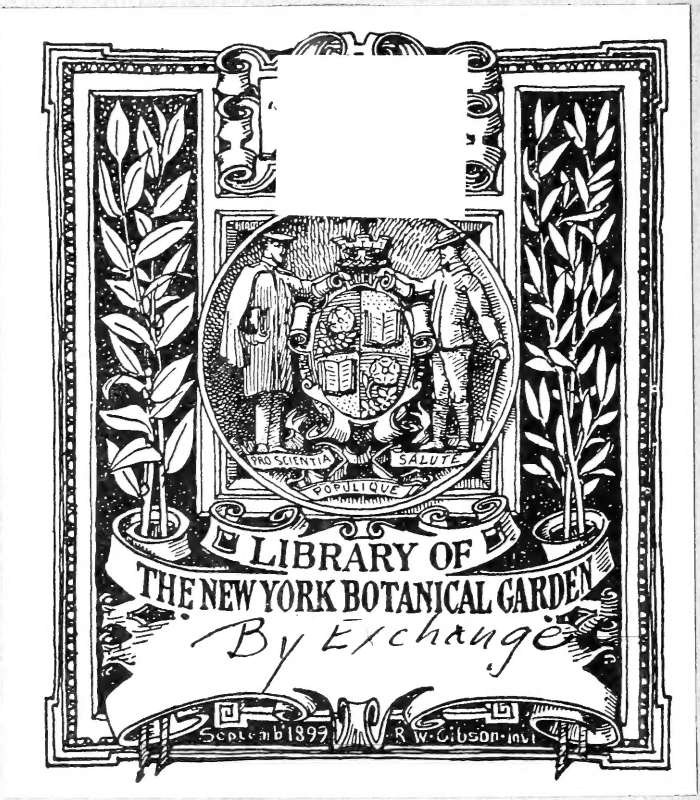
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NOTES ON THE FLORA OF THE CHARLESTON MOUNTAINS, CLARK COUNTY, NEVADA—III

By Ira W. Clokey

Preceding notes were issued in Madrono 4:128-130, 1937, and Bulletin of the Southern California Academy of Science 37:1-11, 1938.

I. Carex interior Bailey subsp. charlestonensis Clokey subsp. nov.

A typica utriculis fortibus nervis ventralibus differt.

Caespitose with dark colored rootstocks, weakly aphylopodic; culms 10-50 cm. high, slender, strict, sharply triangular, slightly roughened on the angles just below the head, longer than the leaves, brown at base; fertile culms arising from a few dried leaves of the preceding year, with 1-3 leaves near the base, but not bunched, usually all with well developed blades, up to 20 cm. long, 1-2 mm. wide, flat or somewhat caniculate, roughened on the margins, sheaths tight, hyaline ventrally, concave at mouth; sterile shoots aphylopodic; spikes 2-4, distinct, close together or somewhat separated, 4-5 mm. wide, terminal gynacandrous, clavate, up to 10 mm. long; lateral spikes sessile, up to 5 mm. long, pistillate or gynacandrous, with up to 20 wide spreading perigynia; bracts scale-like or lower rarely cuspidate but shorter than the subtended spike; scales ovate, blunt, light brown, with distinct hyaline margin, ¾-1 length of body of the perigynia; perigynia substipitate, corky in the lower part, with narrow, thick wings; beak and upper part of body tinged with reddish-brown, serrulate on upper part of body and on beak, ca. 2.5 mm. long, 1.25 mm. wide, widest just above the base, with short beak ¼-⅓ length of body, teeth short, erect, strongly veined both dorsally and ventrally; on ventral side with several strong reddish-brown veins on lower half with 2-3 running full length of body and into beak; achene lenticular, 1½ x 1⅛ mm., ovate, stipitate; styles slightly enlarged at base; stigmas 2.

Location: Charleston Park in damp soil by spring with *Pinus scopulorum* (Engelm.) Lemmon and *Pinus monophylla* T. & F. at an elevation of 2,300 m., June 19, 1937, *Clokey* 7468 (type Clokey herbarium). This is, apparently, the only collection of this subspecies.

The perigynia of *Carex interior* have the ventral face nerveless or with a few nerves on the lower part. When present the nerves are usually weak and of the same color as the body of

the perigynia. The nerves on the ventral face of the perigynia of subspecies *charlestonensis* are strong and distinctly darker than the body of the perigynia. The prominent nerves are, for the most part, confined to the lower part of the perigynia but 2-3 run the full length of the body and into the beak.

Carex interior occurs in the Charleston Mountains (*Clokey* 7871) but is atypical in that the nerves on the ventral face of the perigynia occasionally show the veins darker than the body. The species and subspecies have each been found in a single isolated locality.

II. Silene Andersonii Clokey sp. nov.

Perennis ubique glandulosus, cum laxe ramosa caude; caulibus circa 3 dm. altis, biennis, perumque simplicibus, rigidis, aliquantum geniculatis juxta basim, minute glandulosis inflorescentis; foliis basilaris nullis; foliis caulinis linearibus, acutis, acuminosis ad utrosque terminos, aliquantum supra reductis, grandissimis ad 8 cm. longis, 2-5 mm. latis, foliis inferioribus in petiolum altum gradatim attenuatis, superioribus sellilibus; racemis glandulosis, nudis, cum paucis floribus; calycibus 10-venosis, glandulosis sed non aliter pubescentibus, anguste cylindricis, 10-13 mm. longis cum lobis ovalibus cum marginis albis et hyalinis, circa ¼ longitudine tubae; corollis subviridibus, 13-16 mm. longis, circa 5 mm. latitudine; petalis bifidibus circa 2 mm.; petiolis petalum latioribus quam laminis, glabris aut minute glandulosis marginibus inferioribus, squamis brevibus, semi circulis; staminis et stigmatis inclusis aut aliquantum exsertis anthese; capsulis stipitatis.

Glandular perennial with a loosely branching caudex; stems ca. 3 dm. high, biennial, usually simple, stiff, somewhat geniculate below, minutely glandular to the inflorescence; basal leaves none; cauline leaves linear, acute, tapering to both ends, somewhat reduced upwards, largest 8 cm. or less long, 2-5 mm. wide, lower tapering to a winged petiole, upper sessile; inflorescence a few flowered, glandular, naked raceme; calyx 10-nerved, glandular but not otherwise pubescent, narrowly cylindric, 10-13 mm. long with lobes about ¼ the length of the tube; lobes oval with white hyaline margins; corolla greenish-white, 13-16 mm. long, about 5 mm. wide; petals with somewhat spreading blades which are incised about 2 mm. into two entire lobes; claws wider than the blades, glabrous or minutely glandular along the lower margins; scales short, semi-circular; stamens and styles included or only shortly exserted at anthesis; capsule long stipitate.

Local in southern Clark County, Nevada and eastern San Bernardino County, California.

Nevada: Charleston Mountains, Clark County; on a steep, north slope in Lovell Canyon, associated with *Cercocarpus ledi-*

folius Nutt. and *Artemesia tridentata* Nutt., at an elevation of 2,600 m., August 9, 1937, *Clokey* 7514 (type Clokey Herbarium; isotype California Academy of Science); Trail Griffith's Lodge to mine, among pinyons, in fruit, September 3, 1927; *Jaeger* (Pomona).

California: San Bernardino County, Clark Mountains, June 22, 1930, *Jaeger* (Pomona); Keystone Springs, New York Mountains, elevation 6,400 feet, October 13, 1935, *Munz* 13855 (Pomona).

The two-lobed petal blade and the broad claw indicate a relationship with *Silene columbiana* Howell (*S. Douglasii* Hook. var. *brachycalyx* Rob.). This species differs however in having puberulent not viscid stems, calyx campanulate and inflated and with petals 15-18 mm. long. The corollas 8 mm. or more wide and the narrow claws distinguish *S. Douglasii* Hook., *S. Douglasii* Hook. var. *monantha* (Wats.) Rob., *S. verecunda* Wats. and *S. verecunda* Wats. var. *platyota* (Wats.) Jeps. from *S. Andersonii*. Also the claws of *S. verecunda* and variety are wooly pubescent.

Dr. P. A. Munz kindly compared this material with the specimens in the Gray Herbarium.

III. Gentiana tortuosa Jones.

Proc. Calif. Acad. II, 5:707, 1895.

The identity of this rarely collected gentian has been rendered obscure by published descriptions. Since Jones (original description) and Rydberg (Flora of the Rocky Mountains) disagree, the following observations are presented.

The type (National Herbarium 270748, kindly loaned by Dr. W. R. Maxon) and four collections from near the type locality have been examined: *Hitchcock, Rethke* and *Raadshooven* 4586, and *Eastwood* and *Howell* 7210, 7230 and 7298. In the Charleston Mountains what is considered this species, after comparison with the type of *G. tortuosa,* has been studied three seasons in the field and has been collected in a quantity of several hundred plants.

Both Jones and Rydberg describe this species as an annual. It is a winter annual. This is clearly shown by the Charleston Mountain plants and by all five examined sheets from Utah, including the type. The type is in the fruiting stage and only remnants of the preceding year's leaves remain. Jones considered the plant prostrate. Rydberg more correctly describes it as having spreading branches. The main stem is erect. Some of the lower branches might better be described

as decumbent than prostrate. Rydberg gives the corolla color as yellowish. It is white or with a decided bluish tinge. The length of the calyx lobes, in comparison with the corolla, is quite variable. In *Eastwood* and *Howell* 7230 the sepal lobes are about one-half the length of the corolla. From this the relative length of the sepal lobes passes through the type, *Hitchcock* et al. 4586 to the Charleston Mountain plants where one or two of the sepal lobes exceed the corolla. In the Charleston Mountains most of the plants have a purple color.

Dr. P. A. Munz reports from Gray Herbarium that "what looks like this plant" was distributed from the Charleston Mountains by A. A. Heller, 11072, as *Amarella pumila* Heller sp. nov. No description was published. It is not *G. pumila* Jacq.

It seems advisable to give a description drawn from a greater amount of material.

Compact winter annual, 2-5 (-10) sm. high, glabrous, with short internodes, with numerous spreading branches from the axles, the lower frequently decumbent; leaves purple or green, lower oblanceolate, upper linear to linear lanceolate, 25 mm. or less long, much longer than the internodes; flowers pedicellate, 1-several in the axis of each leaf; calyx deeply incised with narrow somewhat unequal lobes, from ½-as long as the corolla; corolla campanulate, white or tinged with blue, without plaits or folds in the sinuses, 7-10 mm. long, with ovate, acute-obtuse lobes about as long as the tube, with a well developed crown of a few setae; stamens the length of the corolla tube.

IV. Potentilla Beanii Clokey sp. nov.

Perennis cum caude plerumque simplica cum fuscis petiolis et stipulis: caulibus 2-4 (1-6) aptis cuique coronae, *prostratis,* villosis, 4-10 (-15) cm. longis: foliis basalibus paucis, 5 segmentis palmate divisis; petiolis villosis, 4-10 mm. longis; stipulis petiolum pluribus quam semiadnatis, brunneis, glabris exceptis acuminatis, villosis apicibus; foliolis ad 12-15 mm. longis, obovatis, incisis dimidia vel duabus partibus superioribus, villosis ventralibus, villosis et tomentosis dorsualibus; foliis caulibus 1-2, simplicibus ad 5 segmentis palmate divisis, viridicibus, aliquam sericeiis longis in utrisque partibus, aliquam tomentosis dorsualibus; stipulis lanceolatis, viridicibus, villosis: hipanthiis, bractiolis et sepalis viridicibus, villosis, non tomentosis; hipanthiis 4-5 mm. latis in fructu; bractiolis oblongis, obtusis, ca. 2 mm. longis; sepalis lanceolatis, ca. 3 mm. longis: petiolis aureis, obovatis, raro aliquam truncatis, non obcordatis, ca. 5 mm. longis, staminis ca. 20: achenis numerosis.

Perennial with simple or rarely branched caudex covered with dark brown petioles and stipules: stems 2-4 (1-6) to a

crown, *prostrate,* villous, 4-10 (-15) cm. long: basal leaves few, palmately divided into 5 leaflets; petioles villous, 4-10 mm. long; stipules attached to the petioles for more than half their length, brown, glabrous except the acuminate villous tips; leaflets 12-15 mm. long, obovate, incised on upper ½-⅔, villous ventrally, villous and tomentose dorsally; cauline leaves 1-2, simple—palmately divided into 5 segments, green, somewhat long silky on both sides and somewhat tomentose dorsally; stipules lanceolate, green, villous: hipanthii, bractlets and sepals green, villous, not tomentose; hipanthii 4-5 mm. wide in fruit; bractlets oblong, obtuse, about 2 mm. long; sepals lanceolate, about 3 mm. long: petals yellow, obovate, rarely somewhat truncate, not obcordate, about 5 mm. long: stamens about 20: achenes numerous.

P. Beanii has been found only at high elevations on Charleston Peak. Type: *Clokey 7974*, Clokey Herbarium (isotype Carnegie Institute), on a grassy slope with *Pinus aristata* Engelm. on the ridge to the peak, at an elevation of 3,270 m., July 22, 1938. Other collections are; crest of range, elevation 11,500 feet, June 26, 1926, *Jaeger* (Pomona); among broken rock at timberline, with *Pinus aristata* Engelm., elevation 3,300 m., August 8, 1935, *Clokey* 5505 (CI, Clokey); grassy bank with *Pinus flexilis* James and *P. aristata* Engelm. on trail to Charleston Peak, elevation 2,900 m., July 17, 1936, *Clokey* & *Bean* 7144 (CI, Clokey).

This species is separated both geographically and morphologically from *Potentilla concinna* Rich. and *P. concinnaeformis* Rydb., the most closely related species.

A. Stems ascending, not prostrate; leaflets about 7, densely silky on both sides, only slightly if at all tomentose beneath ..... *P. concinnaeformis*

AA. Stems generally spreading to prostrate: leaflets 5, basal leaves densely tomentose below.

B. Low, diffuse; stems many, in the typical form usually spreading; leaves densely white tomentose beneath and slightly tomentose above; hipanthium silky villous and tomentose, in fruit 6-8 mm. wide; bracteolets 3-4 mm. long; sepals ovate, acute, 4-5 mm. long; petals obcordate, about 6 mm. long .... *P. concinna*

BB. Caudex rarely branched; stems few, *prostrate;* basal leaves white silky and tomentose beneath, at least when young, green, silky but not tomentose above; hipanthium silky but not tomentose, in fruit about 5 mm. wide; bracteolets about 2 mm. long; sepals lanceolate, about 3 mm. long; petals obovate, not obcordate, about 5 mm. long ..... *P. Beanii*

Among 800 plants over 96 per cent had the caudex undivided. Of these over 85 per cent had from 2-4 stems. The measurements for the bracteolets and sepals were made on flowers with petals attached. The hipanthii measurements were made on dried specimens where the achenes were well developed but not fully ripe. The maximum measurement was 5 mm.

P. Beanii is remarkable for its uniformity and its prostrate habit.

V. Pedicularis semibarbata Gray var. charlestonensis Pennell & Clokey var. nov.

This California species occurs in the Charleston Mountains in a form that is remarkable for its large flowers and its tendency to bear relatively little cut leaf-blades. (Corolla 20-25 mm. longa; folia pinulis brevibus bipinnatisecta vel fere pinnatisecta.)

Type, wooded hills at the upper edge of the yellow pine belt, Charleston Park, elevation 2,300 m., in flower May 11, 1936, in fruit June 1, 1937, *Clokey* 7718; in the Clokey Herbarium; isotype in the Herbarium of the Academy of Natural Sciences of Philadelphia. Other collections from the type location are: July 3, 1927, *Marcus E. Jones* and May 11, 1936, *Clokey* 7295.

Collections from other stations in the Charlestons are: Clark Canyon, elevation 2,860 m., June 1, 1936, *Clokey* 7294; Lee Canyon, elevation 2,600 m., July 27, 1938, *Clokey* 8123; ridge south of Deer Creek, elevation 2,700 m., in flower May 23, 1937, *Clokey* 7717, in fruit July 14, 1938, *Clokey* 8210; McFarland Springs, elevation 2.425 m., July 4, 1938, *Clokey* 8122.

It is the geographical separation and the combination of two characters, rather than the sharpness of either, that marks this variety of *Pedicularis semibarbata* Gray. Contrasted with the typical, and decidedly variable, California form of the species, the differences would be:

Corolla 12-20 (-22) mm. long; leaf-blades strongly bipinnatifid, the mid-portion very narrow and the lobules well developed, conspicuously spreading ..... *P. semibarbata* Gray var. *typica*

Corolla 20-25 mm. long; leaf-blades usually strongly bipinnatisect, the mid-portion relatively wide and the lobules less developed or obscure ..... *P. semibarbata* var. *charlestonensis*

Pedicularis semibarbata seems to be closely associated with *P. centranthera* Gray, the two forming an alliance to be known

as the CENTRANTHERAE. The dwarf habit, the leaves surpassing the inflorescence, and the mucronate and aristate anther-cells mark this as a natural group. The agreement extends further to the sharp toothing of the bipinnatisect leaf-blades, the long-attenuate calyx-lobes, the lower lip of the dull purple corolla being at least ¾ the length of the beakless galea, and the seeds reaching 4 mm. long. Yet the differences, especially in the capsule, are considerable:

Capsule nearly symmetrical, dehiscing nearly to the base on both posterior and anterior sutures; corolla 27-30 mm. long, glabrous, both upper and lower lips deep purple; anthers long-aristate ..... *P. centranthera*

Capsule unilateral, dehiscing only on the posterior side; corolla 17-25 mm. .long, pubescent externally and on the lower lip internally, both lips more or less yellow, although purple at the apex; anthers mucronate to short-aristate ..... *P. semibarbata*

Isotypes of the above units will be widely distributed.

It is a pleasure to name these two species for friends who have been of special help and whose assistance has facilitated the survey in the Charlestons and made possible the discovery of some plants that would otherwise not have been secured: Forest Ranger R. C. Anderson and former Forest Ranger Russell Bean.

South Pasadena, California

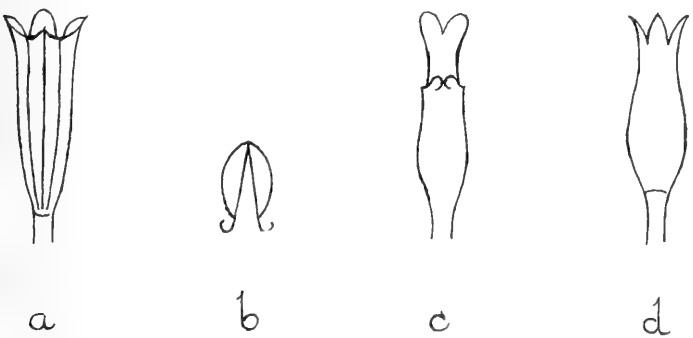

PLATE 1

Silene Andersonii

A. Calyx at anthesis x 2.
B. Calyx lobe x 5.
C. Petal x 2.
D. Mature capsule with stipe x 2.

RECONSIDERATION OF CERTAIN MEMBERS OF PENSTEMON SUBSECTION SPECTABILES

By Ira W. Clokey and David D. Keck

In some sections of the very large genus *Penstemon* the species are morphologically clear cut; in others they are separable with difficulty. The latter condition holds in section *Peltanthera* subsection *Spectabiles*. Here the species and subspecies occupy readily determined and distinct geographic and ecologic areas, but the majority of the systematic units are linked into a network through their basic similarities in form. Each is distinguished by few morphological characters. Evolutionary processes appear to have been very active here and they are probably still in operation. The natural units in many cases are still capable of interchanging genes as evidenced by the occurrence of natural hybrids at several points in the network, and it appears likely that hybridization may play a role in future differentiation in this subsection as it doubtless has done in the past.

This group of species has been revised recently by Keck (1937). In that paper mention has been made of the close connection between *P. Palmeri, rubicundus, floridus, pseudospectabilis, Clevelandii* and *Stephensii*. Four of these species have subspecies so that in all, fourteen recognizable systematic units are involved in this complex. The other five species of *Spectabiles* are more amply distinct from these.

In this species complex, morphological separation of the various units is by small steps, although the extremes are very dissimilar. The origin of these species is open only to speculation at the present time, for no cytological or genetical work has been done on them. Such evidence, when available, should show whether differentiation has proceeded along lines of chromosomal or genic changes, or whether both sorts may have played a part. It should also throw light on the question of whether the invariable and intermediate features of *P. Clutei* are not due to amphidiploidy, with *Palmeri* and *pseudospectabilis* the hypothecated parents. Perhaps amphidiploidy has recurred alsewhere in this complex also. It appears to be an established method of species formation in *Penstemon* as evidenced by the case of *P. neotericus* Keck (Clausen, 1935).

Two reasons for presenting this paper without the desirable cytogenetic evidence available are: first, extensive field work by Clokey on the material retained by Keck (1937) under *P. pseudospectabilis* ssp. *bicolor* have necessitated a new interpreta-

tion in regard to them; second, the facts brought out herein are to be used in a forthcoming flora of Arizona.

Further inquiry into the case of *P. Clutei* has brought out the specific nature of its distinctive characters, particularly the ventricose throat of its corolla, which, together with other features in which *Clutei* is intermediate between *P. Palmeri* and *P. pseudospectabilis* ssp. *connatifolius,* has led to the supposition that it is an amphidiploid species. In Keck's previous treatment, *Clutei* was reduced to subspecific rank under *pseudospectabilis.*

T. S. Brandegee (1916) based his *P. Palmeri* var. *bicolor* on plants collected at Good Springs, Clark County, Nevada, in May, 1915, by K. Brandegee. He states, "The color of the flowers of different plants may be light yellow or purple." This variety was treated by Keck (1937) as *P. pseudospectabilis* ssp. *bicolor.* From the limited material available, he considered the yellow-flowered plant a random color variant of the sort in which the rose-purple pigment fails to develop. This view was strengthened by the study of three separate collections from El Dorado Canyon, not far away, in all of which the flower color was rose-pink or rose-purple.

Discovery of the yellow-flowered form of *P. pseudospectabilis* ssp. *bicolor* in 1937 in the fan below Kyle Canyon, Charleston Mountains, Nevada, led to the search for new stations, to reëxamination of the previously known localities of the subspecies, and to renewed study of the species in herbaria. . Three additional stations were found in the Charleston Mountains; also, Kearney and Peebles extended the known range of *bicolor* into Arizona through their collection of the rose-pink form between Portland Mine and Chloride.

Field Observations on Penstemon bicolor

Good Springs (type locality of *P. Palmeri* var. *bicolor*): The major portion of two days was spent in examining hundreds of plants, probably without covering the entire field. These, so far as observed, are confined to slight elevations in shallow washes and are decidedly uniform in aspect, leaf-shape, flowers and fruit. All had corollas that were yellow or at most merely tinged with pink on the expanded limb with the following exception. In one small area seven plants were found with pink corollas. These were beside the road and this is possibly where Mrs. Brandegee found her pink-flowered specimens. These differed from the yellow-flowered plants only in flower-color, somewhat less glandular calyces and somewhat less glaucous leaves. It was observed that the corolla lobes are erect at first, but by the time the staminode is exserted they are widely spread. At this stage the corollas fall easily. On the type sheets of *P. Palmeri* var.

bicolor no fully expanded corollas are found, so that from these specimens it is impossible to gain a correct impression of the shape of the mature corolla.

At Good Springs, *P. Palmeri* characteristically grows at higher elevations and in better drained situations. Five stray plants of typical *Palmeri,* however, were found growing with *bicolor.* Careful search disclosed only two or three intermediate plants, which seem to be F_1 hybrids, *Clokey* 5849 (CI Clokey).

Nelson: Only the pink-flowered form of *bicolor* was found here. The plants, for the most part, grow on eroded slopes. The leaves are thinner, less coriaceous and glaucous than in the pink form at Good Springs, and the color of the corolla is more uniform. One specimen out of 139 had a glabrous staminode.

Charleston Mountains: On the fan below Kyle Canyon and in the wash below Cottonwood Springs relatively few plants were found, but these were chiefly yellow-flowered. Two pink-flowered plants were found at the former station and one at the latter. Below Mountain Springs only one plant, with yellow flowers, was found in bloom; others were in fruit lower in the wash. At these stations the leaves were somewhat thinner and less glaucous than at Good Springs.

Taxonomic Conclusions

Field observations and the examination of a large number of herbarium specimens have resulted in the following realignment of these units.

A. Staminode included, glabrous; anther-lobes shorter than wide; corolla gradually and moderately inflated, 6-9 mm. wide, with narrow limb; leaves relatively thin ..... 1. *P. pseudospectabilis*

B. Pedicels and calyx glandular-pubescent; leaves glaucous, coarsely serrate-dentate ..... 1a. *P. pseudospectabilis* ssp. *typicus*

BB. Pedicels and calyx glabrous; leaves glaucescent to green, finely serrate-dentate ..... 1b. *P. pseudospectabilis ssp. connatifolius*

AA. Staminode exserted, bearded with long hairs (sometimes glabrous in *Clutei*); anther-lobes at least as long as wide; corolla inflated, with broad limb; pedicels and calyx glandular-pubescent.

C. Inflorescence leafy below; corolla definitely ventricose, 9-12 mm. wide at throat; anther-lobes as long as wide; leaves moderately coriaceous, green to glaucous, finely but sharply serrate-dentate; calyx and pedicels lightly grandular-pubescent ..... 2. *P. Clutei*

CC. Inflorescence not leafy; corolla abruptly inflated but less deeply ventricose, 6-9 mm. wide, somewhat constricted at orifice; anther-lobes longer than wide; leaves coriaceous, coarsely but sharply toothed; calyx and pedicels strongly glandular-pubescent ..... 3. *P. bicolor*

D. Corolla pale yellow, sometimes with pink tinge on lobes; leaves thick and glaucous .... 3a. *P. bicolor* ssp. *typicus*

DD. Corolla rose-pink; leaves medium thick, glaucescent ..... 3b. *P. bicolor* ssp. *roseus*

1. Penstemon pseudospectabilis Jones, Contr. West. Bot. 12:66, 1908.

1a. Penstemon pseudospectabilis ssp. typicus Keck, Amer. Midl. Nat. 18:805, 1937.

P. pseudospectabilis Jones, *loc. cit.*

Southeastern Mohave Desert of California to western Pima County, Arizona.

1b. Penstemon pseudospectabilis ssp. connatifolius (A. Nels.) Keck, *op. cit.* 807.

P. connatifolius A. Nels., Amer. Jour. Bot. 18:437, 1931.

P. Crideri A. Nels., *ibid.* 23:270, 1936. The type, examined by Keck after his 1937 paper was published, proves to be an F_1 hybrid between *P. pseudospectabilis* ssp. *connatifolius* and *P. Eatonii* var. *undosus* Jones. It grew at Superior, Arizona, where the parental species are native; it was morphologically intermediate to these; its pollen was found to be highly sterile on microscopic examination, only 28.5% of the grains being normally developed in contrast to 98% and 98.6% normal development of grains in plants of the parental species chosen at random from the same vicinity.

Common across Arizona from southern Mohave County to Cochise County; eastward to Dona Ana County, New Mexico.

2. Penstemon Clutei A. Nels., Amer. Botanist 33:109, 1927.

P. pseudospectabilis ssp. *Clutei* Keck, *op. cit.* 806.

Local about Sunset Crater, northeast of Flagstaff, Arizona.

3. Penstemon bicolor (Bdg.) Clokey et Keck, comb. nov.

P. Palmeri var. *bicolor* T. S. Brandegee, Univ. Calif. Publ. Bot. 6:360, 1916.

P. pseudospectabilis ssp. *bicolor* Keck, *loc. cit.*

Leaves thick and coriaceous, moderately glaucous, serrate with prominent often caudate teeth; inflorescence strongly glandular-pubescent; corolla abruptly but moderately inflated above the tube, sometimes viscid-puberulent within, usually sparsely villous across the base of the lobes of lower lip, the lips 4.5-7 mm. long with large lobes; staminode exserted and prominently bearded with long yellow hairs.

3a. Penstemon bicolor ssp. typicus Clokey et Keck, nom. nov.

P. bicolor (Bdg.) Clokey et Keck, *loc. cit.*

Brandegee placed the yellow and pink forms together in his variety, which we have now found to be both morphologically and geographically separable. At the University of California there are two sheets that Brandegee took as the type of his variety—one on which the flowers are "light yellow," the other on which they are "purple." Since he mentions the yellow-flowered plants first, we take that sheet to represent the type of the species and of ssp. *typicus*.

Corolla massicot yellow to amber yellow (Ridgeway, Color Standards and Nomenclature, plte 16-21).

Local in southern Clark County, Nevada. Type locality: Good Springs.

Nevada. Good Springs, May, 1915, *K. Brandegee* (C, type), May 2, 1938, *Clokey 5847** (CI, Clokey, topotypes); Cottonwood Springs, June 7, 1938, *Clokey 8138* (CI, Clokey); Kyle Canyon fan, Charleston Mts., May 20, 1937, *Clokey 7696* (CI, Clokey), May 13, 1938, *Clokey 8136** (CI, Clokey); Mountain Springs, Charleston Mts., May 17, 1938, *Clokey 8140* (CI, Clokey).

3b. Penstemon bicolor ssp. roseus Clokey et Keck, subsp. nov.

A subsp. typica foliis minus crassis glaucisque corollis roseis differt.

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* Collections marked with an asterisk are to be widely distributed.

Corolla amaranth pink to Tyrian pink (Ridgeway, plate 12-69).

Local in southern Clark County, Nevada, and western Mohave County, Arizona.

Nevada. Clark County: Nelson (El Dorado Canyon), May 14, 1938, *Clokey 5850** (Clokey, type; isotype CI), 1880, *Davis* (M), *Tidestrom 8834* (Ph), April 30, 1907, *Jones* (CI, Ph, Po, SU); Cottonwood Springs, June 7, 1938, *Clokey 8139* (CI, Clokey); Good Springs, May 15, 1915, *K. Brandegee* (C, FM, M, US), *Clokey 5848** (CI, Clokey); Kyle Canyon fan, May 13, 1938, *Clokey 8137* (CI, Clokey).

Arizona. Mohave County: Portland Mine to Chloride, *Kearney & Peebles 13163* (CI, US).

In conclusion, we suspect both *P. Clutei* and *P. bicolor* have had a hybrid origin. It is possible that they share common progenitors (*P. Palmeri* and *P. pseudospectabilis*). But, differences in the shape of the corolla, length of staminode, texture, cut and distribution of leaves as well as their degree of connation, indicate that *Clutei* and *bicolor* arose at least from very different races of the ancestral species. Furthermore, it is equally plausible that *bicolor*, but not *Clutei*, has a direct phylogenetic connection with *P. floridus* ssp. *Austinii*.

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MICRARIONTAS OF DESERT RANGES BORDERING THE EAST SIDE OF COACHELLA VALLEY AND SALTON SINK, CALIFORNIA

By G. Willett

During a number of years past the writer and his wife have made frequent visits to the desert ranges in the central part of the Colorado Desert, California. A search for land shells has been made in every locality visited, with varying success. The total collection of *Micrariontas* obtained to date, although by far the most complete from the region, still lacks specimens from many localities. A study of this collection, however, has brought to light some interesting facts in distribution which may be worthy of record.

The ranges in the section under discussion are, from northwest to southeast, the Indio and Mecca hills, Orocopia, Chuckwalla, Little Chuckwalla, and Chocolate mountains. These are all separated by expanses of desert floor of varying width, excepting the two Chuckwallas, which are connected by low hills. This mountain region is, on the whole, very rugged and rocky, with sparse vegetation which consists mainly of low brush, with occasional mesquite and palo verde trees, and scattering groves of Washingtonia palms. In some parts of these mountains snails are either entirely absent or very scarce. In many apparently favorable localities search was entirely unsuccessful, and in others the specimens found were almost all dead and bleached. The rarity of some of these snails soon becomes apparent to the field collector. An immense amount of work is necessary in order to obtain even a small representative collection. In most sections a search may be considered successful if a day's hard work moving rocks results in finding two or three living, adult specimens. For instance, on our latest week-end trip 450 miles were traveled by auto, three mountain sides were climbed, and at least ten hours occupied in moving rocks, with a total bag of one living snail (unfortunately albinistic) and half a dozen dead ones good enough to bring in. Any student planning to collect a complete representation of the snails of this region should allow plenty of time to the undertaking.

Below is a list of the species known to inhabit the ranges under discussion, with brief notes on their distribution. As the writer is uncertain as to the character of relationships between

the different forms, and between them and species from other localities, they are treated here as distinct species.

Micrarionta millepalmarum Berry. Indio and Mecca hills. Although the type locality of this snail, Thousand Palms Canyon, Indio Hills, is extremely barren and lacks favorable rock slides, it was found to be fairly easy to collect. Numerous examples were taken from under rocks piled up by storm waters along edges of gullies. An additional locality is in the Mecca Hills, near the Mecca-Blythe highway, at a point about one mile southwest of Shaver's Well. Thirteen specimens secured here are referred to *millepalmarum,* although they are slightly darker in color than typical.

Micrarionta orocopia sp. nov. (Pl. 2, figs. a to c). About the same size as *M. millepalmarum,* but with heavier shell, much darker coloration, and wider brown band at the shoulder. Color nearly like that of *M. chuckwallana,* but differs from that species in much smaller size and less rounded body whorl. Papillae on early whorls in diagonal rows, as in the *M. rowelli* group. Distribution, Orocopia Mountains.

Type, No. 1060 Los Angeles Museum. Type locality, rock slide on side of canyon on south slope of Orocopia Mountains, about two and one-half miles north of Dos Palmas Spring, Riverside County, California. The type and about sixty additional specimens collected by G. and Ora A. Willett, January 1, 1939. Paratypes in Academy of Natural Sciences of Philadelphia, and California Academy of Sciences. Measurements of type: Max. diam., 14; min. diam., 11.5; alt., 8.2 mm. The largest specimen taken (defective) measures: Max. diam., 15.3; min. diam., 12.4; alt., 8.2 mm.

Near the northeastern extremity of the Orocopia Range, at a point about twenty miles distant from the type locality, eight rather poor specimens were taken that appear referable to this species.

Micrarionta rixfordi Pilsbry. Eight specimens secured at the northeast end of the Orocopia Range. The valley is only about three miles wide between this point and the Eagle Mountains, where *rixfordi* is the only known species. Although the eight specimens of *M. orocopia* mentioned above were taken within one-half mile of this lot of *rixfordi,* the peculiar, irregular arrangement of papillae on the early whorls of the latter species easily distinguishes it.

Micrarionta chuckwallana Willett. Secured in two localities in the Chuckwalla Mountains, the type locality, near Corn Springs, and near Chuckwalla Spring. In the latter locality four examples were taken, together with specimens of the next species.

This, the largest helicoid known from the region, is apparently rare in both localities where it was found. A considerable amount of work was required to produce a small series, mostly of imperfect specimens.

MICRARIONTA BRUNNEA Willett. Apparently confined to the southeast end of the Chuckwalla Mountains, the type locality being near Chuckwalla Spring. Although this species appears rather closely related to *M. millepalmarum,* there is evidently considerable territory intervening between the ranges of the two. The fact that this and the last species were collected together is very interesting, and a feature apparently not previously recorded among our California *Micrariontas.*

On December 26, 1938, the writer and his wife visited the Little Chuckwallas for the first time. After getting within about three miles of the range by auto, the remainder of the distance was covered on foot. A three hours' search at a point about six and one-half miles west of Wiley Well turned up about twenty fairly good shells. These are mostly cream-colored, immaculate, but six or seven specimens show very faint traces of a band at the shoulder. They probably represent an albinistic colony of *M. brunnea.* At any rate, it appears inadvisable to give them a new name, as some specimens are practically indistinguishable from unbanded examples of *M. mccoiana,* from the McCoy Mountains, although, in series, the Little Chuckwalla shell is browner. The tendency to albinism in these two forms probably furnishes an example of parallel development, one (*mccoiana*) being derived from *M. unifasciata,* and the other from *M. brunnea.*

MICRARIONTA CHOCOLATA Willett. This species, undoubtedly a close relative of *M. chuckwallana,* is, so far, known only from the type locality, near Beal's Well, Chocolate Mountains. It is apparently a rare shell, a recent search of four or five hours near the type locality having failed to produce a single good specimen. It is hoped that collecting trips can be made to other sections of the Chocolate Mountains in the near future.

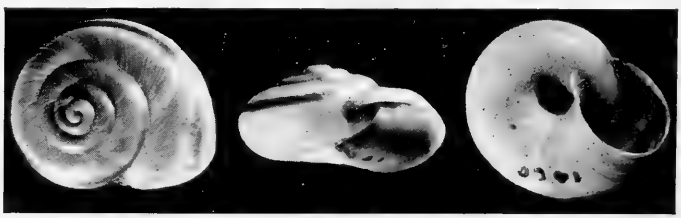

PLATE 2

Micrarionta orocopia Willett.

Type x 2.

A NEW CALIFORNIA SCARABAEID, WITH NOTES

(COLEOPTERA—SCARABAEIDAE)

By Mont A. Cazier
University of California

The author would like to express his thanks and appreciation to Mr. L. W. Saylor who compared material with Linell's types and to Dr. E. C. Van Dyke, H. B. Leech, P. C. Ting, F. H. Parker and F. T. Scott for loans of material.

Gymnopyge hirsuta Cazier, new species

Small, robust, densely pilose; head, pronotum, base of elytra and narrow sutural stripe black, remainder of elytra semi-transparent, pale yellow Male—Head as wide as apex of pronotum, vertex impunctate, granulose, front and clypeus densely, shallowly, confluently punctate, rather densely clothed with long white pile; clypeus with suture distinct, side margins flexed upward, slightly converging in front, angles rounded, front margin flexed prominently upward, straight and at right angles to sides; antennae nine-segmented, scape and funicle piceous, club black. Pronotum widest at middle, asperately punctate, granulate, discal punctures separated by two to three times their own widths, sides densely punctate, each puncture with a long white hair. Elytra semi-transparent, widest at basal third, gradually tapering apically, tips separately rounded; narrow basal band, humeral umbones, scutellum and suture black; irregularly, shallowly, rather densely punctate, each puncture giving rise to a white hair, those on the base as long as on pronotum, becoming gradually shorter apically. Beneath black, legs piceous to black, body densely clothed with long white pile, ventral abdominal segments and propygidium with both long erect and long appressed white pile, pygidium granulate, shallowly, irregularly punctate, clothed only with long erect white pile; legs short, stout, femora and tidiae clothed with long white pile, claws as long as fifth tarsal segment, shallowly cleft at tip. Length 5.5 mm., width 2.8 mm.

Female—Differs from the male in being more robust, by having the pronotum reddish-brown, elytral apices blunt not as angulate as in the male, and the legs reddish-brown. Length 6.0 mm., width 3.1 mm.

Holotype male, allotyype female in the author's collection, collected at Cronise Lake, San Bernardino County, California,

April 28, 1937, on flowers of *Geraea canescens* by the author. Eighteen female, thirty-nine male topotypical paratypes collected by H. B. Leach, P. C. Ting and the author. Three male and one female paratypes collected at Florence, Arizona, April 18, 1935, by F. H. Parker.

The series is remarkably uniform considering the variation present in the closely allied *G. coquilletti*. The size varies from 5 to 8 mm. The basal black markings on the elytra are occasionally a little wider than in the type. *G. hirsuta* can be readily separated from *hopliaformis, pygmaea* and *coquilletti*,[1] the only other members of the genus, by its pale semi-transparent elytra, through which the hind wings can be plainly seen, by the dense and very long pile on the pronotum and base of elytra. Specimens preserved in alcohol lose the transparency of the elytra and the pile becomes matted.

During the course of this short study a large number of specimens of *coquilletti* and *hopliaformis* were examined and a number of interesting variations in the supposed diagnostic characters found. The male genitalia of *hopliaformis, coquilletti* and *hirsuta* are practically the same, differing only in very slight proportions. The antennae vary as to the number of segments between eight and ten. *G. coquilletti* is extremely variable in size and coloration, ranging from small black males to large reddish-brown females. The teeth on the front tibiae are also variable, *hopliaformis* generally having two but often three. The above variations are not confined to this genus in the *Macrodactylini* but are also present in the genus *Coenonycha*.

Since members of this genus are comparatively rare in collections it seems desirable to give the additional distributional data at hand.

G. COQUILLETTI Linell

Several hundred specimens representing many variations were taken at Ludlow, San Bernardino County, California, April 30, 1937, on *Geraea canescens* by H. B. Leech, P. C. Ting and the author; Anlauf, Oregon, July 27, 1928, by Thomas Craig (Calif. Acad. Sci.); Wellton, Arizona, April 15, 1938 (F. H. Parker), on mallow; Yermo, San Bernardino County, California, May 15, 1937 (F. T. Scott).

G. HOPLIAFORMIS Linell

A rather uniform series of about fifty specimens from Oro Grande, Los Angeles County, California, May 18, 1917 (R. T. Garnett); Palm Springs, Riverside County, California, March

[1] Linell, M. L., 1896, Proc. U. S. Nat. Mus., 18:724.

29, 1916 (C. L. Fox); Dos Palmos, Colorado Desert, California, July 17, 1933; Owens Lake, Inyo County, California, May 20, 1930 (F. T. Scott).

In a recent review of the *Chasmatopterinae*,[2] L. W. Saylor gave the known distribution of the supposedly uncommon members of the genus *Chnaunanthus*. The additional notes to follow will be of interest.

C. FLAVIPENNIS (Horn)

This species recorded previously from Utah and Arizona was taken by the hundreds at Cronise Lake, San Bernardino County, California, April 28, 1937 (Leech, Ting, Cazier) on Compositae; Oatman, Arizona, April 16, 1937 (A. E. Michelbacher); Essex, San Bernardino County, California, April 29, 1937 (Cazier); Welton, Arizona, April 15, 1938 (F. H. Parker).

C. CHAPINI Saylor.

The only other described species in the United States was taken sparsely at Cronise Lake, San Bernardino County, California, April 28, 1937 (Leech, Ting, Cazier) and in abundance at Ludlow, San Bernardino County, California, April 30, 1937 (Leech, Ting, Cazier) on Compositae.

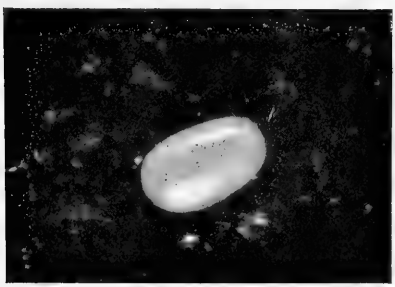

PLATE 3

Egg of *Oidaematophorus grandis*, enlarged x 33.

[2] Saylor, L. W., 1937, Journ. Wash. Acad. Sci., 27:531-535.

EARLY STAGES OF CALIFORNIA PLUME MOTHS —No. 1

(*LEPIDOPTERA—PTEROPHORIDAE*)

By W. Harry Lange, Jr.
University of California, Berkeley

This paper is intended as the first of a series dealing with the early stages of California plume moths, being especially concerned with those of the central California coastal region.

The author would like to express his appreciation to Mr. T. Bainbrigge Fletcher of England, and Mr. August Busck of the United States Bureau of Entomology and Plant Quarantine for determinations of several of these species. The host plants have been determined by Dr. H. L. Mason, Department of Botany, University of California. For the photographs illustrating the stages acknowledgment is made to Mr. W. C. Matthews, photographer for the University of California. Thanks are due Professor E. O. Essig of the University of California, under whose guidance the present study has been made.

Oidaematophorus grandis (Fish).[1] (*Pterophorus baccharides* Grinnell[2]). The mature larva, pupa, and larval habits of this very interesting wood-boring plume moth have been described by F. X. Williams[3] in 1909. Undoubtedly our knowledge concerning the distribution of this species will be increased with further search as the known range includes coastal California, Florida, Mexico, and Quatemala.

On June 24, 1937, adults emerged from infested stems of *Baccharis pilularis* collected at Half Moon Bay, California. On June 25 a pair were placed in a battery jar with a shoot of *Baccharis* and a dish of sucrose solution. Matings occurred on the night of June 28, 29 and 30, with a total of 138 eggs being laid on the under surface of the leaves and on the glass sides of the jar.

Egg: Elongate—oval; glossy. Average length 0.518 mm., average width 0.310 mm. Color, pale yellowish. Laid on horizontal or vertical axis to leaf.

The incubation period of the egg was 21 days under outside temperatures.

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[1] Can. Ent., vol. 13, p. 141, 1881 (orig. desc.).
[2] Can. Ent., vol. 40, p. 317-318, 1908 (orig. desc.).
[3] Ent. News, vol. 20, p. 60-62, 1909.

First instar larva: Length 1.10 mm. Color, yellowish. Body robust, slightly narrowed posteriorly. Head large, dark brown in color; a W-mark on cervical shield. Anal plate dark, armed with long setae. Spiracles brown-ringed. True legs and pro-legs concolorous with body. Duration of instar 15 days.

Second instar larva: Length 2.2 mm. Color, background whitish with reddish-brown markings; a partial lighter dorsal longitudinal line with indefinite brownish markings; a lateral, oblique, brownish-red dash on each abdominal segment. Head large; color brown; glossy; ocelli ring darker. Cervical shield reddish-brown. Anal plate with two chitinized outwardly projecting processes, as in mature larva. Spiracles brown-ringed. Setigerous tubercles inconspicuous. Setae light-colored, long. All legs concolorous with body.

The larval instars between the second instar and the mature larva were not recorded.

Mature larva: Length 20 mm. Color creamy-white with reddish-brown or purplish markings; a dorsal purplish longitudinal line; an oblique sub-dorsal purplish dash on each abdominal segment; a purplish dash cephalad of each spiracle. Body slightly depressed, more robust anteriorly, slightly tapering posteriorly. Head brown; mandibles darker, with four blunt teeth; clypeus reduced; ocelli ring of 6 raised ommatidia. Cervical shield brown, with slight granulations. Abdominal segment 8, above, with granulations. Abdominal segments 9-10 transformed above into a chitinous plate projecting obliquely posteriorly, with two forcep-like processes arising from a slightly raised disc; plate coarsely granulate and periphery with long hairs. Spiracles brown-ringed. Setigerous tubercles inconspicuous. Legs concolorous with body. Crochets in a uniordinal semi-circle.

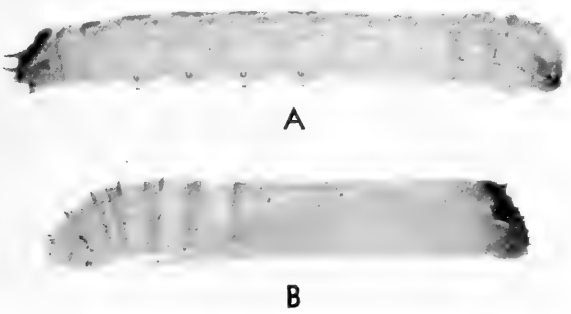

PLATE 4

A. Mature larva of *Oidaematophorus grandis*, enlarged approximately x 4.

B. Pupa of *Oidaematophorus grandis*, enlarged approximately x 4.

Pupa: Length 14-18 mm., greatest width 3 mm. Slender, cylindrical, slightly narrower toward center. Wing cases and appendages a light yellowish-brown; rest of body cream-colored with reddish markings on dorsal part of abdominal segments. Cephalic end obliquely truncate with long hairs and spine-like processes; dorsally a row of forwardly projecting hairs and a few scattered hairs below; a transverse row of spine-like processes ventrad and anterior of the dorsal row of hairs; developed spines at base of the antennae and base of wing cases; rest of cephalic end roughened and with small spines and hairs. Antennae reaching two-thirds of distance to end of appendages. Leg appendages projecting free to center of sixth abdominal segment. Spiracles slightly raised; brown in color. Abdominal segments with setae; on segments 4-9, a transverse row of spines which on segments 4, 5 and 6 are directly cephalad and on 7, 8, and 9 caudad; a group of sub-stigmatal spines on segments 4-9, being more developed on the posterior segments. Cremasteric end blunt and set with a semi-circle of spines.

The writer's observations concerning the larval habits of this insect agree with those of F. X. Williams. Adults emerge from May to September, with a peak of emergence during June for Half Moon Bay. Larvae were found to overwinter in the cylindrical burrows, where they move freely up and down the cylindrical passages. The hook-like processes evidently enable the larvae to move freely in the smooth burrows. Pupation occurred during June in the Half Moon Bay area, in the smooth burrows, without attachment of any kind; in fact, the pupae move freely in the larval burrows, being especially adapted for movement because of the specialized cephalic end and the spines of the abdominal segments. There is but a single generation a year as was indicated by Williams. No parasites were reared,

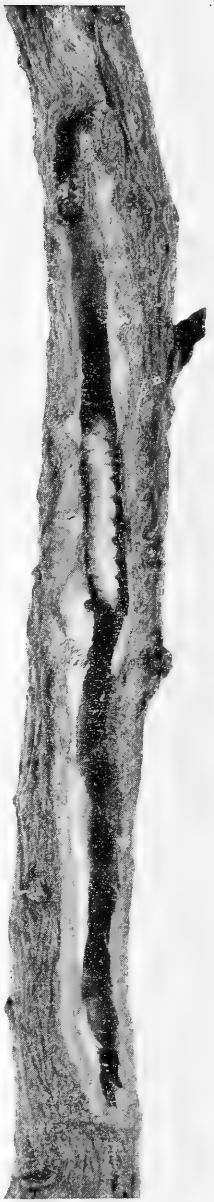

PLATE 5

Larval burrow *of Oidaematophorus grandis*, in stem of *Baccharis pilularis*, enlarged approximately x 1¼.

although *Pimpla pterophorae* Ashm. has been reported reared from a pterophorid in stems of *Baccharis pilularis* at Los Angeles in May.[4]

Oidaematophorus phoebus Barnes and Lindsey.[5] Larvae of this species were collected on *Gnaphalium decurrens* var. *californicum* on January 13, 1938 at Carmel, California, one of the type localities.

Mature larva: Length 8 mm., greatest width 1.8 mm. Depressed, tapering posteriorly. Color, light green. Setae multiple, white, long. Setigerous tubercles white. A dorsal interrupted line of green, running longitudinally; a sub-dorsal, interrupted green line. Head somewhat retracted; color, light-brown with darker speckling. Body covered with secondary setae. Legs concolorous with underside of body.

Pupa: Length 8-9 mm.; width at mesothorax 1.76 mm. Angulate; widest at mesothorax and tapering posteriorly. Color a yellowish-white with dark brown to blackish markings; abdominal segments marked sub-dorsally with a black spot on each side and interrupted longitudinal dark-brown streaks; a black spot on each side of the mesothorax and a larger angulate black spot on each side below these; wing cases more yellowish and grooved with dark reddish-brown streaks; segments of antennae differentiated by darker color; legs and maxillae marked with reddish-brown; eyes partially marked with black; lateral longitudinal black lines on the abdominal segments extend from the wing cases to the end of the eighth segment. Front truncate. Prothorax produced upwardly, forming a longitudinal depression, ridged on each side, which extends posteriorly along the dorsal area of the abdominal segments. Spiracles slightly produced, black ringed. Cremasteric end produced with many hooked setae.

The larvae of this species feed on the parenchyma layer of the leaves leaving the epidermis. The pupal stage was 26 days under inside laboratory conditions.

These reared specimens seem to fit Barnes and Lindsey's description of *phoebus* perfectly. They are darker than examples from San Francisco, California.

Oidaematophorus meyricki Barnes and Lindsey.[6-7] Larvae of what has been taken as this species were collected on March 17, 1938, at Half Moon Bay, California, feeding on *Eriophyllum staechadifolium*. One larva pupated on April 5, with an adult emerging on April 27.

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[4] Insect Life, vol. 3, p. 461, 1890.

[5] Pter. of Amer. North of Mexico, p. 406, 1921 (orig. desc.).

[6] Barnes and Lindsey, Pter. of Amer. North of Mexico, p. 397, 1921 (orig. desc.).

[7] The writer is indebted to T. Bainbrigge Fletcher for determination of this species. The specimens are larger than San Diego examples, but agree in other details.

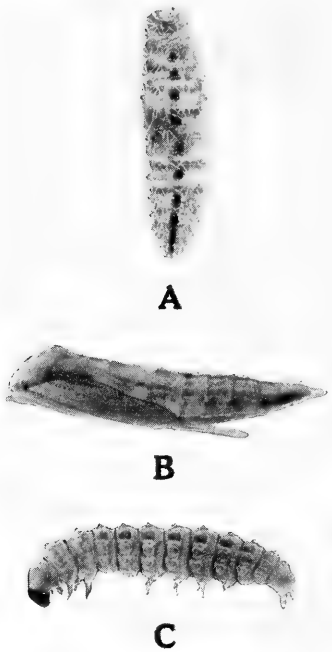


PLATE 6

A. Mature larva of *Oidaematophorus phoebus*, enlarged approximately x 4.
B. Pupa of *Platyptilia albiciliata*, enlarged x 5.
C. Mature larva of *Trichoptilus californicus*, enlarged x 5.

PLATYPTILIA ALBICILIATA Walsingham.[8] On April 17, 1938, several larvae of this species were collected along with larvae of *Platyptilia acanthodactyla* Huebner on the Seaside Painted Cup, *Castilleia latifolia* var. *wightii* growing near the ocean at Sharp Park, San Mateo County, California.

Adult specimens here regarded as *albiciliata* are of a dull cinnamon-brown color with an indication of a dark spot before the cleft of the primaries. Scale tufts are lacking on the inner angle of the primaries distinguishing it from *carolina* Kearf., and the uncus is broadly spatulate as figured by Fernald.[9] As the host plant is reported as far north as Mendocino County and Walsingham's types are from along the coast in Mendocino County, it seems highly probable that this is Walsingham's species. Adults emerged during May and June.

[8] Walsingham, Pter. of Cal. and Ore., p. 17-18, 1880 (orig. desc.).
[9] Fernald, Pter. of North Amer., p. 80, fig. 8, 1898.

Mature larva: Length 12 mm.; width at segment 6, 1.9 mm. Body tapered gradually posteriorly. Color, pale green. Head green with darker blotches; black at ocelli ring; mandibles darker. Cervical shield green, armed with long setae which project forwards over the head. Setae, white, simple, from conical, brown-ringed tubercles. Entire body clothed with white-tipped secondary setae which emerge from a dark base and are dilated apically; also set with dark spinules which show up only under magnification. Stigmata, brown-ringed. Legs concolorous with body. Pro-legs stalk-like. Crochets hook-like, 8-9, arranged in a uniordinal semi-circle.

Pupa: Length 11 mm., greatest width at mesothorax 2 mm. Angulate. Color a dark reddish-brown. Mesothorax produced dorsally and posteriorly to a point from which project two ridges anteriorly and posteriorly extending as separate ridges to abdominal segment 3. Slightly narrowed at first abdominal segment, then enlarged posteriorly. Wing cases show the presence of veins. The appendages are produced to the end of the fifth abdominal segment. Cremasteric end produced, furrowed medially as seen from a dorsal view; divided into two areas of attachment each of which are set with numerous hooked setae.

The pupa is naked, attached by the cremasteric end to the leaves or stems of the plant. When disturbed it makes a spasmodic movement bending at the fifth and sixth abdominal segments, throwing the anterior part of the body backwards. It differs from the pupa of *P. acanthodactyla* Huebner in lacking the dorsal blade-like processes and in the dark reddish-brown color.

Trichoptilus californicus Walsingham.[10-11] Larvae of this species were collected on *Isocoma veneta* var. in the Panoche Hills region, Fresno County, California on April 9, 1938. On April 24, a larva was collected on *Grindelia* at Antioch, Contra Costa County, California which proved to be the same species.

Mature larva: Length 7 mm. Color gray-green. Body tapered slightly anteriorly and posteriorly from the middle. Head black. Cervical shield, green, set with anteriorly projecting setae. Setae arising from well developed tubercles; one or two from a tubercle; setae are thickened and knobbed apically. Intersegmental areas and ventral areas covered with small, black spinules. Occasional short, white, secondary setae are also found which are knobbed apically. Anal plate armed with long setae. True legs black; prolegs slender, stalk-like; crochets 6-7 in number, hooked and arranged in a uniordinal semi-circle.

Pupa: Length 7 mm.; greatest width 1.8 mm. Color light green. Angulate and covered with long, whitish setae. A com-

[10] Walsingham, Pter. of Cal.-Ore., p. 60-62, 1880 (orig. desc.).

[11] T. Bainbrigge Fletcher kindly confirmed my determination of this species.

pound setigerous tubercle bearing two setae are found on the abdominal segments, located sub-dorsally; that of the third abdominal segment, with a black base. Small nodule-like projections are scattered over the surface. The large hairs of the abdomen are slightly swollen apically. Mesothorax produced upwardly. Prothorax produced forward on each side and with an outwardly projecting ridge at the base of the antennae. Eyes and maxillae darker than the rest of the appendages. Wing cases hairy, with hairs lacking swollen tips. Appendages reach to end of sixth abdominal segment. Cremaster divided into two areas, one group of hairs terminally and another on the venter of segment 7. Abdominal segments 4, 5, 6 are movable, and 7-8 fused.

On *Isocoma* a larva pupated on April 22, with an adult emerging May 15. A larva from *Grindelia* pupated May 10 with the adult emerging May 23.

A NEW PLUME MOTH FROM ARIZONA

(LEPIDOPTERA—PTEROPHORIDAE)

By W. Harry Lange, Jr.
University of California

Through the courtesy of Dr. John A. Comstock I have had the opportunity of studying a *Platyptilia* species which apparently can most conveniently be placed close to *percnodactyla* (Walsingham) and *carduidacyla* (Riley), although in coloration it appears to be more like *williamsii* Grinnell.

Platyptilia percnodactyla (Walsingham) was described in 1880[1] from specimens collected in Shasta County, California. There has been some doubt as to its distinctness from *P. carduidactyla* (Riley), but a long series of *carduidactyla* reared from thistles by the author fails to show any reduction in the scale tuft of the third feather of the hind wings as found in *percnodactyla*. Until the life history of *percnodacyla* is known it is perhaps better to retain both as distinct species.

[1] Pterophoridae of California and Oregon, p. 18, 1880.

The artichoke plume moth, *Platyptilia carduidactyla* (Riley) was described in 1869[2] from bull thistle, *Cirsium lanceolatum*. In California it is found on a great many *Cirsium* thistles and on the globe artichoke, *Cynara scolymus*.

Platyptilia williamsii Grinnell was described in 1908[3] from specimens collected by F. X. Williams at Lake Merced, San Mateo County, California.. In California the larvae are general feeders on composite plants, and the author has taken it at the type locality feeding on *Erigeron glaucus* and *Achillea millefolium*.

It gives me a great deal of pleasure to dedicate this species to Dr. John A. Comstock who collected part of the type series, and who kindly allowed me to study this species in the Los Angeles Museum.

Platyptilia comstocki Lange, new species.

Alar expanse 25 mm. Palpi slender, moderately long; length 0.9 mm.; approximately 2 x width of eye; color warm brown with few whitish scales near base. Head concolorous with palpi, with lighter scales; frontal tuft produced bluntly to middle of third palpal segment; upcurved distally; two tufts of hair between antennae, and a few long hairs above eye. Eyes reddish-brown. Antennae brown; basally with indication of dotting; underneath toward base with lighter scales. Thorax concolorous with head with scattered white scales; metathorax with light scales. Patagiae with intermixed light and dark scales. Ground color of forewings a dull reddish-brown with grayish cast; microscopically composed of white, dark brown and yellowish scales. Forewings cleft ¾ distance from base; termen of first lobe directed obliquely inwardly, of second lobe also oblique with contour slightly more curved. Basal half of wing uniform grayish-brown. A dark triangle preceding cleft, but set off from cleft by a yellowish-brown oblique area. Terminal area with an oblique yellowish-brown line crossing both lobes, although more indefinite in the second. Costal margin uniform brown except light area beyond triangle. Apex produced. Cilia of first lobe darker basally, apically white; grayish at anal angle; along cleft, white. Cilia of second lobe darker basally and grayish apically. Inner angle with two scale tufts; a more pronounced one just beyond ½ the distance from the base; a weak tuft this side of ¾ the distance from the base of wing; cilia grayish. Hindwings

[2] Mo. Rept. 1, p. 180, 1869.

[3] Notes on the Pterophoridae or plume moths of Southern California with descriptions of new species. Can. Ent., vol. 40, p. 315, 1908.

dull brown. Cleft first from before center and again near the base. Lobes not much inflated, but slender. Third lobe with a weak scale tuft of equal scales at the center of the lobe. Cilia grayish. Abdomen uniformly brown except for a few white scales. (Removed from type to make genitalic mount.) Legs slender, brown, no outstanding markings. Tarsi of third pair of legs with segments 2-3 lighter in color. Tibia with two pairs of spurs; one approximately ⅓ the length of the tibia from the tarsus; one at the junction of the tibia and tarsus; slender; inner spur longer. Male genitalia similar to *pernodactyla* and *carduidactyla*. Harpes slender; uncus beak-like; aedeagus well developed. Female genitalia not known.

Type, male, collected by Dr. J. A. Comstock in the White Mountains, Arizona, May 26, 1934.

Eight paratypes, several in poor condition, males, collected as follows:

Two specimens, same locality, June 18, 1935, collected by Dr. J. A. Comstock.

One specimen, same locality, and collector, June 30, 1935.

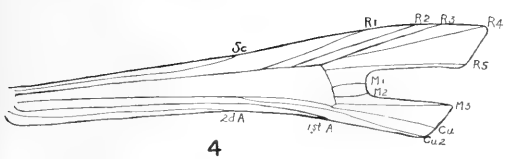
Five specimens, collected at Turkey Creek Road, White Mountains, Arizona, by R. H. Andrews and Lloyd M. Martin, June 6, 1937.

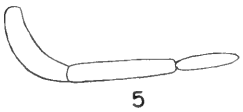
The type is apparently a newly emerged specimen, the paratypes being somewhat rubbed and slightly lighter in color.

The life history which is not known should throw more light upon the exact relationship of this species.

Platyptilia comstocki is readily separated from *percnodactyla* by the brown coloration, and slender wings with oblique outer margin. Both *carduidactyla* and *williamsii* have a triangular scale tuft on the third lobe of the hindwings, although more indefinite in the latter, which will separate these species. They also show differences in coloration and the shape of the forewings from *comstocki*.

Type to be deposited in the collection of the Los Angeles Museum and paratypes in the author's collection, San Francisco Academy of Sciences and the U. S. National Museum.





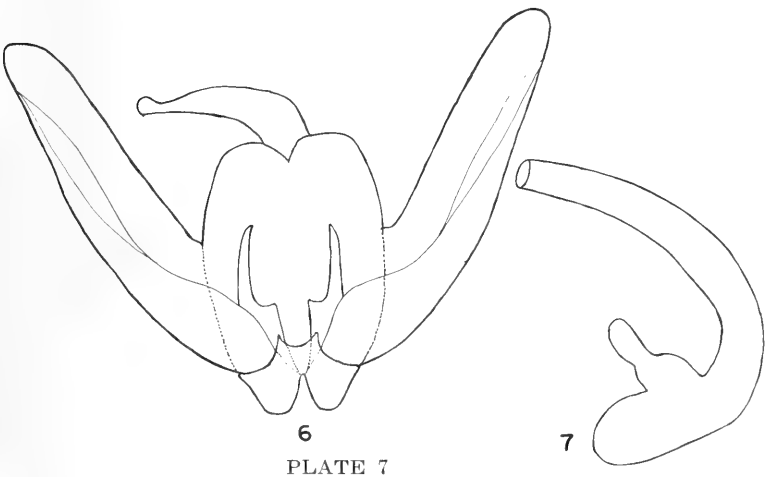


PLATE 7

1. Adult of *Platyptilia williamsii* Grinnell, enlarged x 2.
2. Adult of *Platyptilia carduidactyla* (Riley), enlarged x 2.
3. Adult of *Platyptilia comstocki*, new species (type male), enlarged x 2.

4-7. Morphological features of *Platyptilia comstocki*:

4. Venation of forewing.
5. Labial palpus.
6. Male genitalia.
7. Aedeagus of male genitalia.

A NEW CALIFORNIAN AGROTID*

By J. McDunnough
Ottawa, Ont.

Amongst some material sent for determination by Dr. J. Comstock of the Los Angeles Museum were six specimens of a *Feltia* species which appears to be new. In antennal structure it is allied to *evanidalis* Grt. but is much darker in color of primaries without the strong color contrasts between the s. t. and terminal areas found in this species. It can hardly be *edentata* Sm., described from Pullman, Washington, the only *Feltia* unknown to me, as Smith bases his name on the fact that veins 3 and 4 do not form tooth-like projections into the terminal area, which they certainly do in the present species. I venture, therefore, to describe it as follows:

Feltia californiae n. sp.

Male: Antennae practically bipectinate, the lamellae, especially on inner side, being long and furnished apically with two tufts of bristles but without the single long bristle found in *herilis* and its allies; in this respect much as in *evanidalis* Grt. Vestiture of head, collar, and thorax deep purplish brown (at times considerable admixture of ruddy brown on the patagia); no definite black transverse line on collar. Primaries deep purple-brown, the subterminal space somewhat paler but not contrastingly pale as in *evanidalis*. Maculation of the usual type, costa entirely dark with slight pale streaks marking the inceptions of basal, t. a. and t. p. lines. Cubitus narrowly but distinctly white to below reniform. Orbicular narrowly U-shaped, outlined in pale ochreous, filled with purplish gray; reniform upright, slightly lunate, outlined in pale ochreous and *filled with ruddy brown;* the cell before, between, and beyond these spots, blackish; claviform large, black-filled, this color extending backward to base of wing; above claviform and below vein 2 a narrow pale ochreous streak extends to t. p. line. Small dark arrow-marks define t. p. line on inner side. Subterminal space purple-gray, somewhat paler (but not contrastingly so), than terminal area, this latter being blackish and crossed, nearly to outer margin, by rather indistinct, tooth-like projections of veins 3 and 4. Fringes smoky with a pale line at base. Secondaries smoky, paling in basal half of wing (at times very considerably); discal spot large, dark, fringes pale. Ventrally smoky, secondaries with basal two-thirds whitish with prominent lunate discal mark. Expanse 36 mm.

Holotype— ♂, Petaluma, California, October 7, 1936 (E. C. Johnston); No. 4473 in the Canadian National Collection, Ottawa.

Paratypes—5 ♂, same locality and collector, September 30, 1934; September 13, 15, 1936; September 14, 1938. Two of these in the Canadian National Collection, one in the United States National Museum and two in the Los Angeles Museum.

* Contribution from the Division of Entomology (Systematic Entomology), Department of Agriculture, Ottawa.

NOTES ON THE LIFE HISTORIES OF TWO MOTHS FROM CALIFORNIA

By John A. Comstock and Charles M. Dammers

Homoncocnemis fortis picina Grt.

James Behrens, in Papilio, vol. 4, p. 21, 1884, gave a brief description of the larva of *Homoncocnemis vorax* (now considered a synonym of *fortis*) in which he stated that the larva was "chocolate color, emaciated, thin—" and that it bored into the soil and probably continued feeding underground. He mentioned the caterpillars traveling in an immense swarm as an "army."

This does not agree in any particular with our notes on two larvae, taken in their last instar, feeding on *Penstemon antirrhinoides* Benth, which produced examples of the variety *picina*.

One of these larvae was collected in the Gavilan Hills near Riverside in March of 1931, the other was found at Riverside in the same month of 1936.

The mature larva may briefly be described as follows:

Length, fully extended, 29 mm.

Body cylindrical, stout; skin texture smooth. Color of body, bright apple green. There is a narrow longitudinal mid-dorsal stripe that is slightly darker than the ground color. A prominent longitudinal white band occurs sub-stigmatally. The segmental joints show a tinge of yellow. The eleventh segment bears a well defined dorsal hump. That portion of the body above the white line shows a number of fine longitudinal broken, somewhat wavy white stripes.

Abdomen, bright apple green. Legs, pale green, with flesh colored joints. Prolegs, pale green, with flesh colored claspers.

Head, pale olive-green, blotched with brown, and with an indistinct white bar crossing each cheek. Ocelli, black. The head is sparingly covered with short white hairs.

Each typical segment of the body bears twelve setae, exclusive of those on the legs and prolegs. The setae are black, and each one arises from a small white papillus.

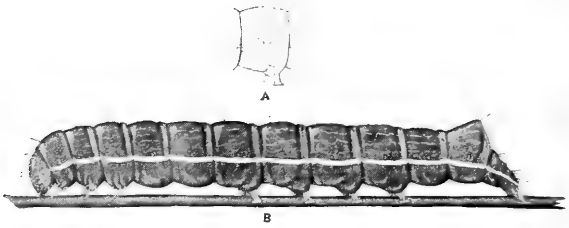


PLATE 8

Mature larva of *Homoncocnemis fortis picina.*

A. Typical segment showing arrangement of setae.
B. Lateral view of larva enlarged approximately x 2.

Reproduced from painting by Comm. C. M. Dammers

The mature larva is illustrated on Plate 8.

Pupation of our two examples took place under the soil in late March. No notes were made of the pupa. The Los Angeles Museum collection contains examples collected in January, May, July, August and October, which would indicate a continuous breeding season in Southern California.

One example was reared by Mr. W. Harry Lange at Porterville, California, on "orange foliage."

PERIZOMA CUSTODIATA form POLYGRAMMATA Hlst.

Our description is drawn from three examples of the larva as follows: one collected at Riverside, California, on *Atriplex canescens* James; one from Del Mar, San Diego County, California on *Atriplex semibaccata* R. Br.; one from Rosemond, Mojave Desert, on *Grayia spinosa* (Hook) Moq.

Mature larva: Length, extended, 25 mm.

Cylindrical, the segments of about equal width except for the tapering three caudal; of the characteristic geometrid type, with a single pair of prolegs and anal prolegs.

Body, pale blue-green, with numerous faint white parallel longitudinal lines. The infrastigmatal fold (overlap) is edged with white and is not markedly protruded. Spiracles, yellow. Segmental joints, yellow.

Abdomen concolorous with body. Legs, blue-green with brown tips. Prolegs, blue-green, with light brown claspers.

A few colorless setae occur on the head and caudal segments.

Head, pale blue-gray, thickly studded with small brown spots. A few spots of similar character also occur on the first segment.

The mature larva is illustrated on Plate 9, fig. A.

Pupation took place on the floor of the breeding cage in a light silken cocoon. Emergence occurred only a few days thereafter.

Pupa: Length, 10 mm.

Body, olive-brown. Wing cases, thorax and head, translucent green, the venules on the wings being lightly striped with brown.

The pupa is pictured on Plate 9, fig. B.

Our examples of the larvae were collected in the months of March and May, but imagos in the Los Angeles Museum collection record captures in every month of the year except December. The species is probably a continuous breeder, and may have a rather wide variety of foodplants in the southwestern states.

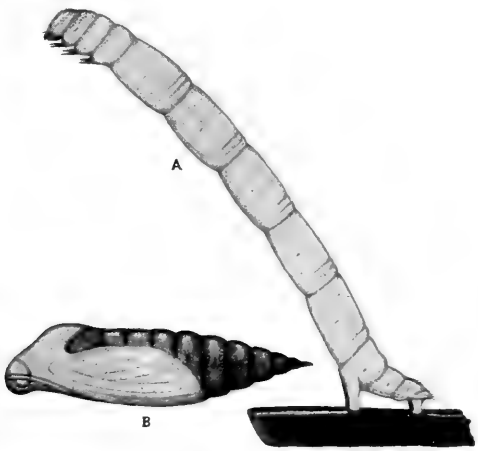


PLATE 9

Mature larva and pupa of *Perizoma custodiata* form *polygrammata*.

A. Larva, lateral view, enlarged approximately x 2.
B. Pupa, lateral view, enlarged approximately x 2.

Reproduced from painting by Charles M. Dammers

STUDIES IN PACIFIC COAST LEPIDOPTERA

By John A. Comstock

Callopistria floridensis Gn.

This species was first described inn 1852[1] by Guénée who placed it in the genus *Eriopus*. Walker, in 1857[2] referred it to *Callopistria*. Butler in 1891[3] recorded it for San Domingo, mentioning the type in the British Museum. A brief note in the Year Book of the Department of Agriculture for 1908[4] recorded the foodplant as ferns. Davis in 1909[5] reported it as being destructive to ferns in greenhouses in Illinois and the District of Columbia, and mentioned the use of pyrethrum sprays as a method of control. His subsequent report in 1912[6] gave the first illustrations of larva and pupa, and recorded the life history.

PLATE 10
Larva of *Callopistria floridensis*, dark form, final instar, enlarged.

Chittenden's Bulletin[7] amplified the work of Davis, recorded the range through the West Indies and from Mexico to Brazil, illustrated the larva, and made note of parasites. Headlee[8] referred to it in the State Report of New Jersey, and Weiss supplemented this in the Canadian Entomologist for 1915[9] and in the Entomological News[10] of the same year. Several additional notes occurred in the literature prior to 1917 as our bibliographic references will indicate.

Hewitt added a record of occurrence in Canada in 1917.[15] In the same year Gibson[16] added several useful items to our knowledge of the species. Felt, in 1918[17] placed New York in the list of states in which the moth had been found infesting ferns in greenhouses. From 1919 to 1936 several items appeared in various journals, as recorded in our footnotes.

In the summer of 1937 an infestation in the greenhouses of the Superior Nursery Company of Los Angeles was brought to our attention. Larvae were secured and reared to maturity on Boston Fern, and we were able to obtain photographs of both larvae and pupae, which are shown in the accompanying plates.

The proprietor of this nursery deserves credit for promptly reporting the occurrence to the Horticultural Commissioner, and

PLATE 11

Pupa of *Callopistria floridensis*, showing three aspects, enlarged.

instituting vigorous measures of control. The use of a 2% Rhotonon solution, one ounce to four gallons of water, together with the use of light traps, for a period of several months, resulted in complete eradication. Pyrethrum sprays were tried in one greenhouse, but were shortly discontinued on account of the unsaleable condition of the plants after application. The methods used were apparently successful as there were no evidences of infestation in 1938 or 1939.

With this record, California can now be added to the growing list of states (which includes Illinois, District of Columbia, Georgia, Ohio, New York, Indiana, New Jersey and certain provinces in Canada) in which outbreaks have occurred.

This is of more than ordinary significance in view of the fact that ferneries are established in large numbers out-of-doors in this state, and a general infestation in this climate might lead to serious results.

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COMMENTS OF A FIELD WORKER ON THE NEW RACE EUPHYDRYAS CHALCEDONA KLOTSI —DOS P. (Lepid.—Rhopalocera)

By W. N. Burdick

An inspection of the original description of this race in the Can. Ent., October, 1938, seems to demand some correction and further comment. It is unfortunate that Mr. Dos Passos while having in mind that Gunder's deductions were frequently erroneous, should have accepted without apparent reserve or further investigation Gunder's mistaken classification of *Euphydryas hermosa* Wgt., which he places in the *anicia* group. It is somewhat consoling that there does exist enough merit in the separation of *klotsi* aside from the rather uncertain procedure of distinguishing races of *Euphydryas* through the dissection of the genitalia. Evidently with the purpose of adding strength to the new description, Mr. Dos Passos has only weakened it by this method as a perusal of the following will demonstrate. Possibly the theory of identification by means of the dissection of the genitalia may support such contentions to a reasonable degree when it is confined to some groups of *Rhopalocer*a but on the other hand these studies when applied to the genera of *Argynnis, Euphydryas* and in fact most of the *Nymphalidae* seem to offer little more than a maze of contradiction. The case at hand is perhaps as good an illustration of this fact as any of the other errors. Gunder's classification placing *hermosa* in the *anicia* division along with quite a number of other similar mistakes, was arrived at through the dissection method. More recent research in the species of *chalcedona* has proven the fallacy of many of Gunder's like determinations.

The writer has been fortunate enough to collect many specimens and to make actual field observations of both *Euphydryas chalcedona klotsi* and *Euphydryas chalcedona hermosa* in various localities in Arizona. These insects are found in overlapping territory. Although both are members of the *chalcedona* division, a definite separation can be made in certain localities and the writer therefore supports the conclusion of Mr. Dos Passos that a separation is justified. It might be interesting to the author of *klotsi* as well as to other students of diurnal Lepidoptera to here state some of the facts concerning the distribution of *klotsi* and its near relative *hermosa*. A fact known to the writer but

not a matter of common knowledge gives additional strength to the standing of *klotsi.* The fact is that some forty-five miles in a straight line south by southeast of Roosevelt Lake, given by the author as the type-locality of *klotsi,* a splendid colony of that insect exists, members of which show an even greater and more constant divergence from *hermosa* than do topotypes from Roosevelt Lake and the Superstition Mountains. This colony serves to emphasize the claim for distinction made by Mr. Dos Passos. This fine colony is located on the south slope of Pinal Pass south of Globe, Arizona.

Apparently the Pinal Pass area represents just about the southern terminus of *klotsi,* as a careful inspection of territory to the south of it shows no trace of a similar insect although *hermosa* is found rather sparingly in the Santa Catalina Range much to the south, where it seems to be without intergrades with *klotsi.* From Pinal Pass north, however, a situation is found that gives us much light on the relationship of *klotsi* and *hermosa.* It is observed in traveling north that *klotsi* more and more resembles *hermosa* in successive stages. For instance at Roosevelt Lake and in the Superstition Mountains a number of individuals that cannot be separated from *hermosa* are found, in this type-locality of *klotsi.* These are flying with *klotsi* as are a good number of intergrades between *hermosa* and *klotsi.* Continuing north the specimens similar to *klotsi* become more and more infrequent until only an occasional one is observed in Oak Creek Canyon in Coconino County. Here the great majority have swung widely to *hermosa.* This area is in fact the metropolis of *hermosa* and it is unfortunate that Wright did not record it as the type-locality in lieu of the vague and unsatisfactory type-locality "Southern Arizona," where it is uncommon.

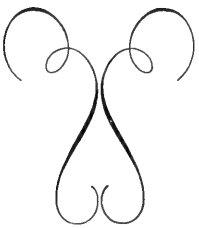
Hermosa bears no resemblance to any member of the *anicia group. Klotsi* and *hermosa* are identical in size, wing shape, habits and food plant and every characteristic is typical of *chalcedona* and foreign to any race of *anicia.*

Recently some very interesting breeding experiments have been made in mating and producing offspring from various divergent races of *chalcedona,* thereby definitely placing under the species of *chalcedona* a number of races heretofore regarded as uncertain. One of these desert colonies too close to *hermosa* to separate it consistently was involved and proved to be *chalcedona* by the most positive of all proofs, that of breeding. This leaves no doubt of the fact that *hermosa* is a *chalcedona* even if all other evidence is disregarded.

It is regrettable that the author of *klotsi* should have been so unacquainted with these very important facts at the time *klotsi* was described and to so have accepted Gunder's error. Even this, however, has certain advantages as it impresses us

with the mistake of separating at least members of the *Euphydryas* group by means of dissection. There occur constantly individuals in *chalcedona* whose genitalia resemble *anicia* or *editha*. The angle of vision is a large factor in the appearance of such parts after dissection. Due to this, mistakes are multiplied. It does not seem that Mr. Dos Passos should have to resort to such an uncertain method to establish the race *klotsi* and to separate it from *hermosa*. Alone the fact that at Pinal Pass an almost purely typical colony of *klotsi* exists justifies the separation and the writer finds it most agreeable to support the author with these evidently unknown circumstances.

Any colony of lepidoptera having recognizable and distinctly variant markings from its closest resembling and described relative and where the large majority comprising such a colony are constantly typical, needs no other symbol to survive synonomy.



THE FAUNA AND FLORA OF THE EL SEGUNDO SAND DUNES

5. BIOTIC FACTORS AFFECTING PLANT GROWTH, REPRODUCTION AND SUCCESSION ON THE SAND DUNES

By W. Dwight Pierce, Ph.D.

In the series of papers which will continue to appear on the fauna and flora of the sand dunes we hope to bring out many of the biotic relationships which exist between the plant and the animal life on the dunes. We aim to show the intricate interrelationships of life and how every phase of growth, reproduction and succession of forms (plant and animal) is dependent upon a multitude of factors. Checks and balances to the *n*th degree are at work here as elsewhere, but are a little easier to study in this region because of the relative scarcity of life. At a later time we shall discuss parasitism and its intricacies as manifested in this region, but in this paper we may summarize the general nature of the checks and balances controlling the plant world of the dunes. This preliminary paper will be followed by detailed reports on the biotics of each species of plant in the area.

Biotic Factors Affecting Soil Fertility. Although up to this time no earthworms have been found, there are numerous other soil burrowers at work on meadow and dune, which accomplish a great deal of soil mixing—for we have numerous burrowing mammals and reptiles, and burrowing owls, all to be reported on later; burrowing roaches (*Arenivaga*), termites (*Hesperotermes*), several species of tenebrionids, at least five or six species of Scarabaeids, cutworms, ant lions, which burrow great distances under the surface, and millipedes.

The large number of mammals and birds on the dunes assures a considerable quantity of rich droppings of fertilizer value scattered over the soil.

The disintegration of plant materials to furnish new plant food goes on at a very rapid pace. Almost every plant in the dunes can be shown to have stem borers—Lepidoptera, buprestids, cerambycids, mordellids or weevils. One of the most striking of these is the barine weevil which completely riddles the stems of *Oenothera cheiranthefolia* from tiny stems far down into the roots, and leaves nothing but dust. Anobiid larvae have

been found pulverizing the interior of stems of *Corethrogyne filaginifolia, Lupinus chamissonis, Cirsium californicum,* and other plants. Scolytid beetles do the same for the stems of *Rhus integrifolia, Lupinus chamissonis, Lotus scoparius* and *Encelia californica.*

But following the work of these stem borers, and often attacking healthy roots and stems, the final disintegrators are the termites, *Hesperotermes,* which have been taken to date in the roots and stems of *Raphanus sativus, Rhus integrifolia, Franseria bipinnatifida, Oenothera cheiranthefolia, Erysimum asperum, Encelia californica,* grasses, etc.

While all of these factors are enriching the soil, there are even tinier organisms at work, the nodule bacteria, drawing nitrogen from air and soil; and these have been found on five species of *Lupinus,* three species of *Lotus,* one species of *Astragalus,* and one *Medicago.* Very likely there are other soil bacteria breaking down the iron particles, so numerous in the dune sand; and making other materials available.

Biotic Factors Affecting Growth. From the moment that the seeds sprout, the biotic factors begin their work on the plant. On the tiniest seedlings of the lupines can be found the bacterial nodules contributing soluble nitrogens to aid the growth of the plant. But even these nodules are the special food of weevil larvae. No sooner has the seedling broken the soil than the Tetranychid mites, or red spiders, and the thrips begin their corroding work sapping the strength of the tiny plants. For this reason multitudes of seedlings die before they are two inches high.

As our series progresses we will show that almost every plant on the dunes has insects which feed on the leaves, and bore in the stems, and juice suckers which sap the plant's life blood. These juice suckers include thrips, aphids, mites, scales, psyllids, white flies, and leaf hoppers.

Leaf miners have been found on *Rhus integrifolia, Abronia umbellata, Convolvulus soldanella, Encelia californica* and *Cirsium californicum.*

Gall makers causing distortion of leaf or stem occur on *Lupinus, Franseria, Croton, Encelia, Ericameria.*

Skeletonized leaves have been found on *Gnaphalium decurrens, G. microcephalum* and *Eremocarpus setigerus.*

Fungous diseases also check the growth of the plants. A smut occurs on Bermuda grass, *Cynodon dactylon,* killing large patches. Toward fall the leaves of *Cucurbita foetidissima* are covered with leaf spots in the spread of which undoubtedly *Dia-*

brotica soror must have a role. *Lupinus bicolor microphyllus* is badly affected by a fungous disease that kills the plants in large areas of the meadow, in the dissemination of which it is very likely that thrips and red spider are deeply involved, as many seedlings are killed by these enemies.

Biotic Factors Affecting Reproduction. Without the aid of fertilizing insects many of the dune plants would be unable to reproduce. Occupying this rôle we shall show a good list of wild bee pollenizers, as well as the honey bee. Many of the smaller flowers are undoubtedly pollenized by flower beetles, of which several species of *Melanophthalmus* are very numerous. The flowers of *Galium angustifolium* appear to be mite pollenated. Thrips have been found in almost every flower in the dune area, and can actively carry the pollen.

On the other hand the thrips and flower bettles are pollen feeders and their rôle as carriers is accidental.

But reproduction is very visibly affected and materially reduced by the seed insects. Seed eating ants carry away the seed of *Eriogonum gracile* and then pile the husks neatly around the entrances to their nests in pretty red circles. The hard, spiny seed of *Franseria bipinnatifida*, the seed of *Ericameria ericoides, Chrysopsis villosa, Corethrogyne filaginifolia, Cirsium californicum, Senecio douglasii, Lupinus chamissonis, Cuscuta californica, Datura meteloides* and *Orthocarpus purpurascens* are already known to be destroyed by fly, weevil and moth larvae. Add to these the active bird and rodent seed feeders and we see that there are numerous biotic factors affecting reproduction of the dune plants.

Biotic Factors Affecting Plant Succession. The disintegration of pioneer plants by insects, millipedes, centipedes, snails, and mites forms plant food for the next series of plants.

The bacterial action at the roots of the eleven species of legumes builds up soil nitrogen for the following series.

Wind, gravity and the soil burrowing life distribute these food materials, more or less concentrating them in the ripples, depressions, ravines and bowls, and here we see forming the various stages of stabilization of flora.

Unlimited multiplication of the plant destroyers would completely eliminate the affected plants. This undoubtedly happens to some less hardy adventurers which reach the dunes to be recorded one year and not seen again, but the majority survive because of the great number of checks on unlimited reproduction of the destroyers. For here on the dunes are many predatory spiders, mites, scorpions, centipedes, insects, lizards, snakes,

rodents and birds preying on the plant feeding insects. In addition to these are many species of true parasites attacking most of the major pests. In this respect the predators are not immune to parasitism, for we have already reported two species of enemies of the eggs of the black widow spider. There is a tremendous warfare among the mites, for we have the plant destroying *Tetranychidae,* the insect destroying *Pediculoididae,* the mite destroying *Erythraeidae* and the predaceous *Trombidiidae.* These are probably in numbers the dominant population on the dunes, and yet their size is so minute that only the acute observer will find them.

Thus the plant feeders are checked before they have completely destroyed their hosts. The predators and parasites are themselves checked before they have exterminated their prey.

It should be apparent then that normal plant succession is not inherent to the plants or the soil, but is due absolutely to the balance held by the checks on reproduction of the pests which would otherwise destroy the plants.

One item in the plant succession and plant population which should not be overlooked is the biotic influence of the individual plants of a species upon each other. Certain species of plants are able to disseminate a huge number of seed and the soil in the spring is literally crowded to capacity by seedlings. The limited amount of space precludes the possibility of more than a very small percentage growing to full stature; but the limited soil nutriment limits the population still more.

Assisting the plant world in solving this over-population problem we find the first major factors are the mites, thrips and fungi which kill multitudes of seedlings.

This paper is merely to serve as an introduction to the series that shall follow in which quite a number of collaborators will present the evidences illustrating the various points covered in this outline, and bringing out even more interesting relationships.

The time has come in biology when the only adequate method of study of a fauna or flora is the group method in which mutual coöperation between representatives of the animal, plant, soil and meteorological sciences makes it possible to get down to fundamental interrelationships.

No entomologist can adequately study his insects without knowledge of their plant hosts.

No botanist can adequately study his plants without knowledge of their method of fertilization, their maladies, and the carriers of these, their deformities caused by insects, and also the soil conditions under which his plants grow.

6. THE DODDER AND ITS INSECTS

By W. Dwight Pierce, Ph.D.

To those who are familiar with the leafless yellow or orange tendrils of dodder which entwine and strangle vegetation, no plant would seem less likely to have insect enemies than it.

In fact there is very little in the literature on insects affecting this interesting genus of plants.

We are able to report at this time on a number of insects taken in flowers, or bred from the flowers of *Cuscuta californica* on the El Segundo, California, sand dunes. The material was all collected on different occasions by the writer, Mrs. Dorothy Pool and Mrs. Pierce in 1938.

Up to date all of the insects taken were in the flowers, and we found several species breeding in these interesting little flower clusters. Working among the flowers in a flower head one frequently encounters little caterpillars, the adult of which is described as a new species and genus by August Busck in a succeeding paper.

These larvae and the weevils discussed in this paper have a very decided part in checking the reproductive activity of this parasite, as they are seed destroyers.

Among the insects collected in the dodder flowers were four specimens of *Scymnus marginicollis* Mann. probably to prey on aphids and thrips, which so far have been very sparingly found.

Eight specimens were taken of a new species of Mycetophagidae, *Berginus californicus,* one of them being found inside of a cell in a dodder flower, possibly as a scavenger.

The other species taken on the dodder are probably not characteristic of it and will be discussed more appropriately in connection with other host plants. These include a species of *Tanaops,* one or two species of *Melanophthalmus,* a *Trichochrous,* and a tiny *Bruchus,* probably all here as flower visitors, and pollen feeders.

Quite in accord with the minute nature of the flowers, and the hair-like tendrils, not an insect has been taken which measures over two millimeters in length. These tiny insects offer considerable difficulty in identification.

Up to the present writing no gall makers attacking the tendrils have been taken, although such injuries have been noted by the writer in Southern California.

The Dodder Weevils of the Smicronychini

Dietz, 1894, revised the genera making a primary separation on the basis of the relative contiguity of the eyes beneath, which would appear to be a very valid basis, necessitating however either careful spreading or dissection of one specimen of each species. It would seem that those species in which the eyes are contiguous must be more closely related to each other than to species in which the eyes are separated. Champion in 1902 discarded the separation of the eyes as a generic character but did not give his reasons.

In view of the fact that only a relatively few of the world species have been studied in this respect, we may follow Champion in holding them in *Smicronyx* and reduce *Synertha* to a subgenus in which the eyes of one or both sexes are contiguous beneath. This means that the entire genus must be restudied in regard to this character. The genus *Pachyphanes* is also reduced by Champion, but might conveniently be saved as a subgenus. The genera *Desmoris* and *Promecotarsus* appear to be sufficiently distinct to hold. This reinterpretation of generic limits requires a new key.

Key to Genera of Smicronychini

1. Fourth tarsal joint shorter than the three preceding joints combined 2

   Fourth tarsal joint about as long as the three preceding joints; form subcylindrical; eyes widely separated; claws connate at base only ..... *Promecotarsus* Casey

2. All tibiae unguiculate—*Smicronyx* Schönherr 3

   Posterior tibiae mucronate; antennal club small, ovoidal; eyes more widely separated ..... *Desmoris* LeConte

3. Subgenera of *Smicronyx*:
   Eyes not contiguous beneath in either sex 4

   Eyes contiguous beneath in at least one sex ..... sg. *Synertha* Dietz

4. Antennal club large, elongate, usually distinct from the funicle ..... sg. *Pachyphanes* Dietz

   Antennal club small, ovoidal, often subcontinuous with the funicle; eyes narrowly separated beneath 5

5. Tarsal claws very small, generally stout, usually not divergent, connate at least to middle ..... sg. *Smicronyx* Schönherr

Tarsal claws moderate; generally slender and evidently not strongly divergent, connate in their basal third only, rarely to middle ..... sg. *Pseudromicronyx* Dietz

In this tribe several species are recorded from dodder, *Cuscuta* spp.

In Europe *Smicronyx jungermanniae* Reich forms long spherical or spindle-shaped galls in the stems of *Cuscuta europaea* L. The larvae pupate in the ground.

In Cuba *Smicronyx albosignatus* forms galls in the stems of *Cuscuta.*

Smicronyx tychoides LeConte was recorded by the writer in 1907, as forming odd-shaped galls in the stems of *Cuscuta arvensis,* at Victoria, Texas, collected July 1, 1906. The larvae pupate in the ground. On reexamination of specimens of this series the Texas specimens at least must be transferred to *Synertha.*

Weiss and West in 1921 recorded *Smicronyx sculpticollis* Casey as forming galls on *Cuscuta cephalanthi* in New Jersey. The larvae pupate in the galls. Zabriskie bred from *Cuscata gronovii* weevils probably of this species, according to Weiss and West. On examination of a ♀ from Stirling, New Jersey, and a ♂ from Washington, D. C., it appears that this species also must be transferred to *Synertha.*

Pachyphanes amoenus Say has been taken on dodder in the East.

On the El Segundo sand dunes we found a species, *Sm. (Syn.) cuscutiflorae* which breeds in the ovaries of the flowers and pupates in situ. In coloration it resembles *Sm. (Syn.) tychoides* and *Sm. (Syn.) sculpticollis* in having the red vittae on the elytra, but is separated by the following key.

Two other species were also bred from the flowers, which we assign to the subgenus *Pachyphanes.*

Key to the Species of Subgenus Synertha

1. Elytra with broad reddish stripes at sides 2
   Elytra without reddish stripes 6

2. Elytra fully one-half wider than thorax 3
   Elytra two-fifths wider than thorax 4

3. Prothorax with indications of a smooth, raised, median line; dorsum sparsely clothed with coarse, decumbent, white, piliform scales. Length 1.75-2.0 mm. Mexico ..... *S.* (*Syn.*) *tenuisquamis* Champion

Prothorax with no indication of smooth, raised, median line; body densely clothed throughout with broad oval scales and linear scale-like setae; beak sparsely scaly; second funicular joint not or hardly longer than third; prothorax distinctly constricted at apex; elytral striae distinct, not concealed by scales. Tarsi with fourth joint scarcely projecting the length of the preceding joint; claws connate two-thirds of their length. Length 1.67-2.4 mm. So. California ..... *S.* (*Syn.*) *cuscutiflorae* n. sp.

4. Scaly vestiture not uniformly dense above, condensed in spots or transverse fasciae or lines; beak strongly curved 5

5. Fourth tarsal joint projecting the length of the third; beak strongly curved near the base; prothorax not strongly convex, nearly straight on the sides behind the middle. Second funicular joint nearly as long as the next two. Length 2.5 mm. Kansas, Texas ..... *S.* (*Syn.*) *tychoides* LeConte

Fourth tarsal joint projecting less than the length of the third; prothorax not strongly convex, sides rounded. Second funicular joint much shorter than the next two. Length 2.1-2.25 mm. Virginia, Indiana, Texas ..... *S.* (*Syn.*) *sculpticollis* Casey

6. Prothorax not wider than long 7

Prothorax wider than long 11

7. Setae of elytral interstices procumbent, scarcely visible 8

Setae of elytral interstices conspicuous, decumbent, curled 10

8. Tarsi slender, fourth joint projecting much more than the length of the preceding joint; claws connate at the base only 9

Tarsi stout, fourth joint scarcely projecting the length of the preceding joint; claws connate two-thirds of their length. Beak densely scaly; second funicular joint a little longer than third; prothorax not evidently constricted at apex; elytral striae fine, concealed by scales. Length 2.75 mm. Arizona ..... *S.* (*S.*) *hornii* Dietz

9. Scales of upper surface very large, broadly oval. Length 2.25-2.75 mm. California, Arizona ..... *S.* (*S.*) *imbricatus* Casey

   Scales of upper surface smaller and narrower, elongate oval. Length 1.4-1.7 mm. Arizona ..... *S.* (*S.*) *silaceus* Casey

10. Vestiture of grayish, oval scales. Length 2.5-2.8 mm. Mexico ..... *S.* (*S.*) *thoracatus* Champion

    Vestiture of brownish, oval, imbricate scales, with a few white ones intermixed. Length 1.9 mm. Mexico ..... *S.* (*S.*) *tenuirostris* Champion

11. Elytra about one-fourth wider at base than thorax; setae suberect, conspicuous. Length 2.0 mm. Arizona ..... *S.* (*S.*) *wickhami* Dietz

    Elytra about one-half wider than thorax 12

12. Elytral interstitial setae coarse. Length 3.0 mm. Mexico ..... *S.* (*S.*) *tectus* Champion

    Elytral interstitial setae fine, inconspicuous 13

13. Elytral vestiture white with a few brownish scales. Length 2.0 mm. Mexico ..... *S.* (*S.*) *loricatus* Champion

    Elytral vestiture tessellate white and brown, denser and scales not so coarse but more intricate. Length 2.0 mm. Guatemala ..... *S.* (*S.*) *cataphractus* Champion

Key to the Weevils of the Amoenus Group of the Subgenus Pachyphanes, Genus Smicronyx

1. Prothorax not wider than long; claws connate at most one-half their length; first and second joints of funicle long and slender; club large, strongly elongate; tarsi slender, first joint elongate 2

   Prothorax slightly wider than long; claws connate beyond the middle 3

2. Fifth interspace densely scaly; third tarsal joint less than twice as wide as the preceding. Length 3.25-4 mm.; Texas, Illinois, Missouri ..... *S.* (*P.*) *lineolatus* Casey

   A broad, irregular stripe of pale scales extending from humerus to the suture behind the middle; third tarsal joint nearly twice as wide as the second. Length 2.75-3 mm.; Texas ..... *S.* (*P.*) *triangularis* (Dietz) n. comb.

3. First and second funicular joints elongate, not slender; tarsi stouter, first joint not elongate; elytra tesselate 4

First funicular joint elongate, second and third subequal; vestiture very sparse. Length 1.5-1.8 mm.; Southern California ..... *S. (P.) elsegundinis* n. sp.

4. Club not strongly elongate, ovoid elliptic; first joint of funicle fully one-half longer than the second, the latter less than one-half longer than the third; prosternum distinctly channelled. Length 2.25-2.75 mm.; Dist. Columbia, Pennsylvania, L. Superior, Dakota ..... *S. (P.) amoenus* Say.

Club elongate, longer than the third to seventh inclusive; first joint of funicle about equal to the next three joints together; second longer than third; prosternum feebly transversely impressed. Length 1.5-2.0 mm., So. California ..... *S. (P.) celaenus* n. sp.

Key to the Dodder Weevils of the Dunes

1. Eyes united beneath the head; prothorax canaliculate; vestiture dense over entire body ..... *Sm. (Synertha) cuscutiflorae*

Eyes separated beneath the head; prothorax flat or lightly transversely sulcate; vestiture irregularly placed 2

2. Interstitial setae elongate scales; broad oval scales in patches on elytra, on pleurae and venter of thorax ..... *Sm. (P.) celaenus*

Interstitial setae very fine hairs; oval scales on third and humeral interspaces at base, and on pleurae; vestiture of venter sparse ..... *Sm. (P.) elsegundinis*

Smicronyx (Synertha) cuscutiflorae n. sp.

Holotype ♀, allotype ♂ and paratype series of 22 ♀♀ 12 ♂♂ from *Cuscuta californica,* taken at El Segundo, California on the sand dunes; first taken May 18, 1938 and subsequently on June 15 and June 19, 1938, and February 25, 1939, by the author, Mrs. Dorothy Pool and Mrs. Clara Pierce, and bred from the flowers July 18-21, 1938.

A minute weevil ranging from 1.67 to 2.4 mm. in length; black with dark reddish stripe on the middle of each elytron, and clad with large oval to elongate, iridescent scales, differing in size and shape on different parts of the body. In many respects

this species resembles *Smicronyx (Syn.) sculpticollis* Casey of the Eastern States.

Female: 1.67 to 2.9 mm. The female differs from the male by the more slender beak with the antennae attached about opposite the middle of the lower edge of the beak. When not abraided the vestiture is dense over the entire body and appendages, except the apical half of the beak. The pattern is mottled with white and dark scales. The dorsum of the thorax is covered with dark oval scales interspersed with slightly lighter, elongate scales; there are four flecks of white scales, two on the collar, and two opposite the widest portion of prothorax; the scales of the lateral margin form a lighter line especially at the posterior angles; in some specimens there are a few white scales on the median line in front of the scutellum. The elytral pattern is distinctive; the scales form a short white line at the base of the third intervals; several indistinctly delineated bands of white scales cross the elytra, one at the middle, two in front of this, and two behind it (the last apical). The scales over the red stripes on the elytra appear pinkish, and those over the black portions darker; the curved decumbent setae in single rows on the elytral intervals are very inconspicuous. The scales of the underside are evenly and closely placed over the entire surface.

The general body color is black, with a reddish band at base of elytra, and a stripe on the middle of each elytron, a reddish tinge to the venter and to the legs and antennae. The beak is moderately slender, more strongly curved dorsally than ventrally, deeply transversely separated at base from head, with a cluster

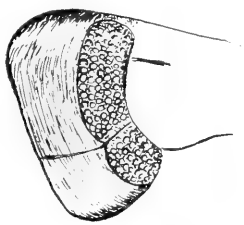


PLATE 12

A. Under side of head of *S. (Syn.) cuscutiflorae*, showing contiguous eyes.

B. Fore tarsus and claws of the same.

of scales on each side intensifying the separation; the scrobes are descending reaching the underside before the eyes; antennae inserted only a little beyond the middle of the underside of the beak. Scape slender, funicle 7-jointed, the first stout and about as long as second and third combined; second joint a little longer than third, the last joint slightly widened in conformity with outline of club, the funicle is clad with bristles; the four-jointed club is very finely pubescent.

Eyes coarsely facetted, meeting on median line beneath (Plate 12, fig. A). Prothorax angulate over eyes but not lobate; almost or entirely as long as broad (measurements show the proportions 36:34 and 35:35), basally distinctly narrowed into a collar; rounded at sides, widest behind the middle: surface closely punctate, but when in full vestiture the entire surface is concealed. Elytra abruptly and squarely wider by half than thorax at widest point (by actual measure 28:18); scutellum minute but distinct; even when in full vestiture the striae are evident, and when denuded, are seen to be sharp and deep between wide interspaces with elongate punctures; humeri prominent; behind humeri sides almost parallel to beyond middle, thence rounded to apex. Prosternum medianly sulcate. Femora clavate; tibiae straight and shorter than femora; tarsi with third joint deeply bilobed, but not much wider than second joint; fourth joint slender surpassing third by its length; claws connate to apical third (Plate 12, fig. B). Posterior margins of second, third and fourth abdominal segments arcuate, with posterior angles acute; second segment as long as the two following segments; fifth segment not impressed.

Male: 1.87 to 2.25 mm. Differs from the female in stouter beak with antennae attached beyond the middle. Thorax wider than long in the proportion 16:14. Fifth abdominal segment with large round depression.

This weevil breeds in the ovaries of the dodder, causing a slight gall-like swelling.

The larvae are bright orange color and quite active crawlers, so that it is possible that some may enter the ground for pupation, but orange-colored pupae were found in the flowers.

Smicronyx (Pachyphanes) celaenus n. sp.

Described from 1 ♀ holotype, 1 ♂ allotype, 6 ♀ paratypes and 2 ♂ paratypes, collected at El Segundo, California, on *Cuscuta californica,* May 18, June 13, and June 28, 1938, by W. D. Pierce, Dorothy Pool and Clara Pierce; and bred from *Cuscuta* flowers July 18.

This species runs in the Dietz (1894) *Smicronyx* key to *S. pusillus* Dietz, a California sp.; and in the Casey (1892) key to

S. defricans, also a California sp., but not conforming in vestiture to either.

Female: 1.5-2.0 mm. Elongate-oblong, convex; black; legs dark rufous, lightest on middle of femora; sparsely clad with white and pale ochreous scales to form indefinite patterns. Upper surface clothed unevenly with moderately large oval, whitish scales, generally denser, or at least more persistent, on the median line and sides of the thorax, on the elytra at bases of third and humeral interspaces, in a diagonal irregular fascia between humeri and middle of elytra, in flecks beyond middle of elytra, on thoracic sternum, meso- and metathoracic pleurae and at base of abdomen. The interstitial setae are ochreous, narrower, and more elongate than the white scales, and placed on a single line on each interspace. The same type of setae occur scattered over the dorsum and pleurae of the prothorax, on the abdominal segments, and legs, but are whiter on the legs. On the abdominal segments they are more concentrated at the posterior margins of the third and fourth segments, and on the fifth segment. The beak near base, and the antennal funicle are also clad with elongate scales. The club is softly pubescent.

Beak slender, lightly curved, as long as head and prothorax, finely punctate in apical half, more coarsely in basal half, basal constriction shallow. Scrobes beginning beyond the middle descend diagonally to underside at eyes. Scape attached at middle of beak, reaching eyes; funicle 7-jointed, the first about equal to the next three and stouter; second longer than third and each succeeding joint slightly shorter and broader, the last two transverse; club elongate, longer than the third to seventh joints inclusive, the first club joint not equal to half of the club. Eyes definitely separated beneath, head finely granulate. Prothorax about as long as broad, constricted apically; ocular lobes not very prominent, vibrissae short; laterally convex, widest at about middle. Elytra abruptly two-fifths wider than prothorax at base, almost twice as long as broad, humeri slightly tumid, sides parallel to beyond middle, thence parabolically curved to narrowly rounded apex; scutellum minute; striae fine, not concealed by vestiture. Prosternum almost flat, feebly transversely impressed. Second abdominal segment as long as the two following, posterior lateral angles very slightly produced; fifth segment as long as third and fourth together, broadly rounded in outline and not impressed.

Femora clavate, longer than tibiae; tibiae unguiculate, tarsi moderately slender, third joint broadly bilobed, fourth joint projecting the length of the third, claws connate about two-thirds their length.

Male: 1.5-1.7 mm.; differs from female in stouter beak, with antennae inserted beyond the middle. On a fully clad specimen the white scales form a sort of network of diagonal lines. The

fifth abdominal segment shows a slight median round depression near apex.

Smicronyx (Pachyphanes) elsegundinis n. sp.

Described from 1 ♀ holotype, 1 ♂ allotype, 12 ♀ paratypes, collected at El Segundo, California on *Cuscuta californica*, June 15 and June 29, 1938 by W. D. Pierce, Clara Pierce and Dorothy Pool.

Female: 1.5-1.8 mm. Elongate oblong, convex; black throughout, sparsely clad with fine, short hairs, with a few scales or thicker hairs at the base of the third and humeral elytral intervals, and occasionally in a spot in the middle of each elytron or at the beginning of the apical declivity; undersides clad with small round scales set in the punctures, not densely placed except on pleurae and apices of abdominal segments.

Beak slender, broadly curved, as long as head and prothorax, finely punctate and very sparsely clothed with scales at base. Scrobes diagonally descending to underside at eyes. Scape attached at middle of beak, reaching eyes; funicle seven-jointed, the first slightly longer than the next two together and stouter, second and third subequal, seventh united with club; club proper as long as five preceding joints (third to seventh) and distinctly wider. Eyes separated beneath. Head finely granulate. Prothorax slightly broader than long, very faintly collared, ocular lobes hardly apparent. Elytra abruptly two-fifths wider than prothorax at widest point, not twice as long as broad (58:34), sides almost parallel, but slightly wider beyond middle. Scutellum minute.

Striae deep; interspaces each with a single row of sparsely placed linear setae, transversely finely rugose.

Second and fifth abdominal segments, each as long as the third and fourth combined; posterior lateral angles slightly produced on second and fourth segments.

Male: 1.6-1.8 mm.; differs from female in stouter beak, with antennae inserted beyond the middle.

Mycetophagidae

The genus *Berginus*, placed by LeConte in Mycetophagidae, but arranged with Lyctidae in the Leng catalogue, has been restored to the Mycetophagidae after residing for a while in the Cisidae. Only two species have been recorded from the United States: *B. pumilus* LeConte from Pennsylvania, and the Mexican, Central American *B. nigricolor* Champion, doubtfully recorded from Texas. Leng records *pumilus* from Southern California, but it does not seem likely that the same species occurs on both coasts. In fact the specimens of *Berginus* before the

writer do not answer to LeConte's description and are consequently described as new.

Key to Species of Berginus

1. Thorax longer than broad; length 2.0 mm; Pennsylvania ..... *B. pumilus* LeConte

   Thorax not longer than broad; length 1.5-1.75 mm.; California ..... *B. californicus* n. sp.

Berginus californicus n. sp.

Holotype and seven paratypes from El Segundo, California sand dunes on *Cuscuta californica,* taken June 15, 1938 (two) and February 25, 1939 (six) by W. D. Pierce, Clara Pierce and Dorothy Pool; three paratypes from Whittier, California, on *Sambucus* and two paratypes from Puente Hills, Whittier, March 24, 1916, L. L. Muchmore; two paratypes from Arch Beach, California, July 2-11, 1925, L. J. Muchmore; one paratype Turnbull Canyon, Whittier, May 12, 1917, L. L. Muchmore; six paratypes, Santa Monica, California, May 1, 1920, L. J. Muchmore, on sunflower; four paratypes, Redondo, California, April, A. Fenyes; all above from Los Angeles County; four paratypes, Mission Beach, San Diego County, November 17, 1932, A. T. McClay.

Size 1.5-1.75 mm. Reddish brown to black with purplish tinge, legs dark reddish; body clothed with clear, elongate, recumbent-curved scales.

Eyes spherical protuberant; head extending forward double the length of the eyes, sharply narrowed so that the apex is only one-half the width between the eyes. Antennae eleven-jointed, finely pubescent, with first joint much wider than second, and this a little wider than the succeeding funicular joints; club of two distinctly separated joints, the first triangular, the second irregularly quadrangular or obliquely truncate.

Thorax minutely wider than long; roughly sculptured, moderately densely clad with linear scales; medianly longitudinally depressed to a transverse elevation slightly behind the middle; laterally sulcate the entire length; broadest behind middle; scutellum transverse. Elytra at base wider than thorax at widest point in proportion of 29:24; striations only indicated by the rows of squamose setae, one row on each of the odd interspaces, which are slightly raised, two rows on the even or depressed interspaces.

Undersides more sparsely clad with finer, hair-like setae. Anterior and median coxae narrowly separated. Metasternum medianly sulcate from middle to apex. Tarsal claws widely separated, angulate at base.

