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A study of the morphology and systematics of the genera Polydrusus and Scythropus (Coleoptera: Curculionidae)

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A STUDY OF THE MORPHOLOGY AND SYSTEMATICS OF THE GENERA POLYDRUSUS AND SCYTHROPUS (COLEOPTERA: CURCULIONIDAE)

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Date_____

Typed by Joanne Jensen

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INTRODUCTION

For many years the taxonomic status of the genera Polydrusus and Scythropus in the United States was uncertain. These genera were confused one with another, and only recently have they been accepted as morphologically distinct. The genus Polydrusus was revised by Sleeper in 1957. There has been little written concerning the biology, ecology, and classification of the genus Scythropus, and the existing keys and descriptions are vague and inaccurate.

The objectives of this study were 1) to further clarify the status of these two genera, and 2) to redescribe and elucidate the morphology and distribution of the species of Scythropus to better facilitate their identification.

The structural aspects studied were integument color, genitalia, eighth tergite, ninth segment, setae on the beaks and mandibles, size, shape, and vestiture of the pregula, base of the beak, variations in the scape and funicular joints of the antennae; size, shape, and vestiture of the thorax; elytra, and abdomen; scale colors, shape, and arrangement; leg color, structure and vestiture, and over-all length.

Totals of 1300 specimens from the collection of the California Academy of Sciences, 265 from the Brigham Young University collection, and three collected by me at Lake Tahoe, California were used in this study.

METHODS AND PROCEDURES

Pinned specimens were examined under a binocular microscope at magnifications between 10X and 40X to determine external morphological variations. Prior to the study of internal structures, specimens were relaxed in a 30% solution of ammonium hydroxide for 5 minutes, then rinsed in water. The abdomens were then carefully removed with the aid of hair-spring tweezers using the following procedure. Holding the specimen ventral side up gently but firmly between the fingers, the abdomen was lifted up to a vertical position until it was broken loose from the remainder of the body. Care was used not to pull the abdomen directly away from the thorax. Such procedure often resulted in breakage of the body into several pieces.

Each abdomen was placed in a 5% solution of potassium hydroxide and heated until the fatty substances and muscles were dissolved. They were then placed in water under a binocular microscope and the tergites were gently teased away to expose the genital structures which could then be lifted out as a unit and further teased apart to facilitate observation.

In order to draw the genitalia in proper perspective, they were held in place by the following procedure. A very small piece of well-masticated chewing gum was pressed on the bottom of a dry plastic cap one inch in diameter and one-eighth inch in depth. Abrasion of the surface facilitated adherence of the gum. The gum was made pliable by covering it with water and heating it slightly under a microscope lamp. Care had to be taken not to heat the water too much, as this made the gum sticky. The genitalia were held in place by stretching a thin thread of gum over them (Fig. 42). This held them firmly in place when fastened down at one or two places in this manner. If stretched thinly enough, the gum did not obscure the view. An optical grid and grid paper were used to draw the parts to scale. After they were drawn, the genitalia were placed in stoppered microvials containing glycerin and placed on the pins with the specimens from which they were dissected.

In the drawings, chitinized structures were left clear and membranes were stippled.

SPECIES STUDIED

This study includes five identified species of the genus Polydrusus, and five identified and two unidentified species of the genus Scythropus. The species are listed as they appear in the Catalogue of the Coleoptera of America, North of Mexico (Leng 1920), except for P. delicatulus Horn which was transferred from Scythropus by Fall in 1901.

Polydrusus Germ., 1817

16621 americanus Gyll., 1834

16622 impressifrons Gyll., 1834

16623 sericeus Schall., 1783

16624 peninsularis Horn, 1894

delicatulus (Horn) 1894

Scythropus Schon., 1826

16626 elegans Couper, 1865

16627 californicus Horn, 1876

16628 ferrugineus Csy., 1888

16631 cinereus Csy., 1888

16633 miscix Fall, 1901

Scythropus sp. "A"

Scythropus sp. "B"

HISTORICAL REVIEW

Both Polydrusus and Scythropus belong to the Family Curculionidae, Linnaeus; Subfamily Othiorhynchinae, LeConte; Tribe Polydrusini, Pierce.

The genus Polydrusus (Gr., "many" + "dewy") was described by Germar in 1817 and has for its type, P. undatus Fabricius, which was designated by Schönherr in 1826. LeConte and Horn (1876), described the genus Cyphomimus with the type C. dorsalis Horn. This genus has since been combined with Polydrusus. There are in the United States according to Sleeper (1957), six native species and two introduced from Europe.

The genus Scythropus (Gr., "morose") was described in 1826 by Schönherr with a European species S. mustella as the type. Couper (1865) described S. elegans, the first American species. S. californicus was added by Horn (1876); S. lateralis, S. ferrugineus, S. crassicornis, and S. cinereus were added by Casey (1888); S. delicatulus by Horn (1894), and S. albidus and S. miscix by Fall (1901). Fall also transferred S. delicatulus to Polydrusus thus leaving a total of eight species in the genus. Apparently all of these are native to the United States and many of them are found only in the western states.

GENERAL MORPHOLOGY

The following description of the genus Polydrusus is taken from Blatchley and Leng (1916). It is condensed from Germar's original description, and although short, gives many of the more important salient characteristics of the genus.

> In this genus, with which Cyphomimus Horn of the Henshaw catalogue has been combined, the beak is a little shorter and narrower than the head, its tip feebly notched; antennal groove deep in front, suddenly bent and passing beneath the eyes, the latter round; antennae long, slender, joints 1 and 2 of funicle longer, 3-7 obconical, gradually decreasing in length; club elongate-oval.

A summary translation of Schönherr's original description of Scythropus as taken from Horn (1876) is reproduced here, after which supplementary notes of later workers, as well as personal observations are added.

> Rostrum, short, stout, slightly narrowed in front, angles rounded, declivous and truncate at tip, with arcuate carina and smooth space. Scrobes short, badly limited and slightly arcuate. Eyes distant from the thorax, round, slightly prominent. Antennae long, scape long, slender, gradually clavate, slightly arcuate and passing the eyes behind; funicle 7-jointed, 1-2 longer, the first slightly longer than the second, 3-7 shorter, gradually decreasing; club elongate, oval. Thorax short, cylindrical, slightly narrower in front. Scutellum small, nearly oval. Elytra wider at base than the thorax, feebly emarginate, humeri obtusely prominent. Metasternum moderately long. Intercoxal process oval at tip. Second abdominal segment longer

than the two following together, first suture arcuate at middle. Articular surfaces of hind tibiae terminal. Tarsal claws small, connate at base. Body densely scaly.

