

Biosystematics of the Genus of *Zabrotes*
of America North of Mexico
(Coleoptera: Bruchidae)

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ABSTRACT

The genus *Zabrotes* is defined, eight previously and poorly described species are re-described, and descriptions of nine new species are proposed. Included are *Zabrotes arenarius* (Wolcott), *cruciger* (Horn), *densus* (Horn), *obliteratus* (Horn), *planifrons* (Horn), *spectabilis* (Horn), *subfasciatus* (Boheman), and *subnitens* (Horn). New species names are *amplissimus*, *bexarensis*, *chandleri*, *cynthiae*, *eldenensis*, *humboldtae*, *stephani*, *vandykei*, and *victoriensis*. Host records, geographic distribution, and a key to species are included along with illustrations of dorsal habitus, pygidium, and male genitalia for each species.

The taxonomy of *Zabrotes* in the United States has been virtually ignored since the genus was described (Horn, 1885). Six species were originally included by Horn, *Bruchus arenarius* Wolcott, described from Illinois, was subsequently transferred to the genus by Bottimer (1956). *Zabrotes subfasciatus* (Boheman), described in the genus *Spermophagus* from Brazil, was added to the United States faunal list by Bottimer (1968) although this species had been reported from the United States numerous times in imported beans. *Zabrotes subfasciatus* has an artificial tropicopolitan distribution because of its affinity with *Phaseolus* spp. Thus it is of primary economic importance in stored legume seeds, and its discrimination from closely related species is critical.

Nine new species are herein described for a total of 17 species of *Zabrotes* north of Mexico although the range of some of the species extends into northern Mexico.

The purposes of this paper are to contribute to our knowledge of the fauna of the United States, and to make names of new species available for a planned handbook of Bruchidae of the United States and Canada.

This genus is found naturally only in the Western Hemisphere from the

United States to Brazil. Most species are small— 1.0 - 2.5 mm — but two undescribed species reach 3.7 mm long. Host plant associations are known for only a few species and these are known only from leguminous seeds.

Immature forms have been described only for *Zabrotres subfasciatus*. No parasites have been recorded from the United States for any species of *Zabrotres*.

I introduce in this paper the term *ocular index*—the ratio of the width across the eyes over the narrowest distance between the eyes.

Genus ZABROTES Horn

Zabrotres Horn, 1885: 156. Type species: *Bruchus cruciger* Horn, 1885, subsequent designation by Zacher, 1930. Leng, 1920: 306; Bridwell, 1932: 106, 1946: 53, 56; Blackwelder, 1946: 763; Kingsolver, 1970: 469; Bottimer, 1968: 1021; Johnson and Kingsolver, 1982: 411, Borowiec, 1987: 62.

Zabrotres, *Amblycerus* and *Spermophagus* are placed in the subfamily Amblycerinae. Borowiec (1987) proposed a new tribe, Spermophagini, for *Zabrotres* and *Spermophagus*, at the same time proposing Amblycerini for *Amblycerus*. Genera included in the Amblycerinae are characterized by the presence of two moveable, apical, metatibial spurs, the metacoxal face broader than the metafemur, visible trochantins in the pro- and mesocoxal cavities, mesepimeron and mesepisternum subequal in width, and the common base of the male genitalic lateral lobes straplike.

The following key (Kingsolver 1970, slightly modified) separates these three genera:

1. Emargination of eye shallow, depth less than one-third of diameter of eye; procoxae well separated by prosternal process; metatibia lacking lateral carina.
 Amblycerini *Amblycerus* Thunberg

- Emargination of eye deep, one-half or more of diameter of eye; procoxae contiguous or separated by only a thin, vertical lamella; metatibia with prominent carinae. Spermophagini 2

2. Anterior end of lateral pronotal carina meeting or nearly meeting short, horizontal supracoxal carina on an angulate lobe partly concealing posterior margin of eye when head is in repose; tenth stria reaching nearly to apex of elytron; apex of metafemur minutely incised *Spermophagus* Schoenherr

- Supracoxal carina lacking, eye free of anterior margin of pronotum; tenth stria extending only one-half length of elytron; apex of metafemur angulate, not incised *Zabrotres* Horn

Species of *Zabrotres* vary little in many of their morphological structures used as taxonomic characters. The following structures appear to be fairly constant in the species found in the United States: Integument of body and

appendages black except basal one or two segments of antenna usually red or reddish brown; tibial spurs dark red. Vestitural pattern relatively constant for each species, occasionally dimorphic. Vertex and frons usually finely punctate, sometimes with mixed larger punctures, frontal carina usually prominent, ocular index 3:1 to 5:1, ocular sinus three-fourths to seven-eighths length of eye; postocular lobe narrow, separated from gena by short sulcus; antenna elongated, narrow, laterally compressed, segments 4-10 subtriangular, terminal segment elongate-parallel (Figs. 44-47). Anterior margin of pronotum semicircular, apex sometimes truncate, base broadly angulate, basal margin gently arcuate from midline to posterior angles, disk evenly convex except basal lobe sometimes marked by short, diagonal sulci delimiting slight median dome, lateral surfaces of disc sparsely foveolate (except densely foveolate in *Z. amplissimus*, n. sp.), intervals between foveolae finely punctate, median one-third usually finely punctate; lateral carina sharp, anterior end hooked toward foramen, hypomeron deeply concave to receive forelegs in repose, prosternum short, triangular, but seldom visible because of reflexed position of head; mesosternum rounded or carinate, sometimes protruding above level of metasternum, mesepisternum and mesepimeron subequal in width, post-mesocoxal sulcus extending across metasternum.

Scutellum narrowly triangular, densely pubescent. Elytra together slightly wider than long, nearly flat in middle two-thirds, convex laterally; striae relatively straight, usually narrow; strial punctation varying from broad and shallow to deep and narrow, each puncture or foveola with seta emerging from beneath its anterior rim, interstices sparsely punctate (except densely foveolate in *Z. amplissimus*). Metacoxal face reniform, broader than metafemur, sparsely foveolate and densely pubescent in lateral one-half (except sparsely pubescent in *Z. amplissimus*), median one-half to one-third either with cluster of about 20 fine punctures (Fig. 41), or polished and impunctate with deep pit adjacent to insertion of trochanter (Fig. 42); hindleg as in figure 43; metafemur with lateroventral carina gently sinuate to subacute apex, mesoventral carina more strongly sinuate to rounded apex; metatibia straight, lateroventral, ventral, and mesoventral carina each with row of short, stiff setae, laterodorsal face with row of setiferous punctures; lateral spur shorter than mesal spur; terminal margin of tibia oblique, finely denticulate; basitarsus with two ventral, parallel, setose carinae. Abdomen with sterna telescoped, fifth sternum of male deeply emarginate for apex of pygidium, pygidium broader than long in both sexes, convex with apex more strongly reflexed in male, disk microfoveolate. Lateral lobes of male genitalia fused basally, straplike, expanded apically.

Characters that constitute the basis for specific differentiation are found in the color pattern of the pronotum, elytra, pygidium, and ventral areas of the metathorax and abdomen, punctation of the pronotum, elytral striae and interstices, metacoxal face, and pygidium; shape of the antenna and of the mesosternal apex; and form of median and lateral lobes of male genitalia.

To attempt to construct a phylogenetic scheme based on the 17 species in

this report would be non-productive since the geographical range of the genus extends through Mexico and Central America into Brazil, and no comprehensive treatment of the neotropical species has yet been attempted. Some preliminary groupings, however, are apparent.

Zabrotes exhibits conflicting combinations of characters. The most obvious consistently divisive feature is the presence or absence of a cluster of coarse punctures on the metacoxal face near the insertion of the trochanter.

This character splits the American species almost evenly. Those with a smooth, polished medial portion of the coxal face also feature a flat mesosternum between the mesocoxal cavities. On the other hand, those species with a cluster of coxal punctures may have either a flat or a carinate mesosternum..

The species groups listed below are tentative, and are based upon: (1) form of the male genitalia; (2) presence or absence of the cluster of punctures on the metacoxal face; (3) mesosternum flat, or carinate, and protruding below the level of the metasternum; (4) dorsal color pattern (limited).

In United States *Zabrotes*, the male genitalia of most species fall into four basic types- (1) **cruciger type**: dorsal valve beaked, a pair of hooked sclerites in middle of sac, and apex of sac bilobed (Figs. 56, 58, 64, and 70), (2) **obliteratus type**: dorsal valve simple, rounded apically, internal sac with a flask-shaped sclerite with a "stopper", and no apical lobes in the sac (Figs. 60 and 66); (3) **subfasciatus type**: dorsal valve slightly beaked, internal sac sclerite vasiform with clusters of small spicules, and no apical lobes in the sac (Figs. 62 and 74); (4) **planifrons type**: dorsal valve broadly beaked, ventral valve scutiform; internal sac with pair of small sclerites, apical sac lobes various (Figs. 68 and 72).

The mesosternum in Bruchidae is reduced to a small, triangular sclerite separating the mesocoxae. Two forms exist in *Zabrotes* species herein included. (1) flat, not protruding below the plane of the metasternum; (2) carinate and protruding below the metasternum. No intermediate conditions were found.

SPECIES GROUPS

1. **Cruciger Group** — Coxal face punctate, mesosternum carinate and protruding below plane of metasternum, male genitalia of *cruciger* type, color pattern of first four species dimorphic, males with sutural stripe; pattern not dimorphic in *arenarius* and *vandykei* —(*cruciger*, *spectabilis*, *cynthiae*, *chandleri*, *arenarius*, *vandykei*).

2. **Planifrons Group** — Coxal face punctate, mesosternum flat, male genitalia of *planifrons* type, dorsal pattern generally uniformly colored on pronotum and elytra with faint maculae near lateral margins of elytra, pygidium uniform— (*planifrons*, *stephani*).

3. **Victoriensis Group**.— Coxal face punctate, mesosternum carinate, male genitalia of *obliteratus* type, color pattern generally uniform but male with faint pronotal stripe extending onto elytral suture — (*victoriensis*).

4. **Subfasciatus Group**.— Coxal face smooth, mesosternum flat, genitalia of *subfasciatus* type, elytral color pattern strongly maculate in females of both species and in males of *eldenae*, mottled in males of *subfasciatus*. Female pygidium dark brown with narrow median stripe — (*subfasciatus*, *eldenae*).

5. **Densus Group**.— Coxal face smooth, mesosternum flat, genitalia of *obliteratus* type, elytral color pattern maculate, pygidium with narrow median stripe — (*densus*, *obliteratus*).

6. **Subnitens Group**.— Similar to *densus* group except color pattern uniformly white with no apparent pattern — (*subnitens*).

7. **Humboldtae Group**.— Coxal face, smooth, mesosternum flat, male genitalia of *cruciger* type, elytral color pattern maculate, pygidium dark brown with narrow median stripe — (*humboldtae*).

8. **Amplissimus Group**.— Coxal face smooth, mesosternum flat, female only known (male genitalia of a related Mexican species similar to *subfasciatus* group). Color uniformly gray, no pattern, integument densely, uniformly foveolate (*amplissimus*).

KEY TO UNITED STATES SPECIES OF *ZABROTES*

1. Medial one-half of metacoxal face with cluster of coarse punctures near trochanteral articulation (Fig. 41). Section I: Punctate metacoxae 2
 Medial one-half of metacoxal face smooth and polished; some species with deep pit surrounding trochanteral articulation (Fig 42). Section II: Smooth metacoxae 10
2. Dorsal color nearly uniformly gray but with apex of elytra brown 3
 Dorsum of different color combination 4
3. Third and fifth elytral interstices striped in basal one-fourth (Fig. 27); male genitalia as in figures 72 and 73 *stephani*, new species
 Interstices not striped, uniformly gray (fig 22); male genitalia as in figures 68 and 69 *planifrons* (Horn)
4. Pronotum, elytra and pygidium with strongly contrasting white maculae on dark brown or golden brown background; males with sutural stripe on pronotum and elytra as in Figs. 10 and 24 5
 Coloration otherwise 7
5. Body length 1.3 to 1.6 mm., golden brown to dark brown vestiture with white pattern, male genitalia (Figs. 58 and 70) 6
 Body length 2.1-2.9 mm; vestiture dark brown with strongly contrasting white pattern (Fig. 24); male genitalia as in figures 56 and 57 *cruciger* (Horn)

6. Male genitalia as in figures 58 and 59, lateral margin of pronotum with diffuse white patch *cynthiae*, new species
- Male genitalia as in figures 70 and 71; lateral margins of pronotum with sharply defined white patch *spectabilis* (Horn)
7. Elytra mostly yellowish orange with white maculae; male pronotum white with orange stripes, elytra with white sutural stripe, pygidium white; female pronotum orange with lateral and basal spots white, pygidium orange with white median stripe (Fig. 7) *chandleri* new species
- Coloration otherwise 8
8. Pronotum and elytra reddish brown or mixed gray and brown; lateral surfaces of abdominal sterna mottled brown; pygidium with indistinct median and lateral gray stripes sometimes connected by transverse band *vandykei*, new species
- Pronotum and elytra brown or gray; abdominal sternites uniformly gray; pygidium with or without median stripe 9
9. Pygidium usually with gray median stripe; male genitalia as in figures 80 and 81; Texas and Mexico *victoriensis*, new species
- Pygidium usually unicolorous, occasionally with narrow evanescent median line; male genitalia as in figure 50 and 51; Eastern U.S. *arenarius* (Wolcott)
10. Vestiture of pronotum and elytra uniformly gray or white, sometimes intermixed with reddish brown, or with vaguely defined median band extending from border to border on elytra 11
- Elytra with distinct maculae of different color from background (Fig. 30) or with mottled pattern (Fig. 31) 13
11. Body length 3.6 mm, pronotum, elytra, and pygidium finely, densely foveolate (Figs. 1 and 2); pygidium with small, white, subbasal spot on either side of midline *amplissimus*, new species
- Body length less than 3 mm; if foveolae present, not evenly distributed; pygidium lacking white spots 12
12. Elytra with vaguely defined, gray median band, remainder of elytra uniformly gray, or gray intermixed with reddish brown (Fig. 5); Texas *bexarensis*, n. sp.
- Elytra lacking band, vestiture uniform; Eastern U. S. *subnitens* (Horn)
13. Metasternum with elongate, pubescent sulcus on midline (Fig. 29); male with mottled elytral pattern (Fig. 31), pygidium uniformly clothed (Fig. 32); female with transverse, white, curved maculae (Fig. 30); pygidial pattern variable (Figs. 33 and 34) *subfasciatus* (Bohe)

- Metasternum convex or flat, with only a median suture 14
14. Male genitalia with flask-shaped median sclerite and small " stopper" sclerite (Figs. 60 and 61) 15
- Genitalic armature differently shaped (Figs. 62 and 64) 16
15. Body length 2.0-2.5 mm; male genitalia as in Figs. 66 and 67; female eighth sternite as in Fig. 49); Texas and Arizona *obliteratus* (Horn)
- Body length 1.6 mm; male genitalia (Figs. 60 and 61); Southern California *densus* (Horn)
16. Body length 1.7 mm. male genitalia (Figs. 64 and 65); Northern California *humboldtiae*, new species
- Body length 2.2 mm; male genitalia as in Figs. 62 and 63, female eighth sternite as in Fig. 48; Arizona *eldenensis*, new species

Section I: Punctate metacoxae

Zabrotes arenarius (Wolcott)

Figs. 3, 4, 50, 51

Bruchus arenarius Wolcott, 1912: 162, Pic, 1913a: 162.*Mylabris arenarius*: Leng, 1920: 305.*Megacerus arenarius*: Bradley, 1947: 37.*Zabrotes arenarius*: Bottimer, 1956: 67; Johnson, 1968: 1271; Bottimer, 1968: 1013, 1038; Johnson and Kingsolver, 1982: 411.

