern the number of beetles per seed and the amount of external damage done to the seed wall. Adults are capable of making circular exits through the pod wall of all host species, but probably most commonly exit following pod dehiscence.

Gibbobruchus cristicollis (Sharp), new combination

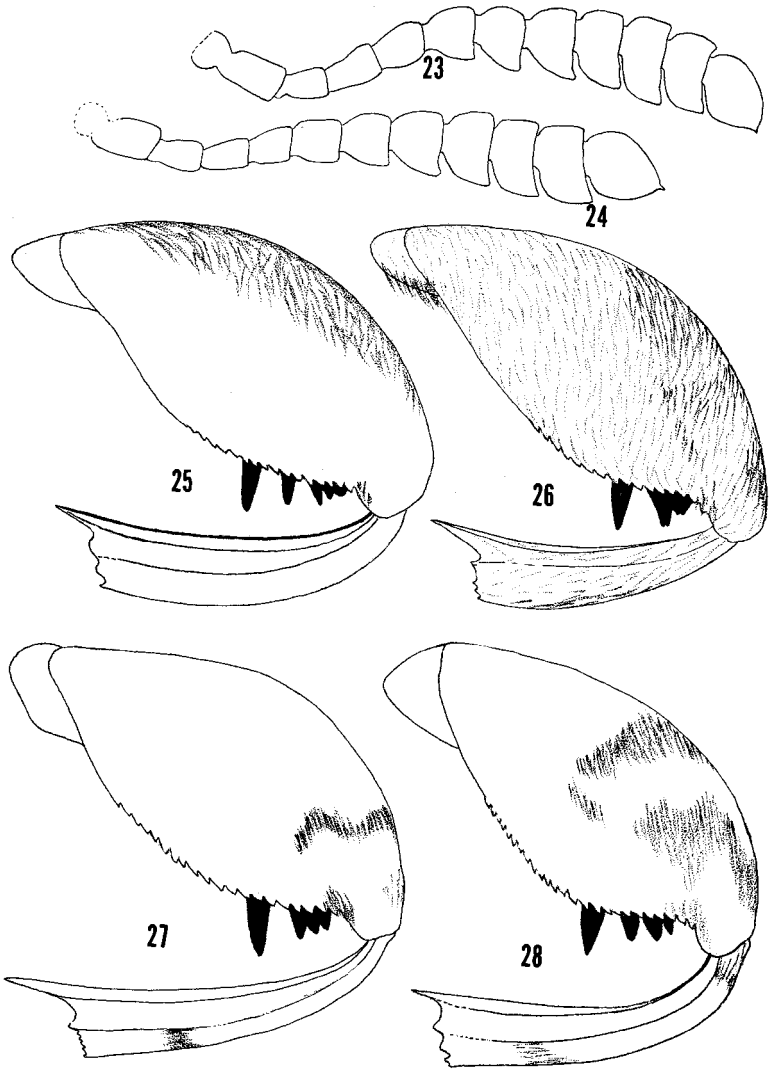
Bruchus cristicollis Sharp 1885: 442. Type-locality: Yolos, Oaxaca, Mexico. Holotype male in British Museum (Natural History), London.
Pseudopachymerus cristicollis: Pic 1913b: 10.
Caryedes cristicollis: Blackwelder 1946: 758.



FIGURES 8-14. — *Gibbobruchus* spp., head: 8, *G. wunderlini;* 9, *G. divaricatae;* 10, *G. iturbidensis;* 11, *G. guanacaste,* female; 12, *G. guanacaste,* male; 13, *G. cristicollis;* 14, *G. mimus.*



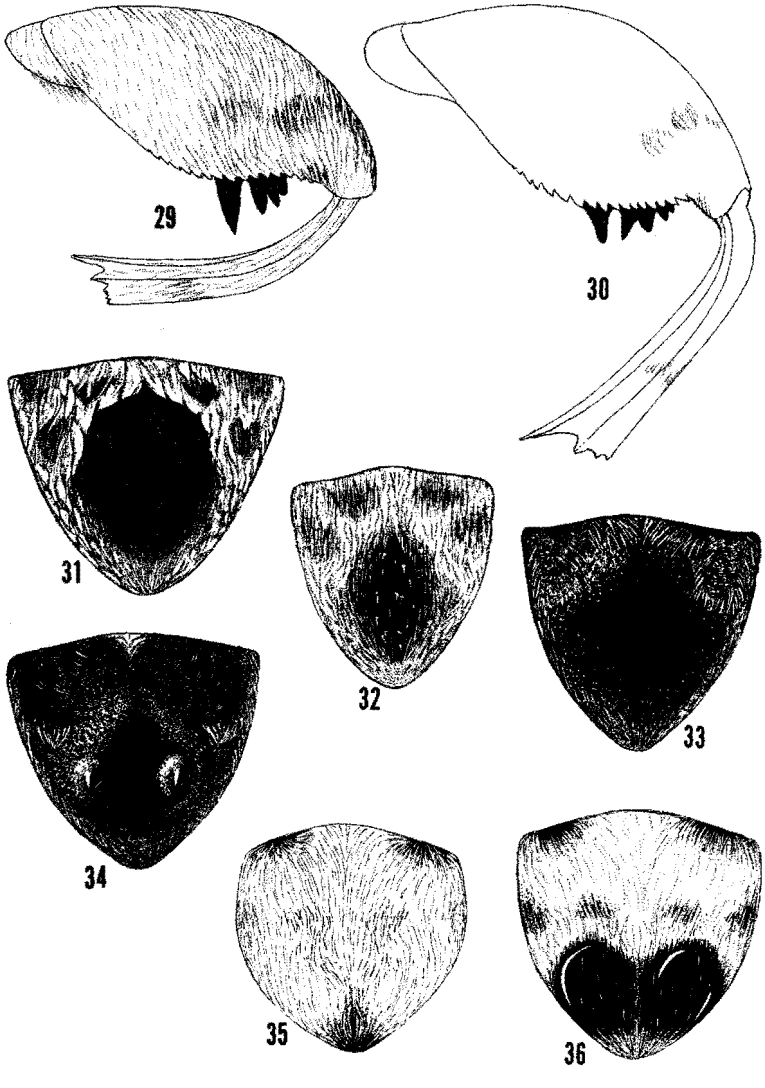
FIGURES 15-22. — *Gibbobruchus* spp., antenna: 15, *G. speculifer;* 16, *G. ornatus;* 17, *G. polycoccus,* female; 18, same, male; 19, *G. scurra;* 20, *G. wunderlini;* 21, *G. divaricatae;* 22, *G. guanacaste.*



FIGURES 23-28. — *Gibbobruchus* spp. Fig. 23-24, antenna: 23, *G. cristicollis;* 24, *G. mimus.* Fig. 25-28, hind leg: 25, *G. wunderlini;* 26, *G. iturbidensis;* 27, *G. divaricatae;* 28, *G. guanacaste.*

Description. — *Gibbobruchus, mimus* Group. Length 2.5-4.7 mm. Width 1.5-2.8 mm. Integument largely rufous to largely piceous, elytra in pale specimens with piceous variegation; antennae pale, articles 7-10 slightly to strongly infuscated; tarsi pale, or hind basitarsus infuscated in basal two thirds; front and middle femora and tibiae slightly to strongly banded. Vestiture strongly variegated in color and density, colors white to brown to black; pattern of dorsum (Fig. 4) best developed in pale specimens, with short velvety black sutural mark; pronotum with basal patch of intense white in most specimens; scutellar vestiture sparse to dense; metepisternum dark centrally; front and middle femora and tibiae banded; hind femur with vestiture largely sparse, white to yellow, small distal patches of dense vestiture dorsally and anteriorly; hind tibia with faint to strong white band at apical third; male pygidial vestiture nearly uniformly dense, tan to nearly white, dense white in small basal triangle; female pygidial vestiture white, sparse above speculum except for small basal triangle of dense white. Head (Fig. 13); antenna (Fig. 23); pronotum and elytra (Fig. 4), gibbosities and elytral tubercles weakly to strongly raised; hind leg (Fig. 30), pecten with 4-5 teeth, structure varied from distinct gap between first and second to second and third teeth; male pygidium (Fig. 45) distinctly bituberculate; female pygidium (Figs. 43, 46) with speculum large, round or oval, convex, finely to distinctly micropunctate, fringed apically by narrow to broad punctate-pubescent border; sternum 1 of male with median patch of velvety pubescence conspicuous or not; male genitalia (Figs. 65, 66, 69, 70).