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A NEW PLIOCENE BADGER FROM MEXICO

By Arthur B. Drescher

Introduction

Remains of Tertiary badgers are rare and of fragmentary character. Consequently any new material that is found, adds to our knowledge of the history of the group. This paper describes a new species of badger on the basis of three fragmentary lower jaws and a distal portion of a right humerus. The specimens were collected by the California Institute of Technology in deposits which appear to be middle Pliocene in age, near Rincon, Chihuahua, Mexico.

The writer is indebted to Dr. Chester Stock for supervision in the study of these specimens and for his criticism of the manuscript. He also wishes to acknowledge the aid of Dr. Robert W. Wilson. The photographs shown in the plate were retouched by John L. Ridgway and David P. Willoughby.

Taxidea mexicana n. sp.

Type specimen: No. 2538, Calif. Inst. Tech. Coll. Vert. Pale., plate 13, figs. 1, 1a. An incomplete right ramus with C-M_1.

Paratypes: A right ramus with crown of P_3, and a left ramus with P_2 present, Nos. 2539 and 2540 respectively, Calif. Inst. Tech. Vert. Pale.

Referred specimen: The distal portion of a right humerus broken off from shaft immediately above entepicondylar foramen, No. 2541, Calif. Inst. Tech. Coll. Vert. Pale., plate 13, fig. 4.

Locality: The type specimen and humerus are from C. I. T. Vert. Pale. Loc. No. 276; the two paratypes are from Loc. No. 289; near Rincon, Chihuahua, Mexico. Middle (?) Pliocene.

Specific diagnosis: Size approximates that of the smallest specimens of *Taxidea taxus;* jaw narrow at P_3, widening at M_1; canine small; P_1 absent; P_4 with prominent accessory cusp posterior and external to principal cusp; carnassial stout and broad, paraconid large and directed well toward inner side, metaconid situated almost as far forward as protoconid and forming approximately an equilateral triangle with protoconid and paraconid, trigonid larger than talonid, accessory cusps on talonid strongly developed.

Description: The type specimen is a right lower jaw which, though broken just behind the alveolus for M_2 and in front of the canine, is otherwise excellently preserved. The jaw tapers toward the anterior end and is slightly deeper under M_1 than

near the symphysis. The dentition is that of an adult badger. The carnassial is stout. P_4 possesses a prominent posterior cusp, while P_3 and P_2 have simple crowns. The small canine has a curved crown.

Of the paratypes, the right ramus, Nos. 2539, retains the alveoli for M_1 and P_2; P_3 is present; P_4 and C are broken off at the level of the jaw. In this specimen the area of the symphysis is small and relatively smooth. The left ramus, No. 2540, is similarly imperfect, but retains that portion of the jaw between and including P_2 and the alveolus for M_2. P_2 is complete. No. 2540 represents a very young individual.

In the humerus, referred to *T. mexicana,* the entepicondylar foramen is more heavily bridged, but the foramen itself is smaller than in recent badgers; the inner condyle is not so massive, and is separated from the trochlea by a notch. The condyle in the humerus of *T. taxus* not only lacks this notch, but its lower side is extended so that it forms the most distal portion of the element. Furthermore, the capitellum is relatively large.

Since no other carnivore or, more specifically, no other mustelid occurs in the fauna to which the fragmentary humerus might be referred, and since the specimen does not resemble the humerus of any recent form more closely than it does the badger, the possibility that the specimen also represents the species *T. mexicana* must receive serious consideration. Should this alocation prove correct one might interpret the evolution of the American badgers, at least from the middle Pliocene to Recent, as showing relatively few noteworthy modifications in dentition, but important changes at least in the upper arm bone. The structural features of the fossil humerus, in contrast to those of the living *Taxidea,* suggest that the characters of the fore-limbs in this instance may have generic value. However, in view of the paucity of information concerning skeletal parts of Tertiary badgers, recognition of the present specimen as paratypic material of *T. mexicana* must await unquestioned association of limb elements and dentition from the Rincon deposits or from related horizons.

Comparisons: *Taxidea mexicana* differs from the type *T. nevadensis,* described by Butterworth[1] from the Thousand Creek Pliocene of Nevada, in being about one and a half times larger. M_1 in the Chihuahuan specimen is more slender, the trigonid in this tooth is larger with more robust paraconid and metaconid. The posterior cusp of P_4 of the Nevada specimen is more external in position and a more pronounced cingulum is present than in the comparable tooth of *T. mexicana.* In addition *T. mexicana* shows less crowding of the premolars, relatively greater reduction in size of these teeth, and presence of an additional cusp on the talonid of M_1. The latter characters,

[1] Butterworth, E. M., Univ. Calif. Publ., Bull. Dept. Geol., vol. 10, no. 2, pp. 21-24, 1916.

however, fall within the limits of individual variation of *T. taxus* and are therefore of little diagnostic value, so far as these Tertiary species are concerned.

T. mexicana differs from the Chinese Pliocene *Parataxidea sinensis*[2] in (1) larger size, (2) absence of rudimentary P_1, (3) greater reduction of P_2 and P_3, and absence of a posterior heel in these teeth, (4) less pronounced cingulum in P_4, (5) carnassial with talonid less basin-shaped and occupying less area of tooth; difference in size between hypoconid and entoconid not so great; position of metaconid more anterior; larger paraconid; width of tooth greatest immediately behind metaconid and not at posterior end, and (6) depth of jaw in region of symphysis less than beneath molars.

Parataxidea crassa from China differs from *T. mexicana* in larger size, presence of P_1, remaining premolars not so much reduced. In this species the talonid of the carnassial is basin-shaped and large, and the tooth is wider and stouter than in the Mexican form.

Meles differs from *T. mexicana* in possessing P_1; P_4 lacks the posterior cusp; M_1 has the cutting shear well developed and the basin-shaped heel is larger. Moreover, the metaconid of M_1 has a position farther back with reference to the protoconid than in *T. mexicana;* the paraconid is smaller, and the carnassial is more slender and tapers slightly from back to front.

Taxidea mexicana appears to resemble more closely the modern badgers than it does known representatives among fossil forms. It exhibits, however, the following dissimilarities, which appear to deserve specific recognition: (1) canine smaller than in modern badgers, (2) metaconid of carnassial more anterior; paraconid more massive; cusps forming horseshoe-shaped ridge at back of talonid relatively larger; trigonid smaller with respect to talonid, (3) jaw narrower at P_3 and wider in back of M_1, tapers more noticeably toward anterior end; symphyseal area suggests that rami were not so strongly united as in Recent badgers of similar age. In addition to the above characters, and those which probably exist in the humerus, the following differences are recognized, with one or two exceptions, in a comparison with eighty skulls of Recent badgers from the United States and Mexico: (1) smaller size of fossil specimen, (2) less prominent cingulum on P_4, and (3) greater curvature of crown of canine.

A lower carnassial tooth, No. 30442, U. C. C., from Optima, Oklahoma, described by Hesse,[3] is intermediate in its characters between *T. nevadensis* and *T. mexicana*, but seems to be closer to the latter species. A similar tooth, No. 30559 U. C. C., from

[2] Zdansky, O., Palaeontologica Sinica, Ser. C, vol. 2, fasc. 1, pp. 47-55, pls. 10, 11, 1924.

[3] Hesse, C. J., Univ. Calif. Publ., Bull. Dept. Geol. Sci., vol. 24, no. 3, pp. 57-70, 1936.

the Hemphill horizon of Texas, is too worn to display diagnostic characters, but the specimen probably belongs to the same type of badger as No. 30442. $M\frac{1}{1}$ and $P\frac{4}{4}$, Nos. 30441 and 30440 U. C. C. are presumably also of this species.

Relationships: Comparison and measurements of the Pliocene and Recent badgers indicate clearly that the Mexican species, as well as that from the Thousand Creek beds of Nevada, are more like *T. taxus* than like *Parataxidea sinensis* or *P. crassa.* Although *P. sinensis* and *T. nevadensis* are of nearly equal size, the latter species shows marked structural similarity to the living *T. taxus.* Butterworth indicated that the Thousand Creek form is more closely related to *Taxidea* than to *Meles.* Likewise, Pilgrim[4] has pointed out the *Meles*-like type of dentition in *Parataxidea.*

In view of the large size of $M\frac{1}{1}$ as compared to $P\frac{4}{4}$, the heel region of the lower carnassial in the Old World badgers, *Meles,* and in *Parataxidea,* is relatively more prominent than in American forms. In the latter, the talonid approaches the trigonid in size, corresponding in this respect to the subequal size of $P\frac{4}{4}$ and $M\frac{1}{1}$. Although, as Butterworth has observed, the heel of $M\frac{1}{1}$ in *T. nevadensis* is larger than that displayed by any of the described mustelid forms with the exception of *Meles,* the heel, nevertheless resembles that in *Taxidea* more than it does that in Old World forms. Moreover, the anteroposterior alignment of the cusps of $M\frac{1}{1}$ of *Meles,* with corresponding basin-shaped heel in $M\frac{1}{1}$ are in marked contrast to the characters of the American forms in which transverse position of these cusps is associated with an entirely different appearing talonid in the lower carnassial. Similar differences are likewise displayed by *T. mexicana,* and it appears, therefore, logical to conclude that the American Pliocene forms were derived from a *Meles*-like ancestor, leading up to modern *Taxidea.* In this development it seems probable that *T. mexicana* and *T. nevadensis* represent separate lines of descent, with that of *T. mexicana* standing nearer the line leading to *T. taxus.*

[4] Pilgrim, G. E., Catalogue of the Pontian Carnivora of Europe in the Department of Geology, Brit. Mus. Nat. Hist. Publ., p. 48, 1931.

MEASUREMENTS (IN MILLIMETERS) AND RATIOS OF FOSSIL AND LIVING BADGERS

	T. mexicana n. sp. Type No. 2538 C. I. T.	T. mexicana n. sp. Paratype, No. 2539 C. I. T.	T. nevadensis Type No. 22290 U. C. C.	P. sinensis* China	Taxidea t. berlandieri No. 221844 U.S.N.M.	T. t. neglecta Dickey K-728	T. t. neglecta No. 14693 Dickey Coll.	T. t. neglecta No. 13971 Dickey Coll.	T. t. berlandieri No. 6841 Dickey Coll.	T. t. neglecta No. 14695 Dickey Coll.	T. t. neglecta No. 46970 U. C. C.	T. t. neglecta No. 17682 Dickey Coll.	T. t. berlandieri No. 14842 Dickey Coll.
$M\bar{1}$, length	12.8	....	9.5	10.5	13.3	13.8	12.3	13.6	13.1	13.2	13.7	13.2	13.4
$M\bar{1}$, width	6.1	....	5.2	6.4	5.4	5.3	5.7	5.8	5.9	5.4	6.1	5.9	5.9
$M\bar{1}$, length / $M\bar{1}$, width	2.10	....	1.83	1.64	2.46	M 2.60	m 2.16	2.34	2.22	2.44	2.24	2.24	2.27
Thickness of jaw below $M\bar{1}$	9.0	9.4	....	....	7.6	8.2	9.0	8.8	8.0	7.5	9.5	8.5	7.3
Thickness of jaw below $P\bar{3}$	6.7	7.5	....	....	8.4	7.9	8.9	8.0	8.4	7.0	9.0	8.0	7.4
Thickness of jaw below $M\bar{1}$ / Thickness of jaw below $P\bar{3}$	1.34	1.25	....	....	m .91	1.04	1.01	M 1.10	.97	1.07	1.05	1.06	.99
C-$M\bar{2}$, length	44.4	....	....	....	48.5	49.6	52.0	46.3	48.0	48.9	51.3	51.1	47.7
C-$M\bar{2}$, length / $M\bar{1}$, length	3.42	....	....	....	3.64	3.59	M 4.22	m 3.41	3.66	3.70	3.82	3.87	3.56
Length of trigonid in $M\bar{1}$	7.8	....	4.8	....	8.6	9.2	7.9	9.2	8.3	9.1	9.3	8.6	8.8
$M\bar{1}$, length / $M\bar{1}$, length of trigonid	1.65	....	1.98	....	1.55	1.50	1.56	1.48	M 1.57	m 1.45	1.48	1.54	1.52
$P\bar{3}$, length	5.4	5.7	....	4.4	6.1	6.3	5.5	5.2	5.1	5.7	6.2	5.6	5.5
$P\bar{2}$, length	4.1	....	....	3.7	3.6	3.6	3.3	4.0	3.4	3.9	4.3	3.7	3.9
$P\bar{3}$, length / $P\bar{2}$, length	1.32	....	....	1.19	1.70	M 1.75	1.67	m 1.30	1.50	1.46	1.44	1.51	1.41
$P\bar{3}$, width	3.1	3.0	....	3.3	3.1	3.3	2.8	2.9	2.9	2.9	3.0	3.3	2.9
$P\bar{3}$, length / $P\bar{3}$, width	1.74	1.90	....	1.33	1.97	1.91	1.96	1.79	1.76	1.97	M 2.06	m 1.70	1.90
$P\bar{4}$, length	7.8	....	6.0	5.5	8.3	8.8	8.3	7.2	7.7	7.9	9.0	8.6	9.3
$P\bar{4}$, width	4.2	....	3.3	4.1	4.2	4.3	4.2	4.2	4.5	3.8	4.3	4.5	4.3
$P\bar{4}$, length / $P\bar{4}$, width	1.86	....	1.82	1.34	1.97	2.04	1.97	m 1.71	m 1.71	2.08	2.09	1.91	M 2.16

M, maximum. m, minimum. *, measurements taken from photograph.

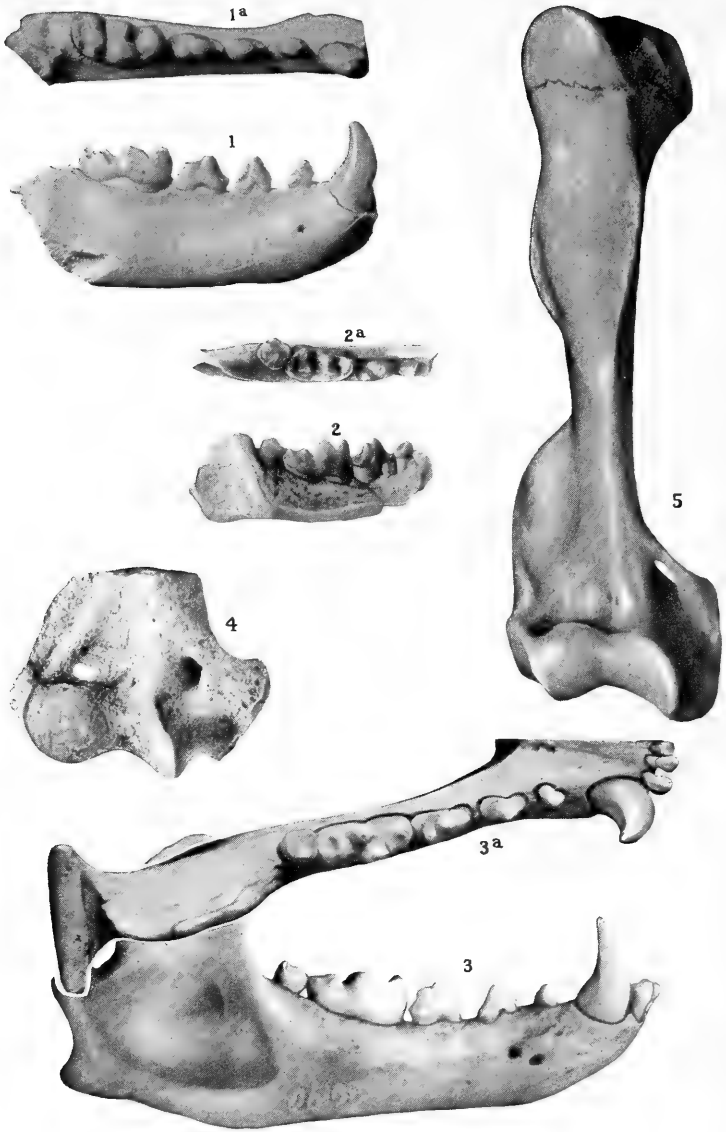

PLATE 13

Figures 1, 1a, *Taxidea mexicana*, n. sp., type specimen, ramus with C-M_1, No. 2538 C. I. T., Pliocene, Rincon, Chihuahua; figs. 2, 2a, *Taxidea nevadensis* Butterworth, type specimen, ramus with P_2-M_2, No. 22290 U. C. C., Pliocene, Thousand Creek, Nevada; figs. 3, 3a, *Taxidea taxus berlandieri* (Baird), ramus with lower dentition, No. 80190 U. S. N. M., Recent; fig. 4, *Taxidea* ? cf. *mexicana*, n. sp., distal portion of humerus, No. 2541 C. I. T., Pliocene, Rincon, Chihuahua; fig. 5, *Taxidea taxus* (Schreber), humerus, No. 13768 Dickey Coll., Recent. All figures natural size.

THE LONGICORN TRIBE ATIMIINI
(COLEOPTERA, CERAMBYCIDAE)

By E. Gorton Linsley[1]
University of California

The systematic position of the Atimiini has long puzzled the Coleopterist. *Atimia* presents such a strong Lamiine facies that Haldeman, who erected the genus, associated it with *Saperda*. Lacordaire (1869), observing the absence of the essential Lamiine groove on the anterior tibiae, placed *Atimia* in the Cerambycine series near *Smodicum*. This arrangement appeared unsatisfactory to LeConte (1873) who shifted the genus to a position roughly between the Clytine and Lepturine series. Gahan (1908), when searching for a connection between the Lepturine and Lamiine groups of longicorns, selected *Atimia* as a possible link. A few years later Webb (1912), solely on the basis of larval characters, associated the genus with *Asemum*. Leng (1920), apparently following Aurivillius (1912), placed the Atimiini toward the end of the Cerambycine series near the Clytini, separating it rather widely from both the Asemini and Lepturini. A careful examination of the external characters of the adults (including wing venation) and the larvae has convinced the writer that Webb's treatment of the group was by far the most satisfactory and that the Atimiini should be regarded as a tribe of the subfamily Aseminae.

Subfamily ASEMINAE Thomson

Thomson, 1864, System. Ceramb., p. 266, *Asemitae*
LeConte, 1873, Smithson. Misc. Coll., XI, 265: 292, *Asemini*
Schiödte, 1875, Naturh. Tidskr., (3) 10: 398, *Asemini*
Webb, 1912, U. S. Dept. Agr., Tech. Ser., Bull. 20: 151, Asemidae
Craighead, 1915, U. S. Dept. Agr., Rep. Ser., 107: 8.
Craighead, 1923, Can. Dept. Agr., Bull. 27: 30.

Head subvertical; antennae inserted near, but usually not embraced by, the eyes, usually shorter than the body in both sexes, segments pubescent, second segment longer than broad, one-half or nearly one-half as long as third segment; eyes emarginate, rarely divided, usually coarsely granulated; labrum free; mandibles acute, molar tooth and pubescent fringe lacking; lobes of maxillae usually feebly developed; palpi with last segment

[1] The writer is indebted to Dr. E. C. Van Dyke, Mr. E. P. Van Duzee, and Mr. Ralph Hopping for the loan of material from their own collections or those in their care, to Mr. W. S. Fisher for certain distributional information, and to Works Progress Administration O. P. 665-08-3-29 for providing the excellent illustrations.

truncate at apex; base of labial palpi connate, not retractile; ligula corneous; mentum trapezoidal; gula without an intermaxillary mentigerous process; pronotum without a lateral margin, sides entire; anterior coxae transverse or subglobose, cavities open or closed behind; mesonotum with a stridulating plate divided by a median vitta; intermediate coxal cavities variable; metepisterna moderate, usually narrowed posteriorly. Legs moderately short; anterior tibiae without a mesial sinus; tarsi pseudotetramerous, padded beneath, third segment dilated, bilobed, concealing the minute fourth segment, paronychium absent. Elytra parallel-sided or narrowed posteriorly, apices variable; posterior wings occasionally with a closed cell in the anal sector, radial cell closed, veins 2A, and $2A_2$ present, 1A connected with $2A_1+_2$.

The Asemine longicorns were first given primary rank by Schiödte (1875) on the basis of larval characters. A restudy of the structure of the adult beetles would seem to confirm Schiödte's views and to warrant recognition of the group as a subfamily. The closest relationships of the Aseminae appear to be with the Lepturinae, a group from which most systematists have separated them rather widely. The outstanding characters shared by the two subfamilies, and which are at variance with those of the groups with which they have been previously associated, are the primitive type of wing venation (with the maximum number of veins for the family and often a closed cell in the anal sector) and a divided mesonotal stridulatory plate. Striking similarities are also apparent in the larvae which in both groups have the tentatorial cross-arm internal and in some cases show intergradation in epicranial and mouth part characters. In general, however, larval Aseminae may be distinguished from larval Lepturinae by the absence of protuberant epipleura from the basal abdominal segments and the partial fusing of the halves of the epicranium. Adult Aseminae differ from Lepturinae by the absence of a mentigerous gular process, in the short, broad head which is not narrowed between the eyes, the elongate second segment of the antennae, and the simple mandibles, without a molar tooth or pubescent fringe.

The Asemini of LeConte and Horn (roughly Aseminae) included three groups, the Asemi, Opsimi, and Smodici (Asemini, Opsimini, and Smodicini of later workers). Craighead (1923), on the basis of larval characters, has transferred the Smodicini to the Cerambycinae but has retained *Opsimus* in the Aseminae. However, the larva of *Opsimus* exhibits the essential character of the Cerambycinae, a rounded, gouge-like cutting edge on the mandibles, and the adult a large, undivided, mesonotal stridulatory plate and typically cerambycine wing venation. It would therefore seem preferable to regard *Opsimus* (and the related *Dicentrus*) as cerambycine, restricting the Aseminae to two tribes as follows:

Base of antennae embraced by eyes; anterior coxal cavities closed behind, intercoxal process dilated at apex; intermediate coxal cavities closed; wings with an anal cell ..... *Atimiini*

Base of antennae not embraced by eyes; anterior coxal cavities open behind, intercoxal process not dilated at apex; intermediate coxal cavities open to epimeron; wings without an anal cell ..... *Asemini*

Tribe ATIMIINI LeConte

LeConte, 1873, Smithson. Misc. Coll., 265: 322.
LeConte and Horn, 1883, Smithson. Misc. Coll., 507: 307.
Leng, 1885, Brooklyn Ent. Soc., 7: 61.
Bradley, 1930, Man. Genera Beetles, 228.

Head transverse, front short, vertical, mouth parts nearly horizontal; antennae eleven-segmented, shorter than the body in both sexes, eyes large, moderately granulated, deeply emarginate, embracing antennal insertion; labrum transverse, ciliated; palpi unequal in length, the maxillary longer. Pronotum quadrate, transverse; anterior coxae rounded, cavities usually not angulated, completely closed behind; mesonotum with a large, divided, stridulatory area; scutellum subquadrate; intermediate coxal cavities closed; metasternum deeply emarginate posteriorly, metepisterna narrow, attenuated behind. Legs short; femora feebly clavate; tibiae armed with short spurs. Wings with a closed cell in the anal sector.

In food habits, this tribe is very specialized. The species of *Atimia* are all restricted to cupressaceous trees (including the closely related *Taxodium* and *Sequoia*) and the single species of *Paratimia* is unique among the American Cerambycidae in that its life history is completed within the cones of the genus *Pinus*.

KEY TO THE GENERA OF *ATIMIINI*

Elytra, and usually the pronotum and abdomen, with denuded areas; last segment of maxillary palpi cylindrical; anterior coxae widely separated by prosternum ..... *Atimia*

Elytra, pronotum, and abdomen without denuded areas; last segment of maxillary palpi triangular; anterior coxae narrowly separated by the prosternum ..... *Paratimia*

Genus ATIMIA Haldeman

Atimia Haldeman, 1847, Trans. Am. Philos. Soc., (2) 10: 56.
Haldeman, 1847, Proc. Am. Philos. Soc., 4: 373.
LeConte, 1850, Jour. Acad. Nat. Sci., Phila., (2) 2: 25.
Thomson, 1864, Systema Ceramb., p. 441.
Lecordaire, 1869, Genera Coleopt., 9: 144.
Gahan, 1908, Ann. Mag. Nat. Hist., (8) 1: 144.
Linsley, 1934, Pan-Pac. Ent., 10: 23-26.

Form elongate oval, moderately convex; vestiture coarse, appressed, with an intermixture of long, erect, setae on dorsal surface, elytra and usually the pronotum and abdominal sternites, with a pattern of denuded areas. Head short, broad; eyes very deeply emarginate, nearly divided, dorsal and ventral lobes connected by a double row of facets; antennal scape subconical, rarely subcylindrical. Pronotum distinctly wider than long, sides obtuse or nearly straight, usually with a distinct subapical angle, never evenly rounded from base to apex; anterior coxae widely separated by prosternum, intercoxal process at least one-half as broad as coxae, cavities rounded or feebly angulate externally. Elytra about twice as long as basal width, broad at base, tapering apically; disk with a feeble costa one-third of the distance between suture and lateral margin, the costa most evident at apical one-third; apices emarginate or truncate, rarely separately rounded. Abdomen of female with fifth tergite wider than long, gradually narrowed from base, apex not more than half as wide as base, emarginate or truncate, fifth sternite barely longer than fourth, rounded or subtruncate at apex.

Genotype: *Atimia tristis* Haldeman (by single reference).

KEY TO THE SPECIES OF *ATIMIA*

1. Antennae with third segment distinctly more than twice as long as second segment; elytral apices distinctly emarginate or very obliquely truncate 2

   Antennae with third segment at most only twice as long as second segment; elytral apices rounded or transversely truncate . 4

2. Scutellum longer than broad, narrowly rounded behind; denuded areas of elytra poorly defined, irregular or vittiform, more or less confluent; elytral apices distinctly emarginate, the outer angles frequently dentiform; abdominal sternites distinctly punctured 3

   Scutellum wider than long, broadly rounded behind; denuded areas of elytra well defined, regular, oval, separate, with a coarse puncture and erect seta in the center of each; elytral apices obliquely truncate; abdominal sternites very finely, indistinctly punctured; large species. 10-14 mm. Southern Arizona, New Mexico ..... *huachucae*

3. Pronotum with sides more or less straight, widest before apex, disk with a large, post-median, glabrous, polished area, vittae sub-parallel; denuded areas of elytra longitudinal, vittiform, with a broad band of dense pubescence at sides; fifth abdominal tergite of female truncate or very feebly emarginate at apex. 6-12 mm. British Columbia to northern Lower California ..... *dorsalis*

   Pronotum with sides obtuse, widest at middle, disk without a large, post-median, polished area, vittae arcuate; denuded areas of elytra small, mostly suboval or transverse, the vestiture mottled; fifth abdominal tergite of female strongly emarginate at apex. 7-12 mm. Atlantic Coast and California ..... *confusa*

4. Pronotum irregularly punctured, disk with longitudinal, subglabrous, nearly impunctate, polished vittae 5

Pronotum more or less evenly, closely punctured, disk without any longitudinal, polished vittae 7

5. Antennae with outer segments cylindrical, not flattened or expanded, scape subconical; depressed pubescence dense, coarse, luteus; elytral apices truncate 6

Antennae with outer segments flattened, expanded, scape very robust, subcylindrical; depressed pubescence sparse, finer, grayish and brownish; elytral apices separately rounded; color dark brown. 8-12 mm. Central California ..... *helenae*

6. Reddish brown; antennal scape slender, about two and one-fourth times as long as broad, third segment twice as long as second, fifth segment barely longer than fourth; pronotum with sides nearly straight, the vittae subparallel; larger species. 11-12 mm. Southern Mexico ..... *mexicana*

Dark brown; antennal scape short, robust, only twice as long as broad, third segment only one and one-half times as long as second, fifth segment distinctly longer than fourth; pronotum with sides rounded, the vittae arcuate; smaller species. 6-8.5 mm. New Mexico ..... *vandykei*

7. Black; pubescence ashy gray; third antennal segment distinctly less than twice as long as second segment; denuded areas of elytra small, irregular, or ladder-like, not vittiform. 6-9 mm. Washington and Oregon ..... *hoppingi*

Dark brown; pubescence luteus; third antennal segment twice as long as second segment; denuded areas of elytra narrow, ladder-like, both longitudinal vittiform and transverse. 6.5 mm. China ..... *chinensis*

Atimia huachucae Champlain and Knull

(Plate 14, fig. 1)

Atimia huachucae Champlain and Knull, 1922, Ent. News, 33: 148
Linsley, 1934, Pan-Pac. Ent., 10: 23.

Female: Form elongate, robust, moderately tapering posteriorly; color brown, antennae, legs, and elytra reddish brown; vestiture coarse, appressed, luteus, with a few scattered, long, erect hairs on head, sides of pronotum and elytra. Head with a well defined, vertical, median, glabrous, impunctate line extending from occiput nearly to clypeus; frons moderately coarsely, closely punctured and very densely clothed with appressed, luteus hairs; neck moderately coarsely, contiguously and subcontiguously punctured on each side of median line; antennae attaining apical one-fourth of elytra, scape subconical, two and one-third times as long as broad, third segment two and one-half times as long as second, fifth segment one and one-third times as long as fourth, outer segments cylindrical, not conspicuously flattened or expanded. Pronotum approximately one and one-fourth times

as broad as long, sides feebly obtuse, widest near middle, subapical angles distinct but obtuse; surface dullish, moderately coarsely, closely punctured and pubescent, with four longitudinal, sparsely pubescent, coarsely but less closely, irregularly punctate vittae, the median pair arcuate, the lateral pair nearly straight; disk without a post-median, polished, glabrous area; scutellum wider than long, broadly rounded posteriorly, densely clothed with appressed luteus hairs. Elytra gradually narrowed to apical one-third, thence more strongly converging to apices; surface moderately finely, closely, distinctly punctured and densely clothed with coarse, appressed, luteus hairs except for the polished denuded areas; denuded areas numerous, oval, well defined, separate, with a very coarse puncture and erect seta in the center of each; apices very obliquely truncate, rarely feebly emarginate. Legs reddish, finely punctured and pubescent; posterior tarsi with first segment distinctly longer than the two following together, second segment about one and one-half times as long as apical width. Abdomen with sternites very finely, indistinctly punctured, densely clothed with appressed luteus hairs except for very small, scattered, oval denuded areas and longitudinal, sublateral, polished vittae; fifth tergite emarginate at apex; fifth sternite broadly rounded at apex. Length 12-14 mm.

Type locality: Cooney, New Mexico.

Distribution: Mountains of southern Arizona and New Mexico.

Host: *Cupressus arizonica* Greene.

Flight period: July to September.

This species, of which I have seen only females, has a larger average size than any of the other known species and may be readily recognized by the small, clearly defined, oval denuded areas of the elytra, broad scutellum, finely punctured abdomen, elongate first segment of the posterior tarsi, and the obliquely truncate elytral apices. Twelve specimens have been examined from Carr Canyon, Huachuca Mts. (Linsley) and Mt. Washington, near Nogales, Arizona (Van Dyke). Specimens from the former locality were beaten from branches of the Arizona Cypress.

Atimia confusa (Say)

(Plate 14, fig. 7)

Clytus confusus Say, 1826, Jour. Acad. Nat. Sci. Phila., 5: 276.

Atimia confusa, Haldeman, 1847, Proc. Am. Philos. Soc., 4: 373 (syn.).
LeConte, 1850, Jour. Acad. Nat. Sci. Phila., (2) 2: 25.
LeConte, 1859, Compl. Writ., Thom. Say, 2: 333.
Leng, 1890, Entom. Amer., 6: 10.
Wickham, 1897, Can. Ent., 29: 169.
Craighead, 1922, Can. Dept. Agr., Bull. 27: 35 (biol.).
Linsley, 1934, Pan-Pac. Ent., 10: 24.

Atimia tristis Haldeman, 1847, Trans. Am. Philos. Soc., (2) 10: 56.

Male: Form short, robust, gradually tapering posteriorly; color brown, legs, elytra, and often antennae reddish; vestiture coarse, appressed, luteus, with a few long, scattered, erect hairs on head, sides of pronotum, and elytra. Head rather densely clothed with appressed, luteus hairs, except for an irregular, glabrous, impunctate area at middle of frons which is not at all linear; frons moderately coarsely, closely punctured; neck coarsely, contiguously punctured; antennae attaining apical one-third of elytra, scape moderately slender, subconical, about two and one-half times as long as broad, distinctly but not closely punctured; antennae attaining apical one-third of elytra, scape moderately slender, subconical, about two and one-half times as long as broad, distinctly but not closely punctured, second segment one and one-third times as long as broad, third segment two and one-third times as long as second, fifth segment more than one and one-third times as long as fourth, outer segments cylindrical, not strongly flattened or expanded. Pronotum about one and one-fourth times as broad as long, sides obtusely rounded, subapical angle feeble, obtuse; surface shining, moderately coarsely, closely punctured, densely clothed with appressed luteus hairs with four longitudinal, glabrous or sparsely pubescent, irregularly, sparsely, coarsely punctured vittae, the median pair arcuate, the lateral pair nearly straight, poorly defined, disk without a post-median, glabrous, impunctate area; scutellum longer than broad, narrowly rounded behind, densely clothed with appressed, luteus hairs. Elytra gradually narrowed to apex; surface shallowly, irregularly, moderately finely punctured, densely clothed with appressed luteus hairs except for the denuded areas; denuded areas irrgular, suboval, not vittiform, often transverse and somewhat confluent, usually with one or more coarse punctures and erect hairs in each; apices emarginate, the outer angles often dentiform. Legs reddish, finely punctured and pubescent; posterior tarsi with first segment about as long as two following together, second segment one and one-third times as long as apical width. Abdomen with sternites shining, moderately finely, closely and distinctly punctured, densely clothed with appressed hairs; fifth sternite broadly, distinctly emarginate at apex.

Female: A little more robust than male; antennae barely surpassing middle of elytra; fifth abdominal tergite distinctly emarginate at apex; fifth sternite broadly rounded at apex.

Type locality: Pennsylvania.

Distribution: Eastern United States and Canada, California.

Host: *Juniperus, Cupressus, Taxodium, Thuja, Chamaecyparis.*

Flight period: Two broods, Spring and Fall (Craighead, 1922).

The typical form of this species is smaller than *A. dorsalis* and occurs along the Atlantic coast from Florida to New York and possibly as far west as Texas and Iowa. The forms recorded from the latter states have not, however, been seen by the writer and may belong to some other species. Of this typical form the writer has examined thirty-eight specimens from New York, Pennsylvania, Maryland and Virginia, all reared from *Juniperus virginiana* Linn. Craighead gives as hosts also *Thuja* and *Chamaecyparis*. Mr. Fisher informs me that the collection of the United States National Museum contains specimens from South Carolina, North Carolina, West Virginia, Maryland, District of Columbia, New Jersey, New York, Pennsylvania, Michigan, Iowa, Texas, and New Mexico.

In Coastal Central California, in the native habitat of the Monterey Cypress, *Cupressus macrocarpa* Hartweg, there is a form which I can separate only in color and size from typical *confusa*. This form is larger (male: 8-11 mm. compared to 6-7 mm., female: 9-12 mm. as compared to 7-9 mm.) and the ground color is dark reddish brown. Although this form is separated by about two thousand miles from typical *confusa*, it appears to be only subspecifically distinct and may be designated as *Atimia confusa maritima* Linsley, new subspecies (Holotype male (No. 4851 Calif. Acad. Sci. Ent.) from California, March 27, 1921, and Allotype female (No. 4852 C. A. S., Ent.) from the same locality, May 22, 1922, both collected by Mr. L. S. Slevin on *Cupressus macrocarpa*). Thirty-eight additional specimens have been studied, of which twenty-one examples in the Slevin Collection (deposited in the California Academy of Sciences) are designated as paratypes.

Atimia dorsalis LeConte

(Plate 14, fig. 4)

Atimia dorsalis LeConte, 1869, Ann. Mag. Nat. Hist., (4) 4: 385.
Leng, 1890, Entom. Amer., 6: 10.
Craighead, 1922, Can. Dept. Agr., Bull. 27: 34 (biol.).
Hardy, 1926, Rep. Prov. Mus. B. C., 1925: 32, pl. 4, f. 6.
Linsley, 1934, Pan-Pac. Ent., 10: 24.
Linsley, 1936, Pan-Pac. Ent., 12: 199 (biol.).

Male: Form elongate, moderately slender, tapering posteriorly; color reddish brown; vestiture coarse, appressed, luteus, closely condensed into a pattern at sides of pronotum, elytra, and abdominal sternites, with a few scattered, long, erect hairs on head, sides of pronotum, and elytra. Head densely clothed with appressed, luteus hairs, except for an irregular, glabrous, impunctate area at middle of frons which is not at all linear;

frons moderately coarsely, closely punctured; neck coarsely punctured, the punctures scarsely separated; antennae attaining apical one-third of elytra, scape moderately slender, subconical, a little more than twice as long as broad, second segment one and one-half times as long as broad, third segment two and one-half times as long as second, fifth segment one and one-third times as long as fourth, outer segments cylindrical, not flattened or expanded. Pronotum one and one-fourth times as broad as long, sides nearly straight, widest before apex, subapical angles distinct, more or less acute; surface coarsely, closely punctured and pubescent with two longitudinal, glabrous, impunctate vittae and a post-median, polished, impunctate area, lateral vittae not evident, pubescence of area between vittae sparse, each hair arising from a coarse puncture; scutellum longer than broad, narrowly rounded posteriorly, densely clothed with appressed, luteus hairs. Elytra nearly parallel to apical one-third, thence gradually narrowed to apices; surface shallowly but densely punctured and clothed with appressed luteus hairs except for denuded areas; denuded areas usually in the form of a longitudinal discal vitta and a transverse post-median and subapical area, the lateral pubescence very dense; apices emarginate, the outer angles often dentiform. Legs reddish brown, finely punctured and pubescent; posterior tarsi slender, first segment a little shorter than the two following together, second segment twice as long as apical width. Abdomen with sternites moderately finely but distinctly punctured, densely clothed with appressed hairs at sides, subglabrous at middle; fifth sternite emarginate at apex. Length: 6-11 mm.

Female: Larger and more robust than male; antennae barely surpassing middle of elytra; fifth abdominal tergite truncate or rarely very feebly emarginate at apex; fifth sternite truncate at apex. Length: 8-12 mm.

Type locality: "Vancouver's Island."

Distribution: Pacific coast of North America from British Columbia to the San Pedro Martir Mountains of Lower California.

Hosts: *Libocedrus, Thuja, Sequoia, Cupressus, Juniperus.*

Flight period: Late Spring and Summer at higher altitudes and northern portion of range, March to May and September to November in southern portion of range.

This species is very closely related to the preceding and may eventually prove to be only subspecifically distinct. In general the two may be distinguished by the characters enumerated in the key, but it is not uncommon to find specimens in which one or more of the differences break down.

As has been pointed out previously (Linsley, 1936), *A. dorsalis* is double-brooded in the southern portion of its range, the largest brood being active in October and November. The species frequently attacks living cupressaceous trees, but usually only after they have first been weakened by the attack of bark beetles (*Phloeosinus* spp.). In areas where the Monterey Cypress (*Cupressus macrocarpa* Hartweg) has been planted as a windbreak or for ornamental purposes and the trees receive inadequate water, *Atimia* damage may be very severe.

Atimia helenae Linsley

(Plate 14, fig. 5)

Atimia helenae Linsley, 1934, Pan-Pac. Ent., 10: 25.

Male: Form elongate, moderately robust, scarcely tapering posteriorly; color dark brown or piceous; vestiture sparse, only moderately coarse, appressed, grayish and brownish, with an intermixture of rather numerous, very long, erect hairs on head, pronotum and elytra. Head sparsely clothed with appressed hairs; frons closely, irregularly, moderately coarsely punctured, without a well defined, median, longitudinal smooth line; vertex with a large, glabrous, impunctate area at middle, coarsely, closely punctured on each side; antennae barely surpassing middle of elytra, scape very robust, subcylindrical, barely more than twice as long as broad, coarsely, sparsely punctured, second segment one and one-third times as long as broad, third segment about one and three-fourth times as long as second; fifth segment barely longer than fourth, outer segments broad, flattened, expanded. Pronotum about one and one-half times as broad as long, sides a little obtuse, widest before apex, subapical angles obtuse; surface moderately coarsely, shallowly, irregularly punctured, sparsely punctured vitta on each side of disk, post-median, polished, discal area absent; scutellum longer than broad, rounded behind, sparsely clothed with appressed, pale hairs. Elytra indistinctly, shallowly, punctured, moderately densely pubescent except for the numerous irregular, confluent, denuded areas, the largest of which are antemedian, post-median, and subapical; apices broadly, separately rounded. Legs piceous, finely punctured and pubescent; posterior tarsi moderately broad, first segment distinctly shorter than the two following together, second segment at most one and one-half times apical width. Abdomen with sternites moderately densely pubescent at sides, subglabrous at middle; fifth sternite broadly, distinctly emarginate at apex. Length: 8-10 mm.

Female: Larger and more robust than male; antennae attaining only basal one-third of elytra, outer segments more strongly flattened; fifth abdominal tergite truncate at apex; fifth abdominal sternite broadly rounded at apex. Length: 9-12 mm.

Type locality: Cypress Ridge, Marin County, California.

Distribution: Dry foothills of central and northern California (Marin, Sonoma, Napa, and Lake counties).

Host plant: *Cupressus sargentii.*

This species may be readily distinguished from all other known members of the genus by the peculiar structure of the antennae (stout, cylindrical scape and broad, flattened, outer segments), and from all except *chinensis* by the separately rounded elytral apices. Twenty-nine examples have been studied, all beaten or reared from the Sargent Cypress, which grows in only a few limited areas in the dry, serpentine foothills of northern and central California.

Atimia mexicana Linsley

Atimia mexicana Linsley, 1934, Pan-Pac. Ent., 10: 24.

Female: Form elongate, robust, tapering posteriorly; color dark brown, elytra, abdomen and legs reddish; vestiture coarse, appressed, luteus, pronotum and elytra almost devoid of erect hairs. Head with a narrow, vertical, polished, glabrous and impunctate, median, longitudinal vitta extending from vertex to level of antennal bases; frons and vertex densely clothed with appressed luteus hairs obscuring surface; antennae barely surpassing middle of elytra; scape robust, subconical, barely more than twice as long as broad, second segment one and one-fourth times as long as broad, third segment twice as long as second, fifth segment barely longer than fourth, outer segments cylindrical, not flattened or expanded. Pronotum one-fourth wider than long, sides feebly obtuse, widest near middle, subapical angles distinct, nearly right angular; surface shining, densely clothed with appressed luteus hairs except for four irregularly, sparsely, and very coarsely punctured, sparsely pubescent, straight, longitudinal vittae, the dorsal pair subparallel, approximate, disk without a post-median, polished, glabrous area; scutellum a little wider than long, broadly rounded behind. Elytra gradually narrowed to apical one-third, thence more strongly to apex; surface indistinctly punctured, densely clothed with appressed luteus hairs except for polished, denuded areas; denuded areas numerous, narrow, longitudinal and transverse; apices transversely truncate. Legs reddish, finely punctured and pubescent; posterior tarsi with first segment nearly as long as two following together, second segment one and one-third times as long as apical width. Abdomen with sternites densely clothed with appressed hairs except for four narrow, longitudinal, glabrous, polished, impunctate vittae; fifth tergite broadly

rounded at apex, fifth sternite subtruncate at apex. Length 11-12 mm.

Type locality: Real de Arriba, Mexico.

Distribution: District of Temescaltepec, Mexico.

Host: *Thuja occidentalis.*

Flight period: May.

This species is about the size of *A. dorsalis* Lec., from which it differs in the short third segment of the antennae (only twice as long as second segment), elytral pattern of denuded areas, and truncate elytral apices.

Atimia vandykei Linsley, new species

(Plate 14, fig. 8)

Male: Form elongate, moderately robust, gradually tapering posteriorly, color very dark brown; vestiture coarse, dense, appressed, luteus, with scattered, long, erect hairs on head, sides of pronotum, and elytra. Head coarsely, closely punctured except for a large, irregular, glabrous, impunctate area on vertex and a narrow, median, longitudinal polished vitta on frons; neck moderately coarsely, closely punctured on each side of midline; antennae nearly attaining apical one-third of elytra, scape short, robust, about twice as long as broad, second segment one and one-fourth times as long as broad, third segment about one and one-half times as long as second, fifth segment one and one-fourth times as long as fourth, outer segments cylindrical, not expanded or flattened. Pronotum one and one-third times as broad as long, sides obtusely rounded, widest at middle, subapical angles rounded; surface shining, coarsely, closely punctured, densely clothed with appressed hairs except for two arcuate, longitudinal, subglabrous, sparsely punctured vittae and a post-median, discal, polished area; scutellum about as wide as long, broadly rounded posteriorly, densely clothed with luteus hairs. Elytra subparallel to apical one-fourth, thence narrowed to apices; surface moderately finely but not closely punctured, densely clothed with coarse, appressed, luteus hairs except for the denuded areas, denuded areas mostly small, irregular, suboval or transverse; apices transversely truncate. Legs dark brown, finely punctured and pubescent; posterior tarsi with first segment nearly as long as two following together, second segment less than one and one-half times as long as apical width. Abdomen with sternites moderately finely but distinctly punctured, densely clothed with appressed luteus hairs at side, subglabrous at middle; fifth sternite broadly, distinctly, emarginate at apex. Length 6.5 mm.

Female: Form more robust than male; antennae attaining only middle of elytra; fifth abdominal tergite rounded at apex, fifth sternite truncate at apex. Length 8.5 mm.

Holotype male (No. 4853 Calif. Acad. Sci., Ent.) from Ft. Wingate, New Mexico, June 9, 1935, allotype female (No. 4854 C. A. S. Ent.), from Gallup, New Mexico, June 6, 1935, and one paratype female (Van Dyke collection, C. A. S., Ent.), from Santa Fe, New Mexico, June 16, 1935. All three specimens were beaten from *Juniperus* by Dr. E. C. Van Dyke, to whom the writer is indebted for the privilege of studying them.

This species is suggestive of *confusa*, but may be readily distinguished by the short, robust antennal scape which is only about twice as long as broad, the short third segment of the antennae which is only one and one-half times as long as the second segment (as compared to two and one-third times as long in *confusa*), the transversely truncate elytral apices, and the shape of the fifth abdominal tergite and sternite of the female which are rounded and truncate respectively.

Atimia hoppingi Linsley, new species

(Plate 14, fig. 6)

Male: Form moderately elongate, robust, scarcely tapering posteriorly; color black, vestiture coarse, appressed, grayish-white, with scattered long, erect, pale hairs on head, pronotum, and elytra. Head densely clothed with appressed hairs; vertex and frons coarsely, closely punctured, without a large, glabrous, impunctate, polished area; antennae attaining apical one-third of elytra, scape moderately robust, subconical, more than two and one-half times as long as broad, second segment one and one-half times as long as broad, third segment less than twice as long as second, fifth segment but little longer than fourth, outer segments cylindrical, not flattened or conspicuously expanded. Pronotum a little wider than long, sides feebly obtuse, widest before apex, subapical angles obtuse; surface coarsely, more or less regularly punctured, disk sparsely pubescent, without any glabrous, impunctate, longitudinal vittiform areas; scutellum longer than broad, narrowly rounded posteriorly, sparsely pubescent. Elytra rather finely, closely punctured, moderately densely clothed with appressed pale hairs except for denuded areas; denuded areas small, irregular, poorly defined, not forming a distinct pattern; apices transversely truncate. Legs black, finely punctured and pubescent; posterior tarsi moderately broad, first segment distinctly shorter than two following together, second segment about one and one-half times as long as broad. Abdomen with sternites finely, closely punctured, densely clothed with appressed hairs at sides, sparsely at middle; fifth sternite broadly, distinctly emarginate at apex. Length 6 mm.

Female: Larger and more robust than male; antennae not quite attaining middle of elytra; pronotum with sides very obtuse; fifth abdominal tergite and sternite feebly emarginate at apex. Length 9 mm.

Type locality: Mt. Rainier, Washington.

Distribution: Washington and Oregon.

Flight period: July.

Host: *Chamaecyparis nootkatensis* (Lamb).

Holotype male and allotype female (collection of R. Hopping), from White R. Camp, Mt. Rainier, Washington, July 27, 1936 and July 30, 1933, respectively, collected by Mr. J. Wilcox. Paratypes, a male and a female, from Santiam National Forest, Oregon, July 20, 1914, on "Alaska Cedar," W. J. Chamberlin collector (collection of California Academy of Sciences).

This species is apparently related to *A. helenae* Linsley, but differs in the slender antennae which are not flattened or expanded apically, uniformly and more finely punctured pronotum, absence of longitudinal vittiform denuded areas on the pronotum and elytra, and transversely truncate elytral apices. The writer is under obligation to his friend Mr. Ralph Hopping for the privilege of studying the first two specimens of this species.

Atimia chinensis Linsley, new species

(Plate 14, fig. 3)

Female: Form elongate, moderately robust, gradually tapering posteriorly; color dark brown; vestiture coarse, appressed, luteus, with a few scattered, long, erect hairs on head and sides of pronotum. Head rather densely clothed with appressed hairs; frons coarsely, contiguously punctured except for a short, irregular, polished, glabrous and impunctate median longitudinal vitta between the eyes and antennal bases; neck coarsely and very closely punctured; antennae barely surpassing the middle of the elytra, scape robust, subconical, a little more than twice as long as broad, second segment one and one-fourth times as long as broad, third segment twice as long as second, fifth segment less than one and one-fourth times as long as fourth, outer segments slender, not expanded. Pronotum one and one-fourth times as wide as long, sides feebly obtuse, widest at middle, subapical angles rounded; surface dull, coarsely, very closely punctured, without longitudinal, glabrous, impunctate vittae; appressed hairs dense at sides, sparse on disk; scutellum about as long as wide, rounded behind, moderately pubescent. Elytra narrowed from apical one-third to apex; surface moderately finely punctured and densely clothed with appressed hairs ex-

cept for a narrow, longitudinal, polished, glabrous and impunctate, subsutural vitta and numerous small, rounder or transverse denuded areas; apices broadly, separately rounded. Legs black, finely punctured and pubescent; posterior tarsi with first segment distinctly shorter than two following together, barely one and one-half times as long as second segment. Abdomen with sternites finely, distinctly punctured, clothed with long, appressed, luteus hairs, sparse on disk; fifth tergite feebly emarginate at apex, fifth sternite feebly truncate at apex. Length 6.5 mm.

Holotype female (Musée Heude, Shanghai), from Chusan Isl., Chekiang Province, May 26, 1931, collected by O. Piel, and very kindly submitted to the writer for study by Mr. J. Linsley Gressitt.

In the sculpturing of the pronotum this species is most similar to *A. hoppingi* Linsley, but differs in the short second antennal segment, luteus rather than ashy gray pubescence, narrow, vittiform and transverse, denuded areas of the elytra, and rounded elytral apices. In this latter character it agrees with *helenae* Linsley, from which it may be readily distinguished by the slender antennal segments, absence of pronotal vittae, and dense, luteus pubescence.

Genus PARATIMIA Fisher

Paratimia Fisher, 1915, Proc. Ent. Soc. Wash., 17: 78.

Form elongate, slender, subcylindrical; vestiture moderately coarse, appressed, with an intermixture of long, erect setae on dorsal surface; pronotum, elytra, and abdominal sternites without denuded areas. Head short, broad; eyes emarginate, dorsal and ventral lobes connected posteriorly by about four rows of facets; antennal scape subconical, outer segments flattened and expanded slightly in the female, slender in the male; maxillary palpi with the last segment triangular. Pronotum as long as broad, sides more or less evenly rounded; anterior coxae narrowly separated by the prosternum, intercoxal process less than one-third as wide as coxae, cavities angulated externally. Elytra about two and one-half times as long as broad, slightly narrowed apically; costae not evident; apices separately rounded. Abdomen of female with fifth tergite about twice as long as basal width, broad at base, sides subparallel, apex truncate, fifth sternite about twice as long as fourth, sides subparallel, apex truncate.

Genotype: *Paratimia conicola* Fisher (by original designation).

This genus may be distinguished from *Atimia* by the narrow, cylindrical form, absence of denuded areas from the elytra and pronotum, narrowly separated anterior coxae, triangular ulti-

nate segment of the maxillary palpi, less deeply emarginate eyes, and the long, parallel-sided fifth tergite and sternite of the female. The following is the only known species:

Paratimia conicola Fisher

(Plate 14, fig. 2)

Paratimia conicola Fisher, 1915, Proc. Ent. Soc. Wash., 17: 78. Craighead, 1923, Can. Dept. Agr., Bull. 27: 35 (larva).

Male: Form elongate, very slender, subparallel; color reddish brown; appressed hairs whitish on head, base of pronotum, scutellum along elytral suture, and on ventral surface reddish, erect setae reddish on pronotum, whitish elsewhere. Head moderately densely clothed with appressed hairs, coarsely, closely, but irregularly punctured; antennae attaining apical one-third of elytra, scape subconical, second segment one and one-half times as long as broad, third segment nearly three times as long as second, fifth segment one and one-fourth times as long as fourth, outer segments subcylindrical, not expanded. Pronotum as long as broad, sides obtuse, widest before apex; surface coarsely, rather regularly punctured, moderately densely clothed with appressed hairs which do not entirely obscure the integument; scutellum a little longer than wide, broadly rounded posteriorly. Elytra with sides subparallel to apical one-fourth; surface less closely punctured than pronotum, the punctures varying from nearly one to two diameters apart; reddish hairs moderately sparse; arising from the coarse punctures, white pubescence dense, finer; apices broadly, separately rounded. Legs moderately finely, not closely punctured, moderately sparsely pubescent; posterior tarsi with first segment about as long as the two following together, second segment twice as long as apical width. Abdomen with sternites moderately finely but distinctly punctured, densely clothed with appressed white pubescence; fifth sternite shorter than fourth, broadly emarginate at apex. Length 8-11 mm.

Female: A little more robust than male; antennae attaining middle of elytra, outer segments flattened, expanded; fifth abdominal sternite longer than fourth, truncate at apex. Length 9-13 mm.

Type locality: "Monumental Mines, California."

Distribution: Coast Range Mountains of California (Santa Lucia Mts., Santa Cruz Mts., Napa to Siskiyou and Shasta counties); Josephine County, Oregon.

Hosts: Cones of *Pinus attenuata* and *bolanderi*.

Flight period: March to May.

This species may be readily known by the narrow, cylindrical body form, reddish-brown in color, and narrow, white, sutural elytral stripe. The larva is similar to that of *Atimia dorsalis* but lacks the pronotal pubescence.

P. conicola has long been thought to be restricted to the cones of the knob-cone pine, *Pinus attenuata*. This tree occurs in only a few scattered localities on barren or rocky slopes, and the cones persist on the trunk and branches for several (sometimes fifteen to twenty) years. Recently, however, the species has been taken on *P. bolanderi* along the Mendocino coast (E. C. Van Dyke, A. E. Michelbacher, R. L. Usinger). This suggests that it may utilize the cones of several species of pine. The eggs are deposited at the base of young cones and the larvae feed in the pithy center and in the seeds and scales. Usually more than one larva lives in a cone and occasionally six or seven will successfully mature. On the average, however, only two or three beetles will emerge from a single cone.[2] Pupation occurs in the fall and transformation occurs almost immediately. Emergence follows in early spring (March and April). The species appears to be very sensitive to temperature changes and if infested cones are brought into a warm room during the winter months, adults will emerge within a few hours. Likewise, in severe winters many adults are killed in their pupal cells.

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[2] These observations were made upon *Pinus attenuata*, a closed cone species, and may not apply in the case of open cone pines.

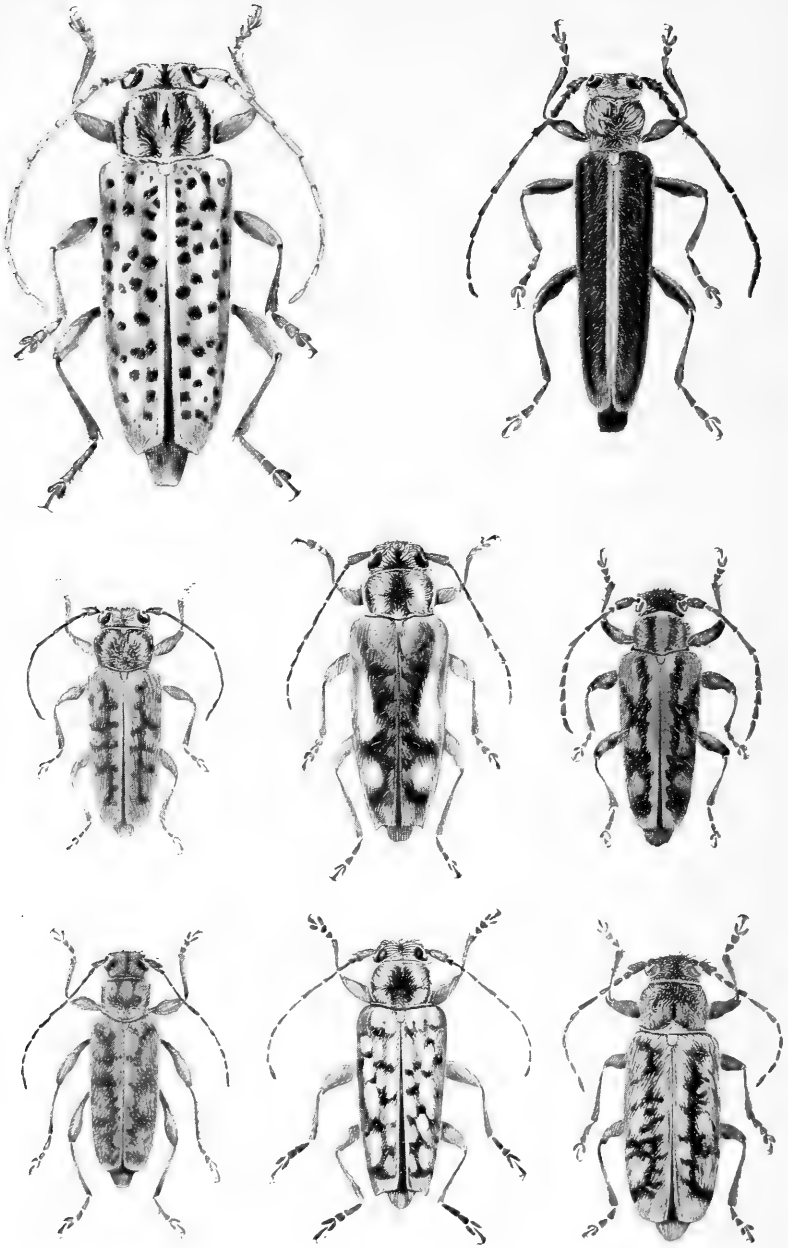

PLATE 14

ATIMIINI

1. *A. huachucae.* 2. *P. conicola.*
3. *A. chinensis.* 4. *A. dorsalis.* 5. *A. helenae.*
6. *A. hoppingi.* 7. *A. confusa.* 8. *A. vandykei.*

A NEW SPECIES OF EUPAGODERES HORN FROM DEATH VALLEY, CALIFORNIA

(*COLEOPTERA: CURCULIONIDAE*)

By Peter C. Ting, Sr.
State Department of Agriculture, San Francisco, California

Eupagoderes californicus Ting, new species

Form of female rather robust; elytra less than one-third longer than broad, sides only slightly rounded but converging abruptly from apical third to apex. Form of male more elongate; elytra more than one-third longer than broad, inflated posteriorly and more evenly rounded at base of declivity than female. Color of vestiture usually predominantly white, pronotal vittae light to dark cinereous, elytral serial punctures surrounded with minute, black areas giving the species a speckled appearance, femora and tibiae without the usual pronounced, dark markings of many species; occasionally, as in other species of the genus, specimens will have a more or less uniform reddish tan color. The closely related *desertus* Horn lacks the distinct, speckled appearance but has faint, yellow vittae (best seen with the unaided eye) on the alternate, elytral intervals which are entirely lacking on *californicus*. Length of females (anterior margin of eye to apex of elytron) 12 mm. to 17 mm., males 10.5 mm. to 15.5 mm.; width, females 5.8 mm. to 8.5 mm., males 4.9 mm. to 7 mm.

Rostrum transversely constricted at base; shorter than pronotum (2.9:3.5); trisulcate, median sulcus shallow generally extending only three-quarters the distance from base to antennal articulation, lateral sulci shorter and closer together at base than apex; nasal plate (epistoma) more deeply emarginate than *desertus* and with larger, triangular-shaped, glabrous area at base of nasal plate. Prothorax wider than long (5:3.5), sides more convex in male than female; pronotum usually with shallow, median sulcus deepest in basal half, surface with rather sparsely-placed punctures of an irregular shape and depth. Elytra generally with convex intervals in females, only slightly so in males; serial punctures broadly shallow not deep and clear cut as in *desertus*; tenth row of serial punctures generally obscured with scaly vestiture except at basal third, is usually visible for full length in *desertus*. Fifth abdominal sternite in both sexes with median area more convex than in *desertus*; female

with a deep, lateral marginal furrow extending along the basal half; male with faint, lateral marginal depression along basal third; the female of *desertus* has a deep lateral marginal furrow along the basal third, male with pronounced, lateral marginal depression along the basal half. Vestigial metathoracic wing, seventh and eighth abdominal tergites of male, and median lobe and ring of tegmen of male genitalia as shown in figures B, E, and F. Female genitalia with mesal margins of coxites (heavily sclerotized dorso-apical structures[1]) nearly parallel —not diverging greatly as in *desertus*; outer apical margins of coxites more convex than in *desertus*.

Type locality: Stove Pipe Wells, Death Valley, California, 89 specimens collected on Arrow-weed, *Pluchea sericea* Cov. by Mr. J. J. du Bois and Mr. B. E. White on April 13, 1938. Dr. E. Gorton Linsley and Dr. A. E. Michelbacher collected 35 more specimens on the west side of Death Valley, twenty miles south of Furnace Creek Ranch on April 8, 1939.

Holotype male and allotype female (Nos. 4819 and 4820) in the entomological museum of the California Academy of Sciences, San Francisco. One hundred paratypes have been designated and will be placed in the collections of the United States National Museum (through L. L. Buchanan), Los Angeles Museum, California Academy of Sciences (through E. C. Van Dyke); State Department of Agriculture, San Francisco; B. E. White, J. J. du Bois, A. C. Davis, E. G. Linsley, A. E. Michelbacher, M. A. Cazier, and in that of the author.

E. californicus is closely related to *desertus* Horn, but is distinct and easily separated from the latter by numerous differences previously given and compared in the description—the most salient characters apparently being found in the fifth abdominal sternite of both sexes, and in the shape (first few rows) and number (tenth row) of the elytral serial punctures. The most variable characters other than size and color (in part) appear to be in the proportional length and width of the prothorax and in the degree of convexity of the elytral intervals.

On the same collecting trip to the type locality of *californicus*, Mr. du Bois and Mr. White were also successful in collecting six specimens of the previously rare *E. mortivallis* Fall. The following year on April 3, 1939, at the same locality Messrs. R. G. Dahl, L. L. Jensen, W. F. Barr, and K. S. Hagen collected over one hundred additional specimens of *mortivallis* on Creosote Bush, *Larrea tridentata* var. *glutinosa* Jep.

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[1] For the present these structures are believed to be parts of the coxites which are bilobed with the styli being borne by the nearly membranous, ventrally placed lobes.

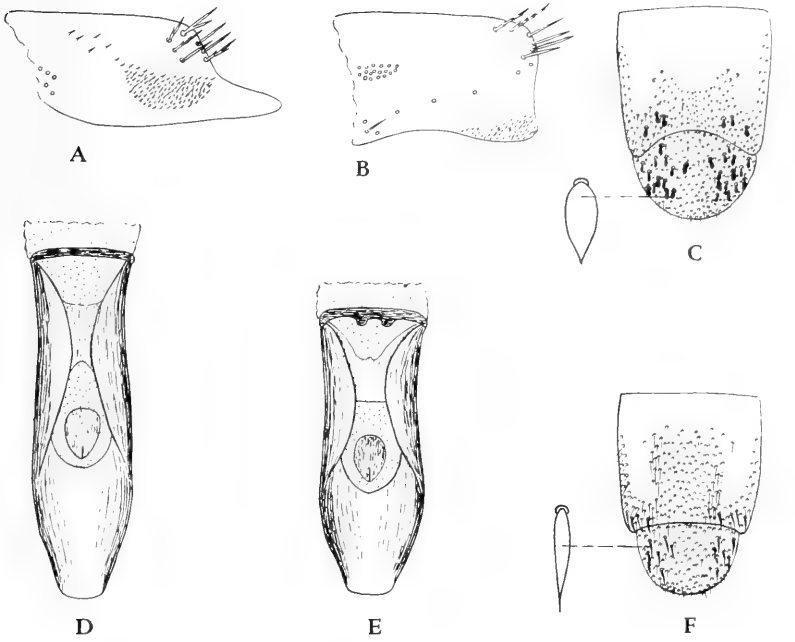

PLATE 15

Structural details of *Eupagoderes desertus* Horn and *Eupagoderes californicus* Ting, new species.

EXPLANATION OF FIGURES

Fig. A. *Eupagoderes desertus* Horn, vestigial metathoracic wing.

Fig. B. *Eupagoderes californicus* new species, same.

Fig. C. *Eupagoderes desertus* Horn, seventh and eighth tergites of male showing distribution and shape of setae with broadest scale-like seta present enlarged.

Fig. D. *Eupagoderes desertus* Horn, median lobe and ring of tegmen (at base) of male genitalia.

Fig. E. *Eupagoderes californicus* new species, same particularly showing dorso-median processes of tegmen.

Fig. F. *Eupagoderes californicus* new species, seventh and eighth tergites of male showing distribution and shape of setae with broadest scale-like seta present enlarged.

THE LIFE HISTORY OF THE SAND WASP, BEMBIX OCCIDENTALIS BEUTENMUELLERI FOX AND ITS PARASITES

By George E. Bohart and John W. MacSwain[1]
University of California, Berkeley

This is the first of a series of papers intended to present results of biological studies by the authors on various aculeate Hymenoptera and their parasites. The present study was made at Antioch, Contra Costa County, California, during the summer and fall of 1938, and the spring of 1939. We have found the works of Fabre (1908), Ferton (1923), and Rau (1918) particularly useful in providing a source of corroborative data on the habits of bembicid wasps and we would refer the reader to these papers which are cited in the bibliography.

Taxonomy and Distribution of Host

Bembix occidentalis Fox[2] was described from Lower California and was based on forms with pronounced yellow maculations. In 1901, from a black specimen Fox described *Bembix beutenmuelleri*[3] from Stockton, California. At Antioch (figs. 1-4) specimens show a complete gradation from the yellow type to an entirely black phase. If black forms are later found in Lower California, it will probably be necessary to retain only *Bembix occidentalis s. str.* Other localities for *B. occidentalis beutenmuelleri* include Los Angeles County, California, and Van Sickle Canyon, Oregon (Parker, 1929). This reference also records specimens of doubtful position from Arizona and New Mexico.

Habitat

The habitat in which this study was made is confined to a few isolated sand dunes east of Antioch, California. The dunes are bounded on the north and east sides by tule marshes and

[1] We would like to acknowledge the assistance of Dr. E. C. Van Dyke under whose direction this paper was prepared; Messrs. E. P. Van Duzee and R. L. Usinger for permission to use material in the California Academy of Sciences; Dr. E. G. Linsley for reading the manuscript and offering suggestions, and Miss Jane M. North for help in gathering field material.

[2] *Bembix occidentalis* Fox, 1893, Proc. Calif. Acad. Sci. (2), 4: 10.

[3] *Bembix beutenmuelleri* Fox, 1901, Journ. N. Y. Ent. Soc., 9: 83.

the banks of the Sacramento River, along the south and west by vineyards. The actual dune slopes are devoid of vegetation and furnish preferred nesting sites. The dunes are relatively permanent in position with a soft, shifting surface layer and a harder packed sub-stratum. Frequent afternoon winds cause a constant movement of this top layer and a consequent covering of burrow entrances. Occasionally a strong wind will remove both the surface layer and sub-stratum to a depth of a foot or more on the windward side and deposit it on the lee of the dune. In some cases wind excavation uncovers and removes living cocoons as well as dead ones from previous years. A complete mortality has been observed in excavated cocoons which have been exposed to the heat of the sun. In addition to this mechanical hazard and to insect parasites, *B. occidentalis beutenmuelleri* in larval state suffers from mold and occasionally as an adult from the predatory attacks of the large asilid fly, *Proctocantha occidentalis* Hine.

In making a study of this species it was found necessary to choose a single large nesting site, since the dunes harbor several colonies whose periods of activity vary. The larger colonies were all located on the slopes of the dunes and only a few isolated specimens made use of the summits.

Emergence

Emergence took place suddenly, a characteristic feature of the wasps of this genus as has been noted by Rau (1918:9) in his study of *Bembix nubilipennis* Cresson. On August 17, 1938, both sexes appeared together and almost immediately commenced what has been called by Rau "the mating dance." This is a rapid zigzag flight a few inches above the ground and within the confines of the colony. At times a male and a female break away from the group in a short rapid flight terminating with a brief contact on the ground. Since this species is both polygamous and polyandrous, the procedure was repeated many times. Often the male and female attempting to leave the "dance" would be followed by one or more additional males causing the attempt to be abandoned or ending on the ground in a brief struggle. The mating period lasted for a week, and during this time no digging was observed. On sunny days flight commenced at about 10 A. M. and reached its peak around noon, after which nearby flowers were visited for nectar, and by 4 P. M. the majority of the wasps returned to their burrows. In contrast to *B. nubilipennis* Cresson both males and females of the present species returned to the burrows for the night, at least at the beginning of the season. This fact was established by opening the burrows in the early evening and taking both sexes from them.

Burrow Construction

On August 28 several females had commenced digging, while males were numerous and still attempted to mate with them. The females which were digging eluded or fought them off. Burrowing activities started at about 10 A. M. and continued intermittently until about 3 or 4 P. M. Although several trial holes were started by each female, these and the first completed burrow were made in one day. Upon completion, this final hole was used by the female as a place to spend the night, while males probably used the holes from which they had emerged originally.

The burrow shaft is sunk at an angle of 15 to 30 degrees from the horizontal, and to a depth of from 16 to 24 inches. The entrance is oval for a depth of an inch, with surface dimensions of one-half by three-eighths of an inch. The main tunnel is circular and of an average width of three-eighths of an inch. It terminates in an elliptical cell with its dimensions about an inch and a half long and five-eighths of an inch wide at the middle and with its long axis horizontal. The wasp digs by seizing the sand particles in the mandibles and tearing them free from their loose surroundings. The sand particles are then thrown backwards by the spines of the anterior tarsi. Since there is no cementing of sand grains, advantage is taken of areas on the dune which have been denuded of the loose topsoil by the wind. In these bare areas there is a great concentration of nests and the entrances may be communal, serving from two to a probable maximum of six single burrows. An entrance of this type is larger and more irregular than that of a single burrow, but only extends for an inch or two below the surface, at which point the individual holes diverge. Communal entrances are left open at all times, but the individual entrances within may be closed upon departure of the females. When provisioning is started and the egg laid, the wasp habitually covers the nest before each departure. When provisioning has been completed, the burrow is plugged with sand and packed for a depth of two or more inches. While plugging the completed nest, the wasp faces away from her entrance and zigzags back and forth in arcs of increasing radius, kicking jets of sands towards it, which are accurately gauged as to distance and direction. At intervals she interrupts this process to back into her burrow and tamp the sand firm with the end of her abdomen. When the plug has been completed, sand is kicked about indiscriminately to disguise traces of occupation.

Food Habits and Oviposition

The observation that *Bembix* uses flies for nest provisioning was first made by Latreille and later confirmed by Lepeletier (1841). Females of *B. occidentalis beutenmuelleri* were

first observed provisioning their nests on September 4. The ortalid fly, *Anacampta latiuscula* Loew, was used, necessitating a trip of at least 150 yards to the nearest habitats harboring this species. First egg laying was coincident with this provisioning. Although we were unable to observe the manner in which this species lays her egg, that of a closely related species, *comata* Parker, was discovered attached to the upper wall of the cell immediately prior to the wasp's entrance with the first food. At variance with this is the method followed by *oculata* Latreille, a European species studied by Ferton (1923:91), which attaches its egg to the underside of the fly's wing base. At the same time Ferton also reported that *mediterranea* Handlirsch deposits its egg on the floor of the cell, supporting it with small, conical sand pellets. It seems likely from the above statements that variations in the oviposition habit may be specific characters within the genus.

Ortalids continued to be the exclusive food for the larvae of our wasp until September 18 when females were found with the green bottle fly, *Lucilia sericata* Meigen. This selection, in all probability, was the direct result of the establishment of a pig pen in direct line with the wasp's ortalid search. Also, at about this time, we noted that other flies were being used, a partial list of which follows: *Eristalis latifrons* Loew, *Elophilus latifrons* Loew, *Calliphora erythrocephala* Meigen, two undetermined metopiids, *Musca domestica* Linnaeus, *Stratiomyia laticeps* Loew, *Chrysops* species. It is of interest to note that the genera *Musca, Lucilia,* and *Eristalis* were included in the list of prey given for *B. oculata* by Ferton (1923:75).

We observed that whereas the ortalids were invariably immobilized when brought to the burrows, some of the syrphids were apparently merely held in captivity and, when taken, both the wasp and its prey would fly about in the net.

In Europe considerable controversy has arisen concerning the method of attack by *Bembix*. Lepeletier (1841) stated that the flies were paralyzed but Fabre (1908, 1:236) and Wesenburg-Lund described the fly as being dead and crushed or scarred by the wasp's mandibles when brought to the nest. Marchal (1893) took a neutral stand by stating that the method was not precise but very variable. Ferton (1923:74), in what seemed to be conclusive experiments, demonstrated that the flies were not mutilated by the wasp but merely paralyzed and, when exhumed, could be kept alive for as long as fifteen days. At the same time he described the act of paralyzing (1923:77) in which the fly was held by the head, the wasp's abdomen recurving to sting it a little behind the mouth. This process was said to occur either in flight or upon the sand.

The female wasp will occasionally visit flowers for nectar

but apparently does not remain long and soon resumes provisioning activities. After mating the males pass the remainder of their active life at flowers. For this purpose *Eriogonum parvifolium* Sm., *Croton Californicus* (Muhl), and *Heliotropium curassavicum* Linn. are most commonly visited.

Host Development

The newly hatched larva feeds upon the first fly provided, chewing and sucking steadily while pouring salivary fluid into it. The fly's abdomen is usually devoured completely whereas the head and thorax may be chewed but are seldom consumed. Provisioning proceeds with the larval development so that flies are brought in at greater frequency as the young wasp increases in size, vigor, and appetite. Apparently, as a general rule, plenty of food is provided since the adult wasps exhibit a very uniform size. Judging from our first records of completed cocoons (September 18) it takes about two weeks for larval development and case formation.

The process of cocoon spinning has been described by Fabre (1908, 1:255) for *B. rostrata* which works in the same manner as *B. beutenmuelleri.* (The size, proportions, thickness, and something of the texture and details of the completed case are shown by the plate figures.) In addition to Fabre's observations on the formation of the cap, we have noted that just prior to its construction, the larva carries the loose ends of silk from the inner wall over the top to the exterior, thus forming a definite line of weakness for later emergence of the adult. Highly characteristic for all bembicids are the small resinous appearing tubercles which resemble minute volcanos or simple craters and are distributed on a single transverse plane throughout the middle of the case. They may be easily observed on the inner wall of the cocoon by the areas of heaviest silk deposition. Rhinehard (1929:36) in a simple experiment with *Sphecius* has demonstrated that these tubercles can act as ventilators since they form the only areas permeable to air. In *B. beutenmuelleri* these pores are tuberculate externally, from four to seven in number, and somewhat unevenly spaced. The cocoon cap, which is provided for the escape of the adult, is illustrated in figure 6. In contrast to *Bembix comata, beutenmuelleri* has a silken cocoon lining so heavy that a broken case is held together by it.

Overwintering takes place in the last larval stage which is dormant and commonly termed the prepupa. Under normal circumstances pupation occurs in the late spring and emergence in the late summer, but exposure to the sun causes premature pupation followed by death which may be delayed enough to allow for pigmentation.

Parasitism by Dasymutilla Sackenii (Cresson)[4] (Hymenoptera-Mutillidae)

A previous biological investigation of *Bembix* parasitism by mutillid wasps was published by Mickel (1928) for *Dasymutilla bioloculata* (Cresson) as a parasite of *Bembix pruinosa* Fox and *Microbembex monodonata* (Say). This paper also includes a comprehensive bibliography of other works dealing with mutillid life histories.

According to Mickel (1928) *Dasymutilla sackenii* (Cresson) ranges throughout the state of California and into bordering areas of Oregon and northern Nevada. This species at Antioch is of a very uniform size (figs. 11-12) which indicates a narrow host selection. However, the general distribution and large number of this multillid on the dunes makes it seem probable that *B. occidentalis beutenmuelleri* is not its only host. Apparently this same species attains a much greater size in southern California.

The activity range of the adults is from June to November and only worn females are present at the end of the season. The adult is active above ground only in the early morning and late afternoon and usually the only specimens seen during the middle of the day are females actively seeking shade. For this purpose they make use of old open holes remaining from previous years or the shaded areas by banks of sand. The males overlap the daily activity period of the females to a slight extent and have been taken in the middle of the day on vegetation.

The flight of the male is slow and irregular, a few inches above the ground, and is often interrupted by a collision with bushes. Both sexes, when taken in the net or pursued over the sand, rub the second and third abdominal tergites together producing an intermittent high-pitched squeak. The female also produces this noise while investigating a burrow. She is protected from the return of the owner by her highly sclerotized integument and by possession of a powerful and extremely long sting. This sting is very flexible and is capable of inflicting a series of painful wounds (which on most humans swell for a short time and then subside). The females will enter any hole of suitable size for varying periods of time but in nearly all of these cases finds nothing upon which to oviposit.

The mutillid often appears to sense the presence of a covered burrow and, after scratching in the sand, will uncover the hole and gain access to the pupal cases of the bembicid. According to Mickel (1928) the wasp cuts a small hole in the pupal case with her mandibles and then oviposits on the prepupa

[4] *Dasymutilla sackenii* (Cresson), 1865, Proc. Ent. Soc. Phila., 4:385 (*Mutilla*).

within. After oviposition she closes the hole in the case and covers the burrow. Figure 13 illustrates a *Bembix* pupal case which has been exposed by the strong winds at Antioch. In this case the mutillid had attacked the *Bembix* either shortly before or after it was exposed. The host had completed pupation and started pigmentation when attacked by the mutillid larva which consumed it and forced the head and the hard parts of the thorax, legs, and abdominal tergites to the end of the case before spinning its case and entering the prepupal stage. Figure 14 shows another excavated pupal case. Here the mutillid has consumed the prepupal stage of the host as usual and then been forced to an abnormally early pupation due to exposure to the weather. Under ordinary conditions this pupation of the parasite would not take place until the spring or early summer of the following year. In the normal cycle of the parasite the larva, upon hatching from its egg, consumes its host and pushes the indigestable portions of the cap end of the *Bembix* cocoon. Using this detritus as a base the larva spins a loose framework of silk which completely fills the host's case and is loosely attached to the walls. This framework is rapidly built up on the inside into a heavy opaque sheath which is only thinly closed toward the cap end in order to allow for emergence.

From a gross examination the parasitic larva can easily be distinguished from its host by the following characters: smaller in size, a more polished integument, prominent lateral margins of segments, apical tergites strongly cleft as opposed to truncate, and the head smaller with sharper mandibles which are opposed rather than parallel.

The parasitism of *Bembix occidentalis beutenmuelleri* was found to be approximately one percent of the total population on the dune studied. On the other dunes having a different host activity range there may be a higher degree of parasitism. The fact that the greatest mutillid population occurs in localities harboring few *Bembix* seems to indicate that this bembicid is host for only a minority of the mutillids present.

Parasitism by Anthrax Atrata Loew[5] and Exoprosopo Eremita Osten Sacken[6] (Diptera-Bombyliidae)

Bombyliid flies have long been known as parasites of aculeate Hymenoptera. As early as 1864 the German worker, Frauenfeld, reared *Argyramoeba leucogaster* (Meigen) from the nest of *Cemonus* and suggested that the larvae of the parasites must find their own way into the nests as did those of meloids and strepsipterans. The most exhaustive account of parasitism

[5] *Anthrax atrata Coquillet*, 1887 Trans. Am. Ent. Soc., 14: 171.
[6] *Exoprosopa eremita* Osten Sacken, 1887, Bull. U. S. Geol. Geog. Surv. Terr., 3: 236.

by flies of this family was made by Fabre (1908) for *Anthrax trifasciata* Meigen, a parasite of the megachilid bee, *Chalicodoma*.

Of the two bombyliid parasites of *B. occidentalis beutenmuelleri, Exoprosopa eremita* has been taken in nearly all of the states west of the Rocky Mountains, whereas *Anthrax atrata* is apparently confined to the Pacific Coast states. The wide distributions here demonstrated as contrasted with the comparatively narrow one of *B. o. beutenmuelleri* obviously indicates the existence of other hosts. Also, in our locality, the numbers and habitats of the flies are not in accord with those of the *Bembix*.

The two species considered here, although members of different genera, appear to behave so similarly that a separate discussion is unnecessary. Considerable gaps in our knowledge and observations have made it as yet impossible for us to distinguish between the larvae of the two species.

The flies do not become active until the dunes are warmed by the late morning sun and become inactive again by 3 or 4 P. M. Since their delicate pubescence and fragile wings (which are held outstretched) would prevent them from spending their dormant period within burrows, it is probable that it is spent on vegetation. During their active hours the females are to be seen largely on bare sand areas, hovering over burrow entrances and darting from one hole to another. As our close scrutiny on these areas revealed few males and no mating, it can be assumed that copulation takes place away from the dunes, probably near the flowers where the males were observed to spend most of their active time. Feeding from flowers is apparently accomplished while settled with the wings held horizontally and nearly at right angles to the body. This method is in contrast to that used by the long tongued bombyliines which sip nectar while hovering in front of the blossoms.

The oviposition habits may be readily observed since this function occurs above ground at the lip of the burrow. The female is most often seen hovering from a few inches to less than an inch above an open hole, advancing slowly until near the opening while flipping the tip of the abdomen at intervals downward and forward toward the entrance, then flying slowly backward. This action apparently throws the eggs close to or within the opening as has been reported by other authors. After making several motions toward the burrow with her abdomen, the bombyliid moves a few inches to one side of the hole and settles on the sand. Upon completion of this act the fly then returns to the air and resumes her search for other open burrows.

Fabre (1908, 1: 189-223) was the first to consider the hypermetamorphism of bombyliid larvae in detail. He first acted on

the inference that the newly hatched larva must make its own way to the wasp's cell, and so discovered the active first instar of *A. trifasciata* which he carefully described and figured (1908, 1 : 205). This larva demonstrated a most decided "tropismic" activity in attempting to burrow downward from whatever point it was placed. This activity would not only explain the migration of a larva to the shallow cells of *Chalicodoma,* but also the much deeper ones of *Bembix.*

When once within the cell of its host, the young larva waits until the *Bembix* has entered the prepupal stage before attacking it. This waiting period was stated by Fabre to occur with *A. trifasciata* and is inferred by us to be the case for *A. atrata* and *E. eremita* since we were unable to find evidence of attack except on prepupae. (The authors have also noted this phenomenon in the case of bombyliid attacks on osmiine bees.) The first moult leaves the larva maggot-like, without bristles, and with the head region retracted. In this condition it is unable to progress in any direction but, being beside its source of food, can apply its head to the body of the larval wasp and apparently suck the body fluids of the latter through the intervening membrane. The host remains alive throughout this process as is shown by its lack of discoloration. The time lapse from the first attack, through the gradual shriveling of the host until it is reduced to an empty skin fragment, was for Fabre's fly about one fortnight. Fabre's description of the process of feeding and the appearance of the repleted fly larva for his *Anthrax* could serve equally well for the two species of the present study. The creamy mottled appearance caused by collections of fatty tissue beneath the skin is highly characteristic and immediately distinguishes a bombyliid larva. Overwintering is undergone by the mature larva and pupation takes place in the summer.

Pupation occurs within the *Bembix* cocoon and transforms the bombyliid (fig. 9) into a heavily sclerotized, reddish pupa with numerous abdominal spines and hairs and a bizarre head armature. Prior to complete development of the imago within the pupal case, the pupa darkens and becomes active. Fabre was able to observe *A. trifasciata* utilizing the spines of its head to break its way out of the stony wall of the *Chalicodoma* cocoon. We have observed the pupae of several species of bombyliids using a corkscrew motion in attempting to penetrate the cotton plugs of the vials in which they were kept. In the case of *Bembix* the pupal fly must not only break its way through the cocoon but also push to the surface of the sand where it thrusts its head and thorax above ground. In this position the imago emerges by splitting the pupal case longitudinally along the back of the head and thorax. Empty cases may be seen in the early autumn following emergence still in the same position.

While excavating for *Bembix* cocoons, we found approximately one bombyliid larva for every hundred cases opened. This low percentage of parasitism may possibly be explained by the habit of the *Bembix* in keeping its entrance covered both while on hunting expeditions and after complete provisioning. Since the fly will oviposit only on open burrows, its effective period is reduced to the times when the *Bembix* is in its burrow.

Parasitism by Physocephala Affinis Williston[7] (Diptera-Conopidae)

Physocephala affinis Williston occurs throughout temperate North America and the West Indies. It is the commonest and most widespread member of the genus in North America, but is most abundant in the western United States. On the pacific slope there is but one other recognized species in the genus *P. burgessi* Williston. At Antioch, California, where this study of *P. affinis* was made, *P. burgessi* is not found.

To our knowledge this is the first study of and the second record of *Physocephala* parasitism of *Bembix*. Published records for other insects include those of Meijere (1903: 145-146, 163-164) citing *Bombus, Apis, Megachile, Xylocopa,* and *Vespa* as hosts. This work also contains an excellent summary of conopid biology as known at that time. In this country Plath (1934: 60) and Van Duzee (1934: 315) have reported parasitism on *Bombus* and on *Apis* respectively. Townsend (1935: 147) records *Bembix, Philanthus, Eucera, Halictus,* and *Sphinogonotus* as additional genera both from original observation and as gleaned from previous publications. His paper includes an excellent morphological discussion of the larva and puparium of *Physocephala sagittaria* (Say).

P. affinis as a parasite of *B. occidentalis beutenmuelleri* has only one brood a year. This was demonstrated by the discovery of living puparia in the abdomens of *Bembix* of the previous year during the earliest period of host activity. Several hundred puparia were collected during the nesting season of the wasp, and only those taken at the beginning of the season yielded adult flies during the same season. The capture of numerous specimens of *P. affinis* several months prior to the time of *Bembix* emergence would also seem to indicate that the fly has other hosts.

On our dune it was observed that the time of emergence of *P. affinis* lagged behind that of *Bembix* by two weeks. The period of activity lasted until the early days of October. Only the females appeared in abundance on the dunes, flying low over the sand and occasionally resting on it. The males were found on the surrounding flowers, mainly *Eriogonum* and *Heliotropium,* where the females sometimes joined them. Mating takes

[7] *Physocephala affinis* (Williston), 1882, Trans. Conn. Acad., 4: 339 (*Conops*).

place about the flowers during the warmest part of the day and continues throughout the major portion of the season. Males pursue the females and alight upon their backs, accomplishing copulation in this position. The pairs remain in contact for several minutes, often flying when disturbed, and only separating when captured.

Soon after mating the female returns to the dunes to oviposit on the *Bembix* which are at this time provisioning their nests. At this early period it is the male bembicid which bears the brunt of the attack since the females spend a large part of the time underground or on hunting expeditions. So successful is this attack that it is a major factor in the disappearance of the male wasps. Knowing the population and approximate sex ratio on our dune, the above conclusion was easily made from the great numbers of parasitized male bodies uncovered in later digging.

The conopid lurks about the nesting site, making repeated swoops at the passing wasps. This procedure is continued until the fly succeeds in following the flight path of the host. The chase, if successful, ends with the fly alighting on the back of its victim and after a short tussle on the ground, inserting an egg between its abdominal tergites. The organs which make this possible are the powerful and highly specialized sternal plates of the parasite. Even when able to follow the complicated flight of the wasp, the fly does not always succeed in oviposition since the wasp often turns rapidly and strikes its tormenter to the ground. In this case the wasp does not follow up its advantage by killing the parasite but flies off, leaving the conopid to recover and continue its activity. At other times, when seized, the wasp may succeed in dislodging the conopid before oviposition has been accomplished.

The egg hatches soon after being layed and the immature larva migrates to the haemocoel where it pierces and sucks the non-vital organs in the region of the second abdominal segment by means of its two mouth hooks. The body of the larva lies in the same planes as the host, with the head region elongate and turned down toward the venter. This orientation is maintained throughout the pupal stage, making it necessary for the emerging adult to sever the connection between the propodeum and abdomen of its host. At any time in mid-season it is possible to collect *Bembix* containing all stages of larvae. To our knowledge there have been no cases of multi-parasitism although it seems unlikely that all wasps would escape or be immune from more than one attack. It is more probable that it is physiologically impossible for more than one larva to develop. From all external appearances the *Bembix* suffers no ill effects from the early development of the larva but with the later consumption of the fat bodies and crowding of the gonads the life span is shortened.

Pupation of the fly occurs only when the host is in the burrow and brings about the immediate death of the wasp. We observed one exception in which a *Bembix* was found writhing on the sand incapable of coordinated movement and this specimen contained a full grown larva which completely filled the abdominal cavity. Underground death of the host is probably of vital importance to the well being of the fly puparium which might otherwise suffer from the attack of predators or from dessication. However, the puparia are remarkably resistant to drying and have been found alive after several weeks of exposure to the sun and wind. The *Physocephala* puparium has prominent stigmal plates and a tri-lobed construction (fig. 18) and is thus easily distinguishable from those of other dipterous parasites.

The percentage of parasitism of any free ranging adult insect is exceedingly difficult to determine. *P. affinis* must parasitize from twenty-five to fifty percent of the *Bembix*, judging from the number of living wasps examined for parasitic larvae and the number of dead wasps containing puparia. However, the effect of this high percent of parasitism on the host population is relatively slight because the majority of those parasitized are males. In addition, even when females are attacked they are able to continue their activities for some time.

Conclusions

Bembix occidentalis beutenmuelleri Fox in the vicinity of Antioch, California, prefers sand dunes as a nesting site. The flight period of a single colony in 1938 was from August 17 to the latter part of November. A mating period of a week was followed by nest construction. Burrows were sunk to an angle of 15 to 30 degrees and to a depth of 16 to 24 inches and each terminated in a single horizontally placed cell provisioned with several species of flies, the most important of which were *Anacampta latiuscula* Loew and *Lucilia sericata* Meigen. The most important parasites at this locality appear to be *Dasymutilla sackenii* (Cresson) (1%), *Anthrax atrata* Loew and *Exoprosopa eremita* Osten Sacken (together about 1%), and *Physocephala affinis* Williston (25-50%).

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EXPLANATION OF PLATE 16

All figures natural size.

Fig. 1. *Bembix occidentalis beutenmuelleri* Fox. Female, fasciate color phase.

Fig. 2. *Bembix occidentalis beutenmuelleri* Fox. Female, black color phase.

Fig. 3. *Bembix occidentalis beutenmuelleri* Fox. Male, fasciate color phase.

Fig. 4. *Bembix occidentalis beutenmuelleri* Fox. Male, black color phase.

Fig. 5. *Bembix occidentalis beutenmuelleri* Fox. Whole cocoon.

Fig. 6. *Bembix occidentalis beutenmuelleri* Fox. Cocoon opened to show mature larva.

Fig. 7. *Anthrax atrata* Coquillet. Female.

Fig. 8. *Exoprosopa eremita* Osten Sacken. Female.

Fig. 9. *Exoprosopa eremita* Osten Sacken. Pupa.

Fig. 10. *Bembix occidentalis beutenmuelleri* Fox. Cocoon opened to show mature bombiliid larva.

Fig. 11. *Dasymutilla sackenii* (Cresson). Male.

Fig. 12. *Dasymutilla sackenii* (Cresson). Female.

Fig. 13. *Bembix occidentalis beutenmuelleri* Fox. Cocoon opened to show mature larva of *Dasymutilla sackenii* (Cresson). With half spun cocoon.

Fig. 14. *Bembix occidentalis beutenmuelleri* Fox. Cocoon opened to show adult *Dasymutilla sackenii* (Cresson). Female *in situ* in its cocoon.

Fig. 15. *Physocephala affinis* (Williston). Male.

Fig. 16. *Physocephala affinis* (Williston). Female.

Fig. 17. *Bembix occidentalis beutenmuelleri* Fox. Abdomen with basal segment removed to show *Physocephala affinis* (Williston). Puparium *in situ*.

Fig. 18. *Physocephala affinis* (Williston). Puparium.

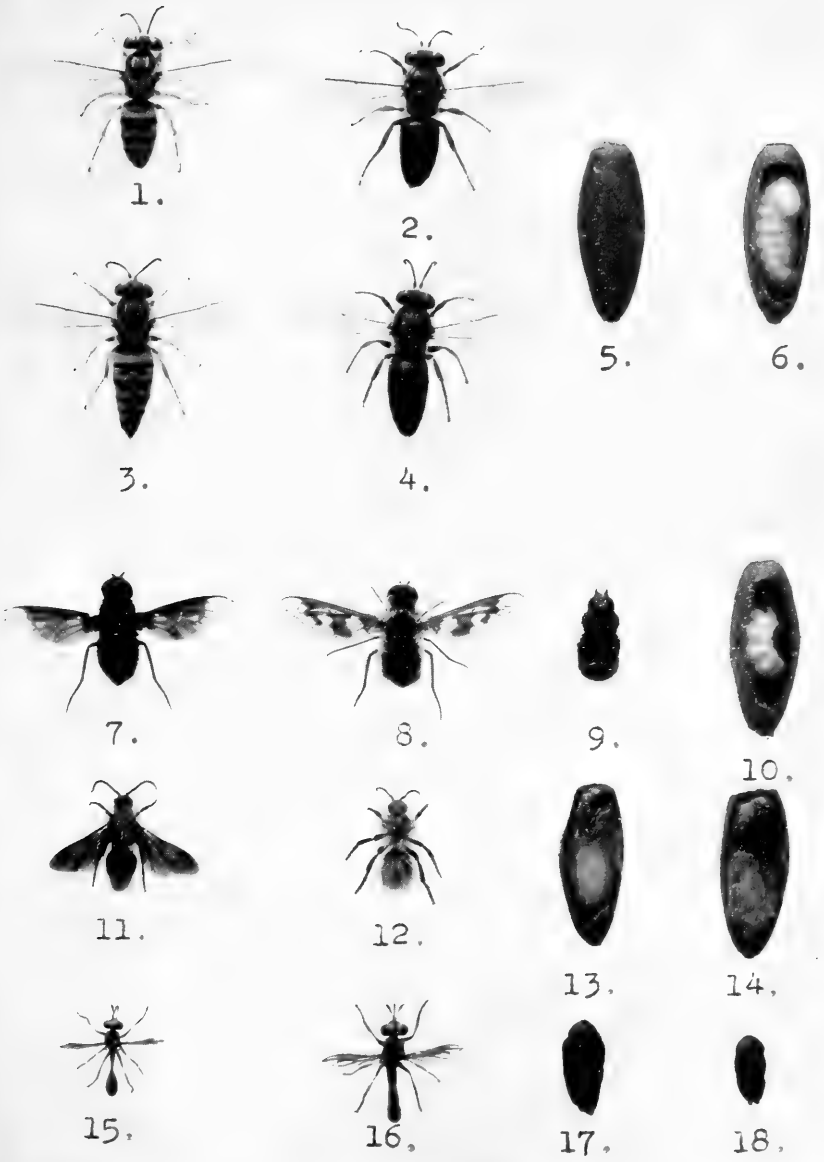

PLATE 16

Bembix occidentalis beutenmuelleri Fox and its parasites.

A GENERIC REVIEW OF THE FAMILY PHALONIIDAE WITH DESCRIPTIONS OF TWO NEW GENERA AND ONE NEW SPECIES

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Dr. John A. Comstock of Los Angeles, California, recently sent for determination a series of moths reared by Dr. W. D. Pierce from dodder, *Cuscuta californica*. It proved to be an undetermined species, a color variety of which has been received repeatedly from Nogales, Arizona, where it was intercepted as injurious to the fruit of bell-peppers, *Capsicum frutescens grossum* Bailey, imported from Sinaloa, Mexico. The species might therefore become an object for possible quarantine measures, if it had not been ascertained that it already is established in California. For this reason as well as for the record of a systematically interesting aberrant form of the family *Phaloniidae* a description of the species is desirable.

The opportunity is taken to give a synoptic key of the American genera of the family, based on the genitalia.

Thirty years ago I published a generic review of the family[1] based on venational characters. These characters are as useful today as then, but our conception of the family limits has been modified. As we proposed in the review, the genus *Carposina* and its allies have since been recognized as a distinct family. The *Carposinidae* are not at all closely related to the *Phaloniidae*. A study of the genitalia abundantly justifies this separation.[2]

Family Phaloniidae

Small moths with more or less roughly scaled head. Antennae simple, shorter than fore wings and without pecten on basal joint. Ocelli present but small and easily overlooked. Tongue weak or obsolete. Labial palpi moderate, second joint roughly scaled, terminal joint porrect. Fore wing elongate with rounded apex and with a bend at the end of the cell which gives the moth a bell-shaped outline when at rest; 12 veins, all separate or with 7 and 8 stalked; vein 2 from outer fourth of cell; vein

[1] Jour. N. York Ent. Soc., vol. 15, pp. 19-36, 1907.
[2] Bull. Brooklyn Ent. Soc., vol. 26, pl. 10, fig. 3, 1931.

1*a* entirely absent even on margin. These last two characters separate the family from the related family *Tortricidae*. Vein 1*b* strongly forked at base. Hind wing trapezoidal with 8 veins; 3 and 4 separate, connate or stalked; 6 and 7 separate, connate or stalked. Posterior tibiae rough-scaled or haired above.

The male genitalia of the family are very diversified in structure. The uncus may be present or absent; the socii are always present but may be soft and pendant or hard and upright or projecting downwards. The harpes are usually broad and short, but exhibit great variation in form; the gnathos, however, is always absent and its function as check on the anal tube is taken over by the strongly developed, normally spined transtilla; the anellus is large and the aedeagus disproportionally large; the penis has strong armature of one or many short cornuti.

The female genitalia are characterized by the wide ostium, necessary for the robust male parts; by the very short and wide ductus, and by the large bursa with numerous spines or other sclerotizations.

The genitalia of *Phaloniidae* substantiate the generic divisions, based on venation. Figures of both sexes of available genotypes are presented.

SYNOPTIC KEY TO GENERA ON CHARACTERS OF MALE GENITALIA

1. Uncus present 2
   Uncus absent 4
2. Cornutus a single strong spine 3
   Cornuti numerous small spines ..... *Lorita* Busck
3. Socii long, pendant ..... *Hysterosia* Stephens
   Socii short ..... *Propira* Durrant
4. Anellus with strong central hook; harpes divided ..... *Euxanthis* Hübner
   Anellus without such hook; harpes not divided 5
5. Penis with single, very long, strong cornutus 6
   Penis with many cornuti or without cornuti 9
6. Transtilla without median projection ..... *Commophila* Hübner
   Transtilla with strong median projection 7
7. Socii upwardly curved ..... *Aethes* Billberg
   Socii pendant 8
8. Socii short, bulgy ..... *Phtheochroa* Stephens
   Socii long, slender ..... *Carolella* Busck
9. Socii pendant 10
   Socii upturned 11

10. Socii soft, bulgy ..... *Heinrichia* Busck
Socii stiff, slender ..... *Clysia* Hübner

11. Harpe with sacculus projecting ..... *Phalonia* Hübner
Harpe not so 12

12. Cornuti present, numerous ..... *Lozopera* Stephens
Cornuti absent ..... *Chlidonia* Hübner

SYNOPTIC KEY TO GENERA ON VENATION

1. Fore wing with 7 and 8 stalked 2
Fore wing with 7 and 8 separate 3

2. Hind wing with 3 and 4 stalked ..... *Clysia* Hübner
Hing wing with 3 and 4 separate ..... *Lozopera* Stephens

3. Fore wing with 7 to costa or apex 4
Fore wing with 7 to termen 9

4. Hind wing with 3 and 4 separate 5
Hind wing with 3 and 4 connate or stalked 8

5. Fore wing with internal vein from between 11 and 12 6
Fore wing with internal vein from between 10 and 11 7

6. Hind wing with 6 and 7 approximate ..... *Phtheochroa* Stephens
Hind wing with 6 and 7 stalked ..... *Aethes* Billberg

7. Fore wing with raised scales ..... *Lorita* Busck
Fore wing smooth ..... *Phalonia* Hübner

8. Hind wing with 6 and 7 stalked ..... *Heinrichia* Busck
Hind wing with 6 and 7 approximate ..... *Propira* Durrant

9. Hind wing with 6 and 7 separate ..... *Hysterosia* Stephens
Hind wing with 6 and 7 stalked 10

10. Hind wing with 3 and 4 separate 11
Hind wing with 3 and 4 connate or stalked 12

11. Fore wing with raised scales ..... *Commophila* Hübner
Fore wing smooth ..... *Chlidonia* Hübner

12. Hind wing with 3 and 4 connate ..... *Carolella* Busck
Hind wing with 3 and 4 stalked ..... *Euxanthis* Hübner

LORITA, new genus.

Type: *L. abornana,* new species.

Plate 17, figs. 1-5.

Labial palpi short, porrect; second joint with large triangular tuft; terminal joint shorter. Fore wing with slightly raised scales; 12 veins, all separate, 7 to costa. Hind wing narrower than fore wing; 8 veins; 6 and 7 long-stalked; 3 and 4 separate; lower cell vein not hairy. Posterior tibia rough-haired above.

Male genitalia with well-developed, slightly curved uncus; socii upright, closely applied to uncus; gnathos absent; transtilla strong, broad, with long, central, unspined process; anellus large, supporting the very large aedeagus; penis with numerous small spine-like cornuti. Vinculum strong, V-shaped; harpes short, broad at base, gently tapering to blunt apex. Female genitalia with large ostium; ductus short, wide, supported by a circle of elongate, narrow sclerotizations; bursa with a wide, longitudinal band of minute spines.

LORITA ABORNANA, new species.

Labial palpi whitish yellow, darker yellowish fuscous on outer sides. Face and head light yellow. Thorax light yellow with anterior edge darker yellowish fuscous. Fore wing light yellow overlaid with large scintillating patches of slightly raised, silvery scales, and with darker yellowish brown and black markings as follows: A large, round, brown spot on the end of the cell, margined above and below with a few scattered black scales; just beyond the middle of costa a similarly colored costal spot; at apical fourth an irregularly wavy, oblique, transverse, brown fascia; tip of wing brown; costal edge with equally spaced, minute, black dots from base to apex; on dorsal edge before middle an ill-defined, large, triangular patch of black scales, cilia light silvery yellow. Hind wing fuscous with cilia a shade lighter. Abdomen dark brownish fuscous. Legs yellowish fuscous, marked sparsely with black on outer sides.

Alar expanse, 10-12 mm.

Type, U. S. National Museum No. 53250.

Paratypes in Los Angeles Museum.

Type locality, El Segundo, Los Angeles, California.

Food plant, *Cuscuta californica* Choisy.

Described from a series bred by Dr. W. D. Pierce.

Named in honor of the young, talented musician, Lora Aborn, who endeavors with success to put the scintillating colors and flight of Lepidoptera into her compositions.

LORITA ABORNANA CHATKA, new variety.

Exactly like *Lorita abornana* in size and markings and identical in genitalia of both sexes, but the ground color of the fore wing is distinctly light gray instead of light ochreous as in the California specimens. This, in my judgment, is merely a color variation, due to the different food plant or climatic conditions, but the difference is very noticeable, and with the very different food plant might cause confusion in future determination.

While it is well known that many species of the family *Phaloniidae* are not confined to a single food plant, but may feed on a variety of such, it is nevertheless surprising to find a species on two such unrelated plants as *Cuscuta* and *Capsicum*.

For this reason and because this form eventually will be treated in the economic literature, it seems desirable to give it a varietal name.

Alar expanse, 10-12 mm.

Type, U. S. National Museum No. 53261.

Type locality, Sinaloa, Mexico.

Food plant, *Capsicum frutescens grossum* Bailey.

Reared repeatedly by Mr. P. X. Peltier of the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, stationed at Nogales, Arizona. The caterpillars were intercepted on green bell-pepper fruits and were observed boring into the stalks and capsules, thereby causing some reduction in the commercial value of the products.

PROPIRA Durrant.

Biol. Centr.-Amer. Heterocera, vol. 4, p. 297, 1914.

Type: *Tortrix schreibersiana* Frölich.

Plate 18, figs. 1, 2.

Fore wing with all veins separate, 7 to apex. Hind wing with 3 and 4 connate, 5 parallel to 4, 6 and 7 closely approximate on basal third.

HYSTEROSIA Stephens.

List. Brit. Anim. Brit Mus., p. 85, 1852.

Type: *Tortrix inopiana* Haworth.

Plate 18, figs. 3, 4.

Bainbrigge Fletcher has substituted the later name *Idiographis* Lederer (Wien. Ent. Monatsschr., vol. 3, p. 246, 1859), with the same genotype, for the earlier name *Hysterosia* on the ground that this genus was not described by Stephens. According to the International Rules, however, the designation of a described species as monotype, is sufficient to validate a generic name and I am glad to resurrect the much better known, older name.

Fore wing, 7 and 8 separate, 7 to termen; with strong costal fold. Hind wing, 3 and 4 connate, 6 and 7 closely approximate, but separate at base.

A large number of species, many yet undescribed, are found in North America.

Clysia Hübner.

Verz. bekannt. Schmett., p. 409, 1825.

Type: *Clysia ambiguella* Hübner.

Plate 18, fig. 5.

Fore wing with 7 and 8 stalked to costa. Hind wing with 3 and 4 stalked, 6 and 7 stalked. The genus has not yet been recognized from North America.

Chlidonia Hübner.

Verz. bekannt. Schmett., p. 393, 1825.

Type: *Tortrix baumanniana* Schiffermüller.

Plate 19, figs. 1, 2.

Fore wing with all veins separate, 7 to termen. Hind wings with 3 and 4 separate, 6 and 7 stalked.

Lozopera Stephens.

Ill. Brit. Ent. Haust., vol. 4, p. 187, 1834.

Type: *Tortrix francillana* Fabricius.

Plate 19, figs. 3, 4.

Fore wing with 7 and 8 stalked to costa; 11 approximate to 10, internal vein from between 11 and 12. Hind wing with 3 and 4 separate, 6 and 7 long stalked.

Heinrichia, new genus.

Type: *Commophila macrocarpana* Walsingham.

Plate 19, fig. 5.

In my review of the family (1907) I used the name *Commophila* Stephens for our American species there included in my concept. Durrant (Biol. Centr.-Amer., Heterocera, vol. 4, p. 297, 1914) pointed out that the name *Commophila* had been restricted to *aeneana* Hübner (Plate 4, figs. 1, 2) by Stephens and that Fernald had definitely cited that species as the genotype.

In an attempt to supply another suitable name Durrant erected the genus *Propira*, but made *schreibersiana* Frölich the type, which is a far cry from our American forms placed in *Commophila*, and this very characteristic group therefore still requires a name; this I supply as above in honor of my col-

league, Carl Heinrich, who has given a figure of the male genitalia of the genotype (Proc. U. S. Nat. Mus., vol. 57, pl. 2, fig. 12, 1920), here reproduced.

Fore wing with 7 and 8 separate, or sometimes connate, 7 to costa or apex. Fore wing with raised scales. Hind wing with 6 and 7 stalked; 3 and 4 connate or stalked.

COMMOPHILA Hübner.

Verz. bekannt. Schmett., p. 392, 1825.

Type: *Commophila aeneana* Hübner.

Plate 20, figs. 1, 2.

Fore wing, 7 and 8 separate, 7 to termen. Hind wing, 3 and 4 very closely approximate or connate; 6 and 7 short stalked, closely approximate on basal half.

CAROLELLA, new genus.

PHARMACIS Hübner (preoccupied).

Zuträge exot. Schmett., vol. 2, p. 10, 1823.

Type: *Pharmacis sartana* Hübner.

Plate 20, figs. 3, 4.

The generic name *Pharmacis* Hübner, utilized in my review of 1907, was preoccupied twice by Hübner himself, in the Geometridae and in the Hepialidae. The genus has incorrectly been made a synonym of *Euxanthis* Hübner by Bainbrigge Fletcher.

Fore wing with all veins separate, 7 to termen. Hind wing with 3 and 4 connate, 6 and 7 stalked.

Named after "Little Carol."

EUXANTHIS Hübner.

Verz. bekannt. Schmett., p. 391, 1825.

Type: *Tortrix hamana* Linnaeus.

Plate 20, figs. 5, 6.

Fore wing with all veins separate, 7 to termen. Hind wing with 3 and 4 stalked, 6 and 7 stalked.

AETHES Billberg.

Billberg's Enumeratia, p. 90, 1820.

Type: *Tortrix smeathmanniana* Fabricius.

Plate 21, figs. 1, 2.

Fore wing with all veins separate, 7 to costa, 11 approximate to 10, internal vein from between 11 and 12. Hind wing with 3 and 4 separate, 6 and 7 long stalked.

The genus was erroneously made a synonym of *Phalonia* by Bainbrigge Fletcher; it is more closely allied to *Lozopera,* which differs mainly in having veins 7 and 8 of fore wing stalked.

PHTHEOCHROA Stephens.

Ill. Brit. Ent. Haust., vol. 4, p. 184, 1854.