Horn (1876) observed that the gular notch is semicircular, the mentum small and rather narrow, that the mandibles are short, robust, and glabrous, and that the scar is oval, terminal, and not prominent. The deciduous pieces are long, moderately stout and falciform.

Casey (1888) made the observations that the species differ among themselves in abdominal structure, structures of the antennae, tarsi and elytra.

Fall (1901) observed that Casey was at fault in supposing that the relative lengths of the abdominal segments were of a specific nature, and stated that they are purely sexual, and substantially the same in all species, the second segment being nearly equal in length to the two following united in the female but distinctly shorter in the male. He was also of the opinion that the use of the differences in the relative lengths of the funicular joints and form of the front and middle tibiae were of sufficient variation to make their use hazardous except in series.

After having observed a great many specimens, I have come to the conclusion that the funicular joints are quite reliable in some species but as Fall stated quite variable in other species, and thus hazardous except in series. Fall was also quite correct in stating

that the segments of the abdomen are substantially the same in all species, that the variation is purely sexual. The tibiae are quite arcuate in most of the species, and I do not consider this characteristic to be a good one for distinguishing the species. The deciduous pieces mentioned by Horn are as he described, but very seldom present, and their use as a characteristic of the genus is of questionable value.

The genus Polydrusus Germar has much variation between the species, but the species are quite constant, showing little variation. The interspecific variation is evident in the external morphology, but especially in the internal structures as is shown in illustrations of some of the male genitalia, Plate I.

The genus Scythropus on the other hand shows relatively little interspecific variation, but considerable intraspecific variation, varying almost as much within the species as between species. This obviously renders it a very difficult group with which to work. The interspecific differences are often relative and vague; not being of a specific nature. Series within a species collected in a common locale on the same date may, however, vary in color, size, shape, vestiture, scale color, antennae, and general features. Some of the similarities and dissimilarities of the different species are evident in the genitalia as illustrated in Plate I.

TREATMENT OF THE SPECIES

S. elegans Coup.

Description: Integument black, legs and antennae dark brown in male, light reddish-brown in the female; scales ovate, never more than twice as long as wide, vary in color and may be brilliant green, slightly cupreous, plumbeous, or cinereus. The scales along the sides of the elytra, prothorax and the elytral suture differ from those on the dorsal surfaces of the prothorax and elytra, usually being lighter in color. Body densely squamose ventrally. Head with four long setae on each side of the anterior margin of scales in the apical impression of the beak; mandibles with two setae on the lateral margins and one on the anterior surface; beak foveate and impressed at the base; pregula short, triangular, squamose; scales dense between scrobe and eyes, encroaching on the posterior margin of the scrobe, but not entering it. Antennal scape long and slender, gradually clavate near the apex; funicle slender, longer than the scape, first joint as long or longer than the next two combined, the third joint of the male shorter than the second or fourth; club widest at the end of the second segment (Fig. 16). Prothorax nearly one-half wider than long; sides quite evenly convex; widest one-third from base; base slightly wider than apex. Elytra one-third

wider at base than prothorax, widest at distal third, gradually broader behind the humeri; striate; striae finely and closely punctured; intervals (Fig. 30), flat, densely scaly, and with minute suberect setiform scales. Abdomen squamose, also with long slender hairs; scales similar in size and color to those on the sides of the elytra and prothorax. Femora squamose; tibiae with scale-like hairs proximally, hirsute distally. Aedeagus (Fig. 1), elongate-oval; median lobe evenly tapered at point, nearly three times as long as wide, ventral side irregular at tip, nearly emarginate in lateral view; median struts nearly as long as median lobe, gradually tapering to spatulate, rounded tips, curving down at apical third; tegmen variable, slightly to distinctly enlarged at junction with tegminal strut as shown in Fig. 1, to evenly concave as shown in Fig. 5; ninth segment (Fig. 38) variable, Y-shaped as shown to club-shaped as in Fig. 39. Ventral lobes are usually present, but may be reduced or absent.

Length 5-7 mm.

Distribution: Canada, Washington, California, and Oregon. Host plant - Pinus monticola.

Comments: This species is the most colorful of the species, being slightly more vivid than Scythropus sp. "A" which has undoubtedly been mistaken for S. elegans by many workers in the past. It differs from Scythropus sp. "A" in that the scales are slightly more robust

and more dense, thus giving it a brighter appearance. The antennae are distinctly different, the first funicular joint being longer than the next two combined with the third joint distinctly shorter than the rest in S. elegans (Fig. 16), but in Scythropus sp. "A", the first funicular joint is distinctly shorter than the next two combined and the remainder of the joints are nearly equal in length, as is indicated in Fig. 15. The median lobe of the aedeagus is distinctly pointed in S. elegans but rounded in Scythropus sp. "A", and the spermathecal duct is firmly united proximally in S. elegans but split in Scythropus sp. "A" (Fig. 3 d).

S. californicus Horn

Description: Integument black, legs and antennae rufous; scales strigose, long and piliform, light brown to ferrugineus, irregularly marmorate with white on the elytral disc; white scales on sides, ventrally and along elytral suture. Head with a row of five or six long discal setae along each side of the anterior margin of scales in the apical impression of the beak, the most anterior two often being very close together; beak foveate and impressed at the base, the impression continuing to the posterior margins of the apical impression; pregula very small, with two long hairs distally. Antennal scape long and slender, suddenly clavate at distal fourth; first funicular joint about as long as the next two combined, the fifth being the shortest. Prothorax one-half wider than long, widest

just posterior to mid point; sides slightly depressed in anterior third. Elytra striate; intervals moderately scaly and with moderately long, erect hairs (Fig. 33). Abdomen convex, squamose, and with hairs slightly longer than the scales which are similar in color to those on the sides of the elytra. Femora with piliform scales; tibiae with similar scales at proximal end, hirsute distally. Aedeagus (Fig. 5), ovate; median lobe slightly more than twice as long as wide, sides tapering uniformly to distal fourth, where they become emarginate slightly before the tip; tip rounded, nearly truncate as seen dorsally or ventrally, in the lateral aspect evenly convex ventrally, concave dorsally; median struts nearly as long as median lobe, tapering gradually to spatulate tips which turn up at the apex; tegmen widened at mid-dorsal line; tegminal strut half as long as median struts; ninth segment (Fig. 40). X- or Y-shaped, with blunt tips dorsally, slightly to prominently split ventrally, upper half prominently pigmented, lower half when present without pigment. Length - 4.5-6 mm.