Material examined. — Extreme southern United States to Costa Rica (Fig. 74). 357. UNITED STATES. Texas: Kinney Co., Anacacho Mountains, 1961, L. J. Bottimer, *ex Bauhinia congesta* (Britt. & Rose) Lundell, emerged by 22.VI-VII.1961. MEXICO. Intercepted at Laredo, 10.VIII.1964, *ex "Acacia"* and *"Bauhinia"*. Durango: La Bajada, Tamazula, 1921, J. G. Ortega, *ex* herbarium specimen of *Bauhinia divaricata* L. Guerrero: Acapulco, X.1894-III.1895, E. Palmer, *ex* herbarium specimen of *Bauhinia divaricata* L. Hidalgo: 16 mi. n. Zimapán, 21.VIII.1971, R. P. Wunderlin, *ex* herbarium specimen of *Bauhinia macranthera* Benth. *ex* Hemsl. Quintana Roo: San Miguel, Cozumel Island, beach, edge of low woods, limestone, 24-28.XII.1967, W. H. Lewis, *ex* herbarium specimen of *Bauhinia divaricata* L. San Luis Potosi: Bagre, 1911, C. A. Purpus, *ex* herbarium specimen of *Bauhinia coulteri* Macbride; Las Canoas, 21.VIII.1891, C. G. Pringle, *ex* herbarium specimen of *Bauhinia coulteri* Macbride; Tamazunchale, 18.VII. 1963, Davis and Duckworth; 3 mi. w. Xilitla, 22.VII.1970,



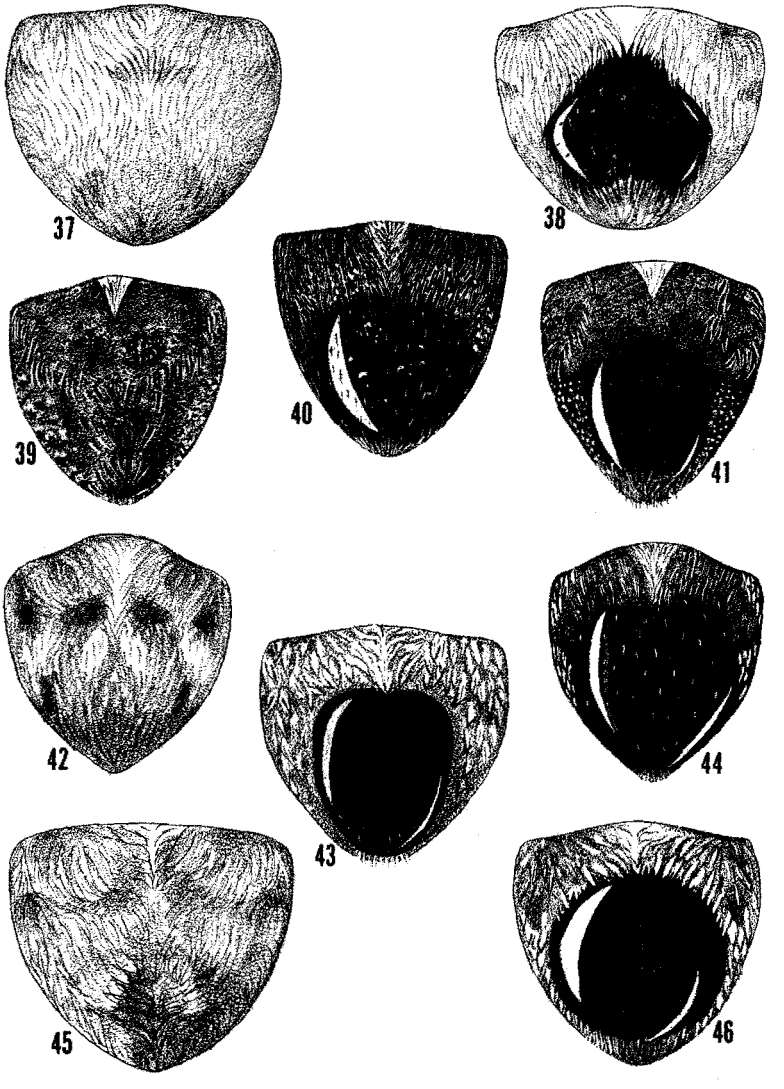
FIGURES 29-36. — *Gibbobruchus* spp. Fig. 29-30, hind leg: 29, *G. mimus;* 30, *G. cristicollis.* Fig. 31-36, pygidium: 31, *G. speculifer;* 32, *G. ornatus;* 33, *G. polycoccus,* male; 34, same, female; 35, *G. scurra,* male; 36, same, female.

Schaffner. Tamaulipas: Tampico, 5-27.XII.1909, E. A. Schwarz. GUATEMALA. Zacapa: Zacapa, 180 m., 1.I.1908, W. A. Kellerman, *ex* herbarium specimen of *Bauhinia divaricata* L. EL SALVADOR. La Union: Volcan Conchagua, 27-29.V.1958, L. J. Bottimer. HONDURAS. Valle: Amapala, Isla Tigre, 14.II. 1922, P. Standley, *ex* herbarium specimen of *Bauhinia pauletia* Pers. NICARAGUA. Granada: Granada, 28.V.1963, L. J. Bottimer, *ex Bauhinia pauletia* Pers. COSTA RICA. Guanacaste: 1 km. w. Cañas, 27.II.1972, D. H. Janzen, *ex Bauhinia pauletia* Pers., emerged by 20.VI.1972; Cañas-Bebedero road, 27.II.1972, D. H. Janzen, *ex Bauhinia pauletia* Pers.; Taboga, 31.I.1972, D. H. Janzen, *ex Bauhinia pauletia* Pers.; Taboga, 27. II.1972, D. H. Janzen, *ex Bauhinia pauletia* Pers., emerged by 20.VI.1972.

Variation. — *Gibbobruchus cristicollis* varies extensively in numerous external characteristics, in an obviously circular geographic pattern (Fig. 74) which is uncorrelated with distributions of host plants (Figs. 76, 78, 79). Differences in form are illustrated for male lateral lobes (Figs. 69, 70) and female speculum (Figs. 43, 46). Geographic variation is summarized in Table 1 and correlated with host plants and distribution in Table 2. We suggest there is or has been substantial gene flow in a rough circle: Anacacho-Canoas-Zimapán-Cozumel-Zacapa-Acapulco-Tamazula-Anacacho, with a spur southward from Acapulco-Zacapa to Amapala-Cañas. Most of the differentiated samples are geographically distant, but the samples from Canoas and the Tamazunchale-Zimapán area are relatively proximate, and we suggest that biological studies of *Gibbobruchus cristicollis* in this area should be particularly rewarding.

Remarks. — *Gibbobruchus cristicollis* is here reported from 5 host species: *Bauhinia congesta* (Britt. & Rose) Lundell, 1 record; *B. coulteri* Macbride, 1 record; *B. divaricata* L., 4 records; *B. macranthera* Benth. *ex* Hemsl., 1 record; and *B. pauletia* Pers., 6 records.

Among reared material of *Gibbobruchus* examined from Guanacaste Province, Costa Rica, are 498 specimens of *G. guanacaste* and none of *G. cristicollis* from *Bauhinia ungulata,* while from



FIGURES 37-46. — *Gibbobruchus* spp., pygidium: 37, *G. wunderlini,* male; 38, same, female; 39, *G. divaricatae,* male; 40, *G. iturbidensis,* female; 41, *G. divaricatae,* female; 42, *G. guanacastes* male; 43, *G. cristicollis,* female, northeastern form; 44, *G. guanacaste,* female; 45, *G. cristicollis,* male; 46; same, female, southern form.

TABLE 1.—Geographic variation in *Gibbobruchus cristicollis* (Sharp); see Fig. 74.