Type: *Tortrix rugosana* Hübner.

Plate 21, figs. 3, 4.

Fore wing with 7 and 8 separate, 7 to costa or apex; 11 approximate to 10, internal vein from between 11 and 12; wings with tufted scales. Hind wing with 3 and 4 connate or stalked; 6 and 7 closely approximate at base.

Bainbrigge Fletcher has erroneously placed *Propira* Durrant as a synonym of this genus. The type of *Propira* is *schreibersiana* Frölich, and the genus differs radically in both venation and genitalia; it is more closely related to *Hysterosia,* but without the uncus and the costal fold of that genus.

No North American species of *Phtheochroa* has yet been recognized.

PHALONIA Hübner.

Verz. bekannt. Schmett., p. 393, 1825.

Type: *Tortrix tessellana* Hübner.

Plate 21, figs. 5, 6.

Fore wing with all veins separate, 7 to costa. Hind wing with 3 and 4 separate, 6 and 7 stalked.

SAPHENISTA Walsingham.

Biol. Centr.-Amer., Heterocera, vol. 4, p. 296, 1914.

Type: *Thyralia lacteipalpis* Walsingham.

Fore wing with all veins separate, 7 to costa. Hind wing with 3 and 4 stalked, 6 and 7 stalked. The genotype is unknown to me except from a cursory examination in the British Museum, and I am not certain that the other West Indian species described under that generic name are truly congeneric; hence I am unwilling to include the genus in the key.

The drawings for the plates accompanying this paper were made from the author's slides by Mrs. Eleanor A. Carlin, of the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

EXPLANATION OF PLATES

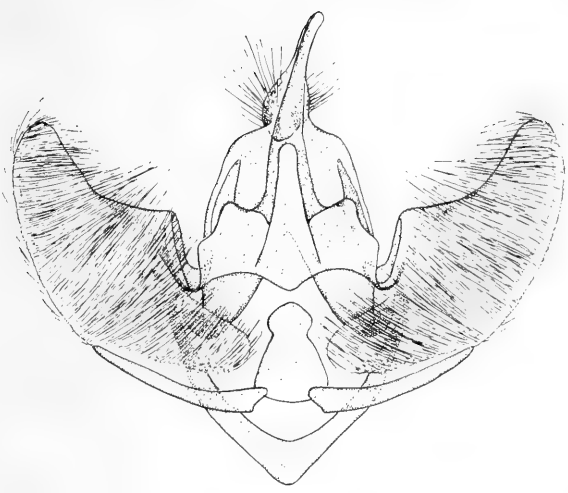
Plate 17. Fig. 1. *Lorita abornana* Busck, male genitalia, aedeagus removed.
Fig. 2. *Lorita abornana*, aedeagus.
Fig. 3. *Lorita abornana*, female genitalia.
Fig. 4. *Lorita abornana*, head and palpus.
Fig. 5. *Lorita abornana*, venation.

Plate 18. Fig. 1. *Propira schreibersiana* (Frölich), male genitalia.
Fig. 2. *Propira schreibersiana* (Frölich), female genitalia.
Fig. 3. *Hysterosia inopiana* (Haworth), male genitalia.
Fig. 4. *Hysterosia inopiana* (Haworth), female genitalia.
Fig. 5. *Clysia ambiguella* Hübner, male genitalia.

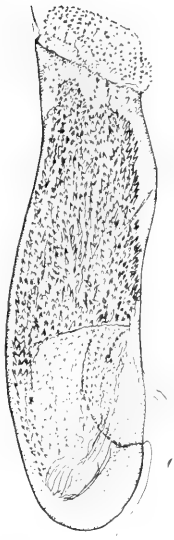
Plate 19. Fig. 1. *Chlidonia baumanniana* (Schiffermüller), male genitalia.
Fig. 2. *Chlidonia baumanniana* (Schiffermüller), female genitalia.
Fig. 3. *Lozopera francillana* (Fabricius), male genitalia.
Fig. 4. *Lozopera francillana* (Fabricius), female genitalia.
Fig. 5. *Heinrichia macrocarpana* (Walsingham), male genitalia (after Heinrich).

Plate 20. Fig. 1. *Commophila aeneana* Hübner, male genitalia.
Fig. 2. *Commophila aeneana* Hübner, female genitalia.
Fig. 3. *Carolella sartana* (Hübner), male genitalia.
Fig. 4. *Carolella sartana* (Hübner), female genitalia.
Fig. 5. *Euxanthis hamana* (Linnaeus), male genitalia.
Fig. 6. *Euxanthis hamana* (Linnaeus), female genitalia.

Plate 21. Fig. 1. *Aethes smeathmanniana* (Fabricius), male genitalia.
Fig. 2. *Aethes smeathmanniana* (Fabricius), female genitalia.
Fig. 3. *Phtheochroa rugosana* (Hübner), male genitalia.
Fig. 4. *Phtheochroa rugosana* (Hübner), female genitalia.
Fig. 5. *Phalonia tessellana* (Hübner), male genitalia.
Fig. 6. *Phalonia tessellana* (Hübner), female genitalia.



1



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3

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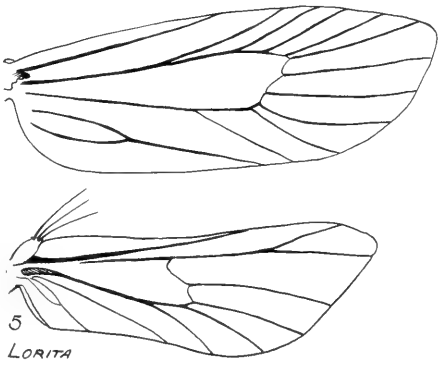


5

LORITA

PLATE 17

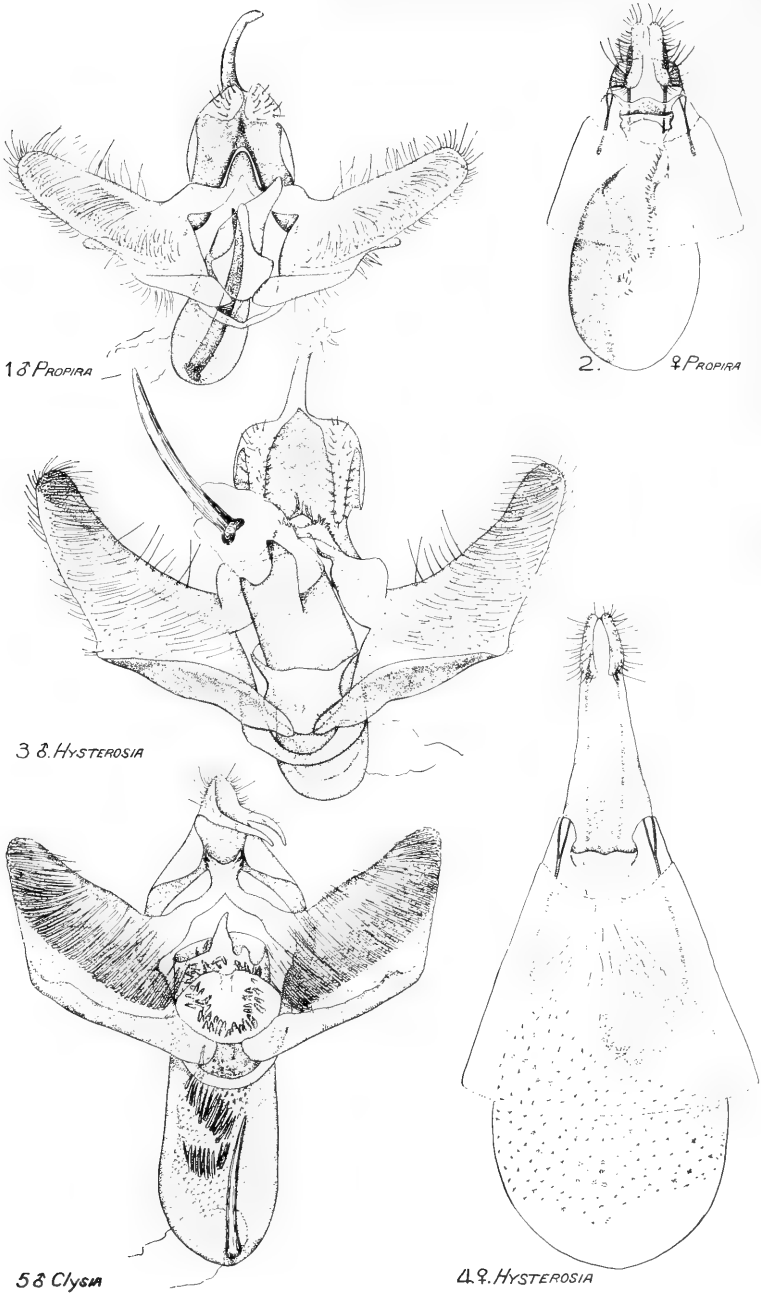
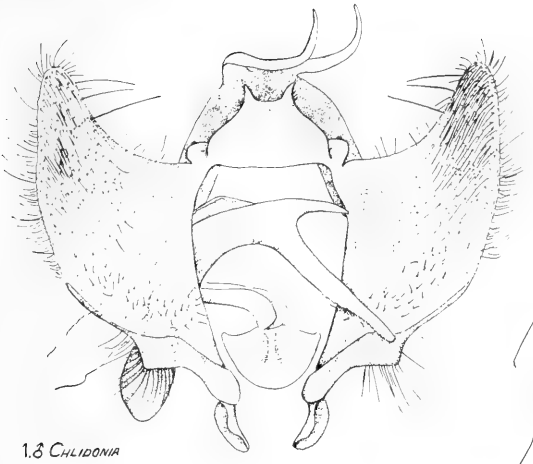
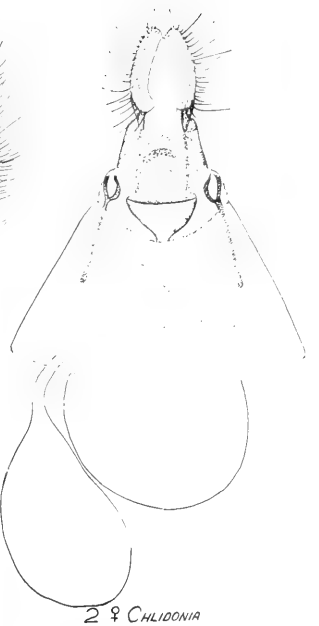


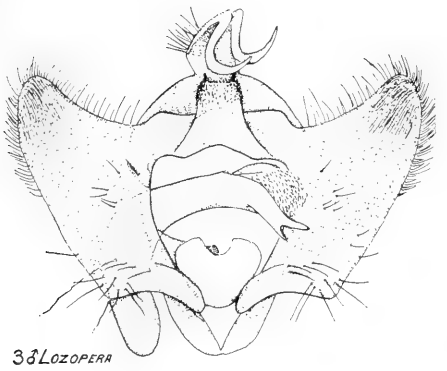
PLATE 18



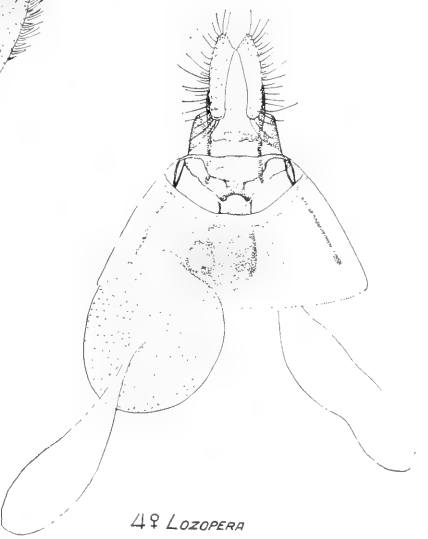
1.♂ *Chlidonia*



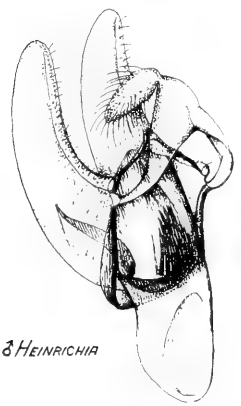
2 ♀ *Chlidonia*



3♂*Lozopera*



4♀ *Lozopera*



5♂*Heinrichia*

PLATE 19

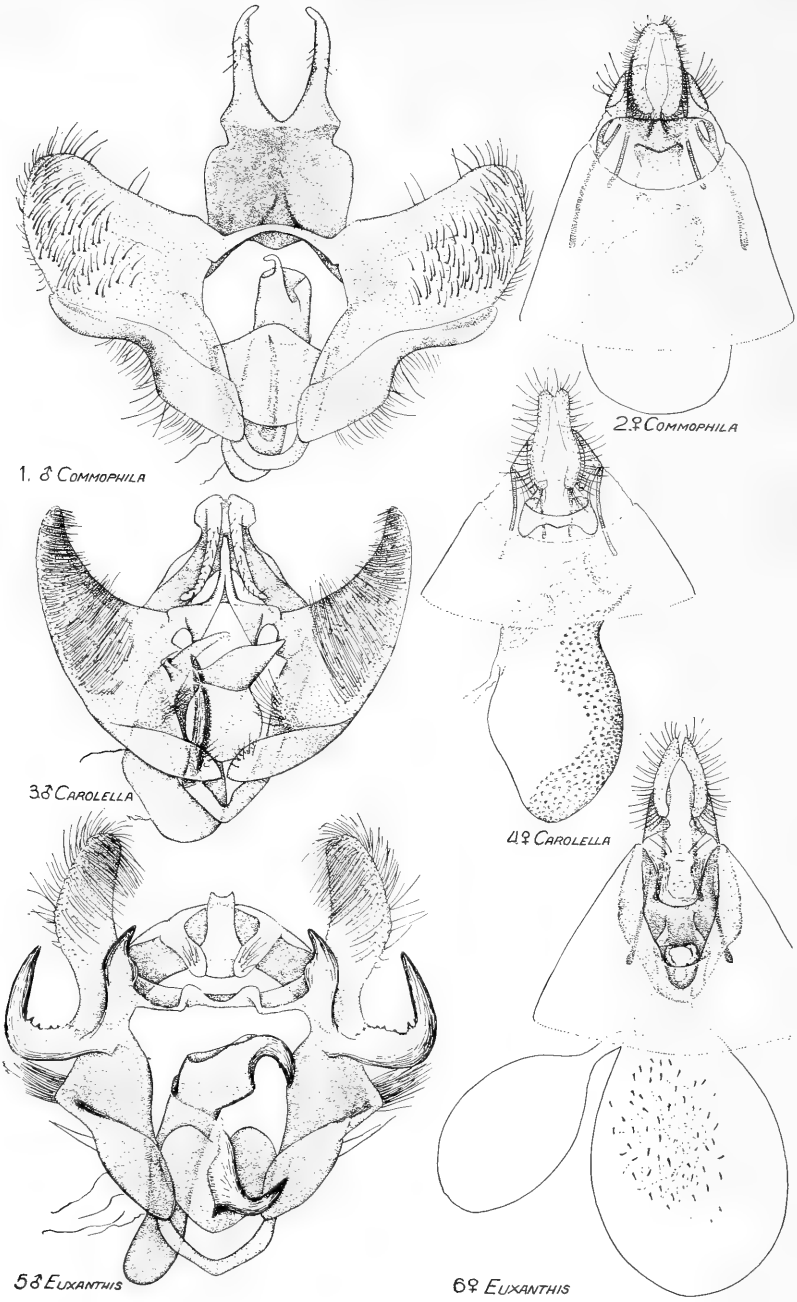
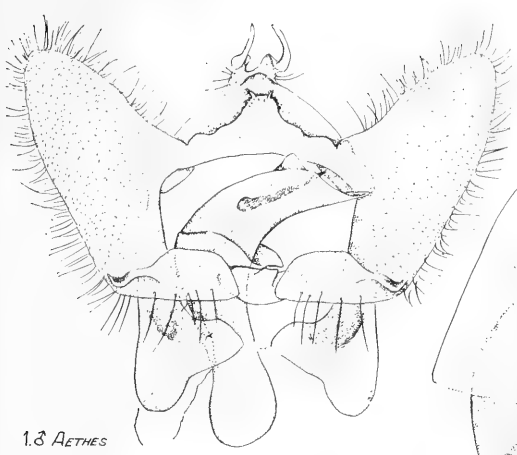
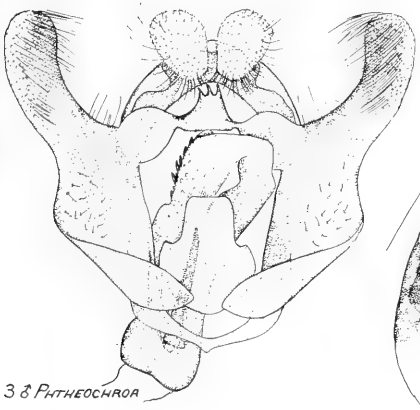

1. ♂ Commophila
2♀ Commophila
3♂ Carolella
4♀ Carolella
5♂ Euxanthis
6♀ Euxanthis

PLATE 20

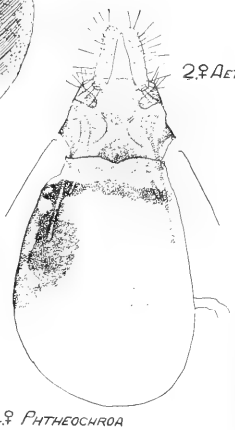


1.♂ *Aethes*

2.♀ *Aethes*

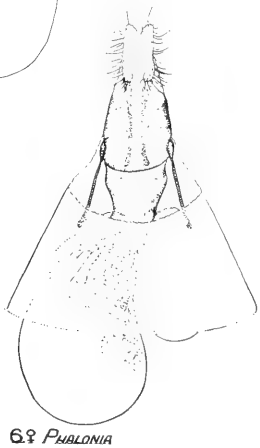


3.♂ *Phtheochroa*



4.♀ *Phtheochroa*

5.♂ *Phalonia*



6.♀ *Phalonia*

PLATE 21

THE FAUNA AND FLORA OF THE EL SEGUNDO SAND DUNES (Continued)

7. TWO NEW PHALONIID MOTHS

By John A. Comstock

Late in 1937 we submitted specimens of a Phaloniid moth to August Busck for determination, and were advised by him that it was a new species. He suggested that we endeavor to study the life history and publish notes thereon, together with a description of the imago.

At that time we were unable to find the larva in spite of the very helpful suggestion given in a letter from Mr. Busck in which he wrote: "The larva will be found to be a stem borer in one or more of your native weeds, probably of the family Compositae."

As a result of the ecological studies carried on in the sand dunes of El Segundo, California, by Dr. W. Dwight Pierce and his co-workers, a boring larva feeding in the stems of *Encelia californica* Nutt., was brought into our laboratory, and the resulting moths proved to be of this new species.

In recognition of Mr. Busck's helpfulness and generosity in this, as in all other matters wherein we have sought his aid, I propose for this species the name

Carolella busckana n. sp.

Holotype male. Alar expanse, 21 mm. Plate 22, fig. A.

Labial palpi, white above, with a few blackish brown scales at the sides; heavily mottled brown ventrally Head and thorax evenly speckled with white and blackish brown spots.

Forewings above covered with an admixture of white and brown scales, giving all areas of the wing a peppered appearance, in addition to which a number of blackish scales occur as spots over certain areas.

A quadrate dark brown large spot runs obliquely across the center of the wing much as in *C. mexicana* Busck. This spot is heavily checkered with black scales. Laterally and also medially to it is an area in which the white scales predominate.

The outer third of the costal margin bears four large blackish bars, separated by white areas. The outer third of the wing is divided into a lateral predominantly whitish area, finely speckled with light brown scales, and an inner deep brown irregularly triangulate area, crossed by wavy broken black lines.

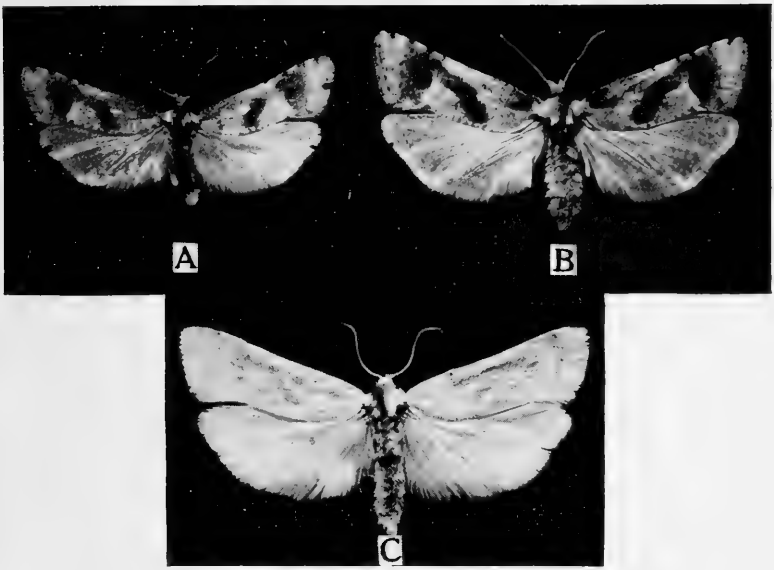


PLATE 22

Fig. A Holotype ♂, *Carolella busckana* Comst. Superior aspect, enlarged x 2.

Fig. B. Allotype ♀, *C. busckana* Comst. Superior aspect, enlarged x 2.

Fig. C. Allotype ♀, *C. busckana willettana* Comst. Superior aspect, enlarged x 2.

Photo by Cobb.

Fringes, speckled black and white, the margins nearly black.

Secondaries, superior surface, uniformly mottled or pebbled light brown and white, the brown irrorations suggesting the pattern of a netting. Fringes predominantly white.

Inferior surface; primaries. The black bars with white interspaces on the outer third of costal margin are the only markings which carry through from the upper surface. The remainder of the wing is a suffused smoky slate-black. The secondaries are similar in appearance to the upper surface, although there is a slightly heavier mottling of brown scales.

Abdomen, transversely barred with black and white scales. Under surface of thorax and legs, speckled black and white.

Allotype female. Expanse, 25 mm. Plate 22, fig. B.

The markings are in every respect similar to those of the male. Except for the larger expanse and stouter abdomen it is practically impossible to distinguish the sexes without resorting to a dissection.

This species is close to *C. mexicana* Busck, but differs in having costal, apical and dorsal blackish brown dots, in the long

curved lobes of the female ovipositor (as compared to short straight lobes in *mexicana*), in the relatively larger size and in the greater preponderance of slaty gray scales in the maculation. The male genitalit are shown on Plate 23.

PLATE 23
Genitalia of ♂ *Carolella busckana* Comst., highly magnified.
From preparation by August Busck.
Photo by Cobb.

There is great disparity in the size of individuals in this species. The smallest in our series has an alar expanse of 15 mm., and the largest measures 28 mm.

Described from a series of 35 examples, as follows:

Holotype male. El Segundo, California, November 16, 1938 (emerged). Coll. W. D. Pierce.

Allotype female. El Segundo, California, November 29, 1938 (emerged). Coll. W. D. Pierce.

Paratype No. 1. Male. Beverly Terrace, California, December 12 - January 5, 1929; genitalic slide A. B.

Paratype No. 2. Female. Same data as No. 1.

Paratypes Nos. 3 and 4. Loma Linda, San Bernardino County, California. No dates.

Paratype No. 5. West Riverside, California, February 10, 1906.

Paratype No. 6. San Diego, California, November 13, 1920. Coll. K. R. Coolidge

Paratype No. 7. San Diego, California, February 26, 1922. Coll. E. Piazza.

All of the above placed with the United States National Museum.

Paratypes Nos. 8-10. San Diego, California, February 26, 1922. Coll. E. Piazza.

Paratypes Nos. 11-12. San Diego, California, December, 1924.

Paratype No. 13. Beverly Terrace, California, December 12 - January 5, 1929.

Paratype No. 14. Los Angeles, California, July 4, 1929.

Paratypes Nos. 15 to 33. El Segundo, California (emerged). Dates run from November, 1938 to January, 1939. Coll. W. Dwight Pierce.

Paratypes will be placed with the Canadian National Museum at Ottawa, through Dr. J. McDunnough; with the Philadelphia Academy of Natural Sciences, the California Academy of Sciences at San Francisco, the San Diego Museum of Natural History, and the British Museum. The remaining paratypes will be retained in the collection of the Los Angeles Museum.

A small series of another *Carolella* was collected by Mr. George Willett at Chuckawalla Springs, Riverside County, California, which seems to be very distinct in spite of the fact that the male genitalia are indistinguishable from *busckana*. In our rather long series of Carolella we find no examples that intergrade between this and the species above described. Mr. Busck considers that the Chuckawalla Springs form is hardly deserving of a name because of the genitalic similarity, yet in spite of the weight of his authority we venture to describe it as a desert race or form of *busckana* on the strength of the very different maculation.

Carolella busckana **willettana** f. nov.

Holotype male. Expanse 27 mm.

Superior surface, primaries; immaculate cream-white, except for two areas. The diagonal quadrate bar crossing the middle of the wing is a light yellow-brown, and is not regularly quadrate as in *busckana,* the margins being distinctly sinuate. A similar color suffuses the inner half of the outer third of wing. A few light brown scales are scattered irregularly throughout the white scales. There is however no conspicuous spotting of black as is the case with *busckana*. The outer margin of the wing is narrowly edged with light brown.

Fringes, white. In a few of the paratypes there is a slightly checkered appearance to these fringes.

Secondaries, immaculate pearly white, with white fringes.

Inferior surface, primaries; gray white, shading to pure white at the outer margin. Fringes, white. Secondaries, immaculate pearly white throughout. A few of the paratypes show a slight admixture of light brown scales, but there is no suggestion of the reticulated pattern characteristic of *busckana*.

Antennae, white above, brown below. Labial palpi, white on the dorsal surface, brownish white below. Head, white. Thorax,

predominantly white, with a few brown scales. Abdomen and legs white.

Allotype female. Expanse 27 mm. Plate 22, fig. C.

All color and markings practically indistinguishable from male.

Described from a series of thirteen specimens, as follows:

Holotype, Chuckawalla Springs, Riverside County, California, December 25, 1937. Coll. G. Willett. Deposited in the U. S. National Museum collection.

Allotype, same data. In the collection of the Los Angeles Museum.

Paratypes Nos. 1 to 7. All taken at the same place and date by Mr. Willett.

Paratypes 8 to 11. San Felipe Wash, San Diego County, California, in February and March of 1937, coll. J. A. Comstock. (Paratype 10 at Mason Valley not far from San Felipe Wash.)

Paratypes will be placed in the Canadian National Collection and in the collection of the San Diego Museum.

Carolella busckana is a gall former in the stems of *Encelia californica* Nutt. The galls begin to form in young green shoots in the spring and reach their maturity in September and October. The average gall measures about 35 mm. long by 12 mm. wide. At the time of maturity the plant appears to be dead, all of the leaves having withered. The stems containing the galls, however, are all living, and young buds are beginning to form on their surfaces. The presence of the gall does not kill the plant, and many vigorous branches may arise from it the following spring.

The young larvae (up to at least 3.5 mm.) are translucent yellow-white, with black heart-shaped heads. In the later instars (the exact number undetermined) the head is light yellow-brown, considerably flattened, the mouth parts being a darker brown, and the ocelli black. The head is much smaller than the first segment.

The mature larva measures approximately 12 mm. It is grub-like in appearance, widest at about the sixth segment, and tapers markedly towards the head and tail. The segments are stout and rounded. The ground color of the body is a soiled ivory or yellowish white. A suggestion of a gray mid-dorsal line is present in the majority of examples. Otherwise there are no spots or distinguishing marks.

Legs, concolorous with body, the terminal segments slightly more yellow; prolegs (four pair in addition to anal prolegs) relatively very small, concolorous with body; crochets in a circle,

light brown, and very minute. Spiracles, very small, circular, brownish black rimmed, with yellowish white centers.

When the larva prepares for pupation it first weaves a fine silken diaphragh at the uppermost part of the gall cavity, thus closing off the excavated area which extends upward a short distance into the stem. Occasionally there are two of these diaphragms, close together. A side channel is then cut at some point in the wall of the upper fourth of the gall chamber. This channel is cut nearly to the outer surface of the bark. The larva then weaves a tubular silk channel from this point downwards to about the central portion of the gall chamber, where the channel is expanded to form a cocoon. The lower third of the gall chamber is filled with excreta. Occasionally the point of exit is made in the lower fourth of the chamber wall. In that case the silken channel runs upward to communicate with the cocoon, and the upper third of the gall chamber is packed with excreta.

The mature larva, in dorsal view, is shown on Plate 24.

Pupa, average length 8:5 mm. sub-fusiform.

Ground color, ivory-white with a tinge of yellow-orange over the thorax and abdomen, the segmental junctures darker. Vertex, dark brown, and protruded forward at the tip to form a keel-like sharp process. Eyes nearly black. The tips of the wing cases reach about three-fourths the distance toward the cauda.

On each typical abdominal segment there are two transverse lines of sharp processes, the first beginning above the spiracle, extending along the anterior margin of the segment close to the segmental juncture, and from thence down to the spiracle of

PLATE 24

Mature larva of *Carolella busckana* Comst., dorsal aspect, enlarged approx. x 5.

Photo by Cobb.

the opposite side. The points of each process incline caudally and are black.

The second line of processes, paralleling the first, runs over the segment at the juncture of the anterior two-thirds with the posterior third. The points in this line are not as long as those of the first. These two lines or rows of spines are undoubtedly developed for the purpose of aiding the chrysalis to propel itself forward in its silken tube to the point of emergence. The sharp keel-like process on the vertex aids in splitting the outer bark of the plant at the point of exit.

a. *b.* *c.*

PLATE 25

Pupa of *Carolella busckana* Comst. shown in (*a*) dorsal, (*b*) lateral, and (*c*) ventral aspects. Enlarged x 5.

Photo by Cobb.

The cremasteric end is well rounded and bears a few fine recurved yellow-brown hooklets. There are also a few short stubby pointed processes on the dorsal aspect of the last two caudal segments.

Plate 25 illustrates the pupa. The example pictured has a slighthly shorter abdomen than occurs in typical specimens. The cremasteric hooklets are too small to be shown in the cut.

When emergence occurs the pupa works its way out through the opening but remains at the entrance, as shown in Plate 26.

The moths emerge from about October or November through to February. At that time the foodplant is woody and appears lifeless, and it would be impossible for the young larvae to burrow into this hard structure. It is presumed therefore that the eggs do not hatch until succulent young growth has made its appearance.

The range of the species is at present unknown, but examples in the Los Angeles Museum collection record it over a territory extending from San Diego north to El Segundo.

The writer examined *Encelia* along the coast highway north of Santa Barbara and found no evidence of galls.

PLATE 26

Upper half of gall on stem of *Encelia* showing cast skin of pupa of *Carolella busckana*, enlarged approx. 2½.

Photo by Cobb.

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8. NOTES ON THE LARVA OF LORITA ABORNANA BUSCK. (LEPIDOPT.)

The mature larva of this species is very elongate and narrow with the body somewhat flattened. Average length, 7 mm.

Head, light orange. Maxilla, white. Mouth parts, dark orange. Ocelli, black.

The first segment is orange, with longitudinal bands of a darker orange.

Body, dorsal area, light tan, with a narrow mid-dorsal stripe, slightly darker. A lateral supra-stigmatal brown longitudinal band is present, and below this the body is a light tan.

Abdomen, yellow-tan.

The entire surface of the body, except the first segment, is covered with minute whitish specks.

Prolegs concolorous with abdomen; legs slightly darker.

The body is clothed with moderately long colorless setae.

Food plant, Dodder, *Cuscuta californica* Choisy. Collected in the sand dune area of El Segundo, California.

A NEW SPARGANOTHIS WITH NOTES ON EARLY STAGES (Lepidoptera, Tortricidae)

By John A. Comstock

Sparagnothis larreana sp. nov.

Male holotype. Alar expanse, 18.5 mm. Plate 27, fig. 1.

Labial palpi light yellow-brown, as are also the face, head and thorax. Primaries, ground color about the equivalent of Ridgeway's "Sayal brown," the outer margins very slightly darker. Diagonally across each wing, beginning at the outer portion of the cell and extending outward and downward is a darker brown bar about 1 mm. in width, its margins poorly delimited. This bar is composed of rich brown scales with a sparse sprinkling of black scales intermixed. Fringes concolorous with ground color.

Secondaries, uniform light cream, very slightly translucent. Fringes light yellow brown at the outer angle, merging to cream at the inner (anal) angle; considerably longer than on the primaries, particularly along the inner margin.

Obtained from a larva collected at Lovejoy Buttes near Llano, Mojave Desert, California; emerged April 13, 1938.

Female allotype. Alar expanse, 18 mm.

Practically the same as the holotype in all particulars except for the stouter abdomen. Collected at the same locality and emerged April 12, 1938.

On the under surface both wings are a uniform light cream except for a slight shading of yellow-brown over the apices of primaries.

Paratypes, Nos. 1 to 40 reared from larvae, all collected at the same locality, the dates of emergence extending from April 11 to 25, 1938.

The larva of this species is a leaf tyer on Creosote bush, the species known generally as *Larrea tridentata* (DC) Cov. var. *glutinosa* Engelm. Munz however designates it *Larrea divaricata* Cav.

The caterpillar binds together a small bunch of leaves at the tip of a branch, weaving a silken tube through the center. The mature larva is a light olive green, without distinguishing marks or spots. Pupation occurs within the protective silken tube. Shortly before emergence the pupa works its way to the outer opening of this tube and partly protrudes from it.

Pupa, average length 9 mm. Color, dark brownish black. Front rounded; thorax not prominent, very short (2 mm. in length). The wing cases extend about three-fifths the distance toward caudal end; antennae reaching .8 mm. from margin of wings.

On each typical abdominal segment there are two transverse rows of sharp pointed tooth-like processes arching over the dorsum, each process pointing posteriorly. The first row on each segment is located close to the anterior segmental margin and the second row is slightly caudal to the center of the segment. These are undoubtedly developed for the purpose of assisting the pupa to propel itself forward in the tube prior to emergence.

The cremaster bears a few short recurved light brown hooklets.

Commander Dammers reports that he has reared this species from an evening primrose (*Oenothera*) and has also carried it to maturity on *Buddleia*.

The holotype and allotype of this species will be deposited in the collection of the Los Angeles Museum. Paratypes will be distributed to the U. S. National Museum, the Canadian National Museum at Ottawa, the California Academy of Sciences in San Francisco, the Natural History Museum, San Diego, the Philadelphia Academy of Sciences and the British Museum.

We are indebted to our ever generous friend, August Busck, of the U. S. National Museum for council and advice in the study of this species.

PLATE 27

Upper figure, holotype ♂, *Sparganothis larreana* Comst., enlarged approx. x 1½.

Lower figure, ♀, *S. larreana* Comst., enlarged approx. x 1½.

Photo by Cobb.

NOTES ON THE EARLY STAGES OF MAMMIFRONTIA RILEYI BENJ. (LEPID.)

By John A. Comstock

This species was described by Dr. Benjamin in the Bulletin of the Southern California Academy of Sciences, vol. 34, part 3, p. 208, 1935, mainly from material submitted by the writer. One of the paratypes was recorded as "E. O. Essig coll., on wild rye, Ventura, Calif." Dr. Benjamin, on page 209 prognosticated the stem boring habits in part of a sentence wherein he stated: ". . . indicating that the larvae are probably stem borers in grasses or similar plants . . ."

A search in the environs of Los Angeles by several workers finally located them boring in the stems of Giant Rye Grass (*Elymus condensatus* Presl.).

Mature larva, length 20 mm. Ground color, light olive.

PLATE 28

Mature larva (dorsal aspect) of *Mammifrontia rileyi* Benj., shown in the pupal chamber prior to final molt. The rye grass has been split and the upper section folded over to the right. Enlarged approx. x 4.

Photo by Cobb.

Head, glistening light orange; ocelli minute, black, on a dark orange base. Antennae, light straw on the two proximal segments, orange at the tip. Mandibles, black. A few colorless setae occur over the face.

The first body segment bears a rough scutellum which is concolorous with the body. This is edged posteriorly and laterally with a brownish black narrow border, and anteriorly by a wide black border.

There are two conspicuous longitudinal stripes along the body, one on each side of the olive mid-dorsal area. These are a light chocolate-brown. A third line of similar character runs stigmatally, but is broken into dark spots on the first three segments.

Colorless setae, each one arising from a large round black spot, are sparsely scattered over the body.

Legs concolorous with the body, their tips somewhat darker.

Prolegs, light olive, the crochets black.

Pupa, length 15 mm.; cylindrical, light brown. All segmental junctures are narrowly edged with darker brown. Spiracles, inconspicuous, only slightly darker than ground color. There are apparently no setae on any portion of the body. The cremaster bears a single small hook.

The larva is illustrated on Plate 28, and the pupa on Plate 29.

The larva feeds within the hollow tubular cavity of the Giant Rye Grass. It begins this feeding usually in younger green stalks, transfers later to older stalks, in which pupation sometimes occurs. Quite frequently however it cuts into old hard dead stalks before pupating.

The pupal chamber is sealed below the larva by a pithy plug. Above the larva there is woven a delicate silk diaphragm which closes off the channel. Frequently two such partitions are constructed. Above this is the exit window which has been gnawed by the larva from the inside. This is cut to paper thinness and scored around the margin so that a slight push from within will open it.

There is but one brood a year, the imagos emerging in late June and July.

The laying habits have not been observed. We are inclined to believe that eggs are deposited at the base of the plant, and overwinter. Examination of the foodplant in mid spring disclosed no evidence of young larvae within the stalks.

PLATE 29
Pupa of *Mammifrontia rileyi* Benj., lateral aspect, resting in pupal chamber. Enlarged approx. x 3½.
Photo by Cobb.

TWO APPARENTLY NEW WESTERN MOTHS

By John L. Sperry
Riverside, California

Cheteoscelis clarkei, n. sp.

Palpi white, male short to moderate, female moderate; first and second joints rough scaled, third joint short, prominent, lightly scaled; head, front rosy-brown with some white scales, vertex white; collar, tegulae and thorax green; abdomen above and below green, flecked with white, becoming white above on the last few segments, dorso-laterally white, sparingly flecked with green. Antennal shaft white, branches very light brown in the male; in the female, antennae dentate, white above, very light brown beneath. Femora on all legs short hairy greenish, tibiae inner side brown, outer white.

Primaries green, almost myrtle green, the color seems rough, the effect being caused by a minute stippling of microscopic greenish white scales over all the fore wing. Lines, two, white, narrow, distinct; t.a. line starts from the costa about two-fifths out from base of the wing, angles sharply out to subcostal vein, then making an acute angle inward, curves gently nearly parallel to the outer margin and reaches the inner margin one-third out. The t.p. line starts on costa, 1½ to 2 mm. from apex, curves nearly parallel to t.a. line reaching inner margin about three-fifths out from base of wing. The t.p. line is the more regular of the two, the t.a. line having a tendency to be rough and sometimes slightly dentate on the veins. The costa is narrowly white on the outer three-fourths, green near the base. Fringe short, white. No discal dots apparent.

Secondaries, white with a wash of green scales on the lower half of the outer third of the wing extending from tornus along the outer margin and fading out in most specimens less than half way to the costa. In most specimens a very faint fairly broad t.p. line is visible, defining the inner edge of the cloud of green scales, it runs subparallel to the outer margin from inner margin to costa. Discal dots and t.a. line wanting. There are tinges of green on inner margin and in some specimens scattered very lightly over all the secondaries. Fringe narrowly light green at base, darker green centrally, white tipped, traces of a narrow broken green line at the base.

Beneath, forewings lighter green than on the upper surface, all lines showing through indistinctly, lower half of fore wings washed with white. Secondaries fairly heavily washed with green with a white space along inner margin, extradiscal

line distinct. Fringe on all wings as on upper surface of secondaries.

Expanse, male 20-26 mm.; female 24-28 mm.

Holotype, male, Split Rock Tank, Mojave Desert, California, May 19, 1938. Grace H. and John L. Sperry, collectors, No. 53438 in the collection of the U. S. National Museum, Washington, D. C.

Allotype, female, May 31, 1938, same locality and collectors and in the collection of the U. S. National Museum.

Paratypes, 38 males, 6 females, Split Rock Tank, Mojave Desert, California, May 19-31, 1938; Granite Wells, Mojave Desert, California, May 24 and 25, 1939; Grace H. and John L. Sperry, in the collections of the U. S. National Museum, Canadian National Mussum; Los Angeles Museum, Los Angeles, California, and of Grace H. and John L. Sperry, Riverside, California. One male, Morongo Valley, California, May 12, 1937; G. H. and J. L. Sperry, in the U. S. National Museum collection; 1 male, Ivanpah Mts., California, May 3, 1939; Dr. John A. Comstock, in the Los Angeles Museum.

When I first submitted this species to my friend, Dr. J. McDunnough of Ottawa, he suggested that it was probably close to *C. orthogramma* Dyar and so it has proven to be. Dr. J. F. Gates Clarke of the U. S. National Museum has been so kind as to compare this species with *orthogramma* and I take the liberty of quoting from his letter:

"Your Cheteoscelis is apparently new. I made a slide of the type of *orthagramma* Dyar and yours is not this species although it is close. The harpe of your species is much broader than that of *orthogramma* and the two long cornuti of the vesica are nearly straight and broadly separated, in *orthogramma* they are strongly curved and closely associated. The two transverse white lines of the fore wings are narrower than those of *orthogramma* and are parallel, the tegula of *orthogramma* has a narrow white inner edge, yours has no such edge."

I note also that the t.p. line of *orthogramma* starts at the costa almost at the apex, whereas in *clarkei* it starts from 1½ to 2 mm. from the apex. The under side of the abdomen in *orthogramma* appears to be light ochreous, in *clarkei* it is green. The front of the head is green in *orthogramma*, rosy brown in *clarkei*. *Clarkei* differs from *bistriaria* Packard in its smaller size and darker color, from *pectinaria* Grossbeck in the lack of the t.a. line on the secondaries and the more distinct and broader lines on the primaries.

It gives me great pleasure to name this beautiful species in honor of Dr. J. F. Gates Clarke of the U. S. National Museum, whose friendly cooperation has made the National Museum available to many of us who are prevented by distance from consulting it as often as we should like.

Euproserpinus wiesti n. sp.

Head: Front creamy ash, vertex, same in female, brownish in male; thorax and tegulae reddish brown with some light ash colored hairs in the male, light gray brown in the female; antennae black. Abdomen dark brown with a broad white encircling band covering the 4th and 5th segments. Breast white, sides brown; under side of thorax and abdomen brown except for the white encircling band and narrow white fringes marking the edges of the segments of the abdomen. Legs brown with a few white hairs covering the tibial spurs.

Primaries, ground color light tan brown with darker brown maculation. A dark brown intradiscal line starts one-fifth out on costa and curves outwardly convex to the inner margin, which it reaches at about one-third out. Preceding the intradiscal line is a narrow diffuse band of light gray scales mixed sparingly with orange, giving it a tinge of tan. Lower two-thirds of basal area is dark brown, upper one-third gray with a subcostal vein marked with brown. There is a median brown line from one-fourth out on the costa at right angles to subcostal vein, thence almost straight to inner margin at right angles at about two-fifths out. Extradiscal line from about two-thirds out on costa curves sharply inward, touching the lower end of the inwardly oblique, black discal dash, continues parallel to costa to within 1½ mm. of the median line, then turning outward at right angles to its former course goes to vein 1, then straight to inner margin. The lower portion of the space enclosed by this line and the median is dark brown with the veins outlined in gray, the upper portion is gray. Beyond the extradiscal line, near the subterminal line are two indistinct irregular light brown lines, roughly subparallel to the outer margin, and made up of tiny brown dots on the ground color of lighter scales. There is an irregular broken subterminal line edged inwardly with tan and outwardly by the broad, terminal, brown band. Fringe light gray brown.

Secondaries white with a fan of dark brown covering the basal quarter of the wing and brown terminal band along the outer margin of the wing from tornus to costa. This band is narrower than that of other species of this genus being about 1¼ mm. wide at its inner border paralleling the outer margin. Fringe white.

Beneath, primaries dirty white, the discal dash and the terminal band showing dimly through. Secondaries white with a patch of black scales covering the lower half of the basal third of the wing; terminal band distinct but lighter than on upper surface, the third nearest the tornus darker than the rest of the band. Fringes as on upper surface. No discal dot apparent on secondaries.

Expanse, male 39 mm.; female 42-48 mm.

Holotype, male, Kelsey, Colorado, May 30, 1938; Ed. B. Andrews, collector, in the collection of Grace H. and John L. Sperry, Riverside, California, through the courtesy of Dr. Wiest.

Allotype, female, same data.

Paratypes, one male; one female, same date and in the collection of Dr. Roy Wiest of Estes Park, Colorado; three females, Roggen, Colorado, May 28-29, 1939, in U. S. National Museum, Canadian National Museum, and collection of Dr. Roy Wiest.

Dr. John A. Comstock, in Bulletin So. Calif. Acad. Sci., XXXVII, 1938, page 33, has given us a very scholarly discussion of the species in this genus and I will therefore only attempt to note the differing characteristics of this species.

Wiesti is larger than *phaeton* G. & R., being 39 mm. as compared to about 31 for the male of *phaeton*; it is of brownish cast whereas *phaeton* is dark gray to black; the course of the extradiscal line and the terminal band differs markedly. *Phaeton* also lacks the broad white band ringing the abdomen in *wiesti*. *Phaeton* is also darker beneath and lacks the basal black patch present on the secondaries of *wiesti*. *Phaeton* race *mojave* Comstock is, if anything, closer but again differs markedly in fore wing maculation, lacks the white encircling band on the abdomen and the black basal patch on the under side of the secondaries, both present in *wiesti*; also the under side of the thorax, brown in *wiesti* is gray in *mojave*. *Wiesti* differs from *euterpe* Hy. Edwards in that the antennal shaft of the male is black and not white as in *euterpe*, also *euterpe* lacks the white abdominal band of *wiesti*.

It may be that this will turn out to be another form of *phaeton* but in the judgment of the author it is sufficiently different to warrant specific rating, at least until something is known about the early stages of this insect.

It gives me great pleasure to name this species in honor of my friend, Dr. Roy Wiest, enthusiastic entomologist, of Estes Park, Colorado, to whom I am indebted for many interesting specimens of Colorado Lepidoptera.

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Southern California Academy *of* Sciences

LOS ANGELES, CALIFORNIA

Vol. XXXVIII September - December, 1939 Part 3

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CONTRIBUTIONS FROM THE LOS ANGELES MUSEUM —CHANNEL ISLANDS BIOLOGICAL SURVEY

Introductory Note

Early in the fall of 1938 we were approached by Prof. Don Meadows with a proposal to organize a Biological Survey of the Channel Islands of the California coastal waters, under the direction of the Los Angeles Museum.

The plan as submitted showed an excellent grasp of the opportunities and factors involved, and outlined a type of organization and method of procedure that immediately appealed to us.

Accordingly, after several conferences, held in December, 1938, a communication was addressed to the Board of Governors of the Los Angeles Museum requesting their approval of the survey along the lines suggested in the submitted recommendations.

This request received favorable action of the Board on December 24, 1938.

Our proposal covered a five year period of study and exploration of the several islands, including particularly Santa Catalina, San Clemente, San Nicolas, San Miguel, Santa Rosa, Santa Cruz, Santa Barbara and Anacapa, with the possible inclusion of the Coronados. The plan laid particular stress on the life forms and their ecological relationships, together with geological and archeological considerations.

After considerable correspondence the necessary permits were secured from the Navy Department, the National Park Service, and owners of such of the islands as are in private hands.

Transportation to and from the islands was assured through the helpful cooperation of Captain Allan Hancock of the Allen Hancock Foundation of the University of Southern California, and the California Fish and Game Commission.

The first reconnaissance trip was made to San Clemente Island on February 18, 1939, returning on the 19th. The party included Prof. Meadows, Mr. George Willett of the Museum staff, and the writer, together with a group of students from the Hancock Foundation.

The second expedition left Terminal Island for San Clemente on the morning of April 1, 1939, and returned April 8. The personnel included Prof. Meadows, Theodore Reddick, M. B. Dunkle and Mr. Russell Sprong, together with the following members of the Museum staff: Arthur Woodward, archeologist; Jack C. von Bloeker, mammalogist; Lloyd Martin, entomologist.

The third trip was to Santa Barbara Island, May 27 to 30, 1939. The party included all who took part in the second expedition, and in addition James DeLong, geologist.

The fourth, and most ambitious of the 1939 operations was in the field from July 21 to August 19, and included a week of work on each of four islands, namely San Nicolas, San Miguel, Santa Rosa and Santa Cruz. It was unusually successful from the standpoint of amount and variety of materials collected. Particularly noteworthy was the helpful cooperation of the Vails, on Santa Rosa, and of Mr. and Mrs. Stanton on Santa Cruz. Mr. and Mrs. Agee, through their representative, Reginald Lamberth, on San Nicolas, and Herbert S. Lester, representing Mr. R. L. Brooks on San Miguel gave valued assistance. The party, in addition to the original contingent (minus only Theo. Reddick, herpetologist) included George Kanakoff and Jewel E. Lewis. The writer joined the expedition for the final week on Santa Cruz.

The fifth and final trip of the year embraced a month's work on San Clemente, from November 9 to December 10. The party included Arthur and Barker Woodward, George and Ora Willett, George Kanakoff, and Jack von Bloeker. This unit concentrated mainly on special studies in archeology, ornithology, mammalogy and entomology, although some collecting was done in other fields of science.

During this period a sixth unit visited San Clemente for three days of intensive work in botany, entomology and herpetology. This party made its base camp at the head of a canyon leading to Mosquito Cove, while the first unit worked at the southern end of the island. This sixth trip extended from November 23 to 26, and those who participated were Don Meadows, Theo. Reddick, Russell Sprong, M. B. Dunkle, Lloyd Martin and E. C. Williams.

The dates of these expeditions, and personnel of each are noted in detail because of the fact that collections made by the several participants have resulted in some important items, that will later find their way into scientific literature.

It is the hope of the survey participants that, at the conclusion of this five year effort, means will be found for insuring the publication of results in a creditable manner. In the interim it will be our policy to publish short papers in the "Bulletin" from time to time, recording new species and races, and noting pertinent facts with relation to distribution, occurrence and ecology of the island species. The first series of these papers follows.

John A. Comstock,
Director of Science,
Los Angeles Museum.

1. BEMICID WASPS FROM THE CALIFORNIAN ISLANDS

By T. D. A. Cockerell

The wasps recorded below were obtained by the Channel Islands Biological Survey of the Los Angeles Museum.

Bembix sanctae-rosae n. sp.

Male: Length about 13 mm.; black, with creamy-white markings on head, none on thorax, light sulphur yellow on legs and abdomen; hair of head, thorax and first tergite white and abundant; clypeus strongly convex, white except a pair of small black spots on upper part; a small hat-shaped supraclypeal mark which is distinctly yellow; large lateral face-marks, broadest at level of antennae, and with a pointed extension near upper end; scape stout, yellowish-white beneath; flagellum with small dentiform projections on segments 8 to 11; tegulae black; wings with no dark cloud; base of legs and femora black, the latter with a yellow mark at apex; tibiae and tarsi, yellow, the former with a large black mark; front tarsi with about ten long bristles; middle femora denticulate beneath, first tergite black, with a yellow mark at each side; tergites 2 to 6 each with an interrupted yellow band, in no case enclosing a black mark; seventh with a pair of contiguous spots; venter black with spots at extreme sides on sternites 2 to 5; first sternite thickened in middle on apical margin; second simple with a faint carina, visible when the light comes from the side; sixth with an obtuse elevation on apical part, appearing as a very small thorn-like process on lateral view; stipes shaped as in *B. viduata,* being long and pointed, with an evenly curved outer margin, but the outer margin is wholly devoid of hairs, whereas the inner margin shows long hairs, as in *B. comata.*

Santa Rosa Island, August 7, 1939.

Related to *B. comata* var. *nevadensis* Rodeck, but distinguished by the abdominal structures. It may be an extreme variation of *B. comata,* but for the present it is best regarded as distinct.

Bembix comata Parker

Santa Cruz Island, three males and four females, the latter very variable in size. Of the males, two have the abdominal bands light sulphur yellow, one has them white. The females have the bands white or creamy white.

Bembix hamata C. L. Fox

San Miguel Island (type locality), five males and twelve females.

Santa Rosa Island, three males and four females.

San Nicolas Island; many specimens of both sexes.

It is interesting to find that *B. hamata,* considered endemic on San Miguel, is equally common on Santa Rosa; but the species on Santa Cruz is the mainland *B. comata.* All the specimens from San Nicolas are *B. nicolai,* which keeps its characters well.

2. A NEW PARASITIC BEE FROM SANTA CATALINA ISLAND

By T. D. A. COCKERELL

Coelioxys catalinica n. sp.

Male: Length 11 mm.; black, including tegulae, but tarsi obscurely reddish; eyes with long hair; face densely covered with long white hair; lower part of cheeks with a broad beveled space; vertex very coarsely punctured, but a smooth shining area around ocelli; mesonotum densely and coarsely punctured; a pair of conspicuous cuneiform patches of white hair at base of scutellum; margin of scutellum simple, gently curved; axillar spines long and slightly curved; wings dusky at apex; basal nervure meeting nervulus; recurrent nervures equally distant from base and apex of second cubital cell; long white hair at sides of metathorax; a spot of white hair on each side between axillar spines and tegulae; abdomen with dense white hair-bands on margins of tergites 1 to 3, and weak bands on 4 and 5; transverse sulci on tergites 2 to 4; foveae on tergite 2 small, transversely oval, almost punctiform; fifth tergite with lateral dentiform angles; sixth with large and long teeth at sides of base and at apex, but upper apical teeth small, widely separated, divergent; no median tooth; venter with broad white hair-bands; fifth sternite emarginate.

I submitted this to Mr. P. H. Timberlake, thinking that it might be a species known to him from the mainland. He reports that "seems to be nearest to *C. rufitarsis* but differs in darker tarsi, foveae on tergite 2 very small, vertex with rather large impunctate space behind each lateral ocellus, margin of clypeus not emarginate but with 6 or 7 small sharp teeth, etc."

Howland's, Santa Catalina Island, May 3, 1933 (Don Meadows). Submitted to me by Professor Hilton. It will be placed in the Los Angeles Museum.

The foveae on second tergite are quite different from those of *C. rufitarsis* Smith; more like those of *C. octodentata* Say, from which the black tegulae and other characters separate our species. *C. grindeliae* Ckll., has much shorter hair on eyes, shorter hair on face; and the dark tarsi separate it from *C. coloradensis* Cresson.

3. BEES OBTAINED BY THE LOS ANGELES MUSEUM-CHANNEL ISLANDS BIOLOGICAL SURVEY

By T. D. A. Cockerell

ANTHOPHORIDAE

Anthophora nicolai Cockerell

San Nicolas Island, 6 ♀, 1 ♂. Three of the females have the pubescence pale, nearly as in *A. urbana* Cresson.

Anthophora edwardsii Cresson

San Clemente I., 2 ♂, April 2 and 4.

Anthophora catalinae Cockerell

Santa Barbara I., May 28, 2 ♀. Previously taken on Santa Catalina I., on one occasion only.

Anthophora urbana Cresson

San Miguel I., 1 ♂ July 29. Santa Cruz I., 1 ♀ and 3 ♂, August 12 and 15. It is noteworthy that the group of *A. urbana* has developed distinct species or races on the southern group of islands, but on the northern group is represented by quite typical *A. urbana*.

Diadasia mimetica Cockerell

Santa Cruz I., August 12 to 15, three of each sex. Santa Rosa I., August 5 and 6, 3 ♀.

Melissodes lupina Cresson

Santa Rosa I., August 7, 1 ♂.

APIDAE

Apis mellifera ligustica Spinola

(Introduced.) Four from Santa Cruz I., August.

BOMBIDAE

Bombus californicus Smith

Many specimens, both sexes, from San Miguel Island. It is singular that the other northern islands are not represented by *Bombus*.

NOMADIDAE

Nomada semisuavis Cockerell

Eight from Santa Rosa I., August 5 to 9, 1 ♀ lacking the supraclypeal mark. Three from Santa Cruz I., August 12 to 15.

Nomada formula Viereck

Fifty-six from Santa Rosa I., August, of which 1 ♂ lacks the supraclypeal mark. One female without supraclypeal mark, and with borders of clypeus very broadly black from San Miguel I., July 31. One ♂ from San Miguel I., July 29.

MELECTIDAE

Melecta pasadenensis Cockerell

Santa Barbara I., May 28, 1939, 1 ♂. Doubtless parasitic on *Anthophora catalinae*. The specimen is smaller than usual, having the size of *M. californica*. The face and tarsi have black hair, and the characters generally are those of *M. pasadenensis*, except that the apical half of mandibles is dark, faintly rufescent. Additional material, of both sexes, might perhaps indicate an island race.

CERATINIDAE

Ceratina acantha submaritima Cockerell

Santa Cruz I., August 12-16, 10 ♀ and 2 ♂. Of the females, seven lack the pale clypeal mark, three have a small mark. The males have the upper median extension of the clypeal band very small. It is interesting to find that the Santa Cruz specimens belong to the more northern subspecies.

MEGACHILIDAE

Anthidium clementinum Cockerell

San Clemente I., April 3 to 4, three of each sex. This was described from the male in a paper awaiting publication. It closely resembles *A. palliventre* Cresson (*A. californicum* Cresson), but is less robust, with hairs of thorax above not fulvescent, spots on tergites 2 to 5 not united, anterior and middle tibiae with longitudinal yellow stripes, hind tibiae striped at base, tarsi with apical joint red, abdomen beneath less hairy, subapical ventral spines small and inconspicuous, pygidial lobes triangular, pointed, hardly curved. The new material has the stripes on front tibiae very small, and on middle tibiae absent, in two males, but well developed in the third. The female is new. It is, as usual in the genus, smaller than the male. In the table by Schwarz (Amer. Mus. Novi-

tates, 253, 1927) it runs nearest to *A. cognatum*. The principal features are as follows: pubescence white, with long black or dark gray hairs on vertex, and an admixture of the same on thorax above; face-marks white including broad lateral marks, and lower part of clypeus, broadest laterally and more or less interrupted in middle (the light part of clypeus may be distinctly yellowish); outer side of mandibles mainly pale; a pyriform or elongated spot at each side of vertex; eyes green or brown; tubercles with a small spot or none; a spot on tegulae in front; light marks on mesonotum confined to small inconspicuous stripes above the tegulae; axillae with small spots or none; scutellum with a pair of transverse stripes; wings dusky; abdominal markings yellowish-white, on tergites 1 to 4 broken up into four spots, on fifth the lateral spots are absent or rudimentary, on sixth is a pair of large spots, or merely two dots (in one female the spots are dull yellow, apparently altered by cyanide); ventral scopa white; tibiae variably striped; front and middle basitarsi pallid. This female is related to *A. catalinense* Ckll., but the abdominal markings are quite different.

Osmia clarescens Cockerell

San Clemente I., April 4 to 6, one of each sex. I add notes on two other species, not obtained by the Museum expedition.

Osmia nemoris Sandhouse

San Miguel I., May 6, (W. P. Cockerell). Determined by Timberlake, who has seen the type. It is a northern species, found in Oregon, Washington and Montana. The type came from the Muir Woods.

Osmia cobaltina Cresson

The form found on Santa Catalina I. is unusually small, and should perhaps be separated as a distinct race. I had referred the specimens to *O. regulina* Ckll., but Miss Sandhouse has now examined both sexes, and considers that they are undoubtedly *O. cobaltina*. According to Miss Sandhouse *O. regulina* should be united with *O. calla* Ckll., but Timberlake writes that he can distinguish it in both sexes.

Megachile coquilletti Cockerell

(det. Timberlake.) One male, Santa Rosa I.

HALICTIDAE

Augochlora pomoniella Cockerell

Santa Cruz I., 41 ♀, 21 ♂.

Agapostemon californicus Crawford

Santa Rosa I., 13 ♀ and 14 ♂.
Santa Cruz I., 2 ♀ and 1 ♂.
San Nicolas I., 5 ♀ and 5 ♂.

These are green in the female sex, like the common mainland form, and are distinctly smaller than *A. c. clementinus.* Looking at the series together, one is convinced that they represent different races. The males have the *A. texanus* type of genitalia; the head and thorax are much bluer than in typical *A. texanus;* the scape in every case is black; the yellow band on first abdominal tergite is entire except in one from S. Nicolas and one from Sta. Rosa.

Agapostemon californicus clementinus Cockerell

San Clemente I., 19 ♀.
Santa Barbara I., 13 ♀ and 2 ♂.

With these long series before me, I cannot see that the females from Santa Barbara differ from those found on San Clemente. The two Santa Barbara males have the *A. texanus* type of genitalia; the scape is black; but contrary to the S. Clemente form, the band on first tergite is entire. The tegulae are dark. The markings of legs and abdomen are like those of *A. c. psammobius,* which also has a robust female like that of *A. c. clementinus.*

Agapostemon californicus psammobius Cockerell

San Miguel I., 3 ♀, 1 ♂.

The distribution of *Agapostemon* on the islands is puzzling. San Nicolas, Santa Catalina, Santa Cruz and Santa Rosa have the ordinary mainland form. San Clemente and Santa Barbara have a larger, bluer race, properly considered a subspecies. San Miguel has a race very like that from San Clemente, but apparently separable. Detailed morphological slides of all these island forms would be of great interest.

Halictus pavonotus Cockerell

San Miguel I., 3 ♀, July.

Halictus miguelensis Cockerell

San Miguel I., July, 9 ♂. With this series before me, I conclude that *H. cooleyi obscurior* Ckll., from Santa Catalina I., should not be separated.

HALICTUS MELILOTI CATALINENSIS Cockerell

Santa Rosa I., August 5, 1 ♀.
Santa Cruz I., August 12, 1 ♀.

4. A NEW IXODES (ACARINA: IXODIDAE)

By G. F. AUGUSTSON

Of the many interesting ectoparasites collected from mammals and birds of the Santa Barbara Channel Islands this new tick, *Ixodes peromysci,* presents such a complete history that all instars are illustrated and described. This is not unusual where many different hosts are under observation, but it is uncommon for members of the family *Ixodidae* to complete their life cycle on single species of host, as is true in this case. All instars were found and preserved by Mr. J. C. von Bloeker, Mammologist (Los Angeles Museum), off the white-footed mouse, *Peromyscus maniculatus elusus,* from Santa Barbara Island, California.

Upon the strength of these facts the most logical name for this parasite is that of the host to which it is apparently specific. Undoubtedly other islands of the Channel with a more varied fauna will disclose other hosts if the parasite is found. Although other islands were under observation the survey is as yet far from completed.

The complete biology of this tick has not as yet been studied, but the facts presented above give some information as to its life cycle. Besides these it might also be added that copulation occurs upon the host, as is evident by the fact that five engorged females taken from the host, and immediately preserved, were later found to be in copula with the male. Whether the male feeds is not definite, but from the appearance of the hypostome it may be assumed that it does not.

All ecological data and analysis of plates are included after the final larval description. Illustrations are original, being completed with the aid of the Abbe Zeiss Camera Lucida. The scale for measurements were obtained with a sub-stage micrometer.

I am greatly indebted to Dr. W. D. Pierce, Entomologist (Los Angeles Museum), for his suggestions and aid, and to J. C. von Bloeker whose excellent field work has made this paper possible.

IXODES PEROMYSCI n. sp.

Measurements. Female: (Holotype)
Body: L. 1.3 mm., W. 0.8 mm.
Scutum: L. 0.85 mm., W. 0.65 mm.
Capitulum: L. 0.45 mm.
Basi capitulum: L. 0.1 mm., W. 0.3 mm.

FEMALE: GENERAL ANALYSIS: Body: L. 1.3 mm., W. 0.8 mm. (an engorged female attains the dimensions of L. 6 mm., W. 4.2 mm.). A very small tick; oval, slightly narrower in front, broadest at level with coxae IV.

DORSUM: Reddish-brown (in 70 percent alcohol); with many long setae, particularly along the posterior border; marginal groove not continuous posteriorly; foveae indistinct; no lateral or median grooves.

SCUTUM: L. 0.85 mm., W. 0.65 mm., uniform dark-brown; with few scattered, short setae; broadly oval, widest at ocular level, not as wide as long; lateral and posterior angles broad; cervical grooves deep at onset, becoming very wide, shallow, and divergent posteriorly, not reaching postero-lateral border; scapula sharp, slightly divergent; no punctuations.

VENTER: Like dorsum; pregenital plate inconspicuous, with many short setae; epimeral plates inconspicuous, with many long setae; anal plate without setae; adanal-median plates together, with many long setae; genital groove continuous around genital orifice, slightly diverging posteriorly to postero-lateral margin; anal groove horse-shoe shape around orifice; genital orifice situated between coxae IV; spiracles with very thin, uniform chitin frame, oval, macula inconspicuous, slightly eccentric, globlet cells large within frame, smaller toward macula.

CAPITULUM: L. 0.45 mm., length of basi capitulum one-third width; porose areas moderate, sub-triangular, interval equal to one and one-half normal width of one area; cornu prominent, long, sharp; digits of chelicerae not reaching level of corona; hypostome dentition 3/3; pedipalps long, slender; article I small, not one-fourth length of article II; article II the largest; article III three-fourths the length of article II; palps sparsely covered with strong, short setae; no palpal setae; auriculae prominent, long, blunt; no ventral ridge.

LEGS: Moderate length, hairy; annulations conspicuous ventrally; coxa I sub-triangular, with internal spur of moderate length, slightly pointed, not reaching coxa II, external spur strong, blunt; coxae II-III rectangular with short, blunt external spur only; coxa IV oval-rectangular, with short, blunt external spur; all coxae with one to three very long, slender setae; tarsus I pseudo-articulation inconspicuous from last annulation, Haller's

organ guarded by a single pillar in front, one prominent hump anteriorly, tapering gradually at extremity; pulvillus moderate, as long as claws.

Measurements. Male: (Allotype)
Body: L. 1.1 mm., W. 0.65 mm.
Capitulum: L. 0.35 mm.
Basi capitulum: L. 0.15 mm., W. 0.21 mm.

Male: General Analysis: Body: L. 1.1 mm., W. 0.65 mm., oval, slightly narrower in front, broadest at level of coxae IV.

Dorsum: Reddish-brown; marginal groove complete posteriorly; pseudoscutum only slightly indicated by a darker brown area; cervical grooves weakly indicated, shallow, divergent posteriorly; setae as in female; scapula short, blunt, not as divergent as in female.

Venter: Ventral plates prominent; epimeral plates with 7 short setae posterior to coxa IV; adanal plates with 8 setae; median plates with 21 setae; no setae in anal plate; all plates separated by a wide shallow suture; with body fold conspicuous along posterior border; general color of venter lighter brown than in female; genital aperture situated between coxae III; pregenital plate obsolete, no visible setae; spiracles as in female.

Capitulum: L. 0.35 mm., basi capitulum not twice as wide as long; cornu shorter than in female, not as prominent; digits of chelicerae reach just to level of corona; pedipalps short, thick; article I the smallest, indistinct dorsally, article II the largest, article III but slightly shorter; palps with very few setae sparsely arranged dorsally; 3 long palpal setae on article II, 2 long, 2 short on article III; ventral ridge visible in the medial field, inconspicuous laterally; auriculae very short, blunt; hypostome dentition irregular, denticles 2 and 3 protrude laterally to others.

Legs: As in female, the annulations being not as conspicuous ventrally, the single dorsal hump of tarsus I being more prominent; coxal shape and armature as in female.

Measurements. Nymph: (Type Nymph)
Body: L. 0.75 mm., W. 0.62 mm.
Scutum: L. 0.4 mm., W. 0.35 mm.
Capitulum: L. 0.3 mm.
Basi capitulum: L. 0.14 mm., W. 0.19 mm.

Nymph: General Analysis: Body: 0.75 mm., W. 0.62 mm., broadly oval, widest at level with coxae IV.

Dorsum: Pale-brown, sparsely covered with long setae along the posterior margin; marginal groove but slightly indicated laterally only.

Scutum: L. 0.4 mm., W. 0.35 mm., dark-brown; broadly oval, lateral angles rather abrupt, posterior angle very broad; at the most about 4 setae over entire surface; cervical grooves very shallow anteriorly, becoming fused and fan-shape posteriorly, obsolete before reaching posterior margin; scapula very short, sharply divergent.

Venter: Like dorsum; ventral plates inconspicuous; genital grooves weakly indicated, not complete anteriorly, slightly divergent posteriorly; anal groove weak, complete around orifice, slightly divergent posteriorly; coxae as in female; spiracles circular, globlet cells distinct just within frame only, macula obsolete.

Capitulum: L. 0.3 mm., basi capitulum width but slightly greater than length; cornu small, sharp, projecting more laterally than posteriorly; digits of chelicerae not reaching corona; pedipalps as in female, somewhat stouter, 2 palpal setae on article II; ariculae prominent, rounded, projecting slightly laterally; hypostome dentition 3/3, with tendency toward irregular as in male, ventral ridge absent.

Legs: As in female, annulations being obsolete.

Measurements. Larva (Type Larva)

Body: L. 0.5 mm., W. 0.45 mm.
Capitulum: L. 0.2 mm.
Basi capitulum: L. 0.1 mm., W. 0.11 mm.

Larva: General Analysis: Body: L. 0.5 mm., W. 0.45 mm., unfed specimens nearly circular; a pale-brown to colorless.

Dorsum: As in nymph, marginal groove being obsolete, setae less numerous.

Scutum: As broad as long, lateral angles acute, posterior angle gradual, not as broad as in nymph; no visible punctuations or setae.

Venter: Ventral plates and grooves obsolete; setae not as numerous as in nymph.

Capitulum: L. 0.2 mm., basi capitulum almost cuboidal; digits of chelicerae reaching corona; cornu as in nymph; pedipalps short, thick, clubshape, the proximal articulation of article II being much narrower than the distal, article II but slightly

longer than article III, setae sparse, long, 2 palpal setae on article II; hypostome dentition 2/2, with tendency toward irregular as in nymph; auriculae prominent, sharper than in nymph.

Legs: As in nymph, tarsus I terminating sharper; coxae I-III as in female respectively.

Type Host: White-Footed Mouse (*Peromyscus maniculatus elusus*)

Type Locality: Santa Barbara Island, Los Angeles County, California

Collector: J. C. von Bloeker, Jr.

Holotype: Los Angeles Museum, No. 1939-585

Allotype: Los Angeles Museum, No. 1939-585

Type Nymph: Los Angeles Museum, No. 1939-585

Type Larva: Los Angeles Museum, No. 1939-585

Paratypes: 2 females (engorged, 1 in copula with male), 2 males in author's collection. The remaining 27 in the Los Angeles Museum.

Lots:

No. 1939-582 (of Los Angeles Museum) 5 females (engorged, 2 in copula with males), 2 nymphs, 1 male (separate). Collected May 28, 1939; 1 host observed.

No. 1939-583, 2 females (engorged, 1 in copula with male), 1 nymph, 1 male (separate). Collected May 30, 1939; 16 hosts observed.

No. 1939-585, 8 females (1 normal, 7 engorged, 2 in copula with male) 4 males (separate), 2 nymphs, 1 larva. Collected May 29, 1939; 11 hosts observed.

No. 1939-586, 1 female (engorged), 1 nymph. Collected May 30, 1939; 3 hosts observed.

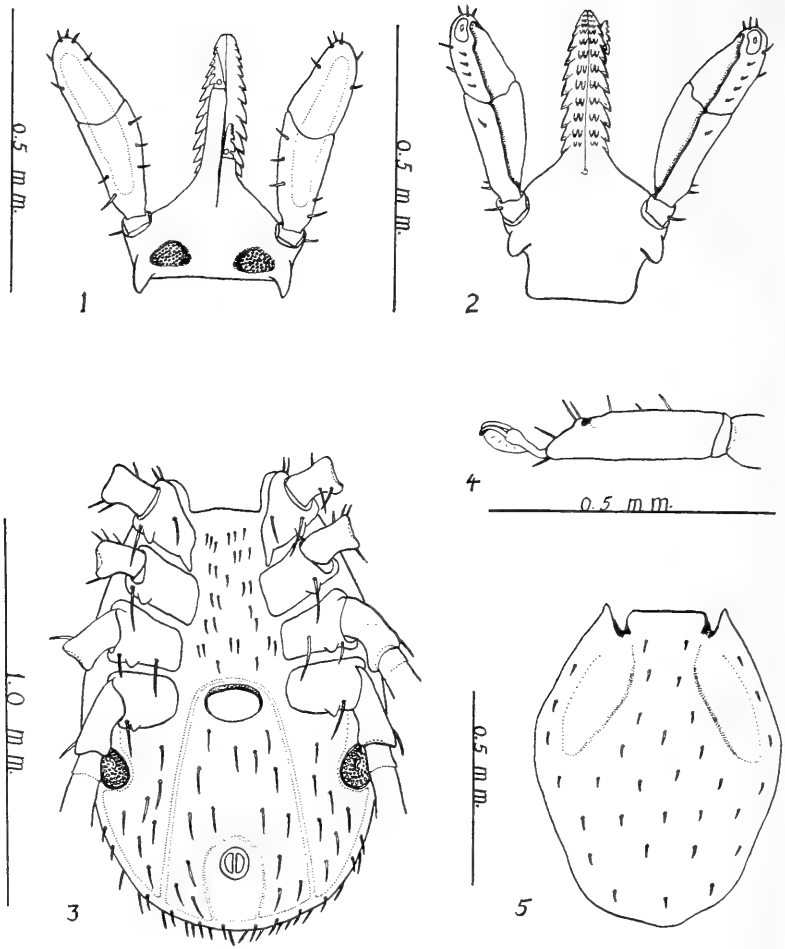

PLATE 30—*Ixodes peromysci*

Fig .1. Capitulum, female, dorsal.
Fig. 2. Capitulum, female, ventral.
Fig. 3. Venter, female.
Fig. 4. Tarsus I, female.
Fig. 5. Scutum, female.

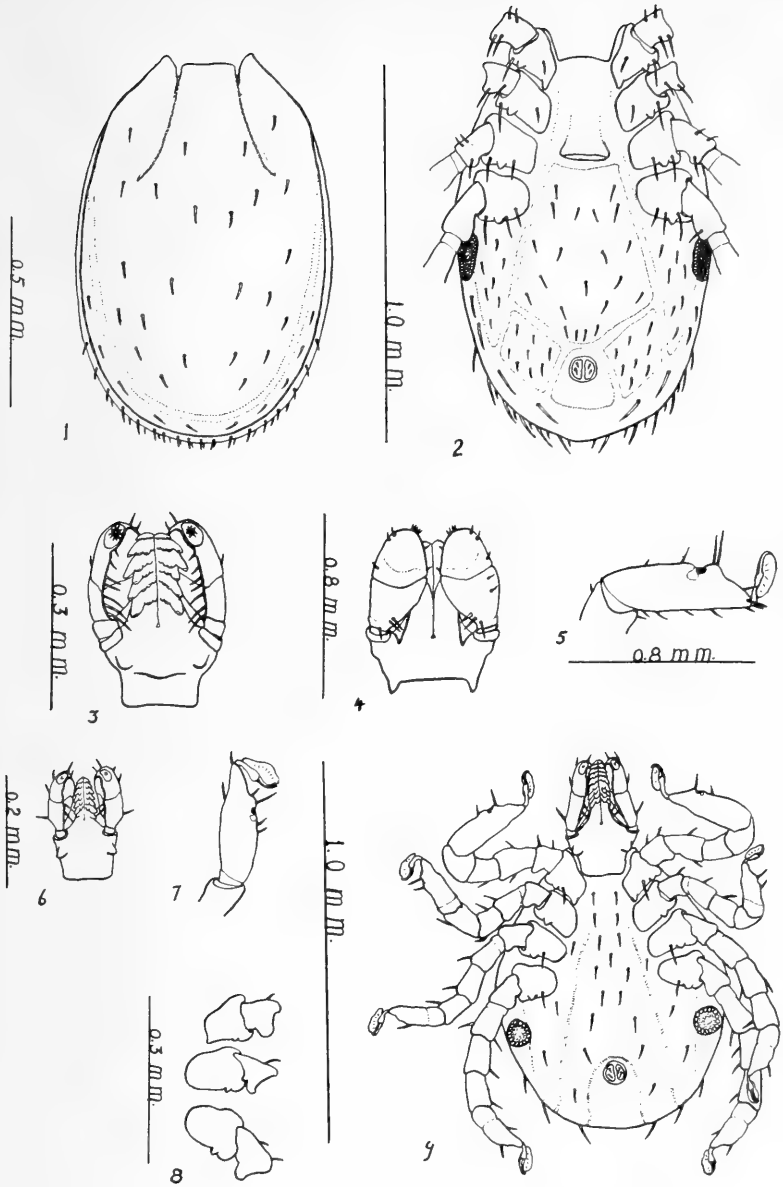

PLATE 31—*Ixodes peromysci*

Fig. 1. Dorsum, male.
Fig. 2. Venter, male.
Fig. 3. Capitulum, male, ventral.
Fig. 4. Capitulum, male, dorsal.
Fig. 5. Tarsus I, male.
Fig. 6. Capitulum, larva, ventral.
Fig. 7. Tarsus I, larva.
Fig. 8. Coxae, larva.
Fig. 9. Ventral view, nymph.

5. FIVE NEW MELOLONTHOID BEETLES

By Jack C. von Bloeker, Jr.

Among the entomological material collected on the fourth expedition of the Los Angeles Museum-Channel Islands Biological Survey there are specimens representing four previously unknown species of the scarabaeoid genus *Polyphylla,* descriptions of which appear below. In addition, opportunity is taken at this time to name a species from the upper Owens Valley region of California from a small series of specimens which has been acquired in recent years by the Los Angeles Museum.

Polyphylla ona, sp. nov.

Holotype male adult and *allotype* female adult (Los Angeles Museum, Ent. Coll.), collected at Prisoners' Harbor, Santa Cruz Island, Santa Barbara County, California, August 12, 1939, by J. C. von Bloeker, Jr.

Diagnosis: A large, moderately dark-colored species apparently intermediate between *Polyphylla crinita* and *P. arguta,* exhibiting a combination of characters of both species.

Description of holotype: Compared with *crinita,* larger and somewhat lighter in color, antennae much paler; sides of prothorax subangulate; hind thoracic margin with very short hairs; edges of vittae straighter and more clearly defined; anterior tibiae tridentate. Compared with *arguta,* larger and more robust; color lighter, femora ferruginous and not blackish; anterior margin of clypeus straight, not concave; lateral vittae of pronotum broken, not entire; pronotum with much, though not especially dense, short erect yellow pile, and broadly and deeply canaliculate; scutellum with small egg-shaped squamous spot; elytral vittae strong and well-defined, not ragged; tarsi stouter. Length 29.5 mm., breadth 13.0 mm.

Description of allotype: Similar to male, but larger and much more robust throughout; antennal club small, slightly longer than one-half rest of antenna; anterior tibiae tridentate as in male. Length 34.5 mm., breadth 16.0 mm.

Specimens examined: Three, the holotype, allotype and one paratopotype female, taken August 16, 1939, by Dr. J. A. Comstock.

Polyphylla santarosae, sp. nov.

Holotype: male adult (Los Angeles Museum, Ent. Coll.), collected at Becher's Bay, Santa Rosa Island, Santa Barbara County, California, August 7, 1939, by Lloyd M. Martin.

Diagnosis: A moderately large, dark brown, hirsute species showing certain relationships of structure with *Polyphylla sobrina* and *P. hirsuta,* and others with *P. crinita* and *P. santacruzae,* yet differing markedly from all known members of the genus.

Description of holotype: Clypeus, pronotum, pygidium and last abdominal segment dark reddish brown, head and first four abdominal segments black, elytra piceous but rufescent on lateral margins; head and pronotum densely hirsute with long, erect, yellow brown hairs; head entirely without squamae and interspaces between vittae of pronotum also entirely devoid of squamae; mid-lateral discal vittae of elytra broken posteriorly and each ending in a distinct white spot; pygidium indistinctly squamose on anterior border and in faint median line, otherwise densely hirsute with extremely short pile; anterior femora densely hirsute with long erect pile; middle and posterior femora with less dense and shorter pile; abdomen with dense covering of short hairs except on posterior margins of all, save the ultimate, segments which are narrowly banded with white squamae; antennal club equals two and one-half times length of rest of antenna; anterior tibiae bidentate. Length 30.0 mm., breadth 14.5 mm.

Specimens examined: One, the holotype.

Polyphylla santacruzae, sp. nov.

Holotype male adult and *allotype* female adult (Los Angeles Museum, Ent. Coll.), collected at Prisoners' Harbor, Santa Cruz Island, Santa Barbara County, California, August 11 and 13, 1939, respectively, by J. C. von Bloeker, Jr.

Diagnosis: A small to moderately large, dark-colored species nearest the *Polyphylla crinita* group, but apparently representing a separable group together with the species named below; female smaller than the male.

Description of holotype: Similar to *P. crinita,* but larger and more robust throughout, general coloration darker, vittae broader and more sharply defined, squamation between vittae somewhat more dense, becoming heavily imbricated in median areas of interspaces; frontal and pronotal vestiture longer and denser; ventral squamation very dense and ventral vestiture of thorax longer and paler. Approaching *P. decemlineata pacifica*

in size, but darker, vittae narrower, and with sparse pronotal and dense frontal vestiture; antennae smaller; tibiae and tarsi longer and relatively more robust. Anterior tibiae bidentate. Length 32.0 mm., breadth 14.0 mm. Range of 58 males: Length 28.0-34.0 mm., breadth 12.0-15.0 mm.

Description of allotype: Similar to male, but smaller and with relatively more robust appendages; antennal club equals less than one-half length of remainder of antenna; anterior tibiae tridentate. Length 26.0 mm., breadth 13.0 mm. Range of 3 females: Length 25.0-26.0 mm., breadth 11.0-13.0 mm.

Specimens examined: Sixty-one, including the holotype, allotype, 57 paratopotype males and 2 paratopotype females, collected August 11-18, 1939, by J. A. Comstock, L. M. Martin, D. Meadows, G. P. Kanakoff, J. E. Lewis and J. C. von Bloeker, Jr.

Polyphylla martini, sp. nov.

Holotype: male adult (Los Angeles Museum, Ent. Coll.), collected at Becher's Bay, Santa Rosa Island, Santa Barbara County, California, August 8, 1939, by Lloyd M. Martin.

Diagnosis: A large and moderately light-colored species of the *Polyphylla santacruzae* group, with distinctive Y-shaped elytral marking.

Description of holotype: Similar to *P. santacruzae,* but differing as follows: Antennal club shorter; head and pronotum longer in relation to width; pronotal vestiture much more sparse; elytral vittae broader and interspaces narrower, the usually short discal vittae of elytra extending posteriorly from humeral umbones connect with middle discal vittae in anterior third of elytra to form a peculiar, Y-shaped marking—a unique feature in this genus. Anterior tibiae bidentate as in *P. santacruzae.* Length 33.0 mm., breadth 13.5 mm.

Specimens examined: One, the holotype.

Polyphylla comstockiana, sp. nov.

Holotype: male adult (Los Angeles Museum, Ent. Coll.), collected at Milford (near Honey Lake), Lassen County, California, July 16, 1937, by Dr. John A. Comstock.

Allotype: female adult (Los Angeles Museum, Ent. Coll.), collected at Lundy Creek (near Mono Lake), Mono County, California, August 1, 1933, by M. L. Walton.

Diagnosis: A medium-sized, pale-colored, densely squamose species of the *Polyphylla decemlineata* group, female slightly larger than the male.

Description of holotype: Medium-sized and moderately robust; dorsally, dark reddish brown; ventrally, head, thorax, last abdominal segment and legs rufous, rest of abdomen black; entire upper surface and ventral surface of abdomen densely clothed with appressed (often overlapping) white scales; mid-front with two nearly parallel, longitudinal lines of long yellowish white pile, head with indistinct median and broadly distinct lateral (supraorbital) vittae; pronotum with distinct narrow median and broad lateral vittae; scutellum densely clothed with white squamae, but with a subglabrous v-shaped posterior margin, elytra each with one sutural and three discal well-defined vittae and a short, distinct vitta extending posteriorly from the humeral umbone for one-fourth the elytral length; squamae of the vittae heavily imbricated, producing moderately broad and quite distinct white stripes; pygidium uniformly densely clothed with white squamae and with a narrow, subglabrous median longitudinal line; pile of prosternum short and moderately dense, pile of meso- and metasternum long and very dense, pale yellowish brown; squamae of ventral surface of abdomen very dense and heavily imbricated, particularly so toward the posterior margins of all, save the ultimate, segments. Entire dorsal surface, and ventral surface of abdomen finely, though shallowly, punctate; femora and tibiae coarsely, elongately punctate. Anterior margin of clypeus straight and very narrowly reflexed, sides of clypeus straight and parallel; frontal margin nearly straight, with outer angles slightly rounded; antennal club large (smaller than in *P. decemlineata,* however), twice length of basal portion of antenna; anterior margin of pronotum evenly and slightly bisinuate, basal margin with broad, shallow median lobe, sides obtusely subangulate; scutellum subtriangulate; sutural length of elytra three and one-half times that of median length of pronotum, outer margins of elytra parallel for anterior three-fifths of their length, becoming gradually and increasingly rounded posteriorly. Anterior tibiae bidentate. Length 25.5 mm., breadth 11.5 mm.

Description of allotype: Similar to male, but differing in the following points: Slightly longer and more robust; dorsal ground color somewhat lighter, legs darker; squamae of interspaces of vittae yellowish rather than white; anterior margin of clypeus slightly rounded and more reflexed; front without median vitta, frontal pile shorter; elytra more rounded in postero-lateral portion; antennal club small, equal to one-third the total length of antenna; anterior and posterior tibiae more robust. Anterior tibiae tridentate. Length 27.0 mm., breadth 13.5 mm.

Specimens examined: The holotype and two paratopotype males collected at Milford, Lassen County, California, July 16,

1937, by Dr. John A. Comstock; and the allotype and three paratype males collected at Lundy Creek, Mono County, California, August 1-2, 1933, and one additional paratype male from the latter locality, July 22, 1935, by M. L. Walton.

Remarks: This pale, densely scaled species with very distinct vittae should be readily identified. In either Casey's Key (1914) or Fall's Key (1928) of the North American *Polyphylla, comstockiana* will key out with *10-lineata* (Say). From *10-lineata* it differs in paler ground color, greater density of squamation, the presence of a median frontal vitta and median subglabrous pygidial line, less reflexed clypeus (male) and convex (rather than concave) clypeus (female); and smaller antennae.

6. ANNOTATED LIST OF THE SCARAB BEETLES OF THE CHANNEL ISLANDS

By Jack C. von Bloeker, Jr.

The most recent paper on the coleopterological fauna of the Channel Islands known to me is that of H. C. Fall (Canad. Ent., vol. 29, pp. 233-244, October, 1897), in which 225 species and varieties are recorded. Only four species of scarabaeoid beetles are included in this list (p. 238) and one of these, *Coenonycha socialis* Horn, is known only from a Lower California island, Guadalupe. To Fall's list may be added *Phobetus testaceus* LeConte (Proc. Acad. Nat. Sci. Phila., 1861, p. 346) and *Coenonycha clementina* Casey (Canad. Ent., 1909, p. 281; erroneously recorded in the Leng List, 1920, p. 258, as from "L. Cal. Is.") and thus the known number of species on record from the Channel Islands proper (thereby eliminating the Guadalupe Island endemic) prior to 1939, was five. As a result of investigations and collections made on the first six expeditions of the Los Angeles Museum-Channel Islands Biological Survey, the scarab list can now be increased to thirty-five.

Unless otherwise stated below, all specimens referred to are adults and all dates are in the year 1939.

Superfamily SCARABAEOIDEA

Family Scarabaeidae

Canthon simplex LeConte.

Pyramid Cove, San Clemente Island, Los Angeles County—four specimens taken from under rotting dead fish placed under a board for the purpose of attracting carion-feeding insects, April 8.

Family Aegialiidae

Aegialia crassa LeConte.

Horse Beach Cove, San Clemente Island—three specimens in loose sand beneath roots of *Abronia maritima,* November 18.

Family Aphodiidae

Aphodius granarius LeConte.

Vail Ranch, Becher's Bay, Santa Rosa Island, Santa Barbara County—one adult found under dessicated cow dung, August.

Aphodius vittatus Say.

Ranch Landing, San Nicolas Island, Ventura County (July), and Vail Ranch, Becher's Bay, Santa Rosa Island (August)—adults, pupae and larvae abundant in and under cow dung.

Aphodius lividus (Olivier).

Pyramid Cove (April) and Horse Beach Cove (November), San Clemente Island; Ranch Landing, Santa Rosa Island (July); Rancho Rambouillet (July) and Cuyler's Harbor (August), San Miguel Island, Santa Barbara County; Becher's Bay, Santa Rosa Island (August); Prisoners' Harbor and Ranch Canyon, Santa Cruz Island, Santa Barbara County (August)—adults common in deposits of sheep dung and abundant in early evening at lights.

Aphodius rugatus Schmidt.

Ranch Landing, San Nicolas Island (July) and Becher's Bay, Santa Rosa Island (August)—common in cow dung.

Aphodius militaris LeConte.

Ranch Landing, San Nicolas Island—one adult under semi-dessicated cow dung, July.

Family Geotrupidae

Bolboceras serratus LeConte.

Pyramid Cove, San Clemente Island—two adult specimens, April.

Family Trogidae

Trox gemmulatus Horn.

Pyramid Cove, San Clemente Island—six specimens under deposit of dessicated fox dung, April.

Trox atrox LeConte.

Chinetti Canyon, San Clemente Island—two adults under bleaching bones of dead goat, April.

Family Melolonthidae

Serica mixta LeConte.

Pyramid Cove and Chinetti Canyon, San Clemente Island (April); Ranch Landing, San Nicolas Island (July); Cuyler's Harbor, San Miguel Island (July-August); Becher's Bay, Santa Rosa Island (August); Prisoners' Harbor and Ranch Canyon, Santa Cruz Island (August)—adults common at light.

Serica alternata LeConte.

Pyramid Cove, San Clemente Island (April); Santa Barbara Island, Los Angeles County (May); Ranch Landing, San Nicolas Island (July)—occasional at lights.

Diplotaxis subangulata LeConte.

Pyramid Cove, San Clemente Island (three, April); Becher's Bay, Santa Rosa Island (two, August); Prisoners' Harbor, Santa Cruz Island (one, August)—all taken at lights.

Diplotaxis fimbriata Fall.

Pyramid Cove, San Clemente Island (one, April) and Prisoners' Harbor, Santa Cruz Island (two, August)—at lights.

Listrochelus mucoreus LeConte.

Chinetti Canyon, San Clemente Island—one adult at light, April.

Polyphylla ona von Bloeker.

Prisoners' Harbor, Santa Cruz Island—three adults taken at light in Santa Cruz and Monterey pine association, August.

Polyphylla santarosae von Bloeker.

Becher's Bay, Santa Rosa Island—one adult taken at light in willow-cypress association, August.

Polyphylla santacruzae von Bloeker.

Prisoners' Harbor, Santa Cruz Island—common at lights in pine and gum-tree associations; one larva taken beneath roots of *Eucalyptus,* August.

Polyphylla martini von Bloeker.

Becher's Bay, Santa Rosa Island—one adult at light in gum-tree association, August.

Polyphylla sp.

Cuyler's Harbor, San Miguel Island—one dead adult female found on sand dune under *Abronia alba,* July; Prisoners' Harbor, Santa Cruz Island—three damaged adult males taken with the aid of a shot-gun while they were flying high (out of reach of a net) around the outer branches of pines in early evening. Unfortunately this species would not come to lights, hence perfect specimens were not obtainable and, in view of this, I refrain from placing a name on them at this time.

Thyce blaisdelli Casey.

Pyramid Cove, San Clemente Island (two, April); Santa Barbara Island (3 dead and badly damaged adults, May); Ranch Landing, San Nicolas Island (two, July)—occasional at lights.

Phobetus comatus LeConte.

Horse Beach Cove, San Clemente Island, three dead adults and three living larvae from loose sand beneath rag-weed (*Franseria bipinnatifida*), November; Santa Barbara Island, two dead adults beneath ice-plant (*Mesembryanthemum crystallinum*), May; Avalon, Santa Catalina Island (recorded by Fall, *loc. cit.,* 1897); East end, San Nicolas Island, two dead adults, July.

Phobetus testaceus LeConte.

Described from a unique male adult from Santa Cruz Island; recorded from Santa Rosa and Santa Cruz Islands (under *Phobetus comatus*) by Fall (*supra cit.,* 1897).

Dichelonyx crotchi Horn.

Prisoners' Harbor, Santa Cruz Island—eight adults, August.

Dichelonyx pusilla LeConte.

Cuyler's Harbor, San Miguel Island, 2 adults; Becher's Bay, Santa Rosa Island, 2 adults; Prisoners' Harbor, Santa Cruz Island, 3 adults—all taken at lights in August.

Coenonycha rotundata LeConte.

Recorded from Santa Catalina Island by Fall (*supra cit.,* 1897).

Coenonycha clementina Casey.

Described from five male and two female adults from "Island of San Clemente." Dates of capture not recorded.

Family Dynastidae

Ochrosidia villosa (Burmeister).

Pyramid Cove, San Clemente Island (April) and recorded from Santa Catalina Island by Fall (*supra cit.,* 1897)—adults at lights.

Ochrosidia pasadenae Casey.

Cuyler's Harbor, San Miguel Island; Becher's Bay, Santa Rosa Island; Prisoners' Harbor, Santa Cruz Island—adults fairly common at lights in August.

Ochrosidia obesula Casey.

Pyramid Cove, San Clemente Island (April); Ranch Landing, San Nicolas Island (July)—occasional at lights.

Ochrosidia longula (LeConte).

Becher's Bay, Santa Rosa Island and Prisoners' Harbor, Santa Cruz Island—fairly common at lights in August.

Dichromina dimidiata (Burmeister).

Cuyler's Harbor, San Miguel Island; West side, Santa Rosa Island; Prisoners' Harbor and Ranch Canyon, Santa Cruz Island —fairly common in flowers of *Datura metalloides,* August.

Ligyrus californicus Casey.

Pyramid Cove and Chinetti Canyon (April), and Horse Beach Cove (November), San Clemente Island; Ranch Landing, San Nicolas Island (July); Cuyler's Harbor, San Miguel Island (July-August); Becher's Bay and Skunk Point, Santa Rosa Island (August)—common in loose sand under *Abronia maritima, A. alba, Franseria bipinnatifida, Astragalus nevinii* and *A. miguelensis,* and occasional at lights.

Ligyrus scitulus Casey.

Pyramid Cove, San Clemente Island (April); Ranch Landing, San Nicolas Island (July); Cuyler's Harbor, San Miguel Island (August)—occasional at lights, much less common than the preceding species.

Family Cetoniidae

Cremastocheilus schaumi LeConte.

Near Avalon, Santa Catalina Island—one adult collected at edge of ant-hill by L. E. Myers, July 10, 1938.

TWO NEW CALIFORNIA PLUME MOTHS

(*LEPIDOPTERA—PTEROPHORIDÆ*)

By W. Harry Lange, Jr.
University of California

The author would like to express his sincere thanks and appreciation to Messrs. August Busck, T. Bainbrigge Fletcher, H. H. Keifer, and Drs. J. F. Gates Clarke and J. McDunnough who have coöperated in many ways to make this contribution possible.

A description of two apparently new pterophorids is presented, with notes on their life histories. One species is of particular interest in California, because of its economic importance.

Platyptilia antirrhina Lange, New Species

A small, grayish-brown species with an expanse of from 15-19 mm. The larvae feed on the cultivated snapdragon, *Antirrhinum* species.

Holotype, male: Alar expanse 18 mm. Palpi exceeding vertex; color dark brown with white markings; slightly ascending; first segment basally with continuous row of white scales and a white patch above at junction with second segment; second segment brown with white scales below and above; third segment with white scaling at apex. Head dark brown; frontal tuft little produced, truncate in front. Antennae dark brown, basally with banded effect due to white scales; slightly ciliate, with serrate effect caused by projecting scales; apex with few lighter scales. Thorax concolorous with head; patagiæ with grayish cast. Forewings dull, dark gray-brown with reddish and black markings; triangle present above base of cleft, black, indefinite; ground color of first lobe reddish-brown, with two triangular black dashes, one on costa, the other below the center followed by the usual subterminal transverse white line; area beyond transverse line to termen reddish-brown with some grayish-white scales; apex produced with termen sloping inwardly; costal margin slightly darker than the basal two-thirds of wing; cilia of termen of first lobe mostly grayish-white, darker at base; forewing cleft two-thirds from base; cilia of cleft grayish-white, with dark tuft just inside anal angle; second lobe with grayish indefinite line immediately below cleft, extending into first lobe; subterminal white line reduced to two white patches of scales, rest of lobe a dark reddish-brown; cilia grayish-white with dark bases, separated in two places by light scales; toward anal angle

cilia verge on fuscous with bases still darker; inner margin with grayish-white to fuscous cilia with several tufts of isolated fuscous spatulate scales. Hindwings fuscous with fuscous cilia; cilia with dark bases on outer margin of first lobe; first lobe slightly inflated, second terminating in a blunt point; third lobe with a well marked scale tuft near apex, triangular in appearance as the outer scales are shorter; inner margin lined with scattered spatulate fuscous scales to base of lobe. Abdomen lighter in front, rest fuscous; vestiture slightly rough, with few lighter scales on each side of dorsum. Forelegs with femora dark brown with a light stripe on each side; tibiae with a dark brown stripe which extends along the tarsal segments, a lateral darker stripe and a tuft of hairs distally; tarsal segments light brown laterally, darker line above. Middlelegs as forelegs except for two tibial spurs. Hindlegs long, femora and tibiae dark brown; two pairs of tibial spurs, one three-fifths from base, a second, at end of tibiae; first pair of spurs longer than second; tarsal segments with dark bands, last three segments lighter.

Allotype, female, as male except slightly lighter and larger.

Male genitalia figured.[1] Harpes (valves) with a cucullus (hook) at apex. Uncus long and slender, but much stouter than *crenulata* B. & McD. Aedeagus well developed, projecting through two partition-like structures. Female genitalia figured. Genital opening situated in a chitinous tube, projecting a short distance beyond the sternite of abdominal segment VII. Signum of bursa found as two well developed spines, basally serrate. (See figure.)

Holotype, male, reared from an egg hatching on November 11, 1938, from adults reared from snapdragon, *Antirrhinum* species, collected a Kelseyville, Lake County, California, the adult emerging April 27, 1939. The duration of the different stages of the holotype is as follows: November 11, 1938, egg hatched; December 1, second instar; December 11, third instar; March 1, 1939, fourth instar; pre-pupal, March 24; pupated March 29; adult emerged April 27, 1939. This rearing took place at outside Half Moon Bay temperatures.

Allotype, female, with same data as the holotype, collected as larva on June 6, 1939, the adult emerging July 14, 1939.

Thirty paratypes, seventeen males and thirteen females, all from snapdragon at Kelseyville during 1938-39.

Two paratypes, male and female, collected as pupa and larva on snapdragon at San Leandro, California, on July 7, 1939, adults emerging July 22 and 28 respectively.

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[1] The male and female genitalia figured are drawn to the same scale and can be superimposed on each other to obtain relative sizes.

Twelve paratypes, five males and seven females, collected at light at Petaluma, California, by Mr. William Bauer with data as follows: October 23, 1937, one male; October 24, 1937, one male, one female; October 25, 1937, two males, one female; October 26, 1937, four females; April 3, 1938, one female; November 1938, one male.

P. *antirrhina* is related to *taprobanes* Felder (*brachymorpha* Meyr., P. *crenulata* B. & McD.). It has been known in California for a number of years as the Snapdragon Plume Moth under a number of names, including *taprobanes* Felder, *marmarodactyla* Dyar, and *acanthodactyla* Hbn. It can be distinguished from the *taprobanes* group by its larger size, darker color, male and female genitalia and certain differences in the characters of the larvae. The male genitalia of *antirrhina* is considerably larger than *crenulata* B. & McD. from Florida or *taprobanes* Felder from India. (See figures.) The aedeagus in *crenulata* is more slender than in *antirrhina*. In the female genitalia the genital tube surrounding the ostium in *crenulata* is larger than *antirrhina* and in the latter it projects out slightly from the inwardly curved margin of abdominal segment VII. The spines of the signum in *crenulata* have a few small teeth apically, in *antirrhina* the teeth are larger and placed basally.

The synonomy of *taprobanes* Felder in Fletcher's "Life Histories of Indian Microlepidoptera"[2] may not be generally available and for convenience is presented here.

Platyptilia taprobanes Felder

Amblyptilia taprobanes Felder

Platyptilia brachymorpha Meyr.

Amblyptilia seeboldi Hofmann

Platyptilia crenulata B. & McD.

Platyptilia acanthodactyla var. *phoenicodactyla Chrétien*[3]

Platyptilia terlizzii Turati[4]

I am not able because of lack of material to cast judgment upon the distinctness of *crenulata* B. & McD. and *taprobanes* Felder, but the male genital characters of a specimen of the latter species from Pusa, India, kindly sent me by Mr. Fletcher does not agree with *crenulata* from Florida. Superficially the two agree very closely. The U. S. National Museum has kindly loaned me three cotypes of *crenulata* through Mr. Busck from which the present study of *crenulata* has been made.

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[2] T. B. Fletcher. Gov. of India Sci. Mon. No. 2, Calcutta, p. 5, 1932.

[3] T. B. Fletcher considers this probably distinct.

Turati considers this distinct, according to Fletcher.

The immature stages of *taprobanes* Felder as given by Mr. Fletcher in his Indian life histories in the reference already cited agrees with *antirrhina* in many respects, but *antirrhina* entirely lacks the conspicuous secondary setae described by Mr. Fletcher as "abdominal segments distinct, covered with very minute scattered black spinous hairs". The pupa of *taprobanes* is more attenuated than *antirrhina,* judging from Fletcher's figure.

It remains for students of this group to carefully record details in the life histories and immature stages of this group which apparently are feeders on members of the Scrophulariaceae.

A species which may be confused with *antirrhina* is P. *"acanthodactyla"* Hbn., inasmuch as it is found on snapdragon. The adults of "acanthodactyla" have the scale tuft of the secondaries just beyond the center of the lobe instead of at the end. The larvae show a purple and green form as in *antirrhina,* but differ in structure and are larger when mature. The dorsal blade-like processes of the pupa of *"acanthodactyla"* readily separate the two. This California species known as "acanthodactyla" Hbn. selects *Mimulus, Scrophularia, Stachys, Pentstemon* and related plants and does not agree in all details with European material, but for the present can be placed under this name.

The sage worm, P. *marmarodactyla* Dyar[5] has been reared by the author from several *Salvia* species in California and reared specimens could be separated on the basis of the host preference. The pupa of *marmarodactyla* Dyar has dorsal blade-like processes which places it in the group with *acanthodactyla* and *punctidactyla.*

The life history of P. *antirrhina* as far as it is known is presented at this time.

EGG: Ovate to elliptical; glossy. Color yellowish. Usually laid on horizontal axis, but can also be laid on end. Length 0.39-0.44 mm., width 0.24-0.26 mm. Surface of egg distinctly reticulated.

The eggs are laid on the underside of the leaves, on the stems or on the flowers or green seedpods. The egg period during November 1938 for Half Moon Bay outside temperatures was 20 days; for laboratory temperatures 12-15 days.

The eggs of plume moths show specific differences for use in their separation, and although a reticulation of the egg is found in other plume moths, its presence in this species can be used to separate it from the related species. *"Acanthodactyla"* has an egg showing a slight reticulation under high powers of the microscope, but in *antirrhina* the reticulated surface is visible even with the naked eye.

[5] Synonymous with P. *fuscicornis* Zeller, according to Meyrick. (See Ent. News, Vol. 33, pp. 311, 1922.

PLATE 32

Egg of *Platyptilia antirrhina*, new species, enlarged x 45.

Larval Instars: Four larval instars are found. The first two and sometimes the third are spent in a leaf mining existence in the snapdragon leaves. Larger larvae bore inside the stems, feed on the flowers, or bore inside the green seed-pods.

First Instar.[6] Length 0.97 mm.; width at thorax 0.18 mm. Greatest width at anterior end. Color pale yellowish-green. Head reddish-brown. Cervical shield and anal plate light brown. Tubercles conspicuous, brown. Legs all concolorous with body.

Second Instar: Length 1.76 mm. (extended); width 0.22 mm. Color pale green, later turning darker. Head, cervical shield and anal plate dark brown. Setae and tubercles as in first instar.

Third Instar: Length 3.08 mm; width at thorax 0.53 mm. Color pale green. Cervical shield and anal plate brown. Setae long, white, slightly clubbed apically. Dorsal vessel shows through as a darker longitudinal line. Setigerous tubercles brown, conical. Legs and underside of body green. Spiracles dark ringed, raised.

Fourth Instar: Length 9-10 mm.; width at first abdominal segment 1.58 mm. Color green or purplish-red (two forms). Body tapering anteriorly and posteriorly from abdominal segments 2-3. Primary setae whitish, arising from black tubercles, slightly swollen apically. Dorsal vessel shows as in third instar and paired testes show in males as lighter areas. Two subdorsal whitish lines, somewhat interrupted. A substigmatal whitish line. Head green with dark ocelli. Spiracles black-ringed, raised. All legs concolorous with body in green form. The setal formula is figured. Verrucae present. A trisetose prespiracular setal group (Kappa group) on prothorax, (in some specimens only bisetose). In some specimens an additional set between Ia and

[6] Measurements from living specimens and are given as being only approximate.

IIa. Setae IV-V and VII form verrucae on certain segments. Mandibles with 4 well developed teeth. Crochets of stalk-like prolegs in a uniordinal semi-circle, 9-10 in number.

PUPA: Length 8-10 mm. Angulate. Greatest width at anterior end, 1.63 mm. Background color varies considerably, from brownish to pinkish-white. A variable amount of fuscous suffusion occurs in different individuals. Prothorax with two converging ridges extending noticeably to abdominal segment 3. Abdominal segments 1-7 with a pair of small, anteriorly projecting spine-like processes placed on each side of the dorsum. Usually with two darker blotches on each side of abdominal segments 1-3, with variable dark markings on the wing cases, appendages and thorax. A subdorsal dark line on abdomen and a similar substigmatal line. Cremasteric and dorsally grooved, with two areas of attachment, set with many hooked setae. Front produced as a truncate ridge downwardly. Pilifers present as side lobes below the labrum. Mesothoracic legs extend to sixth abdominal segment. Metathoracic legs, present, but reduced.

The pupa is naked, suspended by the cremasteric end from the underside of the leaves, seed pods, stems or leaf petioles.

There are apparently two broods in northern California, with a possibility of a third in the more southern localities. The broods overlap considerably so that on the older plants many or all stages can be found. In the laboratory at Half Moon Bay a complete life history from egg to adult took 83-94 days during the period November 1938 to February 1939, while the period at outside temperatures was 166-184 days.

Adults in resting hold the wings outstretched and slightly tilted forwards, and have a peculiar habit of "flitting" the wings up and down. They are not strong fliers and rest during the day on the plants from which they can be "flushed".

This species is apparently widely distributed in California as in addition to the type localities it has been reported on snapdragon at Berkeley, Hayward, Lakeport, and Los Angeles. It often does serious damage to snapdragon seedlings in nurseries where no control measures are practiced, and on the older plants destroys the green seeds.

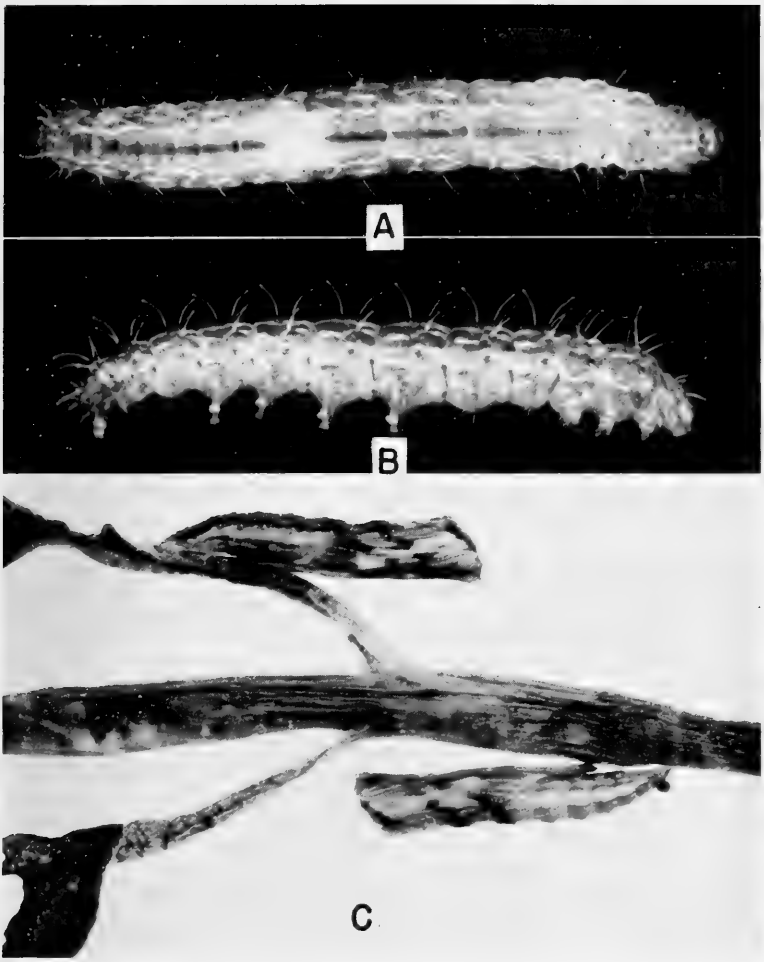


PLATE 33

A-B. Dorsal and lateral aspects of mature larva of *Platyptilia antirrhina*, enlarged approximately x 10.