Distribution: California, Arizona, Oregon, and Washington. Host plant - Pinus sabiniana.

Comments: This species is quite distinct from the other species. It is dull colored, has a very short fifth funicular joint, and the scales are long and often rather disorderly arranged. The pregula is small and squamose with two long setae distally. The

species most closely resemble S. ferrugineus but is usually much paler and the aedeagus is nearly round on the end of the median lobe, more closely resembling Scythropus sp. "B" except that it is shorter and stouter.

S. ferrugineus Csy.

Description: Integument or male piceo-ferrugineus, of female bright rufo-ferrugineus, legs and antennae pale rufous; scales finely strigose, pearly white to ferrugineus in color, arranged in mottled patches on the elytra, the darker patches formed by scales which are slightly to distinctly more setiform; pearly white along the sides, elytral suture, and beneath. Head and beak conical; four or five long discal setae on each side of the anterior margin of scales in the apical impression of the beak; labrum with two converging setae distally; beak deeply and prominently foveate near the base; mandibles with three long setae along the lateral borders; eyes large and prominent; pregula squamose, slightly hairy in the female, more so in the male. Antennal scape reaching to or nearly to the anterior border of the prothorax; first funicular joint distinctly clavate, as long as the next two joints combined, joints three to seven shorter, decreasing in length distally. Prothorax about one-third wider than long, widest at the middle. Elytra less than one-third wider at the base than the prothorax; humeri prominent; intervals (Fig. 32) each with a row of prominent, suberect setiform scales; moderately to

densely squamose; striae punctate with very minute, suberect setae. Abdomen convex, squamose. Legs hairy on both the tibiae and the femora, slightly squamose on femora. Aedeagus (Fig. 4), wedge-shaped, the sides very slightly emarginate in dorsal view; median lobe about two and one-half times as long as wide, very thin and sharp in lateral aspect, coming to a sharp point; median struts about three-fourths as long as median lobe, prominent, tapering slightly towards junction with median lobe, nearly truncate distally, bending downward; tegminal strut half as long as median lobe, quite straight in lateral view, slightly to distinctly spatulate distally as viewed in ventral aspect. Ninth segment (Fig. 39), small, clavate, not split ventrally.

Length - 5.3-6.5 mm.

Distribution: California and Oregon.

Comments: This species closely resembles Scythropus sp. "B" but differs in several respects. The scales of S. ferrugineus are very variable, but in general, the white scales are much broader and shorter than the more setiform ferrugineus scales, while in Scythropus sp. "B" they are nearly the same shape even though they may be larger in size. The antennae differ in that the first funicular joint of S. ferrugineus is as long as the next two joints together, but in Scythropus sp. "B" the first joint is slightly shorter than the next two combined. The most distinguishing characteristic is perhaps the

aedeagus, which is distinctly flattened dorsally and pointed, while in Scythropus sp. "B" it is rounded and not so pointed.

S. cinereus Csy.

Description: Integument black, legs black to dark brown, antennae dark brown to brown; scales strigose, cinereus underneath, along sides of body and elytral suture, elsewhere slightly cupreus or ochreous, irregularly marmorate on elytral disc; sparse on head and elytra, more dense along median line of prothorax. Head with a row of 4 long setae along each side of the anterior margin of scales in the apical impression of the beak; beak deeply foveate at the base with a large shallower impression continuing to the border of the apical impression; scales encroaching upon and entering the scrobe; labrum tumid, shiny, without converging distal setae; pregula long and narrow, bearing numerous hairs or setiform scales. Antennal scape not reaching anterior margin of prothorax, gradually clavate distally; first funicular joint varies from only slightly longer than second to as long as the second and third combined, joints 3-7 decreasing very gradually and uniformly. Prothorax slightly more than one-third wider than long; dorso-lateral surfaces slightly to prominently sinuate; evenly arcuate laterally. Elytral discs sinuate along the lateral border of light colored scales bordering the elytral suture; striae deeply punctate; intervals not densely squamose, each bearing a row of suberect setae which become quite prominent at the

elytral declivity; scales vary from two to three times as long as wide, the cinereus scales usually larger and more ovoid than the darker surrounding scales. Abdomen squamose with sparse hairs except fifth segment which is densely hirsute. Legs rather densely squamose on the femora; tibiae squamose proximally, hirsute distally. Aedeagus (Fig. 7), elongate, heavily pigmented; median lobe nearly three and one-half times as long as wide, sides tapering very gradually to a sudden tapering rounded point; tip in lateral aspect slightly concave dorsally and slightly convex ventrally; median struts short, less than three-fourths as long as the median lobe, broadening rapidly distally, truncate at tips which are directed slightly downward; tegmen enlarged dorsally; tegminal strut short, slightly more than half as long as median struts, S-shaped, slightly enlarged at tip; ninth segment variable, may be heavy H-shaped (Fig. 36) to small wedge-shaped (Fig. 35).

Length - 5.5-7.5 mm.

Distribution: California. Host plant - Pinus jeffreyi.

Comments: S. cinereus is quite distinct from the other species in that the scales are nearly without color, and sparse. The aedeagus resembles that of Scythropus sp. "B" but the median struts appear a bit shorter, and the tip is more wedge-shaped. More research may, however, prove these two to be synonymous.

S. miscix Fall

Description: Integument black, legs dark brown in males, light brown in females; scales strigose, from three to four times as long as wide, pearly white on the sides, along the elytral suture, and beneath, cupreous elsewhere, regularly arranged, not marmorate on elytral disc; body hirsute ventrally. Head with four long discal setae on each side of the anterior margin of scales lining the apical impression of the beak, the anterior most two may be very close together, nearly fused; mandibles with two setae laterally and one on anterior margin; beak with elongate fovea at the base; pregula small, triangular and squamose; scales between scrobe and eyes sparse, not encroaching on posterior margin of scrobe. Antennal scape not reaching the anterior margin of thorax, suddenly clavate at distal third, sparsely clothed with pale hairs; first funicular joint about as long as the next two combined, joint four larger and longer than any of the last five, joints three and five being the smallest and shortest; the club as in S. elegans is widest at the end of the second segment. Prothorax more than one-third wider than long, widest one-third from base; sides evenly convex. Elytra densely squamose; about one-third wider at base than prothorax; striate; intervals each with a row of inconspicuous subrecumbent setae which are slightly longer than the scales surrounding them; striae inconspicuous, punctured, each puncture bearing a minute recumbent seta; the

cupreous scales are distinctly more elongate on the elytra than are the white ones. Abdomen reclined within the elytra; densely hirsute along median line, squamose with setiform scales toward the sides. Legs with squamose femora, tibiae hirsute distally, squamose with setiform scales proximally. Aedeagus (Fig. 6), with emarginate median lobe which tapers to a point in dorsal view, in lateral aspect narrowing to a sinuate point, slightly convex ventrally and slightly concave dorsally; median struts much shorter than median lobe, prominent in both dorsal and lateral views, curving slightly down in the latter, spatulate and rounded at the tip; tegmen slightly emarginate dorsally; tegminal strut one-fourth shorter than median struts; ninth segment (Fig. 34) club-shaped with two small wing-like protrusions ventrally.