Color.— Vestiture evenly distributed of uniformly gray to mixed gray and dark brown, occasionally with white patch on basal lobe of pronotum, and a marginal macula on each elytron (Fig. 3).

Structure.— Antenna not dimorphic, reaching middle of metacoxa; head densely punctulate, frontal carina prominent. Pronotum subtrapezoidal, apex truncate, lateral margins arcuate, base broadly angulate, disk sparsely microfoveolate, foveolae shallow, inconspicuous, lateral carina prominent. Scutellum narrowly triangular. Elytra together as long as wide, slightly depressed medially in basal one-half, striae shallow, inconspicuous, striae punctures approximate; interstices flat, finely, densely punctate-imbricate. Metacoxal face sparsely, shallowly foveolate in lateral one-half, medial one-half with cluster of punctures. Abdomen not modified except usual reflexed male pygidium. Male genitalia as in figures 50 and 51.

Body length 1.5-2.1 mm; *width* 1.2-1.4.

Type depository.— Field Museum of Natural History, Chicago, holotype #234.

Type locality.— Illinois, Havana, Devil's Hole.

Distribution.— ALABAMA: Foley, 1893. D.C., Washington, Chain Bridge, 22-VI-1924. FLORIDA: Gainesville, 6-20-VII-1960, 11-X-1972, 23-XI-19

72, 20-IV-1974, 30-IX-1945, 30-V-1967, 6 mi N Leesburg, 19-VIII-1978; Lake Alfred, 30-VII-1929; 1 mi W Archer, 13-VI-1965. GEORGIA: Satolah, 5-VII-1957. ILLINOIS: Havana, 12-VIII-1907, Mason St. Forest, 29-VII-1955, Topeka, 13-VIII-1907. INDIANA: Bear Wallow, 27-V-1967. MARYLAND: Glen Echo, 15-V-1922, Indian Head, 3-VI-1945, Beltsville, 18-VI-1971, Bladensburg; Berlin 23-V-1946, Westminster. NEW JERSEY: Wenonah, V-1930, Manumuskin, 5-V-1907; New Lisbon, 30-V-1939, Asbury Park, 8-IX-1936; Haddon Heights, 16-VI-1930, 21-IX-1931. NORTH CAROLINA: Highlands, 13-VI-1957; OKLAHOMA: Southland, 18-IV-1962, 9-VI-1962; Spavinaw, 12-V-1984. SOUTH CAROLINA: Aiken, 31-V-1957. TEXAS: Leon Co., 24-V-1948, Austonia, 13-IX-1958; 5 mi W Mathis, 16-VII-1954. VIRGINIA: Vienna, Barcroft, 4-VI-1932, 24-VI-1939.

Host plants.— Swept from *Cassia fasciculata* Michx. flowers at Havana, but the larval host is not known. Bridwell collected it on strawberry flowers in Maryland.

Discussion.— The male genitalia are nearly identical to those of *Z. spectabilis* but the color pattern is uniformly gray or brown with or without faint elytral maculae, but the elytral pattern is not as bold as that of *spectabilis*. Specimens from Havana are uniformly brown or gray whereas the elytra from other localities is usually maculate. *Zabrotes stephani*, n. sp., is also gray but with some faint striping on the elytra, and with a distinctively different male genitalia (Fig. 72).

***Zabrotes chandleri* new species**

Figs. 7, 8, 9, 54 and 55

Color.— Basal antennal segment red or reddish brown. Vestiture of orange and white setae in dimorphic pattern; males with head, pronotum, pygidium (Fig. 9) and ventral areas white, elytra orange with median transverse bars and sutural stripe white (Fig. 7), pronotum sometimes with vague orange spots on middle of disk; female with head white, pronotum orange with white spot on basal lobe and lateral margins, elytra orange, each elytron with elliptical, transverse spot (Fig. 8), pygidium orange with white median stripe expanded at apex, venter white except coxa, a lateral spot on first abdominal sternum and at apex of fifth segment orange.

Structure.— Vertex and frons minutely punctate, clypeus more coarsely punctate, frontal carina prominent, ocular index 5:1, ocular sinus four-fifths length of eye, antenna slightly dimorphic, of male reaching first abdominal segment, of female reaching metacoxa. Pronotum semicircular, disk convex, slightly domed, minutely punctate with larger punctures in lateral areas and along base; lateral carina gently arcuate. Scutellum triangular, densely pubescent, mesosternum projecting, carinate. Elytra slightly wider than long, disk nearly flat; striae nearly concealed by vestiture; interstices flat, punctulate. Pygidium 1.4 x as wide as long, convex, apex in male strongly reflexed into fifth sternum. Metacoxal face with lateral four-fifths densely punctulate and

30-35 shallow foveolae, median one-fifth smooth, polished, with cluster of coarse punctures set in slight depression. Male genitalia as in figures 54 and 55.

Body length 2.4-2.5 mm; *width* 1.7-1.8 mm.

Holotype male, CALIFORNIA, 3 mi N Big Pine (Inyo Co.), 7-V-1970, Chandler.

Allotype female and one male paratype, same data. Other paratypes CALIFORNIA: Inyo Co., Darwin Falls, 17-V-1970, Bohart, 5 mi E Big Pine, 4500', 15-VI-1975, Guliani, (1), Mojave Desert, 31-VII-1940, Knull (1); Coyote Wells, 16-VII-1949, Knull (2).

Holotype and one paratype in collection of University of California, Davis, one paratype in Ohio State University, one in C. D. Johnson collection, Flagstaff, Arizona, and one in the California Department of Agriculture, Sacramento; allotype and one paratype in National Museum of Natural History, Washington, D.C.

Discussion. — The orange and white vestitural pattern is immediately recognizable. This pattern and the form of the male genitalia place this species near *Zabrotes cruciatus* and *Z. spectabilis*. The species is not known outside of California. No host associations are known.

The name is a patronym of Dr. Donald S. Chandler who collected three of the specimens in the type-series.

***Zabrotes cruciger* (Horn)**

Figs. 10, 11, 56, 57

Zabrotes cruciger Horn, 1885: 157; Leng, 1920: 306; Johnson, 1968: 1271; Bottimer, 1968: 1013, 1038; Johnson and Kingsolver, 1982: 411.

Spermophagus cruciger: Pic 1913: 59.

Color.— Basal segment of antenna and tibial spurs dark brown. Vestitural pattern dimorphic: Male- pronotum dark brown dorsally with lateral patches and median stripe white, elytra with sutural stripe and lateral, oblique maculae white, female- median and sutural stripes lacking, otherwise as for male (Fig. 10), vestiture white ventrally except coxal face in both sexes and lateral patch on abdominal segment 1 brown, pygidium white with a large, dark brown patches on either side of midline.

Structure.— Frontal carina prominent, ocular index 5.1; ocular sinus four-fifths length of eye, antenna reaching posterior margin of metacoxa.

Pronotum semicircular apically, broadly angulate basally, evenly convex, basal lobe marked by short, lateral sulci; surface sparsely foveolate, foveolae elliptical, each with seta emerging from its anterior rim; intervals finely punctate, lateral carina sharp; mesosternum carinate, protruding above level of metasternum. Scutellum triangular, densely pubescent. Elytra together as long as wide, nearly flat in middle two thirds, convex laterally, striae regular in course, consisting of large, elliptical foveolae, each with seta emerging from beneath its anterior rim, interstices sparsely punctate. Metacoxal face sparsely

foveolate in lateral two thirds, intervals finely punctate, median one-third with cluster of deep punctures near insertion of trochanter; hindleg as in figure. Male genitalia as in figures 56 and 57.

Body length 2.1-2.9 mm; *width* 1.5-2.1 mm.

Type depository.— Museum of Comparative Zoology, Cambridge, MA, holotype #3899.

Type locality.—"Colorado".

Distribution.— ARIZONA. 5 mi S. Snowflake, 15-VI-1967; Chiricahua Mts.; Flagstaff, VII; 10 mi E Sonoita, 29-VI-1950, St. Johns, 31-VI-1961; Nogales, 3-X-1906, 21 mi S Cameron, 6-VI-1967, sweeping *Hoffmanseggia jamesii* (Johnson), 3-VIII-1971, (Pfaffenberger); 6 mi N Madera Cyn., 16-VIII-1967 (Johnson). COLORADO: Lamar, 18-VII-1901. NEW MEXICO: Silver City, VI-1933; Bingham, 28-VIII-1964; 2 mi W Glenrio, 6-VI-1966, 1 mi SE Melrose, 10-VII-1953. OKLAHOMA: Boise City, 27-VII-1964. TEXAS. 18 mi S Seminole, 11-IX-1979, Big Bend, 17-V-1959, Randall Co., 7-VII-1950, 24 mi SE Marfa, 27-VI-1968, Palo Duro, 10-VIII-1965.

Host Plants.— Unknown.

Discussion.— This large, handsome species could hardly be confused with any other *Zabrotes* except *spectabilis*. The bold, sexually dimorphic color pattern of the dorsal surface is similar to that of *spectabilis* and *chandleri*, n. sp. wherein the sutural and pronotal stripes distinguish the male, and are absent in the female.

***Zabrotes cynthiae* new species**

Figs. 12, 13, 58, 59

Color.— Vestiture mostly golden brown dorsally, head sparsely white, pronotum with white median stripe from base to, or nearly to, apex, lateral margins sometimes with diffuse white patches; elytra with white sutural stripe, each elytron with oblique, elongate white bar (Fig. 12); pygidium variable, usually brown with white median stripe (Fig. 13), but some specimens nearly uniformly white with scattered golden setae, female usually darker brown than male, venter of body mostly white with golden brown on metacoxae, and brown patch on lateral areas of abdomen, especially on sternum 5; legs white. First antennal segment red, remaining segments black.

Structure.— Frontal carina prominent; ocular index 4:1; ocular sinus three-fourths length of eye, male antenna slightly broader and longer than that of female, male reaching pygidial margin, female reaching metacoxa.

Pronotum punctulate with scattered foveolae, pronotal disk semicircular with apex subtruncate; lateral carina normal for genus. Scutellum minute, broadly triangular. Elytra together slightly wider than long; striae shallowly face extremely finely punctulate and sparsely pubescent, median one-third smooth except for depressed cluster of about 30 punctures near trochanteral insertion. Male genitalia (Figs. 58 and 59) similar to those of *Z. spectabilis* except shoulders of dorsal valve rounded, not apically produced (cf. Figs. 58 and 70).

Body length 1.7-1.9 mm; *width* 1.1-1.3 mm.

Holotype male.— CALIFORNIA: San Bernardino Co. Providence Mts., Bonanza King Mine, 23-IV-1966, O'Brien. *Allotype female*.— CALIFORNIA, San Bernardino Co., 5 mi. E. Mentone, 2650', 13-IX-1965 O'Brien. *Paratypes*.— all CALIFORNIA: same data as holotype (1); Riverside Co., Pinyon Flats, 4000', 1-VII-1965, Johnson (1), 5-VII-1981, Bellamy (4); San Bernardino Mts, Cold Cr. Ranch, Muchmore (no date) (1); Inyo Co., 9 mi E Wildrose Sta., 14-V-1969, Doyen & Opler (1), Los Angeles Co., Three Points, 2-V-1968, Veirs (1); Nevada Co., Grass Valley, 5-VII-1956, Powell, *Cupressus macnabiana* (1); San Benito Co., Panoche Pass, 1850', 16-IV-1966, O'Brien (2); San Diego Co., 1 mi N Scissors Crossing, 6-IV-1969, O'Brien (2), Mt. Laguna, 28-VI-1970, Stephan (1), Thomas Camp, 29-VI-1970 (1), Morena Lake, 27-VI-1970 (1); Fresno Co., 10 mi E Clovis, 16-VII-1963, sweeping *Lotus* sp., Johnson (1), Trimmer, 30-VI-1961, *Asclepias* sweep, Johnson (1), 2-4 mi N Academy, 12-VII-1961, *Lotus* and *Eremocarpus* sweep, Johnson (5), San Diego, 6-9-VI-1911, Ricksecker (5); Pasadena, VI (2); Paraiso Hot Springs, 1500', 15-VII-1954, Bryant, on *Quercus agrifolia* (3); Riverside, 21-VII-1936, Pritchard, 13-V-1928 (1); Coronado, 22-VI-1890 (2); Tehachapi, (no date), Wickham (1), Los Angeles (no date), Coquillett (3); Sonoma (no date) (1); Folsom, 1883 (1); Kaweah, 11-X-1936, V-1937, F. Scott, (Bottimer #77) (9), Kaweah, (no date) Hopping (4); Northfork, 16-VII-1933, Allen (1); Sequoia N.P., 2000-5000 ft., Potwisha, 16-VII-1931 and 2-VII-1929 (5); Laguna Mt., 6000', 24-VIII-1924, Martin (1); "Mokel"(umne) Hill, VIII.

Holotype, allotype, and paratypes deposited in the National Museum of Natural History, Washington, DC. Paratypes deposited in the California Academy of Sciences, San Francisco; Canadian National Collections, Ottawa, the C.D. Johnson Collection, Flagstaff, AZ, California Department of Agriculture, Sacramento; Florida Department of Agriculture, Gainesville; University of California, Davis.

Discussion. — Four species found in California—*Zabrotes cynthiae*, *densus*, *humboldtae*, and *spectabilis*—are similar in size and color pattern, and can easily be confused with one another. Two of the species—*densus* and *humboldtae*—are in the group with smooth metacoxae, whereas the remaining two are in the punctate coxa group. Differentiation of *cynthiae* and *spectabilis* can be made by examination of male genitalia (Figs. 58 and 70). The apical margin of the dorsal valve is evenly arcuate for *cynthiae* but recurved for *spectabilis*. The pronotal lateral margin of *spectabilis* carries a lunate white mark (Fig. 24), but the margin of *cynthiae* is without markings (Fig. 12).

I am pleased to name this species after my wife, my companion for 42 years.

***Zabrotes planifrons* (Horn)**

Figs. 22, 23, 68, 69

Zabrotes planifrons Horn, 1885: 158; Leng, 1920: 306; Johnson, 1968: 1271; Bottimer, 1968: 1013, 1038; Johnson and Kingsolver, 1982: 411.

Spermophagus planifrons: Pic 1913: 61.

Color.— Vestiture mostly gray but with intermixed reddish brown setae, especially along lateral margins of elytra, occasionally on pronotum; apex of each elytron with large patch of reddish brown setae (Fig. 22); pygidium with basal band of intermixed gray and reddish brown (Fig. 23); scutellum white. Antennal segments 1 and 2 dark red. Vestiture on pronotal disk directed toward midline.