C. Pupae of P. *antirrhina* on snapdragon, enlarged approximately x 5.

TRICHOPTILUS POTENTELLUS Lange, New Species

A very small dark brown species with white markings; expanse 7-8.5 mm. The larvae feed externally on *Potentilla californica.*

Holotype, male: Alar expanse 8.5 mm. Palpi long, slender, brown and white, slightly exceeding vertex; first segment with whitish scaling basally; second segment brown with white scaling, a tuft projecting under third segment; third segment brown with a white tip above. Head brown with a few white scales, a tuft of brown and white scales projecting over the head to base of antennae. Eyes large. Antennae brown and white banded; scape white striped below. Thorax concolorous with head; patagiae tipped with white scaling. Forewings uniform dark brown with white fasciae and markings; cleft before center into two slender lobes; first lobe with two white fasciae, one less than half-way distant from base, the other, reduced, beyond center; cilia dark brown except for two white patches at apex and three white areas along posterior margin; base of cleft with a longitudinal white line extending a short distance along the posterior margin; second lobe with two white fasciae as in first lobe; ciliae dark brown with white tuft at apex and white scaling at fasciae; a white scaling below cleft on inner margin and another about halfway to base of wing; costal margin with scattered white scales to beyond cleft; cilia show an occasional dark scale at base; undersurface showing fasciae as on uppersurface. Hindwings with the lobes very slender; concolorous with forewings; cilia long with white tuft on apex of first lobe, rest brown; third lobe with few white scales, but no scale tuft along posterior margin. Abdomen dark brown with partial transverse bands of white; basally with white scaling which runs laterally approaching the center in three areas, one near base, again near the center, and a third band near the posterior end; ventrally with white scaling at the intersegmental areas. Legs chiefly white from above with brown bands; forelegs with femora and tibiae brown, longitudinally white striped; tibiae distally enlarged ending in a tuft overlapping tarsal segments; tarsi whitish with brown at the joints; middlelegs with longitudinal white striping; tibia with a tuft just beyond center composed of brown scales, some tipped with white; a long spine from mid-tuft reaching end of tibia; tibia enlarged distally, with a tuft of brown scales and two spines which reach the end of the first tarsal segment; tarsal segments white above, with brown at joints, beneath brown predominating.

Male genitalia figured. Harpes (valves) small, simple, with a basal roughened area corresponding to a sacculus. Aedeagus evidently moves upwardly describing an arc, attached at the center to a ventral process. Uncus absent. Female genitalia figured. Ostium opening through a well developed chitinous genital tube, which projects out a considerable distance from the abdomen. An examination of T. *californicus* Wlshm. shows a

similar chitinous tube, this feature therefore, should be a valuable one in taxonomic work in this group.

Allotype, female, as male; alar expanse 7 mm.

Holotype, male, reared from a larva collected March 8, 1939, at Half Moon Bay, California, on *Potentilla californica* (C. & J.) Greene, emerging on June 18, 1939.

Allotype, female, with the same data, emerging May 17, 1939.

Potentellus is apparently the smallest pterophorid of our fauna reported to date. It agrees with *parvulus* B. & L. in lacking scale tufts on the third feather of the secondaries. *Parvulus*, however, judging from the description of the unique female from Louisiana has prominent longitudinal stripes on the abdomen, is larger, and shows differences in markings and coloration. *Potentellus* has a partial transverse banding of the abdomen.

T. *pygmaeus* Wlshm., the other small species in the genus, is larger than *potentellus*, lighter in color, and in most specimens has scale tufts on the third feather of the secondaries. Dr. J. F. Gates Clarke has reared *pygmaeus* in British Columbia from *Arctostaphylos columbiana* Paper.

A description of the known early stages of *potentellus* is presented at this time.

Mature Larva: Length 3.4 mm. Color green. Slightly flattened, tapering anteriorly and posteriorly from center. Head black, noticeably elongated, subconical. Primary setae long, white, swollen apically. Secondary setae present on abdominal segments as short, white, apically enlarged spines.

PLATE 34

A. Holotype, male, of *Platyptilia antirrhina*, new species, enlarged x 2½.

B. Allotype, female, of P. *antirrhina*, enlarged x 2½.

C. Holotype, male, of *Trichoptilus potentellus*, new species, enlarged x 3.

Skin spinules present, seen under magnification, abundant at intersegmental areas. A trisetose prespiracular group (Kappa group) on the prothorax. True legs large, well developed, tarsal claws long. Prolegs stalk-like, first paid reduced in size; crochets of all except anal pair, 3-5 in number arranged in a uniordinal outer band; anal prolegs enlarged, with 6-7 crochets in a semicircle.

The larvae feed externally on the pubescent and somewhat glandular foliage. Several collections of foliage from the original locality have failed to reveal additional material.

Pupa: Length 3.52 mm.; greatest width at mesothorax 0.84 mm. Color greenish to dark brown. Mesothorax with a medial longitudinal ridge; laterally with two ridges which at the vertex are set with two tubercles, then running as ridges to the second abdominal segment. Front produced downwardly as a blunt projection; laterally above, with a nodular projection on each side so that front appears concave from above. Pilifers present as triangular lobes below labrum. Maxillae well developed. Mesothoracic legs extend to end of wing cases. Abdomen, thorax and head clothed with rather long, white, apically swollen setae. Subdorsal setal group arising from a raised tubercle consisting of an anterior and posterior projecting seta and on certain segments a medial, short, blunt spine. Abdominal segments from 3 posteriorly with an additional pair of subdorsal posteriorly projecting spines. Wing cases longitudinally striate; striations tuberculate. Antennae tuberculate. Spiracles conspicuously raised. Cremasteric end with two areas of attachment; set with numerous hooked setae.

Pupation occurs externally on the leaves, attached by the cremasteric end. The pupal period of the allotype was twenty-four days under laboratory conditions.

Types to be deposited in the collection of the California Academy of Sciences, with paratypes of *antirrhina* to be widely distributed as usual, and in addition to Dr. John A. Comstock for the Los Angeles Museum, Capt. W. P. Medlar for the San Diego Museum and Mr. William Bauer of Petaluma. Specimens of *antirrhina* have been sent prior to its description to Dr. J. McDunnough and Mr. T. B. Fletcher.

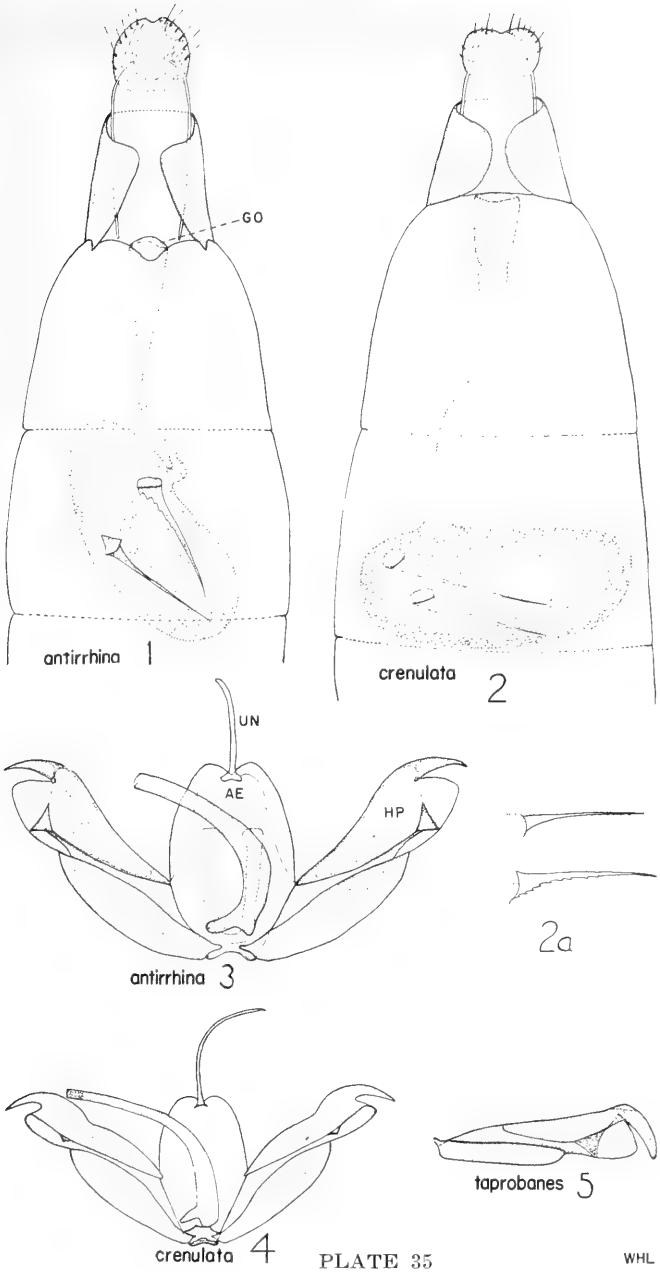


PLATE 35 WHL

Fig. 1. *Platyptilia antirrhina* Lange, female genitalia.
Fig. 2. *Platyptilia crenulata* B. & McD., female genitalia.
Fig. 2a. Above, spine of signum of P. *crenulata;* below, spine of P. *antirrhina.*
Fig. 3. *Platyptilia antirrhina* Lange, male genitalia.
Fig. 4. *Platyptilia crenulata* B. & McD., male genitalia.
Fig. 5. *Platyptilia taprobanes* Felder, right harpe.

ABBREVIATIONS USED

AE—Aedeagus. HP—Harpe (valve).
GO—Genital opening (ostium). UN—Uncus.

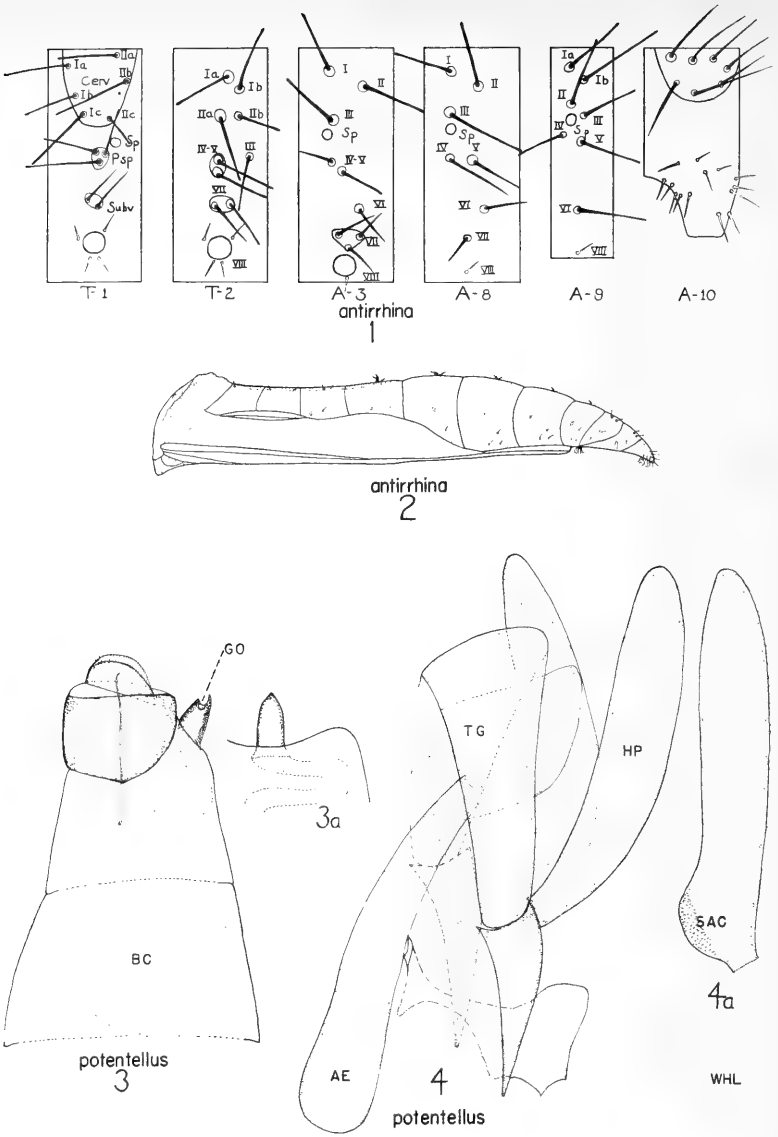


PLATE 36

Fig. 1. *Platyptilia antirrhina* Lange, setal formula of larva.
Fig. 2. P. *antirrhina*, pupa from lateral aspect.
Fig. 3. *Trichoptilus potentellus* Lange, female genitalia from lateral aspect.
Fig. 3a. Same, external genital tube from ventral aspect.
Fig. 4. T. *potentellus*, male genitalia from lateral aspect.
Fig. 4a. Same, harpe from inner aspect.

ABBREVIATIONS USED

AE—Aedeagus.
BC—Bursa copulatrix.
Cerv.—Cervical shield.
GO—Genital opening (ostium).
HP—Harpe (valve).
Psp—Prespiracular wart (verruca).
SAC—Sacculus of harpe.
Sp—Spiracle.
Subv—Subventral wart (verruca).
TG—Tegumen.

A REVIEW OF THE PHILEURINI OF AMERICA NORTH OF MEXICO

(*COLEOPTERA—SCARABAEIDAE*)

By Mont A. Cazier
University of California, Berkeley

This review is not written with the intent of entering into the controversy as to the correct names to be applied to our older species, but is presented as the result of a study of the Casey types. Previous to Casey's 1915 memoir dealing with the *Phileurini* there were three described species from America north of Mexico, two doubtfully recorded from this region and one from Lower California. In the genus *Phileurus*, Casey described as new one species from Mexico and five species and one subspecies from the United States. In *Archophileurus* he described as new two species from Mexico and one from the United States. The author after a careful examination of the types and the genitalia of the male types has concluded that all ten of these species described by Casey from both Mexico and the United States are synonyms. *Phileurus clathratus* Casey, described from Brazil, has the male genitalia quite similar to that of *P. castaneus* Hald. but sufficiently different as to probably represent another species or subspecies, the status of which will have to be determined by a worker with adequate material from this region.

In studying the older species the author was unable to locate the LeConte type of *P. vitulus* but from a study of additional Lower California material it has been found that this species is undoubtedly synonymous with *illatus* Lec. The lectotype (No. 3333 M. C. Z.) of *illatus* also bears the LeConte label of *vitulus*. Concerning the two species doubtfully recorded from the United States, Arrow[1] does not include *P. valgus* (Linn.) in the genus and considers *P. castaneus* Hald. [P. valgus Ol. (nec. Linn.)] as occurring in this country. The arrangement and synonomy given by Arrow is in some question but a discussion of this is beyond the scope of this paper.

The species and synonymy within the tribe should appear in our lists as given below. The Mexican species described by Casey are included as they are synonymous with our United States species.

The writer would like to express his thanks and appreciation to Dr. E. A. Chapin of the United States National Museum for the privilege of studying and dissecting the Casey types and for

[1] Arrow, G. J., 1937, Coleop. Catag. 21:89, par. 156.

his constructive suggestions. Thanks are also due C. W. Leng whose material largely forms the basis of this study and to Thomas G. Aitken for going over the manuscript.

Phileurus truncatus (Beauv.)

Scarabaeus truncatus Beauv., 1807, Ins. Afr. et Amer., p. 41

Phileurus recurvatus Csy., 1915, Memoirs on the Coleop., 6:266 (New Synonym)

Phileurus illatus Lec.

Phileurus illatus Lec., 1854, Proc. Acad. N. S. Phila., 7:80

Phileurus vitulus Lec., 1866, Smiths. Misc. Coll., 6:80 (New Synonym)

Phileurus phoenicis Csy., 1915, Memoirs on the Coleop., 6:267. Type female (New Synonym)

Phileurus puncticollis Csy., 1915, Memoirs on the Coleop., 6:268. Type female (New Synonym)

Phileurus castaneus Hald.

Phileurus castaneus Hald., 1843, Proc. Acad. N. S. Phila., 1:304

Phileurus texensis Csy., 1915, Memoirs on the Coleop., 6:268. Type male (New Synonym)

Phileurus sulcifer Csy., 1915, Memoirs on the Coleop., 6:269. Type male (New Synonym)

Phileurus floridanus Csy., 1915, Memoirs on the Coleop., 6:270. Type male (New Synonym)

Phileurus sulcifer carolinae Csy., 1915, Memoirs on the Coleop., 6:269. Type female (New Synonym)

Archophileurus cribrosus (Lec.)

Phileurus cribrosus Lec., 1854, Proc. Acad. N. S. Phila., 7:80

Archophileurus bullatus Csy., 1915, Memoirs on the Coleop., 6:274. Type male (New Synonym)

Archophileurus longulus Csy., 1915, Memoirs on the Coleop., 6:273. Type female (New Synonym)

Archophileurus brevis Csy., 1915, Memoirs on the Coleop., 6:272. Type female (New Synonym)

KEY TO THE GENERA AND SPECIES OF PHILEURINI IN THE UNITED STATES

1. Head with a transverse ridge at base of clypeus, median portion of head not depressed and sides without tubercles. ..... *Archophileurus cribrosus*

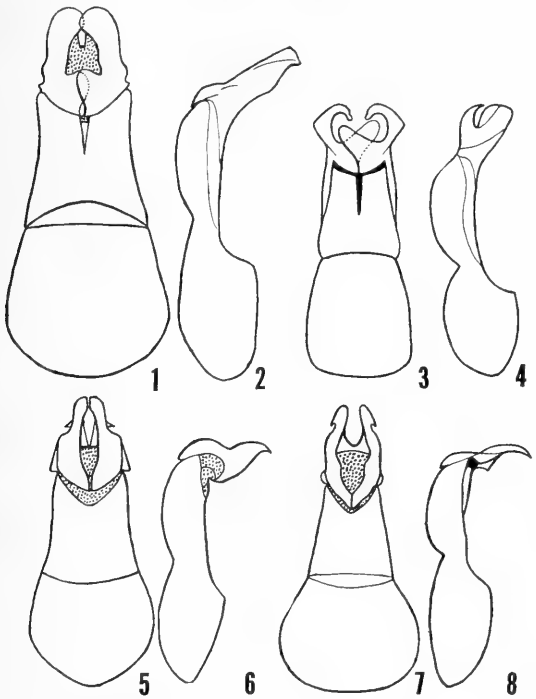
   Head without transverse ridge, median portion depressed, sides in front of eye with small or large tubercles..... *Phileurus*-2

2. Front tibiae with impression between first and second dentations truncate at base; elytral interspaces two, four and six enlarged and raised to form costae..... *castaneous*

   Impression between first and second dentations with apex sharp, not truncate 3

3. Canthus prominent, formed by a continuation of lateral margin of head, frontal tubercles not situated on lateral margins of head ..... *illatus*

   Canthus small, formed by a continuation of a vertical ridge from the frontal tubercle which is situated on margin, lateral margin of head not continuous to canthus, base of frontal tubercle with vertical groove formed by insertion of antenna..... *truncatus*



EXPLANATION OF PLATE 37

Fig. 1. Male genitalia of *Phileurus truncatus* (Beauv.) (dorsal).
Fig. 2. Male genitalia of *Phileurus truncatus* (Beauv.) (side).
Fig. 3. Male genitalia of *Phileurus castaneus* Hald. (dorsal).
Fig. 4. Male genitalia of *Phileurus castaneus* Hald. (side).
Fig. 5. Male genitalia of *Phileurus illatus* Lec. (dorsal).
Fig. 6. Male genitalia of *Phileurus illatus* Lec. (side).
Fig. 7. Male genitalia of *Archophileurus cribrosus* (Lec.) (dorsal).
Fig. 8. Male genitalia of *Archophileurus cribrosus* (Lec.) (side).

FOUR NEW CALIFORNIA MOTHS WITH NOTES ON EARLY STAGES

By John A. Comstock

Early in 1937 Mr. Darwin Tiemann brought to our laboratory a number of larvae which he had taken May 16 of that year in the Cuyama Valley, San Luis Obispo County, California, feeding on *Hymenochloa salsola* T. & G. These were raised to maturity, and submitted to Dr. McDunnough who generously suggested that, in view of our observations on the early stages, we should publish the species. Accordingly we describe it as follows:

Somatolophia cuyama sp. nov.

Holotype ♂. Alar expanse, 30 mm. Plate 38.

Antennae bipectinate from base to tip. Head, thorax and abdomen, dark buff.

Wings, ground color, light straw, overlaid with a sprinkling of light brown scales. From the outer margin to the subterminal

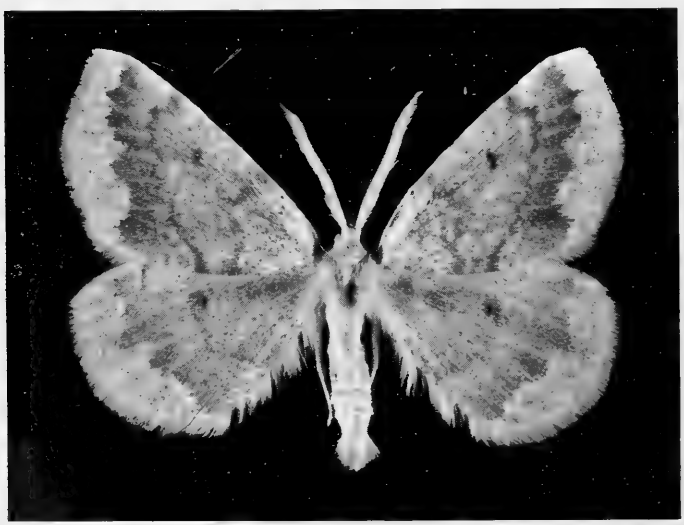


PLATE 38

Somatolphia cuyama Comst. Holotype ♂, enlarged x 2½.

Photo by Cobb.

area both wings are a uniform light straw, sprinkled with light brown. Internal to this is a band of dark brown, dentate on its outer margin and gradually becoming lighter medially. There is a well defined crenulate tp. line of dark brown on the forewing, which is obsolescent or only slightly indicated on the secondary, and a poorly defined ta. line on primary only. Well defined discal spots occur on both wings.

The secondaries are somewhat more lightly maculated than the primaries, as will be noted by reference to the illustration.

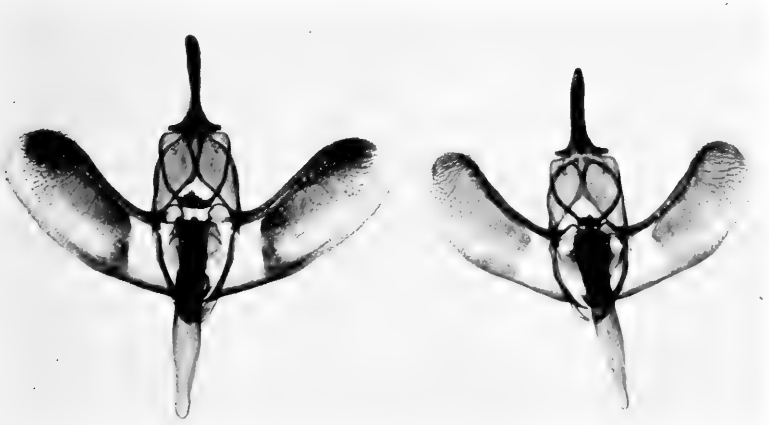
The under surfaces of both wings are very similar to the upper, but with considerably less of the dark brown scaling, hence paler.

The species bears considerable resemblance to *Somatolophia* (Meris) *simplicius* B & McD., (see Cont. Lepid. IV 2, 155, Pl. 20, figs. 4 and 5, 1918), but lacks the black scaling in that species, and has more pronounced ta. and tp. lines. It should be placed next to *S. ectrapelaria* Groosb. in the lists.

Genitalia of *S. simplicius* and *S. cuyama* are shown in Plate 39. The broader and more rounded harpe of the former in comparison with that of *cuyama* will be noted as will also the difference in the uncus.

Type series.

Holotype ♂ and 9 paratypes, all males, emerged June 3 to 10, 1937. Raised from larvae collected in the Cuyama Valley,



A B

PLATE 39

Genitalia of (A) *Somatolophia simplicius* and (B) *S. cuyama*.

Prep. by McDunnough. Photo by Cobb.

San Luis Obispo County, California. We have in addition five females, but as all of these failed to expand their wings, they are not included in the type series.

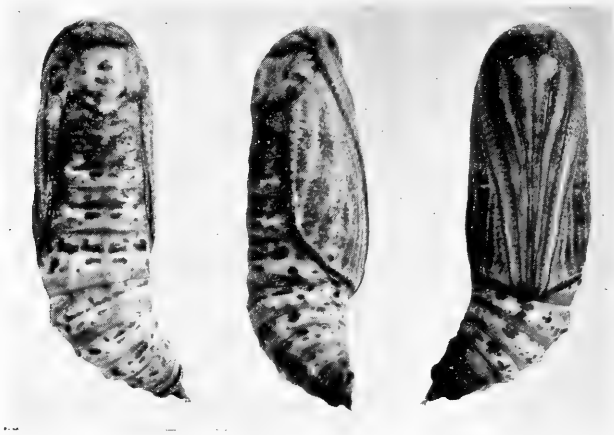
Paratypes will be placed in the Canadian National Museum, Ottawa, and the U. S. National Museum. The remaining paratypes and holotype in the Los Angeles Museum.

Mature larva: length about 33 mm.; cylindrical, of the usual geometrid type. Body ground color, soiled yellow and white.

In the mid-dorsal area there is a wide mottled band of soiled yellow running longitudinally. Lateral to this occurs a wide white area, interrupted at the segmental junctures by an extension of the soiled yellow. In the center of the white area, and placed suprastigmatally there is a longitudinally placed row of black subquadrate spots (one or two to a segment). Spiracles, black or dark gray. A number of small black spots are grouped irregularly around each spiracle, and posterior thereto is a prominent orange spot with a minute black point in its center bearing a single seta. About 2 mm. above each of these orange spots is another of the same color. A number of colorless setae, arising from black points, are scattered over the body.

Legs: the proximal segments are soiled yellow, sparingly blotched with black. Terminal segments, black. Prolegs, soiled yellow, sparingly spotted with black or dull olive.

On the three dorsal segments of the larva there is a dorsolateral broken band of orange which continues forward onto the cheeks, the remainder of the head being soiled yellow, heavily



a b c

PLATE 40

Pupa of *Somatolophia cuyama* Comst., enlarged approximately x 3½.

(a), Dorsal aspect. (b), Lateral aspect. (c), Ventral aspeect.

sprinkled with large black dots. Mouth parts edged with black. The head bears a number of colorless setae.

Pupa: length about 15 mm. Brown, heavily blotched with darker brown spots, disposed as shown on plate 40. The wing cases extend about three-fifths the distance towards cauda, and the antennae reach to their margin. Terminal segment of abdomen, roughened, and somewhat flattened posteriorly. It is topped by a pyramidal roughened button which bears two long recurved black hooks, and six short hooklets.

A few short brown setae are scattered over the front of the head.

Our illustration shows the shape, and such other details of maculation as are not specifically mentioned above.

Lithariopteryx jubarella sp. nov.

Holotype ♂, expanse 11.5 mm. Plate 41, fig. A.

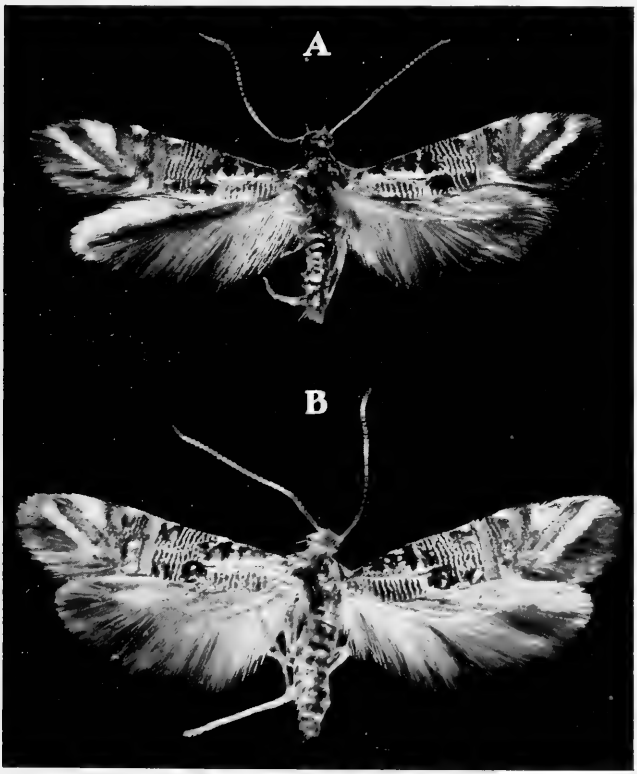


PLATE 41
Lithariopteryx jubarella Comst.
(A), Holotype ♂, superior surface.
(B), Allotype ♀, superior surface.
Enlarged x 7. Photo by Cobb.

Antennae annulate silver and brown. Head and thorax, lustrous gold. Abdomen above, annulate silver and brown.

Forewing: superior surface; ground pattern a series of fine brownish black wavy lines on a white ground, running transversely across the wing. Basally close to the costa there are two metallic raised discs, appearing in some lights to be gold, in others, silver-gold. Around the bases of these are a few black scales interspersed with a sprinkling of rich gold scales. On the outer half of wing, close to costa occurs another pair of raised metallic discs similar to the first described pair. Between these there is a broad band of golden orange running transversely across the wing from costa to hind margin. On its outer edge, and close to the inner margin of the wing is a fourth metallic disc. A fifth and sixth disc of the same character are present medial to the fourth.

The two outermost metallic discs are bounded laterally by a golden orange band, which does not quite extend to the inner wing margin, and which is joined by a similar band running diagonally inward from the apex. The triangle formed by these two orange bands is filled with lustrous white scales. Lateral to the outermost orange band is a prominent white marginal band paralleling it.

Fringes, gray; very long.

Secondaries: narrow, triangular, the surface covered with round gray scales. Fringes very long, gray near outer angle, merging to straw near the base.

The under surfaces of both wings are predominantly gray, with a few scattered white scales.

Allotype ♀, expanse 12 mm. Plate 41, fig. B.

Color and maculation exactly as in the holotype, the only difference being the slightly greater wing expanse and heavier abdomen.

Type series.

Holotype and allotype, Mason Valley, San Diego County, California, April 23, 1939, collected by Lloyd Martin. Paratypes Nos. 1 to 55, same locality, date and collector. Paratypes Nos. 56 to 60, near Llano, Mojave Desert, California, April 10, 1939, collector J. A. Comstock. Paratype No. 61, New York Mts., San Bernardino County, California, May 20, 1939, collector J. A. Comstock. Holotype, allotype and a series of paratypes in the Los Angeles Museum. Paratypes will be placed in the National Museum, Washington, D. C.; the Canadian National Museum at Ottawa; the Academy of Natural Sciences, Philadelphia; the California Academy of Sciences, San Francisco, and the Natural History Museum, San Diego, California. Later on, when ship-

ping conditions become more normal, paratypes will be sent to the British Museum.

The author took a long series of this species flying over and resting on *Mirabilis,* at the Lovejoy Buttes near Llano, Mojave Desert, California, in April, 1939. On the same plants were numerous larvae which we supposed were of the same species. Numbers of these were raised to maturity, and much to our surprise proved to be a Lithariopteryx of quite a different color. No intergrades between the two were encountered. We describe the second species as follows:

Lithariopteryx mirabilinella sp. nov.

Same size, shape and general pattern as *L. jubarella,* but a much darker and grayer insect. The scales over head and thorax are a lustrous blue silver, as are also those on the raised discs of the forewing. There are no gold scales on this species as in *jubarella.* The orange bars on apical portion of forewing which are so characteristic of *jubarella* are suppressed in *mirabilinella* except for a faint suggestion of yellow in the centers of the outer two. The transverse bars of white covering the main ground of the wing are, in *jubarella,* formed of squares running in series, whereas in this species they are formed of elongate lunules, which causes the lines to appear much more crenulated, and wider.

The white triangle and marginal white bar in the apical portion of primary in *jubarella* is here replaced by a spotted black and white area.

The secondaries in this species are nearly black, and the fringes very dark, particularly at the outer angle.

PLATE 42

Lithariopteryx mirabilinella Comst.

Allotype ♀, superior surface, enlarged approximately x 6½.

Photo by Cobb.

On the under side both wings are almost a solid black, with two white short dashes in the costa of primary, near the apex, and a few scattered small white scales along the costal margin. The fringes are contrastingly white at the base and black at the outer margins.

Holotype ♂, allotype ♀, and 25 paratypes, all raised from larvae collected on *Mirabilis* (*laevis?*), at Lovejoy Buttes, near Llano, Mojave Desert, California, all of which emerged on various dates in May, 1939. The same distribution will be made of paratypes as is listed for *jubarella.*

There is, of course, a possibility that *L. mirabilinella* is a dimorphic second brood of *jubarella,* but the two are so very different in many particulars as to warrant our considering them distinct species until such time as further breeding of both will determine their relationship.

The mature larva of *Lithariopteryx mirabilinella* measures about 7 mm. in length. Body ground color, green, shading to darker green toward the caudal end. It is widest through the center, tapering towards head and cauda. The legs, four pair of prolegs and anal prolegs are green.

Head, relatively small; yellow. Ocelli prominent; jet black.

The larva mines a single leaf, starting usually from the base. It also spins a protective webbing over the top of the leaf.

Pupation occurred on the floor of the breeding jar, in a delicate lightly woven cocoon, through which the pupa was dimly visible.

A minute parasite, the species as yet undetermined, killed a considerable percentage of the pupae.

Pupa, length 5 mm. Color, olive green, with an edging of russet brown.

A B C

PLATE 43

Pupa of *Lithariopteryx mirabinella* Comst. enlarged approximately x 7. (a), Dorsal aspect. (b), Lateral aspect. (c) Ventral aspect.

Photo by Cobb.

Shape, navicular, markedly flattened through the posterior half.

Head well rounded; russet brown.

Two prominent ridges occur longitudinally along the dorsum of the abdomen, their outer edges crowned with short spiculiferous processes, two to each segment on each ridge. Along the outer edge of abdomen occurs a similar row of processes.

The wing cases and maxillae extend posteriorly nearly to the cremaster; the latter not prominent, and bearing only a few vibrissae without recurved tips. Antennae terminating two-thirds the distance towards cauda. The wing cases bear a series of fine parallel transverse sculptured striations. The pupa is figured on Plate 43.

I am greatly indebted to that Nestor of microlepidopterists, August Busck, for assistance and helpful suggestions in the study of the last two described species.

PLATE 44

Gall of *carolella beevorana* Comst., on stem of *Franseria dumosa*. Slightly enlarged.

Photo by Cobb.

Late in January, 1938, Mr. Guy Beevor, of the State Plant Quarantine station at Yermo presented us with a number of interesting moths taken at light near Yermo, two of which were Phaloniids which we suspected were new to science. Our recent study of two other species in the genus *Carolella,* (the results of which were published in Bull. So. Calif. Acad. of Sci., Vol. 38, Part 2, pp. 112-118, 1939) have confirmed this suspicion.

Knowing that the species must be a gall former in some desert Composite we decided to search for the larvae in the Yermo area at the first opportunity. Accordingly, on October 30 and 31, 1939, we made a thorough investigation of the native shrubs growing along the highway from Yermo to Essex on the Mojave Desert. At a point near Ludlow, San Bernardino County, a heavy growth of *Franseria dumosa* Gray borders the highway for several miles, and about one out of every fifty bushes that we examined bore stem galls. These were somewhat similar in size and shape to the galls of *Carolella busckana,* but the very different character of the wood and bark of *Franseria* gave them a totally different surface texture.

A considerable number of these galls were collected and placed under observation in our laboratory. The first moth emerged Dec. 4, 1939, and proved to be the species for which we had been searching. Twenty-two examples have hatched to date.

We take pleasure in naming the species for Mr. Beevor, in recognition of his many courtesies throughout the past several years.

Carolella beevorana sp. nov.

Holotype ♂, alar expanse 30 mm.

Head, thorax and abdomen, uniformly sprinkled gray.

Upper surface of primaries: costa, nearly white in its outer two-thirds, becoming darker near base; crossed by four spots or short bars in the subterminal area.

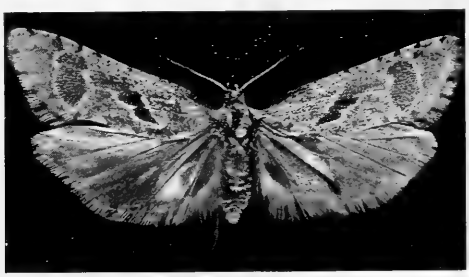


PLATE 45

Carolella beevorana Comst.

Allotype ♀ superior surface, enlarged approximately x 2.

Photo by Cobb.

Ground surface of wing sprinkled with an admixture of gray and white scales. Diagonally across the center of wing, a dark bar, beginning near the outer end of cell where it is widest and lightest, extending medio-posteriorly to terminate in a point near the posterior margin, the lower part of the bar being darker, narrower, and more distinct. This bar has a displacement or "jog" at the beginning of its lower third, in some examples being nearly separated from the upper portion at this point. The entire bar is narrowly margined with white.

A large subreniform dark spot nearly fills the submarginal area of the wing. This also is narrowly margined with white.

The fringes are predominantly white but are narrowly streaked with gray at the ends of the nervules.

Secondary: superior surface; uniform lustrous light gray; fringes, lustrous white.

Under surface: primary; uniform dark gray except for the margins which are liberally sprinkled with white. The four short dark bars on the costa carry through from the superior surface.

Under surface: secondary; same as on the superior surface.

Allotype ♀, expanse 32 mm. Plate 45.

Practically the same as the male in all of its markings, and distinguished only by its larger size and heavier abdomen.

This species differs from *Carolella busckana* in several important particulars. It is much larger on the average, and considerably lighter. The diagonal bar across the primaries is disjointed, and the secondaries have no suggestion of the net-like reticulation that is characteristic of *busckana*. The fringes on the primaries of *busckana* have as many dark scales as they have white, whereas in *beevorana* the white scales far outnumber the dark.

I consider *beevorana* much more closely related to *willettana*, (in spite of their marked difference in appearance) and am now convinced that the last named is a valid species rather than a form of *busckana*.

Type series.

Holotype: near Ludlow, Mojave Desert, California, emerged Dec. 11, 1939, collected by J. A. Comstock.

Allotype, same locality and collector, emerged Dec. 16, 1939.

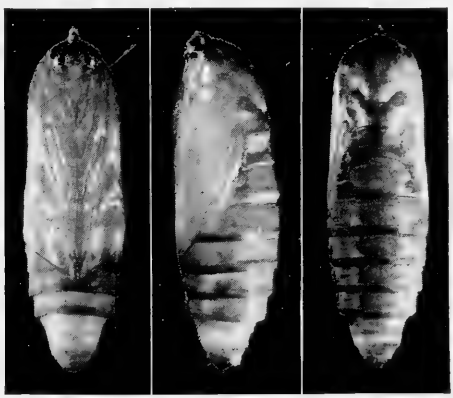
Twenty paratypes, eighteen of which were collected at the above locality, and emerged from Dec. 4 to 31, 1939; two collected by Guy Beevor, Yermo, California, Jan. 28, 1938, at light. Para-

types will be distributed to the National Museum, the Canadian Museum at Ottawa, the California Academy of Sciences, and the Natural History Museum at San Diego. The holotype, allotype, and a series of paratypes in the Los Angeles Museum.

The galls of this species are formed on the medium-sized stems in old bushes of *Franseria dumosa* Gray, (Burro Weed). Mature galls measure about 1½ inches long by slightly more than half an inch wide. See plate 44.) Pupation occurs in mid-winter, the larva spinning a cocoon and exit channel within the gall in about the same manner as was described for *Carolella busckana.*

Along with the mature galls we found an equal number of immatures containing very young larvae, which suggests either a period of two years for full development of the imago, or else a much more protracted season of emergence than seems reasonable to suppose.

The larva is similar to that of *C. busckana* except possibly for its darker coloration. The pupa, which is illustrated on Plate 46 has a stouter and longer keel-like process on the vertex, perhaps as an adaptation to the more woody nature of the plant. It is also considerably darker in color, and more cylindrical in shape. In other respects it resembles the pupa of *C. busckana.*



a b c

PLATE 46

Pupa of *Carolella beevorana* Comst.
(a), Ventral, (b), lateral and (c), dorsal aspects, enlarged x 3½.
Photo by Cobb.

NOTES ON THE EARLY STAGES OF THREE CALIFORNIA MOTHS

By John A. Comstock and Charles M. Dammers

Stretchia plusiaeformis Hy. Edw.

Dyar described the egg and all larval instars of this moth in Proceedings U. S. National Museum, Vol. 25, p. 377, 1903. His notes do not take into consideration the variation in color and pattern of the mature larvae, and his description is of such a nature as to make a visualization rather difficult. John L. Hoerner, in Journal of Economic Entomology, Vol. 30, p. 900, 1937, published brief notes on the larval habits, and illustrated the egg, larva and pupa. His halftone of the larvae is on too small a scale to show markings and pattern. We feel, therefore, that the following notes, supplementing the previously published records, together with our illustration of the mature larva, will be of help to economic entomologists.

In the final instar there are two extreme types of coloration, with every gradation between. The more common type is predominantly brown of various shades; the second type is mottled green.

Brown type: Mid dorsal stripe white, narrow. Lateral to this is a wide mottled band which is yellow in the region of the segmental junctures, and mauve-brown in the middle portion of each segment. A mauve mottling occurs over the entire band. Lateral to this band is a discontinuous white stripe which is obsolete on the anterior half of each segment. Lateral thereto is another wide band of olive, mottled with dark mauve-brown. This is margined latero-inferiorly with a narrow white stripe. Inferior to this is a third longitudinal band, somewhat narrower than the two above described. This is a bright pink, mottled with yellow. The stigmata are placed along the upper third of this band. The inferior margin of this band is also narrowly edged with white. Below this is an area of mauve which gradually is replaced with the green of the abdominal area. The mauve portion is mottled a darker mauve or mauve-brown.

Legs, pale green with yellow tips. Prolegs, pale green with brown crochets. Spiracles, white, with narrow black rims.

On the dorsal surface of the first segment is a glistening black cervical shield. Setae white, arising from round black dots.

Head, soiled orange. Ocelli, dark brown.

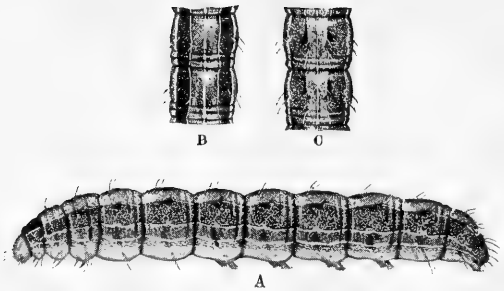


PLATE 47

Mature larva of *Stretchia plusiaeformis*

(A), lateral view of larva. (B), dorsal segments of an intermediate color form. (C), dorsal segments of green form. Enlarged x 2½.

Reproduced from painting by Charles M. Dammers.

Green type: Mid-dorsal stripe white, with dark-green margins. Lateral to this a wide mottled green and yellow-green band, margined laterally with white. Lateral to this a broad olive band heavily mottled with dark green, its latero-inferior edge margined with white. The stigmatal band is pale green, mottled with yellow, and margined inferiorly with white. Abdomen, pale green. In other respects the larva is marked and colored much as in the brown form.

The larval foodplant, as previously noted, is Ribes. Hoerner has pointed out that it may do serious damage to gooseberries. Our description was made from larvae raised from eggs collected by T. W. Hower in Holy Jim Canyon, Orange County, California, March 5, 1935. The eggs hatched March 7, and the first larva went under the soil to pupate April 18, 1935. The imagines emerged during the early summer of that same year.

Cerura candida Lint.

This Notodont is a somewhat infrequent capture in California, and so far as we know is not abundant in any portion of its range. Nothing has been published, to our knowledge, concerning its early stages.

The following brief note will serve as a starting point for a later and more complete study of its metamorphosis.

Mature larva: Length unextended, 32 mm. exclusive of the caudal processes. Ground color of body, pale green. On the dorsum there is a longitudinal wide saddle running the entire length of the body. This is widest at its point of origin on the anterior edge of the first segment, becomes increasingly narrower to the middle of third segment where it is crowned by a short horn, magenta colored. The saddle then widens progressively as far as the seventh segment, and from thence on to the

cauda it again narrows to its point of juncture with the caudal processes. The color of this saddle is a pale blue-white, margined with clear white.

Immediately below the spiracles is a longitudinal white stripe, margined inferiorly with magenta. This band begins at the center of the first segment and extends nearly to the caudal processes.

At the anterior margin of the first segment, close to the edge of the saddle-like area, there is a slight shading of magenta.

At the termination of the caudal segment there arises a pair of long tail-like processes, in line with the white margins of the "saddle". These are regularly tapered, and are conspicuously black dotted on a white ground. At the base of these long caudal processes there are two short spur-like projections rising superiorly, the shafts of which are pale green.

Abdomen, apple green. Legs, pale green, with black perpendicular lines down their sides. Prolegs, green, with a black horizontal line at the lower margin. Crochets, magenta. Spiracles, black.

The segmental joints are slightly tinged with yellow.

Head, pale mauve with two dark patches on the top. Mouth parts, lemon and black.

When disturbed the larva turns its "tails" over its back, and a long fine reddish point or filament is protruded from the end of each process.

On side view the larva is widest at the third segment, tapering sharply towards the head and gradually towards the cauda. On dorsal view it is widest at the second segment, tapering regularly and gradually towards the tail. The shape is accurately given in Plate 48.

This description was prepared from studies of four larva collected by the junior author at Blythe, Riverside County, California, October 18, 1931, on willow. These pupated October 25 of the same year, in thickly woven shiny cocoons, on the foodplant. Only one example was brought to maturity. This emerged May 26, 1932

A similar larva was collected at Riverside, California, on August 10, 1932, but this example lacked the magenta markings.

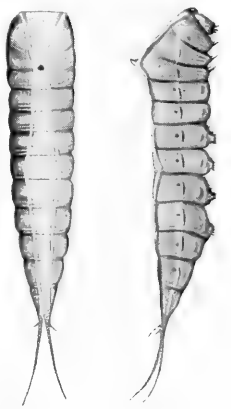


PLATE 48

Mature larva of *Cerura candida*, enlarged x 1¼.
(a), dorsal view.
(b), lateral view.
Reproduced from painting by Charles M. Dammers.

Cosymbia serrulata Pack

This common moth has been bred many times in our laboratories. The only reference to its life history which we find in the literature is Hulst's brief quotation from a letter of Dr. Cockerell's (Entomological News, Vol. XI, p. 556, 1900) in which the latter states: "I think the larva which was of this species was entirely orange yellow, the color of the flowers." Cockerell's material was obtained from the flower heads of *Bigelovia*.

We have found larvae feeding in the blossoms of *Ageratum* and *Acacia* on the mainland, and have recovered it from the flowers of *Encelia californica* on San Clemente Island. Undoubtedly it has a wide choice of foodplants, but is probably partial to the blossoms of yellow flowering species.

The larvae are highly variable in color and pattern, ranging from a green form, through yellow, brown and orange, to a deep pink or magenta. The pupae also partake of this same color variability, ranging from a pale green to heavily mottled brown, with every variety of intergradation.

Mature larva, green type.

Length extended, 19 mm. The form is of the usual cylindrical looper type, with a single pair of prolegs and anal prolegs.

Body, ground color, pale apple green. A broad white middorsal stripe runs longitudinally the entire length of the body. Between this and the infrastigmatal fold there are four parallel narrow white stripes. The green areas between these stripes are finely mottled with darker green.

The infrastigmatal fold is white, sprinkled with yellow at the segmental junctures. The fold flanges out at these junctures into a somewhat shield-shaped projection.

Abdomen, pale apple green, striped longitudinally with irregular pale white narrow stripes.

Legs, soiled white, with brown terminal points. Prolegs, pale green, with brown crochets. Spiracles, white, with narrow yellow rims. Setae, white, arising from black specks.

Head, yellow, speckled with white, and with two white bars across each cheek; sparingly clothed with short white setae arising from black points.

Pupation occurs on the foodplant, the pupa hanging from a delicate silk mat, supported by a silk girdle.

Pupa, length 10 mm. Widest through the posterior edge of the mesothorax, sloping acutely forward to the vertex in a flattened shield-shaped table. Front and eyes prominent. Antennae arising in a deep sulcus. Body gently tapering to a pointed cremaster.

A buff pupa was colored and marked as follows:

Body surface smooth, pale buff, finely mottled with slightly darker buff. Wing and eye cases buff, heavily mottled with white. Laterally there is a pale olive band extending from the edge of the wings to the cremaster. Abdomen, pale olive. Spiracles, white.

There are twelve black specks on each abdominal segment, and similar black points at the terminus of the venules on the wings.

A lateral view of larva and pupa, together with typical segments of larvae of various color phases, in dorsal view, are shown on Plate 49. Arrangement of setae on a typical segment are also shown in fig. B of this same plate.

Our descriptions are drawn chiefly from two lots of larvae, the first collected in July, 1931, on flowers of *Ageratum,* and the second secured in April, 1938, on flowers of an *Acacia,* both lots obtained at Riverside, California. Imagines from the first lot emerged in July and August, 1931, and the second lot emerged in May, 1938. Our Island material emerged in December, 1939. These dates would suggest at least two broods a year for the species.

C. serrulata is parasitized by *Apanteles nemariae* Ashm.

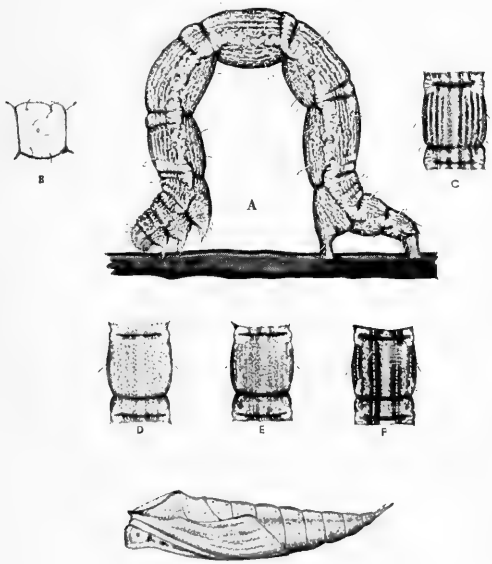


PLATE 49

Larva and pupa of *Cosymbia serrulata*

(A), dorsal view of mature larva. (B), arrangement of setae on a typical segment of larva. (C, D, E, F,) segments of various color forms of larvae, dorsal aspect. (G), pupa, lateral aspect. Enlarged x 3.

Reproduced from painting by Charles M. Dammers.

THE LIFE HISTORY OF POLITES PECKIUS KBY.

By V. G. Dethier
Harvard University

The complete life history of this widespread species has never been studied. Scudder (1889) published accurate descriptions of the egg and first instar. The remaining stages are described below and the appearance of the several broods discussed.

Second Instar: Head width, .75 mm.; head height, .8 mm. Head black with conspicuous punctations and many short fuscous hairs. Body 3 to 5.5 mm. long. Soiled white, mottled with deep maroon to chocolate. Few scattered tapering light fuscous hairs arising from conspicuous black tubercles. Thoracic legs fuscous. To the naked eye the larva appears dark chocolate.

Third Instar: Head width, .9 mm.; head height, 1.0 mm. Head nearly black, faintly corrugate and shiny. When the moulted head capsule is examined, light areas are seen in the region of the epicranial suture. These are the beginnings of the light markings characteristic of the last instar head capsule. Body length 5.5 to 8 mm. The maroon mottling is increased in extent so that the white background as seen in the previous instar is now reduced to a very faint soiled white mottling. On the whole the larva appears much darker than before. The numerous fuscous hairs covering the body are much more conspicuous.

Fourth Instar: Head width, 1.2 mm.; head height, 1.35 mm. Head dull black, roughly shagreened. The light pattern characteristic of the last instar is now faintly indicated. Many delicate fuscous hairs give the head a fuzzy appearance. Body length 8 to 10 mm. The larva is now very dark. There is little or no white visible. It is now replaced by a light brown mottling. The rest of the body is deep maroon.

Fifth Instar: Head width, 1.5 mm.; head height, 1.6 mm. The head now appears as in Plate 50, fig. A. The dark areas of the pattern are black to piceous. They are piceous especially at their edges. On either side of the coronal suture is a prominent white streak. It may, however, be suffused with fuscous. The same is true of the two large white areas adjacent to the ocelli. At the junction of the coronal and frontal sutures are two light areas sienna in color. The remaining light areas of the head are pock-marked with fuscous punctations. The mouthparts are fuscous. Body length 15 mm. Not much change from previous instar. Darker. Hairs longer and darker. Prior to pupation the larva spins a very substantial cocoon by drawing wide blades of grass together. The ends of the cocoon are closed by bending the grass double.

Chrysalis: Length 12 mm. Dark dull reddish purple (Plate 50, figs. B and C). The following areas are white: spiracles, intersegmental membranes, wing pads, antennae, legs, and mouthparts. The tongue case extends to the base of the cremaster and is free from the tips of the wing pads to its extremity. The free portion is brownish. The cremaster is acute. Ventrally the abdominal segments are lighter purple to gunmetal color. Proximal end of antennae on dorsal and lateral side with a white median stripe which follows antennae around to ventral side where the whole of the antennae are white. Soiled white to gray spot on dorsal side of head adjacent to insertion of antenna. Transverse bluish dash at outside corner of pronotum. Streak of bluish bloom on lateral areas of abdominal segments. No hairs on wing pads. Remainder of body covered with many long tawny hairs arising

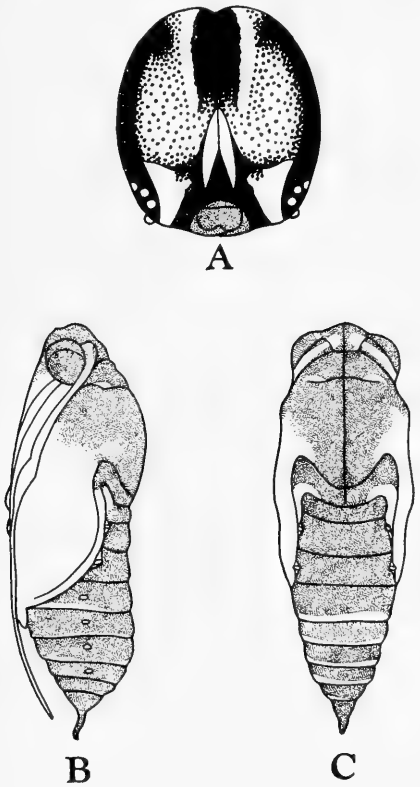


PLATE 50

A. Front aspect of the head of the last instar larva of *Polites peckius* Kby., enlarged approximately x 30.

Chrysalis of *Polites peckius* Kby., x 10.
B. Lateral aspect. C. Dorsal aspect.

from dark purple to black tubercles. Hairs on the posterior segments point caudad.

It has been supposed that this skipper was single brooded in the northern portion of its range and double brooded in the southern part. Moreover, the dividing line was supposed to lie in the latitude of Albany, New York, although Fletcher mentioned the appearance of a late second autumn brood as far north as Ottawa. The condition in the middle part of the range as exemplified by the situation in Franklin, New Hampshire, is unique.

Adults of the first brood appeared on the wing toward the end of June. Eggs from a single captured female were laid July 4. Eleven days later, July 15, all hatched. The first moult occurred July 25; ten days having elapsed. For the second and third instars the minimum amount of time required was ten days apiece. Twenty days may be required for each. Moulting into the fourth instar took place August 14 and 18 and September 5. A minimum of seven to eight days apiece was required for the fourth and fifth instars. From the entire lot of eggs (with zero mortality) a single larva completed its transformation in sixty-nine days. It pupated August 27 and emerged September 20, twenty-four days having elapsed. At this time a few other specimens were taken in the fields. Eggs laid by these females did not hatch though it is probable that larvae of this brood pass the winter in the first or second instar. Most of the remaining larvae of the first or July brood, which remained a total of forty days in the second and third instars combined, required as long as twenty-five days to complete the fourth instar. Some passed the winter in the third instar while still others hibernated in the fourth, fifth, or as chrysalids. Thus part of the progeny of a single female may reach maturity in a single season to form a second brood while the others do not mature till the following spring, having passed the winter as chrysalids or in the third, fourth, or fifth instars. The second brood in the areas between the northern and southern portions of the range hibernates in the early instars.

The food plant of this skipper, in common with other members of the subfamily, is grass. Larvae can be reared to maturity on any common species though preferences do exist.

THE FAUNA AND FLORA OF THE EL SEGUNDO SAND DUNES

9. SOME OF THE MITES (ACARINA) OF THE DUNES

By G. F. Augustson

Of all the biotic relationships existing in the dune area the most intriguing are those between insect and mite pests of plants and their predators. After many months of careful observations the writer has prepared a preliminary report of the activities of some of the mites encountered on the dunes. Two substantial species of predators are here redescribed as well as diagrammed for sake of continuity, in addition to one very well known species. One species new to science is herein described and diagrammed. All diagrams were completed by the writer with the aid of an Abbe Zeiss camera lucida on a compound microscope, measurements of specimens being ascertained with a substage micrometer.

Perhaps the most predominant animal life on the dunes are the mites of the family Tetranychidae. To even the casual observer these mites can be distinguished as a crawling mass over the plants of the meadow area in particular. Among those plants infested appear especially the legumes. However, as is adequately brought out in other papers of this ecological series, many others are as heavily infested. Through the authority of E. A. McGregor who was kind enough to make final determinations of the Tetranychid mites, the following notes are available: *Bryobia praetiosa* Koch, host plant a mallow in February (No. 1939-116); *Tetranychina* sp. near *T. mcdonoughi* McG., host plants *Lupinus bicolor microphyllus, L. truncatus, L. chamissonis, Lotus salsuginosus,* and *Astragalus leucopsis.* Although only two species are here mentioned there are undoubtedly many more. Of the two mentioned *Tetranychina* is the most predominant during March and April. It might be mentioned here also that it is *Bryobia praetiosa* that causes so much annoyance in homes into which they migrate by the hundreds after heavy rains from nearby clover fields. It is also often claimed that in the homes this species becomes obnoxious to man, but whether it actually attacks man there is as yet no authentic record.

Among the controlling factors for these Tetranychid mites is, first of all, summer heat which retards succulent plant growth. However, they are subject to constant attack by predaceous mites of the families *Erythraeidae* and *Bdellidae.* These predators not only attack the adults but also feed liberally upon their eggs. The predators collected and determined by the writer were found to

be *Erythraeus arenicola* (Hall), *Erythraeus tuberculatus* n. sp. (Figs. 2-4) and *Atomus maculatus* Banks (Figs. 5-7), of the family *Erythraeidae; Bdella utilis* Banks (Fig. 1) of the family *Bdellidae*. The Erythraeid mites can be observed by concentrating one's attention on bare sandy patches over which they run very rapidly from plant to plant. These fellows are generally bright red in color and with such unequally long legs (see diagrams) that they appear much like small Phalangids. Members of the family *Bdellidae* are much slower in their activities, and are always found during the day under low hanging shrubs.

Invariably anyone who has worked in open fields, preferably grain fields, must have had experience with the final mite reported on in this article, i.e. *Pediculoides ventricosus* Newport (Figs. 8-11). This is the one mite of medical importance so far recorded from the dune area. It attacks humans avidly, bringing about a dermatitis known as the straw-itch. It is known to science to be either predaceous, parasitic, or a scavenger, depending upon the expediencies of its environment. The writer and Dr. W. D. Pierce after much experience with this species are prone to believe that at no time is it a scavenger, basing our assumption on the fact that its presence would be much greater had it such a facility. These mites are very minute, being invisible to the naked eye (except gravid females) (Fig. 9), and are the only mites so far recorded from the dune area exhibiting dimorphism. They are normally parasitic on the larvae of barine weevils (as yet undetermined) of the dune area, and are most abundant from July to January.

The members of the sand dune ecological group who have made notes or collected mites of the species here reported on are Dr. W. Dwight Pierce, Mrs. Dorothy Pool, George P. Kanakoff, J. C. von Bloeker, Jr., E. S. Cobb, Lloyd M. Martin, Dr. Robt. L. Rutherford, Miss Frances L. Cramer, Frank B. Cramer, Charles A. Fleschner, Mrs. Clara L. Pierce, and the author.

Erythraeus tuberculatus n. sp. (Figs. 2, 3, 4)

Female (Fig. 2):

General Analysis: Body length 1 mm., width 0.7 mm., a large mite, bright red in color, entire body and appendages covered with plumose hairs.

Description: Dorsum: No line of demarcation between cephalothorax and abdomen; dorsal groove present, anterior and posterior ends enlarged, each with two long slender setae; general shape broadly oval, anterior border blunt; entire dorsum thickly beset with many feathery hairs; two pairs of eyes present, small, inconspicuous, pale, and on very short peduncles; pedipalps and

chelicerae visible from above. Venter: same as dorsum, no visible sclerites; coxae arranged radially in pairs; genital aperture arranged in an elliptical groove closely guarded by strong setae; anal groove separate from genital groove, situated on the ventral posterior border. Capitulum: chelicerae needle-like, finely serrate at the tip; tracheal tube openings at the base of the basi-capitulum; hypostome unarmed, triangular, conforming to shape of basi-capitulum; four pairs of long plumose setae on lateral edges of basi-capitulum; pedipalps large, long, basal segment small, not one-third length of the second, second the largest, broadly rounded dorsally, flat ventrally, third segment uniform width, two-thirds as long as second, flattened ventrally, fourth segment shorter than third, terminating in a single strong claw, fifth arising near the base of fourth, club-shape opposing the fourth thumb-like, entire pedipalps thickly beset with many plumose setae, segment three with eighteen prominent dorsal tubercles, fourth with twelve (Fig. 3). Legs: very long, thin, thickly beset with many plumose setae; first pair twice the length of the body, two middle pairs one and one-fourth, fourth pair one and three-fourths length, tarsi not swollen, uniform width, bluntly terminated anteriorly, no pulvilli, two strong clavate claws. (Fig. 4.)

Type locality: Sand Dunes, El Segundo, California.

Predator on other mites and small insects.

Discussion: Although there is a remarkable resemblance of this species to *E. arenicola* in the color and type of plumose setae, the very prominent tubercles on the pedipalpi definitely exhibit the character of a new species.

The holotype female and allotype male on a permanent slide as well as many paratype slides are deposited in the collection of the Los Angeles Museum of History, Science and Art, while paratype slides are available for distribution to other museums.

ATOMUS MACULATUS (Banks 1904), Banks 1915. (Figs. 5, 6, 7)

REDESCRIPTION OF FEMALE (Fig. 5)

Synonmy: *Rhyncholophus maculatus* Banks, 1904, pg. 28-30
Atomus maculatus Banks, 1915, pg. 40-41

GENERAL ANALYSIS: Body length 0.7 mm., width 0.5 mm., a small mite, dull yellow in color, entire body and appendages with scattered long setae.

DESCRIPTION: Dorsum: Broadly oval, no line of demarcation between cephalothorax and abdomen; dorsal groove present, indistinct, anterior and posterior ends enlarged each with two

very long slender setae; two pairs of eyes present, small, pale, flat and inconspicuous. Venter: same as dorsum, no visible sclerites; coxae arranged radially in pairs; genital aperture immediately posterior to fourth coxal segments, groove guarded by long slender setae; no suckers present; anal aperture ventral just within posterior border. Capitulum: chelicerae needle-like, smooth at the tip; tracheal tube openings at the base of the basi-capitulum; hypostome unarmed, triangular; pedipalps long, slender, first segment small, not one-third length of second, third segment one and one-half length of second, fourth segment small ending in a single strong claw, fifth segment attached to base of fourth in opposition to the fourth thumb-like. Legs: moderate length, equal; tarsus of leg one greatly swollen, others normal; no pulvilli, tarsi ending in two strong clavate claws.

Predator on other mites and small insects..

Discussion: This species presents a very unusual life cycle which was first recorded by Banks (1904). Quiescent stages follow stages of active growth. The earliest stage of quiescence was recognized by Banks (1904) as the nympho-chrysalis (Fig. 6), between larva and nymph and the later stage as the teleio-chrysalis (Fig. 7), between nymph and adult. In both of these stages the mite is devoid of appendages.

Pediculoides ventricosus Newport (Figs. 8-11)

Redescription of Female (Fig. 8)

General Analysis: Body length 0.2 mm., width 0.05 mm., very small mites; colorless, setae strong on legs, weak on body.

Description: Dorsum: capitulum visible from above, large, head-like; cephalothorax and abdomen divided by a pseudo-groove of demarcation, the cephalothorax one-third the length of the abdomen; cephalothorax with specific chaetotaxy, one mid-lateral pair of clavate setae (the so-called pseudostigmatic organs) with one pair of strong spinose setae immediately posterior; abdomen with three strong spinose setae at extreme posterior border, one in mid-line, two lateral; a flat velum projecting laterally from pseudo-line of demarcation on each side. Venter: devoid of setae; coxae arranged radially in pairs; spiracles opening ventrally at base of capitulum at union with cephalothorax; genital and anal apertures indistinct, both sub-terminal posteriorly. Capitulum: Distinctly headlike, a distinct pseudo-articulation with cephalothorax; two papillae laterally at the base, the rudimentary pedipalpi not visibly segmented; chelicerae needlelike, retractile, minute; hypostome unarmed, flat, conforming to shape of basi-capitulum. Legs: strong, of uniform length, all with many strong, slender setae; tarsi of legs one-three (Fig. 10), each with a single, long slender seta, tarsus of leg four with a very

long, slender seta in addition, three times the length of the tarsus; all tarsi gradually attenuated and ending in a caruncle, at the base of each a small double clavate claw. In the gravid female the posterior portion of the body becomes greatly distended. (Fig. 9.)

Redescription of Male (Fig. 11)

General Analysis: Body length 0.18 mm., width 0.05 mm., colorless, pseudostigmatic organs absent, very prominent strong setae dorsally.

Description: Dorsum: capitulum pseudo-articulation with cephalo-thorax as in female; pseudostigmatic organs absent; pseudo-groove of division between cephalothorax and abdomen in posterior one-third of dorsum, greatest width of dorsum at this point; one pair of long slender setae lateral to mid-line just above coxae of leg one, a much shorter pair midway to pseudo-groove of cephalothorax just lateral to mid-line, a very strong, long pair of setae in a similar position just above the same groove; abdomen narrowed posteriorly, two very short spinose setae at postero-lateral angles, two much longer setae immediately anterior just lateral to mid-line; distal portion of coxae of legs three and four visible from above. Venter: same as in female. Capitulum: as in female. Legs: uniform length as in female; chaetotaxy as in female with added pair of strong slender setae on legs two-four; tarsus four with extremely long setae; caruncles and claws of legs one-three as in female; tarsus four ending in a single strong seta.

Type Host: Larvae of barine weevils.

(Note: This mite was brought into the Museum laboratory on several occasions, and in spite of great care to isolate, it multiplied rapidly and succeeded in attacking every breeding jar in the room and many of the mites attacked me. Fumigation with cyanide was necessary to destroy the infestation.—W. D. Pierce.)

PLATE 51

Fig. 1. *Bdella utilis* Banks. ♀. Whole mount, dorsal aspect.

Fig. 2. *Erythraeus tuberculatus* Augustson. Holotype ♀. Whole mount, dorsal aspect.

Fig. 3. *Erythraeus tuberculatus.* Pedipalpi of holotype ♀.

Fig. 4. *Erythraeus tuberculatus.* First tarsus of holotype ♀.

Fig. 5. *Atomus maculatus* Banks. ♀. Whole mount, dorsal aspect.

Fig. 6. *Atomus maculatus.* Nympho-chrysalis.

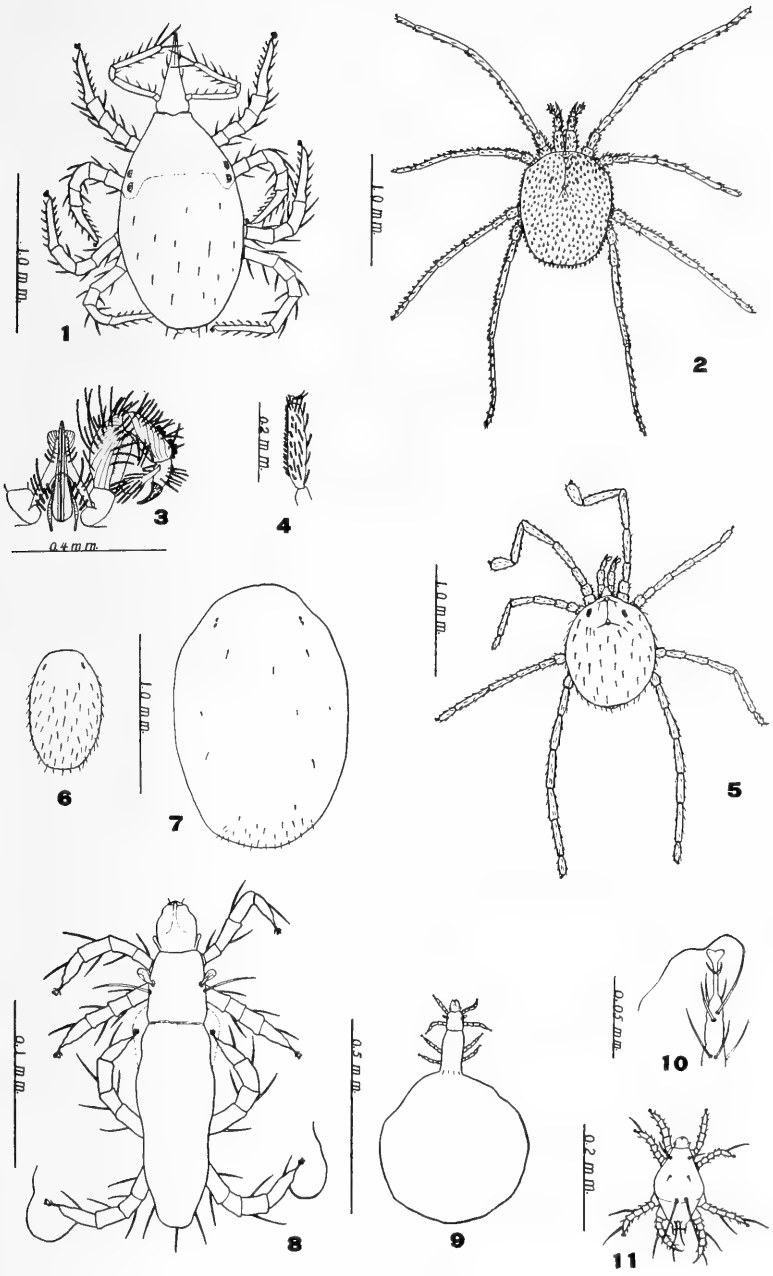
Fig. 7. *Atomus maculatus.* Teleio-chrysalis.

Fig. 8. *Pediculoides ventricosus* Newport. Non-gravid ♀. Whole mount, dorsal aspect.

Fig. 9. *Pediculoides ventricosus.* Gravid ♀. Whole mount, dorsal aspect.

Fig. 10. *Pediculoides ventricosus.* ♀ Tarsus No. 1, claw caruncle.

Fig. 11. *Pediculoides ventricosus.* ♂. Whole mount, dorsal aspect.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11

PLATE 51

10. NOTES ON THE EARLY STAGES OF EUPHYIA IMPLICATA, GN.

By John A. Comstock

We can find no reference to the early stages of this moth in the literature, notwithstanding the fact that it is a common species in all of the arid or sandy areas where *Abronia* occurs.

In the earlier instars the larva works as a leaf miner in the fleshy substance of the leaves of *Abronia umbellata* Lam.

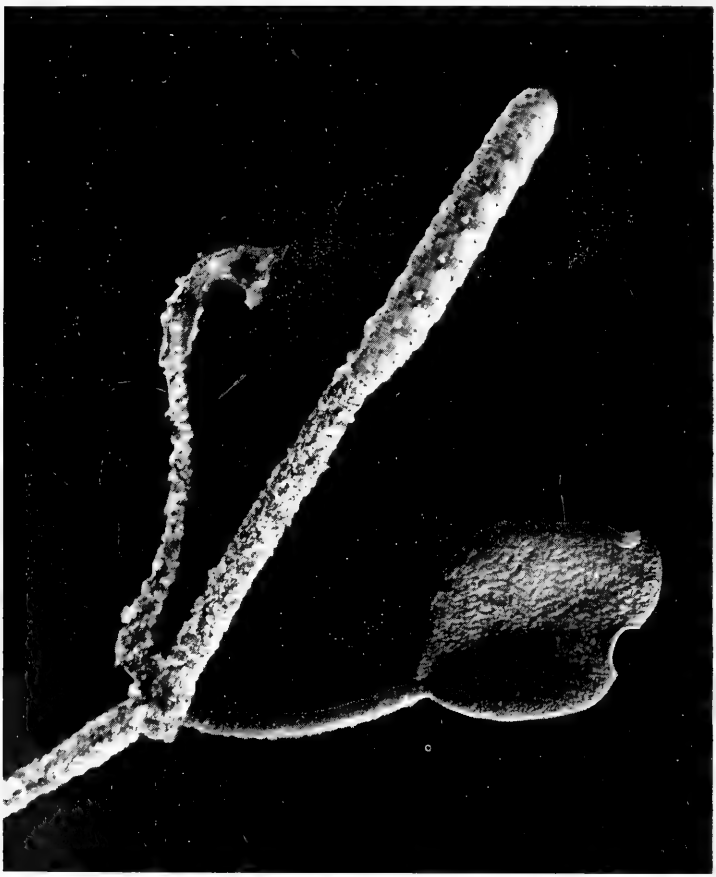

PLATE 52

Larva of *Euphyia implacata* Gn. feeding on stem of *Abronia*, the color and texture of which it closely resembles. Enlarged x 2½.

Photo by Cobb.

At that time it is a minute green larva, with a black head.

As it grows, and becomes too large for its leafy burrow, it transfers to the surface of the plant, and feeds indiscriminately on leaves and stems. By this time it has assumed the mature coloration and markings.

Mature larva. Length, 20 mm. Uniformly cylindrical, the head only slightly smaller than first segment, and the three last caudal segments slightly tapering. Ground color, rose-pink, heavily sprinkled with dots of straw-yellow, light brown and olive. There are no lines or bars, such as occur on the larvae of some other members in the genus.

Legs, straw-yellow, shading to brown at the tips. Prolegs concolorous with body.

Head concolorous with body. Ocelli, black. Spiracles black.

There is considerable variation in larval coloring, some examples showing a predominance of yellow, others being much darker, with a preponderance of olive spots.

The color and markings of this larva are very similar to the sand, and also closely approximate that of the mature moth. This appearance should serve as an excellent camouflage for the caterpillar, as it does unquestionably for the moth. In spite of this protective coloration, the larva prefers to remain hidden during the day time, either in the sand, or under the partially buried portions of the foodplant. This may be due to the relatively high temperatures of its environment whenever the sun is not obscured.

Plate 52 illustrates a mature larva feeding on the stem of

a b c

PLATE 53

Pupa of *Euphyia implicata* shown in (a), ventral, (b), lateral, and (c), dorsal aspects. Enlarged x 3.

Photo by Cobb.

Abronia. The stems of this plant are usually thickly covered with granules of sand, as shown in the cut. It is therefore most difficult to distinguish the larva when it is resting on the stems.

Pupation occurs under ground in an oval cocoon.

Pupa: Length, 14 mm. Color, uniform light yellow-brown. Fusiform, tapering gradually and evenly toward head and cauda. Wings reaching nearly three-fourths the distance toward cauda. Body surface smooth, except for a very faint pitting of the abdominal segments. Maxillary cases extending beyond the margins of wings for a distance of one and a half segments. Antennae terminating at edge of wing. Eyes large, but not prominently protruding. Cremaster ending in a point. There are apparently no setae or other protrusions or processes on any portion of the surface.

The pupa is figured on Plate 53.

In the El Segundo dune area the moth seems most abundant during March and April. Our series from the Coachella and Imperial Valleys show captures in nearly every month of the year. The Los Angeles Museum-Channel Island Survey records list it thus far from San Miguel, San Clemente, Santa Rosa, and San Nicolas Islands. It flies sparingly during the day and comes to light readily at night.

The brief life history notes above given were made from material gathered in February and March, 1938, in the El Segundo sand dunes.

THE LARVA AND CHRYSALIS OF PAPILIO ASTERIAS AMERICUS KOLLAR

By F. Martin Brown

In certain parts of the valley of the Rio Pastaza, Ecuador, this butterfly approaches being an economic pest. With the introduction of small farms in the less arid portions of the temperate region of the valley it has adopted "zanahoria blanca", the white carrot, as its favored food plant. One day last week a native collector, Segundo Velastique, brought me ninety-two larvae in the last three instars. Descriptions of these and of the chrysalis follow.

Third Instar: A velvety black, tuberculate larva about 11 mm. long, with a creamy white "saddle" near the middle of

the back. The head capsule is 1.1 mm. wide and black with whitish markings. These markings take the form of a frontal inverted "V", a vertical bar on each side of the head and a horizontal one across the labrum. The head is densely clothed with short fine black hairs. Segments T1-3, A1-9 are essentially alike (A3-4 excepted). All segments bear four pairs of spinous, glistening black tubercles. These are: a dorsal pair that are rather small and most prominent on the thorax; a subdorsal pair that are much the largest, black except on A3-4 and there white, the black ones with orange-brown bases; a lateral pair, black with orange bases on the thoracic segments, creamy white with a black tip on A3-4 and black with an orange spot dorsad of the base on the other abdominal segments; a sublateral pair, broad and low, orange-brown with a black tuberculate crown on the thoracic segments and with two black points on the abdominal segments. The stigmata are shining black. The "saddle" on A3-4 is an irregular blotch of creamy white not quite reaching the sublateral tubercles. The anal appendages are black. There are a few small, scattered spots of creamy white on T1, 2, A2, 6, 7 and 8, the bases of the forelegs and the prolegs. The legs and prolegs are black. The osmataria are dull burnt orange and translucent.

Fourth Instar: Similar to the preceding stage and is 17.5 mm. long. The head capsule is 1.9 mm. wide. The principal difference between the two instars is the increase in the extent of the creamy white markings in the later stage. T3 and 4 have an irregular vertical line near the posterior margin of the segment. All the abdominal segments bear a few scattered patches of the light color. The bases of the legs, the pro-legs and the anal props are whitish. The legless segments have touches of white in the same position.

Last Instar: Here there is a marked difference from the preceding stages. The larva is banded with green and black and bears orange spots. The length ranges from 25 to 46 mm. The head capsule is 3.0 mm. wide. The light markings on the head are so enlarged as to dominate the picture. They are now yellow. Each segment is marked with three black and two green transverse bands. The median black band of each is marked with six round, bright orange spots. The lateral orange spots are joined to the anterior green band with yellow streaks. The orange spots on the thoracic segments are reduced tubercles. The anal segment bears two irregular greenish white bands. The bases of the legs, pro-legs and anal props are greenish white. The legs are black.

Chrysalis: Typical *asterias* shape. It is girdled with a fine silk thread. It is mottled and streaked with grey, brown, white and black. Upon emergence from the larval skin the color is apple green. The dimensions are: 28.35 mm. long, 18.2 mm. deep and 19.1 mm. wide.

A NEW SPECIES OF MOLLUSK FROM THE SAN PEDRO PLEISTOCENE

By G. Willett

On several occasions during the past two or three years Mrs. Effie M. Clark of Los Angeles, has brought me specimens of an interesting shell obtained by her in the Lower San Pedro fauna at Hill-top Quarry, San Pedro, California. Some time after she had brought me the first specimens, I obtained two imperfect examples of the same species in the Lower San Pedro series at Timms Point, also in San Pedro. There are also three imperfect specimens at hand taken by E. V. Edmonds at Hill-top Quarry. In spite of the fact that this shell is very much larger than any known species of west American *Alabina,* in the absence of soft parts, it appears to me best referable to that genus. Therefore, it may be known as:

Alabina effiae sp. nov. Pl. 54.

Shell elongate-conic, white. Nuclear whorls 2, globular, smooth and shining. Post-nuclear whorls well rounded; sutures deep. Early post-nuclear whorls apparently smooth; later ones with very obscure, raised, irregularly spaced spiral lines, visible only under a lens, and varying in strength in the different specimens examined. Base of last whorl rounded and somewhat wrinkled at the columella. Imperforate. Aperture broadly ovate, without trace of canal; outer lip thin, slightly reflected. Columella strongly curved; parietal wall apparently not calloused.

The type (No. 1061, Los Angeles Museum) was collected by Mrs. Effie M. Clark, in the Lower San Pedro series, Hill-top Quarry, San Pedro, California. It has 2 nuclear and 7 post-nuclear whorls, and measures: Length, 12 mm.; diameter, 4.5 mm. The largest specimen (imperfect), if restored, would have 9 post-nuclear whorls and would measure 18 by 7.5 mm. Mrs.

PLATE 54

Alabina effiae Willett
Type, x 3

Clark and Mr. E. V. Edmonds each have three additional specimens from the type locality, and the Los Angeles Museum has two from the Timms Point formation.

The species is named for Mrs. Effie M. Clark, who brought in the first specimens, and whose diligent and careful work in the fossil deposits of the San Pedro area has resulted in many interesting additions to our knowledge of the shells of that region.

A PROPOSED DICHOTOMY OF THE SNAIL-GENUS MONADENIA

By S. Stillman Berry
Redlands, California

In the course of my studies on the anatomy of certain of our western land-snails it early became evident that the species of the splendid genus *Monadenia* (Pilsbry) so far as investigated align themselves in two very distinct and apparently natural groups. These groups find their strongest characterization in the genitalia, but it has likewise been possible to discover support for them in certain features of the shell. For several years I have been putting off publication of my conclusions in the hope of fortifying them by an investigation of the animals of all or nearly all of the known species. This has as yet been only possible of attainment in part, but since no conflicting evidence has come to light in any of the species studied, and as I wish the privilege of reference to the situation in a taxonomic and distributional paper shortly to appear, it seems desirable to publish this preliminary synopsis.

Genus Monadenia (Pilsbry, 1895:199)
(Type: *Helix fidelis* Gray, 1834:67)

♂ apparatus with large sacculate dart-sac opening into an enormous complex atrium, the single large elongate mucus-gland entering asymmetrically in the angle proximad to the dart-sac; penis very short and stout, containing a verge; epiphallus stout, terminating posteriorly in a very conspicuous "flagellum"[1]; penial retractor entering on the epiphallus.

Adult shell rounded-helicoid to carinate, with varying spiral sculpture and rounded or hyphen-shaped granulation. Embryonic shell always carinate, its surface very closely and finely granulate.

[1] The use of the term "flagellum" for the free appendix of the epiphallus is supported by weighty authority; yet it is open to the serious objection that there exists in biology a very different, much more strongly established, and very much more appropriate morphological meaning to the word. For this reason and because the organ in many of its manifestations is far from flagelliform, some such term as, e.g., epiphallic caecum, would be altogether preferable.

1. Subgenus MONADENIA s. s.

(Type. same as for genus)

♂ apparatus with short pouch-shaped dart-sac, and very large narrowly elongate mucus-gland many times longer than the sac, its terminal portion somewhat more slender and set off by a less thickened and usually more or less constricted intermediate region; epiphallus short and relatively sturdy, with a very thick and stout "flagellum" often terminating in a short, slender, abruptly constricted appendicular process.

Embryonic granulation of shell closely crowded, more or less confluent, and geometrically aligned to give a file-like or cloth-like surface.

2. Subgenus CORYNADENIA nov.

(Type: *Helix Hillebrandi* Newcomb, 1864:115)

♂ apparatus with very large elongate dart-sac, and a relatively short club-shaped mucus-gland, showing no evident external division into regions, its stalk rather narrow; epiphallus slender, with a very long and slender, pointed "flagellum".

Embryonic sculpture copious, but composed of separate rounded[2] granules.

"The new subgeneric name proposed is derived from the Gr. κορῦνη, club, + ἀδην, gland, and has reference to the shape of the mucus-gland as above described."

Further interesting and perhaps significant differences exist, but those cited are the more conspicuous and suffice for my present purpose.

These snails, in our current knowledge of them at least, are the answer to a zoo-geographer's prayer in that they exhibit in their distribution a dichotomy precisely corresponding to their major taxonomy as outlined above. The typical subgenus is recorded in a nearly continuous sweep in the western coastal region, extending from extreme southern Alaska to Alameda County, California, and as far inland as The Dalles, Oregon, and Trinity and western Siskiyou Counties, California. The *Corynadenia* group, omitting the doubtful *churchi* from consideration, occurs as a scattering of more or less isolated colonies from Shasta County, California, south on the western slopes of the Sierra Nevada at least as far as Fresno County. Both groups thus occur in the Shastan area, but sharply divaricate there.

LITERATURE

Gray, J. E. 1834. ....land and fresh-water shells...regarded as hitherto undescribed. Proceedings Zoological Society, London, 2:63-68, 1834.

[2] An exception is the somewhat anomalous *M. churchi* Hanna & Smith (1933:79) where the granules are relatively few, large, and hyphen-shaped. It is also quite possible that the anatomy of this form may show significant peculiarities, but I have not yet had an opportunity to examine it, and the original account and figure are deficient in important particulars.

Hanna, G. D., and Smith, A. G. 1933. Two new species of Monadenia from northern California. Nautilus, 46 (3):79-86, pl. 5, pl. 6, f. 8, 9, January 1933.

Newcomb, W. 1864. Descriptions of nine new species of Helix inhabiting California. Proceedings California Academy of Natural Sciences, 3:115-119, March 1864.

Pilsbry, H. A. 1895. Guide to the study of Helices. Tryon's Manual of Conchology, Structural and Systematic, with illustrations of the species, 2nd series: Pulmonata, 9 [Helicidæ, v. 7]: i-xlviii, 1-366, frontispiece and plas. 1-71, November 1893 to February 1895.

STOMACH CONTENTS OF A GREAT BLUE SHARK

By George P. Kanakoff

Recently, in the past summer (1939), I had the opportunity to examine the stomach contents of a Great Blue Shark, *Prionace glauca* (Linnæus), which was collected June 27, 1939, in Santa Monica Bay, off Point Dume, Los Angeles County, California, by Jack C. von Bloeker, Jr. This specimen, an adult male, measured four feet four inches (1326 mm.) in total length, and its skeleton is now preserved in the osteological research collection of the Los Angeles Museum.

The following information is offered as a contribution to a knowledge of the food habits of this species, in that it provides a partial index to the type and variety of forms preyed upon at this particular time of year. Fourteen fish of four species, one unidentified parasitic (nematode) worm, and three large pieces of kelp of two species were taken from this individual's entrails. Identification of the material is as follows:

Northern Anchovy, *Engraulis mordax mordax* Girard, 1
Length, 270 mm.

Queenfish, *Seriphus politus* Ayres, 7
Length, ranging from 130 to 210 mm.

Pacific White Perch, *Phanerodon furcatus* Girard, 1
Bitten in two; length 316 mm.

Rubberlip Perch, *Rhacochilus toxotes* Agassiz, 5
Immature; average length, 60 mm.

Nematode worm (Gen. et sp. unknown), 1
Undoubtedly parasitic.

Brown Kelp, *Halidrys dioica* Gardner, 1
Length, 306 mm.

Green Kelp, *Eisinia arborea* Aresch., 2
Length, 1 piece 225 mm., 1 piece 330 mm.

To Professor G. R. Johnstone, Department of Botany, University of Southern California, I am indebted for a confirmation of my identification of the two species of kelp listed above.

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Vol. XXXVIII, 1939

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CONTRIBUTIONS FROM THE LOS ANGELES MUSEUM —CHANNEL ISLANDS BIOLOGICAL SURVEY

7. A REVISION OF THE CHANNEL ISLANDS FORMS OF CERCOCARPUS

By M. B. Dunkle

Species of Cercocarpus have been reported on the three Channel Islands that now support a form of chaparral, Santa Catalina, Santa Rosa, and Santa Cruz. *Cercocarpus betuloides* Nutt. has been reported from all three islands; *Cercocarpus betuloides multiflorus* Jepson, *Cercocarpus alnifolius* Rydb., and *Cercocarpus Traskiae* Eastwood have been reported from Santa Catalina and Santa Cruz.

Series of Cercocarpus taken on these islands indicate that there is an increase in the amount of pubescence and the thickness of the leaf as the conditions pass from mesophytic to xerophytic. The length of the petiole and blade of the leaf do not appear to vary according to the aridity of the habitat, but seem to represent a genetic variation.

It would seem that *C. betuloides*, during its long period of insular isolation, has given rise to several variations, which are not, as yet, sufficiently differentiated, especially as they still intergrade to a considerable extent, to be considered as true species. The study of these forms in the field has led to the following conclusions:

1. The different forms tend to intergrade.

2. The differences between the forms are not of sufficient importance to rank as specific differences.

3. It seems desirable to place all of the island forms of Cercocarpus in the same species, and rank them as varieties of *Cercocarpus betuloides* Nutt. T. & G. Fl. N. A. 1:427. 1840. The following key indicates the nature of these new combinations.

Petioles 2-4 mm. long; leaf blades 3 cm. or less long.

Flowers 2 to 3 in a cluster; leaves rather thick.

C. betuloides Nutt.

Flowers 5 to 15 in a cluster; leaves rather thin.

C. betuloides multiflorus Jepson.

Petioles 4-10 mm. long; leaf blades usually over 3 cm.

Hypanthium and underside of leaves strigose or sub-glabrous; leaves plane.

C. betuloides alnifolius (Rydb.) new comb.

Hypanthium and underside of leaves densely tomentose: leaves more or less revolute.

C. betuloides Traskiae (Eastw.) new comb.

8. FERNS OF THE CHANNEL ISLANDS

By M. B. Dunkle

Studies of the Polypodiaceae of the Channel Islands have been made by Lorenzo G. Yates, T. S. Brandegee, Ralph Hoffman and others who have published plant lists from these Islands. As several new records have recently been made it seems fitting at this time to bring together a complete list of all the ferns that have been reported to date.

Ferns have, as yet, been found only on the four larger islands, San Clemente, Santa Catalina, Santa Rosa, and Santa Cruz. Due to the destructive grazing and the resultant erosion on the other islands it is doubtful if any ferns will be found there, unless spores may later be carried there by the wind. However, *Pteridium aquilinum pubescens* was overlooked on Santa Catalina until 1931, although it had been reported in 1902 by Mrs. Trask, but not seen later in the location mentioned by her; and *Notholaena Newberryi* was overlooked on San Clemente until 1939. In view of these facts this list cannot yet be considered as final.

It is interesting to note that no endemic ferns have yet been found on the islands and that the majority of the ferns there are cosmopolitan or very general in their mainland distribution. Over one-third of the ferns are distinctly northern in their mainland distribution, while about one-third are characteristic of southern California. Hydrophytic ferns are all very rare on the islands though six species are reported. About six ferns might be classed as xerophytic, with the remainder classed as mesophytic.

While many of the ferns may have been established on the island areas at the time there was land connection with the mainland it is quite probable that many have been carried there after the insular separation by means of their air-borne spores. As the prevailing winds are from the north and northwest, with occasional storms from the northeast, with few winds from the southeast, especially during the time of the year when the spores are matured, it is not surprising that there is such a large percentage of northern species.

The following ferns are also found on Guadalupe Island, to the southward. As no other ferns are found there this condition seems to point to the fact that Guadalupe has a closer affinity with the Channel Islands than with the peninsula of Lower California or the islands along its coast.

Notholaena Newberryi, Polypodium californicum, Polypodium Scouleri, Pityrogramma triangularis, Pellaea mucronata, and *Polystichum munitum.*

List of Ferns with Their Distribution

Cystopteris fragilis (L) Bernh. Brittle Fern.

This cosmopolitan fern, so widely distributed in our mountains, has been reported only by Hoffman, and only from Orizaba Canyon, Santa Cruz Island.

Dryopteris arguta (Kaulf.) Watt. Wood Fern.

This fern, common throughout California but particularly so in the fog belt and northward to Alaska, is common on the three wooded islands, Santa Catalina, Santa Rosa, and Santa Cruz. It is found principally beneath *Quercus dumosa* and *agrifolia.*

Polystichum munitum (Kaulf.) Pres. Sword Fern.

Widely distributed in all the mountains of the Pacific slope especially northward to Alaska, this fern has been reported from Santa Cruz by both Brandegee and Hoffman. Only one plant was found by Hoffman in Cañada de la Casa.

Athyrium Filix-femina (L) Bernh. var. *sitchense Rupr.* Lady Fern.

This is another of the northern ferns reported south of Monterey only from Santa Cruz Island. It is found in several of the north-side canyons.

Woodwardia Chamissoi Brack. Chain Fern.

This striking cosmopolitan fern occurs on both Santa Rosa and Santa Cruz. It is found only where there is permanent seepage.

Pityrogramma triangularis (Kaulf.) Maxon. Goldenback Fern.

This is probably the most common of all the insular ferns and is one of the four ferns to have been reported from all the four larger islands. Dunkle No. 7244, 1939, is apparently the first report from San Clemente, though it is common there. However the statement by Munz that it is "also on our islands", may include an earlier report.

Pityrogramma triangularis (Kaulf.) Maxon vr. *viscosa* (D. C. Eaton) Weatherby. Sticky Fern.

Abundant on Santa Catalina and occasional on Santa Rosa and Santa Cruz, this fern from the San Diego region may yet be found on San Clemente. It seems to favor more open exposures than does the species.

Pellaea andromidaefolia (Kaulf.) Fee. Coffee Fern.

This might be called the foothill fern as it occurs in the foothills and low coastal ranges from Lower California to Oregon. It has been reported by Brandegee from Santa Catalina, Santa Rosa, and Santa Cruz, and by the writer from San Clemente.

Pellaea mucronata D. C. Eaton. Birds Foot Fern. Tea Fern.

This fern follows the same distribution as *P. andromidaefolia,* but does not reach so far north. It is common on Santa Catalina, and has been reported from Santa Cruz by both Yates and Brandegee, and from Santa Rosa by Hoffman. It may also be expected on San Clemente.

Notholaena Newberryi D. C. Eaton. Cotton Fern.

This common fern of the San Diego region has only been reported from San Clemente Island.

Notholaena candida Hook.

This rare fern of the San Diego region has only been reported by Yates from Santa Cruz Island.

Cheilanthes californica (Nutt.) Mett. Lace Fern.

This dainty California endemic occurs infrequently on Santa Catalina, Santa Rosa, and Santa Cruz.

Cheilanthes Clevelandii D. C. Eaton.

Found occasionally in southern California, particularly in the San Diego region, this fern occurs on both Santa Rosa and Santa Cruz, but is not common on either island.

Adiantum Capillus-Veneris L. Venus-hair Fern.

Munz reports this cosmopolitan fern from all four of the larger islands, but as it is found only about water falls or similar locations near permanent water, it is not common on the islands.

Adiantum Jordani C. Mull. California Maidenhair.

The common California Maidenhair is equally common on all four of the larger islands, and may be expected from some of the smaller islands.

Adiantum pedatum L. *aleuticum* Ruprecht. Five-finger Fern.

Elsewhere in southern California this northern fern is found only very rarely in the higher mountains, but both Yates and Brandegee report it from Santa Cruz Island.

Pteridium aquilinum (L.) Kuhn, var. *pubescens* Underw. Brake.

A common weed of the Pacific coast, and occasional on Santa Rosa and Santa Cruz, this fern has only been collected on Santa Catalina by Fosberg, No. S4834, 1931, in a branch of Cottonwood Canyon.

Polypodium Scouleri Hook. & Grev. Leather-leaf Fern.

While usually found only from Central California northward it has been reported on Santa Cruz by Hoffman, Yates, and Brandegee.

Polypodium californicum Kaulf. Licorice Fern.

This common California fern occurs abundantly on all four of the larger islands. It intergrades with the following variety.

Polypodium californicum Kaulf. var. *Kaulfussii* D. C. Eaton.

Not very clearly differentiated from the species, but has been reported by Hoffman from both Santa Rosa and Santa Cruz, and by the writer from Santa Catalina.

THE FAUNA AND FLORA OF THE EL SEGUNDO SAND DUNES

11. THE DUNE CASE-BEARER BEETLES OF THE GENUS *EXEMA*, WITH REVIEW OF THE GENUS

By W. Dwight Pierce

One of the most interesting groups of beetles to be found in the dune area is the case-bearers of the Chrysomeloidea, Chlamydidae, genus *Exema* Lacordaire (1848). They look more like little pellets of worm droppings than a beetle, and when disturbed can so fold in all appendages that only a sharp eye would detect them as living creatures.

More perfect fitting and grooving can hardly be found anywhere. The anvil-shaped scutellum locking the elytra; the dovetailing teeth of the elytra; the cupped basisternite of the prosternum acting as a receptacle for the mouth parts; the deeply incised eyes; the perfect grooving of the head, and sides of the basisternite for the antennae; the double groove for the two front pairs of legs, and similar groove for the hind legs; the wavy margin of elytra; the rough tubercles and yellow spots; make the whole insect, when sulling, look like an oval pellet of a dropping of a worm.

The species are so roughly carved that they are difficult to describe and differentiate, although the characters are good.

We have a double reason for this article. Not only has *Exema* been taken feeding on three species of dune plants; but Mr. George Elwood Jenks has bred a new species and obtained all stages on a Los Angeles County plant, which is sparingly found on the dune, although his work was done elsewhere in the county. He has taken some remarkable photographs, which will shortly appear in Nature Magazine, but has asked the writer to make the technical descriptions.

The only life history in this group, which is at all well described is that of *Chlamys plicata* given in a footnote to his admirable description of the Dominican case-bearer, *Coscinoptera dominicana* (Fabr.) by Riley in his 6th Missouri Report (pp. 127-131).

Eight specific names have been given to North American members of this genus, and some of the descriptions are so brief as to be almost valueless. The writer was confronted with such contradictions and such meager details, that it became necessary to draw up descriptions of all the material at hand; and where there was any doubt as to specific identity, to give names which would absolutely qualify the material studied, with the expecta-

tion that studies of the types of the species of Olivier, Motschulsky, Mannerheim, and Lacordaire may necessitate future sinking of one or two of the names.

The descriptions are in accord with Snodgrass' morphological terminology; for only by arriving at some coördination of terms in descriptive work can we make proper judgment on phylogenetic relationships.

It is quite evident that biological and comparative morphology studies will reveal *Exema* to be a considerable genus.

Rather than draw up absolutely complete descriptions of each species, two species have been more completely described, and the others only for the characters which vary. Thus the description of *Exema chiricahuana* is most complete as to the general formation of the body, and that of *E. jenksi* goes into such details as were only possible after dissection, to describe.

KEY TO THE NORTH AMERICAN SPECIES OF *EXEMA* DISCUSSED IN THIS ARTICLE

1. Prothorax carinate, tuberculate, and strigosely sculptured..... 2

   Prothorax carinate, tuberculate and punctate 3

2. Face of male and frontal slope of prothorax dull clay yellow; face of female with yellow spots; front and middle legs in great part yellow. Florida ..... 1. *neglecta* Blatchley

   Face of male with two longitudinal yellow bars next to eyes, sometimes transversely connected with a yellow central spot, which merges with a triangular frontal spot; face of female has the bars reduced to two spots, the central spot reduced, and front with only two little spots in anterior corners; all tibiae with subapical and subbasal yellow rings; ocular emargination depressed below level of eyes. Canada (pl. II, fig. 2) ..... 2. *dispar canadensis* n. ssp.

3. Prothorax with six longitudinal costae from base to apex 4

   Prothorax with two to four longitudinal carinae, or the outer pair with short branches in some cases 5

4. Intervals between thoracic costae smooth. Mexico, Colombia, Brazil ..... 3. *punctatipes* Lacordaire

   Intervals between thoracic costae irregularly rugose and punctate. British Honduras, Guatemala ..... 4. *complicata* Jacoby

5. Color dark cupreo-aeneous; antennae, labrum and tarsi beneath pale; thorax and elytra densely punctate, and acutely tuberculate; prosternum concave. Carolina, Florida, Louisiana ..... 5. *gibber* Fabricius (*nodulosa* Blatchley)

   Color black, without metallic lustre, more or less spotted with yellow; thorax and elytra with obtuse tubercles 6

6. Prothorax medianly bicarinate, with two rows of punctures between carinae 7

   Prothorax medianly bicarinate, with the carinae not subparallel, and with more than two rows of punctures, at least in front; face of male completely yellow 9

7. Anterior margin of elytra with parallel strigose lines ascending the tubercles in scutellar angles, and at middle of base; yellow spots confined to face and frontal elevation of thorax 8

Anterior margin of elytra without strigose lines on tubercles; punctuation of face irregular; thorax and elytra with many yellow spots; eyes slightly raised above surrounding areas. California (pls. I-II, fig. 5) ..... 6. *jenksi* n. sp.

8. Punctuation of face irregular, with smooth spots; ocular emargination depressed below level of eyes. Pennsylvania ... . 7. *pennsylvanica* n. sp.

Punctuation of face more regular, without smooth spots. Eyes convex, forming with vertex a marginal depression, emargination depressed. California ..... 8. *inyoensis* n. sp.

9. Male with thorax and elytra predominantly spotted with yellow..10

Male with posterior portion of prothorax and elytra black 11

10. Male pygidium with yellow spot on each side. California.... ..... 9. *deserti* n. sp.

Male pygidium predominantly yellow. Arizona (pl. II, fig. 1) ..... 10. *globensis* n. sp.

11. Male suprascrobal area dark; prothorax with two median rows of punctures from base to beginning of carinae; antecostal suture distinctly marked by deep round punctures; eyes slightly depressed below surrounding areas. Arizona (pl. II, fig. 3) ..... 11. *chiricahuana* n. sp.

Male suprascrobal area yellow; prothorax with indiscriminate punctuation from base to beginning of carinae; antecostal suture more impressed and with transverse punctures; eyes markedly depressed. California ..... 12. *parvisaxi* n. sp.

SPECIES NOT DEFINITELY LOCATED

Exema conspersa (Mannerheim), 1843

Chlamys conspersa Mannerheim, 1843. Bull. Mosc. 16 (1):311.

The original description follows:

"294. Chlamys conspersa: Nigro-fusca, foveolatopunctata, thoracis medio pulvinato, elytris tuberculis elevatis scabris, sutura, crenata, fronte, thoracisque apice maculis majoribus notatis, thoracis disco, elytris et pedibus guttis minutis luteis conspersis. Longit. 1 lin. Latit. 2/3 lin. Habitat in California. D. Tschernikh."

This description is too brief to assign it definitely to one of the California species, for it could be applied to *E. jenksi,* and *E. deserti* of California, and *E. globensis* of Arizona.

I consider it absolutely erroneous to try to fit it to any eastern species as has been done.

Exema rugulosa (Motschulsky), 1845

Chlamys rugulosa Motschulsky, 1845. Bull. Mem. Act. St. Pet., 18(1):109.

The original description follows:

"320. *Chlamys rugulosa* m. Elle est de la taille du *Pachybrachis histrio,* mais plus convexe et fortement raboteuse sur les élytres. Elle est noire avec quelques petites taches jaunes sur la tête et les pattes. De Californie."

With such a brief description it is impossible to assign this name to one of the California species, although, as far as color goes, it can apply to *E. inyoensis,* or *E. parvisaxi,* both of California, or to *E. chiricahuana* of Arizona.

I see no reason why we should assume that it is a synonym of *conspersa,* and as I have found no eastern species agreeing with any western species, I think we should try only to place this species as Californian, leaving it until its type can be examined, as a species inquirendum.

DESCRIPTIONS OF SPECIES CONSIDERED

1. Exema neglecta Blatchley, 1920

Exema neglecta Blatchley, 1920. Can. Ent. 52(3):69.

It is unnecessary to repeat this description. It may be a form of *E. dispar.*

The species is recorded from Florida on huckleberry and other low shrubs.

2. Exema dispar (Dejean Ms.) Lacordaire, 1848

Chlamys dispar Dejean, 1836. Cat. ed. 3:440. Manuscript name.

Chlamys parvula Dejean, 1836. Cat. ed. 3:440. Manuscript name.

Exema dispar Lacordaire, 1848. Monographie des Coléoptères . . . Phytophages. Mem. Soc. Roy. des Sciences de Liège, 5:850-852.

Inasmuch as our American literature has badly mixed up the eastern species, it is best not to try to assign the brief notes to specific species.

This is the species with strigose or rugulose lines on thorax and elytra.

Lacordaire's original description follows:

"6. E. dispar. Quadrato-oblonga, atra, labro, palpis, antennis, tarsisque fulvis; prothorace rugoso-punctulato, utrinque calloso, gibboso, gibbere obtuse conico, dorso obsolete canaliculato, granulis lineolisque elevatis obsito; elytris sat dense punctatis, scabriusculis, lineis elevatis obsoletis, singuloque, tuberculis circiter novem, instructo.—Long. 3/4, 1 1/4. Lat. 2/5, 3/4 lin.

"Mas.: capite, prothoracis parte antica pedibusque fulvis, his nigrovariis.

"Var. A. Capite, prothorace pedibusque fulvo-nigroque variegatis.

"Var. B. Tota cinnamomeo-nigroque varia.

"Chlamys parvula, Dej. Cat. ed. 3, p. 440.

"Foem.: Pedibus fulvis nigro-maculatis, capite nigro interdum fulvovario; abdomine apice vage foveolato."

This description is followed by a fuller French description and statement that a type has been selected. The origin of the material is the United States, with distribution extended to Yucatan.

Inasmuch as Lacordaire included under the species a number of variants, the writer has decided to describe one lot of material at hand from Montreal as a subspecies, in order to clearly define this material, until a comparison can be made with Lacordaire's types.

2a. Exema dispar canadensis new subspecies.

Described from 4 ♂, 3 ♀ from Montreal, in the collection of the Southern California Academy of Sciences, in the Los Angeles County Museum.

Male: Length 2.1-2.3 mm.; breadth 1.6 mm., or 31 to 43% longer than broad.

Black, with exception of yellow markings on face and legs; face with two longitudinal yellow bars next to eyes, sometimes transversely connected with a central yellow spot, which more or less merges with a triangular frontal spot; labrum light brown with yellow margin, of different texture from the rest of the face; antennal scape yellow; funicle and club brown; all tibiae with subapical and subbasal yellow rings.

Face minutely granulate, irregularly punctate, much more sparsely so on yellow than on black areas. Black portion of vertex between eyes depressed, and with punctures in depressed striae; yellow bars on vertex very sparsely punctate. These bars are terminated at a line connecting the posterior margins of the ocular emarginations, and immediately in front of them are the slightly tumid, finely rugulose, impunctate suprascrobal areas over the antennal condyles. The yellow bars and these antennal attachments completely close the ocular emarginations from the balance of the face; this emargination is about as broad as deep, visibly depressed below margin of eyes, and deeply, closely punctate. The central spot marks the usual location of a coronal fossa, and contains one puncture. The frons is triangular with a few irregularly disposed punctures, and is sharply marked off

by a row of deep parietal punctures, which correspond to the frontal sutures (which are clearly defined in the larva of *E. jenksi*). The clypeus is a closely punctate black band separating frons from labrum. Genae black, coarsely punctate. Labrum free, shiny, smooth, apically setose, quadrate, 2/3 as long as broad. Eyes granulate. Antennae with scape stout, yellow, with fine setigerous punctures; first funicular segment moniliform, not half as broad as scape; second to fourth funicular slender, longer than broad; the following joints, being laterally produced, form the club.

This differentiation of the antenna into three parts, scape, funicle and club, is almost as distinct as in the Rhynchophora.

The thorax has a deep, clear-cut antecostal suture, separating a narrow collar-like acrotergite, with a single row of punctures, from a bluntly elevated posttergite, with the whole surface coarsely rugulosely punctate, the striations arranged in longitudinal lines medianly, diagonal or curved lines laterally, and transverse lines basally. The two middle costae on the frontal elevation form a diamond which narrows to parallel costae separated by several rows of punctate striae. From the crest there also arises two irregular ridges with three tumidities, directed toward the anterior angles. Scutellum transversely impressed at base.

The elytra are very tumid, with about fifteen elevations all coarsely rugulosely punctate; these and interspace punctures minutely setigerous and more or less broadly separated; the sutural margins are closely saw-edge dove-tailed.

The plate of the prosternal basisternite (plate II, fig. 2) is shield-shaped, with long posterior stem, with slightly concave basal margin, all edges raised, so that the entire surface is concave, deeply and coarsely sculptured with setigerous punctures. The entire sternum of thorax is deeply and coarsely, transversely rugulose punctate, punctures minutely setigerous. The abdominal punctures are also transverse, minutely setigerous. The last segment is medianly apically transversely impressed in the form of a crescent lunule.

Pygidium basally rugulosely punctate with elongate setigerous punctures, apically with separate round setigerous punctures; surface minutely granulate; median carina faint, lateral margins raised; also two arcuate low ridges which approach the median carina at their basal third and then diverge from it, terminating beyond middle of disc, thus forming an irregular depressed area, which is deepest laterally near base.

Female: Length 2.6-2.8 mm.; breadth 1.8 mm., or 44 to 55% longer than broad. Agrees with male, except in following details:

Facial spots with interocular bars reduced to two faint spots; median spot also reduced; some specimens with two small

spots at anterior angles of frons; otherwise face black; antennal scape reddish brown. Punctures of vertex sparse, but rather evenly dispersed; but in ocular emargination, frons, clypeus and genae coarse, and transversely rugulose; all minutely setigerous.

Last abdominal segment with large round shallow depression, with punctures transverse in this area, and round beyond it.

Pygidium with carinae more distinct, but punctures more shallow and sparser.