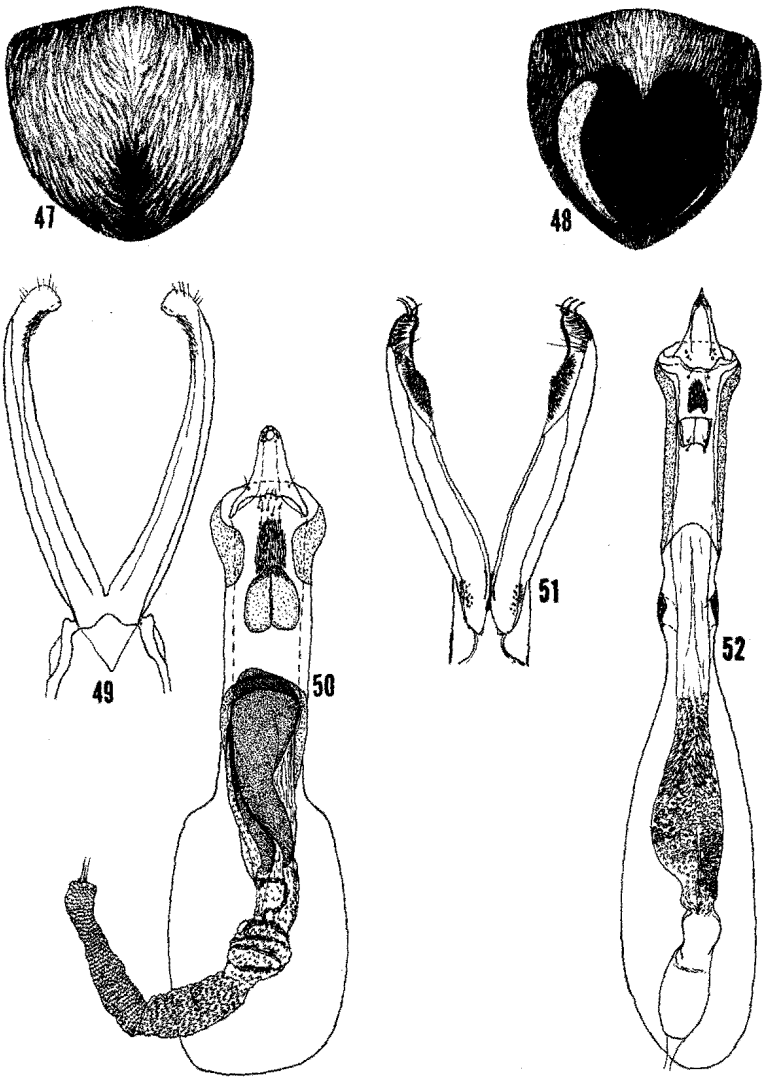
Sample	Locality	Host	Sex	Lateral lobe apex	Pecten structure
1	Anacacho	*B. congesta*	M&F	narrow	gap between teeth 1&2
1A	"Laredo"	?	M&F	narrow	gap between teeth 1&2
2	Tampico	?	M&F	narrow	gap between teeth 1&2
2A	Canoas, Bagre	*B. coulteri*	M	narrow	gap between teeth 1&2
3	Zimapán	*B. macranthera*	M&F	narrow	gap between teeth 1&2
3A	Tamazunchale area	?	M	narrow	gap between teeth 1&2
4	Cozumel	*B. divaricata*	F	?	intermediate
5	Zacapa	*B. divaricata*	M&F	narrow	gap between teeth 2&3
5A	Volcan Conchagua	?	F	?	gap between teeth 2&3
6	Cañas	*B. pauletia*	M&F	broad	gap between teeth 2&3
6A	Granada	*B. pauletia*	M&F	broad	gap between teeth 2&3
7	Amapala	*B. pauletia*	M&F	broad	gap between teeth 2&3
8	Acapulco	*B. divaricata*	M	?	gap between teeth 2&3
9	Tamazula	*B. divaricata*	M	narrow	intermediate

TABLE 1.—Continued

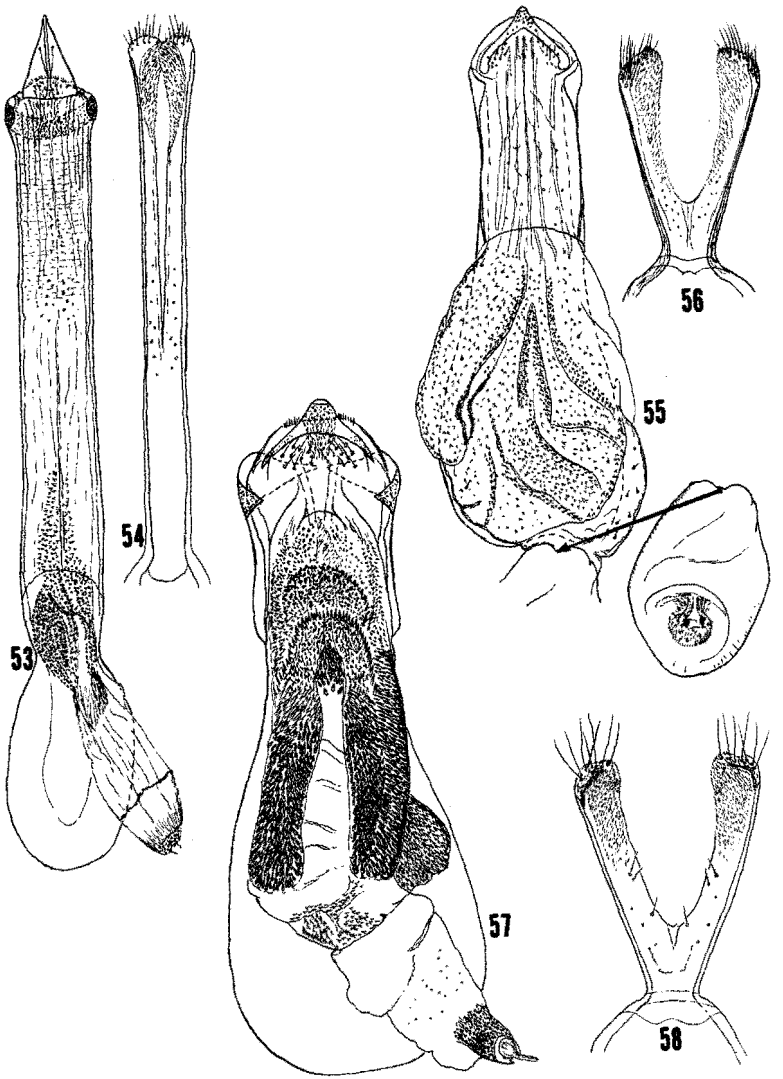
Sample	Speculum shape	Speculum apex	Speculum color	Speculum microsculpture	Color of antennal articles 7 to 10
1	oval	bare	black	strong	moderately dark
1A	oval	bare	black	strong	moderately dark
2	oval	bare	black	strong	moderately dark
2A	?	?	?	?	moderately dark
3	oval	bare	black	fine	dark
3A	?	?	?	?	dark
4	round	bare	black	fine	dark
5	round	pubescent	red	fine	light
5A	round	pubescent	red	strong	light
6	round	pubescent	black	strong	light
6A	round	pubescent	black	strong	light
7	round	pubescent	black	fine	light
8	?	?	?	?	?
9	?	?	?	?	light

TABLE 1.—Continued

Sample	Red color in elytral pattern	Dorsal vestiture of hind femur	Scutellar vestiture	Pronotal gibbosities	Posterior elytral tubercles
1	strong	white	dense	moderate	weak
1A	strong	white	dense	moderate	weak
2	moderate	white	dense	moderate	moderate
2A	moderate	white	dense	moderate	moderate
3	slight	white	moderate	moderate	weak
3A	slight	white	moderate	moderate	weak
4	slight	white	sparse	weak	weak
5	strong	yellow	sparse +	weak	weak
5A	strong	white/yellow	sparse +	weak	weak
6	moderate +	yellow	dense	strong +	strong
6A	moderate +	yellow	dense	strong +	strong
7	moderate +	yellow	sparse	strong	strong
8	strong	yellow	dense	strong	strong
9	moderate	yellow/white	dense	strong	strong



FIGURES 47-52. — *Gibbobruchus* spp. Fig. 47-48, pygidium: 47, *G. mimus*, male; 48, same, female. Fig. 49-52, male genitalia: 49, *G. speculifer*, lateral lobes; 50, same, median lobe; 51, *G. ornatus*, lateral lobes; 52, same, median lobe.



FIGURES 53-58. — *Gibbobruchus* spp., male genitalia: 53, *G. polycoccus,* median lobe; 54, same, lateral lobes; 55, *G. scurra,* median lobe; 56, same, lateral lobes; 57, *G. wunderlini,* median lobe; 58, same, lateral lobes.

B. pauletia these figures are 62 and 32 respectively. Among reared material examined from the Anacacho Mountains of Texas from *Bauhinia congesta* are 295 specimens of *G. cristicollis* and 4 of *G. mimus,* a species known otherwise to attack only various species of *Cercis.* These data indicate that while two or more species may attack the same host species in a particular area there may be marked ecological differences in terms of the preferred host species.

Bauhinia coulteri and *B. macranthera* are not known to be attacked by other bruchid species. Other species of *Gibbobruchus* known to attack *Bauhinia divaricata* are *G. wunderlini, G. guanacaste,* and *G. divaricatae. Bauhinia pauletia* is a secondary food source for *G. guanacaste,* and *B. congesta* is a secondary food source for *G. mimus.*

The type of seed damage done is similar for all host species: one beetle per seed, seed internally completely consumed, and seed coat abraded on both sides. Adults are capable of making exits through the pod wall but probably preferentially await pod dehiscence.

Gibbobruchus mimus (Say)

Bruchus mimus Say 1831: 2 (LeConte edition 1883: 260); Cushman 1911: 493 (life history); Fall 1910: 162; Pic 1913b: 35. Type-locality: Indiana. Type lost.

Gibbobruchus mimus: Bridwell 1938: 74; Bottimer 1968: 1022.

Bruchus crataegi Fåhraeus 1839: 119; Pic 1913b: 35. Type-locality: Carolina Americae borealis. Type in Riksmuseum, Stockholm; not examined, but identified from photograph and type-locality.

Bruchus murinus Schoenherr 1839: 132 (misspelling of *mimus* Say; not *murinus* Boheman 1829).

Bruchus borealis Schoenherr 1839: 132 (new name for *murinus* Schoenherr, a misspelling of *mimus* Say).