Structure.— Vertex densely micropunctate becoming slightly coarser on frons; frontal carina feeble or evanescent; ocular index 4.5:1, ocular sinus seven-eighths length of eye; antenna not sexually dimorphic, reaching posterior margin of metacoxa. Pronotum semicircular, not truncate apically, disk uniformly micropunctate, lateral areas microfoveolate, basal lobe slightly swollen. Scutellum triangular. Elytra wider than long, lateral margins arcuate, striae shallow, well-marked basally, evanescent in apical one-half, striae punctures elongate; interstices with single or double row of shallow punctures, apical one-half of elytra irregularly punctate. Metacoxa with scattered, shallow foveolae in lateral one-half, cluster of 30-40 fine punctures near trochanter. Abdomen with male sternum 5 deeply emarginate; pygidium micropunctate, sparsely microfoveolate. Male genitalia as in figures 68 and 69.

Body length 1.3-1.5 mm; *width* 0.8-1.1 mm.

Type depository.— Museum of Comparative Zoology, Cambridge, MA, lectotype #3904, designated by Johnson, 1968.

Type locality.—Arizona.

Distribution.— ARIZONA: Chiricahua Mts., Rustler Pk., 24-VIII-1968, Cave Cr, 20-VI-1932; Palmerlee, VIII-1917; Sta. Rita Mts., Bear Cyn., 10-IX-1948; 14 mi NE Sonoita, 18-VI-1970; 1 mi W Mt. Wrightson, 18-VI-1970; Nogales, IX-1906, 19-IV-1974, Sta. Catalina Mts., 8-V-1933, Empire Mts., 20-V-1928; 5 mi W Portal, 14-V-1956; Graham Mts., 25-IX-1937; Madera Cyn., 3-IX-1954; Patagonia Mts., 27-VIII-1959; 4 mi W Montezuma Pass, 9-IX-1965; 15 mi E Pearce, 8-IX-1964; 10 mi SW Canelo, 10-IX-1965; Parker Cyn. Lake, 7-IX-1965; 16 mi SE Tucson, 15-VI-1964; 6 mi E Ruby, 15-X-1976; Ramsey Cyn., 13-VII-1955; St. David, 2-V-1956; Sunnyside Cyn., 21-VIII-1967; Carr Cyn., 22-VIII-1967; 1 mi W Bisbee; Greaterville, 16-VIII-1978; Guadalupe Mts., 24-VIII-1978; Sycamore Cyn. nr Ruby, 6-VIII-1978; Pinesy Cyn., 28-VII-1955; Montezuma Pass, 6-VII-1956; Sonora Desert Museum, 9-16-VIII-1962. NEW MEXICO, 1 mi N Rodeo, 15-VI-1964. MEXICO.

Host plants.— Johnson (1979) reared this species from "*Cassia leptadenia*" Greenm., (now *Chamaechrista nictitans mensalis*).

Discussion.— This species is usually easily separated by its small size,

uniformly gray appearance except for a large brown spot at the apex of each elytron, by the cluster of punctures on the metacoxal face, and by the distinctive male genitalia (Fig. 68) with a broad, rounded ventral valve, massive apical frame around the base of the valve, and by the broad central blade of the lateral lobes with alate lateral appendages (Fig. 69). It is generally similar to *Zabrotes stephani*, n. sp. in external appearance. These two species form a subgroup in which the metasternum is flat, the metacoxa is punctate, and the male genitalia are reasonably similar.

***Zabrotes spectabilis* (Horn)**

Figs. 24, 25, 26, 41, 70, 71

Zabrotes spectabilis Horn, 1885: 157, Pic, 1913 62; Leng, 1920: 306; Johnson, 1968: 1271; Bottimer, 1968: 1013, 1038; Johnson, 1979:124; Johnson and Kingsolver, 1982: 411.

Color.— Basal antennal segment red, basic vestitural color varying from gray to golden brown to dark brown; head gray in both sexes; white maculations as follows- male pronotum with median white stripe (Fig. 25), lateral margin with white spot; each elytron with lateral white maculation and white sutural stripe, male pygidium (Fig. 26) with white basal band and median stripe; female pronotum with basal and marginal spots white, lacking sutural stripe (Fig. 24) elytra without sutural stripe; female pygidium lacking basal band but median stripe narrower than for male; venter of male gray except brown on metacoxal face, female with coxal spot and variable patch along lateral margin of abdomen brown.

Structure.— Frontal carina fine, short; ocular index 5:1, ocular sinus seven-eighths length of eye; antenna not dimorphic, reaching posterior margin of metacoxa. Pronotal margins semicircular but truncated apically, punctuation concealed by vestiture; lateral carina slightly arcuate. Mesosternal apex carinate. Elytra slightly wider than long, striae nearly concealed by vestiture, striae punctures coarse, shallow, striae discrete basally but becoming confused apically, interstices finely punctate; metacoxal face finely punctate (Fig. 41) except area around medial cluster of punctures, lateral one-third of face shallowly foveolate; pygidium foveolate, sculpture nearly hidden by vestiture. Male genitalia (Figs. 70 and 71).

Body length 0.7-1.6 mm; *width* 0.5-0.9 mm.

Type depository.— Museum of Comparative Zoology, Cambridge, MA, lectotype #1885, designated by Johnson, 1968.

Type locality.— Nevada.

Distribution.— ARIZONA. Silver Bell, 13-VII-1970; Sta. Rita Mts., 8-19-VII-1970; Lake Roosevelt, 29-V-1972; Tucson, 23-II-1970, 4-V-1968; Sta. Catalina Mts., 15 mi E Chino Valley; 2 mi S Warren, 17-VIII-1977, ex seeds *Cassia bauhinioides* (CDJ #79-77); 17 mi N Tucson, 4-IX-1965; 2 mi N Oracle Jct., 7-VIII-1975, sweeping *Condalia spatulata* (CDJ); Sta. Catalina Mts., Bear Cyn., 8-VIII-1975, ex seeds *Cassia covesii* (CDJ #52-75); 16 mi N Phoe-

nix, 12-VIII-1975, ex seeds *Cassia covesii* (CDJ #70-75); Sta. Rita Mts., Box Cyn., 16-VIII-1967; Madera Cyn., 31-VIII-1965; 16 mi N Flagstaff, 11-VIII-1967; Granite Reef Dam, 7-VI-1969, on *Acacia greggi* (CDJ); 20 mi S Cameron, 6-VI-1969, sweep *Astragalus lentiginosus* (CDJ); 28 mi N Tucson, 17-IV-1963; Sonoita, 21-IV-1969, on *Astragalus*, Black Canyon City, 18-VI-1969, sweep *Condalia lyciodes* (GSP), 8-VIII-1969, on *Olneya tesota*, (GSP); 8 mi S Page, 4-V-1969, sweep *Astragalus* (CDJ); 10 mi S Camp Verde, 10-VII-1969, flowers *Acacia constricta* (CDJ); Canelo, 3 VIII-1956; 5 mi S Payson, 1-IV-1972; Miller Cyn., Huachuca Mts., 26-VII-1976, Palmerlee, 8-VII-1907; Tumacacori, 22-VII-1938, Picacho Pass, 7-VIII-1940; Empire Mts., 20-V-1938; Nogales, IX-1906; Globe, I-IX-1933, 13-X-1924; Serrita Mts., 20-VI-1925; Pinal Mts., 20-VII-1947; Chiricahua Mts., 11-VI-1908; Hualpai Mt., 8-VII-1949. CALIFORNIA: Visalia, 18-IV-1939; Mojave Desert, VII-1956, Mortimer Park, 4-VI-1938; Yucaipa, 11-IX-1941; 3 mi W Brown, 7-IV-1966; Kingston Range, 11-VIII-1981; Mt. Wilson, 13-VIII-1940; San Jacinto, 26-IX-1958; Summit Valley, 26-VII-1978; 3.5 mi S Palm Desert, 19-V-1973; 1.5 mi S Palm Desert, 7-VIII-1969; 2 mi S Perez, 17-VII-1955; Joshua Tree Nat. Mon., 24-VI-1961; Trabuco Cyn., 20-X-1960; San Gabriel Mts., Brown's Flats, 14-IX-1958; Little Rock, 20-VII-1947; Paraiso Hot Springs, 15-VII-1954; Riverside, 13-V-1938, 21-VII-1936, Pasadena, VI, San Diego, 9-VI-1911; Coronado, 1895; Kaweah, V-1937. NEW MEXICO: 3 mi S Organ, 25-VI-1964; Las Cruces, 3-IX-1975, 3-VI-1960, 20-V-1930, 25-IV-1930; Granite Pass, 15-VI-1964; White's City, 27-IX-1971. NEVADA: 14 mi N Caliente, 12-V-1965, on *Astragalus lentiginosus* var. *fremonti*; 22 mi N Las Vegas, 3-IV-1975, on *Stanleya* sp. OREGON: Rome, 9-VI-1960. UTAH. Fairview Ranch., 13 mi S Hanksville, 4-9-VIII-1968; Sevier Lake, IX-1986. TEXAS: Zavala Co., 11-VIII-1960; 2 mi S Buchanan Dam, 7-IX-1963; 24 mi WSW Ft. Davis, 17-VIII-1969; Big Bend N.P., 23-VII-1968, 5-19-VII-1959, ex *Cassia durangensis*; Panther Jct., I-V-1959, ex *Cassia lindheimeriana*; 3 mi N Presidio, 8-VII-1968; Jeff Davis Co., 6-VII-1953; Brewster Co., 28-VIII-1947; Wilson, 21-VI-1976, Hidalgo Co., 20-III-1952; Presidio, 4-V-1948; Austin, 8-VI-1929; Midland, 10-VI-1929; Marfa, VII-1918; Menard, 28-VII-1946, *Cassia roemeriana*; Kerrville, 23-IX-1953, ex *Cassia roemeriana*, 12-XI-1952, ex *Cassia roemeriana*. Plant names are quoted verbatim.

Five host plants have been cited for this bruchid: *Senna roemeriana* Scheele (Bottimer #86b, 90a, 103z), *S. durangensis durangensis* (Rose) Isely (Bottimer #103y, 103z), *S. lindheimeriana* (Scheele) Isely (Bottimer #103s) from Big Bend National Park, Texas; *Senna bauhinioides* (Gray) Irwin (CDJ #79-77) and *Senna covesii* (A. Gray) Irwin (CDJ #52-75 and 70-75) from Arizona. Plant names have been updated following Irwin and Barneby, 1982. Records from *Astragalus*, *Acacia*, *Condalia*, and *Stanleya* cited above are probably incidental, and will need to be confirmed.

Discussion.— The pattern of the dark brown form is similar to that of *Zabrotes cruciger* but the size and different armature in the lobes of the internal sac (cf. Fig. 56 and 70) clearly separate them. In California, the

golden brown forms could be confused with more distinctly marked forms of *cynthiae* but in the latter species, the sexes are not dimorphically marked, they lack the marginal white patches on the pronotum, and the shoulders of the dorsal valve are not recurved. Two similar California species, *densus* and *humboldtae*, n. sp., can easily be separated by their smooth metacoxae.

Zabrotes stephani new species

Figs. 27, 28, 72, 73

Color.— Vestiture on head sparse, very fine; pronotum and elytra with mixed brown and gray fine setae, elytron often with faint brown macula behind humerus and at middle of lateral margin (Fig. 27), interstices, especially the fifth, faintly striped with gray in basal one-half, pygidium gray with denser median line to mixed brown and gray with gray median line (Fig. 28), venter of body gray.

Structure.— As usual for genus, ocular index 6:1; ocular sinus three-fourths length of eye; antenna not dimorphic, reaching posterior margin of metacoxa; frontal carina prominent; apex of pronotum not truncated. Elytral striae lightly impressed, strial punctures elongate. Metacoxa with cluster of about 30 punctures set in smooth medial one-half of metacoxal face, lateral one-half punctulate and sparsely foveolate. Male genitalia as in figures 72 and 73.

Body length 1.4-1.7 mm; *width* 0.9-1.3 mm.

Holotype male.— OKLAHOMA: Latimer Co., 5 mi W Red Oak, 16-IV-1977, Stephan. Allotype female and three paratypes, Oklahoma, Latimer Co., IV-1982. Other paratypes all from Oklahoma, Latimer Co., 26 with following dates: IV-1982; V-1983, VI-1983, X-1983, IV-1984, VI-1984, VIII-1984; IV-1986, X-1986; IV-1987; VIII-1987; X-1987; XI-1987; III-1988; VI-1988; VII-1988; VIII-1988; IX-1988; six from Haskell Co., Whitefield, Canadian River, 5-VI-1983, all collected by K. Stephan. One from Texoma Lake, 15-VII-1954, Chillcott.

Holotype and paratypes deposited in the National Museum of Natural History, Washington, DC. Allotype and paratypes in the Karl Stephan collection, Red Oak, OK. Paratypes in the C. D. Johnson collection, Flagstaff, AZ, the Florida State Department of Agriculture collections, Gainesville, and the Canadian National Collections, Ottawa.

Host plants.— Unknown.

Discussion.— In external appearance, flat mesosternum, and punctate metacoxa, this species most closely resembles *Z. vandykei*, new species, and *planifrons* (Horn). All three species have a fairly uniform vestiture with muted pattern- vestiture is gray in *planifrons* but with the elytral apices brown, the elytra of *stephani* are usually gray with some faint basal stripes, and those of *vandykei* are brown with yellowish gray lateral maculae. The male genitalia, however, are distinctive although those of *vandykei* ally it with the *cruciger* group.

This species is named for Karl Stephan, collector extraordinaire.

***Zabrotes vandykei* new species**

Figs. 37, 38, 78, 79

Color.— Basal antennal segment and metatibial calcaria dark red. Vestiture of brown, gray, and reddish brown slender setae (Fig. 37); head uniformly gray; pronotum with mixed brown and gray, lateral areas paler; elytra with mixed brown and gray setae, usually with pale transverse band, darker apically, pygidium (Fig. 38) with reddish brown basal band, remainder mixed gray and brown with reddish brown patches; ventral side of body mostly gray with reddish brown patches along dorsal margin of abdominal segments, coxa reddish brown.

Structure.— Vertex and frons punctulate, frontal carina evanescent; ocular index 4.5:1; ocular sinus seven-eighths length of eye, antenna not dimorphic, reaching posterior margin of metacoxa. Pronotum semicircular, moderately convex, slightly domed in middle one-third, disk punctulate on dome, more coarsely punctate on lateral surface of disk; lateral carina not arched. Mesosternum flat. Elytra together slightly wider than long, striae deep, evident in basal one-half, nearly hidden by vestiture apically, strial punctures contained within striae; interstices densely punctulate. Metacoxa shallowly foveolate in lateral one-half, lateral margin densely setose, medial one-half with cluster of about 30 punctures set in depression near trochanteral insertion. Pygidium 1.3x as wide as long; disk shallowly foveolate, interspaces about the diameter of one foveola. Male genitalia as in figures 78 and 79.

Body length 1.6-2.2 mm; *width* 1.3-1.6 mm.