Length - 4.5-6.8 mm.

Distribution: California, Washington, and Montana.

Comments: This species resembles S. elegans and Scythropus sp. "B" except that the abdomen is very hairy, the scales on the sides, beneath, and along the elytral suture are white whereas in S. elegans and Scythropus sp. "B" they are colored. It differs from other cupreous colored species in that it does not have the mottled pattern on the elytral disc. The aedeagus is very distinct with the median lobe prominently emarginate laterally, tapering to a wedge-shaped point.

Scythropus sp. "A"

Description: Integument piceo-rufous to piceous, legs and antennae rufous to dark brown; scales ovoid (Fig. 31), whitish with a faint greenish or cupreous tinge beneath, on sides, and along the elytral suture, elsewhere cupreous, cinereus or metallic green; pattern on elytra not mottled. Head with 3-5 long discal setae on each side of the anterior margin of scales in the apical impression of the beak; three setae along the lateral margin of the mandibles; labrum very prominent, convex; beak foveate at the base; pregula small, squamose, or with a few setiform scales; scales encroaching upon and entering the scrobe posteriorly. Antennal scape not reaching the anterior margin of the prothorax; first funicular joint clavate at distal end (Fig. 15), considerably shorter than next two combined, joints 3-7 similar in size, 5 slightly shorter, 3 slightly larger. Prothorax one-third wider than long. Elytra slightly tumid at humeral angles, striate; striae punctured, each puncture bearing a minute subrecumbent seta; intervals each with a row of small inconspicuous subrecumbent setiform scales which are very similar to the strigose scales surrounding them. Abdomen convex, squamose; fifth segment hirsute. Legs with femora densely squamose; tibiae hirsute. Aedeagus (Fig. 3), with a short split ejaculatory duct; median lobe slightly more than two and one-half times as long as wide, very slightly concave at sides; tip irregularly oval as viewed dorsally, in the lateral aspect slightly concave dorsally, convex ventrally; median struts about as

long as the median lobe, nearly straight, spatulate with truncate tips that turn up slightly, or remain straight; tegmen usually prominent dorsally; tegminal strut more than half as long as median struts; ninth segment (Fig. 37), resembling an inverted V, capped with a heavy truncate crown.

Length - 5-6.5 mm.

Distribution: The specimens studied are from Pennsylvania, Massachusetts, Colorado, Wyoming, Vermont, California, Idaho, Oregon, and Canada.

Comments: This species resembles S. elegans except the first funicular joint is shorter than the next two combined (Fig. 15), and the third joint is not the shortest as in S. elegans. The scales are not as dense or ovate, giving this species a slightly less colorful appearance. The scales enter the scrobe in Scythropus sp. "A" but do not in S. elegans. S. crassicornis has a hairy body ventrally which readily distinguishes it from this species.

Scythropus sp. "B"

Description: Integument ferrugineus to piceous, legs and antennae rufous; vestiture variable, sparsely to densely covered with strigose scales which are ovoid, never more than twice as long as wide, pearly white at sides, beneath and along the elytral suture, elsewhere cupreo-ferrugineus, except where irregularly marmorate with white. Head rather densely squamose; beak foveate at base,

with a shallow impression continuing to the apical impression which is densely squamose; labrum with two converging setae distally; scrobe densely squamose posteriorly. Antennal scape long, densely hirsute, reaching to the anterior border of the prothorax; first funicular joint shorter than the next two combined, joints 3-7 nearly equal in size with 3 and 4 slightly longer. Prothorax about one-half wider than long, widest at middle; irregularly convex. Elytra considerably less than one-third wider at base than prothorax; striate; intervals each bearing a line of rather prominent suberect setae (Fig. 31), which are especially prominent on the declivity. Abdomen squamose, slightly hirsute; fifth segment densely hirsute. Legs with densely squamose femora; tibiae squamose proximally, hirsute distally. Aedeagus (Fig. 2), moderately pigmented, slender; median lobe nearly three and one-half times as long as wide, sides tapering slowly to a rounded tip which in the lateral aspect is very slightly concave dorsally, nearly straight ventrally; median struts short, less than three-fourths as long as the median lobe; tegmen slightly enlarged dorsally; tegminal strut two-thirds as long as median struts, slender, relatively straight; ninth segment (Fig. 41), small, club-shaped dorsally, membranous ventrally.

Length 5.5-7 mm.

Distribution: All the specimens studied were from Mammoth, California. Host plant - Pinus jeffreyi.

Comments: This species closely resembles S. cinereus and was taken from the same host plant. They are obviously closely related, but differ in integument and scale color, S. cinereus having a darker integument but lighter scale color. The genitalia are also very similar.

S. crassicornis Csy.

Original description as given by Casey: Rather slender; integuments black; tibiae, tarsi, and antennae dark rufous; rather densely clothed with somewhat elongate scales which are ferrugineus and white, confusedly mottled over the entire surface of the elytra, white at the sides and base of the pronotum and on the under surface. Beak very small, shorter and narrower than the head, rapidly attenuate; sides straight; alae obsolete; front broadly convex, with a small fovea between the anterior portions of the eyes; the latter convex and prominent, beak broadly declivous at apex; antennae rather short; scape very short, robust, and arcuate, much shorter than the funicle, very gradually enlarged from base to apex; first joint of the funicle rather robust, scarcely as long as the next two together, outer joints slightly enlarged and more densely setose, seventh slightly longer than wide. Prothorax very short, nearly two-thirds wider than long, widest in the middle; sides feebly arcuate, slightly convergent and nearly straight thence to the base; apex distinctly constricted; disk very slightly wider than the head, very slightly impressed in the middle near the base, finely and very densely punctate. Scutellum rather distinct, somewhat pointed. Elytra at the narrowly rounded and rather prominent humeri one-third wider than the prothorax; sides parallel, nearly straight, fully twice as long as wide; acute at apex; disk rather coarsely and feebly striate; striae with rather coarse, feebly impressed, and approximate punctures, each bearing a minute, pale seta; intervals feebly convex, nearly smooth; setae extremely sparse and not distinct. Abdomen convex; first suture broadly, rather feebly emarginate in a circular arc in the middle half; second segment nearly as long as the next two together; third longer than the

fourth; rather densely clothed with recumbent squamose pubescence and with very long, slender, sparse, erect setae. Anterior and middle tibiae rather strongly sinuate internally near the apex. Cotyloid surfaces of the posterior tibiae very oblique. Length 4.2 mm.