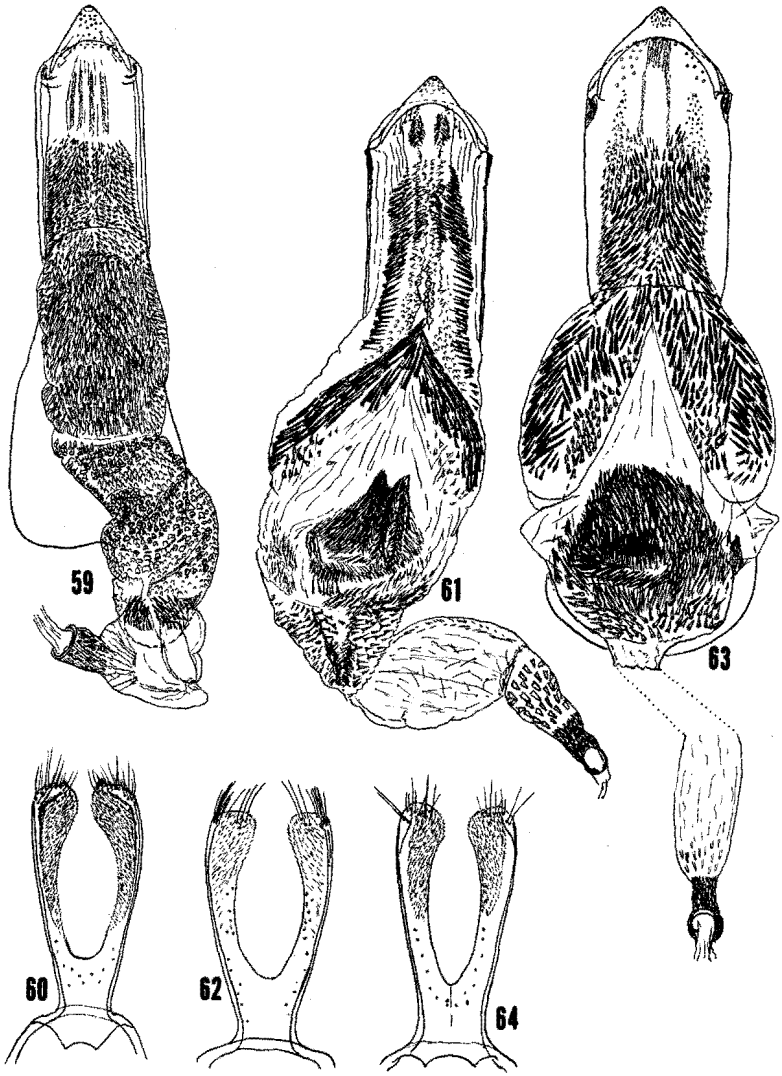
Description. — *Gibbobruchus, mimus* Group. Length 2.3-3.5 mm. Width 1.4-2.1. Integument largely rufous to largely piceous, elytra variegated; antennae pale, articles 8-10 lightly to moderately infuscated, or article 9 paler than articles 8 and 10; tarsi pale; front and middle femora and tibiae faintly banded. Vestiture variegated in density and color, white to orange brown to black; pattern of dorsum (Fig. 6) sharply developed, dark sutural mark W-shaped; pronotum with basal patch of intense white absent or slightly developed; scutellar vestiture moderate or dense, varied in color, not

TABLE 2. — Distribution of *Gibbobruchus cristicollis* (Sharp) and recorded host species.

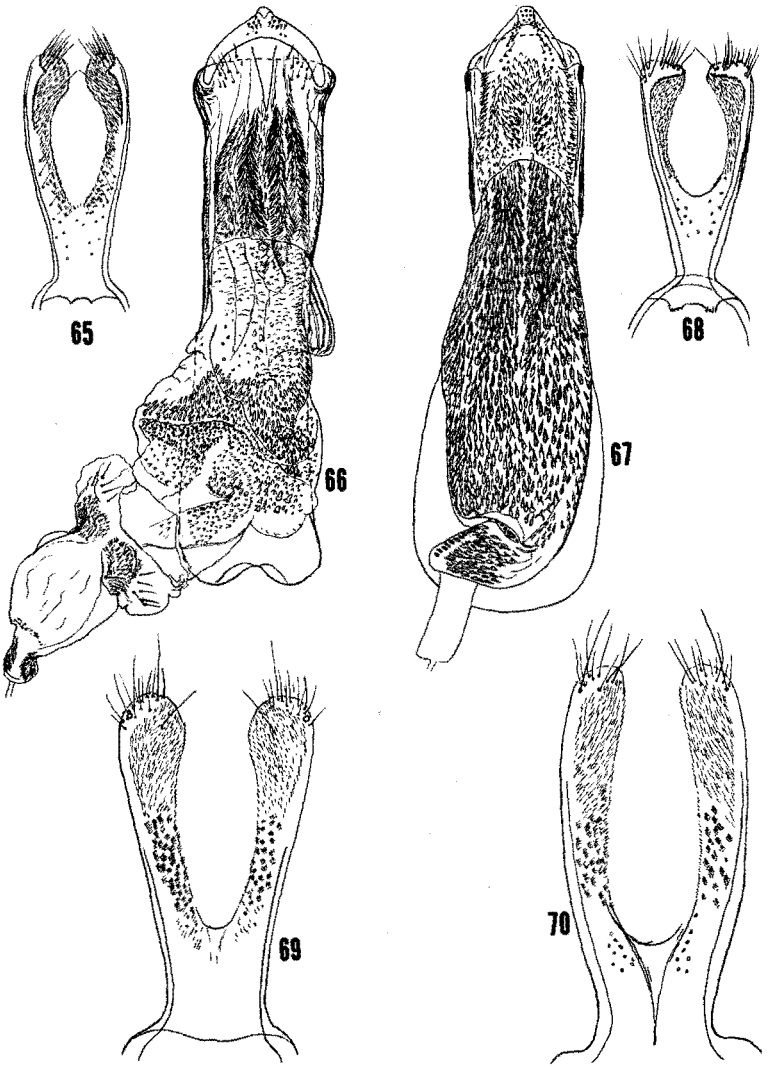
Figs. 74, 76, 78, 79.

Host species Sample: —, not in area; o, in area but no record; x, host record

(Bauhinia)	1, 1A	2, 2A	3, 3A	4	5, 5A	6, 6A	7	8	9	Total records from host (x)	Total records from area of host (o + x)
congesta	x	—	—	—	—	—	—	—	—	1	1
coulteri	—	x	o	—	—	—	—	—	—	1	3
divaricata	—	o	o	x	x	—	—	x	x	4	7
macranthera	—	o	x	—	—	—	—	—	—	1	3
pauletia	—	—	—	—	o	x	x	o	o	2	5
Total o + x	1	3	3	1	2	1	1	2	2	= number of hosts in area of sample	



FIGURES 59-64. — *Gibbobruchus* spp., male genitalia: 59, *G. divaricatae*, median lobe; 60, same, lateral lobes; 61 and 63, *G. guanacaste*, median lobe; 62 and 64, same, lateral lobes.



FIGURES 65-70. — *Gibbobruchus* spp., male genitalia: 65, *G. cristicollis,* lateral lobes; 66, same, median lobe; 67, *G. mimus,* median lobe; 68, same, lateral lobes; 69, *G. cristicollis,* lateral lobes southern form; 70, same, northern form.

intense white; metepisternum largely pale, variegated, dark centrally and dorsally; front and middle femora tibiae banded; hind femur with strongly developed dorsal pattern; hind tibia with pale band dorsally at apical third; vestiture of pygidium of female (Fig. 48) white, variegated in pattern, generally sparse except for basal triangle; vestiture of pygidium of male (Fig. 47) dense except for small bare areas, mostly yellowish except for white basal triangle. Head (Fig. 14); antenna (Fig. 24); pronotum and elytra (Fig. 6), gibbosities and elytral tubercles weakly developed; hind leg (Fig. 29), pecten with about 4 closely spaced teeth; male pygidium (Fig. 47) with apical two thirds convex, small mesial polished areas in some specimens; female pygidium (Fig. 48) with speculum large, oval, convex, deeply penetrated by basal triangle, distinctly micropunctate, sparsely macropunctate, fringed apically by wide punctate-pubescent border; sternum 1 of male with median patch of velvety pubescence conspicuous; male genitalia (Figs. 67, 68).

Material examined. — Eastern North America from Ontario south to Georgia and west to Nevada (Fig. 75), about 575 including larvae and pupae; in Mexico, south to Veracruz. On the distribution map, we give records for *Gibbobruchus mimus,* large circles; records of *Cercis* spp., the host genus, small circles (based on herbarium material in the United States National Herbarium); and herbarium specimens with bruchid exits, large dots.