Holotype male.— UNITED STATES: ARIZONA, 6 mi N Chiricahua National Monument, 21-VIII-1940, Van Dyke, coll.. *Allotype* female and seven *paratypes*, same data. *Other paratypes*.— ARIZONA. Cochise Co., 10 mi E Benson, 21-VIII-1940, (2); Montezuma Pass, 29-X-1956, L. J. Bottimer 98g, ex. seeds *Cassia leptocarpa* (14); 7 mi S Benson, 23-VIII-1967, Johnson (1); Huachuca Mts., Carr Cyn., 22-VIII-1967 (1); Carr Cyn., XI-1956, Bottimer #53y (1); Carr Cyn., 7-VIII-1952, Leech (1); 6 mi S Sierra Vista, 23-VIII-1967, Johnson (1); Ft. Huachuca, 22-VIII-1968, Schuh (1); Huachuca Mts., 21-VI-1925, Bottimer #53y (2); Ramsey Cyn., 2-XII-1956, Bottimer #98y (1); Yuma, 4-VI-1953, Dietrich (1), 6-IV-1959, Muse (1); Rincon Mts., 7-IX-1925 (1); Palmerlee, 20-VIII-1907, Kaeber (1); Willcox, 13-VII-1944, Parker (1); Sta. Cruz Co., 2 mi SW Patagonia, 5-IX-1964, Noller (2), 8 mi W Washington, 19-VIII-1967, swept from *Cassia leptocarpa*, Johnson (1); MEXICO: Matamoros, April; Sinaloa, Mazatlan, 17-23-VII-1963, Spangler (1), 11-IX-1970, Bohart (1); Nayarit, Rio de las Canyas, 6 mi NE Acoponeta, 25-XI-1948, Leech (1).

Holotype and paratypes deposited in the California Academy of Sciences, San Francisco; allotype and paratypes in National Museum of Natural History, Washington, DC; University of Arizona, Tucson; Cornell University, Ithaca, NY; Utah State University, Logan; Canadian National Collections, Ottawa, and the C. D. Johnson Collection, Flagstaff, AZ.

Host plants.— *Cassia leptocarpa* Benth. (now *Senna hirsuta leptocarpa*).

Geographical distribution is largely within the boundaries of Arizona but extends into Mexico. No natural enemies have been recorded, nor have immatures been described.

This species closely resembles *Zabrotes stephani* and *victoriensis*, n. spp., but the lateral abdominal areas are mostly brown in *vandykei* contrasting with almost uniformly gray in the other two species.

I am pleased to name this after the eminent coleopterist, Edwin C. Van Dyke (1869-1952), who made many contributions to Pacific Coast entomology, and who collected the holotype.

***Zabrotes victoriensis* new species**

Figs. 39, 40, 80, 81

Color.— Vertex with extremely fine, white setae, clypeus densely clothed with white; dorsal vestiture mostly reddish brown but intermixed with white; white patches on basal lobe, lateral margins of pronotum, scutellum, and in middle of 6th and 7th interstices of elytra (Fig. 39); pygidium predominantly white with some intermixed reddish brown setae either side of narrow median white stripe (Fig. 40); venter of body densely clothed with white setae except metacoxal face reddish brown.

Structure.— Vertex finely, shallowly micropunctate, punctures slightly deeper on frons; frontal carina prominent, minutely granulose, ocular index 5:1; ocular sinus three-fourths length of eye; antenna not sexually dimorphic, reaching middle of metacoxal face. Pronotum semicircular, slightly swollen medially, minutely punctate on swelling, lateral areas microfoveolate. Scutellum minute, triangular; mesosternum acute and carinate. Elytra together about as long as wide; striae shallow, distinct in basal 4/5 but becoming confused near apex, striae punctures elongated; interstices flat, each with a single row of punctures. Metacoxal face microfoveolate in lateral one-half, medial one-half with cluster of 20-25 punctures near trochanter. Male fifth abdominal sternum deeply emarginate; pygidium punctulate with two sizes of punctures, male pygidium strongly reflexed. Male genitalia as in figures 80 and 81.

Body length 1.7-1.7 mm; *width* 1.2-1.4 mm

Holotype male.— TEXAS: Victoria, 6-IV-1911, on *Xanthoxylum clavaherculis*, J. D. Mitchell. One male paratype, same data. Allotype, female, same locality but 25-X-1907, Mitchell and Jones. Same data, one male. Other paratypes: TEXAS, Columbus, 14-VIII-(no year), two females; same locality but 20-VIII-(no year), Hubbard and Schwarz, one male; Sarita, 15-IX-1975 (1); Kennedy Co., 25-I-1947 (1); Bastrop, 13-IX-1958, LJB 102z (2); Norias, 9/18-V-1947 (3), 10 mi SW Elkhart, 14-IX-1964, Burke (5); Salmon, 14/21-VII-1974 (1); 5 mi W Riviera, 13-VII-1961, Burke (1); Brazos Co., 18-IV-1959, Burke (1); Goose Is. St. Pk., 20/23-VIII-1962, Burke (3). MEXICO: Sin., 36.6 mi NW Villa Union nr. La Capilla Detaxte, 2-VII-1982, Andrews (5).

Holotype, allotype, and paratypes deposited in the National Museum of Natural History, Washington, D. C.. Paratypes also in collections of Texas A & M, University, College Station, Canadian National Collections, Ottawa, and California Department of Agriculture.

Host plants.— The host cited on the holotype label is doubtful since other species of *Zabrotes* for which the host is recorded prefer legumes whereas "*Xanthoxylum*", (now *Zanthoxylum*) is in the Rutaceae.

This species most closely resembles *Z. vandykei*, new species, but that species is mostly gray with some reddish mottling on the dorsal surfaces and the pygidium, the mesosternum is flat, and the male genitalia is of a different type (compare Figs. 78 and 79). See discussions of *vandykei* and *stephani*.

The species is named for the type-locality in Texas.

Section II: Smooth Metacoxa

Zabrotes amplissimus new species

Figs. 1, 2

Color.— Vestiture white, uniformly distributed over entire body except pair of condensed spots near base of pygidium.

Structure.— Punctuation of vertex and frons nearly concealed by vestiture, frontal carina fine but distinct, transverse sulcus at upper level of eyes; ocular index 3:1, eyes angular on lateral margin, ocular sinus five-sixths length of eye, antenna slender (female), reaching middle of metacoxa. Pronotum (Fig. 1) nearly semicircular but lateral margins subparallel near basal angles; disk convex, slightly domed in middle, surface evenly microfoveolate, foveolae mostly discrete; lateral carina arcuate. Mesosternum flat. Elytra together slightly wider than long; arcuately convex; densely microfoveolate as on pronotum, striae traceable only in center of disk, evanescent on lateral areas. Pygidium microfoveolate with slightly larger foveolae than on elytra. Metacoxa with lateral one-half densely foveolate, medial one-half smooth and polished. Metepisternum and lateral areas of abdominal sterna microfoveolate (Fig. 2). Male genitalia not known.

Body length 3.7 mm; *width* 2.7 mm.

Holotype female.— NEW MEXICO: near Grants, ca. 6000', X-1981, R. Buhrow, reared from seeds *Phaseolus metcalfei*. Deposited in National Museum of Natural History, Washington, DC.

Discussion.— *Zabrotes amplissimus* and an undescribed species from Mexico are the largest known *Zabrotes*. The distinctive foveolate elytra and pygidium and large size easily separate them from any other described species. Until males are collected, description of the male genitalia must be delayed. The genitalia of the undescribed Mexican sister species places it near *Z. subnitens*.

The name is derived from the Latin *amplissimus* meaning "the largest".

Zabrotes bexarensis new species

Figs. 5, 6, 46, 47, 52, 53

Zabrotes sp. 1, Johnson, 1978: 124.

Color.— Vestiture of head white, sparsely distributed, pronotum uniformly white to white intermixed with brown, sometimes patchy; elytra (Fig. 5) uniformly white to white intermixed with brown to brown with white maculation, maculation usually vaguely defined; pygidium (Fig. 6) uniformly white or white with evanescent median stripe, or gray with brown lateral patches; ventral surfaces uniformly white.

Structure.— Frontal carina ridgelike; ocular index 6:1; ocular sinus three-fourths length of eye; antennae dimorphic (Figs. 46 and 47), that of male reaching beyond apices of elytra, of female to first abdominal segment; first and sometimes second segment dark red, pronotum truncate apically, disk minutely punctate with scattered microfoveolae, elytra with striae narrow, strial punctures deep, elongate, interstices minutely punctate; apex of mesosternum flat, truncate; metacoxal face with 15-20 shallow foveae in lateral one-half, medial one-half impunctate with deep pit near insertion of trochanter, metasternum slightly depressed in posterior one-half, vestiture extending obliquely from median sulcus, pygidium minutely punctate and foveate, foveae slightly larger than on pronotum. Male genitalia as in figures 52 and 53. Lateral lobes alate and marginal setae spatulate, an unusual form in *Zabrotes*.

Body length 1.6-1.9 mm; *width* 1.1-1.5 mm.

Type locality.— TEXAS: Bexar Co., 19-VI-1962, L. J. Bottimer #112u, reared from *Vicia leavenworthi* Torrey and Gray, allotype and 171 paratypes, same data. Other paratypes, all from TEXAS. (Number-letter combinations are L. J. Bottimer field numbers). Bexar Co.: 5-X-1962, 112r (38); 5-19-1962, 112s, sweeps of *Vicia* sp. flowers (38), same data except 113g, (22l), 24-VII-1954, 94i (1); 5-V to 17-IX-1952, 92x (34); 2-VI to 6-VII-1955, 94r, sweeps of *Vicia* sp. (36), 23-IV-1953, 93k, probably on *Vicia* sp. (8); 10-V-1957, 100a (1). Bexar Co., Camp Bullis, 6-IV-1959, 103i (8). Waco, 3-VIII-1948, Glick; 20-VI-1949, Glick. San Antonio, 27-VI-1969, Stockwell (1). Bastrop State Park, 24-II-1956, and 5-VI-1956, Howden and Howden (2); Kerrville, 2-IV-1959, Becker and Howden (1); Uvalde Co., 23-VI-1948, Knull (1); Garner St. Pk., 10-VIII-1960 Burke (1), Hillsboro, 12-18-V-1923, 51m7, 51ol (14); Bosque Co., Laguna Pk., 13-IV-1986, Wooley (1); Brazos Co., College Sta., 2-IX-1963, Burke (1); San Saba Co., 15 mi NW San Saba, 15-V-1971, Board & Clark (1).

Holotype and paratypes deposited in Canadian National Collection, Ottawa; allotype and paratypes in the National Museum of Natural History, Washington, DC, Florida State Department of Agriculture, Gainesville; C.D. Johnson Collection, Flagstaff, AZ; California Academy of Sciences, San Francisco; and Texas A & M University, College Station.

Host plants.— *Vicia leavenworthi* Torrey and Gray and *Vicia* sp.

Discussion.— Although this species has a smooth metacoxal face, it seems

to be isolated from others in this group. The broad, ogival ventral valve, cluster of slender spines and paired acicular spines in the middle of the sac, and the alate lateral lobes are unlike any other male genitalia in *Zabrotes*.

The evanescent elytral pattern, long male antennae, and the uniformly clothed pygidium with a faint median line are additional salient characters for this species.

The name is derived from the type locality.

***Zabrotes densus* (Horn)**

Figs. 14, 15, 60, 61

Zabrotes densus Horn, 1885: 158, Leng, 1920: 306; Johnson, 1968: 1271; Bottimer, 1968: 1013, 1038; Johnson and Kingsolver, 1982: 411.

Spermophagus densus (Horn): Pic, 1913: 59.

Color.— Vestiture dark brown usually with faint grayish or light brown striping on elytra (Fig. 14), some specimens with a gray bar on each elytron; head brown; pronotum gray on basal lobe, sometimes with faint mottling on disk; pygidium (Fig. 15) mostly brown, basal band and median stripe gray; venter of body gray except coxal face and sometimes lateral abdominal spot brown.

Structure.— Vertex and frons punctulate, frontal carina prominent; ocular index 3:1; ocular sinus three-fourths length of eye, antenna reaching first abdominal segment in both sexes. Pronotum semicircular but with apex truncated, disk convex, slightly domed medially, punctulate with sparsely placed foveolae; lateral carina arcuate. Scutellum small, equilaterally triangular. Elytra together slightly wider than long, striae not impressed, strial punctures elongate, interstices punctulate. Pygidium one and one-fourth times as wide as long, convex, densely but uniformly foveolate.

Metacoxal face sparsely setose, sparsely foveolate in lateral one-half, smooth, impunctate in median one-half. Male genitalia as in figures 60 and 61.

Body length 1.1-1.7 mm; *width* 0.9-1.3 mm.

Type depository.— Museum of Comparative Zoology, Harvard University, Cambridge, MA, holotype #3003.

Type locality.— "California".

Distribution.— ARIZONA: Pinal Mts. CALIFORNIA: S. Bernardino Co., 11-VIII-1981; 4.4 mi SW Rackerby, 6-II-1980; Ft. Tejon, 6-IX-1979; Redding, 1-VI-1980; Sacramento, 9-VI-1980; 5 mi NW Garberville, 8-VIII-1982; 15 mi E Marysville, 6-II-1980; 1.4 mi N New Idria, 8-VI-1981; Tulare Co. Ash Mt., 7-IV-1984; 5 mi E Roseville, 26-VI-1976; Sisquoc, 1976; Jerseydale, 18-II-1976; Kern Co., 25-VI-1940; Bass Lake, 2-VIII-1934; "Mokel"(umne) Hill, 22-VI-1921, Mokelumne Hill, 18-VII-1910; Ukiah, 31-III-1940; Felton, Sta. Cruz Mts., 15-V-1907; Folsom, 7-VIII-1885; Sta. Barbara, 19-VI-1931; Los Angeles Co., VI; Sonoma Co., Pasadena, VII., Green Point, 6-VI-1916; Napa Co., 14 mi W Forest Hill, 22-X-1965; 2.4 mi N

Academy, 12-VII-1981; 10 mi W Montague, 2-VII-1961; O'Neals, 6-VII-1961; Kirch Flat Camp, 20 mi E Trimmer, 18-VII-1962; Lake Algunitas, 19-V-1965; 1 mi E Coloma, 22-X-1965; 5 mi E Clingman's Jct., 13-VII-1961; 8 mi SW Prather, 17-VII-1963, sweeping lotus; Mt. Hamilton, 10-VIII-1965; Fair Oaks, 10-V-1931; Piedra, 3-VII-1962; Auberry, 12-VII-1961, 27-VI-1962, 27-VI-1962; 10 mi N Auberry, 31-I-1966; Sequoia N. P., Hospital Rock, 16-VII-1961; Martinez, 23-V-1965; Lucerne, 17-V-1961; Lake Pilarcitos, 29-X-1966; Boonville, 13-VIII-1963; Los Angeles, 9-XII-1927; Talmage, 21-VIII-1959; Pope Valley, 21-I-1961; French Gulch, 21-VII-1955; 9 mi SE Pope, 20-VII-1965; 6 mi SE Creston, 26-IV-1968; 3 mi W Paso Robles, 28-IV-1968; Del Loma, 21-III-1978; 8 mi WSW Greenfield, 19-IX-1984. OREGON: Butte Falls, 22-V-1941; Applegate, 4-VIII-1952.