3. Exema punctatipes Lacordaire, 1848

Exema punctatipes Lacordaire, 1848. Mon. des Colèoptères. Mem. Soc. Roy. des Sciences de Liege, 5:853-854.

This species is recorded by Jacoby in Biol. Centr. Amer. Coleoptera 6(1):88 from Mexico, Colombia, and Brazil.

4. Exema complicata Jacoby, 1881

Exema complicata Jacoby, 1881. Biol. Centr. Amer. Coleoptera, 6(1):89-90.

This species is recorded by Jacoby from British Honduras and Guatemala.

5. Exema gibber (Fabricius, 1798)

Clythra gibber Fabricius, 1798. Ent. Syst. Suppl., p. 112.

Chlamys gibbera Olivier, 1808. Entomologie. Coléoptères, 6:876, pl. 1, fig. 4.

Exema nodulosa Blatchley, 1913. Can. Ent., 45:22.

A full description is given by Blatchley, who in 1920 sunk his species under *gibber*. He records it from Florida on scrub oak. Linell (1898, Proc. U. S. N. M., 20:480) also recorded it from Louisiana. It will be seen from the original description that the type locality is in one of the Carolinas. Although the Leng (1920) Catalogue attributes this species to Olivier, 1791, Encyc. Meth., 6:876, it is in error, and the correct Olivier citation is as above, where Olivier gives the Fabricius citation.

The original Fabrician description is as follows:

"C. gibber. C. nigra thorace gibbo, elytris tuberculatis. Habitat in Carolina. Dom. Bosc.

"Minuta. Antennae testaceae. Thorax elevatus, gibbosus, immaculatus. Elytra nigra tuberculis plurimis parvis elevatis. Pedes nigri."

No specimens in this species are at hand for the present study.

6. Exema jenksi new species (plates I; II, fig. 5)

Described from holotype ♂ (No. 1), allotype ♀ (No. 3), 4 ♂, and 9 ♀ paratypes, bred January 9 and February 12, 1940 in Los Angeles, California, on *Artemisia californica*, by George Elwood Jenks; of which 1 ♂ and 4 ♀s were dissected and slides made, with chitinous parts mounted separately to show the peculiar sclerite structures. All in Los Angeles Museum. Also one pair taken February 15, 1939, on *Encelia californica*, one ♀ January 26, 1939, on *Gnaphalium decurrens*, one ♀ August 17, 1938, on *Franseria bipinnatifida*, all on the El Segundo sand dunes, collected by W. D. Pierce (paratypes 16-19). In addition the following paratypes: 1 ♀ labelled "Cal. Jan. —" (No. 21); 1 ♀ Hynes, Los Angeles County, California, April 29, 1921, L. L. Muchmore 5759 (No. 22); 1 ♀ Cold Creek Ranch, San Bernardino Mountains, California, July 2, 1922, beating live oak, L. L. Muchmore 2365 (No. 23); 1 ♀ same loc., July 29, 1922, L. L. Muchmore 2500 (No. 24), all in collection Los Angeles Museum; 1 ♀, Los Olivos, Santa Barbara County, California, August 18, 1939, George P. Mackenzie (No. 20) in his collection.

In Mr. Jenks' article in Nature Magazine, to appear in June the name will unfortunately appear as *Exema dispar jenksi* Pierce, but I had not seen the original description of *dispar*, when the name was released to Mr. Jenks.

Male: Length 2.32 mm.; breadth 1.46 mm., or 59% longer than broad. Black with considerable yellow spotting.

Face with yellow on vertex (except punctures and median basal zone), in median stripe between antennal bases, broadening over frontal area; with genal and clypeal zone black. Labrum clear, shining reddish brown. Punctures of face sparse, especially on yellow areas, and absent on suprascrobal above antennal condyles, which area is outlined by a semicircle of dots.

Prothorax with antecostal suture of separate punctures; frontal slope speckled with yellow. Median carinae irregularly parallel, and separated by several irregular rows of shallow setigerous punctures, the tiny setae appearing like shining gold. From the crests of these carinae branch a pair of diagonal carinae, and between these median and lateral carinae is a pair of short carinae.

The elytra are much speckled with yellow; tubercles round and sparsely punctured, not strigose, even at anterior margin. The intermediate punctures are shallow, setigerous (gold), without sharp margins, interspaces irregular and rounded.

Punctuation of undersides shallow, irregular and not as conspicuous as in *E. pennsylvanica*. Basisternite (plate II, fig. 5) transversely impressed, coarsely punctate. Last sternal segment coarsely punctate, medianly flattened, faintly depressed. Preceding segments medianly depressed.

Pygidium deeply, sparsely punctate with a faint median ridge; the surface minutely granulate. Paratype No. 13 has yellow spots on each side of pygidium.

Female: Length 2.29 mm.; breadth 1.5 mm., or 52% longer than broad.

Face with yellow more restricted, consisting of two stripes on vertex against eyes, separated by black, a small median spot connecting their lower angles, a spot in each eye emargination; the scape of the antennae, and the labrum.

Last sternal sclerite with round smooth median depression.

Pygidium more sparsely punctate, with median carina and two indistinctly raised discal carinae, apically diverging. Paratypes 4, 17, 18, 19 with yellow spots on each side.

Internal anatomy: For the first time in this genus it is possible to describe the following characters, as a result of dissections.

Antennae: The antennal scape is yellowish, much thicker than the funicular joints following, and as long as the four following joints, which may be considered as composing the funicle; these are reddish in color, and of these the first is about one-half as thick as the scape, but much thicker than the three following moniliform joints; the following six joints are laterally enlarged the first triangular in outline, 2-5 transverse, subquadrate in outline, 6th ogival pyramidal, and twice as long as 5th. These joints correspond to a club, and all but the first are black or very dark brown in color.

Mouthparts: The mandibles are small, black, concave within, with an outer and inner tooth, and two rounded condyles; with a slender dorsal abductor muscle, and a large flat, fan-shaped dorsal adductor muscle.

The maxillae are attached to the subgenal margin of the head at each side of the mentum and consist of a transverse cardo, subquadrate stipes, lanceolate fringed lacinia, 2-jointed galea with last joint pubescent, and 4-jointed black palpus, moderately pubescent.

The labium consists of a mentum, prementum, with ligula, and 3 jointed palpus. The mentum is a free, black, quadrate plate, very deeply rounded emarginate to beyond its middle, thus appearing two-pronged; it has 3 punctures on each side in a longitudinal arrangement. The prementum is attached in the emargination of mentum, and is free; it is elongate, with the palpi attached at each side of the apex; palpi with the basal joint

small, but indicated by its dark marking, the second joint longer, with the third attached diagonally on the anterior margin, giving the palpus an elbowed form; last joint cylindrical, slightly tapering, truncate at tip. The ligula is pubescent, slightly separating the bases of the palpi.

A tongue-like hypopharyngial plate (plate I, fig. 7) with two long posterior apodemes from the posterior corners, lies below the pharynx with a slight concavity on its inner surface. The apex is emarginate, heart-shaped, the base truncate, shape in general quadrate; with a few discal and marginal setigerous pores.

Wings: The wing (plate I, fig. 8) consists, in the language of Snodgrass, of an axillary region, a remigium, vannus and jugum. The axillary region, consisting of three axillary sclerites; with costa, subcosta, radius and medius arising from the first two, cubitus and the anal veins from the third. The remigium contains all of the major veins, including cubitus. The indentation at which M_4+ Cu reaches the margin is the boundary of vannus, which contains 3 anal veins. The second indentation bounds the jugum, which contains a rudimentary vein. The costal vein extends about one-third the length of the wing, terminating opposite the base of the darkened stigmal area. In its basal half, before and reaching a point opposite the arculus is a dark patch of extremely fine hairs. Subcosta is close to radius at base, but later joins costa, surpassing it and becoming the marginal vein to the end of the stigmal area. Radius is a strong vein thickened into a stigma, beyond which R_1 follows subcosta to the apex of the stigmal area; Radial sector bends downward toward Medius sending a cross vein to join Medius, and R_{2-5} is broken almost at its beginning, but is represented in the folded area by fragmentary darkenings. Medius arises at the side of Radius but crosses to Cubitus by the Arculus, and then faintly diagonally moves over and lies beside Radius in its dark stigmal area, very faintly crooks within the crook of radial sector and cross vein to join the cross vein which extends from radial sector to Cubitus; faint branches are visible in the folded area, indistinctly outlining a cell. Cubitus is a strong vein from base to the junction of Medius, at which point the united veins turn and go to the marginal notch marking the bounds of vannus. The first anal or vannal vein is but a rudiment, the second and third are complete.

Male genitalia: The 9th segment under which the anus issues is a very fragile ring segment with only its outer margin chitinized, and is medianly dorsally shallowly emarginate, separating the chitinous margin. The 10th or ring segment is a very slender rod-like ring. The 11th or oedeagus is elongate oblong, apically squarely truncate with only soft anterior extensions. The flagellum of the ductus ejaculatorius is a very long chitinous

tube, appearing flexible, arising from a single tubular seminal vesicle, and passing through the chitinous endophallus into the oedeagus.

Female genitalia: The 8th segment is dorsally two very narrowly chitinized plates (plate I, fig. 11). The 9th segment consists of 2 dorsal, 2 pleural and 2 ventral plates as illustrated. The 10th segment has a narrow chitinous band of 2 narrow dorsal plates. There is beyond this a faintly chitinized, lightly pubescent, tri-emarginate terminal or 11th segment. Internally were found two types of unpaired chitinous spermathecae attached to the ovipositor, one stout and bent, the other slender and coiled or serpentine. They differed as illustrated in two specimens (plate I, figs. 9-10).

The Life History of Exema jenksi

The following notes on the life history were prepared from data furnished by Mr. George Elwood Jenks, who has prepared a beautiful series of photographs of the life history for Nature Magazine.

The adult beetles are active almost all year round in Los Angeles County, on *Artemisia californica*. Some specimens taken in April or May, 1939, were still alive January 9, 1940.

The egg is deposited, then fastened to a slender stem of frass. She covers the egg completely with abdominal excreta until it forms a stemmed cup flaring wider at mouth, and then covers this with a cap. The act of oviposition and covering is completed in 15 to 20 minutes. The egg stage lasts about 12 days at approximately 65° F. mean temperature.

The larva upon hatching cuts open the cap, and after some effort succeeds in catching hold of the branch. It pulls its case loose from the stem and immediately turns it upside down to cover itself (plate I, fig. 1). Under this case it feeds, walking about with its six legs all brought forward, as we shall see, by the freeing of the coxae. As it grows, it adds to the case from its excreta, forming a nippled cap-like case (plate I, fig. 2), the nipple being the original case. Within the case, the larva's position is unusual, as the abdomen is thrust up into the case, but bent downward at the middle, so that the anus is close to the legs (plate I, fig. 3). This enables it to manipulate the excreta in making its case.

The larval feeding period, in Mr. Jenks' experiments, took about seven weeks. When mature the larva seals the stem end of its case, and pupates. The prepupal, pupal and teneral adult periods occupy 28 to 30 days.

When mature, the adult cuts off a cap from the outer end of the case and emerges, looking almost exactly like the case from which it emerges. The adult resembles a dropping of a Lepidopterous larva, and is so constructed that it can fold all legs, and head appendages into grooves, and drop to the ground in a sull. On the ground it would be impossible to find it.

Descriptions of Immature Stages of Exema jenksi

Egg: Pure white, oval, in the proportion of 13 to 20. Length about 1.2 mm.

Larva: The larva, even in the youngest stage, carries its body above it in a bent position; probably so that it can use its excreta in adding to the tube. The abdomen is bent forward beneath the body at the fifth segment, the anus reaching the base of the legs.

The first larva has the appearance of a little hermit crab, with its legs all extending beyond the head, and the head almost as long as the balance of the folded body. The head capsule measures 0.25 mm. from base to tip of mandibles, or 0.20 to genal margin; and 0.25 mm. in breadth. The two lobes of the occiput are clearly separated by the coronal suture, and separately rounded to this suture at base. The frontal sutures are distinct, clearly defining the front. (This corroborates the assumption that the yellow triangle on the face of the adult is the front.) The antennae are short, two-jointed, and separate two patches of ocelli, four in the upper patch and two in the lower. (In the adult these patches are united to form the compound eyes, with an emargination, in front of which are set the antennae). Each occipital has a semicircle of six punctures beginning with the ocelli, and curving inward, outlining very much the area occupied by the eyes in the adult. On the front there are four pairs of punctures making a sort of semicircle on each half. The labrum is broad and subquadrate. The labrum, mandibles, maxillae and labium viewed centrally appear as a rosette of petals. the legs are very interesting, being clustered closely to the head and all reaching forward, for the insect literally walks with its body erect in the air. Each leg (plate I, fig. 5) has a strong trochantin at the sides, to which is attached a long, movable coxa, which is longer than the femur, and has at its free end an elbow joint or first trochanter, to which is attached the second trochanter, a segment of triangular side view; the second trochanter and femur together almost equal the coxa; the tibia is a little shorter; the tarsus is reduced to a pretarsus in the form of a sickle shaped, or appendiculate single claw. The spiracles are very minute.

The head capsule of an intermediate stage measures from base to tip 0.29 mm., from base to margin of gena 0.25 mm., and in breadth 0.25 mm.

The head capsule of a fully matured larva (plate I, fig. 4) measures from base to tip 0.64 mm., from base to margin of gena 0.58 mm., and in breadth 0.54 mm.

Pupa (plate I, fig. 6): Length 2.29 mm.; breadth 1.37 mm. White, normal in form and not forecasting the peculiarities of the adult except that the head is ventral to the prothorax. The elytra are latero-ventral, leaving the entire dorsum exposed. The spiracles are dorsal. Prothorax dorsally is biemarginate. The seventh dorsal segment has a pair of lateral apical tubercles.

7. Exema pennsylvanica, new species.

Described from 2 ♂, 6 ♀ labelled Allegheny County, Pennsylvania, two bearing the collector's label, Klages. This species has probably gone under the name *E. conspersa* in collections, but, as we have seen, the latter is a California species.

Male: Length 2.4-2.5 mm.; breadth 1.5 mm., or 60-66% longer than broad. Black, except for orange to reddish markings as follows: The markings of the face are squared and resemble a formalized capital Greek psi; the yellow areas are more or less free of punctures, but outlined by them; on each side of vertex next to eyes is an oblong spot separated from a median zone by a row of punctures; the median zone at back is black, and coarsely punctate; then there is a short punctate yellow area, and in front of this an oblong spot which merges into two branches outlining the frontal sutures; a tiny yellow spot within a rim of black punctures in the ocular emarginations; and the scape of the antennae. The suprascrobal area, front of frons and clypeus, genae, and a corner of occiput behind eyes are black. The labrum is shining brown. The thorax is marked with red to orange color on the front margin of the posttergite, and in a narrow vertical column, as wide as between the eyes, and sometimes in a spot on the lower anterior angles; the palpi, spots on the femora, subbasal and subapical rings on the tibia and the tarsi are also of the same color.

The vertex is irregularly punctate, with a cluster of punctures in the median zone, few at sides. Ocular emargination acute angulate with a triangle of marginal punctures. The central spot connecting vertex with front is smooth; front is evenly, sparsely punctate. The black suprascrobal area is smooth, not elevated as in *E. dispar canadensis*. The labrum is transverse, shining, apically setose, and of entirely different texture from the face.

Prothorax with collar-like acrotergite separated from posttergite by the antecostal suture which is represented by a line of deep punctures. Posttergite greatly bluntly elevated, with two median subparallel carinae separated by two rows of coarse punctures. From the crest of these carinae diverge anteriorly a pair of diagonal twice-broken carinae. Surface densely, and coarsely punctate. Scutellum with longitudinal median carina to middle, posterior portion sloping, surface minutely granulate.

Elytra with anterior tubercles ascended by strigose lines. Tubercles acute; interspaces consist of coarse, deep, crater-like, setigerous punctures, separated only by their edges. Entire surface also minutely granulate.

Prosternal basisternite (plate II, fig. 4) squarely truncate, with sides almost parallel, posteriorly narrowed to a slender stem, margins raised, disc deeply pitted with large contiguous punctures.

Sternum of thorax and abdomen, and exposed portions of legs deeply pitted with almost contiguous setigerous punctures, the whole surface minutely granulate.

Pygidium very deeply and coarsely punctate, and tricarinate; the median carina separated from the shorter outward curving discal carinae by a row of deep punctures with a slightly raised cross bar in the middle.

Female: Length 2.3 mm., breadth 1.6 mm., or 43% longer than broad. Differs from male in the following particulars: The orange of the thorax is reduced and sometimes does not extend laterally on the margins of the antecostal suture; the median area of vertex, emargination of eyes, and clypeus is black; punctuation of face is much more regular. Pygidium with punctures smaller, sparser, and carinae less acute. Last ventral segment with a round depression containing smaller punctures than surrounding surface.

One paratype has scattered orange dots on elytra.

8. Exema inyoensis, new species.

Described from one ♂ from Pine Creek, Round Valley, Inyo County, California, July 26, 1921, L. L. Muchmore 2197, on "sage," probably *Artemisia tridentata*.

This species is related to *pennsylvanica* and *jenksi* in face markings and prothoracic sculpture.

Male: Length 2.70 mm., breadth 1.66 mm., or 62% longer than broad. Shining black, with orange brown spots on frontal slope of prothorax and head; antennae, funicle and club, and tarsi reddish brown.

Face minutely granulate; densely, coarsely punctate with setigerous punctures. The color marks are very irregular due to

black punctures; irregular bars next to eyes, narrowly connected to bands entering ocular emarginations, and centrally to an impunctate spot, which is continued on a narrow punctate frontal triangle; scape of same color as spots. The black suprascrobal area is coarsely punctate. Labrum transverse, shining yellow brown, setigerous.

Prothorax with antecostal suture depressed, containing transverse punctures; acrotergite narrow, minutely granulate; with a row of coarse, shallow punctures. The entire surface of the posttergite is densely, coarsely and deeply punctate with setigerous punctures, and with the surface of pits, walls, and tubercles minutely rugose at right angles to directions of walls. There are four orange spots on the anterior margin and two at the beginnings of the median carinae. Between these carinae are two rows of deep punctures. From the crests of these carinae branch a pair of diagonal carinae, and there are minor rugosities and carinations.

The scutellum is bluntly carinate to middle, thence to each apical angle, with its surface minutely transversely rugose.

The elytra are exceedingly roughly sculptured with deep basal striations, and the walls of the punctures very irregular and jagged, but all punctures are setigerous.

Prothoracic basisternite broadest at base, which is almost straight, very slightly narrowed and sides parallel a short distance thence narrowing to the stem, transversely impressed behind apex, lateral edges not elevated, surface closely covered with coarse, shallow punctures, whose walls are minutely transversely rugulose.

Entire under surface closely, deeply punctate with setigerous punctures, with the surface of pits and walls finely rugulose. Legs punctate and minutely granulate; femora and tibiae entirely black. Last abdominal segment medianly broadly depressed, faintly punctate. Pygidium with median carina and two irregular discal carinae; punctures setigerous, broad and shallow, with surface minutely rugulose.

9. Exema deserti, new species.

Described from a single male specimen from Victorville, San Bernardino County, California, on the Mojave Desert, collected by George Pierce Mackenzie, May 20, 1939.

Male: Length 2.66 mm.; breadth 1.62 mm., or 64% longer than broad. Yellow and black, with the yellow predominating dorsally, and the black ventrally. Face yellow, except eyes, condyle of scape, a very narrow clypeal band, and a few black punctures on vertex. Prothorax yellow, with a few black spots, and black punctures. Elytra mainly yellow, especially on the tubercles, with suture, and most punctures, and scattered black

spots. Front femora yellow; middle and posterior femore with yellow apex; tibiae yellow with black median band. Ventral surfaces black, except a long spot on metepimeron, and spots on the first and fifth visible ventral segments. Pygidium with yellow spot opposite the one on fifth ventral on each side.

Entire surface minutely granulose.

Face sparsely punctate, each puncture minutely setigerous. The frontal elevation of prothorax is shining yellow, sparsely punctate. The thorax is much smoother than in most of the forms studied, with the median carinae indistinct, and extending only a short distance, with a confused double series of punctures between. Elytral tubercles low, smooth, more finely punctate than the intervals between. Pygidium with median carina complete, secondary carinae barely manifest, except that the outer side is emphasized by the deep lateral depressions; punctures deep, moderately close; with surface very minutely granulose striate.

9b. Exema deserti boregensis, new subspecies.

Described from one female, collected at Borrego, Imperial County, California, December 1, 1939, by George Pierce Mackenzie.

Female: Length 2.45 mm.; breadth 1.58 mm., or 55% longer than broad. This specimen differs but little from the Victorville specimen, other than this difference in body proportions, which seems to be the normal sexual difference, but I would prefer that the allotype of *deserti* when described should be from the type locality.

The pygidium has the three carinae well defined, and the anterior margin wavy carinate, punctures very deep at base, moderately close and deep throughout; orange spot on each side.

10. Exema globensis, new species.

Described from 1 ♂, 1 ♀ specimens from wheatfields near Globe, Arizona, collected August 2, 1925, by D. K. Duncan.

Face entirely orange yellow, including suprascrobal area, and clypeus, except on its front edge; punctures irregular. Thorax yellow in front half, posteriorly black, with scattered reddish spots. Elytra more or less evenly blotched black and reddish orange. Front femora orange yellow, other femora and tibiae with black junctions and central band. Basisternite (plate II, fig. 1) with central depressed area reddish. Ventral sclerites spotted with orange red on sides; pygidium predominantly black, with orange red spots on apical half.

Thoracic median carina in front separated by several rows of black punctures, and behind by two parallel rows of punctures. All punctures minutely setigerous. Otherwise the thorax

is but moderately tuberculose, not evidently carinate. The elytra are but moderately roughened with rounded tubercles, the most prominent of which are anteriorly concave. The pygidium is medianly faintly carinate, and rather densely punctate.

Female: Length 2:41 mm.; breadth 1.58 mm., or 52% longer than broad.

Differs from male only in having more yellow on thorax; and the pygidium is tricarinate, quadrisulcate, and yellow except at base, and in apical median area.

11. Exema chiricahuana, new species.

Described from 5 ♂, 3 ♀ collected July 3-5-10, 1908, in the Chiricahua Mountains, Arizona, by V. Owen; all in the Los Angeles County Museum.

Male: Length 2.6 mm.; breadth 1.6 mm., or 62% longer than broad. Black, roughly tuberculate; with yellow to orange colored blotchings on head and prothorax, and a few spots on elytra; antennae and blotchings on legs, orange to reddish; a few blotches on abdomen. A lateral spot on each side of pygidium may be present or absent.

All of head concealed in thorax, except face. Vertex, including the projections into emarginations of eyes, and frons, scape and labrum orange yellow, but punctures darker to black; eyes, a ring around antennal fossa, a narrow clypeal strip, and parietals black. Eyes finely granulate; deeply emarginate, with antennal fossa opposite lower lobe and slightly intruding into emargination; emargination about as wide as deep. When at rest the mandibles, maxillae and palpi fit into a socket in the raised prothoracic basisternite. The scape of antennae fits into a diagonal groove immediately in front of and truncating the eyes; the funicle and club lie in a groove between head and prothorax, which extends across prosternum between the basisternite and the pleura. This concealed portion of the antenna is darker, more reddish than the scape.

Prothorax is widest at base, almost as wide as humeri, with sides strongly diagonal, apex rounded and not more than half the width of base; posterior margin bisinuate, medianly with posterior lobe. Surface deeply punctate, roughly gibbous, irregularly blotched with dark reddish or orange.

The microstructure of the surface of the prothorax in front shows ultra-minute radiating striae in each puncture and over the intervening walls. In this character *chiricahuana* is allied to *deserti, boregensis, parvisaxi* and *globensis,* all from desert regions of California and Arizona. For this reason they might all be treated as races of a single species, but such a decision should await larger series and dissections.

The anterior margin or acrotergite is a collar limited by the antecostal suture, which is represented by a line of deep punctures. Anteriorly the thorax is almost perpendicular, then tumidly convex, and posteriorly sloping; the tumid disc is medianly channeled with two rows of punctures, between two carinae which extend to the middle. Behind this two diagonal ridges converge on the middle. The tumid disc is limited by a more or less circular depression. The scutellum is anvil-shaped, fitting the median lobe of prothorax, and with base and apex concave.

The elytra interlock with the scutellum, and are basally sinuate; medianly saw-edged, dovetailing; apically squarely truncate, but emarginate at junction of elytra; laterally broadly S-sinuate. Humeri umbonate; each elytron with about 12 tubercles, including humeri arranged diagonally in four rows; one at base in middle of anterior curve; three near humeri; two in row with basal one; one at outer apical angle; one at middle of side; the other on the lateral slope. Elytral punctuation deep, irregular, with striae twisted; each puncture bearing a fine white scale-like seta; even the tubercles are punctate.

The undersides are greatly modified for the concealment of legs and head appendages, due to the sulling habits of the beetle.

The prothorax has a pleural ridge from humeral angle to the antennal fossa in front of the eyes. From this ridge, except near the antennae, where the coxae are attached, the surface is steeply declivous to form the fossa for the anterior legs. Between the coxa and the basisternite is a deep fossa for the antennal funicle and club (see plate II, fig. 3). The basisternite is raised, anteriorly broadest and cupped for the mouth parts, transversely impressed behind apex, coarsely punctate.

The mesothorax is very short, with coxae in contact, and lateral part punctate depressed in the fossa occupied by the two front pairs of legs. This fossa also is composed of an anterior smooth portion of metathorax, the median portion of which is deeply punctate with broad episternum, and the posterior portion deeply fossate for posterior legs. All sternal punctures are minutely setigerous.

The legs are blotched black and brownish, and fit perfectly into the grooves. The tarsi with first three joints broadly bilobed, with long white fringe. Claws appendiculate.

The abdomen is greatly distorted; the first segment anteriorly forming part of coxal cavity, laterally broad, surrounding the following segments, and almost cutting them from elytral contact; second and fourth very narrow bands, fifth broader, encircling the vertical pygidium, which is coarsely punctate throughout, with four longitudinal impressions, a median ridge

the entire length, and two lateral ridges, reaching beyond the middle, and a bar ridge connecting the three near base, beyond which they are more widely separated. All abdominal punctures minutely setigerous.

Female: Length 2.8 mm.; breadth 1.8 mm., or 55% longer than broad. Very similar to male, but with the light colored area of face smaller, subtriangular, with a more or less disconnected branch into ocular emargination, which is triangular and about as deep as broad. Anterior portion of face, except labrum, black.

Pygidium apically broader, with few punctures in apical half, the three carinae distinct. Fifth abdominal segment medianly with large circular depression.

12. Exema parvisaxi, new species.

The name is the Latin designation for the type locality. Described from 4 ♂ collected at Little Rock, Los Angeles County, California, by George Pierce Mackenzie, September 10, 1939.

Female: Length 2.83-3.08 mm.; breadth 1.8-2.0 mm., or 51 to 54% longer than broad. Black, with face all dull yellowish, except eyes, and narrow clypeal band; prothorax with anterior vertical slope yellow clear around, beginning opposite antennal scape, but with collar-like acrotergite dark leathery brown; and two spots of black punctures in middle of yellow band opposite eyes; anterior and median femora dorsally yellowish; anterior tibiae basally and apically externally and entirely internally yellow; posterior legs black, or but slightly tinted externally.

Paratype 4 has the stature and sculpture of the other three but has the markings of typical *deserti,* indicating that this may only be a race.

Facial punctuation sparse, with a round bare spot on vertex. The punctures in the yellow anterior portion of prothorax are sparse and irregular, and appear to have a golden center; punctuation on the black areas is deep, and dense. The two median carinae are separated by about four rows of punctures, just above the smooth yellow area, and then narrow to two rows of punctures.

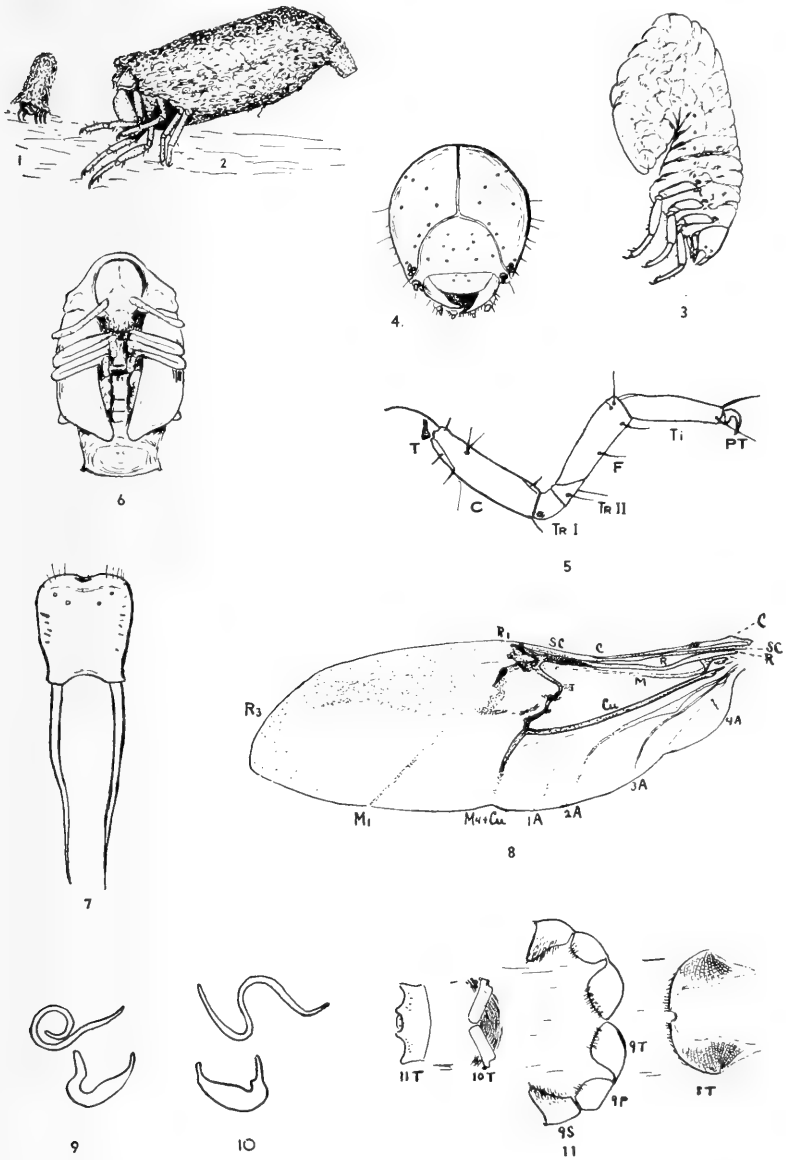
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PLATE 1

Illustrations

PLATE I — *Exema jenksi*

Fig. 1 —First stage larva in inverted egg case.

Fig. 2 —Mature larva in case, showing egg case as nipple.

Fig. 3 —Mature larva removed from its case.

Fig. 4 —Face of mature larva.

Fig. 5 —Ventral side of right posterior leg. Lettering of Fig. 5—T, trochantin. C, coxa. TrI, TrII trochanter. F, femur. Ti, tibia. PT, pretarsus.

Fig. 6 —Venter of pupa.

Fig. 7 —Hypopharyngial plate of adult ♀ (paratype 9).

Fig. 8 —Wing of ♂ (paratype 5). Lettering of Fig. 8—C, costa. SC, subcosta. R, radius. M, medius. Cu, cubitus. A, anal veins.

Fig. 9 —Spermathecae of ♀ (paratype 10).

Fig. 10—Spermathecae of another ♀ (paratype 11).

Fig. 11—Tergites 8, 9, 10, 11, and pleurites and sternites 9 of ♀ (paratype 6).

PLATE II—Basisternites of five species.

Fig. 1—*Exema globensis.*

Fig. 2—*Exema dispar canadensis.*

Fig. 3—*Exema chiricahuana.* C, clypeus. F, frons. G, gena. L, labrum. Md, mandible. Mx, maxilla. AF, antennal fossa. PN, pronotum. Cx, coxa. IBS, invaginated portion of basisternite.

Fig. 4—*Exema pennsylvanica.*

Fig. 5—*Exema jenksi.*

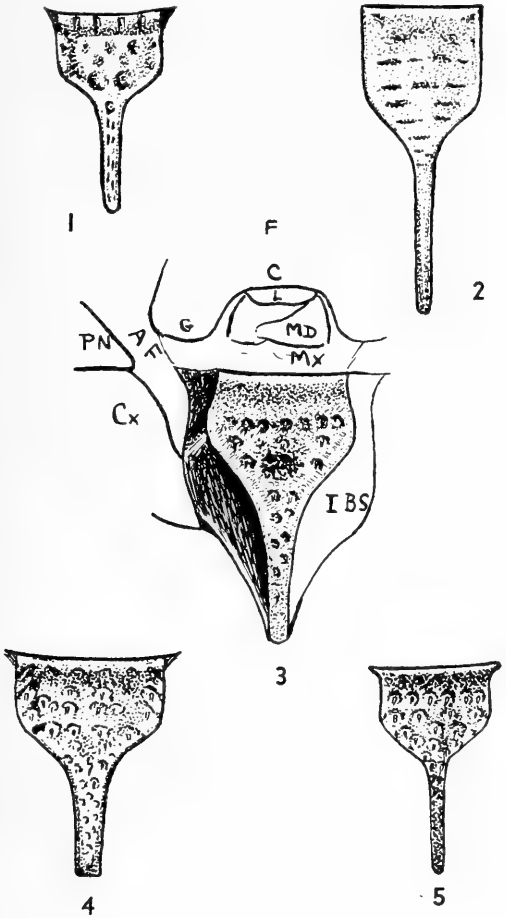

PLATE 2

A GENERIC REVISION OF THE TRIBE METHIINI

(*COLEOPTERA, CERAMBYCIDAE*)

By E. Gorton Linsley

University of California

The longicorn tribe Methiini has long been in need of a thorough revisional study. A number of factors have combined to make this impractical. The most important of these has been the impossibility of obtaining an adequate amount of material for examination. Most of the species are rare and many are known only by the type specimens. Some of these it has not as yet been possible to examine. Those few species which are known in series exhibit a perplexing amount of individual variation, and single specimens, particularly in *Methia*, are often difficult to place. Biological facts are all but unknown for the majority of species since the representatives in most collections have been simply captured at light. However, although the time is still far from ripe for a comprehensive study of the group, it has seemed desirable to present a reclassification of the genera with the hope that it may lead to a more complete revision at some period in the not too distant future.

The tribe Methiini has had a confused history. Thomson (1860), who first proposed a higher category for the group, placed it in the subfamily Lamiinae (Lamiitae). This arrangement was accepted by Lacordaire (1872), LeConte (1873), and LeConte and Horn (1883), although at the same time the latter authors pointed to affinities with *Oeme* in the Cerambycinae. Lameere (1901) removed the group from the Lamiinae but made no suggestion as to its true position. Gahan (1904) agreed that the tribe was not Lamiine and referred it to the Cemambycinae near the Oemini. A few years later (1908) he reiterated this opinion, stating that the "Methiini . . . agree completely with the Cerambycid group Oemini, and ought to be incorporated in that group." Craighead (1923), on the basis of larval characters, confirmed the close relationship of the *Oeme* and *Methia* groups but took no stand as to the distinctiveness of the tribes. Recent workers have maintained the two tribes largely because they exhibit dissimilar habits, a few structural differences, and a different facies. Until the groups can be given a thorough comparative study, it would seem advisable to follow this current usage.

Tribe Methiini Thomson

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Thomson, 1864, Systema Ceramb., pp. 92, 341, *Methitae*.
Lacordaire, 1872, Genera Coleopt., 9: 465, *Methiides*.
LeConte, 1873, Smithson. Misc. Coll., XI, 265: 347.
LeConte and Horn, 1883, Smithson. Misc. Coll., XXVI, 507: 333.
Leng and Hamilton, 1896, Trans. Am. Ent. Soc., 23: 162.
Lameere, 1901, Ann. Soc. Ent. Belg., 45: 315.
Gahan, 1904, in: Distant, Insecta Transvaalensis, part 5, p. 108.
Gahan, 1908, Ann. Mag. Nat. Hist., (8) 1: 162.
Linsley, 1932, Pan-Pac. Ent., 8: 120.

Head short, front vertical; antennae slender, usually longer than the body in both sexes, scape more or less conical, second segment small, transverse, sometimes obsolete; eyes large, usually coarsely granulated, deeply emarginate or divided; mandibles short, broad at base; ligula corneous; palpi short, unequal, maxillary palpi usually truncate at apex. Pronotum cylindrical, rounded, or slightly angulate at sides; scutellum concave; anterior coxae prominent, subconical, cavities very narrow, not attaining posterior margin of coxae; intermediate coxae contiguous, cavities confluent and open to epimera. Elytra usually abbreviated, not entirely covering abdomen, apices rounded, rarely dehiscent; wings scarcely folded at apex. Legs slender; femora sometimes clavate; anterior tibiae arcuate with an oblique groove along inner side; tarsi short. Abdomen usually elongate and cylindrical, rarely greatly abbreviated, usually with six visible sternites in the male, five in the female.

The tribe Methiini is strictly an American group. The known genera may be separated as follows:

TABLE OF GENERA OF METHIINI

1. Eyes with dorsal and ventral lobes connected posteriorly by a line or by one or more rows of facets; second segment of antennae distinct but sometimes small; abdomen with sternites not imbricated at sides in female 2

   Eyes with dorsal and ventral lobes completely separated, not connected by a line or row of facets; second segment of antennae obsolete; abdomen with sternites imbricated at sides in female ..... *Tessaropa*

2. Eyltra gradually narrowing apically, suture entire; abdomen much longer than metathorax; posterior tarsi cylindrical, first segment at least twice as long as broad 3

   Elytra dehiscing suddenly from base, suture deeply arcuate; abdomen abbreviated, shorter than metathorax; posterior tarsi broad, flat, first segment barely longer than broad . *Coleomethia*

3. Antennae with basal segments not distinctly thickened, more slender than scape, third segment longer than scape; pronotum cylindrical or rounded at sides; posterior tarsi less than half as long as tibiae 4

Antennae with basal segments thickened, as wide as scape, third segment shorter than scape; pronotum armed with an obtuse lateral tubercle; posterior tarsi more than half as long as tibiae ..... *Pseudomethia*

4. Pronotum longer than broad, subcylindrical, sides parallel or very feebly convex; femore clavate ..... *Styloxus*

Pronotum as wide as or wider than long, sides rounded; femora slender, not clavate ..... *Methia*

Genus Tessaropa Haldeman

Tessaropa Haldeman, 1847, Proc. Am. Philos. Soc., 4: 375; Linsley, 1932, Pan-Pac. Ent., 8: 120.

Dysphaga LeConte, 1852, Jour. Acad. Nat. Sci. Phila., (2) 2: 143; Thomson, 1860, Class. Ceramb., p. 128; Thomson, 1864, Syst. Ceramb., p. 387; Lacordaire, 1872, Genera Coleopt. 9: 467; LeConte, 1873, Smithson. Misc. Coll., XI, 265: 348; LeConte and Horn, 1883, Smithson. Misc. XXVI, 507: 334; Leng and Hamilton, 1896, Trans. Am. Ent. Soc., 23: 162.

Tessaroptes Gemminger and Harold, 1873, Catal. Coleopt., 10: 3063.

Form slender, somewhat flattened. Head with vertex moderately impressed between antennal bases; antennae slender throughout; antennae longer than the body in both sexes, about twice as long as body in male, segments densely pilose, scape only moderately robust, subconical, second segment obsolete, third segment much longer than scape, subequal in length to fourth segment; eyes moderately finely granulated, widely separated above and below, completely divided, dorsal and ventral lobes not connected by a line or by a row of facets; palpi atrophied. Pronotum nearly as long as broad, sides rounded; scutellum longer than wide, norrowly rounded, posteriorly. Elytra distinctly longer than basal width, gradually narrowing apically, suture entire, apices separately rounded. Legs moderately short; femora very feebly clavate; anterior tibiae strongly bent, oblique sinus distinct, posterior tibiae sinuate, longer than femora; tarsi slender, subcylindrical, posterior pair short, distinctly less than half as long as tibiae, moderately broad, first segment short, not as long as following two segments together. Abdomen flattened, sternites imbricated at sides; fifth sternite hairy, deeply, angularly notched in female, broadly emarginate in male.

Genotype: *Tessaropa tenuipes* Haldeman (Thomson designation, 1864).

Tessaropa may be separated from all other genera in the tribe by the completely divided eyes, obsolete second antennal segment, and imbricated abdomen. The posterior tarsi are quite short with the first segment not as long as the following two united. Five species have been referred to the genus by recent writers. One of these, *debilis* Horn, should be transferred to *Methia*. The same is probably true of *bicolor* Horn, although the latter species is known to the writer only by description.

Tessaropa tenuipes Haldeman

Tessaropa tenuipes Haldeman, 1845, Proc. Acad. Nat. Sci. Phila., 1845: 126.

Tessaropa tenuipes, Haldeman, 1848, Proc. Am. Philos. Soc., 4:374.

Dysphaga tenuipes, LeConte, 1852, Jour. Acad. Nat. Sci. Phila., (2) 2: 143; LeConte, 1873, Smithson. Misc. Coll., XI, 265: 348; Horn, 1895, Proc. Calif. Acad. Sci., (2) 5: 247; Leng and Hamilton, 1896, Trans. Am. Ent. Soc., 23: 163; Girault, 1904, Ent. News, 15: 299 (habits); Craighead, 1923, Can. Dept. Agr. Bull. (n.s.) 27: 40 (larva); Knull, 1932, Ent. News, 43: 62 (habits).

Tessaropa ventralis Haldeman, 1848, Proc. Am. Philos. Soc., 4:375.

Male: Color black, elytra yellowish brown at base, darker brown apically, abdominal sternites dark brown; pubescence thin, cinereous. Head narrower than base of elytra, dullish, moderately coarsely, closely punctured, clothed with fine, short, erect pubescence; eyes much more widely separated below than above, dorsal margin of lower lobe straight; antennae at least twice as long as body, scape moderately coarsely, closely punctured, remaining segments finely punctured. Pronotum widest behind the middle, surface finely, closely punctured with coarse punctures superimposed, pubescence long, erect, fine, moderately dense; stridulatory plate of mesonotum more or less evenly convex, without a median ridge. Elytra at least twice as long as pronotum, about half as long as abdomen; surface scabrous, without evident costae. Legs slender; femora finely, closely punctured, sparsely clothed with fine, erect hairs; tibiae finely, closely punctured, moderately densely clothed with longer, erect hairs. Abdomen brown, sternites shining, finely punctured, sparsely clothed with fine, pale hairs. Length: 4.5-5 mm.

Female: Color black, abdomen wholly or partly yellowish; antennae but little longer than body. Length: 4.5-5.5 mm.

Type locality: Pennsylvania.

Distribution: Eastern North America: New York, New Jersey, Pennsylvania, Indiana.

Genus Coleomethia Linsley, new genus.

Form short, robust; integument coarsely punctate. Head with vertex moderately impressed between antennal bases; antennae slender throughout, longer than the body in both sexes, more than twice as long as body in male, segments densely pilose externally, scape subconical, without an apical cicatrix, second segment distinct, transverse, third segment much longer than scape, a little longer than fourth segment; eyes small, finely granulate, widely separated above and below, very deeply emarginate, nearly divided; maxillary palpi slender, acute at apex. Pronotum a little wider than long, rounded at sides; scutellum transverse, obtusely triangular. Elytra taken together not quite twice as long as basal width, dehiscing suddenly from base, suture arcuate, apices separated by nearly twice their width, inner angle obtuse, outer angle rounded; wings milky white. Legs elongate; femora very slender, not clavate; tibiae longer than femora, slightly swollen apically and clothed with dense, scopa-like pubescence; tarsi very short, broad, flat, posterior pair about one-eighth as long as tibiae, first segment barely longer than broad, shorter than following two segments together, segments two and three broader than long. Abdomen greatly abbreviated, much shorter than metathorax.

Genotype: *Methia evaniformis* Knull.

This genus may be readily distinguished from all other members of the tribe by the dehiscent elytra, greatly abbreviated abdomen (shorter than the metathorax), and the very short, broad, flat tarsi with the first segment barely longer than broad. From *Methia* it further differs in the widely separated eyes, coarse punctation, and acute maxillary palpi. The form of the elytra is much more suggestive of the tribe Rhinotragini than of any other known Methiini.

Coleomethia evaniformis (Knull)

Methia evaniformis Knull, 1937, Ohio Jour. Sci., 37: 306, pl. 1, f. 3.

Male: Form short, stout; color black, antennae and their tubercles reddish-brown, elytra testaceous, legs piceous. Head narrower than base of elytra, coarsely, contiguously punctured, clothed with fine, short, erect pubescence; eyes separated more widely below than above; antennae about two and one-third times as long as body, scape moderately coarsely, closely punctured, moderately densely clothed with short, fine, erect pubescence, remaining segments finely punctured, densely pubescent, especially along outer margin. Pronotum widest at middle, surface coarsely, contiguously punctured with a transverse calloused area at base, pubescence moderately long, dense, fine; stridula-

tory plate of mesonotum more or less evenly convex, without a longitudinal ridge; prosternum transversely carinulate; metasternum coarsely, contiguously punctured at sides, more finely, sparsely on disk; metepisterna coarsely, contiguously punctured. Elytra longer and wider than pronotum; punctation fine, sparse at sides and in humeral area, moderately coarse, contiguous near suture. Legs slender; femora finely punctured, clothed with moderately long, erect, pale hairs; tibiae finely, closely punctured, densely clothed with piceous hairs. Length: 5 mm.

Type locality: Davis Mountains, Texas.

Distribution: Texas: Davis and Chizos Mountains.

Through the kindness of Mr. Knull I have been able to examine a specimen of this extremely interesting species. In appearance and structure it is unique in the Methiini. According to Mr. Knull the species is quite active when disturbed and in appearance is suggestive of an evaniid wasp.

Genus Pseudomethia Linsley

Pseudomethia Linsley, 1937, Ent. News, 48: 65.

Form slender, small; integument finely punctate. Head with vertex moderately impressed between the antennal bases; antennae a little longer than body in male, scape subconical, basal segments thickened and bearing a vague, dorsal, longitudinal, elevated line, second segment nearly as long as broad, segments three and four as wide as scape, third segment a little shorter than scape, distinctly shorter than fourth segment, segments five to eleven filiform; eyes coarsely facetted, distinctly separated above and below, deeply emarginate but not divided; maxillary palpi slender, truncate at apex. Pronotum a little wider than long, sides armed with an obtuse, post-median, lateral tubercle; scutellum transverse, feebly concave. Elytra longer than basal width, gradually narrowed apically, suture entire, apices narrowly, separately rounded. Legs moderately short; posterior femora slender, not clavate; anterior tibiae straight, without a distinct oblique sinus, posterior tibiae not sinuate, but little longer than femora; posterior tarsi slender, subcylindrical, more than half as long as tibiae, first segment distinctly longer than following two together. Abdomen elongate, with six visible tergites and sternites.

Genotype: *Pseudomethia arida* Linsley (by original designation).

This genus differs from all other known members of the tribe in the basally thickened antennae with the third and fourth segments as wide as the scape, the short third segment of the antennae, the laterally tuberculate pronotum, and the elongate tarsi. The following is the only known species.

Pseudomethia arida Linsley

Pseudomethia arida Linsley, 1937, Ent. News, 48: 66, fig.

Male: Color uniformly brownish testaceous, eyes black; integument feebly shining. Head as wide as base of elytra; eyes narrowly rounded beneath, less widely separated below than above, separated above by about the diameter of antennal scape, dorsal and ventral lobes connected posteriorly by three or four rows of facets; vertex finely, closely punctured with coarser punctures superimposed; antennae about one and one-fourth times as long as body, sparsely clothed with very short, fine, micropubescence with a few, scattered, long, erect, cilia intermixed. Pronotum dull, very finely, closely punctured with coarser punctures superimposed, surface clothed with short, fine, suberect, pale hairs intermixed with longer erect setae; stridulatory plate of mesonotum evenly convex, without a median longitudinal ridge. Elytra feebly shining, about twice as long as broad, not attaining apex of first abdominal tergite, surface very finely cribate with coarser punctures superimposed, costae not evident, surface sparsely clothed with very fine, pale, subdepressed pubescence. Legs dullish, very finely, densely punctured with coarser punctures superimposed, sparsely clothed with short, fine, pale, suberect hairs and with an intermixture of long erect setae. Abdomen shining; sternites finely, sparsely punctures and pubescent. Length: 7 mm.

Type locality: Ten miles west of Indio, California.

Genus Styloxus LeConte

Styloxus LeConte, 1873, Smithson. Misc. Coll., XI, 264: 239, 265: 348; LeConte and Horn, 1883, Smithson. Misc. Coll., XXVI, 507: 334; Leng and Hamilton, 1896, Trans. Am. Ent. Soc., 23: 162; Linsley, 1932, Pan-Pac. Ent., 8: 120, 122.

Idoemea Horn, 1880, Trans. Am. Ent. Soc., 8: 137; LeConte and Horn, 1883, Smithson. Misc. Coll., XXVI, 507: 334; Leng and Hamilton, 1896, Trans. Am. Ent. Soc., 23: 162.

Malthopia Casey, 1912, Mem. Coleopt., 3: 308.

Form elongate, slender, subcylindrical. Head with vertex deeply impressed between antennal tubercles; antennae slender throughout, nearly twice as long as body in male, about as long as body in female, second segment small, transverse, third segment longer than scape or fourth segment; eyes large, coarsely granulated, contiguous or narrowly separated in the male, distinctly separated in female, deeply emarginate but not divided; maxillary palpi truncate at apex. Pronotum distinctly longer than broad, sides parallel or a little obtuse; scutellum nearly as long as broad, subtriangular, narrowly rounded posteriorly.

Elytra much longer than basal width, sometimes covering most of abdomen, gradually narrowing to apices, suture entire, apices narrowly separated, rounded. Legs slender, posterior femora clavate; tibiae longer than femora; tarsi nearly one-half as long as tibiae, slender, subcylindrical, first segment more than twice as long as broad, about as long as following two together. Abdomen elongate, cylindrical, that of female with five visible sternites, the fifth hairy deeply, angularly excavated, fifth sternite of male broadly emarginate, revealing sixth sternite.

Genotype: *Styloxus lucanus* LeConte (by single reference).

Styloxus is very closely related to *Methia*, differing in the longer pronotum with the sides subparallel or feebly convex and in the clavate famora. Five species have been described, two from Texas (possibly not distinct), one from Arizona and southern California, one from California, and one from Lower California.

Styloxus lucanus LeConte

Styloxus lucanus LeConte, 1873, Smithson. Misc. Coll., XI, 264: 240; Hamilton, 1885, Trans. Am. Ent. Soc., 23: 162.

Male: Form moderately slender; color dark brown to reddish brown; pubescence pale, erect and suberect. Head nearly as wide as base of elytra; eyes rather broadly rounded beneath, widely separated beneath by at least greatest width of antennal scape, contiguous on vertex, dorsal and ventral lobes connected posteriorly by three rows of facets; vertex contiguously punctured, clothed with fine, pale, suberect hairs; antennae about twice as long as body, scape armed with a stout, apical tooth, clothed with fine pale hairs, those along inner side about as long as width of scape, second segment transverse, segments three to ten subequal in length, eleventh segment shorter. Pronotum longer than broad, surface scabrous, pubescence long, erect, moderately dense; stridulatory plate of mesonotum more or less evenly convex, without a median ridge but with a fine, median, longitudinal, impressed line. Elytra not quite three times as long as basal width, about three-fourths as long as abdomen; sides narrowed a little beyond middle; surface moderately coarsely, closely, shallowly punctured, humeri more finely punctured; pubescence fine, moderately short, suberect; apices separately rounded. Legs moderately densely clothed with long, erect, pale, flying hairs. Abdomen with sternites very finely scabrous, clothed with short, fine, pale hairs. Length: 7-12 mm.

Female: Antennae shorter than the body, outer segments greatly abbreviated; eyes separated on vertex; elytra more elongate but not attaining apex of abdomen. Length: 8-11 mm.

Type locality: Cape San Lucas, Lower California.

Distribution: Cape Region of Lower California.

Genus Methia Newman

Methia Newman, 1842, Entom., 1: 418; LeConte, 1852, Jour. Acad. Nat. Sci. Phila., (2) 2: 144; Thomson, 1860, Class. Ceramb., p. 128; Thomson, 1864, Systema Ceramb., p. 387; Lacordaire, 1872, Genera Coleopt., 9: 466; LeConte, 1873, Smithson. Misc. Coll., XI, 265: 348; LeConte and Horn, 1883, Smithson. Misc. Coll., XXVI, 507: 334; Leng and Hamilton, 1896, Trans. Am. Ent. Soc., 23: 162; Melzer, 1923, Rev. Mus. Paulista, 13: 529; Linsley, 1932, Pan-Pac. Ent., 8: 120.

Thia Newman, 1840, Entom., 1: 18.

Form slender, subcylindrical. Head with vertex moderately impressed between antennal bases; antennae slender throughout, longer than the body in both sexes, nearly twice as long as body in male, segments ciliate, scape subconical, second segment small but distinct, third segment longer than scape, subequal to or longer than fourth segment; eyes large, coarsely faceted, contiguous or nearly contiguous above and below in male, a little more widely separated in female, deeply emarginate but not divided, dorsal and ventral lobes connected posteriorly by a line or by one or more rows of facets; maxillary palpi truncate at apex. Pronotum as wide as or wider than long, sides rounded posteriorly. Elytra longer than basal width, gradually narrowing apically, suture entire, apices narrowly separated, rounded. Legs elongate; femora moderately slender, not clavate; anterior tibiae strongly bent, oblique sinus distinct, posterior, tibiae longer than femora, sometimes moderately pilose; tarsi slender, subcylindrical, posterior pair nearly one-half as long as tibiae, first segment more than twice as long as broad, approximately as long as following two segments together. Abdomen elongate, that of female with five visible sternites and the fifth hairy, deeply, angularly excavated, that of male broadly emarginate, exposing sixth sternite.

Genotype: *Thia pusilla* Newman (by single reference).

Methia is widely distributed in America, with a single species each in Argentina and Brazil, two in the West Indies, one in southeastern United States, and the remainder (thirteen species) in southwestern United States and northern Mexico.

Methia pusilla (Newman)

Thia pusilla Newman, 1840, Entomologist, 1: 18.

Methia pusilla Newman, 1842, Entomologist, 1: 418; LeConte, 1852, Jour. Acad. Nat. Sci. Phila., (2) 2: 144; Leng and Hamilton, 1896, Trans. Am. Tnt. Soc., 23: 162.

Obrium? dejeanii Haldeman, 1847, Trans. Am. Philos. Soc., (2) 10: 42.

Female: Form elongate, slender; color pale testaceous, head and thorax slightly rufotestaceous, eyes black; pubescence short, pale, recumbent. Head distinctly narrower than base of elytra; eyes very broadly rounded beneath, scarcely extending below mouth parts, far more widely separated below than above, separated on vertex by approximately the width of the third antennal segment, on underside of head by more than twice the greatest diameter of the antennal scape, dorsal and ventral lobes connected posteriorly by a single row of facets; vertex coarsely but shallowly and indistinctly punctured behind eyes; antennae one and one-fourth times as long as body, sparsely hairy, scape slender, apical tooth not evident, second segment very short, much broader than long, usually at least in part concealed within the scape, third segment scarcely more robust than, and about one and one-sixth times as long as, fourth segment. Pronotum a little wider than long, sides strongly dilated at middle, basal constriction broad, deep, apical constriction narrow but distinct; disk with numerous callosities, surface concolorous; pubescence short, pale, recumbent, without an intermixture of longer, erect hairs; stridulatory plate of mesonotum feebly, more or less evenly convex without a median, longitudinal ridge. Elytra about four and one-half times as long as pronotum, about two and one-half times as long as broad; sides straight; costae feeble but evident; surface clothed with short, pale, recumbent pubescence, without an intermixture of longer, erect hairs; apices narrowly, separately rounded. Legs clothed with pale, suberect hairs; posterior tibiae straight; posterior tarsi with first segment a little shorter than the two following together. Abdomen dark brownish, fifth sternite pale testaceous and densely clothed with short, pale hairs. Length: 5-9 mm.

Male: Body brownish, elytra wholly or partly testaceous; eyes separated on vertex by about the width of the third antennal segment, on underside of head by a little less than twice the diameter of antennal scape; antennae not quite twice as long as body; elytra about two and one-half times as long as pronotum, about twice as long as broad; abdominal sternites piceous. Length: 5-8 mm.

Type locality: "East Florida."

Distribution: Southeastern United States.

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A STUDY OF THE NORTH AMERICAN MOTHS FORMERLY REFERRED TO DELTA SAALMÜLLER, WITH TWO NEW SPECIES (LEPIDOPTERA: PHALAENIDAE)

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Since Hampson's work appeared in 1909[1] the name *Delta*, proposed by Saalmüller[2] for a phalaenid from Madagascar, has been applied to certain moths from north and Central America. Because there are marked differences between the American moths and Saalmüller's generic description, and since there appears to be no available name for the group, I propose the following new generic name for our American species.

Nedra, new genus.

Genotype: *Cloantha ramosula* Guenée (Hist. Nat. Ins., vol. 6, p. 114, pl. 9, fig. 1, 1852).

Delta Hampson, in part (*nec* Saalmüller), Catalogue of the Noctuidae in the collection of the British Museum, vol. 8, p. 190, 1909.—Barnes and McDunnough, Check List of the Lepidoptera of Boreal America, p. 66, 1917.—Gaede, *in* Seitz, Die Gross-Schmetterlinge der Erde, vol. 7, p. 247, 1926.—McDunnough, Check List of the Lepidoptera of Canada and the United States (Part 1, Macrolepidoptera), p. 98, 1938.

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[1] Hampson, G. F., Catalogue of the Noctuidae in the collection of the British Museum, vol. 8, p. 190-199, 1909.

[2] Saalmüller, M., Lepidopteren von Madagascar, p. 263, 1891. (Genotype: *D. stolifera* Saalmüller [monobasic]).

Antenna ciliate. Labial palpus ascending, reaching to about middle of frons; first and second segments roughened with long scales in front; third segment small, conical, porrect. Frons convex, smooth, with a horizontal ridge of scales above; vertex with raised, horizontal ridge of scales. Eyes moderately large, round. Thorax with posterior divided crest; tegula long, smooth, extending to posterior edge of thorax.

Fore wing rather narrow, costa straight; termen slightly oblique, gently rounded from vein 3 to inner margin, weakly crenulate; cell about three-fifths length of wing, vein 2 from outer fifth of cell; veins 3, 4, and 5 from near angle of cell, approximate; 6 from apical corner of cell, connate with the stalk of 7, 8, and 9; 8 to apex, 9 to costa; 10 from near angle of cell forming small areole with stalk of 7, 8, and 9; 11 from outer third of cell. Hind wing rather broad, costa gently convex, apex rounded, termen crenulate; cell about one-half length of wing; 2 from slightly beyond outer third; 3 and 4 connate; 6 and 7 connate from apical angle of cell. Legs with strongly tufted tibiae. Hind tibia with spurs at posterior two-third and apex. Abdomen with dorsal series of crests on segments 1 to 3 inclusive.

Male genitalia—Symmetrical. Harpe broadest at middle; corona absent; clasper and ampulla present; clavus clothed with fine, short setae. Anellus with U-shaped ventral plate. Uncus simple. Vinculum moderately pointed. Vesica armed.

Female genitalia—Genital plate flat, broad, strongly sclerotized; ostium narrow, longitudinal. Ductus bursae always partly sclerotized. Ductus seminalis entering ductus bursae dorsally. Bursa copulatrix asymmetrical, with ductus bursae entering on right side, posteriorly; signa always present, multiple. Osipositor lobe small, weak, with elongate, sclerotized area dorsally. Collar of 8th segment broad, with median, sclerotized ventro-anterior area.

Remarks—This genus differs from *Delta* by the narrower fore wing and its longer cell, the origin of veins 2 and 11 farther out on cell, and the presence of dorsal crests on the thorax and abdomen.

The similarity of pattern between the American species and that of *stolifera* is strong but the details of the reniform immediately distinguish the former from the latter. Hampson's association of the American and Old World forms appears to be based entirely on similarity of pattern since, in the description of *Delta,* Saalmüller distinctly states that the abdomen is smooth, whereas the American species assigned to the genus by Hampson have the "Abdomen with dorsal series of crests," the character by which Hampson distinguished *Delta* in his key.

If the specimen of *Delta goniosema* Hampson in the U. S. National Museum is correctly identified, it is referable to *Nedra.*

KEY TO THE SPECIES OF *NEDRA* BASED ON COLORATION AND PATTERN

1. Orbicular round, black-edged, distantly removed from reniform ..... *stewarti* (Grote), p. —

   Orbicular elongate or oval, remote from, adjacent to, or fused with reniform 2

2. Orbicular remote from reniform, black-edged..*dora*, new species, p. —

   Orbicular adjacent to or fused with reniform 3

3. Reniform usually open, always fused with apical white or grayish shading; hind wing light fuscous, paler basally .... *ramosula* (Guenée), p —

   Reniform closed, strongly contrasted with dark ground color, no conspicuous light shading at apex of wing; hind wing dark fuscous ..... *hoeffleri*, new species, p. —

KEY TO THE SPECIES OF *NEDRA* BASED ON GENITALIA

Males

1. Anal spine of cucullus strong; ventral margin of harpe deeply excavated before cucullus (Fig. 3) ... *ramosula* (Guenée), p. —

   Anal spine of cucullus absent; ventral margin of harpe not deeply excavated before cucullus 2

2. Vesica armed with two stout thornlike cornuti (Fig. 1a)..... ..... *hoeffleri*, new species, p. —

   Vesica armed with three stout, thornlike cornuti (Figs. 2a, 7a)... 3

3. Aedeagus with sharp terminal tooth and conspicuous dorsal raised area (Fig. 2a) ..... *dora*, new species, p. —

   Aedeagus without sharp terminal tooth or dorsal raised area (Fig. 7a) ..... *stewarti* (Grote), p. —

Females

1. Ostium narrow and deeply V-shaped, edges sharply folded; bursa copulatrix with three long, strong signa (Fig. 8) .... *ramosula* (Guenée), p. —

   Ostium and bursa copulatrix otherwise 2

2. Ostium narrow, edges weakly crenulate; bursa copulatrix with three elongate, weak signa (Fig. 10). *hoeffleri*, new species, p. —

   Ostium narrow, edges smooth or crenulate; bursa copulatrix with four signa (Figs. 6, 9) 3

3. Ostium narrow, edges parallel, smooth; bursa copulatrix with two short and two long, moderately strong signa (Fig. 6) ..... *stewarti* (Grote), p. —

   Ostium narrowly V-shaped, edges slightly crenulate; bursa copulatrix with three large and one small signa (Fig. 9) .... *dora*, new species, p. —

Nedra ramosula (Guenée)

Plate 3, figures 3-3a; Plate 4, figures 4, 5; Plate 5, figure 8.

Cloantha ramosula Guenée, Hist. Nat. Ins., vol. 6, p. 114, pl. 9, fig. 1, 1852.—Grote, Bull. Buff. Soc. Nat. Hist., vol. 1, p. 83, 1873.

Auchmis ramosula (Guenée) Walker, List of the specimens of Lepidopterous insects in the collection of the British Museum, vol. 11, p. 616, 1857.

Actinotia ramosula (Guenée) Grote, Can. Ent., vol. 7, p. 28, 1875; id., Revised Check List of the North American Noctuidae (Part 1), p. 18, 1890.—Smith, List of the Lepidoptera of Boreal America, No. 2184, 1891; id., U. S. Nat. Mus. Bull. 44, p. 167, 1893.—Grote, Abhandl. Naturw. Ver. Bremen, vol. 14 (1), p. 42, 1895.—Dyar, U. S. Nat. Mus. Bull. 52, No. 1291, 1903.—Smith, Check List of the Lepidoptera of Boreal America, No. 1438, 1903.—Holland, The Moth Book, p. 173, pl. 20, Fig. 29, 1903.

Delta ramosula (Guenée) Hampson, Catalogue of the Noctuidae in the collection of the British Museum, vol. 8, p. 193, pl. 127, fig. 23, 1909.—Barnes and McDunnough, Check List of the Lepidoptera of Boreal America, No. 2515, 1917.—Gaede, *in* Seitz, Die Gross-Schmetterlinge der Erde, vol. 7, p. 247, 1926.—Johnson, *in* Procter, The Biological Survey of the Mount Desert Region (Part 1, The Insect Fauna), p. 75, 1927.—Forbes, *in* Leonard, Cornell University Agr. Exp. Sta., Memoir 101, p. 641, 1928.—Brimley, Insects of North Carolina, p. 275, 1938.—Procter, Biological Survey of the Mount Desert Region (Part VI, The Insect Fauna), p. 212, 1938.—McDunnough, Check List of the Lepidoptera of Canada and the United States (Part 1, Macrolepidoptera), No. 2589, 1938.

Male genitalia—Ventral margin of harpe deeply excavated before cucullus; cucullus moderately narrow, rounded; anal spine strong; clavus narrow, flattened, angulate distally; ampulla stout, flattened, extending slightly beyond costa; clasper stout, flattened distally. Anellus pointed anteriorly; lateral arm of ventral plate smooth except for a few minute spines at posterior tip; dorsal arm strongly sclerotized, narrow, furcate at base. Aedeagus long, stout, dilated distally, with a strongly sclerotized plate and a strong toothed projection disto-ventrally; opposite this, and slightly posterior to it, there is a small scobinate patch. Vesica with two broad, thornlike cornuti and an elongate, strongly sclerotized plate. Uncus moderately long, weak, bluntly pointed. Tegumen triangular.

FEMALE GENITALIA—Ostium deeply V-shaped, edges sharply folded. Bursa copulatrix with three long, strong signa.

Alar expanse, 28-38 mm.

TYPE—In the United States National Museum.

TYPE LOCALITY—"North America."

FOOD PLANT—*Hypericum.*

DISTRIBUTION—Eastern United States and Canada.

ARKANSAS: Hope, 7 ♂ ♂ (June to August dates; no collector).

CONNECTICUT: East River, ♂ ("September 1"), ♀ (August 19"), 2 ♀ ♀ (25-31-VIII-1908, Charles R. Ely).

DISTRICT OF COLUMBIA: Washington, ♀ (27-V-1882, Koebele).

FLORIDA: Gainesville, ♀ (15-III-1925, D. M. Bates).

ILLINOIS: Decatur, ♀ (16-23-VIII, no collector); Oconee, ♂ (June 24-30, no collector).

KENTUCKY: Louisville, ♀ ("VI-26", B. Nettelroth).

LOUISIANA: Lake Charles, 2 ♂ ♂ (16-XII-1922; 21-I-1933, Karl R. Coolidge).

MAINE: Sebec Lake, 5 ♂ ♂, 3 ♀ ♀ (June 16-30, no collector).

MARYLAND: Plummer Island, 2 ♂ ♂ (3-V-1904, R. P. Currie; 23-IX-1921, no collector).

MASSACHUSETTS: Attleboro, ♀ (11-VII-1936, R. H. Andrews and Lloyd M. Martin); Forest Hills, ♂, ♀ (10-V-1912, William Reiff); Newton Highlands, 6 ♂ ♂ (no date or collector).

MISSISSIPPI: Agricultural College, ♀ (October 1895, H. E. Weed); Greenville, ♂ (no date, George Dorner).

MISSOURI: St. Louis, ♂ (11-IX-1904, H. McElhose).

NEW JERSEY: Lakehurst, ♂, ♀ ("IV-26"; Sept. 21, 1930, Frederick Lemmer); Patterson, ♀ ("IV-16", no collector).

NEW YORK: Bear Mountain, ♀ (no date, H. J. Erb); Franklin County, ♀ (no date, C. S. McKnight); Greene County, 2,500 ft., ♂ (June, L. O. Howard); Lewis County, ♀ (September 5, 1878, W. W. Hill); 2 ♂ ♂ ("5-8-01" and "8-23-05", without exact locality or collector); Long Island, 2 ♂ ♂ (one, Richmond Hill, "VII-26", no collector; the other without date or collector).

North Carolina: Goldston, ♀ (April, no collector); Southern Pines, 2 ♀ ♀ (April 8-15; October 16-23, no collector).

Pennsylvania: New Brighton, 11 ♂ ♂, 4 ♀ ♀ (May to September dates, 1902 to 1910, H. D. Merrick); Oak Station, Allegheny County, ♀ (September 18, 1908, Fred Marloff); Pittsburgh, ♀ ("May 7", no collector); Wayne County, ♂, ♀ (no date or collector); White Mills, ♂ (July 2, 1906, no collector).

Rhode Island: Elmwood, ♂ (May 3, 1913, no collector).

Tennessee: Clarksville, ♂ (9-23-30, S. E. Crumb); Knoxville, ♂ (18-V-1928, no collector).

New Brunswick: Chamcook, ♀ (30-VII-1938, T. N. Freeman).

Nova Scotia: White Point Beach, Queens County, ♂ (18-VIII-1934, J. McDunnough).

Ontario: Algonquin Peak, ♀ (19-VI-1922, J. McDunnough); Eastman Springs, Ottawa, ♂ (19-VI-1907, C. H. Young); Point Colborne, ♂ (20-VII-1932, J. J. de Gryse); Queenston, 2 ♂ ♂, ♀ (30-VIII-1933, D. F. Patterson).

Remarks—This is the commonest species of the genus but is restricted to eastern United States and Canada. In addition to the specimens listed under distribution, I have a single male from the White Mountains, Arizona, which presumably is this species.

I am indebted to Dr. J. McDunnough for the food plant record. In the material he kindly lent me there were two reared specimens, the female and male from New Brunswick and Nova Scotia, respectively.

Nedra stewarti (Grote)

Plate 4, figures 6, 7-7a.

Actinotia stewarti Grote, Can. Ent., vol. 7, p. 128, 1875; id., Revised Check List of the North American Noctuidae (Part 1), p. 18, 1890.—Smith, List of the Lepidoptera of Boreal America, No. 2185, 1891; id., U. S. Nat. Mus. Bull. 44, p. 167, 1893.—Grote, Abhandl. naturw. Ver. Bremen, vol. 14 (1), p. 42, 1895.—Dyar, U. S. Nat. Mus. Bull. 52, No. 1292, 1903.—Smith, Check List of the Lepidoptera of Boreal America, No. 1439, 1903.

Delta steuarti (sic!) Hampson, Catalogue of the Noctuidae in the collection of the British Museum, vol. 8, p. 193, pl. 127, fig. 24, 1909.

Delta stewarti (Grote) Barnes and McDunnough, Check List of the Lepidoptera of Boreal America, No. 2516, 1917.—Seitz, Die Gross-Schmetterlinge der Erde, vol. 7, p. 247, pl. 36a, 1926.—McDunnough, Check List of the Lepidoptera of Canada and the United States (Part 1, Macrolepidoptera), No. 2590, 1938.

Male genitalia—Harpe tapering to the narrowly rounded cucullus; ventral margin not excavated before cucullus; anal spine absent; clavus narrow, slightly convex, fusing gradually with surface of harpe; ampulla very stout, straight, bluntly pointed; clasper very short, stout, compressed distally. Anellus broadly pointed anteriorly, lateral arm finely scobinate; dorsal arm moderately broad, convex. Aedeagus moderately long, with a small, disto-ventral, scobinate process; slightly posterior and dorsal to this is an elongate scobinate patch. Vesica with three stout, thornlike cornuti. Uncus short, weak. Tegumen convex laterally.

Female genitalia—Ostium narrow, edges parallel. Bursa copulatrix with two short and two long, moderately strong signa.

Alar expanse, 28-33 mm.

Type—In the British Museum.

Type locality—California.

Food plant—*Hypericum perforatum* L. (This record supplied by Mr. S. E. Crumb.)

Distribution—Western United States.

California: Eldridge, ♀ ("V-24," Jacob Doll); Inyo County, ♂ (August 15-30, O. C. Poling); ♂ (labeled "California" but no other data).

Oregon: Cottage Grove, ♂ (27-VII-1937, E. P. Chase); Corvalis, 2 ♂♂, ♀ (May 1, 1900, no collector; April 15-21, 1926, Ella Thompson; April 23, 1921, no collector); Salem, ♂, 2 ♀♀ (August 1, 1906, no collector).

Washington: Parkland, ♂ (May 20, 1934, S. E. Crumb No. 219); Spanway, 2 ♂♂, 3 ♀♀ (June 26 to July 9, 1934, S. E. Crumb, Nos. 215-18, 221); ♀ (Labeled "Washington Terr.," E. L. Graef).

Remarks — The female from Cotton Grove, Oregon has an unusually large, white reniform with only a small amount of dark scaling centrally. Otherwise it agrees with reared females from Washington State.

This species will probably be found in southern British Columbia also.

NEDRA DORA, new species.

Plate 3, figures 2-2a; Plate 5, figure 9.

In general appearance this species is much like *stewarti* but the brown of *stewarti* is entirely replaced by purplish fuscous and the lighter areas have a decided lavender-gray tint.

Antenna purplish fuscous annulated with gray basally. Labial palpus grayish fuscous, the scales tipped with gray, and irrorated with black. Head and thorax purplish fuscous irrorated with gray. Fore wing purplish fuscous; t.a. and t.p. lines indicated on inner margins by zigzag fuscous scaling; basal dash black, edged costad with creamy white, the latter color blending with pale gray which in turn becomes attenuated and is lost in the dark steel-gray of the costa; toward the inner margin the basal dash is bordered by purplish brown; from inner edge of cell to inner margin the wing is overlaid with pale gray, more strongly so toward tornus; orbicular rather large, elongate, edged with black; center of steel-gray scales tipped with paler gray; reniform large, closed, white, edged with black and with pale brown scaling in the center; reniform followed by a longitudinal pale brown shade, the latter bordered toward apex by pale gray; between the longitudinal, pale-brown shade and tornus the reniform is bordered by a broad purplish-fuscous shade, except for a pale-gray shade before termen between veins 2 and 5; before termen five sagittate, blackish-fuscous dashes between the veins (2 to 7), the longest dash between veins 5 and 6; cilia fuscous; with a purplish tint, except at the ends of the veins, where they are buff. Hind wing dark fuscous; cilia buff with a narrow fuscous subbasal band. Underside of wings dusted with reddish purple and with a conspicuous fuscous band at outer third. Legs purplish fuscous irrorated with gray and shaded with buff. Abdomen fuscous above, irrorated with purplish fuscous; beneath pale reddish buff.

MALE GENITALIA—Harpe broadest about middle, abruptly narrowed to the small, rounded cucullus; anal spine absent; clavus moderately broad, convex, rounded distally; ampulla broad (two-thirds the length), compressed, obliquely truncate, and extending slightly beyond costa; clasper short, stout, truncate. Anellus broad, pointed anteriorly; lateral arm broad, strongly toothed; dorsal arm broda, convex, strongly sclerotized. Aedeagus moderately long, stout, slightly curvey; distally, inside tip, a strong tooth with a group of minute ones basally; a prominent, flattened, raised area studded with small teeth distodorsally; vesica with three strong, thornlike cornuti. Uncus moderately long, pointed. Tegumen convex laterally.

FEMALE GENITALIA — Genital plate long; ostium narrowly V-shaped, edges weakly crenulate. Bursa copulatrix with three large and one small signa.

Alar expanse, 31-34 mm.

TYPE—In the Los Angeles County Museum, Los Angeles, California.

TYPE LOCALITY—Grizzly Flats, Eldorado County, California. (August 10, 1938, E. P. Chase.)

FOOD PLANT—Unknown.

REMARKS—Described from the type female and three male and one female paratypes, all with the same data. Two male paratypes in the Los Angeles Museum, one paratype of each sex in the U. S. National Museum (No. 53951).

This species is closely related to *stewarti,* which it closely resembles, but differs from *stewarti* by the absence of the dominant brown color and by the buff cilia of the hind wing. In the male genitalia the chief differences lie in the aedeagus; the sharp terminal tooth and dorsal raised area are absent in *stewarti.* In the female the edges of the ostium converge to form a narrow "V" in *dora,* but in *stewarti* they are parallel. The genital plate of *dora* is much longer than that of *stewarti.*

I am indebted to Dr. J. A. Comstock for the entire series of this species.

NEDRA HOEFFLERI, new species.

Plate 3, figures 1-1a; Plate 5, figure 10.

Labial palpus fuscous, irrorated with black and pale ochreous. Antenna dark fuscous; scape and a few basal segments ochreous white above. Head fuscous, with a few pale ochreous scales mixed; area between the bases of the antennae gray; vertex blackish fuscous. Thorax fuscous; collar pale gray anteriorly and posteriorly, with white-tipped, dark-fuscous scales between the two gray bands. Fore wing fuscous; basal dash black, broadly edged costad with whitish ochreous which fades to white, becomes attenuated, and disappears in the dark ground color before reaching costa; toward the inner margin the basal dash is broadly edged with red-brown scales which continued as an inconspicuous longitudinal band to tornus; orbicular oval, white, edged with blackish fuscous and with reddish-brown scales in the center, adjacent to the reniform; reniform closed, sharply contrasted against the ground color, whitish, edged with blackish fuscous and with a few reddish-brown and fuscous scales in the center; surrounding the reniform, and extending outwardly along costa, a well defined blackish-fuscous shading; between the reniform and apex a reddish-brown shade; veins narrowly indicated by blackish-fuscous scaling; cilia blackish fuscous mixed with pale ochreous-white scales. Hind wing dark fuscous; cilia ochreous white with a dark-fuscous basal band. Legs blackish fuscous; tarsi of fore leg narrowly annulated with ochreous white; tarsi and spurs of hind leg strongly marked with ochreous white. Abdomen fuscous with a few pale ochreous scales mixed posteriorly.

Male genitalia—Harpe gradually tapering to the narrow, rounded cucullus; ventral margin with no appreciable excavation before cucullus; anal spine absent; clavus narrow, somewhat convex, rounded distally; ampulla stout, broad, extending slightly beyond costa; clasper short, stout, compressed distally. Anellus rounded anteriorly, lateral arm of ventral plate broad, pointed, strongly toothed; dorsal arm broad, convex, strongly sclerotized. Aedeagus short, stout, slightly wider distally than basally; a broad, strongly sclerotized, short, scobinate projection distoventrally; vesica with two stout, thornlike cornuti. Uncus short, weak. Tegumen convex laterally.

Female genitalia — Ostium narrow with edges parallel, weakly crenulate. Bursa couplatrix with three elongate, weak signa.

Alar expanse, 23-28 mm.

Type—United States National Museum No. 53438.

Type locality—Sperry Chalet, Glacier National Park, Montana (6,500 feet, 9-VIII-32, W. R. Sweadner).

Food plant—Unknown.

Remarks—Described from the type male and three female paratypes as follows: One, same date as type; two, Logan Pass, Glacier National Park, Montana (July 10, 1936, H. B. Hoeffler). One paratype in the U. S. National Museum, two in the collection of J. G. Franclemont, Ithaca, New York.

The species is named in honor of Mr. H. B. Hoeffler who collected two of the paratypes.

This is the smallest species of the genus and differs from both *ramosula* and *stewarti* by the absence of the light shading from the fore wing except between the basal dash and the costa. The genitalia differ from those of both those species as will be noted in the keys and descriptions.

The drawings were made by Mrs. Eleanor A. Carlin of the Bureau of Entomology and Plant Quarantine.

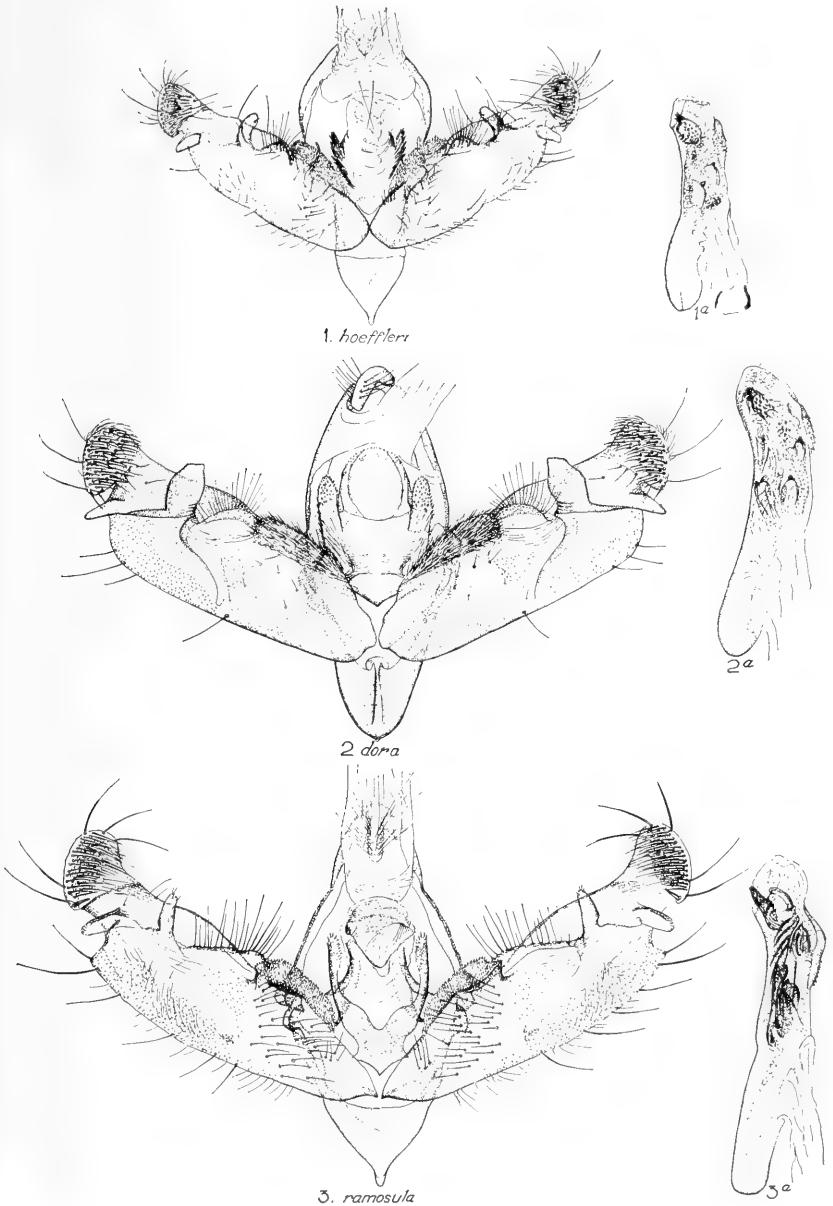

PLATE 3

Explanation of Plates

PLATE 3

1-1a. *Nedra hoeffleri*, new species. 1, ventral aspect of male genitalia with aedeagus removed; 1a, lateral aspect of aedeagus.

2-2a. *Nedra dora*, new species. 2, ventral aspect of male genitalia with aedeagus removed; 2a, lateral view of aedeagus.

3-3a. *Nedra ramosula* Guenée). 3, ventral aspect of male genitalia with aedeagus removed; 3a, lateral view of aedeagus.

PLATE 4

4. *Nedra ramosula* (Guenée). Wings.

5. *Nedra ramosula* (Guenée). Lateral view of head.

6. *Nedra stewarti* (Grote). Ventral view of female genitalia.

7-7a. *Nedra stewarti* (Grote). 7, ventral aspect of male genitalia with aedeagus removed; 7a, lateral aspect of aedeagus.

PLATE 5

Female genitalia; ventral view.

8. *Nedra ramosula* (Guenée).

9. *Nedra dora*, new species.

10. *Nedra hoeffleri*, new species.

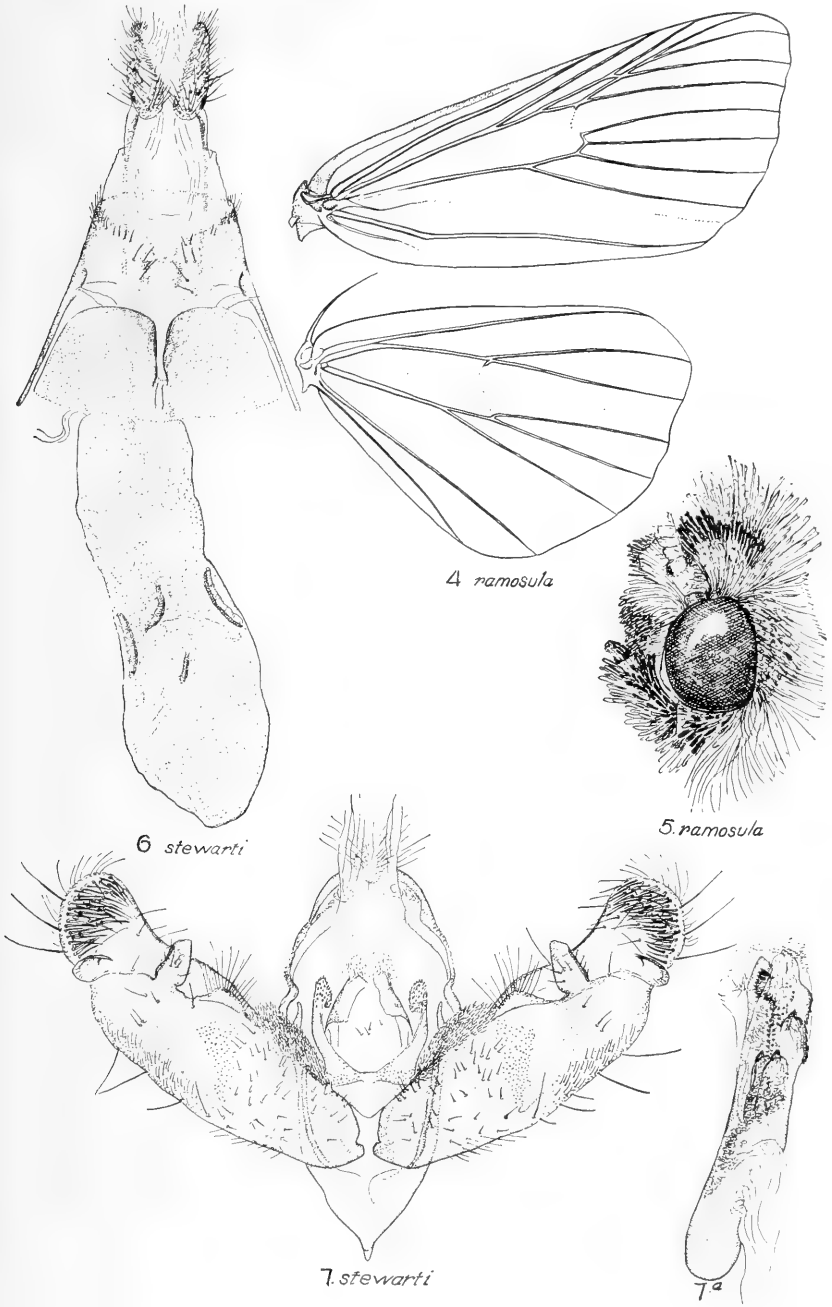

PLATE 4

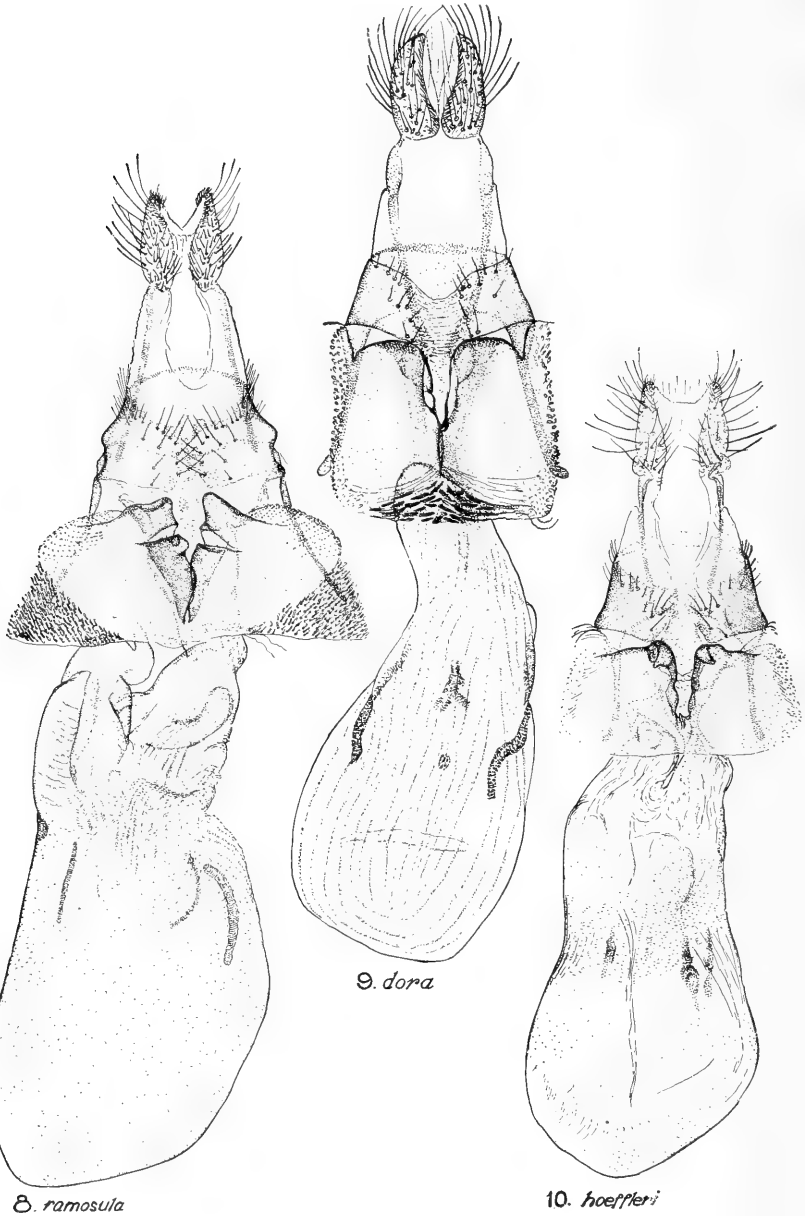

PLATE 5

NORTH AMERICAN CRAMBUS

I. THE SILVERY-STRIPED SPECIES OF CALIFORNIA (PYRALIDIDAE)

By Alexander B. Klots

College of the City of New York

For a number of years the author has been preparing a revision of the North American *Crambus*, which is now well on the way to completion. Circumstances unfortunately make it necessary to publish in a number of short papers, of which this is the first, instead of in one large one.

During the course of this study, material has been loaned to the author by nearly every museum in North America, the entire collections of most of which have been studied. The authorities of the British Museum very kindly sent their collection of North American *Crambus*, exclusive of types, as well as some exotic material. Mr. G. A. Bisset of the British Museum has been very generous with his time, making comparisons with the Zeller, Walker and Grote types and preparing numerous genitalia dissections. Mr. Carl Heinrich of the U. S. National Museum has also been especially kind, particularly in turning over to the author much work done on the genus by himself and the late Geo. G. Ainslie.

Many private collectors have coöperated most wholeheartedly. Although acknowledgments will be made in the appropriate places, special mention must be made of the generosity of Mr. and Mrs. John L. Sperry of Riverside, California.

Probably 90 percent of the North American *Crambus* material in the collections of the world has been studied. On the basis of the material studied, therefore, this revision may be considered as sufficiently thorough.

KEY TO SPECIES BY PATTERN OF FORE-WING

In practically all cases there are recognizable color and pattern characters for the differentiation of *Crambus* species; but in many instances these are relatively very slight and are difficult to use for one who is not well acquainted with the species. The following key should therefore be used with caution; and whenever possible determinations should be made by means of the genitalia. In both sexes these organs offer clear-cut and unmistakable characters.

FORE-WING WITH A SHARPLY DEFINED, PEARLY- OR SILVERY-WHITE STRIPE RUNNING FROM BASE WELL TOWARD OUTER MARGIN.

1. A white patch basad of the subterminal line and distad and dorsad of the tip of the silvery-white stripe; dorsal margin lighter than ground-color, diffusely shaded with whitish; costo-apical markings brownish-yellow, not fuscous; inter-venular lines noticeably darker than ground-color, with semi-metallic, leaden scaling ..... *pascuellus* (L.)

1. No distinct white patch distad and dorsad of tip of stripe; if there is a light shade here, then this is continued on to the outer margin; costo-apical markings dark brown or fuscous .. 2

2. Ground-color brownish-yellow with inter-venular lines darker; stripe very sharply pointed; no small, pointed, pearly-white dash below R_5 between costo-distal angle of stripe and costa; no triangular, white tooth from dorsal margin of stripe; submarginal line very close to outer margin, especially beyond end of stripe ..... *braunellus* n. sp.

2. Ground-color darker or, if light, not yellow; a small, pointed, pearly-white dash usually present below R_5 between costo-distal angle of stripe and costa, sometimes joined to stripe; triangular white tooth from dorsal edge of stripe often present; submarginal line further basad from outer margin .. 3

3. A distinct white or yellowish-white shade connecting end of stripe with outer margin of wing, fusing with white, marginal subapical mark; this shade often obliterating submarginal line; area below this shade, between submarginal line and outer margin, distinctly light grey; black marks between ends of veins in this area sometimes obliterated, when present forming slender lines; small, pointed, pearly-white dash below R_5 between costo-dorsal angle of stripe and costa of wing, rarely present; stripe with at most a rudimentary dorsal tooth, usually with none; ground-color bright golden-brown ..... *sperryellus* n. sp.

3. Whitish shade beyond end of stripe poorly defined, if present at all; fuscous, triangular apical mark proportionately larger, so that white mark below this is proportionately smaller; black marks between ends of veins forming elongated dots rather than slender lines; small, pointed, pearly-white line below R_5, between costo-dorsal angle of stripe and costa, usually present; dorsal tooth of stripe often present, sometimes very strong; ground color dark or light, but not usually bright golden-brown 4

4. Ground-color dark grey-brown; all dark markings heavy; stripe with strong dorsal tooth; stripe heavily outlined with dark shading, especially dorsally in the angle between the tooth and the distal part of the stripe; subterminal line strongly curved distad at costa, heavy and dark there; stripe not infrequently more or less filled in with grey-brown scaling, or considerably narrowed ..... *occidentalis* Grote

4. Ground-color usually lighter, less greyish-brown; dorsal tooth never very strong, nor heavily accentuated with dark scaling below it; subterminal line not bent strongly distad at costa; dark markings all less extensive .... *leachellus* (Zincken) subspecies, 5

5. Size large, length of fore-wing 14-17 mm.; ground-color lighter brown, often very pale; stripe usually broad, somewhat blunt at tip; dorsal tooth of stripe usually more prominent than in following form ..... *leachellus cypridalis* Hulst

5. Size smaller, length of fore-wing 11-13.5 mm.; ground color darker brown; stripe narrower than in *cypridalis*, with dorsal tooth very small or absent; stripe usually more sharply pointed than in other *leachellus* forms; stripe more widely separated from costa by dark brown scaling .... *leachellus rickseckerellus* n. subsp.

KEY TO SPECIES BY MALE GENITALIA

1. Uncus a single structure, often bearing short spines but never long tufts of spines or hairs 2

1. Uncus a pair of rounded pads which bear long, pointed hair-pencils (Fig. 6) ..... *pascuellus* (L.)

2. Costa of harpé with a long, heaviiy chitinized spine; sacculus of harpé with a short, slender spine; oedeagus extending considerably basad of attachment of ductus seminalis 4

2. Costa with no long, free spine; sacculus large, with long, free arm or spine; oedeagus extending but little basad of attachment of ductus seminalis 3

3. Uncus short, stout, flattened, with a mid-dorsal keel, truncate; sacculus not heavily toothed; saccus extending far cephalad, bilobed; gnathos short (Fig. 4) ..... *braunellus* n. sp.

3. Uncus long, slender, simple; gnathos long and slender; sacculus with a number of strong teeth along its dorsal margin, and many smaller teeth along its ventral margin; saccus not extending far cephalad, only slightly bilobed (Fig. 5) .... *sperryellus* n. sp.

4. Portion of oedeagus cephalad of attachment of ductus seminalis very long, curled in a flat spiral of at least one complete turn; free arm of costa of harpé not extending far dorsad of dorsal edge and apex of cucullus (Fig. 1-2) .... *leachellus* (Zincken) subspecies

4. Portion of oedeagus cephalad of attachment of ductus seminalis shorter, not completing a full turn of a spiral; free arm of costa lying further dorsad of dorsal edge and apex of cucullus (Fig. 3) ..... *occidentalis* Grote

KEY TO SPECIES BY FEMALE GENITALIA

1. Ostium protruding caudad far beyond genital plate (Fig. 11) ..... *braunellus* Klots

1. Ostium protruding caudad little if any beyond genital plate 2

2. Ductus bursae extremely long, flatly coiled a number of times (Fig. 8) ..... *leachellus* forms and *occidentalis;* see text

2. Ductus bursae sometimes bent or twisted, but not coiled a number of times 3

3. Ostium a simple, transverse plate; caudal half of ductus bursae very thick and heavily chitinized (Fig. 10) .. *sperryellus* Klots

3. Ostium more complex, consisting of a number of rounded plates; ductus bursae thin, lightly chitinized (Fig. 7) .. *pascuellus* (L.)

CHECK LIST OF SPECIES

1. pascuellus (L.)
   floridus Zeller
   hastiferellus Walker (*partim*—♀♀)

2. leachellus (Zincken)*
   pulchellus Zeller
   lativittellus Zeller
   hastiferellus Walker (*partim*—♂♂)
   (a) cypridalis Hulst
   (b) **rickseckerellus** Klots

3. occidentalis Grote
   agricolellus Dyar

4. **sperryellus** Klots

5. **braunellus** Klots

DESCRIPTIONS, DISCUSSION, ETC.

1. Crambus pascuellus (Linnaeus)

(Figs. 6 and 7)

Tinea pascuellus Linnaeus, 1758, Systema natura, Editio decima, Holmiae [Stockholm], p. 535.

Crambus hastiferellus Walker, 1863, Catalogue of the Lepidoptera Heterocera in the British Museum [*in*] List of the Specimens of Lepidopterous Insects in the Collection of the British Museum . . . London, 1854-1866, vol. 27, p. 155-156.

Crambus floridus Zeller, 1872, Beitrage zur Kenntnis der nordamerikanischen Nachtfalter . . . Verh. der K.-K., Zool.-Bot. Ges. im Wien, 22:537.

Crambus pascuellus Fernald, 1896, The Crambidae of North America, Amherst, Mass., p. 27-28, pl. I, fig. 3.

Crambus floridus = *pascuellus* (L.) Fernald, 1896, loc. cit.

Crambus floridus Forbes, 1920, The Lepidoptera of New York and Neighboring States . . . Ithaca, N. Y., p. 600.

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* I have no record of the occurrence of the nymotypical subspecies, *C. leachellus leachellus* in California.

Pascuellus is an extremely widely distributed species, occurring throughout the northern parts of both the Palaearctic and the Nearctic regions. It does not appear to have evolved any subspecies or races despite this wide range, in which it stands almost alone in its genus. A great many of the North American *Crambus* are closely related to Palaearctic species; in some cases the differences are only racial, although in most cases they seem to have progressed to the point of being specific. However, in comparing specimens of *pascuellus* from England, France and Germany with a large series from North America, I have been unable to find any constant difference that might serve to validate Zeller's name *floridus* as a race.

Pascuellus is a common species in the northern parts of both Palaearctic and Nearctic regions. It appears to be characteristic of the Canadian Life Zone in North America, although occasional specimens may occur south of the true limits of this zone. In the Rocky Mountains I have found it locally very common in grassy meadows and swamps, but not in acid bogs.

Hastiferellus Walker is a name that has caused a great deal of trouble to students of North American *Crambus*. Mr. G. A. Bisset of the British Museum has very kindly compared specimens and genitalia dissections, which I sent to him, with Walker's type specimens, so that we are now able to clear up the trouble. Walker's three female cotypes are specimens of *pascuellus*. The five males are referrable to *leachellus* (Zincken), see following.

Mr. Bisset has also kindly compared specimens sent by me with the single type of *floridus* that remains in the British Museum. I am thus sure of the authenticity of my determination of this name. This specimen is a female; in the absence of knowledge as to the fate of the male specimen mentioned in the original description is seems best to fix it hereby as the lectotype.

Distribution, general—Northern Europe, Asia and North America, extending southward in mountainous regions. New York to California, not occurring in dry, hot plains areas.

Distribution, California — Seneca, Plumas County, 16 June, 18 July; Sisson, July; Eureka, 4-6 June; Truckee, 1-7 July; Siskiyou County.

Type localities—Sweden (?) (*pascuellus*); Beverly, Mass. (*floridus*); Nova Scotia (*hastiferellus*).

Location of types—unknown (*pascuellus*); 1 ♀ in British Museum; 3 ♀ ♀ in British Museum (*hastiferellus*).

Fixation of types—*floridus*: the ♀ in the British Museum is hereby chosen as lectotype; *hastiferellus*: see below under *leachellus* Zincken.

2. Crambus l. leachellus (Zincken)
(Figs. 2 and 9)

Chilo leachellus Zincken, 1818, Magazin der Entomologie, Halle, 3:114.

Crambus pulchellus Zeller, 1863, Chilodinarum et Crambidarum genera et species, Berlin, p. 18, no. 13.

Crambus lativittellus Zeller, 1863, loc. cit., p. 18, no. 13.

Crambus leachellus Zeller, 1863, loc. cit., p. 18-19, no. 14.

Crambus involutellus Zeller, 1863, loc. cit., p. 18, no. 14, (nec *Crambus involutellus* Clemens, 1860, Proc. Acad. Nat. Sci. Philadelphia, 12:203, = *C. praefectellus* (Zincken).)

Crambus hastiferellus Walker, 1863, Cat. Lep. Heteroc. Brit. Mus. . . ., 27:155-156 (*partim*, ♂ ♂).

Crambus leachellus Fernald, 1888, Entomologica Americana, 4:44.

Crambus leachellus Felt, 1894, Bull. 64, Cornell University Agr. Exp. Sta., p. 71-73, pl. II, VII, XII, XIII (genitalia, pattern, biology, etc.).

Crambus leachellus Fernald, 1896, The Crambidae of North America, Mass. Agr. College, Amherst, Mass., p. 29-30, pl. I, fig. 2.

As far as I know the nymotypical subspecies does not occur south of Vancouver, B. C., being replaced southward by the subspecies *cypridalis* Hulst and *rickseckerellus* Klots (see ff.). It is possible, however, that *l. leachellus* may be found in some of the mountainous regions in the northern part of California.

L. leachellus is treated here at some length because of the great amount of misunderstanding that has prevailed regarding the synonomy and application of this name.

Zeller's determination of *leachellus* Zincken may be taken as probably accurate, since he states (loc. cit., p. 19) that he saw Zincken's specimen ("ego in ipsius specimine . . . vidi . . ."). As far as I have been able to determine, the Zincken collection was broken up and sold at auction in Vienna in 1857. Probably all authentic material of *leachellus* has long been lost.

Pulchellus Zeller applies to this name as a synonym, probably a minor variant. Mr. Bisset kindly compared specimens for me with the type, a male, in the British Museum. Likewise into the synonymy must go the hitherto unrecognized name of *lativittellus* which Zeller validated in discussing a female specimen of Kollar's. Possibly this specimen is in the Vienna Museum.

The male specimens of Walker's *hastiferellus* belong here, as is evidenced by comparisons with them made for me by Mr. Bisset. There are five of these in the British Museum, of which one has been chosen lectotype.

Zeller was incorrect in placing Clemens' *involutellus* as a synonym of *leachellus*. I have studied the type of *involutellus*, which is in the Academy of Natural Sciences of Philadelphia; the name is a synonym of *praefectellus* (Zincken), an Eastern species which does not occur west of the Great Plains.

Distribution, general—North America, from British Columbia to Texas and Florida, exclusive of the West Coast States and the Great Basin.

Distribution, California—Probably does not occur in the state, being replaced by *l. cypridalis* and *l. rickseckerellus*.

Type localities—Unknown (*leachellus*); Illinois (*pulchellus*); unknown (*lativittellus*); Nova Scotia (*hastiferellus*).

Location of types—Lost? (*leachellus*); 1 ♂ in British Museum (*pulchellus*); unknown, possibly Vienna (*lativittellus*); ♂ lectotype and 4 ♂ cotypes in British Museum (*hastiferellus*).

2a. Crambus leachellus cypridalis Hulst

(Fig. 1)

Crambus cypridalis Hulst, 1886, Trans. Amer. Ent. Soc., 13:165.

Crambus cypridalis Fernald, 1896, The Crambidae of North America, Mass. Agr. College, Amherst, Mass., p. 26, pl. 3, fig. 1.

Cypridalis is a distinct subspecies of *leachellus*, and may even have differentiated far enough, in the opinion of some workers, to be regarded as a distinct species. It averages considerably larger in size than *l. leachellus*, with a much paler ground-color of the fore-wing on which darker streaking between the veins stands out quite distinctly. In the male genitalia the free arm of the costa of the harpé is much longer than in *l. leachellus*, often or even exceeding the apex of the cucullus. I am not able to say what the characters of the female genitalia are, for although I have studied a considerable number of specimens, they are all males.

In both *l. leachellus* and *l. cypridalis* there is a certain amount of variation in the length and coiling of the basal part of the oedeagus. I have seen one specimen of *l. leachellus* from Florida and one from Kansas in which this does not make a complete coil, which is a normal characteristic of *occidentalis*. In the great majority of specimens, however, this seems to be a reliable character for differentiating *leachellus* and *occidentalis*, as noted in the key.

There appears to be very little overlapping of the ranges of *l. leachellus* and *l. cypridalis*. The former is common at Vancouver; but I have seen one specimen from there that on the basis of color and size would be referrable to *cypridalis*.

Distribution, general—Great Basin States and West Coast States south at least to the San Bernardino Mountains, Calif.

Distribution, California—Lower Klamath Lake; Plumas County; Mendocino; Santa Barbara; Sheep Creek, San Bernardino Mountains, October 26.

Type locality—Utah.

Location of type—Rutgers University (1 ♂).

2b. Crambus leachellus rickseckerellus, new subspecies.
(Fig. 8)

Length of fore-wing, 11.5-13.5 mm. Head and palpi, dull, light brown. Dorsum of thorax more shining brown.

Fore-wing—Ground-color brown, somewhat lustrous, darker around silvery-white stripe, especially between it and costa. Silvery-white stripe narrow, straight, with only a rudimentary dorsal tooth, tapering gradually to a sharp point well basad of submarginal line. A number of slender, intervenular lines of dull, metallic scaling run from stripe toward submarginal line; these all tend to be rudimentary except the one below R_5 (costad of stripe) which often forms a spindle-shaped white dash. A pale, whitish shade running from end of stripe to outer margin. Submarginal line of dull, semi-metallic shading, margined inwardly with darker brown scales. Basad of this on costa is a short, broad, white stripe. Apical area white, with a narrow, fuscous, triangular patch that is connected basally with a dark line running to costa distad of submarginal line. Area between submarginal line and outer margin and below subapical white shade whitish, flecked with dark brown scales. Intervenular dots in this area blackish, elongated. Fringes somewhat lustrous, light brownish, lighter subapically.

Hind-wing—Very pale brown, slightly darker apically and terminally, fringes somewhat paler.

Comparison with L. leachellus:

1. Pattern of fore-wing—The silvery-white stripe is narrower and more acutely pointed, being thus separated from the costal margin by a wider area of dark brown scaling.

2. Male Genitalia—The free arm or spine of the costa is longer than in *l. leachellus,* being sufficiently long if straightened out to reach or exceed the apex of the cucullus; the cucullus seems to be slightly narrower toward its apex than in *l. leachellus.*

3. Female Genitalia—The dorsal edge of the ostium does not protrude further than the ventral edge; while in *l. leachellus* the dorsal edge seems to protrude further quite consistently. The ostium narrows to the ductus bursae less abruptly than in *l. leachellus,* and appears to be proportionately somewhat greater in diameter. A short distance above the bursa copulatrix the ductus bursae makes an abrupt bend cephalad, becoming more

lightly chitinized, and then runs almost directly to the bursa. At this point there is, in *l. leachellus,* a distinct swelling; in *l. rickseckerellus* this swelling appears to be absent.

From *l. cypridalis* it is easy to differentiate *rickseckerellus* at a glance by the characters of size, color and pattern given in the key and diagnosis. No consistent difference in the male genitalia has been noted between these two subspecies. Owing to the lack of females of *cypridalis* nothing can be said about the characters of the female genitalia.

It is possible that *rickseckerellus* may eventually be proven to be a species distinct from *leachellus.* On the other hand it may be merely a distinct variety (although I doubt this) or a habitat subspecies. There is needed a good deal of collecting and life-history work on these forms. However there seems little room for doubt that *rickseckerellus* is a distinct entity of some sort, worthy of a name.

Holotype male, allotype female, 4 male and 2 female paratypes, all San Diego, Calif., November (Ricksecker coll.). One male paratype, Santiago (sic!) Cal., (W. S. Wright, coll.).

Location of types—Holotype, allotype, 2 male and 1 female paratypes in the American Museum of Natural History; 1 male paratype in the U. S. National Museum; 1 male paratype in the Los Angeles Museum; 1 female paratype in the British Museum; 1 male paratype in the author's collection.

3. Crambus occidentalis Grote
(Fig. 3)

Crambus occidentalis Grote, 1880, Canadian Entomologist, 12:16.

Crambus occidentalis Grote, 1881, Canadian Entomologist, 13:66-67.

Crambus occidentalis Fernald, 1896, The Crambidae of North America, Mass. Agr. College, Amherst, Mass., p. 23, pl. 2, fig. 3.

Crambus agricolellus Dyar, 1923, Insecutor Inscitiae Menstruus, 11:28.