New Mexico (Fort Wingate 1).

The single representative of this very distinct and aberrant species I owe to the kindness of Dr. R. W. Shufeldt, who discovered it in the locality above indicated. It is the smallest species known within our faunal limits.

Distribution: New Mexico (Fort Wingate).

Comments: This species was not represented with those studied, but due to its small size, short thorax and short scape, it should be readily distinguishable from the other species in this genus.

S. lateralis Csy.

Original Description as given by Casey: Form oblong, rather depressed, densely clothed with finely strigose scales which are twice as long as wide, and acutely pointed, scales subcupreous in color, cinereous at the sides and beneath; each of the small punctures of the elytral striae bearing a minute robust seta, otherwise devoid of setae, except beneath, where they are fine, rather long, and sparse on the abdomen; integuments black, legs and antennae rufous. Head and beak together evenly conical, convex, densely punctate, with a small, very deep fovea in the middle of a line through the anterior margin of the eyes, which is continued anteriorly to the posterior tumid margin of the apical impression; the latter large, occupying two-fifths the entire length of the beak, inclosing a posteriorly arcuate, lunate, squamose area of scales, otherwise smooth, polished, and almost impunctate, having on each side an oblique line of three long discal setae; scrobes apical, small, deep, irregularly punctiform, far in advance of the eyes; antennae long and slender; scape very slender, not quite reaching the anterior margin of the prothorax; abruptly, but moderately clavate at apex; funicle slender, longer than the scape; outer joints not at all enlarged, all longer than wide; basal joint very long, slender, as long as the next two together;

fifth joint shortest, sixth and seventh equal in length; club elongate, slender. Prothorax nearly one-half wider than long, widest distinctly before the middle; sides feebly arcuate, thence extremely feebly convergent and very feebly arcuate to the base, more rapidly convergent and distinctly sinuate to the apex; the latter distinctly narrower than the base, broadly and very feebly sinuate in the middle; base broadly subtruncate; disk broadly, evenly, and feebly convex, finely, not deeply and very densely punctate; punctures polygonally crowded. Elytra oblong, four times as long and nearly twice as wide as the prothorax; sides nearly straight, parallel, very broadly and feebly sinuate behind the humeri; the latter narrowly rounded, rectangular; disk broadly, evenly convex, finely striate; striae finely, rather closely punctate; intervals nearly flat, equal, except the humeral interval, which is distinctly elevated nearly throughout its length, the flanks beyond the elevation being nearly flat, vertical, and with paler scales. Abdomen broadly convex, densely squamose; first suture abruptly and rather strongly arcuate in circular segment in the middle two-fifths; second segment as long as the next two together; third longer than the fourth. Legs moderate; anterior and middle tibiae strongly, roundly, and almost equally emarginate within near the apex; tarsal claws small, connate at base. Length 7.5 mm.

California (Lake Co.). Mr. L. E. Ricksecker.

The mandibular scar is rather large, terminal, circular, and very distinct, not prominent within; outer margin slightly so. The mentum is small, elongate, attenuate, flat, and more deeply seated behind, very convex and prominent anteriorly, leaving the maxillae and palpi well exposed. The mandibular notch of the genae is extremely broad and shallow.

This species differs from elegans in its more depressed form and much more transverse prothorax.

Distribution: California is the only state listed by Leng (1920) for this species.

Comments: As there is only one length given in the above description, I assume it was described from a single specimen. This, plus the fact that I could not detect any specimens fitting the

above description in the California Academy of Sciences collection which is largely made up of California specimens, gives me doubt as to the validity of this species. I am, however, including his original description for comparison with the descriptions of the other species. The description of a species in this genus from a single specimen seems very hazardous due to intraspecific variation. This variation is usually present even in a species taken from a common locale, on the same date.

S. albidus Fall

> Original description as given by Fall: Slightly more robust, but rather less convex than elegans. Black, legs and antennae bright rufous; vestiture consisting of broad densely placed scales, which are nearly white on the sutural interval and at the sides of the elytra, elsewhere ashy white, with faint greenish or pearly lustre; elytral setae visible only on the declivity, where they are short, subrecumbent and inconspicuous. First funicular joint equal to the second and third united, fourth distinctly longer than the third, fifth shortest. Thorax fully one-half wider than long, widest at middle, sides evenly arcuate. Elytra widest at apical third, posthumeral sinuation feeble. Front and middle tibiae strongly deeply arcuate within in apical half, the inner margin almost angulate above the sinus; outer margin more broadly arcuate toward the apex. Length 6.5 mm.

Distribution: Lake Superior, California, Oregon, and Idaho are listed in Leng (1920).

Comments: This species was described from a single specimen taken by Fall at Lake Tahoe. The original description did not accurately describe any of the specimens studied, but I am

including it to be compared with the descriptions of the other species of Scythropus. It is probable that this species is either Scythropus sp. "B" as constituted in this study, or invalid. The description could also well fit S. cinereus which I consider to be a valid species. I collected 3 specimens of S. cinereus at Lake Tahoe where the type specimen for S. albidus was taken, and there are many more in the collection from the California Academy of Sciences taken from the same area which fit the description of S. cinereus.