Discussion.— This species closely resembles *Zabrotes cynthiae*, new species. The smooth coxal face and male genitalia (Fig. 60), however, ally it with *obliteratus* although the elytral and pygidial patterns are not as contrasting as in that species. *Zabrotes humboldti* is similar in appearance to *densus* and *cynthiae* but the male genitalia are of a different type nearly identical to those of *spectabilis*. The three species, *cynthiae*, *densus*, and *humboldtae* are found almost entirely within California.

***Zabrotes eldenensis* new species**

Figs. 16, 17, 48, 62, 63

Color.— Vestitural color of both sexes similar to that of female *Z. subfasciatus*, males with broad white spot on basal lobe of pronotum (Fig. 16), females with median white stripe; elytral maculation a solid bar, not composed of short stripes, the remainder of elytra uniformly dark brown except some males with short, basal stripe on fifth interstice, females occasionally with narrow, white median stripe, pygidium (Fig. 17) of both sexes dark brown with white basal band and narrow median stripe; only first antennal segment dark red.

Structure.— Metasternum flat or slightly depressed, not sulcate. Male genitalia as in figures 62 and 63. Ventral valve of median lobe broad (Fig. 62), spicules around central sclerite smaller than in *Z. subfasciatus*; dorsal valve with broad, rounded process, apical margin of lateral lobes slightly emarginate. Female eighth sternite with broad basal process (Fig. 48).

Body length 2.3-2.5 mm; *width* 1.5-1.9 mm.

Holotype male, ARIZONA: (Coconino Co.) Flagstaff, 13-VIII-1967, Mt. Elden, Johnson; allotype female, Coconino Co., 8 mi S Flagstaff, 11-VI-1964, Beal. Other paratypes: ARIZONA, Flagstaff, 4-IX-1957, Johnson (1); Sierra Vista, May 1967, Sternitzky (4); Arizona, Nogales (no date), Koebele (1); Nogales, 30-IX-1906, Blaisdell (1); Madera Canyon, Sta. Rita Mts., 14-X-1960, M. L. Noller (1); Sta. Catalina Mts., 15-X-1938, Bryant (1); Cochise Co., 12.2 mi S. Bowie, 15-II-1960, Cazier (1); SWRS, 5 mi. W Portal, 5400 ft., 10-X-1955 and 18-III-1956, Cazier (2); Yavapai Co., 8 mi E Orake, 15-VIII-1972, Beley (1); Cochise Co., Portal, 25-VIII-1970, McCleve (1); South-

west Research Station, Chiricahua Mts., 1980, Roth (1); Pridham Cyn., Chiricahua Mts., 29-VIII-1975, McCleve (1); Pima Co., 6 mi. N. Madera Cyn., 17-VIII-1967, Johnson (1); Santa Cruz Co., Madera Cyn., 20-XI-1971, Chandler (3); Molino Cyn., Mt. Lemmon, 25-XI-1971, Chandler (1).

Holotype, allotype and paratypes in National Museum of Natural History, Washington, DC. Paratypes also in AMNH, CASC, C. D. Johnson Collection, and University of Arizona, Tucson.

Host plants.—Unknown.

Discussion.—Females of this species can easily be mistaken for *Z. subfasciatus* unless the metasternum is examined but males are easily differentiated by the color pattern of the pygidium. In both sexes of *subfasciatus*, the metasternum is longitudinally sulcate and clothed with conspicuous yellowish gray setae whereas the metasternum of *eldenensis* is convex or slightly depressed, and is uniformly clothed; antennal segments 1 and 2 are dark red in *subfasciatus*, but only the first segment is red in *eldenensis*; characters in the male genitalia (Figs. 62 and 63) are clearly diagnostic. Separation of this species from the partly sympatric *Z. obliteratus* is more difficult without resorting to examination of the male genitalia and the eighth sternite. Sufficient variation exists in associated females that unless the elytra and pygidium are contrastingly black with white markings with no brown streaks to differentiate *Z. eldenensis*, identification of this sex is problematical unless the genitalia are examined. For males, the genitalia are clearly diagnostic (cf. Figs. 62 and 66). The broad ventral valve and arched sac sclerite of *Z. eldenensis* contrasts with the narrow ventral valve and flask-shaped sclerite of *Z. obliteratus*.

The specific name is taken from the type-locality, a mountain near Flagstaff.

This species has not been collected outside of Arizona.

Zabrotes humboldtae new species

Figs. 18, 19, 64, 65

Color. - Vestiture predominantly dark brown except median stripe of pronotum white (Fig. 18), elytra with white lateral maculae, pygidium (Fig. 19) with median stripe and basal band white; venter predominantly white but with dark brown patches on metacoxal face and lateral angle of first abdominal sternum; head and legs white.

Structure.—Vertex micropunctate, punctures more elongate on frons, frontal carina prominent; antenna not dimorphic, reaching middle of metacoxa. Pronotum semicircular but with apex truncate; disk micropunctate with coarser punctures toward lateral margins, disk evenly convex. Scutellum triangular. Elytral striae narrow, distinct in basal two-thirds changing to lines of punctures apically, interstices sparsely punctate. Metacoxal face sparsely, shallowly foveolate in lateral two-thirds, impunctate medially; metatibia lacking dorsolateral row of fine punctures. Fifth abdominal sternum nearly divided by pygidial notch, pygidium sparsely microfoveolate. Male genitalia as in figures 64 and 65, nearly identical to those of *Z. spectabilis*.

Body length 1.3 mm; *width* 1.0 mm.

Holotype male.— CALIFORNIA, Humboldt Co., Bair's Rch., Redwood Crk., H. S. Barber, 17-VI-1903; "Mokel"(umne) Hill, 18-VII-1910, Blaisdell, 1 male; same locality, IV (no date), Blaisdell, 1 male; Marin Co. VIII (no date), C. V. Riley, 2 females; Napa Co., Pope Valley, 21-I-1961, O'Brien, 1 male; Napa Co., (no date), Van Dyke, 1 male; Humboldt Co., Green Point, 6-VI-1916, Blaisdell, 2 males.

Holotype, allotype and paratypes deposited in National Museum of Natural History, Washington, D.C. Paratypes also deposited in the California Academy of Sciences, San Francisco, and in the C. D. Johnson collection, Flagstaff, Arizona.

Host plants.— Unknown.

Discussion.— The combination of the smooth metacoxal face and *spectabilis* form of male genitalia is puzzling since other species with this configuration of male genitalia have a puncture cluster on the metacoxa. Likewise, those species with smooth metacoxa have the genital form of *obliteratus* (Fig. 66), or of *subfasciatus* (Fig. 74), or of *bexarensis* (Fig. 52).

The name is derived from the type locality.

***Zabrotes obliteratus* (Horn)**

Figs. 20, 21, 49, 66, 67

Zabrotes obliteratus Horn, 1885: 158; Leng, 1920: 306; Johnson, 1968:1271; Johnson and Kingsolver, 1982: 411.

Spermophagus obliteratus: Pic, 1913: 60.

Color.— Basal two segments of antenna reddish brown. Vestiture of pronotum usually dark brown with light brown patches and streaks, median stripe and posterior corners white (Fig. 20); elytra dark brown to black with indistinct light brown stripes, each elytron with a lateral, white, sinuate band fading to light brown marginal patch; pygidium (Fig. 21) with basal band of white, or white mixed with light brown connected to narrow median white stripe, remainder of pygidium uniformly light brown in males but dark brown to black in females, head and ventral areas gray except metacoxal face and row of vague, brown patches along lateral margins of abdomen.

Structure.— Frontal carina sharp but hidden by vestiture. Antenna reaching first abdominal segment. Pronotum nearly semicircular, not truncated apically, disk evenly convex, basal lobe slightly depressed, surface of disk sparsely microfoveolate, interspaces finely punctate; mesosternal apex broad, truncate in both sexes. Elytral striae narrow, nearly hidden by vestiture, set with recumbent, curved setae, first stria deflected laterad near scutellum; interstices flat, punctate; metacoxal face with shallow, lunate foveolae in lateral two thirds, medial one-third nearly impunctate but with deep pit adjacent to trochanteral insertion; pygidia of both sexes convex, male more strongly reflexed apically. Male genitalia as in figures 66 and 67, female eighth sternite (Fig. 49).

Body length 1.9-2.5 mm; width 1.5-1.7 mm.

Type depository.— Museum of Comparative Zoology, Cambridge, MA, holotype #3901.

Type locality.— "Arizona"

Distribution.— ARIZONA: Tanque Verde, 23-XI-1958; Portal, 1980; Beaver Cr. Ranger Sta., Yavapai Co., 1-VIII-1970. TEXAS: Kerrville, 12-VII-1955, in *Rhynchosia* seeds; Uvalde, 11-VIII-1965. MEXICO.

Discussion.— See also the discussion of *Z. eldenensis*, n. sp. *Zabrotes obliteratus* could easily be confused with *Z. subfasciatus* but for the distinctive deep metasternal sulcus of the latter species and the male genitalia. The female eighth sternite is slender and slightly expanded at the tip of the strut (Fig. 49). The dimorphic pygidium in *Z. obliteratus* serves to separate the sexes but the degree of dimorphism is not as striking as in *Z. subfasciatus*. The disjunct distribution (Kerrville, Texas and southern Arizona) probably reflects random collecting.

***Zabrotes subfasciatus* (Boheman)**

Figs. 29-34, 42-45, 74, 75

- Spermophagus subfasciatus* Boheman, 1833: 111; Pic 1913: 62.
Zabrotes subfasciatus: Zacher, 1930: 236; Bottimer, 1968: 1013; Kingsolver, 1970: 487; Pfaffenberger and Johnson, 1976: 42;
Spermophagus musculus Boheman, 1833: 112.
Spermophagus semifasciatus Boheman, 1839: 137; Bottimer, 1968: 1015.
Amblycerus semifasciatus: Blackwelder, 1946: 763.
Zabrotes semifasciatus: Bottimer, 1968: 1015; Kingsolver, 1970: 487.
Bruchus cingulatus Suffrian, 1870: 169; Sharp, 1885: 493.
Bruchus leucogaster: Sharp, 1885: 493
Spermophagus (Zabrotes) pectoralis Sharp, 1885: 492; Chittenden, 1902: 103.
Spermophagus pectoralis: Back and Duckett, 1918: 16; Wolcott, 1936: 286.
Zabrotes pectoralis: Blackwelder, 1946: 763 (as synonym of *Z. subfasciatus*)
Spermophagus semicinctus Horn, 1894: 411.
Zabrotes semicinctus: Johnson, 1968: 1271; Bottimer, 1968: 1013 (in synonymy with *subfasciatus*).
Spermophagus dorsopictus Lepesme, 1941: 201.
Spermophagus minusculus: Pic, 1943: 148 (misspelling of *musculus*).

Many more references to one or more of these names could be added but with no particular advantage for this paper.

Color.— Sexually dimorphic: *Males*.— Vestiture of head brown, pronotum and elytra with indistinct pattern of yellowish brown and dark brown setae (Fig. 29), pygidium uniformly yellowish brown with indistinct, narrow median stripe, sometimes mottled (Fig. 31); metacoxa and lateral areas of first abdominal segment dark brown, otherwise yellowish brown; integument of segments one and two of antenna and mouthparts reddish brown, forelegs suffused with reddish brown. *Females*.— Vestiture of head gray, pronotum with variable pattern of gray and dark brown, usually with median white

stripe; elytra (Fig. 30) with curved, lateral white to gray maculation composed of short stripes, remainder of elytra light to dark brown in variable pattern, usually with vague stripes, usually with short stripe on second interval near scutellum; pygidium varying from yellowish brown with dark spots (Fig. 33) to dark brown with basal band yellowish brown and median line white (Fig. 34); ventral areas, antenna, mouthparts and legs as in male.

Structure.— Antenna sexually dimorphic (Figs. 44 and 45), that of male reaching first abdominal segment, that of female reaching metacoxa. Apex of pronotum truncate; disk moderately convex, basal lobe slightly prominent; pronotum extremely densely punctulate, lateral areas of pronotal disk with sparse microfoveolae; striae punctures of elytra elongate, deep, interstices densely punctulate, each with a single row of slightly coarser punctures; metasternum in both sexes with a median, depressed sulcus, the sulcus densely setose (Fig. 29); lateral one-half of metacoxal face with 40 to 50 lightly impressed, crescentic foveolae, medial one-half impunctate except for deep pit near trochanter; pygidium densely punctulate with scattered, elliptical foveolae. Male genitalia as in figures 74 and 75.

Body length.— Males 2.0-2.3 mm; females 2.2-2.8 mm. *Width*.— Males, 1.4-1.5 mm, females, 1.3-1.4 mm.

Type depository.— Naturhistoriske Riksmuseet, Stockholm, Sweden (*subfasciatus*).

Type locality - "Brasilia, Insula Saint-Barthelemi" (*subfasciatus*).

This species has a cosmopolitan distribution. In the United States, Bottimer (1968) reported it as being established in Texas. Blanc (1965) reported finding a single adult on cotton at Blythe, California, but its establishment in that state is doubtful.

Host plants.— Literature records are *Phaseolus vulgaris* (L.), *P. lunatus* L., *P. angularis* (Willd.) Wight, *Vigna unguiculata* (L.), *Glycine max* (L.) Merr. Zacher (1952) lists, besides the foregoing, the following species whose names have been updated, *Phaseolus coccineus* L., *Vigna mungo* L., *P. sativum* L., *Vicia faba* L., *Lablab purpureus* L., *Dipogon lignosus* L., *Cajanus cajan* (L.) Huth, *Cicer arietinum* L., *Sebastiania palmeri*. The *S. palmeri* record is questionable since that genus belongs to the Euphorbiaceae.

Immatures.— First instar larva: Pfaffenberger and Johnson, 1976; Steffan, 1945. Final instar: Arora, 1978; Steffan, 1945; Zacher, 1930; Peterson, 1951.

Discussion.— *Zabrotes subfasciatus* is usually easily distinguished from other species of *Zabrotes* by the sulcate, tomentose metasternum, and by the dimorphism. *Zabrotes eldenensis*, n. sp., closely resembles *subfasciatus* but lacks the metasternal sulcus (although in some specimens the metasternum is slightly depressed) and the sexes are similar, especially in the color pattern of the pygidium. The male genitalia are also diagnostic for each species.

Zabrotes subfasciatus undoubtedly originated in Central America where it has been found breeding in "wild" *Phaseolus vulgaris* and *lunatus*. It was described from Brazil in the early nineteenth century but through commerce, mainly in shipments of dried beans, it has become tropicopolitan in distribu-

tion. Various species and varieties of *Phaseolus* seem to be preferred hosts, but in the past 20 years, it has become a storage pest of cowpeas in Africa. Some of the hosts listed above are probably experimental or adventitious.

Zabrotes subfasciatus is a continuous breeder in stored seeds, a logical result of its trait of ovipositing only on seeds that have fallen from a pod, or that are still attached inside a partly dehisced pod. The bruchid apparently does not oviposit on the seed pod itself. Detection of infested seeds is difficult unless the prepupal stage has been reached in which case the larva has excavated to the inner surface of the integument, and has partly cut a "window" to facilitate emergence of the adult after eclosion. Pierre and Pimbert (1981) reported on reproductive activity of this species.