On the basis of the characters set forth in the keys, and of its wide distribution in California, *occidentalis* must be regarded as a separate species, although one closely related to *leachellus.*

Mr. G. A. Bisset very kindly compared specimens, which I sent to him, with the type of *occidentalis* in the British Museum. I have compared the same specimens with the type series of *agricolellus* Dyar in the U. S. National Museum. There is no doubt that the latter is conspecific with the former.

There is, however, a faint possibility that *agricolellus* may be a valid, although extremely close, race of *occidentalis.* I have been able to study far too few specimens from the northern part

of the range of the species, so cannot be sure one way or the other. The northern specimens average a trifle larger and lighter in color than those from San Diego. The latter show striking uniformity except that in an occasional specimen the silvery white stripe is more or less filled in with brown scaling. Some of the northern specimens, however, are just as small and dark as nearly any of the southern.

Available for study have been 10 specimens from the general vicinity of San Francisco, 3 others known only as from "California" and 117 from San Diego. All of these 130 specimens are males, which is a most curious phenomenon.

Distribution, general—California.

Distribution, California — San Francisco; Berkeley, 14 October; Petaluma, 15 October; Sauzalito (sic!) 8-21 October; San Diego, November.

Type localities — Sauzalito (sic!) (*occidentalis*); San Diego (*agricolellus*).

Location of types—British Museum (♂ lectotype, *occidentalis* + 2 cotypes); U. S. National Museum (*agricolellus*).

4. Crambus sperryellus new species.

(Figs. 5 and 10)

Length of fore-wing 11-14 mm. Head and palpi light brown. Dorsum of thorax light, shining, golden brown.

Fore-wing — Ground color bright golden-brown, darker along costal margin and (sometimes) along dorsal edge of silvery-white stripe. Silvery-white stripe broad, very narrowly separated from costal margin along basal half. A rudimentary dorsal tooth from slightly beyond middle of stripe. Submarginal line semi-metallic leaden, oblique in its first third from costa, then forming a rounded angle of approximately 90° and running almost straight to dorsal margin. Submarginal line narrowly margined inwardly with darker brown, this bordered basally toward costa with a white line. Apex white, with a narrow, fuscous triangle in the white area. Short, thin, semi-metallic, whitish lines run, distad from silvery-white stripe between veins R_5 and M_1, M_3 and Cu_1, Cu_1 and Cu_2, and Cu_2 and 2dA, the last of these the longest. A distinct whitish or very light brownish shade connecting end of silvery-white stripe with white, marginal, subapical area. Area below this shade and between submarginal line and outer margin heavily flecked with light brown and very light grey scales. In this area is a series of thin, blackish, intervenular lines. A very thin, dark brown terminal line, much darker below apex. Fringes pale brown, lighter below apex.

Hind-wing—Very pale brownish-white, darker apically and terminally. Fringes almost white.

In general color and pattern *sperryellus* somewhat resembles *leachellus* (Zincken), as which it has usually been identified. In fact, however, *sperryellus* has no close relatives among the *Crambus* of western North America. The characters listed in the keys and diagnoses above will serve to differentiate *sperryellus* from *leachellus* and *occidentalis*.

The range of *sperryellus* probably does not touch that of *l. leachellus*, but overlaps very largely those of *l. cypridalis* and *l. rickseckerellus*. From the former of these it can be distinguished at a glance by size, color and pattern. It resembles *l. rickseckerellus* more closely, and worn specimens are not always easy to differentiate by color and pattern. The genitalic characteristics are, however, absolutely distinctive, and can usually be seen by blowing or scraping away some of the loose hair-scales at the tip of the abdomen.

Both pattern and male genitalia of *sperryellus* seem to show a relationship to *Crambus quinquareatus* Zeller, a species characteristic of the eastern United States that ranges as far west as Texas; so that it is closer to this species than to any other. It may be distinguished from *quinquareatus* as follows:

1. Fore-wing: *Quinquareatus* — silvery-white stripe approaching subterminal line more closely than in *sperryellus*, often touching it; area below whitish subapical shade and beyond subterminal line brownish, not contrasting with general tone of wing.

Sperryellus—silvery-white stripe ending more basad of subterminal line; area below whitish subapical shade and beyond subterminal line distinctly grey, contrasting with general tone of wing.

2. Male genitalia: *Quinquareatus* — costa little produced dorsad or curled mesad; cucullus rather square-ended; dorsal margin of sacculus a rather smooth ridge, without prominent teeth; terminal margin of sacculus rather square-ended, with a number (2-5, usually 2) of teeth; ventral margin of sacculus smooth, without a number of fine teeth; oedeagus with a dorsad-projecting spine at tip and with a slender, not strongly curved cornutus.

Sperryellus—costa considerably produced dorsad and curled mesad; cucullus rounded terminally; dorsal margin of sacculus strongly toothed; sacculus terminating in a long, mesad-curled spine; ventral margin of sacculus finely toothed; oedeagus bent ventrad at tip, with a rather heavy, strongly curved cornutus.

3. Female genitalia: *Quinquareatus*—ostium projecting free far caudad; ductus bursae with at least three rather irregular twists or coils, one of which occurs almost immediately in from the ostium.

Sperryellus—ostium not projecting free caudad; ductus bursae running cephalad for at least half its length, thick, strongly

chitinized, only slightly curved; then narrowing abruptly and bent sharply twice only but not twisted or coiled.

Sperryellus is apparently the commonest and most widely distributed *Crambus* in California. It has consistently been determined as *"leachellus* (Zincken)" and occasionally as *"trichusalis* Hulst" and *"occidentalis* Grote," to none of which species is it at all closely related. I understand from Mr. Richard M. Bohart of the University of California at Los Angeles that it is of some economic importance. Mr. Bohart, who is working on the life-history of this as well as of other California *Crambus,* has very kindly sent me interesting material of the species.

Holotype male, San Diego, Calif., 15 September (Ricksecker); allotype female, San Diego, Calif., November (Ricksecker); 128 paratypes as follows:

California:

Siskiyou County: Dunsmuir, 23 May, 1936 (Sperry) 1 ♀.

Sacramento County: Sacramento, 17 June, 1930 (Browne) 1 ♂.

Santa Cruz County: Santa Cruz, 14 April, 1928, 1 ♀.

Inyo County: Burchim Canyon, 16 May, 1937 (Walton) 1 ♀.

Tulare County: Exeter, 15 April, 1928, 1 ♀.

Kern County: Havilah, 1 ♀; Bakersfield, 27 September, 1939, ex blue grass (Morley), 2 ♂♂, 1 ♀.

Los Angeles County: Saugus, 1 September, 1938, ex lawn grass (Bohart), 1 ♂; Los Angeles, 2 April to 30 September (Coolidge, Pence), 6 ♂♂, 4 ♀♀; Glendale, 2 to 25 August, 1921, 2 ♂♂, 1 ♀; Pasadena (labeled "Pas."), 1 ♂; Alhambra, 22 to 31 July, 1919 (Campbell), 2 ♂♂, 1 ♀; State Insectary, Monrovia (Phillipson), 1 ♂; Claremont (Metz, Baker), 4 ♂♂; Westwood Hills, August, 9 September to 26 October (Bohart), 3 ♂♂, 7 ♀♀.

San Bernardino County: Big Bear Lake, San Bernardino Mountains, 6,000 ft. alt., 4 July, 1931 (Dammers), 1 ♀; Devils Canyon, San Bernardino Mountains, 7 June, 1931 (Dammers), 1 ♀; Colton, 21 August (Pilate), 1 ♀; Loma Linda, 13 April to 8-15 September (Pilate), 4 ♂♂, 2 ♀♀; Needles, 1-6 April, 1918 (Bradley), 1 ♀.

Riverside County: Riverside, 4 April to 24 July (Buckwalter, Dammers, Sperry), 6 ♂♂, 5 ♀♀; Palm Springs, 23-25 May, 1918 (Bradley), 1 ♂, 5 ♀♀; Coachella, 2 May, 1918 (Bradley), 1 ♀.

San Diego County: San Diego, April to November (Ricksecker, Field, Piazza, Wright), 33 ♂♂, 10 ♀♀.

———? County: Pine Lake, So. Calif. (Johnson), 1 ♂; Three Rivers, 800 ft., 6-7 August, 1927 (Bradley), 1 ♂; "Western U. S. A., 89-93," collection British Museum (probably Lower Klamath Lake), 6 ♂♂, 4 ♀♀.

ARIZONA:

Tempe, 28 June to 28 August, 1921 (Walter & Martinez), 1 ♂, 2 ♀♀.

It is with great pleasure that I name this species for Mr. and Mrs. John L. Sperry of Riverside, Calif., in appreciation of their generosity in sending me a great deal of valuable *Crambus* material including a number of new species.

DISTRIBUTION, GENERAL—California and adjacent Arizona.

DISTRIBUTION, CALIFORNIA—see list of type material.

TYPE LOCALITY—San Diego, Calif.

LOCATION OF TYPES—Holotype, allotype and a series of paratypes in the American Museum of Natural History; paratypes in the British Museum, Canadian National Collection, U. S. National Museum, Museum of Comparative Zoology, Cornell University; Academy of Natural Sciences of Philadelphia, Carnegie Museum, Los Angeles County Museum, and the collections of Mr. and Mrs. John L. Sperry, Miss Annette Braun, Mr. R. M. Bohart and the author.

5. CRAMBUS BRAUNELLUS, new species.
(Figs. 4 and 11)

Length of fore-wing, 12-13 mm. Head and palpi very pale brownish. Dorsum of thorax slightly darker and more lustrous.

FORE-WING—Ground-color light brownish-yellow, darker between silvery-white stripe and costa, and dorsad of stripe. Silvery-white stripe narrow, with at most only a bare indication of a dorsal tooth, tapering gradually to a very sharp point well before submarginal line. Running from the stripe to the submarginal line are 7 slender, intervenular lines of semi-metallic, leaden scales, in the spaces between veins from below R_5 to below 2d A. These lines are somewhat margined with darker brown scales. Area over vein M_2 between silvery-white stripe and submarginal line, but dorsad of tip of stripe, whitish, but not forming a clearly-marked white patch. Submarginal line leaving costa at an acute angle, bending opposite end of stripe, then running to dorsal margin quite close to outer margin. Submarginal line of semi-metallic, leaden scales, margined basally with brown. This basal margining is very dark toward costa; basad of it is a white stripe which runs far basad along costa. Apical area white, largely filled by triangular, fuscous mark. Area below apical area and between submarginal line and outer margin whitish,

speckled with dark scales. A series of fuscous, rounded dots on outer margin between tips of veins from M_2 to 2d A. A fine, dark brown marginal line, strongest below apex. Fringes whitish basally, darker terminally.

HIND-WING—Very pale brownish-white, slightly darker apically and terminally. Fringes almost white.

Although I have only three specimens of this species, and the data on one of these are dubious, I have no hesitation in naming it. The characters given in the diagnosis and keys will serve to differentiate it, not only from the other California *Crambus,* but also from all other North American species.

Braunellus must be either extremely rare or else extremely local. I suspect the latter, for a number of other species of *Crambus,* hitherto very rare in collections, have proven in recent years to be common when sought in exactly the right environment at the right time. Acid bogs, an environment seldom collected for moths, seem to harbor many such species.

Two of the three specimens of the type series are in the collection of the Museum of Comparative Zoology and bear labels "Colton, Calif., Pilate" and small, square date labels that are undecipherable. They are from the collection of Frederick Allen Eddy. I have no doubt of the authenticity of the locality on these specimens. From the Eddy Collection material I have studied material of other characteristically Californian *Crambus* (i.e., *sperryellus* and *gausapalis*) bearing similar labels. Some of the latter, be it noted, are specimens collected by Pilate at Loma Linda, a locality at which he resided and did much collecting.

The paratype is from the Holland Collection in the Carnegie Museum. It bears a printed label "Opelousas, La., Pilate" and the date "May 30-96." Inasmuch as Dr. Holland is known to have been at times quite careless with the data on specimens, I think it probable that this, too, is a California specimen and probably came from Colton.

Holotype male and allotype female, Colton, Calif. (G. R. Pilate), ex-coll. Frederick Allen Eddy. Paratype female labeled "Opelousas, La., Pilate," May 30-96, ex Holland Collection (true locality probably California, possibly Colton).

DISTRIBUTION, GENERAL—California.

DISTRIBUTION, CALIFORNIA—Colton.

TYPE LOCALITY—Colton, California.

LOCATION OF TYPES—Holotype and allotype in Museum of Comparative Zoology, Cambridge, Mass. Paratype in Carnegie Museum, Pittsburg, Pa.

Other Silver-striped Crambus of Potential Occurrence in California

Four other species of silver-striped *Crambus* may very well occur in California, although I have seen no specimens of them from there. The following notes will suffice for identification of these:

1. *Unistriatellus* Packard—An easily identified species in which the silvery-white stripe continues without interruption and almost without narrowing to the outer margin. It is of wide distribution in the northern states and Canada, being essentially a Canadian Life Zone species. West Coast records are: British Columbia—various localities, July. Washington — Grayland, Long Beach, Ilivado and Chehalis, July-September. Oregon—Houser, July.

2. *Latiradiellus* Walker (*myellus* auct. nec Huebner)—Characterized by the fact that the white stripe, which nearly reaches the outer margin(is cut twice by heavy, dark, median and postmedian bands. Be it noted that the North American species, for which *latiradiellus* is the oldest name, is not conspecific with the European *myellus* (Huebner) or with at least two other Palaearctic species that are extremely similar in color and pattern. *Latiradiellus* is characteristically a species of Canadian Life Zone; but I have taken it in Transition Zone in Connecticut. West Coast records are: British Columbia—various localities, July-August; Washington—Puyallup, August.

3. *Tutillus* McDunnough—In the key this species would run out to *pascuellus* (L.); from this species it may be distinguished by the very much narrower silvery-white stripe and by the very dark brown ground color. *Tutillus* is another essentially northern species, which may occur in northern California. West Coast records are: British Columbia—Victoria, common, generally about the middle of May. Washington—Toledo, Tumwater, June. Oregon—Salem, Portland.

4. *Bidens* Zeller—In the key this species would run out to *braunellus*. From this species it may be separated at a glance by the shape of the silvery-white stripe which is narrow at the base of the wing and broadens greatly to the very strong dorsal tooth which is located at about two-thirds from the base of the stripe. From *pascuellus,* with which some authors have confused *bidens,* it can be distinguished by the fact that *bidens* has no white patch basad of the subterminal line. Like the three preceding, *bidens* is a northern species. It is extremely local, being apparently a bog species. West Coast records are: British Columbia—various localities, July-August. Oregon — Waldport, July.

Explanation of Figures

The drawings were made with a camera lucida, but subsequently changed and corrected. They do not, therefore, represent actual, single specimens. They are intended to illustrate the characters upon which the conclusions of the author have been based.

Since mere size, within the limits of variation of the species, has little taxonomic significance, no exactly consistent scale of enlargement was used.

In the figures of the male genitalia the uncus, gnathos, anal tube and tegumen have been drawn above the saccus and harpé, and the oedeagus beneath, unless otherwise indicated below.

PLATE 6

Figure 1 —Left lateral aspect, male genitalia, *Crambus leachellus cypridalis* Hulst.

Figure 2 —Left lateral aspect, male genitalia, *Crambus leachellus leachellus* (Zincken).

Figure 3 —Left lateral aspect, male genitalia, *Crambus occidentalis* Grote.

Figure 4 —Left lateral aspect, male genitalia, *Crambus braunellus* new species.

Figure 4A—Dorsal aspect, saccus and harpés, *Crambus braunellus* new species.

Figure 5 —Left lateral aspect, male genitalia, *Crambus sperryellus* new species.

Figure 5A—Dorsal aspect, saccus and harpés, *Crambus sperryellus* new species.

Figure 6 —Left lateral aspect, male genitalia, *Crambus pascuellus* (L.).

PLATE 7

Figure 7 —Left lateral aspect, female genitalia, *Crambus pascuellus* (L.).

Figure 8 —Ventral aspect, female genitalia, *Crambus leachellus rickseckerellus* new subspecies.

Figure 9A—Ventral aspect, *ostium*, *Crambus leachellus leachellus* (Zincken).

Figure 9B—Ventral aspect, final bend of *ductus bursae*, *Crambus l. leachellus* (Zincken).

Figure 10 —Ventral aspect, female genitalia, *Crambus sperryellus*, new species.

Figure 11 —Left lateral aspect, female genitalia, *Crambus braunellus* new species.

Figure 11A—Ventral aspect, protruding portion of ostium, *Crambus braunellus* new species.

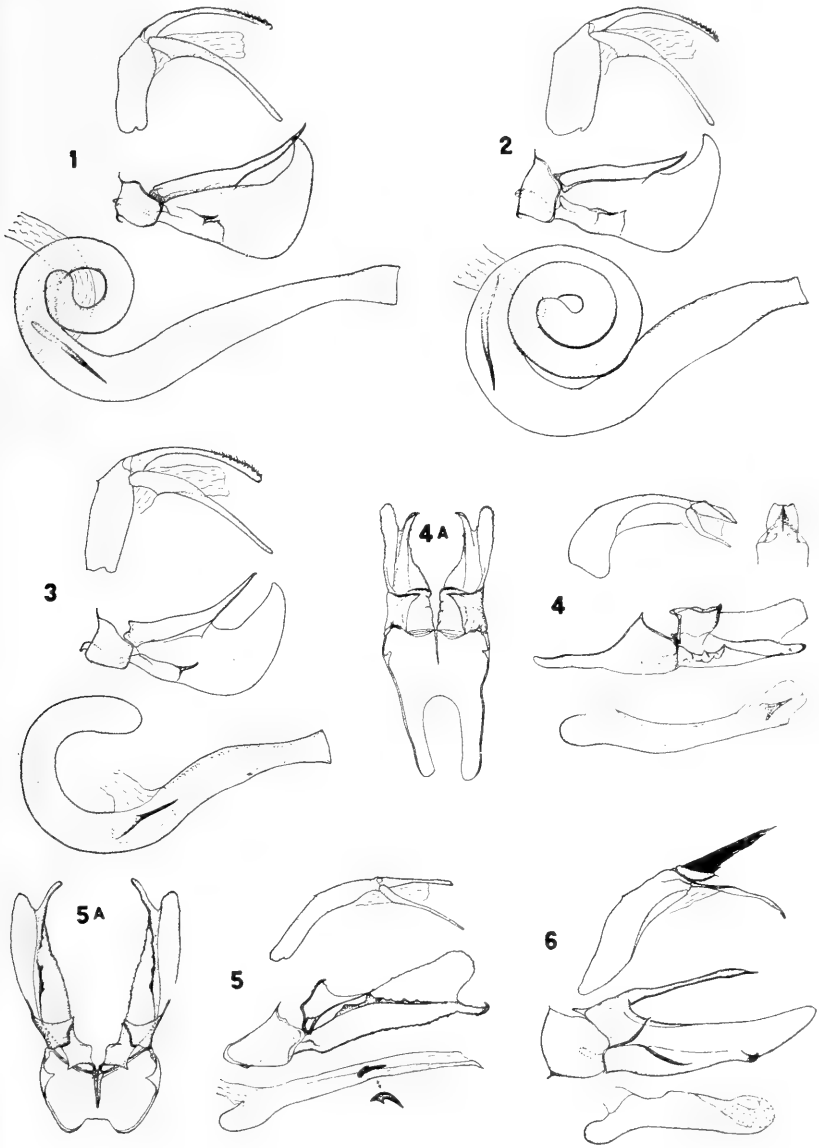


PLATE 6

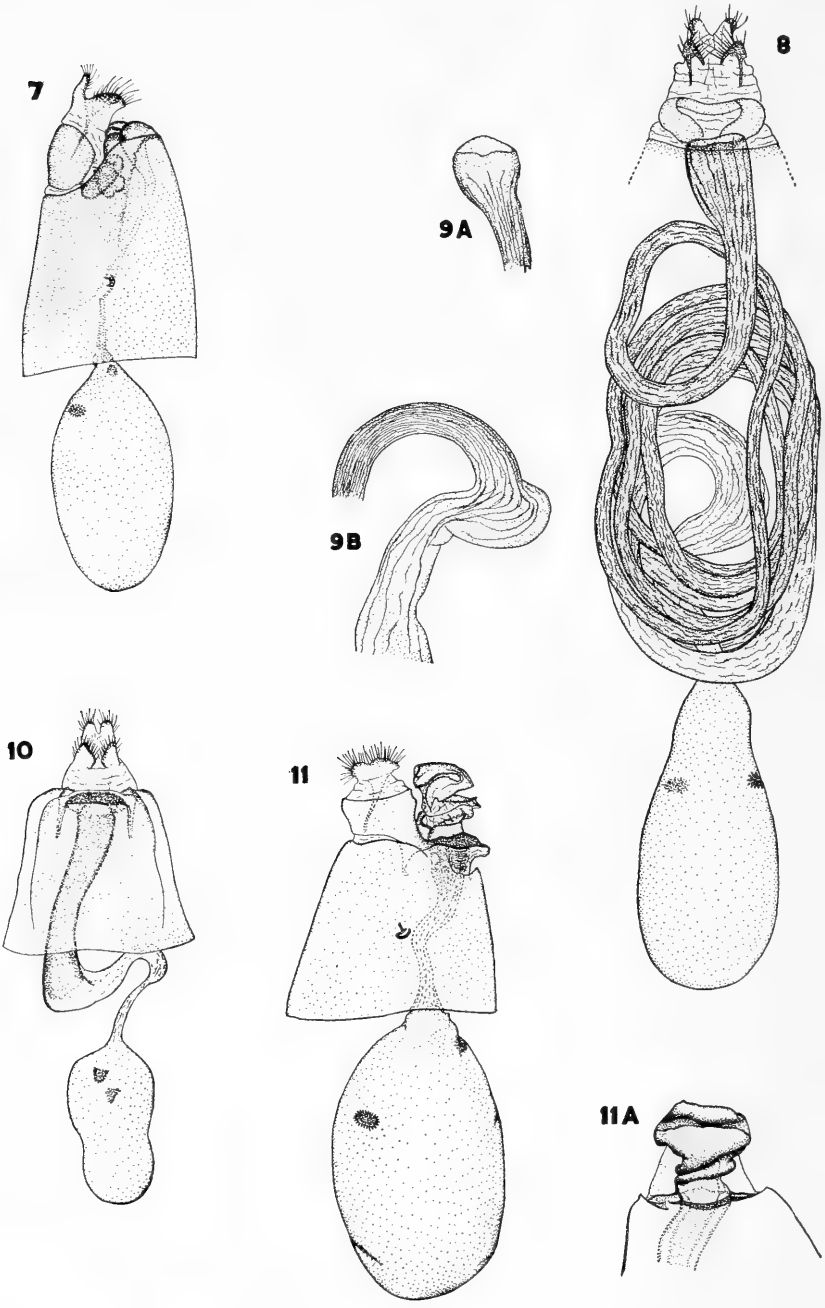


PLATE 7

TWO NEW SPECIES OF LEPIDOPTERA FROM CALIFORNIA

By Christopher Henne

Callophrys comstocki sp. nov.

Superior Surface:

Primaries: Ground color slate grey with brownish cast. Basal area and inner margin a somewhat lighter shade than apical area. Androconial patch lighter than ground color in majority of specimens, sometimes unicolorous, rarely darker. Marginal border narrow and dark, extending slightly beyond apical curve. Fringes white at outer two-thirds with a dark overlapping fringe at base, forming a double layer.

Secondaries: Ground color a somewhat lighter shade than primaries and shading into still lighter in approaching anal angle where it reaches the extreme to form in some specimens a narrow light grey area interior to the dark marginal border but which is restricted to the area adjacent to the anal angle. The marginal border is narrow at the outer angle but increases in width as it approaches the anal angle where it is conspicuously outlined from a point running approximately from the third median nervule to the black tuft at the anal angle which is its terminus. Fringes same as primaries but dark tipped near anal angle where they merge into the black tuft.

Inferior Surface:

Primaries: Ground color brownish grey. The apical third of the wing and the discal cell are superimposed with bluish green scales. An outwardly convex rather inconspicuous broken white line shaded internally with dark brownish grey crosses the median area transversely, originating at the upper radial vein about one-third internal to the costal angle and continuing to the second median nervule. The intensity and length of this line varies in individual specimens. Marginal border not as dark as that on superior surface. Fringes greyish.

Secondaries: Ground color brownish grey but a heavy and uniform suffusion of bluish green scales obliterates the ground color almost entirely. The regions where the ground color is in evidence are possibly cases where the green scales have been removed by contact, as these areas do not appear to be consistent in size nor location. A transverse sinuate broken line shaded internally with dark grey to black similar to that on the primaries but more conspicuous and constant, originates at the costal margin and terminates at the anal angle. This line tends to follow the division between the basal and discal areas and forms

an abrupt outward convexity approximately between the second and third median nervules. The upper part of the line is composed of a series of more or less straight sections whereas those in the lower half are in the form of lunules. Marginal border shaded internally with light grey in vicinity of anal angle. Fringes greyish.

The female is the same as the male in markings and coloration.

Type locality:

Providence Mts., San Bernardino County, California.

Number and sexes of types (described from 20 ♂ ♂ and 8 ♀ ♀):

Holotype ♂, Providence Mts., San Bernardino County, California, April 20, 1938.

Allotype ♀, Providence Mts., San Bernardino County, California, April 21, 1938.

Paratypes Nos. 1 to 18 inclusive:

Providence Mts., San Bernardino County, California, April 20, 1938.

Paratypes Nos. 19 to 24 inclusive:

Providence Mts., San Bernardino County, California, April 21, 1938.

Paratype No. 25:

Providence Mts., San Bernardino County, California, March 23, 1934.

Paratype No. 26:

Emerged August 25, 1938. Ex. conf. ♀, Providence Mts. Reared on *Eriogonum* sp.

Holotype and allotype in the collection of the Los Angeles County Museum. Paratypes will be placed in the U. S. National Museum and the Canadian National collection at Ottawa.

Alar expanse: 2.2 mm. holotype ♂; 2.1 mm. allotype ♀.

Average expanse of type series 2.2 mm.

This new species shows its relationship to *Callophrys apama* Hy. Edw. but is distinct enough to warrant a specific name..

It may be distinguished readily from *apama* by the slate grey ground color in both sexes; the uniform bluish green on the underside of the secondaries and the conspicuous white fringes on the upperside, whereas the ground color of *apama* is russet brown, the golden green does not cover the entire underside of the secondaries and the fringes are ashy brown.

We are greatly indebted to Mr. Charles H. Ingham for his generous coöperation in supplying us with additional specimens to be included with the type series.

Copicucullia mcdunnoughi sp. nov.

Palpi grey, sprinkled and bordered with white. Clypeus light grey. Front dark grey sprinkled with white; a dark transverse line runs from here to the bases of the antennae. Tegulae whitish with a dark line near base; the area below this line is dark grey flecked with white and the area above is bordered with black. Abdomen pale ochreous with two or three small black dorsal tufts on the basal segments.

Primaries: Ground color light bluish grey with lighter shading between veins which are outlined in black, giving a striated appearance to the wings. A dark grey area which includes the orbicular and reniform extends to the costal margin interior to the orbicular at an angle in line with vein Cu_1. This dark shading also extends outwardly along the margin to junction of vein R_2 and costa and is interspaced by three small white dashes. Orbicular round with a dark center and ringed with black and white, center sometimes containing white point. Reniform large, with irregular light colored center and ringed as is the orbicular on the inner two-thirds which is convex. The outer one-third is faintly outlined and concave. A fine black dash extends horizontally from the lower extremity and terminates in a series of dark striations as it nears the margin. T.a. and t.p. lines wanting. A conspicuous black dash occurs just above the inner angle originating at the outer margin where it is widest, and tapering to a point approximately one-third the distance to the base of the wing where it follows and merges with vein Cu_2. This dash forms an acute angle, interior to the outer marginal border, with a series of small black marginal dashes that become concentrated at this point to form a more or less unbroken line. The inner margin of the wing with the exception of the basal portion is heavily marked with black scales. The area above and also the area between the reniform and the apex varies in the intensity of light grey shading. In some specimens these areas are conspicuously light. The outer marginal border is whitish, streaked with brownish grey. Fringes brownish grey tipped with white.

Secondaries: Whitish tinged with ochreous brown in limbal area and shading to lighter in basal area. Veins outlined in darker brown. Fringes whitish with light ochreous base.

Underside of primaries light grey with slight brownish cast and whitish towards apex. Border clear cut, light, streaked with brownish grey. Fringes mottled grey. Secondaries whitish with veins outlined in brown and fringes white.

Female similar to male but primaries are a somewhat darker shade of grey and the secondaries are predominantly a dark brown shading to lighter in the basal area.

Type locality:

Providence Mts., San Bernardino County, California.

Number and sexes of types (described from 5 ♂♂ and 6 ♀♀):

Holotype ♂, April 22, 1938, Providence Mts., San Bernardino County, California.

Allotype ♀, April 1, 1935, Providence Mts., San Bernardino County, California.

Paratype No. 1: ♂, April 1, 1935, Providence Mts., San Bernardino County, California.

Paratype No. 2: ♂, April 21, 1938, Providence Mts., San Bernardino County, California.

Paratype No. 3: ♂, May 9, 1937, Providence Mts. San Bernardino County, California.

Paratype No. 4: ♀, April 3, 1935, Providence Mts., San Bernardino County, California.

Paratype No. 5: ♀, May 6, 1937, Providence Mts., San Bernardino County, California.

Paratype No. 6: ♀, March 19, 1934, Providence Mts., San Bernardino County, California.

Paratype No. 7: ♀, May 9, 1937, Providence Mts., San Bernardino County, California.

Paratype No. 8: ♀, April 21, 1938, Providence Mts., San Bernardino County, California.

Paratype No. 9: ♂, May 22, 1935, Argus Mts., Inyo County, California.

Alar expanse: 3.7 mm. holotype; 3.6 mm. allotype.

Average expanse of type series 3.66 mm.

Holotype and allotype in the Los Angeles County Museum. Paratypes to the U. S. National Museum, and the Canadian National Museum, Ottawa.

This species may be readily separated superficially from other members of the group by the light basal and apical areas on the primaries, the contrasting dark shading on the inner margin of the reniform and orbicular following vein Cu_2, the elongated dash at the inner angle of the wing, and the total lack of transverse lines.

ARGYNNID NOTES

By John A. Comstock

The eggs of our western Argynnids fall roughly into three types. Those of the nokomis - leto group are relatively large and sub-conoid with flattened bases and conspicuous cupped micropyles. The members of this group usually frequent meadows or moist areas at moderate elevations, where the violets grow lush and are in leaf at mid-summer or later.

The hydaspe - zerene group, and related species frequent wooded mountain sides in areas of less moisture, where the violets are past their prime even at earlier periods in the season. The eggs of this group are much more rounded in the upper half, with smaller micropyles, and less cupping on the top, but still with the bases definitely flat.

Argynnis callippe, macaria and their near relatives are on the wing in late spring, and frequent dry areas at relatively low elevations, where violets appear only with the spring rains, and have withered long before the time of ovipositing. The eggs of this group are nearly spherical, with small and inconspicuous micropyles, their bases being usually well rounded. The following notes serve to bring out these points.

Argynnis leto

Egg: Sub-conoidal, the base flat, and the top depressed with the micropyle conspicuous. There are from 20 to 22 longitudinal ridges beginning at the base and running towards the micropyle, but several of these coalesce in the upper third of the egg. The depressions between the longitudinal ridges are crossed by lower transverse subsidiary ridges, giving the egg a checkered or pitted appearance. The color is at first a clear yellow, changing gradually to brown, with purplish mottlings and spots.

Described from eggs secured by Lloyd Martin at Chris Flats, between Bridgeport and Walker River, Calif., the eggs being laid July 27, 1936, and hatching August 6, 1936.

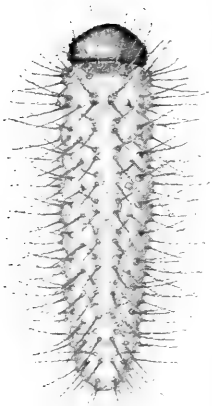
This egg is very similar to that of A. nokomis (=*apacheana* Skin.) which we illustrate on Plate 8, fig. B.

Larva of *A. leto Behr.* First instar.

Length, 1.4 mm. Head, glistening black, covered with numerous spiculiferous setae. Ocelli, black. Antennae, cream colored.

Body: Cylindrical, straw colored, covered with several rows of long curving setae, each topped with a globular hyaline tip or

A B C



D

PLATE 8

A. Egg of *Argynnis hydaspe viridicornis* Comst.

B. Egg of *Argynnis nokomis* Edw. (=*apacheana* Sk.).

C. Egg of *Argynnis callippe comstocki* Gund.

D. Larva (first instar) of *Argynnis leto* Behr.

club-like expansion. The first row of these setae is submedian in position, and is doubled,—that is, two setae arise from a single tubercle on each segment. The next lateral row is composed of single setae, the tubercles giving rise to them being definitely papilliform, and each seta being placed posteriorly on the segment.

The third lateral row of setae also arise from single tubercles. Each seta in this row is placed anteriorly on the segment.

In addition to the above, each segment has, below the spiracle, three additional setae.

The first cervical segment bears, in the mid-dorsal area, a dark scutellum, with several papillae superimposed on it, each of which gives rise to a seta.

The newly emerged larva is shown on figure D of Plate 8.

Argynnis nokomis Edw. (=*apacheana* Skin.)

The egg of this species was described by the author in the "Bulletin" for September - December 1928, Part 3, p. 89. We are showing a retouched photograph on the accompanying cut. Plate 8, fig. B.

Argynnis hydaspe viridicornis Comst.

Eggs of this species were secured from a captive female taken at the type locality in the Greenhorn Mts., July, 1939. A photograph was taken from which the cut shown in Fig. A of Plate 8 was made, but we were unable through lack of time to complete an accurate description. The illustration, however, furnishes the necessary information as to its form. It will be noted that the upper portion is much more rounded than the egg of *A. nokomis,* and the micropyle smaller and less depressed.

Argynnis callippe comstocki Gund.

The egg of this species is nearly spherical, and measures .75 mm. in height and the same in width. There is almost no flattening of the base, and very little cupping of the micropyle. The ridges are developed much as with other species, but they tend to coalesce both in the upper and lower quarters of the egg. The color when first laid is yellow, changing later to a pinkish brown. The example from which our drawing was made was laid June 3, 1930. See Plate 8, fig. C.

NOTES ON THE EARLY STAGES OF NEMORIA PISTACIARIA PACK.

By John A. Comstock and Christopher Henne

In the "Bulletin, Southern California Academy of Sciences" for May - August, 1937, the senior author, in association with Commander Dammers, described the larva and pupa of *Chlorosea naidaria* Swett.

Dr. McDunnough, in his latest Check List now places this species as a synonym of *Nemoria pulcherrima* B. & McD.

During a recent collecting trip in Mint Canyon, Los Angeles County, we had the good fortune to take a gravid female of a closely related species at light, which deposited a number of eggs in the collecting jar. This has enabled us to record some information on the early stages of *Nemoria pistaciaria.*

The egg of this species is shaped like a flattened oval lozenge, the base being flattened and the top slightly cupped. The upper surface is covered with a fine reticulation composed of barely perceptible raised walls enclosing hexagonal cells. This reticulation apparently does not extend over the sides or onto the base of the egg. The color is at first a pale yellow, slowly changing to orange. The egg measures .38 mm long by .23 mm wide and is approximately .18 mm. thick. A photograph of the egg in ltaero-superior aspect is shown on Plate 9.

The newly emerged larvae readily accommodated themselves to young leaves of *Quercus,* which is presumably their native foodplant.

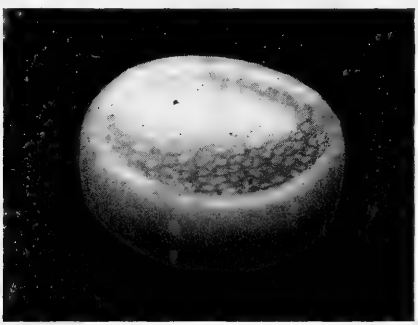


PLATE 9

Egg of *Nemoria pistaciaria,* enlarged x approximately 90 diameters.

Photo by Edw. Cobb, retouched by Comstock.

The young larva is pale orange, its shape somewhat approaching the mature phase, but with less pronounced processes. The mature larva is very similar to that described for *naidaria* as above quoted, the chief difference being in the somewhat more rugose surface, the lighter coloration, and the more regular shape of the keel-like processes along the dorsum of the larva of *pistaciaria*. Plate 10 gives a good representation of the mature larva, at rest on a twig of oak.

This larva has the same quivering habits as have been noted for some others in the group.

Pupation occurs on the food plant, in a delicate webbing.

Pupa: Length, 9.5 mm, the single example measured being somewhat dwarfed. Body ground color, pale buff. The brown spots occurring over the wing cases, and to a lesser extent on the thorax and body, are placed very much as is the case with the pupa of *Nemoria pulcherrima,* but are somewhat reduced in number and are smaller.

PLATE 10
Mature larva of *Nemoria pistaciaria* (enlarged) resting on sprig of oak.
Photo by Edw. Cobb.

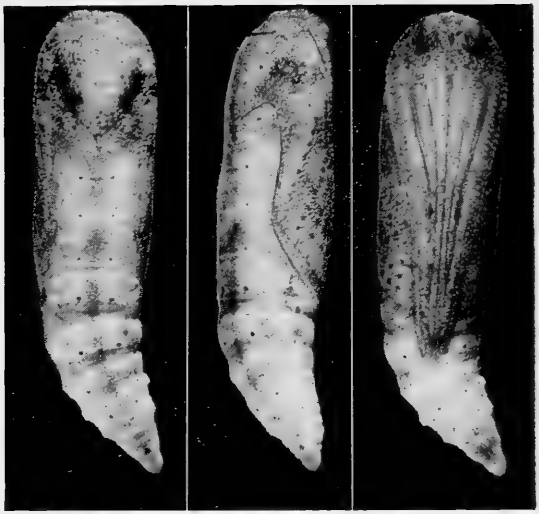


PLATE 11

Pupa of *Nemoria pistaciaria*, dorsal, lateral and ventral aspects, enlarged x 7.

Photo by Edw. Cobb.

The thorax is less robust than in the last named species and the head is proportionately larger and more rounded. In other respects the pupa closely resembles that of *pulcherrima,* as will be noted by reference to Plate 11 of this issue in comparison with Plate 40 of the May - August, 1937 issue of the "Bulletin".

Our pupae of *pistaciaria* gave forth imagines in April of this year rather than carrying over a season, as did *N. pulcherrima.* Our series of *N. pistaciaria* records captures in the months of May (Petaluma, Cal.), June and July (San Diego), September (San Diego), October and December (Los Angeles), and it would therefore seem that the species is multiple brooded.

A NEW LAND SHELL FROM LOWER CALIFORNIA

By G. Willett

On February 22, 1937, Mr. and Mrs. Emory P. Chace and the writer spent an hour or more searching for land shells among rocks on a hillside about nine miles north of Ensenada, Lower California. As a result of our work we obtained three adult, or sub-adult, and two juvenile specimens of a species unknown to us. As the larger specimens were all more or less worn and

bleached, they were laid aside to await accumulation of more material.

On April 21, 1940, the locality was again visited by Mr. and Mrs. Chace, on this occasion accompanied by Dr. W. O. Gregg, and, although no living specimens were found, enough additional material was secured to permit a more comprehensive study of the shell. As these specimens appear to represent a species unknown to science, it may be known as:

MICRARIONTA (? EREMARIONTA) CHACEI, new species.
(Plate 12)

Description: Shell of moderate size, considerably elevated. Whorls 5 to 5¼, rounded. Outer lip strongly descending, slightly reflected. Umbilicus almost entirely covered by the expanded columella. Aperture oblique.

Embryonic whorls transversely wrinkled for a fraction of a turn, then very finely papillated; over this are scattered larger, elongated papillae, rather widely and irregularly spaced. These larger papillae disappear at the end of the second nuclear whorl (the finish of the first growth stage). From this point forward the smaller papillae become finer and more sparse until they disappear near the beginning of the fourth turn. The remainder of the shell is smooth excepting for numerous growth lines.

Periostracum thin and polished. General color near Buffy Brown, with a conspicuous band of Vandyke Brown, about 1 to 1½ millimeters wide, and bordered above and below by poorly defined lighter areas, encircling the shell just above the periphery. (The color characters were not taken from the type, but from a fresher—though imperfect—specimen which is preserved with the type.)

TYPE NO. 1062 Los Angeles Museum, was collected by G. Willett among rocks on the southeast side of the highway, just south of highway bridge, at lower end of El Tigre Canyon, about 9 miles north of Ensenada, Lower California, Mexico, February 22, 1937. It has 5¼ whorls and measures in millimeters: Max. diam., 21.9; min. diam., 18; alt., 16.4. Paratypes are in the collections of Mr. and Mrs. Chace, Dr. Gregg and the writer.

REMARKS: This species can hardly be confused with any previously described. In color, altitude, strongly descending lip and nearly closed umbilicus, it resembles some examples of *M. wolcottiana* (Bartsch), but the sculpture of the nuclear whorls is very different. In the latter feature it is practically identical with *M. inglesiana* Berry, but that shell is much flatter and has an open umbilicus. From *M. merrilli* (Bartsch) and *M. peninsularis* (Pilsbry), *chacei* differs in its closed umbilicus and, from the former at least, in different sculpture of the early whorls.

Because the sculpture of the nuclear whorls of *M. chacei* is practically identical with that of *M. inglesiana,* I have tentatively followed Dr. Berry and assigned this species to the subgenus *Eremarionta.* However, it does not seem certain that such assignment is the correct one. I do not know of any other species of *Eremarionta* with nuclear sculpture like that of *inglesiana* and *chacei,* in fact, as Pilsbry has pointed out (Land Mol., N. Am., 1939, p. 204), in this feature these two species appear to resemble some *Helminthoglyptas* more closely than they do typical *Eremariontas.* It is probable that a definite assignment can not be made until the anatomy of one or both species is studied.

I take pleasure in naming this shell for Mr. and Mrs. Emory P. Chace, who are well and favorably known, not only for their diligence in collecting, but for their willingness to coöperate with other students of conchology.

PLATE 12

Micrarionta chacei
Willett.

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Southern California Academy of Sciences

LOS ANGELES, CALIFORNIA

Vol. XXXIX May-August, 1940 Part 2

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NOTES ON NORTH AMERICAN MICROLEPIDOPTERA WITH DESCRIPTIONS OF NEW GENERA AND SPECIES

By August Busck

FAMILY MOMPHIDAE

Mompha bottimeri n. sp.

Labial palpi with second and third joint slightly roughened in front; white, strongly marked with black on outer sides and with brush sprinkled with black. Tongue well developed, spiraled, scaled at base, white. Antennae dark fuscous with very narrow white annulations; basal joint white. Head and thorax silvery white. Fore wings elongate ovate with apex produced, pointed and slightly ainuate below, but the scaling gives the wing the appearance of being falcate. Venation typical of the genus. Silvery white with fawn-brown and black markings; basal half pure white except for the costal edge which is black with two slight triangular black projections, one near the base, the other at basal fourth. Outer half of the wing heavily overlaid with fawn-colored and slightly raised black scales with an iridescent sheen leaving the silvery white color unmixed only in a small costal streak at apical third and in a somewhat larger area on terminal edge; the darker apical half of the wing is edged basally by an outwardly curved dorsal streak of raised black scale, which nearly meets a similar outwardly curved dorsal streak with raised black scales; this latter limits a triangular costal spot of white, black-tipped scales, followed by the small costal white spot; beyond this is a large arrow-shaped area of white, black-tipped scales, limited apically by an oblique black costal streak followed by a white line and dorsally by the white area on termen, which is edged outwardly by a thin, oblique black line. Costal cilia mixed black and brown; dorsal cilia pure white below apex; yellowish along termen. Hind wing silvery fuscous with dark fuscous cilia. Legs black on outer sides, whitish on inner sides, tarsi black with narrow white annulations; tuft on posterior tibiae yellowish.

Male genitalia (Plate 13, fig. 1) typical of the genus with the harpes divided, costal part thin and soft, apex rounded; dorsal part more heavily chitinized and ending in a short hook; anellus with two lateral triangular processes, enclosing the slightly curved, short aedeagus; two long, strong, hooked cornuti. Uncus long, curved, pointed, spear-shaped.

Female genitalia (Plate 13, fig. 3) with ostium small, cup-shaped, flush with the abdominal wall; ductus long, looped once upon itself; bursa oval with two strong "S"-shaped signa the bases of which extend outside of the bursa.

Alar expanse, 9 - 11 mm.

Type—U. S. Nat. Mus. No. 54052.

Habitat—Gainesville, Florida.

Foodplant—*Crocanthemum corumbosum.*

Reared in large series by Mr. L. J. Bottimer from the seed pods of the above plant. The moths issued in late May and early June.

A very distinct and pretty species which reminds one of and is closest to the much larger *Mompha eloisella* Clemens. Named in honor of my good friend L. J. Bottimer of the U. S. Department of Agriculture, who through many years has added much to our knowledge of the North American Microlepidoptera through his careful rearings and discoveries of many new forms.

Mompha capella n. sp.

Second joint of labial palpi with well developed brush, dark brown closely sprinkled with white; terminal joint roughened in front, blackish brown with a narrow white annulation on middle. Antennae blackish brown with narrow whitish annulations. Tongue well developed, spiraled. Face golden yellow. Head and thorax dark brown, sprinkled with white. Fore wings elongate ovate, pointed, termen slightly sinuate below apex; dark brown, thickly dotted with white and black on base and on outer four-fifths; a large tuft of raised black scales, edged with white and brown on the fold; another similar large tuft below the end of the cell; a narrow, outwardly sharply angulated, brown fascia terminating in a short longitudinal black dash at apical fifth; costal cilia white, tipped with black and with an oblique line on base; dorsal cilia brownish white. Hind wings light brownish fuscous; cilia a shade darker. Abdomen dark brown. Legs dark brown, mottled with white scales. Tarsal joint dark brown with narrow white annulations.

Male genitalia (Plate 13, fig. 2) typical of the genus with uncus long, narrowly spear-shaped, slightly curved, pointed; gnathos and transtilla absent; harpes divided with costal half soft, hairy, a little shorter than dorsal half, which is stronger chitinized, apex pointed. Anellus a small rounded plate with two lateral, elongate, soft projections enclosing the aedeagus. Aedea-

gus short, slightly curved, apex pointed; two long, stout, twisted cornuti. Female genitalia (Plate 13, fig. 4) with small oval ostium; ductus rather wide, long, looped once upon itself; bursa elongate ovate with two long sharply pointed, curved signa, the bases of which extend outside the wall of the bursa.*

Chrysoclista linneella (Clerck)

Clerck, Icones Insectorum, Plate 2, fig. 8, 1764.

This pretty European species has been introduced into northeast United States and was well established in 1928, when I first identified the species from specimens reared from the bark of Linden (*Tilia europaea*) by my friend, Fred M. Schott, at Rutherford, New Jersey, in August, 1928. Mr. Schott has reared the species repeatedly since then in Bergenfield, New Jersey. It has also been received for identification, reared from *Tilia* in Boston, Massachusetts.

The occurrence of the species in America has not hitherto been recorded in the literature.

FAMILY GELECHIIDAE

Aroga alleriella new species

Second joint of labial palpi with well developed furrowed brush, white sprinkled with black; terminal joint nearly as long as second, smooth, apex pointed, black with apex white. Antennae black. Face white. Head whitish fuscous. Thorax black. Fore wings black with white markings; a white costal streak, outwardly oblique from before basal fourth, reaching to the fold; a smaller inwardly oblique costal streak at apical fourth, opposite which a similar white dorsal streak; a short longitudinal white spot on the middle of cell; a minute white dot on the middle of the fold and a few white scales at apex. Abdomen dark fuscous. Legs black with white bars on the tibiae and white spurs; tarsi black with white annulations.

Male and female genitalia typical of the genus (see Proc. U. S. Nat. Museum, vol. 86, pl. 61, fig. 17; pl. 68, fig. 51, 1939).

Alar expanse, 17 - 22 mm.

Type—U. S. National Museum No. 54051.

Habitat—Mobile, Alabama.

Foodplant—*Polygonum maritimum*.

* A page of manuscript to follow this was lost and is not recoverable at present, due to the author's absence in Honolulu. It undoubtedly gave the U. S. National Museum number 54053 and biological notes. Mr. Bottimer reared the species in large numbers from the seed pods of a plant closely allied to the foodplant of the foregoing species. Type locality: New Jersey.—A. B.

Reared in numbers from stems of *Polygonum* by my friend, Dr. Th. Van Aller, for whom I take pleasure in naming the species.

The species is nearest to and nearly identical in ornamentation with *Aroga coloradensis* (Busck), but considerably larger and differing in details of the genitalia; *A. coloradensis* has the strongly chitinized tips of the upper arms of the harpe much longer and strongly curved against the shorter nearly straight tips of *A. alleriella;* the signum in the female of *A. alleriella* has the four spines much stouter and shorter than those of *A. coloradensis.*

Pavolechia Busck

Type: *P. argentea* Busck.

Proc. U. S. National Museum, vol. 47, pp. 20-21, 1914. n. syn. Desmaucha Meyrick.

Type: *D. chrysostoma* Meyrick.

Exot. Micros., vol. 2, pp. 146-147, 1918.

These names apply to the same easily recognized, strikingly marked species, as ascertained by comparison of the types by my old friend Edward Meyrick and myself on a visit in Marlborough in 1932. Meyrick's generic and specific names fall as synonyms. The slight discrepancies in Meyrick's description of the venation of the hind wings were due to the difficulty in seeing the veins in the thickly scaled wings; the denuded wing clearly shows vein 5 absent and veins 6 and 7 connate, diverging. (Meyrick concurring.)

FAMILY OECOPHORIDAE

Hastamea n. n.

Hasta Busck

Type: *H. argentidorsella* Busck.

Proc. U. S. National Museum, vol. 40, p. 210, pl. 8, fig. 3, 1911.

Preoccupied by *Hasta* Kirkaldy, 1906.

My good friend, T. Bainbrigge Fletcher, has repeatedly called my attention to this and asked for correction.

Male and female genitalia are given on Plate 13, figs. 5 and 6.

FAMILY TORTRICIDAE

SYNOPTIC TABLE OF THE SUBFAMILIES OF THE NORTH AMERICAN TORTRICIDAE

On Male Genitalia

1. Uncus absent ..... *Tortricinae*
   Uncus present 2
2. Uncus spiny ..... *Cnephasiinae*
   Uncus smooth 3
3. Uncus long, slender, curved, pointed..... *Sparganothiinae*
   Uncus spoon-shaped, blunt ..... *Archipsinae*

1. Gnathos absent or divided into two free arms..... *Sparganothiinae*
   Gnathos not divided 2
2. Gnathos with flat ventral plate..... *Tortricinae*
   Gnathos hook-like, without plate..... 3
3. Gnathos a strong compressed hook..... *Archipsinae*
   Gnathos weak with small hook..... *Cnephasiinae*

On Female Genitalia

Signum a single smooth horn with bulbed base..... *Archipsinae*
Signum a straight dentate band..... *Cnephasiinae*
Signum a single stellate plate..... *Tortricinae*
Signum a smooth ribbon or a twisted rope .... *Sparganothiinae* * **

SUBFAMILY ARCHIPSINAE

Templemania new genus

Type: *Tortrix animosana* Busck.

Journ. N. Y. Ent. Soc., vol. 15, p. 235, 1907.

Second joint of labial palpi long, upright, close to vertex; terminal joint short, blunt, slightly porrected. Antennae half the length of the fore wings; strongly, doubly pectinate in the male, simple in the female. Tongue well developed, spiraled. Face, head and thorax smooth. Fore wings with base of costa gently curved, apex bluntly pointed, termen rounded, dorsal edge parallel with costa; 12 veins all separate; vein 2 from middle of cell, 3 from end of cell, 4 and 5 approximate, 6, 7, 8, parallel; 7 to termen below apex, 1*b* strongly furcate. Hind wings as broad as fore wings, termen evenly curved; 8 veins, 6 and 7 closely approximate on basal third, thence diverging; 3 and 4 connate; 5 approximate to 4.

* Except *Niasoma* with signum a horn.
** Some species in all subfamilies have no signum.

Male genitalia (Plate 14, fig. 5) with well developed, spoon-shaped uncus; socii porrected, elongate ovate, pointed with long hairs; gnathos a strong hook; transtilla broad, nearly straight with 5 or 6 strong, short spines on each side of the slightly depressed center; harpes simple elongate ovate with rounded apex and short, thickened sacculus; aedeagus long, straight, but bent at the juncture with anellus; cornuti four or five long, slender, deciduous spines.

Female genitalia (Bull. Brooklyn Ent. Soc., vol. 26, pl. 10, figs. 4, 5, 1932) with eighth abdominal segment clothed ventrally with heavily matted, plush-like scales, ninth joint ventrally clothed with curiously inflated club-like scales. Ostium large, funnel-shaped; ductus short, narrow posteriorly, widening towards the bursa which is large, irregularly oval and contains one short, compressed, blunt signum with a broad base; ductus bullae short emitted from the middle of ductus bursae; bulla seminalis half the size of bursa.

Besides the genotype *Templemania animosana* Busck the following species fall in this genus as the general habitus, color and ornamentation would indicate: *Tortrix sarothrura* Felder (Reise Novara Zool., pl. 139, fig. 33, 1875). Syn. *Tortrix auricomana* Busck (Journ. N. Y. Ent. Soc., vol. 15, p. 236, 1907); *Tortrix millestriata* Walsingham (Biol. Centr. Am., vol. 4, p. 277, 1914) and *Tortrix apertana* Walsingham (Biol. Centr. Am., vol. 4, p. 277, 1914).

Named in honor of my friend Mrs. Thomas Carlin (née Miss Eleanor Templeman Armstrong) in grateful recognition of her most valuable, loyal help to me and other students by her painstaking illustrations of the intricate minute structures, with which we deal.

SUBFAMILY TORTRICINAE

GENERIC TABLE OF NORTH AMERICAN SUBFAMILY TORTRICINAE

On Venation and External Characters

1. Fore wing 7 to costa..... 2

   Fore wing with 7 to termen.....*Argyrotoza* Stephens
   type: *bergmanniana* Linn.

2. Hind wing with all veins present.....*Peronea* Curtis
   type. *cristana* Fabricius

   Hind wing with 3 and 4 coincident.....*Apotoforma* Busck
   type: *rotundipennis* Wlsm.

The genus *Tortrix* Linn. should be restricted to the genotype, the European *T. viridana* Linn.

GENERIC TABLE OF THE NORTH AMERICAN SUBFAMILY TORTRICINAE

On Male Genitalia

1. Socii absent ..... *Apotoforma* Busck
type: *rotundipennis* Wlsm.

Socii present, well developed 2

2. Ventral plate strongly chitinized with edges folded over.....
..... *Peronea* Curtis
type: *cristana* Fabr.

Ventral plate weakly chitinized, straight..... *Argyrotoza* Stephens
type: *bergmanniana* Linn.

Synopsis of Subfamily Tortricinae. Fore wing, 7 and 8 separate to costa (*Apotoforma* and *Peronea*) or to termen (*Argyrotoza*); Hind-wing *without* pecten. Uncus absent. Gnathos not divided, with ventral plate.

Peronea negundana new species

(Plate 14, figs. 1 and 2)

Labial palpi, face, head and thorax light whitish yellow. Fore wing light yellow overlaid with slightly darker yellow dusting and with black markings. A large triangular spot, reaching from the basal third to apical fourth and downwards to the middle of the cell, blackish fuscous, normally with the center ochreous; numerous small raised tufts of deep black scales, one on the base of the cell, another below it on the fold; a series of six or seven along the basal edge of the costal triangle; and outwardly curved series of black raised dots from middle of costa to middle of termen and others scattered over apical third of the wing. Cilia light yellow sprinkled with black. Hind wing whitish with terminal edge touched with blackish fuscous. Abdomen light yellowish fuscous. Legs whitish yellow; tarsi with black annulations.

There is considerable variation in the coloration in the nearly hundred specimens before me; some specimens have the triangular costal spot much less prominent, nearly obsolete and the small black tufts of raised scales much more numerous and scattered over the entire wing.

Male genitalia with hood-shaped tegumen; ventral plate elongate, deeply forked at tip with a strong, sharp spine below the furcation; socii long, narrow, erect, reaching beyond the ventral plate; transtilla simple; harpes elongate, apex produces pointed; sacculus emarginate, thickened, terminating in a hair-tuft; aedeagus with strong, long, lateral branch; cornuti two short spines.

Female genitalia with posterior part of ductus strongly reinforced by a line of heavy sclerotizations and another opposite weaker line; bursa large, oval; signum a small star-shaped plate.

Alar expanse, 13 - 17 mm.

TYPE: U. S. National Museum No. 54050.

HABITAT: District of Columbia, Maryland and Virginia along the Potomac River.

FOODPLANT: *Negundum.*

The branched aedeagus of the species is a rare character in the genus *Peronea,* found, as far as known, only in one other species, the European *Peronea fissurana* Pierce; paratypes and genitalia slides of that species, kindly presented to me by Mr. Pierce, are in the U. S. National Museum.

SUBFAMILY SPARGANOTHINAE

This subfamily is confined to the American continent; only a single species, *Spanganothis pilleriana* is found in Europe, introduced accidentally within recent time.

GENERIC TABLE OF THE NORTH AMERICAN SUBFAMILY SPARGANOTHINAE

ON VENATION AND EXTERNAL STRUCTURE

Synopsis of Subfamily: (1) 7 and 8 in fore wing stalked or coincident. (2) Hind wing *with* pecten (except *Coelostathma*). (3) Uncus long, slender, curved. (4) Socii flat erect. (5) Gnathos divided into two free arms, no ventral plate. (6) Cornuti attached on their side, deciduous.

1. Fore wing with vein 9 out of 7; Hind wing without pecten ..... *Coelostathma* Clms.

   Fore wing with 9 free; Hind wing with pecten..... 2

2. Tongue weak or rudimentary; male antennae bipectinate..... 3

   Tongue well developed; male antennae ciliate..... 4

3. Face, head and thorax hairy .....*Synnoma* Wlsm.

   Face, head and thorax normally scaled .....*Niasoma* Busck

4. Fore wing with all veins present in both sexes..... 5

   Fore wing with 7 and 8 coincident at least in male.*Amorbia* Clemens

5. Fore wing with strongly raised scales and decided costal fold ..... *Platynota* Clemens

   Fore wing smooth with slightly raised scales; without or with *small* costal fold .....*Sparganothis* Hbn.

GENERIC TABLE OF THE NORTH AMERICAN SUBFAMILY SPARGANOTHINAE

On Male Genitalia

1. Gnathos absent 2

   Gnathos developed into free arms..... 4

2. Socii large, upright flattened; transtilla without horns..... 3

   Socii small; transtilla with large lateral horns.....*Niasoma* Busck
   type: *metallicana* Wlsm.

3. Transtilla smooth .....*Coelostathma* Clemens
   type: *discopunctana* Clemens

   Transtilla spined .....*Amorbia* Clemens
   type: *humerosana* Clemens

4. Harpes evenly tapering to apex .....*Sparganothis* Hubner
   type: *pilleriana* Schiff.

   Harpes with costa and dorsum nearly parallel....*Platynota* Clemens
   type: *idaeusalis* Walker

Niasoma new genus

Type: *Platynota metallicana* Walsingham.

Trans. Ent. Soc. Lond., Plate 12, fig 1, 1895.

Labial palpi very long, porrected; second joint slightly thickened with rough scaling; terminal joint long, nearly a third as long as second, smooth, obtusely pointed, slightly deflected. Tongue very weak, nearly obsolete, spiraled. Antennae in male bipectinate, in female simple. Face thinly scaled, smooth; vertex smooth with scales protruding over face. Thorax smooth. Fore wing with tufts and ridges of roughly raised scales; 12 veins, 2 from middle of cell, 7 and 8 stalked, 7 to termen. Hind wings with cubital pecten; 3 and 4 separate; 5 parallel to 4; 6 and 7 short stalked.

Male genitalia (Plate 14, fig. 3) with uncus short, stout, curved, spoon-shaped, pointed; socii weak, short, paddle-shaped, pointed, porrected. Gnathos absent. Transtilla a narrow band with two strongly chitinized, lateral pointed and spined horns. Harpes broad, irregularly ovate, sacculus narrow, strongly chitinized, protruding and spiny at apex. Aedeagus long, stout, nearly straight, flaring at tip with four long, thin, needle-like, deciduous cornuti. Vinculum a narrow band.

Female genitalia (Plate 14, fig. 4) with ostium plate strongly chitinized; bursa large, oval; signum a single strong smooth horn.

An aberrant genus, but probably best placed in the subfamily *Sparganothinae* in spite of the feeble pecten on the hind wing and the single hornlike signum of the female, which would place it in the subfamily *Archipsidae*.

Explanation of Plates

PLATE 13

Fig. 1. *Mompha bottimeri* Busck ♂
Fig. 2. *Mompha capella* Busck ♂
Fig. 3. *Mompha bottimeri* Busck ♀
Fig. 4. *Mompha capella* Busck ♀
Fig. 5. *Hastamea argentidorsella* Busck ♀
Fig. 6. *Hastamea argentidorsella* Busck ♂

PLATE 14

Fig. 1. *Peronea negundana* Busck ♂
Fig. 2. *Peronea negundana* Busck ♀
Fig. 3. *Niasoma metallicana* Walsingham ♂
Fig. 4. *Niasoma metallicana* Walsingham ♀
Fig. 5. *Templemania animosana* Busck ♂

The figures were made from the author's slides by Mrs. Eleanor Templeman Carlin of the U. S. Bureau of Entomology and I wish to express my thanks to her for many years' helpful cooperation and my thanks to the Bureau for permission to use these drawings.

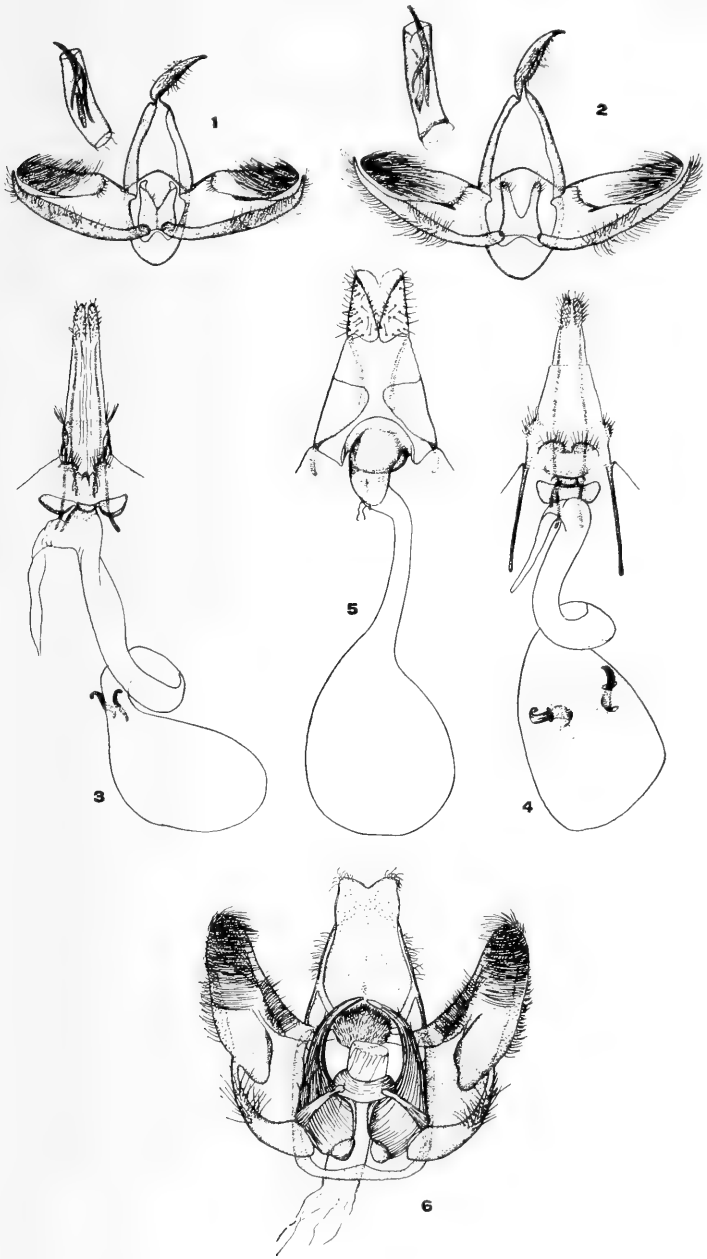
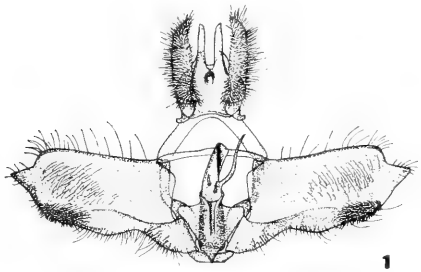
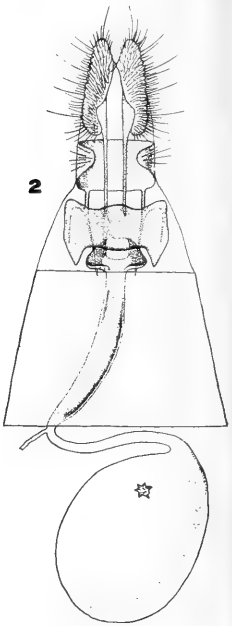
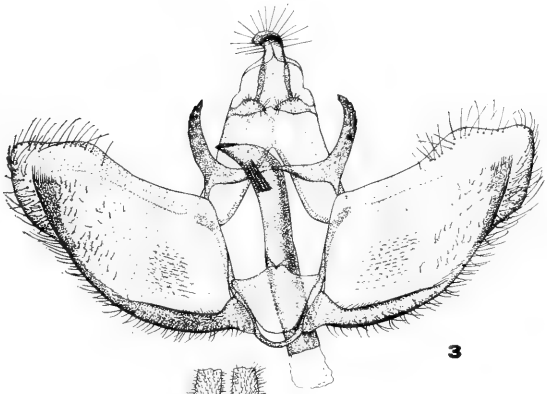
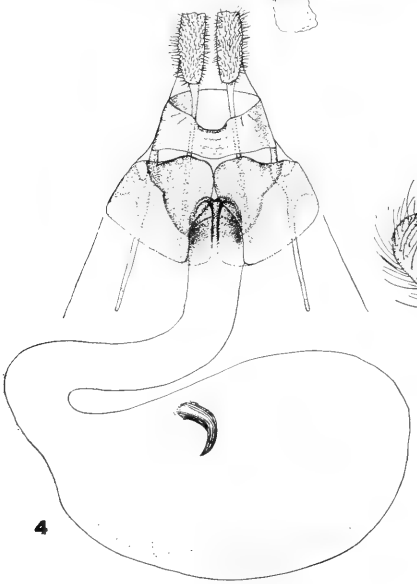


PLATE 13









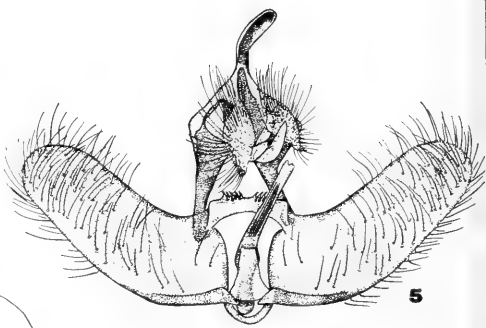


PLATE 14

A NEW CALIFORNIA PLUME-MOTH
(LEPIDOPTERA, ALUCITIDAE)

By T. Bainbrigge Fletcher, R.N., F.L.S., F.R.E.S., F.Z.S.

Platyptilia crataea, n. sp.

♂. Expanse 21 mm.

Head: Dull fuscous: frontal tuft slight, not over one-half breadth of eye, acute.

Antenna: Shortly ciliated (about ½), scape short, stout, flagellar segments dilated at tips, pale fuscous, broadly banded blackish.

Labial Palpus: Short, subascending, apex of second segment level with point of frontal cone; second segment as long as breadth of eye, expanded with rather rough scales which project slightly at its tip; third segment short, slender, moderately acute: dark fuscous, minutely sprinkled with lighter.

Thorax: Dull fuscous minutely sprinkled with whitish and darker, tips of tegulae rather lighter: a few very short hairs directed upwards and forwards on collar.

Abdomen: Rather shorter than distance from base of forewing to cleft, rather slender: dull dark fuscous, very finely sprinkled whitish and darker: first segment black on base of dorsum, whitish laterally and on distal half of dorsum, second segment with an ill-defined white lateral line which is still less evident on succeeding segments as a sublateral line edged above with blackish scales, tip of third segment slightly expanded on sides with looser scales mixed with whitish.

Legs: Rather long and slender. [Foreleg: femur long, dark fuscous, lined whitish beneath; tibia short, about two-thirds of femur, distal half slightly expanded with scales, dark fuscous, lined white beneath; tarsus, first segment longer than 2-5 together, whitish broadly banded with dark fuscous at apex, second segment about two-fifths of first, whitish, its apical half dark fuscous, third segment dark fuscous, slightly paler towards base, fourth and fifth segments rather dark fuscous.]

MIDLEG: Tibia slightly longer than femur, rather reddish—fuscous broadly banded, darker in middle and at apex, which is very slightly dilated, bears an acuminate scale-tuft and emits a pair of short equal spurs only pointed at extreme tips; tarsus as in foreleg but second segment fully half as long as first.

HINDLEG: Femur fuscous, coarsely speckled darker; tibia blackish-fuscous with a slight reddish tinge, especially on basal half, where rather coarsely sprinkled whitish, an indefinitely-edged whitish band, sprinkled with ferruginous, just beyond proximal spurs, apical fifth scarcely dilated with scales which at extreme apex of tibia project rather roughly and are whitish-tipped, proximal spurs from about two-thirds of tibia, rather short, equal, filiform, blunt-tipped, with a few rough scales beneath, white, blackish at bases and with a blackish subapical band, distal spurs subequal, the inner spur very slightly longer than outer, similar to proximal spurs, outer spur as long as fourth tarsal segment; tarsus, first segment shorter than 2-5 together, basal two-fifths whitish minutely flecked ferruginous, otherwise blackish, segments 2-4 whitish broadly banded apically, with slightly ferruginous, fifth segment short, dull fuscous.

FOREWING: Cleft from about two-thirds, segments rather narrow: costa fairly straight to two-thirds of first segment, thence down curved to apex, which is produced, pointed, subfalcate, termen of first segment strongly incurved below apex, much less so on its lower half, lower angle well marked, obtuse, lower margin of first segment gently downcurved from base of cleft to lower angle, the first segment thus being broader outwardly than at its base, second segment also expanded outwardly and as broad as first, its upper margin slightly upcurved from base of cleft to upper angle, its termen oblique, slightly sinuous, excurved in middle, both angles well marked, dorsum of wing faintly excurved near base, strongly downcurved from below base of cleft to tornus: dull brown with a slight ferruginous tinge, minutely and inconspicuously sprinkled with whitish and darker fuscous scales, these latter tending to form short broad outwardly-oblique bars from dorsum on central third of wing and a slight elongate blotch in cell at one-third of wing; costal area between base and triangle almost blackish, cut (but not sharply) with whitish spots; a dull-fuscous-brown costal triangle before and well separated from cleft, its inner side (towards base of wing) not sharply defined, its outer side (towards termen) more defined and slightly concave, its apex terminating in a short black transverse streak-like spot rendered rather more conspicuous by an edging of white scales on either side; a few more white scales also between costal

triangle and base of cleft, which is narrowly edged with black around its base and on either side for about two-thirds of its length; first segment on its central third strongly suffused blackish-fuscous with a minute longitudinal costal patch of white scales, the basal edge of this suffusion indefinite, its terminal edge marked by a transverse line of ground-colour running obliquely inwards from costa to half-breadth of segment, thence very slightly excurved; second segment darker than first, its second and third fifths strongly suffused blackish-fuscous, less evident towards dorsum, this suffusion separated by a transverse paler line of ground-colour from the less strongly suffused fourth and fifth fifths of segment, the darker area and following paler line of second segment being in continuation of those of first segment: cilia on costa blackish-fuscous cut with dull-whitish rather broadly on anterior two-thirds of costal triangle and beyond triangle and more narrowly and faintly opposite paler line on first segment and before apex; on apex with a slight fuscous tuft; on termen of first segment greyish with a blackish basal-scale-line which is slightly but distinctly interrupted at half length of termen; on lower margin of first segment grey mixed with blackish but before lower angle blackish followed by whitish narrowly just before angle; on upper margin of second segment greyish intermixed with black, but blackish before upper angle, on which white; on termen of second segment at bases black, narrowly cut at one-third and two-thirds of termen, then whitish, forming a narrow line above black bases, then greyish; on dorsum whitish with a few scattered black scales and a moderate black scale-tooth at two-thirds, a narrow black wisp beneath cleft, on outer half of segment black narrowly cut with whitish.

Hindwing: Cleft from two-fifths and one-sixth, segments moderate; first segment elongate-spatulate, evenly broadened exteriorly, where about twice as broad as at base, costa strongly downcurved before apex so that the blunt tip of the segment is at half its breadth; second segment with its foremargin very slightly down-curved to acute tip, termen faintly concave, lower angle well-marked but not sharp, greatest breadth of segment (opposite lower angle) about 1½ times that at base; third segment moderately broad, lower angle (at about three-fifths) scarcely evident: pale fuscous thickly overlaid with dark fuscous-brown; *Cilia* dark greyish, a costa with slightly paler patches at one-half of first segment and (less so and scarcely evident) just before apex on termen of first segment with slight subbasal blackish shade, also less evident around tip of second segment, on termen of second segment slightly paler at bases, on foremargin of third segment slightly paler, on dorsum basal half of cilia almost whitish on exterior half of segment, with scattered

black spatulate scales at bases of cilia on basal half of segment, at three-fifths a black triangular scale-tooth, its longest side towards base of wing but only extending two-thirds across cilia, two or three ferruginous-blackish scales at base of cilia beneath tip of third segment and a faint ferruginous shade in cilia on extreme tip of third segment. Type ♂, California, Half Moon Bay, 1-x—1937, W. H. Lange Coll., reared from larva on *Scrophularia californica*. The above description is from the type except for portion within square brackets, from a cotype, the type being defective in this respect (foreleg). The ♀ is similar to the ♂.

Cotypes 14 ♂ ♀ from Half Moon Bay (W. H. Lange: reared from *Antirrhinum, Castilleia latifolia* and *Scrophularia californica*); one ♂ (Fletcher Colln. 9199) from San Francisco (26-XI—1933, Keifer, also reared from *Scrophularia californica*), received from Mr. Keifer; ♂ ♀ from Carmel, California, April, A. H. Vachell, Coll., received from Mr. August Busck as *"acanthodactyla"*.

The above series exhibits considerable variation in the ground-colour of the forewing, most of the Half Moon Bay specimens giving a naked-eye appearance of a dull smoky black; the San Francisco specimen is paler than the type, more of a dark smoky red-brown, whilst the two Carmel examples are still paler, of a light reddish-brown. These last mentioned are apparently part of the "ten specimens from Carmel, Calif., taken in April," referred to by Barnes and Lindsey (Cont. Nat. His. Lep. N. Amer., IV, 4, 322: 1921) under the name of *Platyptilia acanthodactyla* Hb., and their figure (Pl. 41, fig. 13) of one of these Carmel specimens agrees with my type of *crataea*, as regards shape of wings, markings and scale tufts. I note that in one of my Carmel specimens (Fletcher Colln. 9839) the lower portion of the outer edge of the costal triangle of forewing may be resolved into two dark antefissural dots, one above and the other slightly below the base of the cleft, which is interesting as showing the development of the normal *Platyptilia*-triangle from the antefissural dots of *Stenoptilia*; these two genera are very closely allied and it is a practical difficulty to draw any dividing line between them; some African species, *Platyptilia* by scale-tufts, show the antefissural dots and no costal triangle.

Platyptilia acanthodactyla Hb., has been recorded from North America by various authors but I refrain from giving a list of references, as in some cases it is uncertain what species was intended.‡

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‡ Kearfott's figure (Bull. Amer. Mus. Nat. His. xxiii, pl. 8, fig. 16: 1907) of *"acanthodactyla"* has no resemblance to *acanthodactyla* Hb., and Fernald's record (Pteroph. N. Amer., p. 25: 1898) from the state of New York is unlikely to refer to *crataea*: but, so far as I know, the true *acanthodactyla* does not occur in N. America.

In comparison with *acanthodactyla, P. crataea* is more clumsily-built,* less neatly marked, and its male genitalia, although of the same general pattern, are on a larger scale, with much broader claspers (harpes, valvae) and the uncus more broadened toward its tip, which is decidedly acute (blunt-rounded in *acanthodactyla*). The wing-segments in *acanthodactyla* appear narrower, especially the second segment of hindwing, and the cleft of forewing is deeper than in *crataea*, so that the small dark cilial wisp on dorsum of forewing is found outside of a line drawn vertically from base of cleft in *acanthodactyla*, but inside or occasionally on (never outside) this line in *crataea*. These two forms were probably derived originally from the same stock, but I can only consider them to be distinct species.

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* Hence its name (Greek Krataios: potent, strong, robust).

NOTES ON THE LIFE HISTORY OF ASEPTIS PERFUMOSA HAMPS.

By John A. Comstock

On May 22, 1939, we secured a number of green Noctuid larvae in Bouquet Canyon, Los Angeles County, while beating Manzanita. A few were reared to maturity and proved to be *Aseptis perfumosa.*

The mature larva is cylindrical and robust, the head as large as first segment, and last three segments gently tapering toward cauda.

Length, 28 mm. Body ground color, light green. There is a mid-dorsal narrow longitudinal stripe of light yellow or whitish yellow, and a still narrower dorso-lateral line running parallel with it.

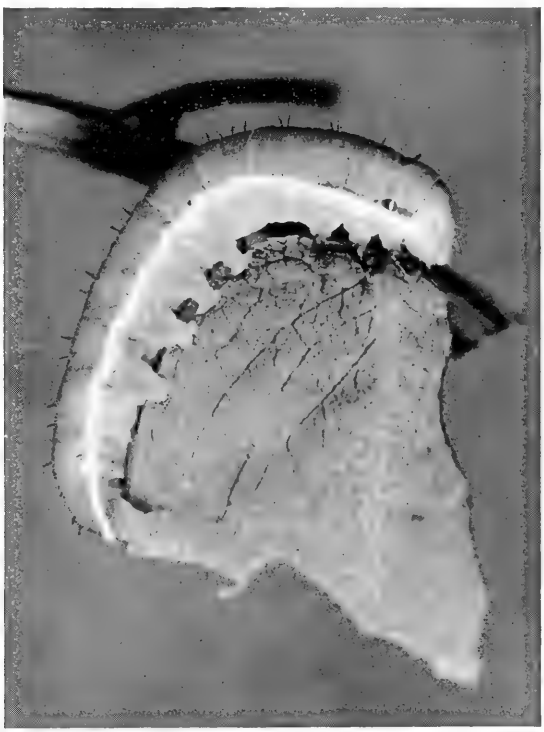

PLATE 15

Mature larva of *Aseptis perfumosa* Hamps., feeding on Manzanita.

Enlarged approximately by 2½.

Photo courtesy Los Angeles County Museum.

Stigmatally, a narrow magenta line runs the entire length of the body, meeting the same line of the other side above the anal orifice. This line is margined inferiorly by a yellow-white line of more than twice the width of the magenta line. Below this, and over the entire abdominal surface, the color is a bright green of a deeper shade than the dorsum. The setae are dark and not markedly conspicuous. Each one arises from a round white spot which is not elevated.

Spiracles: White, with narrow black rims. Legs: Dark magenta. Prolegs: Green on the two proximal segments; tinged with pink on the distal end.

Head: Concolorous with body, but with a faint mosaic of white spots over the crown and along the sagittal suture. Ocelli: Green, with one or two frequently showing dark centers.

Occasional examples lack the stigmatal magenta stripe.

Plate 15 illustrates the mature larva in lateral view.

Pupa: Length, 18.5 mm. Color, deep blackish brown with a tinge of red-brown; stout, and heavily rugose; widest through the third abdominal segment, tapering regularly to the cauda, and rounded over the thorax and head. The caudal end is acutely rounded, with a pyramidal cremaster extending from it, the latter topped by a pair of diverging straight spurs. The illustration on Plate 16 obviates the necessity of further detailed description.

a. *b.* *c.*

PLATE 16

Pupa of *Aseptis perfumosa* Hamps.
a. Ventral aspect. *b.* Lateral aspect. *c.* Dorsal aspect.
Enlarged approximately by 3.

Photo courtesy Los Angeles County Museum.

THE EARLY STAGES OF TRACHEA FUMEOLA HAMPS.

By John A. Comstock

Larvae of this Noctuid moth were secured from Manzanita by beating on May 22, 1939. They were collected in Bouquet Canyon, Los Angeles County, and were raised to maturity in the laboratory.

Notes were made on the mature larva and pupa. The egg, and earlier larval instars are still to be recorded.

Mature larva: Length, 27 mm. Cylindrical, stout, the head much smaller than first segment. Body, thickest from fourth to eighth segments, tapering from ninth segment to cauda. Texture of body surface, smooth.

Body ground color, gray-green. Under a lens it is noted that this color is overlaid by a fine network of crenulated darker green lines, which in some examples tend to become thicker toward the caudal end producing a graduated darkening in this area.

PLATE 17

Mature larva of *Trachea fumeola* Hamps. Enlarged approx. by 2½.
Photo courtesy L. A. County Museum.

Infrastigmatally there is a narrow lemon-yellow line running longitudinally. This is very faint and somewhat blurred on the first four segments, becomes slightly clearer as the eighth segment is approached, and then gradually expands and clarifies on the three caudal segments.

The abdomen is concolorous with the dorsum.

Legs, concolorous with the body. The four pair of prolegs are blue-green, the terminal portions being tinged with pink. The anal proleg has the lemon-yellow stripe on its outer surface as a direct continuation of the infrastigmatal line above described. The terminal portion of this proleg is also tinged with pink.

Spiracles: White centered, narrowly margined with black.

Head: Light gray-green, of a slightly bluish cast, the crown mottled with a mosaic of white. Ocelli: The lower two show some black shading, the remainder being translucent.

There are a number of whitish setae arising on the face, and a few shorter setae of similar character occur on the body.

A lateral view of the mature larva is shown on Plate 17.

Pupa: Length, 21 mm. Color, uniform red-brown throughout, overlaid by a barely perceptible bluish bloom. The shape is sub-cylindrical, stout, the head well rounded and relatively small. The body is widest in the region of the posterior edge of wings, and tapers gradually from that point to the cauda. The surface is smooth and glistening, without any prominences, ridges, or roughened surfaces, and lacks any vestige of setae.

Spiracles, a shade darker than body color, but relatively inconspicuous. Cremasteric end rounded, and topped by a single stout spur, without a recurved tip.

Pupation occurs on the ground under debris, in a loosely woven cocoon into which gravel, soil, and plant fragments are incorporated.

All of our examples pupated prior to June 2, 1939.

The pupa is illustrated on Plate 18.

a. *b.* *c.*

PLATE 18

Pupa of *Trachea fumeola* Hamps.
Enlarged approximately by 3½.
Photo courtesy Los Angeles County Museum.

THE FINAL STAGES OF POLITES MYSTIC SCUD.

By V. G. Dethier

Our knowledge of the life history of *Polites mystic* Scud. is limited to Scudder's (1889) description of the early stages and to a few supplementary notes on these stages by Dethier (1938).

In addition to describing the chrysalis of this species, hitherto unknown, and the last larval instar, which has been incompletely described by Scudder, notes on the younger instars have been included in this paper. It is felt that these additional notes will be of value if keys to Hesperiid larvae are ever to materialize, because any key must take into consideration minute changes in detail, especially, since larvae of the different species of this family so closely resemble each other. On the other hand, there is marked variation in the duration of the different stages, particularly the later ones and all data are important. For this reason supplemental data are given for the early stages. Also, hibernation in this species has been studied for the first time.

Second instar:

Head width, .70 to .75 mm.; head height, .75 to .8 mm. Head shiny piceous, roughly punctate. Bears numerous whitish to brown hairs. Body length, 5 to 8 mm. Body light clear green dorsally, mottled with greenish white. Thin clear green transverse lines in the intersegmental areas. Dorsal line clear green. Lateral and ventral areas yellowish. Later in this instar the body presents a green and brown background with dull white mottling. Darker and duller green dorsally. A scattering of short black hairs. First pair of legs and claws of remaining pairs fuscous.

Third instar:

Head width, 1.45 mm.; head height, 1.5 mm. Head reddish brown to piceous and rougher. Whitish hairs more conspicuous. Body 8 to 13 mm. long. Light milk chocolate faintly mottled with dull white. Dorsal line dull olive brown. Intersegmental membranes dull grass green. Green disappears toward end of instar. Body may also be very dull greenish brown. Anterior and posterior ends more conspicuously brown. Mottling duller. Short black hairs on body more numerous than in preceding instar. Spiracles black.

Fourth instar:

Head width, 1.8 mm.; head height, 2.0 mm. Head piceous, deeply shagreened. No other changes. Body chocolate with dull white mottling. Dorsal line dark due to lack of mottling in that

area. Anal plate shiny with vermiculate furrows. Few black tubercles with black hairs. Most hairs same color as plate. Spiracles black.

FIFTH INSTAR:

Head width, 2.5 mm.; head height, 2.5 mm. Head piceous, roughly shagreened. Short white hairs numerous. Very similar to fourth instar. Body 26 mm. long. Slightly darker chocolate than foregoing instar. Very many short black spiny hairs arising from black tubercles. Dark brown dorsal line. This larva differed from that described by Saunders (as quoted by Scudder) in having no greenish tints, no semi-transparency, and fuscous thoracic legs instead of whitish. The under surface of the body was generally pale brownish with indications of whitish in the region of the terminal segments.

CHRYSALIS:

Length 16 mm; greatest width 4.5 mm. General color fuscous to piceous. On the dorsal side the intersegmental membranes are conspicuously burnt sienna in color. The head and the last five abdominal segments bear numerous long tawny hairs directed

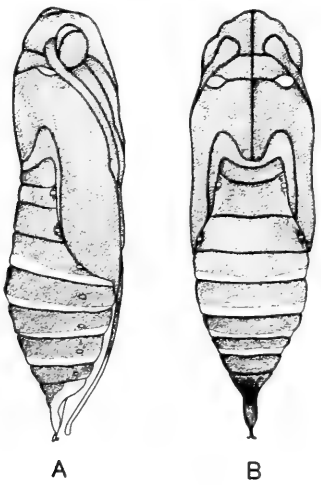

PLATE 19

Chrysalis of *Polites mystic* Scud., approximately x 4.

A. Lateral aspect. B. Dorsal aspect.

posteriorly. The tapering cremaster is longitudinally ridged on the dorsal surface and deeply channeled or scoop-shaped on the ventral surface. Ventrally the cremaster, the wide intersegmental areas, and the median line are suffused with burnt sienna. The free portion of the tongue case is tawny to fuscous. Wing pads solid fuscous to piceous. Few tawny hairs on ventral side of abdominal segments. Spiracles light brown. The shape and markings of the chrysalis are illustrated in Figures A and B.

The insects from which the above descriptions were taken were reared from adults captured in Franklin, New Hampshire. In this area *P. mystic* is single brooded. Eggs were laid on July 4 and hatched eleven days later on July 15. First moults took place on July 23 and 24, the first instar having consumed from eight to nine days. The second moult occurred after a lapse of twenty-one to twenty-nine days on August 14 and 21. The third instar required from twenty-three to thirty-nine days with moults on September 6 and 22.

Cold weather with freezing temperatures usually sets in toward the last week in September, and larvae that were reared out-of-doors ceased eating and hibernated at this time. Thus most of these specimens passed the winter in the fourth instar and not the third, as did most of Scudder's. The duration of the third and fourth instars, therefore, varies considerably. Hibernation usually terminates in May and the first adults appear in June, though weather conditions frequently permit of an earlier appearance.

Several of the fourth instar larvae were maintained indoors. As long as these were fed and kept at room temperature they showed no inclination to hibernate. Thus one moulted on November 25 after having spent thirty-three days in the fourth instar. Having passed twenty days in the fifth instar it spun a rather compact cocoon in the grass and pupated December 15. After eighteen days in the pupal stage it emerged on January 2. The frequency of moults of these larvae kept indoors could be accelerated or retarded by controlling the temperature, or to a lesser extent retarded by reducing the amount of food avaliable. It appears that this species truly hibernates and is not subject to diapause during the winter months.

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NOTES ON THE EARLY STAGES OF EUPHYDRYAS GILLETTI BARNES

By John A. Comstock

In July of 1938, while collecting in the Teton area near Moran, Wyoming, John and Grace Sperry secured a cluster of eggs of *Euphydryas gilletti* Barnes. These were laid July 26, on Twin-berried Honeysuckle (*Lonicera involucrata* Banks). They were sent to us for observation, and hatched August 6, 1938.

The egg is of the characteristic Euphydryas type, with a flattened top, sloping sides, and a rounded base. There are some twenty-two longitudinal ridges, extending from the top to about three-fourths the distance towards base, the area below these being irregularly pitted. The depressions between the ridges are crossed by fine raised striations or minor ridges. The color is at first a yellowish green, changing to a bright salmon-red shortly before hatching.

The young larvae have black heads and delicate greenish bodies. They consume the egg-shell after emergence, and shortly thereafter begin to weave a communal web. They began their feeding on the dry honeysuckle, but gave about equal attention to young *Plantago* leaves which we furnished as a substitute.

August 7: There are 55 larvae of the original 60 still surviving, all in their first instar. Average length of larva, 3 mm.

Head, jet black. The first segment bears a blackish brown roughened scutellum. The usual rows of single colorless hairs are present, each one arising from a black papillus.

August 8: Average length of larva about 3.5 mm. Four examples have now moulted, the remainder are quiescent in preparation for the ecdysis.

August 9: All the larvae have cast their skins and are now in the beginning of the second instar.

Head, jet black. Average width of head case, .60 mm.

Body, soiled yellow. The simple hairs have now given place to branching spines, the shafts of which are concolorous with the body, while the branches are colorless. Scutellum, black and rugose.

Legs, darker than body, tipped with black. Prolegs, soiled yellow, the crochets black.

August 12: Many of the larvae have died. Three examples have changed to the third instar. The head measurement (width) of these ranges between .76 and .8 mm.

Head, jet black, with black setae. Ocelli, black, placed on a raised oval base.

Body, length, 5 mm. In the mid-dorsal area the body is lemon-yellow, merging to soiled yellow on the lateral surface, and becoming lighter on the abdomen. The spines, now large and prominent, are clothed mainly with black hairs. The mid-dorsal row of spines (absent on first three segments) have yellow shafts. The next lateral row, which are most prominent, have darker shafts, the first two or three being black, the others becoming progressively lighter toward the cauda, although considerably darker than those in other areas. This row of spines is placed on a longitudinal band of brown, which is darkest in the cervical area and fades out caudally. The edges of this band are not clearly defined and are irregular.

Latero-inferior to this band is another row of branched spines, the shafts of which are yellow, while the branching hairs are mixed black and yellow. Inferior to these, and placed substigmatally, is another row of somewhat smaller spines, with yellow shafts, bearing yellow hairs.

Finally a row of very short spines occurs, placed inferiorly to the above, some of which are little more than tubercles, several being paired, as is the characteristic arrangement in the genus. These are yellow, and bear yellow hairs.

Spiracles: Black, conspicuous. True legs black. Prolegs, yellow, with black crochets.

The larvae which have survived (14 specimens) seem to feed equally well on *Plantago* and young honeysuckle leaves.

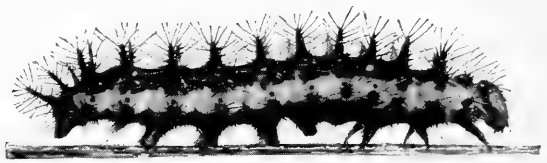

PLATE 20

Larva of *Euphydryas gilletti* Barnes in its fourth instar.

Enlarged approximately by 5.

Photo courtesy Los Angeles County Museum.

August 17: The majority of the larvae have moulted and are now in the fourth instar. Length, 24 hours after moulting, 10 mm.

Head: Jet black, clothed with long black setae. Head width, .92 to .98 mm.

The body appears much as in the prior instar, but the longitudinal dorso-lateral brown band is more conspicuous and darker in color, and the lateral area around the stigmata is pearly white.

The shafts of the mid-dorsal row of spines are still yellow, those of the next lateral row are black, while those of the third latero-inferior row are yellow at the base and blackish on the tips. The infrastigmatal rows are yellow except for three at the cephalic end, which are black.

The legs and prolegs are as in prior instar, except for the anal proleg, which is yellow with a large black spot on its lateral surface.

Spiracles, black. Abdomen, dull yellow, with a narrow longitudinal brown stripe, mid-ventrally placed. A moderately wide band of brown runs along the infrastigmatal fold.

August 20: Of the surviving specimens, four are in the fifth instar, six are in the fourth instar and are still feeding, and four are in the fourth instar and have commenced hibernation. The hibernating individuals show the following divergence in color from the normal feeding examples. All spines are a solid black. The dorso-lateral wide dark line is nearly black, and the line along the infrastigmatal fold is much darker.

In the fifth instar the head still remains a glistening black, but the clypeus is edged with white. The head width in two examples is 1.04 mm; one measures 1.10 mm, and two are 1.14 mm.

All spines are jet black. The mid-dorsal band remains a lemon-yellow, but is proportionately narrower. The stigmatal band is clear white, and somewhat narrower. The infrastigmatal fold is dark brown, and the abdomen a soiled yellow, with a narrow mid-abdominal stripe of brown. The legs are black with a lighter edging at the articular junctures, and the prolegs dull yellow, each with a brown spot on the lateral surface. Stigmata, black.

The length of larva at beginning of the instar, 12 mm.

At this stage the remaining larvae went into hibernation. We were unable to carry them successfully through the winter, and can not therefore record the pupa.

THE EUROPEAN GENUS MOROPHAGA HERRICH-SCHÄFFER IN NORTH AMERICA
(LEPIDOPTERA: TINEIDAE)

By J. F. Gates Clarke
Bureau of Entomology and Plant Quarantine,
U. S. Department of Agriculture

While collecting lepidopterous larvae during the summer of 1935, in the Thatuna Hills (Moscow Mountains), a few miles northeast of Moscow, Idaho, I gathered a small quantity of the fungus *Cryptophorus volvatus* (Peck) Shear. This fungus grows rather commonly on the north sides of pine trees (*Pinus ponderosa* Dougl.) and is heavily infested with coleopterous and lepidopterous larvae.

From the lepidopterous larvae collected I secured a series of seven moths, which, when later referred to Mr. August Busck, were determined by him as probably belonging to the European genus *Morophaga* and representing a new species.

Since coming to the Bureau of Entomology and Plant Quarantine I have had an opportunity to study this material more carefully and, although I have been unable to compare it with European examples of the genus, I have little doubt that the species described below belongs to *Morophaga*.

Morophaga cryptophori, new species

(Plate 21, figs. 1-2; Plate 22, figs. 3-5)

Labial palpus grayish fuscous, scales tipped with pale gray; second segment suffused with fuscous; third segment with a spot at base and one at apex, exteriorly, blackish fuscous. Antenna fuscous, narrowly annulated with gray. Head fuscous, scales tipped with pale gray. Thorax and fore wing gray, the former strongly overlaid and the latter irrorated and streaked with blackish fuscous; from base of fore wing, along vein 1c a broken blackish-fuscous streak (obsolete in some specimens, especially in females); at the end of cell, from vein 10 to vein 3, an outwardly oblique, transverse, irregular blackish-fuscous spot; along costa, around termen to tornus a series of blackish-fuscous spots; cilia gray, suffused and irrorated with blackish fuscous. Hind wing grayish fuscous, darker toward margins; cilia pale fuscous with a fuscous subbasal band. Legs gray suffused and annulated with blackish fuscous. Abdomen gray, irrorated with blackish fuscous.

Male genitalia: Harpe broad, thick, bilobed; costal lobe moderately narrow, spoon-shaped; costa produced basally into a long, slightly twisted projection; ventral lobe thick, with an outwardly curved row of short, stout, toothlike projections beginning at basal third of ventral margin and extending almost to distal end of lobe; from base of harpe, slightly costad of middle, a prominent fleshy protuberance (probably element of transtilla) giving rise to several long, stout hairs. Anellus an elongate, folded plate (which expands broadly when the harpes are spread) articulating with the ventro-anterior edges of the harpes and attached to the ventro-posterior edge of the vinculum by a strong membrane. Aedeagus nearly straight, slender, with a fleshy, tonguelike flap at distal end. Vinculum large, very broad ventrally, narrower laterally and extending dorsally as two stout arms to the articulation with the tegumen. Tegumen short, stout, and produced ventrally into two stout, curved processes. Uncus fleshy, divided.

Female genitalia: Genital plate heavily sclerotized; posterior edge produced as a thick, ribbed, spoon-shaped process. Ostium slightly produced, round, edged laterally with small, curved, sclerotized processes. Ductus bursae sclerotized for about half its length; inception of ductus seminalis on dorsal surface of ductus bursae, slightly anterior to ostium. Bursa copulatrix round, without signum.

Alar expanse 20-27 mm.

Type: U. S. National Museum No. 53775.

Type locality: Thatuna Hills, Latah County, Idaho.

Food plant: *Cryptophorus volvatus* (Peck) Shear.

Remarks: Described from the male type and one male and five female paratypes, all from the same locality. Paratypes in the U. S. National and Canadian National collections.

The moths emerged from July 23 to July 25, 1935.

This species closely resembles the European *morella*, the larva of which feeds in a fungus growth of mulberry. The North American species differs, however, in the more elongate dark markings of the fore wing and the absence of dark spots on the inner margin.

The venation of this species is variable, as will be seen in figures 3-3b, the venation often varying on opposite sides of a specimen.

When the larva has finished feeding, it constructs a tough silk tube to the exterior of the fungus growth. The pupa is extruded at the time of emergence of the moth.

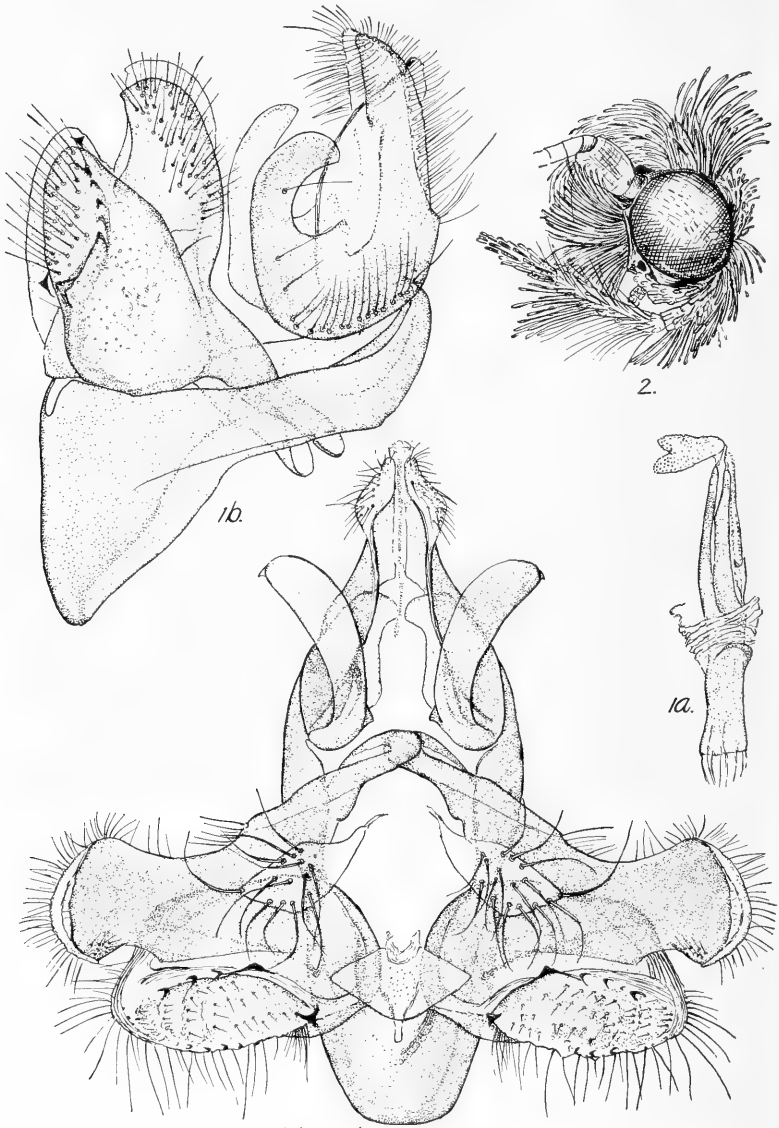

PLATE 21

Morophaga cryptophori

1-1b. Male genitalia: 1, Ventral view of male genitalia with aedeagus removed; 1a, aedeagus, lateral aspect; 1b, lateral view of male genitalia with aedeagus removed.

2. Lateral view of head.

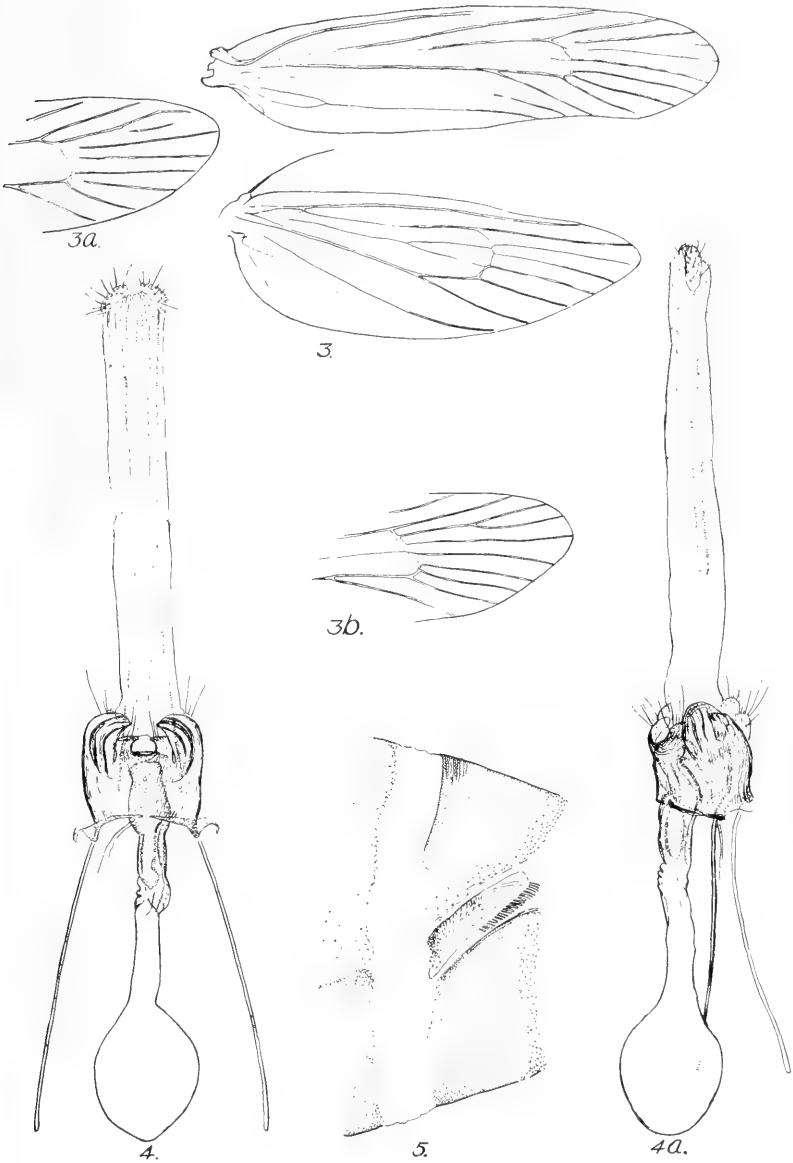

PLATE 22

Morophaga cryptophori

3-3b. Wing venation: 3, Venation of entire wings; 3a, 3b, apical halves of fore wings showing variation in veins 3 and 4 and 7, 8, and 9.

4-4a. Female genitalia: 4, ventral aspect; 4a, lateral aspect.

5. Eighth segment, lateral view, showing scale tuft.

NOTES ON THE LIFE HISTORIES OF TWO WESTERN NORTH AMERICAN MOTHS

By W. P. Medlar

Research Associate of Lepidoptera
San Diego Society of Natural History

APANTESIS INCORRUPTA HENRY EDWARDS

On April 3, 1939, about five to seven miles north of Sonoita, Santa Cruz County, Arizona, at an altitude of five to six thousand feet, the writer collected a large number of larvae, which proved to be of this species. It was noted that the larvae fed naturally during the early morning hours or during rain, but through the brighter hours of the day they were in hiding under rocks, trash, etc. The larvae were found feeding upon a variety of lupines, and, in a few instances, they were found feeding upon artemisa. They were quite numerous and their number ran into the hundreds in the two localities in which they were observed.

The mature larvae are black of body, having a series of nodules upon each segment. Those laterally placed are of a gilded appearance. Other nodules are black except those on the ventral surface, which are brownish. Stiff black hairs arise from the dorsal nodules, while hairs below the stigma and those arising from the gilded nodules are redddish brown.

These larvae seem, from our observation, to pass a considerable time of the resting stage in the larval state, some of them remaining without eating for a period of six weeks or more before pupating. In this characteristic, they are similar to the larvae of *Arachnis picta*.

Pupae. Dark brown, covered with a whitish bloom. The cremaster is composed of some twelve hooks, as shown in the illustration. In this it differs from *A. nevadensis* G. and R., which

is described in Bulletin of the Southern California Academy of Sciences, Volume 34, Part 2, page 150, 1935, as having four stout hooks. Pupation occurs under trash on the ground.

Imagoes. In a series of imagoes raised from these larvae, while the wing patterns varied and the markings on the abdomen of the female were somewhat varied, there were no variations in the markings of the thorax, though in some the head was black; in others, black and cream. No gradation was found toward a black thorax such as is characteristic of the type *A. nevadensis*. The male imago showed very little variations in the maculation of the wing and abdomen, these being practically constant. The illustrations of the two females show the extreme variations.

Eggs. The eggs were lain in captivity in a mass upon the floor of the cage, which was covered with sand. They have no adhesive qualities and hatched in approximately ten days. Their color is pale yellow, darkening just before hatching. They are smooth of shell, indented at the base, as the illustration shows.

B. Neumoegen, in "Papilio", Volume 3, page 150, September-December, 1883, states that "*A. nevadensis* G. and R. is a varietal form of *A. incorrupta* Henry Edwards, which is the ground form."

John B. Smith, in the "Canadian Entomologist," volume 22, page 33, 1890, expresses the opinion that *A. incorrupta* Edwards *and A. nevadensis* Grote and Robinson are forms of a single, not very variable, species.

The following table shows how different the present larvae are from those of *Apantesis nevadensis*. The difference in the cremasters are noted above. From these facts it would seem that *A. incorrupta* deserves classification as a full species and not a subspecies. Henry Edwards first gave it rank as a species, and my investigations seem to substantiate this.

COMPARISONS

We are indebted to Commander C. M. Dammers for data on *Apantesis nevadensis* G. and R.

	Apantesis nevadensis Grote and Robinson On Plantago		**Apantesis incorrupta** Henry Edwards On Artemisia and Lupines
MATURE LARVAE:			
Length extended..	1¼″=32 mm.		1¼″=32 mm.
Body.....	Olive grey		Black, shading to grey at segmental points
Abdomen.....	Olive grey		Kid grey
Dorsal Small Tuft.....	Chestnut	All tubercules soiled yellow	Black; black tubercule
Dorsal Tuft.....	Mauve, with chestnut hairs on upper half		Black; black tubercule
Sub-dorsal Tuft.....	Mauve		Black, with one or two chestnut hairs; lemon tufted tubercules
Lateral Tuft.....	Mauve		Black; black tubercules
Two Lower Tufts.....	Chestnut		Black; black tubercules
Breathing Holes.....	Chestnut with black rims		Black
Head.....	Black; shiny		Black; shiny
Legs.....	Black; shiny		Black; shiny
Prolegs.....	Yellow; flesh colored claspers		Soiled light yellow; black crochets
IMAGO:	Plain black thorax		Black thorax; orange buff bars

Otherwise the imagoes are similar in both cases.

Triocnemis saporis Grote

Several larvae of this insect were collected feeding upon the flowers of *Eriogonum inflatum* in the Gila Mountains, Maricopa County, Arizona, beside Highway 80, on May 7, 1939. They were very difficult to locate, as their camouflage is most excellent.

They are long—approximately 30 mm.—cylindrical and the ground color is chalk white, marked with longitudinal chocolate bars. Two lines of these bars are placed dorsally, broken in the middle of each segment, but overlapping the segment junctures. A brown stripe, placed high laterally, thins out at the middle of each segment, as is shown in the illustration. There is another irregular brown line at the ventral edge of the caterpillar. The anal segment is brown and carries upon its upper surface a white fleur-de-lis. The thoracic legs are pinkish. The prolegs are the same color as the bars.

Pupation takes place under the soil, the insects spinning a very loose cocoon. The pupa is dark brown. The imago emerges approximately three weeks after pupation.

A substitute food plant is *Eriogonum fasiculatum,* upon which the larvae were fed in captivity.