Our only records of *G. mimus* from the far West are the following: UNITED STATES. Arizona: Coconino Co., Grand Canyon, Bright Angel, 10.V.1903, H. S. Barber; Cottonwood Springs, 31.V.1916, L. N. Gooding, on *Fraxinus.* Nevada: Clark Co., 1 mi. se. Mountain Springs, 21.VII.1973, C. D. Johnson #529-73, reared *ex Cercis occidentalis* Torr. Pods with *Gibbobruchus* exit holes have been seen on other herbarium specimens from the Charleston Mountains of Nevada, but on none from California. Otherwise, the distribution of *Gibbobruchus mimus* is probably coincident with the distribution of *Cercis* in Canada and the United States.

Our only records of *G. mimus* from Mexico and Central America are the following: MEXICO. Intercepted at Laredo, Texas *ex Cercis,* 2.XI.1959 and 10.XII.1971. Nuevo Leon: Chipinque Mesa. San Luis Potosi: El Salto de Agua. Veracruz: Jalapa. PANAMA. Chiriqui: 1 mi. n. El Volcan, 20.VII.1961: 5000', J. M. Campbell (1, CNC). Members of the genus *Cercis* extend

southward in eastern Mexico to Hidalgo and northern Puebla. Therefore, the Panama record needs verification. It seems improbable, but is not impossible since *G. mimus* has been reared once from *Bauhinia congesta* in Texas. Pending verification, however, we consider the record erroneous.

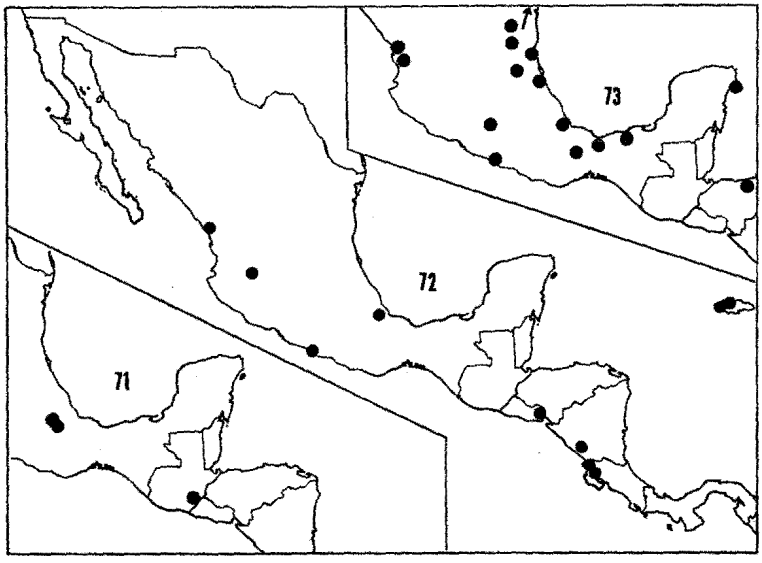
We have numerous records of *G. mimus* from the eastern half of temperate North America that were associated with or reared from *Cercis canadensis* L. and *C. reniformis* Engelm. (= *C. canadensis* var. *texensis* (S. Wats.) Hopk.). The only other certain host record is the following: UNITED STATES. Texas: Kinney Co., Anacacho Mountains, VIII.1959 and VI.1961, L. J. Bottimer, *ex Bauhinia congesta* (Britt. & Rose) Lundell, 4 specimens reared amid several hundred specimens of *G. cristicollis*. A record of association with *Robinia* seeds is doubtless in error.

Variation. — Males from southern Texas (Kinney and Terrell Counties) and Mexico have a distinct polished, sparsely punctate mesial area on the pygidium.

Remarks. — Larvae of *G. mimus* feed on seeds of various species of *Cercis*. They probably attack all American *Cercis*, but confirmation is needed of attack of *C. occidentalis* in extreme western United States and of the species in northeastern Mexico. *Bauhinia congesta* is an apparently secondary host. If substantiated, the questionable isolated record of *G. mimus* from Panama would imply that other *Bauhinia* species may also serve as hosts, but we think this record is erroneous.

Most infested *Cercis* seeds have a circular exit cut through the seed coat, but some seeds are abraded on one side. The pods are indehiscent, and adults emerge through circular exits cut through the pod wall.

Adults associated with the host plant were collected in all months of the year, but for most we cannot determine whether dates of collection refer to the host-plant or to the insect. Most other adults were collected from March to September, but we have records from February (Texas) and October (Maryland, Mississippi, and Wisconsin); thus, adults probably are active throughout the year except during the coldest months. As judged from capture records, adults are most active from April through June.



FIGURES 71-73. — *Gibbobruchus* spp., distribution records: 71, *G. wunderlini;* 72, *G. guanacaste* (known also from Venezuela); 73, *G. divaricatae.*

Adults commonly visit flowers of a wide range of plants. Flower visitation records include the following: Asclepiadaceae *(Asclepias);* Caesalpiniaceae *(Cercis);* Caprifoliceae *(Sambucus, Viburnum);* Compositae *(Chrysanthemum, Eupatorium, Helianthus, Solidago, Vernonia);* Cornaceae *(Cornus);* Euphorbiaceae *(Euphorbia);* Liliaceae *(Smilacina);* Malvaceae *(Hibiscus);* Portulacaceae *(Claytonia);* Rosaceae *(Cotoneaster, Crataegus, Prunus);* Salicaceae *(Salix);* Scrophulariaceae *(Veronicastrum);* and Umbelliferae *(Daucus).*

ZOOGEOGRAPHY

As summarized in Table 3, 4 species groups *(speculifer, polycoccus, scurra,* and *cavillator)* are primarily South American and are sympatric in Brazil; only the *cavillator* Group is represented across northwestern South America and into Panama. In contrast, the other two groups *(wunderlini* and *mimus)* are primarily Central American, although members of the Mimus Group extend to the

TABLE 3. — Distribution of members of the genus *Gibbobruchus*.

Taxon	temperate N. Amer.	south Texas	West Indies	Mexico/ Guatemala	Honduras/ Costa Rica	Panama/ nw. S. Amer.	rest of S. Amer.
speculifer Group							
all species	—	—	—	—	—	—	x
polycoccus Group							
all species	—	—	—	—	—	—	x
scurra Group							
all species	—	—	—	—	—	—	x
cavillator Group							
all species	—	—	—	—	—	x	x
wunderlini Group							
G. wunderlini	—	—	—	x	—	—	—
mimus Group							
G. divaricatae	—	x	—	x	x	—	—
G. iturbidensis	—	—	—	x	—	—	—
G. guanacaste	—	—	x	x	x	x	—
G. cristicollis	—	x	—	x	x	—	—
G. mimus	x	x	—	x	—	?	—

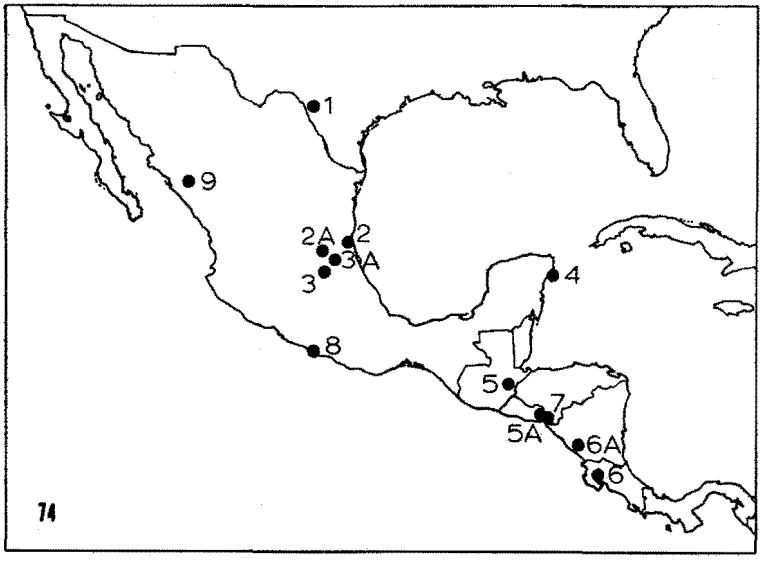


FIGURE 74. — Distribution records of *Gibbobruchus cristicollis;* numbered samples are discussed in text and described in Table 1.

temperate part of North America, to the West Indies, and through Panama to northwestern South America.

We can draw two conclusions from a phylogenetic analysis of sister group relationships (Henning, 1966) of the species groups of *Gibbobruchus,* as developed below. First, *Gibbobruchus* doubtless evolved in South America, as it and all closely related genera are most diverse there whereas only a narrow range of derived forms is present in Central America. Second, the *mimus* and *wunderlini* Groups had a common ancestor that entered tropical North America long before the continents were joined by the Panamanian land bridge.