Wittich (1940) reported that, in Minnesota, *Zabrotes subfasciatus* caused allergic reactions in humans as a result of handling infested beans.

Recent studies by Osborn, et al, (1988) have isolated a seed protein, arcelin, in wild strains of *Phaseolus vulgaris*, that is toxic to *Z. subfasciatus* larvae. Experimental transfer of this trait to lines of cultivated beans resulted in a high degree of resistance to the bruchid.

***Zabrotes subnitens* (Horn)**

Figs. 35, 36, 76, 77

Zabrotes subnitens Horn, 1885: 158; Johnson, 1968: 1271; Bottimer, 1968: 1015; Johnson and Kingsolver, 1982: 411.
Spermophagus subnitens: Pic, 1913: 62.

Color.— First antennal segment sometimes dark red beneath, metatibial spurs dark red. Vestiture white, uniformly distributed over body (Fig. 35).

Structure.— Antenna dimorphic, that of male reaching margin of pygidium, that of female reaching first abdominal segment; pronotal disk sparsely microfoveolate, each foveola elliptical, interspaces densely punctate; elytral striae deep, narrow, strial punctures elongate, interstices minutely punctate; pygidium foveolate as on pronotum, apex of mesosternum truncate; lateral one-half of metacoxal face with about 25 shallow, crescentic foveae, medial one-half polished, impunctate except for trochanteral pit. Male genitalia of the *obliteratus* type (Figs. 76 and 77).

Type depository.— Museum of Comparative Zoology, Cambridge, MA, lectotype 3902, designated by Johnson, 1968.

Type locality.—"Georgia".

Distribution.— ARIZONA: Mt. Magazine, 7-VI-1964. ALABAMA: Oakmont, 24-VI-1977. FLORIDA: Alachua Co., 10-III-1955; Archbold Biological Sta., 7-II-1979; Gainesville, 16-III-1976; San Felasco Hammock, 29-IV-1977; 5-8 km W Archer, 16-I-1986. ILLINOIS: Vienna, 18-V-1932. KENTUCKY: Burnside, 20-VI-1954. MISSISSIPPI: Lucedale, 13-VI-1932. NEW JERSEY: Buena, VIII. OKLAHOMA: 12 mi N Savanna, 8-VIII-1972; Latimer Co., 19-IV-1985, V-1983, VI-1983, VII-1984. SOUTH CAROLINA: Aiken, 31-V-1957, Florence, 13-II-1939, 19-V-1952. TEXAS: Salmon, 14-21-

VII-1974; 4 mi SE Wellborn, 18-III-1972; Comanche, 18-VI-1964; Bastrop St. Pk., 12-VI-1960. VIRGINIA: Barcroft, 10-VIII-1960.

Discussion.—Salient characters for this species include the smooth medial one-half of the metacoxa, evenly distributed white body setae, dimorphic antennae, and male genitalia with a narrow ventral valve and lageniform median sclerite, a pair of spiny, blade-like sclerites and a pair of small, curved, spiny sclerites. This species is most similar to *Zabrotes bexarensis*, n. sp., but the elytra of the latter species is faintly maculate, and the male genitalia are distinct (cf. Figs. 52, 53, and 76, 77).

ACKNOWLEDGEMENTS

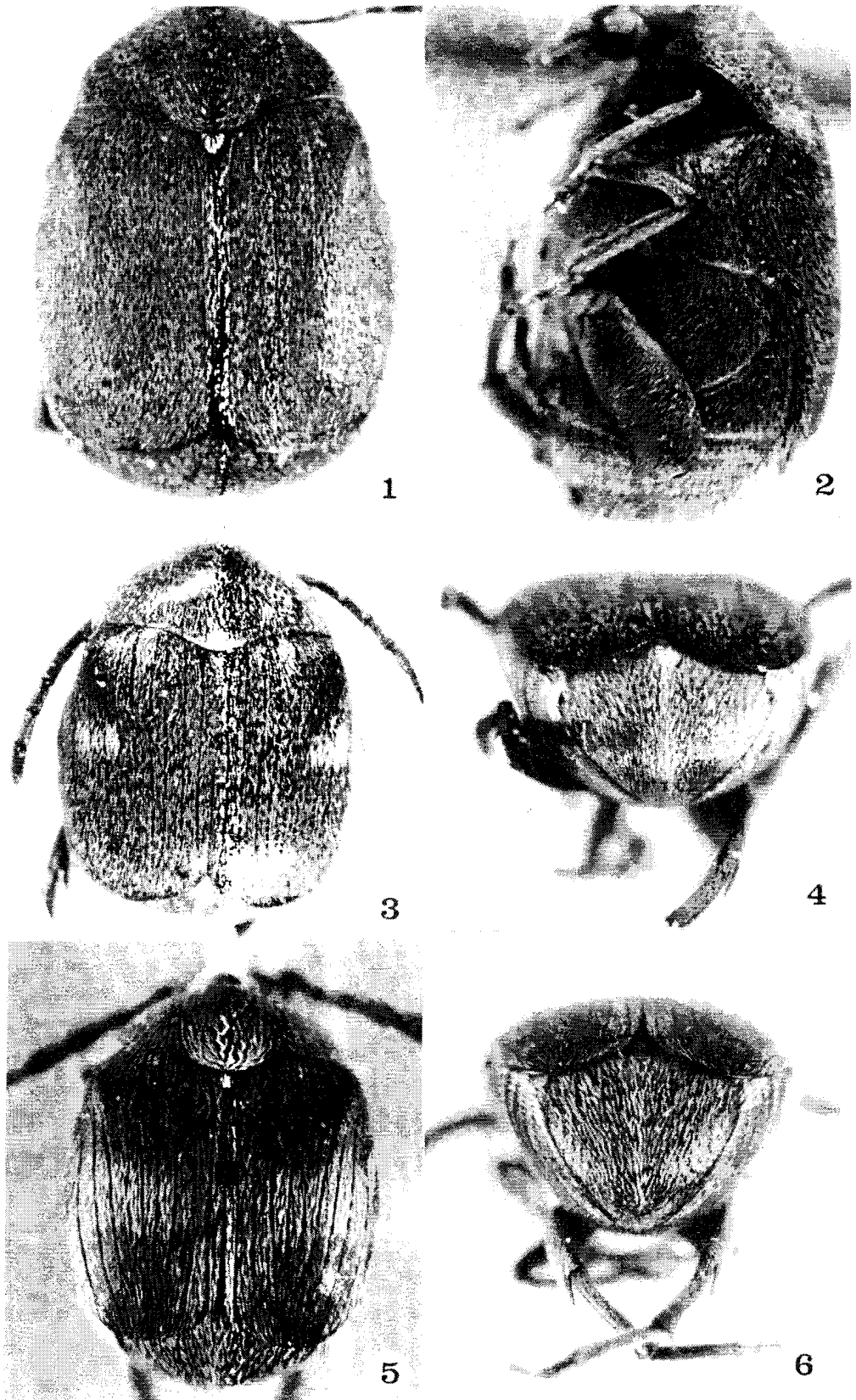
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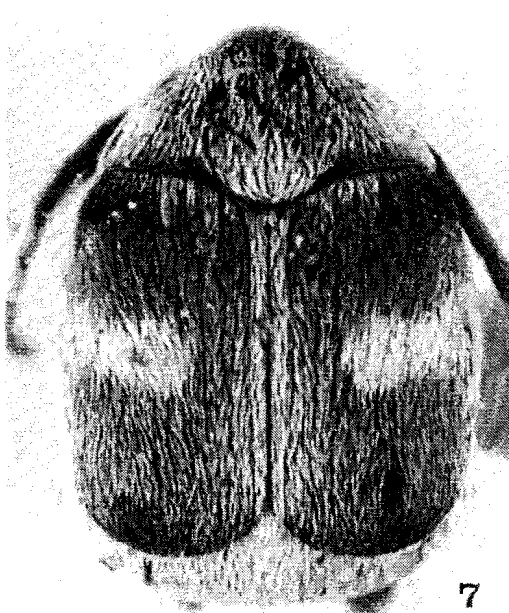
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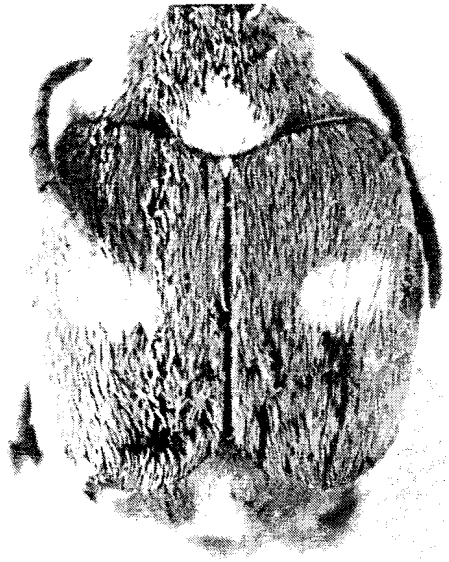
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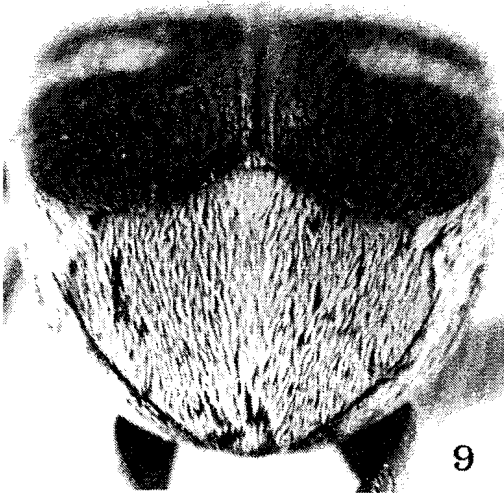
FIGURES 1-6. 1, *Z. amplissimus*, dorsal. 2, Same, pygidium. 3, *Z. arenarius*, dorsal. 4, Same, pygidium. 5, *Z. hexarensis*, dorsal. 6, Same, pygidium.



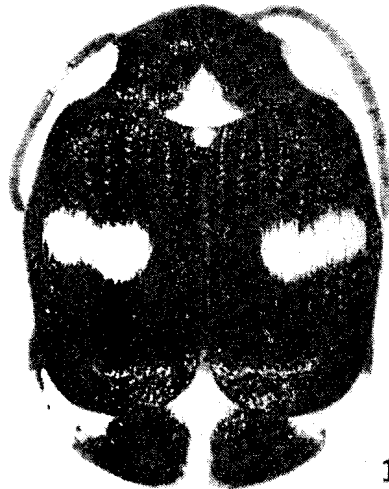
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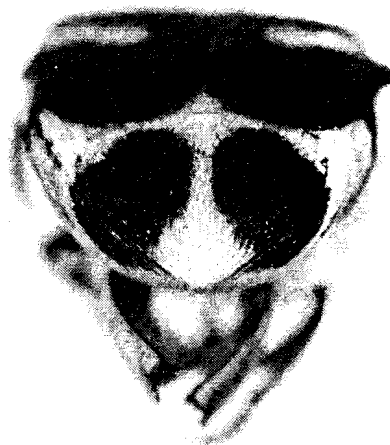
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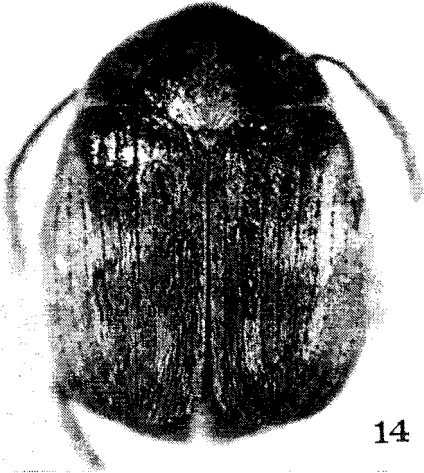
FIGURES 7-11. 7, *Z. chandleri*, dorsal, male. 8, Same, dorsal, female. 9, Same, pygidium. 10, *Z. cruciger*, dorsal. 11, Same, pygidium, male.



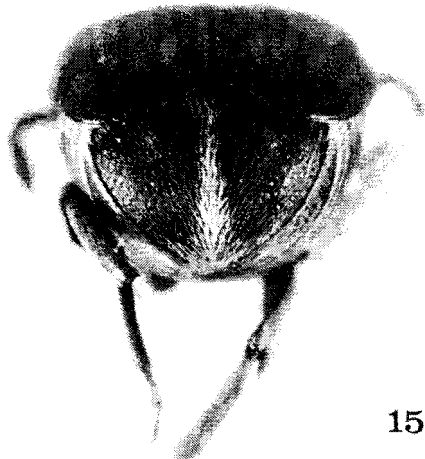
12



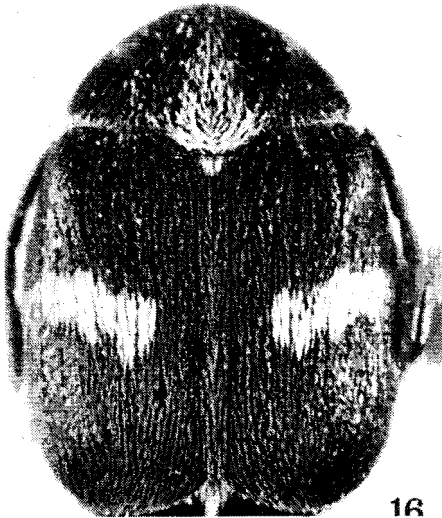
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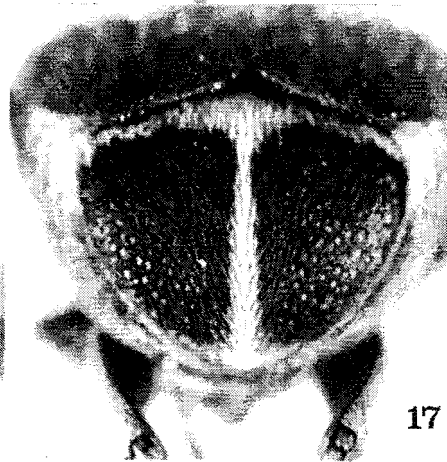
14



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16

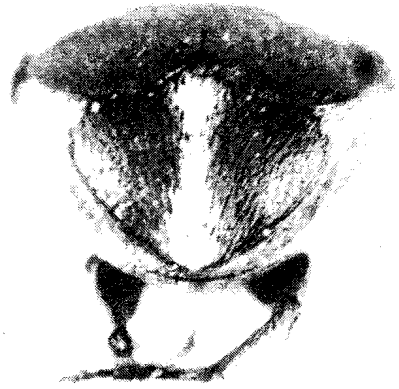


17

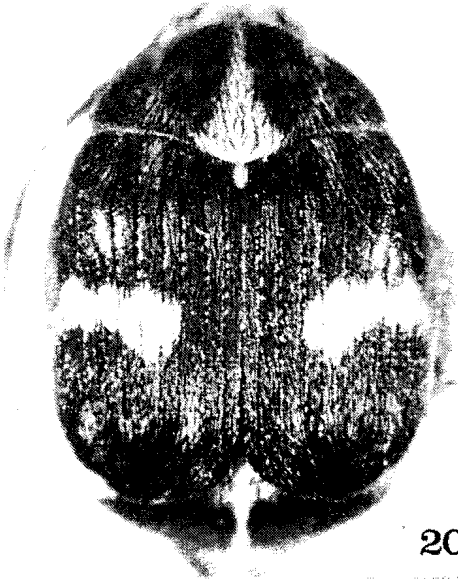
FIGURES 12-17. 12, *Z. cynthiae*, dorsal. 13, Same, pygidium. 14, *Z. densus*, dorsal. 15, Same, pygidium. 16, *Z. eldenensis*, dorsal. 17, Same, pygidium.