KEY TO THE SPECIES OF SCYTHROPUS

1. Scales of elytral disc more or less mottled, especially toward the suture 2

1'. Scales of elytral disc not mottled, the sides and sutural interspace usually paler 6

2. Antennal scape long and slender, passing distinctly beyong the posterior margin of the eye 3

2'. Antennal scape short, robust, arcuate, just passing the posterior margin of the eye..... crassicornis

3. Body black, legs and antennae dark brown or rufus, scales usually not bright ferrugineus..... 4

3'. Body red or dark brown, legs and antennae rufus, scales bright ferrugineus, antenna with funicular joints relatively equal, decreasing gradually distally 5

4. Body black, legs rufus, fifth funicular joint shortest, scales long and piliform, light brown to ferrugineus; aedeagus ovate; broadly rounded distally, slightly emarginate laterally before tip..... ..... californicus

4'. Body black, legs black or dark brown, scales sparse, nearly opaque or slightly cinereus or ochreus; funicular joints rather equal in length decreasing gradually distally; median lobe of aedeagus elongate, sides nearly parallel, tip suddenly tapering to a rounded point..... cinereus

5. Body always red; ferrugineus scales longer and more setiform than white scales, first funicular joint as long as the next two combined, joints 3-7 rather equal, deceasing slightly in length distally; median lobe of aedeagus wedge-shaped very sharply pointed in lateral view...ferrugineus

5'. Body ferrugineus to piceus; contrasting scales similar in form if not in size, first funicular joint shorter than next two combined; median lobe of aedeagus slender, elongate, tip rounded. ..... Scythropus sp. "B"

6. Elytra tumid at sides along the humeral interval ..... lateralis
6'. Elytra evenly convex at sides 7

7. First funicular joint distinctly shorter than the next two combined, third joint as long or longer than the fourth; median lobe of aedeagus ovate, very broadly rounded in ventral aspect, ejaculatory duct split ..... Scythropus sp. "A"
7'. First funicular joint as long or longer than the next two combined, fourth longer than the third..... 8

8. Scales ashy white or with faint greenish or pearly lustre; fifth funicular joint shortest ..... albidus
8'. Scales brightly colored, joints 3 and 5 shortest or joint 3 shortest 9

9. Scales cupreus dorsally, white on sides; long hairs ventrally; third and fifth funicular joints shortest; median lobe of aedeagus prominently emarginate laterally, tapering to a wedge-shaped point ..... miscix
9'. Scales bright green, cinereus, plumbeous, or cupreus, lighter on sides, abdomen with shorter hairs, third funicular joint shortest; median lobe of aedeagus evenly tapered at point, tip irregular in lateral aspect..... elegans

DISCUSSION

The species of the genus Polydrusus vary in size from 2.4-6.8 mm. Scale size, orientation of scales on the pronotum, color, scale patterns on the elytra, legs, genitalia, vestiture, and antennae are all good distinguishing characteristics. Separation, and identification of the species are not difficult.

Fall (1901) was the last person to work with the North American species of the genus Scythropus, and he had very little material with which to work. He admittedly did not have access to the species described by Casey (1888), and thus he used the characters given by Casey in constructing his key to the species. Casey apparently used only five specimens in describing four species (S. lateralis 1, S. ferrugineus 2, S. cinereus 1, and S. crassicornis 1). Fall used only one specimen in describing one of his species (S. albidus), and Horn (1876) in describing S. californicus used only two specimens. Detailed study of several series of each species available gives evidence that many of the characters used by the above authors are nebulous due to the nature of their generality. The describing of a species from a single specimen, or from anything but a good series could be hazardous due to the pronounced intraspecific variation and relatively insignificant interspecific

variation in this genus. In constructing the key and describing the species, I have attempted to use more specific characters to separate and distinguish the species.

The species range from 4.2-7.5 mm. With the exception of S. crassicornis Casey, which is the smallest, most specimens are from 5-6.5 mm in length, however, it appears that there are certain adverse conditions that can reduce the members of each species to a much smaller size of around 4.5 mm.

The heads are all very similar with only a few specific differences in the antennae, scrobes, gulae, and beaks. The antennae have fairly reliable characters except in S. cinereus which seems to be quite diversified in many respects.

The pronotum in every species with a possible exception of S. crassicornis has a similar orientation of the scales (Figs. 17, 18), and are of similar shape and size.

The Elytra are very similar between species, varying almost as much within the species as between the species.

The abdomens (Figs. 24-28) in every case have the second segment as long as the next two combined in the female, but shorter than the next two combined in the male. Differences in vestiture are evident in S. elegans and S. miscix, but in the remainder of the species do not seem significant.

The legs were not studied in any great detail, but further investigation might help establish some good interspecific characteristics.

The male genitalia are perhaps the most reliable single characteristic for separating the species. A great many genitalia, both male and female, were extracted, observed and drawn; however, the female genitalia proved to be as different within the species as between species and were not used as separating factors. In the male, the spiculum gastrale (Figs. 13, 14) seemed to be characteristically different in each species, but further observation showed intraspecific differences to be nearly as pronounced as interspecific variations.

The eighth tergite (Figs. 19-23) and what I consider to be the remains of the ninth segment of the male (Figs. 34-41) seemed to show diagnostic possibilities and many were drawn. Later and more thorough observations proved however, that the eighth tergite is unreliable, being nearly as different within the species (Figs. 21-22) as it is between species (Figs. 19, 20, 23). The ninth segment proved to have greater possibilities, most of those observed within a series being rather constant, but in S. cinereus (Figs. 35, 36) there seemed to be a great amount of difference in different series and thus it can not be used except perhaps in series and/or in conjunction with other features.

Although S. lateralis, S. crassicornis and S. albidus are included in the key, they are not included in this study due to their unavailability.

SUMMARY AND CONCLUSIONS

Thorough examination of the external and internal morphological characteristics in the genus Polydrusus proved them to be quite distinct and reliable for each species, facilitating rapid and accurate identification. Intraspecific variations appear to be negligible.

The species in the genus Scythropus, on the other hand, were found to be quite variable having as much intraspecific variation as interspecific variation. The early descriptions of the species seem quite nebulous in light of the relative nature of many of the characters used, the majority of them being of a generic rather than a specific nature. Reliable characters of taxonomic value are rare in this genus except perhaps in series where many things can be compared. The male genitalia, and the antennae (in all but S. cinereus) are about the only good individual characteristics, and even here there are some variations; however, they seem to be distinct enough to separate the species. Other characteristics seem to be of value only in combination with one another.

Because of the magnitude of intraspecific variations and the relatively insignificant interspecific variations of the species in the genus Scythropus, exact and positive identification of several of the species would seem to require comparison with the types which are

in the National Museum. There are many specimens which do not accurately fit any of the descriptions given, and though they surely belong to a species, revision of the descriptions might be necessary in order to include such specimens. A thorough study of the types of the monotypic species may remove the uncertainty of Scythropus sp. "A" and "B". They may prove to be new species or synonyms of valid species in this study.