In contrast to our findings in the distantly related genus *Caryedes,* in which we reported no evidence of species diversification in Mexico or Central America (Kingsolver and Whitehead 1974), that region obviously is the center of evolution for the *mimus* and *wunderlini* Groups of *Gibbobruchus.* We suspect that the South American group most closely related to the Central American

groups is the *cavillator* Group. This conclusion is suggested by the nearly vicarious distributions of the *cavillator* and *mimus* Groups, with a narrow zone of overlap in Panama and northwestern South America.

Our study of *Gibbobruchus* distributions adds little to conclusions about faunal limits drawn from our previous study of *Caryedes* distributions (Kingsolver and Whitehead 1974). While no species of *Caryedes* is known to extend northward to the United States, two essentially tropical species of *Gibbobruchus* enter southern Texas, and one temperate species is widespread in eastern North America. This pattern is repeated in the mostly tropical genus *Meibomeus,* with one tropical species entering southern Arizona and one temperate species widespread in eastern North America (Kingsolver and Whitehead, in preparation). Most of the tropical species are known only from Mexico or from Mexico and Guatemala, and their southern limits may correspond to what Whitehead (1972) termed the northern limits of Middle America. One species extends southward to Costa Rica, with southern limits corresponding roughly to Whitehead's southern limits for Middle America, while still another extends southward into northwestern South America to the southern limits for Middle America as postulated by Hershkovitz (1969). In contrast, all but one member of the South American groups are South American in the narrow sense; the exception, a member of the *cavillator* Group, extends approximately to Whitehead's southern limits for Middle America.

Among species of the *mimus* and *wunderlini* Groups, the only apparent vicariance pattern is the temperate/tropical one of *G. mimus* in the north and all other species to the south (we assume a Panama record for *G. mimus* to be in error).

PHYLOGENY

Generic relationships. — In our treatment of *Caryedes,* a genus related to *Gibbobruchus,* we suggest three gibbobruchine assemblages corresponding roughly to host plants in the families Mimosaceae, Caesalpiniaceae, and Fabaceae (Kingsolver and Whitehead 1974). The *"Merobruchus"* assemblage, which may comprise several lineages, is a grouping of primitive elements. The

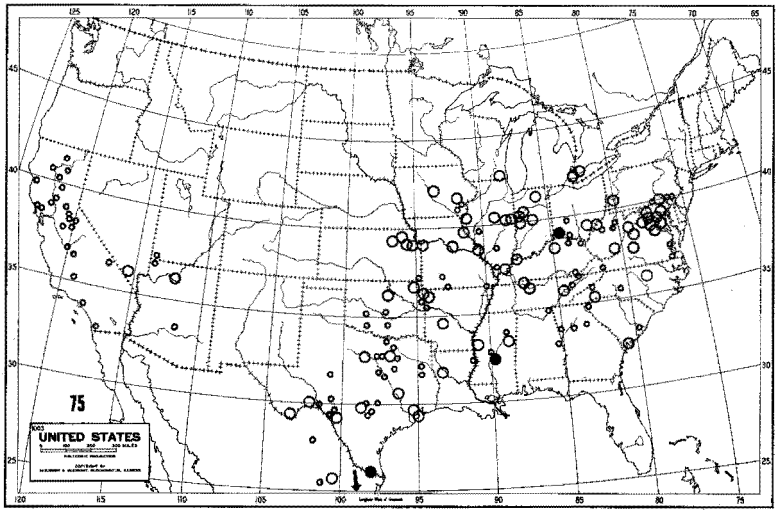


FIGURE 75. — Distribution records of *Cercis* spp. (small circles), *Cercis* specimens with bruchid exit holes (large dots), and *Gibbobruchus mimus* (large circles). *Cercis* extends southward in northeastern Mexico to Hidalgo and Puebla. A record of *G. mimus* from Panama is probably erroneous.

"Gibbobruchus" and *"Caryedes"* assemblages are sister groups that shared a common ancestry at some point near the base of the *"Merobruchus"* assemblage, and probable synapomorphous characteristics are the following: internal hind femoral carina denticulate; and external hind femoral carina reduced or dissected. We define these two assemblages as monophyletic units by the following apomorphous characteristics: *"Gibbobruchus"* assemblage, abdominal sterna and/or female pygidium with glabrous polished areas; *"Caryedes"* assemblage, face relatively elongate, with antennal scrobe of gena as long as or longer than diameter of antennal fossa. Members of the *"Gibbobruchus"* assemblage attack various Caesalpiniaceae, whereas nearly all members of the *"Caryedes"* assemblage attack Fabaceae (members of the *stenocephalus* Group of *Caryedes* attack *Bauhinia,* Caesalpiniaceae).

The *"Gibbobruchus"* assemblage includes three genera: *Gibbobruchus* Pic, *Penthobruchus* Kingsolver, and *Pygiopachymerus*

TABLE 4. — Apomorphous and plesiomorphous conditions in the "*Gibbobruchus*" assemblage.

Character x-plesiomorphous X-apomorphous	*Gibbobruchus*	*Penthobruchus*	*Pygiopachymerus*
Head			
A. Postocular lobe elongate	a	a	A
Pronotum			
B. Disc flat *	b	B	B
Mesosternum			
C. Apex of mesosternal lobe acute	c	C	c
Scutellum			
D. Scutellum minute	d	d	D
Elytron			
E. Basal gibbosity reduced *	e	E	E
Hind femur			
F. Ventral sulcus polished	f	F	F
Female pygidium			
G. With speculum	G	g	g
Male genitalia			
H. Median lobe with lateral processes	h	h	H
I. Keel on basal strut of tegmen reduced	I	i	i

* Pronotal and elytral gibbosities are reduced in *Meibomeus*, a genus of the "*Caryedes*" assemblage, but apparently independently. Indeed, the systematic position of *Meibomeus* is unclear; we place it as a sister group of *Caryedes* because of similarities in male genitalia which we presume to be synapomorphous, but in some other features it is more acanthoscelidine than gibbobruchine.

Pic. *Penthobruchus* includes two South American species predatory on the closely related genera *Cercidium* and *Parkinsonia* (Kingsolver 1973); *Pygiopachymerus* includes two widespread Central and South American species which attack seeds of *Cassia* (Kingsolver 1970). *Penthobruchus* and *Pygiopachymerus* are sister groups within the *"Gibbobruchus"* assemblage, as judged from a survey of characteristics within the *"Caryedes"* and *"Gibbobruchus"* assemblages. They share at least one synapomorphous characteristic, ventral sulcus of hind femur polished at least basally. They agree with one another, but differ from *Gibbobruchus,* in various additional characteristics: pronotum with median gibbosities flattened, median sulcus obsolete or slightly impressed; elytron with basal gibbosity displaced toward base; pygidium without centrally placed speculum in female, though with a large polished area in *Pygiopachymerus theresae;* and basal strut of tegmen of male genitalia with median keel well developed. These and other characteristics are summarized in Table 4 for *Gibbobruchus, Penthobruchus,* and *Pygiopachymerus;* characteristics are coded as apomorphous if developed in one of the three *"Gibbobruchus"* genera, or in two *"Gibbobruchus"* genera but not in *"Caryedes"* genera.

Species group relationships. — Though we recognize six species groups in *Gibbobruchus,* differences among four of them *(scurra, cavillator, wunderlini,* and *mimus)* are rather slight. These four groups form what we here term the *mimus* Lineage. The *speculifer* Group, *polycoccus* Group, and *mimus* Lineage are highly distinctive and their relationships clear.

Speculifer Group: the absence of polished areas on the sides of the abdomen is considered apomorphous, because in all other *Gibbobruchus* and in the related genera *Penthobruchus* and *Pygiopachymerus* these glabrous areas are present. Another apomorphous feature of the *speculifer* Group is the peculiar caliperlike structure of the lateral lobes. The remaining five species groups of *Gibbobruchus* are defined as a monophyletic unit by the structurally sex-dimorphic pygidium and by the lack of a median keel on the basal strut of the tegmen of the male genitalia.

Polycoccus Group: among members of the *"Gibbobruchus"* as-

semblage, only this group has flabellate antennae and sharply produced tubercles on the female pygidium. The male genitalia are elongate only in the *speculifer* and *polycoccus* Groups within the *"Gibbobruchus"* assemblage, but elongation is independent in these two groups; the general structure of the male genitalia, and especially of the lateral lobes, indicate no relationship between the two groups. Although the pygidium is sex-dimorphic, the male retains the speculum, a feature lost in the *mimus* Lineage.

Mimus Lineage: the 4 species groups comprising the *mimus* Lineage are much less distinctive than the *speculifer* and *polycoccus* Groups, are of uncertain relationships, and are distinguished mainly for geographic reasons.