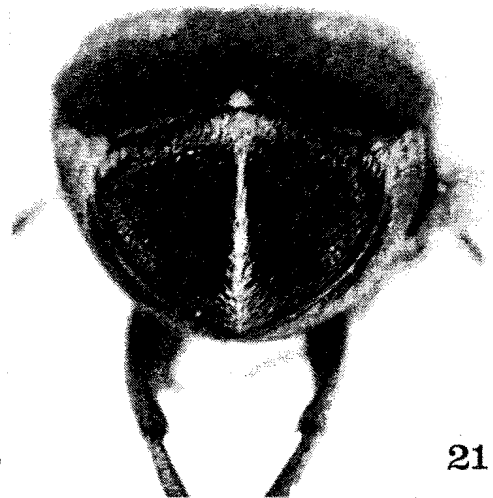
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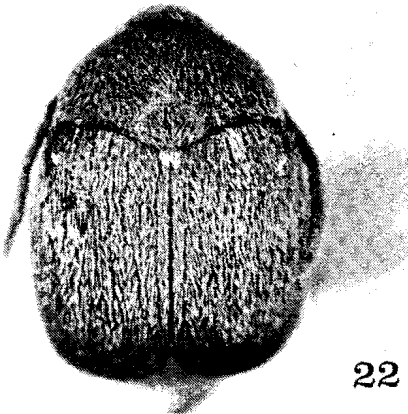
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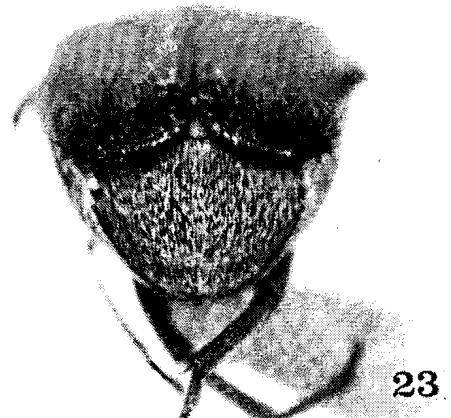
20



21

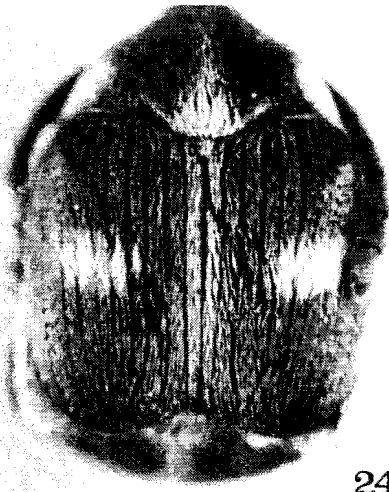


22



23

FIGURES 18-23. 18, *Z. humboldtae*, dorsal. 19, Same, pygidium. 20, *Z. obliteratus*, dorsal. 21, Same, pygidium. 22, *Z. planifrons*, dorsal. 23, Same, pygidium.



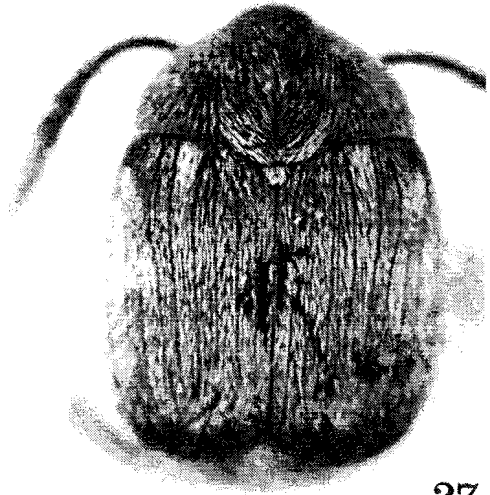
24



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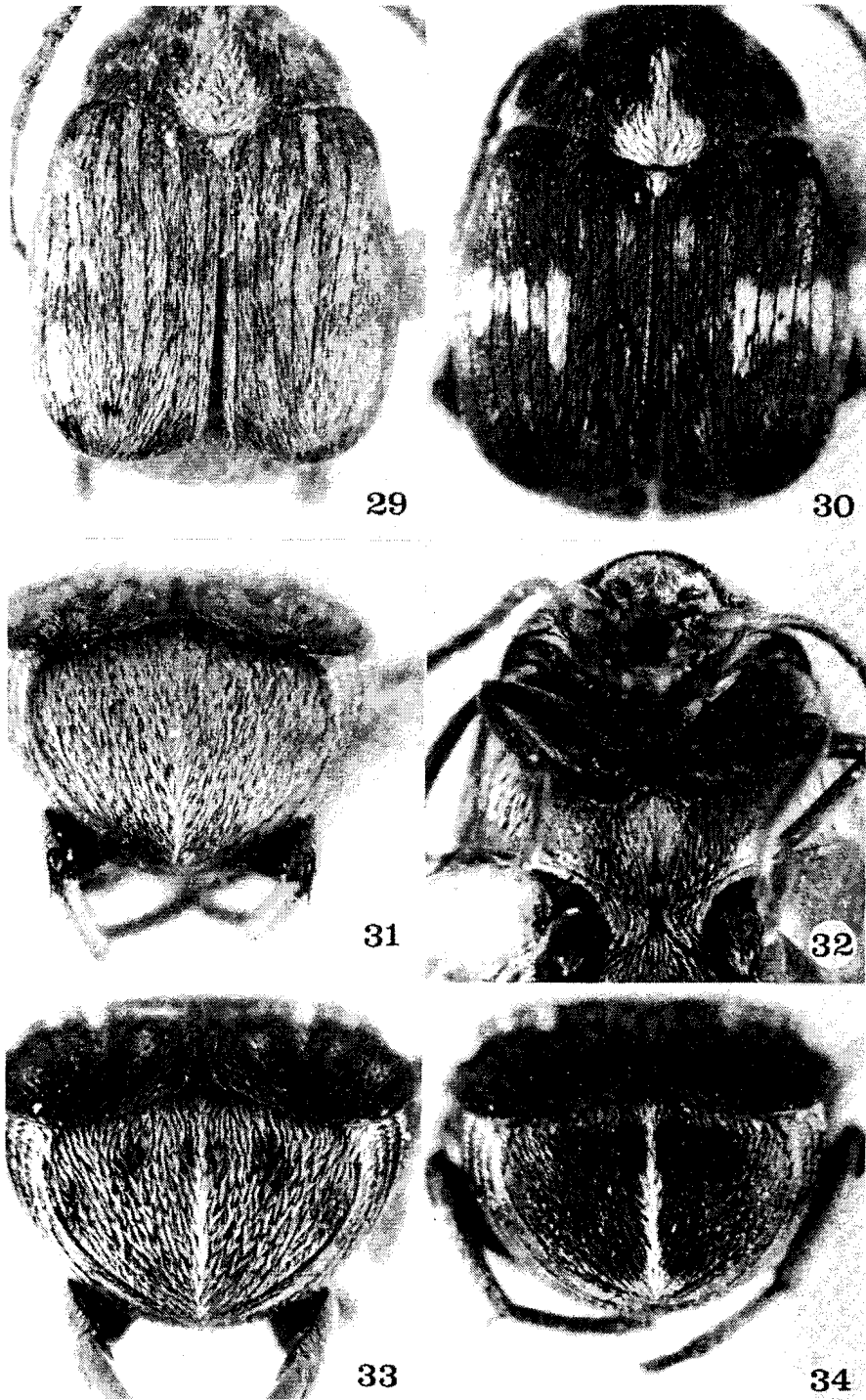


27

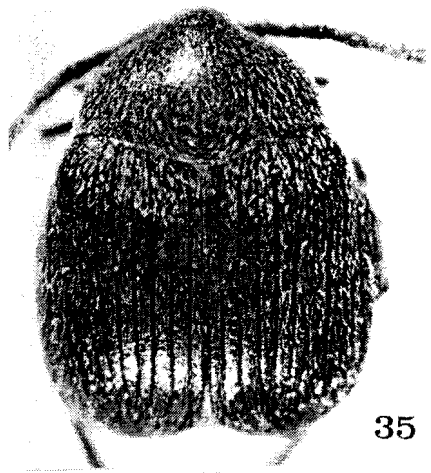


28

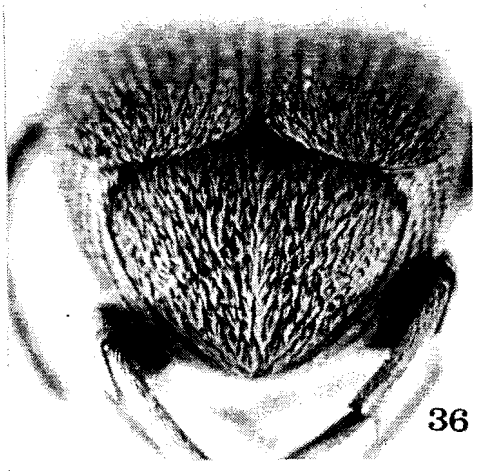
FIGURES 24-28. 24, *Z. spectabilis*, dorsal, male. 25, Same, dorsal, female. 26, Same, pygidium, female. 27, *Z. stephani*, dorsal. 28, Same, pygidium.



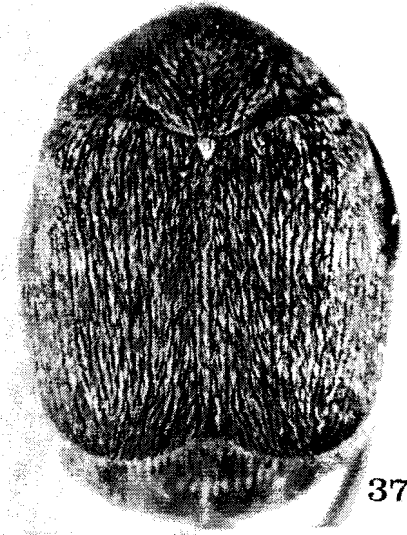
subfasciatus
 FIGURES 29-34. 29, *Z. obtectus*, dorsal, male. 30, Same, dorsal, female. 31, Same, pygidium, male. 32, Same, ventral of thorax. 33 and 34, *Z. obtectus*, female, pygidia, extremes of color pattern.