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EXPLANATION OF THE PLATES

The terminologies employed in this study pertaining to the genitalia are after Bruhn (1947). In Figs. 1-7 views c & d are enlarged sections of a & b. Abbreviations used on plates I & II include the following:

ej - ejaculatory duct

ml - median lobe

ms - median strut

tg - tegmen

ts - tegminal strut

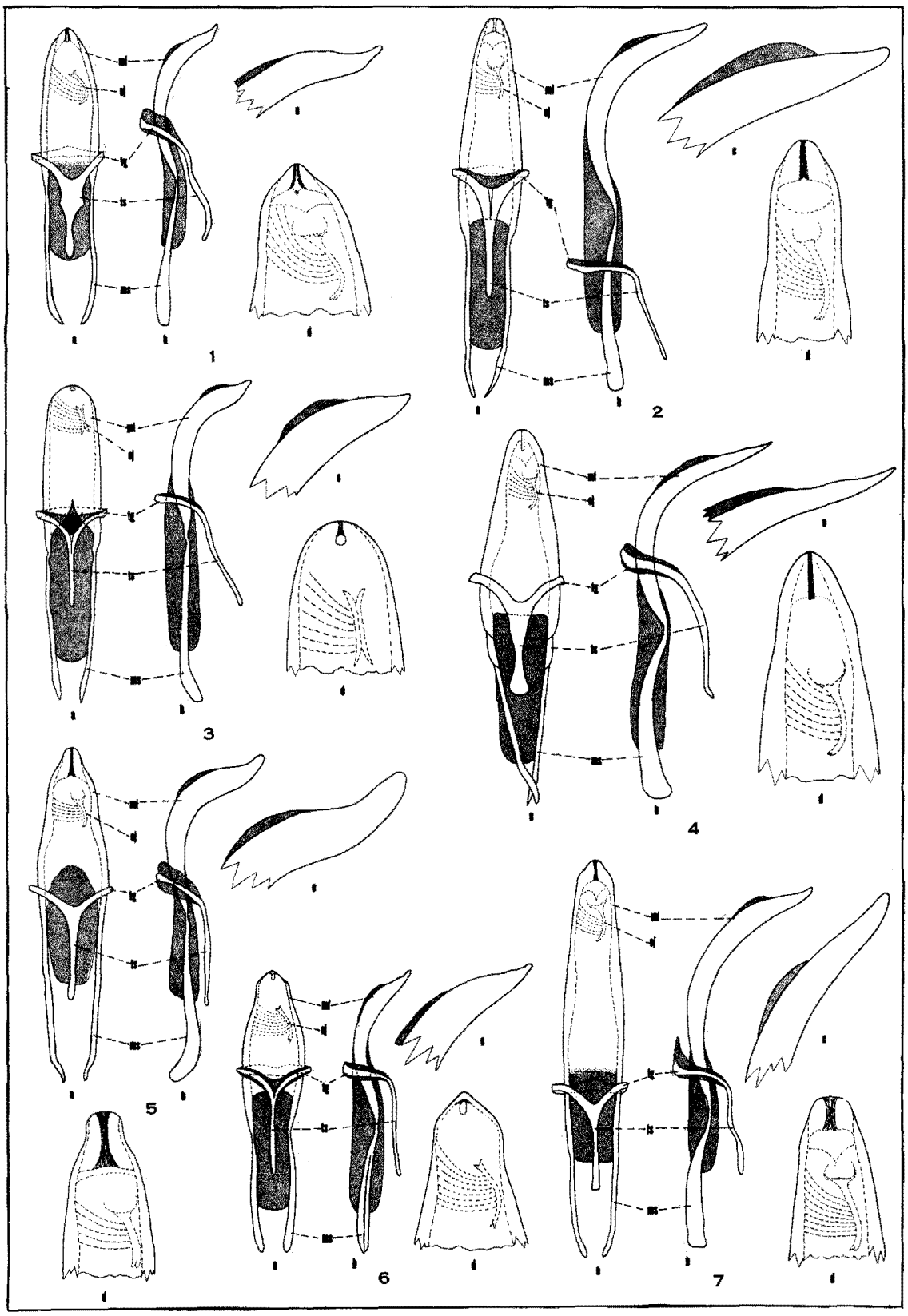
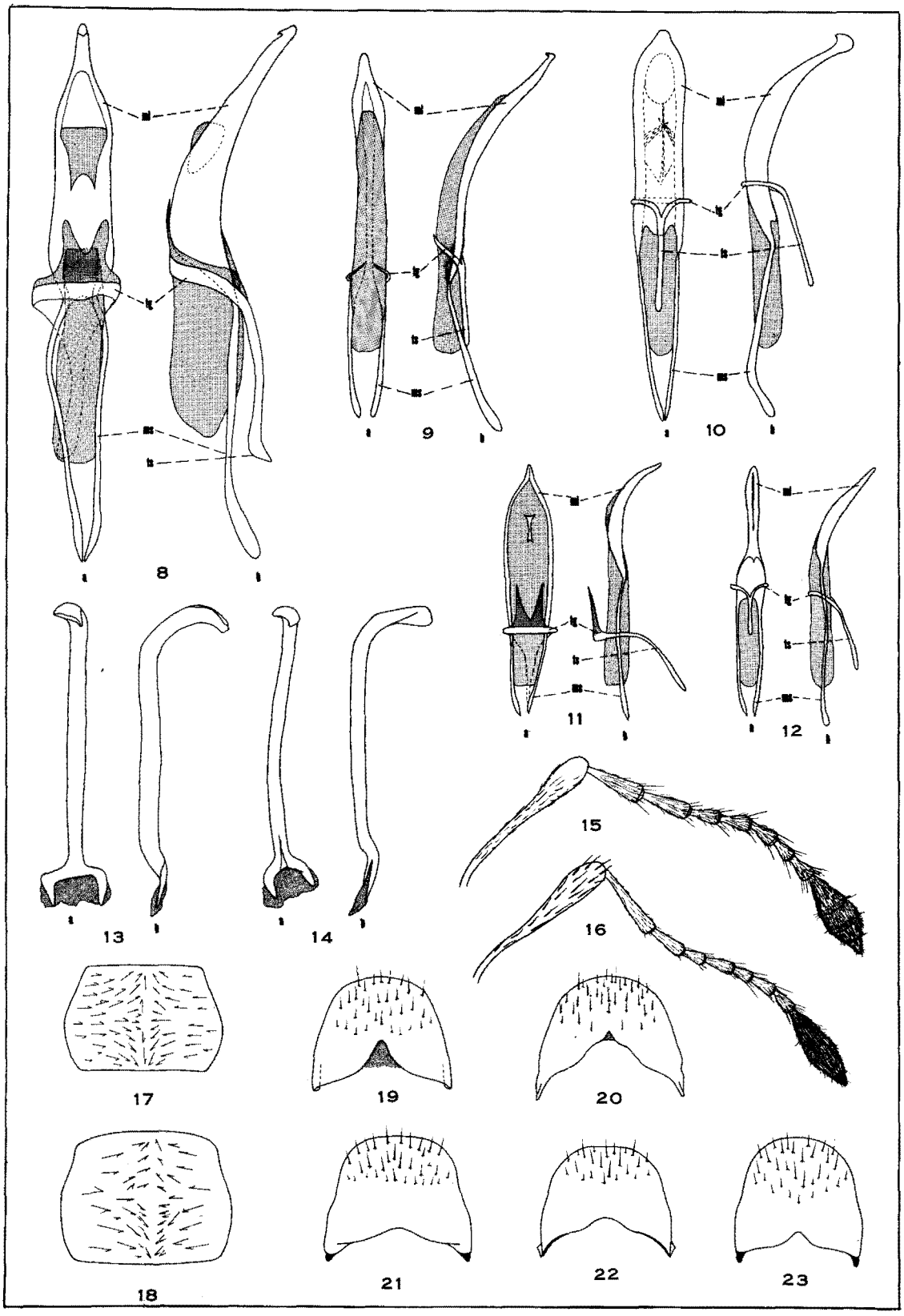