Scurra Group: apomorphous characteristics including the dense white vestiture of venter, pygidium, and hind femur, and the reduced female pygidial speculum, define this as a monophyletic group. However, we are aware of no synapomorphous features to distinguish the *cavillator, wunderlini,* and *mimus* Groups as a monophyletic unit distinct from the *scurra* Group. The internal sac of the male genitalia of members of the *scurra* and *cavillator* Groups, with one possible exception, lacks strongly developed spicules as are characteristic of the *wunderlini* Group and all but *G. cristicollis* of the *mimus* Group. These exceptions are secondary developments, and the strongly developed spicules of the *wunderlini* and *mimus* Groups are considered synapomorphous. We suspect the alutaceous female pygidial speculum was apomorphous in the ancestor of the *mimus* Lineage but plesiomorphous within this lineage: the speculum is polished in the *wunderlini* and *mimus* Groups. Reasons for this supposition are zoogeographic: 1) the ancestor of the lineage was South American; 2) penetration of Central America by ancestral *wunderlini-mimus* occurred before establishment of land connections in Late Pliocene, probably just once; and 3) distribution patterns suggest a sister relationship between the *cavillator* and *wunderlini-mimus* Groups. Some species of the *cavillator* and *mimus* Groups closely resemble one another, suggesting that the ancestor of the *cavillator* and *wunderlini-mimus* Groups may have resembled such extant forms as *G. mimus, G. guanacaste,* and *G. cavillator.*

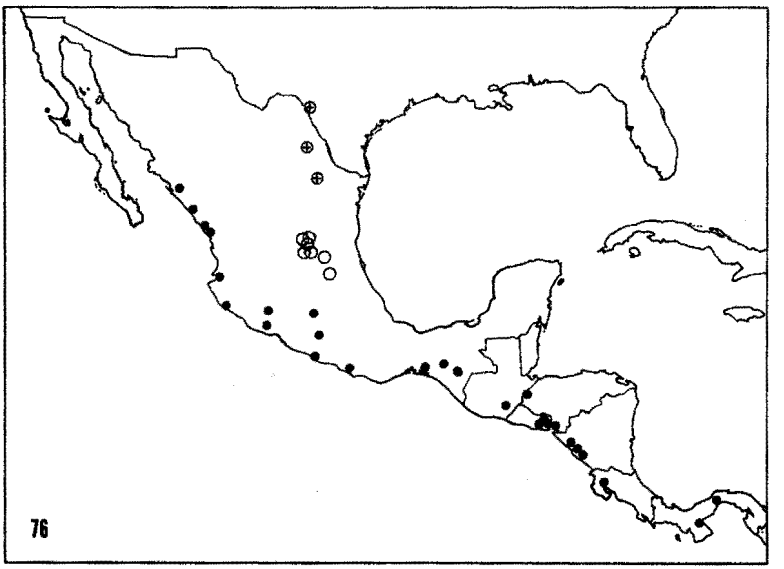


FIGURE 76. — Distribution records of *Bauhinia coulteri* (circles), *B. congesta* (crossed circles), and *B. pauletia* (dots).

Cavillator Group: this group shares with the *scurra* Group the female pygidial speculum alutaceous and the internal sac of the male genitalia not strongly spiculate, both of which we consider as plesiomorphous with respect to the *wunderlini* and *mimus* Group. Alternatively, the alutaceous speculum may be synapomorphous with the *scurra* and *cavillator* Groups, implying either that these are sister groups (in disagreement with distribution data) or that they constitute just one group.

Wunderlini and *mimus* Groups: these are the only groups represented in America north of Panama. The monobasic *wunderlini* Group is distinguished by the apomorphous divergent lateral lobes of the male genitalia, and the *mimus* Group is distinguished by the apomorphous patch of velvety pubescence on male sternum 1.

Species of the Mimus Group. — Among members of the *mimus* Group, *G. mimus* probably is sister to the ancestor of the other four species: the female pygidial speculum is emarginate basally, as

TABLE 5. — Bruchid seed predators of the caesalpiniaceous genera *Bauhinia* and *Cercis*.

Host	Predator
Bauhinia sp.	*"Falsobruchus cristatus"* [d] (=*Caryedes cristatus*): an old and probably incorrect record.
B. aculeata	*Gibbobruchus cavillator* Group: *G.* sp. 4[b] (probably *G. cavillator*).
B. bauhinioides	*Gibbobruchus scurra* Group: *G.* n. sp. nr. *G. scurra*.[b]
B. congesta	*Gibbobruchus mimus* Group: *G. cristicollis*,[a] *G. mimus*[a] (*B. congesta* is probably a secondary host for *G. mimus*).
B. coulteri	*Gibbobruchus mimus* Group: *G. cristicollis*.[b]
B. dipetala	*Gibbobruchus wunderlini* Group: *G. wunderlini*.[b]
B. divaricata	*Gibbobruchus wunderlini* Group: *G. wunderlini*.[b] *Gibbobruchus mimus* Group: *G. cristicollis*,[b] *G. divaricatae*,[b] *G. guanacaste*.[b]
B. forficata	*Gibbobruchus speculifer* Group: *G. speculifer*.[a, d] *Gibbobruchus cavillator* Group: *G. nigronotatus*[d] (probably *G. cavillator*).
B. glabra	*Caryedes stenocephalus* Group: *C. cavatus*,[a] *C. x-liturus*.[a] *Gibbobruchus mimus* Group: *G. guanacaste*.[b]
B. guianensis	*Caryedes stenocephalus* Group: *C.* cf. *plagicornis*.[b]
B. longicuspis	*Gibbobruchus polycoccus* Group: *G. polycoccus*.[b]
B. macranthera	*Gibbobruchus mimus* Group: *G. cristicollis*.[b]
B. monandra	*Gibbobruchus cavillator* Group: *G.* sp. 2[c] (record needs confirmation, and probably is incorrect).
B. pauletia	*Gibbobruchus mimus* Group: *G. cristicollis*,[a] *G. guanacaste*.[a]
B. pes-caprae	*Gibbobruchus mimus* Group: *G. divaricatae*,[b] *G. guanacaste*.[b]
B. pringlei	*Gibbobruchus mimus* Group: *G. guanacaste*.[b]
B. rufa	*Gibbobruchus scurra* Group: *G. scurra*.[b] *Gibbobruchus cavillator* Group: *G.* sp. 2.[b]
B. ungulata	*Gibbobruchus cavillator* Group: *G.* sp. 1,[b] *G.* sp. 3,[b] *G.* sp. 4.[b] *Gibbobruchus mimus* Group: *G. divaricatae*,[b] *G. guanacaste*.[a]
Cercis spp.	*Gibbobruchus mimus* Group: *G. mimus*.[b]

[a] Records based on reared material.

[b] Records based on herbarium material.

[c] Records based on pin label data; host record unconfirmed.

[d] Records based on literature (Bondar 1931 & 1937; Zacher 1952); confirmations needed for host and predator. The host for *G. speculifer* (as *G. atromaculatus*) and *G. nigronotatus* was given as *B. integerrima*, but R. P. Wunderlin (*in litt.*) suggests that this reference probably pertains to *B. forficata*.

in most members of the *cavillator* Group; and the teeth of the femoral pecten are regularly spaced, without a large gap after the first or second teeth as in other members of the *mimus* Group. *Gibbobruchus guancaste* agrees with *G. mimus, G. wunderlini,* and most members of the *cavillator* Group by having strongly patterned hind femora, and the male pygidial structure and pattern are similar in *G. mimus* and *G. guanacaste;* the faintly patterned hind femur is doubtless synapomorphous in *G. divaricatae, G. iturbidensis,* and *G. cristicollis.* The flattened pygidial speculum is apomorphous for *G. iturbidensis,* while the dark sutural mark of the elytra is probably synapomorphous for *G. cristicollis* and *G. divaricatae.*

Discussion

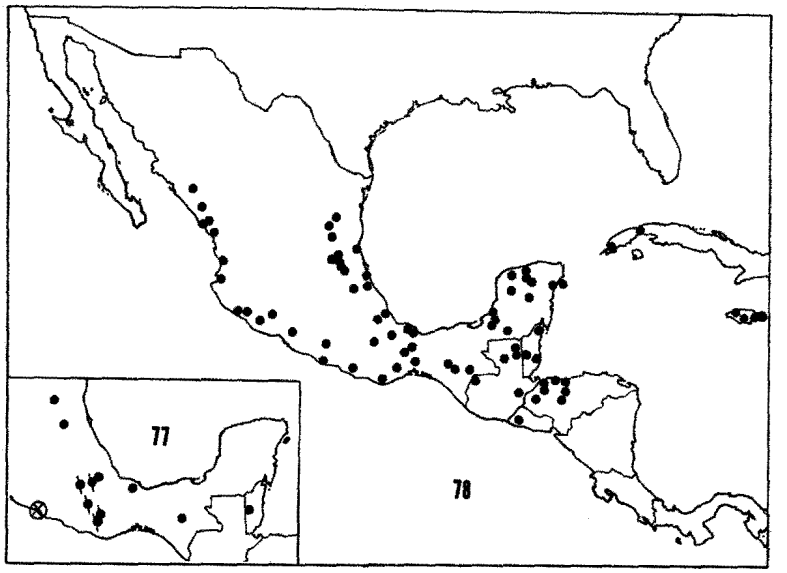
Seed predation. — New World representatives of the caesalpiniaceous genera *Bauhinia* and *Cercis* are preyed upon by members of two related genera of Bruchidae, *Caryedes* and *Gibbobruchus,* as summarized in Table 5. Of 17 *Bauhinia* species listed (*B. monandra* excluded as an unconfirmed host), one is preyed upon by members of both bruchid genera and 4 are attacked by 2 or more groups of *Gibbobruchus.*