EXPLANATION OF PLATE

1. Eggs of *Apantesis incorrupta* Hy. Edw.
2. Dorsal view of *Apantesis incorrupta* larva.
3. Ventral view of *Apantesis incorrupta* larva.
4. Pupa of *Apantesis incorrupta.*
5. Cremaster of *Apantesis incorrupta.*
6. Segment of larva *Apantesis incorrupta.*
7. Male imago *Apantesis incorrupta.*
8. Female imago *Apantesis incorrupta.*
9. Female imago *Apantesis incorrupta.*
10. Dorsal view larva of *Triocnemis saporis* Grote.
11. Lateral view larva of *Triocnemis saporis* Grote.

PLATE 23

EUPHYDRAS CHALCEDONA DBLDY. & HEW.

By Charles M. Dammers
Riverside, California

During the last ten years I have made a special study of this butterfly in that area of Southern California which lies South of the Tehachapi Mountains, and have raised many thousands in captivity. The following notes may be of some interest.

West of Los Angeles City, on the south slope of the San Gabriel Mountains and on the south slope of the San Bernardino Mountains, all specimens collected are all black, with red only on the borders or an occasional slight tinge of red on the primaries and secondaries, but on reaching the Riverside area a small amount of red is found on both primaries and secondaries and then gradually as you reach the desert areas to the East they become redder and redder. In the Cabazon area both to the North and South side of the San Gorognio Pass they are still similar to the Riverside area; but at Whitewater, Snow Creek, and Chino Canyon there is a change to a much redder type. Thence, on through the Morongo Valley and around to the North side of the San Bernardino Mountains, they gradually become redder, culminating at Rattlesnake Canyon, where in the existing small colony they are entirely red. This colony was first found in 1934 by Mr. M. L. Walton of Glendale. West of this point along the Southern edge of the Mojave Desert and on to the Northern slope of the San Gabriel Mountains, no colony has been found, nor their desert food-plant, *Scrophulania antirrhinoides* Benth. Southwards a small isolated desert colony of a medium red form is found in Borego Valley, San Diego County. In Orange and San Diego Counties they are similar to those of the Riverside area. I have no records from Imperial County.

Whitewater is a most interesting canyon, as on the West side of the canyon only the medium red form is to be found, while in some of the small side canyons on the East side, all forms are to be found; red, buffs, black, with every possible combination of intermediate forms, of which I have a most remarkable series, making it hard to believe they are all the same butterfly.

In the early spring of 1934 Mr. C. Henne of Pasadena and Mr. C. Ingham of Los Angeles discovered a brown form in the Providence Mountains which is sixty miles Northeast of the San Bernardino Mountains. This form is quite constant in these mountains and the Granite mountains at their Southwest end.

I have endeavored to find a connecting link between these and those of the San Bernardino mountains, searching the Sheep Hole, Ord. and Bullion mountains and at Newberry Springs to the south but failed to find any traces of the butterfly or its food-plant. I have also searched the Ivanpah and Clark mountains to the north, with similar results.

I have cross-bred, many times, this brown form of the Providence mountains with the black form from the Riverside area, using the females of each kind and the resulting imagines were exactly similar regardless of which female was used and showed a constant type of a combination of the colors of their parents. I then crossed these hybrids with the black forms and the red forms and met with failure over several years, the eggs always being infertile and I was about to assume they were true hybrids, but in 1938, under improved laboratory conditions, (viz.: continual change of air) fertile eggs were produced. It still remains to be proved if these hybrids will interbreed. I then submitted to Mr. Gates Clarke of the U. S. N. M. Washington, who most kindly compared the genitalia:

6 males, brown type, from Providence Mts.
6 males, very red type, from Rock Corral, S. B. Mts.
6 males, black type, from Riverside area.
3 males of each of the two hybrids.

The following is his report: "I have made slides from the various forms, also the hybrids. Except for minor variations, the genitalia are all the same. The slight differences are no more than individual variations. I should say these specimens, including hybrids, are certainly all the same species, and aside from the color and size there is nothing to separate them."

The larvae and their habits are identical in all these forms.

In these desert areas they are confined to one food-plant *Scrophularia antirrhinoides* Benth. which is of assistance in finding new colonies. Only once have I found a stand of the food-plant with no colony of the butterfly. This was close to Twenty-Nine Palms. *Buddleia* can be used as a substitute for their usual *Scrophularias;* the larvae take to it readily in all instars.

In captivity it frequently occurs that the young larvae coming out of hibernation will feed through one or two instars and then go back into hibernation for another year and it may be assumed that this also happens in the field, as we know it is the case with some of our other desert lepidoptera. I have had an occasional specimen feed straight through without going into hibernation at all, and I once had a few larvae collected in San Diego County that went through three hibernations, the resulting

imagines being veritable giants. On two occasions I have come on a fall brood, Oct. 20, 1929 at Aguanga, Riverside County, and Oct. 3, 1931 at Snow Creek, Riverside County. I cannot account for this, as the new born larvae would have nothing to feed on. There were full broods and not an odd specimen or two.

These red forms from the desert areas are not common in collections, probably owing to its not being generally known that they fly very early in the year. My records show, full grown larvae collected at Whitewater in December and imagines on January 15; another year the imagines from this area as late as March 29; also full grown larvae collected at Riverside as early as January 9, while in the San Gabriel and San Bernardino mountains they are on the wing in May and June. In the Providence mountains and Granite mountains late March is the usual date for the imagines.

On June 17, 1928 in Devil Canyon, close to San Bernardino city, I came on a flight of imagines of which at least 80% were aberrant forms. This locality was visited the next year and all were quite normal specimens.

I have raised *Euphydryas colon* Edw. from larvae collected in the northern part of California. These larvae only differ from those of *E. chalcedona* in that the color of the body is white, instead of black speckled with white, and the food-plant is the same. It would be interesting to see if these two species would cross-breed and produce fertile eggs, if ever an opportunity occurs to do it.

To get butterflies to mate in captivity calls for a great deal of patience and time, and the use of every possible means of giving them their natural conditions. When in the larval state they are cannibalistic and will eagerly devour newly formed pupae.

It is quite possible that isolated colonies of this very variable colored butterfly are yet to be discovered in Southern California, which may produce yet other color forms than those now known. In 1940, Mr. Hovanitz discovered a small colony in the Old Woman Mountains, San Bernardino County. These imagoes were similar to those of the Providence Mountains.

A NEW CARPENTER BEE FROM THE GREAT BASIN REGION

(*HYMENOPTERA, XYLOCOPIDAE*)

By Charles D. Michener

University of California, Berkeley

Although the *Xylocopa* herein described has been previously recorded as a form of *X. tabaniformis* Smith (a Mexican species probably not occuring far north of Brownsville, Texas), its relationship to *X. orpifex* Smith of the Pacific Coast is closer than that to *X. tabaniformis*. It is described as a subspecies of *X. orpifex* rather than as a distinct species, in spite of the fact that no intermediate specimens have been found, because the females of the two forms are apparently indistinguishable and because practically no structural characters can be found to separate the males. In order to make the subspecific differences clear, they are described in a comparative manner for typical *X. orpifex* as well as for its Great Basin representative.

Xylocopa orpifex orpifex Smith

Xylocopa orpifex Smith, 1874, Trans. Ent. Soc. London, p. 298.

Male: Pubescence of head mixed black and white, that of yellow areas of face often entirely white. Pubescence of pronotum mixed black and white, that of mesoscutum, mesepisterna, and mesosternum whitish, with a few black hairs intermixed on the mesoscutum; mesoscutellum with pubescence predominantly black, sometimes a few white hairs intermixed; metanotum, metapleura, and propodeum with black pubescence; coxae with pubescence partly white; femora with white hairs intermixed with black on under sides; anterior tibiae and tarsi with yellowish white hairs intermixed with the black and fuscous ones, other tibiae and tarsi largely black haired. Abdomen with black pubescence, sometimes with a few fuscous hairs intermixed.

This is a common form of the Pacific Coast, ranging from Oregon to northern Lower California. The southernmost authentic record is Ensenada, Lower California (J. Elsea). More southern Lower Californian records (Comondu and El Paraiso, Fox, 1893, Proc. Calif. Acad. Sci., (2) 4: 21 and Fox, 1894, Proc. Calif. Acad. Sci., (2) 4: 120) are probably based upon misidentifications, since specimens at hand from Comondu (E. S.

Ross, A. E. Michelbacher) belong to a form agreeing with Smith's description of *X. orpifex* but structurally distinct from that species. In recording *X. orpifex* from Oak Creek Canyon, Arizona, Cockerell (1916, Ann. Mag. Nat. Hist., (8) 17: 286) does not mention the sex of his specimens; they may have been females of the form described below.

XYLOCOPA ORPIFEX ANDROLEUCA Michener, n. subsp.

Xylocopa tabaniformis, Ackerman, 1916, Jour. N. Y. Ent. Soc., 29: 220 (Utah record).

MALE: Structurally similar to *X. orpifex orpifex* except that the smooth, shining, non-tesselated area of the base of the spatha of the genitalia is larger.

Pubescence of head and thorax white, with a few black hairs intermixed on the head (except for the yellow areas) (practically no black hairs on head of Baker paratype) and on the mesoscutum and mesoscutellum; pubescence of anterior legs white, of middle legs largely white with fuscous intermixed in a few areas, of posterior legs mixed fuscous and whitish. First abdominal tergite with white pubescence; remaining tergites with black pubescence and without white pubescence dorsally except on fifth; pubescence of lateral, ventrally directed portions of tergites mixed black and white; fifth tergite with white hairs on posterior margin of dorsal portion at the sides; sternites one to three with white hairs, four to five with mixed black and white hairs, six with black hairs. Length 18 mm. (16 mm. in one paratype).

FEMALE: Pubescence entirely black, as in *X. orpifex orpifex.*

HOLOTYPE MALE (Calif. Acad. Sci., Ent. No. 5120): Kayenta, Navajo County, Arizona, July 29, 1937 (K. L. Maehler). Two females, bearing the same data, are at hand. Paratypes. One male, Hiko, Nevada, August 6, 1940 (I. LaRivers); one male, Baker, San Bernardino County, California, March 15, 1935 (M. Cazier collection). Two additional male specimens have been seen from Wild Rose Canyon, Panamint Mountains, Inyo County, California, elevation 4000 feet (J. W. Johnson), and Ackerman records a male specimen, as a variation of *X. tabaniformis,* from Washington County, Utah. Paratypes will be returned to the collections of Mr. M. Cazier of Berkeley, California and Mr. I. LaRivers of Reno, Nevada.

As will be seen from the preceding list of localities, *X. o. androleuca* is a form of the interior arid regions which constitute the Great Basin and the area immediately south of it.

REVISIONAL NOTES CONCERNED WITH CIMBOCERA AND RELATED GENERA

(*COLEOPTERA, CURCULIONIDAE*)

By Peter C. Ting, Sr.[1]

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In order to more correctly place certain new species described herein a rather critical study was made of the genus *Cimbocera* Horn and other closely related genera which revealed the need for several revisional changes. The so-called *"Cimbocera complex"* in North America includes the genera *Cimbocera* Horn, *Paracimbocera* Van Dyke, *Miloderoides* Van Dyke, *Cryptolepidus* Van Dyke, and *Miloderes* Casey. The apparent close relationship of these five genera now placed in the Tropiphorini is possibly only artificial and further comprehensive studies of the higher categories will probably place *Miloderoides, Cryptolepidus,* and *Miloderes* in other tribes. The present study undertaken by the author is a necessary preliminary step, and is only to reappraise the status of the included species, to assign or transfer them to their proper generic position, and to elucidate their more salient generic and specific characters.

Recently Dr. E. C. Van Dyke (1934, p. 182; 1935, p. 3) properly raised *Cimbocera conspersa* Fall to full specific rank, showing by a discussion of obvious characters that it is not a variety of *pauper* Horn as contended by Dr. W. D. Pierce (1913, p. 379). Van Dyke (1935, p. 3) also has rightly suppressed the variety *sericea* Pierce listing it as a synonym of *conspersa.*

The type specimens of all species discussed have been personally examined by the author, with the exceptions of *Cimbocera conspersa* Fall, *Cimbocera pauper sericea* Pierce, and *Cimbocera pauper* Horn. However, the writer has a specimen of *conspersa* (an undesignated metatype) which was identified for him by its author, the late Dr. H. C. Fall; a paratype of *sericea* is at hand; the location of the unique "Dacota" type of *pauper* is unknown. The species here accepted as *pauper* is the one currently recognized by specialists as such, and which answers perfectly Horn's original description.

[1] The author acknowledges with thanks certain species received for study, either on loan or through exchange, from the United States National Museum and the California Academy of Sciences, San Francisco. The loans and exchanges were particularly facilitated by Mr. L. L. Buchanan, Mr. H. S. Barber, Dr. E. A. Chapin, Dr. E. C. Van Dyke, Mr. E. P. Van Duzee, and Mr. E. S. Ross. I am obliged to Dr. P. J. Darlington, Mr. E. T. Cresson, Jr., and Dr. Hugo Kahl for information relating to the present location of certain type specimens.

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Procedure and Terminology

The length of specimens considered in this paper is measured from the anterior margin of the eye to a point in vertical alignment with the apex of the elytron. The width given is for the widest section of the elytra, pronotum, et cetera. The length of the antennal scape in relation to the eye is determined when the former is lying in its scrobe. The term subapical area of L. L. Buchanan (1939, p. 10) is used for the region on the rostrum immediately posterior to the nasal plate which is often impressed, glabrous, or with sculpturing and vestiture finer or differently colored. The distal more obvious labial region is termed the prementum and the basal part, the gular peduncle or submentum of curculionid literature, is termed the postmentum.

The author (1936, p. 102) has previously shown by comparative anatomical studies that the submentum and mentum of other Coleoptera is fused in the Rhynchophora forming the postmentum. Often the postmentum is not evident externally as a separate region articulating with the prementum and this characteristic is utilized in the present paper. In determining whether the prementum is setose or entirely glabrous on its ventral surface one must exercise care not to confuse the adjacent maxillary, or labial palpal setae with those of the prementum.

Recently L. L. Buchanan (1939, p. 10) and Fritz Van Emden (1936, p. 73) have explained and illustrated the often confused tibial structures of open and closed corbels, as found in the Rhynchophora, and have applied certain new terminology to associated structures which are useful in classification and identification. Briefly, "closed corbel" denotes two transverse or oblique rows of spinules on the outer face (anterior face, if legs extended at right angles to abdomen) near the apex of the hind tibia. The interstice or "corbel plate" may be glabrous, setose, or squamose. Buchanan has termed the most apical row of spinules the "distal comb" (inner spinous row of Van Emden) and the subapical row the "anterior comb" (exterior spinous row of Van Emden). If the distal comb extends along the dorsal margin beyond the end of the anterior comb toward the base of the hind tibia it is then termed the "dorsal comb" (Buchanan). When only a distal comb is present and no corbel plate is evident the corbels are open. On the other hand if only an anterior comb exists with the "interstice" glabrous the condition is termed by Van Emden as "corbel apparently closed" and in this case all three pairs of legs are said to be alike. "Corbels open or closed" refers only to the hind legs. The "tarsal groove" (Van Emden) is the terminal area between the outer and inner extreme apical margins of the hind tibiae—the depressed area on which the tarsi are articulated.

Several of the species discussed in the present paper do not clearly belong in any one of the preceding corbel types, but have the spinules of both the anterior and distal combs irregularly placed with no distinct corbel plate between them (Plate 26). The author believes that in these particular species the condition is a variation or specialization of the closed type of corbel. The fore and middle legs often have the apical row of tibial spinules continued obliquely on the ventral, posterior face of the tibia and these spinules beyond and behind the tibial mucro are termed the "ventral comb" in the present paper. As shown in Plate 26 the spinules of the ventral comb are finer and closer together than those of the apical row.

The terminology and homology of parts of the male and female genitalia are adopted from the studies of Sharp and Muir (1912) and Tanner (1927), and from Herberdey (1931), Barber (1935), Bissell (1937), and Darlington (1938), who have pointed out certain corrections or have added new terminology to the first mentioned comprehensive papers.

Characterization of the Cimbocera Group

The five genera of the *Cimbocera* group may be separated from the rest of the tribe Tropiphorini (of American authors) by the following key:

Tarsal segments on ventral surfaces with bristle-like setae only or with greatly reduced pubescent tufts at their apices (males of certain species with pubescent pads on over half the ventral surface of third tarsal segment; first and second segments with only apical tufts.) Last segment of funiculus closely applied to base of antennal club. Female genitalia, except in *Miloderoides*, without coxal styli.....*Cimbocera* group

Tarsal segments on ventral surfaces completely covered with pubescent pads. Last segment of funiculus not closely associated with base of antennal club. Female genitalia generally with coxal styli.....*remaining Tropiphorini*

KEY TO GENERA

1. No pubescence on ventral surfaces of tarsal segments—only bristle-like setae present. Third tarsal segment only slightly, if at all, larger than second..... 2

   Small tufts of pubescence present at apices of tarsal segments. Third tarsal segment generally distinctly larger than second (both characters much more pronounced on male specimens.. 3

2. Postocular prothoracic lobes distinct. Antennal scrobes shallow and greatly widened at posterior end....Genus *Cimbocera* Horn

   Postocular prothoracic lobes and vibrissae absent. Antennal scrobes deep and only slightly widened at posterior end .....Genus *Cryptolepidus* Van Dyke

3. Antennal scrobes shallow and greatly widened at posterior end. Postocular prothoracic lobes prominent. Pubescent tarsal tufts in both sexes present only on third segment of all legs .....Genus *Paracimbocera* Van Dyke

Antennal scrobes deep and only slightly widened at posterior end. Postocular prothoracic lobes absent or only slightly evident. Pubescent tufts present in males at apices of basal three tarsal segments on fore legs..... 4

4. Rostrum one-fourth longer than distance between eyes. Antennal funicular segments 3 to 7 cupped at apices. Postocular lobes absent.....Genus *Miloderoides* Van Dyke

Rostral length slightly less than distance between eyes. Antennal funicular segments 1 to 6 not cupped at apices. Postocular lobes slightly evident.....Genus *Miloderes* Casey

Genus Cimbocera Horn

1876. *Cimbocera* Horn, p. 55-56.
1883. *Cimbocera,* Horn, p. 443-444.
1888. *Cimbocera,* Casey, p. 253.
1907. *Cimbocera,* Fall, p. 261-262.
1909. *Cimbocera,* Pierce. p. 346-347.
1913. *Cimbocera,* Pierce, p. 377-379.
1934. *Cimbocera,* Van Dyke, p. 182.
1935. *Cimbocera,* Van Dyke, p. 1-4.
1936. *Cimbocera,* Van Dyke, p. 73-77 (1936a).
1938. *Cimbocera,* Van Dyke, p. 1-2.

Genotype: *Cimbocera pauper* Horn (monotypic).

Salient Characters: Vestiture consisting of rather closely adhering scales and suberect setae. Rostrum with transverse constriction at base; prementum bisetose or quadrisetose and narrowed at base; maxillae partly exposed; postmentum evident as a short narrow peduncle; antennal scrobes shallow except at base, margins diverging toward apex, extending to ventral margin of rostrum to a point about one-fourth length of same in front of eyes; antennal scape reaching slightly beyond front margin of eyes, first and second funicular segments longer than wide, remaining segments broader than long and cupped at apices. Eyes slightly oval in vertical plane. Postocular prothoracic lobes and vibrissae present. Elytral striae and serial punctures evident; intervals flat or slightly convex; humeri rounded or nearly so. Fore and middle tibiae always mucronate; hind tibiae with minute mucro in some species. Fore tibiae denticulate along ventral margins; hind tibiae with corbels closed but with spinules

of anterior comb irregularly placed (see Plate 26). Tarsi ventrally clothed with bristle-like setae—no pubescent tufts or pads present; third tarsal segment not noticeably wider than second. Claws free. Female genitalia with coxites separated at base by transverse suture from "valvifers", flexible near apices of "valvifers" and at base of coxal apices; heavily sclerotized coxal apices at right angles to main body of coxites (Plate 25); coxal styli absent. Males unknown.

Discussion: The combination of setose, uniformly-sized tarsal segments, shallow and posteriorly widened antennal scrobes, and prominent postocular lobes does not exist in any of the known related genera. The species *robusta* Van Dyke, *cinerea* Van Dyke, and *cazieri* Van Dyke are here removed from the genus *Cimbocera* and placed as follows:

The former species, *robusta,* is placed in the genus *Paracimbocera* Van Dyke, since a male paratype (to be designated allotype in this paper) now in the collection of the California Academy of Sciences, San Francisco, has the third tarsal segment distinctly larger than the second and with much of its surface pubescent. Van Dyke's allotype is a slender female.

The species *cinerea* belongs in *Miloderoides* Van Dyke as shown by its total lack of postocular lobes, the presence of postocular vibrissae, the presence of small apical pubescent tufts on the third tarsal segments of the fore legs (on the type specimens the pubescent tarsal tufts and the long elytral setae are greatly rubbed or worn down), the deep narrow antennal scrobes, the characteristic shape of the rostrum and head, and the presence of coxal styli on the female genitalia. The single paratype of *cinerea* has the apex of the genitalia exserted so that it can be examined to some extent without further dissection.

The species *cazieri* belongs in *Cryptolepidus* Van Dyke as indicated by its non-setose prementum, its narrow, deep, nearly parallel-sided antennal scrobes, and the absence of postocular lobes and vibrissae.

KEY TO SPECIES

1. Tarsal bristles and tibial spinules pitch black. Pronotum slightly tuberculate.....*buchanani*, new species

   Tarsal bristles and tibial spinules yellow or reddish brown. Pronotum smooth 2

2. Rostral setae length subequal with head setae. Rostrum with narrow median sulcus; slightly constricted at base and one-third to one-half longer than broad. Color predominantly dark brown.....*pauper* Horn

   Rostral setae only one-fourth length of head setae. Rostrum without median sulcus; greatly constricted at base and not, or only slightly, longer than broad. Color grey mottled brown or black.....*conspersa* Fall

Cimbocera pauper Horn

(Plates 25, 26)

1876. *Cimbocera pauper* Horn, p. 56.
1907. *Cimbocera pauper* Horn, Fall, p. 262.
1909. *Cimbocera pauper* Horn, Pierce, p. 347.
1913. *Cimbocera pauper pauper* Horn, Pierce, p. 379.
1934. *Cimbocera pauper* Horn, Van Dyke, p. 182.
1935. *Cimbocera pauper* Horn, Van Dyke, p. 1, 3.

Type Locality: "Dacota".

Distribution: Canada (Southern Alberta. The Carnegie Museum has a specimen, not examined by the author, which is labeled Hudson Bay). United States (Montana, Wyoming, North and South Dakota, Nebraska).

Type: Location of unique type unknown.

Salient Characters: Length 5.9 mm. - 6.1 mm. Width 2.6 mm. - 3 mm. Color dark brown with sides grey; tarsal bristles and tibial spinules reddish brown.

Rostrum with slight transverse constriction at base; one-third to one-half longer than wide; fine median sulcus; setal vestiture about same length as head setae; subapical area rugose and nearly glabrous; prementum quadrisetose. Pronotal sides strongly and evenly convex; surface smooth. Elytral scales imbricated; intervals flat. Metaepisternal suture distinct. Corbels with spinules of anterior comb short and irregularly placed; 12 to 18 spinules in distal comb in front of tibial mucro; 8 to 11 spinules in anterior comb. Fore tibia with ventral comb spinules about uniform size, adjacent basal brush of finer hair-like setae. Female genitalia and eighth abdominal sternite as shown in Plate 25.

Discussion: As previously stated the species accepted as *pauper* agrees with Horn's original description and is the one currently recognized as such by authors. It is easily distinguished from other known *Cimbocera* by its more slender sulcate rostrum; the head and rostral setae of same length; and the rather uniform dark brown color.

Cimbocera buchanani, new species

(Plate 26)

Type Locality: New Mexico (Albuquerque, Bernalillo Co.).

Distribution: New Mexico (Albuquerque, San Marcial, Santa Fe, Mesilla Park, and Torrance Co.); Utah (Marysvale, St. George, Chad's Rch.); Arizona (Winslow, St. John's, Peach Sp'g); Texas (El Paso, Sierra Blanca); Colorado (Florence).

Type: Female Type (June 27—Wickham Collection 1933) and 26 paratypes deposited in the United States National Museum, U.S.N.M. Cat. No. 53757. Eight paratypes in the California Academy of Sciences, San Francisco; thirteen paratypes in the author's collection, Berkeley, California.

Salient Characters: Length 5 mm. - 8 mm. Width 2.2 mm. - 3.5 mm. Color cupreous tan mottled black; pronotum with median white vitta and wide lateral black vittae; antennal club nearly black; tarsal bristles and tibial spinules pitch black.

Rostrum transversely constricted at base; one-sixth longer than broad; often with fine line-like median sulcus; setal vesture one-half shorter than head setae; subapical area depressed and V-shaped with apex of depression extending posteriorly to a point opposite antennal articulation; prementum quadrisetose, but one or more setae generally worn off; mandibular appendage slender without mesal tooth. Pronotal sides evenly rounded; one-eighth broader than long; surface slightly tuberculate. Elytral scales imbricated; humeri slightly evident as reflexed rim; striae deeper than *pauper;* intervals flat. Metaepisternal suture obsolete. Corbels with spinules of anterior comb shorter than those of distal comb and irregularly placed; 14 to 16 spinules in distal comb before minute mucro (mucro occasionally absent), 6 to 7 spinules beyond mucro; 2 to 5 spinules in anterior comb. Fore tibiae with median spinules of ventral comb much finer than outer spinules; all spinules of comb coarser than those of basal brush; basal brush and median spinules of ventral comb dark brown, outer spinules pitch black. Female genitalia with membranous area at apex of "valvifer" one-third larger than on *pauper;* ventral sclerotization of "valvifer" not narrowed into distinct baculum as in *pauper*.

Discussion: This new species was called to my attention by Mr. L. L. Buchanan after whom it is named in appreciation of his co-operation and willingness to assist others in their investigations. It is distinct from *pauper* and *conspersa* by having pitch black tarsal bristles and tibial comb spinules in place of the yellow or reddish brown bristles and spinules of the latter species. The tuberculate pronotum, general appearance, and genitalic structures are also constant diagnostic characters of *buchanani.*

Cimbocera conspersa Fall

(Plate 26)

1907. *Cimbocera conspersa* Fall, p. 261.

1909. *Cimbocera conspersa* Fall, Pierce, P. 347.

1913. *Cimbocera pauper sericea* Pierce, p. 379.

1913. *Cimbocera pauper conspersa* Fall, Pierce, p. 379.

1934. *Cimbocera conspersa* Fall, Van Dyke, p. 182.

1934. *Crocidema albovestita* Van Dyke, p. 190 (new synonomy).

1935. *Cimbocera conspersa* Fall, Van Dyke, p. 1, 3.

Type Locality: Of *conspersa,* New Mexico (Santa Fe); of *pauper sericea,* Utah (American Fork Canyon); of *Crocidema albovestita,* Arizona (19 miles S .W. Kayenta, Navajo Co.).

Distribution: New Mexico, Colorado, Utah, Arizona, and Nevada(?). All specimens from Nevada labeled *conspersa* which were examined by the author belong to a new species of *Paracimbocera.*

Type: Of *conspersa* in Fall collection Mus. Comp. Zool., Cambridge, Mass.; of *pauper sericea* in U. S. Nat. Mus.; of *albovestita,* a Holotype, in Calif. Acad. Sc., San Francisco.

Salient Characters: Length 5.1 mm - 7 mm. Width 2.4 mm. - 3 mm. Color grey mottled black or brown; pronotum generally with white median vitta; tarsal bristles and tibial spinules lighter than *pauper* almost yellow.

Rostrum with deep, transverse, basal constriction; not longer than broad; no median sulcus; setal vestiture four to five times shorter than head setae; subapical area smaller and smoother than *pauper,* only entirely glabrous area belongs to base of nasal plate; prementum bisetose. Pronotal sides less convex than *pauper*; surface smooth; postocular lobes smaller than *pauper.* Elytral scales close but not imbricated except at sides; intervals slightly convex. Metaepisternal suture generally distinct (this character depends upon the abundance and placement of scales in individual specimens). Corbels with spinules of anterior comb more slender than in *pauper* and arranged quite regularly in single transverse row; 14 to 16 spinules in distal comb; 9 to 11 spinules in anterior comb. Fore tibia with spinules of ventral comb finer than *pauper* about uniform-sized and of same color as basal brush. Female genitalia similar to that of *pauper* but with many more setae on coxites; sclerotized apices of coxites slightly shorter and broader than in *pauper.* Eighth abdominal sternite without emargination at apex.

Discussion: *Crocidema albovestita* was described from a single, slightly rubbed specimen of *Cimbocera conspersa*. The genus *Crocidema* Van Dyke is easily separated from *Cimbocera* by the dense pubescence of the tarsi.

As previously stated, Van Dyke has shown that *conspersa* is distinct from *pauper* and that *sericea* is a synonym of the former.

C. conspersa is distinct from the other known *Cimbocera* by the presence of only two setae on the prementum in place of four. Although this premental character is of definite structural significance, it does not appear to be of generic value in this section of the Curculionidae. However, if further studies and additional material should indicate a natural grouping of species into subgenera, the bisetose or quadrisetose prementa would be convenient key characters together with the pubescent third tarsal segment of *Paracimbocera*. Additional distinctive characters of *conspersa* are its yellow tarsal bristles and its non-sulcate rostrum with setae only one-fourth the length of the head setae.

Genus Paracimbocera Van Dyke

1938. *Paracimbocera* Van Dyke, p. 1.

Genotype: *Paracimbocera atra* Van Dyke (original designation).

Salient Characters: Identical to *Cimbocera* Horn except for the following characters: Third tarsal segments slightly to greatly expanded and with apical tufts of pubescence, remaining tarsal segments with setose bristles only (females of *robusta* apparently without pubescent tarsal tufts). Female genitalia with sclerotized coxal apices slightly shorter, broader, and diverging less than in *Cimbocera*. Male genitalia as shown in Plate 24.

Discussion: *Paracimbocera* is unquestionably closely related to *Cimbocera* from which it is chiefly separated by certain tarsal characters. The genus as represented by the genotype and other typical species is separated from closely related genera by the following combination of characters: third tarsal segment wider than the second and with apical pubescent tufts; shallow and posteriorly widened antennal scrobes; and prominent postocular lobes.

Female specimens of *robusta* have the third tarsal segment only slightly wider than the second and apparently without apical pubescent tufts (the pubescence may be worn off on the specimens examined). As previously mentioned the males of *robusta*

have the third tarsal segment much wider than the second and with apical pubescent tufts. Female specimens of *artemisiae* have the third tarsal segment only slightly wider than the second but with apical pubescent tufts. The males of *artemisiae* are unknown. The unique female type of *atra* has the third tarsal segment wider than the second and with apical pubescent tufts. A large series of specimens of *Paracimbocera* sp. probably *atra* in the author's collection has the third tarsal segment wider than the second and with apical pubescent tufts in both sexes. Positively identified males of *atra* are unknown.

From the species and specimens at hand the diagnostic tarsal characters of *Paracimbocera* appear to be constant only in the male sex and the above information would seem to indicate that it is actually but a subgenus of *Cimbocera*. However, until additional evidence is obtained the present writer is inclined to accept *Paracimbocera* as a valid genus.

KEY TO SPECIES

1. Rostral and head setae same length as longer elytral setae. Elytral setae of two types, the shorter one-third length of longer type. Tarsal bristles and tibial spinules pitch black ..... *robusta* (Van Dyke)

   Rostral and head setae one-third (or less) length of elytral setae. Elytral setae on dorsal intervals all about same length. Tarsal bristles and tibial spinules dark or reddish brown 2

2. Elytral setae length on declivity[2] four times width of intervals; three to four irregular rows of setae per interval on declivity. Tarsal bristles and corbel spinules dark brown—nearly black. Metaepisternal suture distinct.... *atra* Van Dyke

   Elytral setae length on declivity two times width of intervals; two or three irregular rows of setae per interval on declivity. Tarsal bristles and corbel spinules reddish brown. Metaepisternal suture obscured..... *artemisiae*, new species

Paracimbocera atra Van Dyke

1938. *Paracimbocera atra* Van Dyke, p. 2.

Type Locality: Nevada (Las Vegas).

Distribution: Known only from the type locality.

Type: Holotype female, a unique, in the California Academy of Sciences, San Francisco.

[2] The unique type of *atra* has the elytral setae worn off on the dorsum making it impossible to compare their length directly with the dorsal intervals.

Salient Characters: Length 6 mm. Width 2.8 mm. Color black with a few indistinct small patches of grey scales, the color undoubtedly is not natural since the unique type is badly rubbed and necessarily discolored. Tarsal bristles and tibial spinules nearly black (probably natural color).

Rostrum transversely constricted at base; prominent median fovea opposite antennal articulation, probably an individual variation; setal vestiture about same length as head setae, but slightly worn down; prementum bisetose; subapical area with small, glabrous, triangular region immediately back of nasal plate, remaining part not depressed and with scales slightly smaller; nasal plate short, nearly truncate. Pronotum 2.1 mm. wide, 1.8 mm. long; sides slightly convex; no median sulcus. Elytral intervals flat; humeri obsolete; declivity with setae four times longer than interval width or three times width of intervals on dorsum; three to four irregular rows of setae per interval. Metaepisternal suture present. Distal comb with 14 spinules to small tibial mucro, 7 spinules behind mucro; anterior comb with 6 spinules one-third length of those in distal comb. Middle tibia at apex with 14 spinules before mucro, 7 or 8 spinules behind mucro. Fore tibia with 8 spinules in ventral comb with those in middle section much finer; basal brush with dark brown hair-like setae; 12 spinules at tibial apex before mucro. Third tarsal segment much more expanded than in females of *robusta* and *artemisiae*.

Discussion: If the unique type of *atra* is typical of the species, the females are peculiarly slender. This species is readily separated from the other named species placed in the genus by the dense setae of nearly uniform length on the elytral declivity which are four times longer than the interval width. The distinct metaepisternal suture, nealy black corbel spinules, and expanded third tarsal segment in the female are also distinctive features of *atra*.

Messrs. M. A. Cazier, T. Aitken, A. Downes, and the author collected a series of over eighty specimens at Coleville, California and Gerlach, Nevada which greatly resemble *atra*. However, until more specimens of *atra* are examined from the type locality it seems impossible to definitely determine the status of the Coleville specimens. This is particularly true since many minute characters are missing on the type of *atra* due to its rubbed and discolored condition. The number of spinules in the anterior comb of the Coleville specimens vary from six to eighteen as compared with six on the type of *atra*. Considerable dimorphism exists in the Coleville and Gerlach specimens, the females being predominantly grey and strongly vittate while the males are dark brown with narrower less prominent elytral vittae. The male genitalia has a slender median lobe, laterally depressed, and with apex beyond median orifice short and oval as shown in Plate 24; apex of internal sac shown in Plate 25.

Paracimbocera artemisiae, new species

(Plate 26)

Type Locality: Wyoming (Rawlins, Carbon Co.).

Distribution: Wyoming (Rawlins); Colorado (Grand Valley); Idaho (Oakley); Nevada (Elko, and Esmeralda Co.).

Type: Holotype female (VI-4-38, P. C. Ting collector, *Artemisia* sp.) and two paratypes deposited in the California Academy of Sciences, San Francisco, (C.A.S. Ent. No. 4821). Three paratypes in the United States National Museum; one paratype in the Los Angeles Museum; one paratype in the collection of M. A. Cazier, Berkeley, California; five paratypes in the author's collection.

Salient Characters: Length 5.8 mm. - 7.5 mm. Width 3 mm. - 3.8 mm. Color grey and black mottled, either color may be predominant; often with a black irregular vitta along second elytral interval. Tarsal bristles and tibial spinules reddish brown.

Rostrum transversely constricted at base, one-tenth longer than broad; setal vestiture one-third to one-half length of head setae; prementum bisetose; subapical area not depressed or convex but with scales slightly sparser and smaller, a narrow glabrous semi-circular area immediately posterior to nasal plate; mandibular appendage slender without mesal tooth, with broad longitudinal channel on exterior surface. Pronotum slightly wider than long (1.8: 1.7); faintly convex at sides; surface smooth or with scales raised giving a slight tuberculate appearance; setae reclinate one-third to one-half shorter than elytral setae. Elytral striae fine; intervals flat; humeri obsolete; setae on dorsum about length of interval width, two to three irregular rows per interval; setae on declivity about twice the length of interval width. Metaepisternal suture obsolete. Distal comb with 11 to 14 spinules; anterior comb with 5 to 6 spinules one-third to one-half length of distal comb spinules. Fore tibia with spinules of ventral comb about uniform size, last two of posterior end larger; basal brush slightly paler than ventral comb. Third tarsal segment slightly wider than second and with small apical tufts of white pubescence. Female genitalia with ventral sclerotization of "valvifer" narrowed into a broad baculum-like structure; sclerotized coxal apices longer and narrower than in specimens from Coleville, California, discussed under *atra*. Males unknown.

Discussion: Distinctive characters of *artemisiae* are: the two or three irregular rows of elytral setae of nearly uniform length one and one-half to two times longer than the interval width; third tarsal segment only slightly larger than the second

but with apical pubescent tufts; reddish brown tarsal bristles and tibial spinules; and the ventral comb of the fore tibia with only two spinules greatly larger than the others instead of four or five larger spinules as in *atra* and *robusta*. Certain large specimens of *artemisiae* are predominantly grey, but are structurally the same as the smaller specimens strongly mottled with black.

The writer collected this species at both Rawlins, Wyoming and Elko, Nevada where they were observed to definitely prefer *Artemisia* sp. The species was collected at Grand Valley, Colorado, on April 5, 1911 by Mr. H. Collier who observed them injuring the twigs of apple trees.

PARACIMBOCERA ROBUSTA (Van Dyke), new combination

1935. *Cimbocera robusta* Van Dyke, p. 2.

TYPE LOCALITY: Of Holotype California (Mason Valley, San Diego Co.). Of Allotype California (San Felipe Valley, San Diego Co.).

DISTRIBUTION: California (Mason Valley, San Filipe Valley, San Diego Co.).

TYPE: Holotype female in California Academy of Sciences, San Francisco. A paratype male is here designated as Allotype[3] (C. A. S. Ent. No. 4942). As previously stated the Van Dyke Allotype is a female.

SALIENT CHARACTERS: Length 5 mm. - 6.5 mm. Width 2.5 mm. - 3.8 mm. Color dark or reddish brown often with grey vittae on pronotum and elytra. Tarsal bristles and tibial spinules pitch black.

Rostrum transversely constricted at base; setal vestiture and head setae about same length and unusual in being as long as longer type of elytral setae; prementum quadrisetose; subapical area not depressed with scales slightly sparser, some specimens with narrow transverse glabrous area just posterior to nasal plate. Pronotum wider than long (2.2: 1.8); dorsum with double type of setal vestiture. Elytra with intervals flat; humeri present as faint basal reflexed rim; elytral vestiture of two types, the longer setae are reddish brown and two to three times longer than interval width, the shorter setae are white and about the length of the interval width. Metaepisternal suture obsolete. Corbels with 15 to 17 spinules in distal comb, before small mucro; 10 to 11 spinules in anterior comb quite regularly placed. Middle

[3] Following Fernald (1939, pp. 691-692) the term Allotype is used in place of Allolectotype, Lectoallotype, or Neallotype. Fernald points out that the term Allotype as originally proposed by Muttkowski may apply to subsequent descriptions by any author.

tibia with 14 spinules at apex before mucro. Fore tibia with 12 spinules before mucro; 11 to 12 spinules in ventral comb four of which are larger than the others. Third tarsal segment of male greatly expanded and with apical pubescent tufts; female with third tarsal segment only slightly larger than second and without pubescent tufts (unless specimens examined have the pubescence worn off).

Discussion: *Paracimbocera robusta* is easily distinguished from the other known species in the genus by the rostral, head, and longer type of elytral setae being nearly the same length. The pitch black tibial spinules and the double type of elytral setae are also characteristic features. The males are disitnguished by the enlarged third tarsal segment. In general the males are probably more slender, but this is not a positive criterion for determining the sex—the most slender specimen in the type series being a female. The eighth abdominal sternite is visible in the latter specimen, making it possible to determine the sex without dissection.

Genus Miloderoides Van Dyke

1936. *Miloderoides* Van Dyke, p. 74-77 (1936a).

1938. *Miloderoides,* Van Dyke, p. 2.

Genotype: *Miloderoides maculatus* Van Dyke (original designation).

Salient Characters: Vestiture of imbricated scales and long suberect dense setae. Rostrum with narrow angulate constriction at base, and with fine median sulcus; prementum without setae; postmentum evident; maxillae partly exposed; antennal scrobe narrow, deep, and nearly parallel-sided; antennal scape reaching middle of eye, first and second funicular segments longer than broad remaining segments broader than long and cupped at apices. Eyes protuberant, nearly round. Postocular prothoracic lobes absent; vibrissae present. Elytral striae and serial punctures faintly evident; intervals flat; humeri evident as faint reflexed basal rim. Metaepisternal suture present. Tibiae of all legs mucronate. Corbels closed with spinules in anterior comb regularly placed. Males with apical pubescent tufts on tarsal segments one to three of fore legs; middle and hind legs with pubescent tufts only on tarsal segment three; third tarsal segment expanded and larger than second. Females with apical pubescent tufts only on third tarsal segment of fore legs; pubescent tarsal tufts absent from middle and hind legs (possible worn off on specimens examined); third tarsal segment only slightly wider than second. Claws free. Female genitalia with coxal

styli; coxites and "valvifers" fused but with small lateral oval-shaped membranous area at base of apparent coxal region (Plate 25). Male genitalia as shown in Plate 24. Eighth abdominal tergite of male with transverse, dorso-apical impression.

Discussion: The following combination of characters will separate *Miloderoides* from other genera of the *Cimbocera* group: postocular prothoracic lobes absent, but vibrissae present; narrow, rather deep, nearly parallel-sided antennal scrobes; antennal funicular segments three to seven cupped at apices; rostrum one-fourth longer than distance between eyes. *Miloderoides* is the only genus in the *Cimbocera* group with coxal styli on the female genitalia.

KEY TO SPECIES

Rostrum without triangular-shaped depression in subapical area; corbel spinules black, well spaced; general color grey and dark brown mottled.....*maculatus* Van Dyke

Rostrum with subapical area depressed, triangular-shaped; corbel spinules amber color and crowded together; general color grey and reddish brown mottled.....
.....*cinereus* (Van Dyke) (=*argenteus* Van Dyke)

Miloderoides maculatus Van Dyke

(Plates 24, 25, 26)

1936. *Miloderoides maculatus* Van Dyke, p. 76 (1936a).

Type Locality: Idaho (Parma).

Distribution: Known only from type locality.

Type: Holotype male in the California Academy of Sciences, San Francisco. A female paratype from the original series is here designated as Allotype (C. A. S. Ent. No. 4944).

Salient Characters: Length 5 mm. - 5.5 mm. Width 2.1 mm. - 2.4 mm. Color grey and dark brown mottled, pronotal vittae often nearly black with cupreous luster. Tarsal bristles and tibial spinules black.

Rostral setae as long as head setae; subapical area not depressed or of any definite shape. Pronotum slightly wider than long (1.6: 1:4). Elytral setae very dense and about four times longer than width of intervals. Tibiae along ventral margins with several black or amber colored spine-like setae. Corbel spinules separated by one-third their length. Male and female genitalia as shown in Plates 24, 25 and 26.

Discussion: The males are only slightly more slender than the females. Tarsal characters for distinguishing the sexes are given in the generic description. *M. maculatus* and *cinereus* (=*argenteus*) the only other named species in the genus are easily separated by the preceding key.

Miloderoides cinereus (Van Dyke), new combination

(Plates 24, 25)

1935. *Cimbocera cinerea* Van Dyke, p. 1. ♀

1935. *Miloderes argenteus* Van Dyke, p. 4 (new synonomy). ♂

1936. *Cimbocera cinerea* Van Dyke, Van Dyke, p. 74 (1936a).

1936. *Miloderoides argenteus* (Van Dyke), Van Dyke, p. 75-76 (1936a).

Type Locality: Of *cinereus,* Colorado (Grand Junction); of *argenteus,* Colorado (Grand Junction).

Distribution: Known only from the type locality.

Type: Of *cinereus,* a Holotype female; of *argenteus,* a Holotype male. Both are in the California Academy of Sciences, San Francisco. A male paratype of *"argenteus"* is here designated as Allotype (C. A. S. Ent. No. 4945).

Salient Characters: Length 4.5 mm. - 6 mm. Width 2 mm. - 3 mm. Color grey and reddish tan or brown mottled. Tarsal bristles and tibial spinules amber color.

Similar to *maculatus* except for the following: Rostral setae probably same length as head setae (badly worn on available specimens); subapical area depressed and triangular-shaped. Eyes less convex. Pronotum wider than long (1.9: 1.6). Tibiae possibly without spine-like setae on ventral margins (legs of available specimens badly rubbed). Corbel spinules crowded together. Male genitalia as shown in Plate 24.

Discussion: The sexes are easily distinguished by the tarsal characters given in the generic description.

M. cinereus was described from two badly rubbed female specimens which have the dense elytral setae worn down to about one-fifth their normal length. The species was placed in the genus *Cimbocera* obviously because of its narrow third tarsal segment and the worn condition of the pubescent tufts on the third tarsal segment of the fore legs. It is not congeneric with *Cimbocera,* even in the female, as indicated by the absence of postocular lobes, the absence of premental setae, and by the form

of the antennal scrobes which are deep, narrow and parallel-sided. *M. argenteus* was described from the males of *cinereus* which were collected on the same day and at the same locality as the latter. They were not associated with *cinereus* evidently because of the long elytral setae and expanded third tarsal segment. As previously stated, the enlarged third tarsal segment bearing pubescent tufts is a secondary sexual character of the species and is also a generic character of *Miloderoides* which appears only in the male. Except for the elytral setae and secondary sexual characters of the tarsi, the original descriptions of *cinereus* and *argenteus* are quite similar.

Genus Cryptolepidus Van Dyke

1936. *Lepidopus* Van Dyke, p. 76-77 (1936a).

1936. *Cryptolepidus* Van Dyke, p. 191, change of name by Van Dyke (1936b).

1938. *Cryptolepidus,* Van Dyke, p. 2.

Genotype: *Lepidopus nevadicus* Van Dyke (original designation).

Salient Characters: Vestiture of imbricated scales and suberect setae. Rostrum generally with transverse constriction at base; prementum non-setose; maxillae partly exposed; postmentum evident as short peduncle; mandibular appendage short, nearly straight, without mesal tooth; antennal scrobe deep, narrow, nearly parallel-sided, extending to ventral margin of rostrum to a point immediately in front of the eye; antennal scape reaching to middle or nearly to hind margin of eye, first, second, and occasionally third funicular segment longer than broad, remaining segments broader than long and cupped at apices. Eyes nearly round, slightly angular opposite end of antennal scrobe. Postocular prothoracic lobes and vibrissae absent. Elytral striae and serial punctures evident; intervals flat or slightly convex; humeri evident as small angular points. Abdominal sternites one and two of males slightly concave in median area; females with median area of basal sternites slightly convex. Fore and middle tibiae with mucro at apex; hind tibiae with minute mucro at apex only in males. Fore tibiae not denticulate along ventral margins. Hind tibia with corbels closed; spinules of either or both distal and anterior combs irregularly arranged. Tarsi ventrally clothed with bristle-like setae only, no pubescent tufts present in either sex; third tarsal segment very slightly wider than second in males, females with third tarsal segment no wider than second. Claws free. Metaepisternal suture not or only slightly visible at posterior end. Female genitalia (Plate 25) with

coxites and "valvifers" fused; large membranous section at apex of apparent "valvifer" and smaller membranous area at base of coxal sclerotized apex; coxal styli absent. Male genitalia as shown in Plates 24, 25; internal sac with sclerotized U-shaped transfer apparatus and a central tubular structure through which the sperm is probably discharged (males from three of the five known species are available for dissection).

Discussion: *Cryptolepidus* is distinct from the other genera of the so-called *Cimbocera* group in lacking both postocular prothoracic lobes and vibrissae. The following are additional important characters; third tarsal segment setose and not or only slightly larger (in males) than second; prementum not setose; antennal scrobes, deep, narrow, and nearly parallel-sided.

Cryptolepidus parvulus (Van Dyke) (1936, p. 78) is a synonym of *Cercopeus artemisiae* Pierce (1910, p. 365). The author has compared specimens with both the Van Dyke and Pierce types. The species, however, is misplaced in the genus *Cercopeus* Schönherr due to its slender and proportionately long postmentum and to the apparent absence of mandibular appendages or scars. Furthermore, the female genitalia of *Cercopeus* lack the coxal styli and have slender "valvifers" fully three times longer than broad, whereas in *artemisiae* the coxal styli are present and the "valvifers" are short triangular-shaped structures. To correctly place this species will require studies much beyond the scope of the present paper.

KEY TO SPECIES

1. Elytral setae short and reclinate, not longer than one-fourth to one-half width of intervals. Head slightly convex between eyes, Pronotal sides faintly convex.....*leechi*, n. sp.

   Elytral setae long and suberect, as long or longer than width of intervals. Head between eyes flat or concave. Pronotal sides strongly convex..... 2

2. Pronotum not tuberculate or rugose..... 3
   Pronotum distinctly tuberculate and rugose..... 4

3. Base of rostrum with broad somewhat arcuate, transverse constriction. Pronotum as broad as long. Elytral intervals flat. Fore tibiae with six spinules and pale colored mucro at apex, exclusive of those in ventral comb.*nevadicus* (Van Dyke)

   Base of rostrum flat. Pronotum one-fourth wider than long. Elytral intervals slightly convex. Fore tibiae with eleven spinules and a black mucro at apex, exclusive of those in ventral comb.....*planifrons*, n. sp.

4. Dorsum of rostrum longitudinally convex between base and subapical area. Median sulcus narrow, line-like. Color brown .....*cazieri* (Van Dyke)

   Dorsum of rostrum longitudinally flat. Median sulcus broad. Color grey.....*rugicollis*, n. sp.

Cryptolepidus nevadicus (Van Dyke)

1936. *Lepidopus nevadicus* Van Dyke, p. 77-78 (1936a).
(See change of name under generic bibliography).

Type: Holotype, probably a female, a unique in the California

Distribution: Known only from type locality.

Type: Holotype, probably a female, a unique in the California Academy of Sciences, San Francisco.

Salient Characters: Length 5 mm. Width 2.1 mm. Color grey, slightly mottled brown and black, slight cupreous luster to some scales; no pronotal vittae present. Tarsal bristles and tibial spinules pale yellow.

Rostrum with slightly concave, somewhat arcuate, broad, transverse constriction at base; subapical area triangular-shaped, central part raised, scales spaced further apart; setal vestiture about same length as head setae; median sulcus narrow extending from antennal articulation to posterior margin of basal transverse constriction. Pronotum smooth, as broad as long (1.7:1.7); sides convex; longer setae four times longer than head setae, length of setae on sides twice the width of elytral intervals; no median sulcus. Elytral intervals flat; setae arranged in two to three irregular rows per interval and two and one-half times longer than interval width; dorsum flattened, sides subparallel, posterior end not greatly inflated. Metaepisternal suture visible at posterior end. Hind tibia with 7 spinules in distal comb before normal position of mucro (no mucro present); anterior comb with 5 to 7 spinules, the unique type has a different number of spinules on each hind tibia. Fore tibiae with 6 spinules at apex, exclusive of pale colored mucro.

Discussion: The following combination of structural characters will distinguish *nevadicus* from the other species of *Cryptolepidus*: setae of pronotum and elytra at least twice longer than elytral interval width; pronotum smooth and not sulcate; tibial spinules and tarsal bristles pale amber color; rostrum with rather broad, somewhat arcuate, transverse basal constriction.

Cryptolepidus planifrons, new species

(Plate 26)

Type Locality: Nevada (9 miles n. w. of Gerlach, Washoe Co.).

Distribution: Known only from type locality.

Type: Holotype female (V-29-39, P. C. Ting, collector, *Sarcobatus vermiculatus*) deposited in the California Academy of Sciences, San Francisco (C. A. S. Ent. No. 4936). One paratype and a badly worn specimen, both females, in the author's collection.

Salient Characters: Length 5.8 mm. - 6 mm. Width 3.3 mm. - 3.5 mm. Color grey and white faintly mottled light brown; pronotal vittae faint, light tan. Tarsal bristles and tibial spinules pale yellow to amber color.

Rostrum without basal transverse constriction; front and dorsum of rostrum on same plane; fine median sulcus broadest in apical half; setae same length as on head; subapical area depressed and V-shaped, a small convex, glabrous V-shaped area at base of nasal plate; nasal plate nearly truncate at apex. Pronotum smooth or slightly granular, one-fourth broader than long (2:1.5); no median sulcus; sides strongly convex; setae two to three times longer than head setae. Elytral intervals slightly convex; setae in two to three irregular rows per interval and about one-fourth longer than interval width; elytral broad, robust. Metaepisternal suture not or only visible in posterior third. Distal and anterior combs of hind tibia separated by about the length of individual spinule; spinules quite regularly placed and about same length in each comb: distal comb with 11 to 12 spinules; anterior comb with 3 to 5 spinules. Fore tibia with 11 spinules at apex exclusive of black mucro and ventral comb. Female genitalia similar to *leechi,* but with "valvifers" and coxal apices shorter. Eighth abdominal sternite not emarginate at apex. Males unknown.

Discussion: The following characters taken together will distinguish *planifrons* from the other known species: rostrum without basal transverse constriction so that the front between the eyes is on the same plane with the dorsum of the rostrum; elytral setae as long or longer than interval width; pronotum one-fourth broader than long and strongly convex at sides.

Cryptolepidus leechi, new species

(Plates 24, 25, 26)

Type Locality: California (Baker, San Bernardino Co.).

Distribution: Type locality. A single specimen the exact origin of which is unknown was intercepted at Yermo Plant Quarantine Station, California.

Type: Holotype male and Allotype female (IV-30-37, H. B. Leech, M. A. Cazier, P. C. Ting, collectors, *Atriplex* sp.) and four paratypes deposited in the California Academy of Sciences, San Francisco (C. A. S. Ent. Nos. 4822-4823). Paratypes distributed as follows: six in the United States National Museum; two in the Los Angeles Museum; two in the collection of the State Department of Agriculture, San Francisco; four in the collection of H. B. Leech; seven in the collection of M. A. Cazier; seventeen and five specimens in the author's collection.

Salient Characters: Length 5.5 mm. - 8.5 mm. Width 2.9 mm. - 3.9 mm. Color predominantly white often mottled with tan or dark brown; scales sometimes with cupreous luster; pronotal vittae obscure or faint tan or brown. Tarsal bristles and tibial spinules nearly black.

Rostrum with only a faint basal transverse constriction; dorsum of rostrum on a slightly lower plane than front between eyes; narrow median sulcus; setae same length as head setae; subapical area slightly and broadly depressed with a semicircular or V-shaped glabrous region immediately back of nasal plate; nasal plate prominent and with broad, deep emargination having straight margins. Head with front between eyes slightly convex. Pronotum smooth or very slightly granular; only slightly broader than long (2.2: 2) with sides slightly convex; often with faint median sulcus; setae about same length as head setae. Elytral intervals flat; setae extremely short one-fourth to one-third as long as interval width; striae fine; sides nearly parallel. Metaepisternal suture visible for posterior half. Spinules of each comb on hind tibia about same length; distal comb with 6 to 7 spinules; anterior comb 4 to 7 spinules. Fore tibia with ventral comb and adjacent brush as shown in Plate 26. Male and female genitalia as shown in Plates 24, 25. Eighth abdominal sternite of female (Plate 25) deeply emarginate at apex.

Discussion: *C. Leechi* is distinguished from all other known species in the genus by its extremely short setal vestiture which length of the elytra is one - fourth to one - third the interval width. Other diagnostic characteristics are: the slightly convex front between the eyes; the nearly black tarsal bristles and corbel spinules; the rather narrow prothorax with only slightly convex sides.

Cryptolepidus cazieri (Van Dyke), new combination

(Plates 24, 25, 26)

1936. *Cimbocera cazieri* Van Dyke, p. 73 (1936a).

Type Locality: Of Holotype California (Baker, San Bernardino Co.). Of Allotype California (Vidal, San Bernardino Co.).

Distribution: California (Baker, Vidal, Essex, San Bernardino Co.; Keeler-Darwin Road, Inyo Co.; Mojave, Cantil, Kern Co.; Blythe, Riverside Co.). Arizona (Ehrenberg, Yuma Co.).

Type: Holotype, a female, in the California Academy of Sciences, San Francisco. A male from Vidal, California (V-12-39, W. A. Miller, collector) is here designated as Allotype and deposited in the California Academy of Sciences, San Francisco (C. A. S. Ent. No. 4946).

Salient Characters: Length 5.2 mm. - 7.1 mm. Width 2.5 mm. - 3.2 mm. Color tan mottled with darker brown, sides of prothorax and elytra a light grey; pronotal vittae dark to nearly black. Tarsal bristles and tibial spinules amber color.

Rostrum with pronounced basal transverse constriction; dorsum convex from base to nasal plate; narrow median sulcus, setae same length as head setae; first funicular segment of antennae more elongate than in other species of the genus; antennal scrobes broader near posterior end than in other species; subapical area broadly depressed between antennal articulation forward to base of nasal plate with scales separated by over half their diameter, scales on rest of rostrum are imbricated; nasal plate broadly and shallowly emarginate. Pronotum tuberculate; often with median sulcus; broader than long (2.1: 1.8) with sides convex; setae slightly longer than head setae. Elytral intervals flat occasionally slightly convex in males; setae about three-quarters length of interval width arranged in two to three irregular rows per interval; dorsum of elytra quite flat in females. Metaepisternal suture not or only visible in posterior third. Hind tibia with spinules of anterior comb about two-thirds length of those in distal comb; spinules quite regularly placed; distal comb with 10 to 13 spinules; anterior comb with 5 to 9 spinules. Fore tibia with more spinules in ventral comb than in other species. Male and female genitalia as shown in Plates 24, 25. Eighth abdominal sternite of female not emarginate at apex.

Discussion: *C. cazieri* is easily distinguished from the other species by the following combination of characters: pronotum tuberculate; dorsum of rostrum convex from base to nasal plate. It is the only known species in the genus which is predominantly tan or brown.

Cryptolepidus rugicollis, new species

(Plates 24, 25, 26)

Type Locality: Nevada (3 miles north of Lovelock, Pershing Co.).

Distribution: Known only from type locality.

Type: Holotype male and Allotype female (VI-7-38, P. C. Ting, collector, *Atriplex* sp.) and four paratypes deposited in the California Academy of Sciences, San Francisco (C. A. S. Ent. Nos. 4824-4825). Paratypes distributed as follows: six in the United States National Museum; one in the Los Angeles Museum; one in the collection of the State Department of Agriculture, San Francisco; two in the collection of M. A. Cazier; one in the collection of H. B. Leech; eight in the author's collection.

Salient Characters: Length 5.5 mm. - 7.5 mm. Width 2.9 mm. - 3.8 mm. Color predominantly grey faintly mottled with tan or dark brown; scales often with cupreous luster; pronotal vittae generally present and light tan. Tarsal bristles and tibial spinules amber to dark brown.

Rostrum with shallow transverse constriction at base; broad median sulcus, triangular-shaped in cross section; setal vestiture same length as head setae; subapical area depressed and V-shaped with a small V-shaped glabrous region immediately back of nasal plate; nasal plate nearly truncate at apex. Pronotum tuberculate and rugose; broader than long (2.1: 1.8) with sides evenly and strongly convex; generally with median sulcus; setae slightly longer than head setae. Elytral intervals flat or slightly convex; setae as long or slightly longer than interval width; setae arranged in two to three irregular rows per interval. Metaepisternal suture visible in posterior third. Spinules of anterior comb on hind tibia slightly shorter than those of distal comb; distal comb with 7 to 9 spinules; anterior comb 3 to 6 spinules. Fore tibia with ventral comb similar to *leechi*. Female genitalia similar to *leechi* but with coxal apices and "valvifers" proportionately shorter and broader; "valvifers" proportionately longer than in *planifrons*. Male genitalia as shown in Plate 24. Eighth abdominal sternite of female truncate at apex similar to *planifrons*.

Discussion: This species is easily separated from the others in the genus by following combination of characters: tuberculate and rugose pronotum; dorsum of rostrum longitudinally flat; rostrum with broad median sulcus; color grey.

Genus Miloderes Casey

1888. *Miloderes* Casey, p. 252-253.
1909. *Miloderes,* Pierce, p. 346-348.
1913. *Miloderes,* Pierce, p. 379-380.
1935. *Miloderes,* Van Dyke, p. 4.
1936. *Miloderes,* Van Dyke, p. 75-77. (1936a.)
1938. *Miloderes,* Van Dyke, p. 2.

Genotype: *Miloderes setosus* Casey (monotypic).

Salient Characters: Setal vestiture long and suberect; scales closely applied, imbricated or merged on elytra. Rostrum extremely short, its length slightly less than distance between eyes; nasal plate short, hardly visible under low magnification; prementum bisetose about one-third wider than long, maxillae completely covered; postmentum not evident as a peduncle; antennal scrobes deep, narrow, parallel-sided extending posteriorly

and ventrally to a point nearly opposite lower end of eye; antennal scape reaching to lower hind margin of eye; first five funicular segments longer than broad and not cupped at apices. Eyes slightly elongate in vertical plane. Postocular prothoracic lobes slightly evident or obsolete; vibrissae present. Elytral intervals and striae poorly defined; humeri rounded. Third tarsal segment, particularly of male, expanded, much larger than second. Male with small apical tufts of pubescence on first, second, and third tarsal segments of fore legs; occasionally with same arrangement on tarsi of middle legs, but always on third tarsal segment; hind legs with pubescent tufts at apex of third tarsal segment. Female with small apical tufts of pubescence on third, tarsal segment only of all legs. All tibiae mucronate; tibial apices in both sexes expanded. Claws free. Female genitalia flexible near apices of "valvifers", but not at base of coxal apices; coxal styli absent.

Discussion: The broad prementum completely covering the maxillae, absence of postmental peduncle, and expanded tibial apices will separate this genus from others in the *Cimbocera* group. The expanded tibial apices superficially resemble those of *Stereogaster globosa* Van Dyke and the genus *Trigonoscuta* Mots. The labial structure completely covering the maxillae indicates that *Miloderes* is not closely related to *Cimbocera*. The female genitalia, however, resembles *Cimbocera* and its close relatives.

KEY TO SPECIES

Color brown and silvery grey. Fore tibiae with outer apical portion evenly rounded. Scales of pronotum and elytra with central puncture ..... *setosus* Casey

Color uniform green. Fore tibiae with outer apical portion elongated. Scales of pronotum and elytra without central puncture ..... *viridis* Pierce

Miloderes setosus Casey

(Plates 24, 25, 26)

1888. *Miloderes setosus* Casey, p. 253-254.
1909. *Miloderes setosus* Casey, Pierce, p. 347-348.
1913. *Miloderes setosus* Casey, Pierce, p. 379-380.
1935. *Miloderes setosus* Casey, Van Dyke, p. 4.
1936. *Miloderes setosus* Casey, Van Dyke, p. 75-76 (1936a).

Type Locality: California (Kern Co.).

Distribution: California (Kern Co.; Baker, Essex, San Bernardino Co.).

Type: In Casey collection, United States National Museum.

Salient Character: Length 4 mm. - 6 mm. Width 2.5 mm. - 3.1 mm. Color reddish-brown with silvery scales; each scale of pronotum and elytra with a central puncture. Setae of pronotum and elytra one-third as long as width of pronotum.

Rostrum as wide as long with broad transverse impression just posterior to antennal articulation. Pronotum broader than long; about evenly rounded at sides; postocular lobes present as angular points opposite lower end of eye. Elytral setae inserted between scales and arranged in somewhat regular rows. Fore tibiae with outer apical portion rather evenly rounded with spinules at apex evenly spaced. Middle tibiae with 9 to 10 spinules at apices exclusive of spinules posterior to tibial mucro. Hind tibia with single row of spinules at extreme apex—corbels open. Male and female genitalia as shown in Plates 24 and 25.

Discussion: In general the males are more slender than the females and the median portion of the first and second apparent abdominal sternites is concave. Tarsal characters for determination of sex are given in the generic description.

Miloderes viridis Pierce

(Plates 24, 25)

1909. *Miloderes viridis* Pierce, p. 348.

1913. *Miloderes viridis* Pierce, Pierce, p. 380.

Type Locality: Arizona (Keams Copper Mine, Navajo Indian Reservation).

Distribution: Known only from type locality.

Type: In the United States National Museum.

Salient Characters: Length 4 mm. - 5.5 mm. Width 2 mm. - 2.8 mm. Color of derm reddish brown covered with green scales; scales of pronotum and elytra without central puncture. Length of vestiture similar to *setosus*.

Similar to *setosus* except for the following: Pronotum distinctly wider in apical half; not evenly convex at sides; postocular lobes practically obsolete. Fore tibiae with outer apical portion elongated with spinules crowded together at summit of apex. Middle tibiae with 12 to 15 spinules at apices exclusive of spinules posterior to tibial mucro. Hind tibiae with the spinules

of the anterior comb situated some distance before the apex of the tibia; the distal comb appears to be absent; the specimens examined may possibly have the spinules rubbed off, if this is true the corbels are closed. Male genitalia as shown in Plate 24.

Discussion: The sexes may be distinguished by the secondary sexual characters given for *setosus*. *M. viridis* is readily separated from *setosus* by its green color, elongated outer apical portion of the fore tibiae, absence of the central puncture in the elytral scales, and in the structure of the male genitalia.

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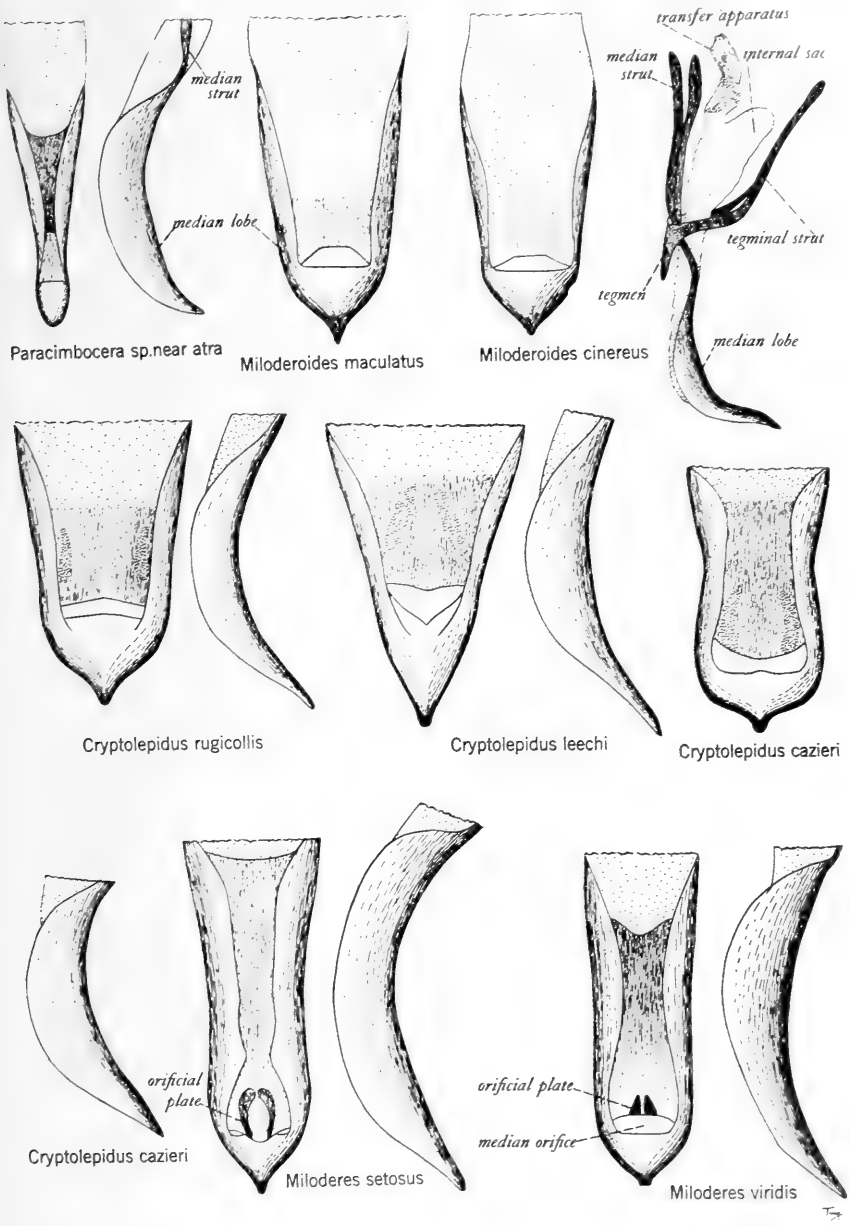
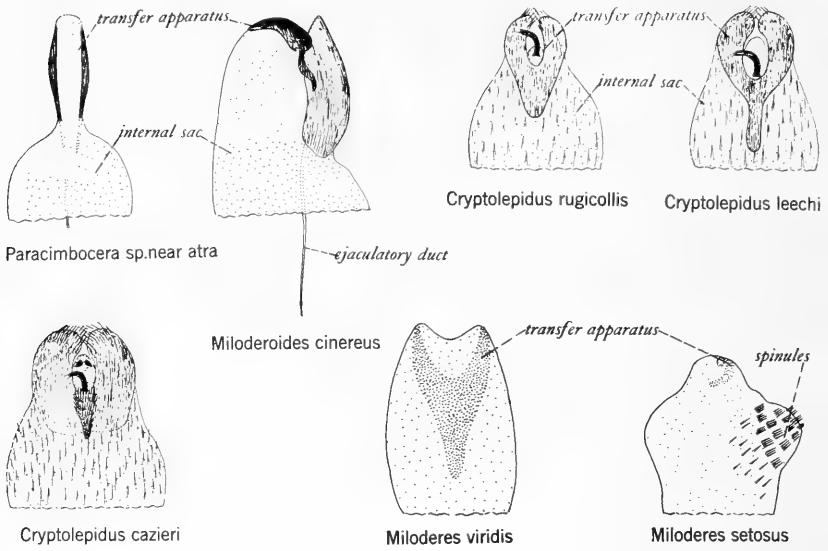
[4] Not read by the present writer.

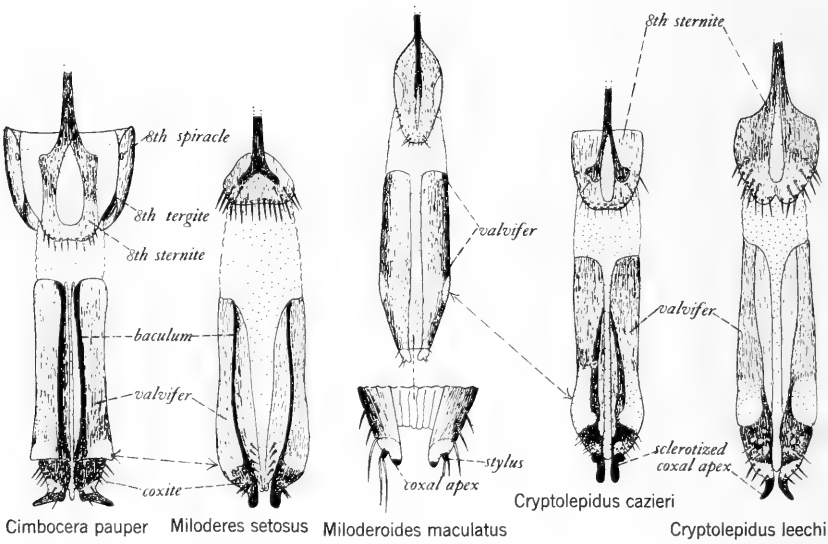


Male Genitalia - Dorsal And Lateral Views

PLATE 24



Apices Of Internal Genital Sacs Of Male



Female Genitalia And Eighth Sternite-Ventral View

PLATE 25

Cimbocera pauper

Cimbocera conspersa

Cimbocera buchanani

Paracimbocera sp. near atra

Paracimbocera artemisiae

Miloderoides maculatus

Cryptolepidus leechi

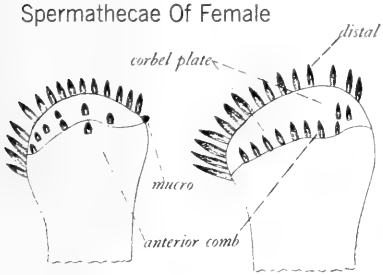
Cryptolepidus cazieri

Cryptolepidus planifrons

Cryptolepidus rugicollis

Miloderes setosus

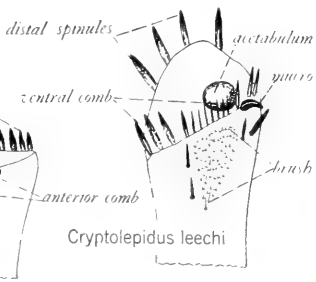
Spermathecae Of Female



Cimbocera pauper

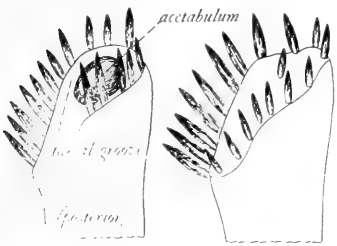
Cimbocera conspersa

Cimbocera buchanani

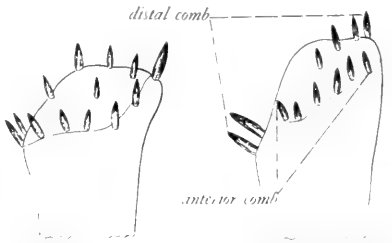


Cryptolepidus leechi

Apex Of Fore Tibia
Ventral View



Cryptolepidus cazieri



Cryptolepidus rugicollis

Cryptolepidus leechi

Apices Of Hind Tibiae - Anterior View

PLATE 26

CONTRIBUTIONS FROM THE LOS ANGELES MUSEUM - CHANNEL ISLANDS BIOLOGICAL SURVEY

9. A RARE MYRIAPOD FROM ANACAPA ISLAND, COMPARED WITH TWO TEXAS SPECIES

By W. Dwight Pierce

The Anacapa Island Expedition of August, 1940, turned up a little colony of creatures, looking like Dermestid larvae, which set the writer's heart into high speed, for only twice before in over 40 years of collecting had he ever seen any other specimens of the rare Diplopod genus Polyxenus Latreille (1802), which is classed in the family Polyxenidae, order Schizocephala, subclass Pselaphognatha, class Diplopoda, superclass Myriapoda, phylum Arthropoda.

The type of Latreille's genus, *Polyxenus lagurus* Linnaeus, is the only species known from Europe; *P. fasciculatus* Say (1817) is the only species known from the United States, while *P. longisetis* Pocock (1894) from Cuba, is questionably referred to the genus. In Hawaii there are two species, one probably erroneously referred to *P. fasciculatus,* and the other *P. hawaiiensis* Silvestri. There are several other genera in the family, with species mostly from Africa, and a few from Central America and the West Indies.

In the writer's collection from Texas are 13 specimens from two localities, and on close examination for the first time, it is concluded that they represent two distinct species, both differing materially from the new Island form.

Close microscopic study reveals startling relationships to the insects. It is quite possible that someone has noted this relationship, but it has never come to the writer's attention that anyone has correlated the diplopod segmentation with insect segmentation; nor has he seen any suggestion of a differentiation of thorax and abdomen.

Polyxenus most definitely has a head, a cervical segment (sometimes called the first segment), three thoracic segments each bearing one pair of legs; five abdominal segments with two pairs of legs each; and two terminal segments without legs; the last bearing two brushes of bristles instead of cerci. Viewed ventrally each pair of legs belongs to a sternal segment with a definite sternite, so that we may definitely conclude that the abdominal tergites are coalesced doublets. We should probably place the Diplopoda and Pauropoda as higher developments than the Chilopoda.

In the following table the segmentation and appendages of Polyxenus, Machilis, Protura, and normal primitive insects is suggestive of a phylogenetic trend.

CORRELATION OF PRIMITIVE SEGMENTATION IN POLYXENUS AND INSECTS

POLYXENUS			MACHILIS		PROTURA		PRIMITIVE INSECTS	
Terg-ites	Stern-ites	Append-ages	Stern-ites	Append-ages	Stern-ites	Append-ages	Stern-ites	Append-ages
Head Cerv-ix	Head Cerv-ix	Mouth	Head Cerv-ix	Mouth	Head Cerv-ix	Mouth	Head Cerv-ix	Mouth
Pro-notum	Prost-ernum	Legs I	Prost-ernum	Legs I	Prost-ernum	Legs I	Prost-ernum	Legs I
Meso N.	Meso St.	II	Meso St.	II	Meso St.	II	Meso St.	II
Meta N.	Meta St.	III	Meta St.	III	Meta St.	III	Meta St.	III
Abdom. Terg.	Abdom. Stern.	Legs	Abdom. Stern.	Styli	Abdom. Stern.	Styli	Abdom. Stern.	None
I	I	IV	I	I	I	I	I	
	II	V	II	II	II	II	II	
II	III	VI	III	III	III	III	III	
	IV	VII	IV	IV	IV		IV	
III	V	VIII	V	V	V		V	
	VI	IX	VI	VI	VI		VI	
IV	VII	X	VII		VII		VII	
	VIII	XI	VIII		VIII		VIII	
V	IX	XII	IX		IX		IX	
	X	XIII	X		X		X	
VI	XI		XI		XI		XI	
VII	XII				XII			
Totals 12	17	13	16	9	17	6	16	3

The development of Polyxenus is anamorphotic, segments being added in each instar between the preanal segment and the preceding abdominal segment. Whether there is a hexapod stage as in Pauropus remains to be determined, but it is suggested below. Pauropus is placed in the class Pauropoda at the bottom of the Myriapod scale, but should probably belong near the Pselaphognatha and Insecta, for it too has thoracic segments with a single pair of legs, and abdominal segments with two pairs of legs. Its first larva has only 3 thoracic pairs of legs, and the succeeding stages have successively (4?), 5, 6, (7?), 8 and 9 pairs of legs, presumably adding one sternite at a time.

At first it seemed that Polyxenus adds two sternites bearing legs at a moult, but we have one specimen with 10 pairs, and six with 12 pairs, so it may be that a single sternite is added each moult.

ANAMORPHOTIC DEVELOPMENT OF POLYXENUS

LARVAL STAGES										ADULT	
STAGE I		STAGE II		STAGE III		STAGE IV		STAGE V			
Terg.	Legs	Terg.	Legs	Terg.	Legs	Terg.	Legs	Terg.	Legs	Terg.	Legs
Head		Head		Head		Head		Head		Head	
Cervix		Cervix		Cervix		Cervix		Cervix		Cervix	
Pro N.	I	Pro N.	I	Pro N.	I	Pro N.	I	Pro N.	I	Pro N.	I
Meso N.	II	Meso N.	II	Meso N.	II	Meso N.	II	Meso N.	II	Meso N.	II
Meta N.	III	Meta N.	III	Meta N.	III	Meta N.	III	Meta N.	III	Meta N.	III
		Abd. I	IV	Abd. I	IV	Abd. I	IV	Abd. I	IV	Abd. I	IV
			V		V		V		V		V
				Abd. II	VI	II	VI	II	VI	II	VI
					VII		VII		VII		VII
						III	VIII	III	VIII	III	VIII
							IX		IX		IX
								IV	X	IV	X
									XI		XI
										V	XII
											XIII
Preanal		Preanal		Preanal		Preanal		Preanal		Preanal	
Anal		Anal		Anal		Anal		Anal		Anal	

Specimens are at hand belonging to stages II, III, IV, V, and adult; and we merely assume that there may be a first larva of the same type as in the Pauropoda. If we are right in this assumption, the Pauropoda and Schizocephala are primarily hexapod, but unlike the majority of insects develop more legs in successive instars. Anamorphosis also occurs in the Proturan insects, which have stages with nine, ten, eleven and twelve abdominal segments.

The legs of Polyxenus are very similar in form to those of the Protura, consisting of Coxa, Trochanter I and III, Femur, Tibia, Tarsus, and Pretarsus (claw), while in Protura there is but one Trochanter.

In most insects the tarsus is divided into 2 to 5 segments but primitive insects and many larvae of higher insects have only one tarsal segment; the pretarsus is usually reduced to a claw or claws. The trochanters are usually fused in insects into a single piece; but in larvae, such as the Coleopterous *Exema jenksi,* there are two trochanter segments, just as in Polyxenus.

A KEY TO THE SPECIES OF POLYXENUS IN THE UNITED STATES

1. Antennae short, sixth joint not one-half longer than wide; sternellum triangular 2

   Antennae longer, exceeding the bristles of the vertigial crown, sixth joint over twice as long as wide; finer tail bristles with single backward barb, faced by a forward pointing barb; dorsal bristles never showing more than three rows of spines at one view; presternum and sternellum broadly arcuate: West Texas.....3. *tuberculatus* n. sp.

2. Body light brown, head with darker coronal band, but no median band; bristles cinereous; the finer tail bristles with single backward barb, faced by a forward pointing barb; dorsal bristles never showing at one view more than three rows of spines; presternum usually divided into subtriangular parts: South Texas.....1. *fasciculatus* Say
   race *victoriensis* n. race

   Body dark brown, head with dark coronal and median bands: bristles snowy white; the finer tail bristles with 2 to 5 (mostly 3) backward barbs; dorsal bristles showing at one view five to six rows of spines; presternum triangular and small; legs stout: Anacapa Island, California.....
   .....2. *anacapensis* n. sp.

COMPARISON OF THE ANTENNAE OF THE THREE SPECIES OF POLYXENUS OF U. S.

Length of Joints (1 space=0.017 mm.)				Breadth of Joints		
Segment	Fascic.	Tuberc.	Anacap.	Fascic.	Tuberc.	Anacap.
1	5	3	4	3	2.5	3.5
2	2	3	3	3	2.5	3.5
3	1	1	2	3	2.5	3.5
4	2	3.5	3	3	2.5	3.5
5	1.5	3	2	3	2.75	3
6	4	7	4.5	3.5	3	3.5
7	2.5	2.5	3.5	2.25	2.25	2.5
8	1	2	1	1.5	1.5	1.5
	19.0	25.0	23.0			

Relatively the segments are to each other in about the same proportions in the three species, but the sixth segment is not one-half longer than wide in *fasciculatus* and *anacapensis,* and is over twice as long as wide in *tuberculatus.* The antennae of *anacapensis* are stouter, and those of *tuberculatus* longer than the others.

1. Polyxenus fasciculatus Say.

Pollyxenus fasciculatus Say. 1821. Journ. Acad. Nat. Sci., Phila., 2:108.

Say's original description is as follows:

"Genus Pollyxenus Latr.

"Body membranaceous, penicillate with setae at tip; antennae inserted under the anterior margin of the head.

"*P. fasciculatus*: Body pale brown, linear, incisures ciliated fasciculated each side; head deeply ciliated before.

"Inhabits the Southern States.

"Segments smooth, ciliate at the incisures, and fasciculate with brown setae each side, terminal pencils cinereous; head semi-orbicular, depressed, deeply and densely ciliated on the edge with setae; eyes small, oval, prominent, placed obliquely in the middle of the lateral margin; antennae very short, thick reddish brown; feet white.

"Length rather more than one-tenth of an inch.

"Beneath stones, etc., in humid situations; not very common."

There are at hand six specimens, mounted one to a slide (slide 5 also has 7 cast skins), from a larger collection made by J. D. Mitchell, at Victoria, Texas, March 2, 1910, under Hunter No, 1861, found as a colony in a Lepidopterous cocoon. The remainder of the series is no doubt in the collections of the U. S. National Museum, but one of these slides is also to be deposited in that Museum.

These specimens agree with Say's description and are here described in detail. Say does not give a type locality, and may possibly have been dealing with a different species; but if his specimens are not now extant, we may consider the present description as a redescription. In order that there may be no doubt as to the identity of the material here described, it is given the race name *victoriensis,* which would become its species name if it is different from Say's species.

Polyxenus fasciculatus Say, race *victoriensis,* new race (figs. 1, 4, 7, 10, 11, 12, 13, 19).

Type locality, Victoria, Texas.

In this small series it was possible only to rather indefinitely correlate size with stage, other than length of body. The head measurements of the 4th and 5th stages seem to be practically identical.

Stage 4: 9 pairs of legs; length of body 1.003-1.581 mm. from tip of head to attachment of tail bristles; breadth of head at eyes 0.544-0.56 mm.; length of head from line connecting the occipital emarginations behind eyes 0.255-0.272 mm.

Stage 5: 11 pairs of legs; length of body 1.87-2.04 mm.; breadth of head 0.56--0.569 mm.; length of head 0.272 mm. (fig. 19).

Head broadly rounded in front; abruptly and strongly emarginate behind eyes by the occipital suture; the vertex is ornamented anteriorly with two broadly rounded rows of setigerous punctures, outlining a dark brown band, behind which the vertex is lighter and semicircular. Each bristle borne on a slender peduncle is elongate, clear, and bears three visible rows of sharp spines. Eye spots dark, with at least 3 clear, separated lenses. Antennae attached under over-hanging vertex, their points of attachment closer together than to eyes; eight-jointed, the first largely in its fossa, the second to fifth transverse, the sixth stout, longer than broad, and the largest of the segments, the seventh, longer than broad, eighth a very small transverse segment with apical papillae, all in the proportions given in the table. The mouthparts are hard to see, but there are two dentate edges visible, as shown in figure 1.

Dorsally the cervix is a transverse plate outlined by a narrow ellipse of stout bristles, shorter than the vertigial crown bristles of the head, each armed with three visible longitudinal rows of spines, and transversely minutely striate; laterally it is very narrow and ventrally is concealed by the mouthparts (figs. 11, 12).

The thoracic segments dorsally bear two rows of bristles pointed ventrally, of the same type as on the cervix, the anterior row being sparser; and laterally are tuberculate and armed with a cluster of spines, longer than the dorsal spines.

The abdominal segments are dorsally and laterally armed as the thoracic segments.

The anal segment is provided with two dense brushes, almost contiguous at base, of bristles which are of varying sizes, but many are much longer than the tubercular bristles, and they are of two distinct types intermingled, some appearing gray, due to the fine transverse striation. The heavier bristles are like the tubercular and dorsal bristles, with three visible rows of spines. The finer bristles are unique in form, with two more or less alternating series of lateral teeth, and near the tip a long proximal spine directed at a more distal recurved and longer spine, and beyond the end of this is a very delicate deciduous piece with long backward barb. (See figs. 12, 13.)

Ventrally the thoracic sternites correspond with the tergites, but there are two abdominal sternites for each tergite, except the preanal and anal. Each sternite of thorax and abdomen, except the cervical, preanal and anal, bears a pair of legs, which consist of coxa, first and second trochanter, femur, tibia, tarsus and pretarsus, which is a claw. Each leg-bearing sternite consists of two anterior presternal plates narrowly separated from the posterior triangular sternellum, by a commissure uniting the two lateral parts of the basisternum, at the outer ends of which the coxae are posteriorly attached (see fig. 4).

2. Polyxenus anacapensis n.sp. (figs. 2, 6, 9, 15, 16, 17, 18, 19)

Described from 102 specimens of various instars and 52 cast skins, the whole series mounted on 50 numbered slides, all but slide 35 collected under bark of Eucalyptus, in colonies, Auugust 22, 1940, on Middle Anacapa Island, California, by Chris Henne and Don Meadows (L. A. Museum No. 1940-1963); slide 35 collected on pods of *Astragalus miguelensis,* August 18, 1940, on West Anacapa Island, by George P. Kanakoff (L. A. Mus. No. 1940-2121).

Some of the material was killed in alcohol, and the bodies are expanded; but the majority shrivelled in dying, so that body lengths are of value only in comparing those in the same condition. The specimens might even be taken for different species. In handling these beautiful little creatures one must use great

care to preserve the bristles in position. The moment they are put into a liquid the spines are whirled away, as their point of attachment is very slender.

Stage 2: 8 dorsal segments; 5 pairs of legs; length of body to attachment of caudal brush 0.425-0.442 mm.; breadth of head 0.306-0.340 mm.; length of head from line connecting occipital emarginations behind eyes 0.153-0170 mm.; 2 specimens measured (fig. 16).

Stage 3: 9 dorsal segments; 7 pairs of legs; length of body 0.595 mm.; breadth of head 0.357 mm.; length of head 0.170 mm.; 1 specimen.

Stage 4: 10 dorsal segments; 9 pairs of legs; length of body 1.003 mm.; breadth of head 0.459 mm.; length of head 0.204 mm.; 1 specimen.

Stage 5A: 11 dorsal segments; 10 pairs of legs; length of body 1.122 mm.; breadth of head 0.442 mm.; length of head 0.187 mm.; 1 specimen.

Stage 5B: 11 dorsal segments; 11 pairs of legs; length of body 1.122 mm.; breadth of head 0.493 mm.; length of head 0.154-0.238 mm. (mean 0.196 mm.); 2 specimens.

Stage 6A: 12 dorsal segments; 12 pairs of legs; length of body 1.275-1.462 mm. (mean 1.377 mm.); breadth of head 0.493-0.527 mm. (mean 0.521 mm.); length of head 0.221-0.238 mm. (mean 0.231 mm.); 6 specimens.

Stage 6B: 12 dorsal segments; 13 pairs of legs; length of body 1.105-3.315 mm. (mean 1.384 mm.); breadth of head 0.476-0.663 mm. (mean 0.538 mm.); length of head 0.187-0.289 mm. (mean 0.241 mm.); 58 specimens measured.

While the material in some instars is insufficient to draw a final conclusion, a charting of the mean head width shows not only that the mean head width conforms with Dyar's Growth Law, but also indicates that there is a moult for each pair of legs, rather than for each two pairs, or single tergite (fig. 19).

Color yellowish to dark brown, with dark bands on head connecting eyes, and on vertigial margin, and a longitudinal median band which divides in front, making five light areas on head; each segment with dark band except at middle; all punctures light and round; vestiture of silvery white bristles, legs tinged with reddish brown.

In vestiture the pattern is as in the other species, but the spines are very different. The coronal and dorsal bristles look like elongate spiny cucumbers, with five to six rows of spines visible at one view (fig. 18); the lateral clusters of bristles are longer, and some are spined only on the sides, some have a

middle row of spines also. The tail bristles are very remarkable, of three types, coarse spiny bristles similar to the lateral ones; very fine toothed bristles with a 3, 4 or 5-backward pointed barbed apex; and fine bristles made up in the most complicated way, of deciduous whorls of distally pointing barbs (fig. 9).

The antennal joints are longer than in *fasciculatus,* but with the joints in about the same proportion, though stouter (fig. 2). The head is not sharply emarginate at occipital suture behind eyes.

The face is convex, with antennal scrobes diagonal, separated at bases by 10/35 the width of the head at the eyes, and extending from base to the eyes, thus outlining the frons.

Eyes prominent, almost acute, with at least five separate ommatidia. Two small spots near the eyes may be ocelli.

The anal segment is ridged medianly between the brushes.

The genitalia are borne on the preanal segment.

3. Polyxenus tuberculatus n. sp. (figs. 3, 5, 8, 14, 19)

Described from 7 specimens, mounted on 4 slides, taken among many others in a colony on *Tillandsia recurvata,* on live oak at Sabinal, Texas, April 1, 1910, by W. Dwight Pierce and F. C. Pratt. The remainder of the series is no doubt in the collections of the United States National Museum, but a paratype slide will be deposited in that Museum.

Stage 4: 9 pairs of legs; length of body to attachment of tail bristles 2.75 mm.; breadth of head at eyes 0.493 mm.; length of head from occipital emargination 0.238 mm. This specimen unduly expanded.

Stage 5: 11 pairs of legs; length of body 2.21, 2.227, 2.244, 2.38 mm.; breadth of head at eyes 0.459, 0.51, 0.561, 0.595 mm. (mean 0.53); length of head 0.255, 0.272, 0.289, 0.289 mm.

Adult: 13 pairs of legs; length of body 3.009, 3.060 mm.; breadth of head at eyes 0.68, 0.85 mm. (mean 0.76); length of head 0.323, 0.425 mm.

There are no essential differences in the instars, other than the number of abdominal leg-bearing segments, and the body measurements and proportions (fig. 19).

The head is hemispherical to the occipital emargination behind the eyes, and has a vertigial crown of dark and light golden bristles, which are very similar to those of *fasciculatus.* The antennae considerably exceed these spines, and are characterized by the elongate sixth joint, the proportions being as given in the table (fig. 3).

The cervix has an oval arrangement of bristles, which have only three visible rows of spines, and each successive segment has a sparse anterior and closely set posterior row of bristles, as well as a cluster of larger bristles on the lateral tubercles. The tail brush is very dense and consists of two kinds of bristles; one similar to the lateral bristles; the other finer and very complicated, similar to the corresponding bristles of *fasciculatus*, but more slender stemmed, with the barbs farther apart, and with a very similar apical armature (fig. 8).

The sternum differs from that of *fasciculatus* by having both presternum and sternellum broadly rounded (fig. 5).

List of Illustrations

Drawings and photomicrographs by the author.

Fig. 1—Antenna and portion of face of *Polyxenus fasciculatus victoriensis*.

Fig. 2—Antenna of *P. anacapensis*.

Fig. 3—Antenna of *P. tuberculatus*.

Fig. 4—Sternal view of one abdominal doublet of *P. fasciculatus victoriensis* (PS = presternite, S = sternellum, BS = basisternite, P = pleurum).

Fig. 5—Sternal view of one abdominal doublet of *P. tuberculatus*.

Fig. 6—Sternal view of one abdominal doublet of *P. anacapensis*.

Fig. 7—Barbed caudal bristle of *P. fasciculatus victoriensis*.

Fig. 8—Two types of caudal bristles of *P. tuberculatus*.

Fig. 9—Five types of caudal bristles of *P. anacapensis*.

Fig. 10—*P. fasciculatus victoriensis*, stage 5, holotype. Photomicrograph taken in two sections.

Fig. 11—Anterior end of *P. fasciculatus victoriensis*, same specimen as fig. 10.

Fig. 12—Dorsal bristles of *P. fasciatus victoriensis*, greatly enlarged. Actual length of a bristle 0.068 - 0.085 mm.

Fig. 13—A few caudal bristles of *P. fasciculatus victoriensis*, showing especially the delicate barbed bristle, greatly enlarged.

Fig. 14—*P. tuberculatus*, adult paratype (slide 1). Photomicrograph taken in three sections.

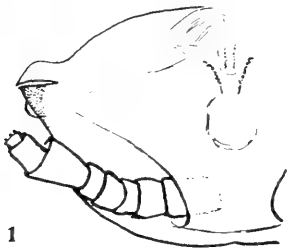
Fig. 15—*P. anacapensis*, paratype adult (slide 4).

Fig. 16—*P. anacapensis*, larva, stage 2 (slide 21), with 5 pairs of legs.

Fig. 17—*P. anacapensis*, same specimen as fig. 15 on dark field, lighted from above.

Fig. 18—Dorsal bristles of *P. anacapensis*, greatly enlarged. Actual length of a bristle about 0.085 mm.

Fig. 19—Correlation between instars and breadth of head. Dyar's law.



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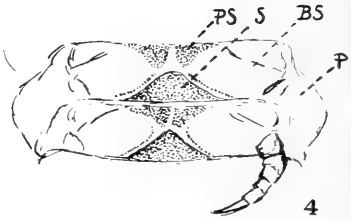

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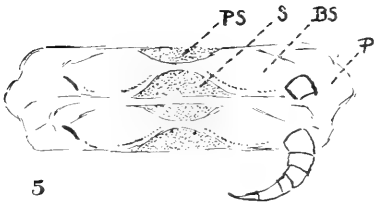

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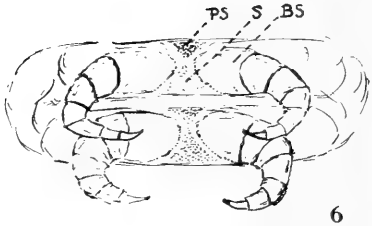

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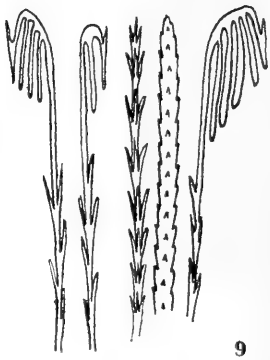

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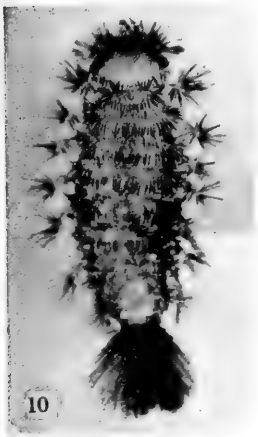
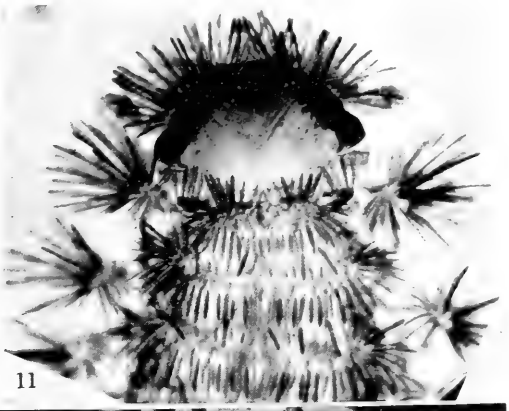
PLATE 27





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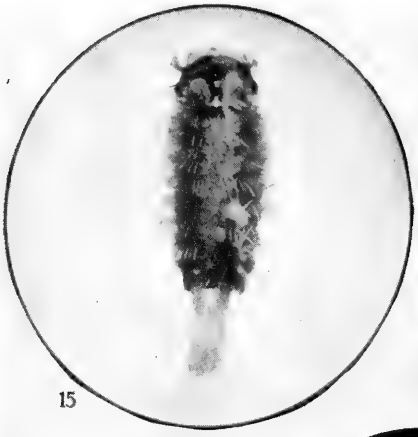

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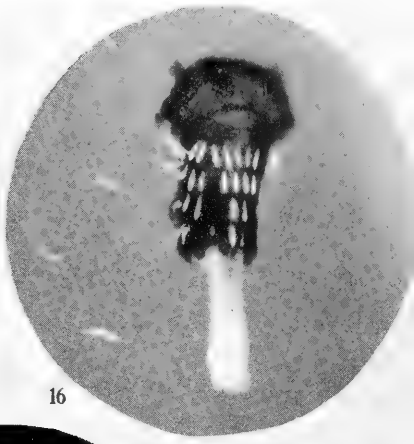

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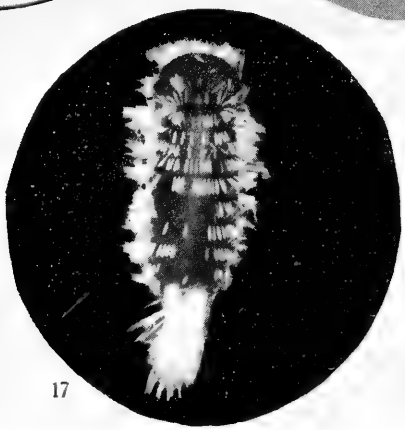

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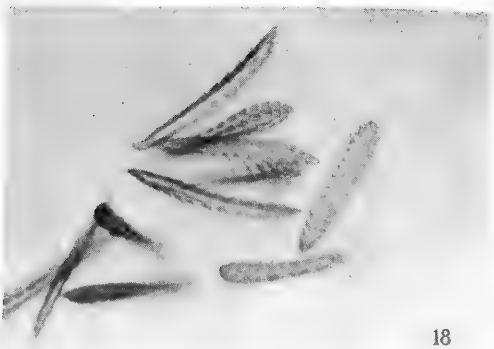

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PLATE 29

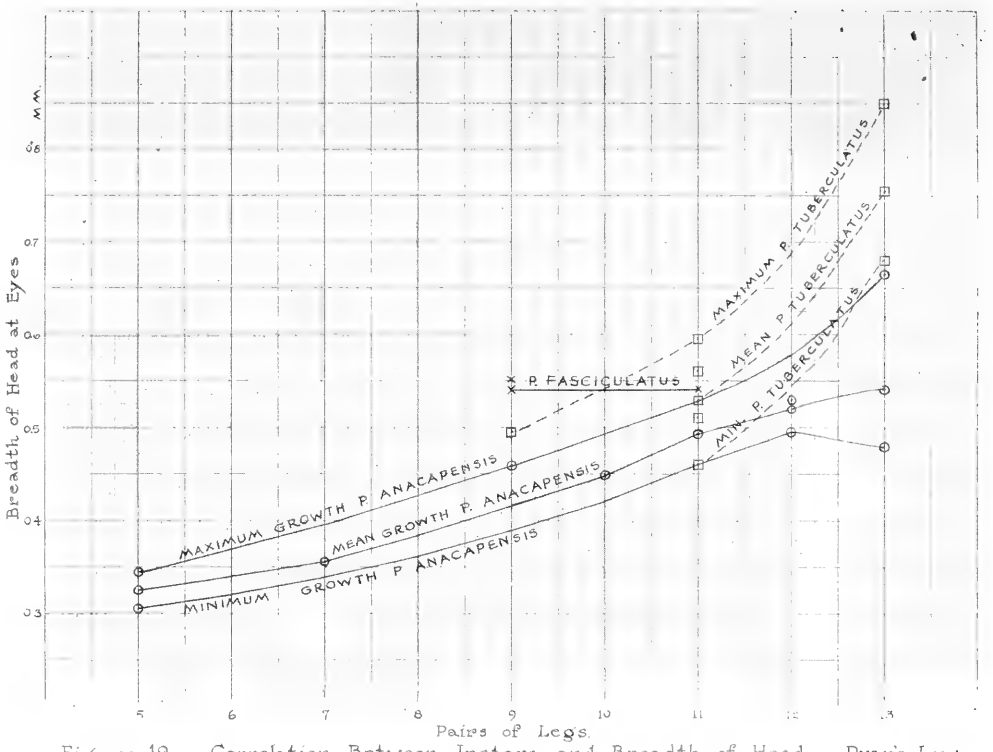

Figure 19 Correlation Between Instars and Breadth of Head. Dyar's Law

PLATE 30

10. BEES OBTAINED BY THE LOS ANGELES MUSEUM-BIOLOGICAL SURVEY—2

By T. D. A. Cockerell

When the report on the bees was published (Bull. So. Cal. Ac. Sci., 1939, Part 3) a few species were left out, as I wished them to pass under the critical eye of Mr. P. H. Timberlake. These are now listed, with Timberlake's determinations.

Colletidae:

Colletes gaudialis Cockerell. Santa Rosa. Described from La Jolla, California.

Andrenidae:

Andrena n. sp. Timberlake. San Clemente.

Halictidae:

Sphecodes n. sp. Timberlake. ♂. July 29. San Miguel.

Halictus trizonatus mellipes (Crawford). Distinguished by the ferruginous tarsi. ♂. Santa Rosa.

Halictus kincaidii Cockerell. ♀. Santa Cruz. Described from Washington state.

Halictus nigrescens avalonensis (Cockerell). ♀. San Clemente. ♂. Santa Rosa. Timberlake considers *H. avalonensis* a sub-species of *H. nigrescens.*

Halictus diversopunctatus Ellis. ♀. Santa Barbara Island. Described from the mainland of California.

Halictus perichlorus Cockerell. ♀. Santa Rosa, San Nicolas. Described from San Miguel Island.

11. A NEW RACE OF WHITE-FOOTED MOUSE FROM SANTA ROSA ISLAND, CALIFORNIA

By Jack C. von Bloeker, Jr.

A recent study of the large series of white-footed mice obtained on the Fourth Expedition of the Los Angeles Museum to the Santa Barbara group of the Channel Islands, California, in August, 1939, has revealed the existence of an unnamed race of *Peromyscus maniculatus* on Santa Rosa Island. E. W. Nelson

and E. A. Goldman (1931) referred specimens of *P. maniculatus* from this island to the race *streatori,* with the remark that they "appear to be inseparable from those of San Miguel Island." On the basis of material I have at hand, I cannot concur in this opinion. Although there are, admittedly, a number of characters shared in common by specimens from San Miguel and Santa Rosa Islands, there are a few which more closely relate the Santa Rosa Island race to that of Santa Cruz Island, and one outstandingly unique character among white-footed mice of the Channel Islands of California, extreme shortness of tail, which, by itself, distinctly characterizes the subspecies.

The new race may be named and described as follows:

PEROMYSCUS MANICULATUS SANCTAEROSAE, subsp. nov.
Santa Rosa Island Mouse

Peromyscus texanus medius Mearns, Proc. U. S. Nat. Mus., 18, 1896: 446, 447, part.

Peromyscus maniculatus clementis, Osgood, No. Am. Fauna, 28, 1909: 96-97, part.

Peromyscus maniculatus streatori Nelson and Goldman, Journ. Wash. Acad. Sci., 21, 1931: 531, part.

TYPE: Male adult, skin and skull, no. 6300, Los Angeles Museum, from Elderberry Canyon, Santa Rosa Island, Santa Barbara County, California, August 6, 1939, collected by Jack C. von Bloeker, Jr., orig. no. 10398.

DISTRIBUTION: Known only from Santa Rosa Island.

DIAGNOSIS: A medium-sized (see measurements), short-tailed, darkly colored race of the *Peromyscus maniculatus* group; skull lightly built, slender, zygomata noticeably tapering anteriorly, and with slender rostrum.

COMPARISONS: Similar to *Peromyscus maniculatus streatori,* but of a richer brown color, with shorter and more profusely haired tail, darker and smaller ears; skull averages slightly smaller throughout, with zygomatic arches tending to taper more anteriorly, and interparietal narrower and longer. Compared with *P. m. santacruzae,* color darker brown and lacking the reddish tinge of adults of *santacruzae;* size smaller throughout. Differs from *P. m. gambelii* in darker color, average shorter tail, and longer hind foot and ear; skull about equal throughout, except longer nasals. Comparisons with other Channel Island or mainland races appear superfluous at this time.

Color (using color terms from Ridgway's *Color Standards and Color Nomenclature,* 1912).—Type: Dorsal hairs with terminal portions black, narrow subterminal bands near pinkish buff; basal portions deep mouse gray; ventral hairs deep mouse gray basally, tipped with white; black tips of latero-dorsal hairs and cheek hairs shorter than those of back, giving effect of lighter brown coloration; a small patch of cinnamon buff hairs at ventral base of tail; ears near blackish brown externally, edged and internally sparsely hirsute with cinereous hairs; hairs of upper surface of feet white; tail bicolor, dorsal hairs clove brown, ventral hairs white.

Measurements (in millimeters): Averages and extremes of ten adults (6 males and 4 females), paratypes: Total length, 162 (156-170); tail, 69 (66-73); hind foot, 20.4 (20-21); ear, from notch, 15.6 (15-16). Skull: Greatest length, 25.5 (24.6-26.0); condylobasal length, 23.0 (22.1-23.3); zygomatic breadth, 13.1 (12.3-13.7); interorbital breadth, 4.0 (3.8-4.1); interparietal, 8.4 x 2.5 (8.1 x 2.1-8.8 x 3.1); length of nasals, 10.4 (10.0-10.7); maxillary toothrow, 3.8 (3.5-4.1).

Remarks: *P. m. sanctaerosae* apparently is the smallest of known races of *P. maniculatus* occurring on the Channel Islands of California. It does not appear to be a strongly differentiated form, but its very short, heavily haired tail is certainly distinctive. The shortness of tail is not closely approximated by any of the other nearby island subspecies, but is only slightly exceeded by that of the mainland race, *P. m. gambelii.* The hairiness of tail is similar to that of the closely adjacent, long-tailed, Santa Cruz Island race, *P. m. santacruzae.* Other features shared in common with the latter subspecies are: small ears and small interparietal. Features approximating the San Miguel Island race, *P. m. streatori,* are: Averages of head and body length, length of skull and of nasals, posterior zygomatic breadth, interorbital breadth, and narrowness of rostrum.

Specimens examined: One hundred and eight, from Santa Rosa Island, Santa Barbara County, California, as follows: Vail Ranch, Becher's Bay, 81; Elderberry Canyon, 18; Cherry Canyon, 9.

12. NEW PLANTS FROM THE CHANNEL ISLANDS

By M. B. Dunkle

On the first expedition of the Los Angeles Museum Channel Islands Biological Survey to the south end of San Clemente Island, three forms of *Lotus argophyllus* (Gray) Greene were collected. After careful comparison of these with forms taken on the other Channel Islands each seems to differ so distinctly that they deserve varietal rank.

Lotus argophyllus (Gray) Greene variety *adsurgens* var. nov. Collected at Pyramid Cove, San Clemente Island. Dunkle No. 7200.

Plant woody, erect; branches ascending, short virgate, with short internodes, 5 to 10 mm. long; leaves more or less imbricated; leaflets 5, broadly elliptic to ovate-elliptic, pointed, silvery canescent; umbels short peduncled, 1 - 2 mm. long approximate at the ends of branches; calyx teeth acuminate, 2 mm. long; corolla 10 - 12 mm. long, yellow and orange; banner broadly obovate, exceeding wings; pod silky, nearly straight, long acuminate with curved beak.

This lotus is most nearly related to *Lotus argophyllus* var. *niveus* (Greene) Ottley, but the internodes are shorter, the branches more virgate, and the calyx teeth are shorter, never exceeding one-third the length of the tube. It is apparently confined to the dry, rocky slopes back of Pyramid cove.

Lotus argophyllus (Gray) Greene variety *Hancockii* var. nov. Collected at China Point, San Clemente Island, Dunkle No. 7252.