PLATE I



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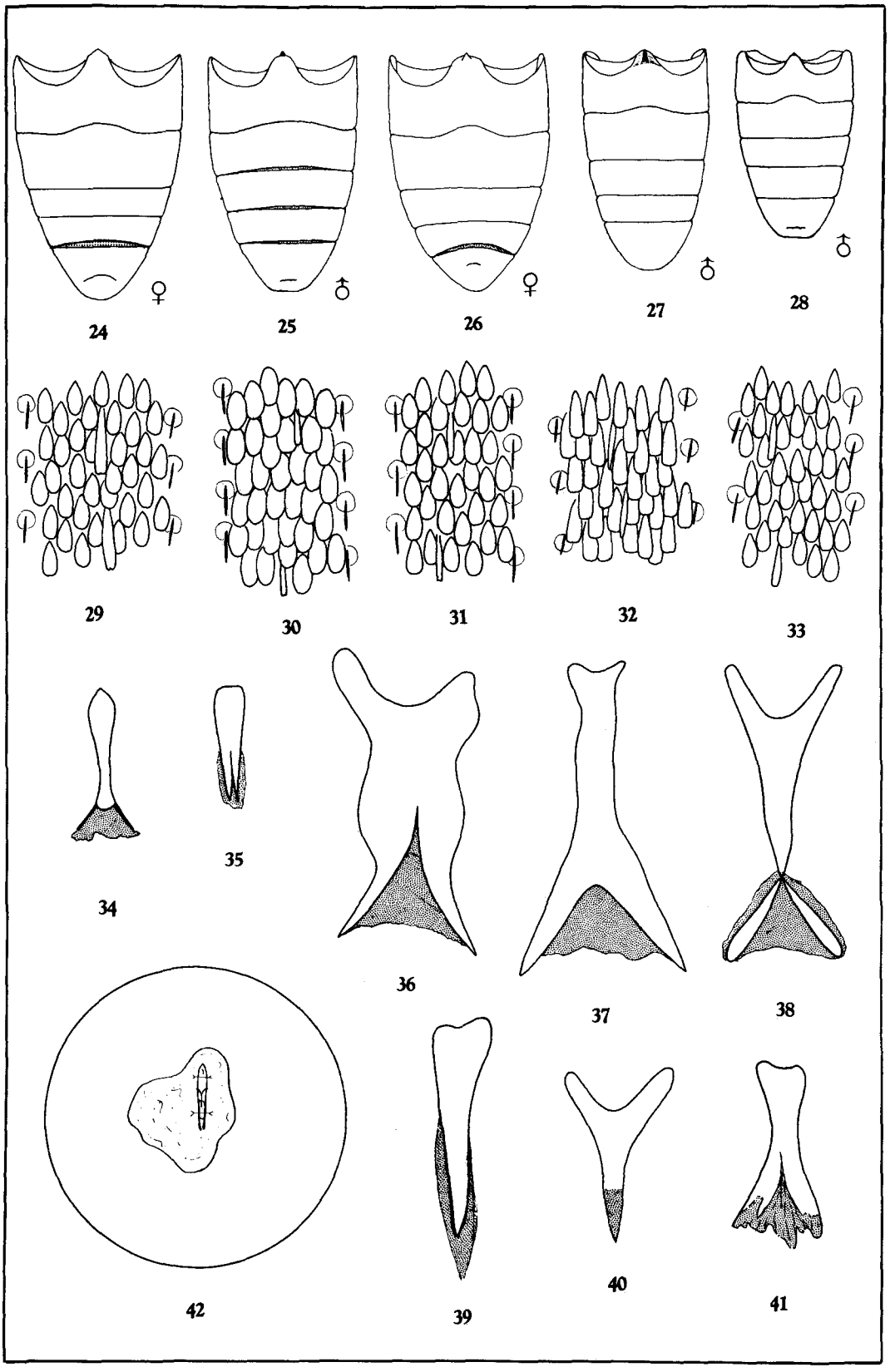

PLATE III

A STUDY OF THE MORPHOLOGY AND SYSTEMATICS OF THE GENERA POLYDRUSUS AND SCYTHROPUS (COLEOPTERA: CURCULIONIDAE)

An Abstract of a Thesis

Presented to the

Department of Zoology and Entomology

Brigham Young University

Provo, Utah

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

by

Gary L. Jensen

July 1963

ABSTRACT

The objectives of this study were 1) to further clarify the status of the genera Polydrusus and Scythropus and 2) to redescribe and elucidate the morphology and distribution of the species of Scythropus in order to better facilitate their identification.

Some 1650 specimens were used in the study and about 300 of these were critically examined for morphological variations of the head, beak, antennae, thorax, elytra, abdomen, integument, legs, genitalia, and eighth tergite and ninth segment of the male. Over one hundred genitalia were dissected and critically examined for good characters. The male genitalia were the most reliable single characters used in separating the species, however, other characters such as variations in antennae, color, vestiture, elytral patterns, integument color, and features of the head and legs were used to describe and further isolate them. A key has been constructed to facilitate more accurate identification of the species of Scythropus, and the distribution is given as well as the host plants when known.

Seventy illustrations were made of the male genitalia, abdomen, pronotum, antenna, elytral vestiture, and the eighth tergite and the ninth segment of the males.

This abstract of a thesis, by Gary L. Jensen, is accepted in its present form by the Department of Zoology and Entomology of the Brigham Young University as satisfying the thesis abstract requirement for the degree of Master of Science.

July 1963