Known host plants for species of *Gibbobruchus* are listed in Table 6; host data are lacking for several South American species, including undescribed members of the *cavillator* Group not listed and for the Mexican *G. iturbidensis.* North and Central American species of *Gibbobruchus* are much better known than are the South American species, and host data are more complete. *Gibbobruchus cristicollis* and *G. guanacaste* are known from 5-6 host species each, and may be expected from several more. Only *G. mimus* is known from both *Bauhinia* and *Cercis.*

At least 6 species of *Bauhinia* are attacked by 2 or more North and Central American species of *Gibbobruchus. Bauhinia congesta* is attacked in southern Texas by *G. cristicollis* and *G. mimus;* although *B. congesta* is clearly a secondary host for *G. mimus,* which normally is predatory on *Cercis* spp., this record suggests a close biochemical relationship between *Cercis* and *Bauhinia* seeds. *Bauhinia divaricata* is attacked by members of the *wunderlini (G. wunderlini)* and *mimus (G. cristicollis, G. divaricatae,*

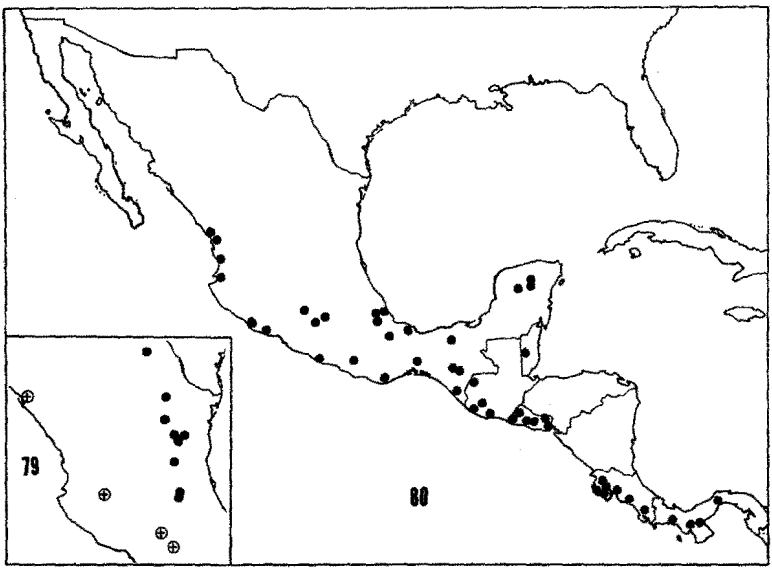
TABLE 6. — Host plants of the bruchid genus *Gibbobruchus* (derived from Table 5).

Group	Species	Host
speculifer	*G. ornatus*	—
speculifer	*G. speculifer*	*Bauhinia forficata.*
polycoccus	*G. polycoccus*	*Bauhinia longicuspis.*
scurra	*G. scurra*	*Bauhinia rufa.*
scurra	*G.* n. sp. nr. *G. scurra*	*Bauhinia bauhinioides.*
cavillator	*G. cavillator*	—
cavillator	*G. nigronotatus*	*Bauhinia forficata.*
cavillator	*G. triangularis*	—
cavillator	*G.* sp. 1	*Bauhinia ungulata.*
cavillator	*G.* sp. 2	*Bauhinia monandra* (?), *B. rufa*
cavillator	*G.* sp. 3	*Bauhinia ungulata.*
cavillator	*G.* sp. 4	*Bauhinia aculeata, B. ungulata.*
wunderlini	*G. wunderlini*	*Bauhinia dipetala, B. divaricata.*
mimus	*G. cristicollis*	*Bauhinia congesta, B. coulteri, B. divaricata, B. macranthera, B. pauletia.*
mimus	*G. divaricatae*	*Bauhinia divaricata, B. pes-caprae, B. ungulata.*
mimus	*G. guanacaste*	*Bauhinia divaricata, B. glabra, B. pauletia, B. pes-caprae, B. pringlei, B. ungulata.*
mimus	*G. iturbidensis*	—
mimus	*G. mimus*	*Bauhinia congesta* (secondary), *Cercis* spp.



FIGURES 77-78. — Distribution records of *Bauhinia* spp: 77, *B. pes-caprae* (crossed circle), *B. dipetala* (dots), *B. dipetala* var. *deserti* (slashed dots); 78, *B. divaricata.*

and *G. guanacaste)* Groups; this fact suggests relatively unspecialized biochemical conditions in *B. divaricata. Gibbobruchus guanacaste* is known from *B. divaricata* only in Jamaica, a fact that may reflect inadequate sampling, opportunism, or some difference between island and mainland forms of *B. divaricata* or more likely of *G. guanacaste. Bauhinia pauletia* is attacked by *G. cristicollis* and *G. guanacaste* in Central America from Honduras to Costa Rica; further study should produce records of these bruchid species from *B. pauletia* elsewhere in its range (Fig. 76), northward to northwestern Mexico. Seeds of *B. pes-caprae* are attacked by *G. divaricatae* and *G. guanacaste,* indicating possible relationship with *B. divaricata. Bauhinia ungulata* may have the least specialized seed biochemistry among Central American species of *Bauhinia,* as not only are species of the *mimus* Group predatory on it in Central America but several species of the *cavillator* Group prey on it in South America.



FIGURES 79-80. — Distribution records of *Bauhinia* spp.: 79, *B. macranthera* (dots), *B. pringlei* (crossed circles); 80, *B. ungulata.*

According to R. P. Wunderlin *(in litt.),* two subgenera include all American species of *Bauhinia.* All but one of the records of *Gibbobruchus* from *Bauhinia* are from various species of the subgenus *Bauhinia,* and no other American bruchids are known to attack this subgenus. The exception is a record of *G. guanacaste* from *Bauhinia glabra* of the subgenus *Schnella;* various members of this subgenus are otherwise attacked by members of the *stenocephalus* Group of *Caryedes* (Kingsolver and Whitehead 1974). We think that *B. glabra* is a secondary host for *G. guanacaste* and that *Gibbobruchus* species normally do not attack *Schnella* species.

Conclusions. — The 6 North and Central American species of *Gibbobruchus* treated in this study are all known from more than one collection although one is known only from 3 collections of single females. There probably are no additional members of the *wunderlini* and *mimus* Groups in Central America, but one species of the *cavillator* Group probably extends at least into Costa Rica. Ranges of the tropical species of the *wunderlini* and *mimus* Groups

are poorly known; only *G. guanacaste* is represented south of Costa Rica. The range of the temperate species *G. mimus* is imperfectly known in the western United States, where the host genus, *Cercis,* extends west to California (Fig. 75).

Because some *Bauhinia* species evidently are subject to attack by more species of *Gibbobruchus* than are others, they probably have less developed ecological or biochemical defenses against bruchid attack. We have insufficient data to develop this theme at this time; R. P. Wunderlin *(in litt.)* plans a future study of *Bauhinia-Gibbobruchus* interrelationships, as data become available. Comparison of bruchid and host distributions indicates some gaps of potential significance, although they may be filled by additional collections. Three notable examples are: 1) lack of records of *G. guanacaste* from mainland *B. divaricata;* 2) lack of records of any bruchids from *B. pauletia* north of Honduras; and 3) the curious predator-host pattern for *G. cristicollis* (Fig. 74, Table 2), due in part to lack of northern records from *B. pauletia.* Examination of further herbarium material may give valuable distributional records but cannot substitute for large reared samples. Except for large samples of bruchids reared from *B. congesta* in Texas and from *B. pauletia* and *B. ungulata* in Guanacaste, we have no data to give insight into which host species are principal hosts and which are secondary hosts.

Geographic variation is most strikingly developed in *G. cristicollis,* as summarized in Fig. 74 and Tables 1-2. We suggest that field studies of this species may be of interest, and accordingly we raise the following questions. Is the pattern of variation continuous, or does it have sharp discontinuities? Is there a tendency toward reproductive or ecological isolation where sharply distinct morphotypes are geographically proximate and from different hosts (sample 2 is approximately 50 miles distant from samples 3 and 4)? Is there really a differential selection of hosts, or does *G. cristicollis* attack *B. pauletia* as well as *B. divaricata* in Mexico?

We have expanded the treatment of North and Central American species of *Gibbobruchus* to include a preliminary discussion of South American forms, brief comments on suspected historical zoogeography, a highly tentative reconstructed phylogeny, and

brief comparative notes on seed predation. We hope this treatment will soon stimulate expansion of study of this interesting group of beetles.

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