Plant herbaceous procumbent; branches long, trailing; leaves silky canescent; leaflets 5 to 7, narrowly elliptic, pointed, 8 to 16 mm. long; umbels scattered along branches; peduncles 2 to 3 mm. long; calyx teeth linear, 2 mm. long; corolla yellow 6 to 8 mm. long; banner broadly oblong, slightly exceeding wings; pods silky, bent, with recurved or spiralled beak.

In habitat and tomentum it is very similar to *Lotus argophyllus* var. ornithopus (Greene) Ottley, but with much longer and narrower leaves. The peduncle length is much shorter than that of the Santa Catalina form of the above variety but approximate those of the Santa Barbara and San Nicolas forms. The calyx teeth, moreover, are shorter than those of any of the forms of *L. argophyllus ornithopus*. The spiralled beak is also a distinctive characteristic. It is extremely common in the general neighborhood of the China Point.

This variety is named for G. Allen Hancock because of his interest in scientific research, and because he has made possible the author's botanical and ecological research on the Channel Islands.

Lotus argophyllus (Gray) Greene variety *argenteus* var. nov. Collected on slopes back of China Point, San Clemente Island, Dunkle No. 7273.

Plant perennial, herbaceous, decumbent; branches long, trailing; with internodes 1 to 3 cm. long; leaves silvery canescent; leaflets 5, 8 to 10 mm. long, broadly elliptic to obovate, abruptly pointed to obtuse; umbels approximate at the ends of the branches, with short peduncles 1 to 6 mm. long; corolla yellow and orange; banner orbicular, subequal to claw, subequal to wings; calyx lobes linear, 1.5 to 2 mm. long; pods silky, nearly straight.

In habit it is very similar to *Lotus argophyllus ornithopus* but in tomentum and flowering habit, it more nearly resembles *Lotus argophyllus niveus*. Its orbicular banner and long claw are its most distinguishing characteristics.

VARIETIES AND DISTRIBUTION OF *LOTUS ARGOPHYLLUS*

Calyx teeth as long as the tube.

Stems woody, branches stocky with short nodes, silvery canescent.

L. *argophyllus niveus* (Greene) Ottley.
Santa Cruz and San Clemente Islands.

Stems herbaceous.

Umbels approximate at the ends of branches, blade of banner shorter than claw, silvery canescent.

L. *Fremonti argophyllus* (Gray) Ottley.
Sierra Nevada Mountains.

Umbels scattered along branches, blade of banner exceeding claw, silky canescent.

L. *argophyllus ornithopus* (Greene) Ottley.
Santa Catalina, Santa Barbara, San Nicolas, San Clemente and Guadalupe Islands.

Calyx teeth shorter than tube.

Stems woody, branches short virgate, leaves more or less imbricated on branches.

L. *argophyllus adsurgens* var. nov.
San Clemente Island.

Stems herbaceous, decumbent.

Umbels sessile or nearly so.

L. *argophyllus* (Gray) Greene.
Pine belt of Southern California Mountains.

Umbels short peduncled.

Umbels approximate at ends of branches, silvery canescent, blade of banner subequalling claw.

L. *argophyllus argenteus* var. nov.
San Clemente Island.

Umbels scattered along branches, blade of banner exceeding claw.

Leaves satiny canescent, leaflets 5, broadly elliptical.

L. *argophyllus decorus* (Johnston) Ottley.
San Gabriel, San Bernardino and San Jacinto Mountains.

Leaves silky canescent, leaflets 5 to 7, narrowly elliptical.

L. *argophyllus Hancockii* var. nov.
San Clemente Island.

On the recent trip of the Los Angeles Museum Channel Islands Biological Survey party to Santa Barbara Island, March 15 to 23, 1940, a new variety of *Platystemon californicus* Benth. was discovered. The plants were apparently restricted to an area of shallow, rather barren soil near the edge of the precipitous northern cliffs. The type number is Dunkle 7400.

PLATYSTEMON CALIFORNICUS Benth., var. *ciliatus,* var. nov.

Plants 5 to 10 cm. high, simple or branched from the base; stems glabrous; leaves linear, 1 to 5 mm. wide, 2 to 3 cm. long, opposite, sessile, glabrate to sparingly short pilose near the tips, ciliate; pedicels scapose, 2 to 5 cm. long, sparingly short pilose; sepals sparingly short pilose; petals light cream, 2 to 8 mm. long; fruit nodding or erect; carpels slightly torose to cylindrical.

This plant is most closely related to *Platystemon californicus* Benth. var. *ornithopus* (Greene) Munz. It is, however, smaller, with fewer and shorter branches, with the pedicels, sepals and leaf tips sparingly short pilose, and the leaves ciliate. There might be a question whether or not this variety might be merely a depauperate form of *Platystemon californicus* Benth. especially in view of its habitat. However, as no typical plants of the species were found on the island, and the vegetative characters are so distinctly different, it must be considered to be worthy of at least varietal rank. It must be considered as an initial endemic with its deviation from the typical species accentuated and preserved by its environment.

VARIETIES OF *PLATYSTEMON CALIFORNICUS* AND THEIR DISTRIBUTION

Plant less than 10 cm. high, fruit sub-cylindrical.

Plant glabrous.

P. *californicus ornithopus* (Greene) Munz.
San Miguel, San Nicholas and Santa Rosa Islands.

Plant sparingly short pilose.

P. *californicus ciliatus* var. nov.
Santa Barbara Island.

Plant over 10 cm. high.

Fruit nodding.

P. *californicus nutans* Brandg.

San Diego County, Santa Rosa and Santa Cruz Islands.

Fruit erect.

Fruit hairy when young.

P. *californicus horridulus* Jepson.
Sierra Nevada Mountains, foothills.

Fruit glabrous.

Plant soft pilose, flowers cream.

P. *californicus* Benth.
Cismontane, California.

Plants with abundant long hair, flowers yellow.

P. *californicus crinitus* Greene.
Tehachapi Mountains to Cuyamaca Mountains and the edge of the adjoining deserts.

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FIRST RECORD FOR BITTER DOCK IN SOUTHERN CALIFORNIA

By Joseph Ewan
University of Colorado, Boulder, Colo.

Though the Bitter Dock (*Rumex obtusifolius* L.) has been a familiar weed of moist creek banks and similar hydric situations in central California for many years past, it seems that this plant has escaped notice in the southern California area. The writer collected it on the 4th of July, 1932, at Millards Canyon, San Gabriel Mts., Los Angeles County, where it was growing in wet sand along the stream. This collection (*Ewan 7573*) has been compared with representative material from other localities and has been found to agree favorably with such sheets as one from Lund, Sweden, taken by G. E. Hylten-Cavallius in August, 1883 (Univ. Colo. Herb.), and with material from Mountain Lake, San Francisco, where it occurs in Salix thickets about the lake (*Ewan 10401*). I have seen collections from as far north on the Pacific Coast as Revelstoke, B. C., where it was collected in 1905 (*Chas. H. Shaw 807*). Trelease (3rd Ann. Rep. Mo. Bot. Gard. 92) does not record this species for California up to 1892, except under the dubious varietal name of Wallroth, based on the purpling of the stem and leaves in the manner of Beta. Under this var. discolor Wallr. Trelease records a collection of Kellogg's for the year 1866. There is under the species discussion, however, mention of a Kellogg and Harford coll. (869) for 1869, credited to "Oregon". This may be correct, though I have no record of his having been in Oregon either alone or with Harford, or this may have been a slip for "California". Though Katherine Brandegee knew Mountain Lake and its plants, she does not mention Bitter Dock in her conspectus of the San Francisco flora (Zoe 2:370. 1892). Jepson writes about two decades later: "naturalized European weed in low lands about San Francisco Bay" (Fl. Calif. 1:386. 1913). In any case, Bitter Dock seems to have held its own about the San Francisco Bay region but to have been unable to spread extensively. It will be of interest to watch the southern California region for this species; from its distribution elsewhere over the world, considering both its native habitats in Europe, and its adopted homes in Asia and North America, it seems to me unlikely that *Rumex obtusifolius* will ever become frequent in southern California. There must be a climatic barrier against its more widespread successful establishment.

When considering "how" this Rumex reached this rather singular station in the mountains behind Pasadena, one is confronted with the well-known vagueness of our data concerning plant migrations in these times. That the plant was growing along a mountain stream frequented by migratory birds—for the front range of the San Gabriel Mountains is a flyway for many species of north-south migrants—suggests the possibility of the seeds having been brought from the north by a limicoline species which paused for a drink along the Millard Canyon streamside. It would be highly significant if an interested bird-banding biologist would consider the problem of migratory birds as effective carriers for plant germules and gather data from the birds they handle, grow the known "takes" from the bodies of birds, and study the resulting germinations. Our knowledge of both birds—their migrations and habits—and of plants and their ranges is sufficiently advanced to give a notable yield to such an undertaking.

This Rumex is to be easily recognized among the southern California species for its large, almost exactly oblong leaves borne upon elongated petioles, for its essentially triangular-winged fruits that bear rather large prominent spines on their margins. The species is illustrated in Britton and Brown's *Illustrated Flora* (1:552) and excellently in Trelease's paper of nearly a half-century ago (plate 30). The leaves of the plant collected by me measure in the blade 14½ inches long by 8 inches broad. The inflorescence is markedly leafy but not unlike many individuals of *Rumex crispus,* with which it apparently hybridizes. Trelease discusses this hybridism. Rechinger considers most of these putative hybrids to represent established species worthy of binomials. James Arata Karakawa, who studied the genus Rumex for California critically and who acquired an excellent knowledge of its field and laboratory characters insofar as his opportunities permitted, examined the Millard Canyon collection and annotated it in 1937 as possibly a hybrid between *Rumex obtusifolius* with *R. crispus.* It manifestly carries the obtusifolius characters prominently if this collection is to be considered a hybrid. The fruits do have relatively few spines upon the margins, it is true, and yet one is forced to ask where then is *Rumex obtusifolius* in southern California?

Addendum: W. W. Robbins specifically mentions the lack of southern California collections or records for this Rumex in his recent bulletin, issued July, 1940, entitled "Alien plants growing without cultivation in California".

CONTRIBUTIONS FROM THE LOS ANGELES MUSEUM - CHANNEL ISLANDS BIOLOGICAL SURVEY

13. A NEW ISCHNOCHITON FROM CATALINA ISLAND, CALIFORNIA

By G. Willett
Curator of Ornithology, Los Angeles County Museum

For several years past the collections of the Los Angeles Museum and the writer have contained specimens of a chiton from Catalina Island that appears to differ from any previously known. The description of this species has been delayed in the hope that specimens might be secured from other localities, but, as such have not come to light, there would seem to be no good reason for further delay. Therefore, this chiton may be known as:

Ischnochiton (Lepidozona) catalinae, sp. nov.
(Plate 31, fig. 2)

Description: Shell small, oval, elevated, with angular dorsal ridge, and nearly straight side slopes. Color reddish brown (about Pecan Brown, of Ridgway), mantle spotted with white,

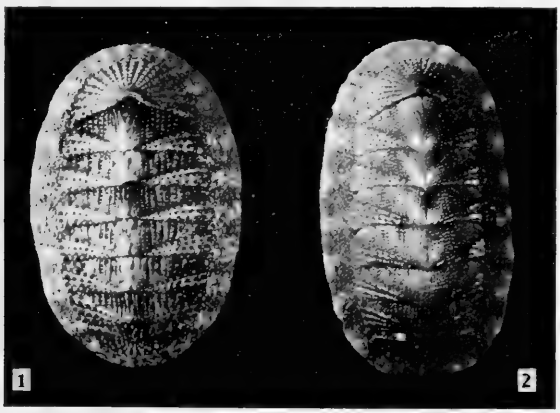


PLATE 31
Fig. 1. *Ischnochiton mertensi* Midd.
Fig. 2. *Ischnochiton catalinae* Willett.
Figures enlarged x 2.
Photo courtesy Los Angeles County Museum.

usually a spot on each side opposite each valve, and occasional spots at the ends. Head valve with about 24 low, rounded ribs, frequently bifurcating near the margin; ribs of tail valve similar, but fewer in number (about 18) and less clearly defined. Lateral areas prominent, with from 3 to 5 low, slightly convex ribs which converge as they near the dorsal ridge. Ribs of end valves and lateral areas irregularly ornamented with small, erect tubercles. End valves, lateral areas and portions of the dorsal ridge covered with a microscopic granulation. Central areas with about 18 sharply defined longitudinal ribs on each side, these ribs connected by rather obscure cross-ridges, forming a lattice-like sculpture which passes entirely over the dorsal ridge. Ribs on dorsal portion of second valve strongly diverging anteriorly, with punctate interspaces. End valves with 10 slits, median valves with one slit on each side. Mantle covered with rather small, oval, convex, smooth, imbricating scales.

Type, No. 1063 Los Angeles Museum. Type locality, off White's Landing, Catalina Island, California, in 30 fathoms. Collected by G. Willett. Measurements of type (including girdle), in millimeters: Length, 16.2; diam., 9.2; alt., 3.2. Paratypes in Academy of Natural Sciences of Philadelphia, and collections of Allyn G. Smith and the writer. Specimens examined 12, all from the type locality.

In general characters *catalinae* most resembles *mertensi*, although none of the specimens examined approaches that species in size. The girdle scales are much like those of *mertensi* from northern California, convex and smooth, except under strong magnification, which shows very faint indication of striations. *Catalinae* differs further from *mertensi* in much smaller tubercles, more numerous (consequently, more closely spaced) horizontal ribs on the central areas, and absence of a smooth area between the diverging ribs on the dorsal ridge of the second valve.

The writer is grateful to Allyn G. Smith, of Berkeley, California, for the loan of his fine series of *Ischnochiton mertensi* for use in this study.

14. A NEW SUBSPECIES OF ARACHNIS FROM CALIFORNIA

(*LEPIDOPTERA: ARCTIIDAE*)

By J. F. Gates Clarke
Bureau of Entomology and Plant Quarantine
U. S. Department of Agriculture

The striking subspecies of *Arachnis picta* Parckard described below was received from Dr. John A. Comstock, Director of Science, and Mr. C. Henne of the Los Angeles Museum.

Prior to receiving these specimens I had completed a paper, dealing with the species of this genus, which is to be published in the Proceedings of the U. S. National Museum. In that paper I have figured the genitalia of all the species, so figures of the genitalia of this new sub-species are not published at this time.

Dr. Comstock has asked me to write this description for publication as part of a series of articles dealing with the fauna of the Channel Islands, rather than insert it in my paper on the genus. I have, however, placed this subspecies in the key, with a note in the text, for the sake of completeness.

Arachnis picta insularis, new subspecies

Similar to typical *picta* but immediately distinguishable from it by the greater amount of white on the fore wing. The light ground color and the dark markings show stronger contrast than in typical *picta*.

Antenna with basal segment white; shaft blackish fuscous overlaid with white above. Labial palpus bright carmine above and outwardly, creamy white beneath and inwardly. Face sooty black; vertex white. Collar broadly white anteriorly, edged narrowly with orange yellow posteriorly and laterally; on each side a large black-edged, dark-gray spot, the scales of which are faintly tipped with cinereous. Tegula dark gray, with the scales faintly tipped with cinereous; a black line, paralleled by white, narrowly borders the dark-gray central portion; laterally the white is broad but dorsally it is narrow and extends along the basal half of the tegula only. Thorax concolorous with tegulae, white edged laterally, with a narrow, black-edged, yellowish median line. Fore wing sordid white (sometimes with a faint yellowish cast); veins sordid white, displayed in sharp contrast where they are crossed by the dark markings of the fore wing; along costa five conspicuous, irregular, black-edged gray spots; from these, extending across the wing, but not confluent with them, five irregular, transverse rows of gray spots and dashes, the latter not (or, rarely, faintly) edged with black. Termen broadly and irregularly

marked with gray, the color being broken by the white veins; on tornus, between veins 1b and 2, a large oval, gray spot, frequently confluent with the outer band of gray spots; inner two-thirds of underside of fore wing strongly suffused with orange yellow; transverse bands much darker than on upper side, with the component parts frequently confluent. Hind wing bright purplish red; in the female crossed by four unbroken, irregular, dark-gray (nearly black in a few specimens) bands; in the male broken into scattered spots and dashes; cilia almost always white at the end of vein 2 and sometimes along entire margin; central area of wing thinly scaled but not semihyaline; underside strongly overlaid with buff or white, especially along costa, and with some orange-yellow scaling at base and along radius. Legs white to buff; femora strongly marked with carmine; tibiae and tarsi with broad, black-edged, gray bands. Abdomen purplish red above, white, with a few gray spots beneath; in the male with black median dorsal and lateral stripes; anal tuft black mixed with orange yellow; in the female the segments broadly marked with black-edged gray bands.

Alar expanse 34-54 mm.

Type—U. S. National Museum No. 55125.

Type Locality—Anacapa Island, Calif.

Food Plant—In the laboratory, *Plantago*. On the Island it is presumably one of the legumes.

Remarks—Described from the type male and 11 male and 14 female paratypes all from the same locality. Paratypes in the U. S. National Museum and the Los Angeles Museum.

The entire type series was reared from larvae collected by Mr. C. Henne. The moths emerged from Septembr 19 to December 5, 1940, the maximum number being produced in November.

This subspecies falls between typical *picta* and *picta verna* in my key. The hind wing of the male of *insularis* is similar to that of *picta verna* but the hind wing of the female places it with typical *picta*. *Arachnis picta insularis* can be distinguished from both *picta* and *picta verna* by the almost total absence of black margins of the gray markings of the fore wing.

In a recent letter Mr. Henne sent the following information concerning this subspecies, which I take the liberty to quote: ". . . You might also be interested in knowing that we were fortunate in securing the eggs of *Arachnis picta maia* Ottolengui from a confined female taken at the Ivanpah Mts., San Bdo. Co., and the young larvae are progressing favorably. We also succeeded in mating a pair of the Anacapa *picta* (*insularis*), with resultant eggs. It is interesting to note that the eggs of the Anacapa form measure only .909 mm. in diameter and are slate gray when freshly laid, whereas the eggs of *maia* are considerably larger, . . . close to 2.00 in diameter and are lemon yellow when first laid, turning dark just before hatching . . ."

15. A COMPARISON OF THE LARVA OF ARACHNIS PICTA INSULARIS AND ARACHNIS PICTA MAIA

By John A. Comstock and Christopher Henne

We have had the opportunity of studing a series of mature larvae of both the above races, and find that they are markedly different.

A. picta insularis Clarke

Ground color of body, dorsally and laterally dull black; ventrally dark reddish or purplish brown. Tubercles, conspicuous, rugose, and yellow-brown in color, in strong contrast to body. The hairs are uniformly black, except for an occasional reddish hair on the latero-inferior tubercles. Legs, dark brown; prolegs, maroon, with the terminal segment a lighter shade. Crochets, brown. Spiracles, yellow, in strong contrast to body color, and with black rims.

Head, black except for the back part of the cheeks, which shades to maroon. Antennae, maroon. Ocelli, black.

A. picta maia Ottol.

Ground color of body, uniform dark brown, slightly lighter on venter. Tubercles concolorous with ground color, prominent, rugose, but appearing less noticeable on account of the uniformity in coloration with adjacent areas. The hairs are all a uniform bright red-brown, except for a few short inconspicuous hairs around the base of the prolegs. Legs, dark brown; prolegs, dark brown merging to a light translucent flesh color on the terminal pads. Crochets, black. Spiracles, orange-yellow, black rimmed.

Ottolengui, in his original description of *A. maia*[1] mentions rearing the larva, but gives no notes on the early stages. Richard Stretch[2] gives a description of the larva of typical *picta* which sets forth the general anatomical features of the genus, and also shows that, in coloration, the larva of the typical form is unlike those described above, being somewhat intermediate in position, having a mixture of the bright reddish and black hairs, with a smoky brown body color, and lighter tubercles.

The habits of our larvae were like those described by Stretch, except for the fact that the *maia* larvae pupated immediately after making their cocoons. The *insularis* larvae have not yet spun.

All of our larvae refused clover, but fed readily on *Plantago*.

The following tabulation will serve to show at a glance the differentiating features of the larva of *maia* and *insularis*.

[1] Entom. News 7 : 125 ; 1896.

[2] Zygaen. Bomb. N. Am. 84; 1873.

	MAIA	INSULARIS
Body color	Dark brown	Black
Ventral surface	Light brown	Dark red-brown
Tubercles	Dark brown	Yellow-brown
Hairs	Red-brown	Black
Legs	Dark brown	Dark brown
Prolegs	Dark brown	Maroon
Pads	Translucent flesh color	Light reddish purple
Crochets	Black	Brown
Spiracles	Orange-yellow black rimmed	Yellow
Head	Black	Black, cheeks purple
Antennae	Black	Maroon

16. NEW OR LITTLE KNOWN CALIFORNIA BEES

By P. H. Timberlake

The following bees are known to occur in the Channel Islands off the coast of southern California, but some of them are described from material collected on the mainland.

Halictus californiae Sandhouse

This species was characterized by Miss Sandhouse in her table of *Chloralictus* (Proc. U. S. Nat. Mus., 65 Art. 19, p. 6, 1924) as a variety of *H. perpunctatus* Ellis. It was too briefly described to be recognized with any certainty, but Doctor Cockerell has sent me one of the two females from Pasadena, California, on which the name was based. In my opinion *californiae* should be considered a distinct species.

The female differs from *perpunctatus* in its more slender form, with the head distinctly but only a little longer than wide. Abdomen in the majority of cabinet specimens unusually extended, exposing the full length of most of the segments. Propodeum much narrowed behind, the truncation being smaller than usual, ill-defined, and about as wide as long. (In *perpunctatus* the truncation is larger, better defined and distinctly broader than long.) Head and thorax darker and more olive-green, a little

less shining and with distinctly finer puncturation throughout. Mesoscutum finely and closely punctured. Mesopleura dullish and obscurely punctured. Face without white tomentum. Abdomen dark brown to fuscous, and entirely lacking the green tinge of *perpunctatus*. Abdomen also a little dullish, with extremely minute punctures on tergites 1 and 2. (In *perpunctatus* tergites 1 and 2 shining, with minute, but more obvious punctures.) From *H. nevadensis* Cwfd. and several other California species as yet undescribed, *californiae* may be distinguished by the shape of the head and by the fine, close and almost uniformly spaced punctures of mesoscutum. Length, about 5.5-6 mm.; anterior wing, 4.1-4.3 mm. (In *perpunctatus* length about 6 mm.; anterior wing 5 mm.)

Male—Head and thorax dark green or blue-green, the abdomen dark brown to fuscous. Tarsi dull yellowish. Flagellum brownish yellow beneath. Tegulae pale testaceous. Wings hyaline, stigma and nervures honey-yellow. Head broadly oval, distinctly but not greatly longer than wide. Clypeus large and prominent, nearly as high as wide, convex, sparsely punctured. Mandibles unusually long. Face narrowed about one-fourth below and sparsely covered with white tomentum. Antennae reaching about apex of scutellum. Mesoscutum shining, finely, rather closely and almost uniformly punctured. Mesopleura shining, distinctly and finely punctured. Rugae of enclosure varying from coarse and nearly straight to a close, irregular and crinkly condition. Apical rim of enclosure usually smooth and distinct in the middle. Sides of propodeum minutely wrinkled. Tergites minutely and closely punctured and hardly impressed at base. Length, 4.5-5 mm.; interior wing 4-4.3 mm.

Specimens of this species are at hand from San Diego, Yorba Linda, Whittier, Puente Hills, Pasadena, Riverside, Santa Catalina Island, three miles west of Three Rivers, and Sacramento, California. The flower records are various, including *Encelia, Gutierrezia, Coreopsis, Layia, Chaenactis, Stephanomeria, Isosoma, Ericameria, Phacelia, Eschscholtzia, Convolvulus, Amsinckia, Eriogonum,* and *Mimulus,* and for the males also *Bidens, Cryptantha* and *Eremocarpus.* At Riverside, where it is one of the less common species, the females have been taken from Feb. 8 to Dec. 24, and the males from May 28 to Nov. 10.

This is the species recorded by Cockerell, without name (Proc. Cal. Acad. Sci. (4):23, p. 434, 1939), from Fisherman Cove and Rancho Escondido, Santa Catalina Island.

Sphecodes nigricans n. sp.

A small black species, with abdomen entirely dark, belonging to the group *Sphecodium* of Robertson, having the male flagellum not at all moniliform and without facets, and antennal joint 4 only a little longer than 3. From the eastern species of this

group (*S. cressonii* Robt., *S. pimpinellae* Robt., *S. knetschi* Ckll., and *S. prosphorus* L. & C., the males of which are briefly described) it presumably can be distinguished by the blackish flagellum, dark venation, and apical margin of tergites only slightly reddened. *S. cressonii* has the flagellum testaceous, more dusky above; wings whitish with pale nervures; abdomen usually yellowish at base. *S. pimpinellae* has a black abdomen, but differs from *nigricans* in the dull, closely punctured scutellum. The male of *S. prosphorus* is imperfectly described, but the apical margin of tergites is said to be obscurely testaceous. *S. knetschi* is a larger species, with probably coarser punctures on mesoscutum.

Western species of this group, although rather numerous on the Pacific Coast, have received little attention. Western males are in some cases so similar that it will be essential to have the genitalia described in detail or figured. The females will be equally difficult to distinguish and there will be additional difficulties in associating the sexes correctly.

Of *nigricans* two subspecies are known as follows: *S. nigricans nigricans* from the mainland and *S. nigricans miguelensis* from San Miguel Island.

S. NIGRICANS NIGRICANS n. subsp.

MALE—Entirely black except as follows: Flagellum very dark brown beneath. Mandibles reddish, black only at extreme base. Tegulae pale testaceous on outer margin, more brownish within. Tarsi dark, but small joints of front pair somewhat reddened. Spurs pale testaceous. Depressed margin of tergites with a reddish tinge. Wings smoky hyaline. Stigma and nervures a very dark brown, or nearly fuscous. Head nearly rotund, barely wider than long. Eyes strongly convergent below. Basal ridge of labrum low, arched, finely roughened and dullish, the disk beyond polished, impunctate. Antennae reaching scutellum, the middle joints of flagellum not much longer than thick. Joint 4 a little shorter than 5, about one and one-third times longer than 3, and distinctly shorter than 2 plus 3. Joints of flagellum not nodose, without facets, the surface uniformly dull, microscopically punctate and set with extremely fine short pile. Clypeus moderately convex, the punctures close. Frons with moderately small dense punctures, but not dull. Vertex with somewhat sparser punctures. Mesoscutum and scutellum, moderately closely punctured, the punctures distinctly coarser than those of frons, and varying mostly from about one to three puncture-widths apart, with a few interspaces much greater. Meso- and metapleura dull, finely rugose, with a few minute punctures in a smooth strip on mesopleura along the posterior suture. Posterior and dorsal faces of propodeum, including enclosure, coarsely reticulate, the reticulations encroaching on sides of

propodeum. Enclosure defined on each side by a carina and broadly at apex by a smooth rim, that is continuous with a polished triangular area on upper part of truncation. Tergites finely and rather closely punctured, the punctures becoming finer and fainter toward apex of abdomen. Depressed apical margin of tergites rather broad, impunctate. Pubescence dull white, dense as usual on lower part of face, clypeus and antennal scapes, and that on frons, vertex and mesonotum slightly ochreous. Aedeagus testaceous brown. Stipites very minutely and densely striate and dull except at base. Apical appendage of stipes small, membranous, nearly nude except an extremely fine, short fringe on outer margin, and broadly oval in shape with the outer half curled upward. Dorsal surface of each sagitta depressed, clavate-fusiform before the geniculation. Portion beyond the geniculation compressed into a thin lamina, broad at base and evenly narrowing to acute apex. Length, 4.9 mm.; anterior wing, 3.5 mm.

Paratype much smaller. Mandibles, except base, and apex of labrum rufo-testaceous. All the tarsi reddened. Rugae of enclosure nearly straight, not forming reticulations, those at sides radiating. Length, 3.5 mm.; anterior wing, 2.5 mm.

Two males collected at Riverside, California, the holotype on *Eriogonum gracile*, Dec. 11, 1929, the paratype on *Euphorbia albomarginata* Aug. 12, 1930. Type in collection of Citrus Experiment Station, Riverside.

S. NIGRICANS MIGUELENSIS n. subsp.

MALE—Similar to typical *nigricans* from the mainland, but larger and less slender, and differing in color as follows: Mandibles black on basal half, rufo-testaceous and red apically. Flagellum black. Tegulae darker brown, subhyaline on outer margin anteriorly. Stigma and nervures almost black. Depressed apical margin of tergites almost perfectly concolorous. Genitalia the same except that the apical appendage of stipites is but little convoluted and thus appears to be much larger, but this portion is membranous and probably would be subject to less curling in larger specimens. Length, 5.5 mm.; anterior wing, 4 mm.

One male (holotype) from San Miguel Island, California, July 27, 1939, collected by the Channel Islands Biological Survey. Type in the Los Angeles Museum.

ANDRENA CLEMENTINA n. sp.

Closely allied to *A. chlorura* Ckll. and perhaps will ultimately prove to be an insular race of that species. It differs strikingly in the large amount of black hair on the antennal scapes, sides of face, frons, vertex, temples and upper part of mesopleura.

Female—Head, thorax and abdomen dark olive-green. Greater portion of clypeus, mandibles, antennae and legs black or blackish. Mandibles red at apex. Claws of legs red, the spurs testaceous. Tegulae reddened posteriorly, the anterior half nearly black. Apical margin of tergites 1 to 4 conspicuously whitish hyaline. Wings dusky, with a reddish tinge. Stigma and nervures dark reddish-brown, the subcosta blackish. Pubescence fulvo-ochraceous, with much black hair on head and upper part of mesopleura, just below bases of wings, as mentioned above. Tegulae also with a few black hairs across the middle, but none anteriorly. Hair of mesonotum distinctly shorter than that of pleura. Hair of abdomen mainly short and erect and not conspicuous except when viewed from the side. Hair of first tergite and some on lateral margins of the second much longer. Tergites 2 to 4 each with a thin apical fascia of whitish hair. Fimbria dark seal-brown, with paler hair at the sides and base of tergite 5. Hair of legs mainly light, but that on front and middle tibiae and tarsi rather dark brownish. Some blackish hair at base of hind tibiae above, near the knee-plate. Flocculus of hind trochanters short and rather thin. Subgenal coronet* dark. Facial foveae black in frontal view and dark seal-brown when viewed from behind. Head a little broader than long. Facial foveae less than half as wide as space between eye margin and antennal socket, somewhat broadened above and not extending below level of antennae. Process of labrum more than twice as broad as long, rounded anteriorly but subtruncate in middle. Clypeus shining on the anterior middle, but the lateral and dorsal margins broadly dullish from minute tessellation. Punctures of clypeus fine, rather sparse and about as in *chlorura,* except that they are less distinct above and leave a narrow impunctate median area anteriorly. Sculpture of head otherwise and of the thorax dull, tessellate or granular-tessellate, but the frons closely and striately roughened as usual. Punctures of mesoscutum fine and indistinct. Enclosure of propodeum narrow, dull, finely rugulose at base. Abdomen a little more dullish than in *chlorura* and dullest at base of tergites 2 and 3. Minute setigerous punctures of abdomen slightly more distinct and more numerous than in *chlorura.* Length about 8 mm.; anterior wing, 7 mm.

One female (holotype), San Clemente Island, California, April 2, 1939 (Channel Islands Survey) in Los Angeles Museum.

Andrena baeriae n. sp.

Belongs to a small group of Californian species, the members of which agree more or less exactly in the following characters taken from *baeriae*: Dorsal face of propodeum carinately ridged

* This is a new term for a specialized structure that I have noticed only in the females of *Andrena* (s. lat.). It is a semicircular ridge set with short, stiff bristles in the subgenal region of the head and guarding the inferior part of the cavity in which the mandible is set. It is sometimes brightly colored, but not conspicuous, except when the mandibles are open.

on lateral margins, the enclosure large and broad. Head much broader than long, with broad rounded cheeks. Facial foveae of medium width, reaching slightly below level of antennae. Hind tibiae rather wide, broadest half-way between middle and apex. Tibial scopa moderately dense and plumose, the hairs on dorsal margin as long as greatest width of tibia, those on outer surface less distinctly plumose and those on lower margin strongly curved upward. Middle and hind basitarsi subequal and moderately broad. Face of male immaculate (but in several undescribed species the clypeus has a large pale yellow or whitish mark). The only previously described species is *A. escondida* Ckll., of which only the male is known. The male of *baeriae* differs from *escondida* in its much smaller size, broader head and facial quadrangle; shorter, depressed, ovate abdomen, with shorter, more appressed pubescence on the tergites; and in the slightly greenish tinge of frons and abdomen.

Female—Black, with slight metallic tints, the frons often distinctly greenish. Legs and abdomen often more or less brownish. Apical half of mandibles dark red. Flagellum strongly reddened, especially beneath. Tarsi ferruginous, the basitarsi usually darker. Tegulae ferruginous, darkened anteriorly. Wings dusky reddish. Stigma and nervures ferruginous, the subcosta blackish. Tergites 2 to 4 rather broadly whitish or testaceous at apex. Pubescence pale ochraceous, more or less white on face, cheeks and under parts of thorax. Facial foveae pale ochreous when viewed from behind. Hair of legs light, the tuft at apex of hind femora pale brown. Tergites 2 to 4 with a rather dense, white, apical hair-band, interrupted medially on 2 and 3. Fimbria light fulvous. Hair of head and thorax of moderate length and density, and somewhat shorter on mesonotum than elsewhere. Floccus of propodeum weakly curled, the pleuron below floccus with a few scattered hairs anteriorly. Flocculus of hind trochanters moderately long and dense. Tergite 1 almost nude, having a few short hairs on lateral margins. Tergites 2 to 4 with a fine short depressed pubescence on the disk, most evident on 4 and nearly absent on middle of 2. Subgenal coronet bright orange red. Mandibles stout, weakly dentate within. Process of labrum very broad and low, subtruncate in front. Facial foveae almost touching eye margins, reaching slightly more than half-way from eye margins to lateral ocellus and somewhat narrowed below. Joint 1 of flagellum barely longer than 2 plus 3, which are equal and somewhat shorter than 4. Middle joints of flagellum no longer than broad. Face below antennae, including clypeus, dull, finely tessellate and with fine, obscure, sparse punctures. Frons more shining, striate. Mesoscutum and scutellum like the clypeus, but the punctures closer and a little more distinct. Pleura, especially the sides of propodeum, tessellate, more shining than dorsum. Enclosure dull, the basal margin finely rugulose. Abdomen oval, depressed, with a dullish, tessellate, impunctate sculpture. Disk of tergite 1 very large, flattened, the basal declivity unusually

short. Tergite 2 depressed about one-fourth at apex. Pygidial area not embossed, rounded at apex. Basal nervure a little postfurcal. Second sub-marginal cell narrowed above and receiving first recurrent nervure at the middle. Stigma narrow, about five times as long as wide. Length, 6.5-7 mm.; anterior wing, 4.5-5 mm.

Male—Similar to female. Abdomen slightly tinged with greenish. Tergite 2 often with a small reddish suffused spot on each side before the apical depression. Pubescence slightly paler, the face between and below antennae with dense long white hair, more or less concealing the surface. Tergite 1 with rather long thin erect hair, and 2 with similar but shorter hair on each side of disk. Disk of tergite 2 otherwise, and that of following segments with fine depressed hair, slightly longer and denser than in the female, but the hair-bands at apex of tergites 2 to 4 very thin. Hair at apex of abdomen whitish. Head much broader than long. Cheeks distinctly broader than eyes, and broadly rounded behind. Mandibles moderately long but reaching distinctly beyond the sides of labrum. Antennae about as in female, the first joint of flagellum equalling 2 plus 3. Process of labrum about three times as broad as long, truncate or truncate-emarginate in front. Sculpture similar, but clypeus with distinct very fine close punctures, which become finer and fainter on the sides. Posterior middle of mesoscutum and the scutellum sometimes rather shiny. Dorsal surface of propodeum rounded off laterally, not at all ridged as in female. Abdomen wider than thorax, more convex than in female, more shining, the surface of tergites minutely tessellate and with rather close microscopic punctures. Length, 5-6.5 mm.; anterior wing, 4.5-5 mm.

Described from five females, eighteen males, including holotype female and allotype, at flowers of *Baeria chrysostoma,* var. *gracilis* and *B. aristata,* Riverside, California, the males from March 3 to April 7 in different years, the females from March 29 to April 6. Also the following paratypes: Two females, two and three miles west of Perris, on *Baeria,* April 13 and 20; sixteen females, five males, at the Gavilan, Riverside County, April 7-30, on *Baeria*; three males, Whittier, and Puente Hills, near Whittier, on *Baeria,* March 13 and April 30; four males, from the hills north of Rosamond, Mohave Desert, on *Baeria,* March 27; and two females, Davis, California, May 12 (J. J. DuBois). Types in collection of Citrus Experiment Station, Riverside.

This is the species recorded by Cockerell as *Andrena* sp. from Santa Catalina Island (Don Meadows). It is very similar in size and general appearance to *Diandrena beatula* Ckll., which flies with it at flowers of *Baeria,* but the two are easily separated when observed under a lens.

17. Supplementing Paper 12

The following Latin diagnoses of the four subspecies of plants, recorded in the last issue of the "Bulletin" will serve to fix the names in accordance with the Rules.

Lotus argophyllus (Gray) Greene, variety *adsurgens* var. nov.

Caules erecti, lignescentes, cum internodis brevissimus, 5-10 mm. longis; folis magis minusive imbricatis; foliolis 5, argente canescentibus; umbellis coacervatis terminis ramorum; calycis acuminatis, circa 2 mm. longibus; corolla 10-12 mm. longa, flava et aurantia; vexillo late obovato excedente alas; legumine sericeo, prope recto, acuminato, rostro curvo.

Lotus argophyllus (Gray) Greene, variety *Hancockii* var. nov.

Caules plurimi, herbacei, procumbentes; foliolis 5-7, lanceolatis, sericeis, incanis, cineraceis, 8-16 mm. longis; umbellis secundum ramos dispersis; calycis dentibus linearibus, circa 2 mm. longis; corolla flava, 6-8 mm. longa; vexillo oblongo late, excedente leviter alas; legumine sericeo, curvo, apice rostri circinato aut spirali.

Lotus argophyllus (Gray) Greene, variety *argenteus* var. nov.

Caules plurimi, herbacei, procumbentes, internodiis 1-3 cm. longis; foliolis 5, argente canescentibus, late ellipticis ad obovatum, apice acuto ad obtusam, 8-10 mm. longis; umbellis coacervatis terminis ramorum; corolla flava et aurantia; vexillo orbiculari, subaequo ad ungui et alis; legumine sericeo, prope recto.

Platystemon californicus Benth., variety *ciliatus* var. nov.

Plantae 5-10 cm. altae; caulibus singulis ex basi vel paucis, glabris; pedicellis scapiforma; foliis linearibus, 1-5 cm. longis, ciliatis; petalis eburneis, 2-8 mm. longis; fructu nutante vel erecto; carpella torosulis ad cylindricis.

M. B. Dunkle.

NOTES ON THE EARLY STAGES OF XANTHOTHRIX RANUNCULI

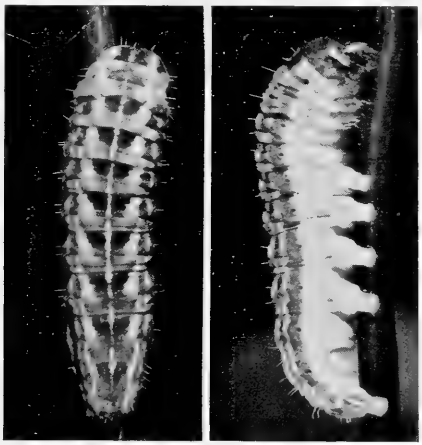
By John A. Comstock and Christopher Henne

This brightly colored little Noctuid moth occurs abundantly in favored years at isolated points on the Mojave Desert, in association with a profuse flowering of Coreopsis, but in years of drought it may be almost completely absent.

The copious spring rains of 1940 in the region of the Lovejoy Buttes near Llano brought it out in numbers, and we were able to secure several gravid females. These oviposited readily in captivity on the flowers of *Coreopsis douglasii* Hall, and made possible the following observations.

Egg: oval. Length, .56 mm. Width, .40 mm. Color, ivory-white. The surface is very finely granular, and is free of ridges and reticulations. The egg is usually deposited between the petals and the achenes on the latter of which the young larvae feed by preference. Here they remain until nearly mature. Fully grown larvae also feed on the petals and stems.

Larva, first instar: length, 3 mm. The body is a uniform light orange-yellow. Short colorless setae are sparsely distributed over the body and head, each one arising from a minute black papillus. A prominent black scutellum occurs on the first segment.



A B

PLATE 32

Mature larva of *Xanthothrix ranunculi* Hy. Edw

A. Dorsal surface. B. Lateral surface.

Figures enlarged approxim. x 4.

Photo courtesy Los Angeles County Museum.

Head, jet black. Legs, black. Prolegs, concolorous with body.

Mature larva: length, 13 mm. Body, stout; cylindrical from about the second to the tenth segments, thence constricting towards the head and more markedly towards the cauda. A narrow mid-dorsal crenulated cream colored stripe occurs, lateral to which on each segment is a triangular red-brown spot. External to this spot is a wide quadrate cream area placed somewhat diagonally on the segment. Latero-inferior thereto is a longitudinal orange-brown band running the length of the body, and inferior to this a narrow cream colored crenulated stripe. Inferior to this is a second longitudinal orange-brown band on the lower margin of which are placed the black spiracles. Inferior to this, and over all of the abdominal surface the larva is a cream-yellow.

Legs, straw colored, the tips tinged with black. Prolegs concolorous with abdomen.

The first segment has a glistening scutellum, tinged with gray over the dorsum.

Head, ground color, cream, blotched with brown. Ocelli, black.

Pupation occurred under debris on the floor of the breeding cage, no attempt being made apparently to bury in the soil, and no cocoon being formed. Under natural conditions the larvae may burrow in the sand, as it would seem unlikely that any pupa could survive the heat and winds of the Mojave Desert through the summer unless they were so buried. The species is single brooded, and the pupa undoubtedly has the ability to hold over for several years awaiting favorable rains.

NOTES ON THE LIFE HISTORY OF SPARGANOTHIS LARREANA COMST.

By John A. Comstock and Charles M. Dammers

This species was described by the senior author in Bull. So. Calif. Academy of Sciences, Vol. 38, Part 2, p. 120, 1939, and brief notes were there given of the larva and pupa. We are now able to add a few additional facts to our knowledge of the life cycle.

The eggs are laid on leaves of the foodplant (*Larrea*) in single layered groups, each row slightly overlapping, much as is the case with *Tholerea reversalis,* as illustrated in the Bull. So. Cal. Acad. of Sciences, vol. 32, p. 36, 1933. The egg is a flat oval measuring approximately .8 mm. long by .6 mm. wide. The thickness is about .08 mm. In color it is a bright green and the surface texture is finely granular. Eggs deposited March 29, 1940 hatched April 8.

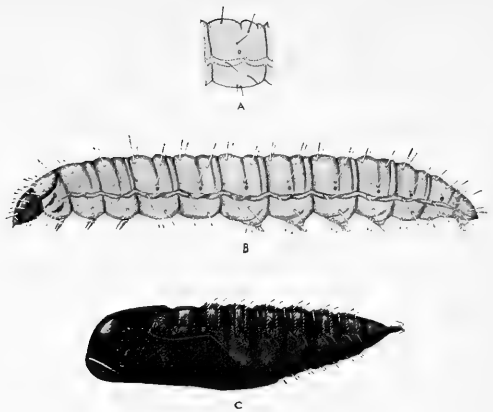


PLATE 33

Larva and pupa of *Sparganothis larreana* Comst.

A. Typical segment of larva showing placement of setae.
B. Mature larva, lateral aspect.
C. Pupa, lateral aspect.

All figures enlarged x 5.

Reproduced from painting by C. M. Dammers.

The newly emerged larva is a light straw color on the body, with a jet black head, and a large gray scutellum on the first segment. A few short, colorless setae are distributed over the body and head. Length, shortly after emergence, .8 mm.

In addition to the notes on larva and pupa which were published with the original description, we can add the following.

Mature larva: length extended, 12 mm. Body cylindrical, tapering toward head and cauda; surface texture, smooth. The color is pale olive over the dorsum and as far down the lateral surface as the infrastigmatal fold; below that point, paler. There is a narrow mid-dorsal line slightly darker than the ground color. Spiracles: pale olive, with brown rims. Legs: pale olive with black points. Prolegs: concolorous with body, the crochets brown. On the dorsum of the first segment there is a pale chestnut scutellum, edged posteriorly with black, and anteriorly with white. Below this are two black horizontal bars. Each body segment bears 14 pale brown punctae, from each of which arises a long white seta.

Head: chestnut, the spinneret and mouth parts, white. Ocelli, black. The head is sparingly clothed with white setae, arising from black punctae.

Pupa: head, thorax and wing cases, blackish brown. Body, dark olive. Two short white setae are paired on each segment, subdorsally, laterally and abdominally. Additional details of the pupal structures were dealt with in the paper originally describing the species.

The statement made in that paper relative to alternate foodplants (*Oenothera* and *Buddleia*) is an error for which the senior author alone was responsible. The only known foodplant is *Larrea*.

ADDITIONAL NOTES ON CAROLELLA WILLETTANA, COMST.

By John A. Comstock
Director of Science, Los Angeles County Museum

This Phaloniid moth was first described by the writer as a subspecies of *Carolella busckana* Comst.,[1] from material taken at Chuckawalla Springs, Riverside Co., Calif., by George Willett.

At that time, nothing was known of the early stages, but we have since observed these, and on the basis of the very distinctive gall, and different foodplant, now consider it a distinct species.

On October 26, 1940, a group of our museum workers camped at Chuckawalla Springs, and I made a diligent search for galls. The types of *willettana* were taken in the canyon wash a short distance below the springs. At this site I found a number of galls on *Hymenoclea salsola* T. & G. which I took to be those of the above species.

The following day our party moved camp to the region near Shaver's Summit. There Mr. Henne and I turned up a gall on *Encelia farinosa* Gray, in considerable numbers.

In our laboratory emergences from both types of galls occurred in December. Those on the *Encelia* proved to be *Carolella willettana,* and the *Hymenoclea* galls gave forth another, and much smaller Phaloniid which we have not yet had time to study..

The larva and pupa of *C. willettana* is very similar to that of *C. busckana,* and works within the gall in much the same manner. The plant, in which it works, is of such a different character as to suggest, superficially, no sunflower relationships whatsoever. It is heavily tomentose, and very light in color, and it will be noted that the moth has this same silky-white texture and coloration as the plant.

Our illustration shows (Plate 34) a typical plant of *Encelia farinosa* (Fig. A) with a gall at the base of the branching stems, and an enlargement (Fig. B) of this same gall. The moths are remarkably constant in long series as regards the silky texture and light, washed out pattern, but they vary greatly in wing expanse.

[1] Bull. So. Calif. Academy of Sci., vol. 38, pt. 2, p. 115, 1939.

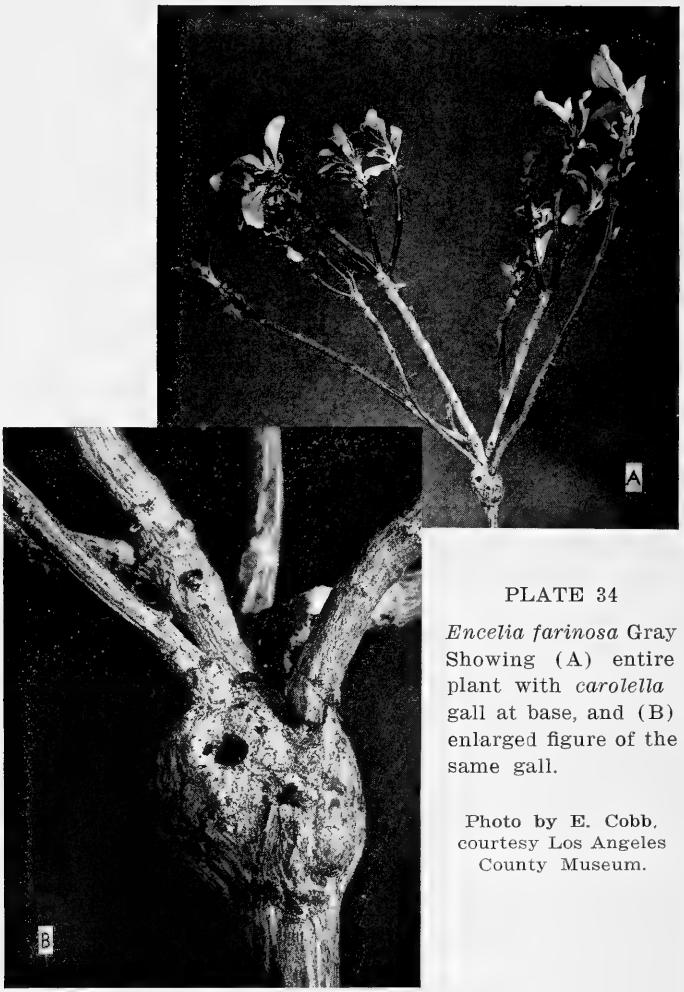


PLATE 34

Encelia farinosa Gray Showing (A) entire plant with *carolella* gall at base, and (B) enlarged figure of the same gall.

Photo by E. Cobb, courtesy Los Angeles County Museum.

A CRAMBUS RECORD

By Alexander B. Klots
College of the City of New York.

Another Silvery-striped *Crambus* Recorded From California (Pyralididae). In the recent paper by the present writer (*Bull. S. Calif. Acad. Sci., January-April, 1940, 39:53-70*) *Crambus unistriatellus* Packard was listed (p. 67) as of potential occurrence in the State. A specimen of this species has just been received from Mr. John L. Sperry, taken at Bartle (Siskiyou Co.), 14 June, 1939 by Grace H. and John L. Sperry. In the article by the present writer the characteristic pattern of the species was described.

A NEW GEUSIBIA* (SIPHONAPTERA: DOLICHOPSYLLIDAE)

By G. F. Augustson
Research Associate, Allan Hancock Foundation,
University of Southern California

During the summer of 1938 the author had the pleasure of accompanying Mr. Granville P. Ashcraft, Mammologist, Allan Hancock Foundation, on a short collecting trip into the central Sierra Nevada Mountains through Bishop Pass, Fresno County, California. From conies of this region, a flea apparently new to science was obtained which is here described and illustrated. It is named in honor of Mr. Ashcraft to whom the author is indebted for the specific identification of the type host involved.

Geusibia ashcrafti n. sp.

Head (Fig. A): Postantennal region with two rows of bristles in which the most proximal to the antennal groove are much the larger. Posterior border of antennal groove with many small setae. Preantennal region with two rows of bristles, the upper with six to eight well up on the frontal angle, the lower with three very long, stout bristles equal distance between the upper row and the eye; numerous very small setae among the two preantennal rows. Eye large, elliptical to panduriform, heavily pigmented. Genal process sharply pointed, somewhat darkly sclerotized along its borders. Maxillae sharply acuminate. Labial palpus reaching to but two-thirds the length of the fore coxa. First antennal segment with two to three short setae, second with four to five of equal size. Frontal notch prominent, blunt. Angle of frons gently rounded from occiput.

Thoracic and Abdominal Segments: Pronotal ctenidium

* Jordan, K., Novitates Zoologicae, XXXVII, 1932, pp. 280-281.

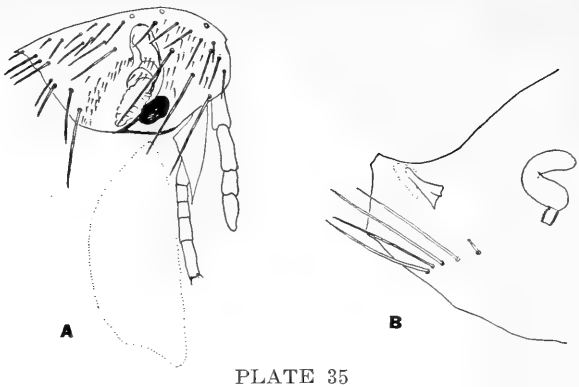


PLATE 35

Geusibia ashcrafti Augusts.
A. Head, lateral aspect. B. Sternite VII, lateral aspect.
(Highly magnified)

of eighteen spines. Two small teeth on metanotum and on the first three abdominal tergites. Bristles on abdominal tergites not reaching spiracles laterally except in first three segments. Antepygidial bristles three, the middle longer than the equal outer two. Style small, blunt, its length not more than twice the basal width; one long terminal bristle, two shorter lateral bristles. Sternite VII (Fig. B) without a sinus, upper lobe extending slightly posteriorly (upper posterior angle blunt to pointed). Bursa copulatrix roughly funnel shaped, the mouth of which is not greater in diameter than twice that of the neck. Spermatheca in the shape of a hand sickle, the handle representing the tail, the blade representing the head.

Legs: All fifth tarsal segments with five lateral plantar bristles. Length of hind tarsus I equal to that of II and III. Hind coxa with many thin, small setae on lower anterior inner half.

Holotype: Female (author's collection number 38-8) deposited in the Los Angeles County Museum, Los Angeles, California.

Paratypes: 16 females collected by author (number 38-8) August 8, 1938 from 5 conies along with the Holotype. Two paratypes placed in the Los Angeles County Museum, the remainder in the author's collection for distribution later with 3 females collected by Dr. R. L. Rutherford from similar host (author's number 40-136), August 27, 1940, Mammoth Meadows (10,500 ft.), Mono County, California.

Type Host: *Ochotona schisticeps albatus* Grinnell.

Type Locality: Dusy Lakes, east of Bishop Pass (11,500 ft.), Fresno County, California.

The genus Geusibia Jordan was founded on *G. torsa* Jordan, an oriental (Chinese) species parasitic upon the genus Ochotona, and this is the first North American record of the genus. This genus is closely related to Odontopsyllus.

STUDIES OF THE SWEET POTATO WEEVILS OF THE SUBFAMILY CYLADINAE

By W. Dwight Pierce

It is very interesting to study the relationships which often exist between plants and insects. The sweet potato, *Ipomoea batatas,* and its related wild morning glory species, are attacked in many parts of the world by primitive weevils belonging to the subfamily Cyladinae Kolbe (1897), family Apionidae LeConte (1876), superfamily Attelaboidea Pierce (1916), series Rhynchophora Latreille (1804), order Coleoptera Linnaeus (1758). Only one species of this interesting group has reached North America, and the sweet potato fields of Louisiana, Florida, Texas, and New Mexico, but has not become established in California, due to excellent quarantine, Cylas formicarius having been intercepted on a number of occasions in California, and *Cylas turcipennis* having been intercepted in quarantine in sweet potatoes from China, at Vancouver, B. C. The remainder of the genus centers around India, Malaya, Africa and Madagascar, lending some evidences to the previous connection of India with Africa in the Gondwana period of Earth evolution. The only species on which we have any host plant data are all recorded from sweet potato. They breed in the stems and tubers of this food plant and other morning glories.

Most of the studies included in this article were made some years ago, and were based upon specimens in the collections of the United States National Museum, Cambridge Museum of Comparative Anatomy, and the American Museum of Natural History. The microscopic slides upon which studies were made are in the Los Angeles Museum collection.

Reference may be made to an earlier paper by the author on this genus: "Weevils which affect Irish potato, sweet potato, and yam", in Journal of Agricultural Research, 1918, vol. 12, No. 9, pp. 601-612, plates 28-34. In this article are to be found descriptions of *Cylas formicarius* Fabricius, adult; *C. f. elegantulus* (Summers), larva, pupa, adult; *C. turcipennis* Boheman, adult; *C. femoralis* Faust, adult.

The two leading sweet potato weevils, *formicarius* and *turcipennis* are so near alike that the following studies were made to obtain some light on the specific values. The common sweet potato weevil of America has been known for generations as *Cylas formicarius,* but to some extent its spread overlaps that of *C. turcipennis.* Whether we have rightly interpreted Fabricius' original species may never be known positively, but this much is certain, that there is a name positively applicable to the American sweet potato weevil, *Cylas elegantulus* (Summers 1875).

Brentus formicarius Fabricius (1798. Supp. Ent. Syst., p. 174, No. 5) was described as a brownish species from India Oriental.

Cylas turcipennis Boheman (1833. Schönherr's Gen. et Sp. Curc., vol. 1, pp. 369, 370) was described as a greenish species from Java, where it has since been found in sweet potato.

Otidocephalus elegantulus Summers (1875. New Orleans Home Journal and Rural Southland, vol. 10, No. 3, p. 68, January 30; No. 26, December 25) was described as a bluish species from Louisiana, infesting sweet potato. We know, therefore, at least that this name applies to our American sweet potato weevil.

We do not know definitely that the real *formicarius* attacks sweet potato. Its description might fit several species in the genus. But, because of common usage of the name *formicarius* for the sweet potato weevil, and at the same time to be technically correct, it has seemed best to designate this insect as *Cylas formicarius elegantulus* (Summers) Pierce 1918.

I. Comparative Measurements of the Three Forms

The material assembled consisted of 147 specimens from nineteen countries and states as follows:

Cylas turcipennis—elytra green.

Oriental material only. Java, Buitenzorg; Paul Van der Goot, coll.; U. S. Nat. Mus.; 16 specimens. Sumatra, Palembang; W. Knappert, coll.; U. S. N. M.; 2 specimens. Philippines, Bay Laguna Prov.; P. L. Stangl, coll.; U. S. N. M.; 2 specimens.

Cylas formicarius elegantulus—elytra blue

Oriental material:

India or.; Deyrolle coll.; Cambridge Mus. Comp. Anat.; 1 specimen.

Society Islands; A. Garrett, coll., Oct. 1864; C. M. C. A.; 5 specimens.

Madagascar; Deyrolle, Coll.; C. M. C. A.; 5 specimens.

Formosa; Sauter, coll.; American Mus. Nat. Hist.; 1 specimen.

China, Hongkong; Deyrolle, coll.; C. M. C. A.; 1 specimen. F. Maskew, coll., 1912; U. S. N. M.; 15 specimens.

Hawaii, Oahu; D. L. VanDine, coll.; U. S. N. M.; 6 specimens.

Occidental material:

British Guiana; F. O. Stockdale, coll.; U. S. N. M.; 1 specimen.

Guatemala; D. G. Eisen, coll.; U. S. N. M.; 1 specimen.

Jamaica; U. S. N. M.; 2 specimens. Kingston; J. E. Duerden, coll.; U. S. N. M.; 4 specimens.

Haiti; Sept. 22, 1913; U. S. N. M.; 1 specimen.

Cuba, Havana; C. F. Baker, coll. 5476; U. S. N. M.; 1 specimen. J. H. Esbiro, coll. April 1904; U. S. N. M.; 1 specimen.

Cayamas; E. A. Schwarz, coll. Jan. 2, Feb. 28; U. S. N. M.; 3 specimens.

Guanajay; Palmer and Riley, coll. May 3; U. S. N. M.; 1 specimen.

Puerto Rico, Rio Piedras; T. H. Jones, Coll. Aug. 9, 1912, No. 584-1912; U. S. N. M.; 4 specimens. R. T. Cotton, coll. May 12, 1916; Puerto Rico Exp. Sta.; 2 specimens.

Las Cabezas; Feb. 23, 1916, No. 94-16; P. R. E. S.; 1 specimen.

Mayaguez; A. Busck, Jan. 1899; U. S. N. M.; 1 specimen. R. H. VanZwaluwenberg, coll. Nov. 6, 1917; U. S. N. M.; 5 specimens.

Arecibo; June 24-26, 1915; A. M. N. H.; 1 specimen.

Florida, Key West; Hubbard and Schwarz, coll.; U. S. N. M.; 5 specimens. Manatee; Hubbard and Schwarz, coll.; U. S. N. M.; 2 specimens. Key near Key West; Wickham, coll. June 17-July 1; U. S. N. M.; 1 spec. Lake Worth; F. Blanchard, coll.; C. M. C. A.; 1 specimen. W. H. Ashmead, No. 2387; U. S. N. M.; 9 specimens. W. G. Dietz; C. M. C. A.; 4 specimens.

Louisiana; Dietz, coll. and Blanchard, coll.; C. M. C. A.; 2 specimens. Wickham. coll., Oct. 15; U. S. N. M.; 1 specimen. New Orleans; Hubbard and Schwarz, coll., and Soltau, coll.; U. S. N. M.; 6 specimens. Baton Rouge; Wickham, coll., Sept. 15, 1892; U. S. N. M.; 1 specimen. Centreville; W. J. Young, coll. Oct. 28, 1909; U. S. N. M.; 1 specimen.

Texas; W. G. Dietz, coll.; C. M. C. A.; 1 specimen. Victoria, Sept. 3, 1904; U. S. N. M.; 6 specimens. Brownsville; Jones and Pratt, March 23, 1908; U. S. N. M.; 7 specimens. Wickham, coll. July; U. S. N. M.; 1 specimen. Corpus Christi; F. C. Pratt, coll. Oct. 23, 1905; U. S. N. M.; 2 specimens.

New Mexico, Fort Wingate; October; A. M. N. H.; 2 specimens. Also a few old Riley and Zabriskie specimens without data.

One male specimen from the Deyrolle coll. from India or. has elytra decidedly bluish black, and may be used as our indication of *Cylas formicarius,* although the species was described as brown.

Three male specimens from Buitenzorg, Java, with green elytra may be chosen as typical examples of *Cylas turcipennis.*

Three male specimens from New Orleans, Louisiana, with blue elytra may be chosen as typical examples of *Cylas formicarius elegantulus.*

Measurements of these have been made with a Spencer binocular microscope, eye piece 6x, objective 48, using an eye piece micrometer, with 17 spaces equal to 1 mm. The figures in this and following tables represent the micrometer spaces.

Measurements of Specimens from Typical Localities

Source and Species	Lengths Expressed in Micrometer Spaces (17 spaces = 1 mm.)						Breadths Expressed in Micrometer Spaces		
	Elytra	Thorax	Head	Beak	Club	Funicle	Elytra at Humeri	Thorax at Base	Thorax at Widest Point
India or formicarius	53	22	12	16	20	10	19	11.5	14
Louisiana elegantus..	54	22	13	16	22	11	20	10	15
	55	21	14	17	19	10	19.5	10	15
	56	20	16	17	22	11	20	10	15
Java turcipennis	52	22	13	18	24	10	20	12	14
	54	24	14	18	24	10	21	12	15
	54	23	15	18	26	11	20	11	15

Proportionately the length of the beak is to the length of the head as 1.28:1 in *turcipennis;* 1.33:1 in *formicarius;* 1.14:1 in *elegantulus.*

The length of the club is to the length of the funicle as 2.37:1 in *turcipennis,* 2:1 in *formicarius,* and 1.96:1 in *elegantulus.*

In every measurement made there has developed a great range of variations, and the proportions of any two series of measurements are likewise variable. The tables presented are of great interest in showing specific variation in cosmopolitan insects, an opportunity very rarely afforded us. They also show conclusively how the individual specimens of the two species range in the same limits of measurement for any given character. Comparison of measurements is of little value in this genus.

1. Measurements of Length of Elytra in Micrometer Spaces (17 = 1 mm.)

COUNTRY	MALES			FEMALES		
	Specimens	Range	Average	Specimens	Range	Average
Cylas turcipennis—						
Java	3	52-54	53.3	16	51-54	52.1
Sumatra	2	45-49	47.0	..	..	..
Philippines	2	50	50.0	..	..	..
	7	45-54	50.5	16	51-54	52.1
Cylas formicarius elegantulus—						
Cuba	3	46-51	49.3	5	48-53	50.0
British Solomons	3	48-52	49.6	..	..	..
Haiti	..	..	..	1	50	50.0
Madagascar	6	50-54	50.1	..	..	..
Formosa	1	52	52.0	..	..	..
Society Islands	4	47-57	52.3	..	..	..
New Mexico	2	51-54	52.5	..	..	..
India Or.	1	53	53.0	..	..	..
Louisiana	8	50-56	53.3	4	50-55	53.2
Texas	7	50-56	53.5	9	51-58	54.3
Honduras	2	54-54	54.0	2	54-54	54.0
Florida	15	50-57	54.1	13	48-54	51.8
Puerto Rico	8	51-57	54.2	6	54-60	55.3
Hongkong	6	53-56	54.6	9	50-59	54.8
British Guiana	1	55	55.0	..	..	..
Hawaii	1	56	56.0	5	54-60	56.1
Jamaica	2	55-57	56.0	4	53-60	55.9
	70	46-57	53.4	58	48-60	52.8

2. Measurements of Length of Prothorax in Micrometer Spaces (17 = 1 mm.)

COUNTRY	MALES			FEMALES		
	Specimens	Range	Average	Specimens	Range	Average
Cylas turcipennis—						
Java	3	22-24	23.0	16	22-23	22.3
Sumatra	2	20-20	20.0	..	..	..
Philippines	2	19-21	20.0	..	..	..
	7	19-24	21.2	16	22-23	22.3
Cylas formicarius elegantulus—						
British Solomons	3	18-20	19.3	..	..	..
Cuba	3	18-21	19.6	5	19-23	21.2
Honduras	2	20-20	20.0	2	21-22	21.5
New Mexico	2	20-20	20.0	..	..	..
Texas	7	19-21	20.2	9	21-23	22.2
Florida	15	19-22	20.5	13	20-22	21.0
Louisiana	8	20-22	20.6	4	20-22	21.0
Formosa	1	21	21.0	..	..	..
Society Islands	4	19-23	21.0	..	..	..
British Guiana	1	21	21.0	..	..	..
Madagascar	6	20-24	21.3	..	..	..
Haiti	..	..	..	1	22	22.0
Puerto Rico	8	20-23	21.5	6	24-25	24.3
Jamaica	2	21-23	22.0	4	23-25	24.0
India Or.	1	22	22.0	..	..	..
Hawaii	1	22	22.0	5	23-26	24.4
Hongkong	6	22-24	22.6	9	22-25	23.6
	70	18-24	20.8	58	19-26	22.5

3. Measurements of Length of Beak in Micrometer Spaces (17 = 1 mm.)

COUNTRY	MALES			FEMALES		
	Specimens	Range	Average	Specimens	Range	Average
Cylas turcipennis—						
Java	3	18-18	18.0	16	13-17	15.0
Sumatra	2	14-15	14.5	..	..	..
Philippines	2	16-17	16.5	..	..	..
	7	14-18	16.5	16	13-17	15.0
Cylas formicarius elegantulus—						
New Mexico	2	14-16	15.0	..	..	..
British Solomons	3	14-16	15.0	..	..	..
Society Islands	4	14.5-18	15.9	..	..	..
Texas	7	14-17	16.0	9	14-17	16.3
Honduras	2	15-17	16.0	2	17-17	17.0
Haiti	..	..	..	1	17	17.0
Hawaii	1	16	16.0	5	16-19	17.7
India Or.	1	16	16.0	..	..	..
Florida	15	15-17	16.3	13	13-17	16.0
Puerto Rico	8	16-18	16.5	6	17-19	18.0
Cuba	3	16-17	16.6	5	14-17	15.4
Louisiana	7	16-17	16.7	4	16-18	16.7
Jamaica	2	17-18	17.5	4	16.5-19	17.7
Hongkong	6	17-19	17.8	9	17-20	18.9
Formosa	1	18	18.0	..	..	..
Madagascar	6	17-19	18.0	..	..	..
British Guiana	1	18.5	18.5	..	..	.
	69	14-19	16.5	58	13-20	17.0

4. Measurements of Length of Club in Micrometer Spaces (17 = 1 mm.)

COUNTRY	MALES			FEMALES		
	Specimens	Range	Average	Specimens	Range	Average
Cylas turcipennis—						
Java	3	24-26	24.6	16	8-10	9.4
Sumatra	2	21	21.0	..	..	..
Philippines	2	21-22	21.5	..	..	..
	7	21-26	22.7	16	8-10	9.4
Cylas formicarius elegantulus—						
Hawaii	1	17	17.0	5	9-10	9.6
Cuba	3	17-20	19.0	5	8-9	8.6
Society Islands	4	16-22	19.2	..	..	..
Jamaica	2	18-21	19.5	4	9-10	9.7
Puerto Rico	8	19-21	19.8	6	9-10	9.6
British Guiana	1	20	20.0	..	..	..
India Or.	1	20	20.0	..	..	..
Honduras	2	20-21	20.5	2	9-10	9.5
British Solomons	3	20-22	21.1	..	..	..
Louisiana	8	19-22	21.1	4	9-10	9.7
Texas	7	20-22	21.1	9	9-10	9.6
Florida	15	20-22	21.2	13	8-10	9.2
New Mexico	2	21-22	21.5	..	..	..
Hongkong	6	20-23	21.6	9	9-10	9.6
Formosa	1	22	22.0	..	..	..
Madagascar	5	21-22.5	22.3	..	..	..
Haiti	..	..	..	1	10	10.0
	69	16-22.5	20.7	58	8-10	9.4

5. Measurements of Length of Funicle in Micrometer Spaces (17 = 1 mm.)

COUNTRY	MALES			FEMALES		
	Specimens	Range	Average	Specimens	Range	Average
Cylas turcipennis—						
Java	3	10-11	10.3	16	12-14	13.5
Sumatra	2	10	10.0	..	..	..
Philippines	2	10-11	10.5	..	..	..
	7	10-11	10.2	16	12-14	13.5
Cylas formicarius elegantulus—						
India Or	1	10	10.0	..	..	..
New Mexico	2	10-11	10.5	..	..	..
Louisiana	8	10-11	10.6	4	12-14	13.2
Texas	7	10-12	11.0	9	11-18	14.1
British Solomons	3	11	11.0	..	..	..
Florida	15	10-12	11.0	13	12-15	13.2
Puerto Rico	8	11.12	11.7	6	13-15	13.8
Society Islands	4	10.5-13	11.8	..	..	..
Formosa	1	12	12.0	..	..	..
British Guiana	1	12	12.0	..	..	..
Honduras	2	12	12.0	2	14	14.0
Jamaica	2	12	12.0	4	14-15	14.3
Madagascar	5	12-13	12.2	..	..	..
Cuba	3	12-13	12.3	5	12-14	13.2
Hongkong	6	12-14	12.6	9	13-15	14.3
Hawaii	1	15	15.0	5	14-15	14.6
Haiti	..	..	..	1	14	14.0
	69	10-15	11.4	58	11-18	13.8

II. Studies of the Immature Stages

Descriptions of the larva and pupa of *Cylas formicarius elegantulus* were published in the 1918 paper.

At first there seemed possibly a tangible difference in the pupae of *elegantulus* and *turcipennis*, as the description of the pupa of *turcipennis* from the Friendly Islands, by Brown, and the illustrations of Indian specimens by Basu and Dutt, indicated six apical prothoracic tubercles, while certain specimens of *elegantulus* had eight.

I have therefore studied a series of pupae from Barbados, and another series from Texas, and find that normally there are six marginal setigerous tubercles, and two discal, with two tiny setigerous tubercles near the larger discal pair. Twelve Barbados specimens (75%) and 17 Texas specimens (85%) were normal. One Barbados specimen had two setae on each of the front pair

of tubercles. One Texas specimen had two setae on one of the front pair. Three Barbados, and two Texas specimens had four tubercles on one side, and three on the other, together with a pair of large and a pair of tiny discal tubercles. It therefore appears that eight tubercles on the margin is abnormal.

I also examined specimens from Java and found six to be the normal number of tubercles, but one individual had three on the left and four on the right.

The structure of the terminal hooks was also so variable as to be of no taxonomic value.

III. A Note on the Mouth Parts

On dissection of adult specimens it appeared that the male maxilla of *turcipennis* has the palpiger and three-jointed palpus equalling in length the lacinia, even when the palpus is drawn in; while in *elegantulus* with palpus extended, it did not equal in length the lacinia.

IV. Studies of Male Genitalia

The first really good characters were found in the genitalia.

1. *Cylas formicarius elegantulus* (Plate 36, figs. 1-9).

Description based on study of nineteen American specimens.

Eighth sternite (fig. 8) transverse, basally strongly emarginate, hence basal angles long; base (v) medianly bilobed; median lines short; apex deeply and broadly emarginate (w), making two strong apical lobes (x) at the outer angles (fig. 2); sides greatly narrowed behind, sinuate.

Ninth sternite, or spicule (figs. 7, 9) stout, forked; the lobes (t) of the fork stout, rounded at apex; cleavage broadly rounded; rod (u) more or less strongly bent at about the middle, slightly hooked at apex. The spicule is too variable in shape to use as a dependable character.

Tenth segment, or ring piece (fig. 6) more or less perpendicular with stout, straight postvinculum composed of two fused struts (1). Tegument membranous (n, o, s), with median chitinous rod or uncus (p), and apical fork (q) of uncus separating and bracing the delicate hairy lobes or socii (s).

The epiphallus, or eleventh tergite (figs. 1, 3, 4, 5) is a pair of slender rods (h) fused from middle posteriorly almost to the genital pore (near i). The verga (i) or tip containing the genital pore is tongue-like and forming a distinct process, hardly visible from above or below, but plain on slide mounts. The anterior struts or epipleurites (f) are enlarged at tip, united to the hypo-

pleurites (g), and apparently continuous with the epiphallus (h). The paramera or hypopleurites (g) are lightly connected to the struts or epipleurites (f), slender at base, broadening below where they join the sternites periphallus (j) and hypophallus (k). These are united at apex to form an ogival process; the edges (j) are turned in to form a sort of protecting trough for the phallus (e) or sac, and the verga (i).

The flagellum and endophallus lie within the sac or ductus ejaculatorius, the anterior or narrow portion of which is the stenazygos (b), and the widened posterior portion, the euryzygos (e). The endophallus consists of two large oval lobes (c) each with a strong apical hook (d) to form the valves of the median foramen. The flagellum (a) is a long and slender rod, with broad, crescentiform base and constriction just beyond base. (Figs. 1, 4).

2. *Cylas turcipennis* (Plate 36, figs. 10, 11).

Described from seven Java specimens.

Eighth sternite transverse (fig. 11), basally strongly emarginate, with long basal angles; medianly slightly angulate; median line longer than in *elegantulus* (fig. 8); apex not so deeply or broadly emarginate, with strong apical lobes; sides greatly narrowed, deeply constricted.

Spicule not so greatly curved, hooked at tip. Lobes of endophallus (fig. 10) each with a short spur.

The two species are very close together, and agree in other points.

3. *Cylas femoralis* Faust (Plate 37, figs. 1-5).

Described from a specimen from Mt. Coffee, Liberia.

Eighth sternite (fig. 5) basally very strongly emarginate, with long basal angles, and without angle or lobe medially; Median line very short; apex deeply and broadly emarginate, with long, narrow lateral lobes; sides greatly narrowed, somewhat broadly constricted opposite base of apical lobes.

Ninth spicule (fig. 4) strongly curved, hooked at tip, with median portion at fork, very thin, giving the impression of very narrow stems to the tines of a fork, which are in reality as broad at base as at apex, but heavily chitinized only on the outsides. That the spicule is a fusion of two struts is apparent by the cleavage line almost to tip.

The postvinculum is almost straight, enlarged at tip. The socii are longer than in elegantulus (fig. 1).

The struts of the epiphallus are fused for a very short distance near verga, which is blunt spear-shaped (fig. 2); struts curved at anterior apex (fig. 1). Paramera rather broad.

The lobes of endophallus (fig. 3) are each armed with a long spur, as long as the body of endophallus. Two palpiform rods (fig. 1) are visible in the phallus beyond the endophallus.

Otherwise very similar to *elegantulus*.

V. Studies of Female Genitalia (Plate 38)

The female abdomen in *Cylas formicarius elegantulus* is composed of five exposed sternites and seven exposed tergites. The seventh tergite is the prepygidium (e7).

The first two sternites are internal, so that the fifth ventral segment is the sternite of the seventh segment. The first eight pleurites bear spiracles. The eighth, ninth and tenth segments are internal. The eighth tergite, or pygidium (e8) is telescoped within the seventh.

The seventh segment is complete, in that it is composed of tergite (e7), tergo-pleural cuticle (f7) or intersegmental skin, epipleurite I (d7), epipleurite II (c7), hypopleurite (b7), and sternite (a7). Between the seventh and eighth segments, when fully expanded, is a broad intersegmental skin (g8).

The eighth tergite (e8) is normal in appearance, but the pleural zone is purely intersegmental or membranous (f8). The eighth sternite (a8) is a flat shield-like plate, which may in folding stand perpendicular. At the base of the eighth sternite is attached internally a long, chitinous rod or apodeme which braces the genital canal and is attached thereto. This apodeme is very similar to the spicule of the ninth sternite in the males. It has been called the kloakstiel by Stein, and may therefore be designated by us as the Cloaca stylyus (h). It is formed by the fusion of two pieces and is probably the fusion of the endo-apophyses mentioned by Böving for Dytiscidae.

In an excellently dilated specimen from New Orleans (figs. 1-3), there was a very definite sternal piece beyond the eighth, which I shall call the ninth sternite. It had a hypopleural piece (b9) attached on each side, and a definite line seemed to separate off a segment with its posterior boundary at the anal valve (j). Dorsally there was no chitinization behind the eighth tergite and before the anal opening (u), but the anterior lip (i) of this orifice was inflated. This anterior lip (i) at least is unquestionably the ninth tergite. The tergo-pleural cuticle is marked with a few flecks of chitin (j) and may possibly thus indicate the cloaca valves described by Böving.

In a single specimen (fig. 5) the anal tube was fully protracted and unquestionably two-segmented, the second segment (w) of the tube has the true anal orifice (x) at tip. In other specimens this eversible tube can be seen within.

The zone beyond the base of this anal tube and the ninth sternite described above, is difficult to interpret.

It consists of an inflated membrane (s) from the anal tube to the vagina or vulva (q), which is an elongate slit bounded by two lateral inflated cheeks (p), at the outer margin of which are palpi (m) with a small terminal joint (n). From the palpi there is a slight chitinization, corresponding to Böving's "Arm". Stein calls the palpi, Vaginal Palpi. Internally the palpi are braced by rods, which may be called the Vaginal Styli. Böving and other authors call that segment bearing the vagina and vaginal palpi, the ninth, placing the palpi and arms as pleurites. If such is the true interpretation, then the sternal plates (a9) are presternum, lobes (o) sternellum, lobes (p) sternum, and the region (r, s) poststernellum.

This makes the first segment of anal tube, the tenth segment, and the second segment the eleventh.

VI. The Genera and Species of Cyladinae

TABLE OF GENERA OF CYLADINAE

1. Trochanters of normal size.....2
   Trochanters very long, arcuate ..... *Myrmacicetus* Chevrolat
2. Slender, elongate insects with beak cylindrical; posterior femora not as a rule exceeding the tip of the elytra; elytra not inflated .....*Cylas* Latreille
   Robust insects with short, stout beak; posterior femora surpassing the tips of the elytra; elytra inflated, globular .....*Protocylas*, new genus

Cylas Latreille (1802)

1802. *Cylas* Latreille. Hist. Nat. Gen. et Part. Crust. et Ins., vol. 3, p. 196.

1815. *Cylanus* Rafinesque. Anal. Nat. Tabl. Univ., p. 115. New name for *Cylas*. Type, *brunneus* Olivier, monotypic.

1. Cylas brunneus (Olivier 1790) Latreille (1802).

1790. *Brentus brunneus* Olivier. Encyc. Meth., vol. 5, p. 190, No. 4.

1802. *Cylas brunneus* (Olivier) Latreille. Hist. Nat. Gen. et Part. Crust. et Ins., vol. 3, p. 196. Type of genus. Senegal.

1842. *Cylas angustatus* (Dejean ms.) Labram and Imhoff. Sing. Gen. Curc., part 1, No. 26. New Synonymy. Senegal.

The description of *brunneus* as given by Olivier is short:

"Corpus brunneum nitidum. Rostrum cylindricum thorace paulo brevius. Oculi nigri ovati vix prominuli. Thoracis partes anterior ovata, postica brevior cylindrica. Elytra ovato-oblonga laevia."

The description of *angustatus* is even briefer:

"Femina: Antennarum clava ovata, obtuse acuminata articulorum praecedentium simul sumtorum dimidiam longitudinem aequante."

There were examined two specimens from the Deyrolle collection loaned by the Cambridge Museum, one of which is labelled "C. *angustatus* Dej. Sénégal". This one is headless, but the other is a female. These have the thorax in two distinct parts, the anterior globular, ovate; the posterior shorter, cylindrical. They are brown. Although the description of *angustatus* does not indicate it, the figure shows the thorax is constructed in the same manner as in *brunneus*. I have therefore united the two species.

The female is 6 mm. long, and was illustrated in the 1918 article.

2. Cylas formicarius (Fabricius 1798) Schönherr (1826).

1798. *Brentus formicarius* Fabricius. Ent. Syst. Suppl., p. 174, No. 5. India.

1826. *Cylas formicarius* (Fabricius) Schönherr. Curc. Disp. Meth., p. 75.

a. Subspecies *elegantulus* (Summers 1875) Pierce (1918).

1875. *Otidocephalus elegantulus* Summers. New Orleans Home Journal and Rural Southland, vol. 10, No. 3, p. 68, Jan.; No. 26, Dec. 25. Louisiana.

1918. *Cylas formicarius elegantulus* (Summers) Pierce. Jour. Agr. Res., vol. 12, No. 9, pp. 605-607; pl. 31, fig. A; pl. 32, figs. A, B; pl. 33, figs. E-H; pl. 34, figs. A-D.

Studies of this subspecies are embodied in the preceding parts of this article.

3. Cylas turcipennis (Schönherr) Boheman (1833).

1833. *Cylas turcipennis* Boheman. Schönherr's Gen. et Sp. Curc., vol. 1, pp. 369-370. Java, India. Oriental.

Studies of this species are also embodied in the preceding parts of this article; and in the 1918 article.

4. Cylas femoralis Faust (1898).

1898. *Cylas femoralis* Faust. Deutsche Ent. Zeitschr., vol. 42, p. 24. Kamerun.

This species was very inadequately described.

There were at hand a series of 29 specimens from Mt. Coffee, Liberia, collected in March and April, 1897, by O. F. Cook and R. P. Currie. It attacks sweet potato. Length 4.2 mm.; breadth 1 mm.

Studies of this species are embodied in the preceding sections of this article and in the 1918 article.

5. Cylas compressus Hartmann (1899).

1899. *Cylas compressus* Hartmann. Deutsche Ent. Zeitschr., vol. 43, pp. 22, 23. German East Africa, Usambara. Length 5.5-6 mm.; breadth 1.5-1.75 mm.

Two specimens were seen which may belong here. One is labelled "*Cylas brunneus* Fab.? *Cylas metallescens* Linell n. sp. (scratched out). Tana River, East Africa, Chanler Exped. 92-

93." The other is labelled "At camp. Inhosenque. Dec. 23, 1908. No. 137" from the collection of C. W. Howard. These measure 5.5 and 6 mm. in length.

6. Cylas punctcollis (Schönherr) Boheman (1833).

1833. *Cylas puncticollis* Boheman. Schönherr's Gen. et. Sp. Curc., vol. 1, pp. 372, 373.

This black species from Senegal appears to differ from *C. brunneus* by having the eyes approximate and front canaliculate.

7. Cylas longicollis Chevrolat (1830).

1830. *Cylas longicollis* Chevrolat. Guérin's Icon. Regn. Anim., p. 139, vol. 36, fig 10. Senegal.

8. Cylas laevigatus Fåhraeus (1871).

1871. *Cylas laevigatus* Fåhraeus. Oefv. Vet. Akad. Förh., vol. 28, p. 237. Caffraria. Length 3.5 mm.; breadth 1 mm.

9. Cylas rufescens Fairmaire (1899).

1899. *Cylas rufescens* Fairmaire. Ann. Soc. Ent. France, vol. 68, p. 501. Madagascar. Length 3.5 mm.

10. Cylas nigrocoerulans Fairmaire (1902).

1902. *Cylas nigrocoerulans* Fairmaire. Ann. Soc. Ent. France, vol. 71, p. 384. Madagascar. Length 6.5 mm.

Protocylas, new genus

Type of genus *Cylas laevicollis* Boheman.

This genus is founded for the blunt-nosed species of Cylas, which have short, broad beaks, inflated elytra, and femora surpassing the elytra. The facies of the genus is quite distinct from that of Cylas.

It is a little difficult to absolutely assign all of the species to one of these two genera, but I have made the following assignments to this genus, after personally examining specimens of six species, which form a definite generic concept.

1. Protocylas laevicollis ((Schönherr) Boheman 1833) n. comb.

1833. *Cylas laevicollis* Boheman. Schönherr's Gen. et Sp. Curc., vol. 1, p. 372. Java.

One female was examined from Depok, Java, collected by Bryant and Palmer, July 22, 1909. Length 5.5 mm.

♀. Black, with greenish metallic lustre on elytra, and purplish hue to thorax. Beak broad, hardly as long as head. Eyes not prominently convex, separated by only about one-third the breadth of the beak. Between the eyes the front is depressed with raised supraocular ridges, and median carina. The sides of the beak in front of the eyes are impressed, and between the eyes the scrobes are pitted. Scrobes at middle of the short beak. The thorax is considerably narrowed behind, but not as deeply constricted as in some species . The elytra are semi-globular when viewed from the sides, but the sides are subparallel from the rectangular humeri.

For comparison with other species, the following micrometer measurements were made as in the preceding tables (17 spaces = 1 mm.).

Length 98 spaces; breadth 33; height 38.
Length of beak 12; breadth 10; height 10.
Length of head 15; breadth 15; height 16.
Length of prothorax 26, to constriction 18, behind it 8; breadth of anterior portion 20, posterior 13.5; height of anterior portion 19; posterior 14; height at constriction 13.
Length of elytra 48; breadth 33; height including abdomen 28.
From anterior edge of hind legs to tip of abdomen 28; length of posterior femora 40.
Length of antennal scape 5; funicle 14; club 11.

2. Protocylas submetallicus (Desbrochers des Loges 1890) new comb.

1890. *Cylas submetallicus* Desbrochers des Loges. Jour. Asiat. Soc. Bengal, p. 214. Sikkim.

1891. *Cylas submetallicus* (Desbrochers) Faust. Stett. Ent. Zeit., vol. 52, p. 282. Nagpore.

I have seen one female from the Deyrolle collection labelled "India or." This species is very close to *impunctatus*, but the differences can best be brought out by the following measurements on the same scale (17 spaces = 1 mm.)

Length 100 spaces; breadth 36; height 38.
Length of beak 12; breadth 11; height 11.
Length of head 15; breadth 16; height 16.
Length of prothorax 27; to constriction 19, behind it 8; breadth of anterior portion 19, posterior 13; height of anterior portion 17, posterior 13; height at constriction 12.
Length of elytra 52; breadth 36; height including abdomen 30.
From anterior edge of hind legs to tip of abdomen 30; length of posterior femora 34.
Length of antennal scape 4; funicle 11; club 10.

3. Protocylas impunctatus (Faust 1891) new comb.

1891. *Cylas impunctatus* Faust. Stett. Ent. Zeit., vol. 52, p. 282. Nagpore India. Length 3.5 mm.; breadth 1.2 mm.

One specimen was examined from India, collected by C. V. Piper in 1911. Measures 4.5 mm.

♂. Black, with violescent lustre; legs and antennae reddish. Beak broad, not as long as head. Eyes not prominently convex, separated by one-third the breadth of the beak. Between the eyes the front is depressed with raised supraocular ridges, and median carina. The sides of beak between eye and scrobe are longitudinally impressed. Scrobes at middle of short beak. The thorax is very shallowly constricted behind. The elytra are more elongate, less globular.

Comparative measures in micrometer spaces (17 = 1 mm.).
Length 86 spaces; breadth 25; height 32.
Length of beak 10; breadth 8; height 9.
Length of head 14; breadth 14; height 14.
Length of prothorax 22; to constriction 15; behind it 7; breadth of anterior portion 17, posterior 11; height of anterior portion 16, posterior 12; height at constriction 11.7.
Length of elytra 42; breadth 25; height including abdomen 26.
Length from anterior edge of hind legs to tip of abdomen 25; length of posterior femora 31.
Length of antennal scape 4; funicle 10; club 14.

4. Protocylas curtipennis (Fairmaire 1887) new comb.

1887. *Cylas curtipennis* Fairmaire. Ann. Soc. Ent. France, ser. 6, vol. 7, p. 322. Zanzibar.

A female from the Deyrolle collection (Cambridge Museum) which has been determined as *senegalensis* Gory, *angustatus* Dejean and *cyanescens* Sch. may be assigned here. It measures 4 mm., and is from Senegalia. Another female is labelled "322", and measures the same.

♀. Black (too much covered with dust to determine lustre). Beak broad, not as long as head. Eyes not surpassing margin of head, very faintly convex, separated by about one-third breadth of beak. Front and beak sulcate. Sides of beak with three longitudinal depressions from eye to scrobe. Scrobes at middle of short beak. The thorax is considerably narrowed behind, but not very deeply constricted. Elytra semiglobular, when viewed from side, but with sides almost straight from humeri.

Comparative measurements in micrometer spaces (17 spaces = 1 mm.).
Length 83 spaces; breadth 30.5; height 34.
Length of beak 10; breadth 9; height 9.
Length of head 12; breadth 13; height 14.
Length of prothorax 22; to constriction 15, behind it 7; breadth of anterior portion 16; posterior 12; height of anterior portion 15.5, posterior 12; height at constriction 11.
Length of elytra 44; breadth 30.5; height 24.
From anterior edge of hind legs to tip of abdomen 28; length of posterior femora 31.
Length of antennal scape 4; funicle 12; club 7.5.

5. Protocylas cyanescens ((Dejean) Boheman 1833) new comb.

1833. *Cylas cyanescens* (Dejean) Boheman. Schönherr's Gen. et Sp. Curc., vol. 1, p. 371. Senegalia.

One male specimen from the Deyrolle collection (Cambridge Mus.) labelled "460. *Cylas cyanescens* Sch. Guinee, Bocandi." Length 6.5 mm.

A broken female from this collection labelled "*Cylas major* Gory. Senegal. 321", is apparently the same species, but measures 8 mm.

C. cyanescense is described as twice as large as *laevicollis,* and this latter specimen would therefore appear to be more typical.

♂. Black. Beak broad, as long as head. Eyes lightly convex, separated by half the breadth of the beak. Front broadly depressed, with supraocular ridges. Beak sharply sulcate opposite scrobes. Sides of beak depressed in longitudinal lines from eyes part way to scrobes. Scrobes at middle of short beak. Thorax not deeply constricted behind. Elytra more elongate, less globular.

Comparative measurements in micrometer spaces (17 spaces = 1 mm.).
Length 114 spaces; breadth 33; height 40.
Length of beak 15; breadth 10; height 11.
Length of head 15.5; breadth 16; height 16.
Length of prothorax 27, to constriction 19, behind it 8; breadth of anterior portion 20, posterior 14.5; height of anterior portion 20, posterior 17.
Length of elytra 58; breadth 33; height 30.
From anterior edge of hind legs to tip of abdomen 32; length of posterior femora 39.
Length of antennal scape 6; funicle 11; club 20.

6. Protocylas semipunctatus (Fåhraeus 1871).
1871. *Cylas semipunctatus* Fåhraeus. Oefv. Vet. Akad. Förh., vol. 28, p. 237. Caffraria. Length 7.5 mm.; breadth 2.2 mm.

One specimen in Deyrolle collection (Cambridge Museum) from Cape of Good Hope. Sex unknown.

Black. Beak short and broad, coarsely punctured. Eyes broadly separated, small and barely surpassing margin of head; front and beak to insertion of antennae deeply, medianly sulcate. Head very finely punctate. Thorax finely punctate, anterior portion globular, constriction very sharp, posterior portion convex. Elytra very large, globular, sides rounded; surface almost impunctate, but with very shallow, minute punctures in rows on sides.

Length 7.5 mm.; breadth 3 mm.; height 3 mm.

Comparative measurements in micrometer spaces (17 = 1 mm.).
Length 142 spaces; breadth 53; height 65.
Length of beak 17; breadth 16; height 15.
Length of head 20; breadth 24; height 24.

Length of prothorax 37, to constriction 23, behind it 14; breadth of anterior portion 29, posterior 21; height of anterior portion 25, posterior 22; height at constriction 21.
Length of elytra 68; breadth 53; height 47.
From anterior edge of hind legs to tip of abdomen 32; length of posterior femora 52.
Length of scape 7; funicle ?; club ?

7. Protocylas glabricennis (Hartmann 1897) new comb.

1897. *Cylas glabripennis* Hartmann. Vien. Ent. Zeit., vol. 16, p. 282. German Africa, Tanga. Length 4.5 mm.; breadth 1.5 mm. Head equal to beak in length.

8. Protocylas robustus (Faust 1894) new comb.

1894. *Cylas robustus* Faust. Stett. Ent. Zeit., vol. 55, p. 149. Erytrea. Length 5 mm.; breadth 2 mm.

9. Protocylas rufipes (Faust 1893) new comb.

1893. *Cylas rufipes* Faust. Ann. Soc. Ent. France, vol. 61, pp. 513, 514. Cochin China. Length 3.3-4.6 mm.; breadth 1.2-1.5 mm.

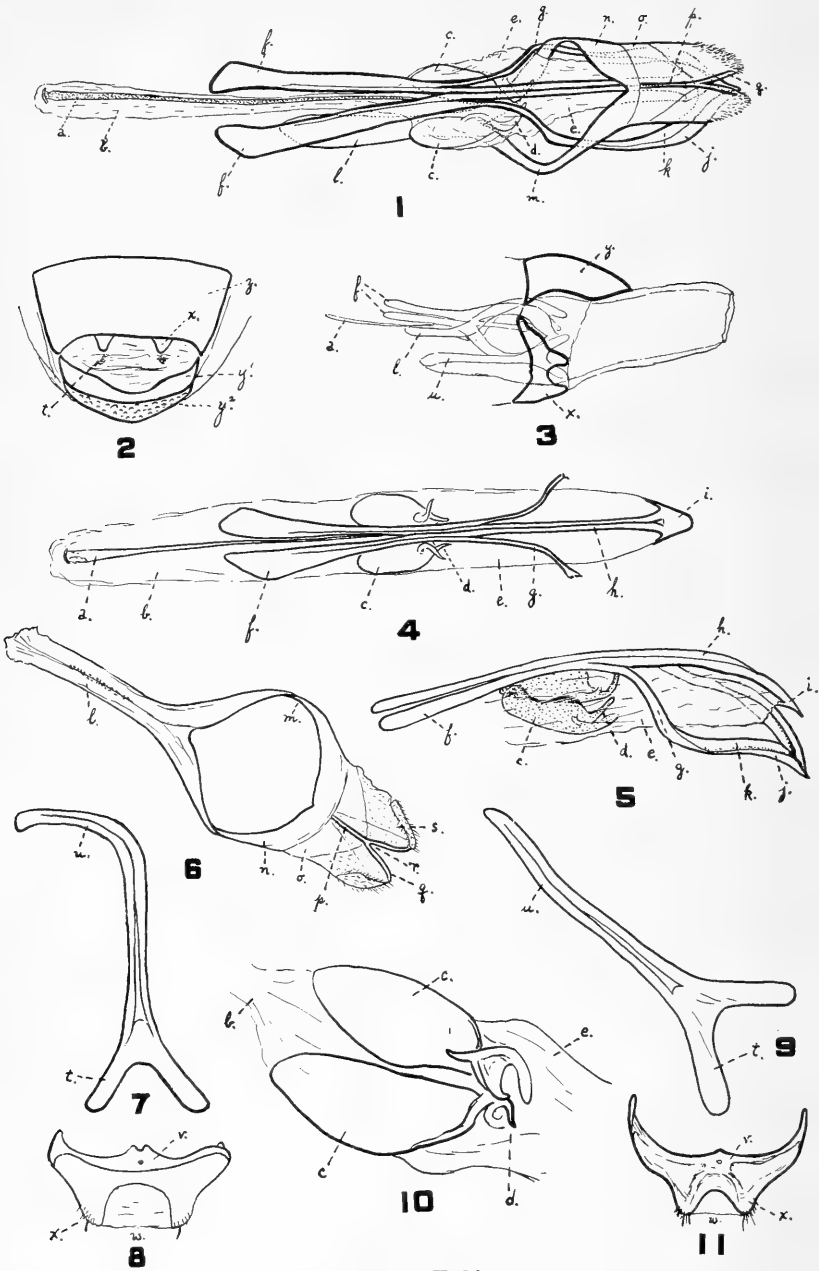


PLATE 36

ILLUSTRATIONS

(All drawings by the author.)

Plate 36—Male genitalia of *Cylas formicarius elegantulus* (Summers) (figs. 1-9), and *C. turcipennis* Boheman (figs. 10, 11).

Fig. 1—Dorsal view of entire genital apparatus of *C. f. elegantulus* from a Daytona, Florida, specimen.

Fig. 2—View of opening of anus, showing tips of eighth sternite, and shadows of ninth sternite (this and figs. 3-9 from New Orleans specimens).

Fig. 3—View of eighth segment from side, with genital tube partly everted, the everted portion being the eighth intersegmental skin.

Fig. 4—Dorsal view of internal sac and epiphallus; periphallus broken off.

Fig. 5—Side view of oedeagus and the internal sac.

Fig. 6—Ventral view of tenth segment, showing posttegumen, ring and strut.

Fig. 7—Spicule, or ninth sternite, showing extreme curvature found.

Fig. 8—Ventral view of eighth sternite of same specimen as fig. 7.

Fig. 9—Spicule, or ninth sternite, of another specimen.

Fig. 10—*Cylas turcipennis* (Buitenzorg, Java) endophallus with its valvae in eurazygos.

Fig. 11—Dorsal view of eighth sternite in *turcipennis*.

EXPLANATION OF LETTERS IN PLATE 36

a. Flagellum in ductus ejaculatorius.
b. Stenazygos, anterior portion of ductus ejaculatorius.
c. Endophallus.
d. Valves of endophallus.
e. Eurazygos, widened posterior portion of ductus ejaculatorius.
f. Struts of oedeagus, or epipleurites (segment 11).
g. Basal portion of periphallus (hypopleurite) (segment 11).
h. Epiphallus, or tergite of segment 11.
i. Verga, containing genital pore, tip of epiphallus (segment 11).
j. Periphallus, hypopleurite of segment 11.
k. Hypophallus or sternite 11.
l. Strut of sternite 10.
m. Ring portion, pleurites of segment 10.
n. Basal portion of posttegumen, of tergite 10.
o. Median portion of posttegumen, of tergite 10.
p. Base of uncus, tergite 10.
q. Rods of uncus, tergite 10.
s. Lobes of tergite 10, cerci, or socii.
t. Forks of spicule, sternite 9.
u. Rod of spicule, sternite 9.
v. Base of sternite 8.
w. Emargination of sternite 8.
x. Lobes of sternite 8.
y. Tergite 8; y^1 inverted portion, y^2 exposed portion.
z. Sternite 7.

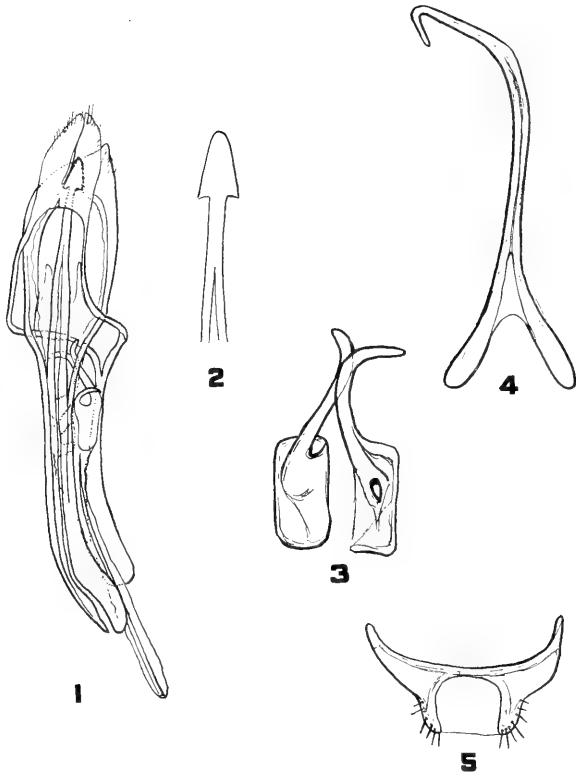


PLATE 37

Plate 37—Male genitalia of *Cylas femoralis* Faust from Mt. Coffee, Liberia.

Fig. 1—Dorsal view of entire genital apparatus.

Fig. 2—Verga.

Fig. 3—Endophallus.

Fig. 4—Ninth spicule.

Fig. 5—Eighth sternite.

Plate 38—Female genitalia of *Cylas formicarius elegantulus*.

Fig. 1—Lateral view of last segments of inflated abdomen, from New Orleans.

Fig. 2—Terminal view of uro-genital area of same specimen.

Fig. 3—Left antero-ventral view of same specimen.

Fig. 4—Left lateral view of last segments of partially inflated abdomen of a specimen from Victoria, Texas.

Fig. 5—Lateral view of a specimen with anal tube exserted, from Victoria.

Fig. 6—Dorso-lateral view of inflated abdomen of Victoria specimen.

Fig. 7—Antero-ventral view of same specimen as figs. 1, 2, 3.

EXPLANATION OF LETTERS ON PLATE 38

a5, a6, a7, a8, a9. Sternite of segments 5 to 9.

a9. Vulvar sclerites.

b. Hypopleurites of segments 5 to 9.

c. Epipleurites II of segments 5 to 9.

d7. Epipleurite I of segment 7.

e. Tergites of segments 7, 8.

g. Intersegmental skin of segment 8.

h. Cloaca stylus.

i. Anterior lip of anal orifice or tergite 9.

j. Flecks of chitin, which may correspond to cloacal valve.

k. Vaginal stylus.

l. Arm of vaginal stylus.

m. Vaginal palpus.

n. Terminal joint of vaginal palpus.

o. Lower lip of vulva.

p. Lateral cheeks of vulva.

q. Vulva, or genital orifice.

r. Upper lip of vulva.

s. Tergo-pleural cuticle of vulvar segment.

t. Base of vulvar segment.

u. Opening for extrusion of anal tube.

v. Basal segment (tenth) of anal segment extruded.

w. Apical segment (eleventh) of anal tube extruded.

x. Anus, or anal orifice.

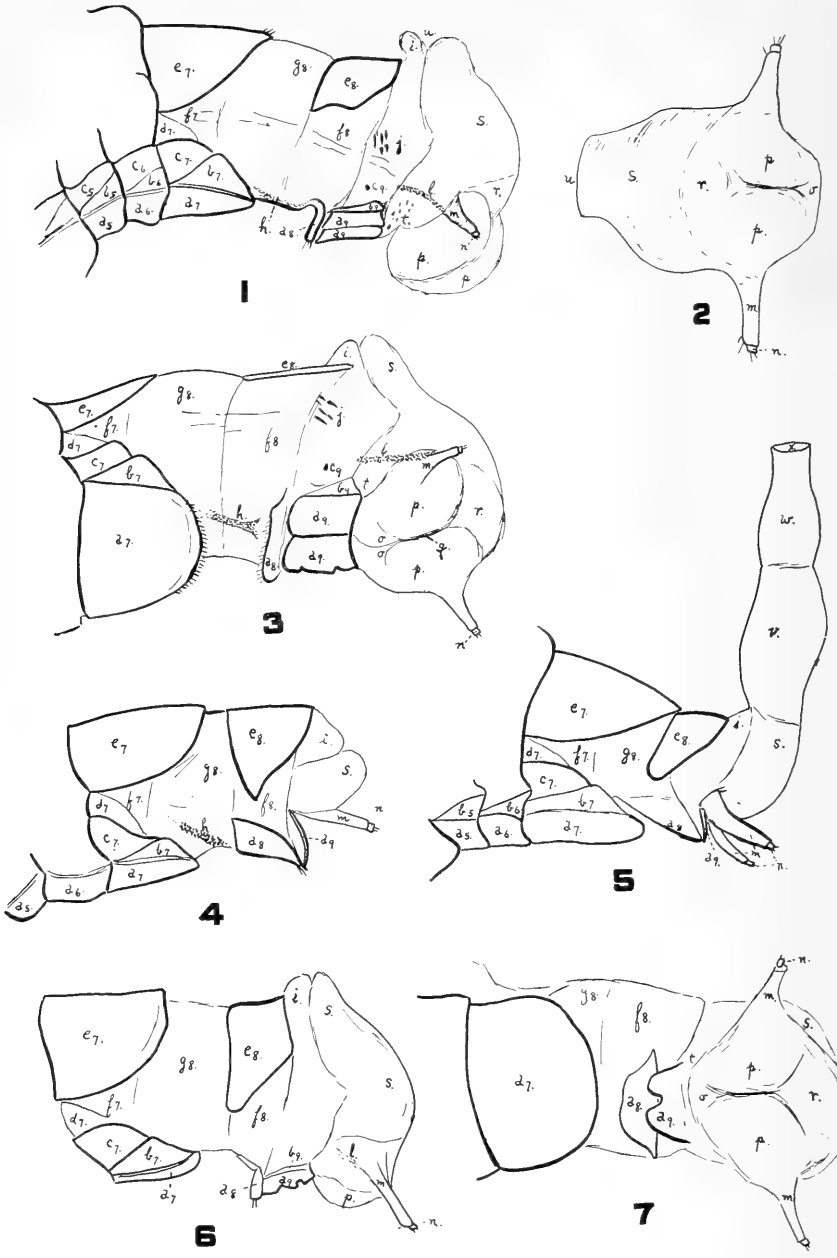


PLATE 38

A FEW REMARKS ON THE POSSIBLE ORIGIN OF THE SWEET POTATO

By W. Dwight Pierce

I have been very much interested in reading the evidences advanced by Roland B. Dixon, in his paper The Problem of the Sweet Potato in Polynesia (1932 Amer. Anthrop. 34(1):40-66), regarding nonSpanish influences in the distribution of this valuable plant; and the subsequent paper by John F. G. Stokes, entitled Spaniards and the Sweet Potato in Hawaii and Hawaiian-American Contacts (1932. Amer. Anthrop. 34(4):594-600).

I have just two points to add to the discussion, one linguistic, and the other entomological.

Dixon says that the word camote is of Mexican origin, introduced by the Spaniards into the Philippines, but I think the reverse is more likely. The Tagalog name for the sweet potato is kamóti, the Visayan word camote (Cebu and Negros), kamote (Panay). Now the Visayan word is supposed to be derived from the word camot (Cebu, Negros, Masbate, Ticao), kamot (Panay), meaning hand, because the leaf resembles a hand, with five points.

The Tagalog word for hand is Kamay, probably of the same root.

I note with interest that Stokes says that the Polynesian names for the plant are kumara, kuara, kumala, kuma'a, 'umara, 'umala, all of which are cognate. The Tagalog word kamay could easily fit into this series.

It would be profitable to hunt up the Polynesian words for hand, for it would seem that the Tagalog kamay and the Visayan kamot are cognate. If so, then all through the Pacific region the plant is known by one group of names derived from the word for hand.

Names linked like these must go back to the time when there was a language connection between the different dialects, that is, to the time of migration.

Dixon states that in 1606 Quiros found the people of the New Hebrides eating roots with flesh of different colors.

While I lived in the Philippines, on Negros, I had growing in my yard, sweet potatoes of three colors of skin, yellow, brown and red; and there were white, yellow, orange, and purple meats. The yellow-fleshed variety was called initlog, because the flesh was yellow like the egg, itlog. The purple variety was called inobi, because the flesh was purple like the flesh of the obi, ubi, or yam (*Dioscorea*). There are various species of yams on Negros, and one of them is called lima-lima, which is from lima, five, because of the five-pointed leaves. Now lima is an ancient

word, meaning five in many oceanic languages, and hand in Hawaiian, traceable clear back to the ancient Sumerian lima, five, from lim, four and a, one, or four plus one.

These two economic roots go hand in hand down the ages.

It looks as if the oriental name came before the Mexican, and that the sweet potato is oriental rather than American.

My second point is entomological. One of the best tests of plant origin is the insect pest test. One of the best groups for the purpose is the portion of the beetles known as weevils. The majority of these insects are specialized in habits, with species limited to species or genera of hosts, and genera limited to families of hosts. There are, of course, exceptions to this in certain genera, which show no preferences, but these belong to well defined groups.

The sweet potato, the world over, is the host of weevils of the subfamily Cyladinae, of which at least 19 species are described. These fall into distinct groups which I separate as distinct genera. The typical genus Cylas is limited to 10 species, of which we definitely know the food plants of four, and these all attack the sweet potato, and sometimes its nearly related species of morning glories (*Ipomoea*). The type, *C. brunneus* (Olivier) was described in 1790 from Senegal. Our familiar species, *C. formicarius* (Fabricius) was described in 1798 from India Oriental. As late as 1871 it was only known from India. In 1875 it was described from Louisiana as *Otidocephalus elegantulus* Summers. I have examined this species from India, Society Islands, Madagascar, Formosa, China, Hawaii, Guatemala, British Guiana, Jamaica, Haiti, Cuba, Puerto Rico, Florida, Louisiana, Texas and New Mexico.

It is probably very closely related to *Cylas turcipennis* Boheman (1833), which attacks sweet potato in Java, Sumatra, and the Philippines.

The fourth species attacking sweet potato is distinct, but closely related, *Cylas femoralis* Faust (1898) from Kamerun.

The other six species in this genus concept are two from Senegal, two from Madagascar, one from German East Africa, and one from Caffraria. The other genus concept, *Protocyclas,* contains species from Java, Cochin China, India, Sikkim, Erytrea, German East Africa, Senegal, and Caffraria.

Thus it may be readily seen that the sweet potato weevils belong to a group typically Asiatic and African in origin, and our American species has undoubtedly come to us from Asia or the Pacific Islands, rather later than the plant.

I think that this lends strong arguments to the contention that the plant is of African or south Asiatic origin.