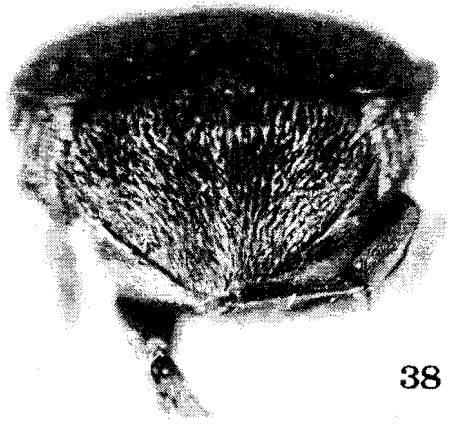
35



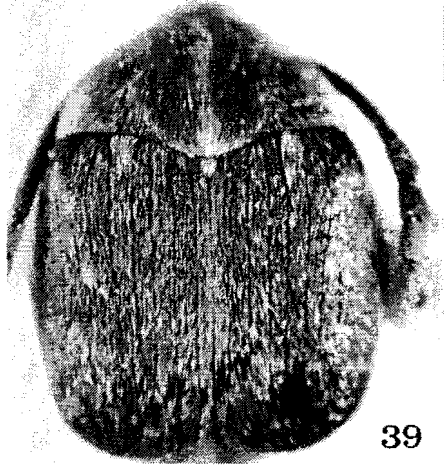
36



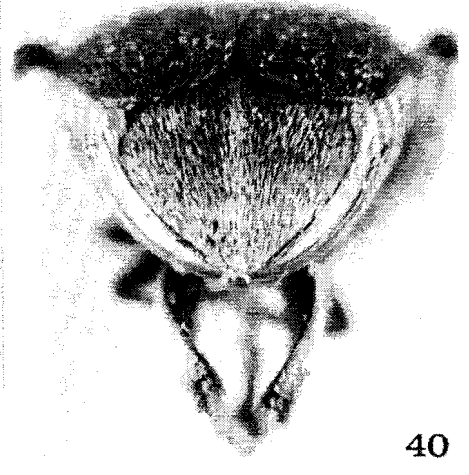
37



38

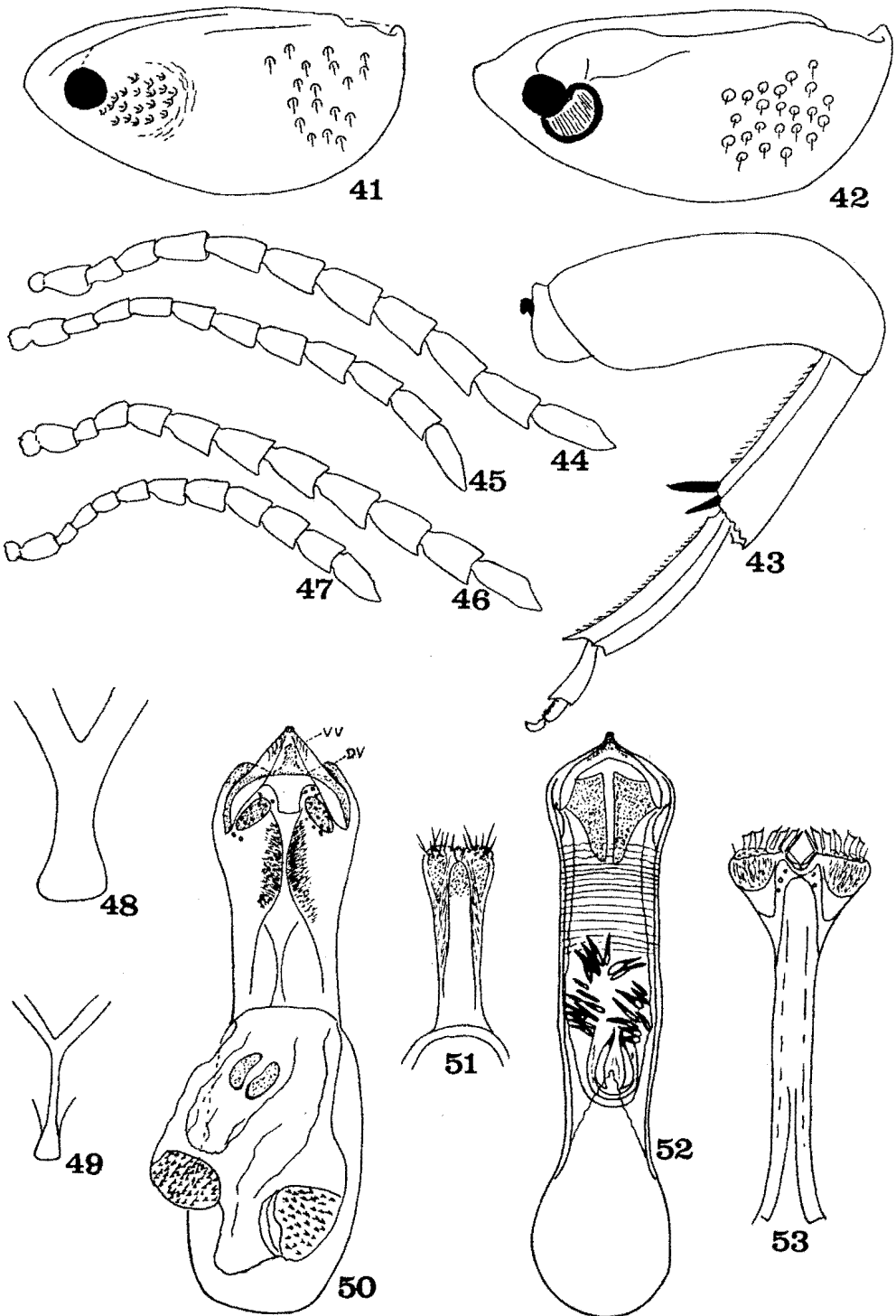


39

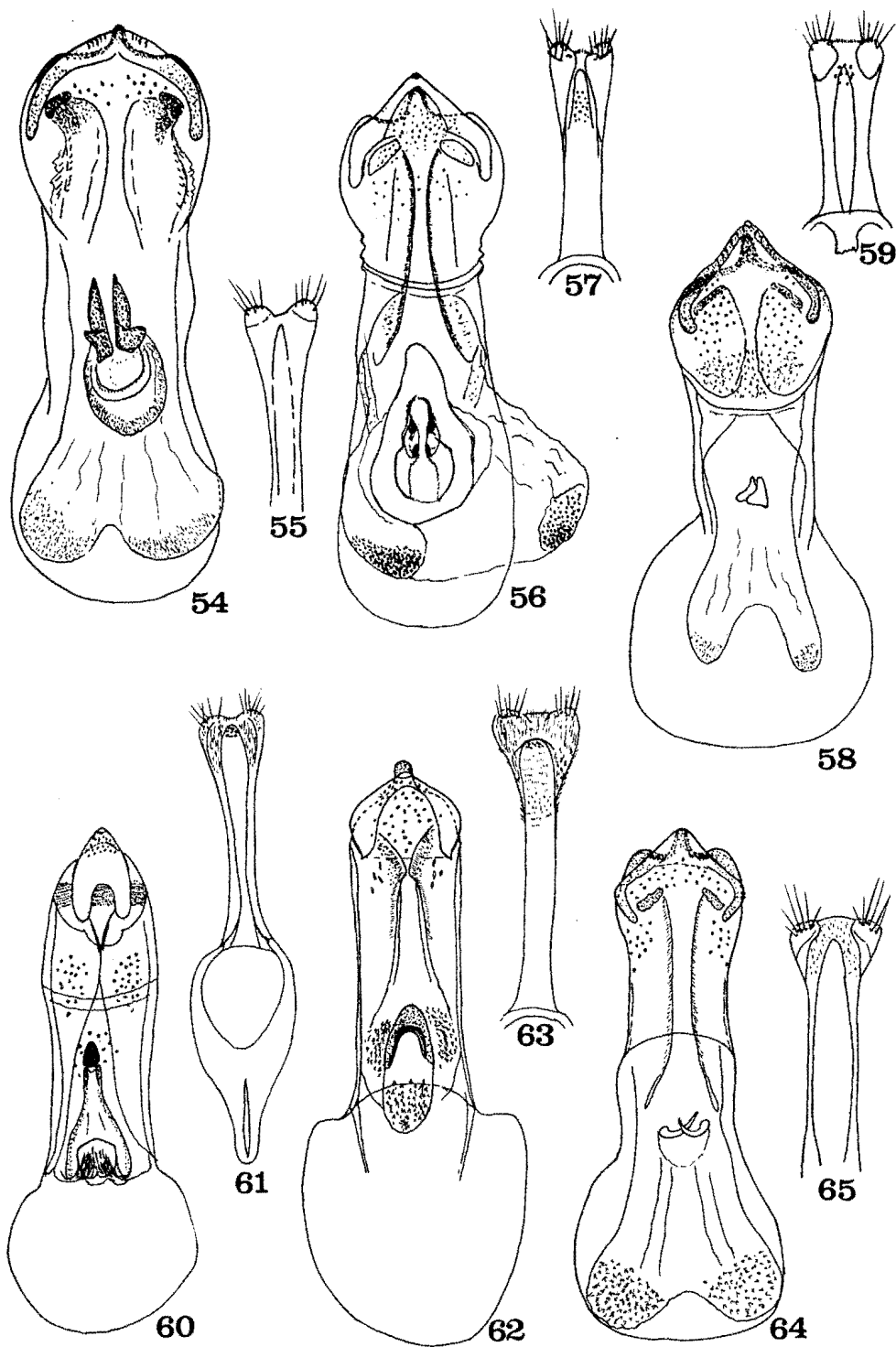


40

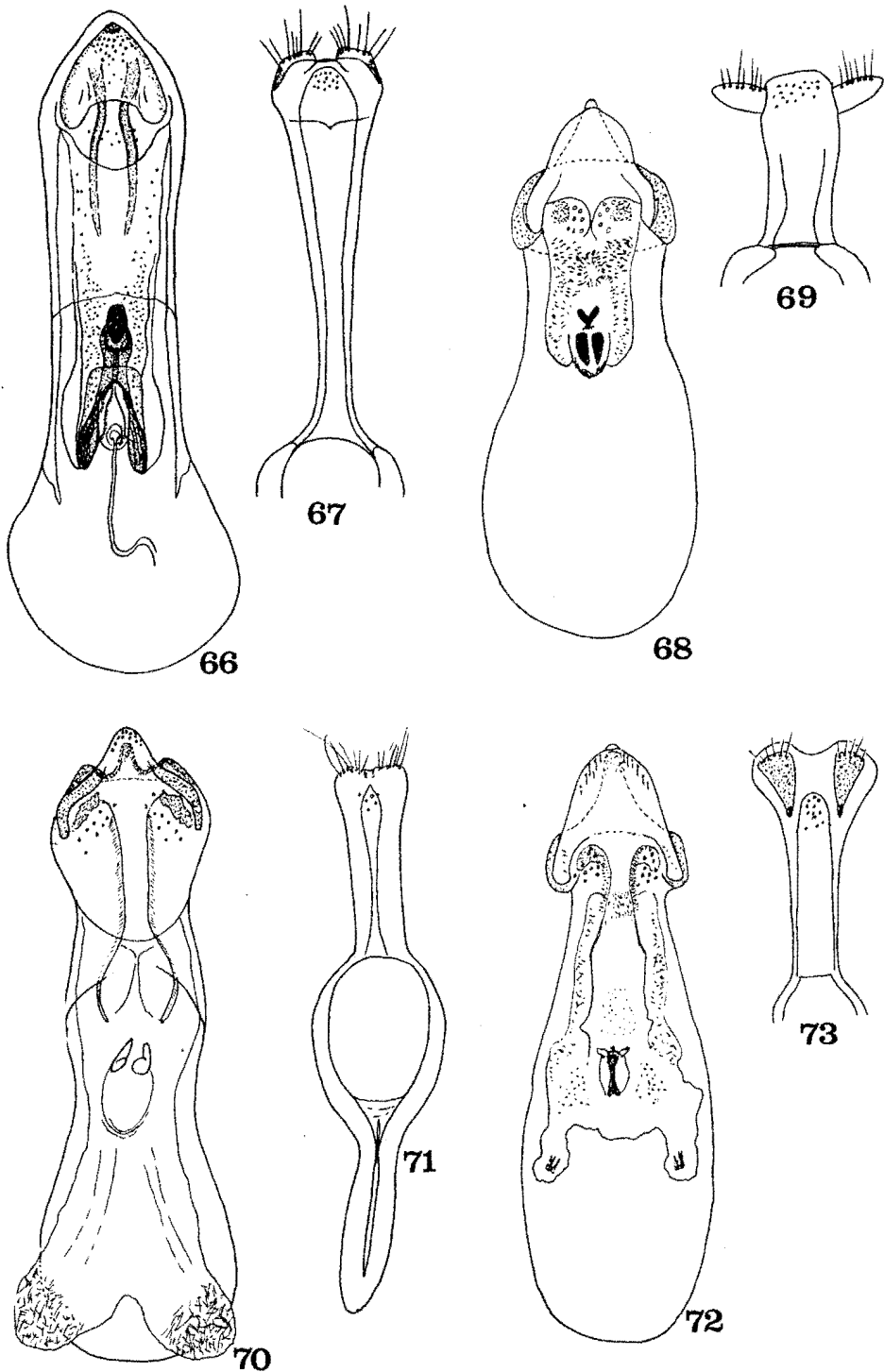
FIGURES 35-40. 35, *Z. subnitens*, dorsal. 36, Same, pygidium. 37, *Z. vandykei*, dorsal. 38, Same, pygidium. 39, *Z. victoriensis*, dorsal. 40, Same, pygidium.



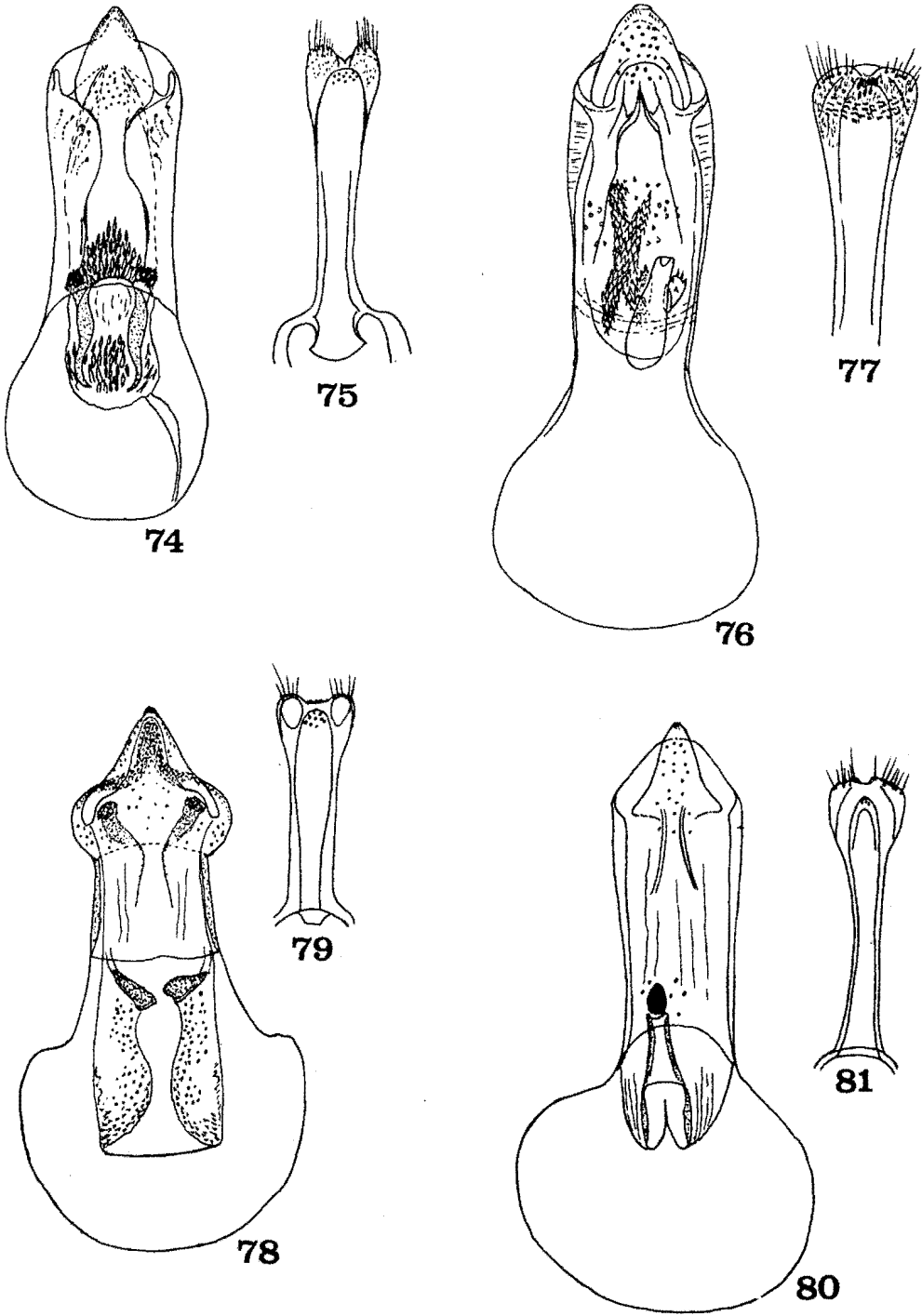
FIGURES 41-53. 41, *Z. spectabilis*, metacoxa. 42, *Z. subfasciatus*, metacoxa. 43, Same, hindleg. 44 and 45, *Z. obtectus*, male and female antennae, respectively. 46 and 47, *Z. bexarensis*, male and female antennae, respectively. 48, *Z. eldensis*, strut of eighth sternite, female. 49, *Z. obliteratus*, strut of eighth sternite, female. 50, *Z. arenarius*, male genitalia, median lobe. 51, Same, lateral lobes. 52, *Z. bexarensis*, male genitalia, median lobe. 53, Same, lateral lobes.



FIGURES 54-65. 54, *Z. chandleri*, male genitalia, median lobe. 55, Same, lateral lobes. 56, *Z. cruciger*, male genitalia, median lobe. 57, Same, lateral lobes. 58, *Z. cynthiae*, male genitalia, median lobe. 59, Same, lateral lobes. 60, *Z. densus*, male genitalia, median lobe. 61, Same, lateral lobes. 62, *Z. eldenensis*, male genitalia, median lobe. 63, Same, lateral lobes. 64, *Z. humboldtae*, male genitalia, median lobe. 65, Same, lateral lobes.



FIGURES 66-73. 66, *Z. obliteratus*, male genitalia, median lobe. 67, Same, lateral lobes. 68, *Z. planifrons*, male genitalia, median lobe. 69, Same, lateral lobes. 70, *Z. spectabilis*, male genitalia, median lobe. 71, Same, lateral lobes. 72, *Z. stephani*, male genitalia, median lobe. 73, Same, lateral lobes.



FIGURES 74-81. 74, *Z. subfasciatus*, male genitalia, median lobe. 75, Same, lateral lobes. 76, *Z. subnitens*, male genitalia, median lobe. 77, Same, lateral lobes. 78, *Z. vandykei*, male genitalia, median lobe. 79, Same, lateral lobes. 80, *Z. victoriensis*, male genitalia, median lobe. 81, Same, lateral lobes.